

The meager weather continued in the second month of 2018. The effective observing time was slightly higher than in January and beyond the output of the previous two years, but as often there were significant regional differences. Cameras in Portugal and Germany enjoyed more than twenty observing nights, whereas observers in other countries had to content with less. Some observers in Eastern Europe could not even collect ten observing nights.

Overall, 76 active video cameras recorded over 16,500 meteors in 8,300 hours of effective observing time. 29 cameras observed in twenty or more observing nights. The average yield of 2.0 meteors per hours matches to the February mean of the last few years and points to the upcoming annual minimum in meteor activity.

In the absence of relevant meteor showers, we want to have a quick look at the observing equipment. Until now, most observers rely on Mintron or Watec cameras for the video observation of meteors. Both are based on the Sony ExView HAD CCD sensor. After Sony announced in August 2015 to discontinue manufacturing of CCD chips and meanwhile stopped production, these cameras will sooner or later disappear from the scenery and we will need a replacement. HD cameras get an ever-higher consumer market share, but meteor detection software is often still adapted to standard video signal. This is why I was particular curious, when Russian amateur Dmitrii Rychkov approached me in August 2018 and asked for my opinion on a new video camera with CMOS sensor. He had assembled a camera from components similar to those used in the commercial camera “RunCam Night Eagle” (which was designed for Drones and other scale model devices) and adapted it to the needs of video meteor observers, e.g. by giving it a convenient CCTV-like body with a c-mount adapter.

In mid-September the test camera DIMCAM1 was ready to use at my site. It replaced my Mintron-based camera MINCAM1 which had been suffering from severe hardware problems for weeks. Already first light was convincing, since despite the lower price the camera was at least half a magnitude more sensitive than MINCAM1, and it also displayed a more “comfortable” line-based noise pattern (probably because of the rolling shutter). Already in the first few clear nights, the camera recorded the same number or more meteors than the image-intensified camera AVIS2, which has the highest long-term average meteor count of all IMO network cameras. That was also confirmed by the camera parameters I measured: Whereas AVIS2 reached a limiting magnitude of 6.7 mag with field of view of 1204 square degrees, the test camera achieved 6.5 mag at 1550 square degrees. The small differences between the cameras should almost cancel each other out. In fact, DIMCAM1 recorded more meteors than AVIS2 in the 4th quarter of 2018, because the camera observed in south eastern direction, whereas AVIS2 pointed in the meteor-poor north-western direction.

Table 1: Observing results of the cameras AVIS2 and DIMCAM1 in the 4th quarter of 2018.

Month	AVIS2			DIMCAM1		
	Nights	Time [h]	Meteors	Nights	Time [h]	Meteors
October 2018	26	192.5	2463	24	170.5	2467
November 2018	16	91.6	806	13	83.5	1041
December 2018	24	82.4	420	23	49.6	412
Sum	66	366.5	3689	60	303.6	3920

However, the tests revealed also a few child diseases of DIMCAM1:

- Because of the housing design, the camera had such a small back focus, that the powerful Computar lens could only be mounted without the aberration filter, which had a bad impact on the image quality. Bright stars were blurred to large blobs (figure 1, left).

- The image was distorted, because the 16:9 sensor was mapped without correction to a 4:3 video signal.
- The camera had no control for settings (e.g. integration time, gain, gamma) and no auto-iris connector.
- The video signal had no fixed frame rate of 25 frames/s. Subsequent video frames were often identical, which lead to problems in meteor detection and velocity determination.



Figure 1: *Meteors in Orion, recorded with DIMCAM1 (left) and DIMCAM2 (right). Both cameras were equipped with an identical 8mm f/0.8 Computar lens.*

After I provided my feedback, Dmitrii soon presented an improved camera with a new firmware version, and a few days ago I received the new camera version for testing. Since I had hardly any clear skies till then, I could not yet test the camera in detail, but the first results with DIMCAM2 are very promising. If we forget the auto-iris connector for a moment, all child diseases are cured. The image is not distorted anymore, the frame rate is fixed at 25 resp. 30 frames/s, and Computar lenses can now be mounted including the aberration filter, which improves the image quality (figure 1, right). The limiting magnitude increased by 0.3 mag and matches now to the image-intensified camera AVIS2. The field of view, however, has reduced by about 1/3 to 970 square degrees, since the image has to be clipped at the left and right side to obtained an undistorted 4:3 aspect ratio. Last but not least the camera got an OSD control to adjust different parameters (PAL/NTSC, gain, integration time, zoom, ...).

In short – the new camera fits excellent to the requirement of video meteor observers and is a dignified successor of Mintron and Watec. It is not only more sensitive, but with a price below 150 € also clearly cheaper.

Unfortunately, there is a problem to provide the modified camera commercially, since the manufacturer of the electronics will offer building components only in larger quantities. Hence. Dmitrii is investigating an alternative camera with smaller sensor, but roughly similar parameters. For urgent cases, he still has a handful of original cameras with new firmware available. Alternatively you may buy the “RunCam Night Eagle 2 Pro Astro Edition” which has the same CMOS sensor and firmware as the test camera. However, then you have to solve the camera housing and the mounting of c-mount lenses on your own.

Observers

Code	Name	Place	Camera	FOV [°]	St.LM [mag]	Eff.CA [km ²]	Nights	Time [h]	Meteors
ARLRA	Arlt	Ludwigsfelde/DE	LUDWIG2 (0.8/8)	1475	6.2	3779	23	167.5	529
BIATO	Bianchi	Mt. San Lorenzo/IT	OMSL1 (1.2/4)	6435	4.0	1705	7	11.2	75
BOMMA	Bombardini	Faenza/IT	MARIO (1.2/4.0)	5794	3.3	739	13	75.1	196
BREMA	Breukers	Hengelo/NL	MBB3 (0.75/6)	2399	4.2	699	16	160.7	237
BRIBE	Klemt	Herne/DE	HERMINE (0.8/6)	2374	4.2	678	2	10.9	18
CARMA	Carli	Berg. Gladbach/DE	KLEMOI (0.8/6)	2286	4.6	1080	20	187.7	353
CASFL	Castellani	Monte Baldo/IT	BMH2 (1.5/4.5)*	4243	3.0	371	16	111.6	395
CINFR	Cineglosso	Monte Baldo/IT	BMH1 (0.8/6)	2350	5.0	1611	12	86.4	164
CRIST	Crivello	Faenza/IT	JENNI (1.2/4)	5886	3.9	1222	14	24.3	169
		Valbrenna/IT	ARCI (0.8/3.8)	5566	4.6	2575	17	119.4	265
			BILBO (0.8/3.8)	5458	4.2	1772	16	117.7	247
			C3P8 (0.8/3.8)	5455	4.2	1586	15	99.2	177
			STG38 (0.8/3.8)	5614	4.4	2007	17	124.8	308
ELTMA	Eltri	Venezia/IT	MET38 (0.8/3.8)	5631	4.3	2151	9	67.0	130
FORKE	Förster	Carlsfeld/DE	AKM3 (0.75/6)	2375	5.1	2154	17	158.0	326
GONRU	Goncalves	Foz do Arelho/PT	FARELHO1 (0.75/4.5)	2286	3.0	208	21	153.6	86
		Tomar/PT	TEMPLAR1 (0.8/6)	2179	5.3	1842	23	218.9	589
			TEMPLAR2 (0.8/6)	2080	5.0	1508	22	214.7	441
			TEMPLAR3 (0.8/8)	1438	4.3	571	20	194.8	210
			TEMPLAR4 (0.8/3.8)	4475	3.0	442	22	209.2	455
			TEMPLAR5 (0.75/6)	2312	5.0	2259	23	193.8	373
GOVMI	Govedic	Sredisce ob Dr./SI	ORION2 (0.8/8)	1447	5.5	1841	11	56.5	53
			ORION4 (0.95/5)	2662	4.3	1043	4	4.0	8
HERCA	Hergenrother	Tucson/US	SALSA3 (0.8/3.8)	2336	4.1	544	21	202.1	288
HINWO	Hinz	Schwarzenberg/DE	HINWO1 (0.75/6)	2291	5.1	1819	23	187.8	305
IGAAN	Igaz	Budapest/HU	HUPOL (1.2/4)	3790	3.3	475	9	30.9	20
JONKA	Jonas	Budapest/HU	HUSOR (0.95/4)	2286	3.9	445	8	42.1	44
			HUSOR2 (0.95/3.5)	2465	3.9	715	5	29.9	29
KACJA	Kac	Kamnik/SI	CVETKA (0.8/3.8)	4914	4.3	1842	5	21.4	38
		Kostanjevec/SI	METKA (0.8/12)*	715	6.4	640	12	48.9	87
		Kamnik/SI	REZIKA (0.8/6)	2270	4.4	840	6	25.0	63
			STEFKA (0.8/3.8)	5471	2.8	379	5	20.9	31
KOSDE	Koschny	La Palma / ES	ICC9 (0.85/25)*	683	6.7	2951	2	10.5	83
			LIC2 (3.2/50)*	2199	6.5	7512	3	6.8	60
LOJTO	Łojek	Grabniak/PL	PAV57 (1.0/5)	1631	3.5	269	8	62.4	172
MACMA	Maciejewski	Chelm/PL	PAV35 (0.8/3.8)	5495	4.0	1584	10	34.7	40
			PAV36 (0.8/3.8)*	5668	4.0	1573	13	59.5	86
			PAV43 (0.75/4.5)*	3132	3.1	319	8	36.9	25
			PAV60 (0.75/4.5)	2250	3.1	281	12	61.8	73
MARRU	Marques	Lisbon/PT	CAB1 (0.75/6)	2362	4.8	1517	27	233.5	502
			RAN1 (1.4/4.5)	4405	4.0	1241	23	212.6	445
MOLSI	Molau	Seysdorf/DE	AVIS2 (1.4/50)*	1230	6.9	6152	22	141.2	675
			ESCIMO2 (0.85/25)	155	8.1	3415	17	148.2	149
			MINCAM1 (0.8/8)	1477	4.9	1084	20	134.5	415
		Ketzür/DE	REMO1 (0.8/8)	1467	6.5	5491	21	157.3	573
			REMO2 (0.8/8)	1478	6.4	4778	21	162.0	608
			REMO3 (0.8/8)	1420	5.6	1967	21	174.0	386
			REMO4 (0.8/8)	1478	6.5	5358	22	175.7	634
MORJO	Morvai	Fülöpszallas/HU	HUFUL (1.4/5)	2522	3.5	532	10	68.0	48
MOSFA	Moschini	Rovereto/IT	ROVER (1.4/4.5)	3896	4.2	1292	16	81.3	105
NAGHE	Nagy	Piszkestető/HU	HUPIS (0.8/3.8)	5615	4.0	1524	2	1.8	7
OCHPA	Ochner	Albiano/IT	ALBIANO (1.2/4.5)	2944	3.5	358	4	23.3	12
OTTMI	Otte	Pearl City/US	ORIE1 (1.4/5.7)	3837	3.8	460	11	59.7	65
PERZS	Perkó	Becsehely/HU	HUBEC (0.8/3.8)*	5498	2.9	460	7	26.9	77
ROTEC	Rothenberg	Berlin/DE	ARMEFA (0.8/6)	2366	4.5	911	19	156.3	152
SARAN	Saraiva	Carnaxide/PT	RO1 (0.75/6)	2362	3.7	381	24	210.3	207
			RO2 (0.75/6)	2381	3.8	459	24	215.6	400
			RO3 (0.8/12)	710	5.2	619	25	220.3	427
			RO4 (1.0/8)	1582	4.2	549	24	200.9	124
			SOFIA (0.8/12)	738	5.3	907	23	173.6	235
SCALE	Scarpa	Alberoni/IT	LEO (1.2/4.5)*	4152	4.5	2052	13	61.3	77
SCHHA	Schremmer	Niederkrüchten/DE	DORAEMON (0.8/3.8)	4900	3.0	409	24	203.5	338
SLAST	Slavec	Ljubljana/SI	KAYAK1 (1.8/28)	563	6.2	1294	2	5.1	6
			KAYAK2 (0.8/12)	741	5.5	920	1	1.4	1
STOEN	Stomeo	Scorze/IT	MIN38 (0.8/3.8)	5566	4.8	3270	16	80.7	284
			SCO38 (0.8/3.8)	5598	4.8	3306	17	83.5	267
STRJO	Strunk	Herford/DE	MINCAM2 (0.8/6)	2354	5.4	2751	23	193.5	597
			MINCAM3 (0.8/6)	2338	5.5	3590	22	162.4	190
			MINCAM4 (0.8/6)	2306	5.0	1412	20	149.6	187
			MINCAM5 (0.8/6)	2349	5.0	1896	22	192.5	375
			MINCAM6 (0.8/6)	2395	5.1	2178	21	165.4	293
TEPIS	Tepliczky	Agostyan/HU	HUAGO (0.75/4.5)	2427	4.4	1036	15	87.8	98
			HUMOB (0.8/6)	2388	4.8	1607	9	50.3	66
WEGWA	Wegrzyk	Nieznaszyn/PL	PAV78 (0.8/6)	2286	4.0	778	14	75.4	96
YRJIL	Yrjölä	Kuusankoski/FI	FINEXCAM (0.8/6)	2337	5.5	3574	13	116.3	151
ZAKJU	Zakrajšek	Petkovec/SI	TACKA (0.8/12)	714	5.3	783	11	56.6	45
Sum							28	8310.9	16565

* 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	9.5	-	3.4	-	10.9	3.1	10.9	9.8	-	0.9	5.4	9.9	10.7	3.5	1.9
BIATO	-	-	-	1.0	-	0.3	1.4	2.6	-	-	0.7	-	-	2.3	2.9
BOMMA	-	-	3.5	0.8	-	-	4.6	8.1	10.8	4.8	7.5	-	11.6	11.2	-
BREMA	-	1.2	-	-	12.4	12.7	12.0	12.3	-	0.2	-	9.5	-	-	10.5
BRIBE	-	-	-	9.1	-	-	-	-	-	-	-	1.8	-	-	-
	-	-	-	7.9	11.8	-	12.2	12.4	-	-	2.1	11.2	12.2	-	1.7
CARMA	-	-	11.0	0.9	-	-	4.7	0.5	6.8	12.2	5.4	-	10.7	11.9	12.1
CASFL	-	-	10.3	0.5	-	-	4.6	-	7.8	12.3	4.9	-	10.9	11.7	12.0
CINFR	-	-	0.9	1.0	0.2	-	1.7	2.2	2.7	1.0	1.4	-	2.1	6.0	2.2
CRIST	0.6	-	11.0	-	-	0.6	6.3	11.9	12.0	12.0	5.8	10.9	-	11.8	-
	-	-	8.8	-	-	0.3	5.2	12.0	11.0	12.0	3.3	10.2	-	11.8	-
	-	-	3.9	-	-	-	2.5	7.3	5.9	12.0	2.2	10.9	-	11.0	-
	-	-	5.9	-	-	0.5	5.5	11.9	11.5	11.9	7.0	9.8	1.8	11.8	-
ELTMA	-	-	-	3.7	0.3	-	-	-	4.7	9.5	-	-	10.2	9.2	11.8
FORKE	0.5	-	-	-	10.1	11.9	2.3	8.0	-	-	-	-	11.9	11.5	-
GONRU	6.8	9.6	1.5	8.4	10.3	10.0	10.5	-	9.1	2.8	3.3	6.1	1.2	-	-
	12.0	11.4	5.2	12.0	11.7	11.4	12.0	1.5	9.8	6.5	5.5	11.5	2.3	-	-
	12.2	11.3	3.5	12.1	11.7	11.5	12.1	-	10.0	6.6	4.9	11.2	2.2	-	-
	12.1	11.1	5.0	12.0	11.5	10.2	11.9	-	9.7	-	3.7	10.4	-	-	2.6
	12.1	11.7	2.9	12.2	11.8	11.1	12.1	-	9.8	5.8	4.4	10.3	0.6	-	-
	9.1	9.3	2.6	11.7	11.0	10.0	11.6	-	9.4	5.5	3.8	9.8	0.5	-	2.5
GOVMI	-	-	2.1	7.9	-	-	-	0.6	-	0.9	-	-	-	8.8	8.7
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HERCA	8.6	11.3	7.5	10.3	10.8	11.3	9.8	10.2	10.6	11.1	9.0	10.9	10.5	5.0	-
HINWO	4.8	-	3.2	5.4	10.6	12.2	1.7	2.9	-	-	2.4	2.9	12.1	11.7	-
IGAAN	-	-	-	5.4	-	-	-	1.4	2.3	0.4	0.8	-	-	-	-
JONKA	-	-	-	7.1	-	-	-	1.1	0.6	-	-	-	-	-	6.6
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6
KACJA	-	-	-	-	-	-	-	-	-	2.2	4.1	-	1.2	8.2	5.7
	-	-	1.5	7.1	-	-	-	-	-	1.3	4.2	-	2.5	9.4	6.9
	-	-	-	-	-	-	-	-	-	3.1	4.5	-	2.5	8.3	5.8
	-	-	-	-	-	-	-	-	-	-	4.2	-	2.2	8.2	5.8
KOSDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOTJO	-	-	-	-	-	12.2	-	-	-	-	-	-	-	-	-
MACMA	-	-	-	-	0.3	11.5	-	-	-	-	-	-	-	-	-
	-	-	-	-	4.0	12.6	-	-	-	-	-	-	0.3	-	-
	-	-	-	-	-	12.5	-	-	-	-	-	-	-	0.2	-
	-	-	-	-	4.4	12.6	-	-	-	-	-	-	-	-	-
MARRU	12.1	11.7	1.8	11.5	10.9	11.9	11.9	3.9	9.2	9.8	3.4	11.4	1.6	5.0	10.7
	10.2	11.5	-	12.0	11.2	11.9	11.4	-	11.7	7.9	1.3	10.7	3.6	-	8.1
MOLSI	-	-	1.0	11.5	11.9	9.8	-	2.3	0.7	1.4	5.1	7.9	11.5	11.1	-
	-	1.0	-	12.0	12.3	10.0	-	2.6	-	-	-	8.3	11.9	11.7	-
	-	-	0.2	11.4	12.1	9.7	-	1.2	0.7	1.2	2.9	7.8	11.9	11.3	-
	6.8	-	2.4	2.6	10.3	-	10.2	10.3	-	3.2	-	-	-	5.4	3.2
	7.4	-	1.9	2.0	11.8	-	11.9	12.0	-	3.8	-	-	-	5.4	3.3
	8.5	-	2.8	3.6	12.7	2.4	12.6	12.6	-	4.1	-	-	-	6.0	3.7
	8.9	-	2.8	3.3	12.7	2.2	12.6	12.6	-	4.0	-	-	-	5.8	3.6
MORJO	-	-	2.4	9.7	4.5	-	-	-	-	-	9.8	-	-	-	4.9
MOSFA	-	-	4.6	-	0.5	-	4.0	-	0.5	11.9	4.0	1.4	9.3	10.4	11.4
NAGHE	-	-	-	-	0.2	1.6	-	-	-	-	-	-	-	-	-
OCHPA	-	-	-	0.3	-	-	-	-	-	9.1	-	-	-	9.2	-
OTTMI	12.4	-	-	0.3	-	-	-	-	-	-	0.5	3.6	12.0	-	-
PERZS	-	-	-	-	-	-	-	-	-	-	-	-	-	5.3	5.6
ROTEC	10.8	-	2.6	-	12.5	-	12.5	12.0	-	-	6.7	9.7	12.1	2.1	1.9
SARAN	7.4	9.1	2.8	11.6	11.9	12.2	11.5	-	11.3	8.2	2.4	11.7	4.2	-	8.8
	11.2	11.4	3.2	12.2	11.5	11.7	11.5	-	11.1	7.3	2.2	11.8	4.8	-	8.1
	11.0	10.9	3.8	11.5	11.2	11.5	10.9	1.1	11.1	7.5	2.5	11.4	4.8	-	7.8
	11.9	11.7	2.3	12.1	11.8	11.9	11.7	-	8.0	6.9	2.2	9.8	3.6	-	5.6
	4.2	11.3	0.7	12.0	11.8	2.2	11.5	-	10.3	7.9	1.8	11.7	1.2	-	2.6
SCALE	-	-	0.2	2.3	-	-	-	2.3	8.3	8.4	-	-	9.9	0.7	9.4
SCHHA	3.1	-	0.9	9.3	10.6	2.4	12.7	12.5	-	0.4	5.4	12.3	12.3	-	5.4
SLAST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STOEN	-	-	0.3	3.6	1.8	-	0.7	-	4.1	6.7	-	-	11.2	12.0	11.8
	-	-	0.4	3.4	3.3	-	0.5	-	5.2	7.2	-	-	6.2	12.0	11.6
STRJO	-	-	-	1.2	12.5	-	12.6	12.3	10.8	-	1.0	10.8	12.3	4.5	5.9
	-	-	-	-	11.9	-	12.6	12.3	2.2	0.3	0.8	10.0	8.6	5.4	4.4
	-	-	-	-	12.5	-	12.6	11.9	9.3	-	-	5.5	12.0	4.7	-
	-	-	-	-	12.3	-	12.6	11.6	11.0	-	1.1	10.5	11.9	5.5	5.3
	-	-	-	0.2	12.2	-	12.6	12.3	1.0	-	-	10.3	12.3	-	3.6
TEPIS	-	-	6.1	10.4	-	-	-	4.0	4.5	7.3	5.3	-	-	-	6.6
	-	-	5.3	10.2	-	4.6	-	5.4	-	6.9	5.3	-	-	-	5.3
WEGWA	-	6.9	-	-	11.6	3.8	-	-	4.9	-	-	-	2.7	-	-
YRJIL	-	-	12.4	9.7	5.0	-	-	-	-	-	-	-	-	-	-
ZAKJU	-	-	-	-	1.1	-	0.9	-	-	-	5.0	-	6.5	10.4	11.9
Sum	214.2	162.4	154.6	326.4	420.4	298.3	377.6	271.9	280.4	266.4	169.2	323.9	318.6	317.4	276.8

February	16	17	18	19	20	21	22	23	24	25	26	27	28
ARLRA	9.2	-	1.7	9.7	10.2	6.3	-	8.0	10.3	6.2	9.9	7.0	9.1
BIATO	-	-	-	-	-	-	-	-	-	-	-	-	-
BOMMA	-	-	-	3.0	0.2	-	-	-	-	-	1.0	8.0	-
BREMA	11.3	12.1	8.1	12.0	11.6	11.8	-	11.4	11.6	-	-	-	-
BRIBE	-	-	-	-	-	-	-	-	-	-	-	-	-
CARMA	9.8	-	11.2	7.3	10.7	11.4	11.5	11.6	11.6	7.5	9.0	11.3	3.3
CASFL	12.0	-	-	1.7	6.1	-	-	-	-	4.9	2.5	8.2	-
CINFR	6.2	-	-	1.9	3.3	-	-	-	-	-	-	-	-
CRIST	-	-	-	0.9	-	-	-	-	-	-	0.5	1.5	-
	-	2.6	7.1	9.0	6.0	-	1.2	-	-	-	7.7	2.9	-
	-	2.9	7.4	10.2	6.0	-	1.1	-	-	-	9.5	6.0	-
	-	3.4	1.7	8.9	5.4	-	-	-	-	7.3	11.1	5.7	-
	-	2.6	8.9	10.8	6.2	-	2.1	-	-	-	8.9	7.7	-
ELTMA	11.6	-	-	-	-	-	-	-	-	6.0	-	-	-
FORKE	9.7	-	-	11.3	-	10.5	10.5	10.9	10.4	10.0	8.9	9.2	10.4
GONRU	-	8.3	5.5	9.8	8.6	9.6	9.2	9.1	8.7	5.2	-	-	-
	6.4	11.6	8.6	11.5	11.5	11.4	11.4	11.3	11.2	11.2	-	-	-
	6.3	11.6	7.4	11.6	11.6	11.5	11.5	11.5	11.4	11.0	-	-	-
	5.9	10.6	-	10.4	11.4	11.4	11.3	11.3	11.3	11.0	-	-	-
	5.7	11.7	7.4	11.0	11.6	11.6	11.5	11.5	11.4	11.0	-	-	-
	6.2	10.5	3.6	10.6	11.1	11.0	10.9	11.1	11.0	11.0	-	-	-
GOVMI	0.5	-	-	-	-	-	-	-	9.8	4.9	-	2.5	9.8
	-	-	-	-	-	-	-	-	1.3	0.3	-	0.3	2.1
HERCA	-	-	-	-	-	9.4	5.1	11.0	10.5	11.1	8.7	9.4	-
HINWO	9.7	-	7.2	11.8	5.0	11.8	11.7	11.5	11.5	9.3	7.2	10.1	11.1
IGAAN	0.3	-	5.4	-	-	-	-	-	4.5	10.4	-	-	-
JONKA	-	-	6.9	-	-	-	-	-	3.6	11.4	-	-	4.8
	-	-	6.1	-	-	-	-	-	2.7	9.5	-	-	5.0
KACJA	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.3	-	-	-	-	-	-	-	2.6	4.4	-	1.5	4.2
	-	-	-	-	-	-	-	-	-	-	-	-	0.8
	-	-	-	-	-	-	-	-	-	-	-	-	0.5
KOSDE	-	-	-	-	-	-	-	8.8	1.7	-	-	-	-
	-	-	-	-	-	-	-	5.9	0.7	-	-	-	0.2
LOTJO	-	-	3.9	12.1	7.0	-	6.3	6.4	8.4	-	6.1	-	-
MACMA	-	-	1.9	11.8	6.6	-	-	0.2	0.8	0.2	0.2	-	1.2
	4.1	-	1.8	12.1	11.0	0.4	-	0.6	4.6	2.2	0.9	4.9	-
	2.4	-	1.6	11.7	6.1	0.5	-	-	-	-	-	-	1.9
	4.4	-	2.1	11.9	11.8	1.2	-	-	2.5	2.8	1.3	6.6	0.2
MARRU	6.8	11.5	7.3	11.5	11.4	11.4	11.3	11.3	11.3	11.2	1.0	-	0.7
	4.3	11.5	8.5	11.0	11.4	11.4	11.3	11.2	9.6	6.0	4.9	-	-
MOLSI	1.2	-	10.8	3.7	0.8	7.9	0.5	5.0	10.7	10.8	4.9	10.7	-
	-	-	11.2	4.2	-	7.7	-	5.3	11.4	11.3	10.3	10.0	7.0
	-	-	10.7	3.5	-	5.6	-	4.7	11.3	11.3	3.9	9.3	3.8
	9.6	-	5.8	8.8	10.9	8.9	6.0	8.2	10.7	8.5	8.8	6.9	9.8
	9.9	-	6.2	9.2	11.2	9.3	6.1	8.4	10.8	7.2	8.8	6.1	9.3
	10.4	-	7.0	9.3	11.9	-	6.3	8.9	11.6	9.8	10.6	7.8	11.4
	10.3	-	7.0	8.0	11.9	9.8	4.8	9.0	11.6	7.8	10.0	6.6	10.4
MORJO	5.0	-	8.1	-	-	-	-	-	3.3	11.5	-	-	8.8
MOSFA	11.0	-	-	-	1.6	-	-	0.2	-	4.5	3.5	2.5	-
NAGHE	-	-	-	-	-	-	-	-	-	-	-	-	-
OCHPA	-	-	-	-	-	-	-	-	-	-	4.7	-	-
OTTMI	9.4	-	-	-	-	0.3	-	1.4	0.4	9.6	-	9.8	-
PERZS	2.9	-	1.0	-	-	-	-	-	5.4	3.9	-	-	2.8
ROTEC	8.3	-	-	6.0	11.7	3.5	5.6	7.9	10.5	-	11.2	-	8.7
SARAN	4.7	11.8	8.2	10.8	11.8	11.5	11.2	9.2	7.9	5.8	4.3	-	-
	2.4	11.7	7.6	11.5	11.6	11.6	11.5	11.5	10.8	3.5	3.9	-	-
	4.6	11.2	8.2	11.1	11.2	11.2	11.2	11.1	10.9	8.7	3.9	-	-
	4.4	11.1	7.1	10.7	11.0	10.6	11.1	11.0	8.0	4.0	2.4	-	-
	-	11.6	1.9	10.7	11.6	11.6	11.5	11.4	9.8	1.9	2.4	-	-
SCALE	11.3	-	-	0.8	2.0	-	-	-	-	4.1	1.6	-	-
SCHHA	6.9	10.2	9.2	3.6	11.7	11.7	11.8	11.7	11.7	6.6	10.4	10.7	-
SLAST	-	-	-	-	-	-	-	-	-	4.9	-	-	0.2
	-	-	-	-	-	-	-	-	-	-	-	-	1.4
STOEN	11.6	-	-	4.3	3.8	-	0.2	-	-	7.4	0.5	0.7	-
	11.8	-	0.2	5.0	4.4	-	-	1.0	-	10.2	0.4	0.7	-
STRJO	11.8	12.1	6.9	8.6	10.0	9.8	4.8	11.5	11.6	2.5	8.8	4.2	7.0
	11.1	12.0	4.3	4.9	4.2	9.9	4.5	11.6	11.6	2.3	8.9	-	8.6
	0.7	0.8	0.9	7.4	8.5	10.3	5.8	11.7	11.6	2.5	8.7	1.7	10.5
	11.6	12.0	6.3	8.6	10.0	10.3	4.7	11.5	11.6	2.6	8.9	6.2	6.4
	10.7	11.8	4.0	7.8	9.9	9.5	4.2	11.6	11.6	1.9	8.6	1.5	7.8
TEPIS	6.0	-	2.3	2.6	-	-	-	0.7	8.5	11.3	-	1.1	11.1
	-	-	-	-	-	-	-	0.9	6.4	-	-	-	-
WEGWA	5.6	-	1.5	8.8	9.9	-	0.6	5.5	-	3.4	4.4	-	5.8
YRJIL	-	-	-	10.4	11.8	11.4	7.8	11.5	6.2	2.8	10.2	9.8	7.3
ZAKJU	7.4	-	-	-	-	-	-	-	0.7	6.9	-	4.0	1.8
Sum	336.7	227.2	267.7	425.8	405.2	335.0	268.1	377.0	431.6	375.5	264.3	213.1	205.2

3. Results (Meteors)

February	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
ARLRA	14	-	9	-	44	4	33	26	-	2	22	32	56	5	8
BIATO	-	-	-	6	-	2	9	17	-	-	5	-	-	17	19
BOMMA	-	-	15	6	-	-	10	19	26	9	11	-	24	42	-
BREMA	-	1	-	-	24	27	22	13	-	1	-	16	-	-	9
BRIBE	-	-	-	17	-	-	-	-	-	-	-	1	-	-	-
	-	-	-	25	15	-	20	28	-	-	2	31	29	-	1
CARMA	-	-	36	2	-	-	21	1	41	53	12	-	64	45	47
CASFL	-	-	20	2	-	-	14	-	9	40	4	-	21	16	22
CINFR	-	-	6	6	1	-	10	13	19	6	8	-	15	52	14
CRIST	2	-	25	-	-	2	9	27	31	36	12	26	-	25	-
	-	-	21	-	-	1	10	20	12	37	8	27	-	26	-
	-	-	8	-	-	-	7	22	15	14	7	24	-	18	-
	-	-	15	-	-	1	11	29	23	22	24	31	2	35	-
ELTMA	-	-	-	3	2	-	-	-	12	15	-	-	32	21	19
FORKE	1	-	-	-	35	33	2	10	-	-	-	-	40	29	-
GONRU	3	6	1	6	5	11	6	-	4	1	6	3	1	-	-
	29	28	15	47	47	39	40	1	19	8	23	39	2	-	-
	27	23	6	21	31	17	37	-	20	7	17	23	2	-	-
	15	13	1	16	14	15	17	-	13	-	5	10	-	-	1
	28	19	11	39	38	25	25	-	17	6	15	18	2	-	-
	21	14	9	21	26	20	23	-	6	4	21	22	1	-	3
GOVMI	-	-	3	5	-	-	-	1	-	3	-	-	-	14	13
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HERCA	26	17	16	12	17	17	15	11	17	18	7	17	12	3	-
HINWO	5	-	6	19	33	19	2	2	-	-	6	6	23	19	-
IGAAN	-	-	-	5	-	-	-	1	2	1	1	-	-	-	-
JONKA	-	-	-	8	-	-	-	1	2	-	-	-	-	-	4
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
KACJA	-	-	-	-	-	-	-	-	-	2	3	-	5	19	9
	-	-	2	15	-	-	-	-	-	9	4	-	4	17	10
	-	-	-	-	-	-	-	-	-	4	15	-	7	22	13
	-	-	-	-	-	-	-	-	-	-	3	-	3	15	9
KOSDE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LOTJO	-	-	-	-	-	40	-	-	-	-	-	-	-	-	-
MACMA	-	-	-	-	2	8	-	-	-	-	-	-	-	-	-
	-	-	-	-	5	30	-	-	-	-	-	-	1	-	-
	-	-	-	-	4	-	-	-	-	-	-	-	-	1	-
	-	-	-	-	1	19	-	-	-	-	-	-	-	-	-
MARRU	33	27	3	39	32	30	39	5	9	17	5	20	4	3	9
	16	23	-	24	31	21	32	-	33	5	4	33	11	-	14
MOLSI	-	-	1	43	68	41	-	3	2	5	13	49	127	55	-
	-	1	-	5	9	8	-	1	-	-	-	8	10	18	-
	-	-	1	27	38	21	-	3	5	2	2	28	65	29	-
	34	-	20	7	29	-	52	21	-	14	-	-	-	21	10
	20	-	11	9	47	-	43	41	-	28	-	-	-	14	19
	29	-	6	6	31	2	27	27	-	15	-	-	-	15	15
	23	-	16	6	64	3	58	46	-	26	-	-	-	24	16
MORJO	-	-	1	11	2	-	-	-	-	-	3	-	-	-	2
MOSFA	-	-	6	-	1	-	6	-	1	34	1	2	15	8	7
NAGHE	-	-	-	-	1	6	-	-	-	-	-	-	-	-	-
OCHPA	-	-	-	1	-	-	-	-	-	8	-	-	-	1	-
OTPMI	16	-	-	2	-	-	-	-	-	-	3	1	9	-	-
PERZS	-	-	-	-	-	-	-	-	-	-	-	-	-	17	18
ROTEC	7	-	4	-	8	-	16	13	-	-	6	10	14	2	2
SARAN	8	9	1	13	12	10	15	-	19	8	4	11	3	-	10
	24	23	7	34	30	17	23	-	18	6	7	22	6	-	6
	22	22	4	33	37	24	28	1	23	14	4	27	5	-	7
	10	9	3	15	8	7	7	-	6	3	1	6	4	-	2
	15	11	2	14	19	15	12	-	15	3	7	15	5	-	8
SCALE	-	-	1	6	-	-	-	8	12	15	-	-	12	2	6
SCHHA	2	-	1	29	17	9	29	15	-	1	3	17	32	-	3
SLAST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STOEN	-	-	2	6	6	-	4	-	19	15	-	-	53	45	27
	-	-	2	5	7	-	3	-	17	36	-	-	27	39	24
STRJO	-	-	-	3	41	-	40	46	41	-	1	36	48	1	6
	-	-	-	-	17	-	24	16	3	1	1	9	7	4	3
	-	-	-	-	25	-	16	11	9	-	-	11	19	3	-
	-	-	-	-	18	-	22	23	23	-	1	38	32	5	5
	-	-	-	1	30	-	26	15	3	-	-	13	38	-	3
TEPIS	-	-	6	24	-	-	-	4	1	6	4	-	-	-	1
	-	-	6	21	-	2	-	5	-	7	9	-	-	-	2
WEGWA	-	8	-	-	15	11	-	-	1	-	-	-	3	-	-
YRJIL	-	-	18	15	6	-	-	-	-	-	-	-	-	-	-
ZAKJU	-	-	-	-	2	-	2	-	-	-	3	-	3	9	12
Sum	430	254	347	680	991	561	867	546	548	567	323	682	898	756	444

Februar	16	17	18	19	20	21	22	23	24	25	26	27	28
ARLRA	31	-	3	24	45	6	-	32	51	22	35	7	18
BIATO	-	-	-	-	-	-	-	-	-	-	-	-	-
BOMMA	-	-	-	14	1	-	-	-	-	-	3	16	-
BREMA	8	26	7	9	11	20	-	15	28	-	-	-	-
BRIBE	-	-	-	-	-	-	-	-	-	-	-	-	-
	11	-	21	13	13	18	17	28	29	16	21	14	1
CARMA	23	-	-	4	7	-	-	-	-	13	8	18	-
CASFL	9	-	-	2	5	-	-	-	-	-	-	-	-
CINFR	-	-	-	7	-	-	-	-	-	-	3	9	-
CRIST	-	7	13	14	8	-	1	-	-	-	16	11	-
	-	7	22	17	7	-	2	-	-	-	18	12	-
	-	16	6	5	3	-	-	-	-	18	12	2	-
	-	6	30	29	11	-	3	-	-	-	26	10	-
ELTMA	11	-	-	-	-	-	-	-	-	15	-	-	-
FORKE	9	-	-	10	-	22	24	23	26	18	16	15	13
GONRU	-	2	1	7	2	6	2	7	4	2	-	-	-
	7	41	12	22	45	37	25	12	33	18	-	-	-
	3	23	8	20	28	30	25	25	21	27	-	-	-
	2	13	-	8	17	13	9	11	7	10	-	-	-
	9	26	4	24	29	19	33	28	19	21	-	-	-
	3	21	3	18	27	18	32	27	17	16	-	-	-
GOVMI	2	-	-	-	-	-	-	-	5	1	-	2	4
	-	-	-	-	-	-	-	-	3	2	-	2	1
HERCA	-	-	-	-	-	11	8	6	15	17	17	9	-
HINWO	8	-	16	16	4	27	14	16	24	11	9	10	10
IGAAN	1	-	4	-	-	-	-	-	4	1	-	-	-
JONKA	-	-	10	-	-	-	-	-	5	12	-	-	2
	-	-	7	-	-	-	-	-	8	6	-	-	2
KACJA	-	-	-	-	-	-	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	4	6	-	1	8
	-	-	-	-	-	-	-	-	-	-	-	-	2
	-	-	-	-	-	-	-	-	-	-	-	-	1
KOSDE	-	-	-	-	-	-	-	76	7	-	-	-	-
	-	-	-	-	-	-	-	53	5	-	-	-	2
LOTJO	-	-	4	39	33	-	1	6	28	-	21	-	-
MACMA	-	-	6	12	3	-	-	1	4	1	1	-	2
	8	-	7	16	7	1	-	1	5	2	1	2	-
	4	-	4	4	2	4	-	-	-	-	-	-	2
	6	-	4	24	8	2	-	-	2	1	3	2	1
MARRU	6	22	5	19	29	28	39	31	22	21	4	-	1
	1	25	12	24	20	32	28	21	14	9	12	-	-
MOLSI	2	-	79	4	1	20	1	25	55	51	8	22	-
	-	-	21	2	-	2	-	5	22	18	1	13	5
	-	-	47	4	-	10	-	6	54	39	5	26	3
	32	-	5	10	53	32	23	36	53	30	40	20	31
	34	-	9	6	55	38	24	44	67	28	40	16	15
	21	-	2	3	33	-	16	25	27	23	30	8	25
	39	-	8	10	66	35	21	34	58	24	25	9	23
MORJO	2	-	6	-	-	-	-	-	3	12	-	-	6
MOSFA	5	-	-	-	3	-	-	1	-	8	5	2	-
NAGHE	-	-	-	-	-	-	-	-	-	-	-	-	-
OCHPA	-	-	-	-	-	-	-	-	-	-	2	-	-
OTTMI	6	-	-	-	-	2	-	4	2	14	-	6	-
PERZS	18	-	3	-	-	-	-	-	8	6	-	-	7
ROTEC	8	-	-	5	13	1	9	11	8	-	11	-	4
SARAN	1	11	4	8	11	11	15	8	4	6	5	-	-
	3	27	5	28	28	18	21	14	18	8	7	-	-
	1	33	7	13	24	29	23	19	17	6	4	-	-
	1	8	3	5	4	4	5	5	5	1	2	-	-
	-	5	8	12	9	15	11	14	7	4	9	-	-
SCALE	5	-	-	1	4	-	-	-	-	4	1	-	-
SCHHA	2	23	5	4	12	20	31	18	24	12	14	15	-
SLAST	-	-	-	-	-	-	-	-	-	5	-	-	1
	-	-	-	-	-	-	-	-	-	-	-	-	1
STOEN	25	-	-	15	24	-	1	-	-	36	2	4	-
	18	-	1	24	16	-	-	4	-	41	1	2	-
STRJO	33	45	5	34	35	30	21	37	41	4	29	10	10
	15	17	2	5	3	14	1	15	18	1	9	-	5
	5	5	5	9	8	12	7	11	17	1	11	1	1
	21	26	5	18	17	22	11	16	28	8	21	7	8
	11	24	3	14	6	18	2	31	23	2	23	1	6
TEPIS	11	-	2	1	-	-	-	1	17	10	-	1	9
	-	-	-	-	-	-	-	2	12	-	-	-	-
WEGWA	12	-	1	5	9	-	2	7	-	5	5	-	12
YRJIL	-	-	-	17	17	17	9	15	8	2	9	9	9
ZAKJU	4	-	-	-	-	-	-	-	1	6	-	2	1
Summe	504	459	445	658	816	644	517	827	987	701	545	316	252