*Bright meteor recorded on 20th January 2021 at 03h 47m 47.9s
captured at Saitama Prefecture, Japan. (Kawagoe City) Credit Takashi Sekiguchi*

■ The activity of meteor showers recorded by SonotaCo Net video observations 2007–2018

Contents

The activity of meteor showers recorded by SonotaCo Net video observations 2007–2018

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The IAUMDC meteor shower database (SD) is confusing for several of the meteor showers (Koseki, 2020). This paper presents the catalogue of clearly recognized meteor showers recorded by SonotaCo net video observations in the period 2009–2018 (SonotaCo, 2009).

1   Introduction

The author has checked the IAUMDC meteor shower database (SD) and compiled a catalogue of attractive meteor showers[1]. This paper provides its essential data for easy use. The version of 2018 January 13 $20^h35^m17^s$ of the IAUMDC meteor shower database (SD) has been used.

The SD contains hundreds of meteor showers but many of them could not be confirmed by video observations. Most of the daytime meteor showers are not observable by optical observations surely and there are important differences between radar and video observations when considering the meteor magnitude range. Some meteor showers might have been lost or may have changed their activity level.

The most important cause of the existence of undetectable meteor showers in the SD is the difference in definition of what is a meteor shower. There is no common and clear conception and that is why the list includes many false meteor showers. It is not possible to make an absolute distinction between meteor shower activities and the sporadic background.

2   Sun-centered ecliptic coordinates

Radiant points are described in equatorial coordinates usually and their radiant drifts are given as $\Delta\alpha$ and $\Delta\delta$ as well. But, if we use 'Sun-centered ecliptic coordinates' to plot radiant points, we can almost eliminate the radiant drift during a week.

Figure 1 shows the star map in equatorial coordinates plotted in Hammer projection centered at $(\alpha, \delta) = (0°, 0°)$. The equator is on the *x*-axis and the ecliptic is shown with a yellow line. *Figure 2* shows the star map in ecliptic coordinates centered at the equinox, that is, $(\lambda, \beta) = (\alpha, \delta) = (0°, 0°)$ and the ecliptic plane is now on the *x*-axis in turn. The position of the Sun at the time of the Orionids maximum is drawn in *Figure 2* as a red circle; a black circle for ANT and a black cross the APEX are added. The Earth moves around the Sun and we see the Sun moving along the ecliptic; the ANT and the APEX also move and the meteor shower radiants drift as well. If we set the position of the Sun as the origin, then the ANT, the APEX and the radiants become fixed.
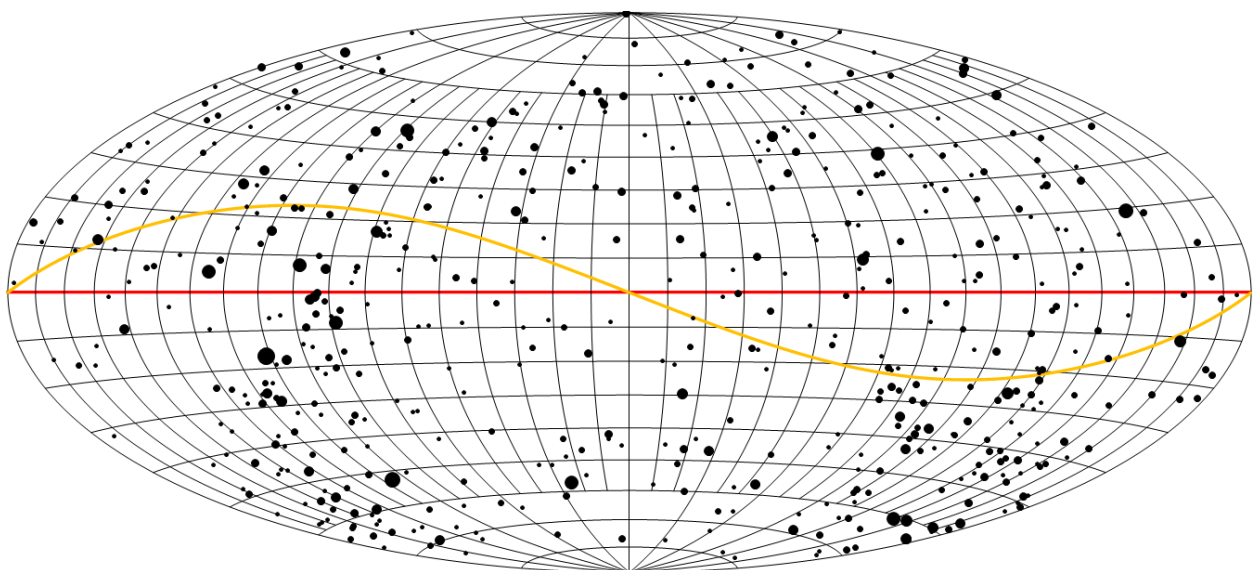
Figure 1 – An equatorial star chart plotted in Hammer projection centered at $(\alpha, \delta) = (0°, 0°)$. The red line is the equator, the yellow line is the ecliptic.

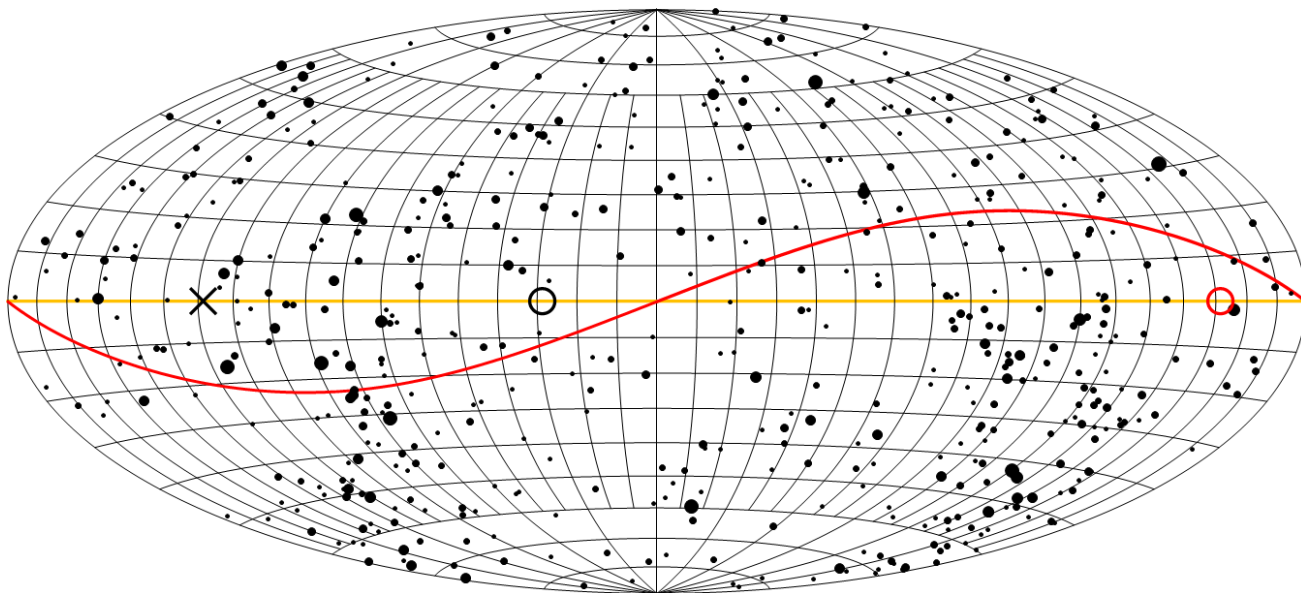[1] MSSonline, http://msswg.net/mssonline/MSS29-RYUSEIGUN-20201120-Koseki-80GUN.pdf

Figure 2 – An ecliptic star map plotted in Hammer projection centered at $(\lambda, \beta) = (\alpha, \delta) = (0°, 0°)$. The red line is the equator, the yellow line is the ecliptic.

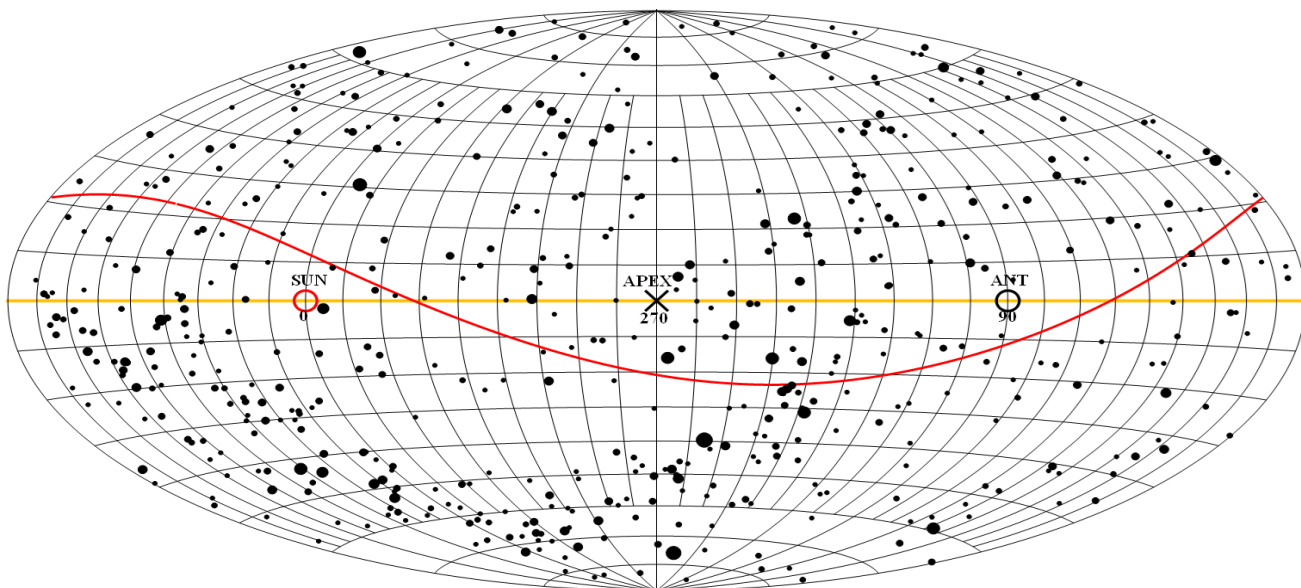*Figure 3* – The Sun-centered ecliptic star map at the Orionids maximum. The center of the map is at $(\lambda–\lambda_\Theta, \beta) = (270°, 0°)$.

Figure 3 shows such star map at the time of the Orionid maximum with the position of the Sun as the origin, which is called Sun centered ecliptic coordinates $(\lambda–\lambda_\Theta, \beta)$. The reason why the center of *Figure 3* is centered at $(\lambda–\lambda_\Theta, \beta) = (270°, 0°)$ is the distribution of the meteor shower radiants; *Figure 4* shows all the SD radiants.

The movement of the Earth around the Sun plays an important role in the distribution of the meteor shower radiants. It is very common to set the center of such figures at $(\lambda–\lambda_\Theta, \beta) = (270°, 0°)$. We can easily point the major showers which include several entries in the SD as the crowded marks in *Figure 4*. It is very clear that the Sun-centered ecliptic coordinates plot centered at $(\lambda–\lambda_\Theta, \beta) = (270°, 0°)$ is very suitable to show the radiant distribution over the entire sky. These coordinates correspond with the observed radiant distribution for the center of each meteor stream activity as shown in the meteor shower datasheets.

3   Selecting meteor showers

The author introduced the radiant density ratio (*DR*) to distinguish meteor shower activity from the sporadic background. *DR3*, *DR10* and *DR15* are the sliding mean of the radiant density ratios within bins of 3 degrees in λ_Θ.

- *DR3*: the density ratio within a circle of 3 degrees relative to a ring of 3 to 6 degrees.
- *DR10*: the density ratio within a circle of 3 degrees relative to a ring of 6 to 10 degrees.
- *DR15*: the density ratio within a circle of 3 degrees relative to a ring of 10 to15 degrees.

DR = 1 means that the radiant density is flat, with other words, no shower activity. We can assume there may be some activity suggested when *DR* > 2. The author has searched every line of the SD by using *DR* and selected several shower activities with *DR* > 5 at their maximum.
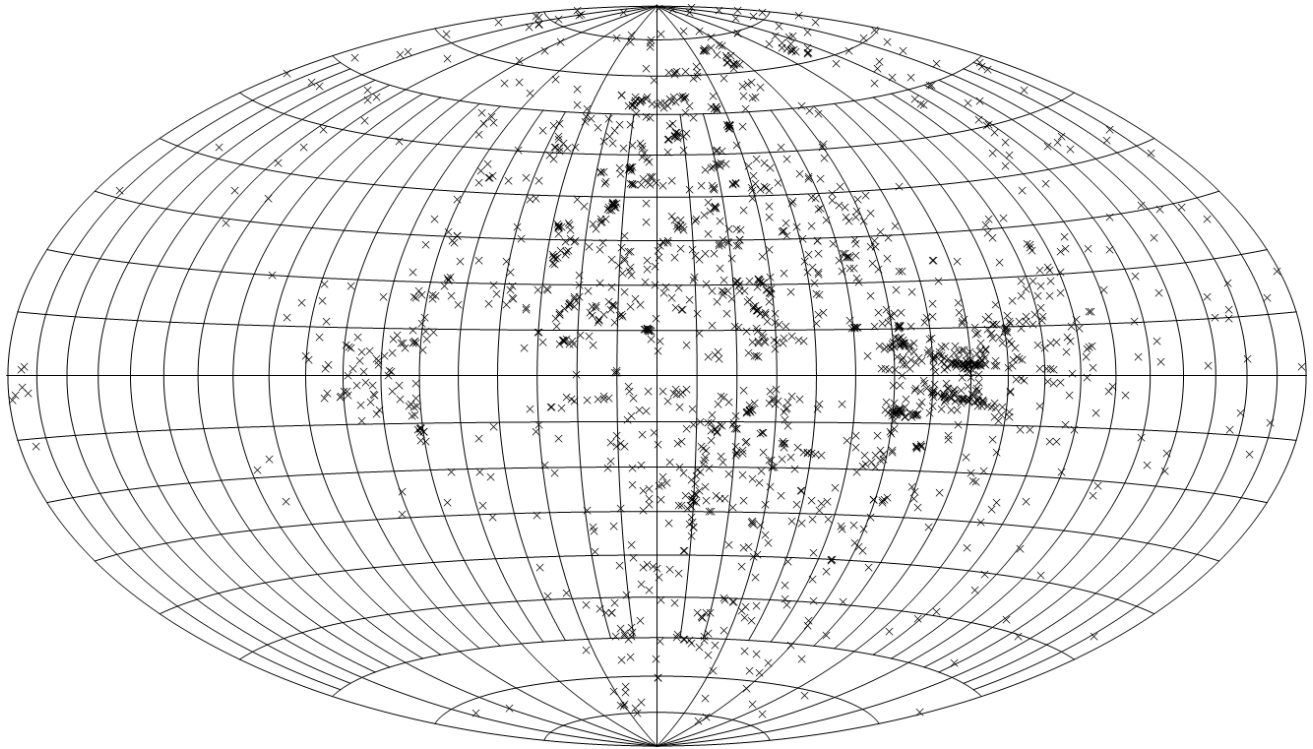
Figure 4 – Sun-centered ecliptic meteor shower radiants of the SD.

4   Calculations

4.1 Selection of the proper radiant position and the solar longitude of the activity

It is logic to select the entry in the SD which gives the highest density ratio *DR* value, as the candidate for the start of the calculation, but the SD has no information on the activity period. The author has drawn the meteor activity profiles according to the value of *DR* and got the required period for the calculation. It seems to be good to explain the process by showing KCG as an example; we select 0012KCG04[2] in this case.
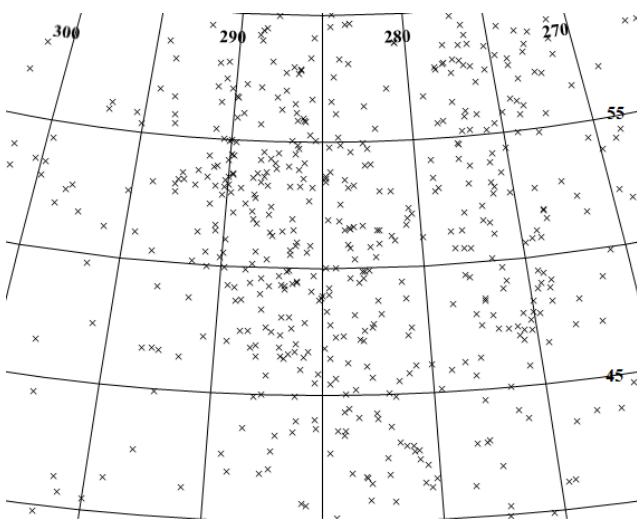
Figure 5 – the radiant distribution of the KCG centered at (α, δ) = (285.0°,+50.1°) between $\lambda_{\odot}$ = 128.7° and 152.7°.

4.2 Calculation of the distance from the selected point (center): Radiant distribution and the profile

It is common to represent the radiant point in Right Ascension and in declination (α, δ) and its radiant drift with the solar longitude as $\Delta\alpha$ & $\Delta\delta$. *Figure 5* shows the radiant distribution of the KCG centered at (α, δ) = (285.0°,+50.1°) between $\lambda_{\odot}$ = 128.7° and 152.7°. The radiants appear distributed in an ellipse and this shape suggests that the radiant shifts with time. We recognize the lines of the declination curve. If we represent the radiant drift by $\Delta\alpha$ & $\Delta\delta$, the radiant would pass through the curved path. It is appropriate to express the radiant drift by using (x, y) coordinates centered at the selected radiant point represented by the coordinates $(\lambda-\lambda_{\odot}, \beta)$.

We calculate the distance from the selected point expressed in $(\lambda-\lambda_{\odot}, \beta)$ and draw the radiant distribution between 12 degrees earlier and later from the selected solar longitude of the activity in the case of KCG (see *Section 6* 'Explanation of the meteor shower datasheets' as well as the datasheet for the KCG). *Figure 6* shows the same KCG data in the Sun-centered ecliptic coordinates centered at $(\lambda-\lambda_{\odot}, \beta)$ = (161.5°, 71.9°) and then the elliptic shaped distribution becomes smaller. We should represent the radiant point in Sun-centered ecliptic coordinates $(\lambda-\lambda_{\odot}, \beta)$ not in equatorial coordinates (α, δ). The *y*-axis runs through the selected $\lambda-\lambda_{\odot}$ value, which is, 161.5°. The scale is in degrees.

We could move on to '4.4 Calculation of the linear regression of $\lambda-\lambda_{\odot}$ and β on $\lambda_{\odot}$' for the usual cases but the

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[2] https://www.ta3.sk/IAUC22DB/MDC2007/Roje/pojedynczy_obiekt.php?kodstrumienia=00012&colecimy=0&kodmin=00001&kodmax=01049&sortowanie=0

situation with the KCG is special; it is better to explain the process for such a special case.
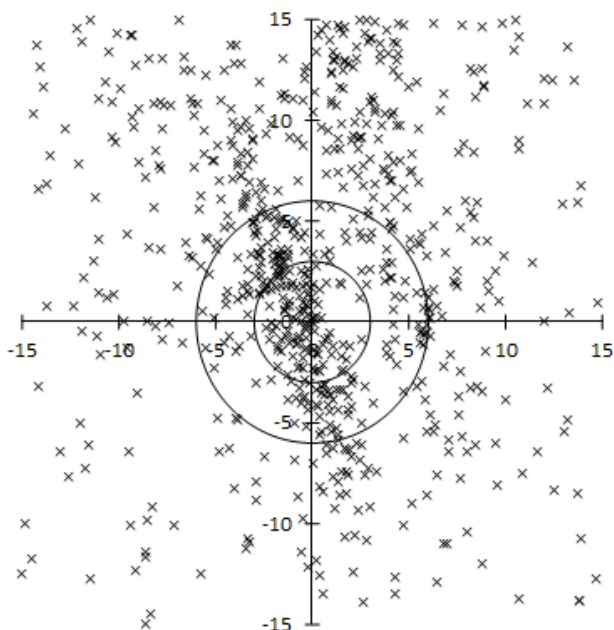
Figure 6 – KCG data in the Sun-centered ecliptic coordinates centered at $(\lambda-\lambda_\Theta, \beta) = (161.5°, 71.9°)$

Figure 7 – KCG data in the Sun-centered ecliptic coordinates rotated counterclockwise over 20° centered at $(\lambda-\lambda_\Theta, \beta) = (161.5°, 71.9°)$, slightly changed to $(168.0°, 74.0°)$.

The kappa Cygnid shower (KCG) has three specific characteristics; the radiant area is inclined to the longitude line and elongated, and the radiants in the shower database are widely spread. First, we rotate the y-axis –20 degrees, that is, 20 degrees counterclockwise and we rename the new coordinate as (x', y'). Secondly, we extend the search area to $\Delta x' < 3°$ and $\Delta y' < 6°$, to have the elliptic shape in order to enclose the elongated area. Thirdly, we need to move the preliminary center from $(\lambda-\lambda_\Theta, \beta) = (161.5°, 71.9°)$ to $(\lambda-\lambda_\Theta, \beta) = (168.0°, 74.0°)$ and the center of the activity period from $\lambda_\Theta = 140.7°$ to $\lambda_\Theta = 142.0°$.

4.3 Calculation of the radiant distribution around the estimated center

The radiant distribution in *Figure 7* appears still elongated which is often the case. This ellipse shape means that the radiant shifts during the activity period of $\Delta\lambda_\Theta = 12°$, although the elliptic shape of the radiant distribution can be natural in some cases. We test whether the radiant drift is real by calculating the preliminary linear regression of x and y in function of λ_Θ, in the case of the kappa Cygnids (KCG) and some others we use x' and y' instead of x and y. Because the radiants are dispersed by the drift itself and because the selected radiant point is tentative, we select the radiant data within a distance of 3 degrees from the center, $\Delta r < 3°$ is most common for the usual cases. We calculate the linear regression for the period of $\Delta\lambda_\Theta$ earlier or later than the selected λ_Θ. Both values Δr and $\Delta\lambda_\Theta$ are shown in each meteor shower datasheet. If we would calculate it for a longer time span, the results might be dispersed by the uncertainty of the tentative data. *Figures 8, 9 and 10* show the linear regressions of x', y' and v_g for KCG at the first step of the iterative approach.
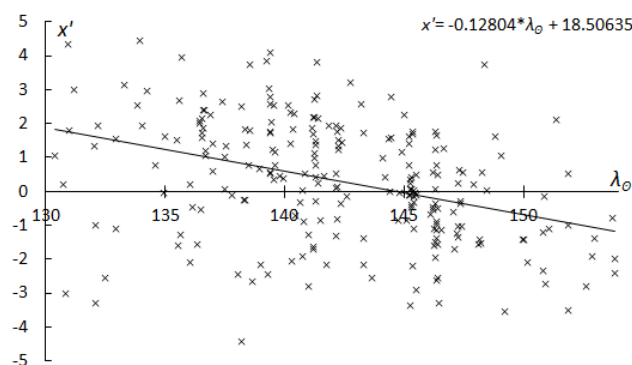
Figure 8 – The linear regression of x' in function of λ_Θ.
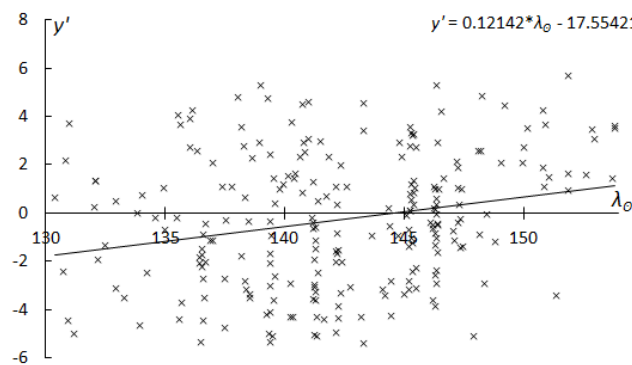
Figure 9 – The linear regression of y' in function of λ_Θ.
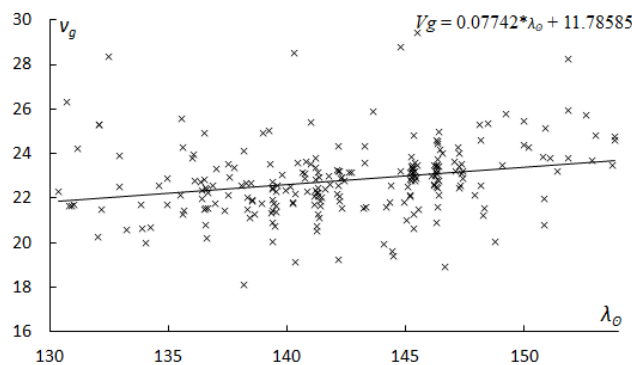
Figure 10 – The linear regression of v_g in function of λ_Θ.

4.4 Calculation of the radiant drift

We use the first linear regression described in point 4.3 to estimate the radiant drift and to calculate the distance from the estimated radiant drift for every radiant as shown in *Figure 7*. We continue to regenerate similar regressions as shown in *Figures 8, 9 and 10* by adding and removing radiant points until the regression results for *x* and *y* (*x'* and *y'* in case of KCG) converge in this iterative approach. We ignore the result for v_g, because it has no significant effect on the final result. *Figures 11, 12 and 13* show the result of the 10th and final regression for the kappa Cygnids (KCG). The radiant distribution becomes more compact (for an example see *Figure 14*) and we can easily convert the radiant drift (x, y) or (x', y') into ($\lambda-\lambda_\odot$, β) and (α, δ) coordinates (see also the KCG sheet).
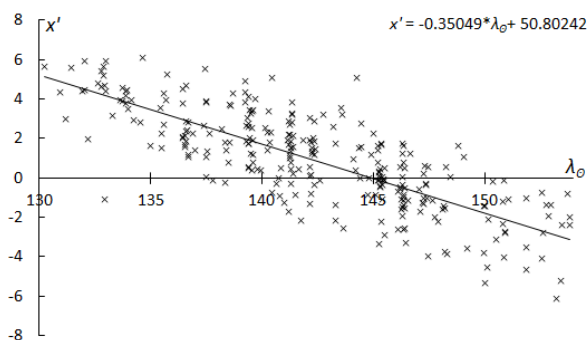
Figure 11 – The linear regression of x' in function of $\lambda_\odot$.

$$x' = -0.35049 * \lambda_\odot + 50.80242$$
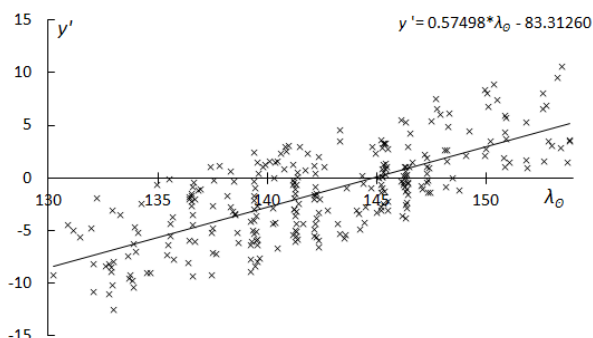
Figure 12 – The linear regression of y' in function of $\lambda_\odot$.

$$y' = 0.57498 * \lambda_\odot - 83.31260$$
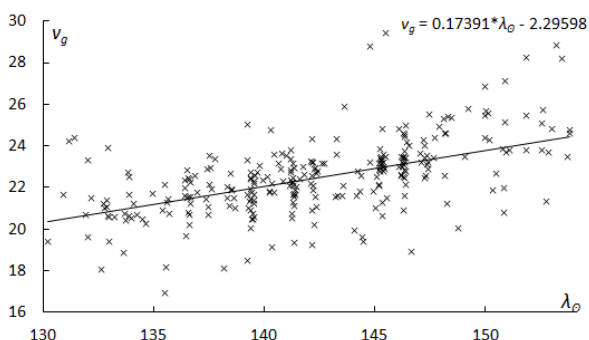
Figure 13 – The linear regression of v_g in function of $\lambda_\odot$.

$$v_g = 0.17391 * \lambda_\odot - 2.29598$$

We can select the possible shower members using two conditions:

- The distance *r* between the radiant point of the candidate and the reference should be within the radius $r \leq 3°$ in case of the KCG, $\Delta x' < 3°$ and $\Delta y' < 6°$;
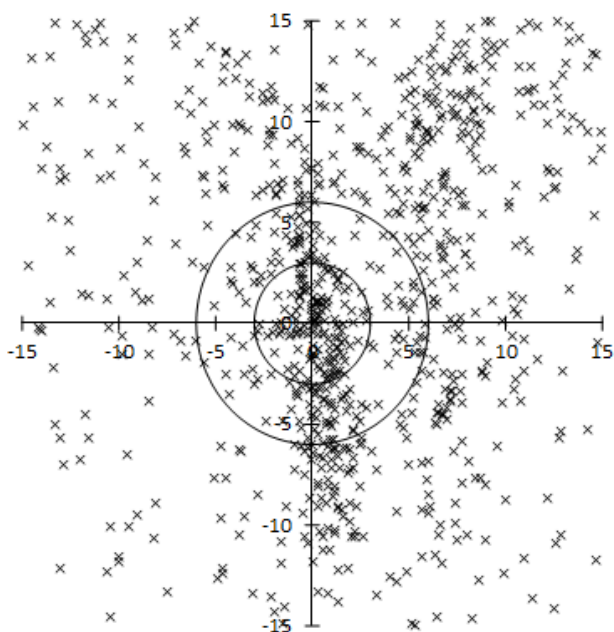- The time of the event should be within the established search period.
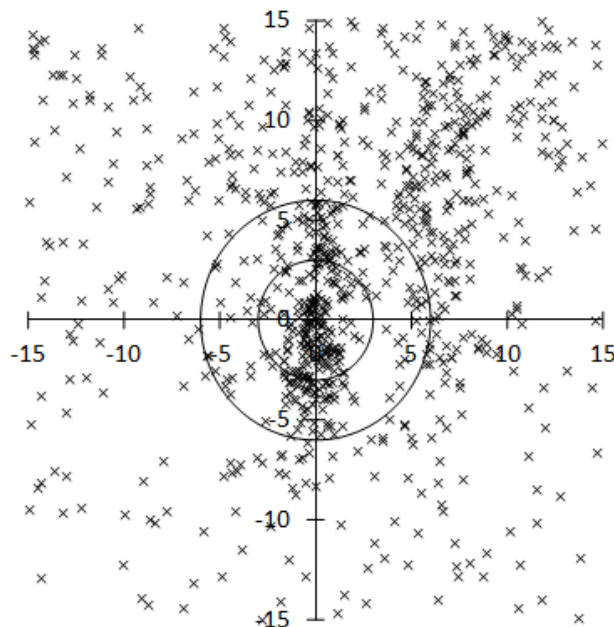
Figure 14 – KCG data in the Sun-centered ecliptic coordinates rotated counterclockwise over 20° centered at ($\lambda-\lambda_\odot$, β) = (161.5°, 71.9°), slightly changed to (168.0°, 74.0°).

The selected radiant points show a change in time, expressed in solar longitude $\lambda_\odot$. In order to include more candidate shower radiants, the iterative procedure with linear regressions is applied until the iteration converges. We calculate the linear regression of ($\lambda_\odot$, x) and ($\lambda_\odot$, y) where (x, y) are the coordinates of the radiant distribution centered at the shower radiant which is the origin shown in *Table 3* and explained in *Appendix 1*. The y-axis runs through the origin $\lambda-\lambda_\odot$ (scales are in degrees).

5   Results

Table 1 lists the basic results of this survey. The column headings of this table are as follows:

- No. is the IAUMDC shower number;
- Code is the three-character code shower identification;
- Name is meteor shower name according to the IAU;
- DR_{max} is the density ratio value of *DR15* at the maximum in general (* and # correspond to *DR3* and *DR10* respectively);
- N_{max} is the number of radiants within 3 degrees from the estimated radiant center at the time of the maximum.
- $\lambda_{\odot DR}$ is the suggested maximum based on the density ratio *DR*;
- $\lambda_{\odot DR}$ and $\lambda_{\odot N}$ are not identical and the difference can be several degrees in some cases. Therefore, it is convenient to give the most probable maximum $\lambda_\odot$; this corresponds to the maximum in *Figure 16* (graph at right marked in yellow). $\lambda_\odot$ was selected for the best fitting activity profile for each observed profile in the graphs marked in yellow and orange in *Figure 16*. The radiant (α, δ), v_g and the orbital elements in *Table 2* are obtained from the regression result for this $\lambda_\odot$;
- $\lambda_\odot$start and $\lambda_\odot$end represent the possible shower activity period determined mainly by the condition *DR* > 2.

Table 1 – The list of 82 meteor showers presented in the datasheets; column headers see above. Click on the Code to skip to the datasheet.

No.	Code	Name	DR_{max}	N_{max}	$\lambda_{\odot DR}$	$\lambda_{\odot N}$	$\lambda_\odot$	$\lambda_\odot Beg$	$\lambda_\odot End$	α	δ	v_g
450	AED	April epsilon Delphinids	28.7	1.4	19.5	19.4	19.4	15	30	307.3	11.4	60.6
27	KSE	kappa Serpentids	23.0	0.9	25.5	25.9	26.0	21	32	247.5	17.9	45.6
21	AVB	alpha Virginids	15.0*	0.9	25.5	25.3	28.0	17	41	201.4	3.9	19.3
6	LYR	April Lyrids	254.2	47.3	32.5	32.4	32.4	25	39	272.4	33.3	46.8
343	HVI	h Virginids	15.8	1.2	41.5	41.6	41.0	34	44	203.7	-11.4	17.6
31	ETA	eta Aquariids	554.9	43.0	44.5	44.9	45.0	25	75	337.5	-1.1	65.5
145	ELY	eta Lyrids	40.8	3.7	50.5	49.4	49.6	46	55	290.6	43.5	43.9
152	NOC	North. Daytime omega Cetids	55.1	0.4	52.5	53.7	53.0	44	63	17.1	19.7	40.1
171	ARI	Daytime Arietids	151.6	0.6	73.5	73.8	73.8	68	86	41.4	23.7	40.5
431	JIP	June iota Pegasids	16.8	2.2	94.5	93.8	93.8	93.4	95.4	331.5	29.3	58.6
372	PPS_0	phi Piscids	21.8	1.5	97.5	92.5	94.0	82	103	9.9	21.4	66.5
165	SZC	Southern June Aquilids	75.8	1.0	103.5	108.2	104.0	95	110	318.3	-27.0	39.7
533	JXA	July xi Arietids	34.4	1.2	102.5	108.5	105.5	93	125	32.7	7.8	68.4
372	PPS_1	phi Piscids	12.4	2.0	110.5	108.2	108.0	101	120	20.7	27.9	65.9
175	JPE	July Pegasids	26.5	3.1	110.5	108.4	108.4	102	136	347.8	10.8	64.1
411	CAN	c Andromedids	19.7	1.3	110.5	109.7	110.0	91	118	32.6	48.3	56.9
164	NZC	Northern June Aquilids	89.6	1.5	101.5	112.7	113.0	81	129	319.4	-2.4	37.7
444	ZCS	zeta Cassiopeiids	27.3	4.5	112.5	113.5	113.5	105	120	7.4	50.9	57.2
184	GDR	July gamma Draconids	82.7	3.3	125.5	125.3	125.3	121	131	280.4	50.6	27.3
5	SDA	Southern delta Aquariids	227.7	24.9	126.5	127.6	127.6	116	148	340.3	-16.3	40.3
1	CAP	alpha Capricornids	85.3	8.5	127.5	127.5	128.0	105	142	306.4	-9.1	22.0
191	ERI	eta Eridanids	32.4	3.5	127.5	134.5	134.0	108	168	40.9	-13.0	63.9
183	PAU	Piscis Austrinids	4.8	0.9	136.5	135.0	135.0	129	138	353.3	-20.2	43.0
7	PER	Perseids	660.3	323.3	139.5	140.0	140.0	112	159	48.1	58.0	58.8
12	KCG	kappa Cygnids	19.7	2.7	145.5	141.7	141.0	129	154	286.2	50.2	22.2
	AXD	August xi Draconids	8.2	1.8	140.5	141.6	142.0	132	155	276.4	53.6	20.3
26	NDA	Northern delta Aquariids	14.5	2.6	147.5	148.7	148.0	127	166	352.6	4.4	38.2
197	AUD	August Draconids	14.5	1.6	154.5	153.2	153.0	140	166	259.1	62.8	21.3
523	AGC	August gamma Cepheids	12.1	1.5	155.5	155.4	155.5	150	161	358.6	76.8	43.8
206	AUR	Aurigids	#21.3	2.5	157.5	158.5	158.4	149	166	91.0	39.2	65.4
33	NIA	Northern iota Aquariids	6.4	1.4	160.5	168.0	162.0	153	183	358.5	3.3	29.9
208	SPE	September epsilon Perseids	37.7	16.9	166.5	167.2	167.2	160	189	47.8	39.5	64.2
337	NUE	nu Eridanids	8.9	2.1	169.5	168.3	168.0	158	181	68.2	0.7	65.7
81	SLY_0	September Lyncids	9.9	1.6	168.5	168.1	168.0	163	176	108.8	55.8	59.3
81	SLY_1	September Lyncids	4.5	0.8	187.5	187.9	185.0	173	190	110.9	47.9	65.4
221	DSX	Daytime Sextantids	96.4	0.4	189.5	190.0	190.0	183	196	156.8	-3.3	32.1
281	OCT	October Camelopardalids	23.6	10.3	191.5	192.7	192.7	192.1	192.8	167.3	78.6	45.4
333	OCU	October Ursae Majorids	41.7	4.9	202.5	202.5	202.5	200	207	145.3	64.2	55.3
23	EGE	epsilon Geminids	*4.7	3.8	204.5	207.9	205.0	191	219	100.8	28.2	68.5
2	STA_SE	Southern Taurids	38.6	7.9	199.5	207.6	205.0	180	230	39.0	10.5	28.2
480	TCA	tau Cancrids	6.6	1.9	206.5	207.3	207.0	183	224	137.3	29.7	67.1
22	LMI	Leonis Minorids	58.4	5.7	209.5	207.9	208.0	198	223	158.8	37.2	61.4
8	ORI	Orionids	255.7	187.9	207.5	208.0	208.0	183	240	95.2	15.6	66.1
524	LUM	lambda Ursae Majorids	8.7	1.7	214.5	214.5	214.7	207	219	158.0	49.4	60.8
526	SLD	Southern lambda Draconids	9.8	2.6	221.5	221.4	221.4	219	225	161.3	68.2	48.6
388	CTA	chi Taurids	#4.2	1.8	222.5	221.9	222.0	210	231	63.9	27.2	40.1
445	KUM	kappa Ursae Majorids	13.7	6.9	223.5	223.0	223.0	220	230	144.2	45.6	64.7
2	STA_SF	Southern Taurids	72.2	19.2	221.5	223.0	223.0	198	256	53.7	14.4	27.7

No.	Code	Name	DR_{max}	N_{max}	$\lambda_{\odot DR}$	$\lambda_{\odot N}$	$\lambda_{\odot}$	$\lambda_{\odot}$Beg	$\lambda_{\odot}$End	α	δ	v_g
18	AND	Andromedids	15.6	2.0	230.5	224.1	230.0	213	245	22.2	32.0	16.9
17	NTA	Northern Taurids	52.1	16.4	229.5	232.4	230.0	200	260	58.7	22.8	27.6
338	OER	omicron Eridanids	11.4	1.2	243.5	224.5	231.0	210	250	58.6	-1.0	27.7
13	LEO	Leonids	120.4	53.7	235.5	235.9	236.0	213	258	154.2	21.6	70.0
246	AMO	alpha Monocerotids	6.9	2.4	240.5	239.8	239.8	237	243	117.6	0.7	61.6
488	NSU	Nov. sigma Ursae Majorids	5.9	2.0	242.5	241.8	242.0	240	245	148.9	59.0	54.5
250	NOO	November Orionids	34.5	10.7	249.5	249.4	248.0	228	265	91.4	15.4	42.3
340	TPY_0	theta Pyxidids	15.7	3.2	248.5	249.4	249.4	246	254	138.7	-25.6	59.7
257	ORS	Southern chi Orionids	4.4	2.5	253.5	253.3	250.0	232	265	78.9	18.1	26.5
336	DKD	December kappa Draconids	38.3	6.9	250.5	250.9	250.9	247	261	186.1	70.7	43.4
339	PSU	psi Ursae Majorids	7.4	3.5	251.5	252.0	252.0	247	259	168.8	43.9	60.8
502	DRV	December rho Virginids	8.8	1.8	252.5	253.4	253.4	247	271	185.5	12.9	68.2
16	HYD	sigma Hydrids	103.2	24.3	254.5	252.6	255.0	240	284	124.3	2.9	58.8
19	MON	December Monocerotids	59.4	11.3	257.5	258.6	259.0	241	273	101.0	8.2	41.0
529	EHY	eta Hydrids	7.9	3.3	260.5	261.6	260.0	244	281	135.4	1.8	61.8
335	XVI	December chi Virginids	#35.4	2.4	259.5	256.4	260.0	244	279	189.4	-9.3	68.2
4	GEM	Geminids	705.9	938.8	262.5	262.1	262.0	237	273	113.5	32.3	33.8
340	TPY_3	theta Pyxidids	7.3	2.1	265.5	266.6	266.6	256	288	154.3	-24.4	62.5
20	COM	Comae Berenicids	33.3	20.5	267.5	266.1	267.0	249	320	160.4	31.1	63.0
428	DSV	December sigma Virginids	11.7	2.3	263.5	276.3	270.0	244	304	207.2	4.6	66.1
15	URS	Ursids	97.8	27.5	270.5	270.4	270.5	261	273	219.0	75.3	33.0
97	SCC	Southern delta Cancrids	4.2	1.2	275.5	274.6	275.0	273	287	105.3	17.6	26.9
319	JLE	January Leonids	6.7	2.1	282.5	282.0	282.0	277	287	147.5	23.9	52.0
10	QUA	Quadrantids	289.1	255.5	283.5	283.3	283.3	275	296	230.0	49.7	40.2
331	AHY	alpha Hydrids	52.2	2.5	285.5	286.4	285.0	264	302	127.9	-8.4	43.3
515	OLE	omicron Leonids	7.0	1.5	289.5	289.0	289.0	269	302	137.7	9.6	41.7
96	NCC	Northern delta Cancrids	4.0	1.4	287.5	290.1	290.0	274	307	122.0	22.5	27.6
323	XCB	xi Coronae Borealids	16.1	0.7	294.5	297.3	295.0	289	300	249.9	30.0	45.5
341	XUM	January xi Ursae Majorids	32.3	5.1	298.5	299.1	299.0	294	301	169.6	32.4	40.9
530	ECV	eta Corvids	6.6	1.6	298.5	304.4	301.0	287	316	190.7	-17.7	67.6
429	ACB	alpha Coronae Borealids	9.3	3.0	308.5	307.4	307.4	306	316	231.1	28.1	56.5
110	AAN	alpha Antliids	5.5	0.5	313.5	313.1	313.1	302	317	158.3	-9.9	44.3
346	XHE	x Herculids	15.6	2.0	350.5	351.3	351.3	346	360	254.4	48.6	35.4
11	EVI	eta Virginids	22.6	2.5	358.5	356.9	357.0	348	5	185.3	3.3	27.0

Table 2 – Orbital elements. Code and $\lambda_{\odot}$ are the same as in Table 1. $(\lambda–\lambda_{\odot}, \beta)$ is the radiant position in the Sun-centered ecliptic coordinates, e is the eccentricity, q is the perihelion distance, i is the inclination, ω is the argument of the perihelion, Ω is the ascending node, $(\lambda_{\Pi}, \beta_{\Pi})$ represents the ecliptic coordinates of the perihelion. Click on the Code to skip to the datasheet.

Code	$\lambda_{\odot}$	$\lambda–\lambda_{\odot}$	β	e	q	i	ω	Ω	λ_{Π}	β_{Π}
AED	19.4	293.6	29.5	0.944	0.719	121.9	114.8	19.4	248.3	50.4
KSE	26.0	216.0	39.2	0.958	0.527	72.8	268.4	26.0	290.4	−72.7
AVB	28.0	170.3	12.0	0.721	0.724	7.0	250.5	28.0	278.4	−6.6
LYR	32.4	241.3	56.7	0.954	0.921	79.7	214.1	32.4	219.3	−33.5
HVI	41.0	165.1	−1.4	0.718	0.775	0.7	63.5	221.0	284.5	0.7
ETA	45.0	293.8	7.7	0.947	0.571	163.6	96.2	45.0	308.5	16.3
ELY	49.6	256.6	64.4	0.945	1.000	74.4	191.5	49.6	232.7	−11.0
NOC	53.0	330.4	11.5	0.956	0.097	38.5	32.0	53.0	79.0	19.2
ARI	73.8	332.3	7.4	0.970	0.084	26.0	30.3	73.8	101.5	12.7
JIP	93.8	252.5	37.9	0.964	0.900	112.4	219.9	93.8	256.2	−36.4
PPS_0	94.0	283.7	15.7	0.895	0.864	151.2	133.1	94.0	317.1	20.6

Code	$\lambda_\odot$	$\lambda-\lambda_\odot$	β	e	q	i	ω	Ω	λ_Π	β_Π
SZC	104.0	208.5	–10.4	0.956	0.098	33.9	148.1	284.0	76.7	17.1
JXA	105.5	284.7	–5.1	0.939	0.830	170.6	308.4	288.5	339.7	–7.3
PPS_1	108.0	281.7	17.7	0.856	0.906	148.0	139.7	108.0	323.7	20.0
JPE	108.4	244.7	14.8	0.961	0.583	148.5	262.6	108.4	207.0	–31.2
CAN	110.0	298.2	32.9	0.910	0.684	112.6	108.3	110.0	339.3	61.2
NZC	113.0	208.0	12.7	0.932	0.129	34.5	324.2	113.0	82.3	–19.4
ZCS	113.5	278.1	42.8	0.946	0.996	107.5	163.4	113.5	298.6	15.8
GDR	125.3	168.1	73.2	0.953	0.977	40.1	202.7	125.3	323.0	–14.4
SDA	127.6	208.1	–7.4	0.968	0.081	26.4	150.5	307.6	100.7	12.6
CAP	128.0	178.5	9.9	0.755	0.602	7.2	266.9	128.0	34.9	–7.2
ERI	134.0	260.0	–27.4	0.922	0.949	132.0	29.9	314.0	292.9	21.7
PAU	135.0	210.7	–15.9	0.965	0.122	55.0	142.3	315.0	111.1	30.1
PER	140.0	283.1	38.4	0.924	0.948	113.0	150.0	140.0	332.7	27.4
KCG	141.0	163.6	71.7	0.703	0.972	33.9	205.5	141.0	342.6	–13.9
AXD	142.0	144.6	76.6	0.651	0.998	31.6	195.9	142.0	335.7	–8.3
NDA	148.0	206.9	7.0	0.953	0.102	20.7	327.5	148.0	117.2	–10.9
AUD	153.0	60.9	84.0	0.638	1.010	34.0	177.3	153.0	330.7	1.5
AGC	155.5	263.7	63.6	0.876	1.006	75.5	187.7	155.5	337.4	–7.5
AUR	158.4	292.4	15.7	0.952	0.670	148.3	108.1	158.4	47.4	30.0
NIA	162.0	198.0	3.6	0.852	0.258	5.3	308.1	162.0	110.2	–4.2
SPE	167.2	249.1	20.9	0.952	0.717	139.2	245.8	167.2	287.9	–36.6
NUE	168.0	258.5	–20.9	0.882	0.902	142.4	38.9	348.0	315.4	22.5
SLY_0	168.0	294.5	33.2	0.950	0.761	115.6	119.9	168.0	24.9	51.4
SLY_1	185.0	280.3	25.6	0.929	0.940	135.0	150.6	185.0	26.8	20.3
DSX	190.0	329.8	–12.1	0.865	0.145	25.7	212.6	10.0	219.9	–13.5
OCT	192.7	281.5	61.9	0.915	0.991	77.6	169.0	192.7	10.3	10.7
OCU	202.5	279.0	46.7	0.920	0.979	100.7	164.2	202.5	25.5	15.5
EGE	205.0	254.6	5.1	0.906	0.778	170.3	237.4	205.0	328.0	–8.1
STA_SE	205.0	194.9	–4.5	0.823	0.318	5.6	120.6	25.0	145.7	4.9
TCA	207.0	283.9	12.7	0.813	0.832	156.3	129.2	207.0	75.3	18.1
LMI	208.0	297.8	26.1	0.961	0.619	124.9	103.2	208.0	95.7	52.9
ORI	208.0	247.0	–7.7	0.932	0.579	163.7	82.4	28.0	305.9	16.1
LUM	214.7	284.2	36.9	0.973	0.918	115.2	147.8	214.7	49.7	28.8
SLD	221.4	264.9	53.6	0.725	0.985	88.1	190.5	221.4	41.8	–10.5
CTA	222.0	204.8	5.8	0.970	0.109	17.1	324.0	222.0	187.2	–9.9
KUM	223.0	267.7	29.5	0.911	0.987	129.4	187.7	223.0	38.1	–6.0
STA_SF	223.0	191.9	–4.7	0.821	0.365	5.3	113.7	43.0	156.8	4.9
AND	230.0	162.8	21.0	0.722	0.799	9.9	237.3	230.0	106.9	–8.3
NTA	230.0	191.4	2.4	0.820	0.370	2.7	293.0	230.0	163.0	–2.5
OER	231.0	185.1	–20.8	0.863	0.515	19.5	92.0	51.0	143.1	19.5
LEO	236.0	272.3	10.2	0.855	0.985	162.2	172.8	236.0	62.9	2.2
AMO	239.8	239.7	–20.0	0.956	0.471	133.3	94.0	59.8	323.9	46.6
NSU	242.0	245.0	42.9	0.919	0.808	99.2	231.5	242.0	50.6	–50.6
NOO	248.0	203.4	–8.1	0.990	0.121	23.6	139.8	68.0	210.3	15.0
TPY_0	249.4	261.7	–39.3	0.915	0.957	112.3	20.1	69.4	61.5	18.6
ORS	250.0	189.4	–4.9	0.801	0.411	5.0	108.1	70.0	178.2	4.8
DKD	250.9	242.8	61.6	0.888	0.928	72.7	209.0	250.9	80.2	–27.6
PSU	252.0	258.3	35.5	0.886	0.919	117.4	211.1	252.0	56.5	–27.3

Code	λ_O	λ–λ_O	β	e	q	i	ω	Ω	λ_Π	β_Π
DRV	253.4	286.5	14.0	0.930	0.782	153.6	124.8	253.4	125.6	21.4
HYD	255.0	230.9	–16.4	0.984	0.254	129.2	119.8	75.0	302.8	42.2
MON	259.0	202.3	–14.8	0.980	0.189	34.6	129.3	79.0	213.8	26.1
EHY	260.0	237.4	–14.5	0.958	0.360	142.4	107.3	80.0	328.6	35.6
XVI	260.0	292.4	–4.9	0.967	0.609	170.0	282.9	80.0	156.9	–9.8
GEM	262.0	208.0	10.5	0.888	0.146	22.7	324.1	262.0	228.3	–13.1
TPY_3	266.6	259.9	–32.4	0.872	0.928	122.8	28.6	86.6	70.2	23.7
COM	267.0	242.9	21.1	0.953	0.560	134.2	263.3	267.0	6.5	–45.4
DSV	270.0	293.5	14.8	0.952	0.609	149.2	102.6	270.0	165.4	29.9
URS	270.5	219.0	72.0	0.809	0.940	52.8	205.9	270.5	106.8	–20.3
SCC	275.0	189.6	–5.0	0.803	0.407	5.2	108.5	95.0	203.6	4.9
JLE	282.0	219.6	10.1	0.991	0.049	104.5	335.3	282.0	288.6	–23.8
QUA	283.3	276.7	63.7	0.625	0.979	70.7	171.9	283.3	100.6	7.7
AHY	285.0	207.8	–26.4	0.966	0.289	57.7	115.9	105.0	237.2	49.5
OLE	289.0	208.3	–6.4	0.971	0.075	23.5	151.0	109.0	262.1	11.1
NCC	290.0	189.4	2.3	0.820	0.400	2.4	288.5	290.0	218.5	–2.3
XCB	295.0	306.5	51.4	0.830	0.789	78.2	124.3	295.0	98.2	54.0
XUM	299.0	218.0	25.6	0.855	0.217	66.9	313.7	299.0	276.7	–41.7
ECV	301.0	255.9	–12.0	0.814	0.808	157.5	53.1	121.0	70.1	17.8
ACB	307.4	271.3	44.8	0.874	0.984	103.9	176.7	307.4	128.2	3.2
AAN	313.1	210.7	–17.7	0.960	0.143	57.2	138.2	133.1	287.3	34.1
XHE	351.3	246.8	70.4	0.679	0.979	60.3	195.6	351.3	179.2	–13.5
EVI	357.0	186.6	5.1	0.817	0.447	5.2	283.1	357.0	280.1	–5.0

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1		λ-λs	β	ε	xa	xb	ya	yb	λ-λs	β		Va	Vb		α	δ	Vg
2	λs	298.114	32.8935	23.4393	-0.0145	1.56178	-0.0134	1.44918				0.02559	54.1156				
3	90	0.25314	0.24719	0.35381	44.319	45.681	0.99999	0.30232	297.812	33.1403	0.65698	0.14098	0.74061	0.19036	10.7777	41.0701	56.4185
4																	

Figure 15 – Radiant drift estimation for CAN (#0411), for the explanation, see appendix 1.

Appendix 1: Calculation of radiant drift by using the regression data

It is useful for the readers to show an example of the EXCEL program to get the radiant coordinates from the radiant drift analysis. The Excel sheet is shown in *Figure 15*. First you must copy the regression parameters from *Table 3* in the input cells marked in red in *Figure 15*. The Excel formulae for the computed cells are as follows:

- A3 = 90
- B3 = $E$2*A3+$F$2
- C3 = $G$2*A3+$H$2
- D3 = SQRT(B3^2+C3^2)
- E3 = DEGREES(ATAN(C3/B3))
- F3 = IF(B3>0,90-E3,270-E3)
- G3 = (COS(RADIANS(D3)) SIN(RADIANS($C$2))*SIN(RADIANS(J3)))/COS(RADIANS($C$2))/COS(RADIANS(J3))
- H3 = DEGREES(ASIN(SIN(RADIANS(D3))*SIN(RADIANS(F3))/COS(RADIANS(J3))))

- I3 = IF(G3>0,$B$2-H3,IF($B$2-180+H3<0,$B$2+180+H3,$B$2-180+H3))
- J3 = DEGREES(ASIN(SIN(RADIANS($C$2))*COS(RADIANS(D3))+COS(RADIANS($C$2))*SIN(RADIANS(D3))*COS(RADIANS(F3))))
- K3 = SIN(RADIANS(J3))*COS(RADIANS($D$2))+COS(RADIANS(J3))*SIN(RADIANS(I3+A3))*SIN(RADIANS($D$2))
- L3 = SIN(RADIANS(J3))*SIN(RADIANS($D$2))+COS(RADIANS(J3))*SIN(RADIANS(I3+A3))*COS(RADIANS($D$2))
- M3 = COS(RADIANS(J3))*COS(RADIANS(I3+A3))
- N3 = L3/M3
- O3 = IF(L3>0,IF(N3>0,DEGREES(ATAN(N3)),DEGREES(ATAN(N3))+180),IF(N3>0,DEGREES(ATAN(N3))+180,DEGREES(ATAN(N3))+360))
- P3 = DEGREES(ASIN(K3))
- Q3 = $L$2*A3+$M$2

Table 3 – Origin for radiant drift calculation. Code is the same as in *Table 1 and 2*, but $\lambda_\odot$, λ–$\lambda_\odot$ and β are different from *Table2*. In the table below, $\lambda_\odot$, λ–$\lambda_\odot$ and β are the origins for the radiant drift calculation (see the first line of *Figure 16*). *xa* and *yb* are the coefficients and the constants in the linear regressions for the radiant drift defined as $x = xa * \lambda_\odot + xb$ and $y = ya * \lambda_\odot + yb$. for the radiant drift in *x* and *y*. *Va* and *Vb* are the coefficient and constant for the linear regression for the change in geocentric velocity in function of the solar longitude; $Vg = Va * \lambda_\odot + Vb$.

Code	$\lambda_\odot$	λ–$\lambda_\odot$	β	xa	xb	ya	yb	Va	Vb
AED	20.2	292.83	29.85	–0.1324	1.92	0.3387	–6.92	–0.0486	61.50
KSE	25.9	216.67	38.35	0.1666	–3.85	0.2559	–5.82	–0.2350	51.66
AVB	27	168.65	11.82	0.4496	–14.21	0.1783	–4.79	–0.1459	23.39
LYR	32.4	240.65	56.72	–0.4016	12.67	–0.2946	9.53	0.3495	35.43
HVI	40.6	165.58	–1.28	0.7416	–29.96	–0.0533	2.05	–0.2392	27.41
ETA	46.3	293.34	7.72	0.2420	–11.31	0.0627	–2.82	0.0791	61.91
ELY	50	257.20	64.11	0.2011	–9.70	0.3545	–17.27	–0.4497	66.20
NOC	52	329.65	12.32	0.3188	–17.62	0.2594	–14.56	0.0781	35.94
ARI	77	331.58	7.34	0.2829	–21.63	–0.0422	3.17	0.1537	29.14
JIP	94	252.76	37.51	–0.0695	6.73	–0.3205	30.46	1.2844	–61.86
PPS_0	94	282.38	16.40	0.1382	–14.23	0.1722	–16.83	0.0225	64.34
SZC	104	209.24	–11.26	0.0953	–9.23	–0.1579	17.30	–0.0511	45.01
JXA	107.3	284.80	–5.11	0.2112	–22.81	0.0844	–9.12	0.0418	63.91
PPS_1	109.6	281.88	19.57	0.2210	–23.71	–0.1459	13.94	0.1004	55.09
JPE	110	244.23	14.25	0.1030	–11.61	–0.0712	8.24	–0.0547	69.98
CAN	107	298.11	32.89	–0.0145	1.56	–0.0134	1.45	0.0256	54.12
NZC	108.09	208.79	13.30	0.1089	–11.56	0.0267	–3.63	–0.1267	52.01
ZCS	111.5	277.80	43.02	–0.2220	25.01	–0.2755	31.09	0.3677	15.47
GDR	124.6	167.94	73.05	0.4031	–50.55	0.1709	–21.29	–0.3667	73.22
SDA	126.8	208.78	–7.36	0.2894	–36.24	–0.1146	14.55	–0.1534	59.88
CAP	127.9	179.32	9.87	0.4127	–52.03	0.1168	–14.93	–0.1956	47.01
ERI	137.6	260.57	–27.33	–0.0135	2.34	0.0397	–5.41	0.0090	62.74
PAU	135.1	210.82	–16.73	0.1632	–21.90	–0.0197	3.49	0.0078	41.95
PER	137	283.28	38.35	–0.0097	1.47	–0.0647	9.08	0.0133	56.96
KCG	142	168.00	74.00	–0.3505	50.80	0.5750	–83.31	0.1739	–2.30
AXD	140	146.58	77.22	0.2201	–30.80	1.2161	–173.26	0.1610	–2.54
NDA	147	207.28	6.94	0.1106	–16.00	0.0460	–6.79	–0.0956	52.38
AUD	155	47.53	81.56	0.6911	–107.13	–1.3007	201.61	–0.1622	46.11
AGC	154.9	263.54	63.98	0.1228	–19.14	0.1199	–19.05	0.1128	26.23
AUR	158	292.56	15.86	0.0849	–13.28	0.1650	–26.25	–0.0197	68.50
NIA	165	198.02	4.34	0.0010	–0.09	0.0104	–2.36	–0.0151	32.33
SPE	167.1	248.75	20.79	0.0496	–8.62	–0.1884	31.57	0.0485	56.08
NUE	167.9	259.26	–20.67	0.0606	–9.49	0.2094	–35.46	0.0405	58.88
SLY_0	167	294.70	32.27	–0.2511	42.35	0.3118	–51.43	–0.2224	96.65
SLY_1	186	278.78	25.99	0.1699	–32.84	–0.0899	16.25	0.0989	47.11
DSX	189.2	329.82	–11.84	–0.0400	7.66	0.0809	–15.60	–0.1431	59.28
OCT	192.6	281.04	62.25	0.7074	–136.52	–0.7154	137.49	–0.5271	146.99
OCU	202	278.95	46.84	–0.4279	86.64	–0.0284	5.58	–0.2001	95.83
EGE	204.1	254.73	5.17	0.2304	–47.05	–0.0754	15.42	–0.0693	82.71
STA_SE	202.6	194.82	–4.45	0.2716	–55.79	–0.0273	5.49	–0.1127	51.35
TCA	206	284.80	12.39	0.2141	–43.47	0.2167	–44.55	0.0150	63.97
LMI	209.6	297.93	26.16	–0.0619	12.96	0.0724	–15.13	–0.0189	65.36
ORI	209	246.73	–7.62	0.2690	–56.27	0.0811	–16.95	–0.0750	81.65
LUM	214.6	284.57	37.05	–0.0025	0.85	–0.0187	3.83	–0.0272	66.64

Code	λ_O	$\lambda-\lambda_O$	β	xa	xb	ya	yb	Va	Vb
SLD	221	265.66	53.73	–0.2435	54.36	–0.0558	12.22	–0.1762	87.58
CTA	221	204.86	4.99	0.1459	–32.33	0.0115	–1.71	–0.1816	80.46
KUM	225	268.21	29.76	0.0489	–10.49	–0.0109	2.20	–0.2103	111.56
STA_SF	221.5	190.70	–5.00	0.4606	–103.89	–0.0682	15.51	–0.2770	89.50
AND	228.6	163.43	18.81	0.4817	–110.15	0.5235	–118.21	–0.2009	63.07
NTA	228	191.71	2.11	0.2650	–60.65	0.0151	–3.16	–0.1467	61.31
OER	231	184.40	–21.54	0.2965	–69.16	–0.2653	62.05	–0.1345	58.78
LEO	235.4	272.26	10.17	0.3138	–74.06	–0.1771	41.86	0.0669	54.27
AMO	239	239.65	–19.91	0.3379	–81.06	0.1829	–43.95	0.0333	53.63
NSU	241.6	244.91	42.93	–0.0529	12.74	–0.1442	34.84	0.5255	–72.69
NOO	246.1	203.71	–8.14	0.2890	–71.35	–0.0594	14.79	–0.1545	80.62
TPY_0	249.4	261.96	–39.09	0.1434	–35.59	0.3144	–78.63	0.4161	–44.09
ORS	247.6	190.26	–5.21	0.2198	–54.13	–0.0137	3.69	–0.0986	51.17
DKD	251.7	243.25	61.57	–0.2642	66.50	0.1677	–42.02	0.0042	42.32
PSU	252.6	258.42	34.92	–0.1819	45.96	–0.1485	37.99	0.1914	12.59
DRV	256	285.61	14.89	0.1120	–29.21	0.2576	–66.18	–0.0533	81.71
HYD	257.5	230.89	–16.81	0.1076	–27.45	–0.0019	0.89	–0.0720	77.18
MON	261	202.24	–15.05	0.2968	–76.90	–0.0894	23.37	–0.1885	89.86
EHY	260.7	237.33	–14.70	0.1444	–37.57	0.0630	–16.19	–0.0434	73.06
XVI	263.7	291.42	–5.15	0.2593	–68.34	–0.0716	18.91	0.0283	60.82
GEM	260	208.05	10.39	0.1009	–26.41	–0.0465	12.26	0.0942	9.07
TPY_3	272	260.34	–31.35	–0.0503	13.82	0.1946	–52.98	0.1269	28.61
COM	280	242.25	20.12	0.0471	–13.15	–0.0694	19.50	–0.0085	65.27
DSV	270	293.72	14.78	0.1250	–33.52	0.1076	–29.05	–0.0008	66.32
URS	271	218.48	72.07	0.1434	–38.93	0.6064	–164.11	–0.3422	125.62
SCC	284.1	188.71	–5.38	0.0427	–12.65	0.1279	–34.82	0.0256	19.83
JLE	281	219.61	10.35	0.3206	–90.41	–0.0500	13.87	0.0516	37.47
QUA	283.2	277.67	63.41	0.0331	–8.95	0.2554	–72.07	–0.1167	73.28
AHY	281.2	207.90	–26.55	0.2252	–64.05	–0.0128	3.79	–0.1206	77.71
OLE	290	207.98	–6.91	0.0666	–19.51	0.1395	–39.80	0.1756	–9.06
NCC	290	189.35	1.17	0.0724	–21.01	–0.0064	2.95	0.0342	17.69
XCB	295	305.32	51.10	–0.1280	37.01	0.0152	–4.15	0.0371	34.56
XUM	298	217.93	25.74	0.3447	–103.13	–0.1309	38.95	–0.2739	122.85
ECV	303.3	255.31	–11.50	0.1935	–58.77	0.1920	–58.26	0.0171	62.40
ACB	309.89	271.81	44.48	–0.3828	118.05	–0.4471	137.79	0.4245	–73.96
AAN	312	210.60	–17.67	0.0181	–5.80	–0.0760	23.80	0.0233	37.00
XHE	350	244.94	70.58	–0.3191	111.46	0.0334	–11.94	–0.2189	112.32
EVI	357	185.85	5.49	0.5153	–184.68	0.0696	–25.19	–0.2581	119.20

6 Explanation for the meteor shower datasheets

The first lines describe the initial data for the iterative search like given in *Table 3*, not the final results listed in *Tables 1 and 2*. For some meteor showers there is an extra comment added. The shower code in the shower database is mentioned with its number between parentheses.
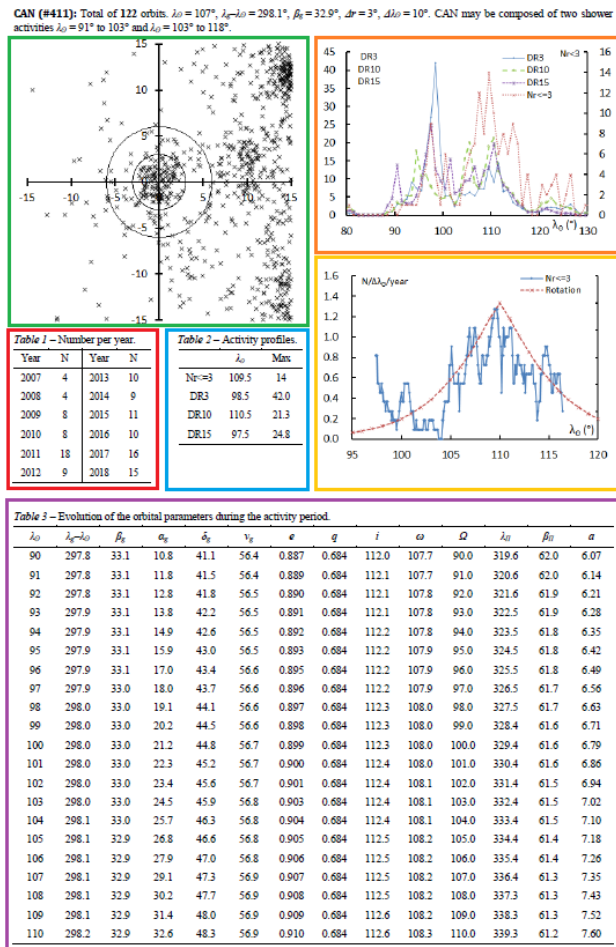
Figure 16 – An example of a meteor shower datasheet, in this case for the c Andromedids (CAN#0411).

- $\lambda_{\odot}$: the supposed time of maximum activity.
- $\Delta\lambda_{\odot}$ is the half width of the search period.
- λ_g–$\lambda_{\odot}$ and β_g are the initial geocentric Sun-centered ecliptic coordinates for the radiant (as given in *Table 3*).
- Δr is the discrimination radius in which the shower radiants are counted and distinguished from the sporadic background.
- The plot at left figure is the radiant plot, marked in green in *Figure 16*. This radiant distribution is plotted taking the radiant drift into account.
- The activity profiles derived by different standards are shown at right. The upper right profile (marked in orange in *Figure 16*) shows the activity according to the density ratios (*DR*); these are obtained using a

sliding mean for a 3 degrees bin in $\lambda_{\odot}$ moved with steps of 1 degree in $\lambda_{\odot}$. The graph for *Nr* <= 3 represents the number of radiants counted within 3 degrees from the estimated reference radiant position in steps of one degree in $\lambda_{\odot}$.

- The second figure at right (marked in yellow in *Figure 16*) displays the detail of the change in activity according to *Nr* <= 3; using a sliding mean with a time bin of one degree in $\lambda_{\odot}$ moved in steps of 0.1 degree. The curve(s) are drawn by the author according to the estimated variation of the activity (Koseki, 2012). We make the activity profiles using two different methods; one with the fixed perihelion (labelled by 'A' or 'B') and another one with the rotation of the perihelion (labelled as 'rotation'). The first one is based on the hypothesis that the axis of the perihelion and the size of the orbit remain fixed. The second method assumes that the orbital plane rotates around the axis of the ecliptic pole which is the usual explanation for radiant drift. We compute the orbital evolution in function of the solar longitude for the encounter condition with the Earth and, then we can obtain the estimated activity profiles from the difference between the orbital elements at the maximum and the computed elements in function of time expressed in solar longitude.
- *Table 1* (marked in red in *Figure 16*) lists for each year the number of radiants counted within 3 degrees from the estimated radiant center of the meteor shower.
- *Table 2* (marked in blue in *Figure 16*) represents the summary of the upper right figure. $\lambda_{\odot}$ stands for the center of the radiant count. However, $\lambda_{\odot} = 12.5°$ means the count id for $\lambda_{\odot}$ between 12 and 13. The decimal '.5' does not mean we have an accuracy at this decimal.
- *Table 3* (marked in purple in *Figure 16*) shows the evolution of the orbital parameters during the activity period.

The range of the considered period maybe wider or shorter than the activity period. The probable activity period is given in the final basic results (*Table 1*). The intervals in $\lambda_{\odot}$ are shorten for meteor showers with a short activity period or for showers with a sudden changing activity at the maximum, for instance AED and LYR are such cases.

References

Koseki M. (2012). "A simple model of spatial structure of meteoroid streams". *WGN, the Journal of the IMO*, **40**, 162–165.

Koseki M. (2020). "Confusions in IAUMDC Meteor Shower Database (SD)". *eMetN*, **5**, 93–111.

SonotaCo (2009). "A meteor shower catalog based on video observations in 2007-2008". *WGN, the Journal of the IMO*, **37**, 55–62.

Acknowledgment

AED (#0450): Total of **54** orbits. $\lambda_\odot = 20.2°$, $\lambda_g–\lambda_\odot = 292.8°$, $\beta_g = 29.9°$, $\Delta r = 3°$, $\Delta\lambda_\odot = 5°$.
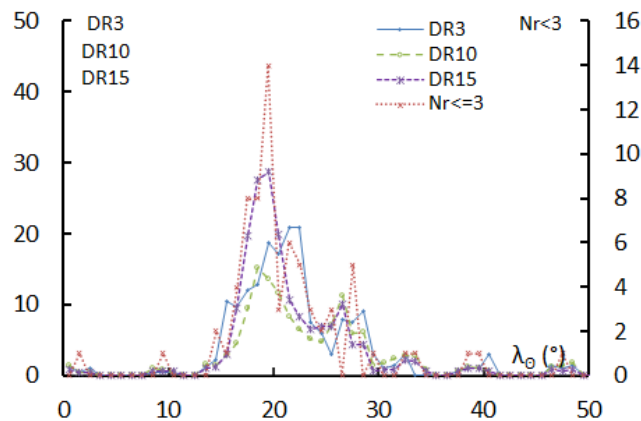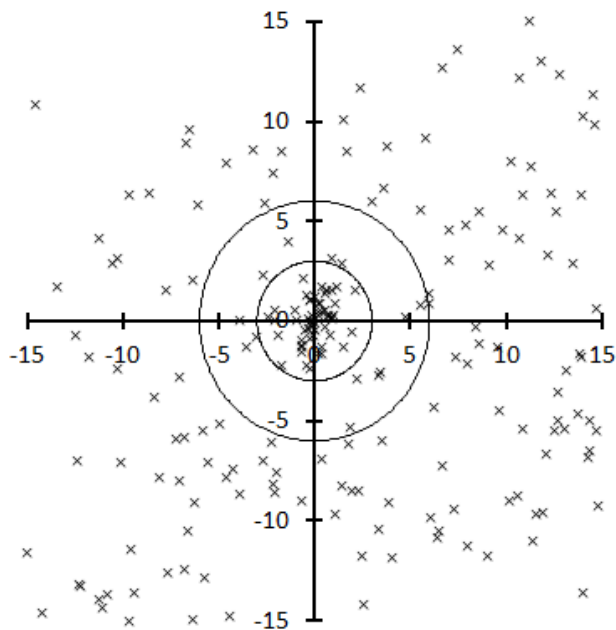
Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	5
2008	0	2014	10
2009	9	2015	2
2010	3	2016	5
2011	5	2017	4
2012	3	2018	7

Table 2 – Activity profiles.

	$\lambda_\odot$	Max
Nr<=3	19.5	14
DR3	21.5	21.0
DR10	18.5	15.2
DR15	19.5	28.7
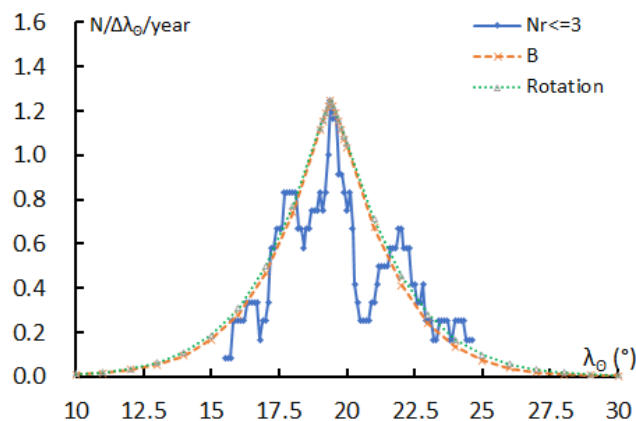
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g–\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
10	292.2	26.3	298.7	6.0	61.0	0.872	0.701	127.6	111.1	10.0	247.7	47.6	5.48
11	292.3	26.7	299.6	6.6	61.0	0.879	0.703	127.0	111.5	11.0	247.8	48.0	5.82
12	292.5	27.0	300.5	7.1	60.9	0.886	0.705	126.4	111.9	12.0	247.9	48.3	6.21
13	292.6	27.3	301.5	7.7	60.9	0.894	0.707	125.8	112.3	13.0	248.0	48.7	6.66
14	292.8	27.7	302.4	8.3	60.8	0.901	0.709	125.2	112.7	14.0	248.1	49.0	7.18
15	292.9	28.0	303.3	8.8	60.8	0.909	0.710	124.6	113.0	15.0	248.1	49.3	7.80
16	293.1	28.3	304.2	9.4	60.7	0.917	0.712	123.9	113.4	16.0	248.2	49.6	8.54
17	293.2	28.7	305.1	10.0	60.7	0.924	0.714	123.3	113.8	17.0	248.2	49.8	9.45
18	293.4	29.0	306.0	10.6	60.6	0.932	0.716	122.8	114.2	18.0	248.3	50.1	10.59
19	293.5	29.4	306.9	11.2	60.6	0.940	0.718	122.2	114.6	19.0	248.3	50.3	12.05
19.1	293.5	29.4	307.0	11.3	60.6	0.941	0.718	122.1	114.6	19.1	248.3	50.4	12.22
19.2	293.5	29.4	307.1	11.3	60.6	0.942	0.719	122.0	114.7	19.2	248.3	50.4	12.39
19.3	293.6	29.5	307.2	11.4	60.6	0.943	0.719	122.0	114.7	19.3	248.3	50.4	12.57
19.4	293.6	29.5	307.3	11.4	60.6	0.944	0.719	121.9	114.8	19.4	248.3	50.4	12.76
19.5	293.6	29.5	307.3	11.5	60.6	0.944	0.719	121.9	114.8	19.5	248.3	50.4	12.95
19.6	293.6	29.6	307.4	11.6	60.5	0.945	0.719	121.8	114.8	19.6	248.3	50.5	13.14
19.7	293.6	29.6	307.5	11.6	60.5	0.946	0.720	121.7	114.9	19.7	248.3	50.5	13.35
19.8	293.6	29.6	307.6	11.7	60.5	0.947	0.720	121.7	114.9	19.8	248.3	50.5	13.56
19.9	293.7	29.7	307.7	11.7	60.5	0.948	0.720	121.6	115.0	19.9	248.3	50.5	13.77

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
20	293.7	29.7	307.8	11.8	60.5	0.949	0.720	121.6	115.0	20.0	248.3	50.6	14.00
21	293.8	30.0	308.7	12.4	60.5	0.957	0.722	121.0	115.4	21.0	248.3	50.8	16.72
22	294.0	30.4	309.6	13.0	60.4	0.965	0.724	120.4	115.8	22.0	248.3	51.0	20.79
23	294.1	30.7	310.4	13.6	60.4	0.974	0.726	119.8	116.2	23.0	248.3	51.1	27.57
24	294.3	31.1	311.3	14.3	60.3	0.982	0.728	119.2	116.6	24.0	248.3	51.3	41.03
25	294.5	31.4	312.2	14.9	60.3	0.991	0.731	118.7	117.0	25.0	248.3	51.4	80.74
26	294.6	31.7	313.0	15.5	60.2	1.000	0.733	118.1	117.4	26.0	248.3	51.6	3203
27	294.8	32.1	313.9	16.2	60.2	1.009	0.735	117.5	117.8	27.0	248.2	51.7	−84.4
28	294.9	32.4	314.7	16.8	60.1	1.018	0.737	117.0	118.2	28.0	248.2	51.8	−41.5
29	295.1	32.7	315.6	17.5	60.1	1.027	0.739	116.4	118.6	29.0	248.2	51.9	−27.4
30	295.3	33.1	316.4	18.1	60.0	1.036	0.741	115.8	119.0	30.0	248.2	51.9	−20.4

KSE (#0027): Total of **33** orbits. $\lambda_\odot = 25.9°$, $\lambda_g–\lambda_\odot = 216.7°$, $\beta_g = 38.3°$, $\varDelta r = 3°$, $\varDelta\lambda_\odot = 5°$. This is another 'kappa Serpentids' activity, suggested from Harvard Super Schmidt observations.
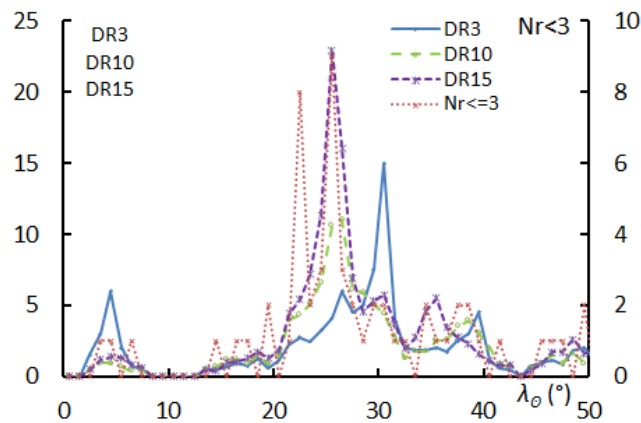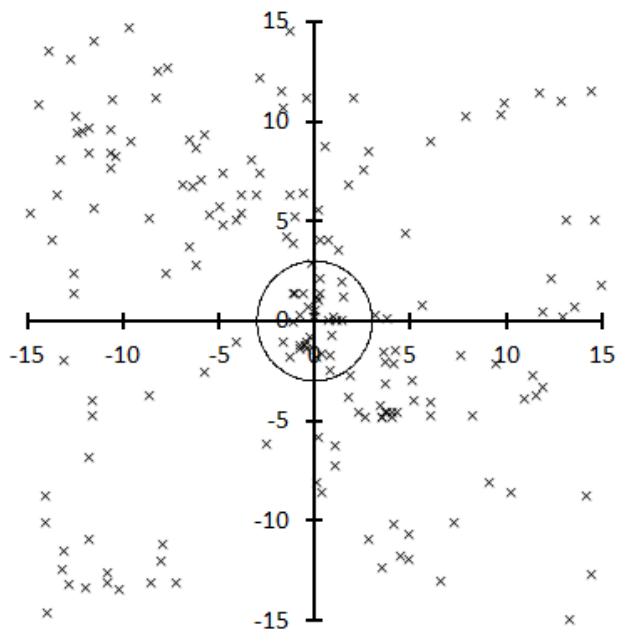
Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	2
2008	1	2014	4
2009	0	2015	2
2010	0	2016	7
2011	2	2017	7
2012	2	2018	5

Table 2 – Activity profiles.

	$\lambda_\odot$	Max
Nr<=3	25.5	9
DR3	29.5	7.5
DR10	26.5	11.0
DR15	25.5	23.0
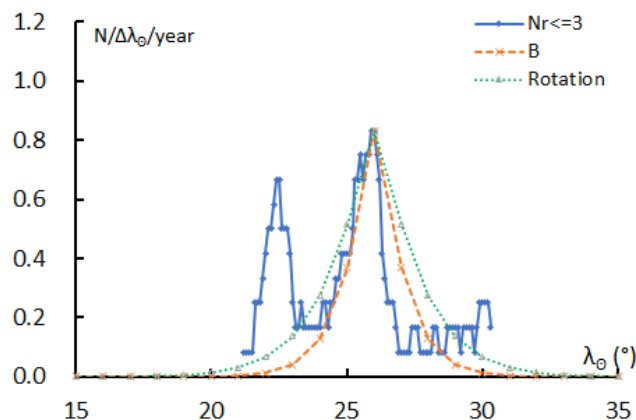
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g–\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
15	218.3	36.4	239.9	16.7	48.1	0.984	0.482	78.7	272.6	15.0	297.8	–78.4	29.51
16	218.1	36.6	240.6	16.8	47.9	0.981	0.486	78.1	272.2	16.0	296.5	–77.9	26.12
17	217.9	36.9	241.3	16.9	47.7	0.979	0.490	77.6	271.8	17.0	295.4	–77.4	23.46
18	217.7	37.1	242.0	17.0	47.4	0.977	0.494	77.0	271.4	18.0	294.4	–76.9	21.30
19	217.5	37.4	242.7	17.1	47.2	0.974	0.498	76.5	271.1	19.0	293.6	–76.4	19.53
20	217.3	37.6	243.4	17.2	47.0	0.972	0.502	75.9	270.7	20.0	292.8	–75.9	18.04
21	217.1	37.9	244.1	17.3	46.7	0.970	0.506	75.4	270.3	21.0	292.2	–75.4	16.78
22	216.9	38.2	244.8	17.4	46.5	0.967	0.510	74.9	269.9	22.0	291.7	–74.9	15.69
23	216.7	38.4	245.5	17.5	46.3	0.965	0.514	74.4	269.5	23.0	291.3	–74.4	14.74
24	216.5	38.7	246.2	17.6	46.0	0.963	0.518	73.8	269.1	24.0	290.9	–73.8	13.90
25	216.3	38.9	246.9	17.8	45.8	0.960	0.523	73.3	268.7	25.0	290.6	–73.3	13.17
26	216.0	39.2	247.5	17.9	45.6	0.958	0.527	72.8	268.4	26.0	290.4	–72.7	12.51
27	215.8	39.4	248.2	18.0	45.3	0.955	0.531	72.3	268.0	27.0	290.3	–72.2	11.92
28	215.6	39.7	248.9	18.2	45.1	0.953	0.535	71.8	267.6	28.0	290.2	–71.6	11.38
29	215.4	39.9	249.6	18.3	44.8	0.951	0.539	71.3	267.2	29.0	290.2	–71.1	10.90
30	215.2	40.2	250.2	18.4	44.6	0.948	0.543	70.8	266.8	30.0	290.2	–70.6	10.46
31	214.9	40.4	250.9	18.6	44.4	0.946	0.548	70.3	266.4	31.0	290.3	–70.0	10.05
32	214.7	40.7	251.5	18.7	44.1	0.943	0.552	69.8	265.9	32.0	290.4	–69.4	9.68
33	214.5	40.9	252.2	18.9	43.9	0.940	0.556	69.4	265.5	33.0	290.5	–68.9	9.34
34	214.3	41.2	252.8	19.0	43.7	0.938	0.560	68.9	265.1	34.0	290.7	–68.3	9.02
35	214.0	41.5	253.5	19.2	43.4	0.935	0.565	68.4	264.7	35.0	290.9	–67.8	8.73

AVB (#0021): Total of **81** orbits. $\lambda_\Theta = 27°$, $\lambda_g-\lambda_\Theta = 168.7°$, $\beta_g = 11.8°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$. This is a different activity than the 'alpha Virginids' of the Super Schmidt observations.
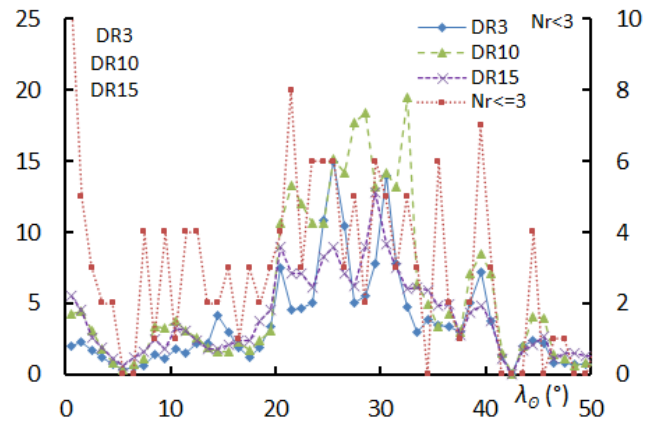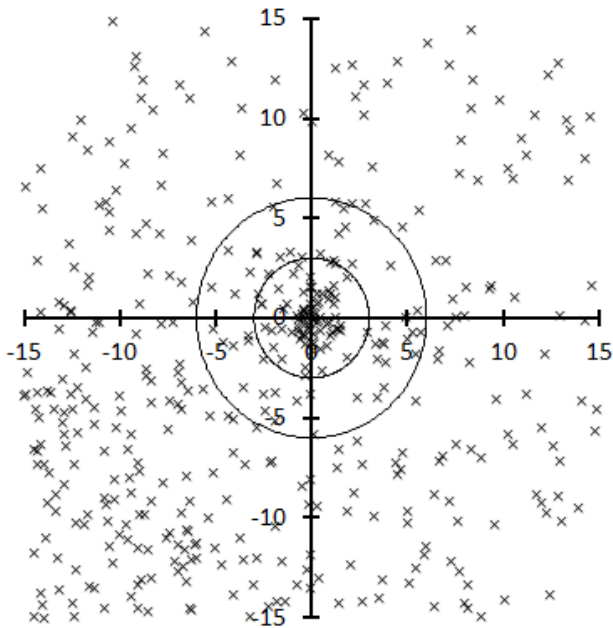
Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	7
2008	5	2014	11
2009	9	2015	5
2010	2	2016	6
2011	9	2017	13
2012	3	2018	10

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	21.5	8
DR3	25.5	15.0
DR10	32.5	19.5
DR15	29.5	12.8
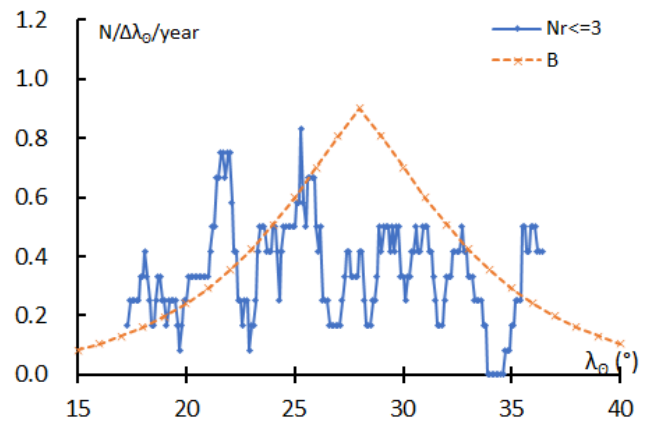
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
15	176.2	9.6	194.1	4.4	21.2	0.729	0.642	6.5	261.4	15.0	276.3	–6.4	2.37
16	175.8	9.8	194.6	4.4	21.1	0.728	0.649	6.5	260.5	16.0	276.4	–6.4	2.39
17	175.3	10.0	195.2	4.3	20.9	0.728	0.655	6.6	259.6	17.0	276.6	–6.5	2.41
18	174.9	10.2	195.8	4.3	20.8	0.727	0.662	6.6	258.8	18.0	276.7	–6.5	2.42
19	174.4	10.4	196.4	4.3	20.6	0.727	0.668	6.7	257.9	19.0	276.8	–6.5	2.44
20	174.0	10.5	196.9	4.2	20.5	0.726	0.675	6.7	257.1	20.0	277.0	–6.5	2.46
21	173.5	10.7	197.5	4.2	20.3	0.725	0.681	6.7	256.2	21.0	277.1	–6.6	2.48
22	173.1	10.9	198.1	4.1	20.2	0.725	0.687	6.8	255.4	22.0	277.3	–6.6	2.50
23	172.6	11.1	198.6	4.1	20.0	0.724	0.694	6.8	254.6	23.0	277.5	–6.6	2.51
24	172.1	11.3	199.2	4.1	19.9	0.724	0.700	6.9	253.8	24.0	277.6	–6.6	2.53
25	171.7	11.5	199.8	4.0	19.7	0.723	0.706	6.9	252.9	25.0	277.8	–6.6	2.55
26	171.2	11.7	200.3	4.0	19.6	0.722	0.712	6.9	252.1	26.0	278.0	–6.6	2.56
27	170.8	11.8	200.9	4.0	19.4	0.722	0.718	6.9	251.3	27.0	278.2	–6.6	2.58
28	170.3	12.0	201.4	3.9	19.3	0.721	0.724	7.0	250.5	28.0	278.4	–6.6	2.59
29	169.9	12.2	202.0	3.9	19.2	0.720	0.729	7.0	249.7	29.0	278.6	–6.6	2.61
30	169.4	12.4	202.6	3.9	19.0	0.719	0.735	7.0	249.0	30.0	278.8	–6.6	2.62
31	168.9	12.6	203.1	3.8	18.9	0.718	0.741	7.0	248.2	31.0	279.0	–6.5	2.63
32	168.5	12.7	203.7	3.8	18.7	0.718	0.746	7.1	247.4	32.0	279.3	–6.5	2.64
33	168.0	12.9	204.2	3.8	18.6	0.717	0.752	7.1	246.7	33.0	279.5	–6.5	2.65
34	167.5	13.1	204.8	3.8	18.4	0.716	0.757	7.1	245.9	34.0	279.7	–6.5	2.66

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
35	167.1	13.3	205.3	3.7	18.3	0.715	0.763	7.1	245.2	35.0	280.0	–6.5	2.67
36	166.6	13.4	205.9	3.7	18.1	0.714	0.768	7.1	244.4	36.0	280.3	–6.4	2.68
37	166.2	13.6	206.4	3.7	18.0	0.713	0.773	7.1	243.7	37.0	280.5	–6.4	2.69
38	165.7	13.8	207.0	3.6	17.8	0.711	0.779	7.2	243.0	38.0	280.8	–6.4	2.70
39	165.2	14.0	207.5	3.6	17.7	0.710	0.784	7.2	242.2	39.0	281.1	–6.3	2.70
40	164.8	14.1	208.1	3.6	17.6	0.709	0.789	7.2	241.5	40.0	281.3	–6.3	2.71

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
35	167.1	13.3	205.3	3.7	18.3	0.715	0.763	7.1	245.2	35.0	280.0	–6.5	2.67
36	166.6	13.4	205.9	3.7	18.1	0.714	0.768	7.1	244.4	36.0	280.3	–6.4	2.68
37	166.2	13.6	206.4	3.7	18.0	0.713	0.773	7.1	243.7	37.0	280.5	–6.4	2.69
38	165.7	13.8	207.0	3.6	17.8	0.711	0.779	7.2	243.0	38.0	280.8	–6.4	2.70
39	165.2	14.0	207.5	3.6	17.7	0.710	0.784	7.2	242.2	39.0	281.1	–6.3	2.70
40	164.8	14.1	208.1	3.6	17.6	0.709	0.789	7.2	241.5	40.0	281.3	–6.3	2.71

LYR (#0006): Total of **810** orbits. $\lambda_O = 32.4°$, $\lambda_g{-}\lambda_O = 240.6°$, $\beta_g = 56.7°$, $\Delta r = 2°$, $\Delta\lambda_O = 5°$.
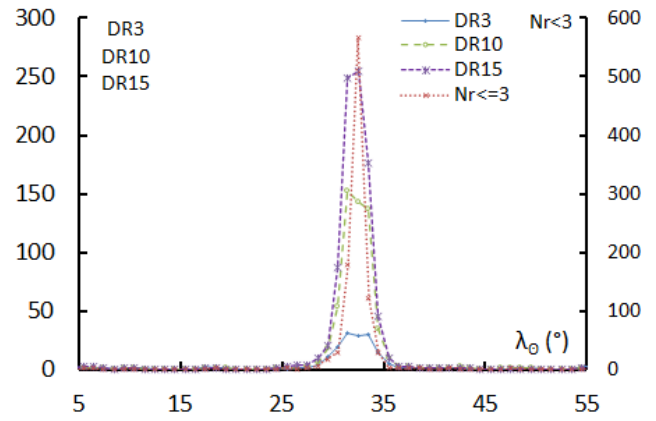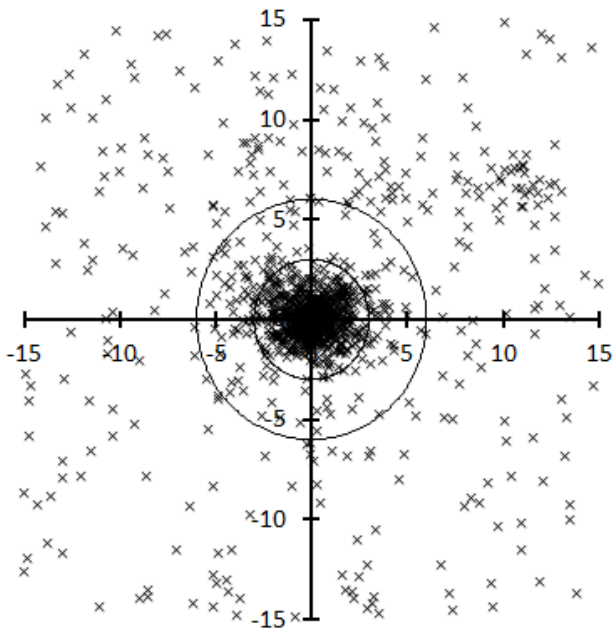

Table 1 – Number per year.

Year	N	Year	N
2007	3	2013	131
2008	57	2014	106
2009	72	2015	103
2010	15	2016	24
2011	27	2017	125
2012	9	2018	138

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	32.5	566
DR3	31.5	30.6
DR10	31.5	152.8
DR15	32.5	254.2
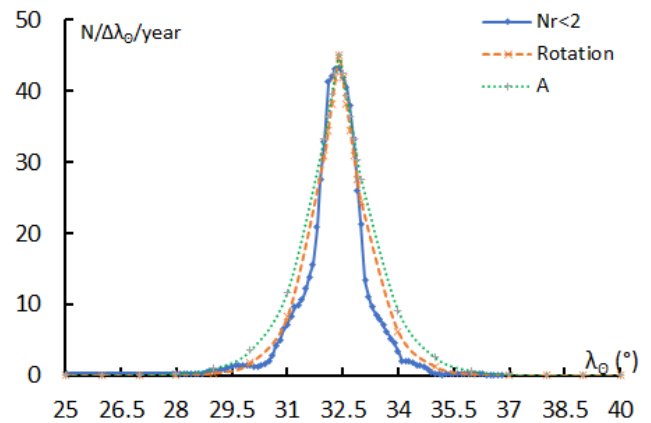
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g{-}\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
17	228.6	60.7	255.1	38.5	41.4	0.908	0.897	68.0	218.5	17.0	213.6	−35.3	9.78
18	229.5	60.5	256.2	38.1	41.7	0.911	0.898	68.8	218.3	18.0	214.0	−35.3	10.08
19	230.4	60.3	257.3	37.7	42.1	0.914	0.900	69.5	218.1	19.0	214.4	−35.3	10.41
20	231.3	60.0	258.4	37.3	42.4	0.916	0.901	70.3	217.9	20.0	214.7	−35.3	10.77
21	232.2	59.8	259.5	37.0	42.8	0.919	0.902	71.0	217.6	21.0	215.1	−35.3	11.15
22	233.1	59.5	260.6	36.6	43.1	0.922	0.904	71.8	217.4	22.0	215.4	−35.2	11.57
23	233.9	59.3	261.8	36.2	43.5	0.925	0.905	72.5	217.1	23.0	215.8	−35.1	12.02
24	234.7	59.0	262.9	35.9	43.8	0.928	0.907	73.3	216.8	24.0	216.2	−35.0	12.52
25	235.6	58.8	264.0	35.5	44.2	0.930	0.908	74.0	216.6	25.0	216.5	−34.9	13.07
26	236.4	58.5	265.1	35.2	44.5	0.933	0.910	74.8	216.3	26.0	216.9	−34.8	13.67
27	237.2	58.2	266.3	34.9	44.9	0.936	0.911	75.6	215.9	27.0	217.3	−34.6	14.35
28	238.0	58.0	267.4	34.6	45.2	0.940	0.913	76.3	215.6	28.0	217.6	−34.5	15.11
29	238.7	57.7	268.5	34.3	45.6	0.943	0.915	77.1	215.3	29.0	218.0	−34.3	15.97
30	239.5	57.4	269.7	34.0	45.9	0.946	0.916	77.8	215.0	30.0	218.4	−34.1	16.96
31	240.2	57.1	270.8	33.7	46.3	0.949	0.918	78.6	214.6	31.0	218.8	−33.8	18.09
32	241.0	56.8	271.9	33.4	46.6	0.953	0.920	79.4	214.3	32.0	219.2	−33.6	19.42
32.1	241.0	56.8	272.1	33.4	46.6	0.953	0.920	79.4	214.2	32.1	219.2	−33.6	19.57
32.2	241.1	56.8	272.2	33.3	46.7	0.953	0.920	79.5	214.2	32.2	219.2	−33.5	19.71
32.3	241.2	56.7	272.3	33.3	46.7	0.954	0.921	79.6	214.1	32.3	219.3	−33.5	19.86
32.4	241.3	56.7	272.4	33.3	46.8	0.954	0.921	79.7	214.1	32.4	219.3	−33.5	20.02
32.5	241.3	56.7	272.5	33.3	46.8	0.954	0.921	79.8	214.1	32.5	219.4	−33.5	20.17

Table 3 – Continued, evolution of the orbital parameters during the activity period.

| $\lambda_\odot$	$\lambda_g - \lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
32.6	241.4	56.6	272.6	33.2	46.8	0.955	0.921	79.8	214.0	32.6	219.4	–33.4	20.33
32.7	241.5	56.6	272.7	33.2	46.9	0.955	0.921	79.9	214.0	32.7	219.4	–33.4	20.49
32.8	241.6	56.6	272.9	33.2	46.9	0.955	0.922	80.0	214.0	32.8	219.5	–33.4	20.65
32.9	241.6	56.5	273.0	33.2	46.9	0.956	0.922	80.1	213.9	32.9	219.5	–33.3	20.82
33	241.7	56.5	273.1	33.1	47.0	0.956	0.922	80.1	213.9	33.0	219.6	–33.3	20.99
34	242.4	56.2	274.2	32.9	47.3	0.960	0.924	80.9	213.5	34.0	220.0	–33.0	22.88
35	243.1	55.9	275.4	32.6	47.7	0.963	0.926	81.7	213.1	35.0	220.4	–32.7	25.19
36	243.8	55.6	276.5	32.4	48.0	0.967	0.928	82.4	212.7	36.0	220.8	–32.4	28.10
37	244.5	55.3	277.7	32.2	48.4	0.971	0.930	83.2	212.3	37.0	221.3	–32.1	31.85
38	245.2	55.0	278.9	31.9	48.7	0.975	0.932	84.0	211.9	38.0	221.7	–31.7	36.89
39	245.8	54.6	280.0	31.7	49.1	0.979	0.934	84.8	211.5	39.0	222.2	–31.3	44.02
40	246.5	54.3	281.2	31.5	49.4	0.983	0.936	85.5	211.0	40.0	222.7	–30.9	54.88
41	247.1	54.0	282.3	31.3	49.8	0.987	0.938	86.3	210.6	41.0	223.2	–30.5	73.44
42	247.7	53.7	283.5	31.1	50.1	0.992	0.940	87.1	210.1	42.0	223.7	–30.1	112
43	248.4	53.3	284.7	31.0	50.5	0.996	0.942	87.8	209.6	43.0	224.2	–29.6	245
44	249.0	53.0	285.9	30.8	50.8	1.001	0.945	88.6	209.1	44.0	224.8	–29.1	–1136
45	249.6	52.6	287.0	30.6	51.2	1.006	0.947	89.4	208.7	45.0	225.3	–28.7	–1679
46	250.2	52.3	288.2	30.5	51.5	1.011	0.949	90.2	208.2	46.0	225.9	–28.2	–89.6
47	250.7	51.9	289.4	30.4	51.9	1.016	0.951	90.9	207.7	47.0	226.5	–27.6	–60.6

HVI (#0343): Total of **42** orbits. $\lambda_O = 40.6°$, $\lambda_g – \lambda_O = 165.6°$, $\beta_g = –1.3°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$. This shower has a distinct periodic nature.
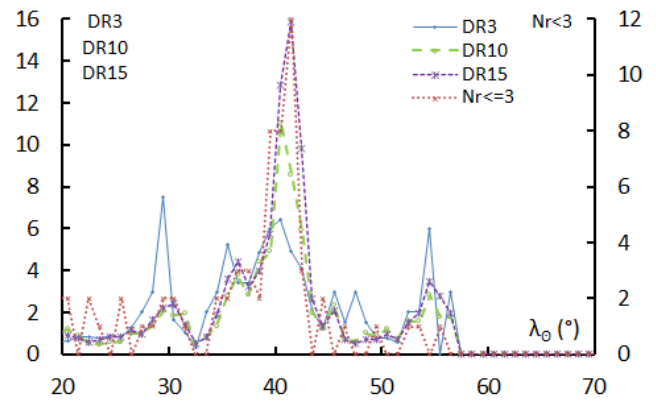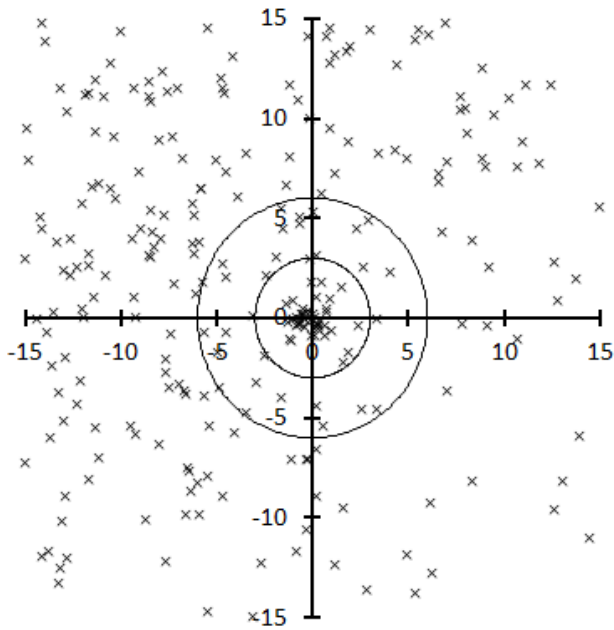
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	1
2008	13	2014	4
2009	14	2015	7
2010	0	2016	1
2011	0	2017	2
2012	0	2018	0

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	41.5	12
DR3	40.5	6.5
DR10	40.5	11.0
DR15	41.5	15.8
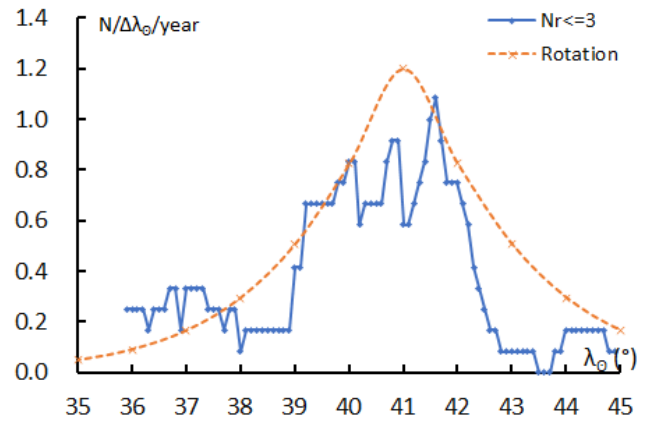
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
30	173.3	–0.8	201.2	–9.8	20.2	0.730	0.675	0.5	77.2	210.0	287.2	0.5	2.50
31	172.5	–0.9	201.5	–10.0	20.0	0.729	0.685	0.5	75.9	211.0	286.9	0.5	2.53
32	171.8	–0.9	201.7	–10.1	19.8	0.729	0.694	0.6	74.6	212.0	286.6	0.5	2.56
33	171.1	–1.0	201.9	–10.3	19.5	0.728	0.704	0.6	73.2	213.0	286.2	0.6	2.59
34	170.3	–1.0	202.1	–10.4	19.3	0.727	0.713	0.6	72.0	214.0	286.0	0.6	2.61
35	169.6	–1.1	202.4	–10.5	19.0	0.726	0.723	0.6	70.7	215.0	285.7	0.6	2.64
36	168.8	–1.2	202.6	–10.7	18.8	0.725	0.732	0.7	69.5	216.0	285.5	0.6	2.66
37	168.1	–1.2	202.8	–10.8	18.6	0.724	0.741	0.7	68.2	217.0	285.2	0.6	2.68
38	167.4	–1.3	203.0	–11.0	18.3	0.722	0.749	0.7	67.0	218.0	285.0	0.6	2.70
39	166.6	–1.3	203.3	–11.1	18.1	0.721	0.758	0.7	65.8	219.0	284.8	0.6	2.72
40	165.9	–1.4	203.5	–11.3	17.8	0.719	0.766	0.7	64.6	220.0	284.6	0.6	2.73
41	165.1	–1.4	203.7	–11.4	17.6	0.718	0.775	0.7	63.5	221.0	284.5	0.7	2.74
42	164.4	–1.5	203.9	–11.6	17.4	0.716	0.783	0.7	62.3	222.0	284.3	0.7	2.75
43	163.6	–1.5	204.2	–11.7	17.1	0.714	0.790	0.8	61.2	223.0	284.2	0.7	2.76
44	162.9	–1.6	204.4	–11.8	16.9	0.711	0.798	0.8	60.1	224.0	284.1	0.7	2.76
45	162.2	–1.6	204.6	–12.0	16.6	0.709	0.806	0.8	59.0	225.0	284.0	0.7	2.77
46	161.4	–1.7	204.8	–12.1	16.4	0.706	0.813	0.8	58.0	226.0	284.0	0.7	2.77
47	160.7	–1.7	205.1	–12.3	16.2	0.703	0.820	0.8	56.9	227.0	283.9	0.7	2.76
48	159.9	–1.8	205.3	–12.4	15.9	0.700	0.827	0.8	55.9	228.0	283.9	0.7	2.76
49	159.2	–1.8	205.5	–12.5	15.7	0.697	0.834	0.8	54.8	229.0	283.8	0.7	2.75
50	158.5	–1.9	205.7	–12.7	15.5	0.693	0.840	0.8	53.8	230.0	283.8	0.7	2.74

ETA (#0031): Total of **2351** orbits. $\lambda_O = 46.3°$, $\lambda_g-\lambda_O = 293.3°$, $\beta_g = 7.7°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$.
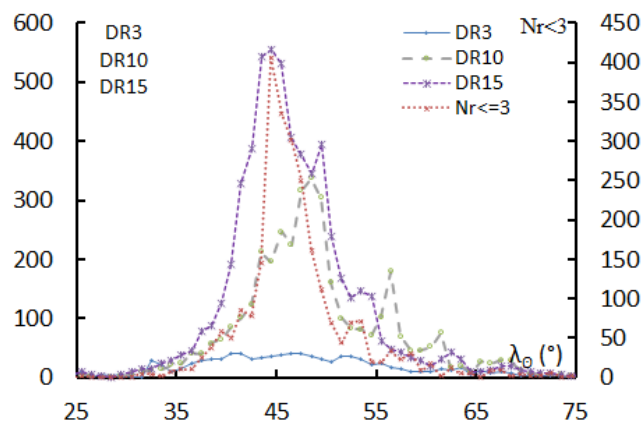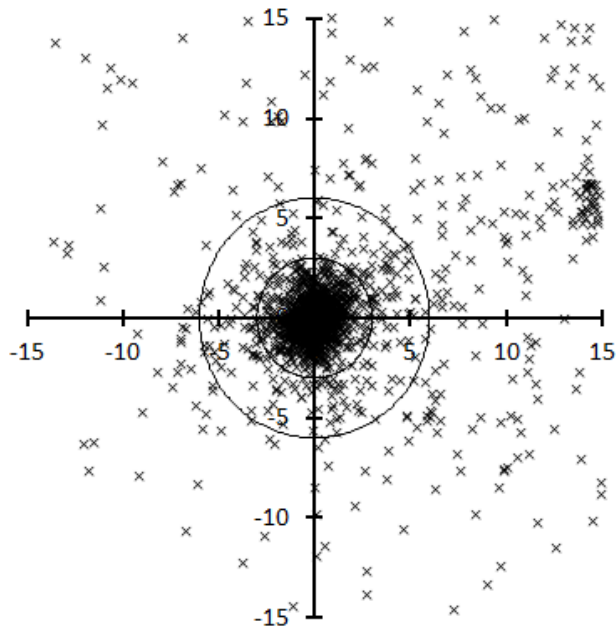
Table 1 – Number per year.

Year	N	Year	N
2007	84	2013	550
2008	104	2014	224
2009	189	2015	137
2010	198	2016	159
2011	120	2017	265
2012	166	2018	155

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	44.5	406
DR3	40.5	41.5
DR10	48.5	337.7
DR15	44.5	554.9
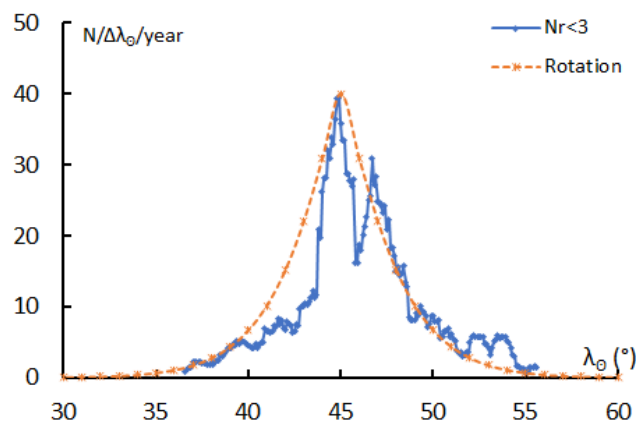
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
26	298.4	6.5	324.5	−7.3	64.0	0.960	0.429	164.6	80.3	26.0	306.0	15.2	10.80
27	298.2	6.6	325.2	−6.9	64.0	0.959	0.437	164.5	81.1	27.0	306.2	15.3	10.73
28	297.9	6.6	325.9	−6.6	64.1	0.958	0.444	164.5	81.9	28.0	306.4	15.4	10.67
29	297.7	6.7	326.6	−6.3	64.2	0.958	0.451	164.4	82.8	29.0	306.5	15.5	10.62
30	297.4	6.8	327.3	−6.0	64.3	0.957	0.458	164.4	83.6	30.0	306.7	15.5	10.58
31	297.2	6.8	328.0	−5.7	64.4	0.956	0.466	164.3	84.4	31.0	306.8	15.6	10.54
32	296.9	6.9	328.7	−5.4	64.4	0.955	0.473	164.3	85.2	32.0	307.0	15.7	10.51
33	296.7	6.9	329.4	−5.1	64.5	0.954	0.481	164.2	86.0	33.0	307.1	15.8	10.49
34	296.5	7.0	330.0	−4.7	64.6	0.953	0.488	164.2	86.9	34.0	307.3	15.8	10.47
35	296.2	7.1	330.7	−4.4	64.7	0.953	0.495	164.1	87.7	35.0	307.4	15.9	10.46
36	296.0	7.1	331.4	−4.1	64.8	0.952	0.503	164.1	88.5	36.0	307.5	15.9	10.46
37	295.7	7.2	332.1	−3.8	64.8	0.951	0.510	164.0	89.4	37.0	307.7	16.0	10.46
38	295.5	7.3	332.8	−3.4	64.9	0.951	0.518	164.0	90.2	38.0	307.8	16.0	10.48
39	295.2	7.3	333.4	−3.1	65.0	0.950	0.525	163.9	91.1	39.0	307.9	16.1	10.49
40	295.0	7.4	334.1	−2.8	65.1	0.949	0.533	163.8	91.9	40.0	308.0	16.1	10.52
41	294.7	7.5	334.8	−2.5	65.2	0.949	0.541	163.8	92.8	41.0	308.1	16.2	10.55
42	294.5	7.5	335.5	−2.1	65.2	0.948	0.548	163.7	93.6	42.0	308.2	16.2	10.59
43	294.3	7.6	336.2	−1.8	65.3	0.948	0.556	163.7	94.5	43.0	308.3	16.3	10.63
44	294.0	7.7	336.8	−1.5	65.4	0.947	0.564	163.6	95.3	44.0	308.4	16.3	10.69
45	293.8	7.7	337.5	−1.1	65.5	0.947	0.571	163.6	96.2	45.0	308.5	16.3	10.75
46	293.5	7.8	338.2	−0.8	65.6	0.947	0.579	163.5	97.1	46.0	308.6	16.3	10.82

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
47	293.3	7.8	338.8	–0.4	65.6	0.946	0.586	163.5	98.0	47.0	308.7	16.3	10.90
48	293.0	7.9	339.5	–0.1	65.7	0.946	0.594	163.4	98.8	48.0	308.8	16.4	10.99
49	292.8	8.0	340.2	0.2	65.8	0.946	0.602	163.4	99.7	49.0	308.9	16.4	11.08
50	292.5	8.0	340.9	0.6	65.9	0.946	0.609	163.3	100.6	50.0	308.9	16.4	11.19
51	292.3	8.1	341.5	0.9	65.9	0.945	0.617	163.3	101.5	51.0	309.0	16.4	11.31
52	292.1	8.2	342.2	1.3	66.0	0.945	0.625	163.2	102.4	52.0	309.1	16.4	11.44
53	291.8	8.2	342.9	1.6	66.1	0.945	0.632	163.2	103.3	53.0	309.1	16.3	11.58
54	291.6	8.3	343.5	1.9	66.2	0.945	0.640	163.1	104.2	54.0	309.2	16.3	11.73
55	291.3	8.3	344.2	2.3	66.3	0.946	0.648	163.1	105.1	55.0	309.3	16.3	11.89
56	291.1	8.4	344.9	2.6	66.3	0.946	0.655	163.1	106.0	56.0	309.3	16.3	12.07
57	290.8	8.5	345.5	3.0	66.4	0.946	0.663	163.0	106.9	57.0	309.4	16.2	12.27
58	290.6	8.5	346.2	3.3	66.5	0.946	0.670	163.0	107.8	58.0	309.4	16.2	12.48
59	290.3	8.6	346.8	3.7	66.6	0.947	0.678	162.9	108.7	59.0	309.5	16.2	12.72
60	290.1	8.6	347.5	4.0	66.7	0.947	0.685	162.9	109.6	60.0	309.5	16.1	12.97
61	289.9	8.7	348.2	4.4	66.7	0.948	0.693	162.8	110.6	61.0	309.6	16.1	13.24
62	289.6	8.8	348.8	4.7	66.8	0.948	0.700	162.8	111.5	62.0	309.6	16.0	13.54
63	289.4	8.8	349.5	5.1	66.9	0.949	0.708	162.7	112.4	63.0	309.6	15.9	13.87
64	289.1	8.9	350.2	5.4	67.0	0.950	0.715	162.7	113.3	64.0	309.7	15.9	14.22
65	288.9	8.9	350.8	5.8	67.1	0.951	0.722	162.6	114.3	65.0	309.7	15.8	14.61
66	288.6	9.0	351.5	6.1	67.1	0.951	0.730	162.6	115.2	66.0	309.7	15.7	15.04

ELY (#0145): Total of **128** orbits. $\lambda_{\Theta} = 50°$, $\lambda_g - \lambda_{\Theta} = 257.2°$, $\beta_g = 64.1°$, $\Delta r = 3°$, $\Delta\lambda_{\Theta} = 5°$.
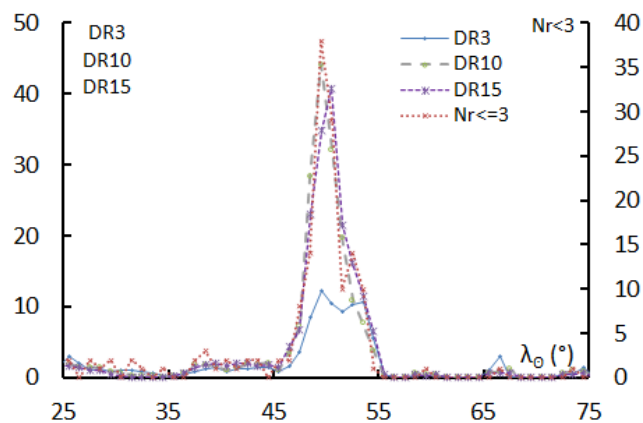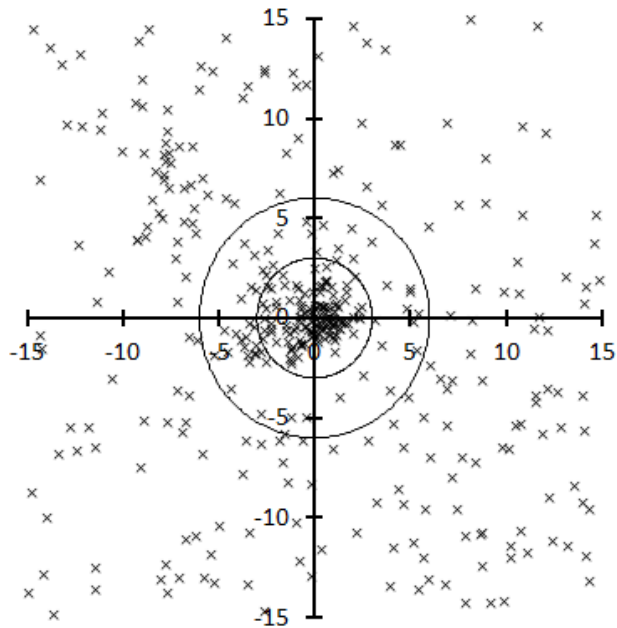
Table 1 – Number per year.

Year	N	Year	N
2007	5	2013	10
2008	4	2014	16
2009	14	2015	18
2010	14	2016	9
2011	4	2017	5
2012	9	2018	20

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	49.5	38
DR3	49.5	12.1
DR10	49.5	44.2
DR15	50.5	40.8
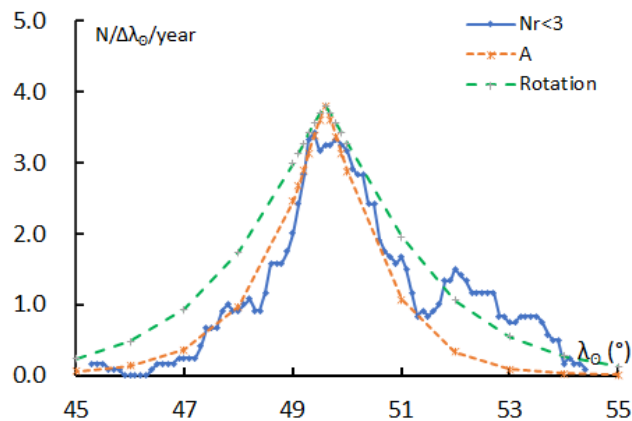
Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g-\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
40	260.6	61.0	288.7	39.5	48.2	1.081	1.001	81.3	188.7	40.0	221.3	−8.6	−12.3
41	260.2	61.3	288.9	39.9	47.8	1.066	1.001	80.5	189.0	41.0	222.5	−8.9	−15.1
42	259.8	61.7	289.2	40.4	47.3	1.052	1.001	79.8	189.3	42.0	223.7	−9.1	−19.4
43	259.4	62.1	289.4	40.8	46.9	1.037	1.001	79.1	189.6	43.0	224.8	−9.4	−26.9
44	259.0	62.4	289.6	41.2	46.4	1.023	1.001	78.4	189.9	44.0	226.0	−9.7	−43.8
45	258.6	62.8	289.8	41.6	46.0	1.009	1.001	77.7	190.1	45.0	227.2	−9.9	−115
46	258.2	63.1	290.0	42.1	45.5	0.995	1.001	77.0	190.4	46.0	228.4	−10.2	184
47	257.7	63.5	290.2	42.5	45.1	0.981	1.000	76.3	190.7	47.0	229.6	−10.4	51.71
48	257.3	63.9	290.3	42.9	44.6	0.967	1.000	75.5	191.0	48.0	230.8	−10.6	30.19
49	256.8	64.2	290.5	43.3	44.2	0.953	1.000	74.8	191.3	49.0	232.0	−10.9	21.38
49.1	256.8	64.2	290.5	43.3	44.1	0.952	1.000	74.8	191.3	49.1	232.1	−10.9	20.78
49.2	256.7	64.3	290.5	43.4	44.1	0.951	1.000	74.7	191.3	49.2	232.2	−10.9	20.21
49.3	256.7	64.3	290.5	43.4	44.0	0.949	1.000	74.6	191.4	49.3	232.4	−11.0	19.67
49.4	256.6	64.4	290.5	43.5	44.0	0.948	1.000	74.5	191.4	49.4	232.5	−11.0	19.16
49.5	256.6	64.4	290.6	43.5	43.9	0.946	1.000	74.5	191.4	49.5	232.6	−11.0	18.68
49.6	256.6	64.4	290.6	43.5	43.9	0.945	1.000	74.4	191.5	49.6	232.7	−11.0	18.22
49.7	256.5	64.5	290.6	43.6	43.9	0.944	1.000	74.3	191.5	49.7	232.8	−11.1	17.78
49.8	256.5	64.5	290.6	43.6	43.8	0.942	1.000	74.2	191.5	49.8	233.0	−11.1	17.37
49.9	256.4	64.5	290.6	43.7	43.8	0.941	1.000	74.2	191.5	49.9	233.1	−11.1	16.97
50	256.4	64.6	290.6	43.7	43.7	0.940	1.000	74.1	191.6	50.0	233.2	−11.1	16.59
51	255.9	64.9	290.8	44.1	43.3	0.926	1.000	73.4	191.9	51.0	234.4	−11.4	13.58

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
52	255.4	65.3	290.9	44.5	42.8	0.913	1.000	72.7	192.1	52.0	235.7	−11.6	11.51
53	254.9	65.6	291.0	44.9	42.4	0.900	0.999	71.9	192.4	53.0	236.9	−11.8	10.00
54	254.3	66.0	291.1	45.3	41.9	0.887	0.999	71.2	192.7	54.0	238.2	−12.0	8.85
55	253.8	66.3	291.1	45.7	41.5	0.874	0.999	70.5	193.0	55.0	239.4	−12.2	7.94
56	253.3	66.6	291.2	46.1	41.0	0.861	0.999	69.8	193.3	56.0	240.7	−12.5	7.21
57	252.7	67.0	291.2	46.4	40.6	0.849	0.999	69.0	193.6	57.0	241.9	−12.7	6.61
58	252.1	67.3	291.3	46.8	40.1	0.836	0.998	68.3	193.9	58.0	243.2	−12.9	6.10
59	251.5	67.7	291.3	47.2	39.7	0.824	0.998	67.6	194.1	59.0	244.5	−13.1	5.67
60	250.9	68.0	291.3	47.6	39.2	0.812	0.998	66.9	194.4	60.0	245.8	−13.2	5.30

NOC (#0152): Total of **15** orbits. $\lambda_\Theta = 52°$, $\lambda_g - \lambda_\Theta = 329.6°$, $\beta_g = 12.3°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$.
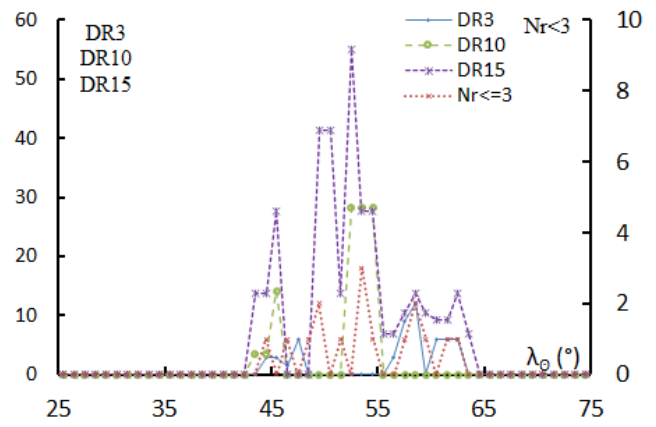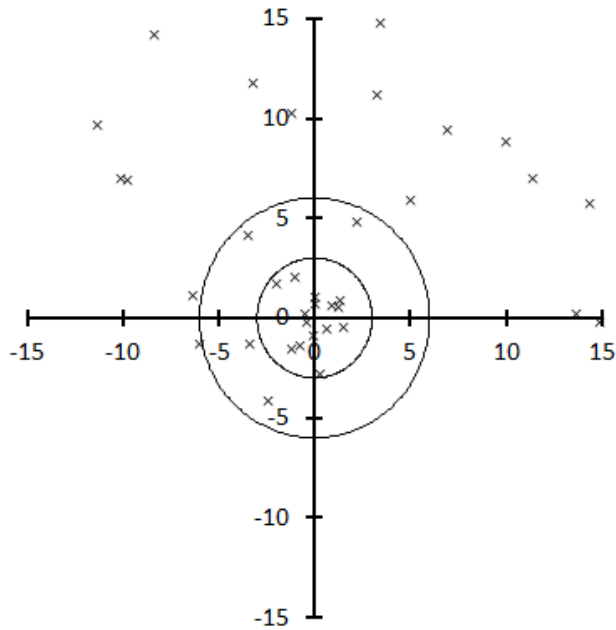
Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	1
2008	0	2014	1
2009	1	2015	2
2010	0	2016	2
2011	3	2017	2
2012	2	2018	0

Table 2 – Activity profiles.

|	λ_Θ	Max
Nr<=3	53.5	3
DR3	58.5	12.0
DR10	52.5	28.4
DR15	52.5	55.1
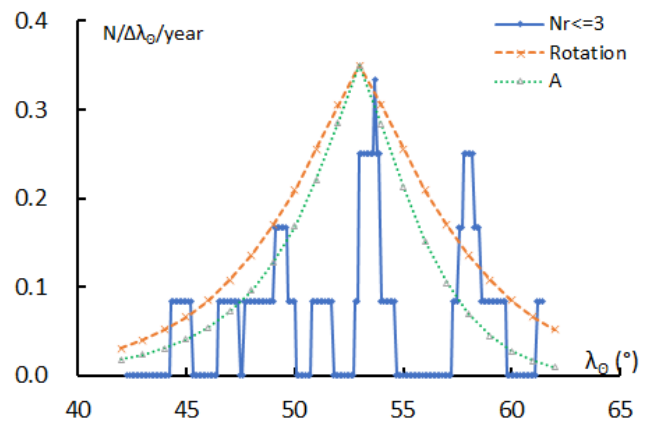
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
42	333.9	8.6	11.3	14.2	39.2	0.959	0.112	25.2	35.3	42.0	74.6	14.2	2.74
43	333.6	8.9	11.8	14.7	39.3	0.959	0.110	26.3	34.9	43.0	75.0	14.7	2.68
44	333.3	9.2	12.3	15.2	39.4	0.959	0.108	27.5	34.5	44.0	75.4	15.2	2.63
45	333.0	9.4	12.8	15.7	39.5	0.959	0.107	28.6	34.2	45.0	75.8	15.6	2.58
46	332.6	9.7	13.4	16.2	39.5	0.958	0.105	29.8	33.8	46.0	76.2	16.1	2.53
47	332.3	9.9	13.9	16.7	39.6	0.958	0.104	31.0	33.5	47.0	76.6	16.5	2.48
48	332.0	10.2	14.5	17.2	39.7	0.958	0.102	32.2	33.2	48.0	77.0	17.0	2.44
49	331.7	10.5	15.0	17.8	39.8	0.958	0.101	33.4	32.9	49.0	77.4	17.4	2.39
50	331.4	10.7	15.5	18.3	39.8	0.957	0.100	34.7	32.6	50.0	77.8	17.9	2.35
51	331.0	11.0	16.1	18.8	39.9	0.957	0.099	35.9	32.4	51.0	78.2	18.3	2.31
52	330.7	11.3	16.6	19.2	40.0	0.957	0.098	37.2	32.2	52.0	78.6	18.8	2.27
53	330.4	11.5	17.1	19.7	40.1	0.956	0.097	38.5	32.0	53.0	79.0	19.2	2.23
54	330.1	11.8	17.7	20.2	40.2	0.956	0.097	39.8	31.8	54.0	79.4	19.7	2.20
55	329.7	12.0	18.2	20.7	40.2	0.956	0.096	41.1	31.6	55.0	79.9	20.1	2.16
56	329.4	12.3	18.8	21.2	40.3	0.955	0.096	42.4	31.4	56.0	80.3	20.6	2.13
57	329.1	12.6	19.3	21.7	40.4	0.955	0.095	43.7	31.3	57.0	80.7	21.0	2.10
58	328.8	12.8	19.9	22.2	40.5	0.954	0.095	45.0	31.2	58.0	81.2	21.5	2.07
59	328.4	13.1	20.4	22.7	40.5	0.953	0.095	46.3	31.1	59.0	81.6	21.9	2.04
60	328.1	13.3	21.0	23.2	40.6	0.953	0.095	47.7	31.0	60.0	82.0	22.4	2.01
61	327.8	13.6	21.5	23.7	40.7	0.952	0.095	49.0	30.9	61.0	82.5	22.8	1.98
62	327.4	13.8	22.1	24.2	40.8	0.951	0.095	50.3	30.9	62.0	82.9	23.3	1.95

ARI (#0171): Total of **40** orbits. $\lambda_\Theta = 77°$, $\lambda_g–\lambda_\Theta = 331.6°$, $\beta_g = 7.3°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$.
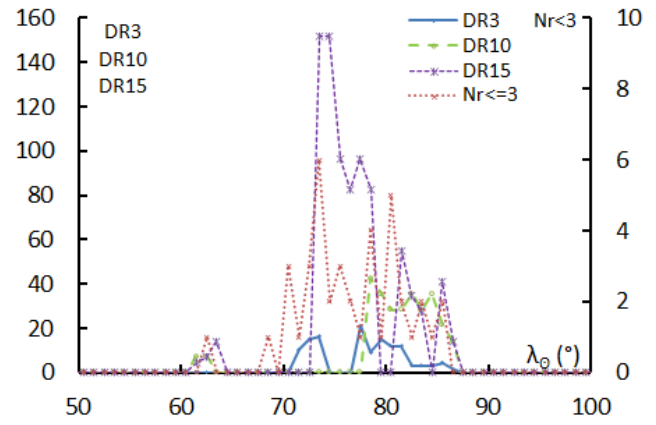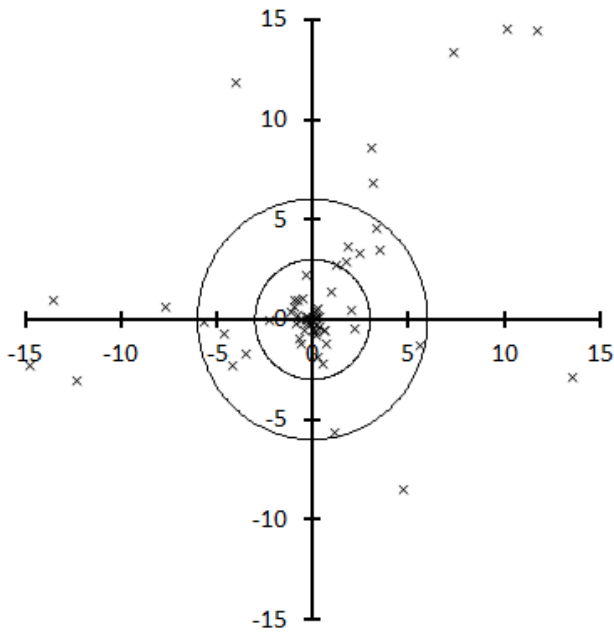
Table 1 – Number per year.

Year	N	Year	N
2007	2	2013	2
2008	2	2014	3
2009	2	2015	5
2010	5	2016	7
2011	1	2017	7
2012	1	2018	3

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	73.5	6
DR3	77.5	21.0
DR10	78.5	42.5
DR15	73.5	151.6
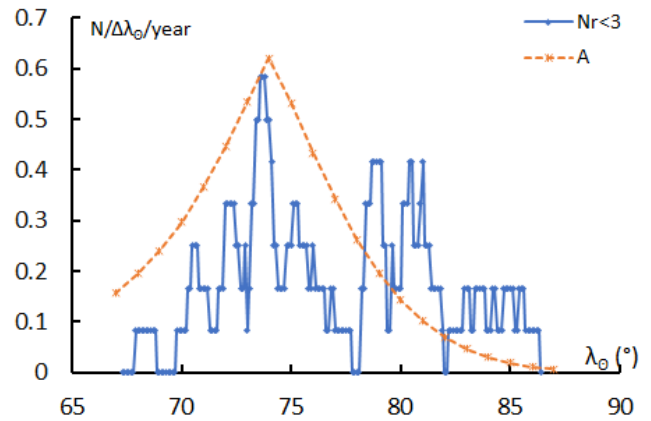
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g–\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
67	334.3	7.7	36.3	22.5	39.4	0.963	0.108	23.0	34.7	67.0	99.5	12.8	2.90
68	334.0	7.6	37.0	22.7	39.6	0.964	0.104	23.4	34.0	68.0	99.8	12.8	2.88
69	333.7	7.6	37.8	22.9	39.8	0.965	0.100	23.8	33.4	69.0	100.1	12.8	2.86
70	333.4	7.6	38.5	23.1	39.9	0.966	0.097	24.2	32.7	70.0	100.4	12.8	2.83
71	333.1	7.5	39.3	23.2	40.1	0.967	0.093	24.6	32.1	71.0	100.7	12.8	2.81
72	332.9	7.5	40.0	23.4	40.2	0.968	0.090	25.1	31.4	72.0	101.0	12.8	2.79
73	332.6	7.4	40.8	23.6	40.4	0.969	0.086	25.6	30.8	73.0	101.3	12.8	2.77
73.1	332.5	7.4	40.8	23.6	40.4	0.969	0.086	25.6	30.7	73.1	101.3	12.8	2.76
73.2	332.5	7.4	40.9	23.6	40.4	0.969	0.086	25.7	30.7	73.2	101.3	12.8	2.76
73.3	332.5	7.4	41.0	23.7	40.4	0.969	0.085	25.7	30.6	73.3	101.3	12.8	2.76
73.4	332.5	7.4	41.1	23.7	40.4	0.969	0.085	25.8	30.5	73.4	101.4	12.8	2.76
73.5	332.4	7.4	41.1	23.7	40.4	0.969	0.085	25.8	30.5	73.5	101.4	12.8	2.75
73.6	332.4	7.4	41.2	23.7	40.5	0.969	0.084	25.9	30.4	73.6	101.4	12.7	2.75
73.7	332.4	7.4	41.3	23.7	40.5	0.969	0.084	25.9	30.3	73.7	101.5	12.7	2.75
73.8	332.3	7.4	41.4	23.7	40.5	0.970	0.084	26.0	30.3	73.8	101.5	12.7	2.75
73.9	332.3	7.4	41.4	23.8	40.5	0.970	0.083	26.0	30.2	73.9	101.5	12.7	2.75
74	332.3	7.4	41.5	23.8	40.5	0.970	0.083	26.1	30.1	74.0	101.5	12.7	2.74
75	332.0	7.40	42.3	23.9	40.7	0.971	0.080	26.6	29.5	75.0	101.8	12.7	2.72
76	331.7	7.3	43.0	24.1	40.8	0.972	0.077	27.1	28.9	76.0	102.1	12.7	2.70
77	331.4	7.3	43.8	24.3	41.0	0.973	0.074	27.6	28.2	77.0	102.4	12.7	2.68
78	331.1	7.2	44.5	24.4	41.1	0.973	0.071	28.2	27.6	78.0	102.7	12.6	2.66

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g–\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
79	330.9	7.2	45.3	24.6	41.3	0.974	0.068	28.8	27.0	79.0	103.0	12.6	2.64
80	330.6	7.1	46.1	24.8	41.4	0.975	0.065	29.4	26.3	80.0	103.3	12.6	2.62
81	330.3	7.1	46.8	24.9	41.6	0.976	0.062	30.1	25.7	81.0	103.6	12.6	2.60
82	330.0	7.1	47.6	25.1	41.8	0.977	0.059	30.8	25.1	82.0	103.9	12.5	2.58
83	329.7	7.0	48.4	25.2	41.9	0.978	0.056	31.5	24.5	83.0	104.2	12.5	2.56
84	329.4	7.0	49.1	25.4	42.1	0.979	0.054	32.2	23.9	84.0	104.5	12.5	2.54
85	329.1	6.9	49.9	25.5	42.2	0.980	0.051	33.0	23.3	85.0	104.8	12.4	2.52
86	328.9	6.9	50.7	25.6	42.4	0.980	0.049	33.9	22.6	86.0	105.1	12.4	2.50
87	328.6	6.8	51.4	25.8	42.5	0.981	0.046	34.7	22.1	87.0	105.4	12.4	2.48

JIP (#0431): Total of **30** orbits. $\lambda_{\mathcal{O}} = 94°$, $\lambda_g - \lambda_{\mathcal{O}} = 252.8°$, $\beta_g = 37.5°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 5°$.
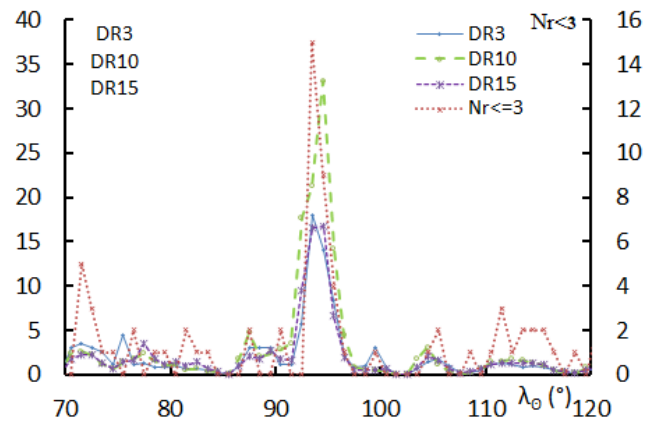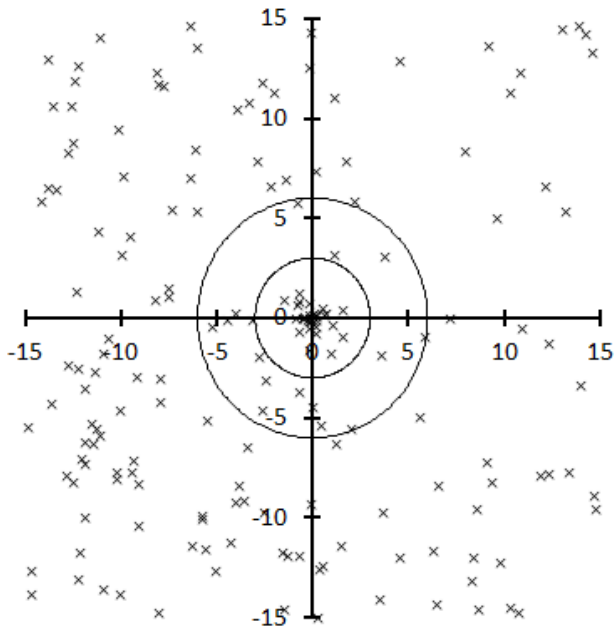
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	0
2008	0	2014	7
2009	10	2015	1
2010	3	2016	1
2011	2	2017	1
2012	1	2018	4

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	93.5	15
DR3	93.5	18.0
DR10	94.5	33.1
DR15	94.5	16.8
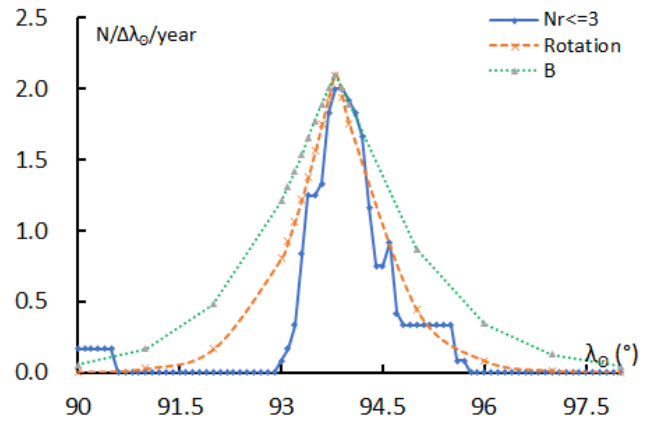
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\mathcal{O}}$	$\lambda_g - \lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
89	252.1	39.4	326.5	28.9	52.5	0.615	0.863	105.5	232.9	89.0	249.6	−50.2	2.24
90	252.1	39.1	327.6	29.0	53.7	0.679	0.873	107.0	229.4	90.0	251.2	−46.5	2.72
91	252.2	38.8	328.6	29.0	55.0	0.748	0.882	108.5	226.4	91.0	252.6	−43.3	3.49
92	252.3	38.5	329.6	29.1	56.3	0.821	0.889	109.9	223.8	92.0	253.9	−40.6	4.97
93	252.4	38.2	330.7	29.2	57.6	0.899	0.896	111.3	221.5	93.0	255.2	−38.1	8.83
93.1	252.4	38.1	330.8	29.2	57.7	0.907	0.896	111.4	221.3	93.1	255.3	−37.9	9.59
93.2	252.4	38.1	330.9	29.2	57.8	0.915	0.897	111.6	221.1	93.2	255.4	−37.7	10.50
93.3	252.5	38.1	331.0	29.2	58.0	0.923	0.898	111.7	220.9	93.3	255.6	−37.4	11.60
93.4	252.5	38.0	331.1	29.3	58.1	0.931	0.898	111.8	220.7	93.4	255.7	−37.2	12.97
93.5	252.5	38.0	331.2	29.3	58.2	0.939	0.899	112.0	220.5	93.5	255.8	−37.0	14.71
93.6	252.5	38.0	331.3	29.3	58.4	0.947	0.899	112.1	220.3	93.6	255.9	−36.8	16.99
93.7	252.5	37.9	331.4	29.3	58.5	0.955	0.900	112.2	220.1	93.7	256.0	−36.6	20.13
93.8	252.5	37.9	331.5	29.3	58.6	0.964	0.900	112.4	219.9	93.8	256.2	−36.4	24.71
93.9	252.5	37.9	331.6	29.3	58.7	0.972	0.901	112.5	219.7	93.9	256.3	−36.2	32.02
94	252.5	37.8	331.7	29.3	58.9	0.980	0.902	112.6	219.5	94.0	256.4	−36.0	45.55
95	252.6	37.5	332.8	29.4	60.2	1.066	0.907	113.9	217.8	95.0	257.6	−34.1	−13.8
96	252.7	37.2	333.8	29.5	61.4	1.155	0.911	115.1	216.2	96.0	258.7	−32.4	−5.87
97	252.8	36.9	334.9	29.6	62.7	1.248	0.915	116.3	214.9	97.0	259.8	−30.8	−3.69
98	252.9	36.6	335.9	29.7	64.0	1.345	0.919	117.5	213.6	98.0	260.9	−29.4	−2.66
99	252.9	36.2	337.0	29.8	65.3	1.445	0.922	118.6	212.5	99.0	262.0	−28.2	−2.07

PPS_0 (#0372): Total of **113** orbits. $\lambda_O = 94°$, $\lambda_g–\lambda_O = 282.4°$, $\beta_g = 16.4°$, $\Delta r = 3°$, $\Delta\lambda_O = 7°$. The listed maxima λ_O of PPS in the shower database are widely dispersed from $\lambda_O = 94°$ to 109.6°. We divide it into two components in *Tables 1 to 3*.
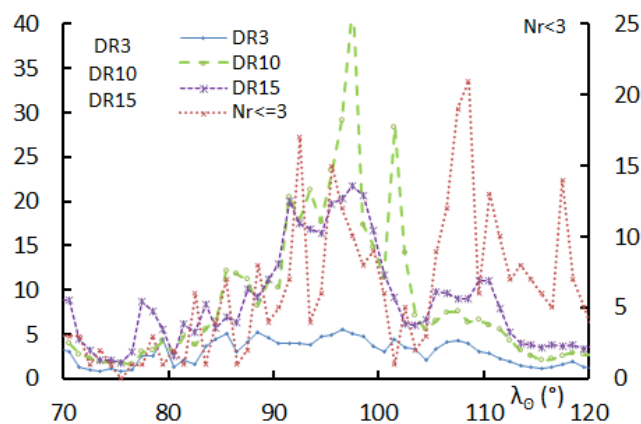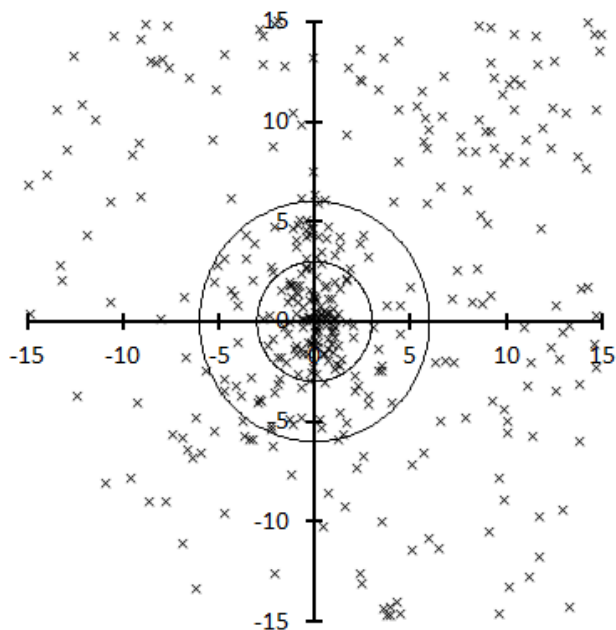
Table 1 – Number per year.

Year	N	Year	N
2007	3	2013	6
2008	2	2014	17
2009	15	2015	11
2010	8	2016	2
2011	9	2017	7
2012	17	2018	16

Table 2 – Activity profiles.

|	λ_O	Max
Nr<=3	92.5	17
DR3	96.5	5.5
DR10	97.5	42.5
DR15	97.5	21.8
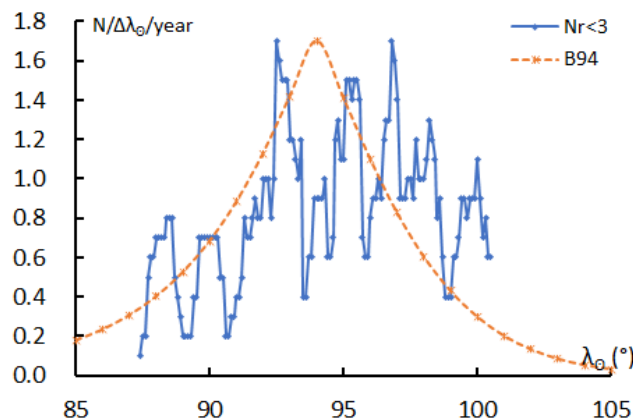
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
77	286.1	12.8	357.6	12.9	66.1	0.871	0.793	155.8	122.0	77.0	312.6	20.3	6.13
78	285.9	13.0	358.3	13.4	66.1	0.872	0.797	155.5	122.6	78.0	312.9	20.4	6.21
79	285.8	13.1	359.1	13.9	66.1	0.873	0.802	155.3	123.3	79.0	313.1	20.5	6.29
80	285.6	13.3	359.8	14.4	66.1	0.874	0.806	155.0	123.9	80.0	313.4	20.5	6.38
81	285.5	13.5	0.5	14.9	66.2	0.875	0.811	154.7	124.6	81.0	313.7	20.6	6.47
82	285.4	13.7	1.2	15.4	66.2	0.876	0.815	154.4	125.2	82.0	313.9	20.6	6.57
83	285.2	13.8	1.9	15.9	66.2	0.877	0.819	154.2	125.9	83.0	314.2	20.7	6.67
84	285.1	14.0	2.6	16.4	66.2	0.878	0.824	153.9	126.5	84.0	314.5	20.7	6.78
85	284.9	14.2	3.4	16.9	66.3	0.880	0.828	153.6	127.2	85.0	314.7	20.7	6.89
86	284.8	14.4	4.1	17.4	66.3	0.881	0.832	153.4	127.9	86.0	315.0	20.7	7.01
87	284.7	14.5	4.8	17.9	66.3	0.883	0.836	153.1	128.5	87.0	315.3	20.7	7.13
88	284.5	14.7	5.5	18.4	66.3	0.884	0.840	152.8	129.2	88.0	315.5	20.7	7.27
89	284.4	14.9	6.3	18.9	66.3	0.886	0.845	152.6	129.8	89.0	315.8	20.7	7.41
90	284.2	15.1	7.0	19.4	66.4	0.888	0.849	152.3	130.5	90.0	316.1	20.7	7.56
91	284.1	15.2	7.7	19.9	66.4	0.889	0.853	152.0	131.1	91.0	316.3	20.7	7.71
92	284.0	15.4	8.4	20.4	66.4	0.891	0.857	151.8	131.8	92.0	316.6	20.7	7.88
93	283.8	15.6	9.2	20.9	66.4	0.893	0.861	151.5	132.4	93.0	316.9	20.6	8.06
94	283.7	15.7	9.9	21.4	66.5	0.895	0.864	151.2	133.1	94.0	317.1	20.6	8.25
95	283.5	15.9	10.6	21.9	66.5	0.834	0.856	29.8	130.7	95.0	229.7	22.1	5.15
96	283.4	16.1	11.4	22.4	66.5	0.899	0.872	150.7	134.4	96.0	317.7	20.5	8.66
97	283.2	16.3	12.1	22.9	66.5	0.902	0.876	150.5	135.1	97.0	318.0	20.4	8.89

Table 3 – Continued, evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g-\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
98	283.1	16.4	12.9	23.4	66.6	0.904	0.880	150.2	135.7	98.0	318.2	20.3	9.14
99	283.0	16.6	13.6	23.9	66.6	0.906	0.883	149.9	136.4	99.0	318.5	20.2	9.40
100	282.8	16.8	14.4	24.4	66.6	0.908	0.887	149.7	137.0	100.0	318.8	20.1	9.69
101	282.7	17.0	15.1	24.9	66.6	0.911	0.890	149.4	137.7	101.0	319.1	20.0	10.00
102	282.5	17.1	15.9	25.3	66.6	0.913	0.894	149.2	138.3	102.0	319.4	19.9	10.33
103	282.4	17.3	16.6	25.8	66.7	0.916	0.897	148.9	139.0	103.0	319.7	19.8	10.69
104	282.2	17.5	17.4	26.3	66.7	0.919	0.901	148.7	139.6	104.0	320.0	19.7	11.09
105	282.1	17.6	18.1	26.8	66.7	0.922	0.904	148.4	140.3	105.0	320.3	19.6	11.52

SZC (#0165): Total of **51** orbits. $\lambda_O = 104°$, $\lambda_g–\lambda_O = 209.2°$, $\beta_g = –11.3°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$. The listed maximum $\lambda_O$ of SZC in the SD are widely dispersed $\lambda_O = 80°$ to $106.2°$. We cannot trace the activity around $\lambda_O = 80°$ and one around $\lambda_O = 104°$ is the same as MIC (#370 Microscopiids). We should call this activity MIC instead of SZC.
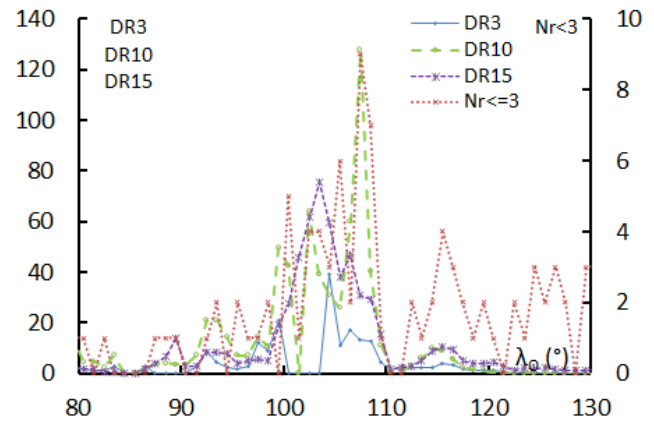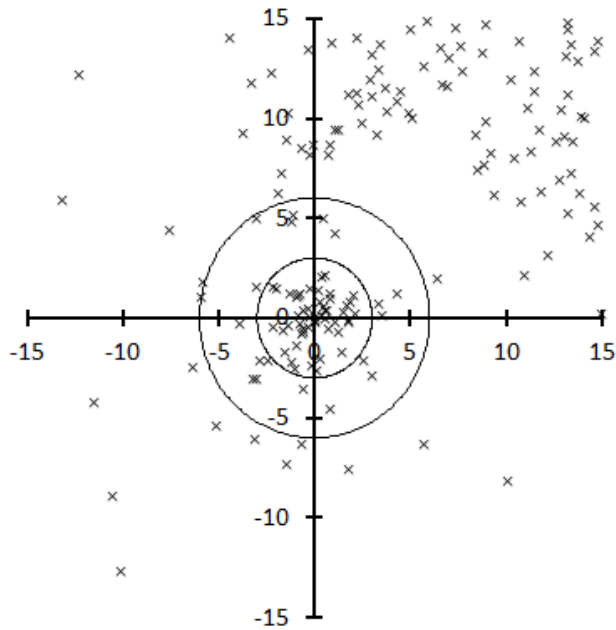
Table 1 – Number per year.

Year	N	Year	N
2007	2	2013	2
2008	2	2014	6
2009	4	2015	3
2010	3	2016	11
2011	7	2017	2
2012	1	2018	8

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	107.5	9
DR3		
DR10	107.5	127.6
DR15	103.5	75.8
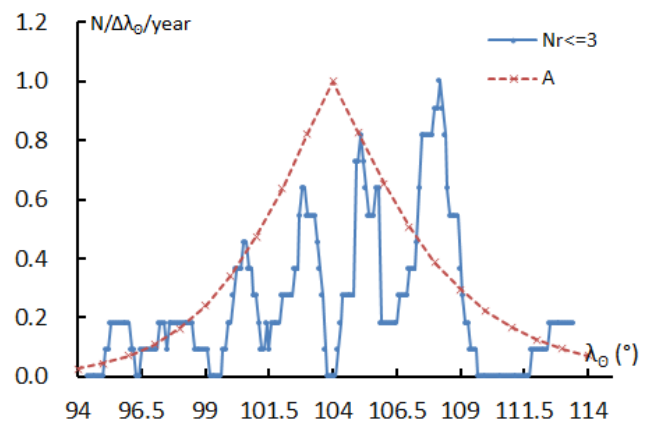
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{II}	β_{II}	a
94	209.5	–8.8	308.1	–27.9	40.2	0.963	0.079	32.3	151.8	274.0	69.6	14.7	2.11
95	209.4	–9.0	309.2	–27.8	40.2	0.962	0.081	32.5	151.4	275.0	70.3	14.9	2.12
96	209.3	–9.1	310.2	–27.8	40.1	0.961	0.082	32.7	151.0	276.0	71.0	15.2	2.13
97	209.2	–9.3	311.2	–27.7	40.1	0.961	0.084	32.9	150.7	277.0	71.7	15.4	2.14
98	209.1	–9.4	312.2	–27.6	40.0	0.960	0.086	33.0	150.3	278.0	72.5	15.7	2.15
99	209.0	–9.6	313.2	–27.5	40.0	0.959	0.088	33.2	150.0	279.0	73.2	15.9	2.16
100	208.9	–9.8	314.2	–27.4	39.9	0.958	0.090	33.4	149.6	280.0	73.9	16.2	2.17
101	208.8	–9.9	315.3	–27.3	39.9	0.958	0.092	33.5	149.2	281.0	74.6	16.4	2.18
102	208.7	–10.1	316.3	–27.2	39.8	0.957	0.094	33.7	148.9	282.0	75.3	16.7	2.19
103	208.6	–10.2	317.3	–27.1	39.7	0.956	0.096	33.8	148.5	283.0	76.0	16.9	2.20
104	208.5	–10.4	318.3	–27.0	39.7	0.956	0.098	33.9	148.1	284.0	76.7	17.1	2.21
105	208.4	–10.5	319.3	–26.9	39.6	0.955	0.100	34.1	147.8	285.0	77.4	17.4	2.22
106	208.4	–10.7	320.3	–26.7	39.6	0.954	0.102	34.2	147.4	286.0	78.1	17.6	2.23
107	208.3	–10.9	321.3	–26.6	39.5	0.953	0.104	34.3	147.0	287.0	78.8	17.9	2.24
108	208.2	–11.0	322.3	–26.5	39.5	0.953	0.106	34.4	146.6	288.0	79.5	18.1	2.25
109	208.1	–11.2	323.3	–26.3	39.4	0.952	0.108	34.6	146.3	289.0	80.2	18.4	2.26
110	208.0	–11.3	324.2	–26.2	39.4	0.951	0.111	34.7	145.9	290.0	80.9	18.6	2.27
111	207.9	–11.5	325.2	–26.0	39.3	0.951	0.113	34.8	145.5	291.0	81.6	18.8	2.28
112	207.8	–11.6	326.2	–25.9	39.3	0.950	0.115	34.9	145.1	292.0	82.3	19.1	2.29
113	207.7	–11.8	327.2	–25.7	39.2	0.949	0.117	35.0	144.8	293.0	82.9	19.3	2.31
114	207.6	–12.0	328.2	–25.6	39.2	0.948	0.119	35.1	144.4	294.0	83.6	19.6	2.32

JXA (#0533): Total of **81** orbits. $\lambda_{\mathcal{O}} = 107.3°$, $\lambda_g - \lambda_{\mathcal{O}} = 284.8°$, $\beta_g = -5.1°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 10°$.
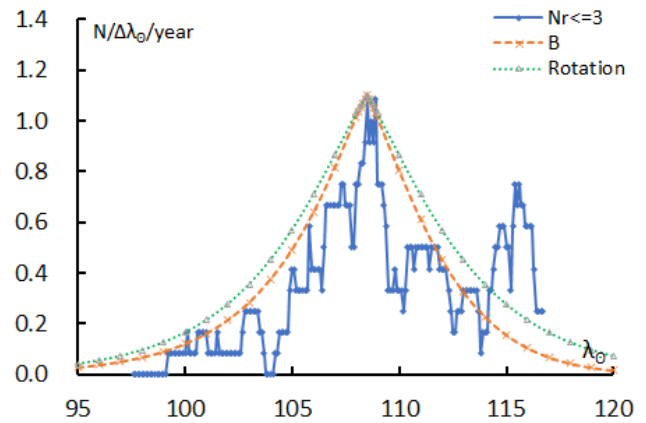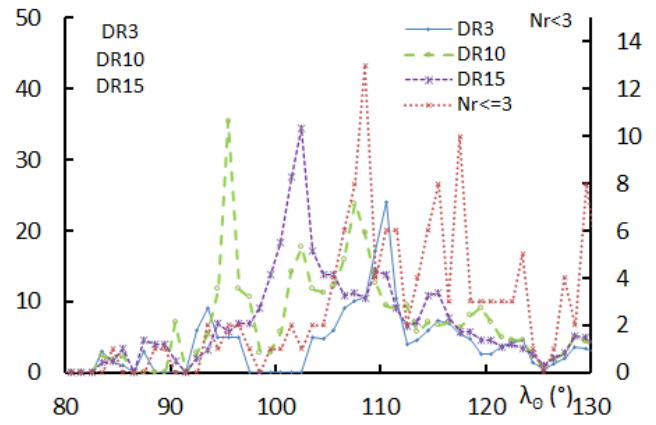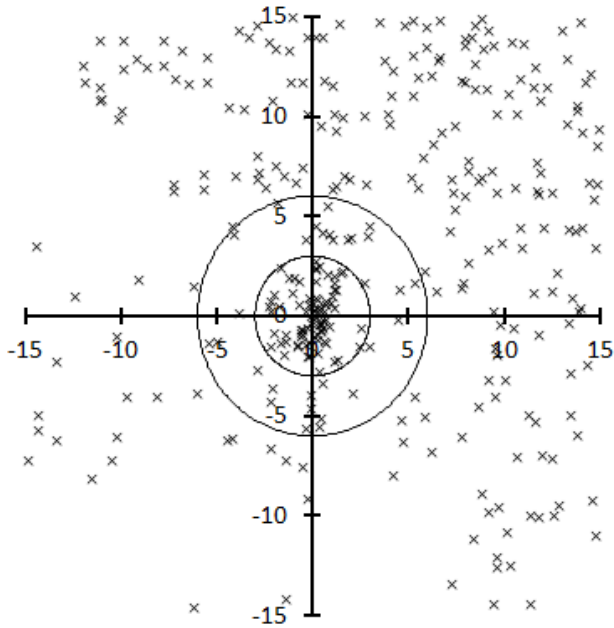
Table 1 – Number per year.

Year	N	Year	N
2007	2	2013	7
2008	2	2014	3
2009	7	2015	4
2010	11	2016	6
2011	14	2017	9
2012	6	2018	10

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	108.5	13
DR3	110.5	24.0
DR10	95.5	35.4
DR15	102.5	34.4

Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_{\mathcal{O}}$	$\lambda_g-\lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
95	287.6	−6.2	23.2	3.0	67.9	0.963	0.762	168.2	299.3	275.0	335.2	−10.3	20.34
96	287.4	−6.1	23.9	3.4	67.9	0.961	0.767	168.4	299.9	276.0	335.5	−10.1	19.50
97	287.1	−6.0	24.6	3.7	68.0	0.959	0.772	168.5	300.6	277.0	335.9	−9.8	18.74
98	286.9	−6.0	25.3	4.1	68.0	0.957	0.778	168.7	301.3	278.0	336.2	−9.6	18.06
99	286.7	−5.9	26.0	4.5	68.1	0.955	0.783	168.9	301.9	279.0	336.6	−9.4	17.44
100	286.5	−5.8	26.7	4.8	68.1	0.953	0.788	169.1	302.6	280.0	336.9	−9.2	16.88
101	286.3	−5.7	27.4	5.2	68.1	0.952	0.793	169.3	303.3	281.0	337.3	−8.9	16.36
102	286.1	−5.6	28.1	5.5	68.2	0.950	0.798	169.5	304.0	282.0	337.6	−8.7	15.89
103	285.9	−5.5	28.8	5.9	68.2	0.948	0.803	169.6	304.6	283.0	337.9	−8.5	15.46
104	285.7	−5.5	29.5	6.2	68.3	0.946	0.808	169.8	305.3	284.0	338.2	−8.3	15.06
105	285.4	−5.4	30.2	6.6	68.3	0.945	0.813	170.0	306.0	285.0	338.6	−8.1	14.69
106	285.2	−5.3	30.9	6.9	68.3	0.943	0.818	170.2	306.7	286.0	338.9	−7.9	14.36
107	285.0	−5.2	31.7	7.3	68.4	0.941	0.823	170.4	307.4	287.0	339.2	−7.7	14.04
108	284.8	−5.1	32.4	7.6	68.4	0.940	0.828	170.5	308.1	288.0	339.5	−7.4	13.75
108.1	284.8	−5.1	32.4	7.7	68.4	0.940	0.828	170.5	308.2	288.1	339.6	−7.4	13.73
108.2	284.8	−5.1	32.5	7.7	68.4	0.939	0.829	170.6	308.2	288.2	339.6	−7.4	13.70
108.3	284.7	−5.1	32.6	7.7	68.4	0.939	0.829	170.6	308.3	288.3	339.6	−7.4	13.67
108.4	284.7	−5.1	32.7	7.8	68.4	0.939	0.830	170.6	308.4	288.4	339.6	−7.4	13.65
108.5	284.7	−5.1	32.7	7.8	68.4	0.939	0.830	170.6	308.4	288.5	339.7	−7.3	13.62
108.6	284.7	−5.1	32.8	7.8	68.5	0.939	0.831	170.6	308.5	288.6	339.7	−7.3	13.59
108.7	284.7	−5.1	32.9	7.9	68.5	0.939	0.831	170.7	308.6	288.7	339.7	−7.3	13.57

Table 3 – Continued, evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g - \lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
108.8	284.6	−5.1	32.9	7.9	68.5	0.939	0.832	170.7	308.7	288.8	339.8	−7.3	13.54
108.9	284.6	−5.0	33.0	7.9	68.5	0.938	0.832	170.7	308.7	288.9	339.8	−7.3	13.51
109	284.6	−5.0	33.1	8.0	68.5	0.938	0.833	170.7	308.8	289.0	339.8	−7.2	13.49
110	284.4	−5.0	33.8	8.3	68.5	0.937	0.838	170.9	309.5	290.0	340.1	−7.0	13.24
111	284.2	−4.9	34.5	8.7	68.6	0.935	0.842	171.1	310.2	291.0	340.4	−6.8	13.01
112	284.0	−4.8	35.2	9.0	68.6	0.934	0.847	171.2	310.9	292.0	340.7	−6.6	12.80
113	283.7	−4.7	36.0	9.3	68.6	0.932	0.852	171.4	311.6	293.0	341.0	−6.4	12.60
114	283.5	−4.6	36.7	9.7	68.7	0.931	0.856	171.6	312.4	294.0	341.3	−6.2	12.41
115	283.3	−4.5	37.4	10.0	68.7	0.930	0.861	171.7	313.1	295.0	341.6	−6.0	12.24
116	283.1	−4.4	38.2	10.3	68.8	0.928	0.866	171.9	313.8	296.0	341.9	−5.8	12.09
117	282.9	−4.4	38.9	10.6	68.8	0.927	0.870	172.1	314.5	297.0	342.2	−5.6	11.94
118	282.7	−4.3	39.6	11.0	68.8	0.926	0.875	172.2	315.3	298.0	342.5	−5.4	11.81
119	282.5	−4.2	40.4	11.3	68.9	0.925	0.879	172.4	316.0	299.0	342.8	−5.3	11.68
120	282.3	−4.1	41.1	11.6	68.9	0.924	0.883	172.6	316.7	300.0	343.0	−5.1	11.57

PPS_1 (#0372): Total of **137** orbits. $\lambda_{\odot} = 109.6°$, $\lambda_g–\lambda_{\odot} = 281.9°$, $\beta_g = 19.6°$, $\Delta r = 3°$, $\Delta\lambda_{\odot} = 7°$. The listed maxima $\lambda_{\odot}$ of PPS in the shower database are widely dispersed from $\lambda_{\odot} = 94°$ to $109.6°$. We divide it into two components in *Tables 1 to 3*.
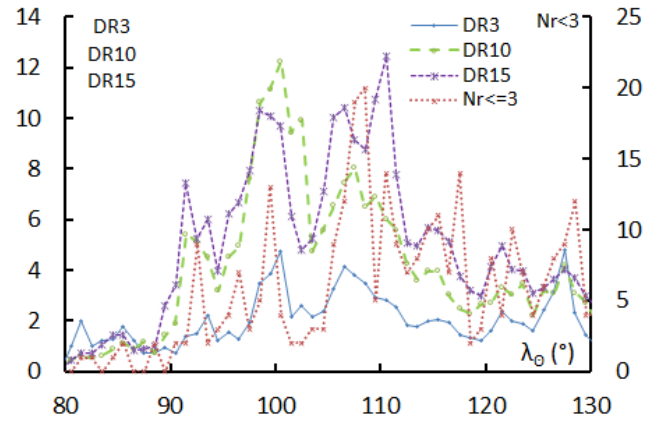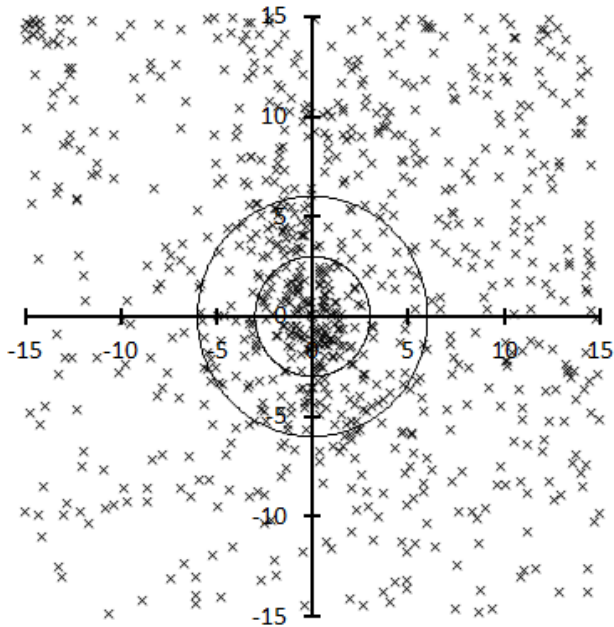

Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	18
2008	2	2014	3
2009	8	2015	12
2010	17	2016	10
2011	25	2017	15
2012	10	2018	16

Table 2 – Activity profiles.

	$\lambda_{\odot}$	Max
Nr<=3	108.5	20
DR3	106.5	4.1
DR10	102.5	9.9
DR15	110.5	12.4
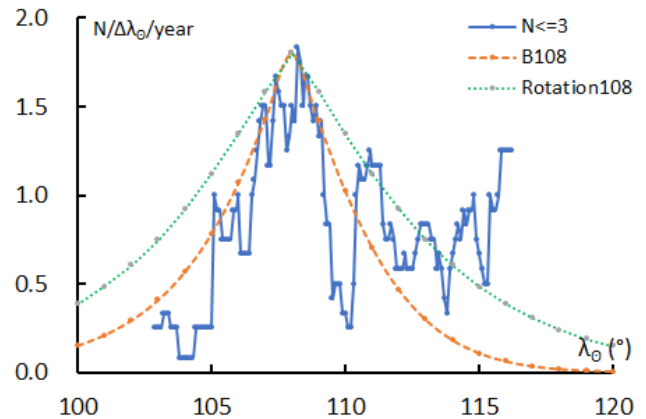
Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_{\odot}$	$\lambda_g–\lambda_{\odot}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
100	283.6	18.9	14.1	26.6	65.1	0.852	0.871	145.4	133.5	100.0	321.0	24.3	5.87
101	283.3	18.8	14.9	26.8	65.2	0.852	0.875	145.7	134.2	101.0	321.3	23.8	5.91
102	283.1	18.6	15.7	26.9	65.3	0.852	0.880	146.1	135.0	102.0	321.7	23.2	5.95
103	282.9	18.5	16.6	27.1	65.4	0.853	0.884	146.4	135.8	103.0	322.0	22.7	5.99
104	282.6	18.3	17.4	27.2	65.5	0.853	0.889	146.7	136.6	104.0	322.4	22.2	6.04
105	282.4	18.2	18.2	27.4	65.6	0.854	0.893	147.1	137.3	105.0	322.7	21.6	6.10
106	282.2	18.0	19.0	27.6	65.7	0.854	0.897	147.4	138.1	106.0	323.0	21.1	6.15
107	281.9	17.9	19.8	27.7	65.8	0.855	0.901	147.7	138.9	107.0	323.4	20.6	6.21
108	281.7	17.7	20.7	27.9	65.9	0.856	0.906	148.0	139.7	108.0	323.7	20.0	6.28
109	281.5	17.6	21.5	28.0	66.0	0.857	0.910	148.3	140.5	109.0	324.0	19.5	6.35
110	281.2	17.5	22.3	28.2	66.1	0.858	0.914	148.7	141.3	110.0	324.4	19.0	6.42
111	281.0	17.3	23.1	28.3	66.2	0.859	0.918	149.0	142.1	111.0	324.7	18.4	6.50
112	280.8	17.2	24.0	28.5	66.3	0.860	0.922	149.3	142.9	112.0	325.0	17.9	6.58
113	280.6	17.0	24.8	28.6	66.4	0.861	0.925	149.6	143.7	113.0	325.3	17.4	6.67
114	280.3	16.9	25.7	28.7	66.5	0.863	0.929	149.9	144.6	114.0	325.6	16.9	6.77
115	280.1	16.7	26.5	28.9	66.6	0.864	0.933	150.2	145.4	115.0	325.9	16.4	6.87
116	279.9	16.6	27.4	29.0	66.7	0.866	0.936	150.6	146.2	116.0	326.3	15.9	6.98
117	279.6	16.4	28.2	29.1	66.8	0.868	0.940	150.9	147.0	117.0	326.6	15.4	7.10
118	279.4	16.3	29.1	29.3	66.9	0.869	0.944	151.2	147.8	118.0	326.9	14.9	7.22
119	279.2	16.1	29.9	29.4	67.0	0.871	0.947	151.5	148.6	119.0	327.2	14.4	7.35
120	279.0	16.0	30.8	29.5	67.1	0.873	0.950	151.8	149.5	120.0	327.5	13.9	7.50

JPE (#0175): Total of **219** orbits. $\lambda_\Theta = 110°$, $\lambda_g–\lambda_\Theta = 244.2°$, $\beta_g = 14.2°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$. The listed maxima λ_Θ of JPE in the SD are dispersed widely between $\lambda_\Theta =107.5°$ and 120.8°. The activity profile of JPE suggests JPE has a sharp maximum at $\lambda_\Theta = 108.4°$ with an overlap of moderate activity peaking around $\lambda_\Theta = 112°$.
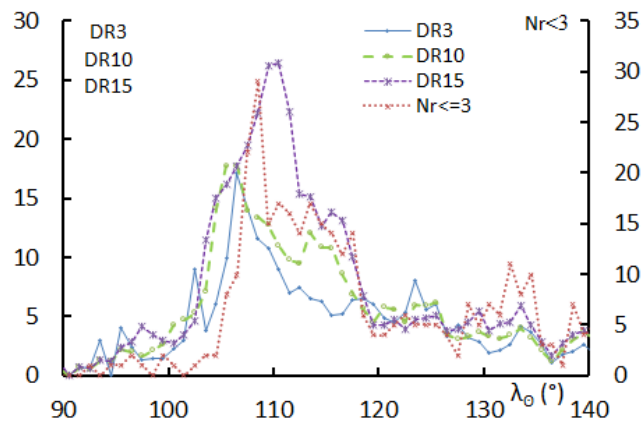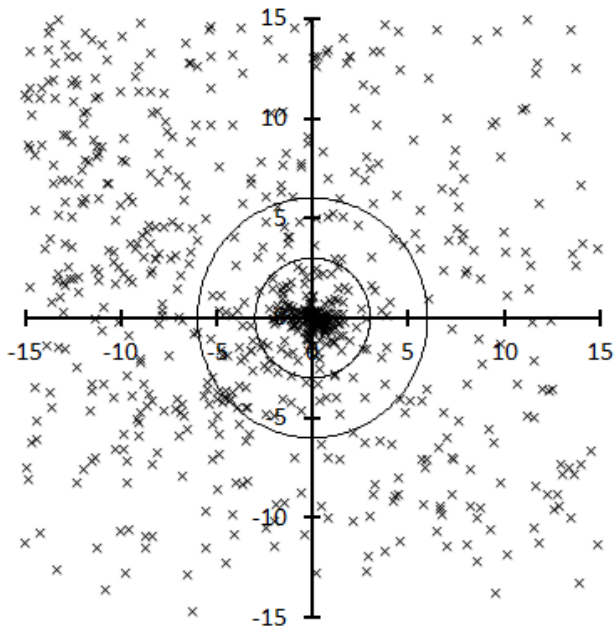
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	22
2008	6	2014	12
2009	18	2015	17
2010	22	2016	8
2011	45	2017	23
2012	19	2018	27

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	108.5	29
DR3	106.5	17.1
DR10	105.5	17.7
DR15	110.5	26.5
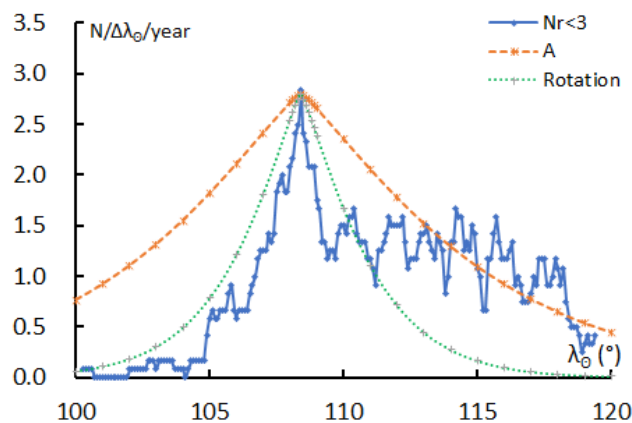
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g–\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
90	246.7	16.1	332.5	5.9	65.1	0.984	0.654	147.3	253.6	90.0	199.2	–31.2	40.10
91	246.6	16.0	333.3	6.1	65.0	0.982	0.651	147.4	254.1	91.0	199.7	–31.2	36.60
92	246.4	15.9	334.2	6.4	64.9	0.981	0.647	147.5	254.6	92.0	200.1	–31.2	33.67
93	246.3	15.9	335.0	6.6	64.9	0.979	0.643	147.5	255.1	93.0	200.5	–31.2	31.18
94	246.2	15.8	335.8	6.9	64.8	0.978	0.639	147.6	255.6	94.0	201.0	–31.3	29.04
95	246.1	15.7	336.6	7.2	64.8	0.977	0.635	147.7	256.1	95.0	201.4	–31.3	27.18
96	246.0	15.6	337.5	7.4	64.7	0.975	0.632	147.7	256.5	96.0	201.8	–31.3	25.54
97	245.9	15.6	338.3	7.7	64.7	0.974	0.628	147.8	257.0	97.0	202.2	–31.3	24.10
98	245.8	15.5	339.1	8.0	64.6	0.973	0.624	147.9	257.5	98.0	202.7	–31.3	22.82
99	245.7	15.4	339.9	8.2	64.6	0.971	0.620	147.9	258.0	99.0	203.1	–31.3	21.66
100	245.6	15.4	340.8	8.5	64.5	0.970	0.616	148.0	258.5	100.0	203.5	–31.3	20.62
101	245.5	15.3	341.6	8.8	64.5	0.969	0.612	148.1	259.0	101.0	203.9	–31.3	19.68
102	245.4	15.2	342.4	9.0	64.4	0.968	0.608	148.1	259.5	102.0	204.3	–31.3	18.83
103	245.3	15.2	343.3	9.3	64.3	0.967	0.604	148.2	260.0	103.0	204.8	–31.3	18.04
104	245.2	15.1	344.1	9.6	64.3	0.965	0.600	148.3	260.4	104.0	205.2	–31.3	17.32
105	245.0	15.0	344.9	9.9	64.2	0.964	0.596	148.3	260.9	105.0	205.6	–31.2	16.66
106	244.9	14.9	345.8	10.1	64.2	0.963	0.592	148.4	261.4	106.0	206.0	–31.2	16.05
107	244.8	14.9	346.6	10.4	64.1	0.962	0.588	148.5	261.9	107.0	206.5	–31.2	15.48
108	244.7	14.8	347.4	10.7	64.1	0.961	0.584	148.5	262.4	108.0	206.9	–31.2	14.95
108.1	244.7	14.8	347.5	10.7	64.1	0.961	0.584	148.5	262.5	108.1	206.9	–31.2	14.90

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g-\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
108.2	244.7	14.8	347.6	10.8	64.1	0.961	0.583	148.5	262.5	108.2	207.0	–31.2	14.85
108.3	244.7	14.8	347.7	10.8	64.1	0.961	0.583	148.5	262.6	108.3	207.0	–31.2	14.80
108.4	244.7	14.8	347.8	10.8	64.1	0.961	0.583	148.5	262.6	108.4	207.0	–31.2	14.75
108.5	244.7	14.8	347.8	10.8	64.0	0.960	0.582	148.6	262.7	108.5	207.1	–31.2	14.70
108.6	244.7	14.8	347.9	10.9	64.0	0.960	0.582	148.6	262.7	108.6	207.1	–31.2	14.65
108.7	244.7	14.7	348.0	10.9	64.0	0.960	0.581	148.6	262.8	108.7	207.2	–31.2	14.60
108.8	244.6	14.7	348.1	10.9	64.0	0.960	0.581	148.6	262.8	108.8	207.2	–31.2	14.56
108.9	244.6	14.7	348.2	11.0	64.0	0.960	0.581	148.6	262.9	108.9	207.3	–31.1	14.51
109	244.6	14.7	348.3	11.0	64.0	0.960	0.580	148.6	262.9	109.0	207.3	–31.1	14.46
110	244.5	14.7	349.1	11.3	64.0	0.959	0.576	148.7	263.4	110.0	207.7	–31.1	14.00
111	244.4	14.6	349.9	11.5	63.9	0.958	0.572	148.7	263.9	111.0	208.1	–31.1	13.57
112	244.3	14.5	350.8	11.8	63.9	0.957	0.568	148.8	264.4	112.0	208.6	–31.0	13.16
113	244.2	14.4	351.6	12.1	63.8	0.956	0.564	148.8	264.9	113.0	209.0	–31.0	12.78
114	244.1	14.4	352.4	12.4	63.7	0.955	0.560	148.9	265.4	114.0	209.4	–31.0	12.43
115	244.0	14.3	353.3	12.7	63.7	0.954	0.556	149.0	265.9	115.0	209.8	–30.9	12.09
116	243.9	14.2	354.1	13.0	63.6	0.953	0.552	149.0	266.4	116.0	210.3	–30.9	11.77
117	243.8	14.2	355.0	13.3	63.6	0.952	0.548	149.1	266.8	117.0	210.7	–30.8	11.47
118	243.7	14.1	355.8	13.6	63.5	0.951	0.544	149.2	267.3	118.0	211.1	–30.8	11.18
119	243.6	14.0	356.7	13.9	63.5	0.951	0.540	149.2	267.8	119.0	211.5	–30.7	10.91
120	243.5	13.9	357.5	14.1	63.4	0.950	0.536	149.3	268.3	120.0	211.9	–30.7	10.65
121	243.3	13.9	358.4	14.4	63.4	0.949	0.531	149.4	268.8	121.0	212.4	–30.6	10.40
122	243.2	13.8	359.2	14.7	63.3	0.948	0.527	149.4	269.3	122.0	212.8	–30.6	10.17
123	243.1	13.7	0.1	15.0	63.3	0.947	0.523	149.5	269.8	123.0	213.2	–30.5	9.94
124	243.0	13.7	0.9	15.3	63.2	0.947	0.519	149.6	270.3	124.0	213.7	–30.4	9.73
125	242.9	13.6	1.8	15.6	63.1	0.946	0.515	149.6	270.8	125.0	214.1	–30.4	9.52
126	242.8	13.5	2.6	15.9	63.1	0.945	0.511	149.7	271.3	126.0	214.5	–30.3	9.33
127	242.7	13.4	3.5	16.2	63.0	0.945	0.507	149.8	271.8	127.0	214.9	–30.2	9.14
128	242.6	13.4	4.3	16.5	63.0	0.944	0.503	149.8	272.3	128.0	215.4	–30.1	8.96
129	242.5	13.3	5.2	16.8	62.9	0.943	0.499	149.9	272.8	129.0	215.8	–30.0	8.79
130	242.4	13.2	6.1	17.0	62.9	0.943	0.494	150.0	273.3	130.0	216.2	–30.0	8.62
131	242.3	13.2	6.9	17.3	62.8	0.942	0.490	150.0	273.7	131.0	216.7	–29.9	8.46
132	242.2	13.1	7.8	17.6	62.8	0.941	0.486	150.1	274.2	132.0	217.1	–29.8	8.31
133	242.1	13.0	8.6	17.9	62.7	0.941	0.482	150.2	274.7	133.0	217.6	–29.7	8.16
134	242.0	12.9	9.5	18.2	62.7	0.940	0.478	150.3	275.2	134.0	218.0	–29.6	8.01
135	241.9	12.9	10.4	18.5	62.6	0.940	0.474	150.3	275.7	135.0	218.4	–29.5	7.88

CAN (#0411): Total of **122** orbits. $\lambda_O = 107°$, $\lambda_g - \lambda_O = 298.1°$, $\beta_g = 32.9°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$. CAN may be a combination of two showers at $\lambda_O = 91°$ to $103°$ and at $\lambda_O = 103°$ to $118°$.
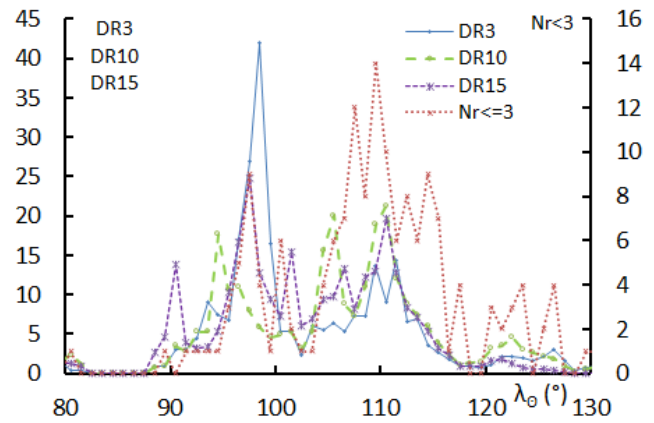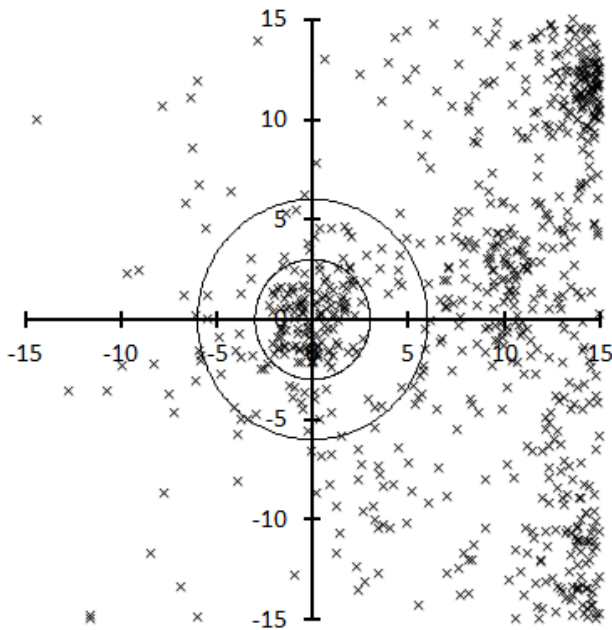
Table 1 – Number per year.

Year	N	Year	N
2007	4	2013	10
2008	4	2014	9
2009	8	2015	11
2010	8	2016	10
2011	18	2017	16
2012	9	2018	15

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	109.5	14
DR3	98.5	42.0
DR10	110.5	21.3
DR15	97.5	24.8
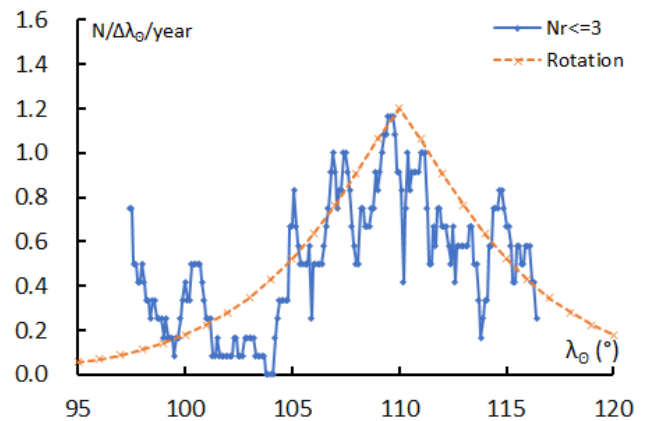
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
90	297.8	33.1	10.8	41.1	56.4	0.887	0.684	112.0	107.7	90.0	319.6	62.0	6.07
91	297.8	33.1	11.8	41.5	56.4	0.889	0.684	112.1	107.7	91.0	320.6	62.0	6.14
92	297.8	33.1	12.8	41.8	56.5	0.890	0.684	112.1	107.8	92.0	321.6	61.9	6.21
93	297.9	33.1	13.8	42.2	56.5	0.891	0.684	112.1	107.8	93.0	322.5	61.9	6.28
94	297.9	33.1	14.9	42.6	56.5	0.892	0.684	112.2	107.8	94.0	323.5	61.8	6.35
95	297.9	33.1	15.9	43.0	56.5	0.893	0.684	112.2	107.9	95.0	324.5	61.8	6.42
96	297.9	33.1	17.0	43.4	56.6	0.895	0.684	112.2	107.9	96.0	325.5	61.8	6.49
97	297.9	33.0	18.0	43.7	56.6	0.896	0.684	112.2	107.9	97.0	326.5	61.7	6.56
98	298.0	33.0	19.1	44.1	56.6	0.897	0.684	112.3	108.0	98.0	327.5	61.7	6.63
99	298.0	33.0	20.2	44.5	56.6	0.898	0.684	112.3	108.0	99.0	328.4	61.6	6.71
100	298.0	33.0	21.2	44.8	56.7	0.899	0.684	112.3	108.0	100.0	329.4	61.6	6.79
101	298.0	33.0	22.3	45.2	56.7	0.900	0.684	112.4	108.0	101.0	330.4	61.6	6.86
102	298.0	33.0	23.4	45.6	56.7	0.901	0.684	112.4	108.1	102.0	331.4	61.5	6.94
103	298.0	33.0	24.5	45.9	56.8	0.903	0.684	112.4	108.1	103.0	332.4	61.5	7.02
104	298.1	33.0	25.7	46.3	56.8	0.904	0.684	112.4	108.1	104.0	333.4	61.5	7.10
105	298.1	32.9	26.8	46.6	56.8	0.905	0.684	112.5	108.2	105.0	334.4	61.4	7.18
106	298.1	32.9	27.9	47.0	56.8	0.906	0.684	112.5	108.2	106.0	335.4	61.4	7.26
107	298.1	32.9	29.1	47.3	56.9	0.907	0.684	112.5	108.2	107.0	336.4	61.3	7.35
108	298.1	32.9	30.2	47.7	56.9	0.908	0.684	112.5	108.2	108.0	337.3	61.3	7.43
109	298.1	32.9	31.4	48.0	56.9	0.909	0.684	112.6	108.2	109.0	338.3	61.3	7.52
110	298.2	32.9	32.6	48.3	56.9	0.910	0.684	112.6	108.3	110.0	339.3	61.2	7.60

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g–\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
111	298.2	32.9	33.8	48.6	57.0	0.911	0.684	112.6	108.3	111.0	340.3	61.2	7.69
112	298.2	32.8	35.0	49.0	57.0	0.912	0.684	112.6	108.3	112.0	341.3	61.2	7.78
113	298.2	32.8	36.2	49.3	57.0	0.913	0.684	112.7	108.3	113.0	342.3	61.2	7.87
114	298.2	32.8	37.4	49.6	57.0	0.914	0.684	112.7	108.4	114.0	343.3	61.1	7.97
115	298.2	32.8	38.7	49.9	57.1	0.915	0.684	112.7	108.4	115.0	344.3	61.1	8.06
116	298.3	32.8	39.9	50.2	57.1	0.916	0.684	112.7	108.4	116.0	345.3	61.1	8.16
117	298.3	32.8	41.2	50.5	57.1	0.917	0.684	112.8	108.4	117.0	346.3	61.0	8.25
118	298.3	32.8	42.4	50.8	57.1	0.918	0.683	112.8	108.4	118.0	347.3	61.0	8.35
119	298.3	32.8	43.7	51.1	57.2	0.919	0.683	112.8	108.4	119.0	348.3	61.0	8.45
120	298.3	32.7	45.0	51.3	57.2	0.920	0.683	112.8	108.5	120.0	349.3	60.9	8.55
121	298.3	32.7	46.3	51.6	57.2	0.921	0.683	112.9	108.5	121.0	350.3	60.9	8.66
122	298.4	32.7	47.6	51.9	57.2	0.922	0.683	112.9	108.5	122.0	351.3	60.9	8.76
123	298.4	32.7	49.0	52.1	57.3	0.923	0.683	112.9	108.5	123.0	352.3	60.9	8.87
124	298.4	32.7	50.3	52.4	57.3	0.924	0.683	112.9	108.5	124.0	353.3	60.8	8.98
125	298.4	32.7	51.6	52.6	57.3	0.925	0.683	113.0	108.5	125.0	354.3	60.8	9.09

NZC (#0164): Total of **131** orbits. $\lambda_O = 108.09°$, $\lambda_g - \lambda_O = 208.8°$, $\beta_g = 13.3°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$. The listed maxima λ_O of NZC in the SD are widely dispersed from $\lambda_O = 86°$ to 108.09°. Sporadic activity in this area is high and the Japanese rainy season hindered the determination of the maximum a lot. There may be three weak activities piling up, around $\lambda_O = 90°$, 100° and 110°.
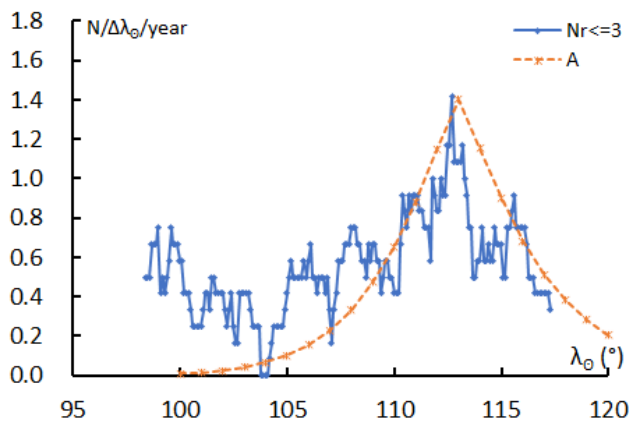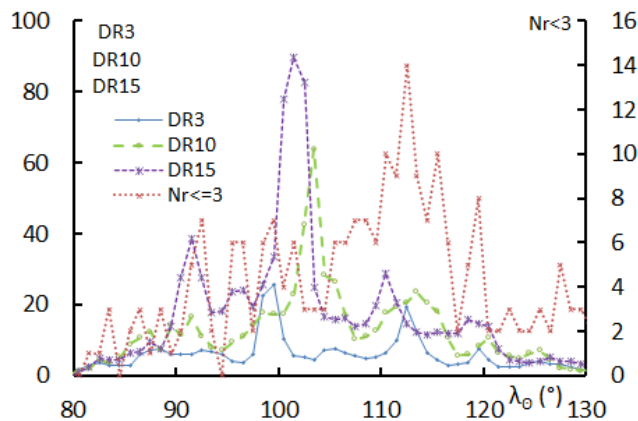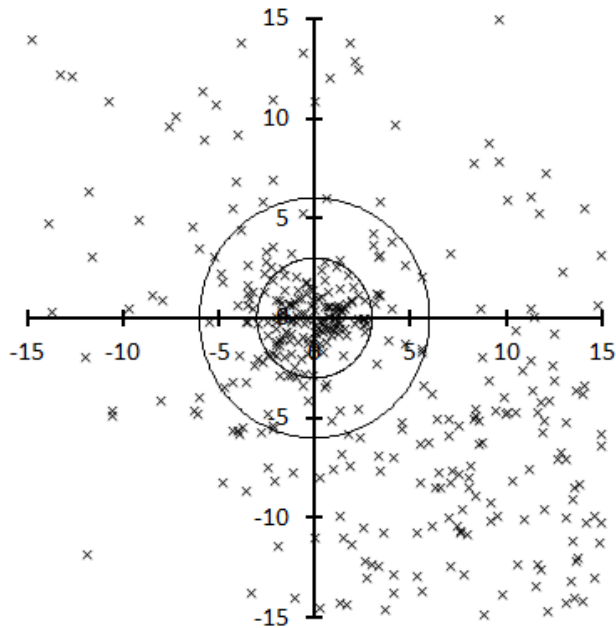
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	9
2008	8	2014	4
2009	14	2015	7
2010	8	2016	15
2011	28	2017	12
2012	7	2018	19

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	112.5	14
DR3	99.5	25.5
DR10	103.5	63.8
DR15	101.5	89.6

Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
95	210.0	12.2	304.4	−7.2	40.0	0.951	0.099	40.9	328.3	95.0	70.0	−20.1	2.03
96	209.9	12.2	305.3	−6.9	39.8	0.950	0.101	40.5	328.1	96.0	70.7	−20.1	2.02
97	209.8	12.3	306.1	−6.7	39.7	0.949	0.102	40.1	327.9	97.0	71.4	−20.0	2.01
98	209.7	12.3	307.0	−6.5	39.6	0.948	0.104	39.7	327.7	98.0	72.0	−20.0	2.00
99	209.6	12.3	307.8	−6.2	39.5	0.947	0.105	39.4	327.4	99.0	72.7	−20.0	1.99
100	209.5	12.3	308.6	−6.0	39.3	0.946	0.107	39.0	327.2	100.0	73.4	−19.9	1.98
101	209.4	12.4	309.5	−5.7	39.2	0.945	0.109	38.6	327.0	101.0	74.1	−19.9	1.97
102	209.3	12.4	310.3	−5.5	39.1	0.944	0.110	38.2	326.8	102.0	74.8	−19.8	1.97
103	209.1	12.4	311.1	−5.2	39.0	0.943	0.112	37.9	326.5	103.0	75.4	−19.8	1.96
104	209.0	12.4	312.0	−4.9	38.8	0.942	0.113	37.5	326.3	104.0	76.1	−19.8	1.95
105	208.9	12.5	312.8	−4.7	38.7	0.941	0.115	37.2	326.1	105.0	76.8	−19.7	1.94
106	208.8	12.5	313.6	−4.4	38.6	0.940	0.117	36.8	325.8	106.0	77.5	−19.7	1.93
107	208.7	12.5	314.5	−4.1	38.5	0.939	0.118	36.5	325.6	107.0	78.2	−19.6	1.93
108	208.6	12.5	315.3	−3.9	38.3	0.937	0.120	36.2	325.4	108.0	78.9	−19.6	1.92
109	208.5	12.6	316.1	−3.6	38.2	0.936	0.122	35.8	325.1	109.0	79.5	−19.5	1.91
110	208.4	12.6	316.9	−3.3	38.1	0.935	0.123	35.5	324.9	110.0	80.2	−19.5	1.90
111	208.2	12.6	317.8	−3.0	37.9	0.934	0.125	35.2	324.7	111.0	80.9	−19.5	1.90
112	208.1	12.7	318.6	−2.7	37.8	0.933	0.127	34.9	324.4	112.0	81.6	−19.4	1.89
113	208.0	12.7	319.4	−2.4	37.7	0.932	0.129	34.5	324.2	113.0	82.3	−19.4	1.88
114	207.9	12.7	320.2	−2.2	37.6	0.930	0.130	34.2	324.0	114.0	83.0	−19.3	1.87

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
115	207.8	12.7	321.0	−1.9	37.4	0.929	0.132	33.9	323.7	115.0	83.7	−19.3	1.87
116	207.7	12.8	321.8	−1.6	37.3	0.928	0.134	33.6	323.5	116.0	84.4	−19.2	1.86
117	207.6	12.8	322.6	−1.2	37.2	0.927	0.136	33.3	323.3	117.0	85.0	−19.2	1.85
118	207.5	12.8	323.5	−0.9	37.1	0.925	0.138	33.0	323.0	118.0	85.7	−19.1	1.84
119	207.4	12.8	324.3	−0.6	36.9	0.924	0.139	32.7	322.8	119.0	86.4	−19.1	1.84
120	207.2	12.9	325.1	−0.3	36.8	0.923	0.141	32.4	322.5	120.0	87.1	−19.0	1.83

Table 3 – Continued, evolution of the orbital parameters during the activity period.

ZCS (#0444): Total of **213** orbits. $\lambda_O = 111.5°$, $\lambda_g{-}\lambda_O = 277.8°$, $\beta_g = 43.0°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$. Perseid activity overlaps ZCS after $\lambda_O = 117°$ but the estimated activity curve suggests ZCS might cease at $\lambda_O = 120°$.
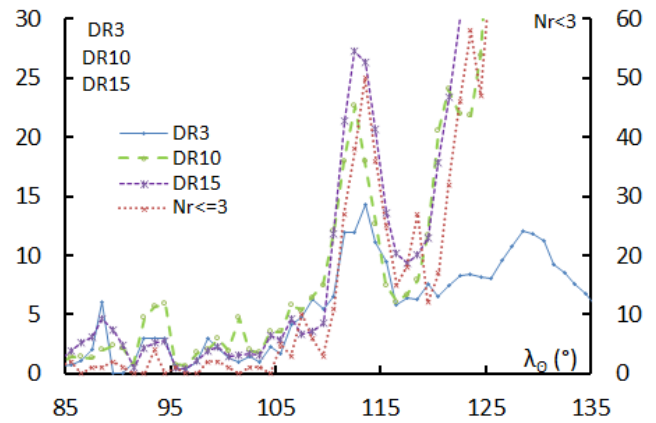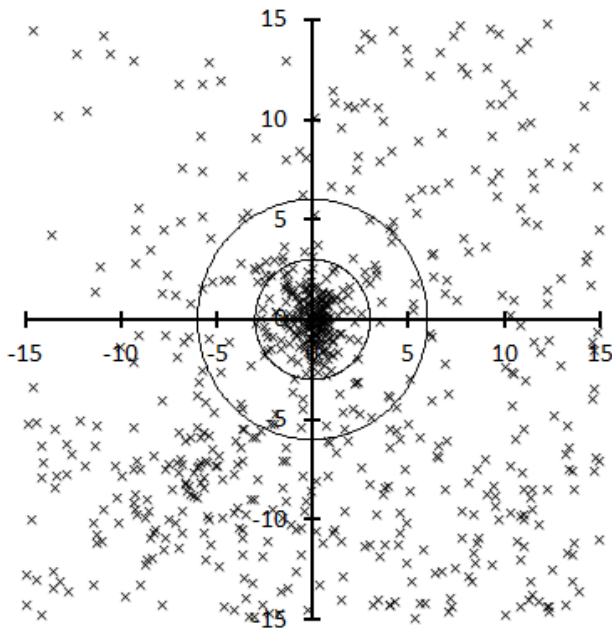
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	9
2008	3	2014	7
2009	30	2015	16
2010	34	2016	5
2011	45	2017	22
2012	17	2018	25

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	113.5	50
DR3	113.5	14.3
DR10	112.5	22.6
DR15	112.5	27.3
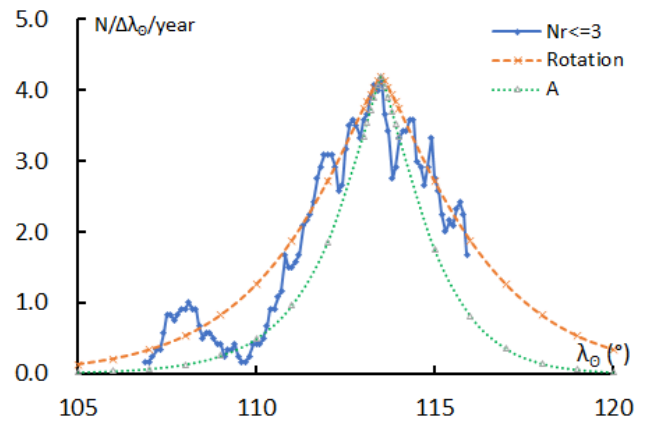
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_O	$\lambda_g{-}\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
100	273.7	46.5	348.3	46.9	52.2	0.704	1.012	99.9	171.5	100.0	281.5	8.4	3.42
101	274.1	46.2	349.6	47.2	52.6	0.721	1.011	100.5	170.8	101.0	282.7	9.0	3.62
102	274.4	46.0	351.0	47.5	53.0	0.738	1.010	101.0	170.2	102.0	283.9	9.7	3.85
103	274.7	45.7	352.3	47.8	53.3	0.755	1.009	101.6	169.5	103.0	285.1	10.3	4.12
104	275.1	45.4	353.7	48.1	53.7	0.772	1.008	102.2	168.9	104.0	286.4	10.9	4.42
105	275.4	45.2	355.1	48.4	54.1	0.790	1.007	102.7	168.2	105.0	287.6	11.5	4.79
106	275.7	44.9	356.5	48.7	54.4	0.807	1.006	103.3	167.6	106.0	288.9	12.0	5.22
107	276.0	44.6	357.9	49.0	54.8	0.825	1.005	103.9	167.0	107.0	290.2	12.6	5.75
108	276.4	44.3	359.3	49.3	55.2	0.843	1.004	104.4	166.4	108.0	291.4	13.1	6.40
109	276.7	44.1	0.8	49.6	55.5	0.862	1.002	105.0	165.9	109.0	292.7	13.6	7.24
110	277.0	43.8	2.2	49.9	55.9	0.880	1.001	105.5	165.3	110.0	294.0	14.2	8.34
111	277.3	43.5	3.7	50.2	56.3	0.899	1.000	106.1	164.7	111.0	295.3	14.7	9.87
112	277.6	43.2	5.2	50.5	56.6	0.918	0.998	106.6	164.2	112.0	296.6	15.1	12.11
113	277.9	43.0	6.7	50.8	57.0	0.937	0.997	107.2	163.6	113.0	298.0	15.6	15.73
113.1	277.9	42.9	6.8	50.8	57.1	0.939	0.996	107.2	163.6	113.1	298.1	15.7	16.22
113.2	278.0	42.9	7.0	50.9	57.1	0.941	0.996	107.3	163.5	113.2	298.2	15.7	16.74
113.3	278.0	42.9	7.1	50.9	57.1	0.942	0.996	107.4	163.5	113.3	298.4	15.7	17.30
113.4	278.0	42.9	7.3	50.9	57.2	0.944	0.996	107.4	163.4	113.4	298.5	15.8	17.90
113.5	278.1	42.8	7.4	50.9	57.2	0.946	0.996	107.5	163.4	113.5	298.6	15.8	18.53
113.6	278.1	42.8	7.6	51.0	57.2	0.948	0.996	107.5	163.3	113.6	298.8	15.9	19.22
113.7	278.1	42.8	7.8	51.0	57.3	0.950	0.995	107.6	163.3	113.7	298.9	15.9	19.96

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
113.8	278.1	42.8	7.9	51.0	57.3	0.952	0.995	107.6	163.2	113.8	299.0	16.0	20.76
113.9	278.2	42.7	8.1	51.0	57.3	0.954	0.995	107.7	163.2	113.9	299.2	16.0	21.63
114	278.2	42.7	8.2	51.1	57.4	0.956	0.995	107.7	163.1	114.0	299.3	16.1	22.58
115	278.5	42.4	9.7	51.4	57.8	0.975	0.993	108.3	162.6	115.0	300.6	16.5	40.38
116	278.8	42.1	11.3	51.6	58.1	0.995	0.992	108.8	162.1	116.0	302.0	16.9	200
117	279.1	41.9	12.8	51.9	58.5	1.015	0.990	109.3	161.6	117.0	303.3	17.4	−66.5

GDR (#0184): Total of **74** orbits. $\lambda_{\mathcal{O}} = 124.6°$, $\lambda_g - \lambda_{\mathcal{O}} = 167.9°$, $\beta_g = 73.0°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 5°$.
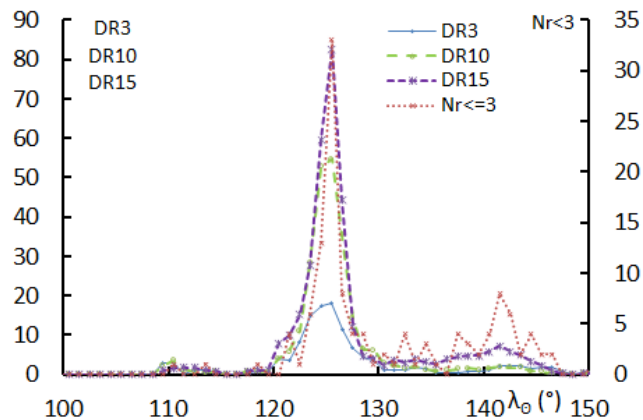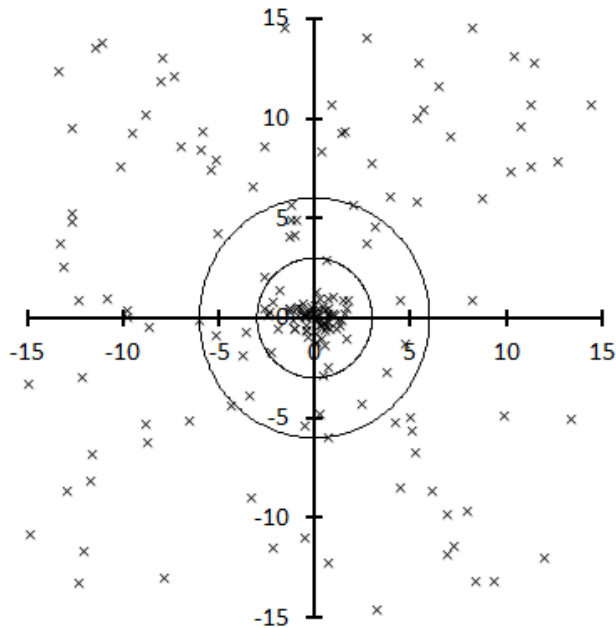
Table 1 – Number per year.

Year	N	Year	N
2007	11	2013	0
2008	11	2014	18
2009	5	2015	6
2010	8	2016	5
2011	0	2017	1
2012	2	2018	7

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	125.5	33
DR3	125.5	18.0
DR10	125.5	54.7
DR15	125.5	82.7
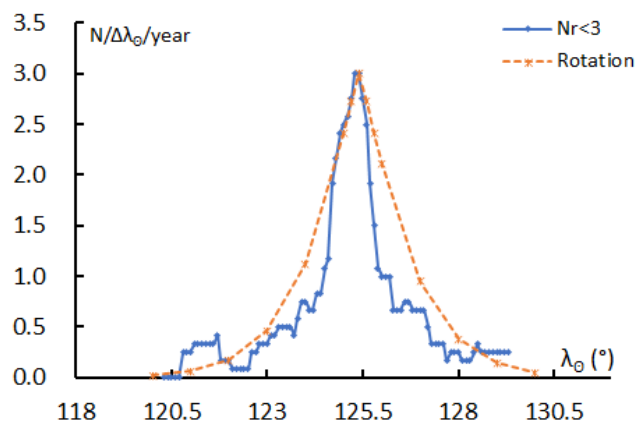
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\mathcal{O}}$	$\lambda_g - \lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
120	175.1	72.1	281.6	49.7	29.2	1.018	0.969	42.8	204.8	120.0	318.7	−16.5	−53.8
121	173.8	72.4	281.4	49.9	28.9	1.006	0.971	42.3	204.4	121.0	319.5	−16.1	−165
122	172.5	72.6	281.2	50.1	28.5	0.994	0.972	41.8	204.0	122.0	320.3	−15.7	153
123	171.2	72.8	281.0	50.2	28.1	0.981	0.974	41.3	203.6	123.0	321.2	−15.3	52.32
124	169.9	72.9	280.7	50.4	27.8	0.969	0.975	40.8	203.2	124.0	322.0	−14.9	31.54
125	168.5	73.1	280.5	50.5	27.4	0.957	0.977	40.3	202.8	125.0	322.8	−14.5	22.56
125.1	168.4	73.1	280.5	50.6	27.3	0.955	0.977	40.2	202.8	125.1	322.9	−14.5	21.94
125.2	168.2	73.2	280.5	50.6	27.3	0.954	0.977	40.2	202.7	125.2	322.9	−14.4	21.35
125.3	168.1	73.2	280.4	50.6	27.3	0.953	0.977	40.1	202.7	125.3	323.0	−14.4	20.79
125.4	168.0	73.2	280.4	50.6	27.2	0.952	0.977	40.1	202.6	125.4	323.1	−14.4	20.26
125.5	167.8	73.2	280.4	50.6	27.2	0.951	0.977	40.0	202.6	125.5	323.2	−14.3	19.75
125.6	167.7	73.2	280.4	50.6	27.2	0.949	0.978	40.0	202.6	125.6	323.3	−14.3	19.27
125.7	167.5	73.2	280.3	50.6	27.1	0.948	0.978	39.9	202.5	125.7	323.3	−14.2	18.81
125.8	167.4	73.3	280.3	50.6	27.1	0.947	0.978	39.9	202.5	125.8	323.4	−14.2	18.38
125.9	167.3	73.3	280.3	50.7	27.1	0.946	0.978	39.8	202.4	125.9	323.5	−14.2	17.96
126	167.1	73.3	280.3	50.7	27.0	0.944	0.978	39.8	202.4	126.0	323.6	−14.1	17.56
127	165.7	73.5	280.0	50.8	26.7	0.932	0.979	39.3	202.0	127.0	324.4	−13.7	14.37
128	164.3	73.6	279.8	50.9	26.3	0.919	0.981	38.8	201.6	128.0	325.2	−13.4	12.16
129	162.8	73.7	279.5	51.0	25.9	0.907	0.982	38.3	201.3	129.0	326.0	−13.0	10.54
130	161.3	73.9	279.2	51.1	25.6	0.894	0.983	37.8	200.9	130.0	326.8	−12.6	9.30

SDA (#0005): Total of **1434** orbits. $\lambda_\Theta = 126.8°$, $\lambda_g - \lambda_\Theta = 208.8°$, $\beta_g = -7.4°$, $\Delta r = 2°$, $\Delta\lambda_\Theta = 5°$.
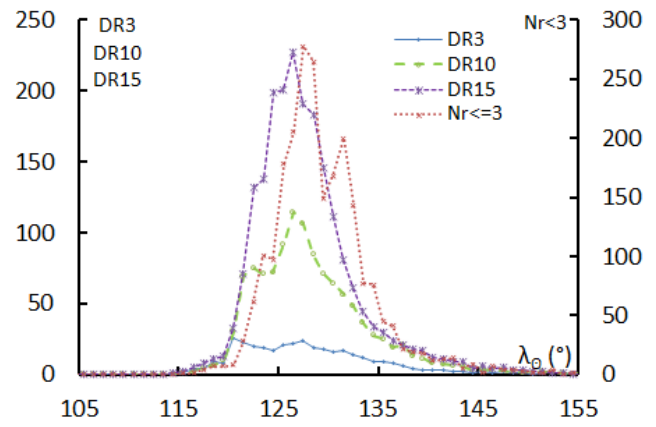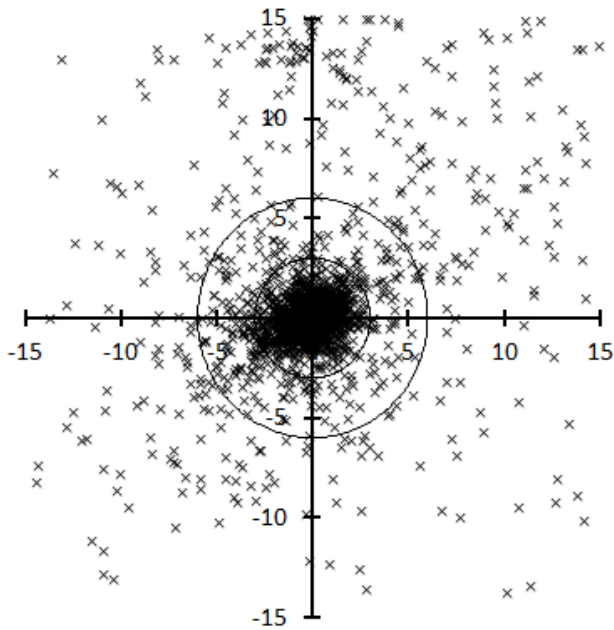
Table 1 – Number per year.

Year	N	Year	N
2007	90	2013	40
2008	90	2014	234
2009	58	2015	116
2010	100	2016	177
2011	50	2017	57
2012	198	2018	224

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	127.5	278
DR3	127.5	23.4
DR10	126.5	114.3
DR15	126.5	227.7

Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
115	211.8	−6.0	331.1	−18.2	42.2	0.982	0.042	31.5	159.4	295.0	97.2	10.6	2.28
116	211.5	−6.1	331.9	−18.1	42.1	0.981	0.044	30.9	158.7	296.0	97.5	10.8	2.30
117	211.2	−6.2	332.6	−17.9	41.9	0.980	0.047	30.4	158.0	297.0	97.8	11.0	2.31
118	210.9	−6.3	333.3	−17.8	41.8	0.979	0.050	30.0	157.3	298.0	98.1	11.1	2.33
119	210.6	−6.4	334.1	−17.6	41.6	0.977	0.053	29.5	156.6	299.0	98.3	11.3	2.35
120	210.3	−6.6	334.8	−17.5	41.5	0.976	0.056	29.1	155.9	300.0	98.6	11.5	2.37
121	210.0	−6.7	335.5	−17.3	41.3	0.975	0.059	28.7	155.2	301.0	98.9	11.6	2.39
122	209.7	−6.8	336.3	−17.2	41.2	0.974	0.062	28.3	154.5	302.0	99.2	11.8	2.41
123	209.4	−6.9	337.0	−17.0	41.0	0.973	0.065	27.9	153.8	303.0	99.5	11.9	2.43
124	209.1	−7.0	337.7	−16.9	40.9	0.972	0.069	27.5	153.1	304.0	99.7	12.1	2.46
125	208.9	−7.1	338.4	−16.7	40.7	0.971	0.072	27.2	152.3	305.0	100.0	12.3	2.48
126	208.6	−7.2	339.2	−16.6	40.6	0.970	0.076	26.9	151.6	306.0	100.3	12.4	2.50
127	208.3	−7.4	339.9	−16.4	40.4	0.969	0.079	26.6	150.9	307.0	100.5	12.6	2.52
127.1	208.2	−7.4	340.0	−16.4	40.4	0.968	0.080	26.5	150.8	307.1	100.6	12.6	2.52
127.2	208.2	−7.4	340.0	−16.4	40.4	0.968	0.080	26.5	150.8	307.2	100.6	12.6	2.52
127.3	208.2	−7.4	340.1	−16.4	40.4	0.968	0.080	26.5	150.7	307.3	100.6	12.6	2.53
127.4	208.2	−7.4	340.2	−16.4	40.3	0.968	0.081	26.4	150.6	307.4	100.7	12.6	2.53
127.5	208.1	−7.4	340.3	−16.3	40.3	0.968	0.081	26.4	150.6	307.5	100.7	12.6	2.53
127.6	208.1	−7.4	340.3	−16.3	40.3	0.968	0.081	26.4	150.5	307.6	100.7	12.6	2.53
127.7	208.1	−7.4	340.4	−16.3	40.3	0.968	0.082	26.3	150.4	307.7	100.7	12.7	2.54
127.8	208.0	−7.5	340.5	−16.3	40.3	0.968	0.082	26.3	150.3	307.8	100.8	12.7	2.54

Table 3 – Continued, evolution of the orbital parameters during the activity period.

| λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
127.9	208.0	−7.5	340.5	−16.3	40.3	0.968	0.082	26.3	150.3	307.9	100.8	12.7	2.54
128	208.0	−7.5	340.6	−16.3	40.3	0.967	0.083	26.3	150.2	308.0	100.8	12.7	2.54
129	207.7	−7.6	341.3	−16.1	40.1	0.966	0.086	26.0	149.5	309.0	101.1	12.8	2.56
130	207.4	−7.7	342.1	−15.9	39.9	0.965	0.090	25.7	148.8	310.0	101.3	13.0	2.59
131	207.1	−7.8	342.8	−15.8	39.8	0.964	0.094	25.4	148.0	311.0	101.6	13.1	2.61
132	206.8	−7.9	343.5	−15.6	39.6	0.963	0.098	25.1	147.3	312.0	101.9	13.3	2.63
133	206.5	−8.0	344.2	−15.4	39.5	0.962	0.102	24.9	146.6	313.0	102.1	13.4	2.66
134	206.2	−8.2	344.9	−15.3	39.3	0.960	0.106	24.6	145.9	314.0	102.4	13.5	2.68
135	205.9	−8.3	345.6	−15.1	39.2	0.959	0.110	24.4	145.2	315.0	102.6	13.7	2.71
136	205.6	−8.4	346.4	−14.9	39.0	0.958	0.114	24.2	144.4	316.0	102.9	13.8	2.73
137	205.3	−8.5	347.1	−14.8	38.9	0.957	0.118	24.0	143.7	317.0	103.1	13.9	2.76
138	205.0	−8.6	347.8	−14.6	38.7	0.956	0.123	23.7	143.0	318.0	103.4	14.0	2.78
139	204.8	−8.7	348.5	−14.4	38.6	0.955	0.127	23.5	142.2	319.0	103.6	14.1	2.81
140	204.5	−8.8	349.2	−14.2	38.4	0.954	0.132	23.3	141.5	320.0	103.9	14.3	2.83
141	204.2	−8.9	349.9	−14.1	38.3	0.952	0.136	23.1	140.8	321.0	104.1	14.4	2.86
142	203.9	−9.1	350.6	−13.9	38.1	0.951	0.141	22.9	140.1	322.0	104.4	14.5	2.89
143	203.6	−9.2	351.3	−13.7	38.0	0.950	0.145	22.7	139.3	323.0	104.6	14.6	2.91
144	203.3	−9.3	352.0	−13.5	37.8	0.949	0.150	22.5	138.6	324.0	104.8	14.7	2.94
145	203.0	−9.4	352.7	−13.4	37.6	0.948	0.154	22.4	137.9	325.0	105.1	14.8	2.97

CAP (#0001): Total of **737** orbits. $\lambda_O = 127.9°$, $\lambda_g–\lambda_O = 179.3°$, $\beta_g = 9.9°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$.
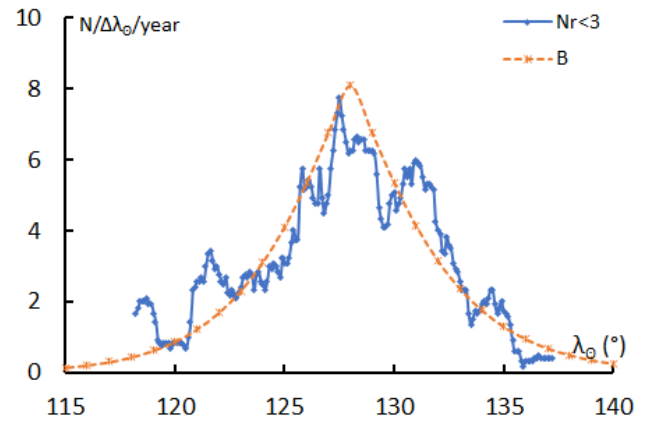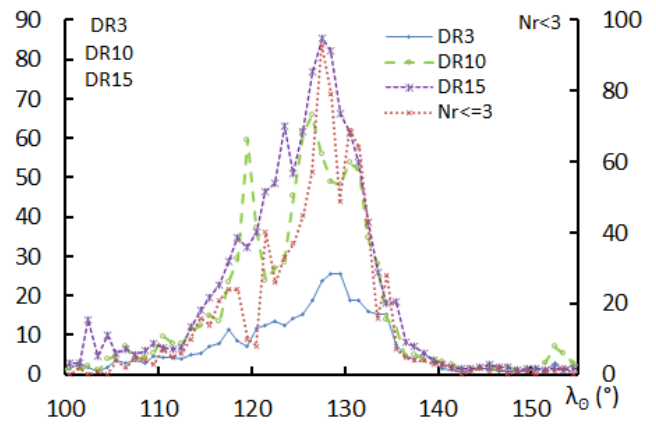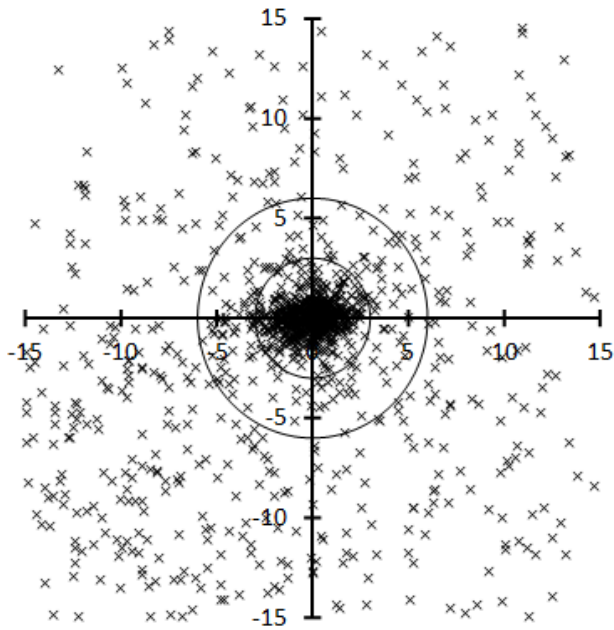
Table 1 – Number per year.

Year	N	Year	N
2007	56	2013	43
2008	42	2014	63
2009	21	2015	74
2010	70	2016	81
2011	30	2017	42
2012	88	2018	127

Table 2 – Activity profiles.

|	λ_O	Max
Nr<=3	127.5	93
DR3	129.5	25.7
DR10	126.5	65.8
DR15	127.5	85.3

Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
100	190.1	6.5	290.8	−15.5	27.4	0.817	0.391	7.2	291.6	100.0	31.8	−6.7	2.14
101	189.7	6.6	291.4	−15.3	27.2	0.815	0.399	7.2	290.7	101.0	31.8	−6.8	2.15
102	189.3	6.7	292.0	−15.1	27.1	0.812	0.407	7.2	289.8	102.0	31.9	−6.8	2.17
103	188.9	6.9	292.5	−14.9	26.9	0.810	0.415	7.3	288.8	103.0	32.0	−6.9	2.18
104	188.5	7.0	293.1	−14.7	26.7	0.808	0.422	7.3	287.9	104.0	32.1	−6.9	2.20
105	188.1	7.1	293.7	−14.5	26.5	0.806	0.430	7.3	287.0	105.0	32.1	−7.0	2.22
106	187.7	7.2	294.3	−14.2	26.3	0.804	0.438	7.3	286.1	106.0	32.2	−7.0	2.23
107	187.3	7.4	294.8	−14.0	26.1	0.801	0.446	7.3	285.2	107.0	32.3	−7.1	2.25
108	186.8	7.5	295.4	−13.8	25.9	0.799	0.454	7.3	284.3	108.0	32.4	−7.1	2.26
109	186.4	7.6	296.0	−13.6	25.7	0.797	0.461	7.3	283.4	109.0	32.5	−7.1	2.27
110	186.0	7.7	296.5	−13.3	25.5	0.795	0.469	7.3	282.5	110.0	32.6	−7.2	2.29
111	185.6	7.9	297.1	−13.1	25.3	0.793	0.477	7.3	281.6	111.0	32.7	−7.2	2.30
112	185.2	8.0	297.7	−12.9	25.1	0.791	0.484	7.3	280.7	112.0	32.8	−7.2	2.31
113	184.8	8.1	298.2	−12.7	24.9	0.789	0.492	7.3	279.8	113.0	32.9	−7.2	2.33
114	184.4	8.2	298.8	−12.4	24.7	0.786	0.500	7.3	278.9	114.0	33.0	−7.2	2.34
115	183.9	8.3	299.3	−12.2	24.5	0.784	0.507	7.3	278.0	115.0	33.1	−7.3	2.35
116	183.5	8.5	299.9	−12.0	24.3	0.782	0.515	7.3	277.1	116.0	33.2	−7.3	2.36
117	183.1	8.6	300.4	−11.7	24.1	0.780	0.522	7.3	276.3	117.0	33.3	−7.3	2.37
118	182.7	8.7	301.0	−11.5	23.9	0.778	0.530	7.3	275.4	118.0	33.4	−7.3	2.38
119	182.3	8.8	301.5	−11.3	23.7	0.776	0.537	7.3	274.5	119.0	33.6	−7.3	2.39
120	181.9	9.0	302.1	−11.0	23.5	0.773	0.545	7.3	273.7	120.0	33.7	−7.3	2.40

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
121	181.4	9.1	302.6	−10.8	23.3	0.771	0.552	7.3	272.8	121.0	33.8	−7.3	2.41
122	181.0	9.2	303.2	−10.5	23.1	0.769	0.559	7.3	272.0	122.0	34.0	−7.3	2.42
123	180.6	9.3	303.7	−10.3	22.9	0.767	0.566	7.3	271.1	123.0	34.1	−7.3	2.43
124	180.2	9.4	304.3	−10.0	22.8	0.765	0.574	7.3	270.3	124.0	34.3	−7.3	2.44
125	179.8	9.5	304.8	−9.8	22.6	0.762	0.581	7.2	269.4	125.0	34.4	−7.2	2.44
126	179.4	9.7	305.3	−9.5	22.4	0.760	0.588	7.2	268.6	126.0	34.6	−7.2	2.45
127	178.9	9.8	305.9	−9.3	22.2	0.758	0.595	7.2	267.8	127.0	34.7	−7.2	2.45
128	178.5	9.9	306.4	−9.1	22.0	0.755	0.602	7.2	266.9	128.0	34.9	−7.2	2.46
129	178.1	10.0	306.9	−8.8	21.8	0.753	0.609	7.2	266.1	129.0	35.1	−7.2	2.46
130	177.7	10.1	307.5	−8.5	21.6	0.750	0.615	7.2	265.3	130.0	35.3	−7.1	2.47
131	177.3	10.2	308.0	−8.3	21.4	0.748	0.622	7.1	264.5	131.0	35.4	−7.1	2.47
132	176.8	10.4	308.5	−8.0	21.2	0.745	0.629	7.1	263.7	132.0	35.6	−7.1	2.47
133	176.4	10.5	309.1	−7.8	21.0	0.743	0.636	7.1	262.9	133.0	35.8	−7.0	2.47
134	176.0	10.6	309.6	−7.5	20.8	0.740	0.642	7.1	262.1	134.0	36.0	−7.0	2.47
135	175.6	10.7	310.1	−7.3	20.6	0.738	0.649	7.0	261.3	135.0	36.2	−7.0	2.47
136	175.2	10.8	310.6	−7.0	20.4	0.735	0.655	7.0	260.5	136.0	36.4	−6.9	2.47
137	174.7	10.9	311.2	−6.8	20.2	0.732	0.662	7.0	259.7	137.0	36.7	−6.9	2.47
138	174.3	11.0	311.7	−6.5	20.0	0.730	0.668	7.0	259.0	138.0	36.9	−6.8	2.47
139	173.9	11.1	312.2	−6.2	19.8	0.727	0.674	6.9	258.2	139.0	37.1	−6.8	2.47
140	173.5	11.2	312.7	−6.0	19.6	0.724	0.680	6.9	257.4	140.0	37.3	−6.7	2.46

ERI (#0191): Total of **510** orbits. $\lambda_{\odot} = 137.6°$, $\lambda_g–\lambda_{\odot} = 260.6°$, $\beta_g = –27.3°$, $\Delta r = 3°$, $\Delta\lambda_{\odot} = 20°$.
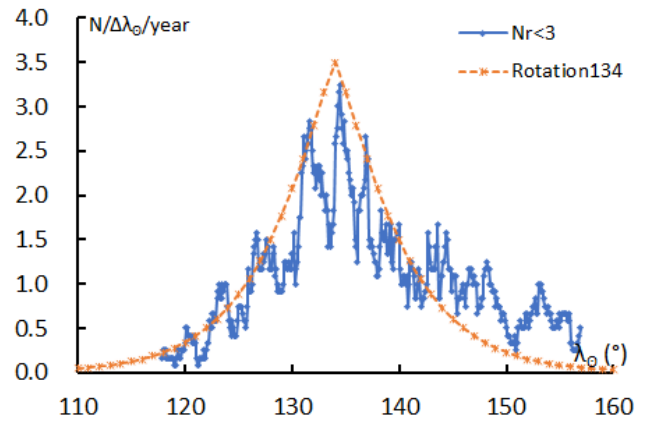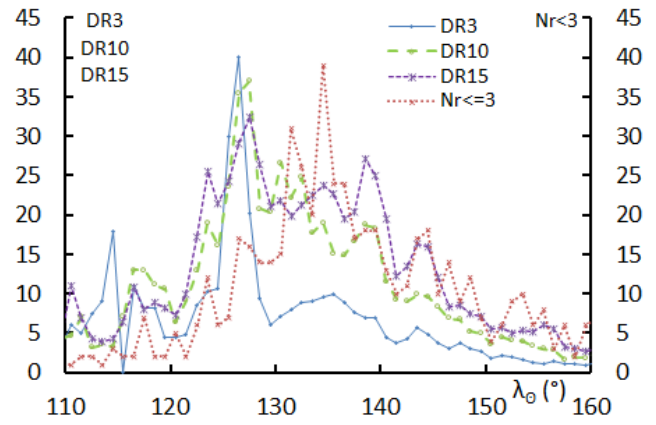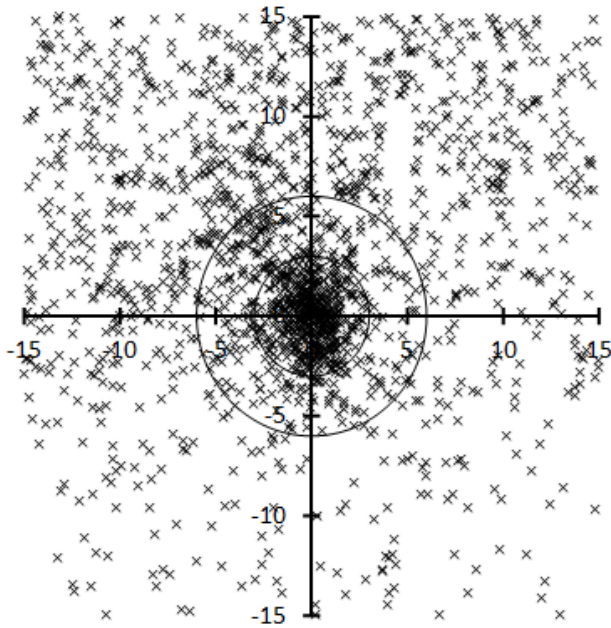
Table 1 – Number per year.

Year	N	Year	N
2007	37	2013	43
2008	35	2014	29
2009	30	2015	35
2010	57	2016	47
2011	35	2017	30
2012	78	2018	54

Table 2 – Activity profiles.

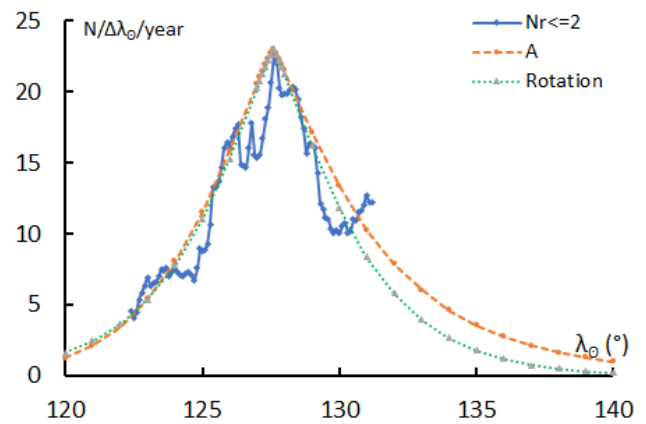|	$\lambda_{\odot}$	Max
Nr<=3	134.5	39
DR3	126.5	40.0
DR10	127.5	37.0
DR15	127.5	32.4

Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\odot}$	$\lambda_g–\lambda_{\odot}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
110	259.6	–28.4	20.5	–22.2	63.7	0.942	0.952	130.5	29.6	290.0	269.8	22.0	16.53
111	259.6	–28.3	21.3	–21.8	63.7	0.942	0.952	130.6	29.6	291.0	270.7	22.0	16.34
112	259.6	–28.3	22.2	–21.4	63.8	0.941	0.952	130.6	29.6	292.0	271.7	22.0	16.14
113	259.7	–28.3	23.0	–20.9	63.8	0.940	0.952	130.7	29.6	293.0	272.7	22.0	15.95
114	259.7	–28.2	23.9	–20.5	63.8	0.940	0.952	130.8	29.6	294.0	273.6	22.0	15.76
115	259.7	–28.2	24.7	–20.1	63.8	0.939	0.952	130.8	29.6	295.0	274.6	22.0	15.57
116	259.7	–28.1	25.6	–19.7	63.8	0.938	0.952	130.9	29.6	296.0	275.6	22.0	15.38
117	259.7	–28.1	26.4	–19.3	63.8	0.937	0.952	131.0	29.7	297.0	276.5	21.9	15.19
118	259.7	–28.1	27.3	–18.9	63.8	0.937	0.952	131.0	29.7	298.0	277.5	21.9	15.00
119	259.7	–28.0	28.1	–18.5	63.8	0.936	0.952	131.1	29.7	299.0	278.5	21.9	14.81
120	259.8	–28.0	29.0	–18.2	63.8	0.935	0.951	131.1	29.7	300.0	279.4	21.9	14.62
121	259.8	–27.9	29.8	–17.8	63.8	0.934	0.951	131.2	29.7	301.0	280.4	21.9	14.43
122	259.8	–27.9	30.7	–17.4	63.8	0.933	0.951	131.3	29.7	302.0	281.4	21.9	14.25
123	259.8	–27.9	31.5	–17.0	63.8	0.932	0.951	131.3	29.7	303.0	282.3	21.9	14.06
124	259.8	–27.8	32.4	–16.6	63.9	0.931	0.951	131.4	29.8	304.0	283.3	21.9	13.88
125	259.8	–27.8	33.3	–16.2	63.9	0.931	0.951	131.5	29.8	305.0	284.3	21.8	13.70
126	259.9	–27.7	34.1	–15.9	63.9	0.930	0.951	131.5	29.8	306.0	285.2	21.8	13.51
127	259.9	–27.7	35.0	–15.5	63.9	0.929	0.951	131.6	29.8	307.0	286.2	21.8	13.33
128	259.9	–27.7	35.8	–15.1	63.9	0.928	0.950	131.6	29.8	308.0	287.1	21.8	13.16
129	259.9	–27.6	36.7	–14.8	63.9	0.927	0.950	131.7	29.8	309.0	288.1	21.8	12.98
130	259.9	–27.6	37.5	–14.4	63.9	0.926	0.950	131.8	29.9	310.0	289.1	21.8	12.81

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
131	259.9	–27.5	38.4	–14.1	63.9	0.925	0.950	131.8	29.9	311.0	290.0	21.8	12.63
132	260.0	–27.5	39.2	–13.7	63.9	0.924	0.950	131.9	29.9	312.0	291.0	21.8	12.46
133	260.0	–27.5	40.1	–13.4	63.9	0.923	0.950	132.0	29.9	313.0	292.0	21.8	12.29
134	260.0	–27.4	40.9	–13.0	63.9	0.922	0.949	132.0	29.9	314.0	292.9	21.7	12.13
135	260.0	–27.4	41.8	–12.7	64.0	0.921	0.949	132.1	29.9	315.0	293.9	21.7	11.96
136	260.0	–27.3	42.7	–12.3	64.0	0.920	0.949	132.1	30.0	316.0	294.9	21.7	11.80
137	260.0	–27.3	43.5	–12.0	64.0	0.918	0.949	132.2	30.0	317.0	295.8	21.7	11.64
138	260.0	–27.3	44.4	–11.7	64.0	0.917	0.949	132.3	30.0	318.0	296.8	21.7	11.48
139	260.1	–27.2	45.2	–11.4	64.0	0.916	0.948	132.3	30.0	319.0	297.8	21.7	11.32
140	260.1	–27.2	46.1	–11.0	64.0	0.915	0.948	132.4	30.0	320.0	298.7	21.7	11.17
141	260.1	–27.1	47.0	–10.7	64.0	0.914	0.948	132.5	30.0	321.0	299.7	21.7	11.01
142	260.1	–27.1	47.8	–10.4	64.0	0.913	0.948	132.5	30.1	322.0	300.6	21.7	10.86
143	260.1	–27.1	48.7	–10.1	64.0	0.912	0.948	132.6	30.1	323.0	301.6	21.7	10.72
144	260.1	–27.0	49.6	–9.8	64.0	0.910	0.947	132.6	30.1	324.0	302.6	21.6	10.57
145	260.2	–27.0	50.4	–9.5	64.0	0.909	0.947	132.7	30.1	325.0	303.5	21.6	10.43
146	260.2	–26.9	51.3	–9.2	64.1	0.908	0.947	132.8	30.1	326.0	304.5	21.6	10.28
147	260.2	–26.9	52.2	–8.9	64.1	0.907	0.947	132.8	30.1	327.0	305.5	21.6	10.15
148	260.2	–26.9	53.0	–8.6	64.1	0.905	0.947	132.9	30.2	328.0	306.4	21.6	10.01
149	260.2	–26.8	53.9	–8.4	64.1	0.904	0.946	132.9	30.2	329.0	307.4	21.6	9.87
150	260.2	–26.8	54.8	–8.1	64.1	0.903	0.946	133.0	30.2	330.0	308.4	21.6	9.74
151	260.2	–26.7	55.6	–7.8	64.1	0.902	0.946	133.1	30.2	331.0	309.3	21.6	9.61
152	260.3	–26.7	56.5	–7.5	64.1	0.900	0.946	133.1	30.2	332.0	310.3	21.6	9.48
153	260.3	–26.7	57.4	–7.3	64.1	0.899	0.945	133.2	30.3	333.0	311.2	21.6	9.35
154	260.3	–26.6	58.3	–7.0	64.1	0.898	0.945	133.2	30.3	334.0	312.2	21.5	9.23
155	260.3	–26.6	59.2	–6.8	64.1	0.896	0.945	133.3	30.3	335.0	313.2	21.5	9.11
156	260.3	–26.5	60.0	–6.5	64.1	0.895	0.945	133.4	30.3	336.0	314.1	21.5	8.99
157	260.3	–26.5	60.9	–6.3	64.2	0.894	0.944	133.4	30.3	337.0	315.1	21.5	8.87
158	260.4	–26.5	61.8	–6.1	64.2	0.892	0.944	133.5	30.3	338.0	316.1	21.5	8.75
159	260.4	–26.4	62.7	–5.8	64.2	0.891	0.944	133.5	30.4	339.0	317.0	21.5	8.64
160	260.4	–26.4	63.6	–5.6	64.2	0.889	0.944	133.6	30.4	340.0	318.0	21.5	8.53

PAU (#0183): Total of **59** orbits. $\lambda_O = 135.1°$, $\lambda_g–\lambda_O = 210.8°$, $\beta_g = –16.7°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$. The listed maximum λ_O for PAU in the SD are dispersed widely $\lambda_O = 123.7°$ to 135.3°. The early traditional 'Piscis Austrinids' in late July cannot be found in recent video observations. The listed activity is another independent one.
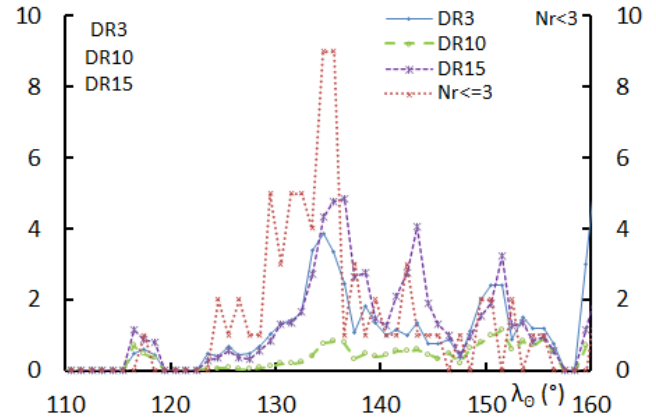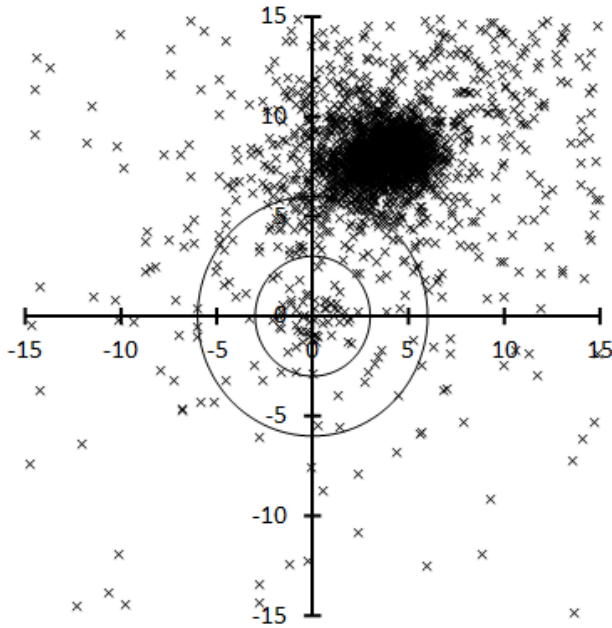
Table 1 – Number per year.

Year	N	Year	N
2007	6	2013	3
2008	6	2014	4
2009	1	2015	4
2010	11	2016	5
2011	4	2017	3
2012	3	2018	9

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	134.5	9
DR3	134.5	3.9
DR10	135.5	0.8
DR15	136.5	4.8
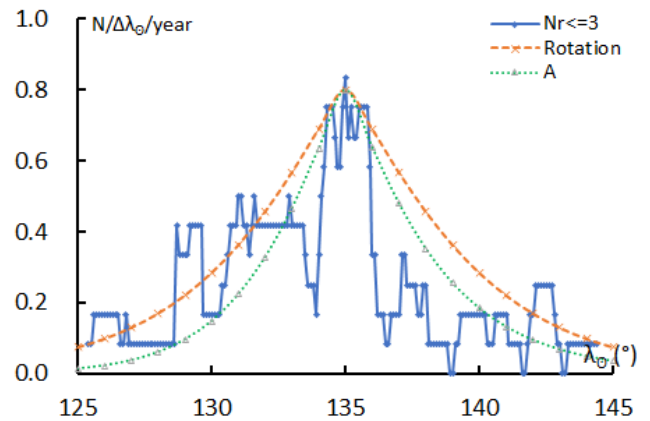
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
125	212.4	–15.7	345.4	–23.3	42.9	0.959	0.111	58.2	145.1	305.0	104.8	29.1	2.70
126	212.2	–15.7	346.2	–23.0	42.9	0.959	0.112	57.9	144.8	306.0	105.4	29.2	2.76
127	212.0	–15.7	347.0	–22.7	42.9	0.960	0.113	57.6	144.5	307.0	106.1	29.3	2.83
128	211.9	–15.8	347.8	–22.4	42.9	0.961	0.114	57.2	144.2	308.0	106.7	29.4	2.89
129	211.7	–15.8	348.6	–22.1	43.0	0.961	0.115	56.9	144.0	309.0	107.3	29.5	2.96
130	211.5	–15.8	349.4	–21.8	43.0	0.962	0.116	56.6	143.7	310.0	108.0	29.6	3.03
131	211.4	–15.8	350.2	–21.5	43.0	0.962	0.118	56.3	143.4	311.0	108.6	29.7	3.11
132	211.2	–15.8	351.0	–21.2	43.0	0.963	0.119	55.9	143.1	312.0	109.2	29.8	3.19
133	211.0	–15.9	351.8	–20.9	43.0	0.963	0.120	55.6	142.9	313.0	109.8	29.9	3.27
134	210.9	–15.9	352.5	–20.5	43.0	0.964	0.121	55.3	142.6	314.0	110.5	30.0	3.36
135	210.7	–15.9	353.3	–20.2	43.0	0.965	0.122	55.0	142.3	315.0	111.1	30.1	3.45
136	210.5	–15.9	354.1	–19.9	43.0	0.965	0.124	54.7	142.0	316.0	111.7	30.1	3.55
137	210.4	–15.9	354.9	–19.6	43.0	0.966	0.125	54.4	141.7	317.0	112.3	30.2	3.65
138	210.2	–16.0	355.7	–19.3	43.0	0.967	0.126	54.0	141.4	318.0	112.9	30.3	3.77
139	210.0	–16.0	356.4	–19.0	43.0	0.967	0.127	53.7	141.1	319.0	113.5	30.4	3.88
140	209.8	–16.0	357.2	–18.7	43.0	0.968	0.128	53.4	140.8	320.0	114.1	30.5	4.01
141	209.7	–16.0	358.0	–18.4	43.1	0.969	0.130	53.1	140.5	321.0	114.7	30.6	4.14
142	209.5	–16.0	358.8	–18.1	43.1	0.969	0.131	52.8	140.2	322.0	115.3	30.6	4.29
143	209.3	–16.1	359.5	–17.7	43.1	0.970	0.132	52.5	139.9	323.0	115.9	30.7	4.44
144	209.2	–16.1	0.3	–17.4	43.1	0.971	0.134	52.2	139.6	324.0	116.5	30.8	4.60
145	209.0	–16.1	1.1	–17.1	43.1	0.972	0.135	51.9	139.3	325.0	117.1	30.9	4.78

PER (#0007): Total of **13993** orbits. $\lambda_{\odot} = 137°$, $\lambda_g - \lambda_{\odot} = 283.3°$, $\beta_g = 38.3°$, $\Delta r = 3°$, $\Delta\lambda_{\odot} = 8°$.
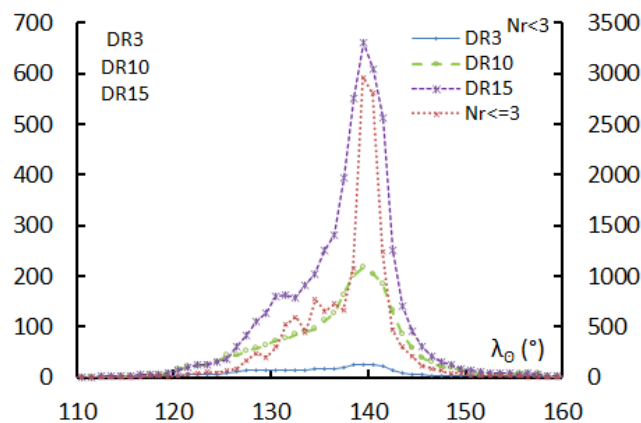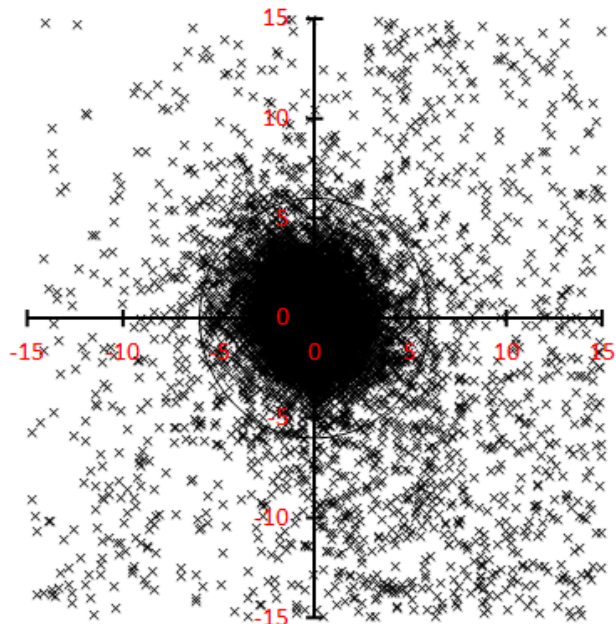
Table 1 – Number per year.

Year	N	Year	N
2007	2067	2013	1627
2008	929	2014	494
2009	604	2015	697
2010	1151	2016	1950
2011	1232	2017	660
2012	1063	2018	1519

Table 2 – Activity profiles.

	$\lambda_{\odot}$	Max
Nr<=3	139.5	2967
DR3	139.5	26.3
DR10	139.5	216.9
DR15	139.5	660.3
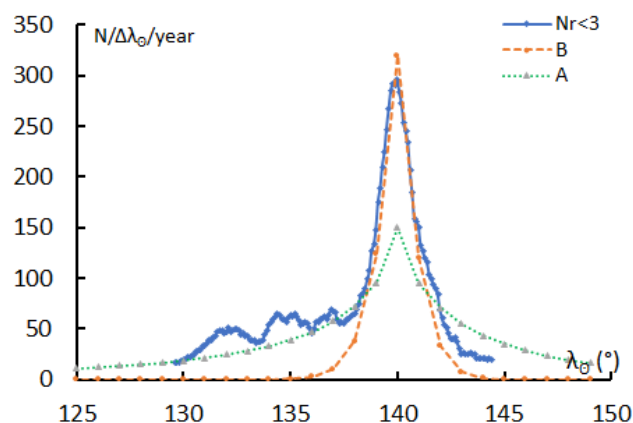
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\odot}$	$\lambda_g-\lambda_{\odot}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
110	282.7	40.3	10.7	49.3	58.4	0.980	0.960	110.5	152.5	110.0	300.3	25.6	47.31
111	282.8	40.3	11.8	49.6	58.4	0.978	0.959	110.6	152.4	111.0	301.4	25.7	43.59
112	282.8	40.2	12.8	49.9	58.4	0.976	0.959	110.7	152.4	112.0	302.5	25.7	40.39
113	282.8	40.1	13.9	50.3	58.5	0.975	0.959	110.8	152.3	113.0	303.6	25.8	37.61
114	282.8	40.1	15.0	50.6	58.5	0.973	0.959	110.9	152.2	114.0	304.6	25.8	35.17
115	282.8	40.0	16.2	50.9	58.5	0.971	0.958	111.0	152.1	115.0	305.7	25.9	33.02
116	282.8	39.9	17.3	51.3	58.5	0.969	0.958	111.0	152.0	116.0	306.8	25.9	31.10
117	282.8	39.9	18.4	51.6	58.5	0.967	0.958	111.1	152.0	117.0	307.9	26.0	29.38
118	282.9	39.8	19.6	51.9	58.5	0.966	0.957	111.2	151.9	118.0	308.9	26.1	27.84
119	282.9	39.7	20.7	52.2	58.5	0.964	0.957	111.3	151.8	119.0	310.0	26.1	26.44
120	282.9	39.7	21.9	52.6	58.6	0.962	0.957	111.4	151.7	120.0	311.1	26.2	25.16
121	282.9	39.6	23.1	52.9	58.6	0.960	0.956	111.5	151.7	121.0	312.2	26.2	24.00
122	282.9	39.5	24.3	53.2	58.6	0.958	0.956	111.5	151.6	122.0	313.2	26.3	22.93
123	282.9	39.5	25.5	53.5	58.6	0.956	0.955	111.6	151.5	123.0	314.3	26.3	21.95
124	282.9	39.4	26.7	53.8	58.6	0.955	0.955	111.7	151.4	124.0	315.4	26.4	21.05
125	282.9	39.3	27.9	54.1	58.6	0.953	0.955	111.8	151.3	125.0	316.5	26.5	20.21
126	283.0	39.3	29.2	54.4	58.6	0.951	0.954	111.9	151.2	126.0	317.6	26.5	19.43
127	283.0	39.2	30.4	54.7	58.6	0.949	0.954	112.0	151.2	127.0	318.6	26.6	18.70
128	283.0	39.2	31.7	55.0	58.7	0.947	0.953	112.0	151.1	128.0	319.7	26.6	18.03
129	283.0	39.1	33.0	55.3	58.7	0.945	0.953	112.1	151.0	129.0	320.8	26.7	17.40
130	283.0	39.0	34.3	55.5	58.7	0.943	0.953	112.2	150.9	130.0	321.9	26.8	16.80

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
131	283.0	39.0	35.6	55.8	58.7	0.941	0.952	112.3	150.8	131.0	323.0	26.8	16.25
132	283.0	38.9	36.9	56.1	58.7	0.939	0.952	112.4	150.7	132.0	324.0	26.9	15.72
133	283.0	38.8	38.3	56.3	58.7	0.938	0.951	112.4	150.6	133.0	325.1	26.9	15.23
134	283.1	38.8	39.6	56.6	58.7	0.936	0.951	112.5	150.6	134.0	326.2	27.0	14.77
135	283.1	38.7	41.0	56.8	58.8	0.934	0.950	112.6	150.5	135.0	327.3	27.1	14.33
136	283.1	38.6	42.4	57.1	58.8	0.932	0.950	112.7	150.4	136.0	328.4	27.1	13.91
137	283.1	38.6	43.8	57.3	58.8	0.930	0.950	112.8	150.3	137.0	329.5	27.2	13.52
138	283.1	38.5	45.2	57.5	58.8	0.928	0.949	112.9	150.2	138.0	330.5	27.3	13.14
139	283.1	38.4	46.6	57.8	58.8	0.926	0.949	112.9	150.1	139.0	331.6	27.3	12.79
140	283.1	38.4	48.1	58.0	58.8	0.924	0.948	113.0	150.0	140.0	332.7	27.4	12.45
141	283.1	38.3	49.5	58.2	58.8	0.922	0.948	113.1	149.9	141.0	333.8	27.5	12.13
142	283.2	38.2	51.0	58.4	58.8	0.920	0.947	113.2	149.8	142.0	334.9	27.5	11.82
143	283.2	38.2	52.5	58.6	58.9	0.918	0.947	113.3	149.7	143.0	336.0	27.6	11.53
144	283.2	38.1	54.0	58.7	58.9	0.916	0.946	113.3	149.6	144.0	337.1	27.7	11.25
145	283.2	38.1	55.5	58.9	58.9	0.914	0.946	113.4	149.5	145.0	338.2	27.7	10.98
146	283.2	38.0	57.0	59.1	58.9	0.912	0.945	113.5	149.4	146.0	339.2	27.8	10.72
147	283.2	37.9	58.6	59.2	58.9	0.910	0.945	113.6	149.3	147.0	340.3	27.9	10.48
148	283.2	37.9	60.1	59.4	58.9	0.908	0.944	113.7	149.3	148.0	341.4	27.9	10.24
149	283.2	37.8	61.7	59.5	58.9	0.906	0.943	113.8	149.2	149.0	342.5	28.0	10.02
150	283.3	37.7	63.2	59.6	59.0	0.904	0.943	113.8	149.1	150.0	343.6	28.1	9.80
151	283.3	37.7	64.8	59.7	59.0	0.902	0.942	113.9	149.0	151.0	344.7	28.1	9.60
152	283.3	37.6	66.4	59.8	59.0	0.900	0.942	114.0	148.8	152.0	345.8	28.2	9.40
153	283.3	37.5	68.0	59.9	59.0	0.898	0.941	114.1	148.7	153.0	346.9	28.3	9.20
154	283.3	37.5	69.6	60.0	59.0	0.896	0.941	114.2	148.6	154.0	348.0	28.3	9.02
155	283.3	37.4	71.2	60.1	59.0	0.894	0.940	114.2	148.5	155.0	349.1	28.4	8.84
156	283.3	37.3	72.8	60.1	59.0	0.892	0.939	114.3	148.4	156.0	350.2	28.5	8.67
157	283.3	37.3	74.4	60.2	59.0	0.890	0.939	114.4	148.3	157.0	351.3	28.6	8.50
158	283.4	37.2	76.0	60.2	59.1	0.888	0.938	114.5	148.2	158.0	352.4	28.6	8.34
159	283.4	37.1	77.7	60.3	59.1	0.886	0.938	114.6	148.1	159.0	353.5	28.7	8.19
160	283.4	37.1	79.3	60.3	59.1	0.883	0.937	114.6	148.0	160.0	354.6	28.8	8.04

KCG (#0012): Total of **283** orbits. λ_{Θ} = 142°, λ_g–λ_{Θ} = 168.0°, β_g = 74.0°, Δr = 3°, $\Delta\lambda_{\Theta}$ = 12°, θ = –20°. 2014 KCG were obstructed by bad weather in Japan. SonotaCo net observers missed the KCG maximum. The maximum of KCG occurs between λ_{Θ} = 140° and 145°.
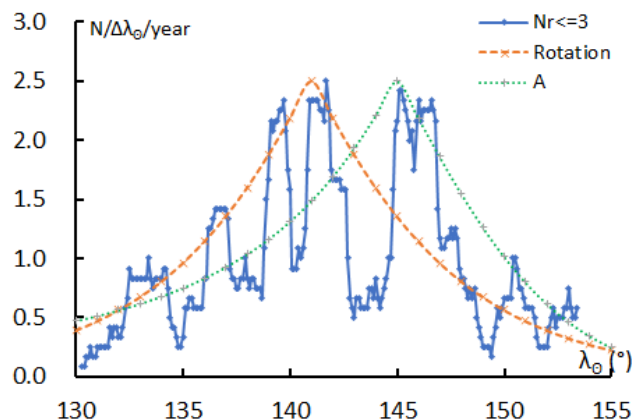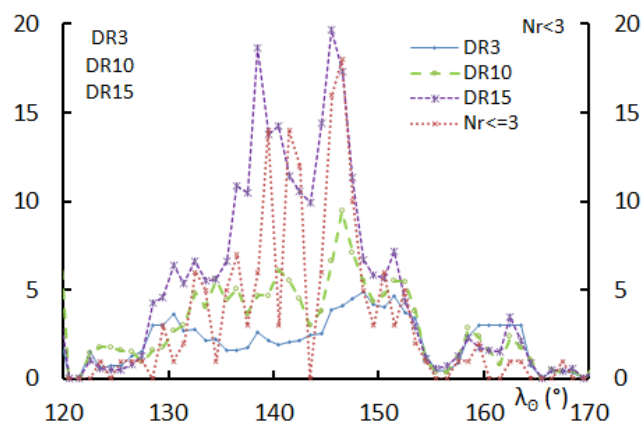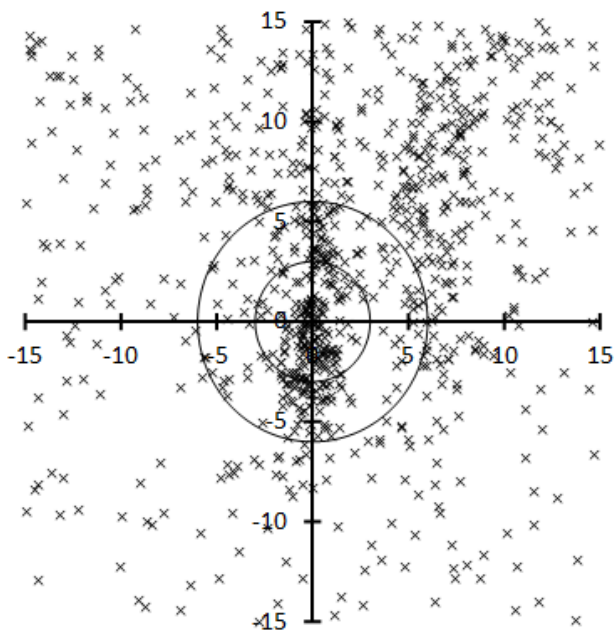
Table 1 – Number per year.

Year	N	Year	N
2007	135	2013	20
2008	2	2014	93
2009	5	2015	4
2010	8	2016	5
2011	2	2017	0
2012	7	2018	2

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	146.5	18
DR3	148.5	4.9
DR10	146.5	9.5
DR15	145.5	19.7

Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	λ_g–λ_{Θ}	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
125	153.2	61.7	275.0	38.4	19.4	0.719	0.957	27.1	210.3	125.0	332.5	–13.3	3.40
126	153.7	62.3	275.8	39.1	19.6	0.719	0.958	27.5	210.1	126.0	333.2	–13.4	3.41
127	154.1	63.0	276.5	39.8	19.8	0.719	0.959	27.9	209.8	127.0	333.9	–13.5	3.41
128	154.6	63.6	277.3	40.5	20.0	0.719	0.960	28.4	209.6	128.0	334.5	–13.6	3.41
129	155.1	64.3	278.1	41.2	20.1	0.718	0.961	28.8	209.3	129.0	335.2	–13.6	3.41
130	155.6	64.9	278.8	41.9	20.3	0.718	0.961	29.2	209.1	130.0	335.9	–13.7	3.41
131	156.2	65.5	279.6	42.7	20.5	0.717	0.962	29.6	208.8	131.0	336.5	–13.8	3.40
132	156.7	66.2	280.3	43.4	20.7	0.716	0.963	30.1	208.5	132.0	337.2	–13.8	3.40
133	157.3	66.8	281.0	44.1	20.8	0.715	0.964	30.5	208.2	133.0	337.8	–13.9	3.39
134	158.0	67.4	281.7	44.9	21.0	0.714	0.965	30.9	207.9	134.0	338.4	–13.9	3.38
135	158.7	68.0	282.4	45.6	21.2	0.713	0.966	31.3	207.6	135.0	339.1	–13.9	3.37
136	159.4	68.7	283.1	46.4	21.4	0.712	0.967	31.8	207.3	136.0	339.7	–14.0	3.36
137	160.1	69.3	283.7	47.1	21.5	0.710	0.968	32.2	206.9	137.0	340.3	–14.0	3.34
138	160.9	69.9	284.4	47.9	21.7	0.709	0.969	32.6	206.6	138.0	340.9	–14.0	3.33
139	161.7	70.5	285.0	48.7	21.9	0.707	0.970	33.1	206.2	139.0	341.4	–14.0	3.31
140	162.6	71.1	285.6	49.4	22.1	0.705	0.971	33.5	205.9	140.0	342.0	–13.9	3.29
141	163.6	71.7	286.2	50.2	22.2	0.703	0.972	33.9	205.5	141.0	342.6	–13.9	3.27
142	164.6	72.3	286.7	51.0	22.4	0.700	0.973	34.4	205.1	142.0	343.2	–13.9	3.25
143	165.7	72.9	287.3	51.8	22.6	0.698	0.975	34.8	204.7	143.0	343.7	–13.8	3.23
144	166.8	73.5	287.8	52.6	22.7	0.695	0.976	35.2	204.3	144.0	344.3	–13.7	3.20
145	168.1	74.1	288.3	53.4	22.9	0.693	0.977	35.7	203.9	145.0	344.8	–13.7	3.18

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
146	169.4	74.6	288.8	54.2	23.1	0.690	0.978	36.1	203.5	146.0	345.3	−13.6	3.15
147	170.8	75.2	289.3	55.0	23.3	0.687	0.979	36.5	203.0	147.0	345.8	−13.5	3.12
148	172.3	75.7	289.7	55.8	23.4	0.683	0.980	37.0	202.6	148.0	346.4	−13.3	3.10
149	174.0	76.3	290.1	56.6	23.6	0.680	0.981	37.4	202.1	149.0	346.9	−13.2	3.07
150	175.8	76.8	290.5	57.4	23.8	0.677	0.983	37.8	201.6	150.0	347.4	−13.0	3.04
151	177.7	77.3	290.8	58.2	24.0	0.673	0.984	38.2	201.1	151.0	347.9	−12.9	3.01
152	179.8	77.8	291.1	59.0	24.1	0.669	0.985	38.7	200.6	152.0	348.3	−12.7	2.98
153	182.1	78.3	291.4	59.8	24.3	0.665	0.986	39.1	200.1	153.0	348.8	−12.5	2.95
154	184.5	78.8	291.7	60.7	24.5	0.661	0.987	39.5	199.5	154.0	349.3	−12.3	2.92
155	187.2	79.2	291.9	61.5	24.7	0.657	0.988	40.0	198.9	155.0	349.7	−12.0	2.88
156	190.0	79.7	292.0	62.3	24.8	0.653	0.990	40.4	198.4	156.0	350.2	−11.8	2.85
157	193.2	80.0	292.1	63.1	25.0	0.649	0.991	40.8	197.8	157.0	350.6	−11.5	2.82
158	196.5	80.4	292.2	63.9	25.2	0.644	0.992	41.3	197.2	158.0	351.1	−11.2	2.79
159	200.1	80.7	292.2	64.8	25.4	0.640	0.993	41.7	196.5	159.0	351.5	−10.9	2.75
160	203.9	81.0	292.1	65.6	25.5	0.635	0.994	42.1	195.9	160.0	351.9	−10.6	2.72

**AXD:** Total of **88** orbits. $\lambda_O = 140°$, $\lambda_g–\lambda_O = 146.6°$, $\beta_g = 77.2°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$, $\theta = 0°$. This activity has been assumed to be the regular KCG but it is clearly distinct from the KCG.
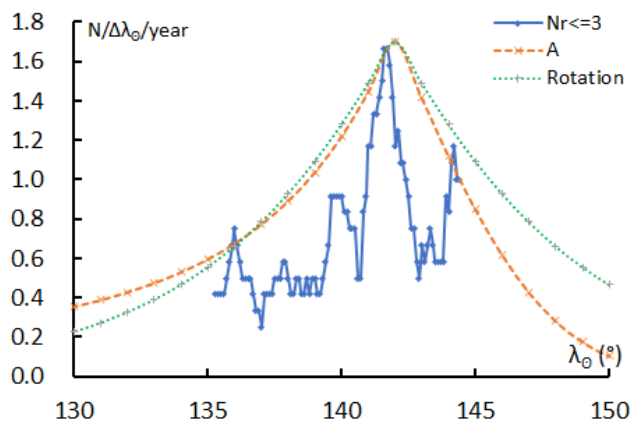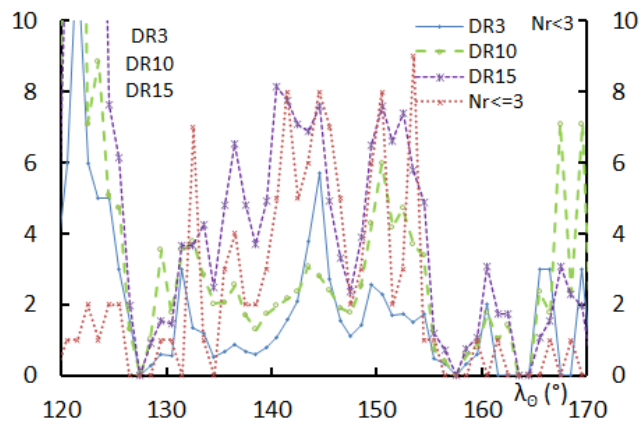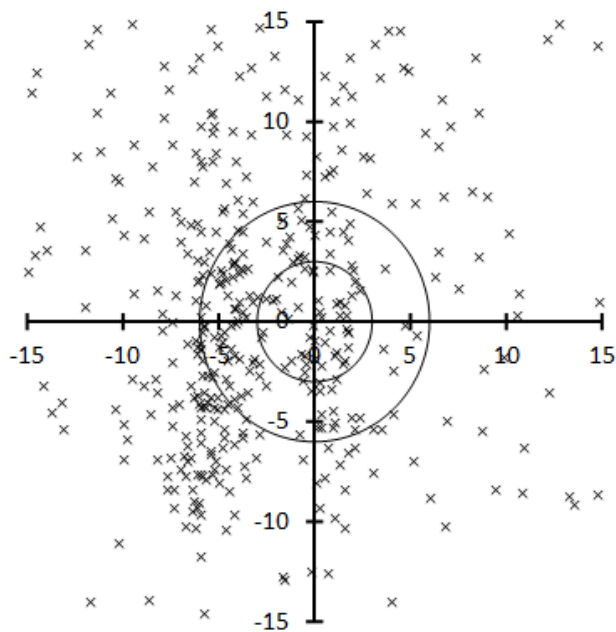
Table 1 – Number per year.

Year	N	Year	N
2007	21	2013	8
2008	2	2014	2
2009	7	2015	6
2010	7	2016	7
2011	7	2017	3
2012	9	2018	9

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	141.5	8
DR3	143.5	3.8
DR10	143.5	3.1
DR15	140.5	8.2

Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
125	152.3	55.8	274.9	32.5	17.6	0.676	0.946	23.2	214.0	125.0	336.8	–12.7	2.92
126	152.1	57.0	275.3	33.8	17.7	0.677	0.949	23.7	213.1	126.0	336.8	–12.7	2.93
127	151.9	58.3	275.7	35.0	17.9	0.677	0.952	24.3	212.3	127.0	336.9	–12.7	2.94
128	151.7	59.5	276.1	36.3	18.1	0.677	0.955	24.8	211.4	128.0	337.0	–12.6	2.95
129	151.5	60.7	276.4	37.5	18.2	0.676	0.959	25.3	210.4	129.0	337.0	–12.5	2.96
130	151.2	62.0	276.7	38.8	18.4	0.675	0.962	25.8	209.5	130.0	337.0	–12.4	2.96
131	150.9	63.2	277.0	40.0	18.5	0.675	0.965	26.4	208.5	131.0	337.0	–12.2	2.97
132	150.6	64.4	277.2	41.3	18.7	0.674	0.968	26.9	207.5	132.0	336.9	–12.1	2.97
133	150.3	65.7	277.4	42.6	18.9	0.672	0.972	27.4	206.5	133.0	336.9	–11.8	2.96
134	149.9	66.9	277.5	43.8	19.0	0.671	0.975	27.9	205.4	134.0	336.8	–11.6	2.96
135	149.5	68.1	277.6	45.0	19.2	0.669	0.978	28.4	204.4	135.0	336.7	–11.3	2.95
136	149.0	69.3	277.6	46.3	19.4	0.667	0.981	28.8	203.3	136.0	336.6	–11.0	2.95
137	148.5	70.6	277.6	47.5	19.5	0.665	0.984	29.3	202.1	137.0	336.5	–10.6	2.94
138	148.0	71.8	277.5	48.7	19.7	0.663	0.987	29.8	200.9	138.0	336.4	–10.2	2.93
139	147.3	73.0	277.3	50.0	19.8	0.660	0.990	30.3	199.7	139.0	336.2	–9.8	2.91
140	146.5	74.2	277.1	51.2	20.0	0.657	0.992	30.7	198.5	140.0	336.0	–9.3	2.90
141	145.7	75.4	276.8	52.4	20.2	0.654	0.995	31.2	197.2	141.0	335.9	–8.8	2.88
142	144.6	76.6	276.4	53.6	20.3	0.651	0.998	31.6	195.9	142.0	335.7	–8.3	2.86
143	143.4	77.8	275.9	54.7	20.5	0.648	1.000	32.0	194.6	143.0	335.4	–7.7	2.84
144	141.9	79.0	275.3	55.9	20.6	0.645	1.002	32.5	193.2	144.0	335.2	–7.0	2.82
145	140.0	80.2	274.6	57.0	20.8	0.641	1.004	32.9	191.8	145.0	334.9	–6.4	2.80

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
146	137.6	81.4	273.8	58.1	21.0	0.637	1.006	33.3	190.3	146.0	334.7	−5.7	2.77
147	134.5	82.6	272.9	59.2	21.1	0.633	1.007	33.7	188.9	147.0	334.4	−4.9	2.75
148	130.3	83.7	271.8	60.3	21.3	0.629	1.008	34.1	187.3	148.0	334.1	−4.1	2.72
149	124.3	84.8	270.6	61.3	21.4	0.625	1.009	34.5	185.8	149.0	333.8	−3.3	2.69
150	115.3	85.8	269.2	62.3	21.6	0.621	1.010	34.9	184.2	150.0	333.4	−2.4	2.67
151	101.4	86.6	267.7	63.3	21.8	0.617	1.011	35.3	182.5	151.0	333.0	−1.4	2.64
152	80.9	87.1	266.0	64.2	21.9	0.612	1.011	35.6	180.8	152.0	332.7	−0.5	2.61
153	56.0	87.2	264.1	65.1	22.1	0.608	1.011	36.0	179.1	153.0	332.2	0.6	2.58
154	34.4	86.7	262.0	65.9	22.3	0.604	1.010	36.3	177.3	154.0	331.8	1.6	2.55
155	19.6	85.9	259.7	66.6	22.4	0.599	1.009	36.7	175.4	155.0	331.3	2.7	2.52
156	10.0	84.9	257.2	67.3	22.6	0.595	1.007	37.0	173.6	156.0	330.8	3.9	2.49
157	3.6	83.9	254.5	67.9	22.7	0.590	1.006	37.3	171.6	157.0	330.3	5.1	2.45
158	359.1	82.7	251.6	68.4	22.9	0.586	1.003	37.6	169.6	158.0	329.8	6.3	2.42
159	355.9	81.6	248.5	68.8	23.1	0.582	1.000	37.9	167.6	159.0	329.2	7.6	2.39
160	353.4	80.4	245.3	69.1	23.2	0.578	0.997	38.2	165.5	160.0	328.5	8.9	2.36

NDA (#0026): Total of **310** orbits. $\lambda_\Theta = 147°$, $\lambda_g-\lambda_\Theta = 207.3°$, $\beta_g = 6.9°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$. This activity should be distinguished from the traditional 'Northern delta Aquariids'. The radiants do not show a clear concentration and the raw observed meteor number changes irregularly. It is suggested there might be several meteor shower activities.
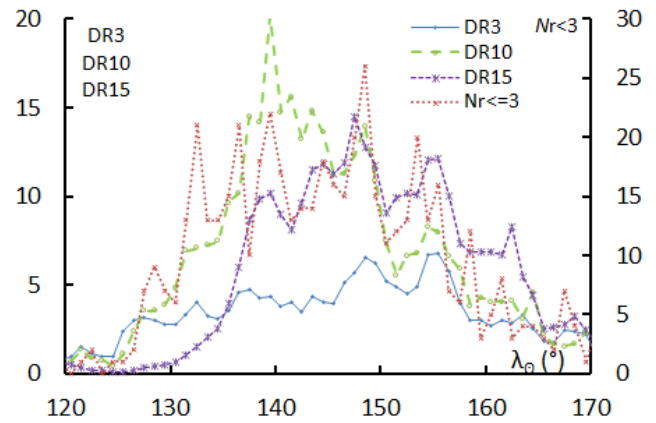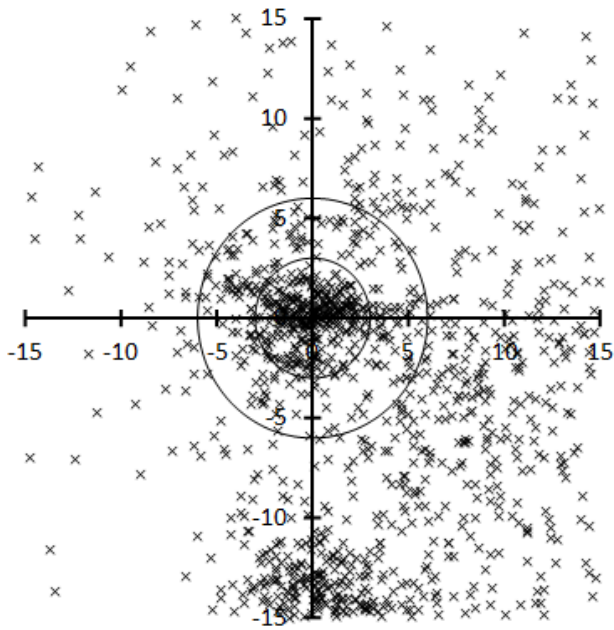
Table 1 – Number per year.

Year	N	Year	N
2007	33	2013	33
2008	8	2014	12
2009	30	2015	11
2010	35	2016	25
2011	8	2017	19
2012	49	2018	47

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	148.5	26
DR3	155.5	6.7
DR10	139.5	20.2
DR15	147.5	14.5
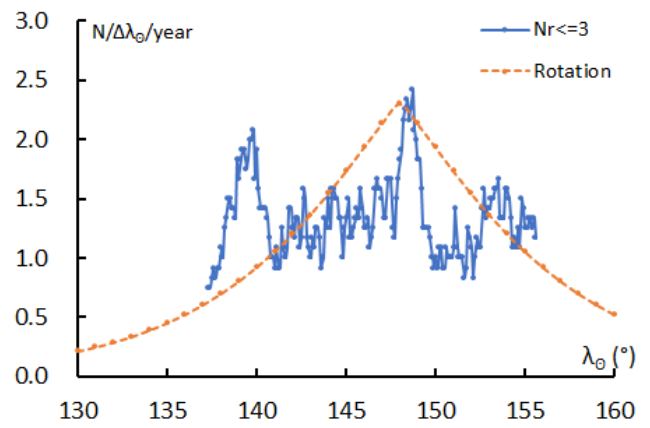
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
130	208.9	6.1	338.2	–2.5	40.0	0.968	0.071	22.8	332.9	130.0	104.7	–10.2	2.21
131	208.8	6.2	339.0	–2.2	39.9	0.967	0.073	22.7	332.6	131.0	105.4	–10.2	2.21
132	208.7	6.2	339.8	–1.8	39.8	0.966	0.075	22.5	332.3	132.0	106.1	–10.3	2.21
133	208.6	6.3	340.6	–1.4	39.7	0.965	0.076	22.4	332.0	133.0	106.8	–10.3	2.21
134	208.5	6.3	341.4	–1.1	39.6	0.965	0.078	22.3	331.7	134.0	107.5	–10.3	2.20
135	208.4	6.4	342.2	–0.7	39.5	0.964	0.079	22.1	331.4	135.0	108.2	–10.4	2.20
136	208.2	6.4	343.0	–0.3	39.4	0.963	0.081	22.0	331.1	136.0	108.9	–10.4	2.20
137	208.1	6.4	343.8	0.1	39.3	0.962	0.083	21.9	330.8	137.0	109.6	–10.5	2.19
138	208.0	6.5	344.6	0.5	39.2	0.962	0.084	21.8	330.5	138.0	110.3	–10.5	2.19
139	207.9	6.5	345.4	0.9	39.1	0.961	0.086	21.7	330.2	139.0	111.0	–10.6	2.19
140	207.8	6.6	346.2	1.2	39.0	0.960	0.088	21.5	329.9	140.0	111.7	–10.6	2.18
141	207.7	6.6	347.0	1.6	38.9	0.959	0.089	21.4	329.6	141.0	112.4	–10.7	2.18
142	207.6	6.7	347.8	2.0	38.8	0.958	0.091	21.3	329.3	142.0	113.1	–10.7	2.18
143	207.5	6.7	348.6	2.4	38.7	0.957	0.093	21.2	329.0	143.0	113.8	–10.7	2.17
144	207.4	6.8	349.4	2.8	38.6	0.956	0.095	21.1	328.7	144.0	114.4	–10.8	2.17
145	207.2	6.8	350.2	3.2	38.5	0.956	0.096	21.0	328.4	145.0	115.1	–10.8	2.17
146	207.1	6.9	351.0	3.6	38.4	0.955	0.098	20.9	328.1	146.0	115.8	–10.9	2.16
147	207.0	6.9	351.8	4.0	38.3	0.954	0.100	20.8	327.8	147.0	116.5	–10.9	2.16
148	206.9	7.0	352.6	4.4	38.2	0.953	0.102	20.7	327.5	148.0	117.2	–10.9	2.16
149	206.8	7.0	353.4	4.8	38.1	0.952	0.103	20.6	327.2	149.0	117.9	–11.0	2.15

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
150	206.7	7.0	354.2	5.1	38.0	0.951	0.105	20.5	326.9	150.0	118.6	−11.0	2.15
151	206.6	7.1	354.9	5.5	37.9	0.950	0.107	20.4	326.6	151.0	119.3	−11.0	2.15
152	206.5	7.1	355.7	5.9	37.8	0.949	0.109	20.3	326.3	152.0	120.0	−11.1	2.14
153	206.4	7.2	356.5	6.3	37.8	0.948	0.111	20.2	326.0	153.0	120.7	−11.1	2.14
154	206.2	7.2	357.3	6.7	37.7	0.947	0.113	20.1	325.7	154.0	121.4	−11.1	2.14
155	206.1	7.3	358.1	7.1	37.6	0.946	0.115	20.0	325.4	155.0	122.1	−11.2	2.13
156	206.0	7.3	358.9	7.5	37.5	0.945	0.116	19.9	325.1	156.0	122.8	−11.2	2.13
157	205.9	7.4	359.7	7.9	37.4	0.944	0.118	19.8	324.8	157.0	123.5	−11.2	2.13
158	205.8	7.4	0.5	8.3	37.3	0.943	0.120	19.7	324.6	158.0	124.2	−11.3	2.12
159	205.7	7.5	1.3	8.7	37.2	0.942	0.122	19.6	324.3	159.0	124.9	−11.3	2.12
160	205.6	7.5	2.1	9.1	37.1	0.941	0.124	19.5	324.0	160.0	125.6	−11.3	2.12

AUD (#0197): Total of **69** orbits. $\lambda_{\mathcal{O}} = 155°$, $\lambda_g - \lambda_{\mathcal{O}} = 47.5°$, $\beta_g = 81.6°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 5°$, $\theta = -15°$. Should be called 'zeta Draconids', though there is another 'ZDR' in the SD. All 'AUD' in the SD have incorrect values, because they are derived from orbits contaminated with sporadics and AXD.
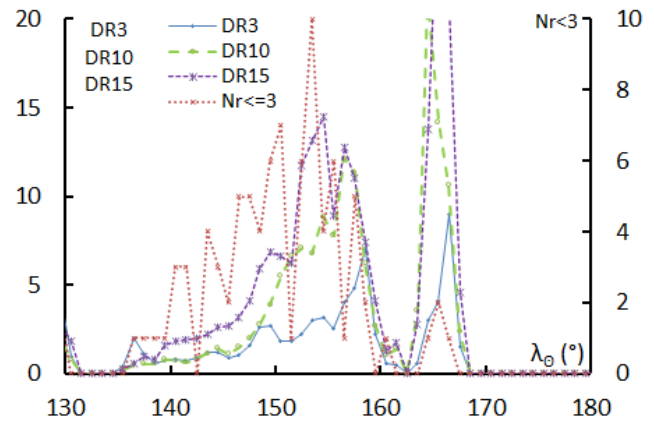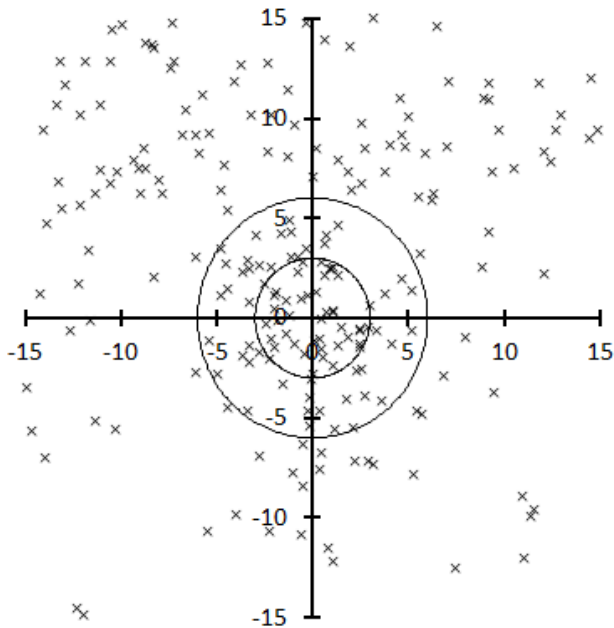
Table 1 – Number per year.

Year	N	Year	N
2007	2	2013	7
2008	1	2014	1
2009	11	2015	1
2010	14	2016	2
2011	3	2017	7
2012	15	2018	5

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	153.5	10
DR3	158.5	7.0
DR10	156.5	12.2
DR15	154.5	14.5
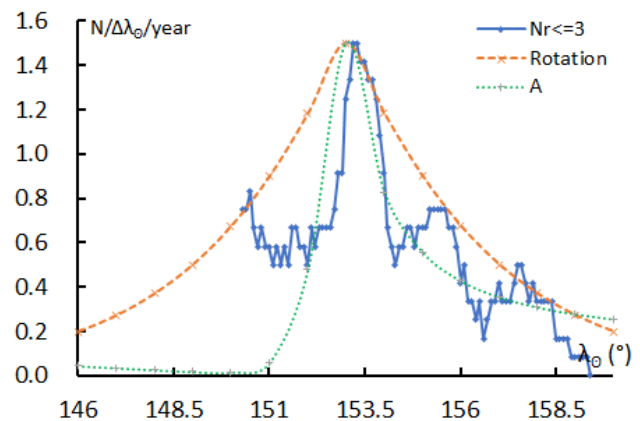
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\mathcal{O}}$	$\lambda_g - \lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
140	185.0	74.9	292.3	55.7	23.4	0.599	0.973	38.1	206.6	140.0	341.5	−16.0	2.43
141	183.4	76.3	290.6	56.8	23.2	0.601	0.980	37.8	204.0	141.0	340.4	−14.5	2.46
142	181.4	77.7	288.7	57.7	23.1	0.603	0.986	37.6	201.5	142.0	339.3	−12.9	2.49
143	178.9	79.1	286.7	58.7	22.9	0.606	0.992	37.3	199.1	143.0	338.4	−11.4	2.52
144	175.7	80.4	284.5	59.5	22.8	0.609	0.996	37.1	196.7	144.0	337.4	−10.0	2.55
145	171.4	81.7	282.1	60.3	22.6	0.612	1.000	36.8	194.3	145.0	336.5	−8.5	2.58
146	165.6	83.0	279.6	61.0	22.4	0.615	1.004	36.5	192.0	146.0	335.7	−7.1	2.60
147	157.4	84.2	276.9	61.6	22.3	0.618	1.006	36.2	189.8	147.0	334.9	−5.7	2.63
148	145.6	85.1	274.2	62.0	22.1	0.621	1.008	35.8	187.5	148.0	334.1	−4.4	2.66
149	129.0	85.8	271.3	62.4	21.9	0.624	1.010	35.5	185.4	149.0	333.4	−3.1	2.69
150	108.3	86.0	268.3	62.7	21.8	0.628	1.011	35.1	183.3	150.0	332.7	−1.9	2.71
151	88.1	85.7	265.2	62.8	21.6	0.631	1.011	34.8	181.2	151.0	332.0	−0.7	2.74
152	72.1	85.0	262.1	62.9	21.5	0.634	1.011	34.4	179.2	152.0	331.4	0.4	2.76
153	60.9	84.0	259.1	62.8	21.3	0.638	1.010	34.0	177.3	153.0	330.7	1.5	2.79
154	53.1	82.8	256.0	62.6	21.1	0.641	1.009	33.6	175.4	154.0	330.1	2.6	2.81
155	47.5	81.6	253.1	62.3	21.0	0.644	1.008	33.2	173.5	155.0	329.6	3.5	2.83
156	43.4	80.2	250.2	61.9	20.8	0.647	1.006	32.7	171.7	156.0	329.0	4.5	2.85
157	40.3	78.9	247.4	61.3	20.6	0.650	1.003	32.3	169.9	157.0	328.4	5.4	2.87
158	37.9	77.5	244.8	60.7	20.5	0.653	1.001	31.8	168.2	158.0	327.9	6.2	2.88
159	36.0	76.1	242.3	60.0	20.3	0.655	0.998	31.3	166.5	159.0	327.4	7.0	2.90

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
160	34.4	74.7	240.0	59.2	20.2	0.658	0.995	30.9	164.9	160.0	326.9	7.7	2.91
161	33.1	73.2	237.9	58.3	20.0	0.660	0.992	30.4	163.3	161.0	326.5	8.4	2.92
162	31.9	71.8	235.9	57.3	19.8	0.662	0.988	29.9	161.7	162.0	326.0	9.0	2.93
163	31.0	70.4	234.0	56.3	19.7	0.664	0.984	29.4	160.2	163.0	325.6	9.6	2.93
164	30.1	68.9	232.3	55.2	19.5	0.666	0.980	28.8	158.7	164.0	325.2	10.1	2.94
165	29.4	67.5	230.8	54.1	19.3	0.668	0.976	28.3	157.3	165.0	324.8	10.6	2.94

Table 3 – Continued, evolution of the orbital parameters during the activity period.

AGC (#0523): Total of **67** orbits. $\lambda_{\mathcal{O}} = 154.9°$, $\lambda_g{-}\lambda_{\mathcal{O}} = 263.5°$, $\beta_g = 64.0°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 5°$.
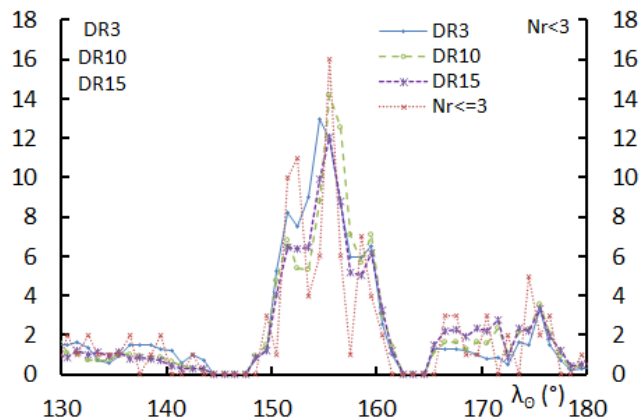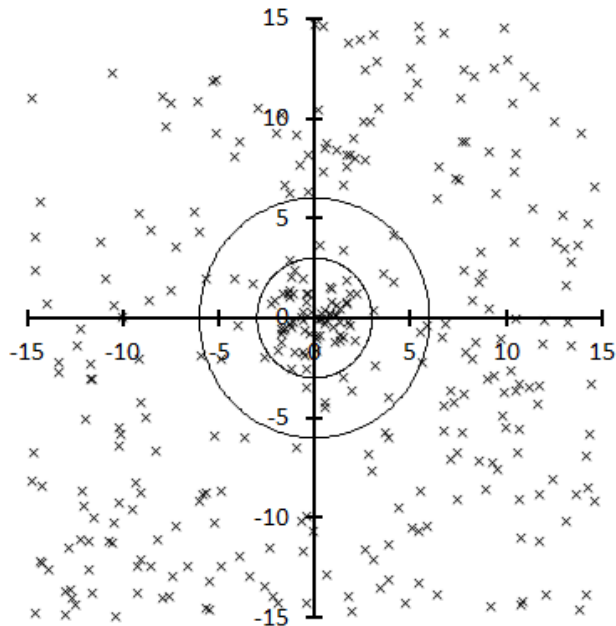
Table 1 – Number per year.

Year	N	Year	N
2007	2	2013	7
2008	1	2014	1
2009	7	2015	1
2010	12	2016	12
2011	8	2017	5
2012	8	2018	3

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	155.5	16
DR3	154.5	13.0
DR10	155.5	14.2
DR15	155.5	12.1
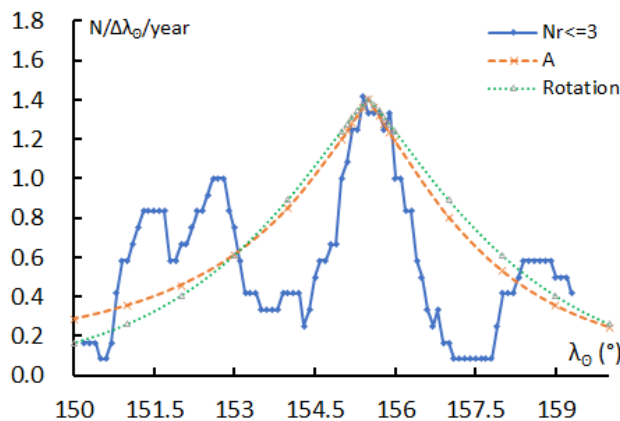
Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_{\mathcal{O}}$	$\lambda_g{-}\lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
145	266.4	62.3	356.3	73.1	42.6	0.733	1.010	75.6	185.5	145.0	326.4	−5.3	3.79
146	266.2	62.4	356.6	73.5	42.7	0.747	1.010	75.6	185.7	146.0	327.4	−5.5	3.99
147	265.9	62.5	356.8	73.8	42.8	0.760	1.010	75.6	185.9	147.0	328.5	−5.7	4.21
148	265.7	62.7	357.1	74.2	42.9	0.773	1.009	75.6	186.2	148.0	329.5	−6.0	4.45
149	265.4	62.8	357.3	74.5	43.0	0.787	1.009	75.6	186.4	149.0	330.6	−6.2	4.73
150	265.1	62.9	357.5	74.9	43.1	0.800	1.008	75.6	186.6	150.0	331.6	−6.4	5.05
151	264.9	63.0	357.7	75.2	43.3	0.814	1.008	75.6	186.8	151.0	332.7	−6.6	5.42
152	264.6	63.2	357.9	75.6	43.4	0.828	1.007	75.6	187.0	152.0	333.8	−6.8	5.85
153	264.3	63.3	358.1	75.9	43.5	0.841	1.007	75.6	187.2	153.0	334.8	−7.0	6.35
154	264.1	63.4	358.3	76.3	43.6	0.855	1.006	75.5	187.4	154.0	335.9	−7.2	6.95
155	263.8	63.5	358.5	76.6	43.7	0.869	1.006	75.5	187.6	155.0	336.9	−7.4	7.68
155.1	263.8	63.5	358.5	76.7	43.7	0.870	1.006	75.5	187.6	155.1	337.0	−7.4	7.76
155.2	263.7	63.5	358.5	76.7	43.7	0.872	1.006	75.5	187.7	155.2	337.1	−7.4	7.85
155.3	263.7	63.6	358.5	76.7	43.7	0.873	1.006	75.5	187.7	155.3	337.2	−7.4	7.93
155.4	263.7	63.6	358.6	76.8	43.8	0.875	1.006	75.5	187.7	155.4	337.3	−7.4	8.02
155.5	263.7	63.6	358.6	76.8	43.8	0.876	1.006	75.5	187.7	155.5	337.4	−7.5	8.11
155.6	263.6	63.6	358.6	76.8	43.8	0.877	1.006	75.5	187.7	155.6	337.5	−7.5	8.20
155.7	263.6	63.6	358.6	76.9	43.8	0.879	1.006	75.5	187.8	155.7	337.7	−7.5	8.29
155.8	263.6	63.6	358.6	76.9	43.8	0.880	1.006	75.5	187.8	155.8	337.8	−7.5	8.39
155.9	263.5	63.6	358.6	76.9	43.8	0.882	1.006	75.5	187.8	155.9	337.9	−7.5	8.49
156	263.5	63.6	358.7	77.0	43.8	0.883	1.005	75.5	187.8	156.0	338.0	−7.6	8.59

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
157	263.2	63.8	358.8	77.3	43.9	0.897	1.005	75.5	188.0	157.0	339.0	−7.7	9.74
158	263.0	63.9	359.0	77.7	44.0	0.911	1.004	75.5	188.2	158.0	340.1	−7.9	11.27
159	262.7	64.0	359.1	78.0	44.2	0.925	1.004	75.4	188.4	159.0	341.1	−8.1	13.37
160	262.4	64.1	359.2	78.3	44.3	0.939	1.003	75.4	188.5	160.0	342.2	−8.3	16.46
161	262.1	64.2	359.3	78.7	44.4	0.953	1.003	75.4	188.7	161.0	343.2	−8.4	21.45
162	261.8	64.3	359.4	79.0	44.5	0.967	1.002	75.4	188.9	162.0	344.3	−8.6	30.82
163	261.5	64.5	359.4	79.3	44.6	0.982	1.002	75.4	189.1	163.0	345.3	−8.8	54.97
164	261.2	64.6	359.5	79.6	44.7	0.996	1.001	75.3	189.2	164.0	346.4	−8.9	258.5
165	260.9	64.7	359.5	80.0	44.8	1.011	1.001	75.3	189.4	165.0	347.4	−9.1	−95.0

AUR (#0206): Total of **99** orbits. $\lambda_\Theta = 158°$, $\lambda_g-\lambda_\Theta = 292.6°$, $\beta_g = 15.9°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 5°$.
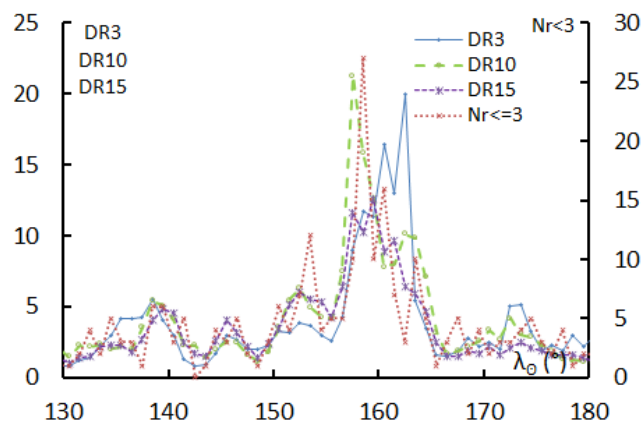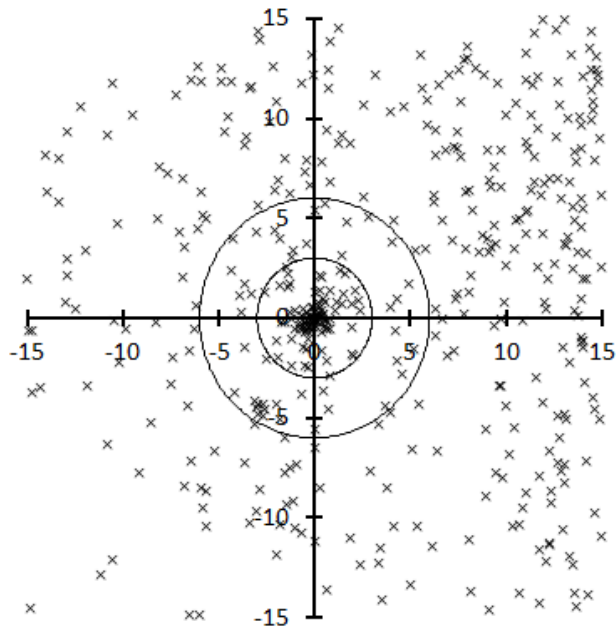
Table 1 – Number per year.

Year	N	Year	N
2007	3	2013	16
2008	6	2014	3
2009	6	2015	1
2010	17	2016	15
2011	2	2017	7
2012	12	2018	11

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	158.5	27
DR3	160.5	16.5
DR10	157.5	21.3
DR15	159.5	12.6
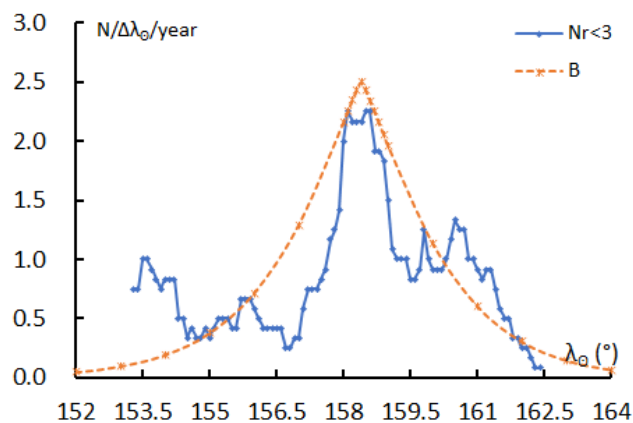
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
153	292.9	14.9	84.9	38.2	65.5	0.961	0.655	149.8	106.4	153.0	44.2	28.8	16.86
154	292.8	15.0	86.0	38.4	65.5	0.959	0.658	149.5	106.7	154.0	44.8	29.1	16.22
155	292.7	15.2	87.1	38.6	65.4	0.958	0.661	149.2	107.0	155.0	45.4	29.3	15.63
156	292.6	15.4	88.3	38.8	65.4	0.956	0.663	148.9	107.3	156.0	46.0	29.5	15.10
157	292.5	15.5	89.4	39.0	65.4	0.954	0.666	148.7	107.6	157.0	46.6	29.7	14.60
158	292.4	15.7	90.5	39.1	65.4	0.953	0.669	148.4	108.0	158.0	47.2	29.9	14.15
158.1	292.4	15.7	90.6	39.1	65.4	0.953	0.669	148.3	108.0	158.1	47.2	30.0	14.11
158.2	292.4	15.7	90.8	39.2	65.4	0.952	0.669	148.3	108.0	158.2	47.3	30.0	14.07
158.3	292.4	15.7	90.9	39.2	65.4	0.952	0.670	148.3	108.1	158.3	47.3	30.0	14.02
158.4	292.4	15.7	91.0	39.2	65.4	0.952	0.670	148.3	108.1	158.4	47.4	30.0	13.98
158.5	292.4	15.8	91.1	39.2	65.4	0.952	0.670	148.2	108.1	158.5	47.5	30.0	13.94
158.6	292.4	15.8	91.2	39.2	65.4	0.952	0.670	148.2	108.1	158.6	47.5	30.1	13.90
158.7	292.4	15.8	91.3	39.2	65.4	0.952	0.671	148.2	108.2	158.7	47.6	30.1	13.86
158.8	292.4	15.8	91.4	39.2	65.4	0.951	0.671	148.1	108.2	158.8	47.6	30.1	13.82
158.9	292.3	15.8	91.5	39.3	65.4	0.951	0.671	148.1	108.2	158.9	47.7	30.1	13.78
159	292.3	15.8	91.7	39.3	65.4	0.951	0.671	148.1	108.3	159.0	47.7	30.1	13.74
160	292.2	16.0	92.8	39.4	65.4	0.949	0.674	147.8	108.6	160.0	48.3	30.3	13.35
161	292.2	16.2	93.9	39.6	65.3	0.948	0.677	147.5	108.9	161.0	48.9	30.5	12.99
162	292.1	16.3	95.1	39.7	65.3	0.946	0.680	147.2	109.2	162.0	49.5	30.7	12.66
163	292.0	16.5	96.2	39.8	65.3	0.945	0.682	146.9	109.6	163.0	50.0	30.9	12.35

NIA (#0033): Total of **121** orbits. $\lambda_\Theta = 165°$, $\lambda_g-\lambda_\Theta = 198.0°$, $\beta_g = 4.3°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$. This activity is not the traditional 'Northern iota Aquariids' and it is slightly above the high sporadic background activity. The maximum is quite unclear between $\lambda_\Theta = 160°\sim170°$.
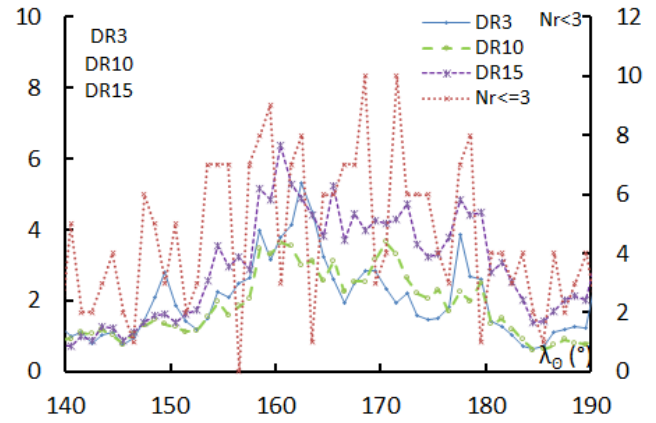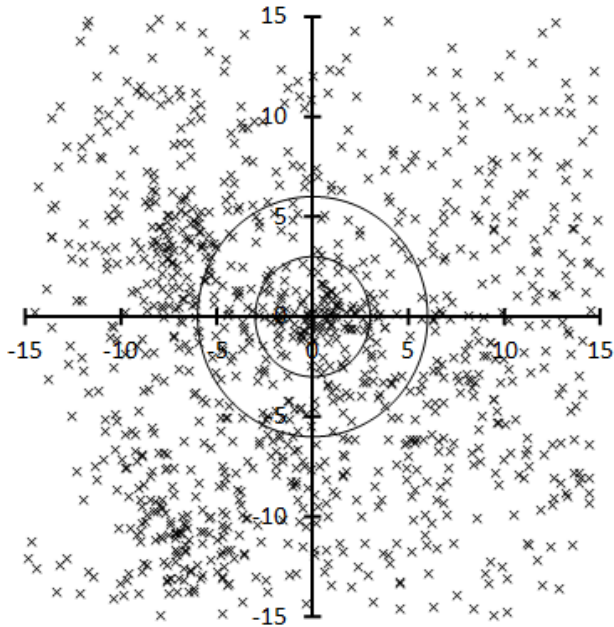
Table 1 – Number per year.

Year	N	Year	N
2007	5	2013	11
2008	6	2014	9
2009	9	2015	1
2010	17	2016	9
2011	20	2017	10
2012	20	2018	4

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	168.5	10
DR3	162.5	5.3
DR10	170.5	3.7
DR15	160.5	6.4
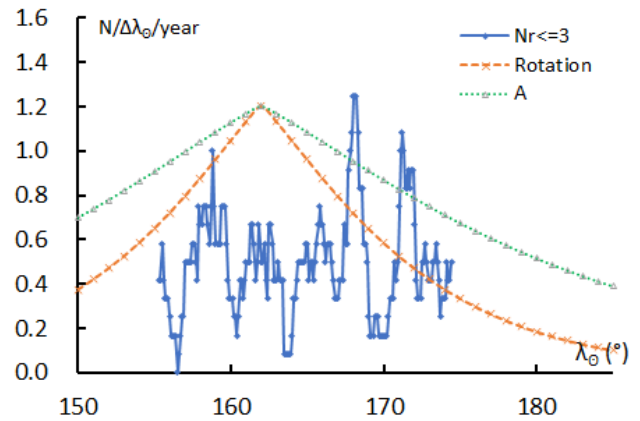
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
150	198.2	3.6	347.8	−1.4	29.8	0.849	0.256	5.2	308.8	150.0	99.0	−4.1	1.70
151	198.2	3.6	348.7	−1.0	29.8	0.850	0.256	5.3	308.8	151.0	99.9	−4.1	1.70
152	198.2	3.6	349.6	−0.6	29.8	0.850	0.256	5.3	308.7	152.0	100.8	−4.1	1.70
153	198.1	3.6	350.5	−0.2	29.9	0.850	0.256	5.3	308.7	153.0	101.8	−4.1	1.71
154	198.1	3.6	351.3	0.2	29.9	0.850	0.256	5.3	308.6	154.0	102.7	−4.1	1.71
155	198.1	3.6	352.2	0.6	29.9	0.850	0.257	5.3	308.5	155.0	103.7	−4.1	1.72
156	198.1	3.6	353.1	1.0	29.9	0.851	0.257	5.3	308.5	156.0	104.6	−4.1	1.72
157	198.1	3.6	354.0	1.3	29.9	0.851	0.257	5.3	308.4	157.0	105.5	−4.2	1.72
158	198.0	3.6	354.9	1.7	29.9	0.851	0.257	5.3	308.4	158.0	106.5	−4.2	1.73
159	198.0	3.6	355.8	2.1	29.9	0.851	0.257	5.3	308.3	159.0	107.4	−4.2	1.73
160	198.0	3.6	356.7	2.5	29.9	0.851	0.258	5.3	308.2	160.0	108.4	−4.2	1.74
161	198.0	3.6	357.6	2.9	29.9	0.852	0.258	5.3	308.2	161.0	109.3	−4.2	1.74
162	198.0	3.6	358.5	3.3	29.9	0.852	0.258	5.3	308.1	162.0	110.2	−4.2	1.74
163	197.9	3.7	359.4	3.7	29.9	0.852	0.258	5.4	308.1	163.0	111.2	−4.2	1.75
164	197.9	3.7	0.3	4.1	30.0	0.852	0.259	5.4	308.0	164.0	112.1	−4.2	1.75
165	197.9	3.7	1.2	4.5	30.0	0.852	0.259	5.4	307.9	165.0	113.1	−4.2	1.75
166	197.9	3.7	2.1	4.9	30.0	0.853	0.259	5.4	307.9	166.0	114.0	−4.2	1.76
167	197.9	3.7	3.0	5.3	30.0	0.853	0.259	5.4	307.8	167.0	114.9	−4.3	1.76
168	197.8	3.7	3.9	5.7	30.0	0.853	0.260	5.4	307.8	168.0	115.9	−4.3	1.76
169	197.8	3.7	4.8	6.1	30.0	0.853	0.260	5.4	307.7	169.0	116.8	−4.3	1.77

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
170	197.8	3.7	5.7	6.5	30.0	0.853	0.260	5.4	307.6	170.0	117.8	−4.3	1.77
171	197.8	3.7	6.6	6.9	30.0	0.853	0.260	5.4	307.6	171.0	118.7	−4.3	1.78
172	197.8	3.7	7.5	7.3	30.0	0.854	0.260	5.4	307.5	172.0	119.6	−4.3	1.78
173	197.7	3.7	8.4	7.7	30.0	0.854	0.261	5.4	307.5	173.0	120.6	−4.3	1.78
174	197.7	3.7	9.3	8.1	30.0	0.854	0.261	5.4	307.4	174.0	121.5	−4.3	1.79
175	197.7	3.7	10.2	8.5	30.1	0.854	0.261	5.5	307.3	175.0	122.5	−4.3	1.79
176	197.7	3.7	11.1	8.8	30.1	0.854	0.261	5.5	307.3	176.0	123.4	−4.3	1.79
177	197.7	3.8	12.0	9.2	30.1	0.854	0.262	5.5	307.2	177.0	124.3	−4.4	1.80
178	197.6	3.8	12.9	9.6	30.1	0.855	0.262	5.5	307.2	178.0	125.3	−4.4	1.80
179	197.6	3.8	13.8	10.0	30.1	0.855	0.262	5.5	307.1	179.0	126.2	−4.4	1.80
180	197.6	3.8	14.8	10.4	30.1	0.855	0.262	5.5	307.0	180.0	127.2	−4.4	1.81
181	197.6	3.8	15.7	10.8	30.1	0.855	0.263	5.5	307.0	181.0	128.1	−4.4	1.81
182	197.6	3.8	16.6	11.2	30.1	0.855	0.263	5.5	306.9	182.0	129.1	−4.4	1.81
183	197.5	3.8	17.5	11.5	30.1	0.855	0.263	5.5	306.9	183.0	130.0	−4.4	1.82
184	197.5	3.8	18.4	11.9	30.1	0.855	0.263	5.5	306.8	184.0	130.9	−4.4	1.82
185	197.5	3.8	19.4	12.3	30.1	0.856	0.264	5.5	306.7	185.0	131.9	−4.4	1.83

SPE (#0208): Total of **513** orbits. $\lambda_{\mathcal{O}} = 167.1°$, $\lambda_g–\lambda_{\mathcal{O}} = 248.8°$, $\beta_g = 20.8°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 5°$.
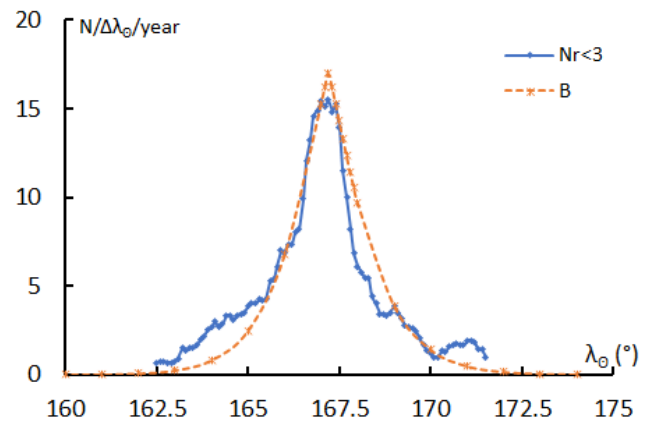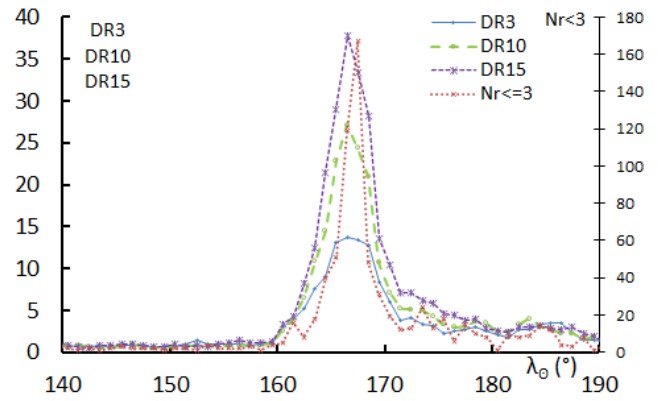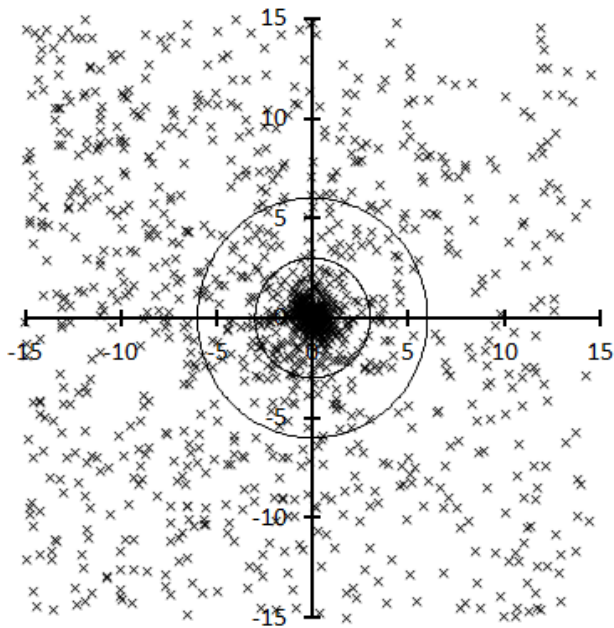
Table 1 – Number per year.

Year	N	Year	N
2007	19	2013	30
2008	60	2014	28
2009	76	2015	24
2010	61	2016	20
2011	83	2017	23
2012	82	2018	7

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	167.5	167
DR3	166.5	13.6
DR10	166.5	27.1
DR15	166.5	37.7

Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_{\mathcal{O}}$	$\lambda_g–\lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
160	249.5	22.2	39.5	38.8	63.8	0.950	0.736	137.0	243.5	160.0	284.3	–37.7	14.82
161	249.4	22.0	40.6	38.9	63.9	0.950	0.734	137.3	243.9	161.0	284.8	–37.5	14.82
162	249.4	21.8	41.8	39.0	63.9	0.951	0.731	137.6	244.2	162.0	285.2	–37.4	14.82
163	249.3	21.6	42.9	39.1	64.0	0.951	0.728	137.9	244.5	163.0	285.7	–37.3	14.82
164	249.3	21.5	44.1	39.2	64.0	0.951	0.726	138.2	244.8	164.0	286.2	–37.1	14.83
165	249.2	21.3	45.2	39.3	64.1	0.951	0.723	138.5	245.1	165.0	286.8	–37.0	14.85
166	249.2	21.1	46.4	39.4	64.1	0.952	0.720	138.8	245.4	166.0	287.3	–36.8	14.87
167	249.1	20.9	47.6	39.5	64.2	0.952	0.718	139.1	245.8	167.0	287.8	–36.6	14.90
167.1	249.1	20.9	47.7	39.5	64.2	0.952	0.717	139.2	245.8	167.1	287.8	–36.6	14.90
167.2	249.1	20.9	47.8	39.5	64.2	0.952	0.717	139.2	245.8	167.2	287.9	–36.6	14.90
167.3	249.1	20.8	47.9	39.5	64.2	0.952	0.717	139.2	245.9	167.3	287.9	–36.6	14.91
167.4	249.1	20.8	48.0	39.5	64.2	0.952	0.717	139.3	245.9	167.4	288.0	–36.6	14.91
167.5	249.1	20.8	48.1	39.5	64.2	0.952	0.716	139.3	245.9	167.5	288.0	–36.5	14.91
167.6	249.1	20.8	48.3	39.5	64.2	0.952	0.716	139.3	245.9	167.6	288.1	–36.5	14.92
167.7	249.1	20.8	48.4	39.5	64.2	0.952	0.716	139.3	246.0	167.7	288.1	–36.5	14.92
167.8	249.1	20.7	48.5	39.5	64.2	0.952	0.715	139.4	246.0	167.8	288.2	–36.5	14.92
167.9	249.1	20.7	48.6	39.5	64.2	0.952	0.715	139.4	246.0	167.9	288.2	–36.5	14.93
168	249.1	20.7	48.7	39.5	64.2	0.952	0.715	139.4	246.1	168.0	288.3	–36.5	14.93
169	249.0	20.5	49.9	39.6	64.3	0.952	0.712	139.8	246.4	169.0	288.8	–36.3	14.97
170	248.9	20.3	51.1	39.7	64.3	0.953	0.710	140.1	246.7	170.0	289.3	–36.1	15.02
171	248.9	20.1	52.3	39.7	64.4	0.953	0.707	140.4	247.0	171.0	289.9	–35.9	15.07

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
172	248.8	20.0	53.4	39.8	64.4	0.953	0.704	140.7	247.3	172.0	290.4	−35.7	15.13
173	248.8	19.8	54.6	39.8	64.5	0.954	0.702	141.0	247.6	173.0	290.9	−35.6	15.19
174	248.7	19.6	55.8	39.8	64.5	0.954	0.699	141.3	247.9	174.0	291.5	−35.4	15.27
175	248.7	19.4	57.0	39.9	64.6	0.955	0.696	141.7	248.2	175.0	292.0	−35.2	15.35
176	248.6	19.2	58.2	39.9	64.6	0.955	0.694	142.0	248.5	176.0	292.6	−35.0	15.44
177	248.6	19.0	59.4	39.9	64.7	0.956	0.691	142.3	248.8	177.0	293.1	−34.7	15.53
178	248.5	18.8	60.6	39.9	64.7	0.956	0.689	142.6	249.1	178.0	293.7	−34.5	15.64
179	248.5	18.6	61.8	39.9	64.8	0.956	0.686	143.0	249.4	179.0	294.3	−34.3	15.75
180	248.4	18.4	63.0	39.9	64.8	0.957	0.683	143.3	249.7	180.0	294.8	−34.1	15.88

Table 3 – Continued, evolution of the orbital parameters during the activity period.

NUE (#0337): Total of **238** orbits. $\lambda_{\Theta} = 167.9°$, $\lambda_g-\lambda_{\Theta} = 259.3°$, $\beta_g = -20.7°$, $\Delta r = 3°$, $\Delta\lambda_{\Theta} = 10°$. One of the clear activities in the tail of the Orionids, though the radiant concentration and the maxima are unclear.
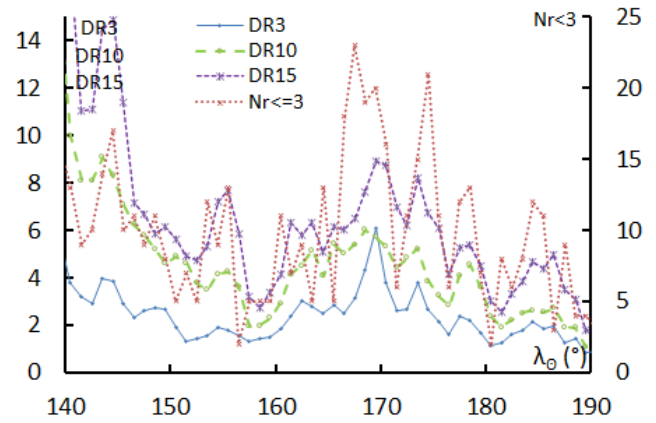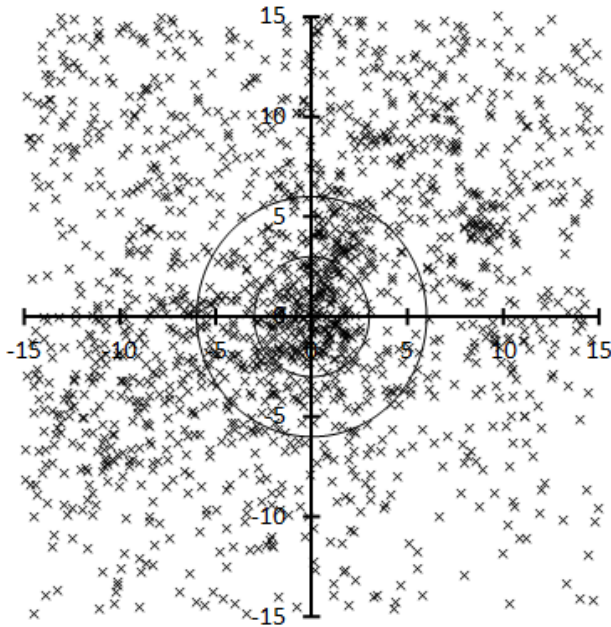
Table 1 – Number per year.

Year	N	Year	N
2007	12	2013	34
2008	27	2014	13
2009	20	2015	9
2010	25	2016	10
2011	29	2017	15
2012	38	2018	6

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	167.5	23
DR3	169.5	6.1
DR10	168.5	6.0
DR15	169.5	8.9
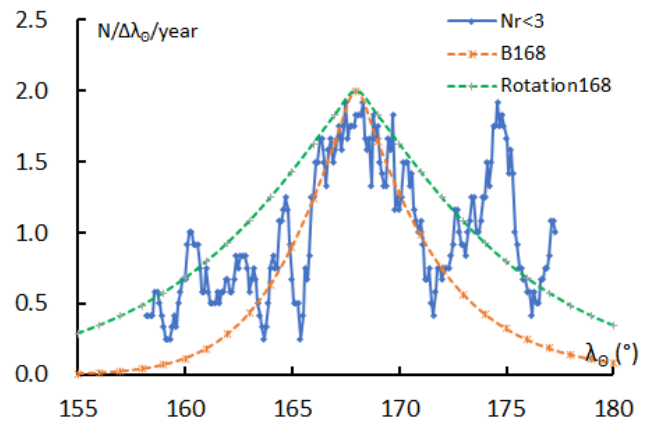
Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g-\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
157	259.2	–23.3	59.2	–3.3	65.2	0.902	0.923	138.8	34.9	337.0	309.3	22.2	9.42
158	259.2	–23.0	60.0	–3.0	65.3	0.900	0.921	139.1	35.3	338.0	309.8	22.2	9.20
159	259.1	–22.8	60.8	–2.6	65.3	0.898	0.920	139.4	35.7	339.0	310.4	22.3	9.00
160	259.0	–22.6	61.6	–2.2	65.4	0.896	0.918	139.8	36.0	340.0	311.0	22.3	8.81
161	259.0	–22.4	62.4	–1.8	65.4	0.894	0.916	140.1	36.4	341.0	311.5	22.4	8.63
162	258.9	–22.2	63.2	–1.4	65.4	0.892	0.914	140.4	36.8	342.0	312.1	22.4	8.46
163	258.8	–22.0	64.0	–1.1	65.5	0.890	0.912	140.8	37.1	343.0	312.6	22.4	8.30
164	258.8	–21.8	64.9	–0.7	65.5	0.888	0.910	141.1	37.5	344.0	313.2	22.5	8.15
165	258.7	–21.6	65.7	–0.3	65.6	0.887	0.908	141.4	37.9	345.0	313.7	22.5	8.01
166	258.6	–21.4	66.5	0.0	65.6	0.885	0.906	141.8	38.2	346.0	314.3	22.5	7.87
167	258.6	–21.2	67.3	0.4	65.6	0.883	0.904	142.1	38.6	347.0	314.8	22.5	7.74
168	258.5	–20.9	68.2	0.7	65.7	0.882	0.902	142.4	38.9	348.0	315.4	22.5	7.62
169	258.5	–20.7	69.0	1.1	65.7	0.880	0.900	142.8	39.3	349.0	315.9	22.5	7.50
170	258.4	–20.5	69.8	1.4	65.8	0.878	0.898	143.1	39.7	350.0	316.5	22.5	7.39
171	258.3	–20.3	70.7	1.7	65.8	0.877	0.896	143.5	40.0	351.0	317.0	22.5	7.28
172	258.3	–20.1	71.5	2.1	65.8	0.876	0.894	143.8	40.4	352.0	317.5	22.5	7.18
173	258.2	–19.9	72.3	2.4	65.9	0.874	0.892	144.1	40.7	353.0	318.1	22.5	7.09
174	258.1	–19.7	73.2	2.7	65.9	0.873	0.890	144.5	41.1	354.0	318.6	22.4	7.00
175	258.1	–19.5	74.0	3.0	66.0	0.872	0.888	144.8	41.4	355.0	319.2	22.4	6.91
176	258.0	–19.3	74.9	3.3	66.0	0.870	0.886	145.2	41.8	356.0	319.7	22.4	6.83

Table 3 – Continued, evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g{-}\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
177	258.0	−19.1	75.8	3.6	66.0	0.869	0.884	145.5	42.1	357.0	320.3	22.3	6.75
178	257.9	−18.8	76.6	3.9	66.1	0.868	0.881	145.9	42.5	358.0	320.8	22.3	6.68

SLY_0 (#0081): Total of **85** orbits. $\lambda_\mathcal{O}$ = 167°, λ_g–$\lambda_\mathcal{O}$ = 294.7°, β_g = 32.3°, Δr = 3°, $\Delta\lambda_\mathcal{O}$ = 10°. SLY in the SD contains clearly two meteor showers. Here we name SLY0 and SLY2 in the SD as SLY_0 and SLY1 as SLY_1 in *Tables 1 to 3*.
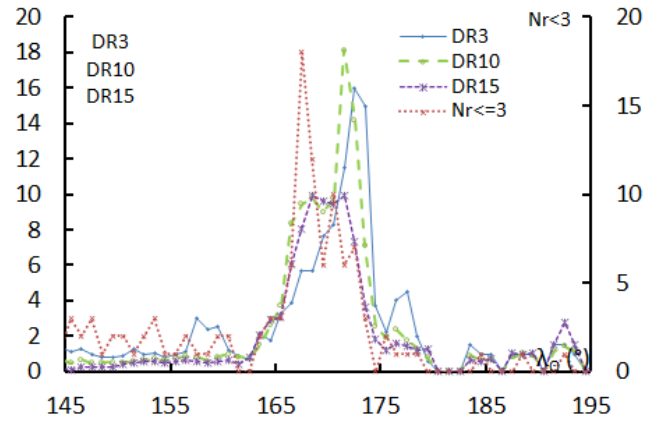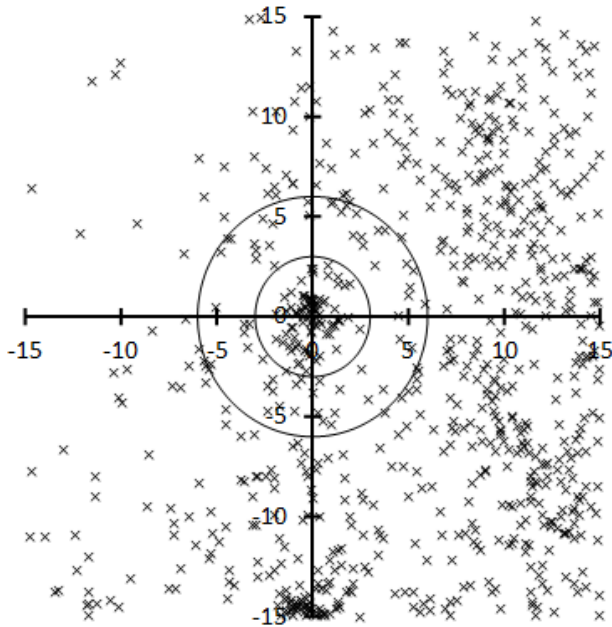
Table 1 – Number per year.

Year	N	Year	N
2007	2	2013	5
2008	2	2014	7
2009	8	2015	6
2010	17	2016	3
2011	17	2017	4
2012	13	2018	1

Table 2 – Activity profiles.

	$\lambda_\mathcal{O}$	Max
Nr<=3	167.5	18
DR3	172.5	16.0
DR10	171.5	18.1
DR15	168.5	9.9
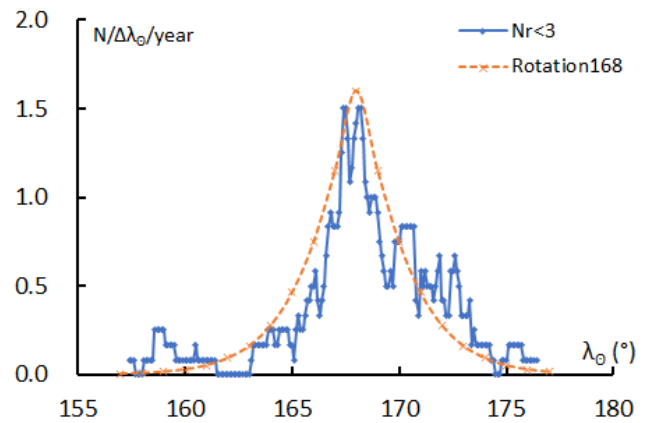
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_\mathcal{O}$	λ_g–$\lambda_\mathcal{O}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
157	291.3	29.7	87.6	53.2	61.7	0.969	0.792	123.7	124.2	157.0	16.2	43.5	25.22
158	291.6	30.1	89.4	53.5	61.5	0.966	0.789	123.0	123.8	158.0	17.1	44.2	23.35
159	291.9	30.4	91.3	53.8	61.3	0.964	0.786	122.2	123.3	159.0	18.0	45.0	21.82
160	292.2	30.7	93.2	54.1	61.1	0.962	0.783	121.5	122.9	160.0	18.9	45.7	20.55
161	292.5	31.0	95.1	54.4	60.8	0.960	0.780	120.8	122.5	161.0	19.8	46.5	19.47
162	292.7	31.3	97.0	54.7	60.6	0.958	0.777	120.0	122.1	162.0	20.6	47.2	18.55
163	293.0	31.7	98.9	54.9	60.4	0.956	0.774	119.3	121.7	163.0	21.4	47.9	17.77
164	293.3	32.0	100.9	55.1	60.2	0.955	0.771	118.5	121.3	164.0	22.1	48.6	17.09
165	293.6	32.3	102.9	55.3	60.0	0.953	0.769	117.8	121.0	165.0	22.9	49.3	16.50
166	293.9	32.6	104.8	55.5	59.7	0.952	0.766	117.1	120.6	166.0	23.6	50.0	15.99
167	294.2	32.9	106.8	55.7	59.5	0.951	0.764	116.3	120.3	167.0	24.2	50.7	15.54
168	294.5	33.2	108.8	55.8	59.3	0.950	0.761	115.6	119.9	168.0	24.9	51.4	15.15
169	294.8	33.5	110.8	56.0	59.1	0.949	0.759	114.8	119.6	169.0	25.5	52.1	14.81
170	295.1	33.8	112.8	56.1	58.8	0.948	0.756	114.1	119.3	170.0	26.0	52.8	14.52
171	295.4	34.2	114.8	56.2	58.6	0.947	0.754	113.4	119.0	171.0	26.6	53.4	14.26
172	295.7	34.5	116.9	56.3	58.4	0.946	0.752	112.6	118.7	172.0	27.1	54.0	14.04
173	296.0	34.8	118.9	56.3	58.2	0.946	0.750	111.9	118.5	173.0	27.5	54.7	13.85
174	296.3	35.1	120.9	56.4	58.0	0.945	0.748	111.1	118.2	174.0	27.9	55.3	13.69
175	296.6	35.4	122.9	56.4	57.7	0.945	0.746	110.4	118.0	175.0	28.3	55.9	13.56
176	297.0	35.7	124.9	56.4	57.5	0.945	0.744	109.6	117.7	176.0	28.6	56.5	13.45
177	297.3	36.0	126.9	56.4	57.3	0.945	0.742	108.9	117.5	177.0	28.9	57.0	13.37

SLY_1 (#0081): Total of **82** orbits. $\lambda_O = 186°$, $\lambda_g - \lambda_O = 278.8°$, $\beta_g = 26.0°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$. SLY in the SD contains clearly two meteor showers. Here we call SLY0 and SLY2 in the SD as SLY_0 and SLY1 as SLY_1 in *Tables 1 to 3*.
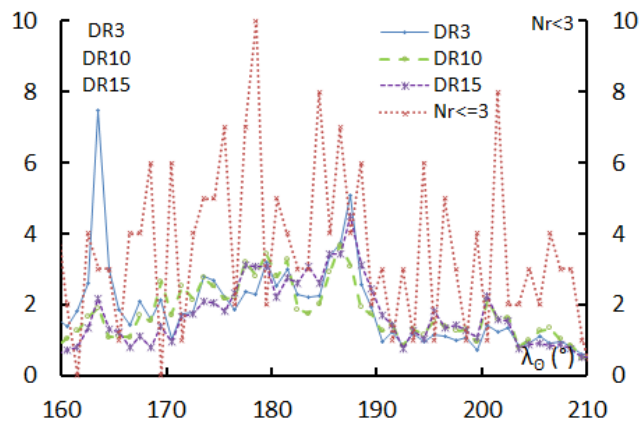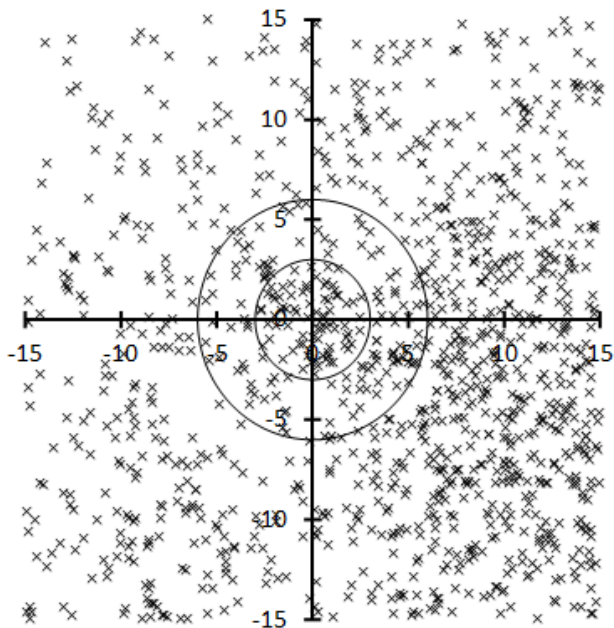
Table 1 – Number per year.

Year	N	Year	N
2007	5	2013	17
2008	0	2014	12
2009	1	2015	8
2010	10	2016	3
2011	11	2017	5
2012	5	2018	5

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	178.5	10
DR3	187.5	5.1
DR10	186.5	3.7
DR15	187.5	4.5
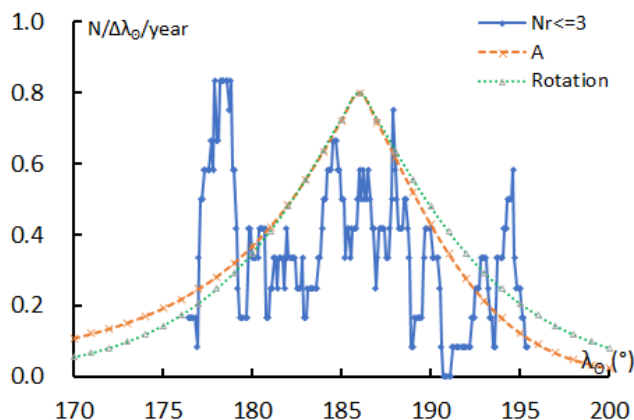
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_O	$\lambda_g - \lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
170	283.2	26.9	94.5	50.3	63.9	0.902	0.906	131.9	142.1	170.0	17.5	27.2	9.24
171	283.0	26.8	95.6	50.2	64.0	0.903	0.908	132.1	142.6	171.0	18.1	26.8	9.40
172	282.8	26.7	96.7	50.0	64.1	0.905	0.911	132.3	143.2	172.0	18.7	26.3	9.58
173	282.6	26.6	97.8	49.9	64.2	0.907	0.913	132.5	143.8	173.0	19.3	25.8	9.77
174	282.4	26.6	98.9	49.8	64.3	0.908	0.915	132.7	144.3	174.0	20.0	25.4	9.97
175	282.2	26.5	100.0	49.7	64.4	0.910	0.918	132.9	144.9	175.0	20.6	24.9	10.18
176	282.1	26.4	101.1	49.5	64.5	0.912	0.920	133.2	145.5	176.0	21.2	24.4	10.40
177	281.9	26.3	102.2	49.4	64.6	0.913	0.923	133.4	146.0	177.0	21.8	24.0	10.64
178	281.7	26.2	103.3	49.2	64.7	0.915	0.925	133.6	146.6	178.0	22.4	23.5	10.90
179	281.5	26.1	104.4	49.0	64.8	0.917	0.927	133.8	147.2	179.0	23.1	23.0	11.17
180	281.3	26.0	105.5	48.9	64.9	0.919	0.929	134.0	147.7	180.0	23.7	22.6	11.46
181	281.1	26.0	106.6	48.7	65.0	0.921	0.931	134.2	148.3	181.0	24.3	22.1	11.78
182	280.9	25.9	107.7	48.5	65.1	0.923	0.934	134.4	148.9	182.0	24.9	21.7	12.12
183	280.7	25.8	108.7	48.3	65.2	0.925	0.936	134.6	149.4	183.0	25.5	21.2	12.48
184	280.5	25.7	109.8	48.1	65.3	0.927	0.938	134.8	150.0	184.0	26.1	20.8	12.88
185	280.3	25.6	110.9	47.9	65.4	0.929	0.940	135.0	150.6	185.0	26.8	20.3	13.31
186	280.1	25.5	111.9	47.7	65.5	0.932	0.942	135.3	151.1	186.0	27.4	19.9	13.78
187	280.0	25.4	113.0	47.5	65.6	0.934	0.944	135.5	151.7	187.0	28.0	19.4	14.30
188	279.8	25.3	114.0	47.3	65.7	0.936	0.946	135.7	152.3	188.0	28.6	19.0	14.86
189	279.6	25.2	115.0	47.1	65.8	0.939	0.947	135.9	152.8	189.0	29.2	18.5	15.48
190	279.4	25.2	116.1	46.9	65.9	0.941	0.949	136.1	153.4	190.0	29.8	18.1	16.17

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
191	279.2	25.1	117.1	46.6	66.0	0.944	0.951	136.3	154.0	191.0	30.4	17.7	16.94
192	279.0	25.0	118.1	46.4	66.1	0.946	0.953	136.5	154.5	192.0	31.0	17.2	17.79
193	278.8	24.9	119.1	46.1	66.2	0.949	0.954	136.7	155.1	193.0	31.7	16.8	18.76
194	278.6	24.8	120.1	45.9	66.3	0.952	0.956	136.9	155.7	194.0	32.3	16.4	19.86
195	278.5	24.7	121.1	45.6	66.4	0.955	0.958	137.1	156.2	195.0	32.9	15.9	21.11
196	278.3	24.6	122.1	45.4	66.5	0.957	0.959	137.3	156.8	196.0	33.5	15.5	22.57
197	278.1	24.5	123.1	45.1	66.6	0.960	0.961	137.5	157.4	197.0	34.1	15.1	24.26
198	277.9	24.4	124.1	44.9	66.7	0.963	0.962	137.7	157.9	198.0	34.7	14.7	26.27
199	277.7	24.3	125.1	44.6	66.8	0.966	0.964	137.9	158.5	199.0	35.3	14.2	28.68
200	277.5	24.3	126.1	44.3	66.9	0.969	0.965	138.1	159.0	200.0	35.9	13.8	31.63

DSX (#0221): Total of **23** orbits. $\lambda_\odot = 189.2°$, $\lambda_g–\lambda_\odot = 329.8°$, $\beta_g = –11.8°$, $\Delta r = 6°$, $\Delta\lambda_\odot = 10°$.
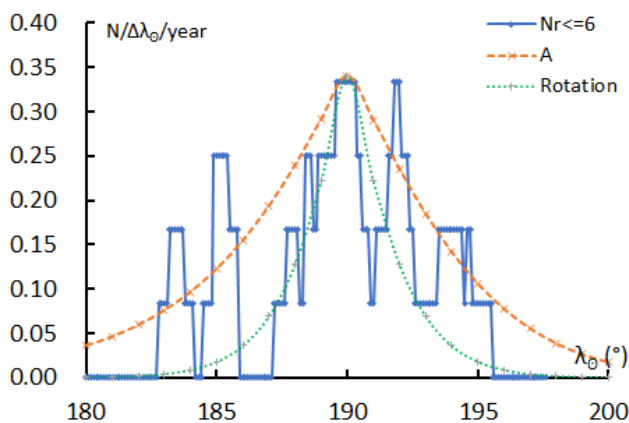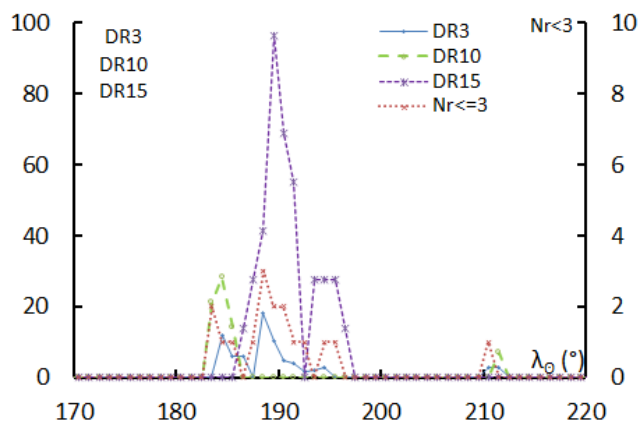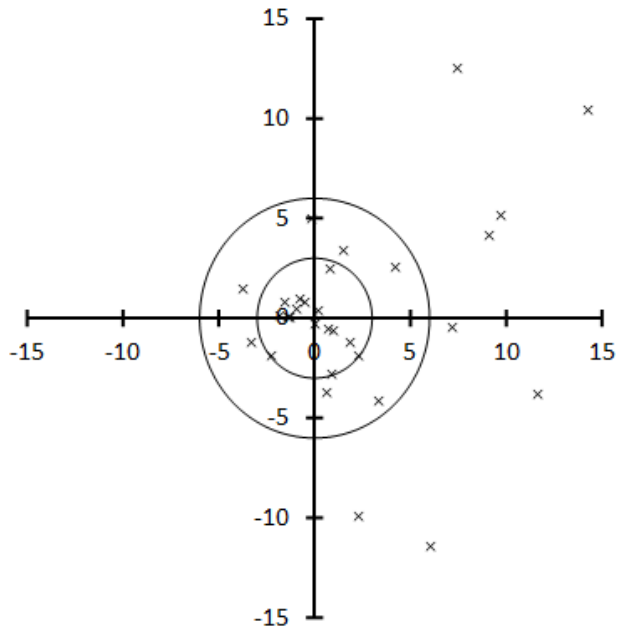
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	1
2008	5	2014	1
2009	1	2015	3
2010	4	2016	0
2011	3	2017	1
2012	2	2018	2

Table 2 – Activity profiles.

	$\lambda_\odot$	Max
Nr<=3	188.5	3
DR3	188.5	18.0
DR10	184.5	28.4
DR15	189.5	96.4

Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_\odot$	$\lambda_g–\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
180	329.4	–12.9	147.0	–0.4	33.5	0.881	0.136	29.8	212.2	0.0	208.7	–15.4	1.14
181	329.4	–12.8	148.0	–0.7	33.4	0.879	0.137	29.4	212.3	1.0	209.8	–15.2	1.13
182	329.4	–12.7	149.0	–0.9	33.2	0.878	0.138	29.0	212.3	2.0	210.9	–15.0	1.13
183	329.5	–12.6	150.0	–1.2	33.1	0.876	0.139	28.5	212.3	3.0	212.1	–14.8	1.12
184	329.5	–12.5	150.9	–1.5	32.9	0.875	0.140	28.1	212.3	4.0	213.2	–14.6	1.11
185	329.6	–12.5	151.9	–1.8	32.8	0.873	0.140	27.7	212.4	5.0	214.3	–14.4	1.11
186	329.6	–12.4	152.9	–2.1	32.7	0.872	0.141	27.3	212.4	6.0	215.4	–14.2	1.10
187	329.6	–12.3	153.9	–2.4	32.5	0.870	0.142	26.9	212.4	7.0	216.6	–14.0	1.09
188	329.7	–12.2	154.8	–2.7	32.4	0.868	0.143	26.5	212.5	8.0	217.7	–13.8	1.09
189	329.7	–12.1	155.8	–3.0	32.2	0.867	0.144	26.1	212.5	9.0	218.8	–13.7	1.08
190	329.8	–12.1	156.8	–3.3	32.1	0.865	0.145	25.7	212.6	10.0	219.9	–13.5	1.08
191	329.8	–12.0	157.8	–3.6	31.9	0.863	0.146	25.3	212.6	11.0	221.1	–13.3	1.07
192	329.9	–11.9	158.7	–3.9	31.8	0.862	0.147	24.9	212.7	12.0	222.2	–13.1	1.07
193	329.9	–11.8	159.7	–4.2	31.7	0.860	0.149	24.5	212.7	13.0	223.3	–12.9	1.06
194	329.9	–11.7	160.7	–4.5	31.5	0.858	0.150	24.1	212.8	14.0	224.4	–12.8	1.06
195	330.0	–11.7	161.7	–4.8	31.4	0.856	0.151	23.7	212.8	15.0	225.5	–12.6	1.05
196	330.0	–11.6	162.6	–5.2	31.2	0.855	0.152	23.3	212.9	16.0	226.7	–12.4	1.05
197	330.1	–11.5	163.6	–5.5	31.1	0.853	0.153	23.0	212.9	17.0	227.8	–12.2	1.04
198	330.1	–11.4	164.6	–5.8	30.9	0.851	0.154	22.6	213.0	18.0	228.9	–12.1	1.04
199	330.1	–11.3	165.6	–6.1	30.8	0.849	0.155	22.2	213.0	19.0	230.0	–11.9	1.03
200	330.2	–11.3	166.5	–6.5	30.7	0.847	0.157	21.9	213.1	20.0	231.2	–11.7	1.03

OCT (#0281): Total of **38** orbits. $\lambda_O = 192.6°$, $\lambda_g{-}\lambda_O = 281.0°$, $\beta_g = 62.2°$, $\Delta r = 3°$, $\Delta\lambda_O = 1.5°$. The activity period of OCT is extremely short $\lambda_O = 192.1°$ to 192.8° and, therefore, we cannot observe them when we fail to cover this short period of activity.
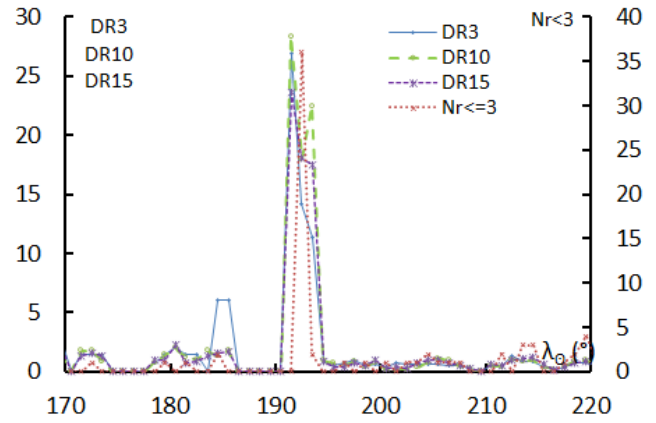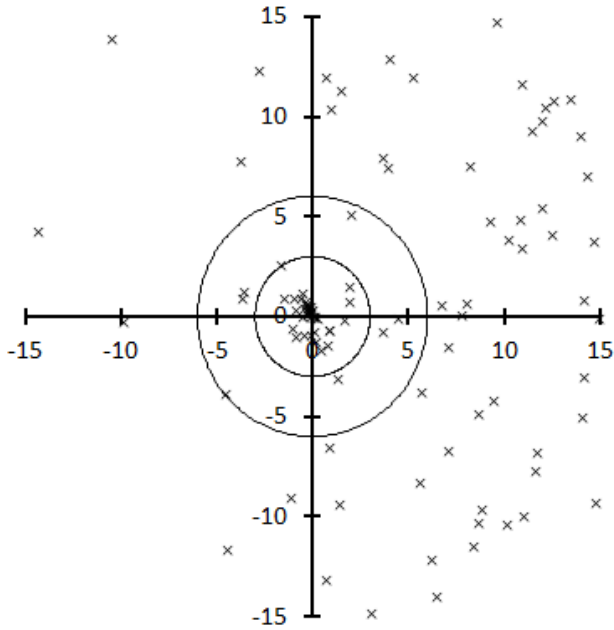
Table 1 – Number per year.

Year	N	Year	N
2007	5	2013	0
2008	0	2014	0
2009	0	2015	14
2010	1	2016	8
2011	2	2017	0
2012	6	2018	2

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	192.5	36
DR3	191.5	27.0
DR10	191.5	28.4
DR15	191.5	23.6
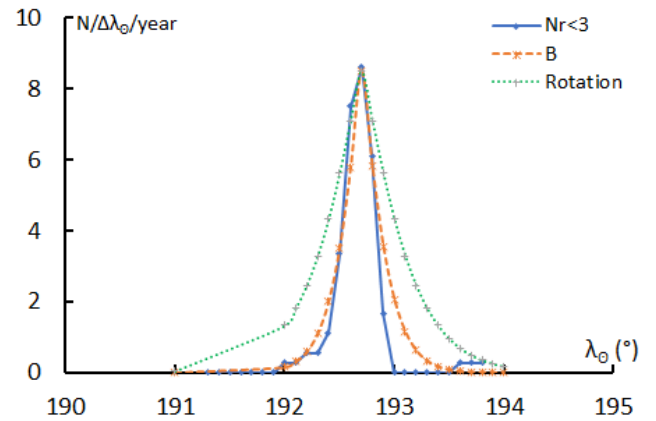
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_O	$\lambda_g{-}\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
191	284.2	63.1	173.6	78.8	46.3	1.048	0.989	77.1	167.8	191.0	8.2	11.9	-20.47
192	282.6	62.4	169.9	78.7	45.8	0.969	0.990	77.4	168.5	192.0	9.5	11.2	31.94
192.1	282.4	62.3	169.5	78.7	45.7	0.961	0.990	77.4	168.6	192.1	9.6	11.1	25.50
192.2	282.3	62.2	169.1	78.7	45.7	0.953	0.990	77.5	168.6	192.2	9.7	11.1	21.23
192.3	282.1	62.2	168.7	78.7	45.6	0.946	0.991	77.5	168.7	192.3	9.8	11.0	18.19
192.4	281.9	62.1	168.4	78.6	45.6	0.938	0.991	77.5	168.8	192.4	9.9	10.9	15.92
192.5	281.8	62.0	168.0	78.6	45.5	0.930	0.991	77.5	168.9	192.5	10.1	10.9	14.15
192.6	281.6	62.0	167.6	78.6	45.5	0.922	0.991	77.6	168.9	192.6	10.2	10.8	12.75
192.7	281.5	61.9	167.3	78.6	45.4	0.915	0.991	77.6	169.0	192.7	10.3	10.7	11.59
192.8	281.3	61.8	166.9	78.6	45.4	0.907	0.991	77.6	169.1	192.8	10.4	10.6	10.64
192.9	281.2	61.7	166.6	78.5	45.3	0.899	0.991	77.6	169.2	192.9	10.6	10.6	9.83
193	281.0	61.7	166.2	78.5	45.3	0.891	0.991	77.7	169.3	193.0	10.7	10.5	9.13
193.1	280.9	61.6	165.8	78.5	45.2	0.884	0.992	77.7	169.3	193.1	10.8	10.4	8.53
193.2	280.7	61.5	165.5	78.5	45.1	0.876	0.992	77.7	169.4	193.2	10.9	10.3	8.01
193.3	280.6	61.5	165.1	78.4	45.1	0.869	0.992	77.7	169.5	193.3	11.0	10.3	7.54
193.4	280.4	61.4	164.8	78.4	45.0	0.861	0.992	77.8	169.6	193.4	11.2	10.2	7.13
193.5	280.3	61.3	164.4	78.4	45.0	0.853	0.992	77.8	169.7	193.5	11.3	10.1	6.76
193.6	280.2	61.2	164.1	78.4	44.9	0.846	0.992	77.8	169.7	193.6	11.4	10.0	6.43
193.7	280.0	61.2	163.7	78.3	44.9	0.838	0.992	77.8	169.8	193.7	11.5	9.9	6.13
193.8	279.9	61.1	163.4	78.3	44.8	0.831	0.992	77.9	169.9	193.8	11.7	9.9	5.86
193.9	279.7	61.0	163.0	78.3	44.8	0.823	0.993	77.9	170.0	193.9	11.8	9.8	5.61
194	279.6	60.9	162.7	78.3	44.7	0.816	0.993	77.9	170.1	194.0	11.9	9.7	5.38

OCU (#0333): Total of **125** orbits. $\lambda_\Theta = 202°$, $\lambda_g - \lambda_\Theta = 278.9°$, $\beta_g = 46.8°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 5°$.
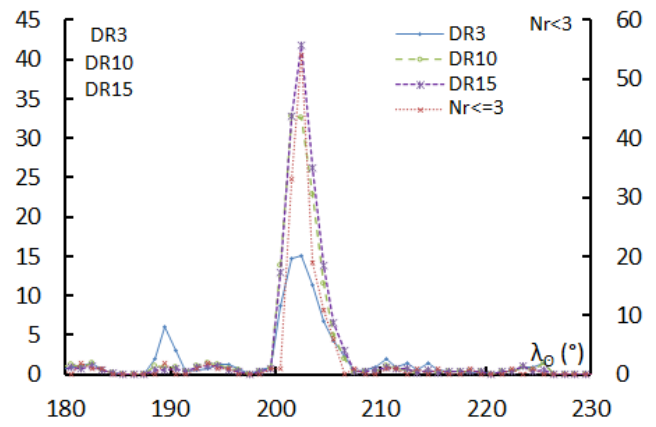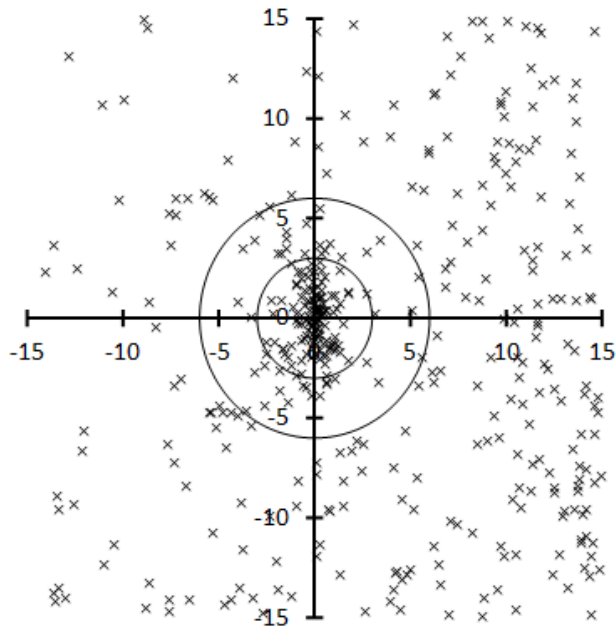
Table 1 – Number per year.

Year	N	Year	N
2007	3	2013	7
2008	5	2014	14
2009	17	2015	17
2010	11	2016	27
2011	4	2017	2
2012	12	2018	6

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	202.5	54
DR3	202.5	15.1
DR10	201.5	32.8
DR15	202.5	41.7
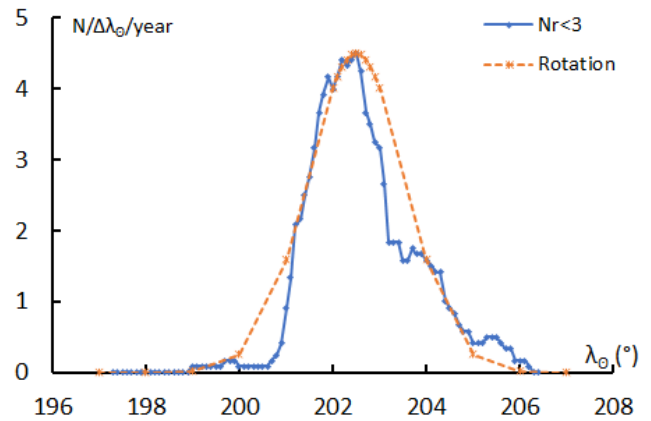
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
197	275.5	46.8	132.1	66.9	56.4	0.999	0.993	101.9	171.2	197.0	18.8	8.6	691.4
198	276.2	46.8	134.6	66.5	56.2	0.984	0.991	101.7	170.0	198.0	20.0	9.8	60.39
199	276.8	46.7	137.1	66.0	56.0	0.969	0.989	101.5	168.7	199.0	21.3	11.0	31.81
200	277.4	46.7	139.6	65.5	55.8	0.955	0.986	101.3	167.5	200.0	22.5	12.3	21.70
201	278.0	46.7	141.9	65.0	55.6	0.940	0.983	101.0	166.2	201.0	23.7	13.5	16.53
202	278.7	46.7	144.2	64.5	55.4	0.927	0.981	100.8	164.9	202.0	24.9	14.8	13.39
202.1	278.7	46.7	144.4	64.4	55.4	0.925	0.980	100.8	164.8	202.1	25.0	15.0	13.14
202.2	278.8	46.7	144.7	64.3	55.4	0.924	0.980	100.8	164.6	202.2	25.1	15.1	12.90
202.3	278.8	46.7	144.9	64.3	55.3	0.923	0.980	100.8	164.5	202.3	25.3	15.2	12.67
202.4	278.9	46.7	145.1	64.2	55.3	0.921	0.979	100.7	164.4	202.4	25.4	15.3	12.45
202.5	279.0	46.7	145.3	64.2	55.3	0.920	0.979	100.7	164.2	202.5	25.5	15.5	12.24
202.6	279.0	46.7	145.6	64.1	55.3	0.919	0.979	100.7	164.1	202.6	25.6	15.6	12.03
202.7	279.1	46.7	145.8	64.1	55.3	0.917	0.978	100.7	164.0	202.7	25.7	15.7	11.83
202.8	279.2	46.7	146.0	64.0	55.2	0.916	0.978	100.7	163.8	202.8	25.9	15.9	11.64
202.9	279.2	46.6	146.2	64.0	55.2	0.915	0.978	100.6	163.7	202.9	26.0	16.0	11.46
203	279.3	46.6	146.4	63.9	55.2	0.913	0.977	100.6	163.6	203.0	26.1	16.1	11.28
204	279.9	46.6	148.6	63.3	55.0	0.900	0.974	100.4	162.2	204.0	27.3	17.5	9.77
205	280.5	46.6	150.7	62.7	54.8	0.888	0.970	100.2	160.9	205.0	28.5	18.8	8.63
206	281.1	46.5	152.7	62.1	54.6	0.875	0.967	99.9	159.5	206.0	29.7	20.2	7.74
207	281.8	46.5	154.7	61.5	54.4	0.863	0.962	99.7	158.1	207.0	30.9	21.6	7.03

EGE (#0023): Total of **419** orbits. $\lambda_O = 204.1°$, $\lambda_g - \lambda_O = 254.7°$, $\beta_g = 5.2°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$. The activity period might be shorter than the real one, because EGE is surrounded by high sporadic background and the dominant nearby Orionids.
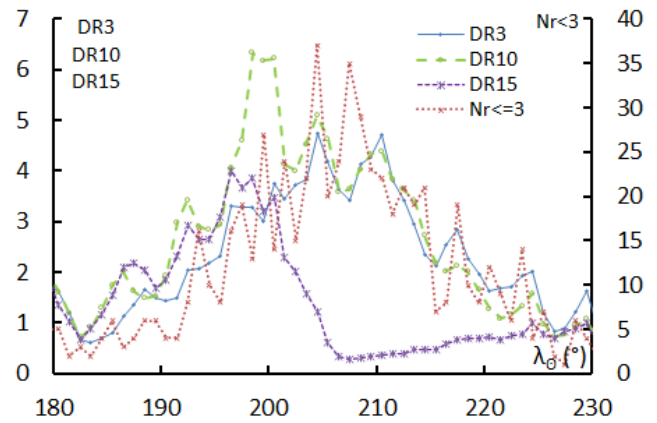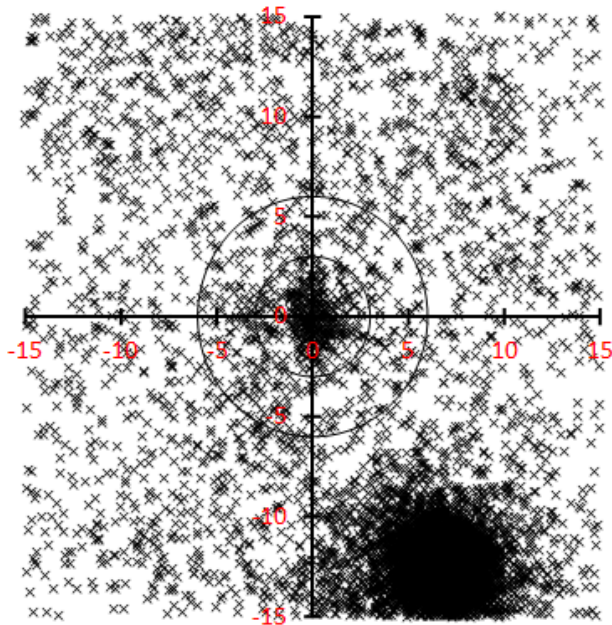
Table 1 – Number per year.

Year	N	Year	N
2007	25	2013	26
2008	32	2014	45
2009	48	2015	40
2010	31	2016	40
2011	24	2017	18
2012	50	2018	40

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	204.5	37
DR3	204.5	4.7
DR10	198.5	6.3
DR15	196.5	4.0
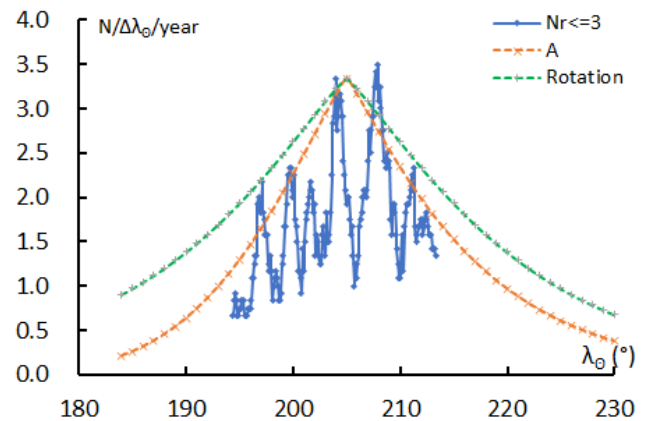
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g - \lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
184	259.4	6.7	82.5	29.9	70.0	0.962	0.899	168.1	217.9	184.0	326.7	−7.3	23.77
185	259.2	6.6	83.3	29.9	69.9	0.958	0.894	168.2	218.8	185.0	326.8	−7.4	21.44
186	259.0	6.5	84.2	29.9	69.8	0.955	0.889	168.3	219.7	186.0	326.9	−7.4	19.56
187	258.7	6.5	85.1	29.8	69.7	0.951	0.884	168.4	220.6	187.0	326.9	−7.5	18.01
188	258.5	6.4	86.0	29.8	69.7	0.947	0.879	168.5	221.6	188.0	327.0	−7.6	16.71
189	258.3	6.3	86.9	29.7	69.6	0.944	0.873	168.6	222.5	189.0	327.1	−7.7	15.60
190	258.0	6.2	87.8	29.7	69.5	0.941	0.868	168.7	223.4	190.0	327.1	−7.7	14.66
191	257.8	6.2	88.6	29.6	69.5	0.938	0.862	168.8	224.3	191.0	327.2	−7.8	13.83
192	257.6	6.1	89.5	29.5	69.4	0.935	0.857	168.9	225.3	192.0	327.3	−7.8	13.11
193	257.3	6.0	90.4	29.5	69.3	0.932	0.851	169.0	226.2	193.0	327.3	−7.9	12.47
194	257.1	5.9	91.3	29.4	69.3	0.929	0.846	169.1	227.1	194.0	327.4	−7.9	11.91
195	256.9	5.9	92.1	29.3	69.2	0.926	0.840	169.2	228.1	195.0	327.4	−8.0	11.40
196	256.6	5.8	93.0	29.2	69.1	0.924	0.834	169.3	229.0	196.0	327.5	−8.0	10.94
197	256.4	5.7	93.9	29.1	69.1	0.921	0.828	169.5	229.9	197.0	327.5	−8.1	10.53
198	256.2	5.6	94.8	29.0	69.0	0.919	0.822	169.6	230.9	198.0	327.6	−8.1	10.16
199	255.9	5.6	95.6	28.9	68.9	0.917	0.816	169.7	231.8	199.0	327.7	−8.1	9.82
200	255.7	5.5	96.5	28.8	68.8	0.915	0.810	169.8	232.7	200.0	327.7	−8.1	9.51
201	255.5	5.4	97.4	28.7	68.8	0.913	0.803	169.9	233.7	201.0	327.8	−8.1	9.23
202	255.3	5.3	98.2	28.6	68.7	0.911	0.797	170.0	234.6	202.0	327.8	−8.1	8.97
203	255.0	5.3	99.1	28.5	68.6	0.909	0.791	170.1	235.5	203.0	327.9	−8.1	8.73
204	254.8	5.2	100.0	28.3	68.6	0.908	0.784	170.2	236.4	204.0	327.9	−8.1	8.50

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
205	254.6	5.1	100.8	28.2	68.5	0.906	0.778	170.3	237.4	205.0	328.0	−8.1	8.30
206	254.3	5.0	101.7	28.1	68.4	0.905	0.772	170.4	238.3	206.0	328.1	−8.1	8.11
207	254.1	5.0	102.5	27.9	68.4	0.904	0.765	170.6	239.2	207.0	328.1	−8.1	7.93
208	253.9	4.9	103.4	27.8	68.3	0.902	0.758	170.7	240.1	208.0	328.2	−8.1	7.77
209	253.6	4.8	104.2	27.6	68.2	0.901	0.752	170.8	241.0	209.0	328.3	−8.1	7.62
210	253.4	4.7	105.1	27.5	68.2	0.900	0.745	170.9	242.0	210.0	328.3	−8.0	7.47
211	253.2	4.7	105.9	27.3	68.1	0.899	0.738	171.0	242.9	211.0	328.4	−8.0	7.34
212	252.9	4.6	106.8	27.2	68.0	0.899	0.732	171.1	243.8	212.0	328.5	−7.9	7.22
213	252.7	4.5	107.6	27.0	67.9	0.898	0.725	171.3	244.7	213.0	328.6	−7.9	7.10
214	252.5	4.4	108.5	26.8	67.9	0.897	0.718	171.4	245.6	214.0	328.7	−7.9	6.99
215	252.2	4.4	109.3	26.6	67.8	0.897	0.711	171.5	246.5	215.0	328.8	−7.8	6.89
216	252.0	4.3	110.2	26.5	67.7	0.896	0.704	171.6	247.4	216.0	328.8	−7.7	6.80
217	251.8	4.2	111.0	26.3	67.7	0.896	0.697	171.7	248.3	217.0	328.9	−7.7	6.71
218	251.6	4.1	111.8	26.1	67.6	0.896	0.690	171.8	249.2	218.0	329.0	−7.6	6.63
219	251.3	4.1	112.7	25.9	67.5	0.896	0.684	172.0	250.0	219.0	329.1	−7.5	6.55
220	251.1	4.0	113.5	25.7	67.5	0.896	0.677	172.1	250.9	220.0	329.2	−7.5	6.48
221	250.9	3.9	114.3	25.5	67.4	0.896	0.670	172.2	251.8	221.0	329.4	−7.4	6.41
222	250.6	3.8	115.1	25.3	67.3	0.896	0.663	172.3	252.7	222.0	329.5	−7.3	6.35
223	250.4	3.7	116.0	25.1	67.3	0.896	0.656	172.5	253.5	223.0	329.6	−7.2	6.29
224	250.2	3.7	116.8	24.9	67.2	0.896	0.649	172.6	254.4	224.0	329.7	−7.1	6.24
225	249.9	3.6	117.6	24.7	67.1	0.896	0.642	172.7	255.3	225.0	329.8	−7.0	6.19

STA_SE (#0002): Total of **531** orbits. $\lambda_O = 202.6°$, $\lambda_g{-}\lambda_O = 194.8°$, $\beta_g = -4.4°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$. Southern Taurids' are very complex but we can clearly distinct two components STA_SE and STA_SF. The former represents the early and regular activity of STA and the latter is main and periodic.
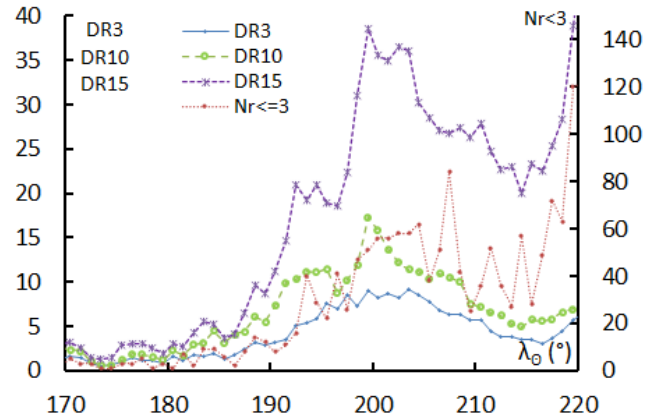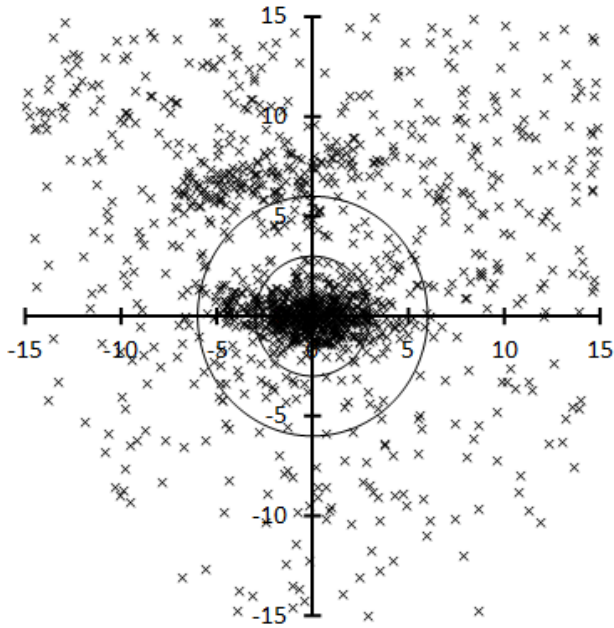
Table 1 – Number per year.

Year	N	Year	N
2007	13	2013	42
2008	54	2014	50
2009	91	2015	61
2010	26	2016	52
2011	17	2017	8
2012	80	2018	37

Table 2 – Activity profiles.

|	λ_O	Max
Nr<=3	204.5	62
DR3	199.5	9.2
DR10	199.5	17.1
DR15	199.5	38.6
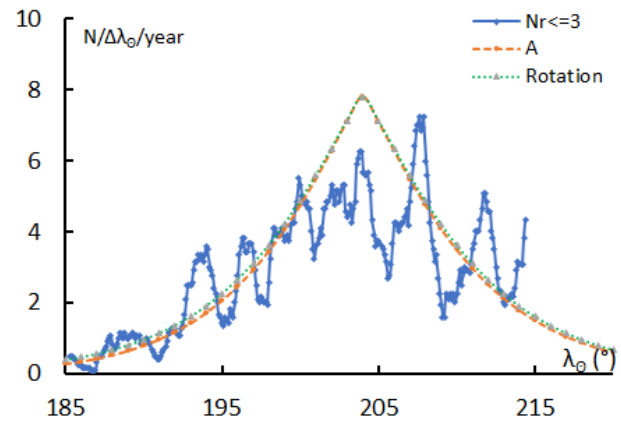
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g{-}\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
185	200.4	−4.0	25.0	6.1	30.5	0.858	0.226	6.3	132.6	5.0	137.8	4.6	1.59
186	200.1	−4.0	25.7	6.3	30.4	0.856	0.230	6.3	132.0	6.0	138.2	4.7	1.60
187	199.8	−4.0	26.4	6.6	30.3	0.854	0.235	6.2	131.4	7.0	138.6	4.7	1.61
188	199.6	−4.1	27.1	6.8	30.2	0.853	0.239	6.2	130.8	8.0	139.0	4.7	1.62
189	199.3	−4.1	27.8	7.0	30.1	0.851	0.244	6.2	130.2	9.0	139.4	4.7	1.63
190	199.0	−4.1	28.4	7.3	29.9	0.849	0.248	6.1	129.6	10.0	139.8	4.7	1.64
191	198.7	−4.2	29.1	7.5	29.8	0.847	0.253	6.1	129.0	11.0	140.2	4.7	1.65
192	198.5	−4.2	29.8	7.7	29.7	0.845	0.257	6.1	128.4	12.0	140.6	4.7	1.66
193	198.2	−4.2	30.5	7.9	29.6	0.843	0.262	6.0	127.8	13.0	141.0	4.8	1.67
194	197.9	−4.2	31.2	8.2	29.5	0.842	0.266	6.0	127.2	14.0	141.4	4.8	1.68
195	197.7	−4.3	31.9	8.4	29.4	0.840	0.271	6.0	126.6	15.0	141.8	4.8	1.69
196	197.4	−4.3	32.6	8.6	29.3	0.838	0.276	5.9	126.0	16.0	142.2	4.8	1.70
197	197.1	−4.3	33.3	8.8	29.1	0.836	0.280	5.9	125.4	17.0	142.6	4.8	1.71
198	196.8	−4.4	34.0	9.0	29.0	0.834	0.285	5.9	124.8	18.0	143.0	4.8	1.72
199	196.6	−4.4	34.7	9.2	28.9	0.833	0.290	5.8	124.2	19.0	143.3	4.8	1.73
200	196.3	−4.4	35.4	9.5	28.8	0.831	0.294	5.8	123.6	20.0	143.7	4.8	1.74
201	196.0	−4.4	36.2	9.7	28.7	0.829	0.299	5.8	123.0	21.0	144.1	4.8	1.75
202	195.8	−4.5	36.9	9.9	28.6	0.828	0.304	5.7	122.4	22.0	144.5	4.8	1.76
203	195.5	−4.5	37.6	10.1	28.5	0.826	0.308	5.7	121.8	23.0	144.9	4.8	1.77
204	195.2	−4.5	38.3	10.3	28.4	0.824	0.313	5.7	121.2	24.0	145.3	4.9	1.78

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g{-}\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
205	194.9	–4.5	39.0	10.5	28.2	0.823	0.318	5.6	120.6	25.0	145.7	4.9	1.79
206	194.7	–4.6	39.7	10.7	28.1	0.821	0.323	5.6	120.0	26.0	146.1	4.9	1.80
207	194.4	–4.6	40.4	10.9	28.0	0.819	0.328	5.6	119.3	27.0	146.5	4.9	1.81
208	194.1	–4.6	41.1	11.1	27.9	0.818	0.332	5.6	118.7	28.0	146.9	4.9	1.82
209	193.8	–4.7	41.8	11.3	27.8	0.816	0.337	5.5	118.1	29.0	147.2	4.9	1.83
210	193.6	–4.7	42.5	11.4	27.7	0.815	0.342	5.5	117.5	30.0	147.6	4.9	1.84
211	193.3	–4.7	43.3	11.6	27.6	0.813	0.347	5.5	116.9	31.0	148.0	4.9	1.85
212	193.0	–4.7	44.0	11.8	27.5	0.811	0.352	5.4	116.3	32.0	148.4	4.9	1.86
213	192.8	–4.8	44.7	12.0	27.3	0.810	0.356	5.4	115.7	33.0	148.8	4.9	1.87
214	192.5	–4.8	45.4	12.2	27.2	0.808	0.361	5.4	115.1	34.0	149.2	4.9	1.88
215	192.2	–4.8	46.1	12.4	27.1	0.807	0.366	5.4	114.5	35.0	149.6	4.9	1.89
216	191.9	–4.8	46.9	12.5	27.0	0.805	0.371	5.3	113.9	36.0	150.0	4.9	1.90
217	191.7	–4.9	47.6	12.7	26.9	0.804	0.376	5.3	113.3	37.0	150.4	4.9	1.91
218	191.4	–4.9	48.3	12.9	26.8	0.802	0.381	5.3	112.7	38.0	150.7	4.9	1.93
219	191.1	–4.9	49.0	13.0	26.7	0.801	0.385	5.2	112.0	39.0	151.1	4.9	1.94
220	190.8	–4.9	49.8	13.2	26.6	0.799	0.390	5.2	111.4	40.0	151.5	4.9	1.95
221	190.6	–5.0	50.5	13.4	26.4	0.798	0.395	5.2	110.8	41.0	151.9	4.9	1.96
222	190.3	–5.0	51.2	13.5	26.3	0.797	0.400	5.2	110.2	42.0	152.3	4.8	1.97
223	190.0	–5.0	51.9	13.7	26.2	0.795	0.405	5.1	109.6	43.0	152.7	4.8	1.98
224	189.8	–5.0	52.7	13.8	26.1	0.794	0.410	5.1	109.0	44.0	153.1	4.8	1.99
225	189.5	–5.1	53.4	14.0	26.0	0.792	0.414	5.1	108.4	45.0	153.5	4.8	2.00

TCA (#0480): Total of **325** orbits. $\lambda_O = 206°$, $\lambda_g - \lambda_O = 284.8°$, $\beta_g = 12.4°$, $\Delta r = 3°$, $\Delta\lambda_O = 20°$.
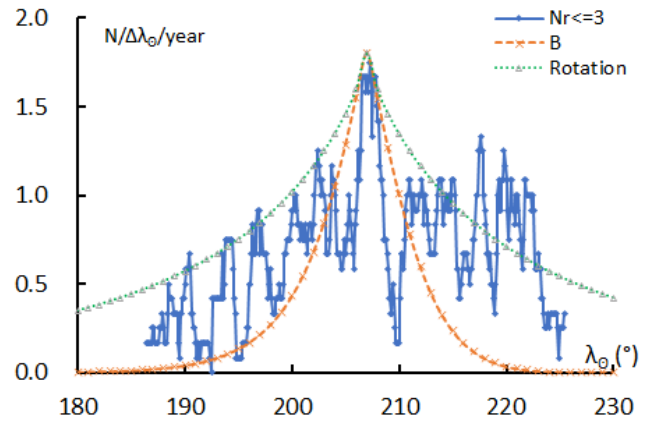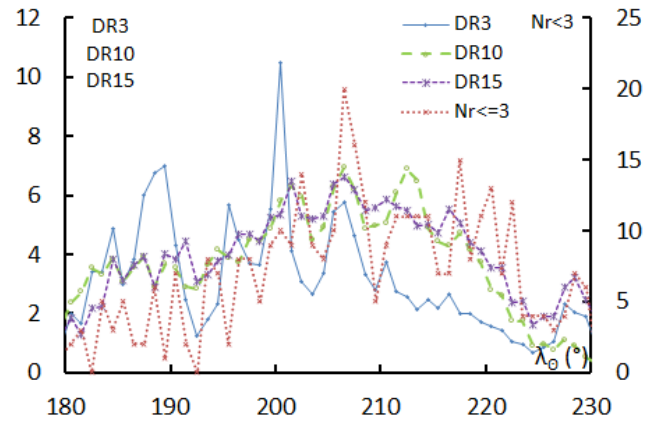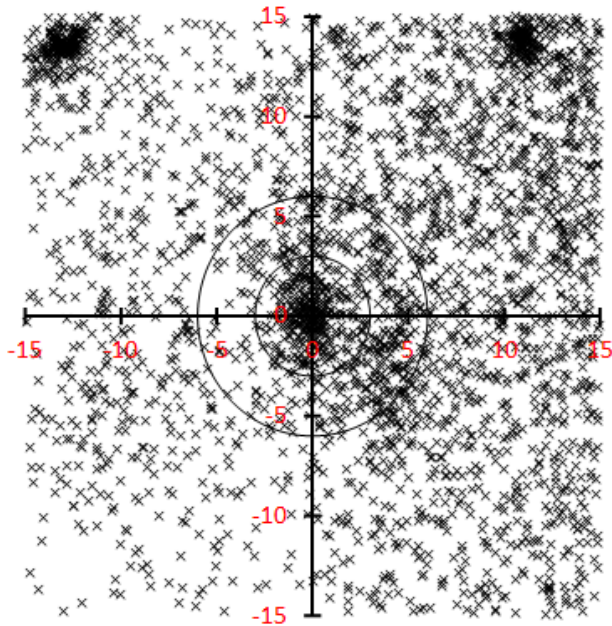
Table 1 – Number per year.

Year	N	Year	N
2007	21	2013	25
2008	17	2014	27
2009	34	2015	40
2010	11	2016	39
2011	20	2017	18
2012	32	2018	41

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	206.5	20.0
DR3	200.5	10.5
DR10	206.5	6.9
DR15	206.5	6.6

Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g - \lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
180	289.8	6.8	112.5	28.7	66.7	0.877	0.683	166.4	108.4	180.0	71.1	12.9	5.57
181	289.5	7.0	113.4	28.8	66.7	0.874	0.688	166.0	109.1	181.0	71.4	13.2	5.47
182	289.3	7.2	114.3	28.9	66.7	0.871	0.694	165.6	109.7	182.0	71.7	13.6	5.38
183	289.1	7.5	115.3	29.0	66.7	0.868	0.699	165.2	110.4	183.0	71.9	13.9	5.29
184	288.9	7.7	116.2	29.1	66.7	0.865	0.705	164.8	111.1	184.0	72.2	14.2	5.21
185	288.7	7.9	117.1	29.1	66.8	0.862	0.711	164.4	111.8	185.0	72.4	14.4	5.13
186	288.5	8.1	118.0	29.2	66.8	0.859	0.716	164.0	112.5	186.0	72.6	14.7	5.06
187	288.3	8.3	119.0	29.3	66.8	0.856	0.722	163.6	113.3	187.0	72.9	15.0	5.00
188	288.0	8.6	119.9	29.3	66.8	0.853	0.728	163.3	114.0	188.0	73.1	15.3	4.94
189	287.8	8.8	120.8	29.4	66.8	0.850	0.733	162.9	114.7	189.0	73.3	15.5	4.88
190	287.6	9.0	121.7	29.5	66.8	0.847	0.739	162.5	115.5	190.0	73.5	15.8	4.83
191	287.4	9.2	122.6	29.5	66.8	0.844	0.745	162.1	116.2	191.0	73.6	16.0	4.78
192	287.2	9.4	123.6	29.5	66.9	0.842	0.750	161.7	117.0	192.0	73.8	16.2	4.74
193	287.0	9.7	124.5	29.6	66.9	0.839	0.756	161.4	117.7	193.0	74.0	16.4	4.70
194	286.8	9.9	125.4	29.6	66.9	0.837	0.761	161.0	118.5	194.0	74.1	16.6	4.66
195	286.5	10.1	126.3	29.6	66.9	0.834	0.767	160.6	119.3	195.0	74.3	16.8	4.63
196	286.3	10.3	127.3	29.7	66.9	0.832	0.773	160.3	120.1	196.0	74.4	17.0	4.60
197	286.1	10.5	128.2	29.7	66.9	0.830	0.778	159.9	120.9	197.0	74.5	17.2	4.57
198	285.9	10.7	129.1	29.7	66.9	0.828	0.784	159.5	121.7	198.0	74.6	17.3	4.54
199	285.7	11.0	130.0	29.7	67.0	0.825	0.789	159.2	122.5	199.0	74.7	17.5	4.52
200	285.5	11.2	130.9	29.7	67.0	0.823	0.795	158.8	123.3	200.0	74.8	17.6	4.50

Table 3 – Continued, evolution of the orbital parameters during the activity period.

| λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
201	285.2	11.4	131.9	29.7	67.0	0.822	0.800	158.4	124.1	201.0	74.9	17.7	4.48
202	285.0	11.6	132.8	29.7	67.0	0.820	0.805	158.1	125.0	202.0	75.0	17.8	4.47
203	284.8	11.8	133.7	29.7	67.0	0.818	0.811	157.7	125.8	203.0	75.1	17.9	4.46
204	284.6	12.1	134.6	29.7	67.0	0.817	0.816	157.4	126.6	204.0	75.1	18.0	4.45
205	284.4	12.3	135.5	29.7	67.1	0.815	0.821	157.0	127.5	205.0	75.2	18.1	4.45
206	284.1	12.5	136.4	29.7	67.1	0.814	0.826	156.7	128.4	206.0	75.2	18.1	4.44
207	283.9	12.7	137.3	29.7	67.1	0.813	0.832	156.3	129.2	207.0	75.3	18.1	4.44
208	283.7	12.9	138.3	29.6	67.1	0.812	0.837	156.0	130.1	208.0	75.3	18.2	4.44
209	283.5	13.1	139.2	29.6	67.1	0.811	0.842	155.6	131.0	209.0	75.4	18.2	4.45
210	283.3	13.3	140.1	29.6	67.1	0.810	0.847	155.3	131.8	210.0	75.4	18.2	4.45
211	283.0	13.6	141.0	29.5	67.1	0.809	0.852	154.9	132.7	211.0	75.4	18.1	4.46
212	282.8	13.8	141.9	29.5	67.2	0.809	0.856	154.6	133.6	212.0	75.5	18.1	4.47
213	282.6	14.0	142.8	29.5	67.2	0.808	0.861	154.2	134.5	213.0	75.5	18.1	4.49
214	282.4	14.2	143.7	29.4	67.2	0.808	0.866	153.9	135.4	214.0	75.5	18.0	4.51
215	282.2	14.4	144.6	29.4	67.2	0.808	0.871	153.6	136.3	215.0	75.5	17.9	4.53
216	281.9	14.6	145.5	29.3	67.2	0.808	0.875	153.2	137.2	216.0	75.6	17.8	4.55
217	281.7	14.8	146.4	29.3	67.2	0.808	0.880	152.9	138.1	217.0	75.6	17.7	4.58
218	281.5	15.1	147.2	29.2	67.3	0.808	0.884	152.5	139.0	218.0	75.6	17.6	4.61
219	281.3	15.3	148.1	29.1	67.3	0.808	0.888	152.2	140.0	219.0	75.6	17.5	4.64
220	281.0	15.5	149.0	29.1	67.3	0.809	0.893	151.9	140.9	220.0	75.7	17.3	4.67
221	280.8	15.7	149.9	29.0	67.3	0.810	0.897	151.5	141.8	221.0	75.7	17.1	4.71
222	280.6	15.9	150.8	29.0	67.3	0.811	0.901	151.2	142.7	222.0	75.7	17.0	4.76
223	280.3	16.1	151.7	28.9	67.3	0.812	0.905	150.9	143.6	223.0	75.8	16.8	4.80
224	280.1	16.3	152.5	28.8	67.3	0.813	0.909	150.6	144.6	224.0	75.8	16.6	4.85
225	279.9	16.6	153.4	28.7	67.4	0.814	0.913	150.2	145.5	225.0	75.8	16.3	4.91
226	279.7	16.8	154.3	28.7	67.4	0.816	0.916	149.9	146.4	226.0	75.9	16.1	4.97
227	279.4	17.0	155.2	28.6	67.4	0.817	0.920	149.6	147.3	227.0	75.9	15.9	5.03
228	279.2	17.2	156.0	28.5	67.4	0.819	0.924	149.3	148.3	228.0	76.0	15.6	5.10
229	279.0	17.4	156.9	28.4	67.4	0.821	0.927	148.9	149.2	229.0	76.1	15.3	5.18
230	278.7	17.6	157.7	28.3	67.4	0.823	0.930	148.6	150.1	230.0	76.1	15.0	5.26

LMI (#0022): Total of **245** orbits. $\lambda_\Theta = 209.6°$, $\lambda_g–\lambda_\Theta = 297.9°$, $\beta_g = 26.2°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 5°$.
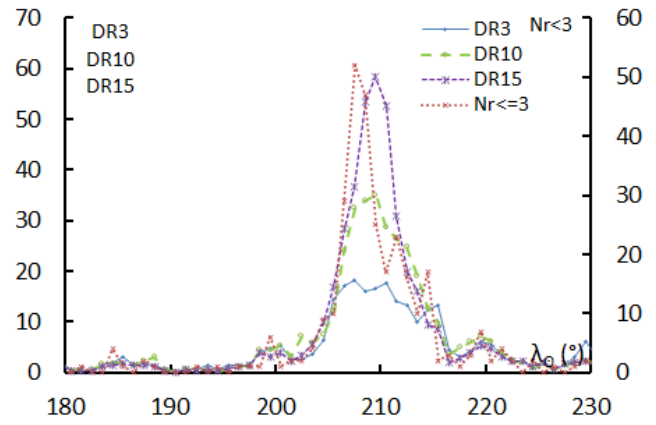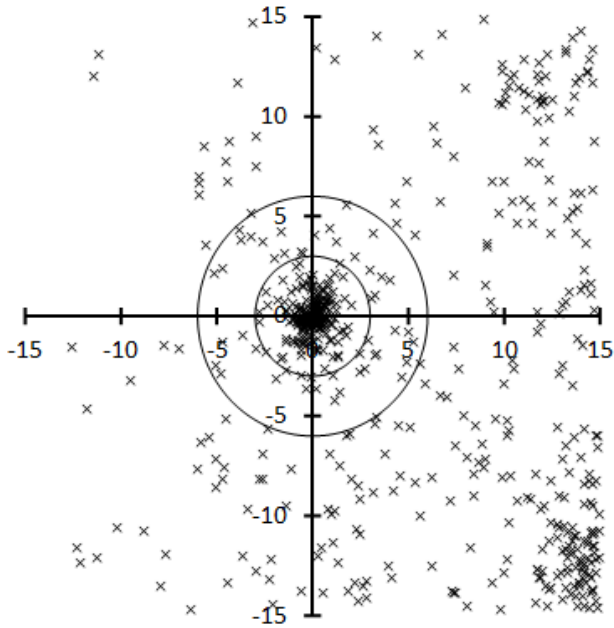
Table 1 – Number per year.

Year	N	Year	N
2007	21	2013	3
2008	12	2014	20
2009	30	2015	29
2010	8	2016	20
2011	11	2017	4
2012	42	2018	45

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	207.5	52
DR3	207.5	18.3
DR10	209.5	35.0
DR15	209.5	58.4
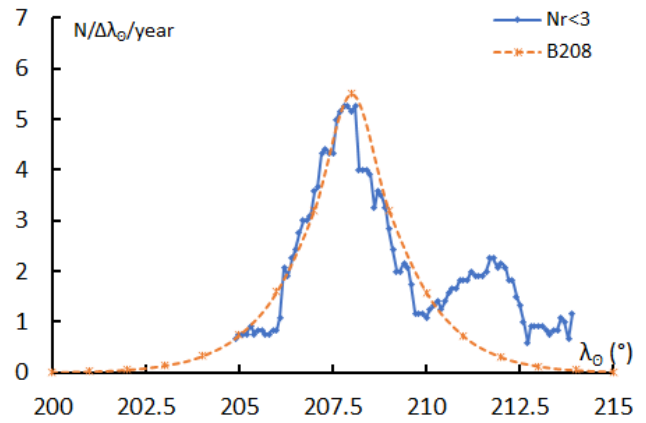
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g–\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
200	297.3	25.5	149.5	39.7	61.6	0.953	0.624	126.4	103.5	200.0	88.0	51.5	13.33
201	297.3	25.6	150.7	39.4	61.6	0.954	0.624	126.2	103.5	201.0	88.9	51.7	13.61
202	297.4	25.7	151.9	39.1	61.5	0.955	0.623	126.0	103.4	202.0	89.9	51.9	13.90
203	297.5	25.7	153.1	38.8	61.5	0.956	0.622	125.8	103.4	203.0	90.9	52.0	14.21
204	297.6	25.8	154.2	38.5	61.5	0.957	0.622	125.7	103.4	204.0	91.8	52.2	14.54
205	297.6	25.9	155.4	38.1	61.5	0.958	0.621	125.5	103.3	205.0	92.8	52.4	14.89
206	297.7	25.9	156.5	37.8	61.5	0.959	0.621	125.3	103.3	206.0	93.7	52.6	15.26
207	297.8	26.0	157.7	37.5	61.5	0.960	0.620	125.1	103.3	207.0	94.7	52.8	15.66
208	297.8	26.1	158.8	37.2	61.4	0.961	0.619	124.9	103.2	208.0	95.7	52.9	16.08
209	297.9	26.2	160.0	36.8	61.4	0.963	0.619	124.8	103.2	209.0	96.6	53.1	16.53
210	298.0	26.2	161.1	36.5	61.4	0.964	0.618	124.6	103.2	210.0	97.6	53.3	17.02
211	298.0	26.3	162.2	36.2	61.4	0.965	0.617	124.4	103.2	211.0	98.5	53.5	17.54
212	298.1	26.4	163.3	35.8	61.4	0.966	0.617	124.2	103.1	212.0	99.4	53.6	18.11
213	298.2	26.5	164.4	35.5	61.3	0.967	0.616	124.0	103.1	213.0	100.4	53.8	18.72
214	298.2	26.5	165.5	35.1	61.3	0.968	0.616	123.9	103.1	214.0	101.3	54.0	19.38
215	298.3	26.6	166.6	34.8	61.3	0.969	0.615	123.7	103.1	215.0	102.3	54.2	20.10
216	298.4	26.7	167.7	34.4	61.3	0.971	0.615	123.5	103.1	216.0	103.2	54.3	20.89
217	298.5	26.7	168.8	34.1	61.3	0.972	0.614	123.3	103.0	217.0	104.1	54.5	21.76
218	298.5	26.8	169.8	33.7	61.2	0.973	0.613	123.1	103.0	218.0	105.1	54.7	22.71
219	298.6	26.9	170.9	33.4	61.2	0.974	0.613	122.9	103.0	219.0	106.0	54.8	23.76
220	298.7	27.0	172.0	33.0	61.2	0.975	0.612	122.8	103.0	220.0	106.9	55.0	24.93

ORI (#0008): Total of **10440** orbits. $\lambda_{\Theta} = 209°$, $\lambda_g–\lambda_{\Theta} = 246.7°$, $\beta_g = 37.5°$, $\Delta r = 3°$, $\Delta\lambda_{\Theta} = 8°$. SonotaCo net caught Orionids outbursts between 2007 and 2009 and the published results, especially DR_{max} and N_{max} reflect such high activity level.
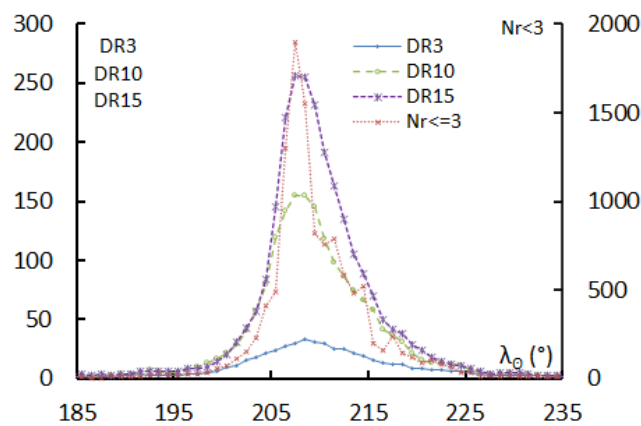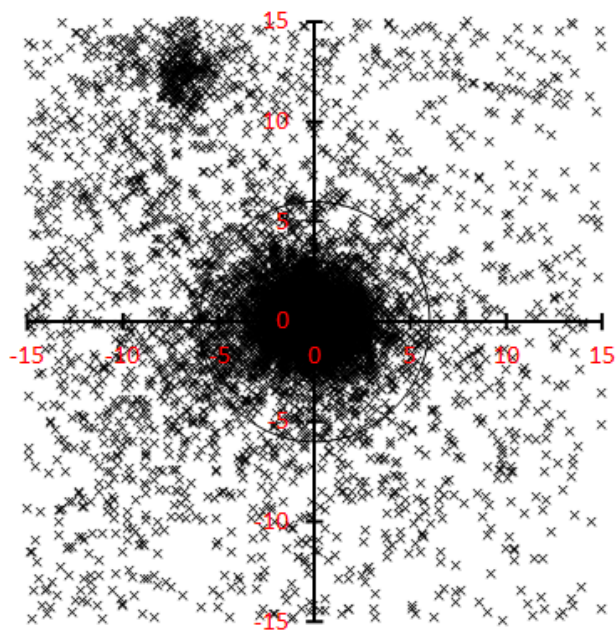
Table 1 – Number per year.

Year	N	Year	N
2007	1505	2013	201
2008	1040	2014	599
2009	1926	2015	705
2010	277	2016	736
2011	722	2017	354
2012	1177	2018	1198

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	207.5	1897
DR3	208.5	33.8
DR10	208.5	155.1
DR15	207.5	255.7
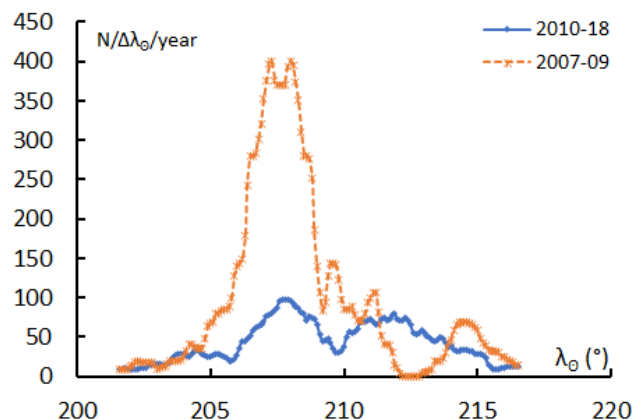
Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g–\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
180	254.7	−9.9	74.5	12.7	68.2	0.940	0.801	161.5	54.2	0.0	307.2	14.9	13.38
181	254.4	−9.8	75.3	12.9	68.1	0.938	0.794	161.6	55.3	1.0	307.1	15.0	12.89
182	254.1	−9.8	76.0	13.0	68.0	0.937	0.787	161.7	56.3	2.0	307.0	15.2	12.45
183	253.9	−9.7	76.7	13.2	67.9	0.935	0.779	161.8	57.4	3.0	307.0	15.3	12.06
184	253.6	−9.6	77.4	13.3	67.9	0.934	0.772	161.8	58.4	4.0	306.9	15.4	11.70
185	253.3	−9.5	78.2	13.4	67.8	0.933	0.764	161.9	59.5	5.0	306.8	15.5	11.37
186	253.0	−9.4	78.9	13.6	67.7	0.932	0.756	162.0	60.5	6.0	306.7	15.6	11.08
187	252.8	−9.4	79.6	13.7	67.6	0.931	0.749	162.1	61.6	7.0	306.7	15.7	10.81
188	252.5	−9.3	80.3	13.8	67.6	0.930	0.741	162.1	62.6	8.0	306.6	15.8	10.57
189	252.2	−9.2	81.1	14.0	67.5	0.929	0.733	162.2	63.6	9.0	306.5	15.9	10.34
190	251.9	−9.1	81.8	14.1	67.4	0.929	0.725	162.3	64.6	10.0	306.4	16.0	10.14
191	251.7	−9.1	82.5	14.2	67.3	0.928	0.717	162.4	65.7	11.0	306.4	16.0	9.96
192	251.4	−9.0	83.3	14.3	67.3	0.928	0.709	162.4	66.7	12.0	306.3	16.1	9.79
193	251.1	−8.9	84.0	14.4	67.2	0.927	0.701	162.5	67.7	13.0	306.3	16.1	9.63
194	250.9	−8.8	84.7	14.5	67.1	0.927	0.693	162.6	68.7	14.0	306.2	16.2	9.49
195	250.6	−8.7	85.5	14.6	67.0	0.927	0.685	162.7	69.7	15.0	306.2	16.2	9.36
196	250.3	−8.7	86.2	14.7	67.0	0.927	0.677	162.8	70.7	16.0	306.1	16.3	9.25
197	250.0	−8.6	87.0	14.8	66.9	0.927	0.669	162.8	71.7	17.0	306.1	16.3	9.14
198	249.8	−8.5	87.7	14.9	66.8	0.927	0.661	162.9	72.7	18.0	306.0	16.3	9.05
199	249.5	−8.4	88.5	15.0	66.7	0.927	0.653	163.0	73.7	19.0	306.0	16.3	8.96

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
200	249.2	−8.4	89.2	15.1	66.7	0.927	0.644	163.1	74.7	20.0	306.0	16.3	8.88
201	248.9	−8.3	89.9	15.2	66.6	0.928	0.636	163.1	75.7	21.0	305.9	16.3	8.82
202	248.7	−8.2	90.7	15.2	66.5	0.928	0.628	163.2	76.6	22.0	305.9	16.3	8.76
203	248.4	−8.1	91.4	15.3	66.4	0.929	0.620	163.3	77.6	23.0	305.9	16.3	8.71
204	248.1	−8.0	92.2	15.4	66.4	0.929	0.612	163.4	78.6	24.0	305.9	16.3	8.66
205	247.9	−8.0	92.9	15.5	66.3	0.930	0.603	163.5	79.5	25.0	305.9	16.2	8.63
206	247.6	−7.9	93.7	15.5	66.2	0.931	0.595	163.6	80.5	26.0	305.9	16.2	8.60
207	247.3	−7.8	94.4	15.6	66.1	0.932	0.587	163.6	81.4	27.0	305.9	16.2	8.58
208	247.0	−7.7	95.2	15.6	66.1	0.932	0.579	163.7	82.4	28.0	305.9	16.1	8.56
209	246.8	−7.6	95.9	15.7	66.0	0.933	0.571	163.8	83.3	29.0	305.9	16.1	8.56
210	246.5	−7.5	96.7	15.7	65.9	0.934	0.562	163.9	84.3	30.0	306.0	16.0	8.56
211	246.2	−7.5	97.4	15.8	65.8	0.935	0.554	164.0	85.2	31.0	306.0	16.0	8.56
212	246.0	−7.4	98.2	15.8	65.8	0.936	0.546	164.1	86.1	32.0	306.0	15.9	8.57
213	245.7	−7.3	99.0	15.9	65.7	0.937	0.538	164.1	87.0	33.0	306.1	15.8	8.59
214	245.4	−7.2	99.7	15.9	65.6	0.939	0.530	164.2	87.9	34.0	306.1	15.8	8.62
215	245.1	−7.1	100.5	15.9	65.5	0.940	0.522	164.3	88.8	35.0	306.2	15.7	8.65
216	244.9	−7.1	101.2	16.0	65.5	0.941	0.514	164.4	89.7	36.0	306.3	15.6	8.69
217	244.6	−7.0	102.0	16.0	65.4	0.942	0.506	164.5	90.6	37.0	306.3	15.5	8.74
218	244.3	−6.9	102.7	16.0	65.3	0.943	0.498	164.6	91.5	38.0	306.4	15.4	8.80
219	244.1	−6.8	103.5	16.0	65.2	0.945	0.490	164.7	92.4	39.0	306.5	15.3	8.86
220	243.8	−6.7	104.3	16.0	65.2	0.946	0.482	164.8	93.3	40.0	306.6	15.2	8.93
221	243.5	−6.6	105.0	16.0	65.1	0.947	0.474	164.9	94.2	41.0	306.7	15.1	9.01
222	243.2	−6.6	105.8	16.0	65.0	0.949	0.467	165.0	95.0	42.0	306.8	15.0	9.10
223	243.0	−6.5	106.5	16.0	64.9	0.950	0.459	165.0	95.9	43.0	306.9	14.9	9.20
224	242.7	−6.4	107.3	16.0	64.9	0.952	0.451	165.1	96.8	44.0	307.0	14.8	9.31
225	242.4	−6.3	108.1	16.0	64.8	0.953	0.443	165.2	97.6	45.0	307.1	14.6	9.42
226	242.2	−6.2	108.8	16.0	64.7	0.954	0.436	165.3	98.5	46.0	307.3	14.5	9.55
227	241.9	−6.1	109.6	16.0	64.6	0.956	0.428	165.4	99.3	47.0	307.4	14.4	9.69
228	241.6	−6.1	110.3	16.0	64.6	0.957	0.421	165.5	100.1	48.0	307.5	14.2	9.85
229	241.4	−6.0	111.1	16.0	64.5	0.959	0.413	165.6	101.0	49.0	307.7	14.1	10.01
230	241.1	−5.9	111.9	16.0	64.4	0.960	0.406	165.7	101.8	50.0	307.8	14.0	10.19
231	240.8	−5.8	112.6	15.9	64.3	0.962	0.398	165.8	102.6	51.0	308.0	13.8	10.39
232	240.6	−5.7	113.4	15.9	64.3	0.963	0.391	165.9	103.4	52.0	308.2	13.7	10.60
233	240.3	−5.6	114.1	15.9	64.2	0.965	0.384	166.0	104.3	53.0	308.3	13.5	10.84
234	240.0	−5.6	114.9	15.8	64.1	0.966	0.377	166.1	105.1	54.0	308.5	13.4	11.09
235	239.7	−5.5	115.7	15.8	64.0	0.967	0.370	166.2	105.9	55.0	308.7	13.2	11.37
236	239.5	−5.4	116.4	15.7	64.0	0.969	0.362	166.3	106.7	56.0	308.9	13.1	11.67
237	239.2	−5.3	117.2	15.7	63.9	0.970	0.355	166.5	107.5	57.0	309.1	12.9	12.00
238	238.9	−5.2	117.9	15.6	63.8	0.972	0.349	166.6	108.3	58.0	309.3	12.7	12.37
239	238.7	−5.1	118.7	15.6	63.7	0.973	0.342	166.7	109.0	59.0	309.5	12.6	12.77
240	238.4	−5.0	119.5	15.5	63.7	0.975	0.335	166.8	109.8	60.0	309.7	12.4	13.21

LUM (#0524): Total of **62** orbits. $\lambda_{\mathcal{O}} = 214.6°$, $\lambda_g - \lambda_{\mathcal{O}} = 284.6°$, $\beta_g = 37.1°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 5°$.
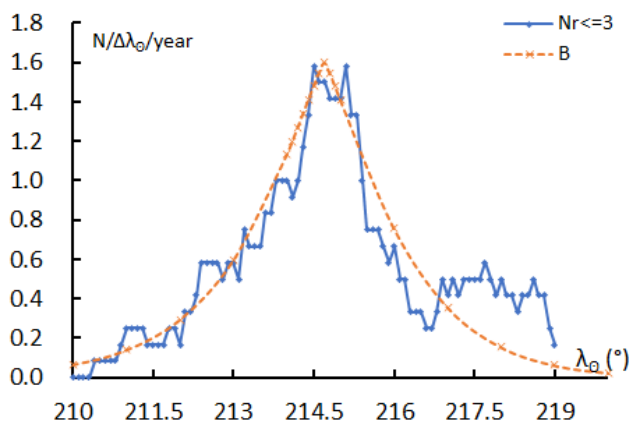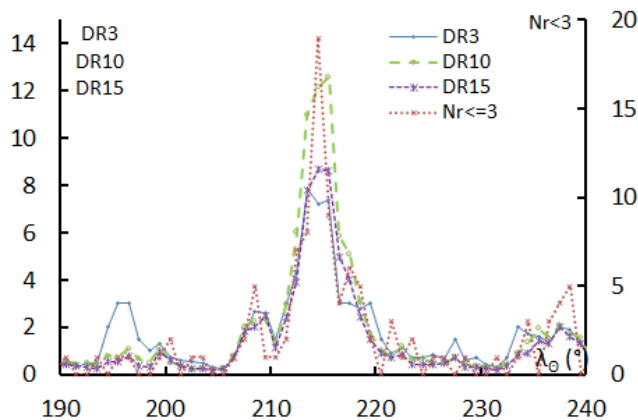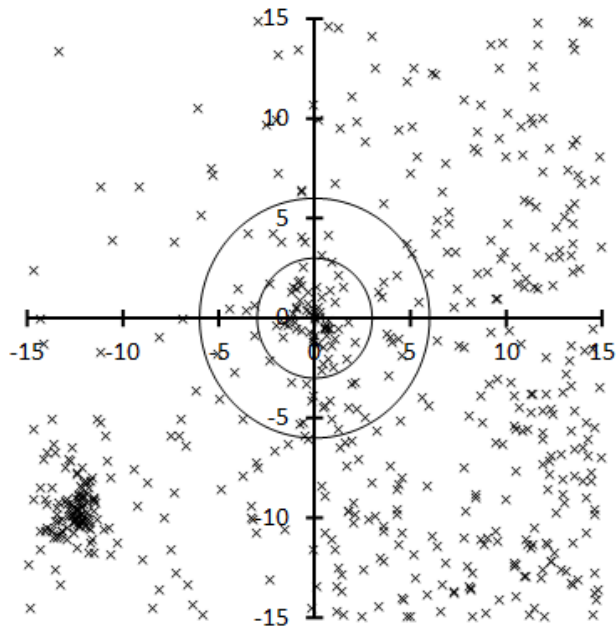
Table 1 – Number per year.

Year	N	Year	N
2007	3	2013	7
2008	8	2014	4
2009	6	2015	2
2010	1	2016	2
2011	13	2017	7
2012	7	2018	2

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	214.5	19.0
DR3	213.5	7.8
DR10	215.5	12.6
DR15	214.5	8.7

Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_{\mathcal{O}}$	$\lambda_g - \lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
205	284.1	37.1	146.9	53.0	61.1	1.007	0.924	115.3	148.7	205.0	39.5	28.0	−126
206	284.2	37.0	148.1	52.7	61.0	1.004	0.923	115.3	148.7	206.0	40.6	28.1	−250
207	284.2	37.0	149.3	52.3	61.0	1.000	0.923	115.3	148.6	207.0	41.6	28.1	–
208	284.2	37.0	150.5	52.0	61.0	0.996	0.922	115.2	148.5	208.0	42.7	28.2	263
209	284.2	37.0	151.6	51.6	61.0	0.993	0.922	115.2	148.4	209.0	43.7	28.3	130
210	284.2	37.0	152.8	51.2	60.9	0.989	0.921	115.2	148.3	210.0	44.8	28.4	86.43
211	284.2	36.9	153.9	50.9	60.9	0.986	0.920	115.2	148.2	211.0	45.8	28.5	64.79
212	284.2	36.9	155.0	50.5	60.9	0.982	0.920	115.2	148.1	212.0	46.9	28.6	51.85
213	284.2	36.9	156.1	50.1	60.8	0.979	0.919	115.2	148.0	213.0	47.9	28.6	43.24
214	284.2	36.9	157.2	49.7	60.8	0.975	0.919	115.2	147.9	214.0	49.0	28.7	37.10
214.1	284.2	36.9	157.3	49.7	60.8	0.975	0.919	115.2	147.9	214.1	49.1	28.7	36.58
214.2	284.2	36.9	157.4	49.6	60.8	0.975	0.919	115.2	147.9	214.2	49.2	28.7	36.08
214.3	284.2	36.9	157.5	49.6	60.8	0.974	0.919	115.2	147.9	214.3	49.3	28.8	35.59
214.4	284.2	36.9	157.6	49.6	60.8	0.974	0.919	115.2	147.9	214.4	49.4	28.8	35.11
214.5	284.2	36.9	157.7	49.5	60.8	0.973	0.918	115.2	147.9	214.5	49.5	28.8	34.64
214.6	284.2	36.9	157.8	49.5	60.8	0.973	0.918	115.2	147.8	214.6	49.6	28.8	34.19
214.7	284.2	36.9	158.0	49.4	60.8	0.973	0.918	115.2	147.8	214.7	49.7	28.8	33.75
214.8	284.2	36.9	158.1	49.4	60.8	0.972	0.918	115.2	147.8	214.8	49.8	28.8	33.32
214.9	284.2	36.9	158.2	49.4	60.8	0.972	0.918	115.2	147.8	214.9	49.9	28.8	32.91
215	284.2	36.9	158.3	49.3	60.8	0.972	0.918	115.2	147.8	215.0	50.0	28.8	32.50
216	284.2	36.8	159.4	48.9	60.8	0.968	0.918	115.2	147.7	216.0	51.1	28.9	28.92

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
217	284.2	36.8	160.4	48.6	60.7	0.965	0.917	115.2	147.6	217.0	52.1	29.0	26.07
218	284.2	36.8	161.5	48.2	60.7	0.961	0.917	115.2	147.5	218.0	53.2	29.1	23.73
219	284.2	36.8	162.5	47.8	60.7	0.958	0.916	115.2	147.4	219.0	54.2	29.2	21.79
220	284.2	36.8	163.6	47.4	60.7	0.955	0.915	115.2	147.3	220.0	55.3	29.3	20.14
221	284.2	36.8	164.6	47.0	60.6	0.951	0.915	115.2	147.2	221.0	56.3	29.3	18.73
222	284.2	36.7	165.6	46.6	60.6	0.948	0.914	115.2	147.1	222.0	57.4	29.4	17.51
223	284.2	36.7	166.6	46.2	60.6	0.944	0.914	115.2	147.0	223.0	58.4	29.5	16.44
224	284.2	36.7	167.6	45.8	60.5	0.941	0.913	115.2	146.9	224.0	59.5	29.6	15.50
225	284.2	36.7	168.6	45.3	60.5	0.938	0.913	115.2	146.8	225.0	60.6	29.7	14.67

SLD (#0526): Total of **60** orbits. $\lambda_\mathcal{O} = 221°$, $\lambda_g{-}\lambda_\mathcal{O} = 265.7°$, $\beta_g = 53.7°$, $\Delta r = 3°$, $\Delta\lambda_\mathcal{O} = 5°$.
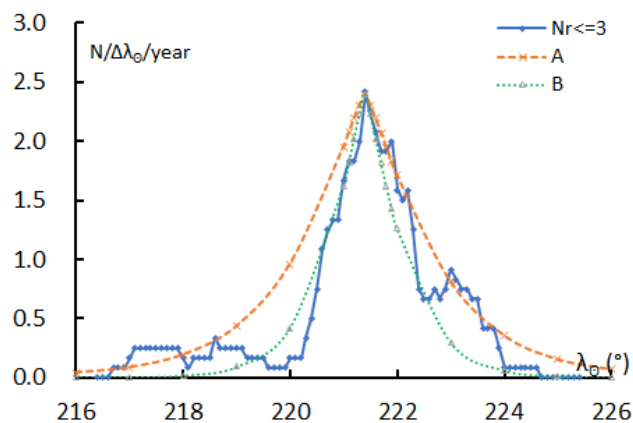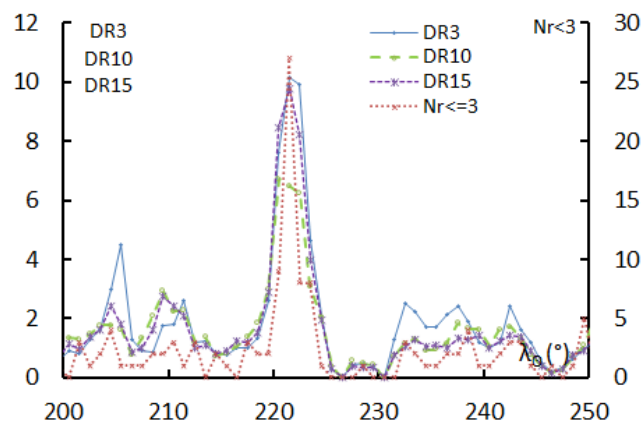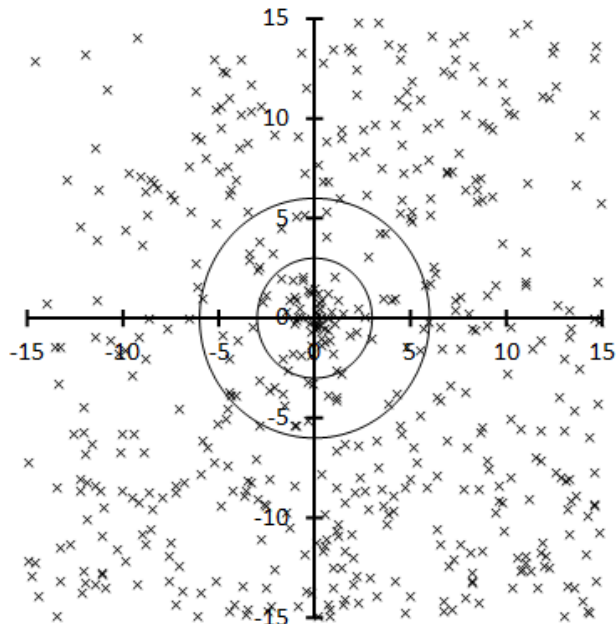
Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	1
2008	2	2014	7
2009	6	2015	9
2010	9	2016	5
2011	8	2017	4
2012	4	2018	4

Table 2 – Activity profiles.

	$\lambda_\mathcal{O}$	Max
Nr<=3	221.5	27.0
DR3	221.5	10.1
DR10	220.5	6.7
DR15	221.5	9.8

Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_\mathcal{O}$	$\lambda_g{-}\lambda_\mathcal{O}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
216	262.7	53.9	151.5	71.2	49.5	0.816	0.981	88.5	193.3	216.0	36.3	−13.3	5.33
217	263.1	53.8	153.5	70.7	49.3	0.799	0.982	88.5	192.8	217.0	37.4	−12.8	4.88
218	263.5	53.8	155.4	70.1	49.2	0.782	0.983	88.4	192.3	218.0	38.4	−12.3	4.50
219	263.9	53.7	157.2	69.6	49.0	0.765	0.983	88.3	191.8	219.0	39.4	−11.8	4.18
220	264.3	53.7	159.0	69.0	48.8	0.748	0.984	88.2	191.2	220.0	40.4	−11.2	3.90
221	264.7	53.6	160.7	68.5	48.6	0.731	0.985	88.1	190.7	221.0	41.4	−10.7	3.66
221.1	264.8	53.6	160.8	68.4	48.6	0.730	0.985	88.1	190.6	221.1	41.5	−10.6	3.64
221.2	264.8	53.6	161.0	68.4	48.6	0.728	0.985	88.1	190.6	221.2	41.6	−10.6	3.62
221.3	264.8	53.6	161.2	68.3	48.6	0.726	0.985	88.1	190.5	221.3	41.7	−10.5	3.60
221.4	264.9	53.6	161.3	68.2	48.6	0.725	0.985	88.1	190.5	221.4	41.8	−10.5	3.58
221.5	264.9	53.6	161.5	68.2	48.5	0.723	0.985	88.1	190.4	221.5	41.9	−10.4	3.55
221.6	265.0	53.6	161.7	68.1	48.5	0.721	0.985	88.0	190.3	221.6	42.0	−10.3	3.53
221.7	265.0	53.6	161.8	68.1	48.5	0.720	0.985	88.0	190.3	221.7	42.1	−10.3	3.51
221.8	265.1	53.6	162.0	68.0	48.5	0.718	0.985	88.0	190.2	221.8	42.2	−10.2	3.49
221.9	265.1	53.6	162.2	68.0	48.5	0.716	0.985	88.0	190.2	221.9	42.3	−10.2	3.47
222	265.1	53.6	162.3	67.9	48.5	0.715	0.985	88.0	190.1	222.0	42.4	−10.1	3.45
223	265.5	53.5	163.9	67.3	48.3	0.698	0.986	87.9	189.5	223.0	43.3	−9.5	3.27
224	266.0	53.5	165.5	66.7	48.1	0.682	0.986	87.8	188.9	224.0	44.3	−8.9	3.10
225	266.4	53.4	167.0	66.1	47.9	0.666	0.987	87.7	188.3	225.0	45.3	−8.3	2.95
226	266.8	53.3	168.4	65.6	47.8	0.650	0.987	87.6	187.7	226.0	46.3	−7.7	2.82

CTA (#0388): Total of **152** orbits. $\lambda_{\odot} = 221°$, $\lambda_g - \lambda_{\odot} = 204.9°$, $\beta_g = 5.0°$, $\Delta r = 3°$, $\Delta\lambda_{\odot} = 10°$.
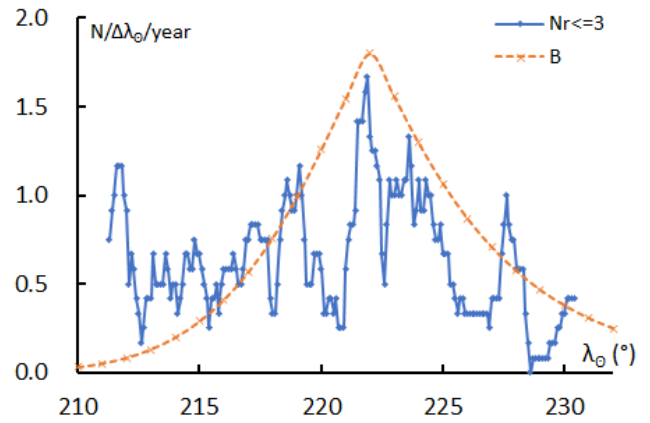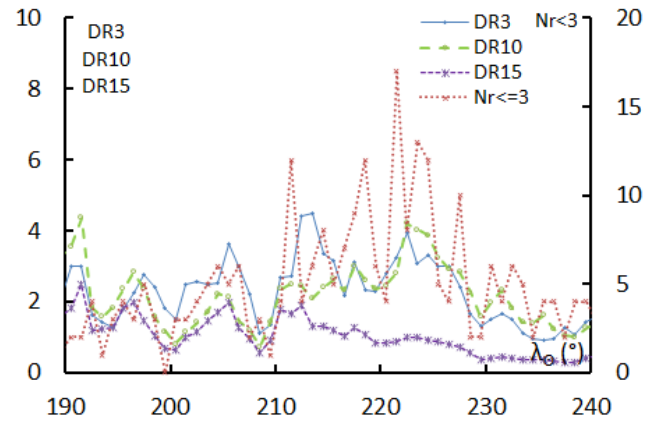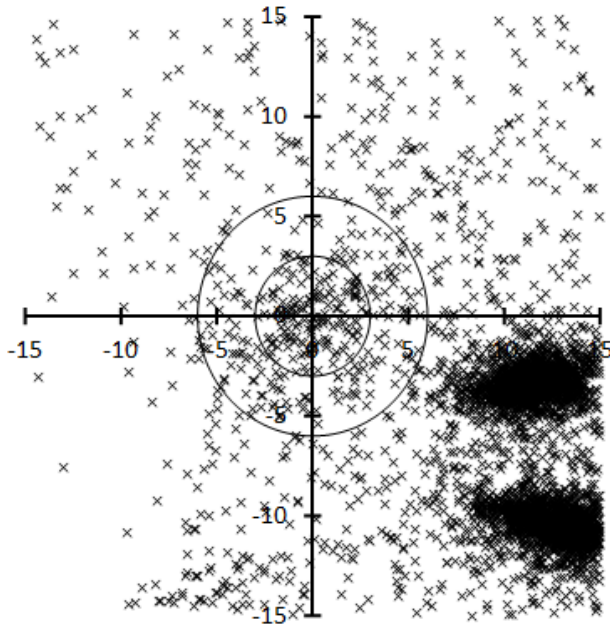
Table 1 – Number per year.

Year	N	Year	N
2007	3	2013	12
2008	9	2014	17
2009	20	2015	10
2010	10	2016	14
2011	14	2017	20
2012	12	2018	11

Table 2 – Activity profiles.

	$\lambda_{\odot}$	Max
Nr<=3	221.5	17
DR3	213.5	4.5
DR10	222.5	4.2
DR15	212.5	1.9

Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\odot}$	$\lambda_g - \lambda_{\odot}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
205	207.3	5.6	48.3	23.8	43.2	0.988	0.068	22.7	331.0	205.0	177.9	−10.8	5.61
206	207.1	5.6	49.2	24.0	43.1	0.987	0.071	22.2	330.5	206.0	178.4	−10.7	5.43
207	207.0	5.7	50.1	24.2	42.9	0.986	0.073	21.8	330.1	207.0	178.9	−10.7	5.25
208	206.8	5.7	51.0	24.5	42.7	0.985	0.075	21.4	329.7	208.0	179.5	−10.6	5.09
209	206.7	5.7	51.9	24.7	42.5	0.984	0.077	21.1	329.3	209.0	180.0	−10.6	4.94
210	206.6	5.7	52.8	24.9	42.3	0.983	0.079	20.7	328.9	210.0	180.5	−10.5	4.79
211	206.4	5.7	53.7	25.1	42.1	0.982	0.082	20.4	328.4	211.0	181.1	−10.5	4.66
212	206.3	5.7	54.6	25.3	42.0	0.981	0.084	20.0	328.0	212.0	181.6	−10.4	4.53
213	206.1	5.7	55.5	25.5	41.8	0.980	0.086	19.7	327.6	213.0	182.2	−10.4	4.41
214	206.0	5.7	56.4	25.7	41.6	0.979	0.089	19.4	327.2	214.0	182.7	−10.3	4.30
215	205.8	5.8	57.4	25.9	41.4	0.978	0.091	19.0	326.8	215.0	183.3	−10.3	4.19
216	205.7	5.8	58.3	26.1	41.2	0.977	0.094	18.7	326.4	216.0	183.8	−10.2	4.09
217	205.5	5.8	59.2	26.3	41.1	0.976	0.096	18.4	326.0	217.0	184.4	−10.2	3.99
218	205.4	5.8	60.1	26.5	40.9	0.975	0.099	18.2	325.6	218.0	184.9	−10.1	3.90
219	205.2	5.8	61.1	26.7	40.7	0.974	0.101	17.9	325.2	219.0	185.5	−10.1	3.82
220	205.1	5.8	62.0	26.9	40.5	0.972	0.104	17.6	324.8	220.0	186.0	−10.0	3.73
221	204.9	5.8	62.9	27.0	40.3	0.971	0.106	17.3	324.4	221.0	186.6	−10.0	3.65
222	204.8	5.8	63.9	27.2	40.1	0.970	0.109	17.1	324.0	222.0	187.2	−9.9	3.58
223	204.7	5.8	64.8	27.3	40.0	0.968	0.111	16.8	323.6	223.0	187.7	−9.9	3.51
224	204.5	5.9	65.7	27.5	39.8	0.967	0.114	16.6	323.2	224.0	188.3	−9.9	3.44
225	204.4	5.9	66.7	27.6	39.6	0.965	0.117	16.3	322.8	225.0	188.9	−9.8	3.37

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
226	204.2	5.9	67.6	27.8	39.4	0.964	0.119	16.1	322.4	226.0	189.5	−9.8	3.31
227	204.1	5.9	68.6	27.9	39.2	0.962	0.122	15.9	322.0	227.0	190.0	−9.7	3.25
228	203.9	5.9	69.5	28.1	39.1	0.961	0.125	15.7	321.6	228.0	190.6	−9.7	3.19
229	203.8	5.9	70.5	28.2	38.9	0.959	0.128	15.4	321.2	229.0	191.2	−9.6	3.13
230	203.6	5.9	71.4	28.3	38.7	0.958	0.130	15.2	320.8	230.0	191.8	−9.6	3.08
231	203.5	5.9	72.4	28.4	38.5	0.956	0.133	15.0	320.4	231.0	192.4	−9.5	3.03
232	203.3	5.9	73.3	28.5	38.3	0.954	0.136	14.8	320.0	232.0	193.0	−9.5	2.98
233	203.2	6.0	74.3	28.6	38.2	0.953	0.139	14.6	319.6	233.0	193.5	−9.4	2.93
234	203.0	6.0	75.3	28.7	38.0	0.951	0.142	14.4	319.2	234.0	194.1	−9.4	2.88
235	202.9	6.0	76.2	28.8	37.8	0.949	0.145	14.2	318.8	235.0	194.7	−9.3	2.84

Table 3 – Continued, evolution of the orbital parameters during the activity period.

KUM (#0445): Total of **218** orbits. $\lambda_\odot = 225°$, $\lambda_g{-}\lambda_\odot = 268.2°$, $\beta_g = 29.8°$, $\Delta r = 3°$, $\Delta\lambda_\odot = 5°$.
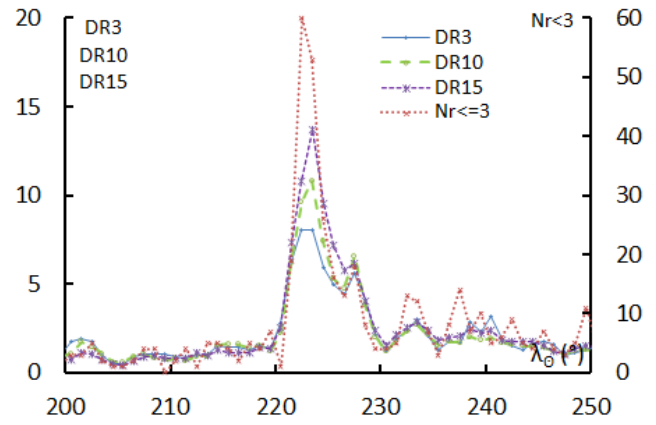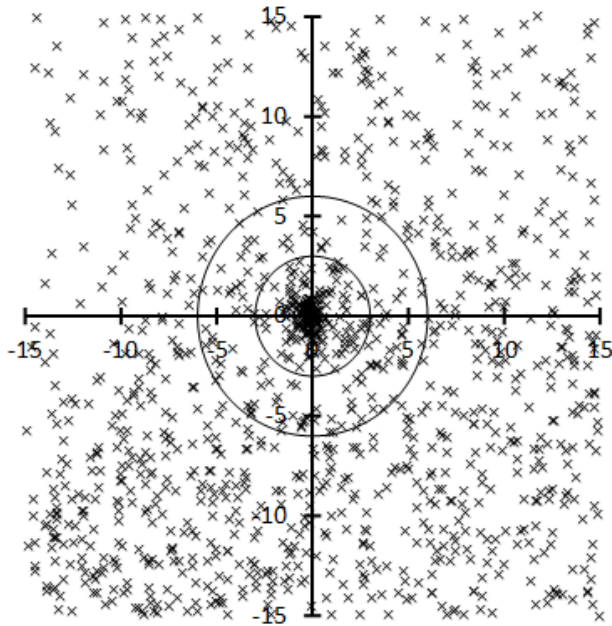
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	17
2008	18	2014	16
2009	26	2015	18
2010	32	2016	27
2011	3	2017	34
2012	14	2018	13

Table 2 – Activity profiles.

	$\lambda_\odot$	Max
Nr<=3	222.5	60
DR3	222.5	8.1
DR10	223.5	10.8
DR15	223.5	13.7
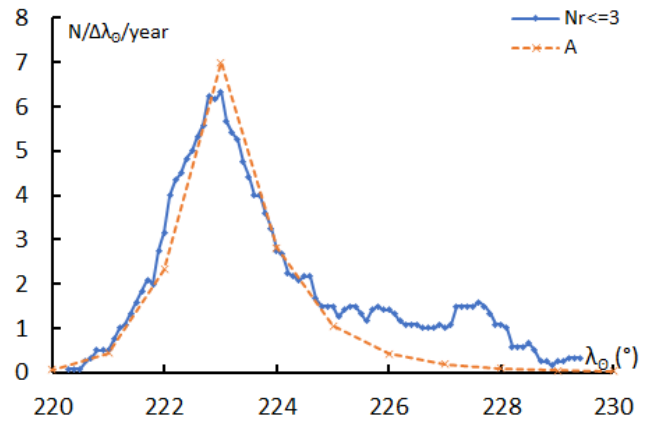
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g{-}\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
215	268.2	29.6	135.3	48.0	66.3	1.069	0.991	130.2	185.9	215.0	31.2	−4.5	−14.4
216	268.1	29.6	136.4	47.7	66.1	1.049	0.990	130.1	186.1	216.0	32.0	−4.7	−20.3
217	268.1	29.6	137.6	47.4	65.9	1.029	0.990	130.0	186.3	217.0	32.9	−4.9	−34.6
218	268.0	29.6	138.7	47.1	65.7	1.009	0.989	129.9	186.6	218.0	33.8	−5.0	−114
219	268.0	29.6	139.8	46.8	65.5	0.989	0.989	129.8	186.8	219.0	34.7	−5.2	88.66
220	267.9	29.6	140.9	46.5	65.3	0.969	0.989	129.7	187.0	220.0	35.5	−5.4	32.06
221	267.8	29.5	142.1	46.2	65.1	0.950	0.988	129.6	187.2	221.0	36.4	−5.6	19.62
222	267.8	29.5	143.2	45.9	64.9	0.930	0.988	129.5	187.5	222.0	37.2	−5.8	14.15
223	267.7	29.5	144.2	45.6	64.7	0.911	0.987	129.4	187.7	223.0	38.1	−6.0	11.09
224	267.7	29.5	145.3	45.3	64.4	0.892	0.987	129.3	188.0	224.0	38.9	−6.2	9.12
225	267.6	29.5	146.4	45.0	64.2	0.873	0.986	129.2	188.2	225.0	39.8	−6.4	7.75
226	267.6	29.5	147.5	44.6	64.0	0.854	0.986	129.1	188.5	226.0	40.6	−6.6	6.75
227	267.5	29.5	148.5	44.3	63.8	0.835	0.985	129.0	188.8	227.0	41.4	−6.8	5.98
228	267.5	29.5	149.6	44.0	63.6	0.817	0.985	128.9	189.1	228.0	42.3	−7.1	5.37
229	267.4	29.5	150.6	43.6	63.4	0.798	0.984	128.8	189.4	229.0	43.1	−7.3	4.88
230	267.3	29.4	151.6	43.3	63.2	0.780	0.984	128.7	189.7	230.0	43.9	−7.5	4.47
231	267.3	29.4	152.7	43.0	63.0	0.762	0.983	128.6	190.0	231.0	44.7	−7.8	4.13
232	267.2	29.4	153.7	42.6	62.8	0.744	0.982	128.5	190.3	232.0	45.5	−8.1	3.83
233	267.2	29.4	154.7	42.3	62.6	0.726	0.982	128.4	190.7	233.0	46.3	−8.3	3.58
234	267.1	29.4	155.7	41.9	62.3	0.708	0.981	128.3	191.0	234.0	47.1	−8.6	3.36
235	267.1	29.4	156.7	41.6	62.1	0.690	0.981	128.1	191.4	235.0	47.9	−8.9	3.17

STA_SF (#0002): Total of **1032** orbits. $\lambda_O = 221.5°$, $\lambda_g–\lambda_O = 190.7°$, $\beta_g = –5.0°$, $\Delta r = 2°$, $\Delta\lambda_O = 5°$. 'Southern Taurids' are very complex but we can clearly distinct the two activities STA_SE and STA_SF. The former represents the early and regular activity of STA and the latter is main and periodic.
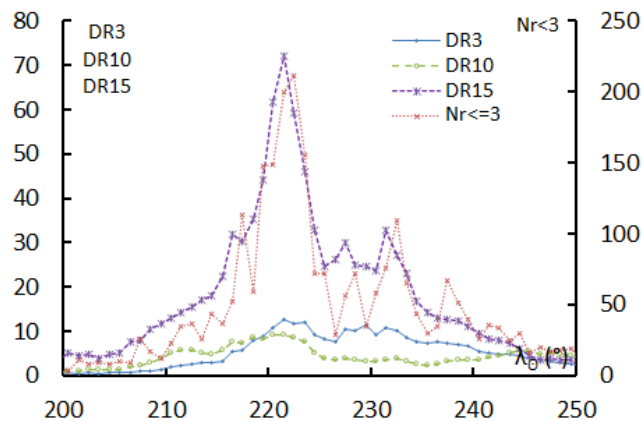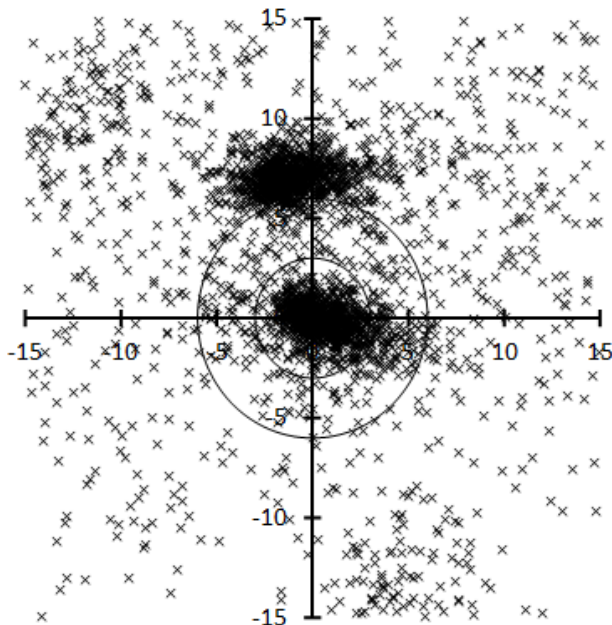
Table 1 – Number per year.

Year	N	Year	N
2007	17	2013	31
2008	170	2014	12
2009	43	2015	359
2010	40	2016	31
2011	27	2017	48
2012	160	2018	94

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	222.5	212
DR3	221.5	12.5
DR10	221.5	9.3
DR15	221.5	72.2
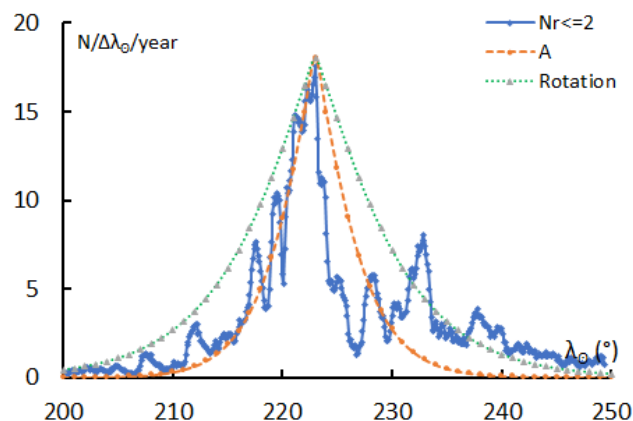
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
200	202.5	–3.0	41.0	12.7	34.1	0.911	0.169	6.1	138.0	20.0	158.2	4.1	1.89
201	202.0	–3.1	41.5	12.8	33.8	0.907	0.176	6.1	137.0	21.0	158.1	4.2	1.90
202	201.6	–3.2	42.1	12.9	33.5	0.904	0.184	6.1	135.9	22.0	158.1	4.2	1.91
203	201.1	–3.3	42.6	13.0	33.3	0.900	0.192	6.0	134.8	23.0	158.0	4.3	1.92
204	200.6	–3.3	43.2	13.0	33.0	0.896	0.200	6.0	133.8	24.0	157.9	4.3	1.92
205	200.2	–3.4	43.7	13.1	32.7	0.892	0.208	6.0	132.7	25.0	157.9	4.4	1.93
206	199.7	–3.5	44.3	13.2	32.4	0.889	0.216	5.9	131.6	26.0	157.8	4.4	1.94
207	199.2	–3.6	44.8	13.3	32.2	0.885	0.224	5.9	130.6	27.0	157.7	4.5	1.95
208	198.8	–3.6	45.4	13.4	31.9	0.881	0.232	5.9	129.5	28.0	157.7	4.5	1.96
209	198.3	–3.7	45.9	13.5	31.6	0.877	0.241	5.8	128.5	29.0	157.6	4.6	1.96
210	197.9	–3.8	46.5	13.5	31.3	0.873	0.249	5.8	127.4	30.0	157.5	4.6	1.97
211	197.4	–3.8	47.0	13.6	31.0	0.870	0.258	5.8	126.3	31.0	157.5	4.6	1.98
212	196.9	–3.9	47.6	13.7	30.8	0.866	0.267	5.7	125.3	32.0	157.4	4.7	1.98
213	196.5	–4.0	48.1	13.8	30.5	0.862	0.275	5.7	124.2	33.0	157.3	4.7	1.99
214	196.0	–4.1	48.7	13.8	30.2	0.858	0.284	5.6	123.2	34.0	157.3	4.7	2.00
215	195.6	–4.1	49.3	13.9	29.9	0.854	0.293	5.6	122.1	35.0	157.2	4.8	2.00
216	195.1	–4.2	49.8	14.0	29.7	0.850	0.302	5.6	121.0	36.0	157.2	4.8	2.01
217	194.6	–4.3	50.4	14.0	29.4	0.846	0.310	5.5	120.0	37.0	157.1	4.8	2.01
218	194.2	–4.3	50.9	14.1	29.1	0.842	0.319	5.5	118.9	38.0	157.1	4.8	2.02
219	193.7	–4.4	51.5	14.2	28.8	0.838	0.328	5.5	117.9	39.0	157.0	4.8	2.02

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
220	193.3	–4.5	52.0	14.2	28.6	0.834	0.337	5.4	116.8	40.0	157.0	4.8	2.03
221	192.8	–4.6	52.6	14.3	28.3	0.830	0.346	5.4	115.8	41.0	156.9	4.9	2.03
222	192.3	–4.6	53.1	14.4	28.0	0.825	0.355	5.4	114.8	42.0	156.9	4.9	2.04
223	191.9	–4.7	53.7	14.4	27.7	0.821	0.365	5.3	113.7	43.0	156.8	4.9	2.04
224	191.4	–4.8	54.2	14.5	27.4	0.817	0.374	5.3	112.7	44.0	156.8	4.9	2.04
225	190.9	–4.8	54.8	14.5	27.2	0.813	0.383	5.2	111.7	45.0	156.7	4.9	2.04
226	190.5	–4.9	55.4	14.6	26.9	0.809	0.392	5.2	110.6	46.0	156.7	4.9	2.05
227	190.0	–5.0	55.9	14.7	26.6	0.804	0.401	5.2	109.6	47.0	156.7	4.9	2.05
228	189.6	–5.0	56.5	14.7	26.3	0.800	0.410	5.1	108.6	48.0	156.6	4.9	2.05
229	189.1	–5.1	57.0	14.8	26.1	0.796	0.419	5.1	107.5	49.0	156.6	4.9	2.05
230	188.6	–5.2	57.6	14.8	25.8	0.791	0.428	5.1	106.5	50.0	156.6	4.9	2.05
231	188.2	–5.2	58.1	14.9	25.5	0.787	0.437	5.0	105.5	51.0	156.6	4.8	2.05
232	187.7	–5.3	58.7	14.9	25.2	0.782	0.446	5.0	104.5	52.0	156.5	4.8	2.05
233	187.2	–5.4	59.2	14.9	24.9	0.778	0.455	4.9	103.5	53.0	156.5	4.8	2.05
234	186.8	–5.4	59.8	15.0	24.7	0.773	0.464	4.9	102.5	54.0	156.5	4.8	2.05
235	186.3	–5.5	60.3	15.0	24.4	0.769	0.473	4.9	101.5	55.0	156.5	4.8	2.05
236	185.9	–5.6	60.9	15.1	24.1	0.764	0.482	4.8	100.5	56.0	156.5	4.7	2.04
237	185.4	–5.6	61.5	15.1	23.8	0.759	0.491	4.8	99.5	57.0	156.5	4.7	2.04
238	184.9	–5.7	62.0	15.2	23.6	0.755	0.500	4.8	98.5	58.0	156.5	4.7	2.04
239	184.5	–5.8	62.6	15.2	23.3	0.750	0.509	4.7	97.5	59.0	156.5	4.7	2.04
240	184.0	–5.8	63.1	15.2	23.0	0.745	0.518	4.7	96.5	60.0	156.6	4.6	2.03
241	183.5	–5.9	63.7	15.3	22.7	0.740	0.527	4.6	95.6	61.0	156.6	4.6	2.03
242	183.1	–5.9	64.2	15.3	22.5	0.735	0.535	4.6	94.6	62.0	156.6	4.6	2.02
243	182.6	–6.0	64.8	15.3	22.2	0.730	0.544	4.6	93.6	63.0	156.6	4.5	2.02
244	182.1	–6.1	65.3	15.4	21.9	0.725	0.553	4.5	92.7	64.0	156.7	4.5	2.01
245	181.7	–6.1	65.9	15.4	21.6	0.720	0.561	4.5	91.7	65.0	156.7	4.5	2.00
246	181.2	–6.2	66.5	15.4	21.3	0.715	0.570	4.4	90.8	66.0	156.8	4.4	2.00
247	180.7	–6.3	67.0	15.4	21.1	0.709	0.578	4.4	89.8	67.0	156.8	4.4	1.99
248	180.3	–6.3	67.6	15.5	20.8	0.704	0.587	4.3	88.9	68.0	156.9	4.3	1.98
249	179.8	–6.4	68.1	15.5	20.5	0.699	0.595	4.3	87.9	69.0	156.9	4.3	1.97
250	179.4	–6.4	68.7	15.5	20.2	0.693	0.603	4.3	87.0	70.0	157.0	4.3	1.97

AND (#0018): Total of **167** orbits. $\lambda_\odot = 228.6°$, $\lambda_g - \lambda_\odot = 163.4°$, $\beta_g = 18.8°$, $\Delta r = 6°$, $\Delta\lambda_\odot = 10°$. This shower is very unique; the radiant drifts towards the position of the 'Great Andromedids'. The activity period is wide and the meteor rates fluctuate; the maximum seems to be at $\lambda_\odot = 224°\sim230°$.
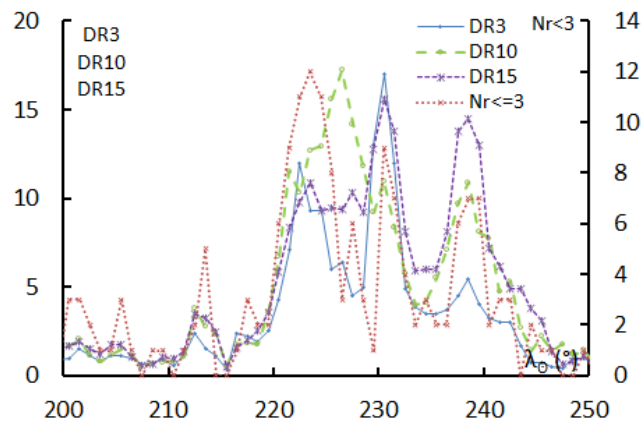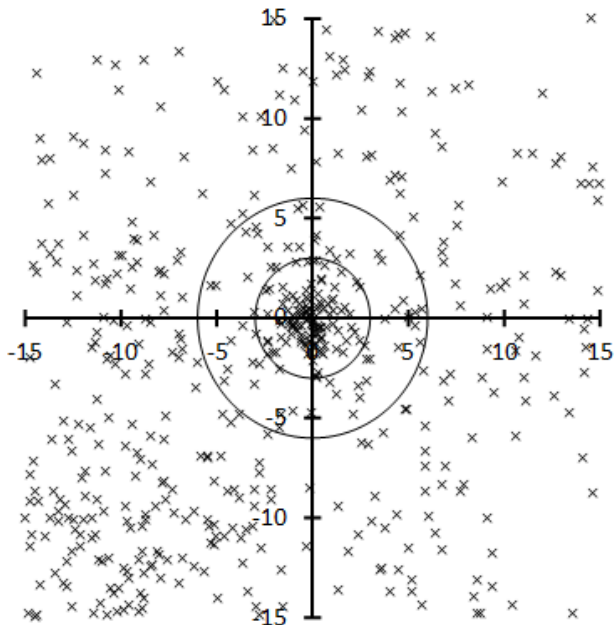
Table 1 – Number per year.

Year	N	Year	N
2007	7	2013	6
2008	12	2014	11
2009	20	2015	17
2010	23	2016	20
2011	6	2017	17
2012	12	2018	16

Table 2 – Activity profiles.

	$\lambda_\odot$	Max
Nr<=3	223.5	12
DR3	230.5	17.0
DR10	226.5	17.2
DR15	230.5	15.6
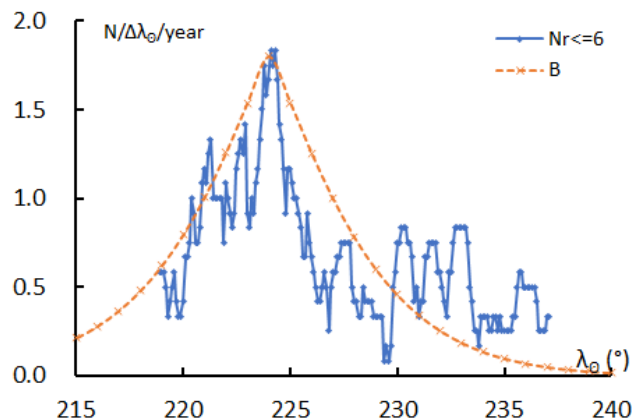
Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_\odot$	$\lambda_g - \lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
210	172.5	10.3	16.8	18.3	20.9	0.796	0.670	6.6	254.8	210.0	104.7	−6.3	3.28
211	172.1	10.9	17.1	19.0	20.7	0.793	0.677	6.8	253.9	211.0	104.8	−6.5	3.27
212	171.6	11.4	17.4	19.7	20.5	0.790	0.684	7.0	253.0	212.0	104.8	−6.7	3.26
213	171.1	12.0	17.7	20.4	20.3	0.787	0.691	7.2	252.1	213.0	104.9	−6.9	3.25
214	170.7	12.5	18.0	21.1	20.1	0.784	0.698	7.5	251.2	214.0	105.0	−7.1	3.24
215	170.2	13.0	18.2	21.8	19.9	0.781	0.705	7.7	250.3	215.0	105.1	−7.2	3.22
216	169.7	13.6	18.5	22.5	19.7	0.778	0.712	7.9	249.4	216.0	105.2	−7.4	3.21
217	169.2	14.1	18.8	23.2	19.5	0.775	0.719	8.1	248.5	217.0	105.3	−7.5	3.19
218	168.7	14.6	19.1	23.9	19.3	0.772	0.725	8.2	247.6	218.0	105.4	−7.6	3.18
219	168.3	15.2	19.4	24.6	19.1	0.768	0.732	8.4	246.7	219.0	105.5	−7.7	3.16
220	167.8	15.7	19.6	25.3	18.9	0.765	0.738	8.6	245.8	220.0	105.6	−7.8	3.14
221	167.3	16.2	19.9	26.0	18.7	0.761	0.745	8.7	245.0	221.0	105.7	−7.9	3.12
222	166.8	16.8	20.2	26.6	18.5	0.757	0.751	8.9	244.1	222.0	105.8	−8.0	3.09
223	166.3	17.3	20.4	27.3	18.3	0.753	0.757	9.0	243.2	223.0	105.9	−8.1	3.07
224	165.8	17.8	20.7	28.0	18.1	0.749	0.764	9.2	242.4	224.0	106.1	−8.1	3.04
225	165.3	18.4	21.0	28.7	17.9	0.745	0.770	9.3	241.5	225.0	106.2	−8.2	3.02
226	164.8	18.9	21.2	29.3	17.7	0.741	0.776	9.4	240.7	226.0	106.3	−8.2	2.99
227	164.3	19.4	21.5	30.0	17.5	0.736	0.782	9.5	239.8	227.0	106.5	−8.2	2.96
228	163.8	20.0	21.7	30.7	17.3	0.732	0.787	9.7	239.0	228.0	106.6	−8.3	2.93
229	163.3	20.5	22.0	31.3	17.1	0.727	0.793	9.8	238.1	229.0	106.8	−8.3	2.91

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
230	162.8	21.0	22.2	32.0	16.9	0.722	0.799	9.9	237.3	230.0	106.9	–8.3	2.88
231	162.2	21.5	22.5	32.6	16.7	0.717	0.804	10.0	236.5	231.0	107.1	–8.3	2.85
232	161.7	22.0	22.7	33.3	16.5	0.712	0.810	10.0	235.7	232.0	107.3	–8.3	2.81
233	161.2	22.6	22.9	33.9	16.3	0.707	0.815	10.1	234.9	233.0	107.4	–8.3	2.78
234	160.7	23.1	23.2	34.6	16.1	0.702	0.821	10.2	234.0	234.0	107.6	–8.2	2.75
235	160.1	23.6	23.4	35.2	15.9	0.696	0.826	10.3	233.2	235.0	107.8	–8.2	2.72
236	159.6	24.1	23.6	35.9	15.6	0.691	0.831	10.3	232.4	236.0	108.0	–8.2	2.69
237	159.0	24.6	23.8	36.5	15.4	0.685	0.836	10.4	231.6	237.0	108.2	–8.1	2.65
238	158.5	25.1	24.1	37.1	15.2	0.679	0.841	10.4	230.9	238.0	108.4	–8.1	2.62
239	157.9	25.6	24.3	37.8	15.0	0.673	0.846	10.5	230.1	239.0	108.6	–8.0	2.59
240	157.4	26.1	24.5	38.4	14.8	0.667	0.850	10.5	229.3	240.0	108.8	–7.9	2.55
241	156.8	26.6	24.7	39.0	14.6	0.661	0.855	10.5	228.5	241.0	109.0	–7.9	2.52
242	156.2	27.1	24.9	39.6	14.4	0.654	0.859	10.6	227.7	242.0	109.3	–7.8	2.49
243	155.7	27.6	25.1	40.2	14.2	0.648	0.864	10.6	227.0	243.0	109.5	–7.7	2.45
244	155.1	28.1	25.2	40.8	14.0	0.641	0.868	10.6	226.2	244.0	109.7	–7.6	2.42
245	154.5	28.6	25.4	41.4	13.8	0.635	0.872	10.6	225.5	245.0	110.0	–7.5	2.39
246	153.9	29.1	25.6	42.0	13.6	0.628	0.877	10.6	224.7	246.0	110.2	–7.4	2.35
247	153.3	29.6	25.8	42.6	13.4	0.621	0.881	10.6	223.9	247.0	110.5	–7.3	2.32
248	152.7	30.1	25.9	43.2	13.2	0.614	0.885	10.6	223.2	248.0	110.7	–7.2	2.29
249	152.1	30.6	26.1	43.8	13.0	0.606	0.888	10.6	222.5	249.0	111.0	–7.1	2.26
250	151.5	31.1	26.2	44.4	12.8	0.599	0.892	10.6	221.7	250.0	111.2	–7.0	2.23

NTA (#0017): Total of **2916** orbits. $\lambda_O = 228°$, $\lambda_g–\lambda_O = 191.7°$, $\beta_g = 2.1°$, $\Delta r = 3°$, $\Delta\lambda_O = 20°$. NTA is different from STA and does not have two components, though it continues to be active longer than STA, $\lambda_O = 200°\sim260°$.
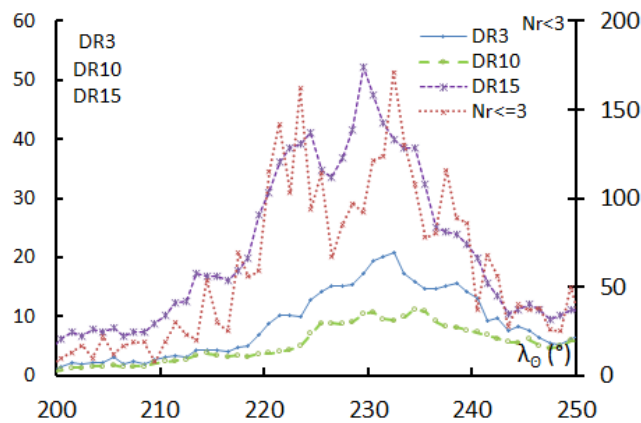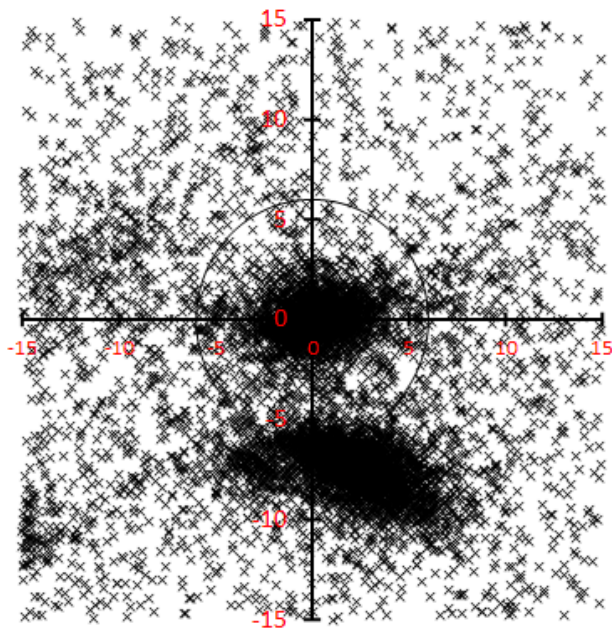
Table 1 – Number per year.

Year	N	Year	N
2007	178	2013	217
2008	202	2014	250
2009	273	2015	163
2010	291	2016	237
2011	196	2017	334
2012	272	2018	303

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	223.5	162
DR3	231.5	20.5
DR10	230.5	10.7
DR15	229.5	52.1
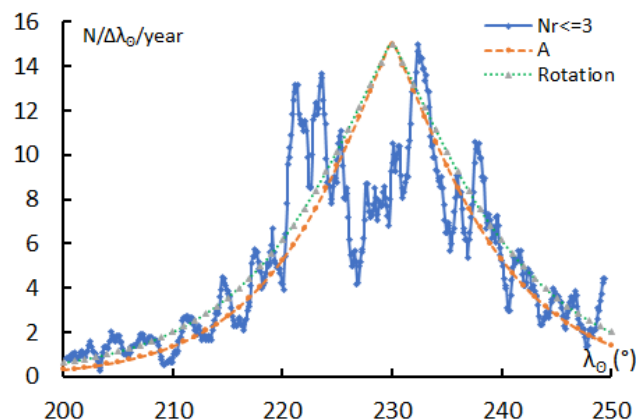
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
200	199.4	2.0	36.3	16.5	32.0	0.883	0.222	3.3	311.1	200.0	151.2	–2.5	1.90
201	199.1	2.0	37.0	16.7	31.8	0.881	0.227	3.2	310.5	201.0	151.6	–2.5	1.91
202	198.8	2.0	37.8	17.0	31.7	0.879	0.231	3.2	309.9	202.0	152.0	–2.5	1.92
203	198.6	2.0	38.5	17.2	31.5	0.877	0.236	3.2	309.3	203.0	152.3	–2.5	1.92
204	198.3	2.0	39.2	17.5	31.4	0.875	0.241	3.2	308.7	204.0	152.7	–2.5	1.93
205	198.0	2.0	39.9	17.7	31.2	0.873	0.245	3.2	308.1	205.0	153.1	–2.5	1.93
206	197.8	2.1	40.7	17.9	31.1	0.871	0.250	3.1	307.5	206.0	153.5	–2.5	1.94
207	197.5	2.1	41.4	18.2	30.9	0.869	0.255	3.1	306.9	207.0	153.9	–2.5	1.95
208	197.2	2.1	42.1	18.4	30.8	0.867	0.260	3.1	306.3	208.0	154.3	–2.5	1.95
209	197.0	2.1	42.9	18.6	30.7	0.865	0.265	3.1	305.6	209.0	154.7	–2.5	1.96
210	196.7	2.1	43.6	18.9	30.5	0.863	0.270	3.1	305.0	210.0	155.1	–2.5	1.96
211	196.4	2.1	44.3	19.1	30.4	0.861	0.274	3.0	304.4	211.0	155.5	–2.5	1.97
212	196.2	2.2	45.1	19.3	30.2	0.859	0.279	3.0	303.8	212.0	155.9	–2.5	1.97
213	195.9	2.2	45.8	19.5	30.1	0.856	0.284	3.0	303.2	213.0	156.3	–2.5	1.98
214	195.6	2.2	46.6	19.8	29.9	0.854	0.289	3.0	302.6	214.0	156.6	–2.5	1.98
215	195.4	2.2	47.3	20.0	29.8	0.852	0.294	3.0	302.0	215.0	157.0	–2.5	1.99
216	195.1	2.2	48.1	20.2	29.6	0.850	0.299	2.9	301.4	216.0	157.4	–2.5	2.00
217	194.9	2.2	48.8	20.4	29.5	0.848	0.304	2.9	300.8	217.0	157.8	–2.5	2.00
218	194.6	2.3	49.6	20.6	29.3	0.846	0.309	2.9	300.2	218.0	158.2	–2.5	2.00
219	194.3	2.3	50.3	20.8	29.2	0.844	0.314	2.9	299.6	219.0	158.6	–2.5	2.01

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g\text{–}\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
220	194.1	2.3	51.1	21.0	29.0	0.842	0.319	2.9	299.0	220.0	159.0	–2.5	2.01
221	193.8	2.3	51.8	21.2	28.9	0.839	0.324	2.9	298.4	221.0	159.4	–2.5	2.02
222	193.5	2.3	52.6	21.4	28.7	0.837	0.329	2.8	297.8	222.0	159.8	–2.5	2.02
223	193.3	2.3	53.4	21.6	28.6	0.835	0.334	2.8	297.2	223.0	160.2	–2.5	2.03
224	193.0	2.3	54.1	21.8	28.5	0.833	0.339	2.8	296.6	224.0	160.6	–2.5	2.03
225	192.7	2.4	54.9	22.0	28.3	0.831	0.344	2.8	296.0	225.0	161.0	–2.5	2.04
226	192.5	2.4	55.7	22.1	28.2	0.829	0.349	2.8	295.4	226.0	161.4	–2.5	2.04
227	192.2	2.4	56.4	22.3	28.0	0.827	0.354	2.8	294.8	227.0	161.8	–2.5	2.04
228	191.9	2.4	57.2	22.5	27.9	0.824	0.360	2.8	294.2	228.0	162.2	–2.5	2.05
229	191.7	2.4	58.0	22.7	27.7	0.822	0.365	2.7	293.6	229.0	162.6	–2.5	2.05
230	191.4	2.4	58.7	22.8	27.6	0.820	0.370	2.7	293.0	230.0	163.0	–2.5	2.06
231	191.1	2.5	59.5	23.0	27.4	0.818	0.375	2.7	292.4	231.0	163.4	–2.5	2.06
232	190.9	2.5	60.3	23.2	27.3	0.816	0.380	2.7	291.8	232.0	163.8	–2.5	2.06
233	190.6	2.5	61.1	23.3	27.1	0.814	0.385	2.7	291.2	233.0	164.2	–2.5	2.07
234	190.3	2.5	61.9	23.5	27.0	0.811	0.390	2.7	290.6	234.0	164.6	–2.5	2.07
235	190.1	2.5	62.6	23.6	26.8	0.809	0.395	2.6	290.0	235.0	165.0	–2.5	2.07
236	189.8	2.5	63.4	23.8	26.7	0.807	0.400	2.6	289.4	236.0	165.4	–2.5	2.07
237	189.5	2.5	64.2	23.9	26.5	0.805	0.405	2.6	288.8	237.0	165.8	–2.5	2.08
238	189.3	2.6	65.0	24.0	26.4	0.803	0.410	2.6	288.2	238.0	166.3	–2.5	2.08
239	189.0	2.6	65.8	24.2	26.3	0.800	0.416	2.6	287.6	239.0	166.7	–2.5	2.08
240	188.8	2.6	66.6	24.3	26.1	0.798	0.421	2.6	287.1	240.0	167.1	–2.5	2.08
241	188.5	2.6	67.4	24.4	26.0	0.796	0.426	2.6	286.5	241.0	167.5	–2.5	2.09
242	188.2	2.6	68.2	24.6	25.8	0.794	0.431	2.5	285.9	242.0	167.9	–2.4	2.09
243	188.0	2.6	69.0	24.7	25.7	0.791	0.436	2.5	285.3	243.0	168.3	–2.4	2.09
244	187.7	2.6	69.8	24.8	25.5	0.789	0.441	2.5	284.7	244.0	168.7	–2.4	2.09
245	187.4	2.7	70.6	24.9	25.4	0.787	0.446	2.5	284.1	245.0	169.2	–2.4	2.09
246	187.2	2.7	71.4	25.0	25.2	0.784	0.451	2.5	283.6	246.0	169.6	–2.4	2.09
247	186.9	2.7	72.2	25.1	25.1	0.782	0.456	2.5	283.0	247.0	170.0	–2.4	2.09
248	186.6	2.7	73.0	25.2	24.9	0.780	0.461	2.5	282.4	248.0	170.4	–2.4	2.10
249	186.4	2.7	73.8	25.3	24.8	0.778	0.466	2.4	281.8	249.0	170.8	–2.4	2.10
250	186.1	2.7	74.6	25.4	24.6	0.775	0.471	2.4	281.3	250.0	171.3	–2.4	2.10
251	185.8	2.7	75.4	25.5	24.5	0.773	0.476	2.4	280.7	251.0	171.7	–2.4	2.10
252	185.6	2.8	76.2	25.6	24.3	0.770	0.481	2.4	280.1	252.0	172.1	–2.4	2.10
253	185.3	2.8	77.0	25.7	24.2	0.768	0.486	2.4	279.5	253.0	172.5	–2.4	2.10
254	185.0	2.8	77.8	25.8	24.0	0.766	0.491	2.4	279.0	254.0	173.0	–2.3	2.10
255	184.8	2.8	78.6	25.8	23.9	0.763	0.496	2.4	278.4	255.0	173.4	–2.3	2.10

OER (#0338): Total of **169** orbits. $\lambda_O = 231°$, $\lambda_g - \lambda_O = 184.4°$, $\beta_g = -21.5°$, $\Delta r = 3°$, $\Delta\lambda_O = 15°$. Unclear activity. The maximum lays somewhere between $\lambda_O = 220°\sim245°$.
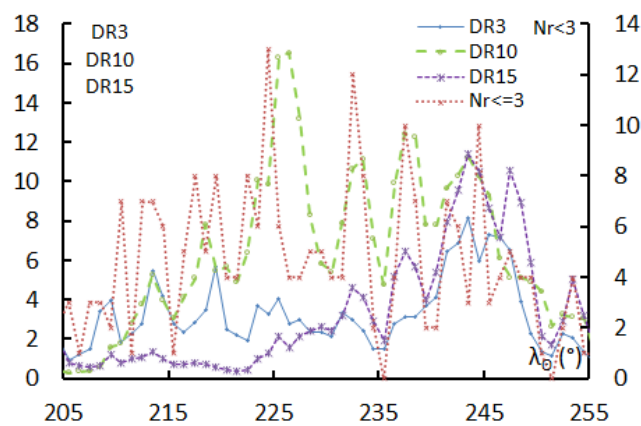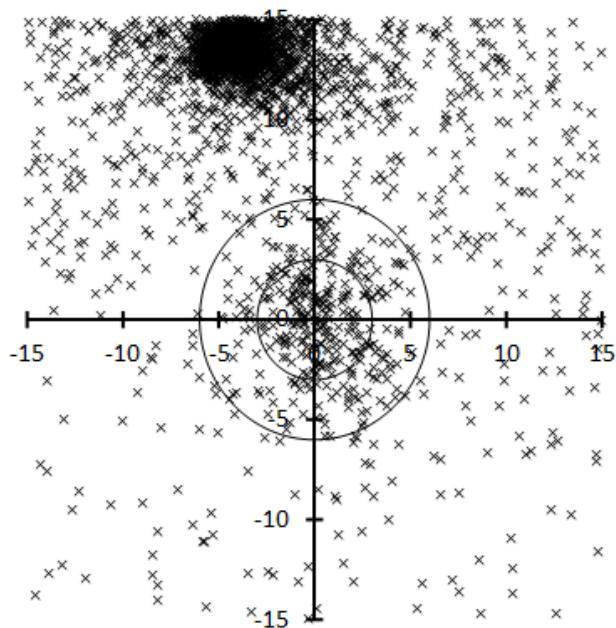
Table 1 – Number per year.

Year	N	Year	N
2007	12	2013	14
2008	14	2014	12
2009	15	2015	11
2010	16	2016	10
2011	15	2017	23
2012	11	2018	16

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	224.5	13
DR3	243.5	8.1
DR10	226.5	16.5
DR15	243.5	11.4
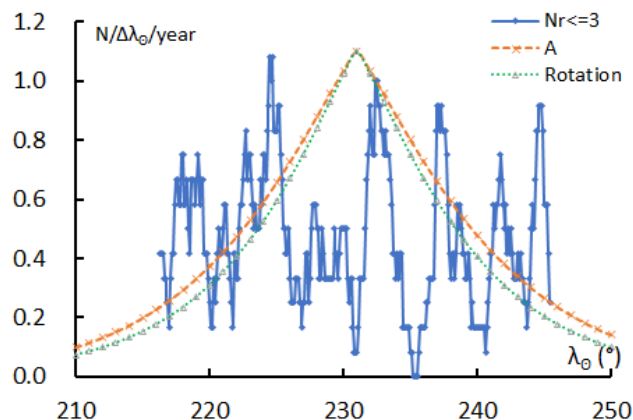
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
210	191.5	−15.1	43.7	0.9	30.5	0.881	0.381	18.3	108.6	30.0	139.5	17.3	3.19
211	191.2	−15.3	44.4	0.9	30.4	0.880	0.387	18.4	107.8	31.0	139.7	17.5	3.22
212	190.9	−15.6	45.2	0.8	30.3	0.879	0.394	18.5	107.0	32.0	139.8	17.6	3.25
213	190.6	−15.9	45.9	0.7	30.1	0.878	0.400	18.5	106.2	33.0	140.0	17.8	3.27
214	190.3	−16.2	46.6	0.7	30.0	0.877	0.407	18.6	105.4	34.0	140.2	17.9	3.30
215	190.0	−16.4	47.3	0.6	29.9	0.876	0.413	18.7	104.6	35.0	140.3	18.1	3.33
216	189.7	−16.7	48.1	0.5	29.7	0.875	0.419	18.8	103.8	36.0	140.5	18.2	3.36
217	189.4	−17.0	48.8	0.4	29.6	0.874	0.426	18.8	103.0	37.0	140.7	18.3	3.38
218	189.1	−17.3	49.5	0.4	29.5	0.873	0.432	18.9	102.2	38.0	140.8	18.5	3.41
219	188.8	−17.5	50.2	0.3	29.3	0.872	0.439	19.0	101.4	39.0	141.0	18.6	3.44
220	188.5	−17.8	50.9	0.2	29.2	0.872	0.445	19.0	100.6	40.0	141.2	18.7	3.47
221	188.2	−18.1	51.6	0.1	29.1	0.871	0.452	19.1	99.8	41.0	141.3	18.8	3.49
222	187.9	−18.4	52.3	0.0	28.9	0.870	0.458	19.1	99.0	42.0	141.5	18.9	3.52
223	187.6	−18.6	53.0	−0.1	28.8	0.869	0.465	19.2	98.2	43.0	141.7	19.0	3.55
224	187.3	−18.9	53.7	−0.2	28.7	0.868	0.471	19.2	97.4	44.0	141.9	19.1	3.58
225	187.0	−19.2	54.4	−0.3	28.5	0.868	0.477	19.3	96.6	45.0	142.0	19.1	3.60
226	186.7	−19.4	55.1	−0.4	28.4	0.867	0.484	19.3	95.9	46.0	142.2	19.2	3.63
227	186.4	−19.7	55.8	−0.5	28.3	0.866	0.490	19.4	95.1	47.0	142.4	19.3	3.66
228	186.1	−20.0	56.5	−0.6	28.1	0.865	0.496	19.4	94.3	48.0	142.6	19.3	3.68
229	185.8	−20.2	57.2	−0.7	28.0	0.864	0.503	19.4	93.5	49.0	142.7	19.4	3.71
230	185.4	−20.5	57.9	−0.8	27.9	0.864	0.509	19.5	92.8	50.0	142.9	19.4	3.74

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
231	185.1	−20.8	58.6	−1.0	27.7	0.863	0.515	19.5	92.0	51.0	143.1	19.5	3.76
232	184.8	−21.0	59.3	−1.1	27.6	0.862	0.521	19.5	91.2	52.0	143.3	19.5	3.79
233	184.5	−21.3	59.9	−1.2	27.5	0.862	0.528	19.5	90.5	53.0	143.5	19.5	3.81
234	184.2	−21.6	60.6	−1.3	27.3	0.861	0.534	19.6	89.7	54.0	143.7	19.6	3.84
235	183.8	−21.8	61.3	−1.5	27.2	0.860	0.540	19.6	88.9	55.0	143.9	19.6	3.86
236	183.5	−22.1	62.0	−1.6	27.0	0.859	0.546	19.6	88.2	56.0	144.1	19.6	3.88
237	183.2	−22.4	62.6	−1.7	26.9	0.859	0.552	19.6	87.4	57.0	144.3	19.6	3.91
238	182.9	−22.6	63.3	−1.8	26.8	0.858	0.558	19.6	86.7	58.0	144.5	19.6	3.93
239	182.6	−22.9	64.0	−2.0	26.6	0.857	0.564	19.6	85.9	59.0	144.7	19.6	3.95
240	182.2	−23.2	64.6	−2.1	26.5	0.857	0.570	19.6	85.2	60.0	144.9	19.6	3.97
241	181.9	−23.4	65.3	−2.3	26.4	0.856	0.576	19.6	84.5	61.0	145.1	19.6	4.00
242	181.6	−23.7	65.9	−2.4	26.2	0.855	0.582	19.7	83.7	62.0	145.3	19.5	4.02
243	181.2	−23.9	66.6	−2.6	26.1	0.854	0.588	19.7	83.0	63.0	145.6	19.5	4.04
244	180.9	−24.2	67.2	−2.7	26.0	0.854	0.594	19.7	82.2	64.0	145.8	19.5	4.06
245	180.6	−24.4	67.9	−2.9	25.8	0.853	0.599	19.7	81.5	65.0	146.0	19.4	4.08
246	180.2	−24.7	68.5	−3.0	25.7	0.852	0.605	19.6	80.8	66.0	146.2	19.4	4.09
247	179.9	−25.0	69.1	−3.2	25.6	0.851	0.611	19.6	80.1	67.0	146.5	19.3	4.11
248	179.6	−25.2	69.8	−3.3	25.4	0.851	0.617	19.6	79.4	68.0	146.7	19.3	4.13
249	179.2	−25.5	70.4	−3.5	25.3	0.850	0.622	19.6	78.6	69.0	147.0	19.2	4.14
250	178.9	−25.7	71.0	−3.7	25.2	0.849	0.628	19.6	77.9	70.0	147.2	19.2	4.16

LEO (#0013): Total of **2784** orbits. $\lambda_O = 235.4°$, $\lambda_g–\lambda_O = 272.3°$, $\beta_g = 10.2°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$. It is well known that the activity of LEO has a periodicity of 33 years. The presented results represent only the period from 2007 to 2018; we can witness the descent.

Table 1 – Number per year.

Year	N	Year	N
2007	390	2013	278
2008	225	2014	266
2009	165	2015	72
2010	314	2016	184
2011	144	2017	286
2012	191	2018	269

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	236.5	471
DR3	234.5	22.4
DR10	235.5	84.8
DR15	235.5	120.4
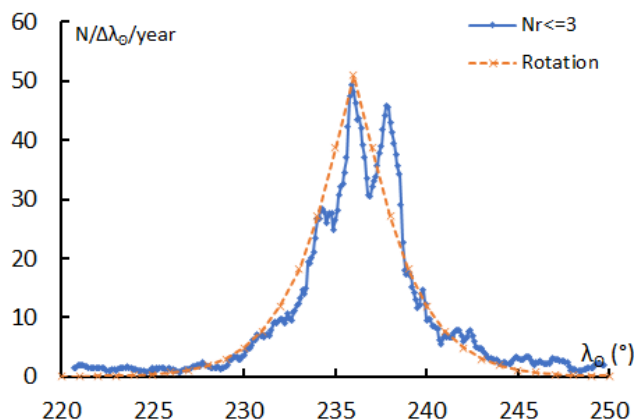
Table 3 – Evolution of the orbital parameters during the activity period.

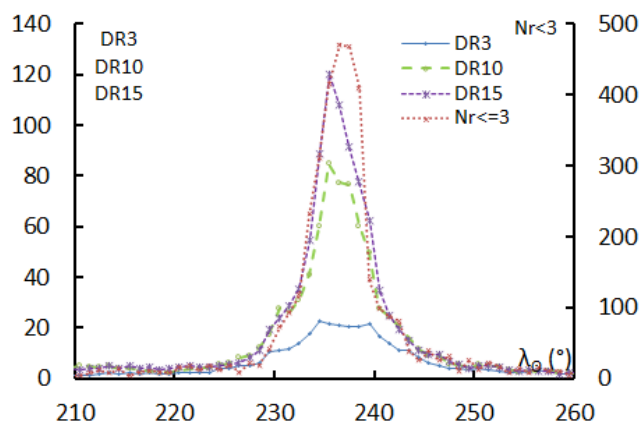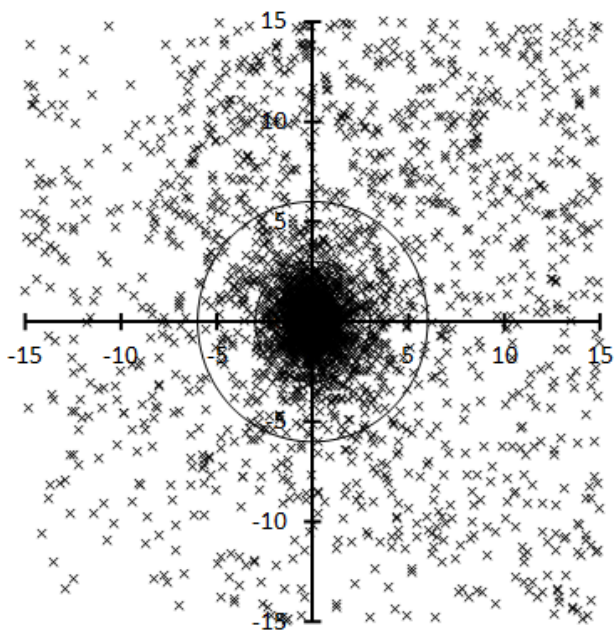| λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
210	280.7	14.7	137.8	31.7	68.3	0.880	0.906	153.6	144.0	210.0	63.0	15.1	7.56
211	280.4	14.5	138.5	31.3	68.4	0.877	0.911	154.0	145.0	211.0	63.1	14.6	7.40
212	280.0	14.4	139.1	30.9	68.4	0.874	0.915	154.3	146.1	212.0	63.2	14.0	7.26
213	279.7	14.2	139.8	30.6	68.5	0.871	0.920	154.6	147.1	213.0	63.3	13.4	7.13
214	279.4	14.0	140.4	30.2	68.6	0.868	0.924	155.0	148.1	214.0	63.4	12.9	7.02
215	279.1	13.9	141.1	29.8	68.6	0.866	0.928	155.3	149.2	215.0	63.5	12.3	6.92
216	278.7	13.7	141.7	29.5	68.7	0.863	0.933	155.7	150.3	216.0	63.5	11.8	6.83
217	278.4	13.5	142.4	29.1	68.8	0.861	0.937	156.0	151.3	217.0	63.5	11.3	6.74
218	278.1	13.4	143.0	28.7	68.8	0.859	0.941	156.3	152.4	218.0	63.6	10.7	6.67
219	277.7	13.2	143.7	28.3	68.9	0.857	0.944	156.7	153.5	219.0	63.6	10.2	6.61
220	277.4	13.0	144.3	28.0	69.0	0.855	0.948	157.0	154.6	220.0	63.6	9.7	6.56
221	277.1	12.9	145.0	27.6	69.0	0.854	0.951	157.3	155.7	221.0	63.6	9.1	6.51
222	276.8	12.7	145.6	27.2	69.1	0.853	0.955	157.7	156.8	222.0	63.6	8.6	6.47
223	276.5	12.5	146.2	26.8	69.2	0.851	0.958	158.0	157.9	223.0	63.6	8.1	6.44
224	276.1	12.3	146.9	26.4	69.2	0.850	0.961	158.3	159.0	224.0	63.6	7.6	6.42
225	275.8	12.2	147.5	26.0	69.3	0.850	0.964	158.7	160.2	225.0	63.6	7.1	6.41
226	275.5	12.0	148.1	25.7	69.4	0.849	0.967	159.0	161.3	226.0	63.5	6.6	6.40
227	275.2	11.8	148.7	25.3	69.4	0.849	0.969	159.3	162.4	227.0	63.5	6.1	6.40
228	274.8	11.6	149.3	24.9	69.5	0.848	0.972	159.6	163.6	228.0	63.5	5.7	6.41
229	274.5	11.5	150.0	24.5	69.6	0.848	0.974	160.0	164.7	229.0	63.4	5.2	6.43

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
230	274.2	11.3	150.6	24.1	69.6	0.849	0.976	160.3	165.9	230.0	63.3	4.7	6.45
231	273.9	11.1	151.2	23.7	69.7	0.849	0.978	160.6	167.0	231.0	63.3	4.3	6.48
232	273.6	10.9	151.8	23.3	69.8	0.850	0.980	160.9	168.2	232.0	63.2	3.8	6.53
233	273.2	10.8	152.4	22.9	69.8	0.851	0.981	161.2	169.3	233.0	63.1	3.4	6.57
234	272.9	10.6	153.0	22.5	69.9	0.852	0.983	161.6	170.5	234.0	63.1	3.0	6.63
235	272.6	10.4	153.6	22.1	70.0	0.853	0.984	161.9	171.6	235.0	63.0	2.6	6.70
236	272.3	10.2	154.2	21.6	70.0	0.855	0.985	162.2	172.8	236.0	62.9	2.2	6.78
237	272.0	10.1	154.8	21.2	70.1	0.856	0.986	162.5	173.9	237.0	62.8	1.8	6.87
238	271.6	9.9	155.4	20.8	70.2	0.858	0.986	162.8	175.1	238.0	62.7	1.5	6.97
239	271.3	9.7	156.0	20.4	70.2	0.861	0.987	163.1	176.2	239.0	62.6	1.1	7.08
240	271.0	9.5	156.6	20.0	70.3	0.863	0.987	163.5	177.4	240.0	62.5	0.8	7.21
241	270.7	9.3	157.2	19.6	70.4	0.866	0.987	163.8	178.5	241.0	62.4	0.4	7.35
242	270.4	9.2	157.8	19.2	70.4	0.869	0.987	164.1	179.6	242.0	62.3	0.1	7.51
243	270.0	9.0	158.4	18.7	70.5	0.872	0.987	164.4	180.8	243.0	62.3	–0.2	7.69
244	269.7	8.8	159.0	18.3	70.6	0.875	0.987	164.7	181.9	244.0	62.2	–0.5	7.89
245	269.4	8.6	159.6	17.9	70.6	0.878	0.986	165.0	183.0	245.0	62.1	–0.8	8.11
246	269.1	8.4	160.2	17.5	70.7	0.882	0.985	165.4	184.2	246.0	62.0	–1.0	8.36
247	268.8	8.3	160.7	17.1	70.8	0.886	0.984	165.7	185.3	247.0	61.9	–1.3	8.64
248	268.5	8.1	161.3	16.6	70.9	0.890	0.983	166.0	186.4	248.0	61.8	–1.5	8.96
249	268.2	7.9	161.9	16.2	70.9	0.895	0.982	166.3	187.5	249.0	61.7	–1.8	9.31
250	267.8	7.7	162.5	15.8	71.0	0.899	0.981	166.6	188.6	250.0	61.7	–2.0	9.72
251	267.5	7.5	163.1	15.4	71.1	0.904	0.979	166.9	189.6	251.0	61.6	–2.2	10.18
252	267.2	7.4	163.7	14.9	71.1	0.909	0.977	167.2	190.7	252.0	61.5	–2.4	10.71
253	266.9	7.2	164.2	14.5	71.2	0.914	0.976	167.5	191.8	253.0	61.5	–2.5	11.33
254	266.6	7.0	164.8	14.1	71.3	0.919	0.973	167.9	192.9	254.0	61.4	–2.7	12.06
255	266.3	6.8	165.4	13.6	71.3	0.925	0.971	168.2	193.9	255.0	61.4	–2.8	12.91
256	266.0	6.6	166.0	13.2	71.4	0.931	0.969	168.5	194.9	256.0	61.3	–3.0	13.94
257	265.6	6.5	166.5	12.8	71.5	0.936	0.967	168.8	196.0	257.0	61.3	–3.1	15.20
258	265.3	6.3	167.1	12.3	71.5	0.942	0.964	169.1	197.0	258.0	61.3	–3.2	16.76
259	265.0	6.1	167.7	11.9	71.6	0.949	0.961	169.4	198.0	259.0	61.3	–3.3	18.75
260	264.7	5.9	168.2	11.5	71.7	0.955	0.958	169.7	199.0	260.0	61.3	–3.3	21.37

AMO (#0246): Total of **91** orbits. $\lambda_{\mathcal{O}} = 239°$, $\lambda_g–\lambda_{\mathcal{O}} = 239.7°$, $\beta_g = –19.9°$, $\Delta r = 3°$, $\Delta\lambda_{\mathcal{O}} = 5°$. It has been claimed that the AMO activity is short with an outburst nature but this shower has been observed every year with a duration of several days.
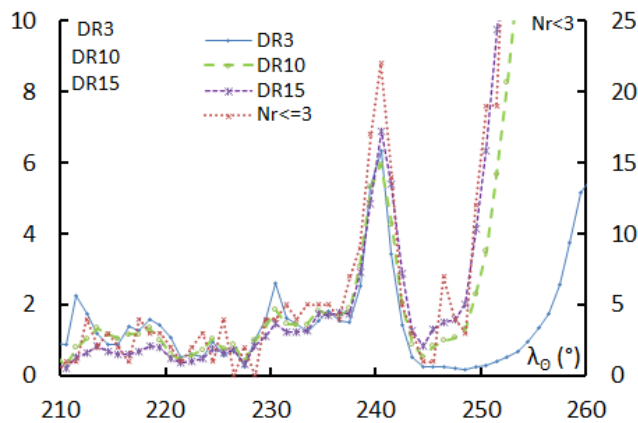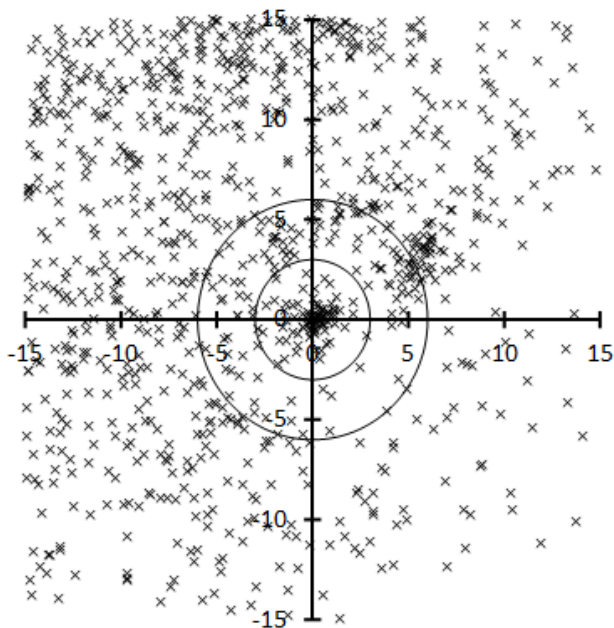
Table 1 – Number per year.

Year	N	Year	N
2007	7	2013	17
2008	5	2014	14
2009	10	2015	3
2010	4	2016	5
2011	11	2017	2
2012	5	2018	8

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	240.5	22
DR3	240.5	6.4
DR10	240.5	6.0
DR15	240.5	6.9
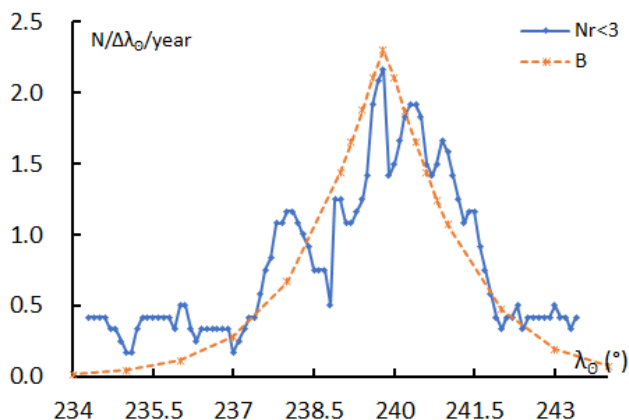
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\mathcal{O}}$	$\lambda_g–\lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
230	243.3	–21.7	111.5	0.0	61.3	0.895	0.552	132.4	86.4	50.0	325.4	47.5	5.28
231	242.9	–21.6	112.1	0.0	61.3	0.902	0.543	132.5	87.2	51.0	325.2	47.4	5.54
232	242.5	–21.4	112.7	0.1	61.3	0.908	0.535	132.6	88.0	52.0	325.0	47.4	5.83
233	242.2	–21.2	113.3	0.2	61.4	0.915	0.527	132.7	88.8	53.0	324.8	47.3	6.17
234	241.8	–21.0	114.0	0.3	61.4	0.921	0.518	132.8	89.6	54.0	324.6	47.2	6.55
235	241.4	–20.9	114.6	0.4	61.4	0.927	0.510	132.9	90.4	55.0	324.5	47.1	7.00
236	241.1	–20.7	115.2	0.4	61.5	0.933	0.502	132.9	91.1	56.0	324.3	47.0	7.51
237	240.7	–20.5	115.8	0.5	61.5	0.939	0.494	133.0	91.9	57.0	324.2	46.9	8.12
238	240.3	–20.3	116.4	0.6	61.5	0.945	0.486	133.1	92.7	58.0	324.1	46.8	8.85
239	240.0	–20.1	117.1	0.6	61.6	0.951	0.478	133.2	93.4	59.0	324.0	46.7	9.74
239.2	239.9	–20.1	117.2	0.6	61.6	0.952	0.476	133.2	93.6	59.2	324.0	46.7	9.94
239.4	239.8	–20.1	117.3	0.6	61.6	0.953	0.474	133.2	93.7	59.4	324.0	46.6	10.15
239.6	239.8	–20.0	117.4	0.7	61.6	0.954	0.473	133.2	93.9	59.6	323.9	46.6	10.37
239.8	239.7	–20.0	117.6	0.7	61.6	0.956	0.471	133.3	94.0	59.8	323.9	46.6	10.60
240	239.6	–20.0	117.7	0.7	61.6	0.957	0.470	133.3	94.2	60.0	323.9	46.6	10.84
240.2	239.5	–19.9	117.8	0.7	61.6	0.958	0.468	133.3	94.3	60.2	323.9	46.5	11.10
240.4	239.5	–19.9	117.9	0.7	61.6	0.959	0.466	133.3	94.5	60.4	323.9	46.5	11.37
240.6	239.4	–19.8	118.1	0.7	61.6	0.960	0.465	133.3	94.6	60.6	323.9	46.5	11.65
240.8	239.3	–19.8	118.2	0.7	61.6	0.961	0.463	133.4	94.8	60.8	323.9	46.4	11.94
240	239.6	–20.0	117.7	0.7	61.6	0.957	0.470	133.3	94.2	60.0	323.9	46.6	10.84

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
241	239.3	−19.8	118.3	0.7	61.6	0.962	0.462	133.4	94.9	61.0	323.8	46.4	12.26
242	238.9	−19.6	118.9	0.8	61.7	0.968	0.454	133.5	95.7	62.0	323.8	46.3	14.12
243	238.5	−19.4	119.6	0.9	61.7	0.973	0.446	133.5	96.4	63.0	323.7	46.1	16.71
244	238.2	−19.2	120.2	0.9	61.7	0.979	0.438	133.6	97.2	64.0	323.7	45.9	20.52
245	237.8	−19.0	120.8	1.0	61.8	0.984	0.430	133.7	97.9	65.0	323.7	45.7	26.69

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
241	239.3	−19.8	118.3	0.7	61.6	0.962	0.462	133.4	94.9	61.0	323.8	46.4	12.26
242	238.9	−19.6	118.9	0.8	61.7	0.968	0.454	133.5	95.7	62.0	323.8	46.3	14.12
243	238.5	−19.4	119.6	0.9	61.7	0.973	0.446	133.5	96.4	63.0	323.7	46.1	16.71
244	238.2	−19.2	120.2	0.9	61.7	0.979	0.438	133.6	97.2	64.0	323.7	45.9	20.52
245	237.8	−19.0	120.8	1.0	61.8	0.984	0.430	133.7	97.9	65.0	323.7	45.7	26.69

NSU (#0488): Total of **58** orbits. $\lambda_{\Theta} = 241.6°$, $\lambda_g - \lambda_{\Theta} = 244.9°$, $\beta_g = 42.9°$, $\Delta r = 3°$, $\Delta \lambda_{\Theta} = 5°$.
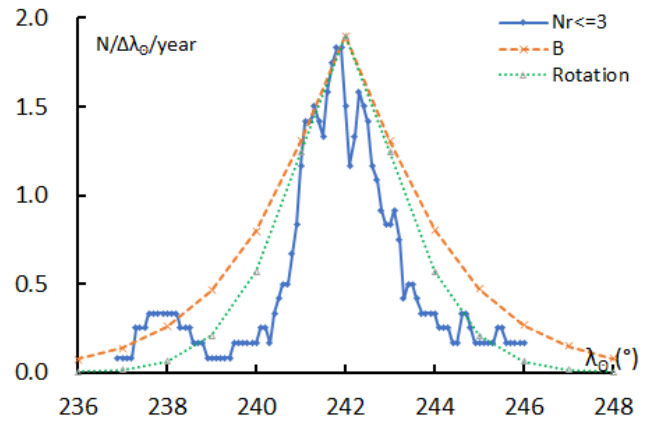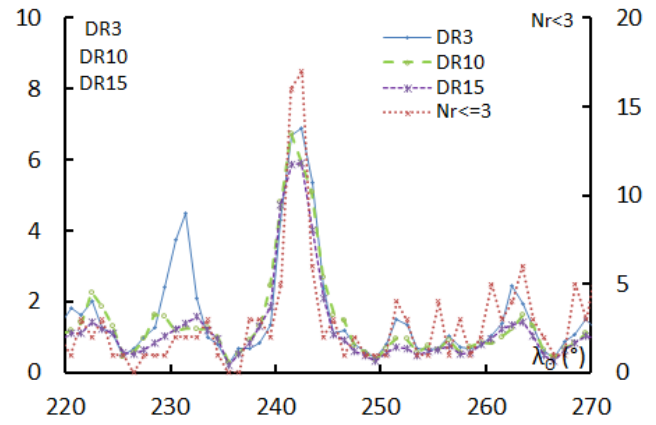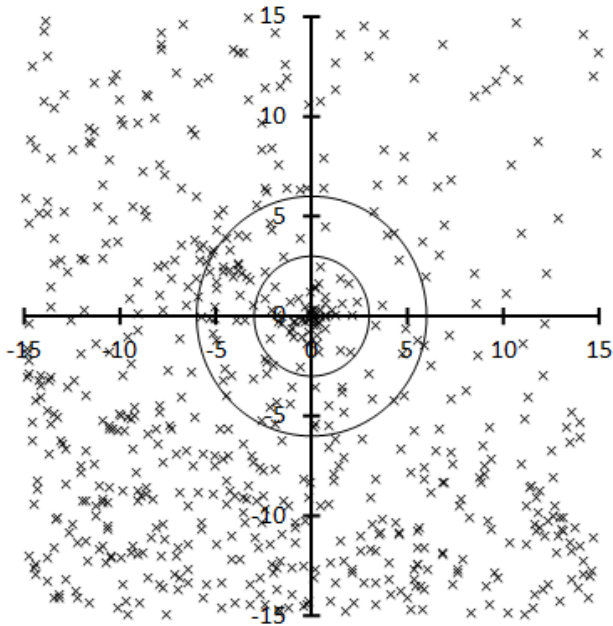
Table 1 – Number per year.

Year	N	Year	N
2007	5	2013	5
2008	2	2014	1
2009	8	2015	3
2010	5	2016	2
2011	8	2017	6
2012	5	2018	8

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	242.5	17.0
DR3	242.5	6.9
DR10	241.5	6.7
DR15	242.5	5.9

Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g - \lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
235	244.5	43.9	139.8	62.3	50.8	0.748	0.788	94.8	238.3	235.0	47.4	−57.9	3.13
236	244.6	43.7	141.2	61.9	51.3	0.771	0.791	95.4	237.2	236.0	47.7	−56.8	3.46
237	244.6	43.6	142.5	61.4	51.9	0.794	0.794	96.1	236.2	237.0	48.0	−55.7	3.86
238	244.7	43.4	143.8	60.9	52.4	0.818	0.797	96.7	235.2	238.0	48.5	−54.6	4.39
239	244.8	43.3	145.1	60.4	52.9	0.843	0.800	97.4	234.2	239.0	48.9	−53.5	5.08
240	244.9	43.2	146.4	60.0	53.4	0.868	0.803	98.0	233.3	240.0	49.4	−52.5	6.07
241	244.9	43.0	147.6	59.5	54.0	0.893	0.806	98.6	232.4	241.0	50.0	−51.6	7.55
242	245.0	42.9	148.9	59.0	54.5	0.919	0.808	99.2	231.5	242.0	50.6	−50.6	10.03
243	245.1	42.7	150.1	58.5	55.0	0.946	0.811	99.8	230.7	243.0	51.2	−49.7	15.07
244	245.1	42.6	151.3	58.0	55.5	0.974	0.813	100.4	229.9	244.0	51.8	−48.8	30.72
245	245.2	42.4	152.4	57.5	56.1	1.001	0.816	101.0	229.2	245.0	52.5	−48.0	−574
246	245.3	42.3	153.6	57.0	56.6	1.030	0.818	101.6	228.4	246.0	53.2	−47.1	−27.4
247	245.4	42.2	154.7	56.5	57.1	1.059	0.820	102.2	227.7	247.0	53.9	−46.3	−13.9
248	245.4	42.0	155.9	56.0	57.6	1.089	0.822	102.8	227.1	248.0	54.6	−45.5	−9.29
249	245.5	41.9	157.0	55.4	58.2	1.119	0.824	103.4	226.4	249.0	55.4	−44.8	−6.95
250	245.6	41.7	158.1	54.9	58.7	1.149	0.826	103.9	225.8	250.0	56.1	−44.1	−5.53

NOO (#0250): Total of **1089** orbits. $\lambda_\Theta = 246.1°$, $\lambda_g - \lambda_\Theta = 203.7°$, $\beta_g = -8.1°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$.
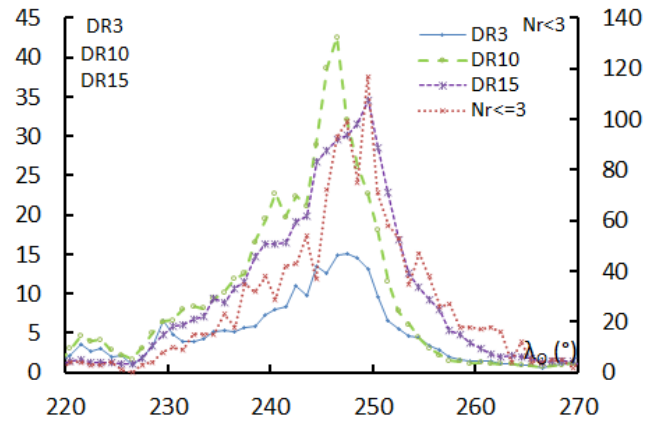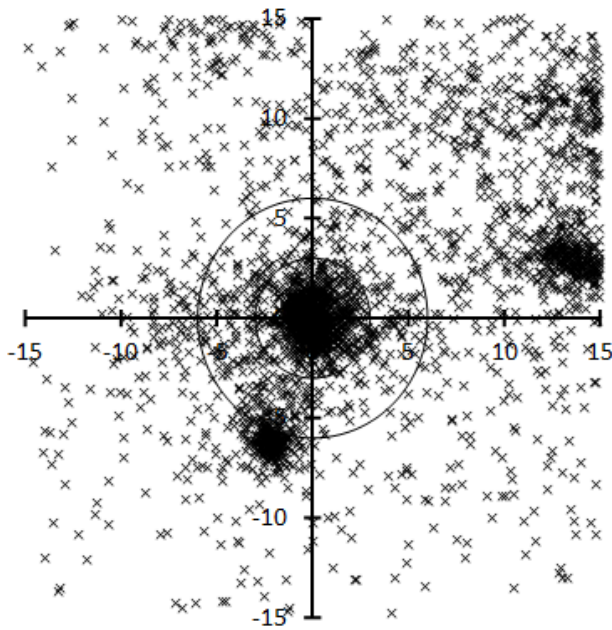
Table 1 – Number per year.

Year	N	Year	N
2007	52	2013	122
2008	117	2014	81
2009	88	2015	102
2010	128	2016	84
2011	68	2017	105
2012	74	2018	68

Table 2 – Activity profiles.

|	λ_Θ	Max
Nr<=3	249.5	117
DR3	247.5	15.1
DR10	246.5	42.5
DR15	249.5	34.5
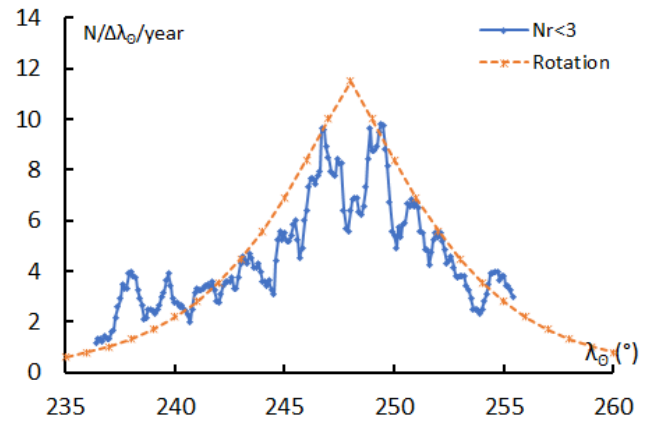
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
228	209.2	−6.8	76.8	16.0	45.4	0.993	0.052	33.8	154.2	48.0	206.1	14.0	7.74
229	208.9	−6.9	77.5	16.0	45.3	0.993	0.055	33.1	153.5	49.0	206.3	14.1	7.87
230	208.6	−7.0	78.3	16.0	45.1	0.993	0.058	32.4	152.8	50.0	206.5	14.2	8.01
231	208.3	−7.0	79.0	16.0	44.9	0.993	0.061	31.7	152.1	51.0	206.7	14.2	8.15
232	208.0	−7.1	79.7	16.0	44.8	0.992	0.064	31.0	151.4	52.0	206.9	14.3	8.30
233	207.8	−7.2	80.5	16.0	44.6	0.992	0.067	30.4	150.7	53.0	207.2	14.3	8.45
234	207.5	−7.2	81.2	16.0	44.5	0.992	0.070	29.8	150.0	54.0	207.4	14.4	8.60
235	207.2	−7.3	81.9	15.9	44.3	0.992	0.073	29.2	149.2	55.0	207.6	14.5	8.77
236	206.9	−7.3	82.7	15.9	44.2	0.991	0.077	28.7	148.5	56.0	207.8	14.5	8.94
237	206.6	−7.4	83.4	15.9	44.0	0.991	0.080	28.2	147.8	57.0	208.0	14.6	9.11
238	206.3	−7.5	84.1	15.9	43.9	0.991	0.083	27.7	147.1	58.0	208.2	14.6	9.29
239	206.0	−7.5	84.9	15.8	43.7	0.991	0.087	27.2	146.4	59.0	208.4	14.7	9.48
240	205.7	−7.6	85.6	15.8	43.6	0.991	0.090	26.7	145.6	60.0	208.6	14.7	9.68
241	205.4	−7.7	86.3	15.7	43.4	0.990	0.094	26.3	144.9	61.0	208.8	14.8	9.88
242	205.1	−7.7	87.1	15.7	43.2	0.990	0.098	25.9	144.2	62.0	209.0	14.8	10.09
243	204.8	−7.8	87.8	15.7	43.1	0.990	0.101	25.5	143.5	63.0	209.2	14.8	10.31
244	204.6	−7.8	88.5	15.6	42.9	0.990	0.105	25.1	142.7	64.0	209.4	14.9	10.54
245	204.3	−7.9	89.2	15.5	42.8	0.990	0.109	24.7	142.0	65.0	209.6	14.9	10.78
246	204.0	−8.0	90.0	15.5	42.6	0.990	0.113	24.3	141.3	66.0	209.8	14.9	11.02
247	203.7	−8.0	90.7	15.4	42.5	0.990	0.117	24.0	140.5	67.0	210.0	15.0	11.28
248	203.4	−8.1	91.4	15.4	42.3	0.990	0.121	23.6	139.8	68.0	210.3	15.0	11.55

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
249	203.1	–8.1	92.1	15.3	42.2	0.989	0.125	23.3	139.1	69.0	210.5	15.0	11.83
250	202.8	–8.2	92.9	15.2	42.0	0.989	0.129	23.0	138.3	70.0	210.7	15.1	12.13
251	202.5	–8.2	93.6	15.1	41.9	0.989	0.133	22.7	137.6	71.0	210.9	15.1	12.43
252	202.2	–8.3	94.3	15.1	41.7	0.989	0.138	22.4	136.9	72.0	211.1	15.1	12.75
253	201.9	–8.4	95.0	15.0	41.5	0.989	0.142	22.1	136.2	73.0	211.3	15.1	13.09
254	201.6	–8.4	95.8	14.9	41.4	0.989	0.146	21.8	135.4	74.0	211.6	15.1	13.44
255	201.3	–8.5	96.5	14.8	41.2	0.989	0.151	21.6	134.7	75.0	211.8	15.1	13.80
256	201.0	–8.5	97.2	14.7	41.1	0.989	0.155	21.3	134.0	76.0	212.0	15.2	14.19
257	200.8	–8.6	97.9	14.6	40.9	0.989	0.160	21.0	133.2	77.0	212.2	15.2	14.59
258	200.5	–8.7	98.6	14.5	40.8	0.989	0.164	20.8	132.5	78.0	212.4	15.2	15.02
259	200.2	–8.7	99.4	14.4	40.6	0.989	0.169	20.6	131.8	79.0	212.7	15.2	15.46
260	199.9	–8.8	100.1	14.3	40.5	0.989	0.173	20.3	131.1	80.0	212.9	15.2	15.93
261	199.6	–8.8	100.8	14.2	40.3	0.989	0.178	20.1	130.3	81.0	213.1	15.2	16.42
262	199.3	–8.9	101.5	14.1	40.2	0.989	0.183	19.9	129.6	82.0	213.3	15.2	16.94
263	199.0	–8.9	102.2	14.0	40.0	0.989	0.188	19.7	128.9	83.0	213.6	15.2	17.48
264	198.7	–9.0	102.9	13.9	39.8	0.989	0.192	19.4	128.2	84.0	213.8	15.2	18.06
265	198.4	–9.0	103.6	13.8	39.7	0.989	0.197	19.2	127.4	85.0	214.0	15.2	18.67

TPY_0 (#0340): Total of **82** orbits. $\lambda_{\mathcal{O}}$ = 249.4°, $\lambda_g - \lambda_{\mathcal{O}}$ = 262.0°, β_g = –39.1°, Δr = 3°, $\Delta\lambda_{\mathcal{O}}$ = 5°. TPY in the SD contains clearly two showers. Here we consider TPY0, TPY1 and TPY2 in the SD as TPY_0 and TPY3 as TPY_3 in *Tables 1~3*.
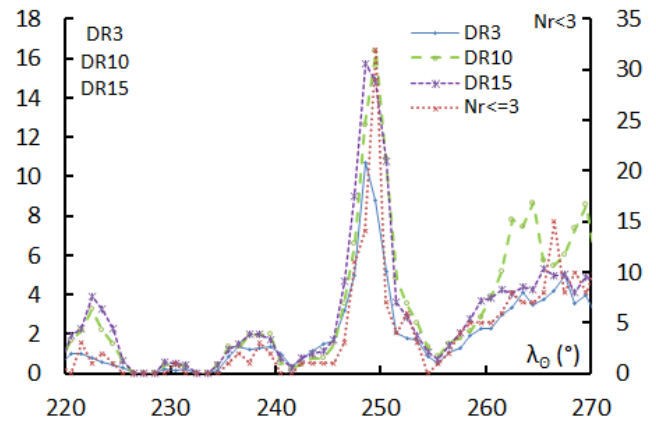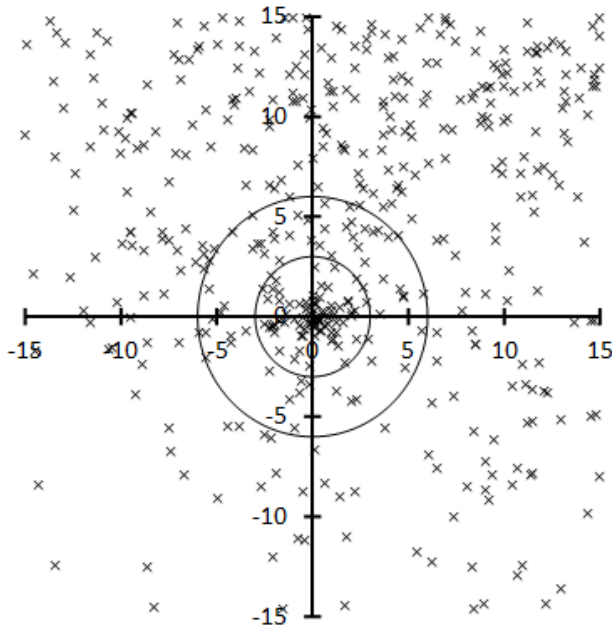
Table 1 – Number per year.

Year	N	Year	N
2007	12	2013	11
2008	12	2014	2
2009	8	2015	7
2010	9	2016	6
2011	2	2017	3
2012	5	2018	5

Table 2 – Activity profiles.

	$\lambda_{\mathcal{O}}$	Max
Nr<=3	249.5	32
DR3	248.5	10.7
DR10	249.5	16.3
DR15	248.5	15.7
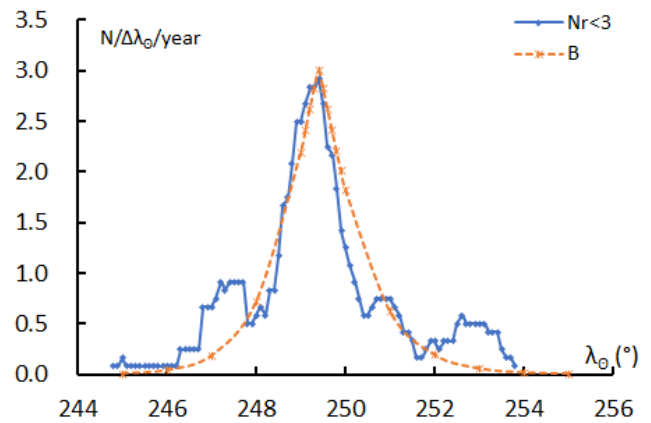
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\mathcal{O}}$	$\lambda_g-\lambda_{\mathcal{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
245	262.6	–40.7	135.3	–25.9	57.9	0.827	0.963	109.5	18.8	65.0	58.5	17.7	5.56
246	262.4	–40.4	136.1	–25.8	58.3	0.846	0.962	110.1	19.1	66.0	59.2	17.9	6.26
247	262.2	–40.1	136.9	–25.8	58.7	0.866	0.960	110.8	19.4	67.0	59.9	18.1	7.18
248	262.0	–39.7	137.6	–25.7	59.1	0.886	0.959	111.4	19.7	68.0	60.5	18.3	8.43
249	261.8	–39.4	138.4	–25.6	59.5	0.907	0.958	112.0	20.0	69.0	61.2	18.5	10.25
249.1	261.8	–39.4	138.5	–25.6	59.6	0.909	0.958	112.1	20.0	69.1	61.3	18.5	10.47
249.2	261.8	–39.4	138.6	–25.6	59.6	0.911	0.957	112.2	20.1	69.2	61.4	18.5	10.71
249.3	261.7	–39.3	138.6	–25.6	59.7	0.913	0.957	112.2	20.1	69.3	61.4	18.5	10.96
249.4	261.7	–39.3	138.7	–25.6	59.7	0.915	0.957	112.3	20.1	69.4	61.5	18.6	11.23
249.5	261.7	–39.3	138.8	–25.6	59.7	0.917	0.957	112.4	20.1	69.5	61.6	18.6	11.50
249.6	261.7	–39.2	138.9	–25.6	59.8	0.919	0.957	112.4	20.2	69.6	61.6	18.6	11.79
249.7	261.7	–39.2	139.0	–25.6	59.8	0.921	0.957	112.5	20.2	69.7	61.7	18.6	12.10
249.8	261.7	–39.2	139.0	–25.6	59.9	0.923	0.957	112.6	20.2	69.8	61.8	18.6	12.42
249.9	261.6	–39.1	139.1	–25.6	59.9	0.925	0.957	112.6	20.3	69.9	61.8	18.6	12.76
250	261.6	–39.1	139.2	–25.6	59.9	0.927	0.956	112.7	20.3	70.0	61.9	18.7	13.12
251	261.4	–38.8	140.0	–25.6	60.4	0.948	0.955	113.3	20.6	71.0	62.6	18.8	18.33
252	261.3	–38.5	140.8	–25.5	60.8	0.969	0.954	114.0	20.8	72.0	63.2	19.0	30.74
253	261.1	–38.2	141.6	–25.5	61.2	0.990	0.953	114.6	21.1	73.0	63.9	19.1	98.16
254	260.9	–37.9	142.4	–25.5	61.6	1.012	0.951	115.2	21.4	74.0	64.5	19.2	–80.0
255	260.7	–37.5	143.2	–25.4	62.0	1.034	0.950	115.9	21.6	75.0	65.2	19.4	–28.2

ORS (#0257): Total of **191** orbits. $\lambda_O = 247.6°$, $\lambda_g–\lambda_O = 190.3°$, $\beta_g = –5.2°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$.
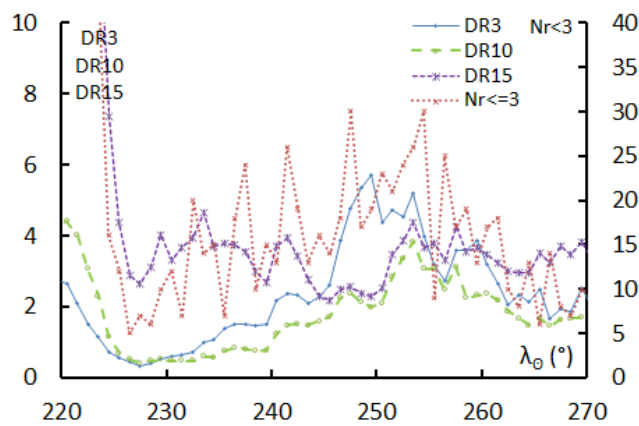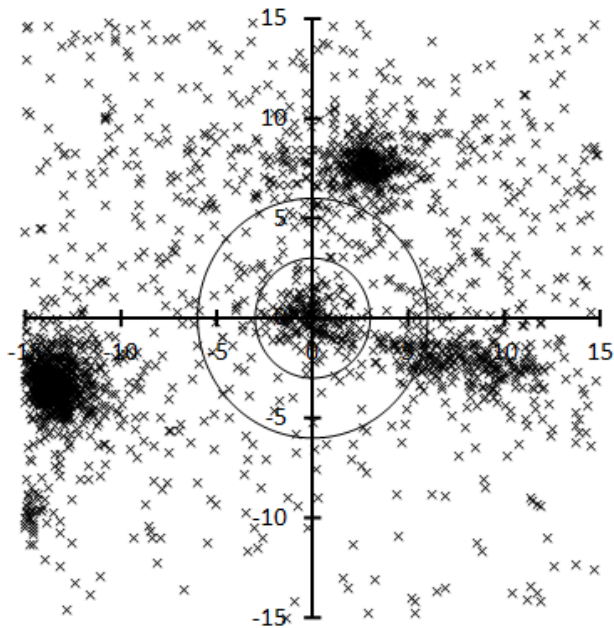
Table 1 – Number per year.

Year	N	Year	N
2007	8	2013	29
2008	24	2014	9
2009	15	2015	13
2010	26	2016	14
2011	11	2017	18
2012	9	2018	15

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	247.5	30
DR3	249.5	5.7
DR10	251.5	2.9
DR15	241.5	3.9
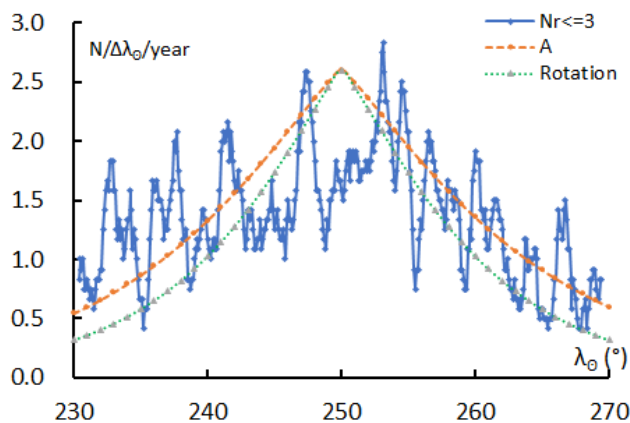
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
230	193.8	–4.7	62.7	16.3	28.5	0.828	0.332	5.7	117.9	50.0	168.0	5.0	1.93
231	193.6	–4.7	63.5	16.5	28.4	0.826	0.336	5.6	117.4	51.0	168.5	5.0	1.93
232	193.4	–4.7	64.3	16.6	28.3	0.825	0.339	5.6	116.9	52.0	169.0	5.0	1.94
233	193.2	–4.7	65.1	16.7	28.2	0.824	0.343	5.6	116.4	53.0	169.5	5.0	1.95
234	193.0	–4.7	65.9	16.8	28.1	0.822	0.347	5.5	115.9	54.0	170.1	5.0	1.95
235	192.7	–4.7	66.8	16.9	28.0	0.821	0.351	5.5	115.5	55.0	170.6	5.0	1.96
236	192.5	–4.7	67.6	17.0	27.9	0.820	0.355	5.5	115.0	56.0	171.1	5.0	1.97
237	192.3	–4.8	68.4	17.1	27.8	0.818	0.359	5.4	114.5	57.0	171.6	5.0	1.98
238	192.1	–4.8	69.2	17.2	27.7	0.817	0.363	5.4	114.0	58.0	172.1	4.9	1.98
239	191.9	–4.8	70.0	17.3	27.6	0.815	0.367	5.4	113.5	59.0	172.6	4.9	1.99
240	191.6	–4.8	70.8	17.4	27.5	0.814	0.371	5.3	113.0	60.0	173.1	4.9	2.00
241	191.4	–4.8	71.6	17.5	27.4	0.813	0.375	5.3	112.5	61.0	173.6	4.9	2.00
242	191.2	–4.8	72.4	17.6	27.3	0.811	0.379	5.3	112.0	62.0	174.1	4.9	2.01
243	191.0	–4.8	73.2	17.7	27.2	0.810	0.383	5.3	111.5	63.0	174.6	4.9	2.02
244	190.7	–4.9	74.0	17.7	27.1	0.809	0.387	5.2	111.0	64.0	175.1	4.9	2.02
245	190.5	–4.9	74.8	17.8	27.0	0.807	0.391	5.2	110.5	65.0	175.6	4.9	2.03
246	190.3	–4.9	75.7	17.9	26.9	0.806	0.395	5.2	110.1	66.0	176.1	4.8	2.04
247	190.1	–4.9	76.5	17.9	26.8	0.805	0.399	5.1	109.6	67.0	176.6	4.8	2.05
248	189.9	–4.9	77.3	18.0	26.7	0.803	0.403	5.1	109.1	68.0	177.1	4.8	2.05
249	189.6	–4.9	78.1	18.0	26.6	0.802	0.407	5.1	108.6	69.0	177.7	4.8	2.06
250	189.4	–4.9	78.9	18.1	26.5	0.801	0.411	5.0	108.1	70.0	178.2	4.8	2.06

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g{-}\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
251	189.2	−5.0	79.7	18.1	26.4	0.800	0.415	5.0	107.6	71.0	178.7	4.8	2.07
252	189.0	−5.0	80.5	18.2	26.3	0.798	0.419	5.0	107.1	72.0	179.2	4.8	2.08
253	188.8	−5.0	81.4	18.2	26.2	0.797	0.423	5.0	106.7	73.0	179.7	4.8	2.08
254	188.5	−5.0	82.2	18.2	26.1	0.796	0.427	4.9	106.2	74.0	180.2	4.7	2.09
255	188.3	−5.0	83.0	18.3	26.0	0.794	0.431	4.9	105.7	75.0	180.7	4.7	2.10
256	188.1	−5.0	83.8	18.3	25.9	0.793	0.435	4.9	105.2	76.0	181.3	4.7	2.10
257	187.9	−5.0	84.6	18.3	25.8	0.792	0.439	4.9	104.7	77.0	181.8	4.7	2.11
258	187.7	−5.0	85.4	18.3	25.7	0.791	0.443	4.8	104.2	78.0	182.3	4.7	2.11
259	187.4	−5.1	86.3	18.3	25.6	0.789	0.447	4.8	103.8	79.0	182.8	4.7	2.12
260	187.2	−5.1	87.1	18.3	25.5	0.788	0.451	4.8	103.3	80.0	183.3	4.6	2.13
261	187.0	−5.1	87.9	18.3	25.4	0.787	0.455	4.7	102.8	81.0	183.9	4.6	2.13
262	186.8	−5.1	88.7	18.3	25.3	0.785	0.459	4.7	102.3	82.0	184.4	4.6	2.14
263	186.6	−5.1	89.5	18.3	25.2	0.784	0.463	4.7	101.9	83.0	184.9	4.6	2.14
264	186.3	−5.1	90.4	18.3	25.1	0.783	0.467	4.7	101.4	84.0	185.4	4.6	2.15
265	186.1	−5.1	91.2	18.3	25.0	0.782	0.471	4.6	100.9	85.0	185.9	4.6	2.15
266	185.9	−5.1	92.0	18.3	24.9	0.780	0.475	4.6	100.4	86.0	186.5	4.5	2.16
267	185.7	−5.2	92.8	18.3	24.8	0.779	0.478	4.6	100.0	87.0	187.0	4.5	2.17
268	185.5	−5.2	93.6	18.2	24.7	0.778	0.482	4.6	99.5	88.0	187.5	4.5	2.17
269	185.2	−5.2	94.4	18.2	24.6	0.776	0.486	4.5	99.0	89.0	188.1	4.5	2.18
270	185.0	−5.2	95.3	18.2	24.5	0.775	0.490	4.5	98.6	90.0	188.6	4.5	2.18

DKD (#0336): Total of **214** orbits. $\lambda_O = 251.7°$, $\lambda_g–\lambda_O = 243.2°$, $\beta_g = 61.6°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$.
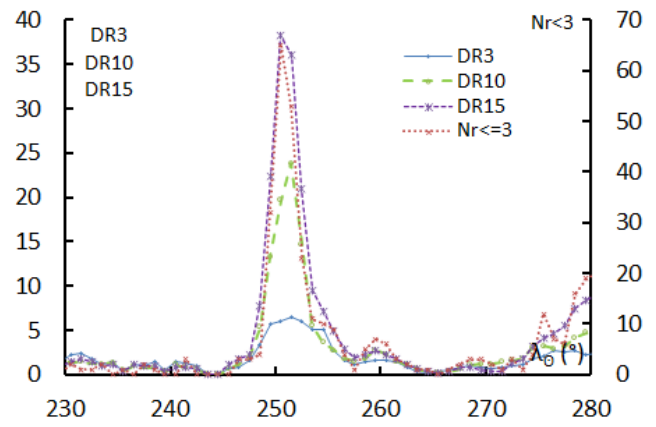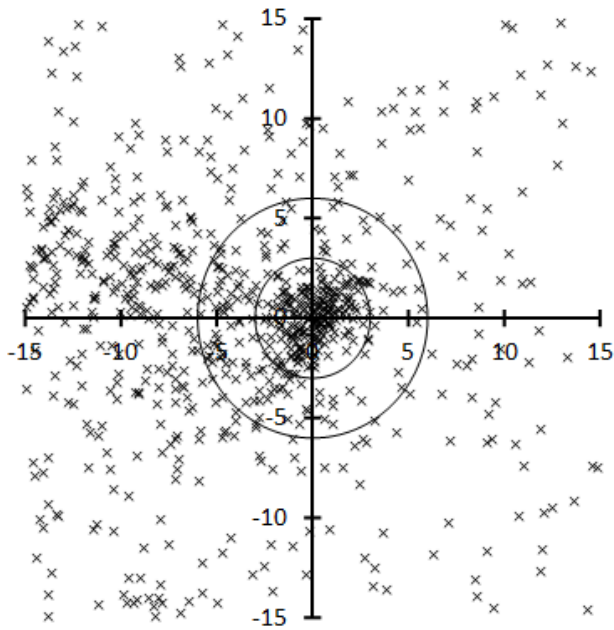
Table 1 – Number per year.

Year	N	Year	N
2007	17	2013	21
2008	34	2014	13
2009	15	2015	20
2010	18	2016	24
2011	12	2017	18
2012	16	2018	6

Table 2 – Activity profiles.

|	λ_O	Max
Nr<=3	250.5	65
DR3	251.5	6.5
DR10	251.5	23.8
DR15	250.5	38.3
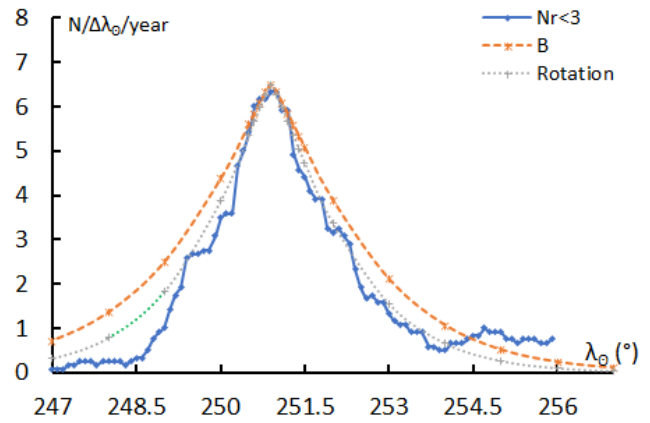
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
247	240.7	60.9	179.1	72.7	43.4	0.888	0.917	72.7	211.8	247.0	77.5	−30.2	8.20
248	241.2	61.1	181.0	72.2	43.4	0.888	0.920	72.7	211.1	248.0	78.2	−29.5	8.22
249	241.8	61.3	182.8	71.7	43.4	0.888	0.922	72.7	210.4	249.0	78.9	−28.9	8.24
250	242.3	61.5	184.5	71.2	43.4	0.888	0.925	72.7	209.6	250.0	79.6	−28.2	8.27
250.5	242.6	61.6	185.4	70.9	43.4	0.888	0.927	72.7	209.3	250.5	80.0	−27.8	8.28
250.6	242.7	61.6	185.6	70.9	43.4	0.888	0.927	72.7	209.2	250.6	80.0	−27.8	8.28
250.7	242.7	61.6	185.7	70.8	43.4	0.888	0.927	72.7	209.1	250.7	80.1	−27.7	8.29
250.8	242.8	61.6	185.9	70.8	43.4	0.888	0.927	72.7	209.1	250.8	80.2	−27.6	8.29
250.9	242.8	61.6	186.1	70.7	43.4	0.888	0.928	72.7	209.0	250.9	80.2	−27.6	8.29
251	242.9	61.6	186.2	70.7	43.4	0.888	0.928	72.7	208.9	251.0	80.3	−27.5	8.29
251.1	242.9	61.7	186.4	70.6	43.4	0.888	0.928	72.7	208.8	251.1	80.4	−27.4	8.30
251.2	243.0	61.7	186.6	70.6	43.4	0.888	0.929	72.7	208.8	251.2	80.5	−27.4	8.30
251.3	243.0	61.7	186.7	70.5	43.4	0.888	0.929	72.7	208.7	251.3	80.5	−27.3	8.30
251.4	243.1	61.7	186.9	70.5	43.4	0.888	0.929	72.7	208.6	251.4	80.6	−27.2	8.31
251.5	243.2	61.7	187.0	70.4	43.4	0.888	0.929	72.7	208.5	251.5	80.7	−27.1	8.31
252	243.4	61.8	187.9	70.1	43.4	0.888	0.931	72.7	208.2	252.0	81.0	−26.8	8.33
253	244.0	62.0	189.4	69.6	43.4	0.888	0.933	72.7	207.5	253.0	81.8	−26.1	8.36
254	244.6	62.1	191.0	69.1	43.4	0.889	0.936	72.7	206.7	254.0	82.5	−25.4	8.40
255	245.1	62.3	192.5	68.6	43.4	0.889	0.938	72.7	206.0	255.0	83.2	−24.7	8.45
256	245.7	62.5	193.9	68.0	43.4	0.889	0.941	72.8	205.3	256.0	84.0	−24.1	8.50
257	246.3	62.6	195.3	67.5	43.4	0.890	0.943	72.8	204.5	257.0	84.7	−23.4	8.55

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
258	246.9	62.8	196.7	67.0	43.4	0.890	0.945	72.8	203.8	258.0	85.4	–22.7	8.61
259	247.5	62.9	198.0	66.5	43.4	0.891	0.948	72.8	203.1	259.0	86.2	–22.0	8.67
260	248.1	63.1	199.4	65.9	43.4	0.891	0.950	72.8	202.3	260.0	86.9	–21.3	8.73
261	248.7	63.2	200.6	65.4	43.4	0.892	0.952	72.8	201.6	261.0	87.7	–20.6	8.81

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
258	246.9	62.8	196.7	67.0	43.4	0.890	0.945	72.8	203.8	258.0	85.4	–22.7	8.61
259	247.5	62.9	198.0	66.5	43.4	0.891	0.948	72.8	203.1	259.0	86.2	–22.0	8.67
260	248.1	63.1	199.4	65.9	43.4	0.891	0.950	72.8	202.3	260.0	86.9	–21.3	8.73
261	248.7	63.2	200.6	65.4	43.4	0.892	0.952	72.8	201.6	261.0	87.7	–20.6	8.81

PSU (#0339): Total of **150** orbits. $\lambda_\mathcal{O}$ = 252.6°, $\lambda_g{-}\lambda_\mathcal{O}$ = 258.4°, β_g = 34.9°, Δr = 3°, $\Delta\lambda_\mathcal{O}$ = 5°.
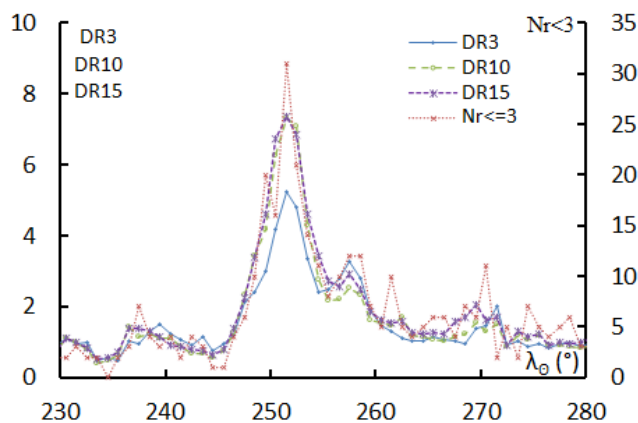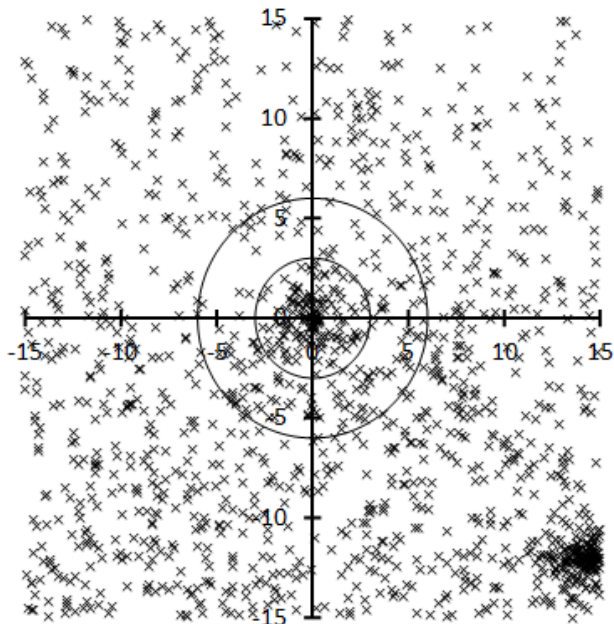
Table 1 – Number per year.

Year	N	Year	N
2007	14	2013	23
2008	22	2014	5
2009	16	2015	5
2010	18	2016	17
2011	7	2017	13
2012	8	2018	2

Table 2 – Activity profiles.

	$\lambda_\mathcal{O}$	Max
Nr<=3	251.5	31
DR3	251.5	5.2
DR10	251.5	7.3
DR15	251.5	7.4
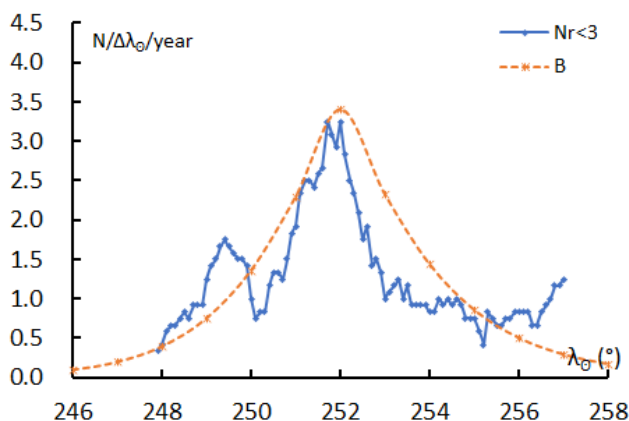
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_\mathcal{O}$	$\lambda_g{-}\lambda_\mathcal{O}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
245	256.7	36.5	160.7	48.1	59.5	0.850	0.903	114.8	215.4	245.0	48.4	−31.7	6.01
246	256.9	36.4	161.9	47.5	59.7	0.855	0.905	115.2	214.7	246.0	49.6	−31.1	6.23
247	257.1	36.2	163.1	46.9	59.9	0.860	0.908	115.5	214.1	247.0	50.7	−30.4	6.47
248	257.4	36.1	164.3	46.3	60.1	0.865	0.910	115.9	213.5	248.0	51.9	−29.8	6.73
249	257.6	35.9	165.4	45.7	60.3	0.870	0.912	116.3	212.9	249.0	53.0	−29.2	7.01
250	257.8	35.8	166.6	45.1	60.4	0.875	0.915	116.6	212.3	250.0	54.2	−28.5	7.32
251	258.0	35.6	167.7	44.5	60.6	0.881	0.917	117.0	211.7	251.0	55.4	−27.9	7.67
252	258.3	35.5	168.8	43.9	60.8	0.886	0.919	117.4	211.1	252.0	56.5	−27.3	8.06
253	258.5	35.3	169.9	43.3	61.0	0.892	0.921	117.7	210.4	253.0	57.7	−26.7	8.50
254	258.7	35.2	171.0	42.7	61.2	0.897	0.924	118.1	209.8	254.0	58.9	−26.0	9.00
255	258.9	35.0	172.1	42.1	61.4	0.903	0.926	118.5	209.2	255.0	60.1	−25.4	9.57
256	259.1	34.9	173.2	41.5	61.6	0.909	0.928	118.8	208.6	256.0	61.3	−24.8	10.22
257	259.4	34.7	174.3	40.8	61.8	0.915	0.930	119.2	208.0	257.0	62.5	−24.2	10.98
258	259.6	34.6	175.3	40.2	62.0	0.922	0.932	119.5	207.4	258.0	63.7	−23.6	11.88
259	259.8	34.4	176.4	39.6	62.2	0.928	0.934	119.9	206.8	259.0	64.9	−23.0	12.96
260	260.0	34.3	177.4	39.0	62.4	0.934	0.936	120.3	206.2	260.0	66.1	−22.4	14.27

DRV (#0502): Total of **195** orbits. $\lambda_O = 256°$, $\lambda_g–\lambda_O = 285.6°$, $\beta_g = 14.9°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$.
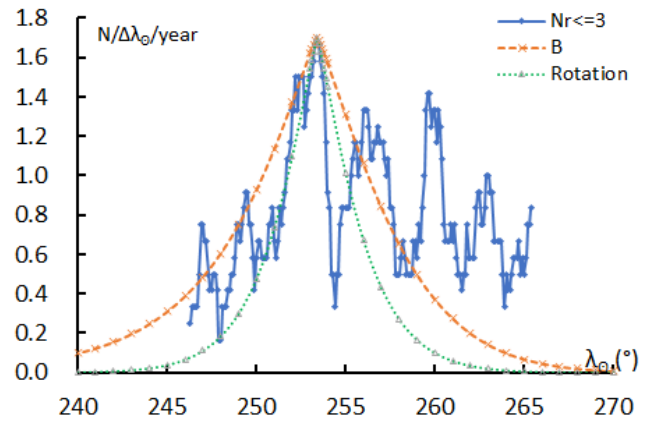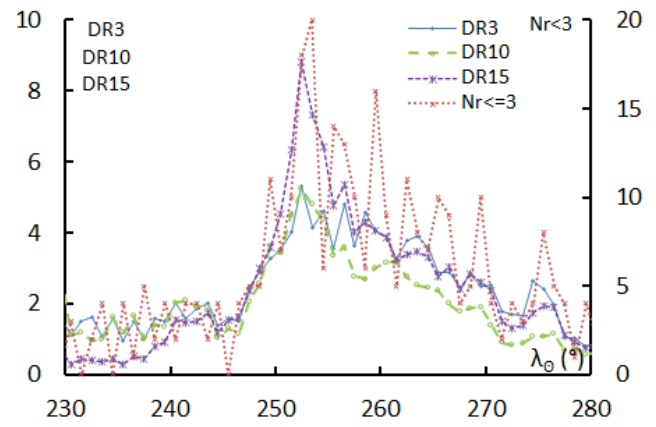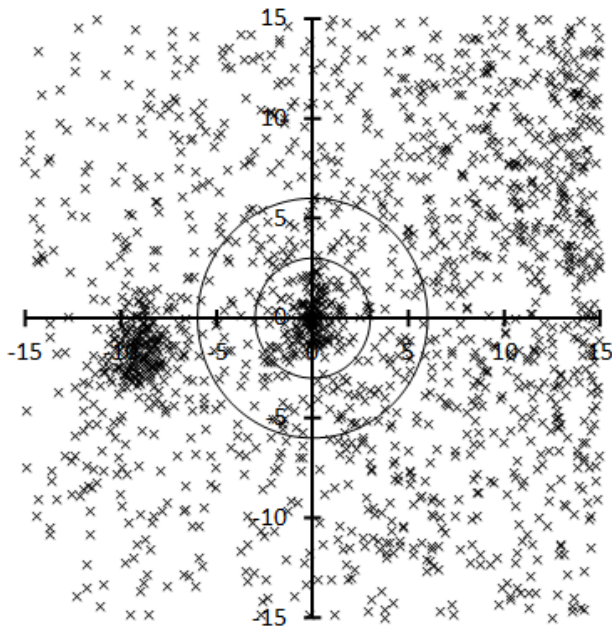
Table 1 – Number per year.

Year	N	Year	N
2007	15	2013	22
2008	20	2014	7
2009	11	2015	17
2010	22	2016	17
2011	11	2017	21
2012	18	2018	14

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	253.5	20
DR3	252.5	5.3
DR10	252.5	5.2
DR15	252.5	8.8

Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
245	287.4	11.8	177.8	13.9	68.6	0.953	0.759	157.5	121.8	245.0	121.1	19.0	15.99
246	287.3	12.1	178.7	13.7	68.6	0.950	0.762	157.0	122.1	246.0	121.7	19.3	15.09
247	287.2	12.3	179.7	13.6	68.5	0.947	0.764	156.6	122.5	247.0	122.2	19.6	14.31
248	287.1	12.6	180.6	13.5	68.5	0.944	0.767	156.1	122.8	248.0	122.8	19.9	13.64
249	287.0	12.9	181.5	13.4	68.4	0.941	0.770	155.6	123.2	249.0	123.3	20.2	13.04
250	286.8	13.1	182.4	13.3	68.4	0.938	0.772	155.2	123.5	250.0	123.8	20.5	12.52
251	286.7	13.4	183.3	13.2	68.3	0.936	0.775	154.7	123.9	251.0	124.4	20.8	12.05
252	286.6	13.6	184.2	13.0	68.3	0.933	0.778	154.3	124.3	252.0	124.9	21.0	11.64
253	286.5	13.9	185.2	12.9	68.2	0.931	0.781	153.8	124.7	253.0	125.4	21.3	11.26
253.1	286.5	13.9	185.3	12.9	68.2	0.930	0.781	153.8	124.7	253.1	125.4	21.3	11.23
253.2	286.5	13.9	185.3	12.9	68.2	0.930	0.781	153.7	124.7	253.2	125.5	21.3	11.19
253.3	286.5	14.0	185.4	12.9	68.2	0.930	0.781	153.7	124.8	253.3	125.5	21.4	11.16
253.4	286.5	14.0	185.5	12.9	68.2	0.930	0.782	153.6	124.8	253.4	125.6	21.4	11.13
253.5	286.4	14.0	185.6	12.9	68.2	0.930	0.782	153.6	124.9	253.5	125.6	21.4	11.09
253.6	286.4	14.0	185.7	12.9	68.2	0.929	0.782	153.5	124.9	253.6	125.7	21.4	11.06
253.7	286.4	14.1	185.8	12.8	68.2	0.929	0.783	153.5	124.9	253.7	125.7	21.5	11.03
253.8	286.4	14.1	185.9	12.8	68.2	0.929	0.783	153.4	125.0	253.8	125.8	21.5	10.99
253.9	286.4	14.1	186.0	12.8	68.2	0.929	0.783	153.4	125.0	253.9	125.8	21.5	10.96
254	286.4	14.1	186.1	12.8	68.2	0.928	0.783	153.3	125.1	254.0	125.9	21.5	10.93
255	286.3	14.4	187.0	12.7	68.1	0.926	0.786	152.9	125.4	255.0	126.4	21.8	10.63
256	286.2	14.7	187.9	12.6	68.1	0.924	0.789	152.4	125.8	256.0	126.8	22.0	10.36

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
257	286.0	14.9	188.8	12.5	68.0	0.922	0.792	152.0	126.2	257.0	127.3	22.3	10.11
258	285.9	15.2	189.7	12.4	67.9	0.920	0.795	151.5	126.6	258.0	127.8	22.5	9.89
259	285.8	15.4	190.6	12.2	67.9	0.918	0.797	151.1	127.1	259.0	128.2	22.7	9.69
260	285.7	15.7	191.5	12.1	67.8	0.916	0.800	150.6	127.5	260.0	128.7	22.9	9.51
261	285.6	16.0	192.4	12.0	67.8	0.914	0.803	150.2	127.9	261.0	129.1	23.1	9.35
262	285.5	16.2	193.3	11.9	67.7	0.912	0.806	149.8	128.3	262.0	129.5	23.3	9.20
263	285.3	16.5	194.2	11.8	67.7	0.911	0.809	149.3	128.8	263.0	130.0	23.4	9.07
264	285.2	16.7	195.1	11.7	67.6	0.909	0.812	148.9	129.2	264.0	130.4	23.6	8.95
265	285.1	17.0	196.0	11.6	67.6	0.908	0.815	148.4	129.6	265.0	130.8	23.8	8.84
266	285.0	17.2	196.9	11.5	67.5	0.907	0.817	148.0	130.1	266.0	131.2	23.9	8.74
267	284.9	17.5	197.8	11.4	67.5	0.905	0.820	147.6	130.5	267.0	131.6	24.0	8.66
268	284.8	17.8	198.7	11.3	67.4	0.904	0.823	147.1	131.0	268.0	132.0	24.2	8.58
269	284.6	18.0	199.6	11.2	67.4	0.903	0.826	146.7	131.5	269.0	132.4	24.3	8.52
270	284.5	18.3	200.5	11.1	67.3	0.902	0.829	146.3	131.9	270.0	132.8	24.4	8.47
271	284.4	18.5	201.3	11.0	67.3	0.901	0.832	145.8	132.4	271.0	133.2	24.5	8.42
272	284.3	18.8	202.2	10.9	67.2	0.900	0.835	145.4	132.9	272.0	133.6	24.6	8.38
273	284.2	19.0	203.1	10.9	67.1	0.900	0.838	145.0	133.4	273.0	133.9	24.7	8.36
274	284.0	19.3	204.0	10.8	67.1	0.899	0.840	144.6	133.8	274.0	134.3	24.7	8.34
275	283.9	19.6	204.9	10.7	67.0	0.899	0.843	144.1	134.3	275.0	134.7	24.8	8.32

HYD (#0016): Total of **2844** orbits. $\lambda_\Theta = 257.5°$, $\lambda_g - \lambda_\Theta = 230.9°$, $\beta_g = -16.8°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$.
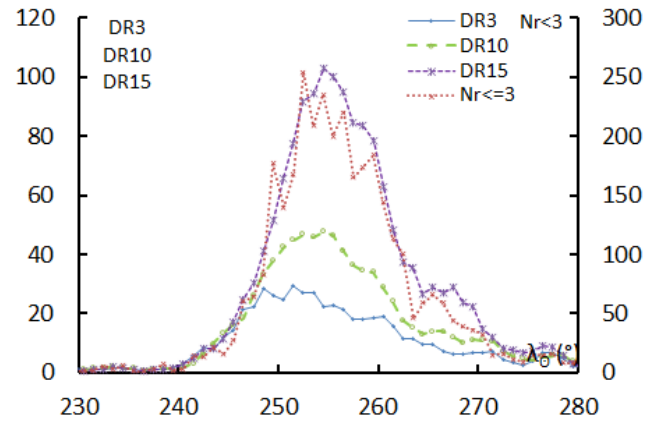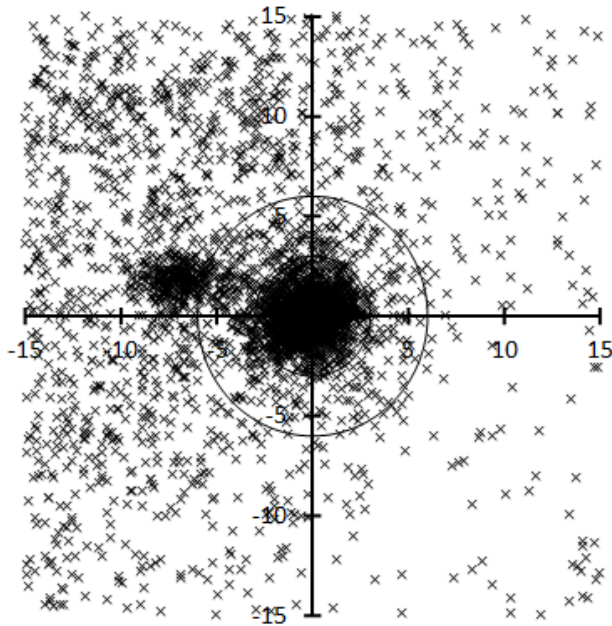
Table 1 – Number per year.

Year	N	Year	N
2007	233	2013	352
2008	309	2014	149
2009	252	2015	194
2010	260	2016	218
2011	187	2017	247
2012	306	2018	137

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	252.5	254
DR3	251.5	29.6
DR10	254.5	47.6
DR15	254.5	103.2
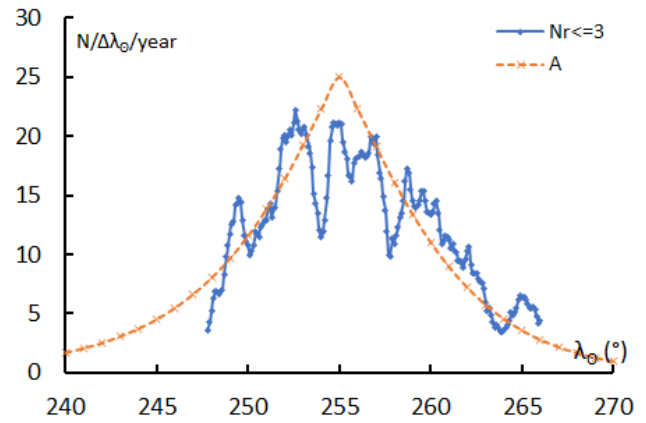
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
240	232.6	−16.4	111.7	5.4	59.9	0.991	0.290	132.5	114.8	60.0	295.7	42.0	33.38
241	232.5	−16.4	112.6	5.2	59.8	0.991	0.287	132.3	115.1	61.0	296.2	42.0	30.93
242	232.4	−16.4	113.4	5.1	59.7	0.990	0.285	132.1	115.5	62.0	296.6	42.1	28.84
243	232.2	−16.4	114.2	5.0	59.7	0.990	0.282	131.9	115.8	63.0	297.1	42.1	27.02
244	232.1	−16.4	115.1	4.8	59.6	0.989	0.280	131.7	116.2	64.0	297.6	42.1	25.42
245	232.0	−16.4	115.9	4.7	59.5	0.988	0.277	131.5	116.5	65.0	298.0	42.1	24.02
246	231.9	−16.4	116.8	4.5	59.5	0.988	0.275	131.2	116.8	66.0	298.5	42.1	22.77
247	231.8	−16.4	117.6	4.3	59.4	0.987	0.272	131.0	117.2	67.0	299.0	42.2	21.65
248	231.7	−16.4	118.4	4.2	59.3	0.987	0.270	130.8	117.5	68.0	299.4	42.2	20.64
249	231.6	−16.4	119.3	4.0	59.2	0.986	0.268	130.6	117.8	69.0	299.9	42.2	19.73
250	231.5	−16.4	120.1	3.8	59.2	0.986	0.265	130.4	118.2	70.0	300.4	42.2	18.91
251	231.3	−16.4	120.9	3.6	59.1	0.986	0.263	130.1	118.5	71.0	300.9	42.2	18.15
252	231.2	−16.4	121.8	3.5	59.0	0.985	0.261	129.9	118.8	72.0	301.4	42.2	17.46
253	231.1	−16.4	122.6	3.3	59.0	0.985	0.258	129.7	119.2	73.0	301.8	42.2	16.83
254	231.0	−16.4	123.4	3.1	58.9	0.984	0.256	129.4	119.5	74.0	302.3	42.2	16.24
255	230.9	−16.4	124.3	2.9	58.8	0.984	0.254	129.2	119.8	75.0	302.8	42.2	15.70
256	230.8	−16.4	125.1	2.7	58.7	0.983	0.251	129.0	120.1	76.0	303.3	42.2	15.20
257	230.7	−16.4	125.9	2.5	58.7	0.983	0.249	128.7	120.5	77.0	303.8	42.3	14.73
258	230.6	−16.4	126.8	2.2	58.6	0.983	0.247	128.5	120.8	78.0	304.3	42.3	14.30
259	230.4	−16.4	127.6	2.0	58.5	0.982	0.245	128.3	121.1	79.0	304.8	42.3	13.89
260	230.3	−16.4	128.4	1.8	58.4	0.982	0.243	128.0	121.4	80.0	305.3	42.3	13.51

Table 3 – Continued, evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g - \lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
261	230.2	−16.4	129.2	1.6	58.4	0.982	0.240	127.8	121.7	81.0	305.8	42.3	13.15
262	230.1	−16.4	130.0	1.4	58.3	0.981	0.238	127.5	122.0	82.0	306.3	42.2	12.82
263	230.0	−16.4	130.9	1.1	58.2	0.981	0.236	127.3	122.3	83.0	306.8	42.2	12.50
264	229.9	−16.4	131.7	0.9	58.2	0.981	0.234	127.0	122.6	84.0	307.3	42.2	12.20
265	229.8	−16.4	132.5	0.7	58.1	0.981	0.232	126.8	122.9	85.0	307.8	42.2	11.92
266	229.7	−16.4	133.3	0.4	58.0	0.980	0.230	126.5	123.2	86.0	308.3	42.2	11.66
267	229.5	−16.4	134.1	0.2	57.9	0.980	0.228	126.3	123.5	87.0	308.8	42.2	11.40
268	229.4	−16.4	134.9	−0.1	57.9	0.980	0.226	126.0	123.8	88.0	309.3	42.2	11.17
269	229.3	−16.4	135.8	−0.3	57.8	0.980	0.224	125.8	124.1	89.0	309.8	42.2	10.94
270	229.2	−16.4	136.6	−0.6	57.7	0.979	0.222	125.5	124.4	90.0	310.3	42.2	10.73
271	229.1	−16.4	137.4	−0.8	57.7	0.979	0.220	125.3	124.7	91.0	310.8	42.2	10.52
272	229.0	−16.4	138.2	−1.1	57.6	0.979	0.218	125.0	125.0	92.0	311.3	42.2	10.33
273	228.9	−16.4	139.0	−1.4	57.5	0.979	0.216	124.7	125.3	93.0	311.8	42.1	10.14
274	228.8	−16.4	139.8	−1.6	57.4	0.979	0.214	124.5	125.6	94.0	312.4	42.1	9.97
275	228.7	−16.4	140.6	−1.9	57.4	0.978	0.212	124.2	125.8	95.0	312.9	42.1	9.80
276	228.5	−16.4	141.4	−2.2	57.3	0.978	0.210	123.9	126.1	96.0	313.4	42.1	9.64
277	228.4	−16.4	142.2	−2.5	57.2	0.978	0.209	123.7	126.4	97.0	313.9	42.1	9.48
278	228.3	−16.4	143.0	−2.7	57.2	0.978	0.207	123.4	126.7	98.0	314.5	42.0	9.33
279	228.2	−16.4	143.8	−3.0	57.1	0.978	0.205	123.1	126.9	99.0	315.0	42.0	9.19
280	228.1	−16.4	144.6	−3.3	57.0	0.978	0.203	122.8	127.2	100.0	315.5	42.0	9.06
281	228.0	−16.4	145.4	−3.6	56.9	0.977	0.202	122.6	127.5	101.0	316.1	42.0	8.93
282	227.9	−16.4	146.2	−3.9	56.9	0.977	0.200	122.3	127.7	102.0	316.6	42.0	8.81
283	227.8	−16.4	147.0	−4.2	56.8	0.977	0.198	122.0	128.0	103.0	317.1	41.9	8.69
284	227.6	−16.4	147.8	−4.5	56.7	0.977	0.196	121.7	128.3	104.0	317.7	41.9	8.57

MON (#0019): Total of **1129** orbits. $\lambda_{\odot} = 261°$, $\lambda_g - \lambda_{\odot} = 202.2°$, $\beta_g = -15.0°$, $\Delta r = 3°$, $\Delta\lambda_{\odot} = 10°$.
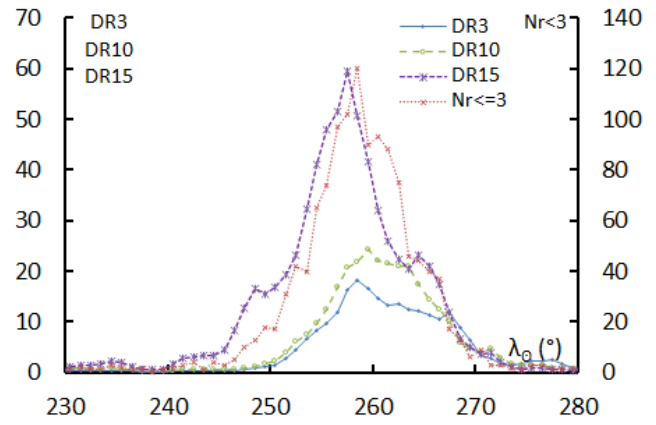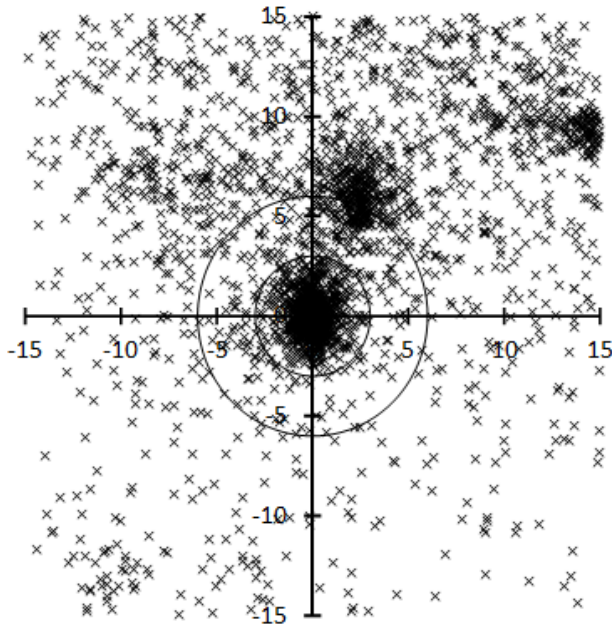

Table 1 – Number per year.

Year	N	Year	N
2007	58	2013	133
2008	103	2014	73
2009	68	2015	75
2010	98	2016	87
2011	93	2017	135
2012	140	2018	66

Table 2 – Activity profiles.

	$\lambda_{\odot}$	Max
Nr<=3	258.5	120
DR3	258.5	18.3
DR10	259.5	24.4
DR15	257.5	59.4
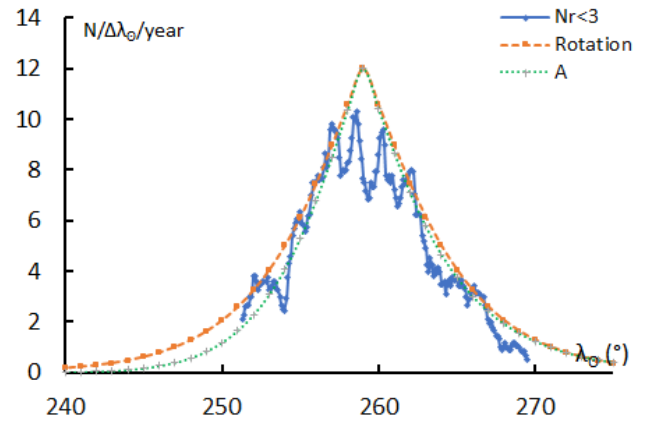
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\odot}$	$\lambda_g - \lambda_{\odot}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
235	209.6	−12.6	84.6	10.8	45.6	0.989	0.092	50.5	145.5	55.0	211.4	25.9	8.71
236	209.3	−12.7	85.3	10.7	45.4	0.989	0.095	49.5	144.9	56.0	211.5	25.9	8.73
237	209.0	−12.8	86.0	10.6	45.2	0.989	0.098	48.6	144.3	57.0	211.6	26.0	8.76
238	208.7	−12.9	86.7	10.5	45.0	0.988	0.101	47.7	143.6	58.0	211.6	26.0	8.78
239	208.4	−13.0	87.4	10.5	44.8	0.988	0.105	46.9	143.0	59.0	211.7	26.1	8.81
240	208.1	−13.1	88.1	10.4	44.6	0.988	0.108	46.1	142.3	60.0	211.8	26.1	8.83
241	207.7	−13.1	88.8	10.3	44.4	0.987	0.112	45.3	141.7	61.0	211.9	26.2	8.86
242	207.4	−13.2	89.5	10.2	44.2	0.987	0.116	44.5	141.0	62.0	212.0	26.2	8.89
243	207.1	−13.3	90.1	10.1	44.1	0.987	0.120	43.8	140.3	63.0	212.1	26.2	8.92
244	206.8	−13.4	90.8	10.0	43.9	0.986	0.123	43.1	139.7	64.0	212.2	26.2	8.94
245	206.5	−13.5	91.5	9.9	43.7	0.986	0.127	42.4	139.0	65.0	212.3	26.2	8.97
246	206.2	−13.6	92.2	9.8	43.5	0.985	0.131	41.7	138.3	66.0	212.4	26.3	9.00
247	205.9	−13.7	92.9	9.7	43.3	0.985	0.135	41.0	137.6	67.0	212.5	26.3	9.03
248	205.6	−13.8	93.6	9.6	43.1	0.985	0.139	40.4	136.9	68.0	212.6	26.3	9.06
249	205.3	−13.9	94.3	9.5	42.9	0.984	0.144	39.8	136.2	69.0	212.7	26.3	9.09
250	205.0	−14.0	94.9	9.4	42.7	0.984	0.148	39.2	135.6	70.0	212.8	26.3	9.12
251	204.7	−14.1	95.6	9.2	42.6	0.983	0.152	38.6	134.9	71.0	212.9	26.3	9.14
252	204.4	−14.2	96.3	9.1	42.4	0.983	0.157	38.1	134.2	72.0	213.0	26.3	9.17
253	204.1	−14.3	97.0	9.0	42.2	0.982	0.161	37.5	133.5	73.0	213.1	26.2	9.20
254	203.8	−14.4	97.6	8.9	42.0	0.982	0.166	37.0	132.8	74.0	213.2	26.2	9.23
255	203.5	−14.5	98.3	8.7	41.8	0.982	0.170	36.5	132.1	75.0	213.3	26.2	9.26

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
256	203.2	−14.6	99.0	8.6	41.6	0.981	0.175	36.0	131.4	76.0	213.4	26.2	9.28
257	202.9	−14.6	99.7	8.5	41.4	0.981	0.179	35.5	130.7	77.0	213.6	26.2	9.31
258	202.6	−14.7	100.3	8.3	41.2	0.980	0.184	35.1	130.0	78.0	213.7	26.1	9.34
259	202.3	−14.8	101.0	8.2	41.0	0.980	0.189	34.6	129.3	79.0	213.8	26.1	9.36
260	202.0	−14.9	101.7	8.0	40.9	0.979	0.194	34.2	128.6	80.0	213.9	26.0	9.39
261	201.6	−15.0	102.3	7.9	40.7	0.979	0.199	33.7	127.9	81.0	214.1	26.0	9.41
262	201.3	−15.1	103.0	7.8	40.5	0.978	0.203	33.3	127.2	82.0	214.2	26.0	9.43
263	201.0	−15.2	103.7	7.6	40.3	0.978	0.208	32.9	126.5	83.0	214.4	25.9	9.45
264	200.7	−15.3	104.3	7.4	40.1	0.977	0.213	32.5	125.8	84.0	214.5	25.9	9.47
265	200.4	−15.4	105.0	7.3	39.9	0.977	0.218	32.1	125.1	85.0	214.6	25.8	9.49
266	200.1	−15.4	105.6	7.1	39.7	0.977	0.224	31.7	124.4	86.0	214.8	25.7	9.51
267	199.8	−15.5	106.3	7.0	39.5	0.976	0.229	31.4	123.6	87.0	214.9	25.7	9.53
268	199.5	−15.6	106.9	6.8	39.3	0.976	0.234	31.0	122.9	88.0	215.1	25.6	9.54
269	199.2	−15.7	107.6	6.6	39.2	0.975	0.239	30.6	122.2	89.0	215.2	25.5	9.56
270	198.9	−15.8	108.3	6.5	39.0	0.974	0.244	30.3	121.5	90.0	215.4	25.5	9.57
271	198.6	−15.9	108.9	6.3	38.8	0.974	0.250	29.9	120.8	91.0	215.6	25.4	9.58
272	198.2	−15.9	109.6	6.1	38.6	0.973	0.255	29.6	120.1	92.0	215.7	25.3	9.59
273	197.9	−16.0	110.2	6.0	38.4	0.973	0.260	29.3	119.4	93.0	215.9	25.2	9.60
274	197.6	−16.1	110.8	5.8	38.2	0.972	0.266	29.0	118.7	94.0	216.1	25.1	9.60
275	197.3	−16.2	111.5	5.6	38.0	0.972	0.271	28.7	118.0	95.0	216.3	25.0	9.61

EHY (#0529): Total of **497** orbits. $\lambda_O = 260.7°$, $\lambda_g - \lambda_O = 237.3°$, $\beta_g = -14.7°$, $\Delta r = 3°$, $\Delta\lambda_O = 15°$.
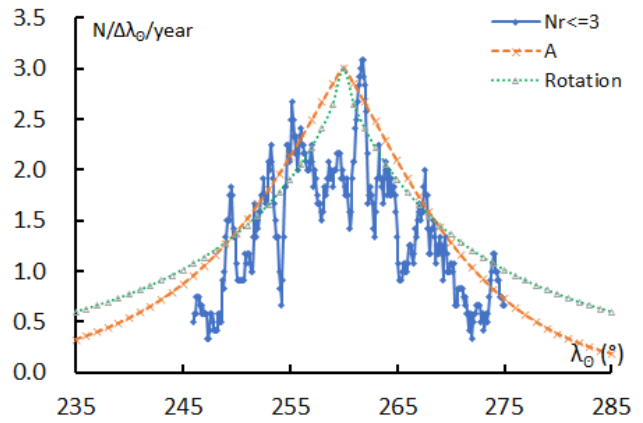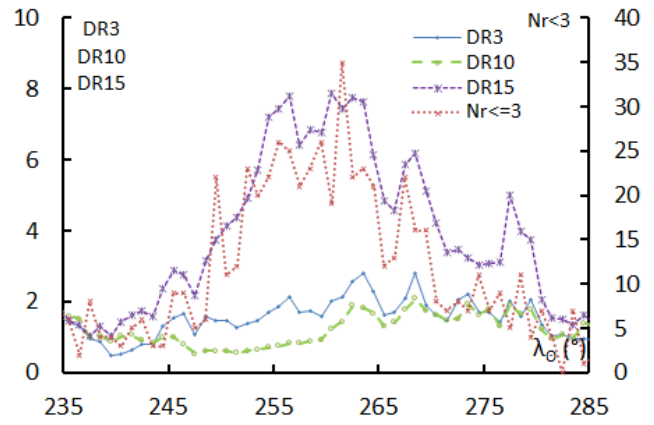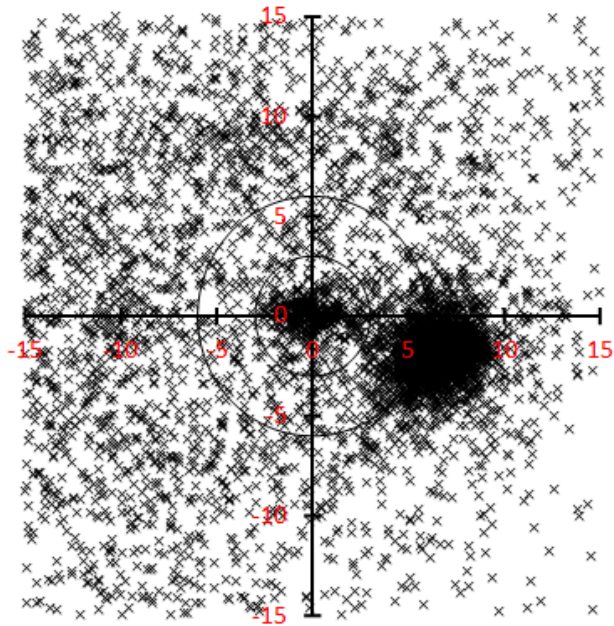
Table 1 – Number per year.

Year	N	Year	N
2007	44	2013	44
2008	32	2014	25
2009	38	2015	35
2010	45	2016	32
2011	46	2017	55
2012	61	2018	40

Table 2 – Activity profiles.

|	λ_O	Max
Nr<=3	261.5	35
DR3	268.5	2.8
DR10	268.5	2.1
DR15	260.5	7.9

Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g - \lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
244	239.8	−15.5	122.5	4.2	62.5	0.951	0.425	142.6	99.6	64.0	321.9	36.8	8.67
245	239.6	−15.4	123.3	4.1	62.4	0.951	0.421	142.6	100.1	65.0	322.3	36.7	8.65
246	239.5	−15.4	124.1	4.0	62.4	0.952	0.417	142.6	100.6	66.0	322.7	36.7	8.63
247	239.3	−15.3	124.9	3.8	62.3	0.952	0.413	142.6	101.1	67.0	323.1	36.6	8.61
248	239.2	−15.3	125.7	3.7	62.3	0.952	0.408	142.6	101.6	68.0	323.5	36.6	8.60
249	239.0	−15.2	126.5	3.6	62.2	0.953	0.404	142.6	102.1	69.0	323.9	36.5	8.58
250	238.9	−15.1	127.3	3.4	62.2	0.953	0.400	142.5	102.6	70.0	324.3	36.4	8.57
251	238.7	−15.1	128.2	3.3	62.2	0.954	0.396	142.5	103.0	71.0	324.7	36.3	8.57
252	238.6	−15.0	129.0	3.1	62.1	0.954	0.392	142.5	103.5	72.0	325.1	36.3	8.56
253	238.4	−14.9	129.8	3.0	62.1	0.955	0.388	142.5	104.0	73.0	325.6	36.2	8.56
254	238.3	−14.9	130.6	2.8	62.0	0.955	0.384	142.5	104.5	74.0	326.0	36.1	8.56
255	238.1	−14.8	131.4	2.6	62.0	0.956	0.380	142.5	104.9	75.0	326.4	36.0	8.56
256	238.0	−14.8	132.2	2.5	61.9	0.956	0.376	142.5	105.4	76.0	326.8	36.0	8.56
257	237.8	−14.7	133.0	2.3	61.9	0.957	0.372	142.5	105.9	77.0	327.3	35.9	8.57
258	237.7	−14.6	133.8	2.1	61.9	0.957	0.368	142.5	106.4	78.0	327.7	35.8	8.58
259	237.5	−14.6	134.6	2.0	61.8	0.958	0.364	142.4	106.8	79.0	328.1	35.7	8.59
260	237.4	−14.5	135.4	1.8	61.8	0.958	0.360	142.4	107.3	80.0	328.6	35.6	8.60
261	237.2	−14.4	136.2	1.6	61.7	0.959	0.356	142.4	107.8	81.0	329.0	35.5	8.62
262	237.1	−14.4	137.0	1.4	61.7	0.959	0.352	142.4	108.2	82.0	329.5	35.4	8.64
263	236.9	−14.3	137.9	1.2	61.6	0.960	0.348	142.4	108.7	83.0	329.9	35.3	8.66
264	236.8	−14.2	138.7	1.0	61.6	0.960	0.344	142.4	109.1	84.0	330.4	35.2	8.68

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
265	236.6	−14.2	139.5	0.8	61.6	0.961	0.340	142.4	109.6	85.0	330.8	35.1	8.71
266	236.5	−14.1	140.3	0.6	61.5	0.962	0.336	142.4	110.0	86.0	331.3	35.0	8.74
267	236.3	−14.1	141.1	0.4	61.5	0.962	0.333	142.3	110.5	87.0	331.7	34.9	8.77
268	236.2	−14.0	141.9	0.2	61.4	0.963	0.329	142.3	110.9	88.0	332.2	34.8	8.81
269	236.0	−13.9	142.7	0.0	61.4	0.963	0.325	142.3	111.4	89.0	332.7	34.7	8.84
270	235.9	−13.9	143.5	−0.2	61.3	0.964	0.321	142.3	111.8	90.0	333.1	34.6	8.88
271	235.7	−13.8	144.3	−0.4	61.3	0.964	0.318	142.3	112.3	91.0	333.6	34.5	8.93
272	235.6	−13.7	145.1	−0.6	61.3	0.965	0.314	142.3	112.7	92.0	334.1	34.4	8.97
273	235.4	−13.7	145.9	−0.8	61.2	0.966	0.310	142.3	113.2	93.0	334.6	34.3	9.02
274	235.3	−13.6	146.7	−1.1	61.2	0.966	0.307	142.2	113.6	94.0	335.1	34.1	9.07
275	235.1	−13.5	147.5	−1.3	61.1	0.967	0.303	142.2	114.0	95.0	335.6	34.0	9.13
276	235.0	−13.5	148.3	−1.5	61.1	0.967	0.299	142.2	114.5	96.0	336.0	33.9	9.19
277	234.8	−13.4	149.1	−1.7	61.0	0.968	0.296	142.2	114.9	97.0	336.5	33.8	9.25
278	234.7	−13.4	149.9	−2.0	61.0	0.969	0.292	142.2	115.4	98.0	337.0	33.7	9.32
279	234.5	−13.3	150.7	−2.2	60.9	0.969	0.289	142.2	115.8	99.0	337.5	33.5	9.39
280	234.4	−13.2	151.5	−2.4	60.9	0.970	0.285	142.1	116.2	100.0	338.0	33.4	9.47
281	234.2	−13.2	152.3	−2.7	60.9	0.970	0.282	142.1	116.6	101.0	338.6	33.3	9.55

XVI (#0335): Total of **265** orbits. λ_Θ = 263.7°, $\lambda_g–\lambda_\Theta$ = 291.4°, β_g = –5.1°, Δr = 3°, $\Delta\lambda_\Theta$ = 10°. XVI may be divided into two showers, XVI0 around λ_Θ = 256° and XVI1 and XVI2 around λ_Θ = 265°.
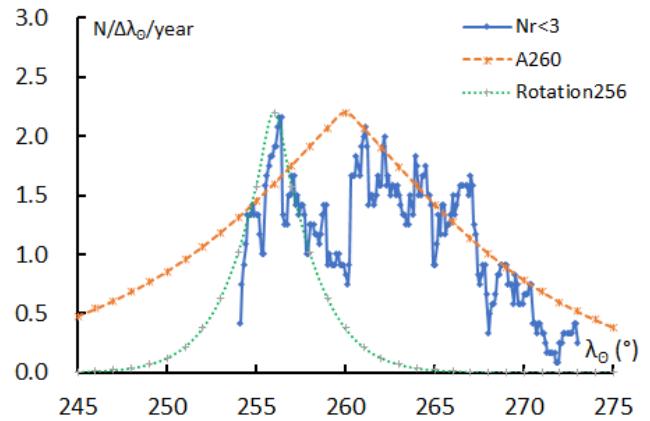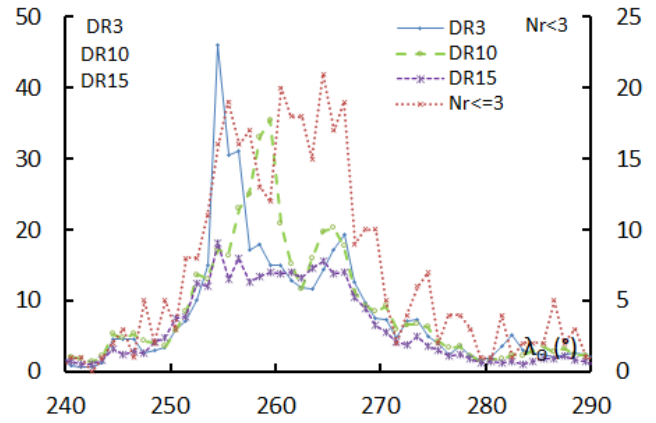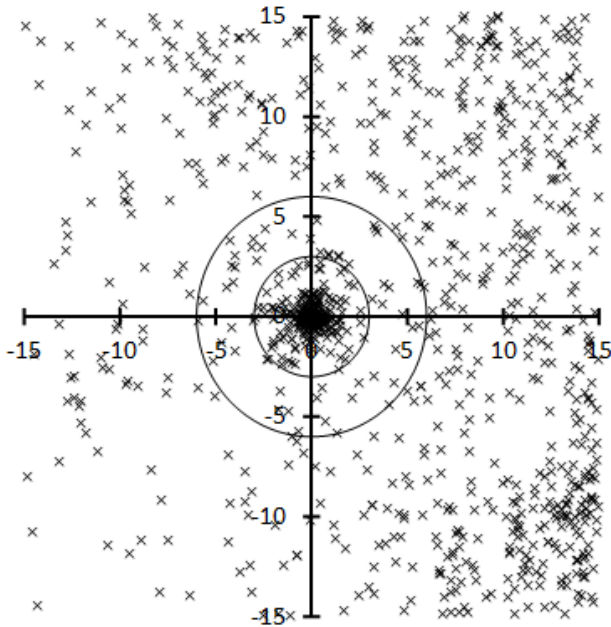
Table 1 – Number per year.

Year	N	Year	N
2007	18	2013	27
2008	25	2014	21
2009	25	2015	14
2010	17	2016	15
2011	30	2017	24
2012	26	2018	23

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	264.5	21
DR3	254.5	46.0
DR10	259.5	35.4
DR15	254.5	18.1

Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g–\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
244	296.5	–3.7	179.0	–3.6	67.7	1.019	0.510	171.8	272.5	64.0	151.5	–8.2	–26.8
245	296.3	–3.8	179.6	–3.9	67.8	1.016	0.516	171.7	273.1	65.0	151.9	–8.3	–32.4
246	296.0	–3.8	180.3	–4.3	67.8	1.013	0.522	171.6	273.7	66.0	152.2	–8.4	–40.7
247	295.7	–3.9	181.0	–4.7	67.8	1.010	0.528	171.5	274.4	67.0	152.6	–8.5	–54.5
248	295.5	–4.0	181.6	–5.0	67.8	1.007	0.534	171.3	275.0	68.0	153.0	–8.6	–81.7
249	295.2	–4.1	182.3	–5.4	67.9	1.003	0.541	171.2	275.6	69.0	153.3	–8.7	–161
250	295.0	–4.1	182.9	–5.8	67.9	1.000	0.547	171.1	276.3	70.0	153.7	–8.8	–3311
251	294.7	–4.2	183.6	–6.1	67.9	0.997	0.553	171.0	276.9	71.0	154.0	–9.0	181.2
252	294.4	–4.3	184.2	–6.5	68.0	0.994	0.559	170.9	277.6	72.0	154.3	–9.1	88.98
253	294.2	–4.3	184.9	–6.8	68.0	0.990	0.565	170.7	278.2	73.0	154.7	–9.2	59.31
254	293.9	–4.4	185.5	–7.2	68.0	0.987	0.571	170.6	278.9	74.0	155.0	–9.3	44.68
255	293.7	–4.5	186.2	–7.6	68.0	0.984	0.578	170.5	279.5	75.0	155.3	–9.3	35.96
256	293.4	–4.6	186.8	–7.9	68.1	0.981	0.584	170.4	280.2	76.0	155.6	–9.4	30.19
257	293.1	–4.6	187.5	–8.3	68.1	0.977	0.590	170.3	280.9	77.0	156.0	–9.5	26.07
258	292.9	–4.7	188.1	–8.6	68.1	0.974	0.596	170.2	281.6	78.0	156.3	–9.6	23.00
259	292.6	–4.8	188.8	–9.0	68.2	0.971	0.603	170.1	282.2	79.0	156.6	–9.7	20.62
260	292.4	–4.9	189.4	–9.3	68.2	0.967	0.609	170.0	282.9	80.0	156.9	–9.8	18.72
261	292.1	–4.9	190.1	–9.7	68.2	0.964	0.615	169.9	283.6	81.0	157.2	–9.9	17.17
262	291.8	–5.0	190.8	–10.1	68.2	0.961	0.621	169.7	284.3	82.0	157.4	–9.9	15.89
263	291.6	–5.1	191.4	–10.4	68.3	0.958	0.628	169.6	285.0	83.0	157.7	–10.0	14.80
264	291.3	–5.1	192.1	–10.8	68.3	0.954	0.634	169.5	285.7	84.0	158.0	–10.1	13.87

Table 3 – Continued, evolution of the orbital parameters during the activity period.

$\lambda_\odot$	$\lambda_g–\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
265	291.1	−5.2	192.8	−11.1	68.3	0.951	0.640	169.4	286.5	85.0	158.3	−10.1	13.08
266	290.8	−5.3	193.4	−11.5	68.3	0.948	0.647	169.3	287.2	86.0	158.5	−10.2	12.38
267	290.5	−5.4	194.1	−11.8	68.4	0.945	0.653	169.2	287.9	87.0	158.8	−10.3	11.77
268	290.3	−5.4	194.7	−12.2	68.4	0.941	0.659	169.1	288.6	88.0	159.0	−10.3	11.22
269	290.0	−5.5	195.4	−12.5	68.4	0.938	0.666	169.0	289.4	89.0	159.3	−10.4	10.74
270	289.8	−5.6	196.1	−12.9	68.5	0.935	0.672	168.9	290.1	90.0	159.5	−10.4	10.31
271	289.5	−5.6	196.7	−13.2	68.5	0.932	0.678	168.8	290.9	91.0	159.8	−10.5	9.92
272	289.2	−5.7	197.4	−13.6	68.5	0.929	0.685	168.7	291.6	92.0	160.0	−10.5	9.57
273	289.0	−5.8	198.1	−13.9	68.5	0.925	0.691	168.6	292.4	93.0	160.2	−10.5	9.26
274	288.7	−5.8	198.8	−14.3	68.6	0.922	0.697	168.5	293.2	94.0	160.4	−10.6	8.97
275	288.4	−5.9	199.4	−14.6	68.6	0.919	0.703	168.4	293.9	95.0	160.6	−10.6	8.71
276	288.2	−6.0	200.1	−14.9	68.6	0.916	0.710	168.3	294.7	96.0	160.8	−10.6	8.47
277	287.9	−6.1	200.8	−15.3	68.7	0.913	0.716	168.2	295.5	97.0	161.0	−10.6	8.25
278	287.7	−6.1	201.5	−15.6	68.7	0.910	0.722	168.1	296.3	98.0	161.2	−10.7	8.04
279	287.4	−6.2	202.2	−16.0	68.7	0.907	0.729	168.0	297.1	99.0	161.4	−10.7	7.86

GEM (#0004): Total of **19938** orbits. $\lambda_{\varnothing} = 260°$, $\lambda_g - \lambda_{\varnothing} = 208.1°$, $\beta_g = 10.4°$, $\Delta r = 2°$, $\Delta\lambda_{\varnothing} = 5°$.
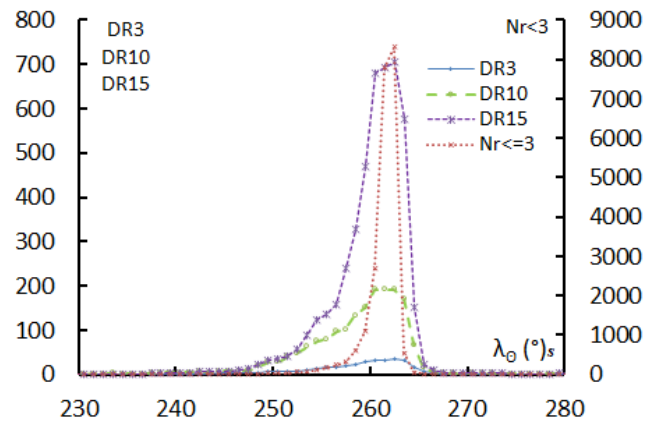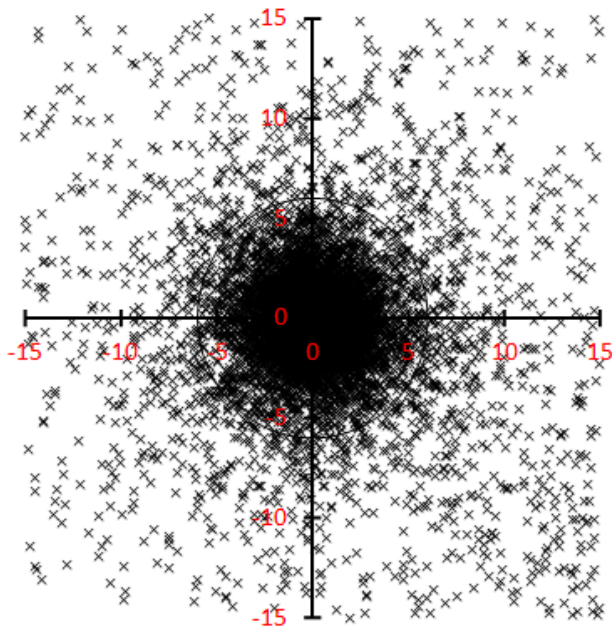
Table 1 – Number per year.

Year	N	Year	N
2007	1357	2013	2593
2008	533	2014	1994
2009	1110	2015	468
2010	1160	2016	706
2011	2103	2017	2233
2012	3613	2018	2068

Table 2 – Activity profiles.

	$\lambda_{\varnothing}$	Max
Nr<=3	262.5	8321
DR3	262.5	34.0
DR10	262.5	192.2
DR15	262.5	705.9
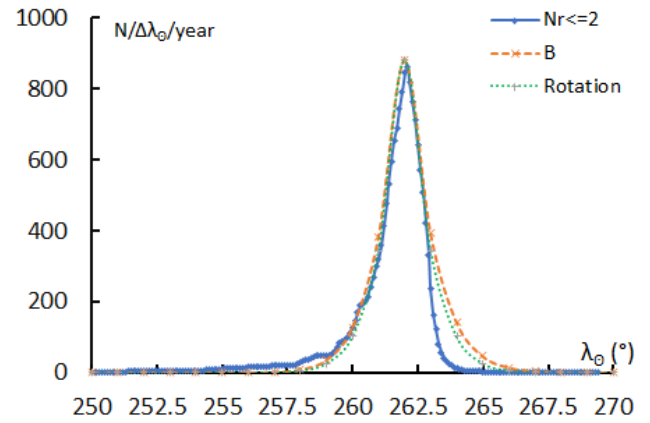
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\varnothing}$	$\lambda_g - \lambda_{\varnothing}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
237	210.6	11.6	87.1	35.0	31.4	0.863	0.148	23.6	326.7	237.0	206.0	−12.7	1.08
238	210.5	11.6	88.2	35.0	31.5	0.864	0.148	23.6	326.6	238.0	206.9	−12.7	1.08
239	210.4	11.5	89.3	35.0	31.6	0.865	0.148	23.6	326.5	239.0	207.8	−12.7	1.09
240	210.3	11.5	90.3	34.9	31.7	0.866	0.148	23.5	326.4	240.0	208.7	−12.8	1.10
241	210.2	11.4	91.4	34.9	31.8	0.867	0.147	23.5	326.3	241.0	209.6	−12.8	1.11
242	210.1	11.4	92.5	34.8	31.9	0.868	0.147	23.5	326.2	242.0	210.5	−12.8	1.11
243	210.0	11.4	93.6	34.8	32.0	0.869	0.147	23.5	326.1	243.0	211.4	−12.8	1.12
244	209.9	11.3	94.6	34.7	32.1	0.870	0.147	23.4	326.0	244.0	212.3	−12.8	1.13
245	209.8	11.3	95.7	34.6	32.2	0.871	0.147	23.4	325.9	245.0	213.2	−12.9	1.14
246	209.7	11.2	96.8	34.5	32.2	0.872	0.147	23.4	325.8	246.0	214.1	−12.9	1.15
247	209.6	11.2	97.8	34.4	32.3	0.873	0.147	23.3	325.7	247.0	215.0	−12.9	1.15
248	209.5	11.1	98.9	34.3	32.4	0.874	0.147	23.3	325.6	248.0	215.8	−12.9	1.16
249	209.4	11.1	99.9	34.2	32.5	0.875	0.147	23.3	325.5	249.0	216.7	−12.9	1.17
250	209.3	11.0	101.0	34.1	32.6	0.876	0.147	23.2	325.4	250.0	217.6	−12.9	1.18
251	209.2	11.0	102.0	34.0	32.7	0.877	0.147	23.2	325.3	251.0	218.5	−13.0	1.19
252	209.0	10.9	103.1	33.9	32.8	0.878	0.147	23.1	325.2	252.0	219.4	−13.0	1.20
253	208.9	10.9	104.1	33.8	32.9	0.879	0.147	23.1	325.1	253.0	220.3	−13.0	1.21
254	208.8	10.9	105.2	33.6	33.0	0.880	0.147	23.1	325.0	254.0	221.2	−13.0	1.22
255	208.7	10.8	106.2	33.5	33.1	0.881	0.147	23.0	324.9	255.0	222.1	−13.0	1.23
256	208.6	10.8	107.3	33.3	33.2	0.882	0.147	23.0	324.8	256.0	223.0	−13.0	1.24
257	208.5	10.7	108.3	33.2	33.3	0.883	0.146	22.9	324.7	257.0	223.8	−13.0	1.25

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g\!-\!\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
258	208.4	10.7	109.4	33.0	33.4	0.884	0.146	22.9	324.5	258.0	224.7	−13.0	1.26
259	208.3	10.6	110.4	32.8	33.5	0.885	0.146	22.9	324.4	259.0	225.6	−13.1	1.27
260	208.2	10.6	111.4	32.7	33.6	0.886	0.146	22.8	324.3	260.0	226.5	−13.1	1.28
261	208.1	10.5	112.4	32.5	33.7	0.887	0.146	22.8	324.2	261.0	227.4	−13.1	1.29
262	208.0	10.5	113.5	32.3	33.8	0.888	0.146	22.7	324.1	262.0	228.3	−13.1	1.31
263	207.9	10.4	114.5	32.1	33.8	0.889	0.146	22.7	324.0	263.0	229.2	−13.1	1.32
264	207.8	10.4	115.5	31.9	33.9	0.890	0.146	22.6	323.9	264.0	230.0	−13.1	1.33
265	207.7	10.3	116.5	31.7	34.0	0.891	0.146	22.6	323.8	265.0	230.9	−13.1	1.34
266	207.6	10.3	117.5	31.5	34.1	0.892	0.146	22.5	323.7	266.0	231.8	−13.1	1.36
267	207.5	10.2	118.5	31.3	34.2	0.893	0.146	22.5	323.6	267.0	232.7	−13.1	1.37
268	207.4	10.2	119.5	31.1	34.3	0.894	0.146	22.4	323.4	268.0	233.6	−13.1	1.38
269	207.3	10.2	120.5	30.8	34.4	0.895	0.146	22.4	323.3	269.0	234.5	−13.1	1.40
270	207.2	10.1	121.5	30.6	34.5	0.896	0.146	22.3	323.2	270.0	235.3	−13.2	1.41
271	207.1	10.1	122.5	30.4	34.6	0.897	0.146	22.3	323.1	271.0	236.2	−13.2	1.43
272	207.0	10.0	123.5	30.1	34.7	0.898	0.146	22.2	323.0	272.0	237.1	−13.2	1.44
273	206.9	10.0	124.5	29.9	34.8	0.900	0.146	22.2	322.9	273.0	238.0	−13.2	1.46

TPY_3 (#0340): Total of **173** orbits. $\lambda_O = 272°$, $\lambda_g - \lambda_O = 260.3°$, $\beta_g = -31.4°$, $\Delta r = 3°$, $\Delta \lambda_O = 10°$. TPY in the SD contains clearly two showers. Here we call TPY0, TPY1 and TPY2 in the SD as TPY_0 and TPY3 as TPY_3 in *Tables 1~3*.

Table 1 – Number per year.

Year	N	Year	N
2007	7	2013	15
2008	13	2014	19
2009	21	2015	15
2010	10	2016	9
2011	14	2017	20
2012	12	2018	18

Table 2 – Activity profiles.

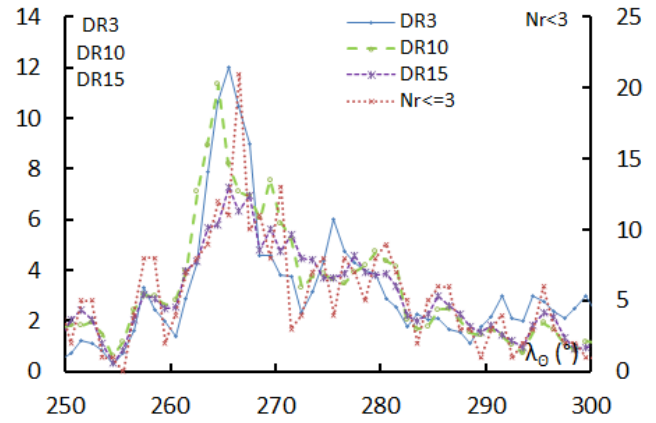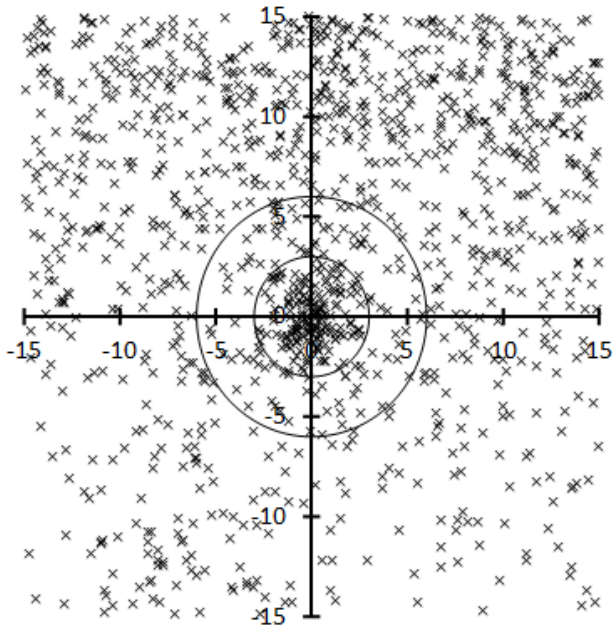|	λ_O	Max
Nr<=3	266.5	21
DR3	265.5	12.0
DR10	264.5	11.3
DR15	265.5	7.3
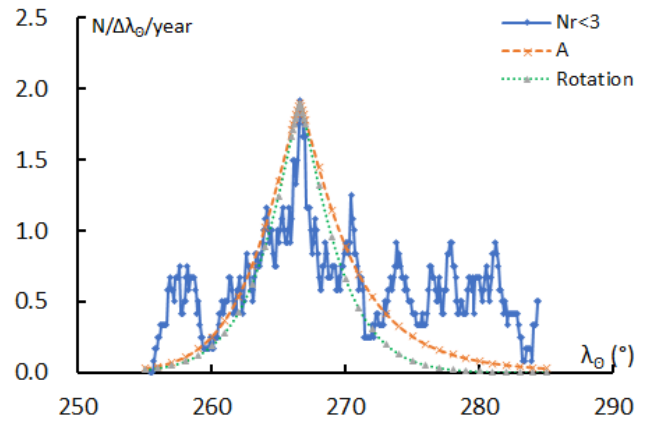
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g - \lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
255	259.1	−34.7	143.1	−22.3	61.0	0.855	0.925	118.7	29.9	75.0	59.6	25.9	6.39
256	259.2	−34.5	144.1	−22.5	61.1	0.856	0.925	119.1	29.8	76.0	60.5	25.7	6.44
257	259.3	−34.3	145.0	−22.6	61.2	0.858	0.925	119.4	29.7	77.0	61.4	25.5	6.50
258	259.3	−34.1	146.0	−22.8	61.4	0.859	0.926	119.8	29.6	78.0	62.3	25.4	6.56
259	259.4	−33.9	146.9	−23.0	61.5	0.860	0.926	120.1	29.4	79.0	63.2	25.2	6.62
260	259.5	−33.7	147.9	−23.2	61.6	0.862	0.926	120.5	29.3	80.0	64.1	25.0	6.69
261	259.5	−33.5	148.9	−23.3	61.7	0.863	0.926	120.8	29.2	81.0	65.0	24.8	6.76
262	259.6	−33.3	149.8	−23.5	61.9	0.864	0.927	121.2	29.1	82.0	65.9	24.6	6.83
263	259.6	−33.1	150.8	−23.7	62.0	0.866	0.927	121.5	29.0	83.0	66.8	24.4	6.91
264	259.7	−33.0	151.8	−23.9	62.1	0.867	0.927	121.9	28.9	84.0	67.8	24.2	6.99
265	259.8	−32.8	152.7	−24.1	62.2	0.869	0.928	122.3	28.8	85.0	68.7	24.0	7.08
266	259.8	−32.6	153.7	−24.3	62.4	0.871	0.928	122.6	28.6	86.0	69.6	23.8	7.18
266.1	259.8	−32.5	153.8	−24.3	62.4	0.871	0.928	122.6	28.6	86.1	69.7	23.8	7.19
266.2	259.8	−32.5	153.9	−24.4	62.4	0.871	0.928	122.7	28.6	86.2	69.8	23.8	7.20
266.3	259.8	−32.5	154.0	−24.4	62.4	0.871	0.928	122.7	28.6	86.3	69.9	23.8	7.21
266.4	259.9	−32.5	154.1	−24.4	62.4	0.871	0.928	122.8	28.6	86.4	70.0	23.7	7.22
266.5	259.9	−32.5	154.2	−24.4	62.4	0.872	0.928	122.8	28.6	86.5	70.1	23.7	7.23
266.6	259.9	−32.4	154.3	−24.4	62.5	0.872	0.928	122.8	28.6	86.6	70.2	23.7	7.24
266.7	259.9	−32.4	154.4	−24.5	62.5	0.872	0.928	122.9	28.6	86.7	70.2	23.7	7.25
266.8	259.9	−32.4	154.5	−24.5	62.5	0.872	0.928	122.9	28.5	86.8	70.3	23.7	7.26
266.9	259.9	−32.4	154.6	−24.5	62.5	0.872	0.928	122.9	28.5	86.9	70.4	23.6	7.27

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
267	259.9	−32.4	154.7	−24.5	62.5	0.872	0.928	123.0	28.5	87.0	70.5	23.6	7.28
268	259.9	−32.2	155.7	−24.7	62.6	0.874	0.929	123.3	28.4	88.0	71.5	23.4	7.38
269	260.0	−32.0	156.7	−24.9	62.8	0.876	0.929	123.7	28.3	89.0	72.4	23.2	7.49
270	260.1	−31.8	157.7	−25.1	62.9	0.878	0.929	124.0	28.1	90.0	73.3	23.0	7.61
271	260.1	−31.6	158.7	−25.4	63.0	0.880	0.930	124.4	28.0	91.0	74.3	22.8	7.74
272	260.2	−31.4	159.6	−25.6	63.1	0.882	0.930	124.8	27.9	92.0	75.2	22.6	7.87
273	260.2	−31.2	160.6	−25.8	63.3	0.884	0.930	125.1	27.7	93.0	76.2	22.4	8.02
274	260.3	−31.0	161.6	−26.0	63.4	0.886	0.931	125.5	27.6	94.0	77.1	22.2	8.17
275	260.4	−30.8	162.7	−26.3	63.5	0.888	0.931	125.8	27.5	95.0	78.1	22.0	8.33
276	260.4	−30.6	163.7	−26.5	63.6	0.891	0.932	126.2	27.3	96.0	79.0	21.8	8.51
277	260.5	−30.4	164.7	−26.7	63.8	0.893	0.932	126.6	27.2	97.0	80.0	21.5	8.70
278	260.5	−30.2	165.7	−26.9	63.9	0.895	0.933	126.9	27.1	98.0	80.9	21.3	8.90
279	260.6	−30.0	166.7	−27.2	64.0	0.898	0.933	127.3	26.9	99.0	81.9	21.1	9.12
280	260.7	−29.8	167.7	−27.4	64.2	0.900	0.933	127.6	26.8	100.0	82.9	20.9	9.35
281	260.7	−29.6	168.7	−27.7	64.3	0.903	0.934	128.0	26.6	101.0	83.8	20.7	9.61
282	260.8	−29.5	169.8	−27.9	64.4	0.905	0.934	128.4	26.5	102.0	84.8	20.5	9.88
283	260.8	−29.3	170.8	−28.1	64.5	0.908	0.935	128.7	26.3	103.0	85.8	20.2	10.18
284	260.9	−29.1	171.8	−28.4	64.7	0.911	0.935	129.1	26.2	104.0	86.8	20.0	10.50
285	260.9	−28.9	172.9	−28.6	64.8	0.914	0.936	129.5	26.0	105.0	87.8	19.8	10.85
286	261.0	−28.7	173.9	−28.9	64.9	0.917	0.936	129.8	25.9	106.0	88.7	19.6	11.24
287	261.1	−28.5	175.0	−29.1	65.0	0.920	0.937	130.2	25.7	107.0	89.7	19.4	11.67
288	261.1	−28.3	176.0	−29.3	65.2	0.923	0.937	130.5	25.6	108.0	90.7	19.1	12.14

COM (#0020): Total of **4092** orbits. $\lambda_\Theta = 280°$, $\lambda_g - \lambda_\Theta = 242.3°$, $\beta_g = 20.1°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 40°$. COM (#0020), DLM (#0032), JCO (#0090) and FEV (#0506) are wrapped up in COM, though DLM is rejected now in the SD. The activity period seems to be over 70 degrees and too long for a meteor shower having such high inclination orbit. The name of COM is not suitable for this activity, because the maximum coincides with the former DLM.
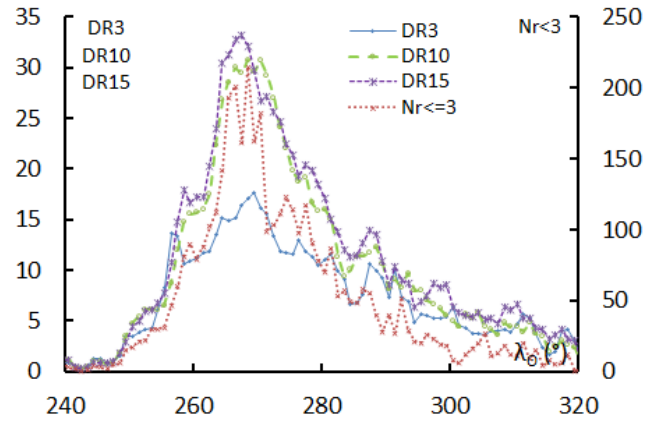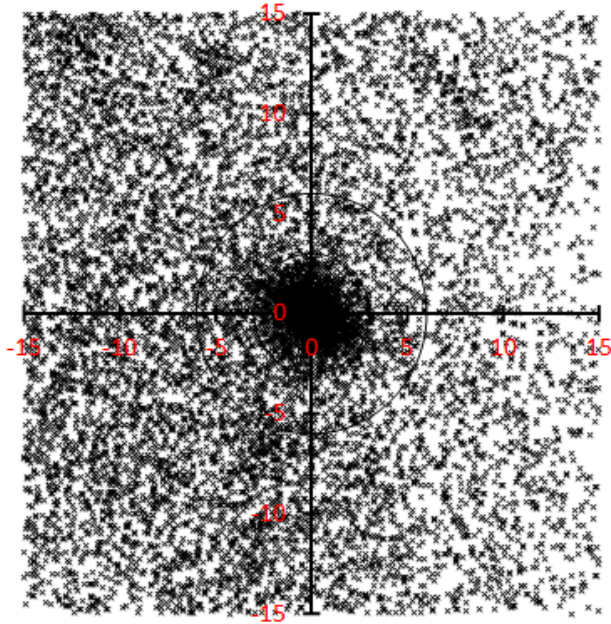
Table 1 – Number per year.

Year	N	Year	N
2007	220	2013	335
2008	374	2014	322
2009	372	2015	282
2010	377	2016	342
2011	406	2017	446
2012	286	2018	330

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	268.5	215
DR3	269.5	17.6
DR10	270.5	30.8
DR15	267.5	33.3
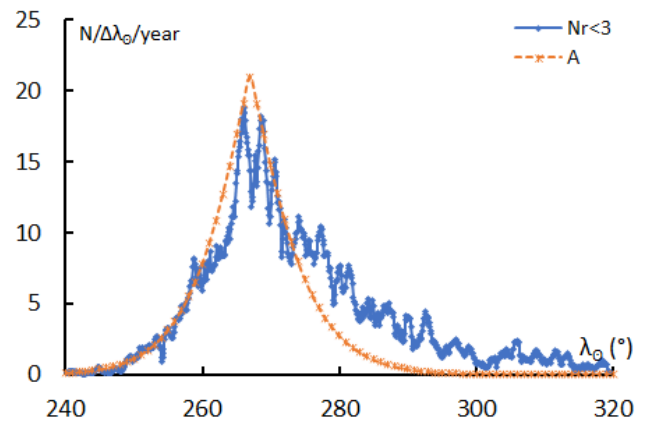
Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
240	244.3	22.9	133.7	41.3	63.2	0.978	0.615	132.1	256.3	240.0	350.0	–46.1	27.61
241	244.2	22.9	134.7	41.0	63.2	0.977	0.613	132.2	256.6	241.0	350.6	–46.1	26.17
242	244.2	22.8	135.8	40.7	63.2	0.975	0.611	132.3	256.8	242.0	351.2	–46.1	24.88
243	244.1	22.7	136.9	40.3	63.2	0.974	0.609	132.4	257.1	243.0	351.8	–46.1	23.72
244	244.1	22.7	137.9	40.0	63.2	0.973	0.607	132.4	257.4	244.0	352.4	–46.1	22.68
245	244.0	22.6	139.0	39.6	63.2	0.972	0.605	132.5	257.6	245.0	353.0	–46.1	21.72
246	243.9	22.5	140.0	39.3	63.2	0.971	0.602	132.6	257.9	246.0	353.6	–46.0	20.85
247	243.9	22.5	141.1	38.9	63.2	0.970	0.600	132.7	258.2	247.0	354.2	–46.0	20.06
248	243.8	22.4	142.1	38.6	63.2	0.969	0.598	132.7	258.4	248.0	354.8	–46.0	19.32
249	243.8	22.3	143.1	38.2	63.2	0.968	0.596	132.8	258.7	249.0	355.4	–46.0	18.65
250	243.7	22.3	144.1	37.8	63.2	0.967	0.594	132.9	258.9	250.0	356.0	–46.0	18.02
251	243.7	22.2	145.1	37.5	63.1	0.966	0.592	133.0	259.2	251.0	356.6	–46.0	17.44
252	243.6	22.1	146.1	37.1	63.1	0.965	0.590	133.0	259.5	252.0	357.2	–45.9	16.91
253	243.6	22.0	147.1	36.7	63.1	0.964	0.588	133.1	259.7	253.0	357.8	–45.9	16.41
254	243.5	22.0	148.1	36.3	63.1	0.963	0.586	133.2	260.0	254.0	358.5	–45.9	15.94
255	243.5	21.9	149.1	35.9	63.1	0.962	0.584	133.3	260.3	255.0	359.1	–45.9	15.50
256	243.4	21.8	150.1	35.6	63.1	0.961	0.582	133.3	260.5	256.0	359.7	–45.8	15.09
257	243.4	21.8	151.0	35.2	63.1	0.961	0.580	133.4	260.8	257.0	0.3	–45.8	14.70
258	243.3	21.7	152.0	34.8	63.1	0.960	0.578	133.5	261.0	258.0	0.9	–45.8	14.34

Table 3 – Continued, evolution of the orbital parameters during the activity period.

| λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
259	243.3	21.6	153.0	34.4	63.1	0.959	0.576	133.6	261.3	259.0	1.5	−45.7	14.00
260	243.2	21.6	153.9	34.0	63.1	0.958	0.574	133.7	261.6	260.0	2.1	−45.7	13.68
261	243.2	21.5	154.9	33.6	63.1	0.957	0.572	133.7	261.8	261.0	2.8	−45.6	13.37
262	243.1	21.4	155.8	33.2	63.1	0.956	0.570	133.8	262.1	262.0	3.4	−45.6	13.08
263	243.1	21.4	156.7	32.7	63.0	0.956	0.568	133.9	262.3	263.0	4.0	−45.6	12.81
264	243.0	21.3	157.7	32.3	63.0	0.955	0.566	134.0	262.6	264.0	4.6	−45.5	12.55
265	243.0	21.2	158.6	31.9	63.0	0.954	0.564	134.1	262.8	265.0	5.3	−45.5	12.31
266	242.9	21.1	159.5	31.5	63.0	0.953	0.562	134.1	263.1	266.0	5.9	−45.4	12.08
267	242.9	21.1	160.4	31.1	63.0	0.953	0.560	134.2	263.3	267.0	6.5	−45.4	11.85
268	242.8	21.0	161.4	30.7	63.0	0.952	0.558	134.3	263.6	268.0	7.1	−45.3	11.64
269	242.8	20.9	162.3	30.2	63.0	0.951	0.556	134.4	263.8	269.0	7.8	−45.3	11.44
270	242.7	20.9	163.2	29.8	63.0	0.951	0.554	134.5	264.1	270.0	8.4	−45.2	11.25
271	242.7	20.8	164.1	29.4	63.0	0.950	0.552	134.6	264.3	271.0	9.0	−45.2	11.07
272	242.6	20.7	165.0	29.0	63.0	0.950	0.550	134.6	264.6	272.0	9.7	−45.1	10.90
273	242.6	20.7	165.9	28.5	63.0	0.949	0.548	134.7	264.8	273.0	10.3	−45.0	10.73
274	242.5	20.6	166.7	28.1	63.0	0.948	0.546	134.8	265.1	274.0	11.0	−45.0	10.57
275	242.5	20.5	167.6	27.7	62.9	0.948	0.544	134.9	265.3	275.0	11.6	−44.9	10.42
276	242.4	20.5	168.5	27.2	62.9	0.947	0.542	135.0	265.6	276.0	12.2	−44.8	10.27
277	242.4	20.4	169.4	26.8	62.9	0.947	0.540	135.1	265.8	277.0	12.9	−44.8	10.14
278	242.3	20.3	170.2	26.4	62.9	0.946	0.538	135.2	266.1	278.0	13.5	−44.7	10.00
279	242.3	20.2	171.1	25.9	62.9	0.946	0.536	135.2	266.3	279.0	14.2	−44.6	9.88
280	242.2	20.2	172.0	25.5	62.9	0.945	0.534	135.3	266.5	280.0	14.8	−44.6	9.75
281	242.2	20.1	172.8	25.1	62.9	0.945	0.532	135.4	266.8	281.0	15.5	−44.5	9.64
282	242.1	20.0	173.7	24.6	62.9	0.944	0.530	135.5	267.0	282.0	16.2	−44.4	9.53
283	242.1	20.0	174.6	24.2	62.9	0.944	0.529	135.6	267.3	283.0	16.8	−44.3	9.42
284	242.0	19.9	175.4	23.7	62.9	0.943	0.527	135.7	267.5	284.0	17.5	−44.3	9.32
285	242.0	19.8	176.3	23.3	62.9	0.943	0.525	135.8	267.7	285.0	18.1	−44.2	9.22
286	241.9	19.8	177.1	22.9	62.9	0.943	0.523	135.9	268.0	286.0	18.8	−44.1	9.12
287	241.9	19.7	178.0	22.4	62.8	0.942	0.521	136.0	268.2	287.0	19.5	−44.0	9.03
288	241.8	19.6	178.8	22.0	62.8	0.942	0.519	136.0	268.5	288.0	20.2	−43.9	8.95
289	241.8	19.5	179.7	21.5	62.8	0.942	0.517	136.1	268.7	289.0	20.8	−43.8	8.86
290	241.7	19.5	180.5	21.1	62.8	0.941	0.516	136.2	268.9	290.0	21.5	−43.8	8.78
291	241.7	19.4	181.3	20.7	62.8	0.941	0.514	136.3	269.1	291.0	22.2	−43.7	8.71
292	241.6	19.3	182.2	20.2	62.8	0.941	0.512	136.4	269.4	292.0	22.9	−43.6	8.63
293	241.6	19.3	183.0	19.8	62.8	0.940	0.510	136.5	269.6	293.0	23.5	−43.5	8.56
294	241.5	19.2	183.8	19.3	62.8	0.940	0.508	136.6	269.8	294.0	24.2	−43.4	8.50
295	241.5	19.1	184.7	18.9	62.8	0.940	0.506	136.7	270.1	295.0	24.9	−43.3	8.43
296	241.4	19.1	185.5	18.5	62.8	0.940	0.505	136.8	270.3	296.0	25.6	−43.2	8.37
297	241.4	19.0	186.3	18.0	62.8	0.939	0.503	136.9	270.5	297.0	26.3	−43.1	8.31
298	241.3	18.9	187.2	17.6	62.7	0.939	0.501	137.0	270.7	298.0	27.0	−43.0	8.25
299	241.3	18.9	188.0	17.1	62.7	0.939	0.499	137.1	271.0	299.0	27.7	−42.9	8.20
300	241.2	18.8	188.8	16.7	62.7	0.939	0.498	137.2	271.2	300.0	28.4	−42.8	8.15
301	241.2	18.7	189.6	16.3	62.7	0.939	0.496	137.3	271.4	301.0	29.1	−42.7	8.10
302	241.1	18.6	190.5	15.8	62.7	0.939	0.494	137.4	271.6	302.0	29.8	−42.6	8.05
303	241.1	18.6	191.3	15.4	62.7	0.938	0.492	137.5	271.9	303.0	30.5	−42.5	8.00
304	241.0	18.5	192.1	15.0	62.7	0.938	0.491	137.6	272.1	304.0	31.2	−42.4	7.96
305	241.0	18.4	192.9	14.5	62.7	0.938	0.489	137.7	272.3	305.0	31.9	−42.3	7.92

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ☉	λg–λ☉	βg	αg	δg	vg	e	q	i	ω	Ω	λΠ	βΠ	a
306	240.9	18.4	193.7	14.1	62.7	0.938	0.487	137.8	272.5	306.0	32.6	–42.2	7.88
307	240.9	18.3	194.6	13.7	62.7	0.938	0.485	137.9	272.7	307.0	33.3	–42.1	7.85
308	240.8	18.2	195.4	13.2	62.7	0.938	0.484	138.0	272.9	308.0	34.0	–42.0	7.81
309	240.8	18.2	196.2	12.8	62.7	0.938	0.482	138.1	273.2	309.0	34.8	–41.9	7.78
310	240.7	18.1	197.0	12.4	62.6	0.938	0.480	138.2	273.4	310.0	35.5	–41.8	7.75
311	240.7	18.0	197.8	12.0	62.6	0.938	0.479	138.3	273.6	311.0	36.2	–41.6	7.72
312	240.6	17.9	198.7	11.5	62.6	0.938	0.477	138.4	273.8	312.0	36.9	–41.5	7.69
313	240.6	17.9	199.5	11.1	62.6	0.938	0.475	138.5	274.0	313.0	37.7	–41.4	7.66
314	240.5	17.8	200.3	10.7	62.6	0.938	0.473	138.6	274.2	314.0	38.4	–41.3	7.64
315	240.5	17.7	201.1	10.3	62.6	0.938	0.472	138.7	274.4	315.0	39.1	–41.2	7.62
316	240.4	17.7	201.9	9.9	62.6	0.938	0.470	138.8	274.6	316.0	39.9	–41.1	7.60
317	240.4	17.6	202.8	9.4	62.6	0.938	0.469	138.9	274.8	317.0	40.6	–41.0	7.58
318	240.3	17.5	203.6	9.0	62.6	0.938	0.467	139.0	275.0	318.0	41.3	–40.8	7.56
319	240.3	17.5	204.4	8.6	62.6	0.938	0.465	139.1	275.2	319.0	42.1	–40.7	7.54
320	240.2	17.4	205.2	8.2	62.6	0.938	0.464	139.2	275.5	320.0	42.8	–40.6	7.53

DSV (#0428): Total of **615** orbits. $\lambda_O = 270°$, $\lambda_g - \lambda_O = 293.7°$, $\beta_g = 14.8°$, $\Delta r = 3°$, $\Delta\lambda_O = 30°$. JPV (#0500) and EPV (#5013) should be included into this DSV activity. The activity curve looks like a plane convex lens and the maximum is unclear.
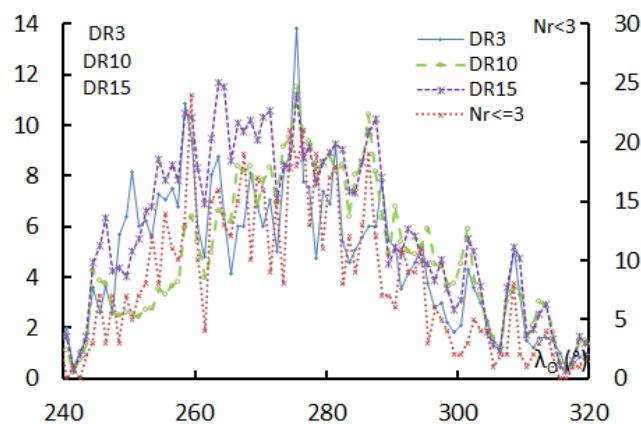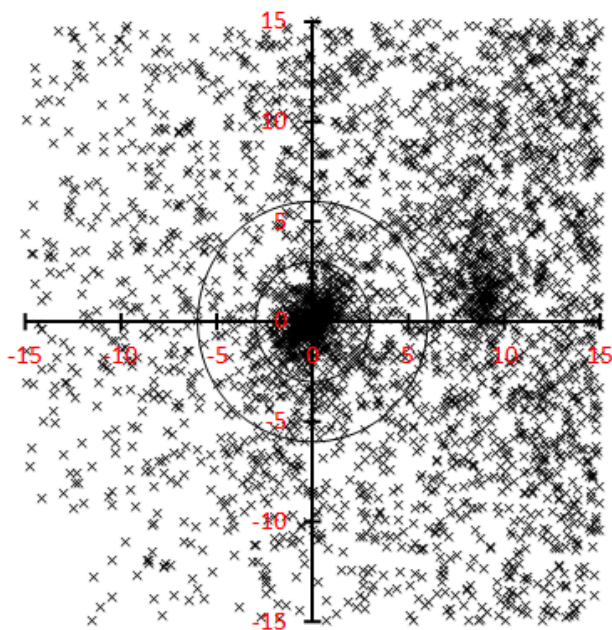

Table 1 – Number per year.

Year	N	Year	N
2007	33	2013	49
2008	59	2014	46
2009	50	2015	48
2010	55	2016	44
2011	78	2017	63
2012	39	2018	51

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	259.5	24
DR3	275.5	13.8
DR10	275.5	11.5
DR15	263.5	11.7
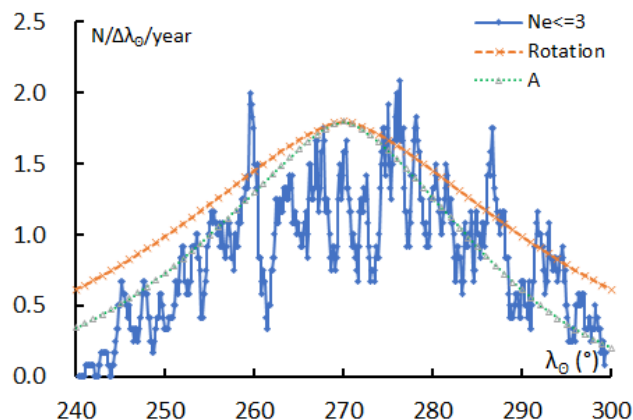
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
240	297.3	11.5	182.2	11.6	66.1	0.998	0.511	154.3	91.9	240.0	147.9	25.7	247.2
241	297.2	11.6	183.0	11.4	66.1	0.996	0.514	154.1	92.2	241.0	148.5	25.9	137.9
242	297.1	11.8	183.9	11.1	66.1	0.995	0.517	153.9	92.5	242.0	149.2	26.1	96.10
243	296.9	11.9	184.7	10.9	66.1	0.993	0.520	153.7	92.9	243.0	149.8	26.2	74.01
244	296.8	12.0	185.6	10.7	66.1	0.991	0.523	153.5	93.2	244.0	150.4	26.4	60.35
245	296.7	12.1	186.4	10.4	66.1	0.990	0.526	153.4	93.6	245.0	151.0	26.6	51.08
246	296.6	12.2	187.2	10.2	66.1	0.988	0.530	153.2	93.9	246.0	151.6	26.7	44.37
247	296.4	12.3	188.1	9.9	66.1	0.986	0.533	153.0	94.2	247.0	152.3	26.9	39.30
248	296.3	12.4	188.9	9.7	66.1	0.985	0.536	152.8	94.6	248.0	152.9	27.1	35.33
249	296.2	12.5	189.7	9.4	66.1	0.983	0.539	152.7	94.9	249.0	153.5	27.2	32.14
250	296.0	12.6	190.6	9.2	66.1	0.982	0.542	152.5	95.3	250.0	154.1	27.4	29.52
251	295.9	12.7	191.4	8.9	66.1	0.980	0.546	152.3	95.6	251.0	154.7	27.5	27.33
252	295.8	12.8	192.3	8.7	66.1	0.978	0.549	152.2	96.0	252.0	155.3	27.7	25.48
253	295.7	13.0	193.1	8.5	66.1	0.977	0.552	152.0	96.3	253.0	155.8	27.8	23.88
254	295.5	13.1	193.9	8.2	66.1	0.975	0.555	151.8	96.7	254.0	156.4	28.0	22.51
255	295.4	13.2	194.7	8.0	66.1	0.974	0.559	151.7	97.0	255.0	157.0	28.1	21.30
256	295.3	13.3	195.6	7.8	66.1	0.972	0.562	151.5	97.4	256.0	157.6	28.3	20.24
257	295.2	13.4	196.4	7.5	66.1	0.971	0.565	151.3	97.8	257.0	158.2	28.4	19.30
258	295.0	13.5	197.2	7.3	66.1	0.969	0.569	151.2	98.1	258.0	158.8	28.5	18.45
259	294.9	13.6	198.1	7.1	66.1	0.968	0.572	151.0	98.5	259.0	159.3	28.7	17.70
260	294.8	13.7	198.9	6.8	66.1	0.966	0.575	150.8	98.9	260.0	159.9	28.8	17.01

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
261	294.6	13.8	199.7	6.6	66.1	0.965	0.579	150.7	99.2	261.0	160.5	28.9	16.40
262	294.5	13.9	200.6	6.4	66.1	0.963	0.582	150.5	99.6	262.0	161.0	29.0	15.83
263	294.4	14.0	201.4	6.2	66.1	0.962	0.585	150.3	100.0	263.0	161.6	29.2	15.32
264	294.3	14.1	202.2	5.9	66.1	0.960	0.589	150.2	100.3	264.0	162.1	29.3	14.85
265	294.1	14.3	203.0	5.7	66.1	0.959	0.592	150.0	100.7	265.0	162.7	29.4	14.42
266	294.0	14.4	203.9	5.5	66.1	0.958	0.595	149.9	101.1	266.0	163.2	29.5	14.02
267	293.9	14.5	204.7	5.3	66.1	0.956	0.599	149.7	101.5	267.0	163.8	29.6	13.65
268	293.7	14.6	205.5	5.1	66.1	0.955	0.602	149.6	101.9	268.0	164.3	29.7	13.31
269	293.6	14.7	206.3	4.9	66.1	0.953	0.606	149.4	102.3	269.0	164.8	29.8	12.99
270	293.5	14.8	207.2	4.6	66.1	0.952	0.609	149.2	102.6	270.0	165.4	29.9	12.70
271	293.4	14.9	208.0	4.4	66.1	0.951	0.612	149.1	103.0	271.0	165.9	30.0	12.43
272	293.2	15.0	208.8	4.2	66.1	0.949	0.616	148.9	103.4	272.0	166.4	30.1	12.17
273	293.1	15.1	209.6	4.0	66.1	0.948	0.619	148.8	103.8	273.0	166.9	30.2	11.94
274	293.0	15.2	210.5	3.8	66.1	0.947	0.623	148.6	104.2	274.0	167.5	30.3	11.72
275	292.8	15.3	211.3	3.6	66.1	0.946	0.626	148.5	104.6	275.0	168.0	30.4	11.51
276	292.7	15.4	212.1	3.4	66.1	0.944	0.630	148.3	105.0	276.0	168.5	30.5	11.32
277	292.6	15.5	212.9	3.2	66.1	0.943	0.633	148.2	105.4	277.0	169.0	30.6	11.14
278	292.4	15.6	213.8	3.1	66.1	0.942	0.637	148.0	105.8	278.0	169.5	30.6	10.97
279	292.3	15.8	214.6	2.9	66.1	0.941	0.640	147.9	106.2	279.0	170.0	30.7	10.81
280	292.2	15.9	215.4	2.7	66.1	0.940	0.644	147.7	106.7	280.0	170.5	30.8	10.66
281	292.1	16.0	216.2	2.5	66.1	0.939	0.647	147.6	107.1	281.0	171.0	30.8	10.52
282	291.9	16.1	217.1	2.3	66.1	0.937	0.650	147.4	107.5	282.0	171.5	30.9	10.39
283	291.8	16.2	217.9	2.2	66.1	0.936	0.654	147.3	107.9	283.0	172.0	31.0	10.27
284	291.7	16.3	218.7	2.0	66.1	0.935	0.657	147.1	108.3	284.0	172.5	31.0	10.15
285	291.5	16.4	219.5	1.8	66.1	0.934	0.661	147.0	108.7	285.0	173.0	31.1	10.05
286	291.4	16.5	220.4	1.7	66.1	0.933	0.665	146.8	109.2	286.0	173.4	31.1	9.95
287	291.3	16.6	221.2	1.5	66.1	0.932	0.668	146.7	109.6	287.0	173.9	31.2	9.85
288	291.1	16.7	222.0	1.3	66.1	0.931	0.672	146.5	110.0	288.0	174.4	31.2	9.77
289	291.0	16.8	222.8	1.2	66.1	0.930	0.675	146.4	110.5	289.0	174.9	31.2	9.69
290	290.9	16.9	223.7	1.0	66.1	0.929	0.679	146.3	110.9	290.0	175.3	31.3	9.61
291	290.7	17.0	224.5	0.9	66.1	0.928	0.682	146.1	111.3	291.0	175.8	31.3	9.54
292	290.6	17.1	225.3	0.7	66.1	0.928	0.686	146.0	111.8	292.0	176.3	31.3	9.47
293	290.5	17.2	226.1	0.6	66.1	0.927	0.689	145.8	112.2	293.0	176.7	31.3	9.41
294	290.3	17.3	226.9	0.5	66.1	0.926	0.693	145.7	112.6	294.0	177.2	31.3	9.36
295	290.2	17.5	227.8	0.3	66.1	0.925	0.696	145.5	113.1	295.0	177.7	31.4	9.31
296	290.1	17.6	228.6	0.2	66.1	0.924	0.700	145.4	113.5	296.0	178.1	31.4	9.26
297	289.9	17.7	229.4	0.1	66.1	0.924	0.703	145.3	114.0	297.0	178.6	31.4	9.22
298	289.8	17.8	230.2	0.0	66.1	0.923	0.707	145.1	114.4	298.0	179.0	31.4	9.18
299	289.7	17.9	231.1	-0.2	66.1	0.922	0.710	145.0	114.9	299.0	179.5	31.4	9.15
300	289.5	18.0	231.9	-0.3	66.1	0.922	0.714	144.9	115.3	300.0	179.9	31.4	9.12
301	289.4	18.1	232.7	-0.4	66.1	0.921	0.717	144.7	115.8	301.0	180.4	31.3	9.10
302	289.3	18.2	233.5	-0.5	66.1	0.921	0.721	144.6	116.2	302.0	180.8	31.3	9.07
303	289.1	18.3	234.4	-0.6	66.1	0.920	0.725	144.4	116.7	303.0	181.3	31.3	9.06
304	289.0	18.4	235.2	-0.7	66.1	0.919	0.728	144.3	117.2	304.0	181.7	31.3	9.04
305	288.9	18.5	236.0	-0.8	66.1	0.919	0.732	144.2	117.6	305.0	182.2	31.2	9.03

URS (#0015): Total of **390** orbits. $\lambda_\odot = 271°$, $\lambda_g–\lambda_\odot = 218.5°$, $\beta_g = 72.1°$, $\Delta r = 3°$, $\Delta\lambda_\odot = 5°$.
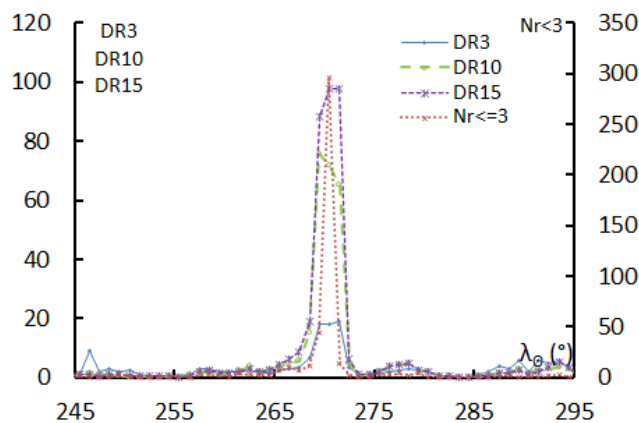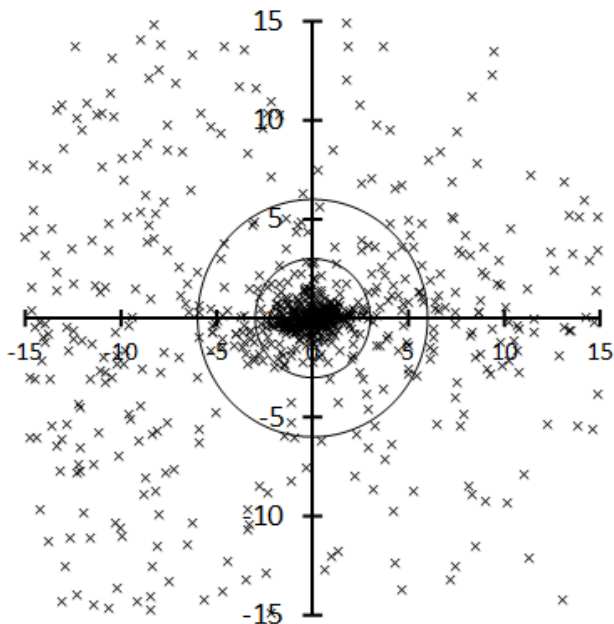
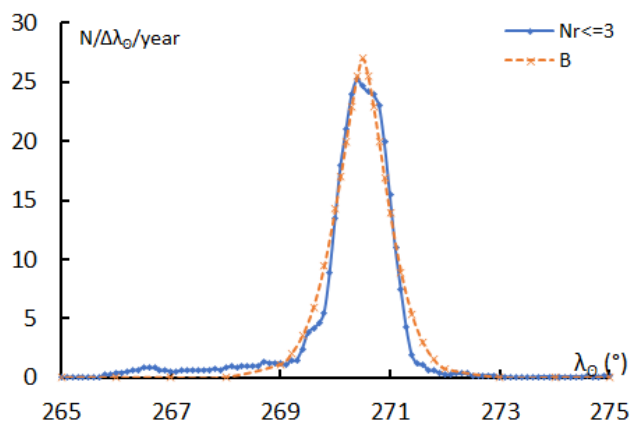*Table 1* – Number per year.

Year	N	Year	N
2007	2	2013	19
2008	11	2014	18
2009	45	2015	5
2010	45	2016	14
2011	81	2017	124
2012	6	2018	20

Table 2 – Activity profiles.

	$\lambda_\odot$	Max
Nr<=3	270.5	296
DR3	271.5	19.1
DR10	269.5	75.8
DR15	270.5	97.8

Table 3 – Evolution of the orbital parameters during the activity period.

| $\lambda_\odot$	$\lambda_g–\lambda_\odot$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
260	222.5	65.6	190.7	76.9	36.6	0.840	0.900	59.0	215.8	260.0	100.4	−30.1	5.63
261	222.2	66.2	193.7	76.8	36.3	0.837	0.904	58.4	214.8	261.0	101.0	−29.1	5.55
262	222.0	66.8	196.6	76.7	36.0	0.834	0.909	57.8	213.8	262.0	101.6	−28.1	5.48
263	221.7	67.4	199.5	76.6	35.6	0.831	0.913	57.2	212.9	263.0	102.3	−27.2	5.41
264	221.4	68.0	202.3	76.5	35.3	0.828	0.917	56.6	211.9	264.0	102.9	−26.2	5.34
265	221.1	68.6	205.0	76.3	34.9	0.825	0.921	56.0	211.0	265.0	103.5	−25.3	5.27
266	220.7	69.2	207.7	76.1	34.6	0.822	0.924	55.5	210.0	266.0	104.1	−24.3	5.21
267	220.4	69.9	210.3	76.0	34.2	0.819	0.928	54.9	209.1	267.0	104.7	−23.4	5.14
268	220.0	70.5	212.9	75.8	33.9	0.816	0.932	54.3	208.1	268.0	105.3	−22.5	5.07
269	219.6	71.1	215.4	75.6	33.6	0.813	0.935	53.7	207.2	269.0	105.9	−21.6	5.01
270	219.2	71.7	217.8	75.4	33.2	0.810	0.938	53.1	206.3	270.0	106.5	−20.8	4.94
270.1	219.2	71.7	218.1	75.4	33.2	0.810	0.938	53.0	206.2	270.1	106.6	−20.7	4.94
270.2	219.1	71.8	218.3	75.4	33.1	0.810	0.939	53.0	206.1	270.2	106.7	−20.6	4.93
270.3	219.1	71.9	218.5	75.4	33.1	0.809	0.939	52.9	206.0	270.3	106.7	−20.5	4.92
270.4	219.0	71.9	218.8	75.4	33.1	0.809	0.939	52.9	205.9	270.4	106.8	−20.4	4.92
270.5	219.0	72.0	219.0	75.3	33.0	0.809	0.940	52.8	205.9	270.5	106.8	−20.3	4.91
270.6	218.9	72.0	219.2	75.3	33.0	0.808	0.940	52.7	205.8	270.6	106.9	−20.2	4.90
270.7	218.9	72.1	219.5	75.3	33.0	0.808	0.940	52.7	205.7	270.7	106.9	−20.2	4.90
270.8	218.8	72.2	219.7	75.3	32.9	0.808	0.941	52.6	205.6	270.8	107.0	−20.1	4.89
270.9	218.8	72.2	220.0	75.3	32.9	0.807	0.941	52.6	205.5	270.9	107.1	−20.0	4.88
271	218.7	72.3	220.2	75.2	32.9	0.807	0.941	52.5	205.4	271.0	107.1	−19.9	4.88

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
272	218.3	72.9	222.5	75.1	32.5	0.804	0.944	51.9	204.5	272.0	107.7	−19.1	4.81
273	217.8	73.5	224.8	74.9	32.2	0.801	0.947	51.4	203.6	273.0	108.3	−18.2	4.75
274	217.2	74.1	227.0	74.7	31.8	0.797	0.950	50.8	202.7	274.0	108.8	−17.4	4.69
275	216.6	74.7	229.2	74.5	31.5	0.794	0.952	50.2	201.9	275.0	109.4	−16.6	4.62

SCC (#0097): Total of **135** orbits. $\lambda_O = 284.1°$, $\lambda_g-\lambda_O = 188.7°$, $\beta_g = -5.4°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$. SCC is a problematic activity in the SD. The author checked every SCC line in the SD and the activity shown below seems to be most plausible shower, although its activity profile is as unclear as the ANT behavior.
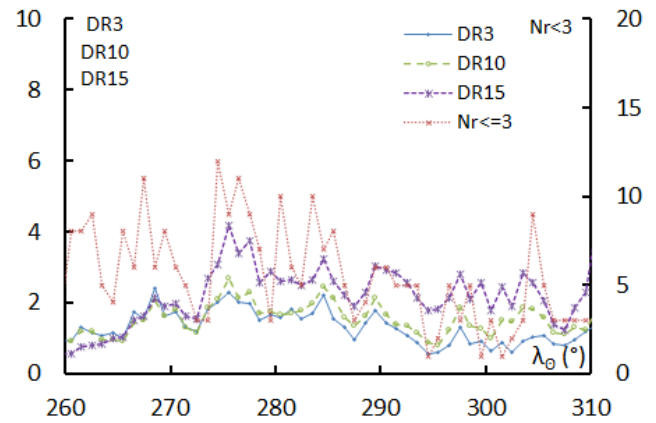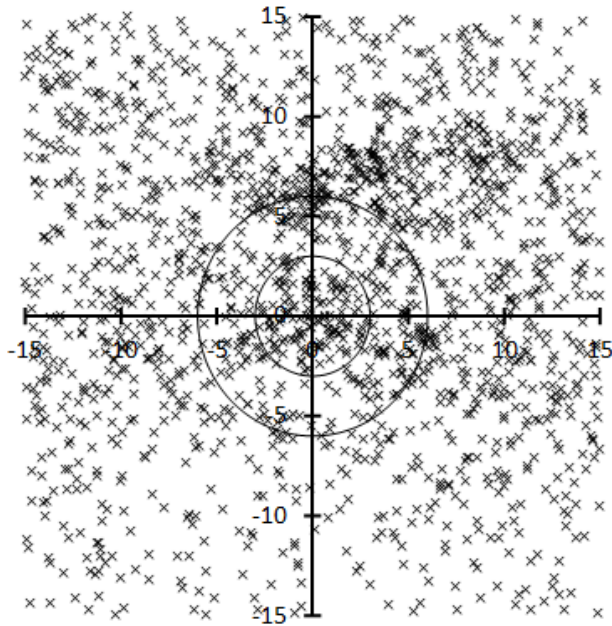
Table 1 – Number per year.

Year	N	Year	N
2007	4	2013	14
2008	13	2014	7
2009	7	2015	14
2010	8	2016	11
2011	13	2017	15
2012	10	2018	19

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	274.5	12
DR3	275.5	2.3
DR10	275.5	2.7
DR15	275.5	4.2
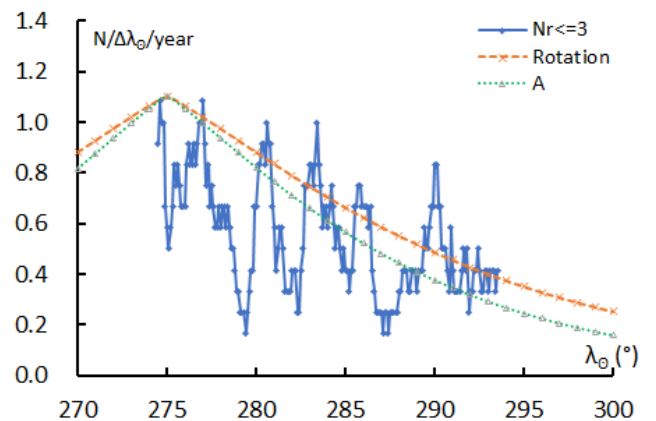
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
270	189.8	–5.7	100.3	17.4	26.7	0.799	0.406	5.9	108.8	90.0	198.9	5.6	2.02
271	189.8	–5.5	101.3	17.5	26.8	0.800	0.406	5.7	108.7	91.0	199.8	5.4	2.03
272	189.7	–5.4	102.3	17.5	26.8	0.800	0.406	5.6	108.7	92.0	200.8	5.3	2.04
273	189.7	–5.3	103.3	17.6	26.8	0.801	0.406	5.5	108.6	93.0	201.7	5.2	2.04
274	189.7	–5.2	104.3	17.6	26.9	0.802	0.407	5.3	108.6	94.0	202.6	5.1	2.05
275	189.6	–5.0	105.3	17.6	26.9	0.803	0.407	5.2	108.5	95.0	203.6	4.9	2.06
276	189.6	–4.9	106.3	17.7	26.9	0.803	0.407	5.1	108.4	96.0	204.5	4.8	2.07
277	189.5	–4.8	107.3	17.7	26.9	0.804	0.407	5.0	108.4	97.0	205.4	4.7	2.08
278	189.5	–4.6	108.3	17.7	27.0	0.805	0.407	4.8	108.3	98.0	206.4	4.6	2.09
279	189.4	–4.5	109.3	17.7	27.0	0.806	0.407	4.7	108.2	99.0	207.3	4.5	2.10
280	189.4	–4.4	110.3	17.7	27.0	0.807	0.407	4.6	108.2	100.0	208.2	4.3	2.11
281	189.4	–4.3	111.4	17.7	27.0	0.807	0.408	4.4	108.1	101.0	209.2	4.2	2.11
282	189.3	–4.1	112.4	17.7	27.1	0.808	0.408	4.3	108.0	102.0	210.1	4.1	2.12
283	189.3	–4.0	113.4	17.6	27.1	0.809	0.408	4.2	108.0	103.0	211.0	4.0	2.13
284	189.2	–3.9	114.4	17.6	27.1	0.810	0.408	4.0	107.9	104.0	212.0	3.8	2.14
285	189.2	–3.8	115.4	17.6	27.1	0.810	0.408	3.9	107.9	105.0	212.9	3.7	2.15
286	189.1	–3.6	116.4	17.5	27.2	0.811	0.408	3.8	107.8	106.0	213.8	3.6	2.16
287	189.1	–3.5	117.4	17.5	27.2	0.812	0.409	3.7	107.7	107.0	214.8	3.5	2.17
288	189.1	–3.4	118.4	17.4	27.2	0.813	0.409	3.5	107.7	108.0	215.7	3.4	2.18
289	189.0	–3.2	119.4	17.4	27.2	0.813	0.409	3.4	107.6	109.0	216.6	3.2	2.19
290	189.0	–3.1	120.4	17.3	27.3	0.814	0.409	3.3	107.5	110.0	217.6	3.1	2.20

JLE (#0319): Total of **66** orbits. $\lambda_{\Theta} = 281°$, $\lambda_g - \lambda_{\Theta} = 219.6°$, $\beta_g = 10.3°$, $\Delta r = 3°$, $\Delta\lambda_{\Theta} = 5°$.
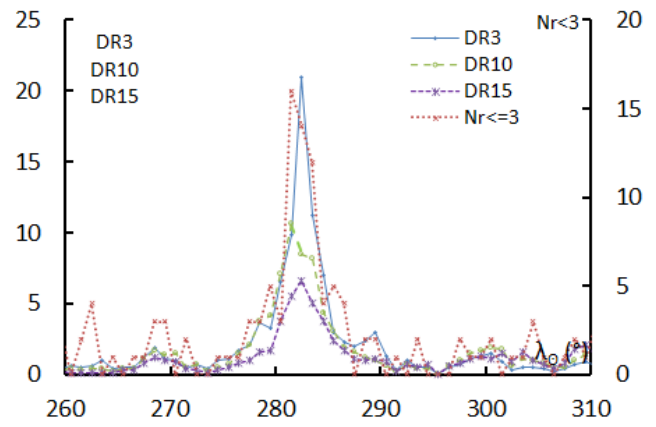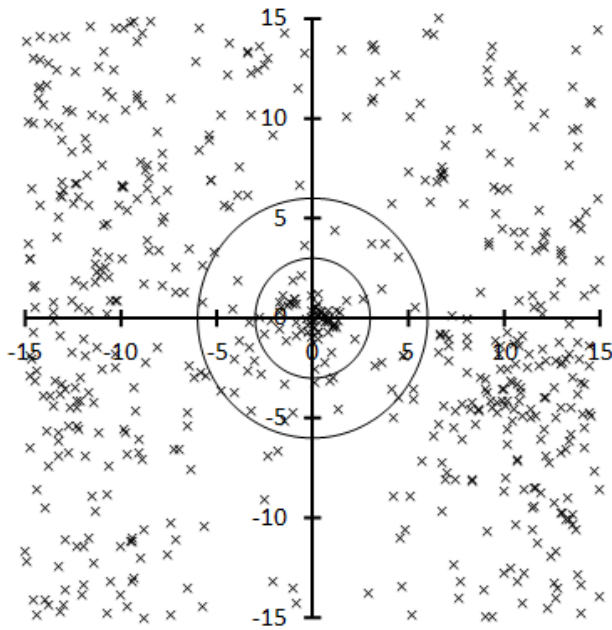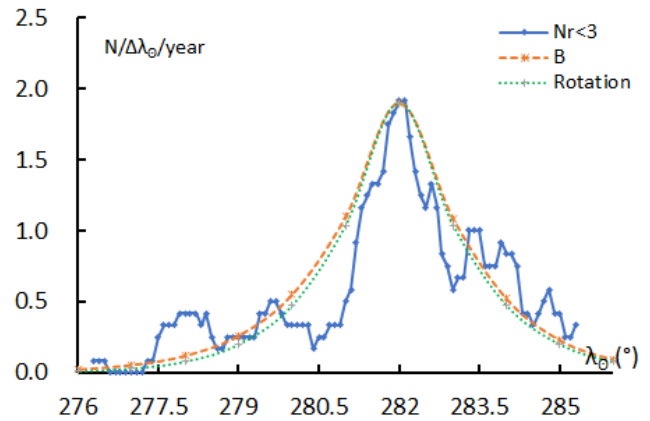

Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	8
2008	4	2014	5
2009	7	2015	4
2010	5	2016	6
2011	9	2017	5
2012	4	2018	8

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	281.5	16
DR3	282.5	21.0
DR10	281.5	10.6
DR15	282.5	6.7

Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g - \lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
270	223.5	10.7	139.4	27.0	51.4	0.976	0.062	115.3	333.8	270.0	281.9	−23.5	2.60
271	223.2	10.7	140.1	26.7	51.5	0.978	0.060	114.5	334.0	271.0	282.5	−23.5	2.72
272	222.9	10.6	140.8	26.5	51.5	0.979	0.059	113.7	334.1	272.0	283.1	−23.6	2.85
273	222.5	10.6	141.5	26.2	51.6	0.981	0.058	112.9	334.2	273.0	283.6	−23.6	3.00
274	222.2	10.5	142.2	26.0	51.6	0.982	0.057	112.1	334.4	274.0	284.2	−23.6	3.16
275	221.9	10.5	142.8	25.7	51.7	0.983	0.056	111.2	334.5	275.0	284.8	−23.7	3.34
276	221.6	10.4	143.5	25.5	51.7	0.985	0.055	110.3	334.6	276.0	285.4	−23.7	3.55
277	221.2	10.4	144.2	25.2	51.8	0.986	0.054	109.4	334.7	277.0	285.9	−23.7	3.79
278	220.9	10.3	144.9	24.9	51.8	0.987	0.053	108.5	334.9	278.0	286.5	−23.8	4.05
279	220.6	10.3	145.5	24.7	51.9	0.988	0.052	107.5	335.0	279.0	287.0	−23.8	4.37
280	220.3	10.2	146.2	24.4	51.9	0.989	0.051	106.5	335.1	280.0	287.5	−23.8	4.74
281	219.9	10.2	146.9	24.1	52.0	0.990	0.050	105.5	335.2	281.0	288.0	−23.8	5.17
282	219.6	10.1	147.5	23.9	52.0	0.991	0.049	104.5	335.3	282.0	288.6	−23.8	5.71
283	219.3	10.1	148.2	23.6	52.1	0.992	0.048	103.4	335.4	283.0	289.1	−23.9	6.36
284	219.0	10.0	148.9	23.3	52.1	0.993	0.047	102.4	335.5	284.0	289.6	−23.9	7.20
285	218.6	10.0	149.5	23.0	52.2	0.994	0.046	101.3	335.6	285.0	290.1	−23.9	8.29
286	218.3	9.9	150.2	22.8	52.2	0.995	0.046	100.1	335.7	286.0	290.5	−23.9	9.79
287	218.0	9.9	150.8	22.5	52.3	0.996	0.045	99.0	335.8	287.0	291.0	−23.9	11.95
288	217.7	9.8	151.5	22.2	52.3	0.997	0.044	97.8	335.9	288.0	291.5	−23.9	15.38
289	217.3	9.8	152.1	21.9	52.4	0.998	0.044	96.6	335.9	289.0	291.9	−23.9	21.62
290	217.0	9.7	152.8	21.6	52.4	0.999	0.043	95.3	336.0	290.0	292.4	−23.9	36.53

QUA (#0010): Total of **2404** orbits. $\lambda_{\odot} = 283.2°$, $\lambda_g - \lambda_{\odot} = 277.7°$, $\beta_g = 63.4°$, $\Delta r = 3°$, $\Delta\lambda_{\odot} = 5°$.
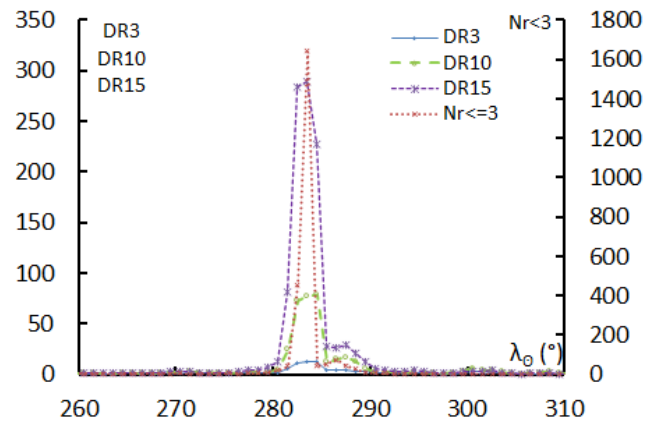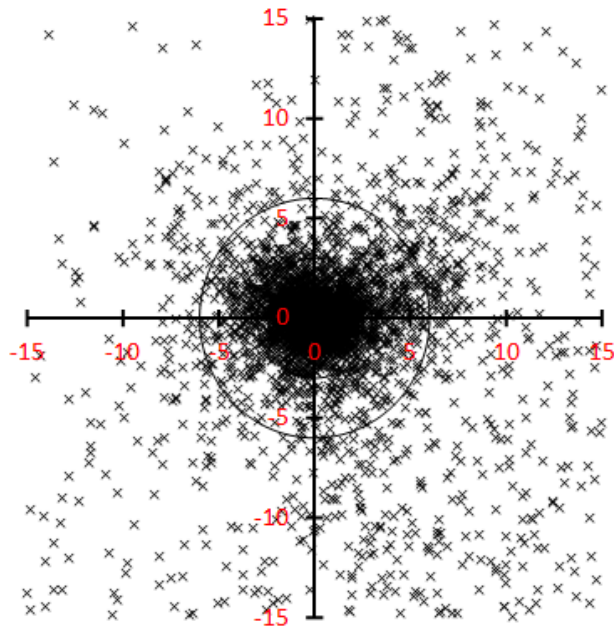
Table 1 – Number per year.

Year	N	Year	N
2007	71	2013	238
2008	124	2014	469
2009	471	2015	47
2010	138	2016	247
2011	98	2017	112
2012	159	2018	230

Table 2 – Activity profiles.

	$\lambda_{\odot}$	Max
Nr<=3	283.5	1641
DR3	284.5	13.2
DR10	284.5	78.4
DR15	283.5	289.1
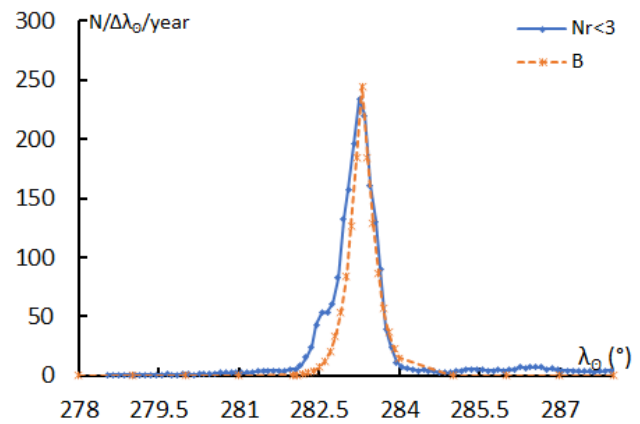
Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\odot}$	$\lambda_g - \lambda_{\odot}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
275	277.4	61.6	223.6	50.0	41.2	0.596	0.978	73.3	170.1	275.0	92.1	9.5	2.42
276	277.3	61.8	224.4	50.0	41.1	0.599	0.978	73.0	170.3	276.0	93.1	9.3	2.44
277	277.2	62.1	225.2	49.9	41.0	0.603	0.978	72.7	170.5	277.0	94.2	9.0	2.46
278	277.1	62.3	226.0	49.9	40.8	0.606	0.979	72.4	170.8	278.0	95.2	8.8	2.48
279	277.1	62.6	226.7	49.8	40.7	0.610	0.979	72.1	171.0	279.0	96.2	8.6	2.51
280	277.0	62.9	227.5	49.8	40.6	0.613	0.979	71.8	171.2	280.0	97.2	8.4	2.53
281	276.9	63.1	228.3	49.7	40.5	0.617	0.979	71.5	171.4	281.0	98.2	8.2	2.55
282	276.8	63.4	229.0	49.7	40.4	0.620	0.979	71.1	171.6	282.0	99.3	7.9	2.58
282.1	276.8	63.4	229.1	49.7	40.4	0.620	0.979	71.1	171.6	282.1	99.4	7.9	2.58
282.2	276.8	63.4	229.2	49.7	40.3	0.621	0.979	71.1	171.6	282.2	99.5	7.9	2.58
282.3	276.8	63.4	229.2	49.7	40.3	0.621	0.979	71.1	171.7	282.3	99.6	7.9	2.58
282.4	276.8	63.5	229.3	49.7	40.3	0.621	0.979	71.0	171.7	282.4	99.7	7.9	2.59
282.5	276.8	63.5	229.4	49.7	40.3	0.622	0.979	71.0	171.7	282.5	99.8	7.8	2.59
282.6	276.8	63.5	229.5	49.7	40.3	0.622	0.979	71.0	171.7	282.6	99.9	7.8	2.59
282.7	276.8	63.5	229.5	49.7	40.3	0.623	0.979	70.9	171.7	282.7	100.0	7.8	2.59
282.8	276.8	63.6	229.6	49.7	40.3	0.623	0.979	70.9	171.8	282.8	100.1	7.8	2.60
282.9	276.7	63.6	229.7	49.7	40.3	0.623	0.979	70.9	171.8	282.9	100.2	7.8	2.60
283	276.7	63.6	229.8	49.7	40.3	0.624	0.979	70.8	171.8	283.0	100.3	7.7	2.60
283.1	276.7	63.6	229.8	49.7	40.2	0.624	0.979	70.8	171.8	283.1	100.4	7.7	2.60
283.2	276.7	63.7	229.9	49.7	40.2	0.624	0.979	70.8	171.8	283.2	100.5	7.7	2.61
283.3	276.7	63.7	230.0	49.7	40.2	0.625	0.979	70.7	171.9	283.3	100.6	7.7	2.61

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g - \lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
283.4	276.7	63.7	230.0	49.7	40.2	0.625	0.980	70.7	171.9	283.4	100.7	7.7	2.61
283.5	276.7	63.8	230.1	49.7	40.2	0.625	0.980	70.7	171.9	283.5	100.8	7.6	2.61
283.6	276.7	63.8	230.2	49.6	40.2	0.626	0.980	70.7	171.9	283.6	100.9	7.6	2.62
283.7	276.7	63.8	230.3	49.6	40.2	0.626	0.980	70.6	171.9	283.7	101.0	7.6	2.62
283.8	276.7	63.8	230.3	49.6	40.2	0.626	0.980	70.6	172.0	283.8	101.1	7.6	2.62
283.9	276.7	63.9	230.4	49.6	40.1	0.627	0.980	70.6	172.0	283.9	101.2	7.6	2.62
284	276.7	63.9	230.5	49.6	40.1	0.627	0.980	70.5	172.0	284.0	101.3	7.5	2.63
285	276.6	64.1	231.2	49.6	40.0	0.631	0.980	70.2	172.2	285.0	102.3	7.3	2.65
286	276.5	64.4	232.0	49.6	39.9	0.634	0.980	69.9	172.4	286.0	103.4	7.1	2.68
287	276.4	64.6	232.7	49.6	39.8	0.638	0.980	69.6	172.6	287.0	104.4	6.9	2.70
288	276.3	64.9	233.4	49.6	39.7	0.641	0.980	69.3	172.8	288.0	105.4	6.8	2.73
289	276.2	65.2	234.1	49.6	39.5	0.645	0.980	69.0	173.0	289.0	106.5	6.6	2.76
290	276.1	65.4	234.8	49.6	39.4	0.648	0.981	68.7	173.1	290.0	107.5	6.4	2.79
291	276.0	65.7	235.5	49.6	39.3	0.651	0.981	68.4	173.3	291.0	108.5	6.2	2.81
292	275.9	65.9	236.2	49.6	39.2	0.655	0.981	68.1	173.5	292.0	109.6	6.0	2.84
293	275.8	66.2	236.9	49.6	39.1	0.658	0.981	67.8	173.7	293.0	110.6	5.8	2.87
294	275.7	66.4	237.6	49.6	39.0	0.662	0.981	67.5	173.9	294.0	111.6	5.7	2.90
295	275.6	66.7	238.2	49.7	38.8	0.665	0.982	67.2	174.0	295.0	112.7	5.5	2.93
296	275.5	66.9	238.9	49.7	38.7	0.669	0.982	66.9	174.2	296.0	113.7	5.3	2.96

AHY (#0331): Total of **264** orbits. $\lambda_{\odot} = 281.2°$, $\lambda_g–\lambda_{\odot} = 207.9°$, $\beta_g = –26.6°$, $\Delta r = 3°$, $\Delta\lambda_{\odot} = 10°$.
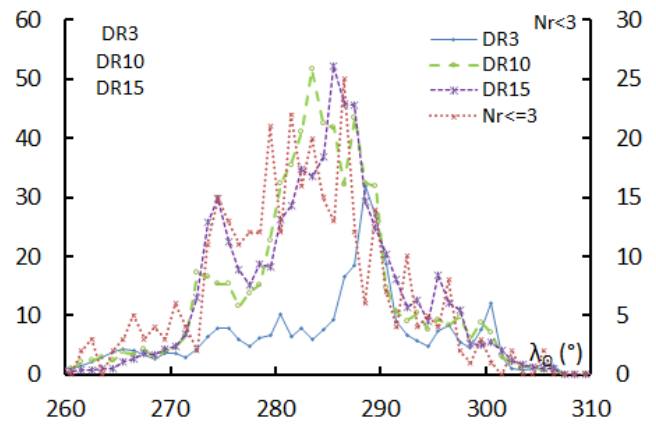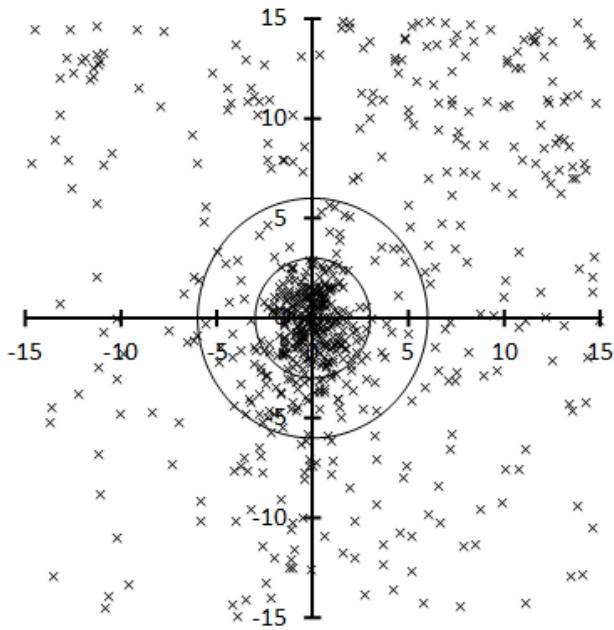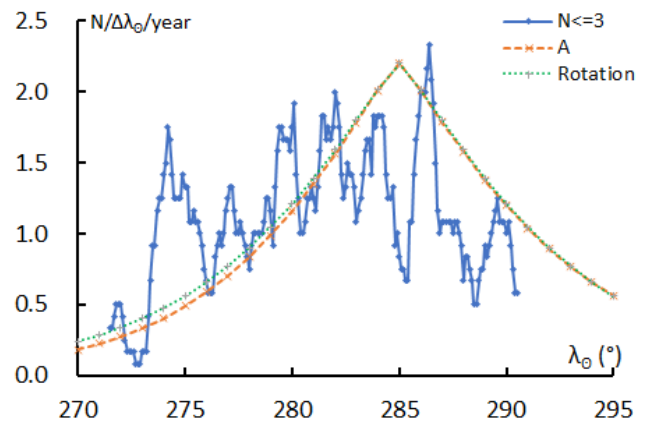

Table 1 – Number per year.

Year	N	Year	N
2007	11	2013	24
2008	18	2014	22
2009	26	2015	16
2010	27	2016	22
2011	28	2017	26
2012	15	2018	29

Table 2 – Activity profiles.

	$\lambda_{\odot}$	Max
Nr<=3	286.5	25
DR3	288.5	32.0
DR10	283.5	51.6
DR15	285.5	52.2

Table 3 – Evolution of the orbital parameters during the activity period.

$\lambda_{\odot}$	$\lambda_g–\lambda_{\odot}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
264	213.0	–26.1	114.2	–4.9	45.9	0.962	0.260	68.8	120.0	84.0	232.0	53.8	6.86
265	212.8	–26.1	114.8	–5.0	45.7	0.962	0.261	68.3	119.9	85.0	232.2	53.6	6.92
266	212.5	–26.1	115.5	–5.2	45.6	0.963	0.262	67.7	119.7	86.0	232.4	53.5	6.99
267	212.3	–26.1	116.2	–5.3	45.5	0.963	0.263	67.1	119.6	87.0	232.6	53.3	7.06
268	212.0	–26.1	116.8	–5.5	45.4	0.963	0.264	66.6	119.4	88.0	232.8	53.1	7.13
269	211.8	–26.2	117.5	–5.6	45.3	0.963	0.265	66.0	119.2	89.0	233.0	52.9	7.20
270	211.5	–26.2	118.1	–5.8	45.1	0.963	0.267	65.5	119.1	90.0	233.2	52.7	7.27
271	211.3	–26.2	118.8	–5.9	45.0	0.964	0.268	64.9	118.9	91.0	233.5	52.5	7.34
272	211.0	–26.2	119.5	–6.1	44.9	0.964	0.269	64.4	118.7	92.0	233.7	52.3	7.42
273	210.8	–26.2	120.1	–6.3	44.8	0.964	0.270	63.8	118.5	93.0	233.9	52.1	7.49
274	210.5	–26.3	120.8	–6.4	44.7	0.964	0.272	63.3	118.3	94.0	234.2	51.9	7.57
275	210.3	–26.3	121.4	–6.6	44.5	0.964	0.273	62.8	118.1	95.0	234.4	51.7	7.65
276	210.0	–26.3	122.1	–6.8	44.4	0.965	0.275	62.2	117.9	96.0	234.7	51.4	7.73
277	209.8	–26.3	122.7	–6.9	44.3	0.965	0.276	61.7	117.7	97.0	234.9	51.2	7.82
278	209.5	–26.3	123.4	–7.1	44.2	0.965	0.278	61.2	117.5	98.0	235.2	51.0	7.91
279	209.3	–26.3	124.0	–7.3	44.1	0.965	0.279	60.7	117.3	99.0	235.5	50.8	8.00
280	209.0	–26.3	124.7	–7.5	43.9	0.965	0.281	60.2	117.1	100.0	235.8	50.6	8.09
281	208.8	–26.4	125.3	–7.7	43.8	0.965	0.282	59.7	116.8	101.0	236.0	50.4	8.18
282	208.5	–26.4	126.0	–7.9	43.7	0.966	0.284	59.1	116.6	102.0	236.3	50.1	8.28
283	208.3	–26.4	126.6	–8.0	43.6	0.966	0.286	58.6	116.4	103.0	236.6	49.9	8.37
284	208.0	–26.4	127.3	–8.2	43.5	0.966	0.287	58.2	116.1	104.0	236.9	49.7	8.47

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
285	207.8	−26.4	127.9	−8.4	43.3	0.966	0.289	57.7	115.9	105.0	237.2	49.5	8.58
286	207.5	−26.4	128.6	−8.6	43.2	0.967	0.291	57.2	115.7	106.0	237.5	49.2	8.68
287	207.3	−26.4	129.2	−8.8	43.1	0.967	0.293	56.7	115.4	107.0	237.9	49.0	8.79
288	207.0	−26.5	129.9	−9.0	43.0	0.967	0.294	56.2	115.2	108.0	238.2	48.8	8.90
289	206.8	−26.5	130.5	−9.2	42.9	0.967	0.296	55.7	114.9	109.0	238.5	48.5	9.02
290	206.5	−26.5	131.2	−9.4	42.7	0.967	0.298	55.3	114.7	110.0	238.8	48.3	9.13
291	206.3	−26.5	131.8	−9.6	42.6	0.968	0.300	54.8	114.4	111.0	239.2	48.1	9.25
292	206.0	−26.5	132.5	−9.9	42.5	0.968	0.302	54.3	114.1	112.0	239.5	47.8	9.38
293	205.8	−26.5	133.1	−10.1	42.4	0.968	0.304	53.9	113.9	113.0	239.9	47.6	9.50
294	205.5	−26.5	133.8	−10.3	42.2	0.968	0.306	53.4	113.6	114.0	240.2	47.4	9.63
295	205.2	−26.5	134.4	−10.5	42.1	0.968	0.308	53.0	113.3	115.0	240.6	47.1	9.77
296	205.0	−26.5	135.0	−10.7	42.0	0.969	0.310	52.5	113.0	116.0	240.9	46.9	9.90
297	204.7	−26.5	135.7	−10.9	41.9	0.969	0.312	52.1	112.8	117.0	241.3	46.7	10.05
298	204.5	−26.5	136.3	−11.1	41.8	0.969	0.314	51.6	112.5	118.0	241.7	46.4	10.19
299	204.2	−26.6	137.0	−11.4	41.6	0.969	0.317	51.2	112.2	119.0	242.1	46.2	10.34
300	204.0	−26.6	137.6	−11.6	41.5	0.970	0.319	50.8	111.9	120.0	242.4	45.9	10.49
301	203.7	−26.6	138.3	−11.8	41.4	0.970	0.321	50.3	111.6	121.0	242.8	45.7	10.65
302	203.5	−26.6	138.9	−12.0	41.3	0.970	0.323	49.9	111.3	122.0	243.2	45.4	10.81

OLE (#0515): Total of **172** orbits. $\lambda_{\mathit{O}} = 290°$, $\lambda_g - \lambda_{\mathit{O}} = 208.0°$, $\beta_g = -6.9°$, $\Delta r = 3°$, $\Delta\lambda_{\mathit{O}} = 15°$.
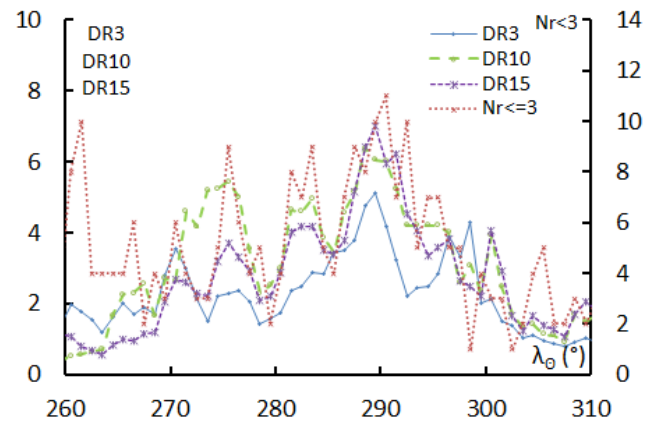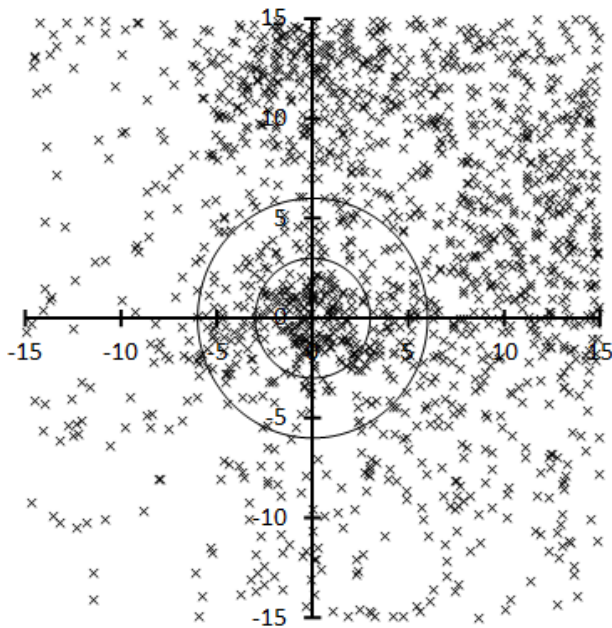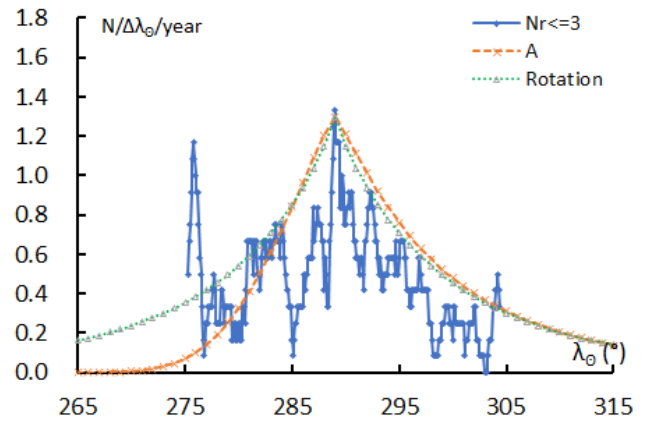

Table 1 – Number per year.

Year	N	Year	N
2007	6	2013	18
2008	11	2014	13
2009	17	2015	22
2010	10	2016	10
2011	14	2017	25
2012	9	2018	17

Table 2 – Activity profiles.

	λ_{O}	Max
Nr<=3	290.5	11
DR3	289.5	5.1
DR10	288.5	6.4
DR15	289.5	7.0

Table 3 – Evolution of the orbital parameters during the activity period.

λ_{O}	$\lambda_g-\lambda_{\mathit{O}}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
265	209.9	−9.7	115.0	11.6	37.5	0.933	0.102	28.1	149.0	85.0	237.0	14.0	1.52
266	209.8	−9.6	116.0	11.6	37.6	0.934	0.101	27.9	149.1	86.0	238.1	13.9	1.54
267	209.7	−9.4	116.9	11.5	37.8	0.936	0.100	27.8	149.1	87.0	239.1	13.9	1.57
268	209.7	−9.3	117.9	11.5	38.0	0.938	0.099	27.7	149.2	88.0	240.2	13.8	1.59
269	209.6	−9.2	118.8	11.5	38.2	0.940	0.097	27.5	149.3	89.0	241.2	13.7	1.62
270	209.5	−9.0	119.8	11.4	38.3	0.942	0.096	27.4	149.4	90.0	242.3	13.6	1.65
271	209.5	−8.9	120.7	11.4	38.5	0.943	0.095	27.3	149.4	91.0	243.3	13.5	1.68
272	209.4	−8.7	121.7	11.3	38.7	0.945	0.094	27.1	149.5	92.0	244.4	13.4	1.71
273	209.3	−8.6	122.6	11.2	38.9	0.947	0.093	26.9	149.6	93.0	245.4	13.2	1.74
274	209.3	−8.5	123.6	11.2	39.1	0.949	0.091	26.8	149.7	94.0	246.4	13.1	1.78
275	209.2	−8.3	124.5	11.1	39.2	0.950	0.090	26.6	149.8	95.0	247.5	13.0	1.82
276	209.1	−8.2	125.5	11.0	39.4	0.952	0.089	26.4	149.9	96.0	248.5	12.9	1.85
277	209.1	−8.1	126.4	10.9	39.6	0.954	0.088	26.2	150.0	97.0	249.6	12.8	1.89
278	209.0	−7.9	127.4	10.9	39.8	0.955	0.087	26.0	150.0	98.0	250.6	12.7	1.94
279	208.9	−7.8	128.3	10.8	39.9	0.957	0.086	25.8	150.1	99.0	251.7	12.5	1.98
280	208.9	−7.6	129.3	10.7	40.1	0.958	0.084	25.6	150.2	100.0	252.7	12.4	2.03
281	208.8	−7.5	130.2	10.6	40.3	0.960	0.083	25.4	150.3	101.0	253.7	12.3	2.08
282	208.7	−7.4	131.1	10.5	40.5	0.961	0.082	25.2	150.4	102.0	254.8	12.1	2.13
283	208.7	−7.2	132.1	10.3	40.6	0.963	0.081	25.0	150.5	103.0	255.8	12.0	2.19
284	208.6	−7.1	133.0	10.2	40.8	0.964	0.080	24.7	150.6	104.0	256.9	11.9	2.25
285	208.5	−6.9	134.0	10.1	41.0	0.966	0.079	24.5	150.7	105.0	257.9	11.7	2.31

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
286	208.5	–6.8	134.9	10.0	41.2	0.967	0.078	24.2	150.7	106.0	258.9	11.6	2.38
287	208.4	–6.7	135.9	9.9	41.3	0.969	0.077	24.0	150.8	107.0	260.0	11.4	2.45
288	208.3	–6.5	136.8	9.7	41.5	0.970	0.076	23.7	150.9	108.0	261.0	11.3	2.53
289	208.3	–6.4	137.7	9.6	41.7	0.971	0.075	23.5	151.0	109.0	262.1	11.1	2.62
290	208.2	–6.2	138.7	9.4	41.9	0.973	0.074	23.2	151.1	110.0	263.1	11.0	2.71
291	208.1	–6.1	139.6	9.3	42.0	0.974	0.073	22.9	151.2	111.0	264.1	10.8	2.80
292	208.1	–6.0	140.6	9.1	42.2	0.975	0.072	22.6	151.3	112.0	265.2	10.6	2.91
293	208.0	–5.8	141.5	9.0	42.4	0.977	0.071	22.3	151.4	113.0	266.2	10.5	3.02
294	207.9	–5.7	142.4	8.8	42.6	0.978	0.070	22.0	151.5	114.0	267.3	10.3	3.15
295	207.9	–5.5	143.4	8.7	42.7	0.979	0.069	21.6	151.6	115.0	268.3	10.1	3.29
296	207.8	–5.4	144.3	8.5	42.9	0.980	0.068	21.3	151.7	116.0	269.3	9.9	3.44
297	207.7	–5.3	145.2	8.3	43.1	0.981	0.067	21.0	151.8	117.0	270.4	9.7	3.61
298	207.6	–5.1	146.2	8.1	43.3	0.983	0.066	20.6	151.8	118.0	271.4	9.6	3.79
299	207.6	–5.0	147.1	8.0	43.4	0.984	0.065	20.2	151.9	119.0	272.4	9.4	4.00
300	207.5	–4.8	148.0	7.8	43.6	0.985	0.065	19.9	152.0	120.0	273.5	9.2	4.24
301	207.4	–4.7	149.0	7.6	43.8	0.986	0.064	19.5	152.1	121.0	274.5	9.0	4.50
302	207.4	–4.6	149.9	7.4	44.0	0.987	0.063	19.1	152.2	122.0	275.5	8.8	4.81
303	207.3	–4.4	150.8	7.2	44.1	0.988	0.062	18.7	152.3	123.0	276.6	8.6	5.16
304	207.2	–4.3	151.7	7.0	44.3	0.989	0.061	18.3	152.4	124.0	277.6	8.4	5.57
305	207.2	–4.1	152.7	6.8	44.5	0.990	0.060	17.9	152.5	125.0	278.6	8.2	6.05

NCC (#0096): Total of **126** orbits. $\lambda_\Theta = 290°$, $\lambda_g–\lambda_\Theta = 189.4°$, $\beta_g = 1.2°$, $\Delta r = 3°$, $\Delta\lambda_\Theta = 10°$. NCC is slightly better than SCC. The author checked every NCC line in the SD and this seems to be most plausible activity, though its activity is nearly buried under the sporadic background.
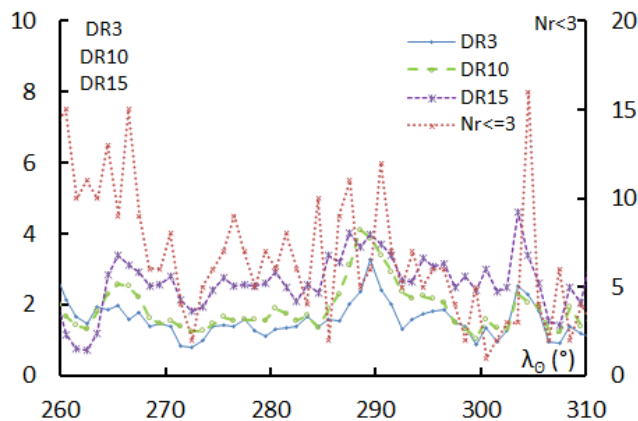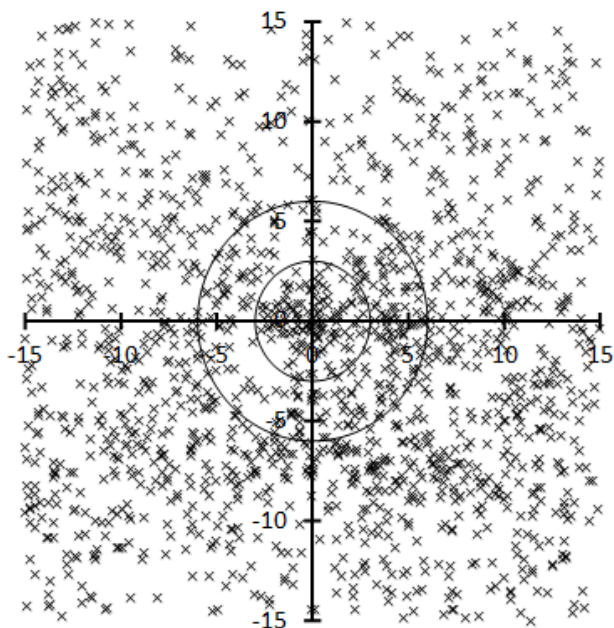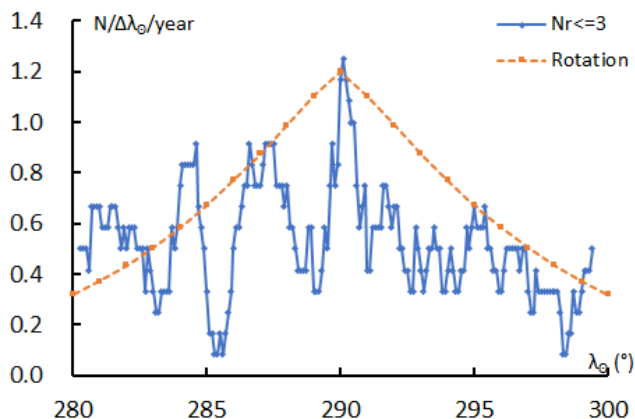

Table 1 – Number per year.

Year	N	Year	N
2007	4	2013	15
2008	10	2014	8
2009	11	2015	9
2010	9	2016	14
2011	14	2017	18
2012	6	2018	8

Table 2 – Activity profiles.

	λ_Θ	Max
Nr<=3	290.5	12.0
DR3	289.5	3.3
DR10	288.5	4.1
DR15	287.5	4.0

Table 3 – Evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g–\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
270	190.8	2.4	102.0	25.4	26.9	0.799	0.387	2.6	291.4	270.0	201.4	–2.4	1.93
271	190.7	2.4	103.0	25.3	27.0	0.800	0.388	2.6	291.3	271.0	202.3	–2.4	1.94
272	190.7	2.4	104.0	25.2	27.0	0.801	0.388	2.5	291.1	272.0	203.1	–2.4	1.95
273	190.6	2.4	105.0	25.1	27.0	0.802	0.389	2.5	291.0	273.0	204.0	–2.4	1.97
274	190.5	2.4	106.0	25.0	27.1	0.803	0.390	2.5	290.8	274.0	204.8	–2.4	1.98
275	190.4	2.4	107.1	24.9	27.1	0.804	0.390	2.5	290.7	275.0	205.7	–2.4	1.99
276	190.4	2.4	108.1	24.8	27.1	0.805	0.391	2.5	290.5	276.0	206.5	–2.4	2.01
277	190.3	2.4	109.1	24.7	27.2	0.806	0.392	2.5	290.4	277.0	207.4	–2.4	2.02
278	190.2	2.4	110.1	24.5	27.2	0.807	0.392	2.5	290.2	278.0	208.2	–2.4	2.04
279	190.2	2.3	111.1	24.4	27.2	0.808	0.393	2.5	290.1	279.0	209.1	–2.4	2.05
280	190.1	2.3	112.1	24.3	27.3	0.809	0.393	2.5	289.9	280.0	210.0	–2.3	2.06
281	190.0	2.3	113.1	24.1	27.3	0.810	0.394	2.5	289.8	281.0	210.8	–2.3	2.08
282	189.9	2.3	114.1	24.0	27.3	0.812	0.395	2.5	289.6	282.0	211.7	–2.3	2.09
283	189.9	2.3	115.1	23.8	27.4	0.813	0.395	2.5	289.5	283.0	212.5	–2.3	2.11
284	189.8	2.3	116.1	23.6	27.4	0.814	0.396	2.5	289.3	284.0	213.4	–2.3	2.13
285	189.7	2.3	117.1	23.5	27.4	0.815	0.397	2.5	289.2	285.0	214.2	–2.3	2.14
286	189.6	2.3	118.1	23.3	27.5	0.816	0.397	2.5	289.1	286.0	215.1	–2.3	2.16
287	189.6	2.3	119.1	23.1	27.5	0.817	0.398	2.5	288.9	287.0	215.9	–2.3	2.17
288	189.5	2.3	120.1	22.9	27.5	0.818	0.399	2.4	288.8	288.0	216.8	–2.3	2.19
289	189.4	2.3	121.0	22.7	27.6	0.819	0.399	2.4	288.6	289.0	217.6	–2.3	2.21

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ$_\Theta$	λ$_g$–λ$_\Theta$	β$_g$	α$_g$	δ$_g$	v$_g$	e	q	i	ω	Ω	λ$_\Pi$	β$_\Pi$	a
290	189.4	2.3	122.0	22.5	27.6	0.820	0.400	2.4	288.5	290.0	218.5	–2.3	2.23
291	189.3	2.3	123.0	22.3	27.6	0.822	0.400	2.4	288.3	291.0	219.3	–2.3	2.24
292	189.2	2.3	124.0	22.1	27.7	0.823	0.401	2.4	288.2	292.0	220.2	–2.3	2.26
293	189.1	2.3	124.9	21.9	27.7	0.824	0.402	2.4	288.0	293.0	221.1	–2.3	2.28
294	189.1	2.3	125.9	21.7	27.7	0.825	0.402	2.4	287.9	294.0	221.9	–2.3	2.30
295	189.0	2.2	126.9	21.4	27.8	0.826	0.403	2.4	287.7	295.0	222.8	–2.3	2.32
296	188.9	2.2	127.8	21.2	27.8	0.827	0.404	2.4	287.6	296.0	223.6	–2.3	2.34
297	188.8	2.2	128.8	21.0	27.8	0.829	0.404	2.4	287.5	297.0	224.5	–2.3	2.36
298	188.8	2.2	129.8	20.7	27.9	0.830	0.405	2.4	287.3	298.0	225.3	–2.3	2.38
299	188.7	2.2	130.7	20.5	27.9	0.831	0.406	2.4	287.2	299.0	226.2	–2.3	2.40
300	188.6	2.2	131.7	20.2	27.9	0.832	0.406	2.4	287.0	300.0	227.0	–2.3	2.42
301	188.6	2.2	132.6	20.0	28.0	0.834	0.407	2.4	286.9	301.0	227.9	–2.3	2.44
302	188.5	2.2	133.6	19.7	28.0	0.835	0.407	2.4	286.7	302.0	228.8	–2.3	2.47
303	188.4	2.2	134.5	19.5	28.0	0.836	0.408	2.4	286.6	303.0	229.6	–2.3	2.49
304	188.3	2.2	135.5	19.2	28.1	0.837	0.409	2.3	286.5	304.0	230.5	–2.2	2.51
305	188.3	2.2	136.4	18.9	28.1	0.839	0.409	2.3	286.3	305.0	231.3	–2.2	2.54
306	188.2	2.2	137.3	18.7	28.1	0.840	0.410	2.3	286.2	306.0	232.2	–2.2	2.56
307	188.1	2.2	138.3	18.4	28.2	0.841	0.411	2.3	286.0	307.0	233.0	–2.2	2.59
308	188.1	2.2	139.2	18.1	28.2	0.842	0.411	2.3	285.9	308.0	233.9	–2.2	2.61
309	188.0	2.2	140.1	17.8	28.3	0.844	0.412	2.3	285.7	309.0	234.8	–2.2	2.64
310	187.9	2.1	141.0	17.5	28.3	0.845	0.413	2.3	285.6	310.0	235.6	–2.2	2.66

XCB (#0323): Total of **36** orbits. $\lambda_{\Theta} = 295°$, $\lambda_g - \lambda_{\Theta} = 305.3°$, $\beta_g = 51.1°$, $\Delta r = 3°$, $\Delta\lambda_{\Theta} = 5°$.
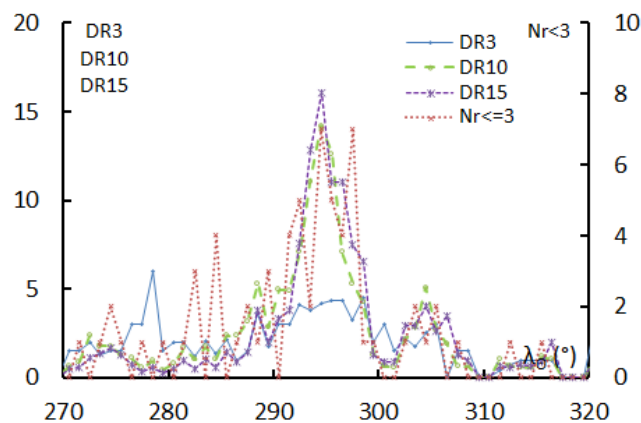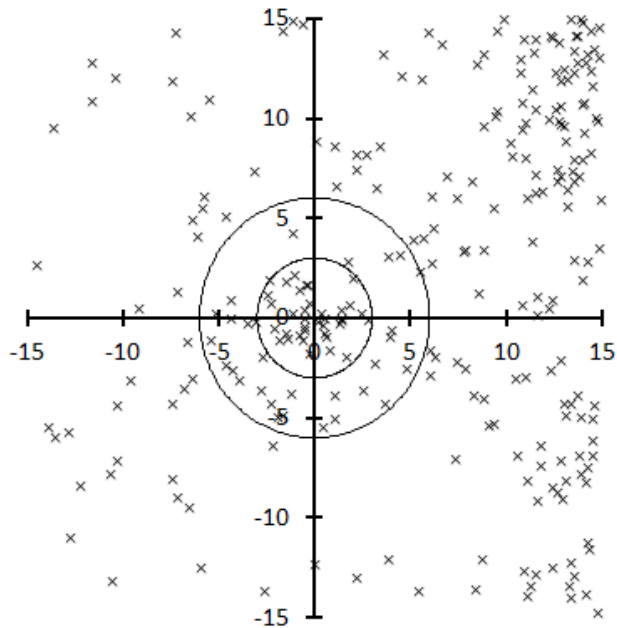
Table 1 – Number per year.

Year	N	Year	N
2007	1	2013	3
2008	0	2014	2
2009	6	2015	3
2010	8	2016	2
2011	2	2017	5
2012	3	2018	1

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	294.5	7
DR3	298.5	4.5
DR10	294.5	14.2
DR15	294.5	16.1
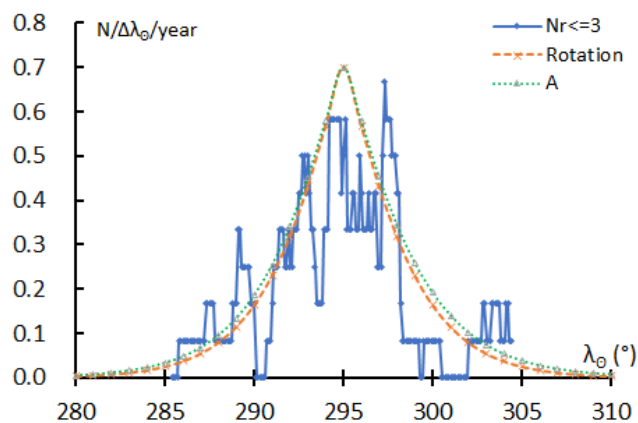
Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g-\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
285	304.5	51.3	241.4	31.8	45.1	0.770	0.795	78.8	124.1	285.0	88.9	54.3	3.45
286	304.7	51.3	242.3	31.6	45.2	0.776	0.795	78.7	124.1	286.0	89.9	54.3	3.54
287	304.9	51.3	243.1	31.4	45.2	0.782	0.794	78.6	124.1	287.0	90.8	54.3	3.63
288	305.1	51.3	244.0	31.2	45.3	0.788	0.793	78.6	124.1	288.0	91.7	54.2	3.73
289	305.3	51.3	244.8	31.0	45.3	0.794	0.793	78.5	124.2	289.0	92.7	54.2	3.84
290	305.5	51.4	245.7	30.8	45.3	0.800	0.792	78.5	124.2	290.0	93.6	54.1	3.95
291	305.7	51.4	246.5	30.6	45.4	0.806	0.791	78.4	124.2	291.0	94.5	54.1	4.07
292	305.9	51.4	247.4	30.4	45.4	0.812	0.791	78.3	124.2	292.0	95.5	54.1	4.20
293	306.1	51.4	248.2	30.3	45.4	0.818	0.790	78.3	124.2	293.0	96.4	54.0	4.34
294	306.3	51.4	249.1	30.1	45.5	0.824	0.789	78.2	124.3	294.0	97.3	54.0	4.48
295	306.5	51.4	249.9	30.0	45.5	0.830	0.789	78.2	124.3	295.0	98.2	54.0	4.64
296	306.7	51.4	250.8	29.8	45.6	0.836	0.788	78.1	124.3	296.0	99.2	53.9	4.81
297	306.9	51.4	251.6	29.7	45.6	0.842	0.788	78.0	124.3	297.0	100.1	53.9	4.99
298	307.1	51.5	252.5	29.5	45.6	0.848	0.787	78.0	124.3	298.0	101.0	53.9	5.19
299	307.3	51.5	253.3	29.4	45.7	0.855	0.786	77.9	124.4	299.0	102.0	53.8	5.41
300	307.5	51.5	254.2	29.3	45.7	0.861	0.786	77.9	124.4	300.0	102.9	53.8	5.64
301	307.7	51.5	255.0	29.2	45.7	0.867	0.785	77.8	124.4	301.0	103.8	53.8	5.90
302	307.9	51.5	255.9	29.0	45.8	0.873	0.785	77.7	124.4	302.0	104.8	53.7	6.18
303	308.2	51.5	256.7	28.9	45.8	0.879	0.784	77.7	124.4	303.0	105.7	53.7	6.49
304	308.4	51.5	257.6	28.8	45.9	0.885	0.784	77.6	124.4	304.0	106.6	53.7	6.84
305	308.6	51.5	258.4	28.8	45.9	0.892	0.783	77.6	124.5	305.0	107.6	53.6	7.23

XUM (#0341): Total of **133** orbits. $\lambda_{\Theta} = 298°$, $\lambda_g - \lambda_{\Theta} = 217.9°$, $\beta_g = 25.7°$, $\Delta r = 3°$, $\Delta\lambda_{\Theta} = 5°$.
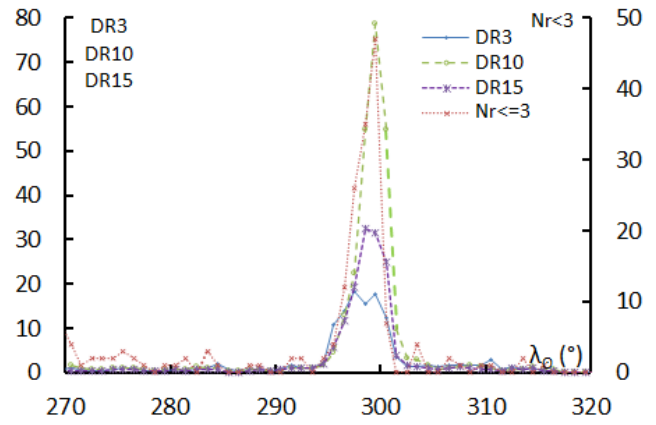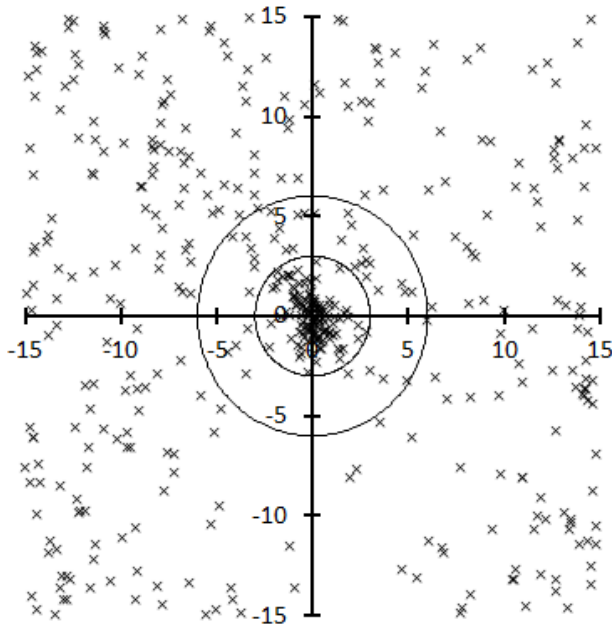
Table 1 – Number per year.

Year	N	Year	N
2007	4	2013	26
2008	7	2014	12
2009	10	2015	9
2010	15	2016	8
2011	8	2017	11
2012	8	2018	15

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	299.5	47
DR3	297.5	18.2
DR10	299.5	78.9
DR15	298.5	32.3
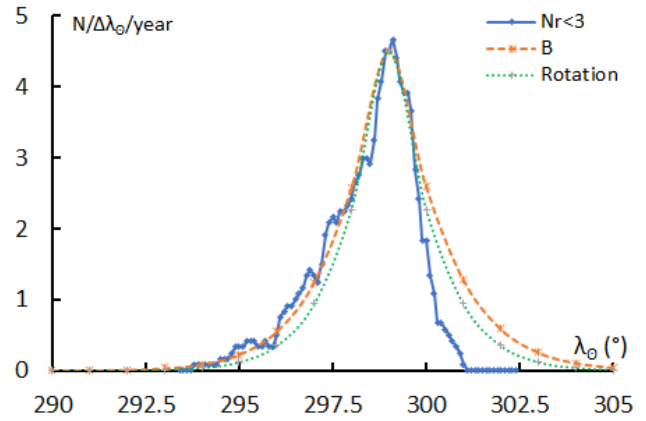
Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g-\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
290	221.5	26.7	164.8	35.6	43.4	0.850	0.237	76.7	310.7	290.0	275.0	−47.6	1.58
291	221.1	26.6	165.4	35.2	43.1	0.851	0.234	75.7	311.1	291.0	275.2	−46.9	1.57
292	220.7	26.4	165.9	34.9	42.9	0.852	0.231	74.6	311.5	292.0	275.3	−46.2	1.56
293	220.3	26.3	166.4	34.5	42.6	0.853	0.229	73.5	311.9	293.0	275.5	−45.5	1.55
294	219.9	26.2	167.0	34.2	42.3	0.853	0.226	72.4	312.3	294.0	275.6	−44.9	1.54
295	219.5	26.1	167.5	33.8	42.0	0.854	0.224	71.3	312.6	295.0	275.8	−44.2	1.53
296	219.1	25.9	168.0	33.5	41.8	0.854	0.222	70.2	312.9	296.0	276.0	−43.6	1.52
297	218.8	25.8	168.6	33.1	41.5	0.854	0.220	69.1	313.2	297.0	276.2	−42.9	1.51
298	218.4	25.7	169.1	32.8	41.2	0.855	0.219	68.0	313.5	298.0	276.5	−42.3	1.50
299	218.0	25.6	169.6	32.4	40.9	0.855	0.217	66.9	313.7	299.0	276.7	−41.7	1.49
300	217.6	25.4	170.2	32.1	40.7	0.855	0.216	65.8	313.9	300.0	276.9	−41.1	1.49
301	217.2	25.3	170.7	31.7	40.4	0.859	0.201	68.9	316.2	301.0	281.9	−40.2	1.43
302	216.9	25.2	171.2	31.3	40.1	0.855	0.214	63.6	314.3	302.0	277.5	−39.9	1.47
303	216.5	25.0	171.7	31.0	39.8	0.854	0.213	62.5	314.5	303.0	277.8	−39.3	1.46
304	216.1	24.9	172.3	30.6	39.6	0.854	0.213	61.3	314.6	304.0	278.1	−38.7	1.46
305	215.7	24.8	172.8	30.2	39.3	0.854	0.212	60.2	314.7	305.0	278.4	−38.1	1.45

ECV (#0530): Total of **201** orbits. $\lambda_{\Theta} = 303.3°$, $\lambda_g–\lambda_{\Theta} = 255.3°$, $\beta_g = –11.5°$, $\Delta r = 3°$, $\Delta\lambda_{\Theta} = 10°$.
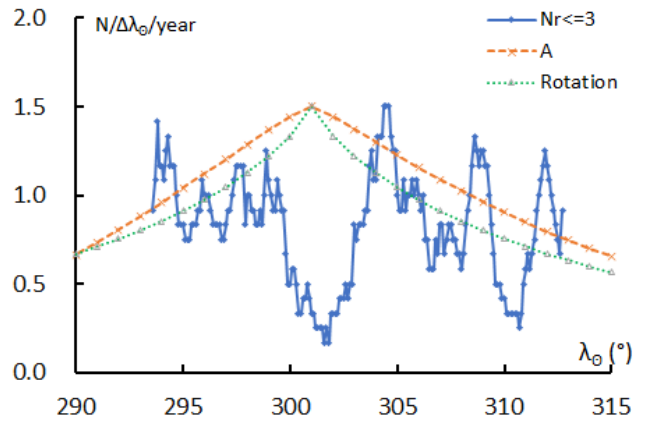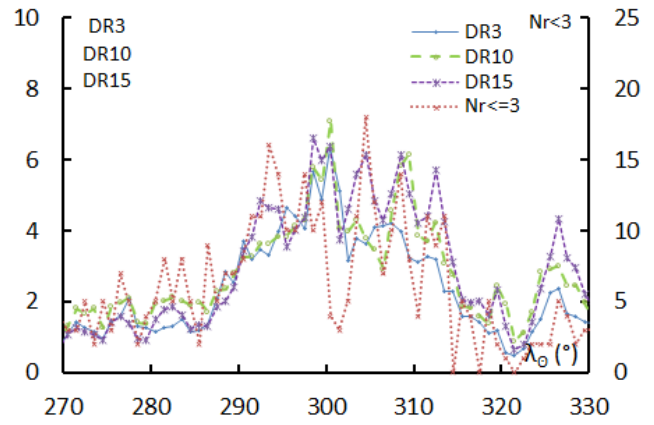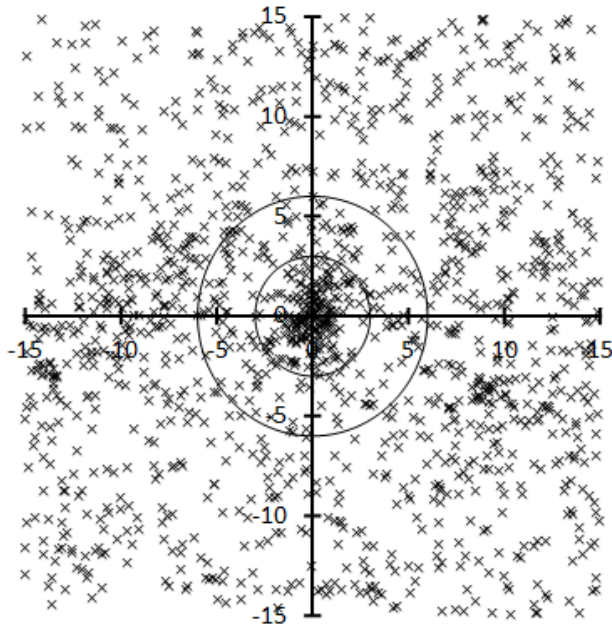
Table 1 – Number per year.

Year	N	Year	N
2007	8	2013	15
2008	9	2014	18
2009	13	2015	16
2010	38	2016	16
2011	12	2017	17
2012	14	2018	25

Table 2 – Activity profiles.

	λ_{Θ}	Max
Nr<=3	304.5	18
DR3	300.5	6.3
DR10	300.5	7.1
DR15	298.5	6.6

Table 3 – Evolution of the orbital parameters during the activity period.

λ_{Θ}	$\lambda_g–\lambda_{\Theta}$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_{Π}	β_{Π}	a
285	259.1	–15.0	177.6	–15.4	67.3	0.780	0.875	152.5	41.4	105.0	66.9	17.8	3.97
286	258.9	–14.8	178.4	–15.5	67.3	0.781	0.872	152.8	42.2	106.0	67.1	17.9	3.98
287	258.7	–14.6	179.2	–15.7	67.3	0.782	0.868	153.1	43.0	107.0	67.3	18.0	3.99
288	258.5	–14.5	180.0	–15.8	67.3	0.784	0.863	153.4	43.7	108.0	67.5	18.0	4.00
289	258.3	–14.3	180.9	–16.0	67.4	0.786	0.859	153.7	44.5	109.0	67.6	18.1	4.01
290	258.1	–14.1	181.7	–16.1	67.4	0.788	0.855	154.0	45.2	110.0	67.8	18.1	4.03
291	257.9	–13.9	182.5	–16.2	67.4	0.790	0.851	154.3	46.0	111.0	68.0	18.1	4.04
292	257.7	–13.7	183.3	–16.4	67.4	0.792	0.847	154.6	46.7	112.0	68.2	18.2	4.06
293	257.5	–13.5	184.1	–16.5	67.4	0.794	0.843	155.0	47.4	113.0	68.4	18.2	4.08
294	257.3	–13.3	184.9	–16.7	67.4	0.796	0.838	155.3	48.2	114.0	68.6	18.2	4.11
295	257.1	–13.1	185.8	–16.8	67.5	0.798	0.834	155.6	48.9	115.0	68.8	18.1	4.13
296	256.9	–12.9	186.6	–17.0	67.5	0.800	0.830	155.9	49.6	116.0	69.0	18.1	4.16
297	256.7	–12.7	187.4	–17.1	67.5	0.803	0.826	156.2	50.3	117.0	69.2	18.1	4.19
298	256.5	–12.6	188.3	–17.2	67.5	0.805	0.821	156.5	51.0	118.0	69.4	18.0	4.22
299	256.3	–12.4	189.1	–17.4	67.5	0.808	0.817	156.8	51.7	119.0	69.7	18.0	4.26
300	256.1	–12.2	189.9	–17.5	67.5	0.811	0.812	157.2	52.4	120.0	69.9	17.9	4.29
301	255.9	–12.0	190.7	–17.7	67.6	0.814	0.808	157.5	53.1	121.0	70.1	17.8	4.33
302	255.7	–11.8	191.6	–17.8	67.6	0.816	0.803	157.8	53.7	122.0	70.4	17.7	4.38
303	255.5	–11.6	192.4	–17.9	67.6	0.819	0.799	158.1	54.4	123.0	70.6	17.6	4.42
304	255.3	–11.4	193.3	–18.1	67.6	0.822	0.795	158.4	55.1	124.0	70.9	17.5	4.47
305	255.1	–11.2	194.1	–18.2	67.6	0.825	0.790	158.8	55.7	125.0	71.2	17.4	4.52

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
306	254.9	−11.0	194.9	−18.3	67.6	0.829	0.786	159.1	56.4	126.0	71.5	17.3	4.58
307	254.7	−10.8	195.8	−18.5	67.7	0.832	0.781	159.4	57.0	127.0	71.7	17.2	4.64
308	254.5	−10.6	196.6	−18.6	67.7	0.835	0.777	159.7	57.6	128.0	72.0	17.0	4.71
309	254.3	−10.4	197.5	−18.7	67.7	0.838	0.772	160.1	58.3	129.0	72.3	16.9	4.77
310	254.1	−10.3	198.3	−18.8	67.7	0.842	0.768	160.4	58.9	130.0	72.6	16.7	4.85
311	253.9	−10.1	199.2	−19.0	67.7	0.845	0.763	160.7	59.5	131.0	73.0	16.5	4.93
312	253.7	−9.9	200.0	−19.1	67.7	0.849	0.758	161.1	60.1	132.0	73.3	16.3	5.01
313	253.5	−9.7	200.9	−19.2	67.8	0.852	0.754	161.4	60.7	133.0	73.6	16.2	5.10
314	253.3	−9.5	201.7	−19.3	67.8	0.856	0.749	161.7	61.3	134.0	74.0	16.0	5.20
315	253.1	−9.3	202.6	−19.5	67.8	0.860	0.745	162.1	61.9	135.0	74.3	15.8	5.30
316	252.9	−9.1	203.5	−19.6	67.8	0.863	0.740	162.4	62.5	136.0	74.7	15.5	5.41
317	252.7	−8.9	204.3	−19.7	67.8	0.867	0.736	162.7	63.0	137.0	75.0	15.3	5.53
318	252.5	−8.7	205.2	−19.8	67.8	0.871	0.731	163.1	63.6	138.0	75.4	15.1	5.66
319	252.3	−8.5	206.1	−19.9	67.9	0.875	0.727	163.4	64.2	139.0	75.8	14.9	5.80
320	252.1	−8.3	206.9	−20.0	67.9	0.879	0.722	163.8	64.7	140.0	76.2	14.6	5.95

ACB (#0429): Total of **106** orbits. $\lambda_O = 309.89°$, $\lambda_g-\lambda_O = 271.8°$, $\beta_g = 44.5°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$.
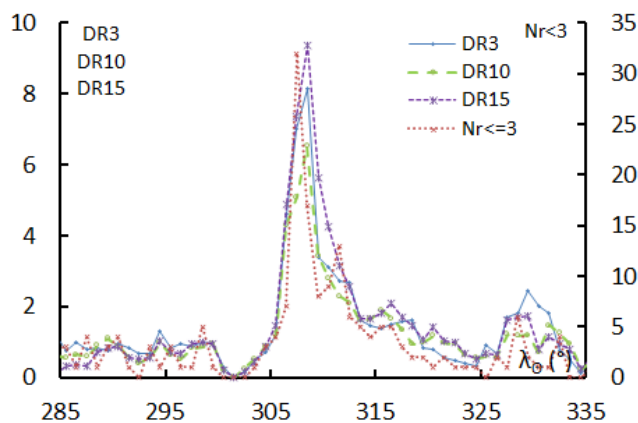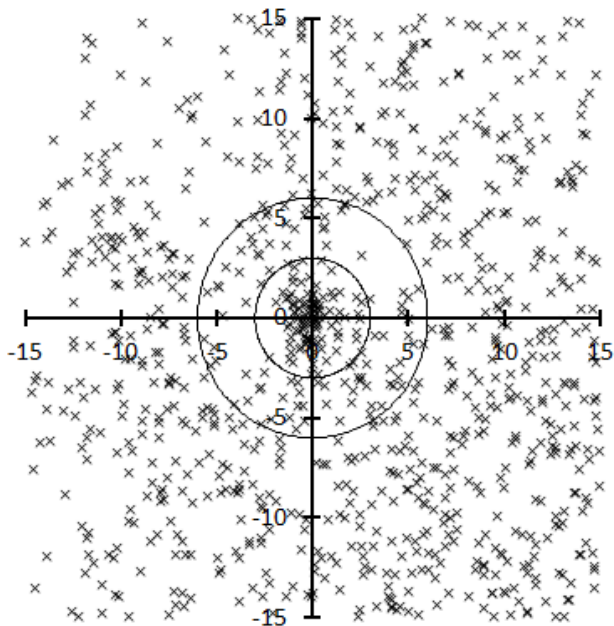
Table 1 – Number per year.

Year	N	Year	N
2007	5	2013	8
2008	4	2014	14
2009	14	2015	7
2010	8	2016	3
2011	17	2017	6
2012	8	2018	12

Table 2 – Activity profiles.

|	λ_O	Max
Nr<=3	307.5	32
DR3	308.5	8.1
DR10	308.5	6.5
DR15	308.5	9.3
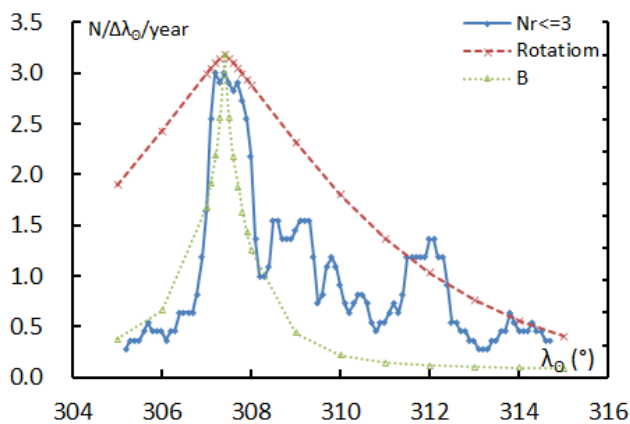
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
300	267.0	48.0	224.0	34.2	53.4	0.787	0.982	97.7	185.6	300.0	119.2	−5.5	4.60
301	267.6	47.6	224.9	33.3	53.8	0.797	0.983	98.6	184.4	301.0	120.3	−4.3	4.84
302	268.2	47.2	225.9	32.5	54.2	0.808	0.984	99.4	183.1	302.0	121.5	−3.1	5.12
303	268.8	46.7	226.8	31.6	54.7	0.819	0.984	100.2	181.9	303.0	122.7	−1.9	5.45
304	269.4	46.3	227.8	30.8	55.1	0.831	0.984	101.1	180.7	304.0	123.9	−0.7	5.83
305	269.9	45.9	228.8	30.0	55.5	0.843	0.984	101.9	179.5	305.0	125.1	0.5	6.28
306	270.5	45.4	229.8	29.2	55.9	0.856	0.984	102.7	178.3	306.0	126.4	1.6	6.84
307	271.1	45.0	230.7	28.4	56.4	0.869	0.984	103.6	177.2	307.0	127.7	2.7	7.52
307.1	271.1	45.0	230.8	28.3	56.4	0.870	0.984	103.6	177.1	307.1	127.8	2.9	7.59
307.2	271.2	44.9	230.9	28.2	56.5	0.872	0.984	103.7	176.9	307.2	127.9	3.0	7.67
307.3	271.2	44.9	231.0	28.1	56.5	0.873	0.984	103.8	176.8	307.3	128.1	3.1	7.75
307.4	271.3	44.8	231.1	28.1	56.5	0.874	0.984	103.9	176.7	307.4	128.2	3.2	7.84
307.5	271.3	44.8	231.2	28.0	56.6	0.876	0.984	104.0	176.6	307.5	128.3	3.3	7.92
307.6	271.4	44.7	231.3	27.9	56.6	0.877	0.984	104.1	176.5	307.6	128.5	3.4	8.01
307.7	271.4	44.7	231.4	27.8	56.7	0.878	0.984	104.1	176.4	307.7	128.6	3.5	8.10
307.8	271.5	44.6	231.5	27.7	56.7	0.880	0.984	104.2	176.2	307.8	128.7	3.6	8.19
307.9	271.5	44.6	231.6	27.7	56.8	0.881	0.984	104.3	176.1	307.9	128.9	3.8	8.28
308	271.6	44.6	231.7	27.6	56.8	0.883	0.984	104.4	176.0	308.0	129.0	3.9	8.38
309	272.1	44.1	232.7	26.8	57.2	0.897	0.983	105.2	174.9	309.0	130.4	5.0	9.50
310	272.7	43.7	233.7	26.0	57.6	0.911	0.982	106.0	173.7	310.0	131.7	6.0	11.02
311	273.2	43.2	234.7	25.2	58.1	0.926	0.981	106.8	172.6	311.0	133.2	7.1	13.20

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
312	273.7	42.7	235.7	24.4	58.5	0.797	0.979	82.2	170.3	312.0	130.7	9.6	4.82
313	274.2	42.3	236.7	23.7	58.9	0.957	0.979	108.5	170.4	313.0	136.1	9.1	22.54
314	274.7	41.8	237.7	22.9	59.3	0.973	0.977	109.3	169.3	314.0	137.6	10.1	35.75
315	275.2	41.4	238.7	22.2	59.8	0.989	0.975	110.1	168.2	315.0	139.1	11.1	90.19
316	275.7	40.9	239.8	21.4	60.2	1.006	0.974	110.9	167.2	316.0	140.7	12.0	−159
317	276.1	40.4	240.8	20.7	60.6	1.023	0.972	111.7	166.1	317.0	142.2	12.9	−41.4
318	276.6	40.0	241.8	19.9	61.0	1.041	0.969	112.5	165.1	318.0	143.8	13.7	−23.5
319	277.1	39.5	242.9	19.2	61.5	1.059	0.967	113.3	164.1	319.0	145.4	14.6	−16.3
320	277.5	39.0	243.9	18.5	61.9	1.078	0.964	114.1	163.1	320.0	147.1	15.4	−12.4

AAN (#0110): Total of **36** orbits. $\lambda_O = 312°$, $\lambda_g–\lambda_O = 210.6°$, $\beta_g = –17.7°$, $\Delta r = 3°$, $\Delta\lambda_O = 10°$.
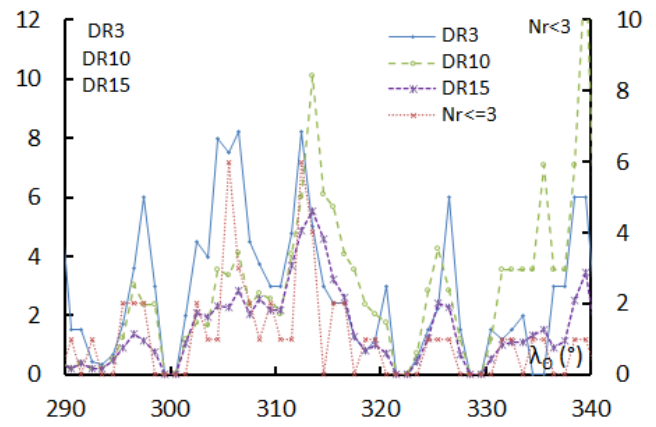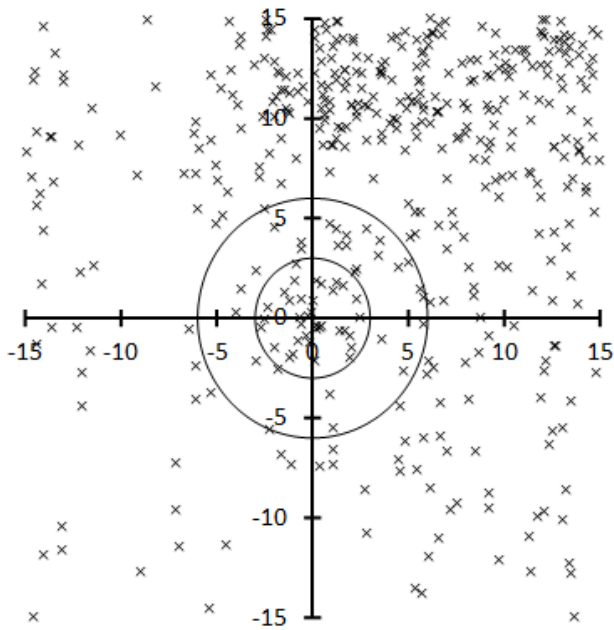
Table 1 – Number per year.

Year	N	Year	N
2007	0	2013	3
2008	0	2014	1
2009	4	2015	1
2010	6	2016	3
2011	5	2017	6
2012	7	2018	0

Table 2 – Activity profiles.

|	λ_O	Max
Nr<=3	305.5	6
DR3	306.5	8.2
DR10	313.5	10.1
DR15	313.5	5.5
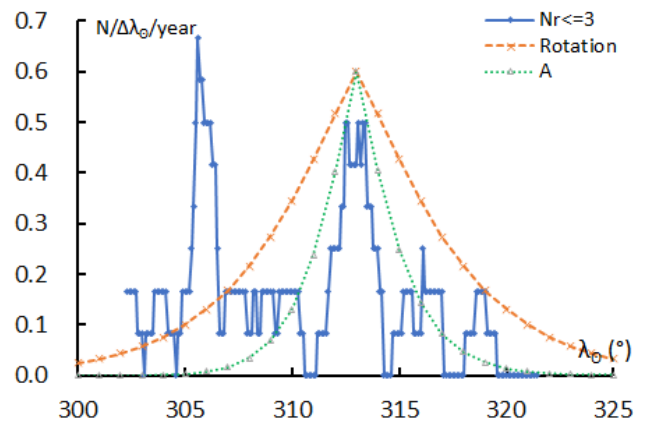
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
300	211.0	–16.7	147.2	–4.5	44.0	0.960	0.130	55.8	140.6	120.0	275.2	31.6	3.23
301	211.0	–16.7	148.0	–4.9	44.0	0.960	0.131	55.9	140.4	121.0	276.2	31.8	3.26
302	211.0	–16.8	148.9	–5.3	44.0	0.960	0.131	56.0	140.3	122.0	277.1	32.0	3.28
303	210.9	–16.9	149.7	–5.7	44.1	0.960	0.132	56.1	140.1	123.0	278.0	32.2	3.31
304	210.9	–17.0	150.6	–6.1	44.1	0.960	0.133	56.2	139.9	124.0	278.9	32.4	3.33
305	210.9	–17.0	151.5	–6.5	44.1	0.960	0.134	56.3	139.7	125.0	279.8	32.6	3.36
306	210.9	–17.1	152.3	–6.9	44.1	0.960	0.135	56.5	139.5	126.0	280.8	32.7	3.39
307	210.9	–17.2	153.2	–7.3	44.1	0.960	0.136	56.6	139.4	127.0	281.7	32.9	3.42
308	210.8	–17.3	154.0	–7.8	44.2	0.960	0.137	56.7	139.2	128.0	282.6	33.1	3.45
309	210.8	–17.3	154.8	–8.2	44.2	0.960	0.138	56.8	139.0	129.0	283.5	33.3	3.48
310	210.8	–17.4	155.7	–8.6	44.2	0.960	0.139	56.9	138.8	130.0	284.4	33.5	3.51
311	210.8	–17.5	156.5	–9.0	44.2	0.960	0.140	57.0	138.6	131.0	285.4	33.7	3.54
312	210.8	–17.6	157.4	–9.5	44.3	0.960	0.141	57.1	138.4	132.0	286.3	33.9	3.57
313	210.7	–17.6	158.2	–9.9	44.3	0.960	0.143	57.2	138.2	133.0	287.2	34.0	3.61
313.1	210.7	–17.7	158.3	–9.9	44.3	0.960	0.143	57.2	138.2	133.1	287.3	34.1	3.61
313.2	210.7	–17.7	158.4	–10.0	44.3	0.960	0.143	57.2	138.2	133.2	287.4	34.1	3.61
313.3	210.7	–17.7	158.5	–10.0	44.3	0.960	0.143	57.2	138.2	133.3	287.5	34.1	3.62
313.4	210.7	–17.7	158.6	–10.1	44.3	0.961	0.143	57.3	138.2	133.4	287.6	34.1	3.62
313.5	210.7	–17.7	158.7	–10.1	44.3	0.961	0.143	57.3	138.1	133.5	287.7	34.1	3.62
313.6	210.7	–17.7	158.7	–10.2	44.3	0.961	0.143	57.3	138.1	133.6	287.7	34.2	3.63
313.7	210.7	–17.7	158.8	–10.2	44.3	0.961	0.143	57.3	138.1	133.7	287.8	34.2	3.63

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g-\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
313.8	210.7	−17.7	158.9	−10.2	44.3	0.961	0.143	57.3	138.1	133.8	287.9	34.2	3.63
313.9	210.7	−17.7	159.0	−10.3	44.3	0.961	0.143	57.3	138.1	133.9	288.0	34.2	3.64
314	210.7	−17.7	159.1	−10.3	44.3	0.961	0.144	57.3	138.1	134.0	288.1	34.2	3.64
315	210.7	−17.8	159.9	−10.8	44.3	0.961	0.145	57.4	137.9	135.0	289.0	34.4	3.67
316	210.7	−17.9	160.8	−11.2	44.4	0.961	0.146	57.5	137.7	136.0	289.9	34.6	3.71
317	210.7	−17.9	161.6	−11.6	44.4	0.961	0.147	57.6	137.5	137.0	290.9	34.8	3.75
318	210.6	−18.0	162.5	−12.1	44.4	0.961	0.148	57.7	137.3	138.0	291.8	35.0	3.78
319	210.6	−18.1	163.3	−12.5	44.4	0.961	0.149	57.8	137.1	139.0	292.7	35.2	3.82
320	210.6	−18.2	164.1	−13.0	44.4	0.961	0.150	57.9	136.9	140.0	293.6	35.4	3.86

XHE (#0346): Total of **61** orbits. $\lambda_O = 350°$, $\lambda_g - \lambda_O = 244.9°$, $\beta_g = 70.6°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$.
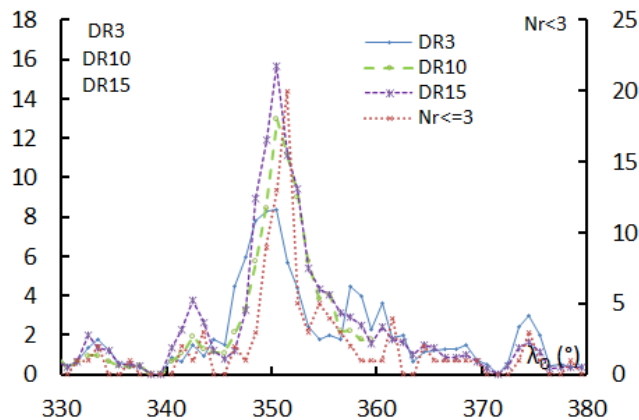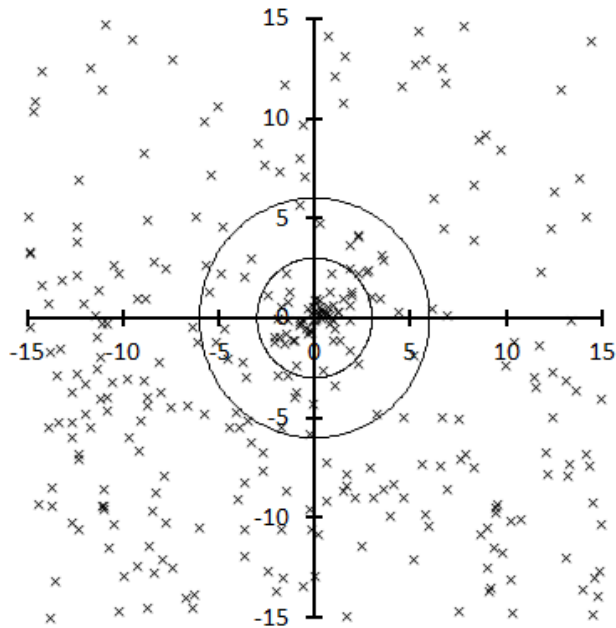
Table 1 – Number per year.

Year	N	Year	N
2007	4	2013	6
2008	0	2014	4
2009	7	2015	10
2010	1	2016	2
2011	8	2017	4
2012	3	2018	12

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	351.5	20
DR3	350.5	8.4
DR10	350.5	12.9
DR15	350.5	15.6
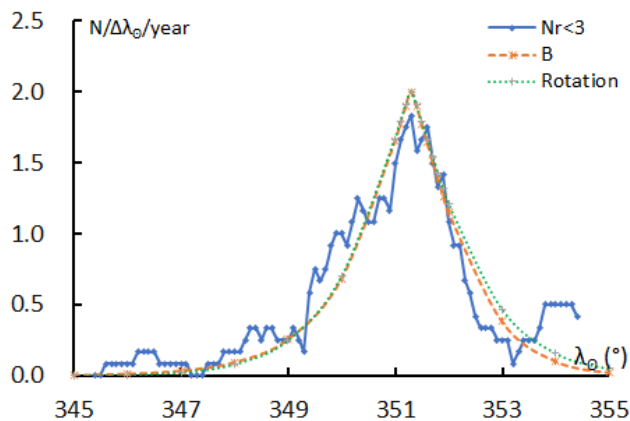
Table 3 – Evolution of the orbital parameters during the activity period.

| λ_O	$\lambda_g-\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
345	240.9	70.1	248.4	50.0	36.8	0.789	0.969	61.1	198.5	345.0	174.2	−16.1	4.59
346	241.8	70.2	249.4	49.7	36.6	0.771	0.971	61.0	198.0	346.0	175.0	−15.7	4.24
347	242.7	70.2	250.3	49.5	36.4	0.753	0.973	60.9	197.6	347.0	175.8	−15.3	3.94
348	243.7	70.2	251.3	49.3	36.1	0.736	0.974	60.7	197.1	348.0	176.6	−14.9	3.69
349	244.6	70.3	252.2	49.1	35.9	0.718	0.976	60.6	196.7	349.0	177.4	−14.5	3.46
350	245.6	70.3	253.2	48.9	35.7	0.701	0.977	60.5	196.2	350.0	178.1	−14.0	3.27
351	246.5	70.3	254.1	48.7	35.5	0.684	0.978	60.3	195.7	351.0	178.9	−13.6	3.09
351.1	246.6	70.3	254.2	48.7	35.5	0.682	0.979	60.3	195.7	351.1	179.0	−13.6	3.08
351.2	246.7	70.4	254.3	48.7	35.4	0.680	0.979	60.3	195.6	351.2	179.1	−13.5	3.06
351.3	246.8	70.4	254.4	48.6	35.4	0.679	0.979	60.3	195.6	351.3	179.2	−13.5	3.05
351.4	246.9	70.4	254.5	48.6	35.4	0.677	0.979	60.3	195.5	351.4	179.2	−13.4	3.03
351.5	247.0	70.4	254.6	48.6	35.4	0.675	0.979	60.3	195.5	351.5	179.3	−13.4	3.02
351.6	247.1	70.4	254.7	48.6	35.4	0.674	0.979	60.3	195.4	351.6	179.4	−13.3	3.00
351.7	247.2	70.4	254.8	48.6	35.3	0.672	0.979	60.2	195.4	351.7	179.5	−13.3	2.98
351.8	247.3	70.4	254.9	48.5	35.3	0.670	0.980	60.2	195.3	351.8	179.5	−13.2	2.97
351.9	247.4	70.4	255.0	48.5	35.3	0.668	0.980	60.2	195.3	351.9	179.6	−13.2	2.96
352	247.5	70.4	255.1	48.5	35.3	0.667	0.980	60.2	195.2	352.0	179.7	−13.2	2.94
353	248.4	70.4	256.0	48.3	35.0	0.650	0.981	60.1	194.7	353.0	180.5	−12.7	2.80
354	249.4	70.4	257.0	48.2	34.8	0.633	0.983	59.9	194.2	354.0	181.2	−12.2	2.68
355	250.3	70.4	257.9	48.0	34.6	0.617	0.984	59.8	193.6	355.0	182.0	−11.7	2.57
356	251.3	70.4	258.9	47.8	34.4	0.600	0.985	59.6	193.1	356.0	182.7	−11.3	2.46

Table 3 – Continued, evolution of the orbital parameters during the activity period.

λ_Θ	$\lambda_g{-}\lambda_\Theta$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
357	252.3	70.4	259.8	47.7	34.2	0.584	0.986	59.4	192.5	357.0	183.4	−10.8	2.37
358	253.2	70.4	260.8	47.6	34.0	0.568	0.988	59.3	191.9	358.0	184.2	−10.2	2.29
359	254.2	70.4	261.7	47.4	33.7	0.552	0.989	59.1	191.3	359.0	184.9	−9.7	2.21
360	255.1	70.4	262.7	47.3	33.5	0.536	0.990	58.9	190.7	0.0	185.6	−9.2	2.13

EVI (#0011): Total of **161** orbits. $\lambda_O = 357°$, $\lambda_g–\lambda_O = 185.9°$, $\beta_g = 5.5°$, $\Delta r = 3°$, $\Delta\lambda_O = 5°$. The radiant distribution looks a long ellipse extending west-eastward. The activity represents a clear periodic nature.
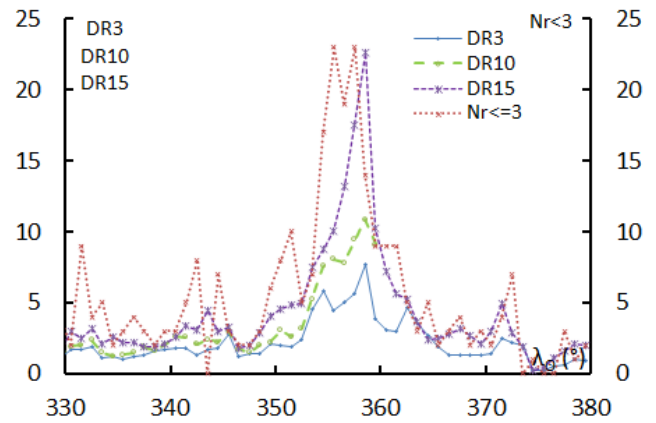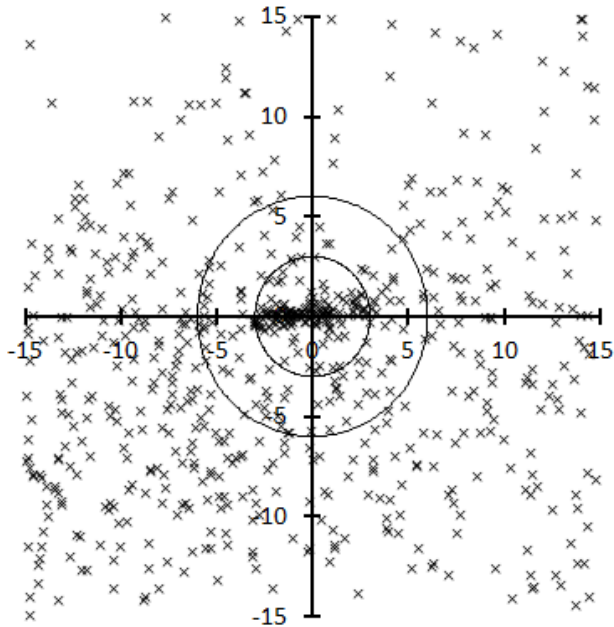
Table 1 – Number per year.

Year	N	Year	N
2007	3	2013	24
2008	0	2014	15
2009	45	2015	1
2010	16	2016	5
2011	2	2017	37
2012	2	2018	11

Table 2 – Activity profiles.

	λ_O	Max
Nr<=3	355.5	23
DR3	358.5	8.8
DR10	358.5	10.7
DR15	358.5	20.9
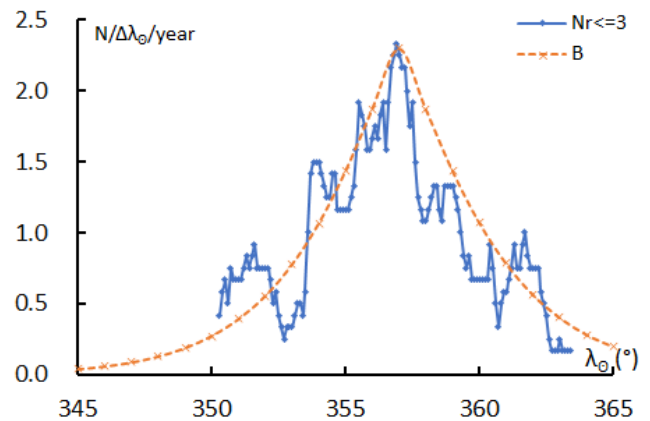
Table 3 – Evolution of the orbital parameters during the activity period.

λ_O	$\lambda_g–\lambda_O$	β_g	α_g	δ_g	v_g	e	q	i	ω	Ω	λ_Π	β_Π	a
345	192.8	4.3	179.7	4.8	30.1	0.850	0.331	5.5	296.8	345.0	281.9	–4.9	2.21
346	192.3	4.3	180.1	4.7	29.9	0.847	0.340	5.5	295.6	346.0	281.7	–4.9	2.23
347	191.7	4.4	180.6	4.6	29.6	0.844	0.350	5.4	294.4	347.0	281.5	–4.9	2.25
348	191.2	4.5	181.1	4.4	29.4	0.841	0.360	5.4	293.3	348.0	281.4	–5.0	2.27
349	190.7	4.6	181.6	4.3	29.1	0.839	0.369	5.4	292.1	349.0	281.2	–5.0	2.29
350	190.2	4.6	182.0	4.2	28.9	0.836	0.379	5.4	291.0	350.0	281.1	–5.0	2.31
351	189.7	4.7	182.5	4.1	28.6	0.833	0.389	5.3	289.8	351.0	280.9	–5.0	2.33
352	189.2	4.8	183.0	3.9	28.3	0.830	0.398	5.3	288.7	352.0	280.8	–5.0	2.35
353	188.7	4.9	183.4	3.8	28.1	0.828	0.408	5.3	287.6	353.0	280.6	–5.0	2.37
354	188.1	4.9	183.9	3.7	27.8	0.825	0.418	5.2	286.4	354.0	280.5	–5.0	2.38
355	187.6	5.0	184.4	3.5	27.6	0.822	0.427	5.2	285.3	355.0	280.4	–5.0	2.40
356	187.1	5.1	184.9	3.4	27.3	0.819	0.437	5.2	284.2	356.0	280.2	–5.0	2.42
357	186.6	5.1	185.3	3.3	27.0	0.817	0.447	5.2	283.1	357.0	280.1	–5.0	2.44
358	186.1	5.2	185.8	3.2	26.8	0.814	0.456	5.1	281.9	358.0	280.0	–5.0	2.45
359	185.5	5.3	186.3	3.0	26.5	0.811	0.466	5.1	280.8	359.0	279.9	–5.0	2.47
360	185.0	5.4	186.7	2.9	26.3	0.808	0.476	5.1	279.7	0.0	279.8	–5.0	2.48
361	184.5	5.4	187.2	2.8	26.0	0.806	0.485	5.0	278.6	1.0	279.7	–5.0	2.49
362	184.0	5.5	187.7	2.7	25.8	0.803	0.495	5.0	277.5	2.0	279.6	–5.0	2.51
363	183.5	5.6	188.1	2.5	25.5	0.800	0.504	5.0	276.4	3.0	279.5	–4.9	2.52
364	183.0	5.6	188.6	2.4	25.2	0.797	0.513	4.9	275.4	4.0	279.4	–4.9	2.53
365	182.4	5.7	189.1	2.3	25.0	0.794	0.523	4.9	274.3	5.0	279.3	–4.9	2.54

Table 4 – Index datasheets of analyzed meteor showers. Click on the shower code to skip to the datasheet.

No.	Code	Name	No.	Code	Name
1	CAP	alpha Capricornids	208	SPE	September epsilon Perseids
2	STA_SE	Southern Taurids	221	DSX	Daytime Sextantids
2	STA_SF	Southern Taurids	246	AMO	alpha Monocerotids
4	GEM	Geminids	250	NOO	November Orionids
5	SDA	Southern delta Aquariids	257	ORS	Southern chi Orionids
6	LYR	April Lyrids	281	OCT	October Camelopardalids
7	PER	Perseids	319	JLE	January Leonids
8	ORI	Orionids	323	XCB	xi Coronae Borealids
10	QUA	Quadrantids	331	AHY	alpha Hydrids
11	EVI	eta Virginids	333	OCU	October Ursae Majorids
12	KCG	kappa Cygnids	335	XVI	December chi Virginids
13	LEO	Leonids	336	DKD	December kappa Draconids
15	URS	Ursids	337	NUE	nu Eridanids
16	HYD	sigma Hydrids	338	OER	omicron Eridanids
17	NTA	Northern Taurids	339	PSU	psi Ursae Majorids
18	AND	Andromedids	340	TPY_0	theta Pyxidids
19	MON	December Monocerotids	340	TPY_3	theta Pyxidids
20	COM	Comae Berenicids	341	XUM	January xi Ursae Majorids
21	AVB	alpha Virginids	343	HVI	h Virginids
22	LMI	Leonis Minorids	346	XHE	x Herculids
23	EGE	epsilon Geminids	372	PPS_0	phi Piscids
26	NDA	Northern delta Aquariids	372	PPS_1	phi Piscids
27	KSE	kappa Serpentids	388	CTA	chi Taurids
31	ETA	eta Aquariids	411	CAN	c Andromedids
33	NIA	Northern iota Aquariids	428	DSV	December sigma Virginids
81	SLY_0	September Lyncids	429	ACB	alpha Coronae Borealids
81	SLY_1	September Lyncids	431	JIP	June iota Pegasids
96	NCC	Northern delta Cancrids	444	ZCS	zeta Cassiopeiids
97	SCC	Southern delta Cancrids	445	KUM	kappa Ursae Majorids
110	AAN	alpha Antliids	450	AED	April epsilon Delphinids
145	ELY	eta Lyrids	480	TCA	tau Cancrids
152	NOC	North. Daytime omega Cetids	488	NSU	Nov. sigma Ursae Majorids
164	NZC	Northern June Aquilids	502	DRV	December rho Virginids
165	SZC	Southern June Aquilids	515	OLE	omicron Leonids
171	ARI	Daytime Arietids	523	AGC	August gamma Cepheids
175	JPE	July Pegasids	524	LUM	lambda Ursae Majorids
183	PAU	Piscis Austrinids	526	SLD	Southern lambda Draconids
184	GDR	July gamma Draconids	529	EHY	eta Hydrids
191	ERI	eta Eridanids	530	ECV	eta Corvids
197	AUD	August Draconids	533	JXA	July xi Arietids
206	AUR	Aurigids		AXD	August xi Draconids

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