Results of the IMO Video Meteor Network – February 2016

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In Europe, February is not really renowned for pleasant weather, and 2016 was no exception in this respect. The lowlight was February 22/23, when 18 cameras recorded less than a hundred meteors in 64 hours of effective observing time. Many observers really had to be patient to get through the many clouded nights. Slovenia and Hungary experienced particularly poor conditions, whereas Portuguese and German observers were still relatively lucky. In addition we faced technical problems with computers (HINWO1, REMO3), camera housings (ICC7) and software (LIC1, LIC2). In the end, only 16 out of 79 cameras managed to observe in twenty or more observing nights. With a total of 7,000 observing hours, the yield was comparable to 2012 and 2014, but far inferior to 2015. The same is true for those 15,500 meteors that we recorded.

There are no ponderable meteor showers in February – but still this month surprises us every now and then. I'm neither talking about the Chelyabinsk meteorite fall of February 2013, nor of the meteorite fall in Copenhagen this year. I rather refer to the outburst of a hitherto unknown meteor shower that Peter Brown reported about at the 2016 IMC. His search for unusual activity spikes in the 2013 -2016 Canadian CMOR radar data was successful twice. On February 5, 2015, CMOR discovered the gamma Lyrids (794 GLY) which stood out almost 20 sigma from the background. On previous occasions we learned, that some meteor showers detected by CMOR are invisible in the optical domain because they consist of very small particles, but we had also successful confirmations. So it was worthwhile to check the data of the IMO video meteor network. Our long-term analysis based on a million meteors recorded until 2011 showed not a single radiant which at least somehow resembled the radar data. Also a re-calculation of the shower membership of the observations on February 4 and 5, 2015, revealed just a few chance alignments. The subsequent radiant search did not yield any similar radiant at all. So we can safely assume that the gamma Lyrids are either another radar meteor shower, or that the peak fell exactly into the European daytime hours.

The second event occurred only a few days earlier on January 9/10, 2015. This time the signal of the wavelet analysis was 17 sigma above the mean background level. The kappa Cancrids (793 KCA) peaked just one week after the Quadrantids, and this time the search in our video data was more fruitful. We found a first sign of activity in our long-term analysis at 287° and 288° solar longitude. Between 289° and 292° the shower was clearly detected – with a rank of five it was one of the strongest sources in the sky by that time. At solar longitude 293° and 294° it disappeared again. Since the activity interval is relatively short and the shower was hardly detected at 291° solar longitude, we did not recognize it in our previous shower search. Details about the radiants are given in table 1. They prove that the kappa Cancrids were 2015 not for the first time active, but already before 2012. That is consistent with the observations of Peter Brown, since the radar data also showed a weak annual component beside the strong outburst in 2015.

Table 1: *Individual radiants of the kappa Cancrids, derived from IMO video observations between 1999 and 2011. Rk is the rank of the radiant. The last row gives the figures that Peter Brown derived from CMOR radar data.*

SL	α	δ	v_{geo}	Rk
287	138.3	13.5	50	46
288	141.6	12.0	46	27
289	138.7	7.5	50	5
290	138.2	7.5	49	5
291	136.9	6.5	42	22
292	139.5	8.5	48	5
293	144.2	7.5	48	8
294	144.2	7.5	48	11
289.5	***137.8***	***8.9***	***47.3***	**-**

Finally we re-calculated the meteor shower assignments for the years 2012-2016 in the solar longitude interval in question. This was to check if the outburst of 2015 was also visible in the optical domain, or if it consisted of minor particles only. The result is given in figure 1. Whereas the kappa Cancrids do hardly stand out from the sporadic background in all other intervals, they were well detected on January 9/10, 2015, with a flux density of 8 meteoroids per 1,000 km^2 and hour.

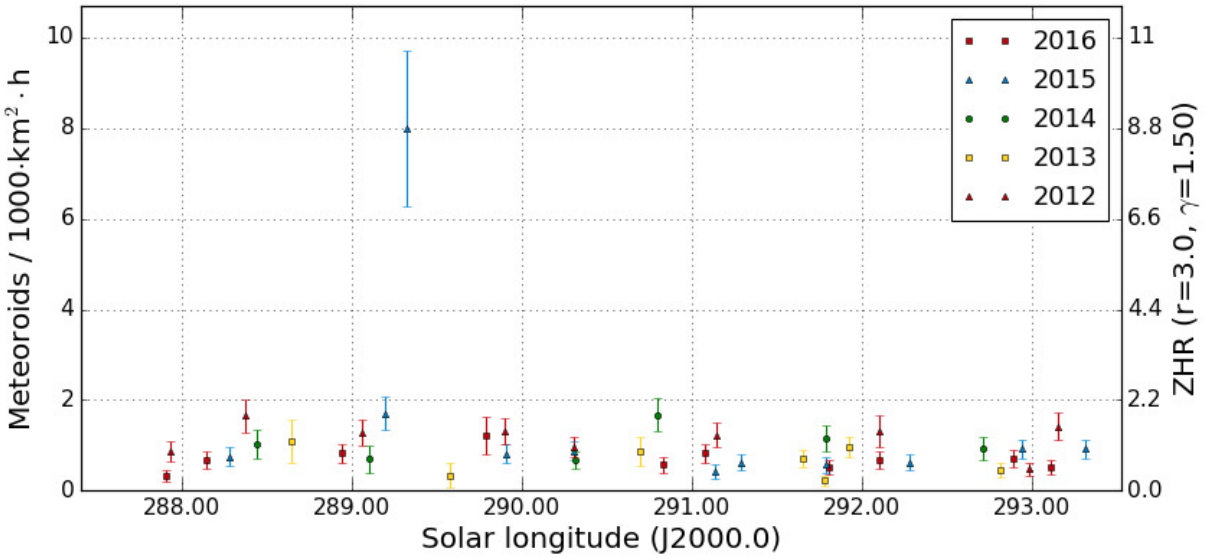

Figure 1: *Flux density of the kappa Cancrids in the years 2012-2016, derived from observations of the IMO network.*

To refine the peak time, the video data of 2015 were analysed once more with a higher resolution (figure 2). The minimum bin size was 30 minutes, whereby each bin needed to contain at least five shower members or 10,000 km^2 and hour of normalized collection area. Luckily the peak fell exactly into the European nighttime hours – in this resolution we can discern both the ascending and descending activity branch. Based on roughly 50 shower meteors which were recorded by all video cameras together in the night of question, we determined peak activity at January 10, 2015 at 2:50 UT, corresponding to 289.315° solar longitude. The full width at half maximum (FWHM) of the peak was only about 40 minutes.

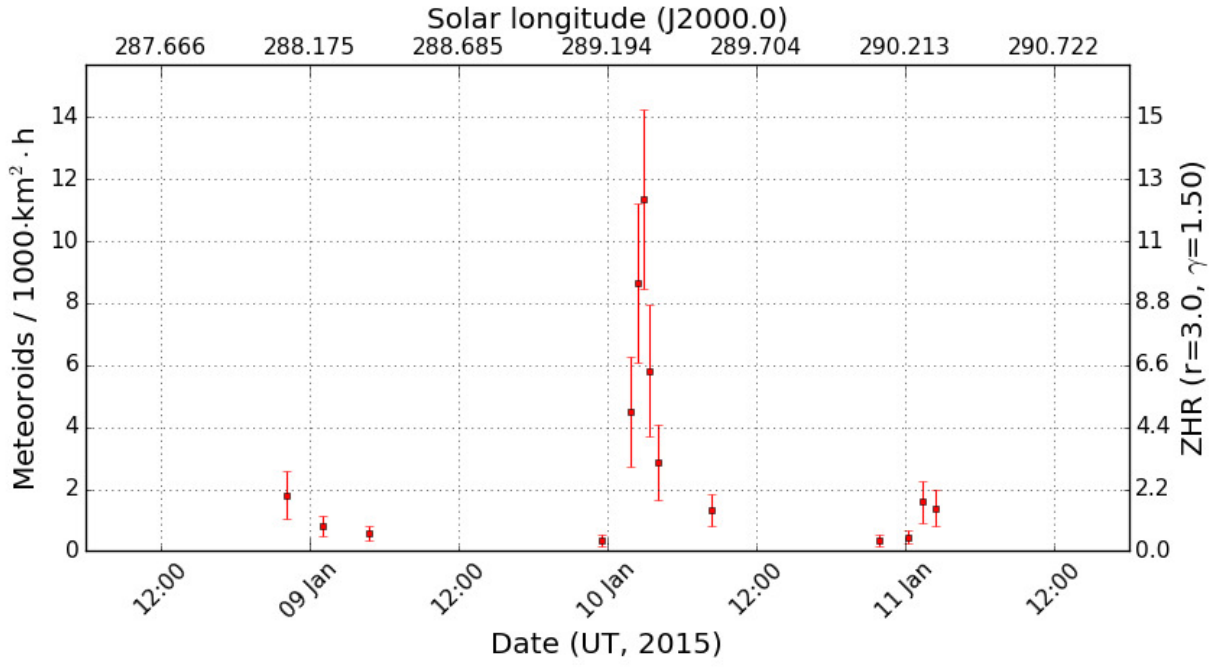

Figure 2: *High resolution activity profile of the kappa Cancrids in 2015, derived from observations of the IMO network.*

And how strong was the outburst? Our video data yield a factor of ten compared to other years and observing intervals. Two things have to be considered when interpreting the 17 sigma of CMOR: On the one hand, that was obtained relative to the background. In the year before, the kappa Cancrids were also detected several sigma above the background, as otherwise the annual component would not have been visible. In this respect, the increase was less than a factor of ten. On the other hand, the temporal resolution of the CMOR wavelet analysis was lower than in the video data, which smeared out the narrow peak. Hence, the factor of ten should be of the right order.

1. Beobachterübersicht

Code	Name	Ort	Kamera	Feld [°²]	St.LM [mag]	Eff.CA [km²]	Nächte	Zeit [h]	Meteore
ARLRA	Arlt	Ludwigsfelde/DE	LUDWIG2 (0.8/8)	1475	6.2	3779	20	107.4	427
BANPE	Bánfalvi	Zalaegerszeg/HU	HUVCSE01 (0.95/5)	2423	3.4	361	4	3.6	23
BERER	Berkó	Ludanyhalaszi/HU	HULUD1 (0.8/3.8)	5542	4.8	3847	1	1.6	10
BOMMA	Bombardini	Faenza/IT	MARIO (1.2/4.0)	5794	3.3	739	14	92.9	248
BREMA	Breukers	Hengelo/NL	MBB3 (0.75/6)	2399	4.2	699	18	161.9	205
BRIBE	Klemt	Herne/DE	HERMINE (0.8/6)	2374	4.2	678	21	145.4	202
		Berg. Gladbach/DE	KLEMOI (0.8/6)	2286	4.6	1080	19	101.8	118
CASFL	Castellani	Monte Baldo/IT	BMH1 (0.8/6)	2350	5.0	1611	17	134.8	283
			BMH2 (1.5/4.5)*	4243	3.0	371	17	106.9	187
CRIST	Crivello	Valbrevenna/IT	BILBO (0.8/3.8)	5458	4.2	1772	17	92.6	236
			C3P8 (0.8/3.8)	5455	4.2	1586	16	91.1	171
			STG38 (0.8/3.8)	5614	4.4	2007	17	105.0	387
DONJE	Donati	Faenza/IT	JENNI (1.2/4)	5886	3.9	1222	12	59.8	217
ELTMA	Eltri	Venezia/IT	MET38 (0.8/3.8)	5631	4.3	2151	9	55.2	106
FORKE	Förster	Carlsfeld/DE	AKM3 (0.75/6)	2375	5.1	2154	10	67.2	140
GONRU	Goncalves	Tomar/PT	TEMPLAR1 (0.8/6)	2179	5.3	1842	24	174.8	438
			TEMPLAR2 (0.8/6)	2080	5.0	1508	22	170.0	345
			TEMPLAR3 (0.8/8)	1438	4.3	571	18	155.6	142
			TEMPLAR4 (0.8/3.8)	4475	3.0	442	23	156.9	316
			TEMPLAR5 (0.75/6)	2312	5.0	2259	24	163.3	367
GOVMI	Govedic	Sredisce ob Dr./SI	ORION2 (0.8/8)	1447	5.5	1841	9	46.7	68
			ORION3 (0.95/5)	2665	4.9	2069	10	57.5	90
			ORION4 (0.95/5)	2662	4.3	1043	12	62.4	70
HERCA	Hergenrother	Tucson/US	SALSA3 (0.8/3.8)	2336	4.1	544	29	286.7	438
IGAAN	Igaz	Hodmezovasar./HU	HUHOD (0.8/3.8)	5502	3.4	764	16	81.1	116
		Budapest/HU	HUPOL (1.2/4)	3790	3.3	475	10	63.5	17
JONKA	Jonas	Budapest/HU	HUSOR (0.95/4)	2286	3.9	445	2	3.9	2
			HUSOR2 (0.95/3.5)	2465	3.9	715	15	78.8	74
KACJA	Kac	Kamnik/SI	CVETKA (0.8/3.8)	4914	4.3	1842	6	24.3	36
		Ljubljana/SI	ORION1 (0.8/8)	1399	3.8	268	4	19.2	10
		Kamnik/SI	REZIKA (0.8/6)	2270	4.4	840	6	27.0	98
			STEFKA (0.8/3.8)	5471	2.8	379	5	23.5	30
KOSDE	Koschny	Izana Obs./ES	ICC7 (0.85/25)*	714	5.9	1464	4	25.0	138
		La Palma / ES	ICC9 (0.85/25)*	683	6.7	2951	24	173.3	1413
		Izana Obs./ES	LIC1(2.8/50)*	2255	6.2	5670	11	62.9	550
		La Palma / ES	LIC2 (3.2/50)*	2199	6.5	7512	12	106.2	1084
		Noordwijkerhout/NL	LIC4 (1.4/50)*	2027	6.0	4509	7	28.8	18
LOJTO	Łojek	Grabniak/PL	PAV57 (1.0/5)	1631	3.5	269	9	48.1	79
LOPAL	Lopes	Lisboa/PT	NASO1 (0.75/6)	2377	3.8	506	17	138.9	74
MACMA	Maciejewski	Chelm/PL	PAV35 (0.8/3.8)	5495	4.0	1584	14	96.0	160
			PAV36 (0.8/3.8)*	5668	4.0	1573	16	83.5	127
			PAV43 (0.75/4.5)*	3132	3.1	319	13	86.2	67
			PAV60 (0.75/4.5)	2250	3.1	281	16	93.3	161
MARGR	Maravelias	Lofoupoli/GR	LOOMECON (0.8/12)	738	6.3	2698	16	92.7	133
MARRU	Marques	Lisbon/PT	RAN1 (1.4/4.5)	4405	4.0	1241	16	131.2	163
MASMI	Maslov	Novosimbirsk/RU	NOWATEC (0.8/3.8)	5574	3.6	773	11	54.9	109
MOLSI	Molau	Seysdorf/DE	AVIS2 (1.4/50)*	1230	6.9	6152	9	55.3	142
			ESCIMO2 (0.85/25)	155	8.1	3415	7	56.3	24
			MINCAM1 (0.8/8)	1477	4.9	1084	22	101.7	215
		Ketzür/DE	REMO1 (0.8/8)	1467	6.5	5491	21	123.8	467
			REMO2 (0.8/8)	1478	6.4	4778	24	130.8	439
			REMO3 (0.8/8)	1420	5.6	1967	3	8.6	10
			REMO4 (0.8/8)	1478	6.5	5358	23	133.7	434
MORJO	Morvai	Fülöpszallas/HU	HUFUL (1.4/5)	2522	3.5	532	19	134.3	109
MOSFA	Moschini	Rovereto/IT	ROVER (1.4/4.5)	3896	4.2	1292	16	12.6	79
OCHPA	Ochner	Albiano/IT	ALBIANO (1.2/4.5)	2944	3.5	358	2	15.6	15
OTTMI	Otte	Pearl City/US	ORIE1 (1.4/5.7)	3837	3.8	460	14	75.2	83
PERZS	Perkó	Becsehely/HU	HUBEC (0.8/3.8)*	5498	2.9	460	13	89.4	225
ROTEC	Rothenberg	Berlin/DE	ARMEFA (0.8/6)	2366	4.5	911	9	48.2	36
SARAN	Saraiva	Carnaxide/PT	RO1 (0.75/6)	2362	3.7	381	16	131.2	172
			RO2 (0.75/6)	2381	3.8	459	19	159.7	229
			RO3 (0.8/12)	710	5.2	619	19	169.1	281
			SOFIA (0.8/12)	738	5.3	907	17	148.0	185
SCALE	Scarpa	Alberoni/IT	LEO (1.2/4.5)*	4152	4.5	2052	8	38.4	47
SCHHA	Schremmer	Niederkrüchten/DE	DORAEMON (0.8/3.8)	4900	3.0	409	18	125.0	164
SLAST	Slavec	Ljubljana/SI	KAYAK1 (1.8/28)	563	6.2	1294	7	36.9	102
			KAYAK2 (0.8/12)	741	5.5	920	7	45.8	42
STOEN	Stomeo	Scorze/IT	MIN38 (0.8/3.8)	5566	4.8	3270	17	74.3	259
			NOA38 (0.8/3.8)	5609	4.2	1911	19	85.3	261
			SCO38 (0.8/3.8)	5598	4.8	3306	16	89.3	353
STRJO	Strunk	Herford/DE	MINCAM2 (0.8/6)	2354	5.4	2751	24	133.1	310
			MINCAM3 (0.8/6)	2338	5.5	3590	20	118.9	198
			MINCAM4 (1.0/2.6)	9791	2.7	552	14	68.2	89
			MINCAM5 (0.8/6)	2349	5.0	1896	20	127.1	162
			MINCAM6 (0.8/6)	2395	5.1	2178	23	135.1	185
TEPIS	Tepliczky	Agostyan/HU	HUAGO (0.75/4.5)	2427	4.4	1036	13	70.0	78
			HUMOB (0.8/6)	2388	4.8	1607	12	77.0	122
TRIMI	Triglav	Velenje/SI	SRAKA (0.8/6)*	2222	4.0	546	12	34.9	75
YRJIL	Yrjölä	Kuusankoski/FI	FINEXCAM (0.8/6)	2337	5.5	3574	7	28.6	41
Sum							29	7024.9	15526

* active field of view smaller than video frame

2. Observing Times (h)

February	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	-	4.6	5.9	6.6	2.4	11.1	5.8	5.6	1.9	1.4	11.1	11.3	1.5	-	-
BANPE	-	-	-	-	-	0.5	-	1.4	-	-	1.1	-	0.6	-	-
BERER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOMMA	-	-	-	12.1	12.5	2.4	-	6.7	-	12.3	2.6	2.3	-	-	-
BREMA	-	8.5	8.3	-	-	7.8	5.9	-	-	8.2	9.4	11.3	-	-	12.1
BRIBE	-	7.9	4.7	-	4.2	9.8	7.1	1.1	-	3.0	5.7	12.2	-	-	7.5
	-	7.0	-	1.7	4.1	8.4	6.1	1.1	2.0	0.5	2.5	12.1	-	-	-
CASFL	9.1	-	9.0	12.6	12.5	2.4	-	1.2	-	12.5	5.0	-	10.5	5.9	-
	6.6	-	8.6	4.3	-	-	-	3.1	-	12.2	3.4	5.2	7.6	6.1	0.2
CRIST	5.0	-	7.2	12.2	8.4	-	1.2	0.6	3.9	12.0	5.6	-	5.4	4.2	-
	-	-	6.8	12.2	3.7	-	2.4	-	4.0	12.0	4.6	6.6	4.2	6.0	-
	7.0	-	8.6	12.2	8.5	-	1.2	0.9	4.3	12.0	6.0	-	6.5	4.4	-
DONJE	-	-	-	12.4	-	1.8	-	-	-	10.8	2.4	2.3	-	-	-
ELTMA	-	-	-	12.5	12.2	5.5	-	-	-	11.7	4.7	-	-	-	-
FORKE	-	-	0.9	-	-	12.3	0.2	-	-	-	-	7.8	-	-	-
GONRU	12.0	10.5	12.1	12.1	4.8	-	1.4	-	1.4	-	-	-	3.3	4.4	11.6
	11.4	10.3	12.2	12.2	4.6	-	1.4	-	1.0	-	-	-	3.4	4.0	11.8
	11.0	7.3	12.1	12.1	4.0	3.3	-	-	-	-	-	-	-	-	11.7
	10.3	10.3	12.2	12.2	3.7	-	-	0.3	0.2	-	-	-	2.5	3.0	11.8
	9.4	8.9	12.0	12.1	4.1	3.3	0.9	-	0.5	-	-	-	3.2	3.7	11.5
GOVMI	-	-	1.6	4.4	11.8	9.7	-	9.4	-	2.4	-	-	-	-	-
	-	-	2.1	3.1	11.2	8.9	0.8	7.4	-	-	11.1	-	5.7	-	-
	-	2.1	0.6	3.2	11.4	8.7	-	8.5	-	2.8	10.5	-	7.0	-	-
HERCA	1.9	6.3	11.5	11.4	11.4	11.4	11.4	11.2	11.3	7.3	11.2	11.3	11.3	11.3	9.1
IGAAN	4.8	-	-	6.6	6.0	7.2	6.5	-	1.7	2.6	6.8	-	2.3	4.3	4.0
	-	-	3.6	7.1	7.6	11.3	3.7	4.4	-	-	11.6	-	-	-	-
JONKA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	6.8	8.2	12.5	3.0	3.9	-	-	12.1	-	-	4.1	-
KACJA	-	-	-	1.2	5.2	-	-	-	-	1.8	7.1	-	-	-	-
	6.1	-	-	0.2	8.9	-	-	-	-	-	-	-	-	-	-
	-	-	-	1.2	4.6	-	-	-	-	7.2	7.4	-	-	-	-
	-	-	-	-	5.1	-	-	-	-	1.8	7.3	-	-	-	-
KOSDE	-	-	-	-	-	-	-	-	-	-	10.9	-	8.1	3.6	2.4
	2.3	3.2	10.2	9.9	-	9.9	6.1	7.8	9.6	10.8	10.8	10.8	10.7	10.7	8.4
	-	-	-	-	4.5	5.1	4.4	0.2	8.3	8.2	8.2	10.2	8.4	3.4	2.0
	2.7	3.6	10.4	9.9	-	10.1	-	7.9	10.6	10.8	10.8	10.3	8.3	10.8	-
	-	-	-	-	-	-	-	-	0.7	6.8	-	6.9	-	-	4.6
LOJTO	-	-	-	0.6	-	9.5	9.9	5.7	-	-	-	1.5	-	4.7	-
LOPAL	6.4	8.7	11.6	11.7	4.1	-	-	-	-	-	-	-	-	-	9.5
MACMA	0.9	-	5.8	3.8	-	11.7	12.6	5.3	5.2	-	-	6.9	-	6.1	-
	0.9	0.3	2.9	2.9	-	11.5	12.3	4.1	4.3	-	-	4.7	-	6.3	-
	1.0	-	3.2	4.6	-	11.5	11.8	3.6	-	-	-	5.5	-	6.7	-
	1.1	-	4.0	4.6	-	11.6	12.0	4.4	4.4	-	-	5.4	-	6.6	-
MARGR	8.9	5.0	7.2	1.9	-	4.6	7.5	6.1	-	-	9.3	0.7	2.3	-	-
MARRU	4.1	7.9	9.7	9.4	-	-	-	-	-	-	-	-	-	4.8	11.7
MASMI	-	-	-	-	-	-	-	-	-	-	-	-	-	8.2	8.7
MOLSI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	9.6	4.5	4.6	-	12.2	12.2	-	-	-	-	9.4	3.8	-	-	-
	7.1	2.7	3.0	-	11.6	11.7	1.8	2.0	-	-	8.2	2.5	3.3	0.4	0.7
	1.2	5.8	8.2	3.2	-	12.4	4.5	5.2	2.4	0.5	12.0	9.8	-	-	-
	1.1	5.8	7.8	5.6	2.3	12.6	6.7	5.3	2.8	0.2	12.1	9.7	2.3	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1.3	6.0	8.1	5.4	1.2	12.7	6.9	5.3	2.4	1.1	12.2	9.6	2.5	-	-
MORJO	8.2	-	-	9.3	10.7	12.4	8.0	6.6	-	-	12.1	-	5.3	0.7	4.4
MOSFA	0.3	-	1.3	1.0	1.1	-	-	0.5	-	2.2	0.2	0.7	0.2	0.2	-
OCHPA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTTMI	-	0.9	-	3.2	4.3	-	-	-	8.4	-	11.8	-	-	-	1.4
PERZS	-	-	2.2	5.1	10.6	11.1	1.5	9.3	-	4.9	12.2	-	10.4	3.9	-
ROTEC	-	5.3	4.2	-	-	-	-	-	-	-	-	-	-	-	-
SARAN	7.5	10.6	10.8	10.6	-	-	-	-	-	-	-	-	-	7.8	9.5
	7.6	6.8	10.7	11.3	-	-	-	0.2	-	-	-	-	-	6.8	11.9
	9.4	11.3	12.0	11.0	2.4	-	-	-	-	-	-	-	-	9.7	11.7
	5.3	9.6	9.1	9.8	-	-	-	-	-	-	-	-	-	9.0	11.9
SCALE	-	-	1.6	12.0	12.2	-	-	-	-	-	-	-	-	-	-
SCHHA	-	9.6	2.2	-	-	7.2	6.5	2.7	4.2	4.4	3.0	11.3	-	-	12.2
SLAST	3.1	-	-	7.7	11.3	2.0	-	-	-	5.3	4.4	-	-	-	-
	5.6	-	-	8.2	12.3	1.9	-	-	-	5.9	8.6	-	-	-	-
STOEN	-	-	2.3	12.0	12.2	7.0	-	2.4	2.3	12.3	4.0	1.2	1.2	0.5	-
	-	-	2.8	12.5	11.8	6.3	-	1.9	2.4	12.4	4.1	1.6	1.6	0.5	-
	-	-	3.0	12.7	12.4	7.9	-	2.6	2.4	12.4	4.3	1.3	2.2	0.2	-
STRJO	0.3	8.6	2.3	-	1.3	11.4	8.2	1.7	1.6	1.0	5.2	12.3	-	-	6.5
	0.4	7.4	1.2	-	1.4	12.2	7.6	-	1.6	0.9	5.6	11.9	-	-	-
	-	2.9	-	-	-	-	7.3	-	-	-	3.1	2.4	-	-	1.1
	0.2	8.5	2.2	-	1.7	11.9	8.3	1.5	1.3	-	4.8	12.4	-	-	6.5
	0.3	8.5	1.8	-	1.2	11.6	8.0	1.5	1.2	1.2	3.7	12.4	-	-	6.7
TEPIS	-	-	-	-	6.8	12.3	7.9	5.4	-	-	-	-	6.6	1.9	-
	4.9	-	-	5.7	6.3	12.2	7.7	4.2	0.2	-	10.1	-	6.0	-	-
TRIMI	-	-	-	5.1	4.7	0.8	-	4.0	-	6.2	1.8	-	4.3	0.6	-
YRJIL	-	2.0	2.1	-	-	-	-	-	-	-	-	-	-	-	-
Sum	196.3	229.2	308.5	415.4	341.7	413.6	226.5	174.2	108.5	242.0	352.1	248.2	158.7	175.5	223.1

February	16	17	18	19	20	21	22	23	24	25	26	27	28	29
ARLRA	8.7	0.6	-	0.8	-	-	-	4.5	7.1	2.2	9.9	-	4.4	-
BANPE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BERER	-	-	-	-	-	-	-	-	-	-	1.6	-	-	-
BOMMA	-	-	5.8	5.7	9.8	6.6	0.5	11.3	-	-	-	-	-	2.3
BREMA	12.1	6.8	-	-	-	-	3.3	11.0	7.3	10.3	5.4	11.5	11.4	11.3
BRIBE	11.5	1.9	5.0	4.6	-	-	-	4.8	9.9	9.3	2.2	11.5	10.3	11.2
	11.7	-	-	4.3	-	-	-	0.4	10.4	1.7	1.0	11.4	4.2	11.2
CASFL	-	1.7	10.3	8.5	11.9	3.7	-	6.4	-	11.6	-	-	-	-
	-	2.3	7.9	8.6	11.2	2.4	-	6.1	-	11.1	-	-	-	-
CRIST	-	0.4	4.0	6.4	2.9	-	-	5.2	-	8.0	-	-	-	-
	-	-	1.2	9.6	2.6	-	-	5.1	-	5.2	-	-	-	4.9
	-	0.5	4.3	9.4	2.5	-	-	7.4	-	9.3	-	-	-	-
DONJE	-	-	4.3	3.0	5.6	5.9	0.3	9.1	-	-	-	-	-	1.9
ELTMA	-	-	2.6	1.0	4.4	-	-	-	-	0.6	-	-	-	-
FORKE	-	-	7.6	0.7	-	-	-	-	10.7	4.8	10.8	11.4	-	-
GONRU	11.5	7.2	11.5	11.4	10.4	5.9	3.2	1.7	3.9	1.5	1.8	8.9	11.2	11.1
	11.6	7.4	11.7	11.6	11.6	7.3	4.3	-	2.6	-	1.5	8.8	8.1	11.2
	11.5	9.2	11.5	11.4	8.9	7.0	-	-	3.3	-	2.0	7.3	11.0	11.0
	11.0	5.3	11.6	11.3	6.2	4.5	2.4	3.4	3.0	-	1.2	8.2	11.1	11.2
	11.5	9.5	11.2	11.0	8.3	6.5	1.8	0.4	2.4	-	1.8	7.5	10.9	10.9
GOVMI	-	-	-	-	-	1.0	-	0.2	6.2	-	-	-	-	-
	-	-	-	-	-	1.4	-	-	5.8	-	-	-	-	-
	-	-	-	0.2	-	1.3	-	-	6.1	-	-	-	-	-
HERCA	11.0	11.3	10.9	4.3	7.5	6.7	9.6	10.8	11.0	10.2	11.1	11.1	11.1	10.8
IGAAN	3.0	-	-	6.1	-	-	-	-	7.1	-	4.8	7.3	-	-
	-	-	-	-	-	2.8	-	-	8.2	-	3.2	-	-	-
JONKA	-	-	-	-	-	-	-	-	-	-	0.4	3.5	-	-
	2.0	3.2	-	1.7	-	1.0	1.9	-	10.4	-	5.8	2.2	-	-
KACJA	-	-	-	-	7.6	-	-	-	-	-	1.4	-	-	-
	-	-	-	-	-	-	-	-	-	-	4.0	-	-	-
	-	-	-	-	5.2	-	-	-	-	-	1.4	-	-	-
	-	-	-	-	7.9	-	-	-	-	-	1.4	-	-	-
KOSDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	9.2	6.6	-	-	-	2.2	2.0	2.9	5.6	5.6	5.6	-	5.4	7.0
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.6	2.4	-	-	-	-	-	-	0.8	-	-	-	-	-
LOJTO	-	-	-	-	3.3	-	-	-	9.2	-	3.7	-	-	-
LOPAL	11.7	2.9	10.9	10.2	7.1	5.3	5.7	-	4.8	-	-	6.7	10.2	11.4
MACMA	-	-	-	-	7.7	1.7	-	-	9.6	-	9.9	8.8	-	-
	0.2	-	-	-	7.2	1.5	-	-	9.0	-	9.8	5.6	-	-
	-	-	-	-	8.2	1.6	-	-	9.8	-	9.9	8.8	-	-
	0.3	-	0.2	-	8.4	1.8	-	-	9.6	-	10.0	8.9	-	-
MARGR	-	-	-	-	-	6.8	-	5.4	4.5	3.9	7.5	11.1	-	-
MARRU	11.5	4.8	11.1	11.3	11.0	5.4	3.4	-	3.6	-	-	-	10.5	11.0
MASMI	4.0	3.5	7.8	-	-	2.5	1.3	5.8	-	4.4	8.0	-	-	0.7
MOLSI	-	5.3	5.1	6.2	-	11.0	-	1.0	3.1	3.2	10.8	9.6	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	4.8	4.1	6.0	-	8.8	-	0.2	2.0	2.5	10.5	7.4	0.4	-
	9.2	2.4	-	5.8	-	-	-	6.9	7.2	1.8	11.1	1.2	7.1	5.9
	10.0	2.2	-	3.2	0.6	-	-	5.9	6.9	2.1	11.1	0.2	7.5	6.8
	-	-	-	-	-	-	-	2.0	1.3	-	-	-	-	5.3
	9.1	2.1	-	5.5	-	-	-	5.7	7.4	2.0	11.5	0.4	7.6	7.7
MORJO	1.9	5.0	-	8.4	2.7	2.6	4.0	-	11.6	-	11.0	9.4	-	-
MOSFA	-	-	0.2	1.7	0.7	0.3	-	1.0	-	1.0	-	-	-	-
OCHPA	-	-	-	-	-	10.5	-	-	-	5.1	-	-	-	-
OTTMI	-	0.8	11.7	5.8	4.2	-	4.9	-	5.1	11.4	-	1.3	-	-
PERZS	-	-	-	-	-	-	-	-	5.7	-	9.5	3.0	-	-
ROTEC	7.5	-	-	3.3	-	-	-	4.1	6.7	2.2	11.1	-	3.8	-
SARAN	8.3	5.5	8.3	7.9	8.1	4.8	-	-	-	1.9	-	7.0	11.1	11.5
	11.3	6.4	11.7	11.1	11.7	9.7	7.7	-	3.8	-	1.6	7.5	10.8	11.1
	10.8	-	11.4	10.9	11.4	10.3	7.6	-	4.8	2.1	2.9	7.6	11.1	10.7
	11.8	7.0	11.4	10.9	10.2	8.7	-	-	-	2.0	1.8	7.6	10.7	11.2
SCALE	-	-	0.9	1.8	3.5	2.2	-	-	-	4.2	-	-	-	-
SCHHA	12.2	-	4.4	-	-	-	-	7.7	10.0	4.3	0.2	11.5	-	11.4
SLAST	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	3.3	-	-	-
STOEN	-	1.4	1.4	1.9	4.7	-	-	-	0.7	6.8	-	-	-	-
	-	1.4	3.9	1.2	6.8	2.6	-	0.2	1.1	10.2	-	-	-	-
	-	-	6.1	2.0	9.2	-	-	-	0.6	10.0	-	-	-	-
STRJO	8.8	2.8	2.4	3.6	-	-	0.2	2.7	3.4	4.0	10.9	11.4	11.3	11.2
	8.9	4.4	3.9	5.1	-	-	-	4.4	4.2	-	9.2	10.7	7.7	10.2
	8.8	-	0.2	0.2	-	-	-	0.2	0.4	-	8.4	11.2	11.4	10.6
	8.8	4.2	3.7	4.1	-	-	-	-	4.0	-	9.5	11.4	10.9	11.2
	8.8	4.0	2.8	4.7	-	-	-	4.9	3.9	3.1	11.0	11.4	11.1	11.3
TEPIS	0.7	-	-	-	-	3.9	-	1.0	8.7	1.5	11.3	2.0	-	-
	-	-	-	-	-	0.9	-	-	7.5	-	11.3	-	-	-
TRIMI	-	-	-	-	2.2	1.7	-	-	1.7	-	1.8	-	-	-
YRJIL	7.6	3.9	-	-	-	-	-	1.8	-	-	-	-	4.1	7.1
Sum	305.1	151.1	245.0	264.4	256.5	170.8	64.1	151.6	293.7	181.1	306.9	292.3	246.4	282.3

3. Results (Meteors)

February	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	-	18	14	38	4	62	29	12	1	5	50	53	1	-	-
BANPE	-	-	-	-	-	3	-	9	-	-	7	-	4	-	-
BERER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BOMMA	-	-	-	54	32	3	-	16	-	41	2	16	-	-	-
BREMA	-	21	9	-	-	4	6	-	-	8	3	26	-	-	16
BRIBE	-	6	3	-	3	10	12	1	-	7	4	23	-	-	13
	-	6	-	1	5	6	2	1	2	3	1	17	-	-	-
CASFL	11	-	19	43	35	5	-	2	-	36	3	-	8	18	-
	11	-	18	5	-	-	-	6	-	28	2	10	12	13	1
CRIST	2	-	37	49	17	-	3	1	17	39	7	-	2	3	-
	-	-	16	26	2	-	13	-	11	25	6	7	4	16	-
	5	-	50	78	22	-	2	1	22	57	13	-	11	8	-
DONJE	-	-	-	49	-	2	-	-	-	45	7	12	-	-	-
ELTMA	-	-	-	26	23	6	-	-	-	29	2	-	-	-	-
FORKE	-	-	1	-	-	30	1	-	-	-	-	30	-	-	-
GONRU	16	27	51	29	7	-	1	-	5	-	-	-	9	4	42
	22	21	27	14	9	-	2	-	2	-	-	-	9	7	28
	8	9	9	10	1	4	-	-	-	-	-	-	-	-	14
	9	21	28	25	2	-	-	2	1	-	-	-	4	3	38
	11	20	46	17	5	6	1	-	1	-	-	-	9	5	26
GOVMI	-	-	3	5	26	11	-	16	-	4	-	-	-	-	-
	-	-	4	6	30	8	3	12	-	-	10	-	12	-	-
	-	1	4	8	12	7	-	9	-	5	8	-	9	-	-
HERCA	1	18	17	16	22	21	16	15	13	23	25	11	14	12	16
IGAAN	8	-	-	8	9	10	10	-	1	1	16	-	2	7	1
	-	-	1	1	1	1	1	3	-	-	4	-	-	-	-
JONKA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	2	7	9	4	8	-	-	16	-	-	6	-
KACJA	-	-	-	3	3	-	-	-	-	4	10	-	-	-	-
	2	-	-	2	5	-	-	-	-	-	-	-	-	-	-
	-	-	-	3	6	-	-	-	-	41	26	-	-	-	-
	-	-	-	-	4	-	-	-	-	2	10	-	-	-	-
KOSDE	-	-	-	-	-	-	-	-	-	-	51	-	58	17	12
	3	19	59	100	-	82	42	41	112	95	88	94	93	80	57
	-	-	-	-	21	54	53	3	56	66	106	87	61	21	22
	3	31	110	106	-	107	-	54	127	119	119	129	88	91	-
	-	-	-	-	-	-	-	-	2	3	-	6	-	-	1
LOJTO	-	-	-	2	-	30	9	7	-	-	-	1	-	3	-
LOPAL	2	4	9	6	1	-	-	-	-	-	-	-	-	-	6
MACMA	1	-	11	8	-	30	25	3	3	-	-	4	-	15	-
	1	1	6	6	-	16	23	3	4	-	-	1	-	9	-
	1	-	3	7	-	12	10	2	-	-	-	1	-	3	-
	1	-	4	9	-	20	24	4	6	-	-	1	-	11	-
MARGR	27	2	14	2	-	7	11	2	-	-	19	4	6	-	-
MARRU	5	10	16	11	-	-	-	-	-	-	-	-	-	4	11
MASMI	-	-	-	-	-	-	-	-	-	-	-	-	-	17	11
MOLSI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	1	2	-	3	8	-	-	-	-	5	1	-	-	-
	10	1	3	-	22	41	11	7	-	-	12	2	17	1	1
	2	30	35	20	-	69	20	6	8	1	42	51	-	-	-
	2	27	28	23	2	49	29	4	7	1	56	58	1	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	44	35	20	1	40	26	10	5	2	60	43	3	-	-
MORJO	5	-	-	1	17	10	6	4	-	-	10	-	2	1	3
MOSFA	2	-	9	7	7	-	-	3	-	14	1	4	1	1	-
OCHPA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTTMI	-	6	-	4	1	-	-	-	4	-	12	-	-	-	10
PERZS	-	-	14	10	47	26	2	32	-	7	40	-	21	2	-
ROTEC	-	6	2	-	-	-	-	-	-	-	-	-	-	-	-
SARAN	2	15	11	12	-	-	-	-	-	-	-	-	-	12	18
	6	10	18	19	-	-	-	1	-	-	-	-	-	6	22
	6	12	26	23	3	-	-	-	-	-	-	-	-	13	24
	1	15	16	11	-	-	-	-	-	-	-	-	-	4	25
SCALE	-	-	5	17	13	-	-	-	-	-	-	-	-	-	-
SCHHA	-	16	2	-	-	8	4	5	4	5	1	23	-	-	11
SLAST	8	-	-	22	36	3	-	-	-	14	11	-	-	-	-
	2	-	-	11	17	1	-	-	-	2	6	-	-	-	-
STOEN	-	-	17	60	51	12	-	3	12	50	3	2	3	2	-
	-	-	21	53	43	5	-	2	7	59	3	5	3	2	-
	-	-	18	76	66	28	-	9	8	63	7	3	7	1	-
STRJO	1	18	4	-	4	23	15	2	4	3	11	43	-	-	36
	1	15	1	-	4	27	15	-	3	2	7	29	-	-	-
	-	4	-	-	-	-	9	-	-	-	3	14	-	-	2
	1	16	4	-	1	13	9	1	1	-	4	28	-	-	21
	2	15	3	-	2	11	8	1	1	2	2	37	-	-	9
TEPIS	-	-	-	-	10	13	2	9	-	-	-	-	10	2	-
	6	-	-	8	15	18	5	10	1	-	17	-	10	-	-
TRIMI	-	-	-	11	12	3	-	8	-	12	2	-	8	2	-
YRJIL	-	4	3	-	-	-	-	-	-	-	-	-	-	-	-
Sum	216	490	866	1183	691	974	464	350	451	923	930	876	502	422	497

February	16	17	18	19	20	21	22	23	24	25	26	27	28	29
ARLRA	57	5	-	1	-	-	-	10	30	3	30	-	4	-
BANPE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BERER	-	-	-	-	-	-	-	-	-	-	10	-	-	-
BOMMA	-	-	18	15	15	9	3	19	-	-	-	-	-	5
BREMA	26	7	-	-	-	-	6	11	15	7	5	14	13	8
BRIBE	11	1	2	1	-	-	-	6	24	11	1	21	17	25
	7	-	-	3	-	-	-	1	18	2	1	16	4	22
CASFL	-	4	11	26	22	4	-	22	-	14	-	-	-	-
	-	5	5	17	10	4	-	19	-	21	-	-	-	-
CRIST	-	1	9	24	3	-	-	13	-	9	-	-	-	-
	-	-	2	20	1	-	-	10	-	5	-	-	-	7
	-	1	18	43	1	-	-	30	-	25	-	-	-	-
DONJE	-	-	24	8	19	19	1	24	-	-	-	-	-	7
ELTMA	-	-	9	4	6	-	-	-	-	1	-	-	-	-
FORKE	-	-	19	2	-	-	-	-	10	9	13	25	-	-
GONRU	37	14	29	32	10	16	4	4	5	2	5	13	30	46
	25	18	20	23	8	11	9	-	6	-	4	14	30	36
	14	6	14	9	8	4	-	-	4	-	1	5	16	6
	25	15	28	27	6	3	7	2	8	-	2	11	26	23
	35	39	27	21	8	10	2	1	8	-	4	16	25	24
GOVMI	-	-	-	-	-	1	-	1	1	-	-	-	-	-
	-	-	-	-	-	1	-	-	4	-	-	-	-	-
	-	-	-	1	-	5	-	-	1	-	-	-	-	-
HERCA	15	17	18	6	6	21	8	16	14	15	14	16	17	15
IGAAN	4	-	-	4	-	-	-	-	18	-	12	5	-	-
	-	-	-	-	-	2	-	-	2	-	1	-	-	-
JONKA	-	-	-	-	-	-	-	-	-	-	1	1	-	-
	3	2	-	1	-	1	1	-	7	-	6	1	-	-
KACJA	-	-	-	-	12	-	-	-	-	-	4	-	-	-
	-	-	-	-	-	-	-	-	-	-	1	-	-	-
	-	-	-	-	20	-	-	-	-	-	2	-	-	-
	-	-	-	-	11	-	-	-	-	-	3	-	-	-
KOSDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	95	76	-	-	-	42	21	51	16	49	30	-	36	32
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	1	-	-	-	-	-	-	2	-	-	-	-	-
LOJTO	-	-	-	-	3	-	-	-	20	-	4	-	-	-
LOPAL	3	1	7	10	1	2	1	-	4	-	-	3	8	6
MACMA	-	-	-	-	8	3	-	-	23	-	19	7	-	-
	1	-	-	-	4	3	-	-	28	-	20	1	-	-
	-	-	-	-	3	1	-	-	11	-	10	3	-	-
	2	-	1	-	11	1	-	-	29	-	28	9	-	-
MARGR	-	-	-	-	-	5	-	2	8	2	8	14	-	-
MARRU	24	8	10	13	7	8	2	-	4	-	-	-	8	22
MASMI	10	5	16	-	-	3	4	9	-	10	19	-	-	5
MOLSI	-	6	8	26	-	33	-	2	1	11	36	19	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	7	2	16	-	16	-	1	1	16	19	8	1	-
	47	1	-	22	-	-	-	22	32	1	31	5	11	11
	39	8	-	16	1	-	-	14	15	6	37	1	6	9
	-	-	-	-	-	-	-	1	4	-	-	-	-	5
	25	4	-	16	-	-	-	11	28	2	30	4	5	15
MORJO	1	2	-	5	2	2	1	-	14	-	17	6	-	-
MOSFA	-	-	1	11	4	2	-	6	-	6	-	-	-	-
OCHPA	-	-	-	-	-	9	-	-	-	6	-	-	-	-
OTTMI	-	6	16	2	3	-	1	-	1	9	-	8	-	-
PERZS	-	-	-	-	-	-	-	-	1	-	17	6	-	-
ROTEC	12	-	-	5	-	-	-	1	2	1	6	-	1	-
SARAN	16	5	7	20	5	6	-	-	-	3	-	7	14	19
	16	7	18	19	12	7	4	-	7	-	2	12	20	23
	31	-	30	23	15	2	7	-	9	1	1	9	17	29
	15	8	18	18	8	8	-	-	-	2	6	6	9	15
SCALE	-	-	2	3	3	1	-	-	-	3	-	-	-	-
SCHHA	28	-	4	-	-	-	-	6	13	3	1	12	-	18
SLAST	-	-	-	-	8	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	3	-	-	-
STOEN	-	6	2	6	17	-	-	-	1	12	-	-	-	-
	-	2	9	6	16	3	-	1	1	20	-	-	-	-
	-	-	7	6	29	-	-	-	1	24	-	-	-	-
STRJO	8	3	1	1	-	-	1	2	9	6	15	36	25	39
	12	3	5	5	-	-	-	9	8	-	9	17	5	21
	13	-	1	1	-	-	-	1	1	-	3	13	8	16
	11	3	2	3	-	-	-	-	3	-	9	11	7	14
	13	5	2	1	-	-	-	6	6	2	8	21	9	19
TEPIS	1	-	-	-	-	5	-	1	8	1	15	1	-	-
	-	-	-	-	-	1	-	-	11	-	20	-	-	-
TRIMI	-	-	-	-	7	5	-	-	3	-	2	-	-	-
YRJIL	13	3	-	-	-	-	-	5	-	-	-	-	6	7
Sum	698	305	422	542	333	279	83	340	500	320	545	397	378	549