

Center

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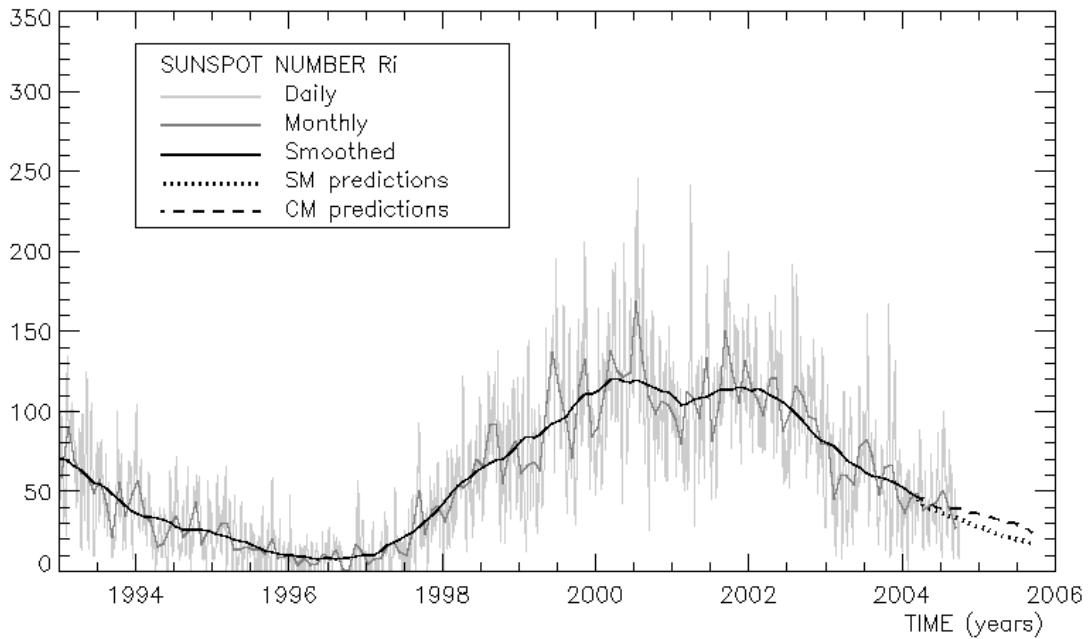
SUNSPOT BULLETIN

2004 n° 9

Provisional international and normalized hemispheric daily sunspot numbers for September 2004

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	8	0	8
2	8	0	8
3	18	0	18
4	20	0	20
5	37	0	37
6	32	0	32
7	38	0	38
8	47	0	47
9	51	7	44
10	44	10	34
11	42	13	29
12	43	19	24
13	39	23	16
14	32	32	0
15	39	30	9
16	38	26	12
17	36	21	15
18	33	13	20
19	34	16	18
20	27	9	18
21	24	7	17
22	17	0	17
23	10	0	10
24	10	0	10
25	10	0	10
26	15	0	15
27	15	0	15
28	8	0	8
29	25	0	25
30	31	14	17
Monthly mean	27.7	8.0	19.7
Cooperating stations	46	41	41



Predictions of the monthly smoothed Sunspot Number
 using the last provisional value, calculated for March 2004 : 47.1 ($\pm 5\%$)

	SM	CM		SM	CM		SM	CM
2004 Apr	44	45	2004 Oct	37	40	2005 Apr	28	33
May	43	43	Nov	36	38	May	27	32
Jun	42	41	Dec	34	37	Jun	25	31
Jul	41	40	2005 Jan	33	36	Jul	24	29
Aug	40	40	Feb	31	35	Aug	22	27
Sep	38	40	Mar	30	34	Sep	21	25

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, October 1, 2004 08:21 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	9	1	37	88	896	0	1/0	37	
1	8	3	38	90	896	0	0/0	10	
2	8	8	40	94	901	0	0/0	6	
3	18	24	38	97	905	0	0/0	3	
4	20	44	39	99	907	0	0/0	3	
5	37	149	40	103	912	0	0/0	9	
6	32	58	42	107	921	0	0/0	16	
7	38	82	45	119	913	1	0/0	12	
8	47	87	46	125	913	2	0/0	8	
9	51	82	46	131	918	4	0/0	6	
10	44	73	45	130	914	0	0/0	2	
11	42	53	44	116	907	0	0/0	2	
12	43	61	43	115	920	102	2/0	2	
13	39	43	43	118	917	0	0/0	10	
14	32	61	46	115	880	10	1/0	31	
15	39	69	43	110	877	1	0/0	18	
16	38	61	44	108	879	2	0/0	21	
17	36	56	42	105	878	0	0/0	23	
18	33	66	41	103	875	0	0/0	17	
19	34	57	41	105	877	0	1/0	6	
20	27	59	43	101	878	0	0/0	12	
21	24	57	41	95	888	1	0/0	9	
22	17	56	39	91	886	1	0/0	22	
23	10	47	36	90	886	0	0/0	14	
24	10	33	36	89	888	0	0/0	8	
25	10	22	37	90	895	0	0/0	5	
26	15	15	37	90	903	0	0/0	4	
27	15	13	37	90	901	0	0/0	5	
28	8	14	36	90	906	0	0/0	8	
29	25	23	37	90	909	0	0/0	6	
30	31	36	37	88	909	0	0/0	4	

- 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 : $1 \times \text{Sn} + 10 \times "1" + 100 \times ">1"$).
- 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 SEPTEMBER 2004

DATE	UT	NUMBER		RELATIVE SUNSPOT NUMBERS			PPSI 10-3 WM-2	QUAL	OBS	
		OF GROUPS	OF SPOTS	TOTAL	NORTH	SOUTH				CENTRAL
1	816	1	1	11	0	11	0	2.4	3	VI
2	721	1	1	11	0	11	0	1.4	3	VI
3	723	2	7	27	0	27	0	12.1	2	VI
4	1120	2	6	26	0	26	0	19.9	3	ER
5	955	5	19	69	0	69	0	31.2	3	FC
6	1329	4	20	60	0	60	49	33.9	3	SG
7	824	3	20	50	0	50	33	38.8	2	VI
8	755	4	30	70	0	70	49	37.7	3	VI
9	838	4	31	71	11	60	40	41.4	3	VI
10	734	4	26	66	13	53	0	46.9	3	VI
11	738	3	24	54	29	25	0	31.1	2	VI
12	659	4	28	68	32	36	12	31.5	3	VI
13	930	3	9	39	17	22	17	27.0	1	AB
14	724	1	31	41	41	0	41	29.4	3	VI
15	814	2	37	57	46	11	46	34.8	3	VI
16	853	2	41	61	45	16	45	36.8	3	VI
17	742	2	26	46	27	19	27	40.3	3	VI
19	816	3	25	55	28	27	0	44.7	3	DB
20	836	2	17	37	16	21	21	27.7	1	SG
21	739	2	13	33	11	22	22	28.7	3	VI
24	758	2	10	30	0	30	0	20.0	2	VI
25	830	2	2	22	0	22	0	16.1	1	SG
29	900	3	4	34	12	22	0	24.7	1	AB

The relative mean sunspot number is 45.1.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR SEPTEMBER 2004

K' = 0.844 (*)

1	9	7	42	13	33	19	46	25	19
2	9	8	59	14	35	20	31	26	***
3	23	9	60	15	48	21	28	27	***
4	22	10	56	16	51	22	***	28	***
5	58	11	46	17	39	23	***	29	29
6	51	12	57	18	***	24	25	30	***

The normalised relative monthly mean sunspot number is 38.

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

The Sun has been observed 23 days on 30 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR SEPTEMBER 2004
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type			West Limb Date
		1st obs	CMP	Last obs	
3-2020	8 19.3	19 E	8 26.1	31 J	9 1.8
15-2020	8 29.1	6 A	9 4.8	10 E	9 11.6

PROBABLE RETURN OF MAJOR GROUPS FOR OCTOBER 2004

Nø	New East Limb	New CMP	New West Limb
15	9 25.3	10 2.1	10 8.8

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

September was a relatively quiet month, with no X-class flares and only 4 M-flares near the middle of the month. Catania sunspot group 12 (NOAA 0672) was the most active region; it was responsible for 3 of the M-flares, including the largest event: an M4.8 early in the morning on Sep 12. Small proton events occurred late on Sep 13 (lasting until Sep 15) and late on Sep 19 (ending on Sep 20). Many halo CMEs were reported, but most were backsided.

After the disappearance of Catania sunspot group 01 at the turn of the months, the solar X-ray output dropped to about B2.0 level on Sep 01. Flaring activity was low: only occasional small B-flares were observed, never even getting near the C-level. This was surprising since on Sep 01 we greeted an old acquaintance on its return to the earth-facing side of the sun: Catania sunspot group 06 (NOAA 0667) was the return of Catania 90 (NOAA 0656), which produced X1.0 and X1.8 flares and many M-flares on its previous rotation. During its transit of the backside of the sun, the region had apparently decayed to a rather inactive sunspot group consisting of one large and a few small sunspots with a simple magnetic structure. Also from Sep 01 onwards, Catania 05 (NOAA 0668) started to develop in the southwest quadrant. Its growth became particularly fast on Sep 03 and it seemed destined to lead to an increase in solar activity, but the growth stalled and it remained inactive. No flares were reported from this group. On Sep 10, Catania sunspot group 10 (NOAA 0669) started to develop to the northeast of Catania 06. It was the dominant group for a few days, but in total it produced only a handful of C-class flares.

On Sep 05, a large filament erupted in the northwest with a corresponding CME. Several other CMEs were observed in the first week of the month, including *partial and full halo CMEs*. Halo CME alerts were sent out by our forecast center for CMEs on Sep 03 at 00:30 UT and 10:30 UT, on Sep 04 at 06:54 UT, on Sep 05 at 18:06, on Sep 07 at 15:54. All of these were determined to be backsided events, indicating the presence of an active sunspot group on the far side of the sun. This group was most likely Catania sunspot group 12 (NOAA 0672), which appeared at the east limb on Sep 09. It generated C-flaring activity on Sep 9, 10 and 11 to finally burst out in an **M4.8 flare** just after midnight on Sep 12. This long duration event was followed half an hour later by another nearly invisible peak, this time coming from sunspot group 06 (NOAA 0667). This second M-flare lasted only a few minutes! A full halo CME originating from the first M-flare was clearly visible in LASCO-images. On Sep 13, a short time after the arrival of the interplanetary shock due to this event (see below), the >10MeV proton flux increased above the threshold level. The >50MeV flux was enhanced also but did not exceed the threshold. This *proton event* lasted until the morning of Sep 15.

On Sep 13, Catania sunspot groups 06 (NOAA 0667) and 10 (NOAA 0669) were situated at the west limb. Before rotating behind the limb, both groups still showed C-class flaring activity. Catania sunspot group 12 was still the dominant sunspot group however, reaching its largest size on Sep 14, measuring at that time 0.06 percent of the solar disk in about 80 spots. On this day it generated an M1.5 flare (its second M-class flare) and several C-flares. On Sep 15 there were still several C-class flares from this group. For the following three days, solar conditions remained quiet, despite the appearance of another large sunspot group (Catania 20, NOAA 0673) at the east limb on Sep 15. This medium-sized group also had a beta-gamma magnetic classification for some days and produced many small flares, but only a few C-class events. The quiet conditions ended on Sep 19 when Catania 12, already in decay and near the west limb, generated a sequence of C-flares and an M1.9 flare. This flare was accompanied by a CME and also caused a proton event: the >10 MeV proton flux levels slightly exceeded the 10 pfu threshold until about noon UT on Sep 20.

Catania sunspot group 12 crossed the west limb on Sep 21. This started a period in which flaring activity decreased progressively with only a few C-flares from Catania 20 until Sep 23 and not even that for the rest of the month. Some small sunspot groups produced some B flares, but no more C-flares occurred. A few filament eruptions were noticed, of which the most important one occurred near central meridian on Sep 28, at 14:45. This event spawned a faint semi-halo.

II. Geomagnetic Activity

Geomagnetic conditions were mostly quiet this month. Short periods of active conditions were observed during Sep 06-08 and Sep 16 - Sep 23. The strongest perturbations occurred on Sep 13-15, when minor storm conditions were reached due to the arrival of a CME shock front.

Although the solar wind speed was still elevated (about 550km/s) on Sep 01 following the arrival of a shock on Aug 30, geomagnetic conditions were quiet at the start of the month, since the north-south component of the IMF had changed to values near zero early on Aug 31. From Sep 01 onwards, the solar wind speed started to decrease, down to less than 350km/s on Sep 05. During Sep 06-08, small periods of active geomagnetic conditions were seen. At that time, the solar wind speed had risen again to 450 km/s and the north-south component of the interplanetary magnetic field was fluctuating between -10nT and +8nT. As the solar wind slowed down (300 km/s) and the total IMF decreased, quiet conditions reigned from Sep 08 until Sep 13.

On Sep 13 a shock in the solar wind arrived near earth. It was observed by SOHO/CELIAS at 19:29UT, and by ACE at 19:36UT. This shock was due to the full halo CME accompanying the M4.8 flare of Sep 12. The solar wind speed increased from 300km/s to 600km/s. The magnetic field measurements from ACE indicated a very variable north-south component of the IMF, with short periods of southwards orientation. K-indices up to 5 (minor storm) were reported by most observatories from the evening of Sep 13 until early on Sep 15, with even single values of 6 in e.g. Niemegek. The solar wind speed remained high until Sep 17. Further periods of active to minor storm conditions were reached late Sep 16 - early Sep 17 and again on late Sep 17 - early Sep 18. After that, mostly quiet conditions returned until Sep 22.

On Sep 22, K-indices around the world showed active to minor storm conditions (K=4-5), following a small perturbation in the solar wind observed by ACE. The wind speed jumped from 440 to 500 km/s. The solar wind perturbation was most likely related to the CME associated with the M1.9 flare on Sep 19. Geomagnetic conditions returned to quiet early on Sep 23, and remained so until the end of the month.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO	TYPE	600 (Humain)	Cat	NOAA	NOTE
12	0004	0056	0133	N04E42	M4.8	2N	2400	IV/2, II/3, III/3			12	0672	full halo CME with median speed about 950km/s
12	0136	0139	0141	S14W61	M3.2	SN		II/3			06	0667	very short duration
14	0747	0930	1000	N04E17	M1.5	1F	120	IV/1, II/1	0922		12	0672	
19	1646	1712	1739	N03W58	M1.9		520	III/1, II/3, IV/1	1655		12	0672	SXI-derived loc.

loc: approximate heliographic location
Xray: X-ray flare class
op: optical flare class
10 cm: 10 cm radio flux
type: type of radio burst

600: peak time (UT) of 600 Mhz radio bursts in Humain
Cat: Catania sunspot group identification
NOAA: NOAA active region identification
p: proton event
CME: Coronal Mass Ejection

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