Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

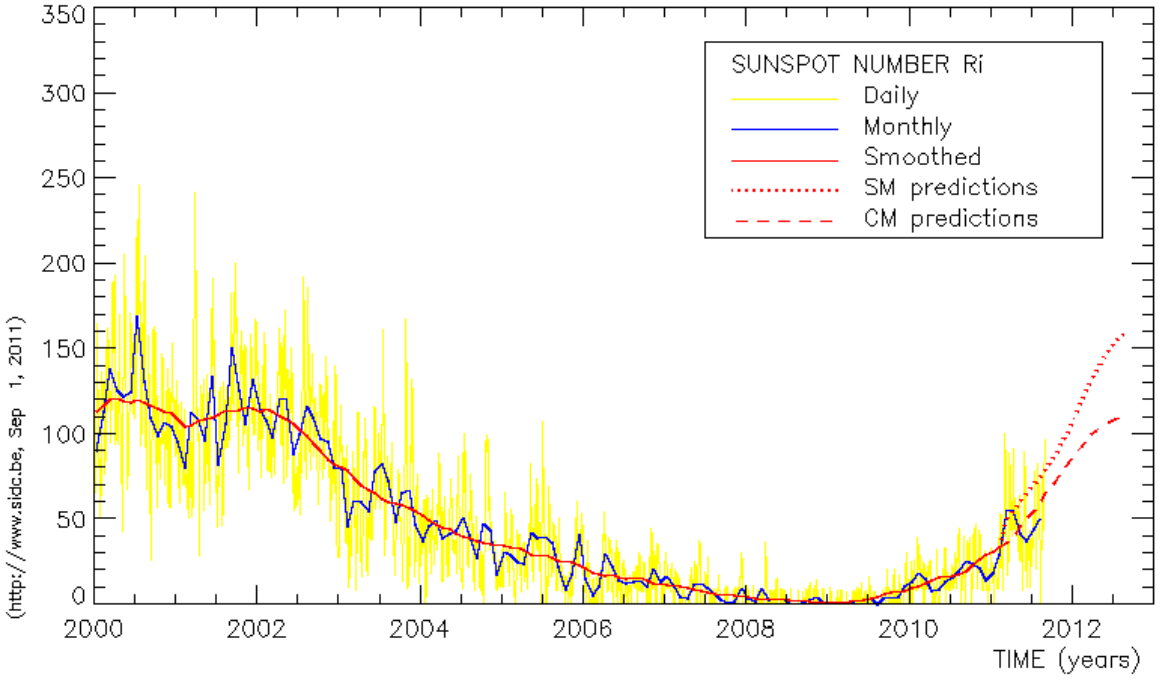
SUNSPOT BULLETIN

2011 n° 8

Provisional international and normalized hemispheric daily sunspot numbers for August 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	82	82	0
2	73	73	0
3	62	62	0
4	71	71	0
5	68	57	11
6	61	50	11
7	61	48	13
8	54	46	8
9	47	40	7
10	28	28	0
11	29	18	11
12	22	13	9
13	14	7	7
14	0	0	0
15	9	9	0
16	24	17	7
17	39	22	17
18	45	26	19
19	46	30	16
20	45	35	10
21	56	44	12
22	71	58	13
23	75	63	12
24	54	46	8
25	50	44	6
26	66	66	0
27	59	59	0
28	49	41	8
29	43	34	9
30	69	51	18
31	96	73	23
Monthly mean	**50.6**	**42.4**	**8.2**
Cooperating stations	**71**	**66**	**66**



Predictions of the monthly smoothed Sunspot Number

using the last provisional value, calculated for February 2011: 33.4 (± 5%)

	SM	CM		SM	CM		SM	CM
2011 Mar	35	36	2011 Sep	66	67	2012 Mar	102	99
Apr	39	41	Oct	71	72	Apr	111	102
May	45	46	Nov	76	78	May	120	105
Jun	50	50	Dec	81	83	Jun	129	107
Jul	56	55	2012 Jan	87	88	Jul	136	109
Aug	61	61	Feb	94	93	Aug	143	111

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

Brussels, September 1, 2011 10:25 UT

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Web: http://sidc.oma.be, "Sunspots" section in sidebar.

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

Date	R'_i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
31	67	147	-	119	////	12	0/0	11	
1	82	167	-	125	////	49	0/0	8	
2	73	198	-	122	////	39	1/0	6	
3	62	162	-	120	////	129	3/0	5	
4	71	140	-	116	////	131	1/0	6	
5	68	131	-	109	////	9	0/0	45	
6	61	82	-	110	////	12	0/0	28	
7	61	71	-	105	////	16	0/0	11	
8	54	50	-	102	////	16	1/0	10	
9	47	29	-	98	////	121	1/1	11	
10	28	7	-	90	////	4	0/0	8	
11	29	3	-	84	////	0	0/0	6	
12	22	4	-	83	////	0	0/0	5	
13	14	4	-	83	////	0	0/0	4	
14	0	///	-	88	////	0	0/0	15	
15	9	2	-	90	////	0	0/0	14	
16	24	12	-	93	////	0	0/0	10	
17	39	24	-	98	////	5	0/0	8	
18	45	36	-	98	////	7	0/0	3	
19	46	55	-	98	////	0	0/0	4	
20	45	45	-	101	////	4	0/0	6	
21	56	58	-	101	////	8	0/0	4	
22	71	59	-	108	////	0	0/0	10	
23	75	53	-	104	////	2	0/0	13	
24	54	32	-	104	////	8	0/0	9	
25	50	21	-	104	////	4	0/0	7	
26	66	30	-	105	////	4	0/0	6	
27	59	29	-	104	////	0	0/0	7	
28	49	18	-	101	////	4	0/0	7	
29	43	23	-	101	////	0	0/0	11	
30	69	35	-	101	////	13	0/0	4	
31	96	47	-	109	////	8	0/0	1	

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 2011

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-5 WM-2	QUAL	OBS
1	645	4	50	90	90	0	79	106.4	3	SV
2	640	4	46	86	86	0	60	116.1	3	SV
4	700	4	43	83	83	0	26	45.1	3	SV
7	720	3	39	69	51	18	34	63.3	3	OL
8	1051	4	37	77	65	12	50	51.2	2	OL
9	655	3	25	55	41	14	37	39.0	4	OL
10	840	2	12	32	32	0	0	1.7	3	SV
11	730	3	5	35	23	12	0	2.1	2	OL
12	930	3	6	36	23	13	13	2.3	3	OL
15	630	1	1	11	11	0	0	0.0	2	SV
16	915	1	7	17	17	0	0	5.1	3	SV
17	815	2	11	31	20	11	0	8.6	3	SV
18	950	2	13	33	22	11	0	14.6	1	SV
20	735	2	11	31	20	11	20	22.7	3	SV
21	845	3	15	45	29	16	34	41.8	3	SV
22	1310	4	42	82	66	16	59	28.4	2	OB
23	1150	4	34	74	57	17	32	29.0	3	FC
24	1345	4	17	57	46	11	0	18.2	2	FC
25	755	5	20	70	59	11	0	15.0	2	FC
26	635	4	18	58	58	0	12	26.7	2	FC
27	730	7	22	92	69	23	40	29.7	3	FC
28	820	4	10	50	38	12	14	6.3	2	FC
29	635	4	9	49	35	14	24	5.9	3	FC
31	755	8	37	117	83	34	59	12.3	3	OB

The relative mean sunspot number is 57.5.

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

K'= 0.747 (*)

1	67	7	52	13	***	19	***	25	52
2	64	8	58	14	***	20	23	26	43
3	***	9	41	15	8	21	34	27	69
4	62	10	24	16	13	22	61	28	37
5	***	11	26	17	23	23	55	29	37
6	***	12	27	18	25	24	43	30	***
								31	87

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 24 days on 31 possible.

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

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
2-2113	7 25.7	27 D	8 1.5	4 D	8 8.2
3-2113	7 27.5	28 D	8 3.3	10 C	8 10.0

PROBABLE RETURN OF MAJOR GROUPS FOR SEPTEMBER 2011

Nø	New East Limb	New CMP	New West Limb
2	8 21.6	8 28.4	9 4.1
3	8 24.4	8 31.1	9 6.9

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

The Sun is shifting to an even higher activity level compared to the previous month. The higher values of the International Sunspot Number and the 10cm flux translated into a series of events: a sequel of Earth-directed CME's and flares, the up to now strongest flare of the current cycle and a proton event.

There were two periods with remarkable strong solar activity during the first part of the month, from Aug 02 until Aug 04 and from Aug 08 to Aug 09.

During the first period, a sequence of 3 M-flares and associated CME's was spread over 3 days. Each flare was stronger then the previous one. The same holds for the plasma clouds: the speed of each CME was estimated to be faster then the previous one. Full details are found in the weekly bulletin - http://www.sidc.be/html/SWAPP/weeklybulletin/2011/week553.txt.

The flare of the second period with strong solar activity was press-worthy: the X6.9 flare in the morning of Aug 09 is up to now the largest flare of the present solar cycle. The source region was located at N18W80. The event triggered a proton storm but the associated CME could not reach the Earth. More to read on http://www.sidc.be/html/SWAPP/weeklybulletin/2011/week554.txt

Further flaring activity was located in the C-level.

We list the coronal holes (CH) present on the solar disk and indicate when the first part touches the central meridian.

- Aug 04, small southern CH,
- Aug 11, long stretched equatorial CH,
- Aug 17, small southern CH, between 20°S and 40°S, 20° wide,
- Aug 19, near the solar equator, diagonal between 10°S and 20°N.
- Aug 24, main part between 20°N and 40°N with a small extension towards the north pole.

II. Geomagnetic Activity

The event of this month occurred on Aug 05-06 when a CME cannibal arrived: the geomagnetic disturbance was the strongest once measured this solar cycle.

The consequences for Earth of the solar activity were the strongest on Aug 05 and 06 when two CME's bundled together and arrived as one. Aurora was seen in places with latitudes comparable to Belgium. More to read on http://www.sidc.be/html/SWAPP/weeklybulletin/2011/week553.txt

The plasma eruption linked with the X6.9 flare did not blow over our magnetosphere, there was not even a glancing blow. The source region was located near the west limb.

The solar wind emanating from the Aug 04 CH peaked on Aug 08-09. The arrival of the co-rotating interaction region is masqueraded by the arrival on Aug 05 and aftermath of the cannibal CME. The geomagnetic conditions became only unsettled.

The solar wind speed curve profile from late Aug 13 until Aug 16-17 matches the length of the Aug 11 CH. The planetary geomagnetic conditions became unsettled, we had one period of active conditions early Aug 15.

The solar wind emanating from the Aug 17 CH could hardly overrun the background solar wind, while the solar wind of the Aug 19 CH left a clear ACE signature from Aug 23 until Aug 25. The arrival of the co-rotating interaction region linked with this hole is however vague, but the magnetically compressed region followed by a fast solar wind is easily recognized (a bump in the curve). The planetary geomagnetic response was limited: unsettled conditions and one active period late Aug 23.

The influence of the Aug 24 CH was also limited: unsettled conditions on Aug 29.

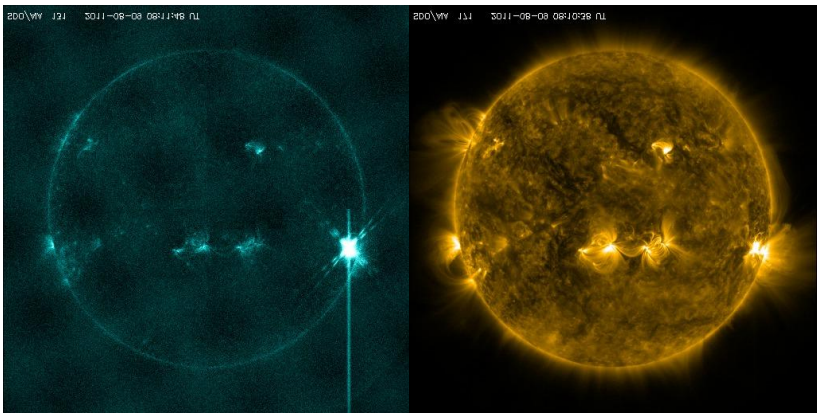
III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	TENCM	TYPE	Cat	NOAA	NOTE
02	0519	0619	0648	N14W15	M1.4	1N	220	CTM/1,II/2		1261	CME
03	0308	0337	0351	N17W24	M1.1	SF				1261	
03	0429	0432	0435	N15E08	M1.7	1F	130			1263	
03	1317	1348	1410	N16W30	M6.0	2B	180	IV/2,III/1,II/1,VI/1		1261	Halo CME
04	0341	0357	0404	N19W36	M9.3	2B	720	III/3,II/2,V/3,VI/2		1261	Halo CME
08	1800	1810	1818	N16W61	M3.5	1B	300	II/1,VI/2		1263	
09	0319	0354	0408	N18W68	M2.5	1B		VI/1,III/2		1263	
09	0748	0805	0808	N17W69	X6.9	2B	710	II/1		1263	

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. Report of the solar event on Aug 09, 2011

A powerful solar event occurred on Aug 09 at 08:05 UT on the Sun. Email alerts were sent.



A strong **burst of radiation**, a flare, was measured by the GOES satellite. The flare was also seen as a light flash in PROBA2/SWAP and SDO/AIA images. Solar radiation reaches the Earth after 8 minutes. This flare is up to now the strongest flare of the current solar cycle.

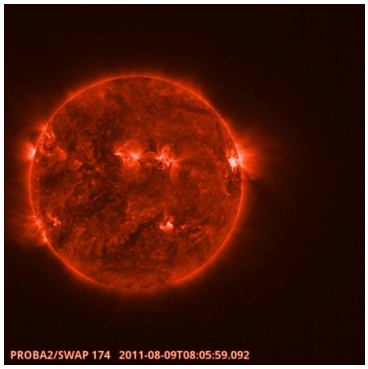
Shortly after the peak of the flare, the **proton flux** near Earth increased. GOES is also capable of measuring these energetic electrical particles. The Sun throws a whole bunch of these particles into space, more than usual. The proton flux passed the storm threshold. The storm level is not dramatic.

A **plasma cloud** left the Sun at the moment of the event. It is now traveling through space at a speed of more than 1000 km/s. At this speed of 1000 km/s and without any deceleration, a cloud bridges the distance between the Sun and the Earth in 1 day and 17 hours. The plasma cloud is not directed straight at Earth. But a glancing blow is possible and can cause a geomagnetic storm.

Possible **consequences** on the day side of the Earth associated with the radiation burst:
Radio communication can be interrupted - satellites orbiting just above the Earth's atmosphere can feel a drag force - less accurate measurements with navigation systems based on satellites - disturbance of radio signals passing through the ionosphere, i.e. satellite telephone.
Possible **consequences** associated with the proton event:
Additional radiation at the Earth poles and in space (ISS is vulnerable) - Radio communication disruption at the poles.
Possible **consequences** when the the plasma cloud arrives at Earth:

Aurora, chances are higher in high latitude regions, near the Earth poles. The chances for aurora in Belgium are limited. - drag on satellites - disturbances in HF radio.

Through the eye of PROBA2



SWAP and LYRA onboard PROBA2 also recorded the solar flare of class X6.9, the strongest so far in the current solar cycle. At the time of the flare, PROBA2 was off pointed to the west limb, close to where the flaring active region was located, so that part of the event could be observed off-limb.
The whole event was also observed in many different wavelengths, and high resolution, by SDO/AIA. But unfortunately blooming (see the blue-green Sun, left side) and diffraction highly affect the observations of the flaring site. As the CMOS detector of SWAP does not suffer from blooming, and thanks to its large FOV, SWAP and AIA data are