

Center

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SUNSPOT BULLETIN

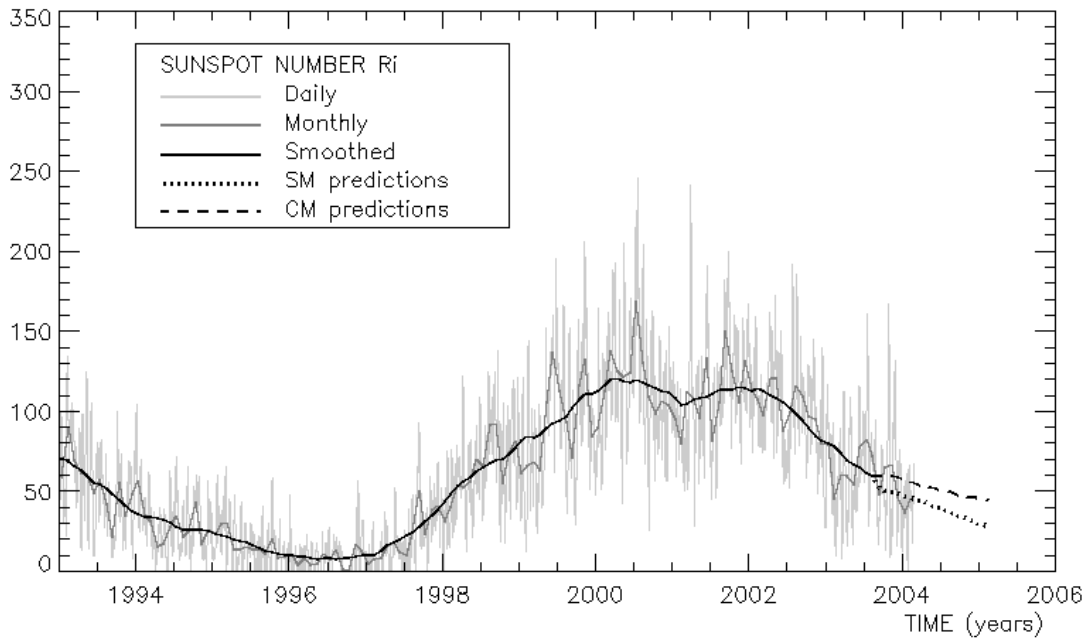
2004

n° 2

Provisional international and normalized hemispheric daily sunspot numbers for February 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	43	16	27
2	64	18	46
3	63	18	45
4	60	18	42
5	66	20	46
6	51	20	31
7	40	18	22
8	45	14	31
9	48	12	36
10	48	14	34
11	44	10	34
12	48	12	36
13	48	11	37
14	38	19	19
15	50	22	28
16	41	18	23
17	18	10	8
18	22	14	8
19	20	6	14
20	26	8	18
21	30	16	14
22	30	15	15
23	55	29	26
24	47	26	21
25	53	28	25
26	53	27	26
27	67	23	44
28	66	23	43
29	50	17	33
Monthly mean	46.0	17.3	28.7
Cooperating stations	42	36	36



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for August 2003 : 60.0 ($\pm 5\%$)

	SM	CM		SM	CM		SM	CM
2003 Sep	61	60	2004 Mar	49	55	2004 Sep	41	49
Oct	60	60	Apr	48	54	Oct	39	48
Nov	54	60	May	46	53	Nov	38	47
Dec	53	59	Jun	45	52	Dec	36	47
2004 Jan	52	58	Jul	44	51	2005 Jan	35	46
Feb	50	57	Aug	42	50	Feb	33	45

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	38	11	37	94	////	0	0/0	8	
1	43	28	39	97	////	2	0/0	12	
2	64	63	40	102	////	0	0/0	21	
3	63	46	38	99	////	0	0/0	20	
4	60	64	41	101	////	10	0/0	21	
5	66	82	41	106	////	3	0/0	16	
6	51	93	41	107	////	0	0/0	24	
7	40	98	41	111	////	0	0/0	8	
8	45	112	42	116	////	1	1/0	30	
9	48	95	42	118	////	4	0/0	7	
10	48	74	44	117	////	0	0/0	7	
11	44	72	43	114	////	0	0/0	25	
12	48	74	45	112	////	0	0/0	32	
13	48	58	46	108	////	0	0/0	30	
14	38	54	48	104	////	0	0/0	25	
15	50	39	47	102	////	0	0/0	24	
16	41	29	47	99	////	1	0/0	8	
17	18	9	46	102	////	0	0/0	4	
18	22	18	45	98	////	0	0/0	11	
19	20	5	43	96	////	0	0/0	10	
20	26	7	43	95	////	0	0/0	4	
21	30	9	43	98	////	0	0/0	10	
22	30	50	43	104	////	10	0/0	10	
23	55	72	44	104	////	0	0/0	10	
24	47	109	44	106	////	2	0/0	15	
25	53	160	43	119	////	9	0/0	9	
26	53	159	46	121	////	103	1/1	3	
27	67	176	44	122	////	0	0/0	18	
28	66	149	41	116	////	0	0/0	24	
29	50	78	40	110	////	0	0/0	25	

- 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 FEBRUARY 2004

DATE	UT	NUMBER		RELATIVE SUNSPOT NUMBERS			PPSI 10-3 WM-2	QUAL	OBS	
		OF GROUPS	OF SPOTS	TOTAL	NORTH	SOUTH				CENTRAL
3	1405	6	32	92	36	56	24	12.4	3	OB
4	1245	5	37	87	34	53	28	26.0	2	OB
7	1000	2	66	86	86	0	86	128.3	2	IT
8	1200	2	19	39	15	24	24	119.7	2	IT
9	1020	4	48	88	21	67	36	76.0	3	OB
10	1055	3	26	56	0	56	0	68.9	2	OB
15	810	7	12	82	35	47	34	29.3	2	OB
16	1120	5	9	59	36	23	11	23.0	3	OB
18	920	3	4	34	23	11	0	0.7	3	OB
19	1020	2	2	22	11	11	11	0.4	2	OB
20	850	3	4	34	11	23	11	0.6	3	OB
22	1215	3	20	50	28	22	0	74.2	2	FC
23	940	5	38	88	44	44	43	68.9	3	OB
24	1000	4	37	77	46	31	66	79.8	3	OB
25	1033	3	42	72	38	34	72	131.2	3	VI
26	1245	3	68	98	61	37	98	133.4	3	OB
27	1145	5	84	134	58	76	61	84.8	3	OB
29	934	4	28	68	24	44	32	38.5	2	VI

The relative mean sunspot number is 70.3.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS $U'=K'U$ FOR FEBRUARY 2004

$K' = 0.926$ (*)

1	***	7	80	13	***	19	20	25	67
2	***	8	36	14	***	20	31	26	91
3	85	9	81	15	76	21	***	27	124
4	81	10	52	16	55	22	46	28	***
5	***	11	***	17	***	23	81	29	63
6	***	12	***	18	31	24	71		

The normalised relative monthly mean sunspot number is 65.

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

The Sun has been observed 18 days on 29 possible.

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

Uccle Nø	East Limb Date	Date and type			West Limb Date
		1st obs	CMP	Last obs	
12-2012	1 30.7	3 C	2 6.5	8 E	2 13.2
16-2012	1 31.9	3 C	2 7.7	10 E	2 14.4
17-2012	2 1.3	67 E	2 8.1	7 E	2 14.8
12-2013	2 18.2	22 F	2 24.9	29 E	3 2.7
13-2013	2 19.2	23 C	2 26.0	29 C	3 3.7

PROBABLE RETURN OF MAJOR GROUPS FOR MARCH 2004

Nø	New East Limb	New CMP	New West Limb
16	2 28.3	3 6.0	3 12.8
12	3 16.3	3 23.1	3 29.8
13	3 17.4	3 24.1	3 30.9

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

Solar activity started at low levels in February, turned very low towards the middle of the month, but then increased again, culminating in a day of high activity on Feb 26, when X1.1 and M5.7 flares were recorded from Catania sunspot group 67 (NOAA 0564). The only other large flare this month was an M1.2 on Feb 08.

The scarce flaring activity in the beginning of the month came mostly from Catania sunspot groups 49 (NOAA 0547), 51 (NOAA 0549) and 55 (NOAA 0551), which produced just weak flares of the C-level. The exception was a C9.9 flare in Catania 49 on February 4. On Feb 07 Catania sunspot group 57 (NOAA 0554) appeared at the eastern limb. It immediately produced several C-class flares, later followed by an M1.2 flare on Feb 08. On Feb 09, the group was still very active, generating several C-flares, the largest one being a C9.6. From Feb 10 on however, its flaring activity decreased abruptly, although the group continued to increase in size for a few days. The background X-ray radiation decreased slowly, reaching the A-level on Feb 15. Besides a single C-flare recorded on Feb 16, no flares of class C or higher occurred between Feb 10 and Feb 21. Also the sunspot number became very low during this period. Most sunspot groups either decayed or rotated out of sight so that only a few small spots remained on Feb 17, the day with the lowest sunspot number of the month.

Things took a different turn on Feb 22 when Catania sunspot group 67 (NOAA 0564) started a rapid development into a large group with complex magnetic fields (beta-gamma on Feb 23, beta-gamma-delta on Feb 27). This active region produced many C-flares from Feb 22 onwards. Its activity peaked on Feb 26, with an X1.1 flare at 02:03 UT and a M5.7 flare later on the same day. In neither case, no type II bursts or clear CMEs were observed. While the high energy particle channels of both GOES and ACE remained flat, both flares did result in increased proton fluxes in the lower energy channels of ACE.

II. Geomagnetic Activity

The only sources of geomagnetic perturbations this month were due to coronal holes, leading to a mix of quiet and active conditions on most days. Brief minor storm periods were observed on Feb 02, 06, 12, 15 and 28-29, while the most disturbed day was Feb 11 when the estimated Kp index reached 6.

At the start of the month a large low-latitude coronal hole was situated mostly in the western hemisphere. The geomagnetic situation during the first week of February was determined by the fast solar wind flows from this coronal hole. On February 2 ACE spacecraft registered the arrival of an interaction region between the fast flow from this coronal hole and the slow wind flow. This interaction region contained substantial portions of southward interplanetary magnetic field, so the Kp index suddenly jumped from 1 to 5. Geomagnetic conditions remained at active to minor storm levels until Feb 06. From Feb 07 to Feb 10, conditions were quiet.

Another large transequatorial coronal hole crossed the central meridian on Feb 09 and became geo-effective a few days later. The solar wind speed started increasing clearly from Feb 11 to reach 700 km/s. On Feb 15 peaks up to 800 km/s were measured by ACE. As a consequence of these flows, the estimated Kp index reached the major storm level of 6 on Feb 11. On Feb 12, once again the minor storm level was reached. Active to minor storm levels continued until early on Feb 16. The ensuing period of quiet conditions with only sporadic active intervals (K=4) lasted until Feb 27. From then onwards, geomagnetic activity increased to active conditions with minor storm levels (K=5) on February 28 and 29. This was again the consequence of a high speed solar wind stream from a coronal hole, with wind speeds increasing from 300 km/s on Feb 26 to 700 km/s on Feb 29.

III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO	TYPE	600 (Human)	Cat	NOAA	NOTE
08	2024	2051	2102	S08E68	M1.2	SF		III/3			57	0554	
26	0150	0203	0210	N14W14	X1.1	2N					67	0564	
26	2214	2230	2239	N14W26	M5.7	1N					67	0564	

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

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SIDC DEFINITIVE INTERNATIONAL AND HEMISPHERIC SUNSPOT NUMBERS FOR 2003

Date	OCTOBER			NOVEMBER			DECEMBER		
	Ri	Rn	Rs	Ri	Rn	Rs	Ri	Rn	Rs
1	76	20	56	124	52	72	92	10	82
2	68	15	53	112	40	72	72	8	64
3	62	8	54	72	31	41	72	9	63
4	49	0	49	52	26	26	66	9	57
5	50	0	50	12	0	12	59	8	51
6	41	0	41	9	0	9	45	8	37
7	41	0	41	12	0	12	32	9	23
8	43	0	43	21	0	21	26	7	19
9	47	10	37	39	0	39	16	0	16
10	45	13	32	39	0	39	25	8	17
11	44	16	28	30	0	30	25	8	17
12	25	9	16	11	5	6	25	15	10
13	13	0	13	21	21	0	28	19	9
14	13	7	6	23	23	0	31	22	9
15	13	13	0	33	33	0	30	20	10
16	19	10	9	42	42	0	39	22	17
17	30	16	14	34	34	0	68	30	38
18	41	27	14	52	36	16	71	38	33
19	41	34	7	70	37	33	71	47	24
20	47	36	11	90	44	46	74	54	20
21	59	38	21	97	45	52	60	46	14
22	58	37	21	83	42	41	74	58	16
23	61	36	25	109	50	59	76	58	18
24	75	46	29	107	50	57	59	42	17
25	88	48	40	123	56	67	44	34	10
26	89	45	44	119	49	70	40	28	12
27	133	61	72	132	53	79	31	20	11
28	165	71	94	121	34	87	34	18	16
29	167	66	101	113	29	84	26	18	8
30	167	55	112	116	29	87	17	17	0
31	160	54	106				12	6	6
MEAN :	65.5	25.5	40.0	67.3	28.7	38.6	46.5	22.5	24.0

The Definitive yearly Sunspot Number for 2003 is 63.7