

## Center

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**SUNSPOT BULLETIN**

2010 n° 6

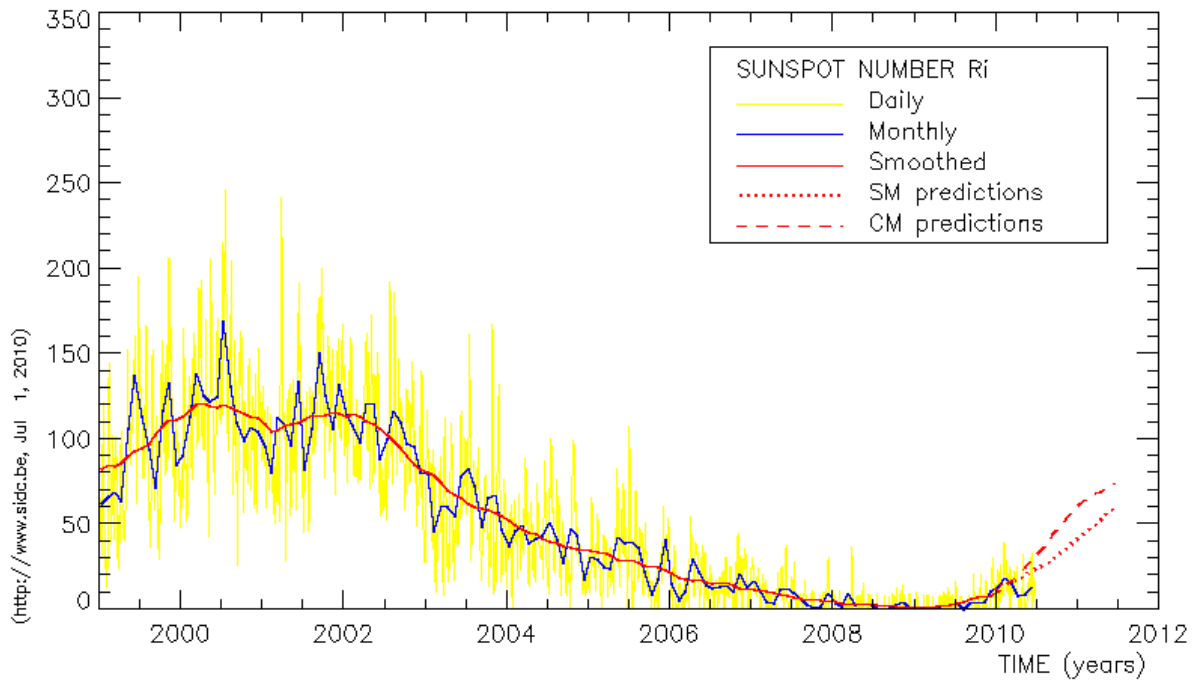
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**Provisional international and normalized hemispheric daily sunspot numbers for June 2010**


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computed at the *Royal Observatory of Belgium* using observations from an international network with the *Locarno Specola Solare* as reference station.

Date	R' <sub>1</sub>	R' <sub>N</sub>	R' <sub>S</sub>
1	11	0	11
2	13	0	13
3	15	0	15
4	20	0	20
5	19	8	11
6	9	0	9
7	13	7	6
8	10	0	10
9	21	0	21
10	28	0	28
11	33	14	19
12	33	15	18
13	18	11	7
14	10	10	0
15	0	0	0
16	0	0	0
17	9	9	0
18	9	9	0
19	19	19	0
20	11	11	0
21	10	10	0
22	11	11	0
23	10	10	0
24	9	9	0
25	12	6	6
26	13	0	13
27	8	0	8
28	8	0	8
29	16	0	16
30	8	0	8
<b>Monthly mean</b>	<b>13.5</b>	<b>5.3</b>	<b>8.2</b>
<b>Cooperating stations</b>	<b>70</b>	<b>62</b>	<b>62</b>



**Predictions of the monthly smoothed Sunspot Number**  
 using the last provisional value, calculated for December 2009 :  $8.3 (\pm 5\%)$

	<b>SM</b>	<b>CM</b>		<b>SM</b>	<b>CM</b>		<b>SM</b>	<b>CM</b>			
2010	Jan	9	11	2010	Jul	19	34	2011	Jan	33	62
	Feb	11	14		Aug	21	38		Feb	36	65
	Mar	13	17		Sep	23	44		Mar	39	67
	Apr	14	21		Oct	25	49		Apr	43	69
	May	15	25		Nov	28	53		May	46	72
	Jun	17	29		Dec	30	58		Jun	50	74

**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' <sub>i</sub>	PPSI	600	2800	COS	SFI	XI	Ak	SEA
31	11	2	-	72	////	0	0/0	22	
1	11	4	-	73	////	0	0/0	16	
2	13	6	-	74	////	2	0/0	10	
3	15	32	-	75	////	1	0/0	12	
4	20	14	-	72	////	0	0/0	16	
5	19	10	-	70	////	0	0/0	6	
6	9	5	-	68	////	0	0/0	8	
7	13	1	-	69	////	0	0/0	6	
8	10	5	-	72	////	0	0/0	4	
9	21	22	-	///	////	///	///	6	
10	28	19	-	///	////	///	///	9	
11	33	19	-	75	////	0	0/0	5	
12	33	14	-	76	////	2	1/0	3	
13	18	7	-	76	////	10	1/0	8	
14	10	0	-	73	////	1	0/0	5	
15	0	1	-	70	////	0	0/0	10	
16	0	///	-	72	////	0	0/0	24	
17	9	2	-	70	////	1	0/0	12	
18	9	2	-	71	////	0	0/0	8	
19	19	7	-	69	////	0	0/0	4	
20	11	7	-	70	////	0	0/0	5	
21	10	10	-	72	////	0	0/0	8	
22	11	6	-	73	////	0	0/0	7	
23	10	6	-	74	////	0	0/0	5	
24	9	2	-	74	////	0	0/0	7	
25	12	2	-	75	////	0	0/0	10	
26	13	2	-	75	////	0	0/0	15	
27	8	5	-	73	////	0	0/0	16	
28	8	8	-	74	////	0	0/0	10	
29	16	13	-	74	////	0	0/0	14	
30	8	2	-	74	////	0	0/0	18	

- R'<sub>i</sub>** : provisional international sunspot numbers from the S.I.D.C.
- PPSI** : prompt photometric sunspot index from the S.I.D.C. in  $10^{-5} \text{ w/m}^2$  : 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 :  $1 \times \text{Sn} + 10 \times "1" + 100 \times ">1"$ ).
- 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 JUNE 2010

DATE	UT	NUMBER		RELATIVE SUNSPOT NUMBERS			PPSI 10-5 WM-2	QUAL	OBS	
		OF GROUPS	OF SPOTS	TOTAL	NORTH	SOUTH				CENTRAL
1	923	1	10	20	0	20	20	1.4	2	OL
2	1131	1	12	22	0	22	22	5.5	3	OL
3	640	1	9	19	0	19	0	18.7	3	SV
4	1058	1	11	21	0	21	0	14.4	3	OL
5	724	2	8	28	12	16	0	3.1	4	OL
6	713	1	4	14	0	14	0	1.6	3	OL
7	1105	0	0	0	0	0	0	0.0	1	SV
8	735	1	3	13	0	13	0	1.0	3	SV
11	950	4	11	51	25	26	0	12.9	3	SV
12	925	4	11	51	16	35	0	5.6	2	SV
14	720	1	6	16	16	0	0	0.3	3	OL
15	745	0	0	0	0	0	0	0.0	2	OL
16	718	0	0	0	0	0	0	0.0	2	OL
17	732	1	3	13	13	0	0	0.9	2	OL
18	955	1	3	13	13	0	0	4.3	3	OL
19	823	2	10	30	30	0	14	6.7	4	OL
21	1630	1	5	15	15	0	15	19.0	3	AE
22	800	1	5	15	15	0	0	4.7	2	AE
23	730	1	2	12	12	0	0	13.4	2	AE
24	800	1	3	13	13	0	0	2.5	2	AE
25	700	3	5	35	23	12	0	0.6	4	AE
26	900	3	5	35	11	24	0	1.6	3	AE
27	830	3	4	34	0	34	11	1.2	3	AE
28	803	1	1	11	0	11	0	1.0	2	OB
29	730	1	1	11	0	11	0	1.4	2	OB
30	755	1	1	11	0	11	0	1.8	2	OB

The relative mean sunspot number is 19.3.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS  $U'=K'U$  FOR JUNE 2010

$K' = 0.741$  (\*)

1	15	7	0	13	***	19	22	25	26
2	16	8	10	14	12	20	***	26	26
3	14	9	***	15	0	21	11	27	25
4	16	10	***	16	0	22	11	28	8
5	21	11	38	17	10	23	9	29	8
6	10	12	38	18	10	24	10	30	8

The normalised relative monthly mean sunspot number is 14.

(\*)  $K'$  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 JUNE 2010  
E AND F BRUNNER'S TYPE GROUPS

NONE

PROBABLE RETURN OF MAJOR GROUPS FOR JULY 2010

NONE

# MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

## I. Solar Activity

*Solar activity is going moderately up. Only two days with an estimated sunspot index of zero were counted this month.*

Jun 08 marked the birth of two strong magnetic field line bundles in the southern hemisphere: the Catania Sunspot groups 81 (NOAA AR 1078) and 82. Catania 82 restructured into Cat 82/85/86 on Jun 10 and was labeled by NOAA as AR 1079 and AR 1080. On Jun 11, Catania sunspot group 87 / NOAA AR 1081 popped up in the northern hemisphere.

On Jun 09, Cat 82/AR 1080 was the source region of several small flares associated with a coronal dimming and tiny mass ejections. A June 12-13 SWAP movie shows increasing activity, flares, post-flare loops, opening of magnetic field lines and escaping mass in the active regions 1080 and 1081. These magnetic regions are at that moment located near the west limb. CACTus detected several westward ejected CME's.

To quantize the flaring activity: NOAA AR 1081 was responsible for an M2.0 flare peaking at 00:57 on Jun 12. NOAA AR 1079 produced an M1.0 flare peaking at 05:39, Jun 13.

The remaining days of the month, some B-flares were captured in the northeast, near Cat 89/NOAA AR 1082. But this flaring activity had no space weather response.

We list the coronal holes (CH) transiting the solar disk and indicate when the leading edge touched the central meridian (CM):

- A low-latitude extension of the northern polar CH reached the CM on May 28,
- a small horizontally long stretched (from the south pole up to 30°N) CH, Jun 04,
- again a horizontally long stretched (from 45°S up to 45°N) CH, Jun 12,
- the recurrent vertically long stretched extension of the northern polar CH, Jun 23. The polar part is on Jun 28 located near the middle of the solar disk.

## II. Geomagnetic Activity

*Quiet periods alternated with active periods. The active periods were induced by fast winds emanating from CHs or a sector boundary crossing.*

The Earth was on the first day of the month under the influence of the CH first mentioned in the previous section. The Kp was 4.

Due to the sector boundary crossing on Jun 03, the geomagnetic conditions became active and during one exceptional period Kp became 5.

A magnetically compressed co-rotating interaction region (CIR) arrived late Jun 09. This structure was linked with the second CH. The solar wind speed increased to almost 500 km/s. A geomagnetic response was absent.

Another CIR signature was visible in ACE data on Jun 15. The associated CH was stronger compared with the previous long stretched CH. The geomagnetic conditions were active on Jun 16.

The next period with geomagnetic disturbances was caused by the recurrent extension of the northern polar CH. The geomagnetic response was similar as during the first day of the month.

## III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	TENCM	TYPE	Cat	NOAA	NOTE
12	0030	0057	0102	N23W43	M2.0	SN	130	II/2	87	1081	EIT wave, limb CME
13	0530	0539	0544	S25W84	M1.0	SF		II/1	86	1079	SWAP: eruption@limb

**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