

Center

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SUNSPOT BULLETIN

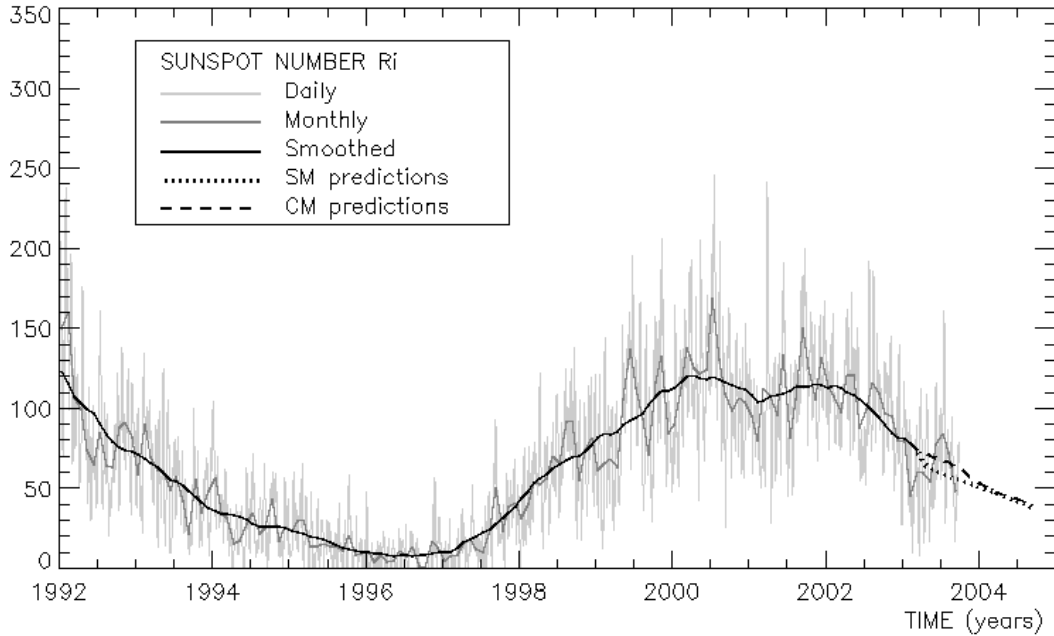
2003

n° 9

Provisional international and normalized hemispheric daily sunspot numbers for September 2003

computed at the *Observatoire Royal de Belgique* using observations from an international network with the *Locarno Specola Solare* as reference station.

Date	R' _I	R' _N	R' _S
1	46	13	33
2	43	12	31
3	47	9	38
4	50	7	43
5	39	0	39
6	37	0	37
7	30	0	30
8	25	0	25
9	17	0	17
10	28	0	28
11	34	0	34
12	29	0	29
13	30	0	30
14	36	0	36
15	42	12	30
16	46	17	29
17	58	33	25
18	58	34	24
19	52	30	22
20	46	25	21
21	50	35	15
22	57	30	27
23	65	35	30
24	64	37	27
25	67	43	24
26	77	48	29
27	79	46	33
28	71	37	34
29	74	32	42
30	66	21	45
Monthly mean	48.8	18.5	30.3
Cooperating stations	37	34	34



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for March 2003 : 74.1 ($\pm 5\%$)

		SM	CM			SM	CM			SM	CM
2003	Apr	69	73	2003	Oct	60	62	2004	Apr	51	47
	May	65	71		Nov	58	58		May	50	46
	Jun	67	69		Dec	57	56		Jun	48	45
	Jul	65	68	2004	Jan	56	53		Jul	47	43
	Aug	63	66		Feb	54	50		Aug	45	42
	Sep	62	64		Mar	53	49		Sep	44	41

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' _i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
31	65	44	45	110	837	0	0/0	7	
1	46	35	44	108	837	0	0/0	16	
2	43	30	45	106	840	0	0/0	14	
3	47	26	46	111	////	1	0/0	17	
4	50	28	48	112	////	0	0/0	21	
5	39	39	47	108	////	0	0/0	17	
6	37	27	44	105	////	0	0/0	12	
7	30	14	42	108	////	1	0/0	6	
8	25	6	43	99	////	0	0/0	8	
9	17	13	43	96	////	0	0/0	24	
10	28	35	44	99	////	0	0/0	20	
11	34	40	42	97	////	0	0/0	18	
12	29	38	42	94	////	1	0/0	10	
13	30	33	41	96	////	2	0/0	9	
14	36	16	40	95	////	2	0/0	6	
15	42	10	40	97	////	10	0/0	7	
16	46	15	41	99	////	0	1/0	27	
17	58	34	45	106	////	0	0/0	53	
18	58	47	44	109	////	0	0/0	47	
19	52	38	46	111	////	0	0/0	33	
20	46	30	48	112	////	0	0/0	27	
21	50	46	47	120	////	0	0/0	18	
22	57	53	47	123	////	0	0/0	18	
23	65	102	50	125	////	0	0/0	18	
24	64	124	51	134	////	9	0/0	37	
25	67	160	50	133	////	0	0/0	27	
26	77	165	51	131	////	2	0/0	16	
27	79	159	52	130	////	3	0/0	7	
28	71	159	52	137	////	2	0/0	7	
29	74	105	49	135	////	12	0/0	5	
30	66	81	49	133	////	15	0/0	6	

- 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 atmospheric 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 2003

DATE	UT	NUMBER		RELATIVE SUNSPOT NUMBERS			PPSI 10-3 WM-2	QUAL	OBS	
		OF GROUPS	OF SPOTS	TOTAL	NORTH	SOUTH				CENTRAL
1	1210	5	19	69	19	50	34	13.6	2	ER
2	710	4	16	56	18	38	31	13.2	3	ER
3	1345	5	18	68	14	54	28	7.5	3	ER
4	825	6	25	85	11	74	26	4.0	3	ER
5	810	3	17	47	0	47	15	21.6	2	ER
7	905	3	7	37	0	37	13	5.9	2	ER
8	800	1	8	18	0	18	18	1.4	3	ER
9	851	1	5	15	0	15	15	6.0	2	VI
11	1124	2	16	36	0	36	36	19.8	2	VI
13	825	2	29	49	0	49	17	34.8	3	FC
14	900	3	21	51	0	51	0	10.8	3	FC
15	1030	5	23	73	12	61	13	5.4	3	DB
16	734	5	18	68	24	44	33	2.2	2	VI
17	733	6	25	85	50	35	20	5.9	2	VI
18	749	6	25	85	54	31	17	4.8	3	VI
19	731	5	17	67	39	28	27	10.2	3	VI
20	845	5	13	63	33	30	11	10.0	3	DB
21	745	5	29	79	61	18	37	15.0	3	DB
22	810	4	28	68	44	24	11	34.6	3	VI
23	816	4	33	73	47	26	11	53.3	3	VI
24	1017	4	41	81	53	28	53	70.3	3	VI
25	1010	4	47	87	58	29	72	78.8	3	VI
26	838	4	61	101	67	34	90	81.3	3	VI
27	850	5	68	118	71	47	107	105.0	1	ST
29	1000	7	46	116	53	63	23	57.8	2	OB
30	945	6	37	97	31	66	0	48.9	3	OB

The relative mean sunspot number is 68.9.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS U'=K'U FOR SEPTEMBER 2003

K' = 0.844 (*)

1	58	7	31	13	41	19	57	25	73
2	47	8	15	14	43	20	53	26	85
3	57	9	13	15	62	21	67	27	100
4	72	10	***	16	57	22	57	28	***
5	40	11	30	17	72	23	62	29	98
6	***	12	***	18	72	24	68	30	82

The normalised relative monthly mean sunspot number is 58.

(*) 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 SEPTEMBER 2003
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb		Date and type			West Limb	
	Date	1st obs	CMP	Last obs	Date		
10-2007	9 2.8	8 B	9 9.5	15 H	9 16.3		
19-2007	9 19.4	20 C	9 26.2	30 E	10 2.9		

PROBABLE RETURN OF MAJOR GROUPS FOR OCTOBER 2003

Nø	New East Limb	New CMP	New West Limb
10	9 29.7	10 6.5	10 13.2
19	10 16.8	10 23.6	10 30.3

<http://sidc.oma.be>

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

Solar activity was low during September, with extended periods without any significant activity. Sunspot numbers were decreasing at first, reached a minimum on Sep 09 and, then gradually rose until the end of the month. A single, small M-flare occurred on Sep 16. Plenty of C-flares were recorded (about 60, of which 12 on Sep 24 and 10 on Sep 30), but most of these were in the low C range.

At the start of the month, sunspot group 21 (NOAA 0450) was the largest group on disk. The only significant event identified from this group was a long duration C5.3 flare on Sep 07 peaking at 14:07UT. This event included a nearby filament eruption, leading to a CME on the south-west solar limb. In the more distant corona, it was seen as a streamer blow-out CME, first visible in C2 at Sep 08, 00:30 UT. The event gave rise to pronounced enhancements of the low energy (310-580 keV) proton fluxes (measured by ACE). However, no higher energy protons were recorded in the 10 MeV proton flux channel onboard the GOES satellite.

By Sep 08, sunspot group 21 disappeared at the west limb. Most other sunspot groups also either rotated from view or decayed, leaving only a few small sunspot groups (groups 33, 34 and later 35) near the centre of the disk for some days. Another long duration flare - but only at the B8 level - was observed on Sept 11, 22:37 UT). EIT/SOHO showed an associated eruption left of Catania sunspot groups 34 and 35 (NOAA 0457). The LASCO coronagraphs showed a partial halo CME, mostly southward. During this period Catania Sunspot group 33 (NOAA 0456), which reached a beta-gamma configuration on Sep 11, was clearly the group with the highest flaring potential. Nevertheless it produced no major events until Sep 16 when a long duration M1.4 flare erupted from this region, at that moment already behind the west limb. Following this event, the low energy (<2 MeV) proton fluxes measured by ACE increased, but the higher energy protons - as recorded by GOES - were not enhanced.

On Sep 20 sunspot group 41 (NOAA 0464) appeared at the east limb. It soon developed into a large and complex group (surrounded by several 'satellite' sunspot groups) and remained the center of solar activity until the end of the month. This sunspot group ranks amongst the biggest groups in recent months, growing to about 70 spots with a total area just over 0.1% of the solar disk. Its beta-gamma magnetic configuration and type F McIntosh classification indicated it was capable of strong flaring activity. However, the background X-ray flux was at a low B level, so most of the numerous flares produced by this active region were recorded as just low C level.

On Sep 24 a large filament in the southern hemisphere erupted around 06:00 UT - 07:00 UT, but this eruption was not directed towards the Earth.

In the beginning of the month, EIT284 images showed a large high latitude coronal hole with two distinct equatorial extensions (in fact this coronal hole already persists over several rotations). The leading edge of this coronal hole turned in a geo-effective position during the first few days of the month, while its second equatorial extension reached the center of the disk on Sep 07. Another large coronal hole (likewise a recurrent one) reached the central solar meridian on Sep 14. A third one, this time a small low-latitude coronal hole in the southern hemisphere, arrived at the central meridian on Sep 22. And finally, the end of the month saw the return of the first-mentioned coronal hole, but by this time it had shrunk to a single elongated trans-equatorial coronal hole.

II. Geomagnetic Activity

During the first days of the month the solar wind speed increased gradually from 400 km/s to approximately 700 km/s due to the leading equatorial extension of the high latitude coronal hole in the northern hemisphere. Meanwhile the interplanetary magnetic field (IMF) varied between +10 and -10 nT. Active geomagnetic conditions were observed on Sep 03-04. From about 21 UT on Sep 04

onwards, the solar wind started to decrease slowly, reaching a speed of approximately 380 km/s by Sep 08. The geomagnetic conditions remained therefore quiet from Sep 05 until early on Sep 09. On the latter day, the second equatorial extension of the same coronal hole became geo-effective and made the solar wind speed increase again. It remained above 600km/s until Sep 13, and then returned to the slow regime below 400km/s on Sep 14. This led to minor geomagnetic storm conditions on Sep 09, followed by active conditions on Sep 10-11. During Sep 12-15, geomagnetic conditions were quiet.

The first signs of the effect of the next coronal hole were noted as a slight increase in the solar wind speed (from 355 to 380 km/s) and a large density enhancement in the solar wind recorded both by ACE and CELIAS/SOHO on the evening of Sep 15, 18h20 till midnight. After that a slow, but steady increase of the solar wind speed was measured, peaking at 800 km/s around noon on Sep 18. The interplanetary magnetic field was mostly southward during this time, with peaks down to -20 nT. The geomagnetic field therefore switched to a major storm regime on Sep 16 and even severe storm (estimated Kp=7) on Sep 17. Stormy geomagnetic conditions persisted until Sep 20. Active conditions then reigned for 3 days, but on Sep 24 the estimated Kp index again reached 5 (the Wingst K-index recorded 6) as the Earth entered the fast flow coming from the low-latitude coronal hole in the southern hemisphere. On Sep 25, minor storm conditions were observed, going down to active levels on Sep 26 as the solar wind speed started to decrease again. From Sep 27 to the end of the month, geomagnetic conditions remained quiet.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO	TYPE	600 (Humain)	Cat	NOAA	NOTE
16	2130	2224	2331		M1.3						33	0456	

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