Results of the IMO Video Meteor Network – July 2017

Sirko Molau, Abenstalstr. 13b, 84072 Seysdorf *2018/02/21*

37 observers of the IMO network enjoyed perfect observing conditions in July with their 73 active video cameras. In two nights, 70 of these cameras were active. 66 of the cameras collected twenty and more observing nights, and seven of these observed without a break at all. This time, the German observers were below the average with "only" little more than twenty observing nights. In total we recorded over 35,000 meteors in 8,300 hours of effective observing time. The output is smaller than in the years before because there were fewer active cameras.

The two most important showers of July – the Southern delta Aquariids and alpha Capricornids – reach their peak just before the end of the month. Their descending activity branch is reaching well into August, which is why we will discuss their flux density profiles in the next monthly report.

The July gamma Draconids presented a remarkable outburst last years with a short peak of up to 20 meteoroids per 1,000 km^2 and hour at 125.132° solar longitude. This solar longitude interval was outside the European observing window in 2017, but in the nights before and thereafter we recorded lower activity than on average between 2011 and 2015 (figure 1).

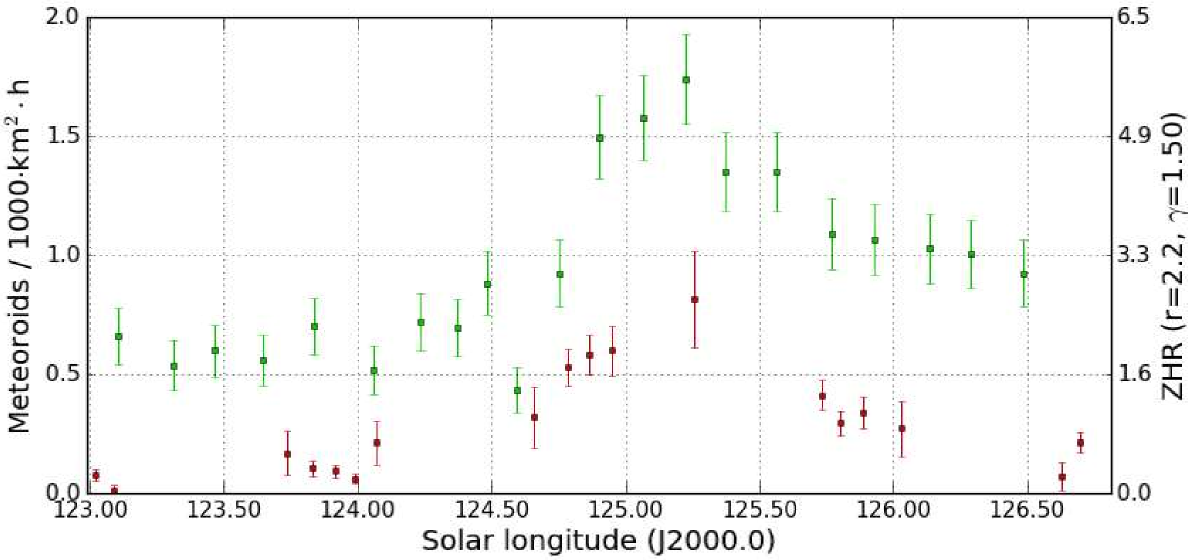

***Figure 1:** Flux density profile of the July gamma Draconids 2011-2015 (green) and 2017 (red), derived from video data of the IMO Network.*

Since there is no other relevant meteor shower in July, we now want to continue and conclude our analysis of the effective collection area of video cameras and the best observing direction. Last month we showed the impact of boundary conditions like the meteor shower velocity, population index and atmospheric extinction. Depending on these parameters, the detection probability may vary significantly, whereby either observing fields near the radiant or near the horizon are privileged. In practice meteor cameras have a larger field of view, and the detection probability has to be integrated over the full field of view. Due to this, local effects like the "blind spot" at the radiant disappear. If the camera is pointed towards the horizon, the lower part of the observing fields points below the horizon and does not contribute to the effective collection area at all, whereas higher parts reach to those areas with maximum detection probability.

To analyze the effect quantitatively we extended the simulation by a variable camera field of view. For simplicity we simulate a circular field of view, since rectangular fields give even more degrees of freedom (proportion and orientation of axes) without changing the result significantly. Figure 2 presents the effective collection area for an “average meteor shower” as in the last report (radiant at south with 10° declination, a population index of r=2.5 and a velocity of v_{inf}=50 km/s). Left each pixel represents the effective collection area per each square degree at the celestial sphere, right each pixel represents the collection area of a camera with 50° field of view diameter pointing in that direction. The deviation in detection probability between the individual observing directions are getting smaller, but they are still substantial. If we compare a spot at 30° altitude in northern and southern direction, for example, the difference is 210% in the left and 180% in the right case. That is, a camera pointing towards the radiant is recording almost twice as many shower meteors as a camera pointing north. That matches the subjective impression when analyzing data of respectively oriented camera pairs like REMO2 and REMO3.

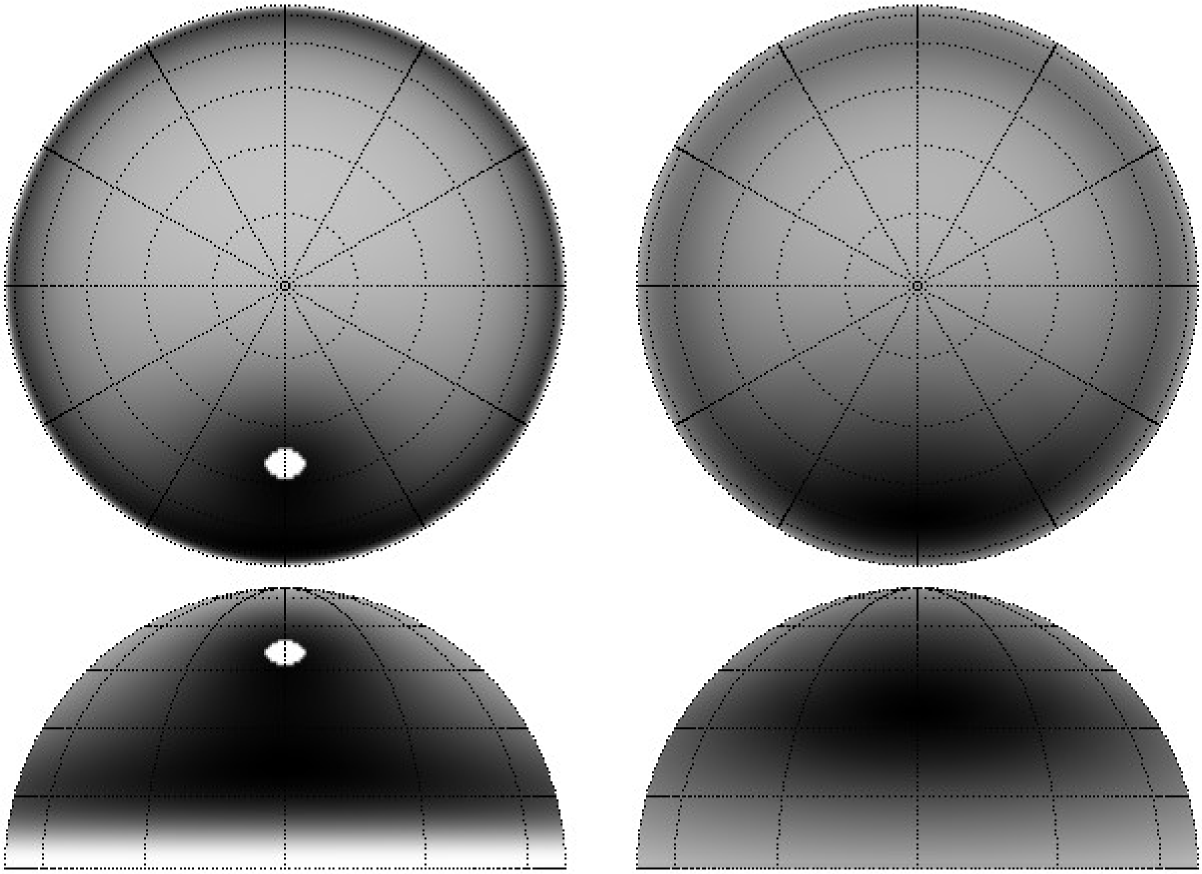

Figure 2: *Effective collection area per square degree at the celestial sphere (left) and with 50° camera field of view diameter (right) for an “average meteor shower”. Above is the total view of the sky with the zenith at the center, below is the horizontal view in radiant direction. White represents zero, black the biggest effective collection area. The grey levels of the two figures are scaled independently of each other.*

Comparing the impact of the individual meteor shower parameters pixel-wise and with a camera of 50° field of view, we get qualitatively the same picture. At low meteor shower velocities, small population indices or low atmospheric extinction, fields of view near the horizon have the largest effective collection area. At high meteor shower velocities, large population indices or large extinction, observing fields near the radiant are privileged. That is particularly prominent if we combine parameters with similar effects: Figure 3 shows at the left the effective collection area of a camera with 50° field of view for a shower with v_{inf}=30km/s, r=2.0 and an extinction of 0.20, and at the right for a shower with v_{inf}=70km/s, r=3.0 and an extinction of 0.45. In the first case, the difference between an observing field in the south at 25° altitude and at zenith is almost 400%. In the second case we have a difference of 300% when the center is at 45° altitude south (near the radiant) and at zenith.

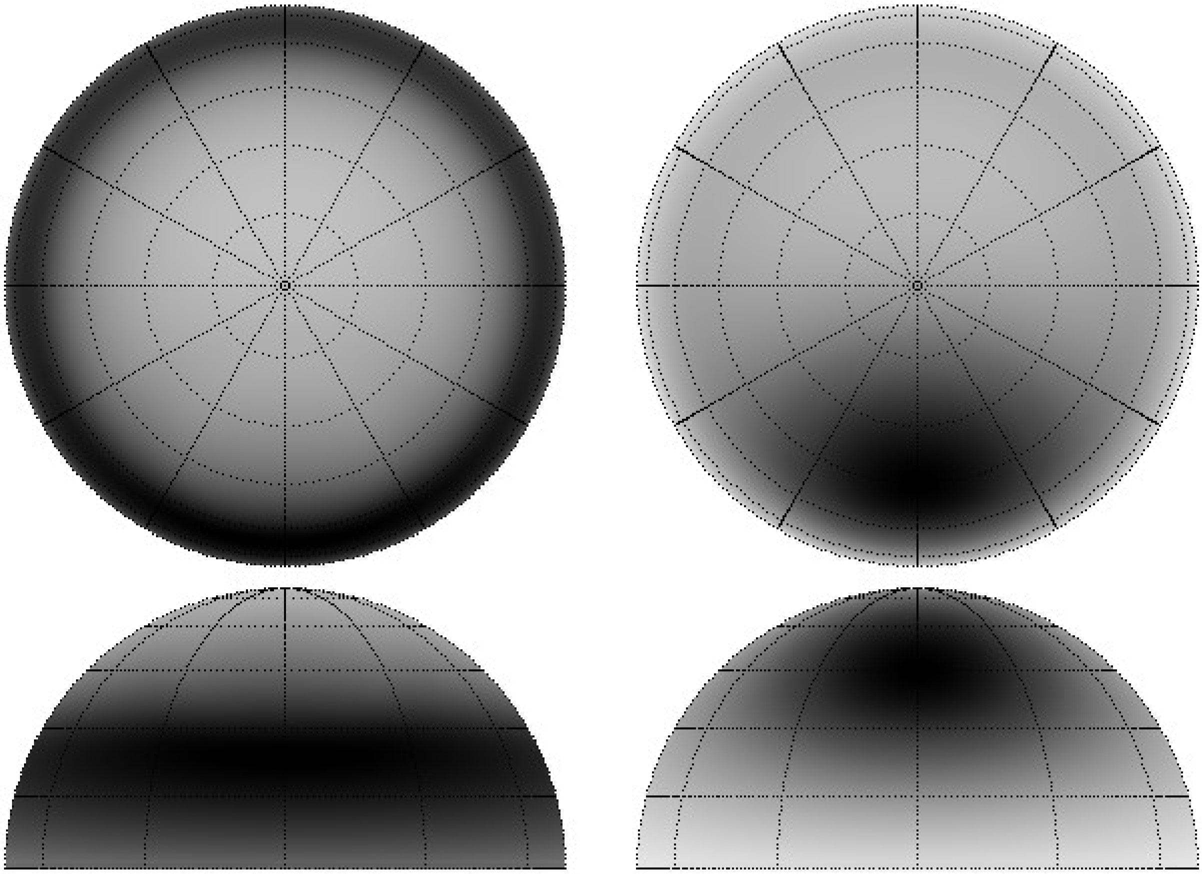

Figure 3: *Comparison of the effective collection area of a camera with 50° field of view for a meteor shower with low velocity and small population index at low extinction (left), and for a meteor shower with high velocity and a large population index at high extinction (right). The grey levels of the two figures are scaled independently of each other.*

Now we are only missing the temporal aspect, because the camera does not only observe when the radiant culminates, but all-night long. So we take once more the "average meteor shower" from figure 2 and let the radiant raise from east to south during six hours of observing time (figure 4). Left is the picture from the last monthly report with the effective collection area per pixel, right the collection area of a camera with 50° field of view diameter. The best detection rate is achieved with a field of view in south-eastern direction at about 30° altitude.

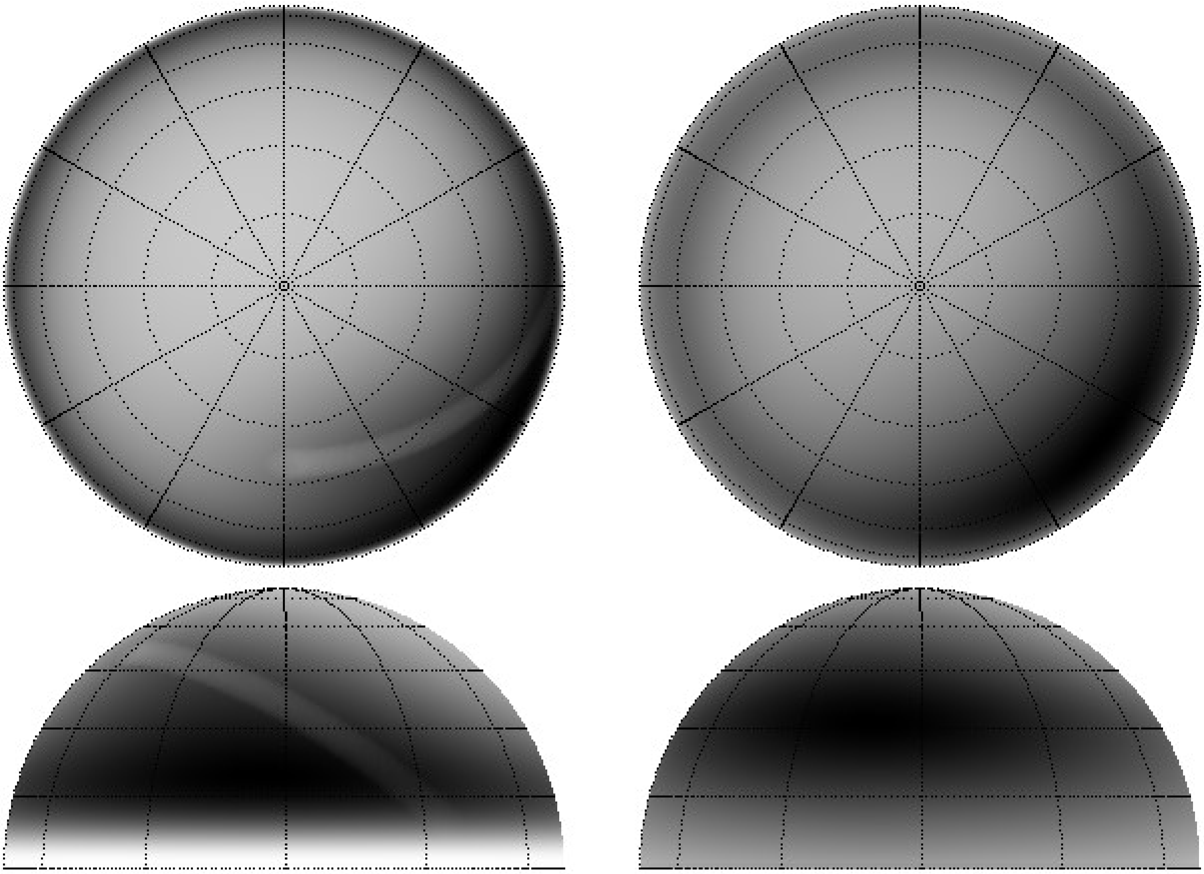

Figure 4: *Effective collection area per square degree at the celestial sphere (left) and with 50° camera field of view diameter (right) for an "average meteor shower", whose radiant is moving from east to south during six hours of observation. The grey levels of the two figures are scaled independently of each other.*

Let's return to the July gamma Draconids in the end: Where should a camera be pointed best for this in central Europe circum-polar meteor shower radiant? The answer is given in figure 5: The observing direction does hardly matter – the camera just needs to be pointed at 30° altitude. Fields of view near the zenith are not advised.

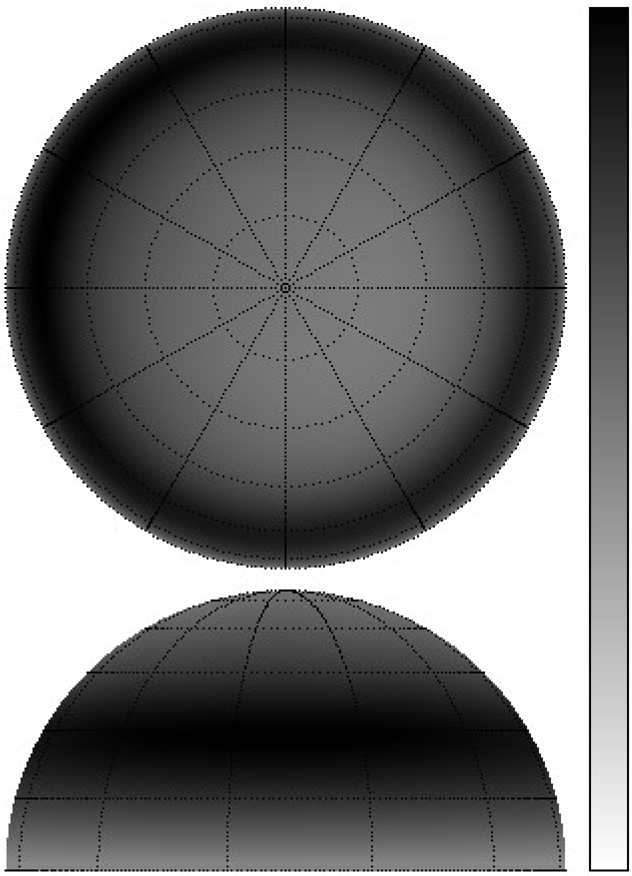

Figure 5: *Best observing direction for a video camera to record the July gamma Draconids. The lower figure is oriented north-west towards the maximum effective collection area.*

1. Observers

Code	Name	Place	Camera	FOV [°²]	Slim [mag]	Eff.CA [km²]	Nights	Time [h]	Meteors
ARLRA	Arlt	Ludwigsfelde/DE	LUDWIG2 (0.8/8)	1475	6.2	3779	24	72.5	434
BERER	Berkó	Ludanyhalaszi/HU	HULUD1 (0.8/3.8)	5542	4.8	3847	17	82.6	616
BOMMA	Bombardini	Faenza/IT	MARIO (1.2/4.0)	5794	3.3	739	31	183.7	1222
BREMA	Breukers	Hengelo/NL	MBB3 (0.75/6)	2399	4.2	699	19	51.5	188
BRIBE	Klemt	Herne/DE	HERMINE (0.8/6)	2374	4.2	678	23	52.5	230
		Berg. Gladbach/DE	KLEMOI (0.8/6)	2286	4.6	1080	18	64.5	234
CARMA	Carli	Monte Baldo/IT	BMH2 (1.5/4.5)*	4243	3.0	371	24	108.7	856
CASFL	Castellani	Monte Baldo/IT	BMH1 (0.8/6)	2350	5.0	1611	29	154.4	600
CINFR	Cineglosso	Faenza/IT	JENNI (1.2/4)	5886	3.9	1222	31	190.3	697
CRIST	Crivello	Valbrevenna/IT	BILBO (0.8/3.8)	5458	4.2	1772	30	169.1	901
			C3P8 (0.8/3.8)	5455	4.2	1586	29	131.3	548
			STG38 (0.8/3.8)	5614	4.4	2007	31	176.8	1390
ELTMA	Eltri	Venezia/IT	MET38 (0.8/3.8)	5631	4.3	2151	31	134.4	618
FORKE	Förster	Carlsfeld/DE	AKM3 (0.75/6)	2375	5.1	2154	15	52.6	292
GONRU	Goncalves	Foz do Arelho/PT	FARELHO1 (0.75/4.5)	2286	3.0	208	12	56.0	27
		Tomar/PT	TEMPLAR1 (0.8/6)	2179	5.3	1842	28	192.1	1088
			TEMPLAR2 (0.8/6)	2080	5.0	1508	28	196.3	769
			TEMPLAR3 (0.8/8)	1438	4.3	571	28	181.3	345
			TEMPLAR4 (0.8/3.8)	4475	3.0	442	28	194.6	806
			TEMPLAR5 (0.75/6)	2312	5.0	2259	29	178.5	855
GOVMI	Govedic	Sredisce ob Dr./SI	ORION2 (0.8/8)	1447	5.5	1841	29	125.8	462
			ORION4 (0.95/5)	2662	4.3	1043	30	116.7	295
HERCA	Hergenrother	Tucson/US	SALSA3 (0.8/3.8)	2336	4.1	544	22	119.5	289
HINWO	Hinz	Schwarzenberg/DE	HINWO1 (0.75/6)	2291	5.1	1819	21	69.0	278
IGAAN	Igaz	Budapest/HU	HUPOL (1.2/4)	3790	3.3	475	26	117.6	151
JONKA	Jonas	Budapest/HU	HUSOR (0.95/4)	2286	3.9	445	29	118.4	304
			HUSOR2 (0.95/3.5)	2465	3.9	715	29	137.2	332
KACJA	Kac	Kamnik/SI	CVETKA (0.8/3.8)	4914	4.3	1842	23	113.4	777
		Kostanjevec/SI	METKA (0.8/12)*	715	6.4	640	29	128.1	366
		Ljubljana/SI	ORION1 (0.8/8)	1399	3.8	268	28	128.6	736
		Kamnik/SI	REZIKA (0.8/6)	2270	4.4	840	23	116.1	1114
			STEFKA (0.8/3.8)	5471	2.8	379	23	106.3	538
LOJTO	Łojek	Grabniak/PL	PAV57 (1.0/5)	1631	3.5	269	9	40.3	200
MACMA	Maciejewski	Chelm/PL	PAV35 (0.8/3.8)	5495	4.0	1584	28	94.8	396
			PAV36 (0.8/3.8)*	5668	4.0	1573	29	118.5	625
			PAV43 (0.75/4.5)*	3132	3.1	319	26	105.5	322
			PAV60 (0.75/4.5)	2250	3.1	281	27	112.9	508
MARRU	Marques	Lisbon/PT	CAB1 (0.75/6)	2362	4.8	1517	29	202.4	784
			RAN1 (1.4/4.5)	4405	4.0	1241	23	124.3	286
MASMI	Maslov	Novosimbirsk/RU	NOWATEC (0.8/3.8)	5574	3.6	773	21	60.6	301
MOLSI	Molau	Seysdorf/DE	AVIS2 (1.4/50)*	1230	6.9	6152	24	85.5	810
			ESCIMO2 (0.85/25)	155	8.1	3415	21	87.0	190
			MINCAM1 (0.8/8)	1477	4.9	1084	23	81.6	423
		Ketzür/DE	REMO1 (0.8/8)	1467	6.5	5491	24	73.9	496
			REMO2 (0.8/8)	1478	6.4	4778	24	79.3	552
			REMO3 (0.8/8)	1420	5.6	1967	24	91.5	517
			REMO4 (0.8/8)	1478	6.5	5358	25	90.4	600
MORJO	Morvai	Fülöpszallas/HU	HUFUL (1.4/5)	2522	3.5	532	30	155.5	339
MOSFA	Moschini	Rovereto/IT	ROVER (1.4/4.5)	3896	4.2	1292	26	56.0	347
OCHPA	Ochner	Albiano/IT	ALBIANO (1.2/4.5)	2944	3.5	358	15	68.6	155
OTTMI	Otte	Pearl City/US	ORIE1 (1.4/5.7)	3837	3.8	460	29	128.6	274
PERZS	Perkó	Becsehely/HU	HUBEC (0.8/3.8)*	5498	2.9	460	28	128.1	629
ROTEC	Rothenberg	Berlin/DE	ARMEFA (0.8/6)	2366	4.5	911	19	58.6	197
SARAN	Saraiva	Carnaxide/PT	RO1 (0.75/6)	2362	3.7	381	26	172.5	331
			RO2 (0.75/6)	2381	3.8	459	28	183.4	475
			RO3 (0.8/12)	710	5.2	619	25	170.7	701
			RO4 (1.0/8)	1582	4.2	549	26	152.3	222
			SOFIA (0.8/12)	738	5.3	907	26	137.9	339
SCALE	Scarpa	Alberoni/IT	LEO (1.2/4.5)*	4152	4.5	2052	28	127.2	220
SCHHA	Schremmer	Niederkrüchten/DE	DORAEMON (0.8/3.8)	4900	3.0	409	22	75.7	280
SLAST	Slavec	Ljubljana/SI	KAYAK1 (1.8/28)	563	6.2	1294	25	105.2	416
			KAYAK2 (0.8/12)	741	5.5	920	26	121.5	164
STOEN	Stomeo	Scorze/IT	MIN38 (0.8/3.8)	5566	4.8	3270	31	136.9	1090
			NOA38 (0.8/3.8)	5609	4.2	1911	31	138.7	904
			SCO38 (0.8/3.8)	5598	4.8	3306	31	140.5	1008
STRJO	Strunk	Herford/DE	MINCAM2 (0.8/6)	2354	5.4	2751	23	61.3	278
			MINCAM3 (0.8/6)	2338	5.5	3590	24	51.6	163
			MINCAM4 (0.8/6)	2306	5.0	1412	24	61.4	124
			MINCAM5 (0.8/6)	2349	5.0	1896	23	55.5	181
			MINCAM6 (0.8/6)	2395	5.1	2178	23	45.9	134
TEPIS	Tepliczky	Agostyan/HU	HUAGO (0.75/4.5)	2427	4.4	1036	29	122.5	323
			HUMOB (0.8/6)	2388	4.8	1607	26	109.4	474
WEGWA	Wegrzyk	Nieznaszyn/PL	PAV78 (0.8/6)	2286	4.0	778	23	75.5	291
Sum							31	8309.9	35427

* active field of view smaller than video frame

2. Observing Times (h)

July	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	-	3.4	-	2.9	3.0	3.1	1.6	1.3	3.9	-	2.2	1.1	2.7	2.7	1.9
BERER	-	3.5	5.3	-	-	5.0	-	5.5	-	-	-	-	5.7	-	-
BOMMA	6.7	4.9	6.6	5.1	6.8	6.8	6.8	4.0	1.9	6.9	6.4	6.7	2.3	7.0	4.1
BREMA	1.3	4.6	0.9	0.3	3.7	-	1.3	2.7	0.5	-	-	5.0	0.7	1.1	-
BRIBE	0.2	3.7	-	4.8	4.4	1.5	3.1	-	0.9	1.3	-	5.2	3.2	1.2	-
	-	4.1	2.8	3.7	4.8	2.0	4.7	4.5	-	2.5	0.9	5.2	2.2	3.5	-
CARMA	4.4	4.5	5.0	3.6	3.6	4.7	3.3	0.4	-	2.1	4.8	5.5	0.6	3.6	5.0
CASFL	6.2	5.9	5.8	4.8	6.5	6.6	4.7	1.0	-	1.3	6.7	6.8	0.7	4.8	6.6
CRIST	6.6	4.4	6.6	6.4	6.8	6.8	6.7	4.2	3.6	6.9	0.5	6.8	5.0	6.9	5.8
	6.2	5.6	6.3	3.9	6.3	6.3	6.4	0.8	6.0	-	6.2	6.4	5.5	6.6	6.2
	5.0	5.7	3.7	4.0	6.3	6.4	3.1	2.8	-	0.2	4.5	6.3	2.0	6.6	6.4
DONJE	6.2	6.1	6.3	4.5	6.3	6.3	6.4	3.7	6.3	1.2	6.4	6.4	5.9	6.6	6.6
ELTMA	4.3	4.9	1.1	4.4	4.9	5.1	4.9	0.5	0.7	5.8	5.8	5.8	2.6	3.2	1.9
FORKE	-	-	-	5.0	3.4	-	-	-	-	-	3.3	-	3.5	-	1.2
GONRU	5.1	7.2	7.3	-	-	2.4	-	-	5.0	7.1	-	-	-	-	-
	7.2	7.2	7.3	7.3	5.9	5.9	-	-	2.8	7.3	6.8	7.3	6.0	7.4	7.5
	7.3	7.3	7.4	7.4	3.9	5.6	-	-	5.3	7.5	7.0	7.5	5.8	7.5	7.6
	7.0	7.0	7.1	6.7	5.3	6.0	-	-	4.4	7.3	7.2	7.4	4.5	3.0	7.4
	7.3	7.3	7.3	7.4	4.3	6.0	-	-	5.2	7.4	7.0	7.5	6.1	7.6	7.6
	7.1	7.1	7.2	7.0	4.6	5.7	-	-	3.2	6.7	6.7	6.0	4.4	3.0	7.3
GOVMI	5.7	2.4	5.8	2.8	3.9	4.7	3.9	3.7	1.1	6.0	-	0.6	6.2	1.1	6.3
	5.4	1.6	5.6	3.8	4.4	4.7	3.4	3.3	1.0	5.8	0.7	1.5	5.9	1.4	6.0
HERCA	8.0	7.8	7.3	8.3	4.3	6.8	7.0	6.4	5.7	-	-	7.1	-	-	0.2
HINWO	-	-	-	4.0	2.6	0.2	1.7	0.3	4.4	0.6	3.3	-	4.5	0.4	2.7
IGAAN	5.3	3.2	5.4	1.9	2.9	5.0	4.2	-	-	1.6	-	-	5.7	4.7	4.4
JONKA	5.6	2.1	5.8	0.4	5.1	4.8	1.9	3.5	-	1.4	1.0	0.4	6.3	3.3	1.6
	5.6	3.0	5.9	0.5	6.0	5.5	5.0	4.7	0.7	2.0	-	0.5	6.2	4.2	5.1
KACJA	6.0	-	5.2	6.1	1.2	6.0	2.8	1.0	-	3.4	-	3.4	-	-	6.5
	6.0	1.4	6.0	5.8	3.5	3.4	3.9	1.5	-	5.4	1.0	2.9	6.2	1.0	6.5
	6.3	0.3	3.8	5.6	5.0	5.9	5.0	-	0.4	6.3	-	4.2	3.3	3.6	6.5
	6.1	-	5.3	6.3	1.6	6.2	2.6	1.2	-	3.6	-	3.6	-	-	6.5
	6.1	-	5.0	6.2	1.2	6.0	2.3	1.0	-	3.5	-	3.4	-	-	6.6
LOJTO	-	-	-	4.9	-	-	-	-	5.3	-	4.1	-	-	-	-
MACMA	4.2	3.5	4.4	2.1	0.5	3.6	-	-	5.1	1.0	1.9	1.6	5.3	2.9	4.3
	4.4	5.1	5.3	4.6	0.3	5.3	-	0.6	5.4	1.9	5.1	2.7	5.6	4.8	4.7
	3.0	3.6	5.1	4.8	-	5.0	-	0.4	5.1	1.8	4.0	2.1	5.3	4.1	3.5
	4.5	5.0	5.0	4.9	-	5.1	-	1.2	5.2	1.6	5.1	2.6	5.4	4.6	4.9
MARRU	7.2	7.2	7.2	7.0	4.8	6.4	-	-	7.3	7.4	7.4	7.5	7.4	6.2	7.5
	7.1	7.5	7.4	6.9	2.3	-	-	-	-	-	7.0	7.2	7.4	7.4	7.4
MASMI	-	-	2.1	-	-	-	-	-	1.2	1.6	1.8	-	1.2	3.1	3.2
MOLSI	-	-	4.6	-	4.7	4.5	4.4	3.6	1.6	-	2.5	4.2	4.0	0.4	1.3
	-	-	5.4	-	5.4	5.3	5.4	4.6	0.9	-	1.6	4.1	4.6	-	1.3
	-	-	4.7	-	5.4	4.8	4.4	1.8	1.6	-	1.2	3.3	3.5	0.4	0.3
	-	3.6	0.8	1.2	3.2	3.0	2.1	3.6	3.9	-	1.8	1.9	3.7	-	4.1
	-	4.0	0.9	1.1	3.3	2.6	1.2	1.8	4.0	-	1.4	2.2	4.3	-	4.6
	-	4.5	1.1	1.3	4.0	3.3	2.0	3.9	4.8	-	2.5	2.5	4.9	-	5.1
	-	4.4	1.0	1.5	3.7	3.2	1.7	3.6	4.6	-	2.3	2.7	4.9	-	5.0
MORJO	6.0	2.5	6.0	3.3	6.1	6.2	5.9	6.1	2.8	3.1	1.3	1.8	6.3	3.5	6.2
MOSFA	1.9	0.6	1.0	0.3	0.8	-	0.6	-	-	-	2.1	1.9	-	2.2	0.9
OCHPA	-	6.5	2.1	-	-	5.2	-	0.7	-	-	5.9	-	-	0.3	-
OTTMI	1.0	4.4	7.0	1.0	6.9	6.7	6.7	1.3	4.9	0.4	1.5	7.2	-	3.2	6.1
PERZS	6.0	6.0	6.1	6.2	4.4	3.3	4.5	0.6	0.7	6.1	-	1.3	6.4	1.1	6.4
ROTEC	-	3.8	-	0.7	2.0	2.8	-	-	3.9	-	0.9	0.9	-	-	3.9
SARAN	7.3	6.9	7.4	7.6	-	-	-	0.2	2.7	6.7	5.9	6.5	7.2	7.3	7.9
	7.6	7.6	7.5	7.6	1.1	1.7	-	-	3.8	7.7	7.8	7.7	7.8	7.5	7.8
	7.3	7.3	3.5	7.4	1.0	-	-	-	-	7.5	7.5	7.6	7.5	7.3	7.6
	7.3	0.3	7.4	7.1	-	-	-	-	0.8	7.4	7.6	7.4	7.8	6.5	7.7
	7.4	7.5	6.5	2.9	1.3	1.0	-	-	1.0	2.4	6.1	3.9	2.1	5.0	7.8
SCALE	3.0	4.3	2.3	6.3	6.3	6.5	6.1	-	2.2	6.4	6.1	-	2.4	2.4	2.4
SCHHA	1.1	5.0	1.9	5.0	5.2	2.6	3.5	1.1	1.0	4.3	-	5.0	3.9	5.2	-
SLAST	4.5	-	4.1	4.5	3.6	5.3	4.0	-	-	2.9	-	3.8	1.7	2.7	5.9
	4.9	-	4.7	6.2	5.0	6.2	6.0	-	0.4	6.2	3.2	5.7	3.7	3.7	6.2
STOEN	2.0	5.4	1.6	3.4	4.4	6.4	4.4	0.5	1.1	6.1	6.2	6.8	2.3	2.2	3.1
	1.5	5.0	2.0	2.3	3.7	6.5	4.1	0.8	0.3	5.2	6.0	6.6	1.8	5.6	3.6
	2.1	5.1	1.3	3.1	4.6	6.5	4.3	0.6	1.8	5.4	6.1	6.6	2.1	3.9	3.2
STRJO	2.8	2.2	1.4	-	2.0	1.1	2.7	-	1.3	-	-	3.3	4.0	1.7	2.8
	2.1	1.6	1.7	-	1.8	1.2	2.4	0.2	0.4	-	-	3.1	2.3	0.9	2.1
	2.6	2.5	1.2	1.2	3.2	1.3	3.6	-	1.6	-	-	3.5	4.0	1.0	3.3
	1.0	2.2	1.3	1.2	2.8	1.2	2.7	-	-	-	-	2.4	2.9	1.2	2.8
	0.6	1.6	1.9	-	2.1	0.9	2.2	-	0.8	-	-	3.1	2.1	1.3	1.2
TEPIS	2.0	4.5	5.6	1.6	4.1	5.4	4.0	4.8	0.5	5.0	-	0.8	5.9	4.4	5.9
	2.8	4.8	5.6	1.4	4.3	5.7	4.4	4.9	-	5.0	-	1.1	5.9	5.0	6.0
WEGWA	-	-	3.9	1.6	1.0	3.8	-	3.5	2.6	1.7	2.8	0.8	5.0	-	4.4
Sum	269.4	272.2	305.1	263.1	247.8	291.0	190.0	108.4	153.6	215.9	215.1	273.9	276.3	221.0	314.4

July	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ARLRA	-	4.4	4.5	-	4.7	4.7	1.4	3.8	-	-	0.2	3.1	4.0	5.2	2.6	4.1
BERER	-	4.5	3.2	3.7	4.4	6.1	-	2.5	-	6.1	-	4.0	4.4	6.1	6.3	6.3
BOMMA	7.1	7.0	7.2	7.2	4.0	3.2	7.2	2.3	6.7	7.5	7.6	7.4	7.4	4.3	7.4	7.2
BREMA	-	5.3	5.3	-	3.2	2.2	-	-	-	-	-	3.6	-	2.6	5.3	1.9
BRIBE	-	5.5	4.4	0.5	4.7	0.7	1.2	0.7	-	-	-	2.0	0.2	0.9	1.9	0.3
	2.1	5.5	5.4	1.2	3.9	-	-	-	-	-	-	-	-	-	5.5	-
CARMA	5.9	6.2	4.8	6.6	6.8	-	6.9	2.9	3.3	6.9	7.3	-	-	-	-	-
CASFL	6.9	6.5	6.5	7.0	7.0	2.1	6.5	2.5	3.0	7.1	7.0	3.9	7.2	-	5.3	7.5
CRIST	7.0	7.1	7.2	7.2	6.4	5.4	7.3	2.8	7.3	7.5	7.6	5.5	7.6	5.6	7.6	7.2
	6.0	6.7	6.5	5.2	5.8	1.3	5.6	2.6	5.9	6.5	6.4	6.9	6.6	3.8	7.3	7.3
	6.1	6.7	6.5	4.8	3.7	0.4	0.7	-	5.3	5.0	6.7	2.1	3.6	2.1	7.3	7.3
DONJE	5.6	6.7	6.6	5.0	5.7	1.4	5.5	3.3	5.5	6.4	6.8	7.1	6.8	4.6	7.3	7.3
ELTMA	6.7	5.8	6.9	6.5	4.2	3.0	4.8	1.6	7.1	6.5	6.2	1.7	5.9	0.3	4.5	6.8
FORKE	1.1	-	5.2	-	3.2	4.1	4.3	3.8	-	-	-	-	1.9	5.2	1.3	6.1
GONRU	-	-	-	5.3	6.6	-	-	-	-	-	-	0.8	3.0	-	1.9	4.3
	7.2	6.3	-	7.6	7.2	7.0	7.7	5.4	5.8	7.8	7.9	5.2	7.1	8.0	8.0	8.0
	7.4	6.2	-	7.7	7.1	7.5	7.8	4.8	7.9	7.9	8.0	5.4	7.2	8.1	8.1	8.1
	5.3	6.0	-	7.7	4.2	6.6	7.6	5.9	7.7	7.8	7.8	5.4	6.8	6.9	7.4	7.9
	7.4	6.2	-	7.7	5.9	7.0	7.8	4.8	7.9	7.9	8.0	4.8	7.1	8.1	7.9	8.1
	5.1	6.2	0.4	7.5	4.8	6.7	7.6	6.1	7.6	7.7	7.7	6.2	6.0	7.2	7.8	7.9
GOVMI	6.3	6.3	6.4	6.4	6.4	4.2	6.5	1.5	-	0.7	0.5	2.0	3.6	6.8	7.0	7.0
	6.0	6.1	3.6	3.8	2.8	3.6	6.3	2.4	0.3	1.2	-	2.0	3.9	6.7	6.7	6.8
HERCA	-	-	3.5	4.1	6.7	1.2	7.7	-	3.0	5.8	7.6	5.5	0.9	-	-	4.6
HINWO	-	1.3	5.8	-	5.7	5.6	5.8	5.3	-	0.3	-	-	2.9	6.4	-	5.2
IGAAN	4.2	5.9	6.1	0.7	5.4	5.9	3.7	4.3	-	6.4	2.3	3.8	5.4	6.4	6.4	6.4
JONKA	3.1	6.3	6.5	6.3	6.1	6.4	3.0	2.9	-	6.8	0.3	4.9	5.0	6.9	3.7	7.0
	4.4	6.4	6.4	6.5	6.2	6.6	3.8	3.3	-	6.8	1.0	4.8	6.8	7.0	5.2	7.1
KACJA	6.4	6.2	6.6	6.6	6.7	-	6.6	-	-	3.6	1.3	2.3	4.5	6.8	7.2	7.0
	6.3	6.5	6.7	5.4	5.2	2.6	6.7	2.4	-	2.9	2.6	2.4	4.3	5.4	7.1	7.1
	6.1	6.1	6.9	5.0	5.8	2.9	6.8	3.8	-	0.7	3.0	3.3	3.2	4.7	7.0	7.1
	6.6	6.6	6.7	6.8	6.9	-	6.8	-	-	3.9	1.2	1.9	4.6	6.7	7.2	7.2
	6.5	6.6	0.1	6.7	6.6	-	6.7	-	-	3.8	1.3	2.2	4.5	5.9	6.9	7.2
LOJTO	-	5.6	-	-	-	-	6.2	-	-	1.9	2.3	-	4.2	-	5.8	-
MACMA	5.3	4.4	4.3	2.8	2.1	0.2	4.9	1.4	1.1	-	4.3	5.9	1.0	6.2	6.2	4.3
	5.7	5.3	4.2	2.8	3.3	0.2	5.8	2.1	3.0	-	4.8	6.3	1.4	6.4	6.5	4.9
	5.3	5.2	4.1	2.4	2.9	-	5.8	-	2.1	-	4.1	6.3	1.8	6.4	6.4	4.9
	5.5	5.6	4.5	3.1	3.7	0.5	5.7	-	0.2	-	4.3	5.8	1.6	6.3	6.4	4.6
MARRU	6.7	7.6	1.4	7.7	7.7	7.8	7.7	7.9	4.6	4.8	7.9	7.9	7.9	8.1	8.1	8.1
	5.3	4.4	-	2.9	6.7	0.3	4.0	1.7	-	-	4.5	2.9	6.4	5.1	7.5	5.0
MASMI	1.7	2.9	1.8	3.4	3.5	3.7	3.8	3.9	-	2.6	4.2	4.0	3.8	3.4	3.7	-
MOLSI	5.2	5.3	5.3	2.1	5.0	4.0	3.1	-	4.6	-	-	0.2	1.4	5.9	1.5	6.1
	5.7	5.9	5.9	2.7	5.8	3.9	3.3	-	1.7	-	-	-	-	6.5	0.4	6.6
	5.6	5.9	5.3	2.6	5.8	3.2	3.1	-	3.3	-	-	-	1.2	6.5	1.1	6.6
	-	4.1	4.2	-	3.9	4.3	3.1	2.3	-	-	4.2	2.7	2.9	4.3	1.7	3.3
	-	4.8	4.8	-	4.5	4.8	3.5	3.2	-	-	5.1	2.9	3.4	5.2	2.3	3.4
	-	5.2	5.3	-	4.7	5.4	4.2	2.6	-	-	5.4	3.2	3.2	5.5	3.0	3.9
	-	5.2	5.3	0.3	4.9	5.2	4.3	2.5	-	-	5.6	3.2	3.5	5.5	2.5	3.8
MORJO	6.4	6.4	6.5	6.4	6.4	6.5	6.3	4.1	-	6.9	2.4	6.4	5.5	6.8	4.4	7.0
MOSFA	2.3	1.2	1.9	2.1	1.5	0.2	2.0	0.2	3.4	2.5	2.8	4.9	7.4	0.6	3.2	7.5
OCHPA	6.6	4.2	-	-	5.1	-	5.0	3.8	7.0	-	4.7	-	6.3	-	-	5.2
OTTMI	1.4	6.1	1.5	1.7	-	1.7	5.2	7.5	2.7	0.3	7.6	7.7	7.7	7.8	3.7	7.7
PERZS	6.5	6.6	6.6	6.2	5.9	5.6	6.7	1.5	-	0.8	-	1.1	1.3	6.1	7.0	7.1
ROTEC	-	5.0	5.0	-	4.7	5.0	2.3	2.7	-	-	-	1.8	3.1	5.1	1.9	3.1
SARAN	7.8	6.1	-	4.7	8.1	-	8.3	5.9	8.3	6.5	8.4	3.8	7.8	6.3	8.5	8.4
	7.3	5.7	1.3	4.0	7.9	-	7.5	4.0	8.2	8.0	8.3	7.0	7.7	6.6	8.3	8.4
	7.2	5.5	-	5.8	7.7	-	7.2	5.5	7.8	7.3	7.9	6.9	7.4	6.7	8.2	8.1
	7.3	5.7	0.8	2.3	5.8	-	7.3	2.8	7.9	5.4	8.0	5.1	7.1	4.7	7.9	6.9
	-	6.6	-	3.0	7.5	-	8.1	5.9	8.2	5.6	8.1	6.8	7.3	2.7	8.1	5.1
SCALE	6.3	4.5	6.8	6.2	4.5	1.5	4.4	1.3	6.9	6.5	5.2	1.4	4.3	-	3.7	7.0
SCHHA	-	5.6	5.6	-	6.0	-	0.3	-	0.5	-	-	4.4	-	2.6	3.9	2.0
SLAST	5.9	5.9	5.9	6.0	6.0	1.7	5.9	1.5	-	-	0.9	1.3	4.7	4.7	5.6	6.2
	6.2	6.2	6.2	-	6.2	3.2	1.2	4.7	-	-	1.1	2.4	4.8	5.1	5.8	6.3
STOEN	6.7	4.5	5.8	5.7	6.8	3.2	4.6	2.3	7.2	6.9	5.0	2.3	7.0	1.0	4.5	7.5
	6.9	4.0	7.0	5.3	6.2	3.4	4.7	2.2	7.3	7.0	6.3	2.7	7.0	1.4	4.8	7.5
	6.7	4.4	7.1	5.4	6.5	3.5	4.9	2.0	7.0	7.3	5.2	2.9	6.9	1.5	5.0	7.5
STRJO	-	5.3	5.4	3.8	2.4	2.3	2.1	1.4	-	-	1.9	4.9	-	2.7	2.1	1.7
	-	5.2	4.7	3.2	2.0	2.2	2.8	0.9	-	-	1.9	4.4	-	2.6	0.7	1.2
	-	2.0	5.4	3.8	2.4	2.5	2.6	0.9	-	-	2.1	4.9	-	2.5	1.3	2.0
	-	5.2	5.4	3.4	2.3	2.2	2.3	1.6	-	-	0.9	4.9	-	2.4	1.9	1.3
	-	5.2	5.3	2.7	2.2	1.7	2.0	1.0	-	-	1.4	3.3	-	2.1	0.7	0.5
TEPIS	5.8	6.1	6.1	4.7	4.9	6.3	2.8	0.2	-	6.0	1.6	1.5	4.6	6.3	4.3	6.8
	6.0	6.1	-	3.0	0.6	5.4	2.6	0.2	-	4.9	-	0.8	4.9	5.7	5.8	6.5
WEGWA	0.6	1.4	-	4.8	-	5.1	2.1	5.1	-	3.4	1.2	-	3.8	6.1	5.5	5.3
Sum	298.7	381.2	302.6	283.7	358.1	215.1	340.0	178.5	187.3	236.1	265.9	255.1	302.7	330.1	355.0	402.6

3. Results (Meteors)

July	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	-	21	-	10	16	17	4	2	12	-	6	6	8	9	10
BERER	-	19	47	-	-	18	-	25	-	-	-	-	38	-	-
BOMMA	46	20	32	17	31	37	29	15	12	41	29	30	15	55	11
BREMA	2	18	4	1	13	-	5	5	3	-	-	17	3	5	-
BRIBE	1	19	-	16	9	9	10	-	2	3	-	25	9	8	-
	-	18	10	14	13	10	15	4	-	3	2	17	4	16	-
CARMA	37	32	39	24	21	31	25	4	-	14	46	53	3	18	33
CASFL	15	15	16	11	15	13	14	4	-	3	28	25	1	12	21
CRIST	24	12	25	22	22	21	15	6	8	20	2	22	15	18	9
	31	13	31	19	22	30	15	3	20	-	24	30	10	39	21
	13	20	10	6	12	15	5	10	-	1	11	21	3	37	16
DONJE	46	40	39	27	32	44	33	14	39	5	50	48	19	67	37
ELTMA	15	12	5	15	22	20	13	3	3	16	19	18	8	16	13
FORKE	-	-	-	19	8	-	-	-	-	-	13	-	5	-	8
GONRU	1	2	2	-	-	1	-	-	1	3	-	-	-	-	-
	33	47	51	34	13	39	-	-	22	30	22	34	28	38	36
	29	26	29	25	19	23	-	-	11	29	13	19	8	38	25
	8	8	9	8	11	16	-	-	1	17	10	6	3	2	15
	26	23	25	28	8	26	-	-	9	27	22	21	13	29	32
	31	31	34	31	15	19	-	-	8	19	25	12	8	5	34
GOVMI	27	4	17	4	10	14	5	6	4	17	-	3	25	6	21
	13	1	8	4	2	6	5	4	1	20	1	4	15	3	16
HERCA	25	23	20	23	10	14	14	9	14	-	-	11	-	-	1
HINWO	-	-	-	8	6	1	3	1	7	3	12	-	8	1	6
IGAAN	4	2	10	3	2	5	2	-	-	3	-	-	6	6	6
JONKA	12	8	10	2	10	6	4	2	-	6	3	4	19	11	6
	12	6	15	1	13	7	11	8	1	8	-	3	16	10	8
KACJA	32	-	19	50	4	32	12	1	-	13	-	13	-	-	50
	15	3	14	18	3	6	8	1	-	10	6	5	12	1	21
	29	1	24	43	26	29	24	-	1	20	-	3	1	1	47
	51	-	42	58	15	53	16	1	-	8	-	18	-	-	68
	26	-	13	39	4	27	5	1	-	9	-	6	-	-	36
LOJTO	-	-	-	21	-	-	-	-	19	-	10	-	-	-	-
MACMA	9	8	16	5	4	19	-	-	9	5	8	6	20	5	6
	9	19	25	19	2	24	-	1	22	2	18	3	25	15	12
	8	15	16	7	-	13	-	2	11	5	6	6	14	10	5
	12	33	21	19	-	29	-	4	17	1	9	12	31	10	10
MARRU	24	26	21	16	12	14	-	-	24	23	20	22	21	17	17
	19	17	23	13	6	-	-	-	-	-	2	10	1	16	4
MASMI	-	-	5	-	-	-	-	-	2	6	6	-	7	10	21
MOLSI	-	-	37	-	32	28	16	13	4	-	18	31	24	2	8
	-	-	14	-	14	3	12	12	9	-	1	8	11	-	1
	-	-	22	-	36	15	15	4	6	-	7	7	20	1	2
	-	21	8	3	24	14	6	11	24	-	6	16	10	-	33
	-	32	6	3	21	18	4	5	6	-	3	14	25	-	40
	-	30	9	2	12	15	5	13	14	-	14	18	14	-	42
	-	30	6	4	17	22	2	12	20	-	12	15	19	-	35
MORJO	11	5	13	5	9	11	5	5	4	8	2	4	16	8	8
MOSFA	11	4	7	2	5	-	4	-	-	-	15	15	-	14	7
OCHPA	-	11	3	-	-	9	-	1	-	-	5	-	-	2	-
OTTMI	7	8	18	2	7	5	4	6	5	3	10	14	-	8	16
PERZS	22	19	17	21	24	17	7	2	4	8	-	8	23	4	23
ROTEC	-	12	-	1	6	3	-	-	10	-	1	1	-	-	12
SARAN	15	3	24	13	-	-	-	1	3	9	9	8	10	12	11
	13	13	5	11	3	1	-	-	5	20	25	12	13	17	25
	27	37	12	29	5	-	-	-	-	24	36	15	14	28	32
	3	1	3	5	-	-	-	-	1	11	10	7	3	8	10
	16	15	17	11	2	1	-	-	3	8	5	10	8	4	11
SCALE	4	4	4	2	15	6	5	-	2	5	5	-	1	10	5
SCHHA	2	17	2	15	13	6	11	3	2	17	-	20	11	23	-
SLAST	25	-	4	22	5	12	5	-	-	1	-	6	2	3	24
	8	-	10	7	7	10	7	-	1	5	4	4	2	1	15
STOEN	22	34	9	18	34	30	16	3	5	27	28	36	15	17	23
	5	34	10	10	28	27	13	1	2	22	19	26	5	31	24
	19	32	8	16	30	30	24	2	10	27	24	23	9	19	26
STRJO	5	13	12	-	12	3	4	-	1	-	-	15	10	5	4
	9	7	5	-	5	3	4	1	2	-	-	8	8	1	2
	4	3	7	3	6	1	5	-	1	-	-	8	4	5	3
	3	7	6	2	3	6	5	-	-	-	-	7	3	2	6
	1	2	4	-	7	1	3	-	2	-	-	8	7	3	2
TEPIS	3	9	26	5	7	6	8	7	1	10	-	3	18	12	21
	5	15	21	5	13	12	14	14	-	15	-	5	30	15	24
WEGWA	-	-	8	12	4	11	-	7	6	7	9	1	9	-	13
Sum	925	980	1084	909	837	1014	496	259	436	617	691	906	766	789	1190

July	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ARLRA	-	45	37	-	30	29	4	22	-	-	1	10	23	64	14	34
BERER	-	10	27	22	25	40	-	12	-	52	-	23	37	51	78	92
BOMMA	46	48	39	24	22	22	39	12	45	70	76	79	98	53	56	73
BREMA	-	12	17	-	9	3	-	-	-	-	-	20	-	10	31	10
BRIBE	-	31	25	1	19	1	2	1	-	-	-	15	1	5	16	2
	5	25	18	3	24	-	-	-	-	-	-	-	-	-	33	-
CARMA	62	54	46	52	41	-	46	5	17	79	74	-	-	-	-	-
CASFL	36	25	22	19	34	3	21	3	5	42	44	21	47	-	36	49
CRIST	28	31	13	18	14	18	22	1	40	33	35	30	58	23	51	41
	26	46	21	13	15	1	23	3	41	33	43	75	60	66	53	74
	30	21	21	6	12	2	5	-	32	26	35	12	40	20	43	63
DONJE	42	62	43	28	34	5	33	9	54	59	54	89	88	80	81	89
ELTMA	31	25	28	10	17	10	13	9	53	38	52	13	34	2	26	59
FORKE	6	-	16	-	30	13	14	13	-	-	-	-	7	81	3	56
GONRU	-	-	-	4	5	-	-	-	-	-	-	1	1	-	1	5
	32	22	-	43	18	41	32	26	46	54	65	38	49	55	65	75
	18	15	-	34	12	23	25	12	38	38	56	27	36	33	52	56
	3	7	-	16	2	13	10	14	12	20	20	19	18	16	29	32
	25	15	-	30	15	27	35	14	22	44	51	18	37	42	63	79
	17	21	3	37	15	23	29	23	51	59	51	42	34	42	65	71
GOVMI	25	25	19	17	12	4	28	12	-	6	3	11	21	33	46	37
	20	15	9	10	6	3	14	7	1	4	-	7	10	23	28	35
HERCA	-	-	6	7	14	1	21	-	6	14	16	17	10	-	-	13
HINWO	-	2	17	-	23	17	17	22	-	1	-	-	11	72	-	40
IGAAN	4	8	4	2	3	3	3	2	-	12	4	5	14	12	10	16
JONKA	10	11	14	10	10	16	3	4	-	20	2	20	23	25	12	21
	10	12	11	14	6	6	11	3	-	21	3	13	24	31	23	25
KACJA	50	45	35	38	29	-	51	-	-	16	5	16	47	62	68	89
	11	18	24	13	8	2	14	2	-	12	6	6	14	25	44	44
	40	39	41	26	22	14	40	10	-	4	13	10	29	48	67	84
	59	58	72	64	45	-	58	-	-	63	9	9	54	92	94	107
	36	31	29	20	25	-	15	-	-	11	4	9	34	45	44	69
LOJTO	-	20	-	-	-	-	21	-	-	6	21	-	22	-	60	-
MACMA	23	18	7	8	3	1	14	8	1	-	27	33	19	39	42	33
	25	18	14	9	8	1	16	9	6	-	56	55	17	69	61	65
	11	15	5	5	6	-	14	-	2	-	19	23	7	39	26	32
	23	29	16	11	12	3	23	-	1	-	25	35	9	39	41	33
MARRU	9	13	2	36	37	23	24	34	18	7	31	52	44	47	78	72
	2	3	-	7	10	1	3	1	-	-	34	6	23	15	41	29
MASMI	6	5	13	19	9	20	15	14	-	13	26	21	23	23	37	-
MOLSI	78	89	38	6	54	27	11	-	31	-	-	1	10	117	5	130
	13	18	7	3	7	5	5	-	9	-	-	-	-	25	1	12
	42	41	13	5	12	3	6	-	24	-	-	-	7	65	3	67
	-	30	41	-	39	38	22	9	-	-	37	11	12	40	18	23
	-	49	38	-	32	36	14	20	-	-	62	12	15	56	10	31
	-	37	40	-	33	31	21	10	-	-	43	12	17	45	13	27
	-	56	45	1	29	42	31	12	-	-	68	13	18	51	4	36
MORJO	12	18	15	11	8	15	13	2	-	19	9	26	22	28	5	22
MOSFA	16	7	13	15	12	1	14	2	27	22	23	31	40	1	6	33
OCHPA	21	5	-	-	15	-	10	7	2	-	13	-	26	-	-	25
OTTMI	3	9	2	5	-	10	11	16	8	2	18	9	27	16	14	11
PERZS	36	38	26	28	16	10	38	8	-	3	-	6	7	58	79	77
ROTEC	-	28	20	-	15	9	7	2	-	-	-	3	13	29	6	19
SARAN	6	6	-	8	5	-	22	6	12	17	24	6	32	3	40	26
	6	11	2	11	16	-	29	6	25	16	32	20	34	15	35	54
	10	14	-	17	23	-	37	20	45	30	53	31	44	25	44	49
	12	5	1	2	4	-	8	3	11	9	19	9	20	11	16	30
	-	3	-	4	9	-	24	12	27	7	31	16	21	14	26	34
SCALE	13	8	21	3	8	4	4	3	10	15	14	4	13	-	11	21
SCHHA	-	19	23	-	24	-	1	-	1	-	-	28	-	11	21	10
SLAST	22	31	25	12	26	10	28	4	-	-	5	4	26	40	27	47
	8	5	8	-	7	1	3	5	-	-	1	3	9	6	12	15
STOEN	52	34	32	30	35	24	22	10	103	93	77	35	92	4	53	77
	64	23	51	26	30	16	20	9	60	48	83	34	60	2	44	77
	51	25	60	18	28	23	23	10	72	72	72	42	72	6	54	81
STRJO	-	40	37	20	16	10	9	2	-	-	7	32	-	8	5	8
	-	17	12	8	5	9	7	1	-	-	4	19	-	18	4	4
	-	14	16	3	5	4	3	1	-	-	10	8	-	6	2	2
	-	32	18	8	11	4	5	2	-	-	2	25	-	11	10	3
	-	15	19	5	11	1	3	2	-	-	4	19	-	11	3	1
TEPIS	14	9	15	10	7	12	5	1	-	16	1	7	13	29	18	30
	24	22	-	9	2	25	6	1	-	30	-	2	40	39	32	54
WEGWA	4	10	-	9	-	11	4	17	-	16	9	-	35	28	30	31
Sum	1278	1668	1352	953	1225	770	1224	510	958	1272	1682	1348	1848	2200	2269	2971