Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

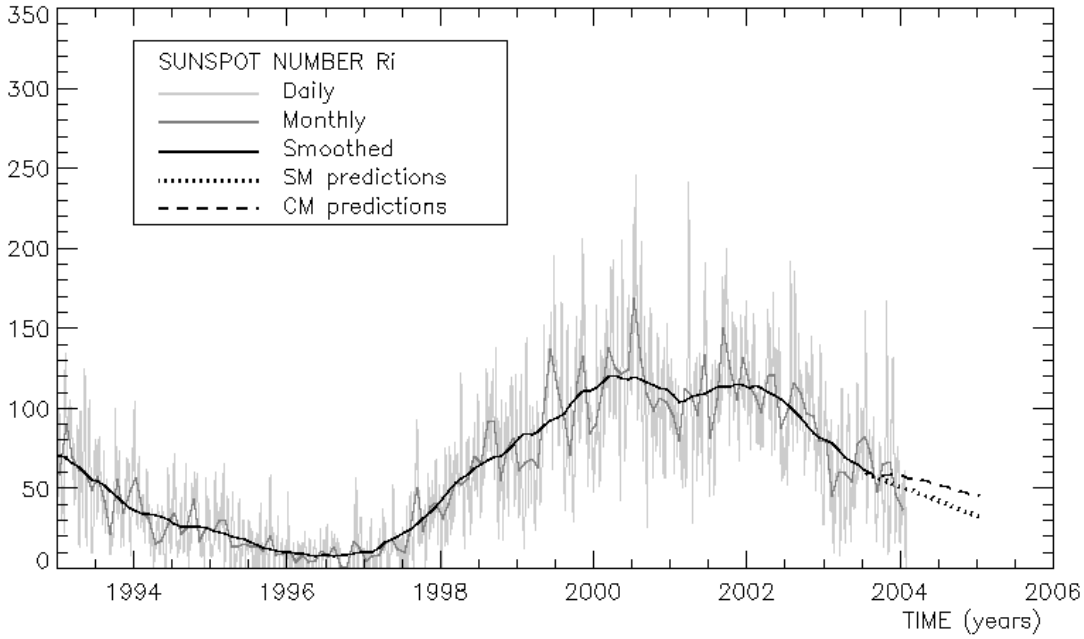
SUNSPOT BULLETIN

2004 n° 1

Provisional international and normalized hemispheric daily sunspot numbers for January 2004

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	32	0	32
2	40	0	40
3	45	0	45
4	46	0	46
5	44	0	44
6	39	0	39
7	50	15	35
8	53	23	30
9	38	15	23
10	36	16	20
11	32	15	17
12	27	11	16
13	35	13	22
14	34	12	22
15	43	20	23
16	50	21	29
17	49	20	29
18	40	9	31
19	54	22	32
20	61	30	31
21	61	32	29
22	49	28	21
23	42	24	18
24	34	19	15
25	16	8	8
26	13	7	6
27	0	0	0
28	8	4	4
29	16	0	16
30	27	0	27
31	38	16	22
Monthly mean	**37.2**	**12.3**	**24.9**
Cooperating stations	**41**	**37**	**37**



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for July 2003 : 61.8 (± 5%)

	SM	CM		SM	CM		SM	CM
2003 Aug	63	60	2004 Feb	54	57	2004 Aug	46	51
Sep	63	58	Mar	53	57	Sep	44	50
Oct	60	58	Apr	52	56	Oct	42	49
Nov	59	59	May	50	55	Nov	41	48
Dec	57	59	Jun	49	54	Dec	39	47
2004 Jan	56	58	Jul	47	52	2005 Jan	38	46

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	16	3	46	106	////	0	1/0	28	
1	32	19	50	116	////	2	0/0	26	
2	40	59	46	117	////	1	0/0	18	
3	45	95	-	116	////	2	0/0	25	
4	46	109	47	119	////	1	0/0	23	
5	44	158	-	123	////	0	1/0	34	
6	39	179	40	117	////	1	1/0	23	
7	50	178	38	119	////	102	2/0	29	
8	53	175	38	120	////	13	1/0	10	
9	38	132	-	118	////	113	2/0	25	
10	36	105	39	119	////	14	0/0	26	
11	32	79	40	119	////	3	0/0	21	
12	27	57	40	118	////	3	0/0	14	
13	35	47	41	118	////	2	0/0	24	
14	34	56	43	121	////	0	0/0	14	
15	43	50	45	119	////	10	0/0	14	
16	50	68	46	120	////	1	0/0	29	
17	49	87	49	123	////	4	1/0	24	
18	40	62	51	120	////	12	1/0	25	
19	54	91	53	135	////	3	2/0	22	
20	61	124	51	129	////	100	1/0	25	
21	61	102	51	130	////	1	0/0	17	
22	49	63	51	122	////	0	0/0	57	
23	42	35	47	115	////	0	0/0	41	
24	34	15	47	108	////	0	0/0	21	
25	16	4	42	102	////	2	0/0	40	
26	13	1	42	98	////	0	0/0	20	
27	0	999	41	94	////	0	0/0	19	
28	8	1	39	89	////	0	0/0	32	
29	16	3	38	87	////	0	0/0	8	
30	27	11	39	93	////	0	0/0	25	
31	38	11	37	94	////	0	0/0	8	

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 JANUARY 2004

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-3 WM-2	QUAL	OBS
2	1030	3	40	70	0	70	33	82.3	3	OB
3	1000	3	42	72	0	72	27	102.4	2	FC
10	1030	2	21	41	19	22	19	70.2	2	RV
15	1015	4	29	69	19	50	15	10.7	3	OB
18	1125	4	26	66	12	54	41	13.6	2	DB
21	1035	6	39	99	56	43	88	46.0	3	OB
23	915	6	19	79	44	35	27	33.4	3	OB
24	1400	5	7	57	35	22	0	6.8	2	OB
25	1005	2	3	23	12	11	0	1.7	3	OB
28	1359	0	0	0	0	0	0	0.0	1	VI
29	1115	2	3	23	0	23	12	1.6	2	OB
30	1323	2	5	25	0	25	14	2.8	2	VI

The relative mean sunspot number is 52.0.

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

K'= 0.882 (*)

1	***	7	***	13	***	19	***	25	20
2	62	8	***	14	***	20	***	26	***
3	64	9	***	15	61	21	87	27	***
4	***	10	36	16	***	22	***	28	0
5	***	11	***	17	***	23	70	29	20
6	***	12	***	18	58	24	50	30	22
								31	***

The normalised relative monthly mean sunspot number is 46.

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

The Sun has been observed 12 days on 31 possible.

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

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
12-2011	12 28.3	2 E	1 4.0	3 E	1 10.8
13-2011	12 31.9	2 E	1 7.6	10 E	1 14.4

PROBABLE RETURN OF MAJOR GROUPS FOR FEBRUARY 2004

Nø	New East Limb	New CMP	New West Limb
13	1 28.1	2 3.8	2 10.6

http://sidc.oma.be

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

The activity of the sun was again very variable, ranging from very low to moderate. On 27-28 January, the visible side of the sun became totally spotless, leading to the first day with a zero (provisional) value for the international sunspot number since the latest solar maximum.

In the beginning of the month, the dominant active region was Catania sunspot group 30 (NOAA0536), which consisted of a rather large sunspot and a bunch of small ones. Until Jan. 4, this region did not develop a complex magnetic structure and only produced a few C flares. Late on Jan 04, it started to become more active, and generated the first major flare of the month, an M6.9 flare on Jan 05. This, however, remained the only major flare from this group, despite its beta-gamma-delta magnetic classification. On Jan 06, Catania 33 (NOAA 0537) appeared at the west limb and became the dominant sunspot group. It produced several high M flares of which three were CME related. On Jan 07, the largest flare of the month, an M8.3, originated from this group. The last M-flares from this group were observed on Jan 09, though it continued generating small C-class flares until it disappeared from view on Jan 18.

After Jan 10, solar activity became really low, with most peaks in the X-ray radiation hardly reaching the C-level. On January 17, activity increased slowly, mostly due to sunspot group 35 (NOAA 0540) becoming active, leading to an M5.0 flare peaking at 17.50 UT on January 17 and an M1.4 flare at 00.17 on January 18. Both flares were associated with a radio type II outburst. Several more large flares were observed from this group, including a long duration C8.2 flare late on Jan 19, accompanied by a full halo CME. On Jan 20, the last M-flare of the month occurred. On Jan 21 there were 2 big prominence eruptions, each one leading to a CME. From Jan 22 to Jan 25, solar activity was very low, but during the night of Jan 25 to Jan 26 a C6.3 flare erupted with contributions from the upper and lower regions at the west limb of the sun. A few smaller flares followed, but when these groups rotated over the limb, the sun headed for its first day of the current cycle with no spots, and solar activity dropped to extremely low levels, with the X-ray background decreasing to the A-level (below 0.1 microWatts per square meter). The X-ray background bottomed out on Jan 29, when it started to increase due to the apparition at the east solar limb of Catania sunspot groups 48 and 51 (NOAA 0546 and 0549). Group 51 was most active of the two and produced a handful of small C-class flares in the final days of the month.

II. Geomagnetic Activity

Throughout the whole month, geomagnetic conditions were quite volatile, with many periods of minor storm conditions. On 31/12/03 around 11:00UT, the Earth had entered a high-speed stream that disturbed the geomagnetic field until Jan 05. The solar wind speed rose to 600km/s, and the N-S component of the interplanetary magnetic field oscillated between +5 and -10nT. Minor storms conditions (Kp=5) occurred several times during this period.

A small shock was recorded late on Jan 06. This was probably the arrival of the partial halo CME connected to the long duration M-flare of Jan 05. The solar wind speed reached 800 km/s and the IMF pointed predominantly southward (-10nT) resulting again in minor storm conditions (estimated Kp=5, Wingst even recorded K=6) late on Jan 06. Also on the following days, the estimated Kp index reached 5 on every day except on Jan 08. These short periods of minor storms were all due to the passage of different CMEs. The solar wind speed oscillated between 500 km/s and 800 km/s. The two large temperature drops in the ACE data late on Jan 08 and on Jan 10, are clear signatures of CME arrivals.

On Jan 13, a sudden increase in solar wind speed from 500 to 600 km/s was measured by ACE. The cause of this solar disturbance was not clear, but it could be due to a glancing blow of the prominence eruption on January 12. Again, active to minor storm conditions were observed. Jan 14 was quiet, but Jan 15 again saw active conditions. From Jan 16 onwards, a half circular coronal hole dominated the solar wind and caused minor storm conditions. The solar wind speed started increasing from that date to reach a peak of 700 km/s during midnight in the night between 16 and 17 Jan. Then, the speed decreased down to 550 km/s. From January 18 on, we experienced the influence of the second part of the hole, with active to minor storm conditions lasting until Jan 20.

A large shock was recorded by ACE data at 01:00 UT on Jan 22. This was the arrival of a halo CME that was related to the C8.2 flare late on Jan 19. The solar wind speed jumped from 500 to 560 km/s, and Bz turned to -20 nT. The geomagnetic activity reached major storm levels. Active to minor storm conditions persisted for another day. The solar wind speed stayed elevated above 460 km/s. This could be due to contributions from the CMEs related to the two prominence eruptions on Jan 21, and/or possibly the influence from a small trans-equatorial coronal hole that was situated around the meridian on Jan 22. Late on Jan 24 Bz turned southward, leading to a 9-hour minor storm on Jan 25. After that quiet conditions resettled again.

On Jan 27, the solar wind speed started to increase due to the effect of another equatorial coronal hole, which crossed the central solar meridian on Jan 24. This coronal hole influenced the geomagnetic environment from Jan 27 to Jan 29, leading to active geomagnetic conditions on these days, with a brief minor storm period early on Jan 28. The solar wind speed peaked at about 600km/s on Jan 28, then decreased again to 400km/s on Jan 29. Another, much larger, coronal hole became geo-effective on Jan 30. The leading section of this coronal hole is mostly located in the northern solar hemisphere, and the earth is only influenced from the equatorial edge of this section. Therefore, though the solar wind speed got pushed up to 700km/s on Jan 30, it didn't hold steady at this high value. Therefore, the geomagnetic response was limited to minor storm conditions for part of Jan 30, and quiet to active conditions on Jan 31.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	600 (Humain)	Cat	NOAA	NOTE
05	0250	0345	0520	S10E36	M6.9		400	IV/2,III/2		30	0536	SXI derived loc., CME
06	0610	0629	0650	N04E81	M5.8		340	V/2		33	0537	SXI der. loc., halo CME
07	0343	0404	0421	N02E76	M4.5	2N		V/2,II/1		33	0537	SXI derived loc.
07	1016	1027	1033	N06E71	M8.3	SF	510	V/2,II/1	1022	33	0537	SXI derived loc., partial halo CME
08	0453	0507	0521	N01E64	M1.3	1N	73			33	0537	SXI derived loc.
09	0113	0122	0127	N03E49	M1.1	2N				33	0537	SXI derived loc.
09	0114	0144	0158	N02E47	M3.2		130	III/1		33	0537	SXI derived loc.
17	1735	1750	1759	S15E19	M5.0		580	II/2,III/2		35	0540	
18	0007	0017	0021	S15E19	M1.4	1N	190	II/3,III/3,V/3		35	0540	
19	0525	0532	0535	S17E05	M1.0	SF		V/2,III/3		35	0540	
19	1230	1240	1246	S16W00	M1.0		59	III/2	1233,1240	35	0540	SXI derived loc.
20	0730	0743	0747	S14W13	M6.1	2N	150	II/3,III/3		35	0540	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 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