Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

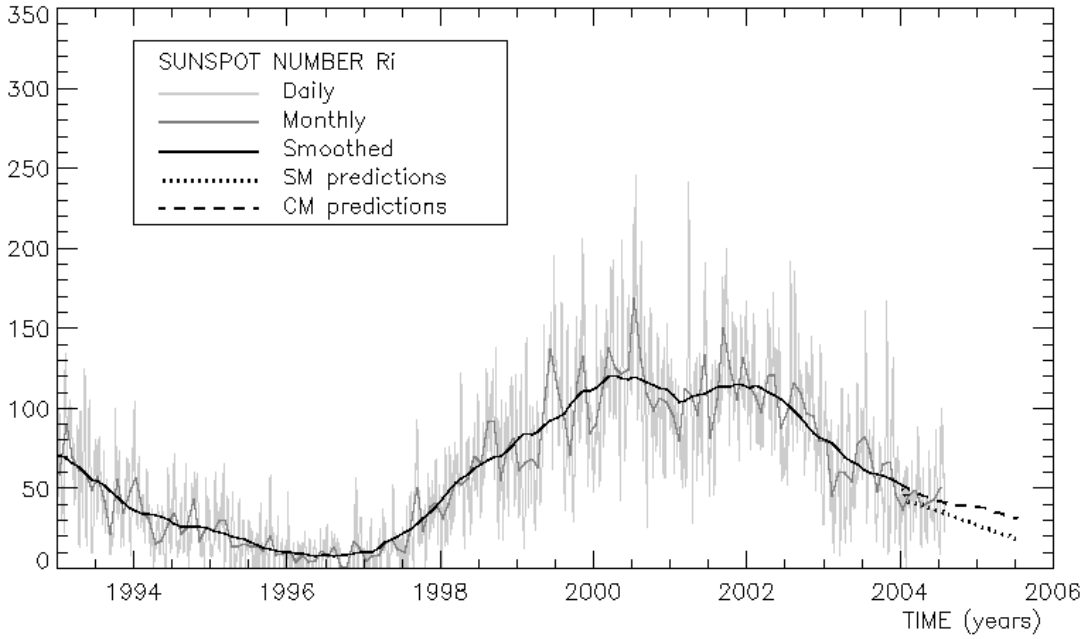
SUNSPOT BULLETIN

2004 n° 7

Provisional international and normalized hemispheric daily sunspot numbers for July 2004

computed at the *Royal Observatory of Belgium* using observations from an international network with the *Locarno Specola Solare* as reference station.

Date	R'_I	R'_N	R'_S
1	17	9	8
2	20	11	9
3	20	10	10
4	19	11	8
5	16	16	0
6	17	9	8
7	9	0	9
8	11	0	11
9	27	0	27
10	38	15	23
11	47	24	23
12	50	26	24
13	88	41	47
14	90	37	53
15	82	29	53
16	65	10	55
17	79	27	52
18	93	34	59
19	100	44	56
20	91	47	44
21	88	52	36
22	84	54	30
23	74	52	22
24	69	50	19
25	57	48	9
26	64	51	13
27	55	45	10
28	39	31	8
29	24	24	0
30	24	16	8
31	23	14	9
Monthly mean	**51.0**	**27.0**	**24.0**
Cooperating stations	**40**	**36**	**36**



Predictions of the monthly smoothed Sunspot Number

using the last provisional value, calculated for January 2004 : 52.0 (± 5%)

	SM	CM		SM	CM		SM	CM
2004 Feb	49	50	2004 Aug	39	41	2005 Feb	30	38
Mar	45	48	Sep	38	40	Mar	29	36
Apr	44	46	Oct	36	40	Apr	27	35
May	43	45	Nov	35	40	May	26	34
Jun	42	43	Dec	33	40	Jun	24	33
Jul	40	42	2005 Jan	32	39	Jul	23	32

SM : SIDC classical method : based on an interpolation of Waldmeier's standard curves; the estimated error ranges from 7% (first month) to 35% (last month)

CM : Combined method : the combined method is a regression technique coupling a dynamo-based estimator with Waldmeier's idea of standard curves, due to K. Denkmayr.

ref. : **K. Denkmayr, P. Cugnon**, 1997 : "About Sunspot Number Medium-Term Predictions", in "Solar-Terrestrial Prediction Workshop V", eds G. Heckman et al., Hiraiso Solar Terrestrial Research Center, Japan, 103

Brussels, August 1, 2004 13:28 UT

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S.I.D.C. SUMMARY OF THE URSIGRAMS

Date	R'_i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
30	20	14	-	82	900	2	0/0	10	
1	17	18	37	81	901	0	0/0	13	
2	20	38	36	81	905	0	0/0	12	
3	20	15	36	80	905	0	0/0	9	
4	19	10	36	79	910	0	0/0	10	
5	16	7	36	78	913	1	0/0	10	
6	17	4	35	79	914	0	0/0	6	
7	9	2	34	79	913	0	0/0	4	
8	11	3	35	82	914	1	0/0	4	
9	27	13	37	87	////	0	0/0	5	
10	38	24	37	93	913	0	0/0	9	
11	47	33	38	104	907	0	0/0	24	
12	50	52	39	125	903	1	1/0	16	
13	88	96	41	127	899	37	5/0	19	
14	90	74	41	138	899	14	2/0	8	
15	82	87	44	146	901	1	0/2	10	
16	65	104	45	147	896	123	1/3	12	
17	79	111	49	149	891	38	3/1	17	
18	93	191	50	155	896	31	3/0	9	
19	100	221	-	170	898	17	0/0	12	
20	91	247	-	175	895	104	1/0	14	
21	88	322	50	172	895	21	0/0	4	
22	84	309	-	173	898	103	2/0	26	
23	74	427	46	165	857	3	2/0	40	
24	69	272	46	147	858	14	2/0	34	
25	57	253	45	145	854	122	4/0	91	
26	64	134	42	128	857	104	3/0	37	
27	55	100	41	118	806	32	2/0	126	
28	39	57	40	101	840	17	1/0	22	
29	24	28	38	100	859	1	0/0	8	
30	24	24	38	89	////	0	0/0	9	
31	23	22	37	86	////	0	0/0	8	

R'_i : provisional international sunspot numbers from the S.I.D.C.

PPSI : prompt photometric sunspot index from the S.I.D.C. in 10-5 w/m^2 : the quantity to be subtracted from the mean solar constant to account for the sunspot contribution.

600 : 600 Mhz solar flux from the station at Humain (Belgium).

2800 : 2800 Mhz solar flux from Ottawa (origin : Ursigrams - UGEOI). The 10.7cm Flux data are a service of the National Research Council of Canada.

COS : thousands of the cosmic ray counts (origin : Ursigrams - UCOSE Terre Adélie).

SFI : From October 1992, Solar Flare Index from the S.I.D.C. (origin : Ursigrams – UGEOR, evaluation : 1 x Sn+10 x "1"+100 x ">1".

XI : X-flares index from the Ursigrams (M-flares/X-flares) (origin : Ursigrams – UGEOR, UGEOI).

Ak : geomagnetic index from Wingst, Germany (origin : Ursigrams).

SEA : sudden enhancements of atmospherics from Uccle & Humain (Royal Observatory, Belgium).

Note that due to problems of interferences saturating our receivers, no SEA could be detected this month.

SOLAR PHYSICS DEPARTMENT

UCCLE DAILY PROVISIONAL RELATIVE SUNSPOT NUMBERS FOR JULY 2004

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-3 WM-2	QUAL	OBS
1	700	2	8	28	16	12	28	10.7	3	OB
2	1330	2	11	31	16	15	31	70.2	3	OB
3	1010	2	11	31	14	17	31	12.3	1	ER
5	1225	1	3	13	13	0	13	5.0	2	ER
6	708	1	1	11	11	0	0	4.4	3	VI
7	718	0	0	0	0	0	0	0.0	1	VI
8	655	1	5	15	0	15	0	0.2	2	VI
10	1330	4	16	56	23	33	23	25.0	2	ER
11	907	4	24	64	37	27	53	23.5	2	VI
14	714	5	32	82	30	52	29	34.4	2	VI
16	1145	4	52	92	14	78	26	62.0	2	OB
17	840	6	80	140	40	100	89	82.0	4	OB
18	1340	6	121	181	55	126	100	173.4	3	OB
19	740	4	106	146	65	81	57	115.6	3	OB
20	1210	4	55	95	42	53	28	126.6	2	ST
21	1234	4	65	105	58	47	66	131.1	2	ST
22	800	4	84	124	77	47	85	127.7	3	ST
24	905	3	120	150	113	37	138	136.4	4	RV
26	1010	5	91	141	118	23	0	58.1	3	OB
27	740	4	80	120	106	14	16	47.9	3	OB
28	840	4	32	72	61	11	29	40.4	4	OB
29	815	3	17	47	47	0	28	22.4	3	OB
30	805	3	14	44	33	11	33	13.3	3	OB
31	1205	3	13	43	29	14	29	13.7	2	AZ

The relative mean sunspot number is 76.3.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR JULY 2004

K'= 0.755 (*)

1	21	7	0	13	***	19	110	25	***
2	23	8	11	14	62	20	72	26	106
3	23	9	***	15	***	21	79	27	91
4	***	10	42	16	69	22	94	28	54
5	10	11	48	17	106	23	***	29	35
6	8	12	***	18	137	24	113	30	33
								31	32

The normalised relative monthly mean sunspot number is 58.

(*) K' is the mean of the monthly K' for the last five years.

The Sun has been observed 24 days on 31 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR JULY 2004
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
3-2018	6 26.6	28 C	7 3.4	6 C	7 10.1
12-2018	7 12.0	14 D	7 18.8	18 E	7 25.5
2-2019	7 16.3	17 E	7 23.1	29 E	7 29.8
13-2018	7 12.4	18 E	7 19.2	24 E	7 25.9
3-2019	7 16.6	19 D	7 23.4	28 A	7 30.1

PROBABLE RETURN OF MAJOR GROUPS FOR AUGUST 2004

Nø	New East Limb	New CMP	New West Limb
2	8 12.9	8 19.7	8 26.4
13	8 7.8	8 14.5	8 21.3
3	8 13.3	8 20.0	8 26.8

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

The sun showed once again immense variations of activity. The month started with 10 days of very low solar activity. From July 11 onwards activity increased markedly, first to moderate, then becoming very high on July 15-17. During these three days, 6 X-class flares were produced by Catania sunspot group 78 (NOAA 0649), which was clearly the dominant center of solar activity this month. The largest event was an X3.6 peaking at 13:55 on July 16. Activity was moderate (mainly M-class flares) from July 18 to 28, and finally became low again at the end of the month.

On the first day of the month only two sunspot groups were left on the solar disk: in the north Catania 65 (NOAA 0639), consisting of one large spot accompanied by a few small ones, and in the south Catania 64 (NOAA 0640), a group of small spots. Neither of these groups showed strong flaring. Only occasional small B-flares were observed and the solar X-ray output stayed mostly in the A-level until July 09. The X-ray solar background then rose into the B-level due to the full rotation onto the disk of Catania sunspot group 67 (NOAA 0642) and the development of a few other small sunspot groups. One of the newly developing groups was Catania sunspot group 70 (NOAA 0645), which showed its first spots near the central solar meridian on Jul 09. The big change started on July 11, when Catania 74 (NOAA 0648) appeared at the east limb. This region pushed the X-ray background up to the C1 level and produced several C-flares on July 11. In the days that followed, it soon became clear that Catania 74 was simply the forepart of a complex of active regions clustered around one very active sunspot group: Catania 78 (NOAA 0649). Although not very big, this region was extremely active. It rotated in view on Jul 12 and on the same day, the first M-flare was observed from this region. At the same time, Catania 70 was developing fast in the northwest and produced 4 large M-flares on July 13-14 before rotating behind the west limb. Due to this activity the >10 MeV proton flux was slightly enhanced on July 13 but did not cross the 10 pfu threshold. Several EIT waves were seen following the flares from this region.

On July 15, Catania 78 developed a beta-gamma-delta magnetic configuration and started to produce X-class flares. The biggest event was an X3.6 flare on July 16 (peak time 13h55 UT). Besides the 6 X-class flares, the group also spawned many M-class and scores of C-class flares. From July 17 onwards, the group started to decay; its last big flares were observed on July 18 when the group was near the central meridian. In the mean time, a new active sunspot group (Catania 82, NOAA 0652) had appeared at the east limb with a complex magnetic configuration. It grew into a very large group (dubbed 'The Eyeballs Group' because of its appearance in the SOHO/MDI magnetograms on July 23 - 25) of some 70 spots with an area of 0.15 percent of the solar disk. From July 20 until July 28, a steady supply of M-class flares (a total of 18, amongst which M8.6, M9.1 and M7.7 flares) originated from this region. Several of these were accompanied by geo-effective CMEs (see below). A large amount of C-class flares were also seen. Furthermore, a proton event started on July 25 somewhat after 18 UT (enhanced fluxes were already measured since July 22), but only the flux of the lowest energy (>10MeV) protons passed the threshold. The proton flux fell back below the event threshold late on July 27 but stayed at enhanced levels until the end of the month. On July 30, Catania 82 rotated over the west limb, leaving Catania 86 (NOAA 0654) as the only sunspot group on disk. Although this group has also a beta-gamma magnetic configuration, it did not produce any major flares, so that solar activity remained low on July 30. On July 31, a very long duration C8.4 flare accompanied by a partial halo CME was still seen from Catania 82 behind the western solar limb.

II. Geomagnetic Activity

The variations in geomagnetic conditions were just as diverse as those in solar activity. Conditions were quiet for the first 10 days, while from July 11 until July 22 we saw a few short periods of active to minor storm conditions. Major geomagnetic storms then followed on July 22-23, July 24-26 and a severe geomagnetic storm on July 27. The remainder of the month was quiet.

We started the month under the influence of a small recurrent equatorial coronal hole. The solar wind speed stood at 550km/s on July 01. The interplanetary magnetic field never turned strongly southwards, so that, as on the previous rotation, this coronal hole had little geomagnetic effect. Geomagnetic conditions remained quiet with K-values of 3 or less. The solar wind speed was slowly decreasing, reaching 400km/s late on July 03 and 300km/s late on July 08. These very quiet conditions lasted until July 10. On July 11, conditions changed due to the presence of a small equatorial coronal hole. The solar wind picked up speed to 500 km/s leading to active geomagnetic conditions (K=4) on July 11-13, with an isolated value of K=5 on July 11.

Geomagnetic conditions remained quiet on July 14-15, but late on July 16 a minor geomagnetic storm commenced (local K-values mostly reached up to 5, NOAA's estimated Kp peaked at 6). This storm ended before noon on July 17. This geomagnetic storm followed a shock in the solar wind speed with a southward interplanetary magnetic field (Bz down to -10 nT) during 4 hours.

From the second half of July 17 until noon on July 22, the geomagnetic field remained at quiet to unsettled levels. On July 22, a shock was observed in the solar wind, recorded by GENESIS (at 11:36), by SOHO/CELIAS (at 09:45) and by ACE (at 09:55). It was probably due to a partial halo CME seen in LASCO C2 at 13:31 on July 20. These geo-effective perturbations due to the CME activity associated with Catania region 82 (NOAA 0652) brought the K-index to 5 and 6 at Dourbes and elsewhere on July 22-23, corresponding to major storm levels. After a 12-hour-break with quiet conditions round midnight UT on July 23-24, the major geomagnetic storm recommenced early on July 24, following the arrival of another interplanetary shock (from a halo CME observed at 07:31 on July 22) detected by GENESIS (at 06:58) and ACE (at 05:39). The storm lasted until the first hours of July 26. This time, K-indices reached up to 7 in e.g. Wingst, Niemegk and Izmiran, while the estimated Kp index reached 8.

Then the geomagnetic situation was quiet for most of July 26 until the arrival of a third interplanetary shock on July 26, seen by ACE and SOHO/CELIAS at 22:28 UT and by GENESIS at 23:22. This shock originated from the fast partial halo CME detected by the SOHO/LASCO C2 coronagraph at 14:30 UT on July 25. After the arrival the Kp index jumped to 6 again and another geomagnetic storm started. The shock was followed by the ICME plasma with a strong southward interplanetary magnetic field (down to -25 nT on July 27). The estimated Kp index reached 9 (severe storm level) in the second half of July 27 and stayed at a level 5 or higher until the end of the day.

Starting from July 28 the geomagnetic situation was quiet until the end of the month, although another interplanetary shock was registered by the ACE spacecraft around 20:40 UT on July 30. This was probably produced by the partial halo CME detected in SOHO/LASCO data at 03:54 UT on July 28. As the source region (NOAA 0652, Catania sunspot group 82) was situated at the Western limb at the time of the eruptions, the ICMEs themselves have probably missed the Earth and only the shocks were encountered by ACE. The interplanetary magnetic field in the post-shock sheaths was predominantly northward, so it did not produce any significant geomagnetic disturbance.

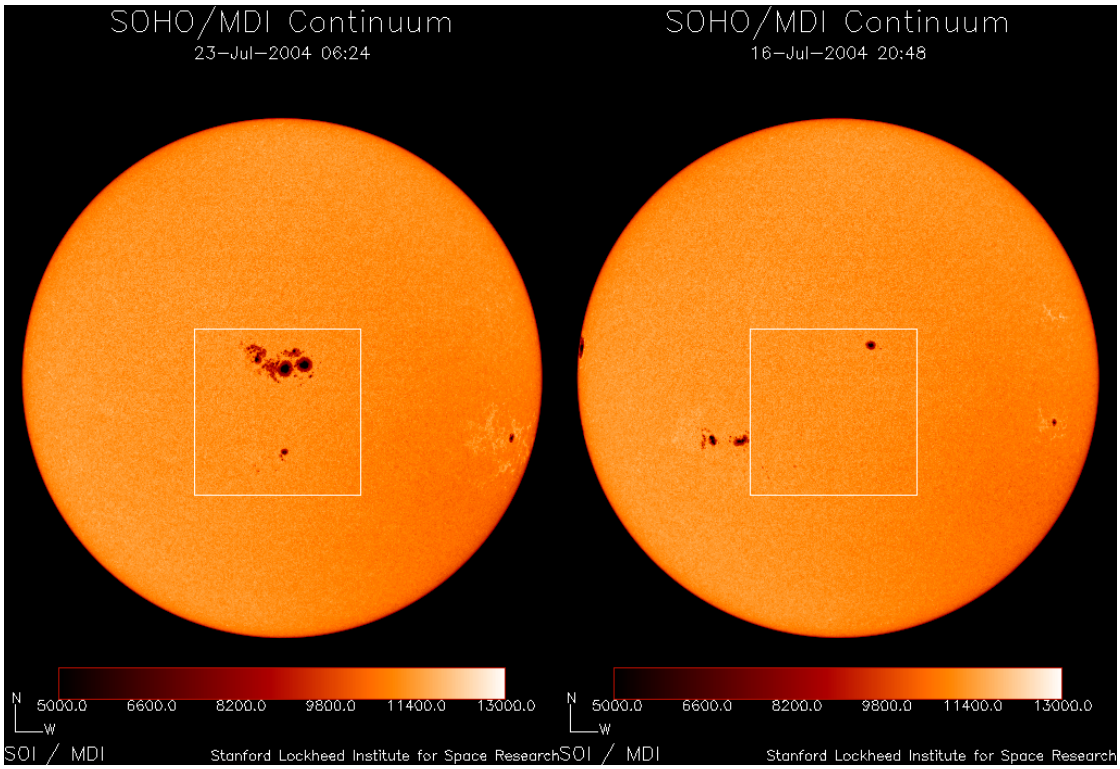
III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	600 (Humain)	Cat	NOAA	NOTE
12	0736	0808	0859	S08E90	M1.6		52	II/1	0757	78	0649	SXI derived loc.
13	0009	0017	0023	N14W45	M6.7		350	III/1,II/2		70	0646	SXI derived loc.
13	0840	0848	0855	N12W52	M5.4	1N	89	III/2,II/2	0847	70	0646	
13	1159	1208	1212	S10E72	M2.9		260		1205	78	0649	SXI derived loc.
13	1833	1838	1842	S10E65	M1.1	1N				78	0649	
13	1924	1932	1936	N13W56	M6.2	1B	170	III/1	1934	70	0646	
14	0502	0523	0527	N12W62	M6.2	1N	46	III/2		70	0646	
14	1812	1816	1818	S11E56	M1.0	SF				78	0649	
15	0130	0141	0148	S10E54	X1.8		310			78	0649	SXI derived loc.
15	1815	1824	1828	S11E45	X1.6		700			78	0649	SXI derived loc.
16	0143	0206	0212	S11E41	X1.3		450			78	0649	SXI derived loc.
16	1032	1041	1046	S10E36	X1.1	1F	600	III/1	1038	78	0649	
16	1349	1355	1401	S11E35	X3.6	3B	2900	II/1		78	0649	
16	1622	1628	1631	S11E30	M1.2	SF				78	0649	
17	0751	0757	0759	S10E24	X1.0	1F	670			78	0649	
17	1645	1651	1657	S10E18	M2.5	1N	52			78	0649	
17	2124	2131	2138	S09E13	M2.0	1F				78	0649	
17	2254	2308	2316	S10E15	M1.1				78	0649		SXI derived loc.
18	0005	0035	0040	S09E12	M2.0	1F		III/3		78	0649	
18	0251	0257	0303	S12E12	M1.5	SF				78	0649	
18	1704	1713	1715	S11E05	M1.9	1F		III/1		78	0649	
20	1222	1232	1245	N11E34	M8.6	3B	3000	IV/2,II/2	1304	82	0652	halo CME
22	0014	0032	0043	N03E17	M9.1					82	0652	SXI derived loc.
22	2240	2258	2307	N05E04	M1.6	2N	68	III/3		82	0652	
22	2310	2324	2343	N03E02	M1.2					82	0652	SXI derived loc.
23	1707	1728	1735	N03W04	M2.2	SF		III/2		82	0652	
23	2115	2123	2130	N05W07	M1.7		110			82	0652	SXI derived loc.
24	0601	0606	0610	N07W20	M1.0	1F	230		0605	82	0652	
24	1840	1850	1856	N05W19	M2.5		100		1848	82	0652	SXI derived loc.
25	0539	0551	0558	N10W31	M7.1	2B	810		0549	82	0652	
25	0630	0639	0645	N03W27	M1.0	1F		V/1,III/1		82	0652	
25	1337	1349	1355	N04W30	M2.2		65		1354	82	0652	SXI derived loc.
25	1419	1514	1643	N08W33	M1.1	1F	120	IV/2	1520	82	0652	
26	0536	0552	0601	N02W41	M1.3	SF	61		0551	82	0652	
26	1723	1730	1737	N03W45	M1.1	2N	38		1725	82	0652	
26	2346	0000	0011	N10W54	M1.2	1F				82	0652	
27	0541	0545	0552	N02W53	M1.1	1N	100	V/3,III/3,CTM/1		82	0652	
27	1959	2020	2037	N09W65	M1.5	1F				82	0652	
28	2345	0006	0016	N10W83	M2.0					82	0652	SXI derived loc.

loc: approximate heliographic location
Xray: X-ray flare class
op: optical flare class
10 cm: 10 cm radio flux
type: type of radio burst

600: peak time (UT) of 600 Mhz radio bursts in Humain
Cat: Catania sunspot group identification
NOAA: NOAA active region identification
p: proton event
CME: Coronal Mass Ejection

IV. Picture of the month



MDI images from the main players of this month. On the left, Catania sunspot group 82 ('The Eyeballs Group' is visible near the disk center on this image from July 23. On the right, Catania 78 and its close neighbours are visible in the southeast of the 16 July image. On this image, Catania 82 is just showing up in the east. (MDI is an instrument onboard the joint NASA/ESA mi