Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

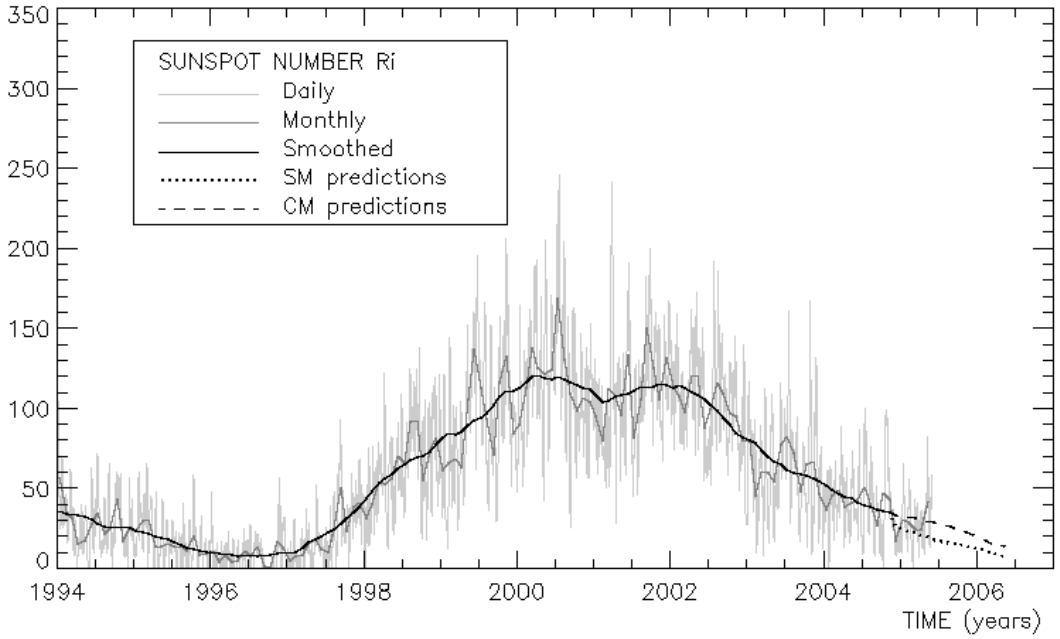
SUNSPOT BULLETIN

2005 n° 5

Provisional international and normalized hemispheric daily sunspot numbers for May 2005

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	39	0	39
2	42	0	42
3	47	0	47
4	43	0	43
5	40	0	40
6	45	0	45
7	37	0	37
8	46	11	35
9	63	20	43
10	77	23	54
11	82	19	63
12	80	16	64
13	62	18	44
14	51	18	33
15	39	12	27
16	43	12	31
17	33	11	22
18	26	9	17
19	23	23	0
20	15	15	0
21	13	13	0
22	24	16	8
23	25	13	12
24	25	11	14
25	30	12	18
26	44	13	31
27	44	10	34
28	37	0	37
29	43	10	33
30	46	14	32
31	58	22	36
Monthly mean	**42.6**	**11.0**	**31.6**
Cooperating stations	**49**	**42**	**42**



Predictions of the monthly smoothed Sunspot Number

using the last provisional value, calculated for November 2004 : 35.3 (± 5%)

	SM	CM		SM	CM		SM	CM
2004 Dec	33	34	2005 Jun	23	29	2005 Dec	16	21
2005 Jan	32	33	Jul	21	28	2006 Jan	16	20
Feb	28	33	Aug	20	27	Feb	15	18
Mar	27	32	Sep	19	26	Mar	14	16
Apr	26	31	Oct	18	25	Apr	13	15
May	24	30	Nov	17	23	May	12	14

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	37	193	37	106	////	11	0/0	28	
1	39	112	37	112	906	2	0/0	24	
2	42	103	39	112	904	0	0/0	10	
3	47	83	38	112	908	0	0/0	14	
4	43	76	38	109	918	3	0/0	6	
5	40	73	39	109	920	3	0/0	6	
6	45	76	40	110	915	103	1/0	8	
7	37	///	39	100	906	10	1/0	17	
8	46	80	39	101	897	0	0/0	81	
9	63	85	41	110	////	0	0/0	12	
10	77	94	42	119	874	14	1/0	9	
11	82	120	42	125	878	123	2/0	17	
12	80	169	40	117	889	218	2/0	17	
13	62	///	40	126	////	103	1/0	25	
14	51	///	39	100	886	2	0/0	8	
15	39	///	40	103	842	11	1/0	99	
16	43	105	37	99	871	20	2/0	32	
17	33	77	36	90	////	23	1/0	19	
18	26	48	35	84	862	1	0/0	10	
19	23	20	34	85	870	0	0/0	10	
20	15	2	34	84	872	0	0/0	24	
21	13	1	34	82	882	0	0/0	21	
22	24	7	35	82	888	0	0/0	11	
23	25	12	35	83	897	0	0/0	6	
24	25	21	36	85	905	3	0/0	6	
25	30	24	35	84	909	0	0/0	6	
26	44	34	36	90	913	10	0/0	2	
27	44	68	38	96	917	114	1/0	2	
28	37	69	38	92	914	1	0/0	14	
29	43	56	38	93	893	0	0/0	20	
30	46	55	36	95	886	0	0/0	66	
31	58	38	37	96	895	1	0/0	20	

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 2005

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-5 WM-2	QUAL	OBS
1	700	2	28	48	0	48	48	90.6	4	OB
2	615	2	23	43	0	43	30	83.0	3	ST
3	1000	3	28	58	0	58	0	79.3	3	ST
4	1350	3	53	83	0	83	0	72.6	3	OB
5	755	2	32	52	0	52	0	69.7	2	FC
6	750	2	38	58	0	58	0	73.0	3	FC
8	850	2	39	59	12	47	47	76.4	3	RV
9	620	3	59	89	27	62	62	80.9	3	ST
10	620	5	46	96	28	68	35	90.4	3	ST
11	1010	6	73	133	33	100	25	115.2	3	OB
12	715	5	62	112	21	91	61	161.6	3	AZ
16	800	2	31	51	16	35	35	123.2	2	DB
17	745	2	27	47	15	32	32	113.3	3	OB
18	712	2	9	29	11	18	18	52.2	3	ST
19	730	3	20	50	35	15	0	36.7	4	OB
20	720	2	5	25	25	0	0	1.8	3	OB
21	600	1	1	11	11	0	0	0.2	3	OB
22	615	2	12	32	16	16	0	10.0	3	OB
23	645	2	19	39	24	15	0	14.7	3	OB
24	1330	1	9	19	0	19	0	13.8	3	ST
25	845	2	20	40	14	26	0	19.0	3	OB
26	654	3	32	62	18	44	48	22.9	3	OB
27	1100	4	46	86	27	59	73	72.5	3	ST
28	1030	1	32	42	0	42	42	68.1	3	ST
29	730	2	31	51	14	37	51	62.8	3	ST
31	700	5	38	88	30	58	16	40.1	3	OB

The relative mean sunspot number is 57.8.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR MAY 2005

K'= 0.779 (*)

1	37	7	***	13	***	19	39	25	31
2	33	8	46	14	***	20	19	26	48
3	45	9	69	15	***	21	9	27	67
4	65	10	75	16	40	22	25	28	33
5	41	11	104	17	37	23	30	29	40
6	45	12	87	18	23	24	15	30	***
								31	69

The normalised relative monthly mean sunspot number is 45.

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

The Sun has been observed 26 days on 31 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR MAY 2005
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
2-2029	4 24.5	26 E	5 1.2	6 E	5 8.0
6-2029	5 1.2	3 D	5 7.9	12 E	5 14.7
7-2029	5 7.6	8 E	5 14.3	20 D	5 21.1
10-2029	5 5.4	10 C	5 12.1	12 E	5 18.9
12-2029	5 10.2	11 D	5 16.9	19 D	5 23.7
3-2030	5 20.8	22 D	5 27.6	31 E	6 3.3

PROBABLE RETURN OF MAJOR GROUPS FOR JUNE 2005

Nø	New East Limb	New CMP	New West Limb
2	5 21.6	5 28.4	6 4.1
6	5 28.2	6 4.0	6 10.7
7	6 3.5	6 10.2	6 17.0
3	6 16.9	6 23.6	6 30.4

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

Solar activity increased this month resulting in several M-flares and (halo) CMEs. Flares with intensity in the M-band did not occur anymore since mid-February.

First of May, solar images show us the presence of two groups: Catania 57 (NOAA 0756) and Catania 59 (NOAA 0757). The breaking news at that moment came however from behind the east limb: a new group announced itself by a C8.0 long duration flare on May 2 with accompanying eastward directed CME. On May 3, the group was assigned number 60 (NOAA 0758). On its record, it has 3 moderate M flares on May 10 and 11 and a C8.5 long duration flare peaking at 17:05UT. This flare was accompanied by a CME which triggered an alert from CACTus, the automated detection software developed at the SIDC.

Sunspot group 57 (NOAA 0756) which turned over the east limb on April 25, 2005 was still a strong candidate to disturb space weather, having its complex magnetic configuration in mind and the fact that it was even visible with the naked eye. It produced in total two M-flares with no consequences. We do mention the flares because the M-flare on May 6 was the first M-flare since February 19!

The next group to discuss is group 61 (NOAA 0759) which came in view at the east on May 8. It produced 2 strong C-flares, a C5.8 on May 9 and a C9.4 on May 12. In the neighborhood of the group, an EIT-dimming (i.e. local darkening in EIT-images) was visible at the flaring time. A dimming is a signature for a CME. The C9.4 flare was the precursor of an M1.6 and M1.4 flare, peaking respectively at 07:33UT and 17:41UT on May 12, and an M8.0 long duration event peaking at 16:57UT on May 13. The latter one was accompanied by a beautiful full halo CME clearly visible in LASCO C2 at 17:22UT and in C3 at 17:42UT. Its real speed was estimated around 1300 km/s, although from LASCO images, an apparent speed of only 600 km/s was measured. This made the arrival of the CME at earth to be sooner than expected, at the beginning of May 15.
Around 18UT on May 13 the 10MeV proton flux started to increase continuously (CME accelerated particles) and early on May 14, it crossed the threshold level. Beginning of May 15, another strong sudden increase was seen in the curve around the time of the arrival of the shock front of the May 13 CME. From about 13 UT May 15 onwards, the proton flux decayed and fell below the threshold.
Another halo CME visible in LASCO C2 from 13:50UT, May 16 was associated with a small eruption in active region NOAA 759. A CACTus analysis showed that the CME was slow with an estimated speed of only 500/s.

Group 65 (NOA 0763) visible at the east from May 11 deserves also some attention in this monthly overview. It produced in total 4 M-flares. Around the time of the M1.8 flare on May 17, LASCO/EIT observed a very faint full halo CME. The two events are thought to be related.

On May 21, the SIDC issued an 'all quiet alert': no C-flares, no geomagnetic storms or proton flux enhancements. This alert was suspended at noon May 23 because of expected flaring activity from Catania 69 (NOAA 0767). The group became active late May 26 and produced 1 minor M-flare and a handful of C-flares. By May 29, flaring activity dropped below C-class level.

On May 25, a recurrent coronal hole was visible near the central meridian.

A last event to report is a halo CME in the LASCO/C2 field of view detected on May 26, around 15:00UT, most clearly seen in SW-direction. A projected speed of just above 500 km/s was measured. The corresponding EIT 30.4nm movie showed a spectacular filament eruption corresponding to this event from as early as 07:19UT.

II. Geomagnetic Activity

Shock fronts of CMEs arriving at Earth mostly determined the geomagnetic conditions this month. We had 4 minor-major-severe storm periods caused by CMEs hitting the earth magnetic field. Coronal holes were responsible for the two other geomagnetic storms.

On May 1, we were in the awakening of a big recurrent northern hole, which was at the central meridian on April 27. The recurrent northern coronal hole was the source of the active conditions and minor storm starting end May 29 until May 1. Boulder estimated even once a Kp value of 6 early May 1. From May 1 onwards, the geomagnetic disturbances diminished.

On May 8, a major geomagnetic storm occurred, Kp even reached once 7, which we label as a severe storm. This storm can be brought into relation with the partial halo CME associated with the duration C8.5 flare which erupted from Catania 60 (NOAA 0758, east). The solar wind speed started to rise late on May 7 and reached a value of 600 km/s on May 8. Bz had a value of -10 nT. This resulted in active to major storm conditions. At 6 UT on the 8th, the solar wind speed started to rise again and reached a value of almost 900 km/s. Bz became -15 nT. This gave a second interval of major geomagnetic storm conditions with one severe storm period. On May 9, the geomagnetic conditions turned quiet again.

Another period of interest occurred on May 15. Around 04UT, the halo CME related to the M8.0 long duration flare of May 13, arrived on earth; it caused a major to severe geomagnetic storm and several days of active conditions. The solar wind speed jumped to 900 km/s and the Bz turned very strongly southward (-40 nT).

A relatively small disturbance in the solar wind was observed by ACE at 03:30UT on May 20. This disturbance was probably due to the weak/slow halo CMEs of May 16 and May 17. While the solar wind speed made only a small jump (from 450 to 480 km/s), there was a significant southward rotation of the interplanetary magnetic field (down to -10nT for several hours). This caused a relatively strong perturbation of the geomagnetic field as indicated by the Kp-index reaching the value of 6.

Another small shock was observed in the solar wind speed on May 28, from 280 to 320 km/s. This shock followed a slow rise in the solar wind density over the previous 24 hours and was the consequence of the recurrent coronal hole located near the central meridian on May 25. This resulted in active geomagnetic conditions.

On May 29, an interplanetary shock was recorded at 09:15UT by SOHO/CELIAS. It was followed by an ICME with southward interplanetary magnetic field (Bz down to almost -20 nT). Consequently, the Kp index jumped to 5. The ICME was most probably an interplanetary counterpart of the full halo CME of May 26.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	600 (Humain)	Cat	NOAA	NOTE
06	1111	1128	1135	S04W76	M1.3		73	V/2,III/1	1121,1132	57	0756	CME,SXI-derived location
07	0757	0813	0819	S05W89	M1.4					57	0756	CME
10	0503	0523	0536	S10W30	M1.3	SF		III/1,IV/2,CTM/2		60	0758	
11	0611	0641	0656	60	M1.2			III/3,CTM/2	0614,0619, 0637,0648	60	0758	CME in SW
11	1922	1938	1955	S10W47	M1.1	1F				60	0758	CME in SW
12	0727	0733	0737	N11E30	M1.6	2B	55			61	0759	
12	1733	1741	1745	N11E21	M1.4	1N	98			61	0759	
13	1613	1657	1728	N12E12	M8.0	2B	2900	II/3,III/1,IV/3	1705	61	0759	halo CME, EIT wave, dimming, p
15	2227	2236	2242	S15E13	M3.5	1N	83	III/3,CTM/1		65	0763	
16	0233	0243	0250	S17E17	M1.4	1B	61	V/2,III/3		65	0763	
16	0856	0908	0915	S17E15	M1.6	SF	29	III/2		65	0763	
17	0231	0239	0252	S16W01	M1.8	1B	100	II/2,IV/1,III/2		65	0763	
27	1153	1230	1240	S08E04	M1.1	2F	130	III/3	1227	69	0767	

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