Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

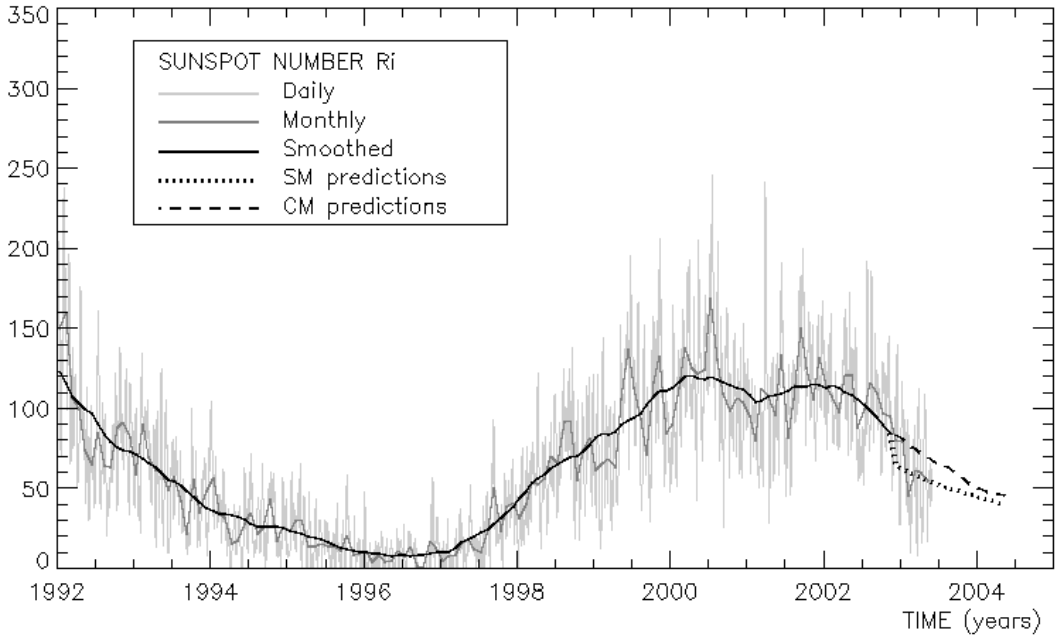
SUNSPOT BULLETIN

2003 n° 5

Provisional international and normalized hemispheric daily sunspot numbers for May 2003

computed at the *Observatoire Royal de Belgique* using observations from an international network with the *Locarno Specola Solare* as reference station.

Date	R'_I	R'_N	R'_S
1	99	29	70
2	86	27	59
3	95	26	69
4	96	29	67
5	93	32	61
6	78	31	47
7	65	18	47
8	33	17	16
9	20	20	0
10	17	17	0
11	36	20	16
12	38	19	19
13	41	22	19
14	43	23	20
15	50	29	21
16	51	29	22
17	48	0	48
18	44	15	29
19	54	0	54
20	61	0	61
21	50	0	50
22	65	0	65
23	57	18	39
24	40	10	30
25	39	0	39
26	52	8	44
27	57	0	57
28	62	9	53
29	56	9	47
30	44	8	36
31	42	9	33
Monthly mean	**55.2**	**15.3**	**39.9**
Cooperating stations	**34**	**31**	**31**



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for November 2002 : 85.2 (± 5%)

	SM	CM		SM	CM		SM	CM
2002 Dec	82	84	2003 Jun	59	67	2003 Dec	50	52
2003 Jan	75	81	Jul	57	66	2004 Jan	49	50
Feb	67	78	Aug	56	64	Feb	48	49
Mar	65	75	Sep	54	61	Mar	47	48
Apr	63	72	Oct	52	58	Apr	45	47
May	61	70	Nov	51	55	May	44	46

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

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

Date	R'_i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
30	98	224	52	154	837	0	0/0	41	
1	99	242	53	149	832	7	0/0	35	
2	86	224	49	144	834	5	1/0	16	
3	95	176	42	148	////	2	0/0	12	
4	96	192	41	142	840	6	0/0	8	
5	93	151	46	129	837	3	0/0	18	
6	78	111	43	122	832	1	0/0	32	
7	65	66	44	110	837	2	0/0	40	
8	33	39	42	101	836	0	0/0	43	
9	20	33	40	97	828	0	0/0	33	
10	17	20	40	93	832	0	0/0	31	
11	36	33	40	92	834	0	0/0	29	
12	38	17	40	94	839	0	0/0	22	
13	41	22	40	96	846	0	0/0	27	
14	43	32	40	96	846	0	0/0	36	
15	50	30	42	99	847	0	0/0	22	
16	51	27	43	103	848	1	0/0	14	
17	48	23	42	102	850	1	0/0	8	
18	44	17	43	109	851	///	///	11	
19	54	34	46	115	847	1	0/0	15	
20	61	50	47	117	848	3	0/0	12	
21	50	40	49	119	851	0	0/0	29	
22	65	35	50	118	849	2	0/0	28	
23	57	22	50	118	854	1	0/0	20	
24	40	23	50	117	851	0	0/0	21	
25	39	56	49	121	844	4	0/0	18	
26	52	77	48	125	847	21	2/0	21	
27	57	90	55	129	838	24	2/1	25	
28	62	147	53	130	830	27	0/1	30	
29	56	118	48	138	820	121	2/1	80	
30	44	84	48	117	787	18	0/0	55	
31	42	51	42	113	777	104	1/0	22	

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 MAY 2003

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-3 WM-2	QUAL	OBS
1	847	6	52	112	38	74	71	128.7	2	VI
2	812	6	47	107	37	70	70	128.5	3	VI
3	930	9	101	191	49	142	79	118.3	3	FC
4	735	7	107	177	33	144	0	154.6	3	FC
7	700	6	33	93	22	71	39	57.0	3	FC
8	1000	2	3	23	11	12	11	28.6	2	OB
10	700	2	3	23	23	0	0	20.2	2	OB
11	830	3	5	35	22	13	0	15.8	3	OB
12	820	3	4	34	22	12	0	17.2	2	OB
13	1220	4	10	50	37	13	26	18.9	3	OB
14	830	6	17	77	53	24	42	28.4	2	OB
15	800	5	12	62	49	13	50	31.6	3	OB
16	820	6	18	78	53	25	35	17.0	2	OB
18	1025	3	16	46	0	46	22	6.9	2	JY
20	1210	4	43	83	0	83	24	43.2	3	OB
26	840	4	48	88	15	73	76	81.0	3	OB
27	1020	4	56	96	11	85	80	79.0	3	OB
28	845	5	48	98	23	75	54	68.2	3	OB
29	850	4	66	106	15	91	14	71.5	3	OB
30	1002	3	19	49	11	38	0	58.1	4	ST
31	1010	3	14	44	11	33	0	48.8	3	ST

The relative mean sunspot number is 79.6.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR MAY 2003

K'= 0.779 (*)

1	87	7	72	13	39	19	***	25	***
2	83	8	18	14	60	20	65	26	69
3	149	9	***	15	48	21	***	27	75
4	138	10	18	16	61	22	***	28	76
5	***	11	27	17	***	23	***	29	83
6	***	12	26	18	36	24	***	30	38
								31	34

The normalised relative monthly mean sunspot number is 62.

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

The Sun has been observed 21 days on 31 possible.

http://sidc.oma.be

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

This month saw big variations in solar activity. Roughly speaking, solar activity was low to moderate at the start of the month, then became very low for more than two weeks, and moved rapidly to high at the end of the month.

In the beginning of the month, the most prominent feature on the face of the sun was Catania sunspot group 84 (corresponding to NOAA active region 0349), which was near disk centre at the time. This group covered an area of about 0.1 percent of the solar disk and had a maximum of about 40 spots. Together with the smaller neighbouring sunspot group 79 (NOAA 0345), it formed the dominant centre of solar activity. Only one M-flare was observed (M1.0 from group 79 on May 2), but between the two of them, groups 79 and 84 produced well over 30 C-class flares during the first 8 days of May. On May 7-9, this activity complex rotated over the west limb, and solar activity then dropped sharply. Only small B-class flares (or sometimes not even those) were observed for some time after that. It took until May 20 before the next C-flare was observed. But even then, activity only consisted of several small C flares mainly from Catania regions 7, 8 and 13 (respectively NOAA regions 0362, 0364 and 0368). Things took another turn on May 25, when Catania sunspot group 18 (NOAA 0365) started a very rapid development and became a compact sunspot group with strong, complex and dynamical magnetic fields and more than 70 visible sunspots. It produced its first major flare (an M2.0) on May 26, thereby ending the long period of relative quiet on the sun. Many more large flares followed from this group, including three X-class flares, with the largest event an X3.6 on May 28. Catania sunspot group 13 (NOAA 0368) briefly joined in on the action on May 28 and was responsible for 2 M-flares as well, but this region never reached a comparable state of activity or magnetic complexity. Towards the end of the month, while sunspot group 18 headed for the west limb, strong activity from another group became visible at the east limb in EIT and SXI images, which highlighted the sun's ability to continue this streak of increased solar activity. But that's already the start of the report for next month…

The proton fluxes remained at quiet levels for most of the month, but the flaring activity from Catania sunspot group caused two small proton events. In the first event, the proton fluxes started increasing following the X3.6 flare early on May 28. The >10MeV flux reached the event threshold at the beginning of May 29, reached its maximum at 15-18UT and decreased below the threshold again by the end of the same UT day. On May 31, an M9.3 flare from group 18 again made the proton fluxes increase, and the >10MeV component exceeded the event threshold for a 9-hour-period on this day.

Most of the large flares from Catania sunspot group 18 were accompanied by CMEs, and in view of its location on the solar disk (crossing the central meridian on May 26), several of these had an earth-directed component, causing geomagnetic disturbances (see below). For most of the month, however, the main solar driver of the space weather was the presence of many coronal holes in geo-effective position (see below).

II. Geomagnetic Activity

A small low latitude coronal hole was in a geo-effective position in the western hemisphere at the beginning of the month, leading to a high solar wind speed (with maximum 650km/s on May 1) and active geomagnetic conditions on May 1 and 2 (early in the day). The wind speed then decreased to 400km/s and mostly quiet conditions reigned from May 2 (late) until midday on May 6. The leading edge of another, much larger, trans-equatorial coronal hole rotated across the central meridian on May 3. This hole blew a high speed solar wind in the Earth direction between May 5 and May 11, reaching a peak value of about 900 km/s on Friday, May 9, then coming down to 550 km/s on Sunday May 11, only to start rising again immediately to more than 700km/s on May 14 and then gradually decrease to 400km/s on May 18. During most of the first high wind speed episode the Bz component was weakly

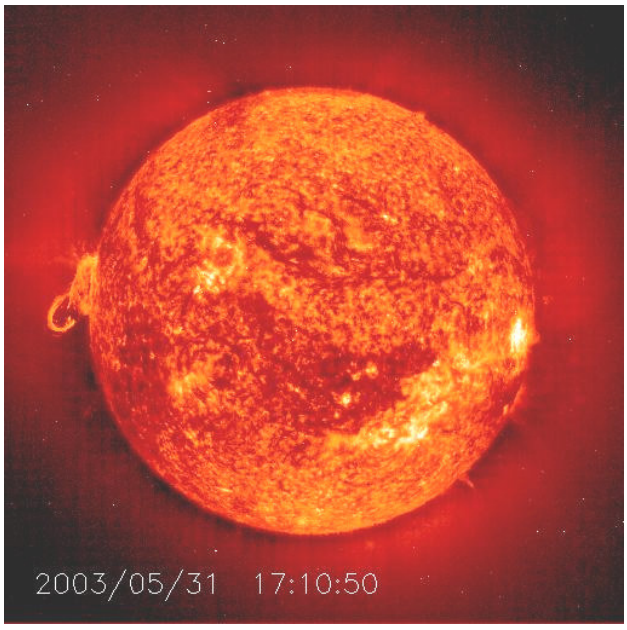
southward pointing (about -5 nT). As a consequence, geomagnetic conditions were at minor to major storm level during May 6-11, reaching K=6 in Wingst on May 8 and May 10. Then, active to minor geomagnetic storm conditions followed until May 15, while May 16-20 were mostly quiet days.

Several more coronal holes followed suit. A smaller equatorial coronal hole reached the central meridian on May 15. A third, again larger coronal hole with equatorial extension reached the disk centre on May 18. The influence of these was limited, leading to a minor geomagnetic storm on May 21-22 and active geomagnetic conditions from May 22 to May 28. Another small coronal hole reached central meridian on May 24 and pushed up the solar wind speed a few days later, reaching a maximum above 700km/s on May 28 before going down again to just above 600km/s. But on May 29-30 a sequence of 3 shocks due to CME fronts arrived, causing a peak of nearly 900km/s and a few short periods of strongly southwards oriented interplanetary magnetic field. This set off a major geomagnetic storm with the K-index in Wingst reaching 7 for a 12-hour period on May 29-30. Auroral sightings were reported in Belgium on this occasion! After the last shock, the solar wind speed decreased fairly rapidly to just above 600km/s by the end of May 31, and also the geomagnetic storm came to an end.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	Cat.	NOAA	NOTE
02	0247	0308	0344	S17W18	M1.0	SF	37		79	0345	EIT derived loc.
26	0538	0550	0602	S07E06	M2.0	1F	91	III/1, IV/1, CTM/1	18	0365	EIT derived loc.
26	1622	1637	1651	S08W00	M1.0		56	CTM/2	18	0365	EIT derived loc.
27	0240	0306	0321	S07W03	M1.4	1F	98	III/3	18	0365	
27	0506	0626	0716	S07W07	M1.6	1F	150	III/2	18	0365	EIT derived loc.
27	2256	2307	2313	S07W17	X1.3	2B	910	II/3, III/2, IV/2	18	0365	
28	0017	0027	0039	S07W20	X3.6		1600	II/3, III/3, IV/3	18	0365	EIT derived loc.
29	0051	0105	0112	S07W38	X1.1	2B	730	II/3, III/3, IV/1	18	0365	
29	0209	0218	0224	S37E03	M1.5	1F		III/3, IV/1	13	0368	
29	1928	1937	1943	S35W13	M2.8	1N	310	II/3	13	0368	
31	0213	0224	0240	S07W65	M9.3	2B	1300	II/3, V/3	18	0365	

IV. Picture of the month



A new active region announces its arrival. This eruption (on the left) from Catania sunspot group 22 (NOAA 0375) while still behind the solar disk was taken by the EIT telescope in the 304 Å passband. The bright spot on the right hand side is the flare-productive Catania sunspot group 18, about to rotate out of view. *(The EIT instrument is onboard SOHO, a joint ESA-NASA/ESA mission.)*