

## Results of the IMO Video Meteor Network – January 2017

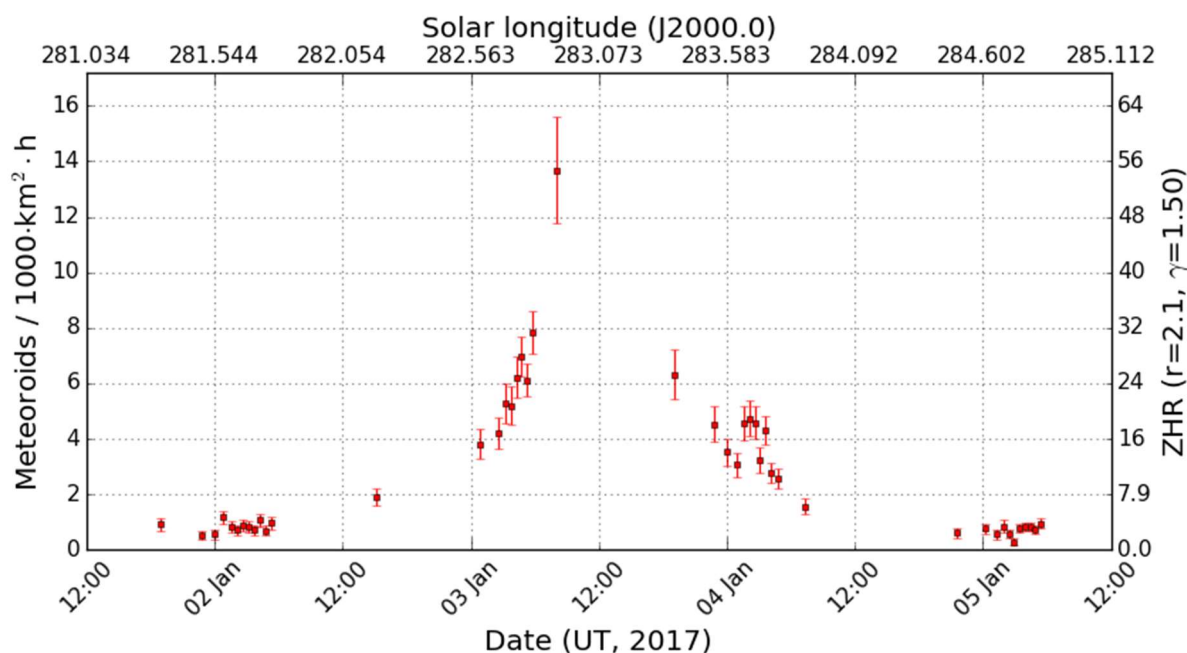
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2017/07/12

The year starts with long nights for the IMO video observers, but also with typically poor observing conditions. This year the weather was mediocre but still above par for a January which led to the best January output in the history of the IMO network. We counted a total of 77 active cameras, half of which with twenty or more observing nights. On January 6 and 21 we had 65 cameras in operation. The effective observing time summed up to almost 11,900 hours, which is 2,000 more than in the previously best January 2012. With over 33,000 meteors we recorded 10% more than in 2012.

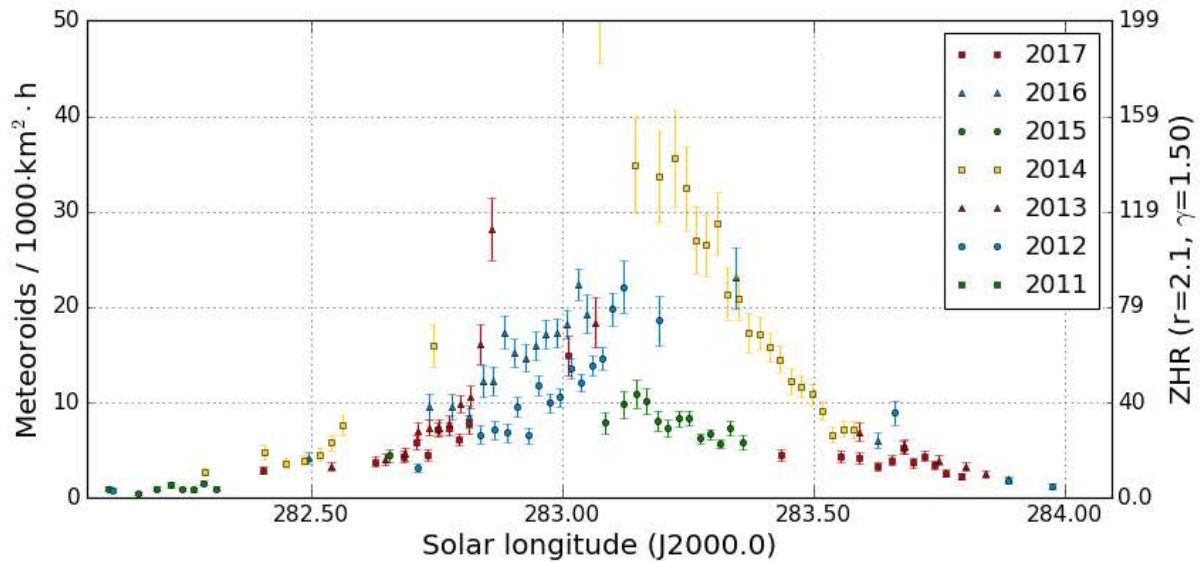
There was no new camera, but operation of the Italian camera JENNI was taken over by Francesca Cinegrosso at the begin of year.

To get a nice display from the most important meteor shower of January, which is also the last major shower for the next half year, you need three prerequisites: a convenient lunar phase, pleasant weather and a peak in the European night time hours. The first two conditions were given in 2017, but the peak fell into the noon hours UT of January 3. So we could only observe the increase in rates in the night before, and the decrease in the night after the peak. The peak activity as such could not be recorded by us (figure 1).



**Figure 1:** Flux density profile of the Quadrantids in January 2017, derived from video data of the IMO Video Meteor Network.

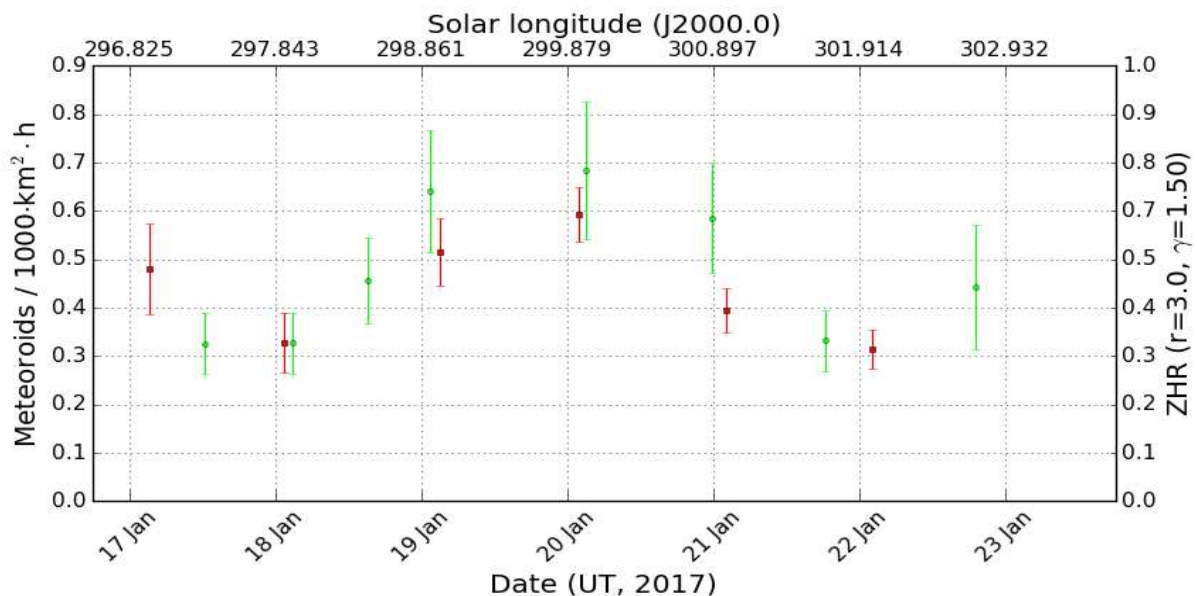
It is difficult to estimate the strength of the peak from these data, but the ascending and descending branches were similar to the data set of 2012 and 2015, when the activity was below the average (figure 2). That fits to visual observations. The automated analysis of visual data at the IMO homepage yields a peak ZHR of 80 – in vintage years the ZHR may reach values twice as high!



**Figure 2:** Comparison of the flux density profile of the Quadrantids 2011 till 2017.

In 2015, the Canadian CMOR radar detected a short, but intense outburst of the kappa Cancrids. Unfortunately, also the peak of this shower at 289.3° solar longitude fell into the European daytime hours. We re-calculated the meteor shower assignment on January 9 and 10, anyway, but the activity of the shower remained negligible as expected.

Also the gamma Ursae Minorids were checked in detail. This minor shower was discovered by CMOR in 2010 and could be detected visually last year, even though video observations evidenced only a low activity level near the detection limit. That picture has not changed in 2017. Once more we measured a flux density below one meteoroid per 1,000 km<sup>2</sup> and hour at 299° and 300° solar longitude (figure 3). That is equivalent to a ZHR below one.



**Figure 3:** Comparison of the flux density profile of the gamma Ursae Minorids in 2016 (green) and 2017 (red).

Surprisingly even such a weak shower presents a high-quality activity profile with only little scatter. Not so much the absolute activity level but rather the effective collection area of the camera network is essential here, and in this respect the shower seems well positioned with its circumpolar radiant and the long January nights. How good the conditions really are was verified

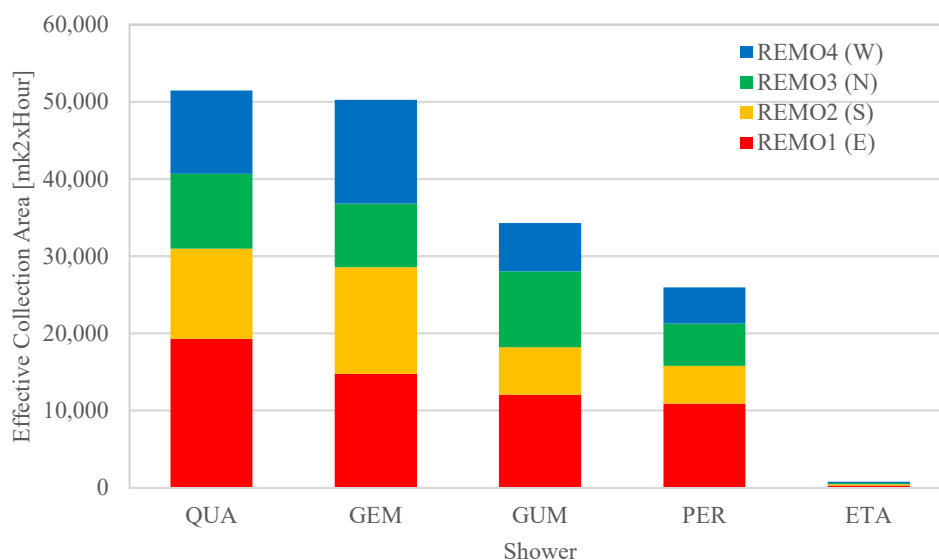
with a simple experiment. We compared the typical effective collection area of the gamma Ursae Minorids with some major shower (QUA, ETA, PER, GEM). In order to get a representative picture, we calculated the total collection area of the four cameras REMO1-4 (which point in all four directions at about 45° altitude) near Berlin under normalized observing conditions (constant limiting magnitude of 6.3 mag) for the peak night of each shower.

It is no surprise that the Geminids yield a perfect result, since their radiant is well positioned in the long December nights. However, surprisingly the Quadrantids perform a few percent better, even though they are typically not observed before midnight. At 52° northern latitude, the radiant is circumpolar and has even at the lower culmination an altitude of more than 10°. It is not too far away from the center of field of view of the cameras, which causes a lower angular meteor velocity, and at dawn the radiant lies close to the zenith.

With over 34,000 km<sup>2</sup> and hour, the collection area of the gamma Ursae Minorids is 1/3 smaller than that of the Geminids, and the collection area of the Perseids even only half of it. For comparison: The eta Aquariids accumulated less than 1,000 km<sup>2</sup> and hour in this experiment!

It is also noteworthy how the cameras perform in comparison to each other. REMO1 observing eastward has always the biggest effective collection area, since the combination of radiant altitude and distance from center of field of view is best here. In case of the Quadrantids, Perseids and eta Aquariids, the other three cameras have about the same collection area. During the Geminids, the northward directed camera REMO3 is clearly inferior of the southward oriented REMO2 and westward oriented REMO4, and in case of the gamma Ursae Minorids it is just the other way round (Figure 4).

Overall the gamma Ursae Minorids are well positioned for IMO network video observers which explains the fine quality of the data set.



**Figure 4:** Effective collection area of the cameras REMO1 to REMO4 per night under normalized conditions (same limiting magnitude) for the peaks of different meteor showers.

# 1. Observers

Code	Name	Place	Camera	FOV [°]	St.LM [mag]	Eff.CA [km <sup>2</sup> ]	Nights	Time [h]	Meteors
ARLRA	Arlt	Ludwigsfelde/DE	LUDWIG2 (0.8/8)	1475	6.2	3779	19	111.3	558
BANPE	Bánfalvi	Zalaegerszeg/HU	HUVCS01 (0.95/5)	2423	3.4	361	8	15.3	34
BERER	Berkó	Ludanyhalaszi/HU	HULUDI (0.8/3.8)	5542	4.8	3847	16	132.6	509
BOMMA	Bombardini	Faenza/IT	MARIO (1.2/4.0)	5794	3.3	739	23	172.2	621
BREMA	Breukers	Hengelo/NL	MBB3 (0.75/6)	2399	4.2	699	14	135.0	286
BRIBE	Klemt	Herne/DE	HERMINE (0.8/6)	2374	4.2	678	20	156.4	398
		Berg. Gladbach/DE	KLEMOI (0.8/6)	2286	4.6	1080	16	161.3	407
CARMA	Carli	Monte Baldo/IT	BMH2 (1.5/4.5)*	4243	3.0	371	5	39.2	210
CASFL	Castellani	Monte Baldo/IT	BMH1 (0.8/6)	2350	5.0	1611	25	280.7	835
CINFR	Cineglosso	Faenza/IT	JENNI (1.2/4)	5886	3.9	1222	24	178.2	509
CRIST	Crivello	Valbrevenna/IT	BILBO (0.8/3.8)	5458	4.2	1772	25	227.7	1025
			C3P8 (0.8/3.8)	5455	4.2	1586	23	205.9	529
			STG38 (0.8/3.8)	5614	4.4	2007	25	232.5	1319
ELTMA	Eltri	Venezia/IT	MET38 (0.8/3.8)	5631	4.3	2151	19	187.1	552
FORKE	Förster	Carlsfeld/DE	AKM3 (0.75/6)	2375	5.1	2154	15	142.9	435
GONRU	Goncalves	Foz do Arelho/PT	FARELHO1 (1.0/2.6)	6328	2.8	469	27	192.1	354
		Tomar/PT	TEMPLAR1 (0.8/6)	2179	5.3	1842	24	222.1	653
			TEMPLAR2 (0.8/6)	2080	5.0	1508	24	227.9	628
			TEMPLAR3 (0.8/8)	1438	4.3	571	21	210.1	255
			TEMPLAR4 (0.8/3.8)	4475	3.0	442	22	213.0	564
			TEMPLAR5 (0.75/6)	2312	5.0	2259	24	201.9	491
GOVMI	Govedic	Sredisce ob Dr./SI	ORION2 (0.8/8)	1447	5.5	1841	15	118.6	238
			ORION4 (0.95/5)	2662	4.3	1043	16	117.2	174
HERCA	Hergenrother	Tucson/US	SALSA3 (0.8/3.8)	2336	4.1	544	27	224.0	501
HINWO	Hinz	Schwarzenberg/DE	HINWO1 (0.75/6)	2291	5.1	1819	14	143.6	324
IGAAN	Igaz	Hodmezovasar./HU	HUHOD (0.8/3.8)	5502	3.4	764	9	67.0	73
		Budapest/HU	HUPOL (1.2/4)	3790	3.3	475	17	165.2	110
JONKA	Jonas	Budapest/HU	HUSOR (0.95/4)	2286	3.9	445	20	151.3	247
			HUSOR2 (0.95/3.5)	2465	3.9	715	23	169.0	228
KACJA	Kac	Kamnik/SI	CVETKA (0.8/3.8)	4914	4.3	1842	15	131.3	545
		Kostanjevec/SI	METKA (0.8/12)*	715	6.4	640	20	165.8	361
		Ljubljana/SI	ORION1 (0.8/8)	1399	3.8	268	16	132.5	291
		Kamnik/SI	REZIKA (0.8/6)	2270	4.4	840	17	145.8	916
			STEFKA (0.8/3.8)	5471	2.8	379	15	129.6	445
KOSDE	Koschny	Izana Obs./ES	ICC7 (0.85/25)*	714	5.9	1464	16	117.7	651
		La Palma / ES	ICC9 (0.85/25)*	683	6.7	2951	11	82.8	580
		Izana Obs./ES	LIC1(2.8/50)*	2255	6.2	5670	16	127.9	605
LOJTO	Łojek	Grabniak/PL	PAV57 (1.0/5)	1631	3.5	269	14	93.3	138
LOPAL	Lopes	Lisboa/PT	NASO1 (0.75/6)	2377	3.8	506	22	203.9	270
MACMA	Maciejewski	Chelm/PL	PAV35 (0.8/3.8)	5495	4.0	1584	14	93.6	177
			PAV36 (0.8/3.8)*	5668	4.0	1573	16	104.1	163
			PAV43 (0.75/4.5)*	3132	3.1	319	11	14.2	98
			PAV60 (0.75/4.5)	2250	3.1	281	13	97.8	210
MARRU	Marques	Lisbon/PT	CAB1 (0.75/6)	2362	4.8	1517	24	236.4	511
			RAN1 (1.4/4.5)	4405	4.0	1241	23	235.4	480
MOLSI	Molau	Seysdorf/DE	AVIS2 (1.4/50)*	1230	6.9	6152	20	156.2	965
			ESCIMO2 (0.85/25)	155	8.1	3415	18	166.8	385
			MINCAM1 (0.8/8)	1477	4.9	1084	19	154.3	631
		Ketzür/DE	REMO1 (0.8/8)	1467	6.5	5491	20	137.6	691
			REMO2 (0.8/8)	1478	6.4	4778	20	143.0	672
			REMO3 (0.8/8)	1420	5.6	1967	20	146.4	323
			REMO4 (0.8/8)	1478	6.5	5358	21	143.9	574
MORJO	Morvai	Fülöpszallas/HU	HUFUL (1.4/5)	2522	3.5	532	17	148.9	180
MOSFA	Moschini	Rovereto/IT	ROVER (1.4/4.5)	3896	4.2	1292	4	9.0	59
OTTMI	Otte	Pearl City/US	ORIE1 (1.4/5.7)	3837	3.8	460	11	72.4	91
PERZS	Perkó	Becsehely/HU	HUBEC (0.8/3.8)*	5498	2.9	460	21	134.8	439
ROTEC	Rothenberg	Berlin/DE	ARMEFA (0.8/6)	2366	4.5	911	18	104.5	145
SARAN	Saraiva	Carnaxide/PT	RO1 (0.75/6)	2362	3.7	381	26	219.7	336
			RO2 (0.75/6)	2381	3.8	459	23	216.5	486
			RO3 (0.8/12)	710	5.2	619	24	222.6	637
			RO4 (1.0/8)	1582	4.2	549	22	207.4	229
			SOFIA (0.8/12)	738	5.3	907	24	237.1	381
SCALE	Scarpa	Alberoni/IT	LEO (1.2/4.5)*	4152	4.5	2052	25	195.3	296
SCHHA	Schremmer	Niederkrüchten/DE	DORAEMON (0.8/3.8)	4900	3.0	409	20	171.8	333
SLAST	Slavec	Ljubljana/SI	KAYAK1 (1.8/28)	563	6.2	1294	11	89.6	221
			KAYAK2 (0.8/12)	741	5.5	920	15	133.4	136
STOEN	Stomeo	Scorze/IT	MIN38 (0.8/3.8)	5566	4.8	3270	27	243.8	1145
			NOA38 (0.8/3.8)	5609	4.2	1911	28	253.0	1070
			SCO38 (0.8/3.8)	5598	4.8	3306	27	253.8	1298
STRJO	Strunk	Herford/DE	MINCAM2 (0.8/6)	2354	5.4	2751	18	115.6	495
			MINCAM3 (0.8/6)	2338	5.5	3590	15	109.2	222
			MINCAM5 (0.8/6)	2349	5.0	1896	15	113.2	209
			MINCAM6 (0.8/6)	2395	5.1	2178	16	108.8	249
TEPIS	Tepliczky	Agostyan/HU	HUAGO (0.75/4.5)	2427	4.4	1036	15	128.8	229
			HUMOB (0.8/6)	2388	4.8	1607	17	180.0	312
WEGWA	Wegrzyk	Nieznaszyn/PL	PAV78 (0.8/6)	2286	4.0	778	16	148.3	243
YRJIL	Yrjölä	Kuusankoski/FI	FINEXCAM (0.8/6)	2337	5.5	3574	12	98.7	213
Sum							31	11877.8	33403

\* 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	3.3	5.6	1.7	3.7	12.5	7.9	-	-	3.5	4.3	-	-	5.1	1.1	0.8
BANPE	2.6	-	3.6	-	-	2.3	-	-	-	1.2	-	-	-	-	1.2
BERER	-	9.0	4.1	-	10.2	13.4	13.0	12.8	-	12.6	2.9	-	-	-	2.5
BOMMA	13.3	2.3	13.3	8.7	12.2	13.4	8.1	5.8	3.2	-	5.8	-	4.7	6.5	6.3
BREMA	-	10.9	1.7	11.9	14.0	-	-	-	-	-	-	-	-	9.4	7.2
BRIBE	-	8.6	-	10.0	12.4	7.0	-	-	-	0.3	3.0	-	1.1	4.4	-
-	-	-	-	8.6	13.8	7.8	-	-	-	-	1.6	-	1.1	-	-
CARMA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CASFL	13.5	4.8	11.5	13.6	13.5	13.3	13.5	13.4	9.7	-	-	-	-	3.9	13.3
CRIST	3.9	5.4	13.1	12.9	13.1	13.1	-	13.0	1.5	-	-	-	12.2	5.0	12.9
-	0.2	5.0	13.1	8.5	13.1	13.1	-	11.3	-	8.9	-	-	11.7	5.8	12.9
-	4.9	5.7	13.1	13.1	13.1	13.1	-	13.0	2.9	-	-	0.2	12.2	8.6	12.9
DONJE	13.4	-	13.4	10.0	13.1	13.4	8.4	5.9	3.1	1.6	3.9	-	5.1	7.5	6.8
ELTMA	8.6	4.1	11.5	7.2	-	13.0	10.9	12.7	-	5.0	-	-	-	-	1.2
FORKE	8.7	-	-	-	-	7.0	-	-	0.9	2.3	-	-	-	-	-
GONRU	0.2	0.4	5.2	5.7	2.0	12.9	12.0	12.8	3.9	0.3	-	0.4	7.4	12.8	12.4
-	-	-	-	1.8	-	12.6	12.6	11.9	6.9	4.5	1.9	6.7	12.4	12.4	12.4
-	-	-	-	3.5	-	12.9	12.9	12.3	8.0	5.3	3.7	8.1	12.8	12.8	12.7
-	-	-	-	4.6	1.3	12.2	12.7	12.7	-	4.0	-	8.3	12.7	12.7	12.6
-	-	-	-	-	-	12.9	12.8	12.2	5.2	2.9	3.8	6.7	12.7	12.7	12.6
-	0.2	-	-	3.2	-	12.0	12.2	12.1	3.3	2.9	1.2	5.4	8.4	12.3	12.2
GOVMI	12.5	3.0	11.0	-	11.6	-	6.9	4.6	-	-	2.7	-	-	7.8	-
-	12.4	2.8	10.8	10.2	-	-	5.9	4.4	-	8.4	1.5	-	0.2	6.5	-
HERCA	-	5.3	10.5	4.4	11.1	8.7	11.5	10.4	11.8	5.8	8.0	9.1	7.5	-	-
HINWO	8.0	-	-	-	-	9.2	-	-	-	10.7	-	-	2.4	-	-
IGAAN	-	7.8	4.5	6.6	10.0	13.0	13.1	8.9	-	-	-	-	-	-	-
-	-	7.8	4.1	6.5	10.0	13.0	13.1	8.9	-	11.4	-	-	-	6.8	12.7
JONKA	-	3.0	1.0	5.9	3.7	13.5	12.4	8.7	3.9	8.4	-	-	-	2.1	11.9
-	-	2.5	3.2	7.9	9.8	13.5	13.5	9.1	3.5	5.4	2.7	-	-	4.7	12.4
KACJA	13.3	-	11.6	8.5	-	9.2	3.5	7.0	-	5.6	6.0	-	-	-	0.7
-	13.3	4.7	11.5	9.5	12.7	13.1	3.1	10.1	-	6.8	4.5	-	-	5.1	6.0
-	13.2	-	4.7	6.0	11.5	13.6	3.2	9.8	-	7.9	4.2	-	-	-	-
-	13.3	-	12.0	10.0	-	9.2	5.7	8.0	-	6.2	6.6	-	-	3.1	0.7
-	13.3	-	11.4	9.7	-	9.2	1.7	8.1	-	3.9	4.6	-	-	-	1.2
KOSDE	-	-	-	-	-	-	-	-	3.5	3.5	-	-	-	5.9	10.2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	6.7	7.8	4.6	-	2.2	7.9	11.1
LOJTO	5.2	-	-	-	7.2	2.3	10.5	-	1.0	12.2	6.4	-	-	-	1.4
LOPAL	-	-	0.2	1.5	-	12.2	11.1	11.1	6.9	2.9	7.4	5.8	11.9	11.6	12.0
MACMA	8.8	1.9	-	-	0.7	13.0	9.2	-	-	8.8	2.8	0.6	-	-	3.5
-	8.6	2.2	-	-	1.3	13.2	10.0	0.5	-	12.4	5.3	0.3	-	-	3.4
-	1.8	1.8	-	-	-	-	-	-	-	1.1	1.1	0.2	-	-	1.4
-	9.0	3.2	-	-	-	-	8.2	1.6	-	13.7	7.5	1.8	-	-	3.4
MARRU	-	1.6	2.7	-	-	12.7	11.8	12.6	12.2	6.5	8.7	7.2	12.7	12.5	12.5
-	-	-	-	5.2	-	12.7	12.7	12.5	12.2	3.4	12.2	6.9	12.6	12.5	12.5
MOLSI	4.0	0.4	1.2	4.7	11.7	10.8	-	-	-	-	-	-	2.7	-	0.8
-	4.8	-	-	5.2	13.4	12.2	-	-	-	-	-	-	1.9	1.6	-
-	3.5	-	1.1	2.5	12.7	11.4	-	-	-	-	-	-	1.1	-	0.2
-	3.0	5.1	1.8	8.6	13.0	9.0	-	-	5.8	4.3	6.8	-	4.2	2.3	6.6
-	3.9	5.1	1.9	9.1	13.0	9.3	-	-	5.4	2.9	5.7	-	5.0	2.4	5.9
-	3.5	5.1	2.1	8.8	13.2	9.9	-	-	6.5	4.4	8.6	-	5.3	3.1	6.9
-	3.6	5.3	1.8	9.0	12.9	9.5	-	-	5.0	4.6	5.7	-	5.6	2.9	7.7
MORJO	1.7	7.1	8.5	8.9	6.9	13.5	13.5	-	8.5	-	4.5	-	-	7.2	11.6
MOSFA	3.3	1.8	1.9	2.0	-	-	-	-	-	-	-	-	-	-	-
OTTMI	3.0	-	10.3	-	12.6	9.8	12.4	-	-	-	-	0.6	-	10.6	0.2
PERZS	13.5	4.9	12.1	7.0	10.4	9.6	0.3	0.5	-	3.5	1.2	-	-	3.7	1.9
ROTEC	-	5.9	1.7	1.6	11.9	7.8	-	-	2.7	3.9	-	-	1.8	-	1.6
SARAN	-	-	0.3	5.7	0.2	9.9	8.7	9.9	9.2	3.7	8.5	5.8	10.2	10.2	11.4
-	-	-	0.2	5.1	-	5.2	12.4	12.4	9.2	1.8	11.8	6.9	11.8	12.7	12.6
-	-	-	0.3	5.7	-	12.0	11.6	11.6	10.7	4.7	11.5	8.0	11.0	10.6	11.3
-	-	-	0.2	3.9	-	12.6	12.3	12.4	7.9	1.8	10.8	7.0	11.8	12.6	12.5
-	-	-	0.2	4.8	-	12.7	9.7	12.6	12.3	3.5	11.9	8.6	12.7	12.6	12.5
SCALE	8.6	2.0	10.5	7.5	10.6	12.2	7.5	12.5	-	4.6	4.1	-	1.4	-	4.3
SCHHA	-	6.4	-	10.6	12.1	4.0	-	-	0.2	-	4.7	-	3.2	6.8	-
SLAST	11.9	-	7.7	9.3	10.8	-	0.4	7.2	-	-	1.8	-	-	-	-
-	13.3	-	8.2	10.8	12.1	8.3	2.6	9.5	-	4.8	3.6	-	-	-	-
STOEN	13.3	2.8	11.2	8.7	13.6	13.4	9.9	9.3	-	5.1	2.1	-	2.2	2.2	5.5
-	13.3	2.8	11.4	9.5	13.5	13.5	12.8	13.4	0.5	3.4	2.3	-	2.0	4.6	5.7
-	13.5	2.8	11.1	10.7	9.9	13.3	12.7	13.4	-	5.2	6.4	-	2.2	3.0	6.0
STRJO	-	5.0	-	9.9	13.4	4.4	-	-	-	-	1.1	-	-	0.8	0.8
-	-	4.1	-	8.9	13.8	-	-	-	-	-	-	-	-	-	1.8
-	-	4.6	-	9.7	13.5	4.2	-	-	-	-	1.1	-	-	-	-
-	-	4.5	-	8.8	13.9	4.0	-	-	-	-	0.4	-	-	0.9	-
TEPIS	13.4	2.7	1.5	6.8	12.5	13.3	13.1	13.2	5.3	12.9	2.4	-	-	-	-
-	11.8	-	-	6.6	12.0	13.3	13.3	13.1	3.8	8.5	-	-	-	-	13.1
WEGWA	10.3	4.2	-	-	3.0	11.9	4.1	13.5	12.9	13.3	-	-	-	-	-
YRJIL	-	6.3	1.8	14.8	14.8	6.2	-	-	-	-	9.9	-	-	-	-
Sum	362.7	198.3	313.5	444.1	545.3	691.8	453.5	462.7	219.7	305.8	251.5	104.6	265.2	325.2	410.8

January	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ARLRA	2.8	6.9	-	-	-	3.9	5.3	-	-	-	11.7	11.8	11.5	7.9	-	-
BANPE	0.9	-	-	-	2.8	0.7	-	-	-	-	-	-	-	-	-	-
BERER	-	5.5	12.3	5.6	11.4	11.8	-	3.6	-	-	-	-	-	-	1.9	-
BOMMA	-	-	-	11.5	0.5	1.1	-	-	12.3	11.7	7.4	6.9	1.4	12.5	3.3	-
BREMA	-	-	3.6	13.5	9.8	13.5	9.0	-	-	12.6	12.7	5.2	-	-	-	-
BRIBE	3.0	-	8.3	13.3	13.4	13.4	12.4	-	-	13.0	13.0	10.7	1.9	3.2	-	4.0
	12.5	13.3	13.3	13.2	13.3	13.2	12.5	-	-	13.0	13.0	9.8	1.3	-	-	-
CARMA	-	-	-	-	-	-	-	-	-	-	5.4	4.1	12.9	12.7	4.1	-
CASFL	5.9	4.9	3.2	13.2	13.1	13.1	13.1	12.9	12.9	13.0	12.9	12.8	12.9	12.8	-	-
CRIST	0.9	8.6	12.3	12.3	12.7	11.8	12.5	12.6	6.9	11.2	6.9	1.3	4.9	6.7	-	-
	6.7	7.7	12.6	12.8	12.7	11.0	6.1	12.6	4.7	9.4	3.1	-	-	2.9	-	-
	1.2	9.6	12.8	12.3	12.7	12.7	12.7	12.6	-	12.3	7.1	1.8	5.5	6.4	-	-
DONJE	0.2	-	-	11.7	0.9	-	0.2	-	12.8	12.0	8.7	7.5	1.6	12.6	4.4	-
ELTMA	-	11.5	1.9	12.9	13.0	10.8	-	-	12.8	12.5	12.7	12.5	-	12.3	-	-
FORKE	-	-	13.2	12.9	10.6	13.2	13.2	13.1	-	-	12.5	11.2	11.6	11.5	-	1.0
GONRU	6.7	7.7	12.5	12.7	9.0	6.9	11.4	11.4	10.8	0.9	3.2	6.4	-	-	-	4.1
	12.4	12.5	12.5	12.5	11.2	12.4	12.4	12.4	10.7	1.0	1.2	9.3	-	-	5.5	-
	12.7	12.7	12.7	12.7	11.3	12.6	12.4	12.5	9.5	-	1.3	8.7	-	-	2.8	1.0
	12.5	12.5	12.5	12.5	11.4	12.5	12.1	12.4	12.3	-	0.7	4.9	-	-	-	-
	12.7	12.7	12.7	12.6	11.2	12.6	11.8	12.5	9.3	-	1.2	8.4	-	-	-	0.8
	12.2	12.2	11.1	12.0	11.0	12.4	11.4	12.3	12.2	-	0.7	8.3	-	-	-	0.7
GOVMI	-	-	0.7	12.2	12.3	9.6	9.3	-	-	-	5.8	8.6	-	-	-	-
	-	-	-	12.3	12.1	9.5	9.2	-	-	-	2.5	8.5	-	-	-	-
HERCA	0.2	6.6	6.6	9.0	2.4	-	8.9	9.4	1.6	11.3	10.7	11.2	11.3	9.0	11.2	10.5
HINWO	-	-	13.1	12.9	5.1	13.1	12.8	-	-	6.2	12.9	12.6	12.7	11.9	-	-
IGAAN	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	2.8	-
	5.2	7.8	12.7	12.5	12.4	12.8	-	-	-	-	7.5	-	-	-	-	-
JONKA	1.6	7.2	4.5	13.2	12.7	13.1	-	9.2	8.7	-	-	-	-	6.6	-	-
	2.1	5.3	11.8	13.2	11.6	12.0	0.2	7.8	6.9	-	4.3	-	-	5.6	-	-
KACJA	-	-	-	12.4	12.9	10.4	-	8.5	-	-	-	12.8	8.9	-	-	-
	0.8	0.7	-	13.0	12.9	12.9	12.8	-	-	-	3.2	9.1	-	-	-	-
	-	-	-	10.3	12.7	8.6	2.0	4.6	-	-	-	11.8	8.4	-	-	-
	-	-	-	12.7	13.0	10.6	4.0	8.7	-	-	-	12.8	9.2	-	-	-
	-	-	-	12.8	13.1	10.3	-	8.5	-	-	-	12.8	9.0	-	-	-
KOSDE	-	9.4	10.1	-	-	-	3.5	11.1	10.2	9.0	3.9	10.2	8.5	9.0	8.4	1.3
	-	-	-	-	2.5	2.3	9.5	11.0	-	5.9	10.3	10.1	9.9	8.9	5.7	6.7
	-	11.1	11.5	11.3	-	-	-	-	-	9.7	7.0	10.8	11.2	11.3	2.3	1.4
LOJTO	-	-	-	-	-	-	-	6.0	-	-	12.3	6.9	0.8	-	13.0	8.1
LOPAL	12.1	12.0	12.0	12.0	8.4	11.9	10.9	11.3	11.9	-	-	6.8	-	-	-	-
MACMA	3.4	-	-	-	-	-	-	13.2	-	13.2	12.1	2.4	-	-	-	-
	2.9	-	-	-	-	-	-	13.4	-	13.5	13.0	3.7	-	-	-	0.4
	0.3	-	-	-	-	-	-	1.7	-	2.1	2.2	0.5	-	-	-	-
	5.2	-	-	-	-	-	-	13.3	-	13.2	12.9	4.8	-	-	-	-
MARRU	12.5	12.5	12.5	12.3	10.0	12.2	12.1	12.4	12.4	-	-	9.7	-	0.5	3.6	-
	12.5	12.5	12.5	12.5	9.1	12.4	10.1	11.3	12.3	-	2.6	8.3	-	-	-	3.9
MOLSI	8.4	6.0	6.9	12.4	12.4	12.4	12.0	-	-	-	12.2	10.9	12.2	12.2	-	1.9
	11.0	5.9	8.0	13.0	13.0	13.0	12.6	-	-	-	12.8	11.2	12.7	12.6	-	1.9
	7.6	4.5	7.3	13.0	13.0	12.8	12.4	-	-	-	12.7	11.1	12.7	12.6	-	2.1
	6.0	6.4	-	-	-	4.7	7.1	-	-	-	11.6	11.6	11.3	8.4	-	-
	6.2	7.3	-	-	-	5.6	7.4	-	-	-	12.4	12.5	12.1	9.9	-	-
	6.5	6.4	-	-	-	5.0	6.8	-	-	-	11.7	11.4	11.3	9.9	-	-
	6.7	7.0	-	0.2	-	5.5	7.2	-	-	-	11.3	11.3	11.3	9.8	-	-
MORJO	-	-	11.8	13.0	12.7	11.9	-	2.8	-	-	-	-	-	-	4.8	-
MOSFA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTTMI	-	-	1.6	-	-	0.8	-	-	-	-	-	-	-	10.5	-	-
PERZS	1.3	2.4	2.9	12.9	12.9	12.8	10.3	-	-	-	4.6	6.1	-	-	-	-
ROTEC	3.0	6.9	-	-	-	2.4	4.3	-	-	1.2	13.0	13.1	12.9	8.8	-	-
SARAN	12.0	12.6	12.6	12.5	9.5	12.6	12.1	11.9	12.3	-	3.0	10.5	-	0.8	-	3.6
	11.5	12.2	12.6	12.3	9.7	10.7	12.1	11.8	11.0	-	2.6	7.9	-	-	-	-
	10.7	11.4	10.9	11.6	8.9	9.9	11.4	11.4	10.3	-	4.0	9.4	-	-	-	3.7
	11.4	12.2	12.6	12.3	8.2	10.6	12.3	10.7	11.1	-	-	0.2	-	-	-	-
	12.6	12.6	12.6	12.6	9.5	12.6	12.2	11.4	12.3	-	2.1	9.5	-	-	-	3.0
SCALE	2.6	9.9	2.0	12.6	10.2	12.9	-	6.9	9.6	11.4	10.1	11.3	0.2	9.8	-	-
SCHHA	6.0	13.3	12.8	13.3	13.2	13.2	9.1	-	-	12.7	13.0	7.4	2.2	-	-	7.6
SLAST	-	-	-	-	10.8	8.2	-	-	-	-	-	11.3	10.2	-	-	-
	-	1.7	-	13.0	13.0	9.8	-	-	-	-	-	12.4	10.3	-	-	-
STOEN	1.7	13.0	5.0	13.1	13.1	13.0	8.1	11.4	12.9	12.9	12.8	12.9	2.1	12.5	-	-
	2.5	12.7	3.7	13.1	13.1	13.0	8.9	11.3	12.8	12.9	12.8	12.6	2.3	12.6	-	-
	1.8	13.0	4.5	11.7	12.7	13.1	9.3	11.1	12.5	13.0	12.9	12.8	2.5	12.7	-	-
STRJO	-	6.9	2.2	7.3	13.4	13.4	1.2	-	0.6	7.9	13.2	11.4	-	2.7	-	-
	0.5	7.0	3.2	7.0	13.5	13.3	1.1	-	-	8.0	13.2	11.9	1.9	-	-	-
	-	6.1	1.6	7.3	13.3	13.1	-	-	-	7.9	13.1	12.4	2.0	3.3	-	-
	-	6.6	1.2	7.6	13.5	13.4	1.1	-	-	7.9	13.2	9.5	-	2.3	-	-
TEPIS	-	-	-	-	-	12.9	5.3	-	0.8	-	12.7	-	-	-	-	-
	7.7	6.6	13.0	13.0	12.9	12.9	5.7	-	-	-	12.7	-	-	-	-	-
WEGWA	-	-	-	0.6	-	5.5	12.9	-	-	-	12.8	12.9	12.8	12.8	4.8	-
YRJIL	-	-	-	13.9	10.7	4.3	-	-	4.4	-	8.5	-	-	-	3.1	-
Sum	299.8	434.0	424.5	674.1	628.4	676.6	476.7	403.0	301.8	302.5	533.6	591.5	298.4	328.8	81.7	67.7

### 3. Results (Meteors)

January	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	7	18	19	11	93	31	-	-	30	10	-	-	9	2	9
BANPE	8	-	5	-	-	7	-	-	-	4	-	-	-	-	1
BERER	-	57	16	-	69	71	75	63	-	19	3	-	-	-	1
BOMMA	61	2	106	21	55	62	34	32	10	-	10	-	26	11	24
BREMA	-	37	2	36	40	-	-	-	-	-	-	-	-	16	9
BRIBE	-	28	-	22	46	19	-	-	-	1	2	-	5	7	-
	-	-	-	22	60	11	-	-	-	-	3	-	3	-	-
CARMA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CASFL	52	46	44	41	38	46	43	50	12	-	-	-	-	1	27
CRIST	12	122	118	70	87	65	-	52	9	-	-	-	29	8	46
	2	64	52	29	46	39	-	25	-	19	-	-	28	8	27
	18	153	130	97	109	84	-	78	13	-	-	1	59	16	67
DONJE	64	-	77	33	58	41	13	25	7	8	11	-	25	10	14
ELTMA	25	52	60	44	-	37	36	35	-	20	-	-	-	-	4
FORKE	18	-	-	-	-	29	-	-	1	4	-	-	-	-	-
GONRU	1	2	19	7	2	28	27	23	5	2	-	2	16	19	25
	-	-	-	4	-	49	28	35	7	13	3	10	25	39	42
	-	-	-	5	-	44	39	43	12	16	1	16	38	35	35
	-	-	-	1	3	15	20	22	-	6	-	11	19	23	14
	-	-	-	-	-	42	45	42	4	11	2	14	34	23	46
	1	-	-	4	-	33	32	38	5	3	2	14	5	27	42
GOVMI	44	7	37	-	31	-	12	4	-	-	7	-	-	12	-
	27	3	44	23	-	-	4	2	-	6	3	-	1	6	-
HERCA	-	10	55	18	17	18	39	12	33	8	19	14	27	-	-
HINWO	13	-	-	-	-	22	-	-	-	19	-	-	5	-	-
IGAAN	-	9	9	10	11	10	12	4	-	-	-	-	-	-	-
	-	9	9	10	10	10	12	4	-	4	-	-	-	5	5
JONKA	-	17	6	17	19	30	20	6	20	9	-	-	-	13	17
	-	18	13	21	21	21	25	7	6	4	2	-	-	8	11
KACJA	87	-	64	30	-	70	10	30	-	29	24	-	-	-	3
	41	13	32	18	44	38	10	30	-	4	9	-	-	5	8
	57	-	12	18	42	40	4	18	-	14	6	-	-	-	-
	143	-	112	73	-	96	23	62	-	56	32	-	-	1	2
	83	-	52	28	-	63	15	28	-	20	15	-	-	-	1
KOSDE	-	-	-	-	-	-	-	-	7	14	-	-	-	32	61
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	35	13	5	-	6	17	45
LOJTO	7	-	-	-	18	2	14	-	1	17	7	-	-	-	1
LOPAL	-	-	1	3	-	15	13	21	8	4	8	9	13	15	14
MACMA	24	15	-	-	2	27	14	-	-	14	9	1	-	-	12
	18	19	-	-	1	15	14	1	-	17	3	1	-	-	4
	14	19	-	-	-	-	-	-	-	7	7	1	-	-	10
	33	19	-	-	-	-	19	1	-	23	9	2	-	-	8
MARRU	-	12	10	-	-	31	20	32	19	1	16	15	46	23	34
	-	-	-	15	-	28	29	28	16	6	12	13	38	28	25
MOLSI	22	1	3	51	108	100	-	-	-	-	-	-	3	-	1
	9	-	-	4	38	30	-	-	-	-	-	-	4	2	-
	8	-	2	8	83	57	-	-	-	-	-	-	4	-	1
	9	19	22	39	130	49	-	-	34	9	18	-	10	3	31
	7	12	25	45	95	34	-	-	41	5	10	-	8	1	34
	2	2	18	11	50	24	-	-	22	5	13	-	4	7	20
	4	17	29	35	93	33	-	-	26	7	5	-	9	6	39
MORJO	1	1	19	17	16	18	19	-	12	-	3	-	-	10	12
MOSFA	19	16	12	12	-	-	-	-	-	-	-	-	-	-	-
OTTMI	9	-	13	-	14	8	14	-	-	-	-	3	-	3	1
PERZS	66	5	83	19	42	38	1	2	-	4	5	-	-	15	4
ROTEC	-	7	7	1	13	7	-	-	12	2	-	-	2	-	3
SARAN	-	-	2	9	1	23	15	19	8	5	15	10	14	13	17
	-	-	1	6	-	23	24	23	9	6	20	12	26	23	42
	-	-	2	8	-	47	31	44	24	4	25	18	29	29	44
	-	-	1	3	-	21	17	10	11	6	9	8	13	14	10
	-	-	1	10	-	16	26	23	10	1	15	10	27	20	13
SCALE	13	13	26	19	18	19	23	21	-	8	1	-	4	-	5
SCHHA	-	25	-	26	32	4	-	-	1	-	4	-	5	11	-
SLAST	50	-	29	39	39	-	1	6	-	-	4	-	-	-	-
	27	-	11	10	20	13	1	5	-	10	2	-	-	-	-
STOEN	52	45	56	52	72	68	59	49	-	23	7	-	30	2	12
	56	44	60	50	64	71	51	45	3	16	6	-	11	5	17
	75	52	87	55	59	84	55	60	-	24	10	-	19	4	24
STRJO	-	10	-	59	91	5	-	-	-	-	3	-	-	2	1
	-	7	-	23	31	-	-	-	-	-	-	-	-	-	3
	-	4	-	25	24	4	-	-	-	-	3	-	-	-	-
	-	7	-	25	35	7	-	-	-	-	2	-	-	3	-
TEPIS	35	11	2	10	29	31	20	21	11	18	1	-	-	-	-
	17	-	-	11	28	20	30	28	7	12	-	-	-	-	24
WEGWA	23	32	-	-	2	20	10	22	16	21	-	-	-	-	-
YRJIL	-	20	4	33	34	9	-	-	-	-	19	-	-	-	-
Sum	1364	1101	1619	1446	2183	2172	1098	1231	507	611	430	185	679	583	1052

Januar	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ARLRA	11	23	-	-	-	18	13	-	-	-	70	87	74	23	-	-
BANPE	1	-	-	-	6	2	-	-	-	-	-	-	-	-	-	-
BERER	-	6	54	6	31	36	-	1	-	-	-	-	-	-	1	-
BOMMA	-	-	-	34	3	3	-	-	40	34	15	16	1	19	2	-
BREMA	-	-	12	23	21	35	5	-	-	23	22	5	-	-	-	-
BRIBE	6	-	33	44	26	36	26	-	-	29	46	11	5	1	-	5
	25	27	41	40	28	33	29	-	-	21	48	13	3	-	-	-
CARMA	-	-	-	-	-	-	-	-	-	-	44	31	60	62	13	-
CASFL	3	20	3	47	35	49	41	29	40	41	40	26	32	29	-	-
CRIST	6	29	43	54	51	37	25	29	49	37	8	3	27	9	-	-
	17	19	24	29	26	13	12	15	16	16	1	-	-	2	-	-
	1	32	59	59	66	51	41	52	-	61	8	6	42	16	-	-
DONJE	1	-	-	22	2	-	1	-	27	25	13	6	5	19	2	-
ELTMA	-	31	3	25	29	37	-	-	35	28	22	21	-	8	-	-
FORKE	-	-	40	36	37	49	44	16	-	-	38	47	39	35	-	2
GONRU	7	14	25	15	15	15	19	27	11	2	4	7	-	-	-	15
	48	48	55	42	38	57	37	36	21	1	1	13	-	-	1	-
	36	40	48	39	30	40	37	36	25	-	1	5	-	-	3	4
	14	9	19	11	11	10	12	18	15	-	1	1	-	-	-	-
	36	37	45	38	26	29	29	29	18	-	4	7	-	-	-	3
	32	32	21	25	28	29	23	44	32	-	5	13	-	-	-	1
GOVMI	-	-	4	22	25	10	7	-	-	-	7	9	-	-	-	-
	-	-	-	22	17	6	3	-	-	-	3	4	-	-	-	-
HERCA	1	10	13	16	3	-	21	18	4	12	24	26	15	27	25	16
HINWO	-	-	27	37	25	34	25	-	-	16	27	24	30	20	-	-
IGAAN	-	-	-	-	-	-	-	-	-	-	-	-	-	1	7	-
	3	3	10	8	4	3	-	-	-	-	1	-	-	-	-	-
JONKA	6	5	22	16	6	11	-	4	1	-	-	-	-	2	-	-
	3	1	17	16	13	8	1	6	3	-	2	-	-	1	-	-
KACJA	-	-	-	55	48	22	-	11	-	-	-	44	18	-	-	-
	1	1	-	19	36	19	22	-	-	-	6	5	-	-	-	-
	-	-	-	16	15	10	1	5	-	-	-	27	6	-	-	-
	-	-	-	72	87	34	4	18	-	-	-	66	35	-	-	-
	-	-	-	35	32	17	-	6	-	-	-	33	17	-	-	-
KOSDE	-	70	62	-	-	8	60	73	46	26	64	68	46	4	4	10
	-	-	-	-	16	23	66	90	-	29	81	75	93	49	19	39
	-	67	51	59	-	-	-	-	-	60	53	64	73	47	5	5
LOJTO	-	-	-	-	-	-	6	-	-	-	21	14	1	-	23	6
LOPAL	14	15	16	15	7	16	13	24	13	-	-	13	-	-	-	-
MACMA	1	-	-	-	-	-	-	14	-	25	16	3	-	-	-	-
	6	-	-	-	-	-	-	17	-	21	23	2	-	-	-	1
	2	-	-	-	-	-	-	10	-	14	13	1	-	-	-	-
	6	-	-	-	-	-	-	24	-	31	28	7	-	-	-	-
MARRU	40	33	31	28	18	12	19	26	24	-	-	17	-	3	1	-
	23	26	39	24	17	20	13	22	27	-	7	13	-	-	-	11
MOLSI	26	10	40	82	86	57	39	-	-	-	106	64	79	83	-	4
	17	2	28	38	32	26	24	-	-	-	46	12	34	37	-	2
	27	7	30	63	52	39	32	-	-	-	57	49	43	67	-	2
	42	15	-	-	-	30	29	-	-	-	69	60	55	18	-	-
	32	19	-	-	-	32	21	-	-	-	68	84	80	19	-	-
	6	6	-	-	-	16	9	-	-	-	34	31	37	6	-	-
	33	22	-	1	-	22	20	-	-	-	52	54	44	23	-	-
MORJO	-	-	16	17	7	6	-	1	-	-	-	-	-	-	5	-
MOSFA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTTMI	-	-	10	-	-	5	-	-	-	-	-	-	-	11	-	-
PERZS	3	2	8	44	43	37	13	-	-	-	3	2	-	-	-	-
ROTEC	7	10	-	-	-	3	1	-	-	3	22	20	18	7	-	-
SARAN	20	16	24	19	13	18	15	15	25	-	3	10	-	2	-	5
	30	37	27	28	23	29	23	27	23	-	6	18	-	-	-	-
	40	31	42	29	20	34	33	31	39	-	8	18	-	-	-	7
	8	12	16	6	11	10	12	14	16	-	-	1	-	-	-	-
	21	18	26	22	17	17	24	17	28	-	6	4	-	-	-	9
SCALE	3	17	2	23	14	12	-	9	10	13	13	8	1	1	-	-
SCHHA	1	20	28	42	30	23	6	-	-	22	22	8	9	-	-	14
SLAST	-	-	-	-	10	11	-	-	-	-	-	25	7	-	-	-
	-	2	-	16	7	4	-	-	-	-	-	6	2	-	-	-
STOEN	5	67	30	65	60	76	22	55	64	47	62	42	4	19	-	-
	9	62	17	61	47	60	29	56	60	60	51	34	2	23	-	-
	8	71	23	88	68	73	28	63	52	77	60	45	8	26	-	-
STRJO	-	16	7	21	62	64	1	-	1	34	60	53	-	5	-	-
	2	15	5	8	25	31	3	-	-	27	28	13	1	-	-	-
	-	4	1	4	13	9	-	-	-	30	42	40	2	4	-	-
	-	9	5	6	29	43	2	-	-	19	36	20	-	1	-	-
TEPIS	-	-	-	-	-	22	1	-	1	-	16	-	-	-	-	-
	15	8	18	23	25	22	4	-	-	-	20	-	-	-	-	-
WEGWA	-	-	-	1	-	8	17	-	-	-	17	18	14	21	1	-
YRJIL	-	-	-	37	31	8	-	-	5	-	10	-	-	-	3	-
Summe	705	1096	1220	1793	1603	1671	1005	981	798	904	1646	1568	1084	792	115	161