Results of the IMO Video Meteor Network – January 2013

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The new year did not start very encouraging for most video observers. In Germany, for example, the winter 2012/13 was the one with least Sunshine hours since the beginning of regular weather recordings. Hence, the observers enjoyed only few observing nights. Whereas the first half of January was still acceptable, the second half was almost a total loss. Also other north and east-European observers shared the same fate – only observers in southern Europe could collect more observations. So it's no surprise that only seven of the 71 cameras in operation managed to obtain twenty or more observing nights. With less than 4,900 hours, the effective observing time reduced by 50% compared to 2012, and those 13,000 meteors are even only a third of the January 2012 outcome.

With the Quadrantids at the begin of year, the meteor season ends. The nights are getting shorter and meteor activity is clearly diminishing. The Quadrantids themselves have a strong, short peak, but only once in a few years they can be well perceived. Three prerequisites are necessary: Clear skies, a peak in the local morning hours, and no moon. In central Europe, you may find these conditions every ten years or so – certainly not in 2013. The weather was mediocre, the maximum was predicted for daytime (UT) of January 3, and the waning moon was located high in the sky. Still we could obtain a fair activity profile. It shows a clear increase in flux density in the morning hours of January 3 with up to 25 meteoroids per 1,000 km^2 and hour. Both the shape of the profile and the peak density match to the values of the previous year – the peak occurred only 0.3° earlier in solar longitude (figure 1). Unfortunately, visual observations are too sparse in in this year to confirm the result.

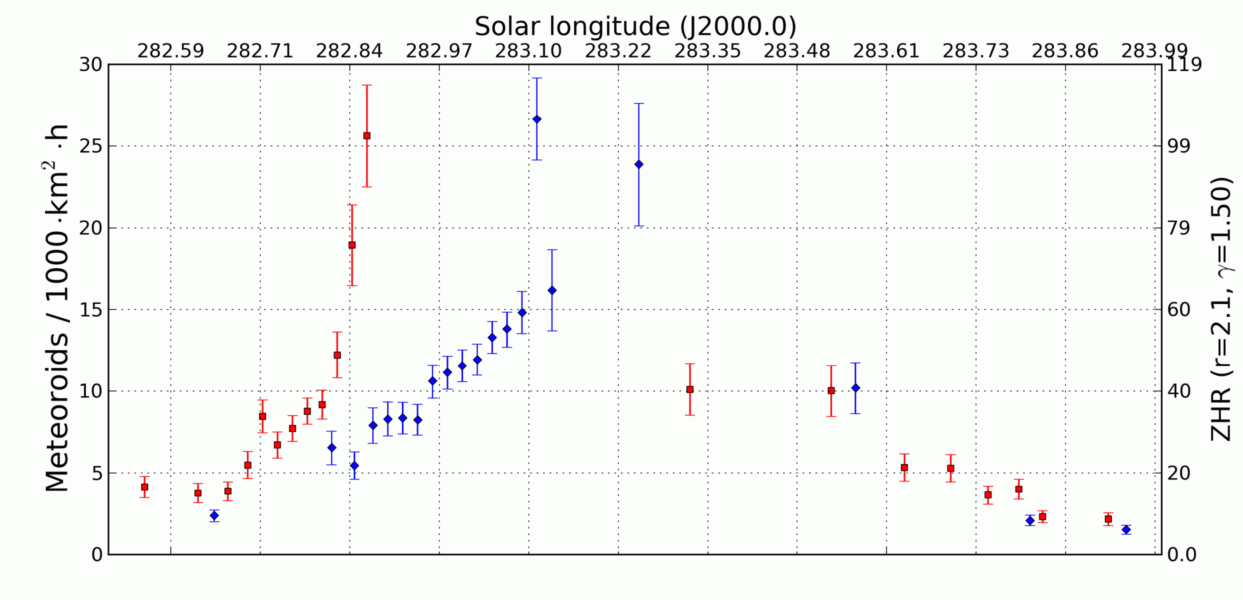

Figure 1: *Activity profile of the Quadrantids from data of the IMO network in 2012 (blue diamonds) and 2013 (red squares).*

The spring 2012 long-term analysis revealed activity of the Quadrantids (10 QUA) between December 30 and January 12. From January 2 to 9 they are the strong meteor source in the sky (table 1).

Table 1: *Parameters of the Quadrantids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	283.3	-	230.0	+0.4	+49.5	-0.2	42.9	-
IMO 2012	283	278-293	230.9	+0.1	+48.7	+0.0	42.4	-

Still there is significant scatter in the shower parameters, in partical towards the edges of the activity interval. It is particulary strange, that the radiant can be found unequivocally with a little different position on December 28 and 29, then it almost disappears over New Year's Eve, and on January 2 it is clearly back. Analysing the situation in more detail we found, that there are in fact two similar showers with slightly overlapping activity interval.
The second shower can be traced between December 26 and January 2. At this time, it is equally strong than the early Quadrantids, has the same velociy – only the radiant position is some 7° north-west. The scatter in the shower parameters is even lower than for the Quadrantids, and with a rank of two for five days, there is no doubt about the reality of this shower. In the MDC list there is no entry with similar parameters at the given time of year. However, the shower resembles to the December alpha Draconids (334 DAD), whose maximum in 20° in solar longitude earlier in time. When extrapolationg the radiant position we find a good agreement, and also SonotaCo reported activity up to 278° solar longitude for this shower.
Note that we detected this shower already between 249 and 264° solar longitude as described in our December report. If both sections of the shower are linked, they are in good agreeement – only the drift in right ascension has a different sign, which is difficult to explain. Still we currently believe that these are two segments of the same shower. The parameters are given in table 2.

Table 2: *Parameters of the December alpha Draconids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	256.5	-	207.9	+0.4	+60.6	-0.14	43.1	-
IMO 2012	255	253-266	205.1	+0.8	+60.1	-0.3	42.8	-
	278	274-281	222.8	-0.7	+53.5	-0.1	43.0	-

Of course, there are further minor showers in January. They seem to stand out stronger from the background than at other times – maybe because sporadic activity is generally somewhat lower in January
The first shower are the January Leonids (319 JLE), which could be detected with 250 meteors between New Year's Eve and January 6. At maximum on January 2, the shower has a rank of four and the shower parameters show only little scatter. There is perfect agreement with the MDC parameters with respect to the radiant position, but the meteor shower velocity deviates strongly (table 3). The MDC data were obtained from Canadian radar data, and there were cases of similar large deviation in the past (e.g. for the Daytime Arietids in June).

Table 3: *Parameters of the January Leonids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	282.5	-	148.3	+0.66	+23.9	-0.14	53.9	-
IMO 2012	281	279-285	146.6	+0.6	+24.3	-0.2	60.4	-

The northern delta Cancrids (96 NCC) can be found between January 10 and 28. An overall of 900 meteors from our database are assigned to that shower. Normally it would be omitted due to the large scatter in meteor shower parameters, but we report the shower anyway, because it is the second strongest source in the sky for a longer amount of time. Furthermore, according the MDC there are also the southern delta Cancrids (97 SCC) active at the same time, which cannot be detected separately by us. Maybe the scatter is just a side effect of this second radiant? At least our shower parameters fit well to the MDC values (table 4).

Table 4: *Parameters of the Northern delta Cancrids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	296.3	-	130	-	+20	-	28.3	-
IMO 2012	299	290-308	131.4	+0.4	+17.6	-0.2	29.9	-

Very little scatter is present in the data of the xi Coronae Borealids (323 XCB), even thoug their rank is only shortly below ten. About 200 meteors can be assigned to that shower between January 11 and 18. It shows a weakly pronounced activity profile with maximum on January 15. The shower parameters derived by us are given in table 5. Once more, there is significant deviation in the meteor shower velocity, and once more the MDC data are from the Canadian radar data analysis published in 2008. It looks as if these deviations are of systematic nature.

Table 5: *Parameters of the xi Coronae Borealids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	294.5	-	244.8	+0.69	+31.1	-0.11	45.6	-
IMO 2012	295	291-298	249.0	+0.1	+29.8	+0.0	49.9	-

There is also no doubt about the January xi Ursae Majorids (341 XUM), which are represented by 340 meteors in our database. The shower is active between January 16 and 20, on January 18 and 19 it's the strongest source in the sky. The shower parameters show almost no scatter and the activity profile has a clear peak, which leaves no doubts about the detection. A comparison with the MDC list values (table 6) shows a good agreement. Once more, our velocity is higher that the MDC values – this time the reference data come from Japanese video observations, though.

Table 6: *Parameters of the January xi Ursae Majorids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	300.6	-	169.0	-0.13	+33.0	+0.01	41.7	-
IMO 2012	298	296-300	169.2	+0.3	+32.6	-0.5	45.6	-

The gamma Ursae Minorids (404 GUM) are detected with 250 meteors between January 18 and 24. The shower presents moderate parameter scatter – only the shower velocity shows large scatter. At maximum on January 20, the gamma Ursae Minorids are the strongest source in the sky. Our shower parameters match well to the MDC values (table 7). This time there is also no discrepancy in the meteor shower velocity.

Table 7: *Parameters of the gamma Ursae Minorids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	299	-	231.7	+0.7	+66.8	-0.57	33.7	-
IMO 2012	300	298-204	228.5	+1.0	+67.3	-0.7	31.6	-

Another safe detection are the January Comae Berenicids (90 JCO). They are active between January 21 and 27, and during all that time there is no stronger meteor source in the sky. Almost 400 meteors are assigned to that shower. The scatter in shower parameters is moderate, but the agreement with the MDC values is excellent (table 8).

Table 8: *Parameters of the January Comae Berenicids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	301	-	188.9	+1.3	+16.8	-0.3	64.9	-
IMO 2012	304	301-307	192.7	+0.8	+15.0	-0.2	65.7	-

The alpha Coronae Borealids (429 ACB) are detected with almost 500 meteors in our data between January 27 and February 5. End of January, they are the strongest source in the sky. There is significant scatter in the meteor shower parameters, but we have no doubts about the detection because of the strong activity. There is good agreement with the MDC values (table 9).

Table 9: *Parameters of the alpha Coronae Borealids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	309.9	-	233.3	-	+27.0	-	59.1	-
IMO 2012	308	307-316	231.5	+1.8	+26.0	-1.0	57.8	-

Finally we do also find the February epsilon Virginids (506 FEV) in our data. Between January 29 and February 9, almost 600 meteors from our database are assigned to that shower, and the shower is the second or third strongest source in the sky all time long. There is only little scatter in the radiant position, but significant scatter in the velocity. Overall the agreement with the MDC values is excellent (table 10).

Table 10: *Parameters of the February epsilon Virginids from the MDC Working List and the analysis of the IMO network in 2012.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
MDC	315	-	201.7	-	+10.4	-	64.0	-
IMO 2012	315	309-320	201.0	+0.9	+10.6	-0.3	65.0	

In the end we would like to introduce a possibly new meteor shower, which is present in our data between Janauary 20 and 26. There is a chain of radiants in the southern hemisphere, which yields a rank of up to four. An overall of 300 meteors were assigned to the shower candidate, which present moderate scatter in the shower parameters (table 11). After publication of the shower candidate in the Internet we got a fast response from Damir Segon, that he could confirm this shower based on data of the SonotaCo network and their own observations. Thus, we reported this candidate to the MDC, where it was temporarily added to the working list of meteor shower under the designation eta Corvids (530 ECV).

Table 11: *Parameters of an unknown meteor shower from the analysis of the IMO network in 2012, which got the preliminary MDC designation eta Corvids.*

Source	Solar Longitude		Right Ascension		Deklination		Vinf	
	Mean [°]	Interval [°]	Mean [°]	Drift [°]	Mean [°]	Drift [°]	Mean [km/s]	Drift [km/s]
IMO 2012	303	300-306	193.8	+0.5	-17.0	+0.6	70.3	-

Beyond that, our meteor database shows signs of the Canum Venaticids and the nu Bootids, but both shower are too weak for a safe detection.

1. Observers

Code	Name	Place	Camera	FOV [^{o2}]	St.LM [mag]	Eff.CA [km^2]	Nights	Time [h]	Meteors
ARLRA	Arlt	Ludwigsfelde/DE	LUDWIG1 (0.8/8)	1488	4.8	726	4	13.5	9
BANPE	Bánfalvi	Zalaegerszeg/HU	HUVCSE01 (0.95/5)	2423	3.4	361	8	48.8	41
BASLU	Bastiaens	Hove/BE	URANIA1 (0.8/3.8)*	4545	2.5	237	3	15.6	3
BERER	Berkó	Ludanyhalaszi/HU	HULUD1 (0.8/3.8)	5542	4.8	3847	7	58.5	451
			HULUD2 (0.95/4)	3398	3.8	671	7	61.4	181
			HULUD3 (0.95/4)	4357	3.8	876	7	56.8	153
BIRSZ	Biro	Agostyan/HU	HUAGO (0.75/4.5)	2427	4.4	1036	13	62.8	155
BOMMA	Bombardini	Faenza/IT	MARIO (1.2/4.0)	5794	3.3	739	9	32.6	267
BREMA	Breukers	Hengelo/NL	MBB3 (0.75/6)	2399	4.2	699	7	46.4	57
			MBB4 (0.8/8)	1470	5.1	1208	8	49.2	58
BRIBE	Brinkmann	Herne/DE	HERMINE (0.8/6)	2374	4.2	678	10	55.0	84
		Berg. Gladbach/DE	KLEMOI (0.8/6)	2286	4.6	1080	10	57.4	95
CASFL	Castellani	Monte Baldo/IT	BMH1 (0.8/6)	2350	5.0	1611	11	106.1	202
			BMH2 (1.5/4.5)*	4243	3.0	371	9	88.1	164
CRIST	Crivello	Valbrevenna/IT	BILBO (0.8/3.8)	5458	4.2	1772	22	177.8	598
			C3P8 (0.8/3.8)	5455	4.2	1586	22	132.8	380
			STG38 (0.8/3.8)	5614	4.4	2007	21	163.1	616
CSISZ	Csizmadia	Baja/HU	HUVCSE02 (0.95/5)	1606	3.8	390	9	24.2	72
ELTMA	Eltri	Venezia/IT	MET38 (0.8/3.8)	5631	4.3	2151	7	45.0	150
GONRU	Goncalves	Tomar/PT	TEMPLAR1 (0.8/6)	2179	5.3	1842	16	134.3	367
			TEMPLAR2 (0.8/6)	2080	5.0	1508	18	150.1	368
			TEMPLAR3 (0.8/8)	1438	4.3	571	21	168.8	360
			TEMPLAR4 (0.8/3.8)	4475	3.0	442	18	141.3	366
GOVMI	Govedic	Sredisce ob Dr./SI	ORION2 (0.8/8)	1447	5.5	1841	8	36.8	62
			ORION3 (0.95/5)	2665	4.9	2069	7	31.9	41
			ORION4 (0.95/5)	2662	4.3	1043	11	36.7	79
IGAAN	Igaz	Baja/HU	HUBAJ (0.8/3.8)	5552	2.8	403	15	52.6	98
		Debrecen/HU	HUDEB (0.8/3.8)	5522	3.2	620	14	33.0	104
		Budapest/HU	HUPOL (1.2/4)	3790	3.3	475	9	41.1	48
JONKA	Jonas	Budapest/HU	HUSOR (0.95/4)	2286	3.9	445	9	55.7	142
KACJA	Kac	Kamnik/SI	CVETKA (0.8/3.8)	4914	4.3	1842	9	51.9	130
		Ljubljana/SI	ORION1 (0.8/8)	1402	3.8	331	8	46.9	37
		Kamnik/SI	REZIKA (0.8/6)	2270	4.4	840	13	59.3	164
			STEFKA (0.8/3.8)	5471	2.8	379	12	57.0	131
KERST	Kerr	Glenlee/AU	GOCAM1 (0.8/3.8)	5189	4.6	2550	21	102.2	491
KOSDE	Koschny	Izana Obs./ES	ICC7 (0.85/25)*	714	5.9	1464	22	189.5	1328
		Noordwijkerhout/NL	LIC4 (1.4/50)*	2027	6.0	4509	9	47.4	71
LERAR	Leroy	Gretz/FR	SAPHIRA (1.2/6)	3260	3.4	301	5	33.7	22
MACMA	Maciejewski	Chelm/PL	PAV35 (1.2/4)	4383	2.5	253	7	41.9	45
			PAV36 (1.2/4)*	5732	2.2	227	12	50.1	94
			PAV43 (0.95/3.75)*	2544	2.7	176	11	56.6	51
MARGR	Maravelias	Lofoupoli/GR	LOOMECON (0.8/12)	738	6.3	2698	15	96.9	342
MOLSI	Molau	Seysdorf/DE	MINCAM1 (0.8/8)	1477	4.9	1084	10	40.4	76
		Ketzür/DE	REMO1 (0.8/8)	1467	5.9	2837	15	69.5	271
			REMO2 (0.8/8)	1478	6.3	4467	16	69.0	227
			REMO3 (0.8/8)	1420	5.6	1967	11	60.3	55
MORJO	Morvai	Fülöpszallas/HU	HUFUL (1.4/5)	2522	3.5	532	9	56.6	98
OCAFR	Ocana Gonzales	Madrid/ES	FOGCAM (1.4/7)	1890	3.9	109	18	129.7	134
OCHPA	Ochner	Albiano/IT	ALBIANO (1.2/4.5)	2944	3.5	358	17	29.9	207
OTTMI	Otte	Pearl City/US	ORIE1 (1.4/5.7)	3837	3.8	460	21	158.9	449
PERZS	Perkó	Becsehely/HU	HUBEC (0.8/3.8)*	5498	2.9	460	14	52.6	172
PUCRC	Pucer	Nova vas nad Dra./SI	MOBCAM1 (0.75/6)	2398	5.3	2976	13	99.3	251
ROTEC	Rothenberg	Berlin/DE	ARMEFA (0.8/6)	2366	4.5	911	5	17.5	7
SARAN	Saraiva	Carnaxide/PT	RO1 (0.75/6)	2362	3.7	381	13	96.3	177
			RO2 (0.75/6)	2381	3.8	459	19	156.5	281
			SOFIA (0.8/12)	738	5.3	907	19	146.3	250
SCALE	Scarpa	Alberoni/IT	LEO (1.2/4.5)*	4152	4.5	2052	8	39.4	56
SCHHA	Schremmer	Niederkrüchten/DE	DORAEMON (0.8/3.8)	4900	3.0	409	12	64.3	122
SLAST	Slavec	Ljubljana/SI	KAYAK1 (1.8/28)	563	6.2	1294	7	13.6	57
STOEN	Stomeo	Scorze/IT	MIN38 (0.8/3.8)	5566	4.8	3270	16	94.7	405
			NOA38 (0.8/3.8)	5609	4.2	1911	15	84.6	247
			SCO38 (0.8/3.8)	5598	4.8	3306	16	100.5	376
STORO	Štork	Kunzak/CZ	KUN1 (1.4/50)*	1913	5.4	2778	1	1.9	69
		Ondrejov/CZ	OND1 (1.4/50)*	2195	5.8	4595	1	1.5	27
STRJO	Strunk	Herford/DE	MINCAM2 (0.8/6)	2362	4.6	1152	7	41.4	68
			MINCAM3 (0.8/12)	728	5.7	975	10	51.4	54
			MINCAM5 (0.8/6)	2349	5.0	1896	11	50.2	114
TEPIS	Tepliczky	Budapest/HU	HUMOB (0.8/6)	2388	4.8	1607	6	41.9	162
TRIMI	Triglav	Velenje/SI	SRAKA (0.8/6)*	2222	4.0	546	14	18.2	118
YRJIL	Yrjölä	Kuusankoski/FI	FINEXCAM (0.8/6)	2337	5.5	3574	8	53.9	144
ZELZO	Zelko	Budapest/HU	HUVCSE03 (1.0/4.5)	2224	4.4	933	3	19.0	68
Sum							31	4870.1	13419

* active field of view smaller than video frame

2. Observing Times (h)

January	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	-	-	-	-	-	-	-	-	-	-	5.4	-	-	-	-
BANPE	-	-	0.4	-	5.0	-	-	-	-	-	11.4	-	-	-	-
BASLU	-	-	-	-	-	-	-	-	2.6	-	11.0	-	-	-	-
BERER	-	9.7	-	4.1	12.8	2.1	9.4	-	-	-	13.4	7.0	-	-	-
	-	9.6	-	4.5	13.2	2.7	10.8	-	-	-	13.4	7.2	-	-	-
	-	9.7	-	4.1	11.1	1.4	10.5	-	-	-	13.3	6.7	-	-	-
BIRSZ	7.2	9.9	0.6	1.0	4.0	0.6	13.3	-	-	-	13.0	3.9	-	-	-
BOMMA	-	-	5.3	4.9	5.7	3.1	-	-	-	-	-	-	-	-	0.8
BREMA	7.8	-	-	-	-	-	-	-	1.8	2.3	-	13.8	-	6.7	-
	8.7	-	-	-	-	-	-	-	2.1	1.8	-	13.7	-	7.1	-
BRIBE	5.2	-	-	-	-	-	-	-	-	4.6	3.1	13.7	-	5.1	-
	3.4	-	-	-	-	-	-	-	-	4.0	12.0	13.6	3.6	7.0	-
CASFL	-	-	-	-	-	-	12.2	1.2	-	9.3	10.9	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRIST	-	1.9	13.1	10.5	13.1	10.8	11.2	8.7	-	4.8	13.0	-	0.9	-	-
	-	6.9	13.1	5.8	2.4	-	2.8	1.5	-	3.0	10.8	0.6	-	-	-
	-	1.2	13.1	11.8	13.1	13.1	11.4	7.8	-	3.5	13.0	-	-	-	-
CSISZ	-	1.7	0.3	0.7	6.0	-	3.6	-	-	-	9.0	-	-	-	-
ELTMA	-	1.1	2.1	-	-	-	-	-	-	-	-	-	-	-	-
GONRU	12.0	12.7	12.5	12.3	9.6	5.1	-	-	-	3.3	-	-	12.5	4.6	1.9
	12.1	12.8	13.0	12.9	8.8	4.0	-	-	-	3.3	-	9.1	12.6	9.2	1.5
	11.5	12.8	12.7	12.7	12.8	6.6	0.2	-	-	-	-	7.4	12.0	8.2	-
	11.9	12.8	13.0	12.9	8.7	4.6	-	-	-	2.2	1.5	7.0	12.6	8.5	-
GOVMI	9.3	-	6.0	1.3	1.8	3.9	-	-	3.4	-	8.5	2.6	-	-	-
	9.3	-	5.0	0.9	1.9	4.0	-	-	-	-	8.3	-	-	-	-
	9.2	0.2	5.7	1.2	2.1	1.9	-	-	2.8	-	8.2	2.5	-	-	-
IGAAN	-	1.8	-	1.2	10.9	-	6.2	-	-	-	12.4	2.5	-	-	-
	2.0	-	0.2	1.4	-	5.0	8.1	1.4	0.7	-	1.9	1.8	2.3	0.2	-
	-	8.1	-	0.5	5.6	-	0.6	-	-	-	12.6	0.2	-	-	-
JONKA	-	7.8	-	1.5	6.6	-	9.2	-	-	-	13.4	-	-	-	-
KACJA	-	-	6.6	4.4	4.4	4.4	-	-	-	7.1	-	-	-	-	-
	-	-	6.6	2.2	8.9	5.9	0.5	-	-	-	-	-	-	-	-
	4.4	-	7.3	1.1	2.6	4.1	-	1.2	-	10.6	3.9	0.5	-	-	-
	5.0	-	5.8	3.4	2.3	2.1	-	1.3	-	8.7	0.9	-	-	-	-
KERST	-	5.0	-	0.7	1.9	-	1.6	5.4	8.4	8.3	6.4	8.5	3.3	0.2	-
KOSDE	10.5	11.8	-	11.8	11.8	11.8	-	8.4	11.8	11.7	9.3	11.7	11.7	11.7	10.2
	3.8	-	-	-	-	-	-	-	-	5.5	-	2.8	6.5	-	7.6
LERAR	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MACMA	13.1	0.9	-	-	-	2.1	-	4.2	-	1.8	-	-	11.5	-	-
	13.2	1.2	-	-	0.7	1.5	-	4.2	0.3	1.7	1.5	0.4	12.0	-	-
	13.2	-	-	-	0.8	1.6	-	-	-	2.0	1.9	1.9	13.1	-	-
MARGR	-	1.8	-	-	-	-	-	-	-	3.7	2.9	8.6	10.2	3.7	8.2
MOLSI	2.5	10.3	-	-	-	-	1.9	-	-	4.8	3.6	-	-	5.1	1.2
	1.7	1.5	8.8	-	-	-	-	-	1.7	0.7	10.6	-	5.3	-	-
	1.9	2.0	8.1	0.4	-	-	-	-	1.6	0.8	10.7	-	5.8	-	-
	2.0	1.9	7.9	-	-	-	-	-	1.2	-	9.5	-	5.4	-	-
MORJO	-	10.1	-	2.2	10.5	-	5.1	-	-	-	13.3	2.0	-	-	-
OCAFR	10.0	11.5	5.9	12.4	12.1	4.1	-	-	-	-	0.2	-	7.6	9.8	3.0
OCHPA	0.3	2.8	3.2	1.9	2.8	2.2	2.9	0.7	-	2.2	3.0	-	-	-	-
OTTMI	8.1	0.6	10.2	8.2	4.9	9.5	7.8	7.4	12.1	-	-	-	10.4	9.3	10.9
PERZS	4.2	1.1	-	0.4	7.3	-	-	-	-	-	12.1	2.4	-	-	-
PUCRC	-	-	-	3.8	12.1	11.0	5.4	-	-	1.5	11.4	-	-	4.9	5.7
ROTEC	-	-	2.4	-	-	-	-	-	0.3	-	3.3	-	-	-	-
SARAN	8.8	12.4	12.6	12.6	2.9	-	-	-	-	6.9	-	-	-	-	-
	11.8	12.7	12.7	12.7	3.4	-	-	-	-	7.6	5.6	3.9	11.9	4.8	-
	10.2	12.5	12.6	12.3	2.6	-	-	-	-	6.9	6.4	-	11.8	4.7	-
SCALE	-	-	1.1	-	-	-	-	-	-	-	8.1	-	-	-	-
SCHHA	5.5	-	-	-	-	0.2	-	-	1.0	3.0	13.1	10.3	1.0	3.7	-
SLAST	-	-	3.9	1.7	1.6	-	0.5	-	-	4.6	-	-	-	-	-
STOEN	-	-	2.7	12.1	13.4	10.7	3.8	-	-	0.3	12.3	-	-	-	1.2
	-	-	1.9	7.0	11.4	10.2	4.0	-	-	-	12.0	-	-	-	1.1
	-	-	2.9	12.4	11.1	12.0	3.5	-	-	0.4	12.9	-	-	-	0.3
STORO	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-
STRJO	-	-	-	-	-	-	-	-	-	-	8.1	10.3	-	7.9	-
	3.2	-	-	-	-	-	-	-	-	1.0	7.6	10.8	-	8.9	-
	2.5	-	-	-	-	-	-	-	-	4.5	8.1	10.9	-	7.7	-
TEPIS	5.6	5.8	0.4	-	-	-	12.1	-	-	-	13.2	-	-	-	-
TRIMI	1.5	-	2.4	-	2.6	4.2	-	0.2	0.9	1.2	-	0.3	-	-	-
YRJIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZELZO	-	5.6	-	-	3.4	-	-	-	-	-	10.0	-	-	-	-
Sum	261.4	235.6	242.1	229.9	290.7	166.5	158.6	53.6	52.7	149.6	441.4	198.6	184.0	139.0	53.6

January	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ARLRA	-	-	-	-	-	-	-	-	-	1.0	-	-	3.7	-	3.4	-
BANPE	-	-	-	-	2.4	-	-	-	-	11.4	9.5	-	-	-	2.9	5.8
BASLU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0
BERER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIRSZ	-	-	-	-	0.9	-	-	-	-	-	-	-	0.8	-	2.1	5.5
BOMMA	-	-	4.1	-	-	-	6.0	-	-	0.5	2.2	-	-	-	-	-
BREMA	-	-	-	-	-	-	-	-	-	-	-	8.0	-	-	6.0	-
	-	-	-	-	-	-	-	-	-	1.0	-	9.6	-	-	-	5.2
BRIBE	-	-	-	2.8	-	-	-	-	-	3.8	-	9.2	-	-	4.6	2.9
	-	-	-	4.9	-	-	-	-	-	1.1	-	5.1	-	-	2.7	-
CASFL	-	4.8	-	-	-	-	9.4	-	-	-	8.2	-	12.0	12.5	12.8	12.8
	-	3.6	7.9	-	-	-	12.8	-	-	4.8	9.7	-	11.9	12.1	12.6	12.7
CRIST	8.2	12.4	2.8	-	-	1.7	10.1	1.4	-	12.4	9.8	-	6.5	3.7	8.4	12.4
	10.9	11.9	2.9	-	-	2.3	8.7	0.6	0.6	12.6	12.0	-	10.5	1.6	3.6	7.7
	0.7	12.8	4.8	-	-	1.9	9.1	0.3	-	2.3	8.6	-	5.0	8.4	9.0	12.2
CSISZ	-	-	-	-	-	-	0.8	-	-	-	0.6	-	-	-	1.5	-
ELTMA	-	-	9.9	-	-	-	8.2	-	-	8.3	10.9	-	4.5	-	-	-
GONRU	-	-	-	-	-	-	-	-	-	-	3.4	7.5	9.3	11.7	7.2	8.7
	-	-	-	-	-	4.2	-	-	-	-	4.5	7.9	8.7	11.9	7.1	6.5
	1.2	-	0.9	2.9	-	3.3	7.7	-	-	-	2.5	8.8	11.3	12.1	12.1	9.1
	-	-	-	-	-	3.0	-	-	-	-	2.8	8.2	8.0	11.2	6.4	6.0
GOVMI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	1.7	-	-	-	-	1.2	-	-	-	-	-	-
IGAAN	-	-	-	2.6	0.2	-	4.2	-	2.0	-	1.5	0.2	1.3	-	2.0	3.6
	-	-	-	-	-	0.9	-	-	-	-	3.7	-	-	-	-	3.4
	-	-	-	-	-	-	-	-	-	-	5.9	-	-	-	2.3	5.3
JONKA	-	-	-	-	-	-	-	-	-	-	7.4	-	4.6	-	1.1	4.1
KACJA	-	-	-	-	-	-	-	-	-	-	2.6	-	-	4.0	5.9	12.5
	-	-	-	-	-	-	-	-	-	-	-	-	-	7.8	7.1	7.9
	-	-	-	-	-	-	-	-	-	-	2.9	-	-	3.0	5.2	12.5
	-	-	-	-	-	-	-	-	-	-	5.9	-	-	3.3	5.7	12.6
KERST	8.1	6.4	7.7	8.1	6.4	2.9	2.2	-	-	-	-	-	1.2	2.2	-	7.3
KOSDE	8.7	7.6	1.1	5.6	-	-	1.2	4.5	5.6	5.7	5.3	-	-	-	-	-
	-	-	-	-	-	-	1.7	2.5	8.7	-	-	8.3	-	-	-	-
LERAR	9.1	0.3	-	-	-	-	-	-	-	-	-	4.5	-	-	11.0	-
MACMA	-	-	-	-	-	-	-	-	-	-	8.3	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	12.5	-	-	-	0.9	-
	-	-	-	-	-	-	-	-	-	-	13.4	6.0	-	-	0.9	1.8
MARGR	9.5	6.1	2.1	8.3	8.3	9.7	9.0	-	4.8	-	-	-	-	-	-	-
MOLSI	-	-	-	-	-	-	-	0.7	-	-	-	-	2.4	-	7.9	-
	-	-	-	4.3	-	-	-	-	9.6	13.0	-	1.0	1.8	0.6	5.5	3.4
	-	-	-	4.0	-	-	-	-	7.9	11.3	0.7	-	2.5	0.7	7.2	3.4
	-	-	-	4.0	-	-	-	-	10.1	12.3	-	0.9	-	-	5.1	-
MORJO	-	-	-	-	-	-	-	-	-	-	1.8	-	4.2	-	-	7.4
OCAFR	3.6	-	-	-	-	-	-	-	1.8	7.4	-	6.9	7.2	7.1	9.7	9.4
OCHPA	-	-	0.3	-	-	-	-	-	-	0.3	0.7	-	1.3	1.4	1.7	2.2
OTTMI	8.9	5.6	4.7	5.1	5.0	11.1	-	8.8	-	3.5	-	-	-	-	-	6.8
PERZS	-	-	-	0.2	0.5	-	-	-	-	4.8	7.0	-	3.9	1.0	2.1	5.6
PUCRC	-	-	8.8	-	-	-	2.6	-	-	12.4	11.9	-	7.8	-	-	-
ROTEC	-	-	-	-	-	-	-	-	-	6.8	-	-	-	-	4.7	-
SARAN	-	-	-	-	-	-	2.9	0.3	-	-	-	6.9	6.2	5.1	7.9	10.8
	-	-	-	8.5	5.0	5.9	6.0	1.5	-	-	-	10.8	8.6	-	11.0	12.1
	-	-	-	4.4	5.7	-	6.0	1.8	-	-	3.2	10.8	7.9	5.5	10.9	10.1
SCALE	-	-	9.4	-	-	-	4.9	-	1.4	3.9	6.3	-	4.3	-	-	-
SCHHA	-	-	-	-	-	-	-	2.0	-	6.7	-	12.2	-	-	5.6	-
SLAST	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	0.6	-
STOEN	-	-	10.8	-	-	-	8.0	-	3.3	4.0	5.7	1.2	4.3	-	-	0.9
	-	-	10.1	-	-	-	5.4	-	2.5	3.9	7.4	2.4	4.6	-	-	0.7
	-	-	11.0	-	-	-	7.7	-	3.6	4.4	9.3	1.3	5.7	-	-	2.0
STORO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STRJO	-	-	-	-	-	-	-	-	3.3	6.1	-	-	-	-	3.7	2.0
	-	1.1	-	-	-	-	-	1.9	-	10.0	-	-	-	-	3.4	3.5
	-	1.1	-	-	-	-	-	1.1	2.4	5.6	-	-	-	-	2.9	3.4
TEPIS	-	-	-	-	-	-	-	-	-	-	4.8	-	-	-	-	-
TRIMI	-	-	0.3	-	0.5	-	-	-	-	-	0.9	-	-	1.4	0.3	1.5
YRJIL	-	12.3	10.1	3.7	1.8	6.8	3.0	8.8	7.4	-	-	-	-	-	-	-
ZELZO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum	68.9	86.0	109.7	69.4	40.9	53.7	137.6	36.2	75.0	182.5	213.8	137.7	172.0	129.0	234.7	265.7

3. Results (Meteors)

January	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-
BANPE	-	-	1	-	2	-	-	-	-	-	19	-	-	-	-
BASLU	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
BERER	-	180	-	35	73	7	45	-	-	-	91	20	-	-	-
	-	67	-	9	43	6	17	-	-	-	32	7	-	-	-
	-	77	-	7	13	3	18	-	-	-	32	3	-	-	-
BIRSZ	5	58	1	1	1	3	26	-	-	-	31	6	-	-	-
BOMMA	-	-	52	38	52	20	-	-	-	-	-	-	-	-	5
BREMA	11	-	-	-	-	-	-	-	6	3	-	23	-	4	-
	7	-	-	-	-	-	-	-	3	2	-	25	-	4	-
BRIBE	3	-	-	-	-	-	-	-	-	9	2	28	-	3	-
	3	-	-	-	-	-	-	-	-	14	19	29	8	2	-
CASFL	-	-	-	-	-	-	14	3	-	32	17	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRIST	-	23	81	19	54	42	35	22	-	9	61	-	4	-	-
	-	83	76	4	6	-	9	1	-	4	26	2	-	-	-
	-	8	104	29	70	37	42	10	-	7	65	-	-	-	-
CSISZ	-	15	1	5	12	-	9	-	-	-	26	-	-	-	-
ELTMA	-	12	8	-	-	-	-	-	-	-	-	-	-	-	-
GONRU	27	75	62	55	21	7	-	-	-	3	-	-	39	8	2
	26	79	51	50	6	3	-	-	-	4	-	26	43	20	1
	15	62	50	49	18	5	1	-	-	-	-	20	28	19	-
	25	101	68	44	12	3	-	-	-	4	2	10	23	19	-
GOVMI	15	-	12	5	3	6	-	-	2	-	14	5	-	-	-
	7	-	13	4	5	2	-	-	-	-	9	-	-	-	-
	13	1	24	3	1	2	-	-	1	-	21	4	-	-	-
IGAAN	-	20	-	3	17	-	10	-	-	-	25	1	-	-	-
	9	-	1	3	-	26	23	3	4	-	5	1	6	1	-
	-	22	-	1	1	-	2	-	-	-	9	1	-	-	-
JONKA	-	51	-	1	6	-	27	-	-	-	27	-	-	-	-
KACJA	-	-	31	7	13	10	-	-	-	9	-	-	-	-	-
	-	-	7	1	9	5	2	-	-	-	-	-	-	-	-
	8	-	36	2	8	13	-	3	-	26	5	1	-	-	-
	5	-	28	7	9	9	-	1	-	8	1	-	-	-	-
KERST	-	27	-	3	5	-	1	19	45	49	21	32	13	1	-
KOSDE	67	122	-	99	93	86	-	37	68	84	65	71	74	84	78
	13	-	-	-	-	-	-	-	-	9	-	8	3	-	15
LERAR	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MACMA	18	1	-	-	-	5	-	4	-	5	-	-	7	-	-
	39	1	-	-	2	3	-	7	1	8	2	2	9	-	-
	20	-	-	-	3	1	-	-	-	5	1	1	6	-	-
MARGR	-	28	-	-	-	-	-	-	-	10	15	35	35	24	35
MOLSI	2	28	-	-	-	-	2	-	-	9	2	-	-	15	3
	13	3	51	-	-	-	-	-	9	1	52	-	17	-	-
	4	4	37	2	-	-	-	-	3	4	53	-	12	-	-
	3	2	16	-	-	-	-	-	1	-	12	-	4	-	-
MORJO	-	44	-	4	8	-	4	-	-	-	18	1	-	-	-
OCAFR	3	31	24	13	6	1	-	-	-	-	1	-	8	2	1
OCHPA	2	24	21	15	22	16	17	4	-	15	20	-	-	-	-
OTTMI	25	4	39	24	16	37	16	25	20	-	-	-	20	26	36
PERZS	9	22	-	1	9	-	-	-	-	-	60	7	-	-	-
PUCRC	-	-	-	10	37	45	15	-	-	1	18	-	-	19	12
ROTEC	-	-	1	-	-	-	-	-	1	-	1	-	-	-	-
SARAN	19	39	28	28	8	-	-	-	-	2	-	-	-	-	-
	16	62	38	26	7	-	-	-	-	10	8	4	19	3	-
	9	62	39	24	2	-	-	-	-	1	16	-	14	7	-
SCALE	-	-	6	-	-	-	-	-	-	-	7	-	-	-	-
SCHHA	6	-	-	-	-	1	-	-	1	12	32	17	2	2	-
SLAST	-	-	22	1	18	-	3	-	-	7	-	-	-	-	-
STOEN	-	-	16	43	65	36	5	-	-	1	31	-	-	-	5
	-	-	7	23	37	23	3	-	-	-	35	-	-	-	4
	-	-	26	40	48	38	8	-	-	2	43	-	-	-	1
STORO	-	69	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-
STRJO	-	-	-	-	-	-	-	-	-	-	26	13	-	10	-
	1	-	-	-	-	-	-	-	-	1	17	7	-	14	-
	1	-	-	-	-	-	-	-	-	22	30	21	-	17	-
TEPIS	8	70	4	-	-	-	33	-	-	-	31	-	-	-	-
TRIMI	9	-	16	-	15	30	-	1	6	6	-	2	-	-	-
YRJIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZELZO	-	50	-	-	1	-	-	-	-	-	17	-	-	-	-
Sum	473	1654	1098	738	857	531	387	140	172	398	1179	433	394	304	198

January	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ARLRA	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	-
BANPE	-	-	-	-	3	-	-	-	-	6	5	-	-	-	4	-
BASLU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BERER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIRSZ	-	-	-	-	2	-	-	-	-	-	-	-	3	-	2	-
BOMMA	-	-	34	-	-	-	48	-	-	3	15	-	-	-	-	-
BREMA	-	-	-	-	-	-	-	-	-	-	-	9	-	-	1	-
	-	-	-	-	-	-	-	-	-	2	-	14	-	-	-	-
BRIBE	-	-	-	4	-	-	-	-	-	10	-	15	-	-	4	-
	-	-	-	4	-	-	-	-	-	2	-	12	-	-	2	-
CASFL	-	2	-	-	-	-	19	-	-	-	21	-	20	24	25	-
	-	2	18	-	-	-	30	-	-	4	17	-	21	20	24	-
CRIST	12	53	5	-	-	5	21	8	-	34	32	-	13	6	25	12
	24	27	1	-	-	4	16	3	1	23	23	-	14	1	10	24
	2	53	6	-	-	5	36	2	-	14	47	-	7	11	36	2
CSISZ	-	-	-	-	-	-	1	-	-	-	2	-	-	-	1	-
ELTMA	-	-	30	-	-	-	41	-	-	29	12	-	18	-	-	-
GONRU	-	-	-	-	-	-	-	-	-	-	2	7	11	23	10	-
	-	-	-	-	-	5	-	-	-	-	1	5	22	16	8	-
	5	-	2	1	-	5	24	-	-	-	1	4	9	8	26	5
	-	-	-	-	-	1	-	-	-	-	5	13	10	20	4	-
GOVMI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	1	-	-	-	-	8	-	-	-	-	-	-
IGAAN	-	-	-	1	1	-	4	-	3	-	3	1	2	-	3	-
	-	-	-	-	-	4	-	-	-	-	6	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	4	-	-	-	3	-
JONKA	-	-	-	-	-	-	-	-	-	-	13	-	9	-	1	-
KACJA	-	-	-	-	-	-	-	-	-	-	5	-	-	11	11	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	5	6	-
	-	-	-	-	-	-	-	-	-	-	1	-	-	7	8	-
	-	-	-	-	-	-	-	-	-	-	5	-	-	14	9	-
KERST	55	26	54	35	39	10	7	-	-	-	-	-	8	19	-	55
KOSDE	54	64	9	44	-	-	14	36	37	25	17	-	-	-	-	54
	-	-	-	-	-	-	2	3	11	-	-	7	-	-	-	-
LERAR	7	1	-	-	-	-	-	-	-	-	-	6	-	-	1	7
MACMA	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	17	-	-	-	3	-
	-	-	-	-	-	-	-	-	-	-	9	3	-	-	1	-
MARGR	28	14	2	33	25	18	25	-	15	-	-	-	-	-	-	28
MOLSI	-	-	-	-	-	-	-	1	-	-	-	-	1	-	13	-
	-	-	-	7	-	-	-	-	45	42	-	1	3	1	15	-
	-	-	-	6	-	-	-	-	30	43	2	-	5	1	12	-
	-	-	-	2	-	-	-	-	4	6	-	1	-	-	4	-
MORJO	-	-	-	-	-	-	-	-	-	-	5	-	5	-	-	-
OCAFR	4	-	-	-	-	-	-	-	1	7	-	13	9	2	7	4
OCHPA	-	-	2	-	-	-	-	-	-	2	4	-	8	9	11	-
OTTMI	25	5	8	22	15	25	-	16	-	30	-	-	-	-	-	25
PERZS	-	-	-	1	3	-	-	-	-	14	13	-	16	3	4	-
PUCRC	-	-	23	-	-	-	4	-	-	33	15	-	19	-	-	-
ROTEC	-	-	-	-	-	-	-	-	-	1	-	-	-	-	3	-
SARAN	-	-	-	-	-	-	7	2	-	-	-	15	4	7	7	-
	-	-	-	16	14	5	4	1	-	-	-	11	5	-	12	-
	-	-	-	6	16	-	7	4	-	-	1	10	9	2	8	-
SCALE	-	-	14	-	-	-	8	-	4	10	3	-	4	-	-	-
SCHHA	-	-	-	-	-	-	-	6	-	14	-	25	-	-	4	-
SLAST	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	-
STOEN	-	-	42	-	-	-	77	-	28	20	14	3	18	-	-	-
	-	-	25	-	-	-	36	-	19	4	16	1	11	-	-	-
	-	-	35	-	-	-	57	-	20	15	22	1	17	-	-	-
STORO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STRJO	-	-	-	-	-	-	-	-	3	8	-	-	-	-	5	-
	-	1	-	-	-	-	-	2	-	4	-	-	-	-	4	-
	-	3	-	-	-	-	-	2	9	6	-	-	-	-	1	-
TEPIS	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-
TRIMI	-	-	2	-	3	-	-	-	-	-	6	-	-	11	2	-
YRJIL	-	33	35	15	4	19	11	15	12	-	-	-	-	-	-	-
ZELZO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum	216	284	347	197	127	106	499	101	242	421	385	177	301	225	344	216