Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

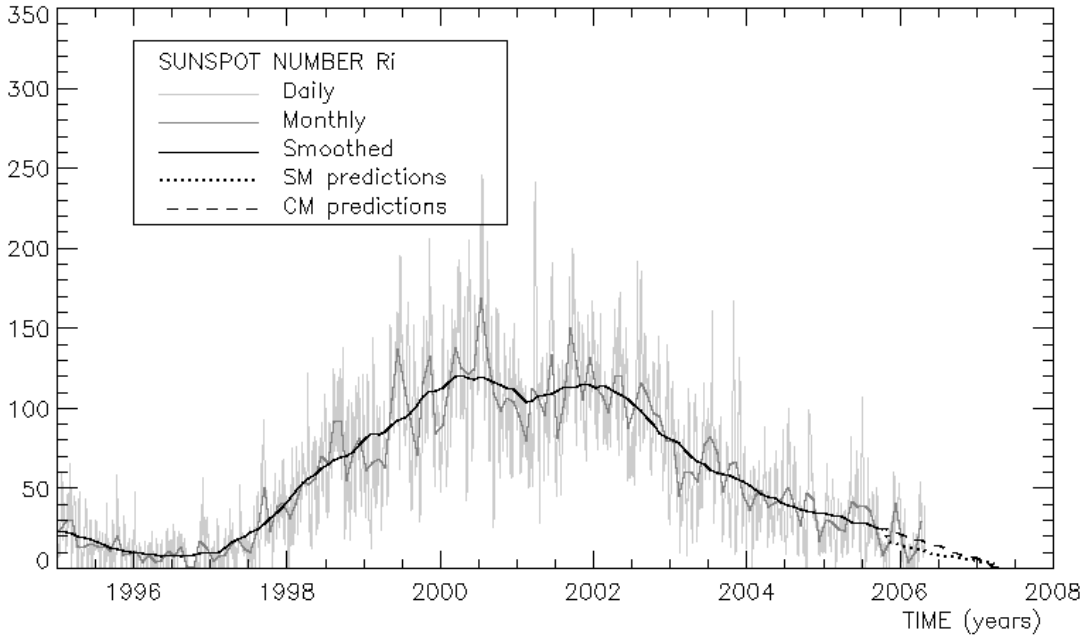
SUNSPOT BULLETIN

2006 n° 4

Provisional international and normalized hemispheric daily sunspot numbers for April 2006

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	35	0	35
2	39	0	39
3	44	0	44
4	49	0	49
5	50	0	50
6	54	0	54
7	46	0	46
8	41	0	41
9	33	0	33
10	36	0	36
11	38	0	38
12	41	0	41
13	40	0	40
14	36	0	36
15	23	0	23
16	15	0	15
17	8	0	8
18	7	0	7
19	14	0	14
20	10	0	10
21	9	0	9
22	11	6	5
23	8	0	8
24	11	0	11
25	28	0	28
26	35	0	35
27	39	0	39
28	37	0	37
29	32	0	32
30	37	0	37
Monthly mean	**30.2**	**0.2**	**30.0**
Cooperating stations	**47**	**39**	**39**



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for October 2005 : 25.5 (± 5%)

	SM	CM		SM	CM		SM	CM
2005 Nov	23	24	2006 May	14	16	2006 Nov	8	8
Dec	19	23	Jun	13	15	Dec	8	8
2006 Jan	18	21	Jul	12	14	2007 Jan	7	6
Feb	17	20	Aug	11	12	Feb	6	5
Mar	16	19	Sep	10	11	Mar	6	2
Apr	15	18	Oct	9	9	Apr	5	2

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, May 1, 2006 11:13 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	24	47	-	86	////	0	0/0	6	
1	35	65	-	87	////	0	0/0	2	
2	39	88	-	91	////	0	0/0	2	
3	44	114	-	100	////	0	0/0	2	
4	49	148	-	100	////	0	0/0	15	
5	50	129	-	99	////	0	0/0	25	
6	54	91	-	99	////	10	2/0	8	
7	46	38	-	95	////	0	0/0	3	
8	41	22	-	91	////	0	0/0	5	
9	33	12	-	89	////	0	0/0	41	
10	36	28	-	89	////	0	0/0	13	
11	38	26	-	90	////	11	0/0	5	
12	41	25	-	81	////	0	0/0	2	
13	40	22	-	80	////	0	0/0	14	
14	36	15	-	79	////	0	0/0	38	
15	23	17	-	78	////	0	0/0	31	
16	15	9	-	77	////	0	0/0	11	
17	8	3	-	78	////	0	0/0	8	
18	7	3	-	75	////	0	0/0	10	
19	14	3	-	76	////	0	0/0	3	
20	10	6	-	79	////	0	0/0	6	
21	9	10	-	79	////	0	0/0	11	
22	11	2	-	82	////	0	0/0	24	
23	8	3	-	87	////	0	0/0	8	
24	11	13	-	93	////	2	0/0	6	
25	28	38	-	95	////	0	0/0	4	
26	35	58	-	100	////	13	1/0	4	
27	39	41	-	101	////	10	1/0	5	
28	37	88	-	100	////	1	0/0	10	
29	32	75	-	101	////	1	0/0	3	
30	37	94	-	100	////	1	0/0	0	

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 APRIL 2006

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-5 WM-2	QUAL	OBS
1	920	3	25	55	0	55	31	25.5	2	AE
2	1020	3	49	79	0	79	79	39.5	3	AE
3	1440	3	53	83	0	83	83	76.1	2	AE
4	810	4	60	100	0	100	100	115.1	3	OB
5	1400	5	41	91	0	91	49	83.2	3	OB
6	800	5	42	92	0	92	30	72.4	3	OB
7	745	5	21	71	0	71	29	14.3	3	OB
8	705	4	21	61	0	61	17	6.7	2	FC
9	910	4	19	59	0	59	25	2.6	3	FC
10	1030	4	23	63	0	63	39	28.9	2	AE
11	755	4	22	62	0	62	17	23.0	3	AE
12	1220	5	18	68	0	68	23	19.2	3	OB
13	1150	4	7	47	0	47	25	7.7	1	AE
14	830	5	5	55	0	55	22	5.0	1	AE
16	1210	1	1	11	0	11	11	0.3	2	OB
17	1000	1	1	11	0	11	0	0.3	2	OB
18	620	1	1	11	0	11	0	0.2	3	OB
19	1000	0	0	0	0	0	0	0.0	2	OB
20	1510	1	10	20	0	20	20	1.6	2	OB
21	1530	1	5	15	0	15	15	21.3	3	OB
22	1025	0	0	0	0	0	0	0.0	2	DB
23	810	1	2	12	0	12	0	0.6	2	DB
24	900	1	6	16	0	16	0	6.4	1	AE
25	825	4	16	56	0	56	0	4.6	2	AE
26	1110	4	28	68	0	68	0	8.4	2	AE
27	1100	4	28	68	0	68	28	11.8	2	AE
28	1230	3	36	66	0	66	34	44.6	3	AE
29	715	3	29	59	0	59	46	95.7	3	LR
30	820	4	35	75	11	64	64	78.6	3	OB

The relative mean sunspot number is 50.8.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR APRIL 2006

K'= 0.784 (*)

1	43	7	56	13	37	19	0	25	44
2	62	8	48	14	43	20	16	26	53
3	65	9	46	15	***	21	12	27	53
4	78	10	49	16	9	22	0	28	52
5	71	11	49	17	9	23	9	29	46
6	72	12	53	18	9	24	13	30	59

The normalised relative monthly mean sunspot number is 40.

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

The Sun has been observed 29 days on 30 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR APRIL 2006
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
5-2041	3 26.6	28 B	4 2.3	6 E	4 9.1
7-2042	4 22.6	23 C	4 29.4	30 E	5 6.1

PROBABLE RETURN OF MAJOR GROUPS FOR MAY 2006

Nø	New East Limb	New CMP	New West Limb
5	4 22.6	4 29.4	5 6.1
7	5 19.5	5 26.2	6 2.0

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

For the first time in 2006, the noticeable events list is not empty. GOES recorded 4 M-flares, the largest an M7.9. None of the flares was associated with a CME or proton event. The monthly mean of the provisional international sunspot number indicated also an increase in activity: its value was 30.0 this month compared with 9.1 in March. But in all, apart from the M-flares and increased solar activity indices, we had once again a relatively quiet month.

In the first part of the month, sunspot groups came in gangs of 3: Catania sunspot group 19, 20 and 21 (NOAA 0865, 0866 and 0867) and Catania sunspot group 26, 27 and 28 (NOAA 0871, 0873 and 0872 respectively). Catania 19 rotated onto the east limb at the end of March, with Catania sunspot group 20 just behind, while Catania 21 popped up on the solar disk on Apr 01. During Apr 10-11, they rotated behind the west limb. Just before this time, the second series of groups became visible at the east limb. Catania 19 produced two M-flares on Apr 06, while Catania 21 was responsible for C8 and C9.7 flares on Apr 05 and 07 respectively. The second group of 3 active regions did not produce any M-flare.

On Apr 22, SOHO/MDI showed the magnetic imprint of a quiet big and complex group on the east limb: Catania sunspot group 31 (NOAA 0875). A trailing group was visible from Apr 24: Catania 32 (NOAA 0876). Catania 31 produced one C-flare on Apr 24. The next day, it was responsible for a long duration C-flare. Small post-flare loops were visible in EIT195. LASCO showed an east-directed CME. The same group was responsible for several more C-flares and for the M1.3 and M7.9 flares on Apr 26 and 27 respectively. The flares were not accompanied by a CME and the proton fluxes stayed at a normal level. From Apr 26, the magnetic configuration of this sunspot group became less complex, but it still produced on May 1 a long duration C-flare. A coronal dimming and the post flare loops were clearly visible in EIT195. CACTus detected a small west-directed CME that had no earth-directed component. On Apr 29, some loops in EIT195 became visible from behind the solar disk on the east side. It was Catania sunspot group 34 (NOAA 0878) producing also several C-flares that and the next days.

A few other eruptive events were noticed this month. On Apr 1, a nice prominence eruption was visible in EIT304, 19:18UT on the west limb. The associated CME was directed to the west. From Apr 10, one could follow the transit of a large filament over the solar disk in H-alpha images made by Catania Observatory. The filament remained stable and did not erupt. The trailing part disappeared behind the west limb on Apr 24. On Apr 19 SOHO/EIT observed the development of coronal dimmings south of the solar disc center. It was accompanied by the disappearance of the H-alpha filament. No halo CME was reported.

Once again, coronal holes characterized EIT284. We counted 4 of them this month. More details are given in the section below.

II. Geomagnetic Activity

There were 5 periods with some geomagnetic activity. None of them were caused by ICME arrivals. The causes of 4 out of 5 were found in fast solar wind streams emanating from coronal holes.

1. A small northern coronal hole passing the central meridian on Apr 02 was the cause of the active to minor storm conditions on Apr 05-06. The hole was rather small and the solar wind speed didn't rise above 450 km/s.
2. The first part of a southern coronal hole with an extension to the south pole passed the central meridian on Apr 07. On Apr 09-10, the solar wind emanating from this hole reached earth causing a geomagnetic storm with Kp up to 6.
3. A third hole, this time located on the equator, passed the central meridian on Apr 12. The north-south component (B_z) of the interplanetary magnetic field (IMF) imbedded in the solar wind was negative for a long episode resulting in a severe geomagnetic storm on Apr 14. On Apr 15, the solar wind speed reached even 700 km/s. This hole caused already during the previous rotation a storm with a similar magnitude.
4. On Apr 21 – 22, the interaction region between a slow and fast solar wind flow arrived and several intervals of Kp = 4 were observed. Late on Apr 22 the fast solar wind flow arrived. The solar wind could be traced to come from a small recurrent northern coronal hole passing the central meridian on Apr 17. The IMF magnitude remained close to average, so the geomagnetic conditions were quiet.
5. The last disturbance took place on Apr 28 for some confined period when B_z was temporarily -8nT. We found in ACE-data some evidence for a sector boundary crossing. The geomagnetic disturbances were only short-lived.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	Cat	NOAA	NOTE
06	0522	0533	0536	S07W54	M1.4	2F	65		19	0865	small EIT dimming
06	2033	2042	2050	S05W62	M1.2	1N	100		19	0865	
26	1651	1702	1710	S11E38	M1.3	1F		III/1	31	0875	
27	1522	1552	1558	S11E21	M7.9	1N			31	0875	

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

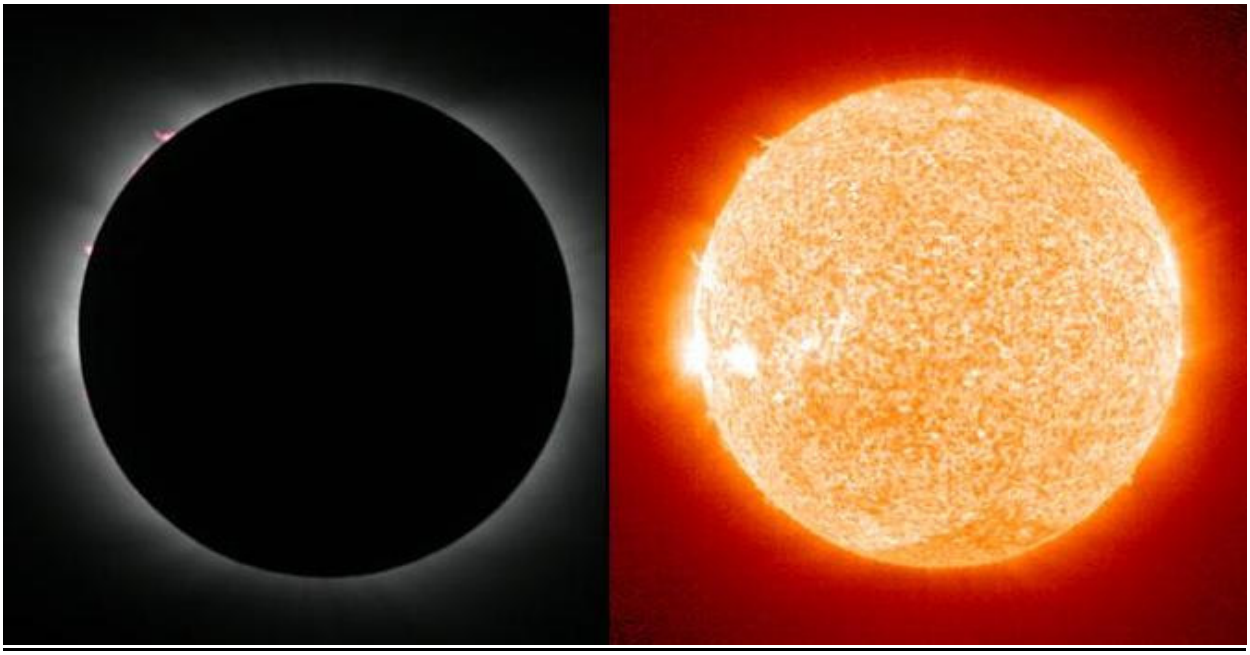
IV. Halo CME list

onset time	e-mail time CACTus	da	e-mail time LASCO	e-mail time FF	Ass. Events	consequences
04/10 11:06	-	-	04/11 13:50	-	backsided	-

Onset time: Utime 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: Utime alert e-mail sent by group
da: angular width of CME, measured by CACTus
Ass. Events: Associated Events, Long Duration Event, flare class

V. Picture of the montht



On the left, a picture in visible light (Jeroen Vanheuverswyn, Belgium, solar eclipse March 29, 2006, Turkey). There are two filaments visible on the eastern edge of the solar disk. For comparison, we put an SOHO/EIT 304 picture on the right showing the same two filaments.