Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

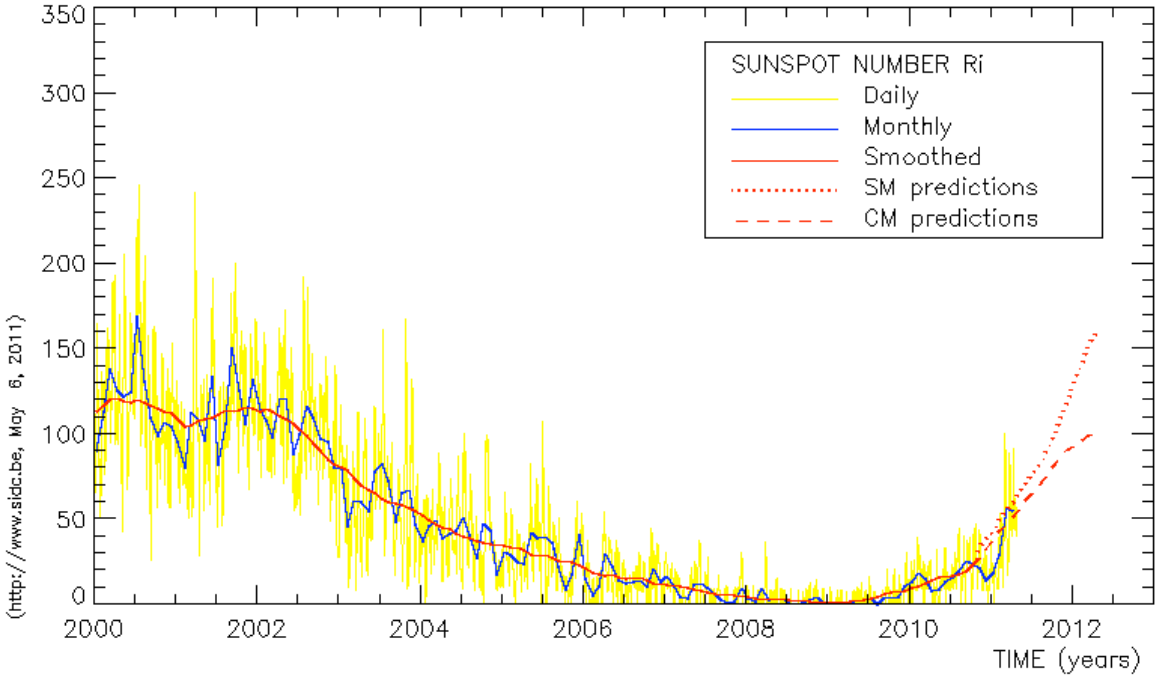
SUNSPOT BULLETIN

2011 n° 4

Provisional international and normalized hemispheric daily sunspot numbers for April 2011

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	48	37	11
2	45	29	16
3	43	43	0
4	48	48	0
5	40	40	0
6	41	41	0
7	58	45	13
8	60	41	19
9	56	45	11
10	40	32	8
11	48	40	8
12	66	66	0
13	79	79	0
14	88	88	0
15	91	83	8
16	66	66	0
17	51	51	0
18	51	51	0
19	51	42	9
20	52	38	14
21	57	26	31
22	62	20	42
23	56	17	39
24	46	14	32
25	40	11	29
26	53	21	32
27	52	28	24
28	44	25	19
29	44	25	19
30	57	36	21
Monthly mean	**54.4**	**40.9**	**13.5**
Cooperating stations	**66**	**62**	**62**



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for October 2010: 23.2 (± 5%)

	SM	CM		SM	CM		SM	CM
2010 Nov	26	27	2011 May	50	57	2011 Nov	85	88
Dec	28	32	Jun	56	62	Dec	92	91
2011 Jan	30	38	Jul	61	66	2012 Jan	101	93
Feb	34	43	Aug	67	72	Feb	110	96
Mar	39	47	Sep	73	77	Mar	121	99
Apr	44	52	Oct	79	82	Apr	132	102

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 method 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
31	66	53	-	113	////	3	0/0	3	
1	48	51	-	109	////	1	0/0	15	
2	45	47	-	108	////	1	0/0	24	
3	43	38	-	114	////	0	0/0	17	
4	48	43	-	113	////	0	0/0	8	
5	40	35	-	109	////	0	0/0	7	
6	41	58	-	117	////	0	0/0	28	
7	58	25	-	112	////	0	0/0	5	
8	60	23	-	109	////	1	0/0	16	
9	56	18	-	105	////	2	0/0	6	
10	40	20	-	105	////	0	0/0	3	
11	48	27	-	106	////	5	0/0	12	
12	66	29	-	110	////	18	0/0	23	
13	79	50	-	118	////	6	0/0	11	
14	88	79	-	119	////	29	0/0	5	
15	91	104	-	129	////	30	1/0	6	
16	66	95	-	119	////	10	0/0	4	
17	51	91	-	114	////	1	0/0	3	
18	51	86	-	111	////	5	0/0	8	
19	51	79	-	111	////	6	0/0	5	
20	52	63	-	117	////	5	0/0	18	
21	57	67	-	113	////	20	0/0	6	
22	62	69	-	115	////	55	2/0	6	
23	56	73	-	119	////	8	0/0	4	
24	46	70	-	117	////	101	0/0	8	
25	40	66	-	112	////	0	0/0	4	
26	53	38	-	109	////	0	0/0	3	
27	52	46	-	108	////	1	0/0	2	
28	44	40	-	110	////	1	0/0	4	
29	44	31	-	110	////	2	0/0	(28)	
30	57	23	-	110	////	5	0/0	(32)	

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 2011

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-5 WM-2	QUAL	OBS
2	715	4	22	62	38	24	39	74.2	3	OB
4	1115	4	39	79	79	0	39	26.0	3	SV
6	710	3	13	43	43	0	0	20.7	3	SV
7	725	6	19	79	56	23	12	9.2	3	SV
8	755	5	25	75	47	28	12	12.0	3	SV
9	725	4	18	58	45	13	21	7.4	2	SV
10	735	3	21	51	40	11	24	10.7	3	SV
11	735	3	32	62	62	0	51	10.9	2	OB
12	850	5	39	89	89	0	60	26.7	2	OB
13	800	5	24	74	74	0	38	29.3	2	OB
15	720	6	61	121	109	12	53	55.1	3	SV
16	800	6	51	111	111	0	12	49.3	2	OB
17	930	5	37	87	87	0	33	59.5	2	OB
18	700	4	47	87	87	0	70	74.4	3	OL
19	920	5	37	87	74	13	61	73.5	3	OL
20	705	4	42	82	66	16	54	66.8	4	OL
21	705	5	41	91	43	48	0	69.6	3	OL
22	720	4	59	99	28	71	0	63.4	3	OL
23	650	3	59	89	25	64	42	53.5	3	OL
24	945	3	29	59	16	43	27	33.1	2	AE
25	945	3	21	51	12	39	39	24.0	3	AE
26	800	5	23	73	29	44	61	33.5	3	AE
27	615	5	27	77	38	39	26	24.8	2	AE
28	1400	3	15	45	17	28	13	28.2	2	AE
29	945	4	12	52	27	25	12	14.2	2	AE
30	705	5	28	78	46	32	20	11.7	3	OL

The relative mean sunspot number is 75.4.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR APRIL 2011

K'= 0.784 (*)

1	***	7	62	13	58	19	68	25	40
2	49	8	59	14	***	20	64	26	57
3	***	9	45	15	95	21	71	27	60
4	62	10	40	16	87	22	78	28	35
5	***	11	49	17	68	23	70	29	41
6	34	12	70	18	68	24	46	30	61

The normalised relative monthly mean sunspot number is 59.

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

The Sun has been observed 26 days on 30 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR APRIL 2011
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
6-2108	3 21.4	22 D	3 28.1	2 G	4 3.9
14-2108	3 25.9	27 B	4 1.7	7 A	4 8.4
5-2109	4 12.5	15 E	4 19.2	25 C	4 26.0

PROBABLE RETURN OF MAJOR GROUPS FOR MAY 2011

Nø	New East Limb	New CMP	New West Limb
14	4 22.3	4 29.0	5 5.8
5	5 10.1	5 16.9	5 23.6

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

Flaring activity was situated mainly in the C-level, several sunspot groups populated the solar disk and every day at least one CME was identified by CACTus in e.g. STEREO B/COR2 images.

A large number of sunspot groups transited the solar disk this month. The background X-ray radiation stayed although in the B-level, except on Apr 15-16 and Apr 22. These days, 3 M-flares occurred. There was no plasma eruption associated with these pulses of radiation.

Early Apr 15, a faint CME becomes visible in STEREO/COR2. With a speed of 328 - 390 km/s according to CACTus measured with coronographic images of respectively STEREO A and STEREO B, it is heading Earth.

On Apr 17, LASCO detected a halo CME. Putting the LASCO images next to the images of the coronograph STEREO-B/COR2, we determine the CME to be backwards and not directed towards the Earth.

We list the coronal holes (CH) transiting the solar disk this month:

- A small faint southern CH reached the central meridian (CM) on Mar 31.
- An extension of the southern polar CH reached the CM on Apr 08.
- Another extension of the southern polar CH reached the CM on Apr 15.
- An equatorial CH reached the CM on Apr 26.

II. Geomagnetic Activity

The magnetosphere responded to coronal hole wind streams. One CME arrival could be identified.

The arrival of the co-rotating interaction region linked with the first CH mentioned in the previous section is hard to distinguish in ACE data. The plasma structure that arrived on Mar 29 was still dominating the data. The solar wind was at its maximum of 700 km/s on Apr 02. Kp reached several times the value 4 from Apr 01 to Apr 03. It is although not clear if the CH is the origin of this high solar wind speed stream.

The jump in the interplanetary magnetic field ACE data of Apr 06 originated probably from a sudden sector boundary crossing. The north-south component changed instantaneously from positive to negative values (-10nT) leading to an isolated minor geomagnetic storm on Apr 06.

The solar wind carried a compressed magnetic field with it on Apr 11. This was the precursor from the fast solar wind emanating from the second CH mentioned in the previous section, leading to two periods with Kp=5 on Apr 12.

Another discontinuity was visible in ACE data on Apr 18. Although the total magnetic field carried by the solar wind jumped from a low value (3nT) to a high value (>10nT), the geomagnetic response was limited to one period with Kp=4. This jump can be traced back to the CME of early Apr 15 (see previous section).
A shock like co-rotating interaction region arrived on Apr 19. The solar wind rose to 550 km/s on Apr 20 leading to a maximum for Kp of 5 on that day.

Another CH fast solar wind arrived on Apr 29. The maximum value of the speed was reached on Apr 30. The solar wind speed started to decline only from May 03. The magnetosphere was disturbed with Kp=4 from end Apr 29 until May 03. Kp became twice 5, on Apr 30 and May 02.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	TENCM	TYPE	Cat	NOAA
15	1702	1712	1728	N14W19	M1.3	1F	64			1190
22	0435	0457	0514	S18E43	M1.8	SN			58	1195
22	1547	1553	1611	S18E35	M1.2	1N			58	1195

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. Noticeable radio bursts in Humain

DAY	BEGIN	END	TYPE	DESCRIPTION	BRIGHTNESS	START FREQ	STOP FREQ
05	13:17:45	13:20:59	III	G	3	79	46
19	14:22:58	14:23:16	III	B, U	3	80	45X
20	05:43:58	05:45:28	III	G	3	80	45X
20	06:33:45	06:52:15	III	G, N	3	79	45X
20	14:39:12	14:41:49	III	G	3	204	46
21	12:00:04	12:01:23	III	G, U	3	159	46
21	12:14:42	12:14:54	III	B	3	80	47

Explanations: times are in UT. G and GG mean respectively group of less and more than 10 type III bursts; N means sporadic occurrence; B means single burst; U means type U burst. Frequencies are expressed in MHz. An X in the frequency column means that the burst extends beyond the frequency range of the instrument. Only the brightest bursts (brightness of 3) or the ones significant for space weather are reported.