Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

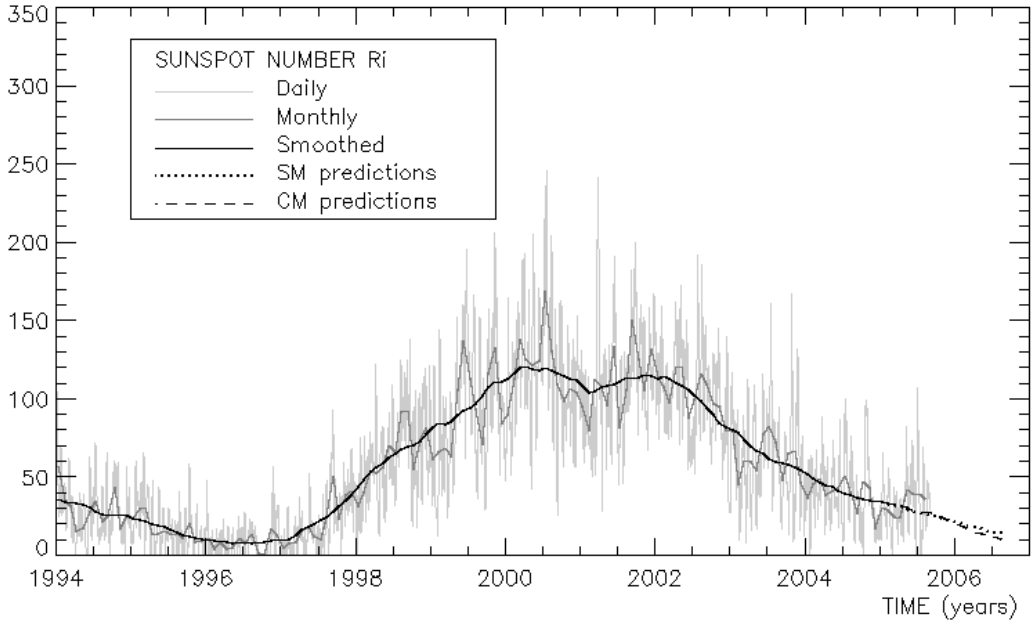
SUNSPOT BULLETIN

2005 n° 8

Provisional international and normalized hemispheric daily sunspot numbers for August 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	63	54	9
2	69	57	12
3	48	35	13
4	40	24	16
5	40	22	18
6	33	20	13
7	39	20	19
8	37	18	19
9	34	17	17
10	16	8	8
11	22	8	14
12	27	9	18
13	22	0	22
14	26	0	26
15	27	0	27
16	24	0	24
17	20	0	20
18	19	0	19
19	44	15	29
20	48	18	30
21	39	18	21
22	38	19	19
23	36	24	12
24	42	26	16
25	41	41	0
26	37	37	0
27	42	42	0
28	46	38	8
29	43	27	16
30	37	19	18
31	29	0	29
Monthly mean	**36.4**	**19.9**	**16.5**
Cooperating stations	**48**	**40**	**40**



Predictions of the monthly smoothed Sunspot Number

using the last provisional value, calculated for February 2005 : 33.9 (± 5%)

	SM	CM		SM	CM		SM	CM
2005 Mar	34	33	2005 Sep	29	27	2006 Mar	23	17
Apr	32	32	Oct	28	26	Apr	22	15
May	34	31	Nov	27	24	May	21	14
Jun	33	29	Dec	26	22	Jun	20	13
Jul	32	28	2006 Jan	25	20	Jul	18	12
Aug	30	28	Feb	24	19	Aug	17	11

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, September 1, 2005 13:07 UT

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

Date	R'_i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
31	69	////	40	110	894	2	1/0	12	
1	63	81	-	111	////	11	1/0	18	
2	69	96	-	110	893	11	1/0	12	
3	48	50	-	109	893	13	1/0	12	
4	40	38	-	106	895	3	0/0	11	
5	40	////	-	99	898	1	0/0	10	
6	33	60	-	93	890	1	0/0	31	
7	39	58	-	92	873	0	0/0	20	
8	37	37	-	86	880	0	0/0	10	
9	34	20	-	83	886	0	0/0	11	
10	16	13	-	76	887	0	0/0	14	
11	22	6	-	76	886	0	0/0	4	
12	27	4	-	76	894	0	0/0	8	
13	22	5	-	75	894	0	0/0	25	
14	26	5	-	75	896	0	0/0	12	
15	27	33	-	76	911	0	0/0	10	
16	24	34	-	76	902	0	0/0	20	
17	20	25	-	77	906	0	0/0	16	
18	19	22	-	83	910	0	0/0	17	
19	44	60	-	93	913	0	0/0	10	
20	48	113	-	98	////	0	0/0	4	
21	39	102	-	99	912	0	0/0	13	
22	38	89	-	105	914	20	2/0	11	
23	36	73	-	112	923	1	1/0	10	
24	42	69	-	99	888	1	0/0	69	
25	41	60	-	92	868	20	1/0	27	
26	37	50	-	93	892	0	0/0	7	
27	42	38	-	92	900	1	0/0	6	
28	46	39	-	90	899	1	1/0	8	
29	43	40	-	89	909	1	0/0	8	
30	37	38	-	86	907	1	0/0	4	
31	29	32	-	84	897	0	0/0	42	

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 AUGUST 2005

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-5 WM-2	QUAL	OBS
1	1525	5	43	93	81	12	14	36.5	2	FC
2	1550	5	54	104	86	18	49	41.3	3	FC
3	645	4	30	70	52	18	27	48.1	3	JD
4	1130	4	36	76	37	39	63	36.1	2	FC
6	1320	3	18	48	29	19	33	57.5	3	FC
7	740	4	16	56	29	27	28	55.9	2	FC
8	1216	4	12	52	24	28	12	35.6	2	ST
9	1049	4	9	49	24	25	0	19.4	2	ST
10	1235	2	3	23	11	12	0	12.2	2	AE
11	1340	3	5	35	12	23	0	6.2	2	AE
12	1150	4	16	56	13	43	0	3.9	2	AE
13	855	2	14	34	0	34	0	4.4	2	AZ
14	840	2	30	50	0	50	39	5.1	2	AZ
16	739	2	13	33	0	33	22	6.0	2	ST
17	710	2	10	30	0	30	30	5.8	2	ST
18	1320	3	15	45	13	32	20	23.2	2	AE
19	1445	5	58	108	34	74	49	40.0	2	AE
22	1005	2	32	52	29	23	29	32.2	2	ST
24	710	3	34	64	39	25	50	70.1	2	ST
25	1212	3	28	58	58	0	35	63.1	2	ST
26	925	3	35	65	65	0	11	76.0	2	ST
27	1010	4	22	62	62	0	23	52.1	2	GL
28	1105	4	18	58	45	13	0	57.7	2	GL
29	750	4	26	66	48	18	22	72.3	2	ST
30	720	3	32	62	37	25	26	63.0	2	ST
31	1325	2	28	48	21	27	21	61.0	3	ST

The relative mean sunspot number is 57.6.

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

K'= 0.747 (*)

1	69	7	42	13	25	19	81	25	43
2	78	8	39	14	37	20	***	26	49
3	52	9	37	15	***	21	***	27	46
4	57	10	17	16	25	22	39	28	43
5	***	11	26	17	22	23	***	29	49
6	36	12	42	18	34	24	48	30	46
								31	36

The normalised relative monthly mean sunspot number is 43.

(*) 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 AUGUST 2005
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
7-2032	7 28.1	29 E	8 3.8	9 A	8 10.6
5-2033	8 16.4	18 A	8 23.1	29 C	8 29.9
10-2033	8 24.1	25 D	8 30.9	31 C	9 6.6
13-2033	8 26.6	28 C	9 2.3	31 E	9 9.1

PROBABLE RETURN OF MAJOR GROUPS FOR SEPTEMBER 2005

Nø	New East Limb	New CMP	New West Limb
5	9 13.0	9 19.8	9 26.5

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

At the beginning of the month, we were still in the awakening of the X1.3 flare of July 30. Further, we could distinguish two periods of strong solar activity: Aug 1-3 with 3 M-flares and Aug 22-28 with 5 M-flares.

Three M-**flares** marked the first period of the month. An M1 flare was produced by the dominant active region *Catania 09 (NOAA 0792)* on Aug 1 at 13:00UT, N13E32. Catania *15 (NOAA 0794)* located at the east at that time, was responsible for an M4.2 flare on Aug 2 and an M3.4 flare on Aug 3, both accompanied with a **CME** of less relevance since they were not geoeffective.
Group 09/0792, which was the biggest at start of the month, decayed continuously from Aug 4 onwards. Although, it had still enough strength to produce a long-duration C2.8 flare on Aug 5 peaking at 06:59UT. A filament eruption happened at the same time and place. A faint halo CME was directed towards the North-East. After a last C-flare on Aug 7 from this group, we had a flaring silence. By the 18th, the background X-ray flux started to increase gradually, with some small B-flares superimposed.
Sunspot group *24 (NOAA 0798)* was only recognized as a group on Aug 15 and evolved rapidly to a beta-gamma on Aug 20. Before rotating off the west limb, it was responsible for an M2.6, M5.6 on Aug 22 and an M2.7 on Aug 23, peaking respectively at 01:33UT, 17:27UT and 14:44UT. These 3 major events all had halo CMEs associated with them with primary speeds of 637, 726 and 801 km/s, respectively. All three were later detected in ACE solar wind data, the first two in quick succession on Aug 24 and the third on Aug 25. This group continued to be in overdrive on the backside of the solar disk. At the time of writing this report, it had produced an X17, X5.4 and X1.1 flare! It seems that the group (now 37,0808) gained strength on its trip on the backside of the Sun.
Sunspot group with Catania number *29 (NOAA 0803)* subsequently produced 2 M-class events after rotating over the East limb. The M6.4 flare on Aug 25 occurred right on the E limb and so whilst a fast bright CME was observed it did not appear to have an earth-directed component. The M1.6 flare from Aug 28 had only a modest CME in association, with no significant earthward component. This group was further responsible for a long duration C2.0 flare peaking at 11:46UT on Aug 31 and an associated partial halo CME over the solar North pole.

At this time, several other halo CMEs were observed, all backsided. On Mon Aug 29, the CACTus software detected a strong partial halo CME in LASCO data predominantly in the Western direction. The event was first observed at 11:06UT. The projected speed of the CME was on the order of 1500 km/s. Another event detected by CACTus occurred on Aug 31. A symmetric and very strong halo CME was visible in the field of view of C2 at 22:30UT with an apparent speed of the order of 1500 km/s. On Aug 31, before this halo CME, two other CMEs were visible, detected by CACTus but not triggering an alert as the angular width was smaller then 180°. However, we make notice of these two CMEs as they were mentioned in the CME information report from the LASCO operations group.
An overview of all (full) halo CMEs of this month can be found in Section IV.

The >10MeV **proton flux** started to rise late on July 26, previous month, and surpassed the event threshold near the end of July 27. These protons were probably accelerated by the shock driven by a halo CME that erupted on July 27 and which was associated with the M3.7 flare peaking at 05:02UT. The curve passed the threshold with a small jump. This jump can be related to the M1.0-flaring activity at that time. *We have two kinds of drivers of proton events: flare driven and CME driven both with a typical curve signature: sharp high rise and steep drop for flares as the acceleration lasts only for a short period, while a CME-shock accelerates the protons more*

moderate and continue doing this until the CME passes the point were the proton flux is measured. This results in an elevated flattened curve. In practice, the curve is a combination of both. The proton flux remained above the threshold until Aug 1 with protons accelerated at the shocks driven by the following halo CMEs associated with the persisting flaring activity from this period. Around 10:00UT, Aug 1, the flux fell below the threshold and dropped to background levels on Aug 2.
From Aug. 22 until early Aug 25, we had a second period of elevated >10MeV proton fluxes. On Aug. 22, two distinct increases were visible in the flux curve. The first rise can be linked with the M2.6 flare peaking at 01:33UT and accompanied with a halo CME, the second rise is linked with the M5.6 flare peaking at 17:27UT, also accompanied with a halo CME. The second event pushed the curve above the threshold. The third event: the M2.7 flare on Aug 23 with associated CME was not capable to leave a clear signature in the proton flux curve as it was still at an elevated level. The passing of the three CMEs at the L1 point was visible in the ACE solar wind data as the curve decreased more rapidly on Aug 24-25. The curve eventually passed the threshold early Aug 25 to come back to normal levels on Aug 26.

The last features to discuss are the **coronal holes and solar wind speed**.
A shock in the solar wind stroke the Earth on Aug. 1 around 06:00UT. It was associated with the July 30 X1.3 flare (speed= 600km/s). Thereafter, the solar wind speed decayed steadily to a minimum of 400 km/s on Aug. 5. Late that day, the Earth entered a high-speed stream associated with a recurrent polar coronal hole extension. The speed peaked at 650 km/s on Aug 6.
A small equatorial coronal hole has passed the central meridian on August 8-9. It was very small and its flow did not arrive to the Earth.
Another equatorial coronal hole, of a larger size, passed the central meridian on August 13-14. The fast flow emanating from it was visible in the solar wind data from Aug 16 to Aug 18.
On Aug 18, a small coronal hole in the south was situated at the central meridian, leading to an increased solar wind speed on Aug 21 with a maximum of 550 km/s.

II. Geomagnetic Activity

We can distinguish 4 periods of strong geomagnetic activity that catch the eyes: Aug 6-7, 10, 24-25 and 31. All were probably initiated by CMEs bumping upon the earth magnetic shield. Further, we had 4 periods of active conditions: the first one we inherited from last month, the raison for the disturbances of the second period is unclear; the last two active periods were caused by a coronal hole. We give a chronological overview of all events.

The week started with active conditions for a few hours on Aug 1 due to the solar wind shock arrival.

The arrival of the fast solar wind stream on Aug 5 induced active to minor storm conditions (Kp=4 and locally 5) for a few hours mainly on Aug 6 and again for a few hours in the first half of Aug 7, because of negative excursion of the Bz compoent of the IMF.

Early Aug 10, a colder flow with higher magnetic field arrived. The north-south interplanetary magnetic field component Bz was negative during several hours, so the Kp index reached 4 (Dourbes, IZMIRAN) or 5 (NOAA). This geoeffective structure may have been a glancing blow of the partial halo CME observed on Aug 5, with a speed around 400 km/s, according to CACTus software.

A shock-like discontinuity has been recorded in the solar wind around 01:55 UT on Aug 13. The speed, density and temperature of the solar wind plasma changed abruptly. The Bz inside the structure was almost steadily positive, so no strong geomagnetic disturbance was produced. The Kp index values of maximum 4 were recorded on Aug 13 and 14. The solar source of this ICME is somewhat unclear. A possible explanation can be the filament eruption near the central meridian on Aug 7. CACTus estimated a very low speed. If this identification of the solar source is correct, this ICME had one of the longest travel times from the Sun to the Earth ever observed. It had to be very slow near the Sun and gradually accelerating en route to the Earth. Another explanation is the possible eruption manifested by a slow-developing dimming detected by SOHO/EIT on August 8 starting around 03:23 UT to the south-west of sunspot group 15 (NOAA 0794). Alternatively, the corresponding eruption on the Sun occurred late on August 9, when the SOHO/EIT data were very scarce. No halo CME has been registered during these periods.

On Aug. 16-18, the solar wind speed was elevated to a maximum of about 650 km/s. At that moment, the wind from the coronal hole at the central meridian on Aug 13-14, reached us. This resulted in periods of active conditions.

On Aug. 21, a shock was visible in all solar wind parameters. The speed jumped from below 400 km/s to around 550 km/s, the density decreased and the IMF field strength increased to above 10 nT. The azimuth angle phi showed a clear signature of a sector change. We believe that this high speed originated from the small southern coronal hole, at the central meridian on Aug 18. It gave one interval of active to minor storm conditions on Aug 21.

The three CMEs associated with the 3 major events from 24/0798 were responsible for the storm on Aug 24-25. The first CME left a signature in ACE data a little before 6UT, the second around 9UT. Following the arrival of the second the IMF, Bz reached ~-60nT while the solar wind speed was raised to over 700km/s. Shortly afterwards, Kp increased to 7 and then to 9, and it remained at minor to major storm levels until early Aug 25. A third CME was detected weakly around 13UT Aug 25 - Kp later increased to 5 for a 3-hr period but returned to active/unsettled conditions.

Geomagnetic acitivity became quiet up till mid Aug. 31 when a co-rotating interaction region passed L1 and resulted in K-indices measured in Dourbes (Belgium) of value 6. This plasma cloud can be possibly related to a glancing blow of the backsided halo CME that left from the SW limb on Aug 29.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	Cat	NOAA	NOTE
01	1300	1351	1429	N15E30	M1.0	1F	290	IV/1	09	0792	semi-halo CME
02	1822	1831	1837	S12E47	M4.2	1N	160	II/3	15	0794	Possible halo CME
03	0454	0506	0511	S13E45	M3.4		120	III/2	15	0794	
22	0044	0133	0218	S09W48	M2.6	1N	1600	IV/3,III/3,II/3	24	0798	LASCO halo CME; EIT position
22	1646	1727	1802	S12W60	M5.6	1N	2800	IV/3	24	0798	EIT position, LASCO Halo CME
23	1419	1444	1608	N70W16	M2.7	SF	3500	IV/1,II/1	24	0798	EIT position; Halo CME;CACTUS alert sent
25	0431	0440	0445	N09E80	M6.4	1N	260	III/1	29	0803	EIT position,non-halo LASCO CME
28	1017	1028	1037	N09E36	M1.6	SF	520	III/3	29	0803	EIT position, no LASCO data

LOC: approximate heliographic location
XRAY: X-ray flare class
OP: optical flare class
10CM: peak 10 cm radio flux

RADIO TYPE: radio burst type
Cat: Catania sunspot group number
NOAA: NOAA active region number
NOTES: **p** = proton event
CME = coronal mass ejection

IV Halo CME List

onset time	e-mail time CACTus	da	e-mail time LASCO	e-mail time FF	Ass. Events	consequences
08/02 19:31	-	-	-	08/03 06:44	M4.2	
08/03 05:06	-	-	-	-	M3.4	
08/05 08:30	-	-	08/05 18:10	08/06 06:41	LDE C2.6	Aug. 7, minor storm
08/22 01:31	08/22 16:29	290	-	08/22 22:09	LDE M2.6	Aug. 24, Severe storm (Bz=-60 nT) Proton event
08/22 17:30	08/22 22:26	196	-	08/23 03:09	LDE M5.6	Aug. 24, Severe storm (Bz=-60 nT) Proton event
08/23 14:54	08/23 19:23	238	-	08/23 21:36	LDE M2.7	Aug. 25, minor storm
08/29 11:06	08/29 19:19	202	08/29 19:01	08/31 16:46	backsided SW limb	Aug. 31 major storm (Bz=- 20 nT)
08/31 07:54	-	-	08/31 19:42	-		Sept. 2-3, major storm (Bz=~ -15 nT)
08/31 10:06	-	-	08/31 19:42	-		
08/31 11:06	-	-	08/31 19:42	-	LDE C2.0	
08/31 22:30	09/01 01:00	320	09/01 14:34	09/03 21:56	backsided SE limb	

Onset time: time first visible in C2 field of view
CACTus: Computer Aided CME Tracking (software developed by the SIDC)
LASCO: SOHO-LASCO Operations, G. Stenborg
FF: Fearless Forecast (a NOAA trial service)
e-mail time CACTus/LASCO/FF: time alert e-mail sent group
da: angular width of CME, measured by CACTus
Ass. Events: Associated Events, Long Duration Event, flare class