

Center

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SUNSPOT BULLETIN

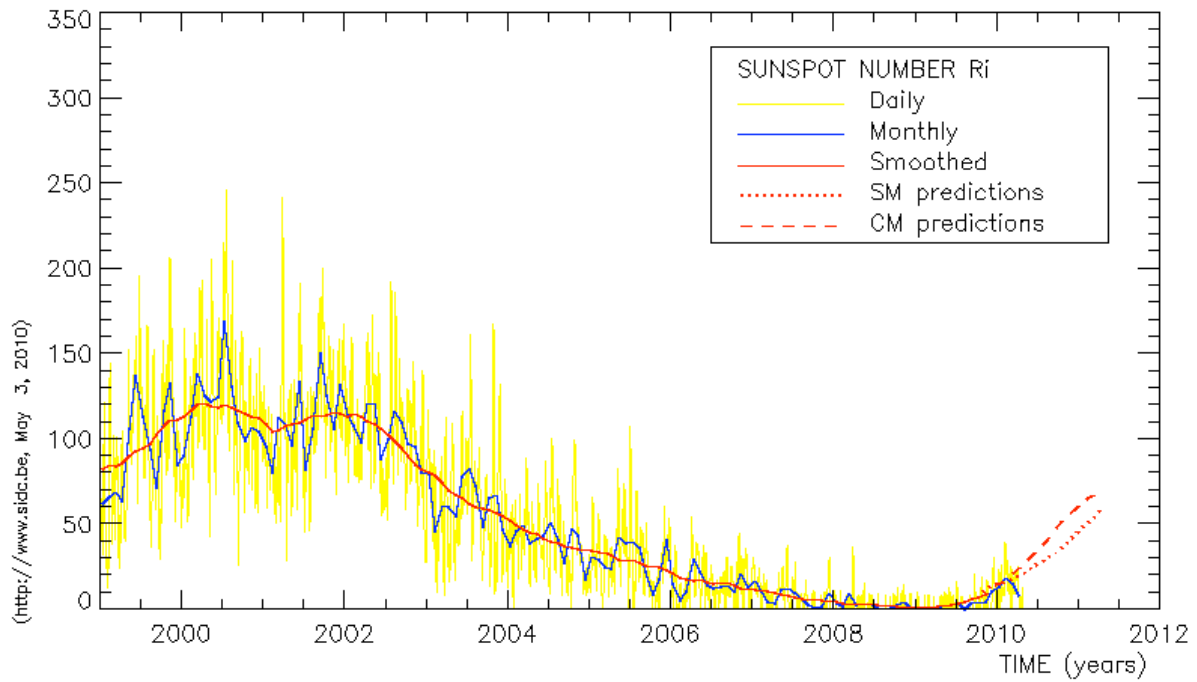
2010

n° 4

Provisional international and normalized hemispheric daily sunspot numbers for April 2010

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	17	9	8
2	17	9	8
3	18	9	9
4	25	17	8
5	24	17	7
6	19	19	0
7	16	16	0
8	22	22	0
9	7	7	0
10	8	8	0
11	8	0	8
12	8	0	8
13	7	0	7
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	0	0	0
21	7	7	0
22	7	7	0
23	0	0	0
24	0	0	0
25	12	12	0
26	0	0	0
27	0	0	0
28	8	8	0
29	0	0	0
30	7	7	0
Monthly mean	7.9	5.8	2.1
Cooperating stations	66	62	62



Predictions of the monthly smoothed Sunspot Number
 using the last provisional value, calculated for October 2009 : 7. ($\pm 5\%$)

		SM	CM			SM	CM			SM	CM
2009	Nov	8	9	2010	May	17	28	2010	Nov	31	55
	Dec	9	12		Jun	19	32		Dec	33	58
2010	Jan	11	15		Jul	21	36	2011	Jan	36	62
	Feb	13	18		Aug	23	41		Feb	40	65
	Mar	14	21		Sep	25	46		Mar	44	67
	Apr	16	25		Oct	28	51		Apr	47	69

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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 Ed. Ronald Van der Linden, Ass. Ed. Petra Vanlommel
 Editing contributions from various members of the SIDC team

Fax 32-(0)2-373 02 24 Tel 32-(0)2-373 04 91
 e-mail : arille@oma.be, ronald@oma.be
 ftp anonymous : omaftp.oma.be, directory dist/astro/sidcdata
 http://sidc.oma.be

S.I.D.C. SUMMARY OF THE URSIGRAMS

Date	R' _i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
31	17	49	-	81	////	0	0/0	7	
1	17	32	-	79	////	0	0/0	12	
2	17	30	-	76	////	0	0/0	14	
3	18	19	-	77	////	1	0/0	14	
4	25	9	-	79	////	0	0/0	18	
5	24	11	-	79	////	0	0/0	50	
6	19	25	-	78	////	0	0/0	39	
7	16	15	-	76	////	0	0/0	24	
8	22	8	-	76	////	0	0/0	15	
9	7	2	-	76	////	0	0/0	8	
10	8	1	-	75	////	0	0/0	3	
11	8	3	-	75	////	0	0/0	18	
12	8	2	-	75	////	0	0/0	19	
13	7	2	-	75	////	0	0/0	3	
14	0	1	-	75	////	0	0/0	12	
15	0	///	-	75	////	0	0/0	9	
16	0	///	-	75	////	0	0/0	3	
17	0	0	-	74	////	0	0/0	5	
18	0	0	-	75	////	0	0/0	4	
19	0	///	-	75	////	0	0/0	6	
20	0	///	-	76	////	0	0/0	5	
21	7	0	-	76	////	0	0/0	8	
22	7	1	-	76	////	0	0/0	6	
23	0	0	-	75	////	0	0/0	10	
24	0	0	-	74	////	0	0/0	8	
25	12	0	-	75	////	0	0/0	3	
26	0	///	-	76	////	0	0/0	2	
27	0	1	-	75	////	0	0/0	7	
28	8	2	-	76	////	0	0/0	4	
29	0	0	-	76	////	0	0/0	6	
30	7	2	-	79	////	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/m² : 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 APRIL 2010

DATE	UT	NUMBER		RELATIVE SUNSPOT NUMBERS			PPSI 10-5 WM-2	QUAL	OBS	
		OF GROUPS	OF SPOTS	TOTAL	NORTH	SOUTH				CENTRAL
1	820	2	11	31	17	14	14	3.6	2	OB
2	830	2	6	26	13	13	13	3.3	2	AE
3	1200	2	9	29	13	16	16	6.4	3	AE
4	1015	4	14	54	39	15	27	2.1	2	AE
6	1145	3	12	42	29	13	16	23.8	3	OL
7	755	2	5	25	25	0	0	19.4	2	OL
8	1505	2	6	26	26	0	11	3.6	4	OL
9	745	2	3	23	12	11	11	1.1	2	OL
10	822	1	1	11	11	0	0	0.4	3	OL
11	1125	1	2	12	0	12	12	0.4	3	OL
12	910	1	1	11	0	11	11	0.4	2	OB
13	750	1	1	11	0	11	11	0.4	2	OB
14	835	0	0	0	0	0	0	0.0	3	OB
15	700	0	0	0	0	0	0	0.0	2	OB
16	620	0	0	0	0	0	0	0.0	3	FC
17	705	0	0	0	0	0	0	0.0	3	OB
18	810	0	0	0	0	0	0	0.0	3	OB
19	835	0	0	0	0	0	0	0.0	3	SV
20	705	0	0	0	0	0	0	0.0	3	SV
21	925	0	0	0	0	0	0	0.0	1	SV
22	710	0	0	0	0	0	0	0.0	3	SV
23	655	0	0	0	0	0	0	0.0	3	SV
24	630	0	0	0	0	0	0	0.0	2	SV
25	615	0	0	0	0	0	0	0.0	2	SV
26	730	0	0	0	0	0	0	0.0	2	AE
27	745	0	0	0	0	0	0	0.0	2	AE
28	815	0	0	0	0	0	0	0.0	3	AE
29	800	0	0	0	0	0	0	0.0	3	AE
30	945	1	1	11	11	0	0	0.3	2	AE

The relative mean sunspot number is 10.8.

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

$K'= 0.784$ (*)

1	24	7	20	13	9	19	0	25	0
2	20	8	20	14	0	20	0	26	0
3	23	9	18	15	0	21	0	27	0
4	42	10	9	16	0	22	0	28	0
5	***	11	9	17	0	23	0	29	0
6	33	12	9	18	0	24	0	30	9

The normalised relative monthly mean sunspot number is 8.

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

The Sun has been observed 29 days on 30 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR APRIL 2010
E AND F BRUNNER'S TYPE GROUPS

NONE

PROBABLE RETURN OF MAJOR GROUPS FOR MAY 2010
NONE

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

The activity of the Sun is normal for the time being. The new cycle is now in full swing, as can also be seen from the increased number of coronal mass ejections.

The first event on the Sun this month was the one of Apr 03. From 08:43UT, we see a coronal dimming in PROBA2/SWAP images in the neighborhood of Catania 56/NOAA AR 1059. The sunspot group is at that moment located around S25W05. The boundary of the dark region from where the plasma is evacuated is extending clearly to the north and to the south of the source region. A B7.4 long duration event was measured by GOES and an EIT wave was visible in SOHO/EIT images. The post-flare loops were nicely west-east oriented. The ejected flux rope was aligned along the north-south axis pointing towards the south. The coronagraphs onboard STEREO show a CME propagating towards the south of the ecliptic.

Another B3.7 long duration flare occurred on Apr 08 peaking at 03:25 UT. The source region was Catania 60/NOAA AR 1060, at that time about 20 degrees east of the central meridian. The flare was accompanied by an Earth-directed halo CME.

Worthwhile to mention also is the spectacular polar crown filament eruption on Apr 13. STEREO-A/SECCHI captured the cool, dark material being ejected near the northern pole. The event triggered an EUV-wave and a small coronal dimming located more to the equator and at the central meridian as seen from STEREO-A.

We list the coronal holes transiting the solar disk viewed from STEREO-A/SECCHI-EUVI. When the coronal hole (CH) is located 15° to the east of the central meridian seen from STEREO-A, the hole is at a geo-effective position. We indicate the day when this occurred.

- A large Y-shaped northern CH with an equatorial extension, the upper left arm of the Y reached the north pole, Apr 06,
- A small northern CH at a latitude 40°, Apr 14,
- A relatively large extension of the south pole with more and less dark regions, Apr 14,
- A small northern CH at a latitude of 40°, early Apr 22,
- A small southern CH at a latitude of 40°, late Apr 22.

II. Geomagnetic Activity

One period of geomagnetic disturbances struck the eye. It was induced by the arrival of a shock front preceding a magnetic plasma cloud.

An interplanetary shock was detected by ACE on Apr 02 at 06:45 UT. The solar source of this shock can be traced back to the CME-activity of end Mar 2010. No halo CME was detected, so it was probably only a bow shock that passed ACE. The north-south component was fluctuating between negative and positive values. The geomagnetic response was limited: Kp reached only 3.

On Apr 01, 04 and early 05, isolated unsettled conditions were measured. These were triggered by the north-south component of the interplanetary magnetic field (IMF), which was negative for a considerable time. The total IMF was below 5 nT.

The upper part of the interplanetary plasma cloud, which was associated to the Apr 03 event, swept along Earth on Apr 06. The shock in front of the Interplanetary CME actually arrived around 07:50 UT on Apr 05 according to ACE. The Earth magnetic field was disturbed strongly, even at low latitudes. The Kp went up to 7.

Without interruption, the solar wind speed stayed at a high level on Apr 06. It was the wind emanating from the first mentioned coronal hole (see previous section) that kept the speed on a high level. Geomagnetic conditions returned to quiet level from Apr 08.

A weak interplanetary shock was observed by the ACE spacecraft on Apr 11 at 12:15 UT, in relation with the halo CME of Apr 08. The planetary geomagnetic K index was 6 during the first period on Apr 12.

The last disturbance was caused by the Apr 22 CHs. However, the arrival of the co-rotating interaction region is difficult to extract from ACE data. The peak in disturbance was measured on Apr 23 when the Kp reached once 5.

III. News item: SWAP & LYRA data release – PROBA2 Guest Investigator Program

The ESA micro-satellite PROBA2 was launched last November with two solar instruments onboard: SWAP, an EUV imager, and LYRA, a UV radiometer. SWAP and LYRA have an open data policy. We are happy to announce the beta data release of the science data products.

We also announce the open call for the PROBA2 Guest Investigator Program to promote & fund SWAP and LYRA data analysis by external scientists (submission deadline June 10!).

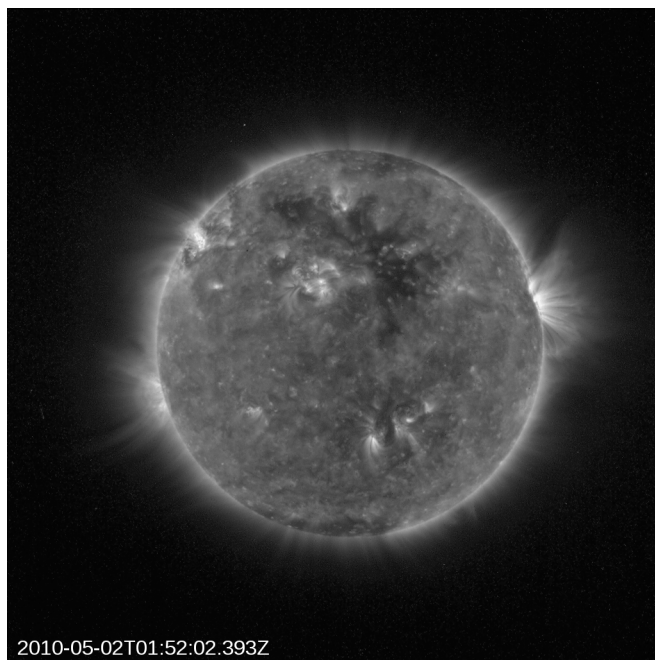
For the time being, we have online the following FITS files in YYYY/MM/DD directories:

- SWAP raw images, e.g. <http://proba2.oma.be/swap/data/eng/2010/05/01/>
- SWAP calibrated images, e.g. <http://proba2.oma.be/swap/data/bsd/2010/05/01/>
- LYRA raw 'standard' time curves, e.g. <http://proba2.oma.be/lyra/data/eng/2010/05/01/>

New data will become available in (near) real time. Older data will gradually become available as we backward process the received telemetry. Users are encouraged to feedback problems and questions such that we can further fine-tune the format of the data products. The latest SWAP image and a recent LYRA time-curve can be found on the front page of <http://sidc.be>. More information on the instruments and data will become available on <http://proba2.sidc.be>.

A Guest Investigator Program is available to promote the use of PROBA2 data. Selected proposers will be invited to spend one or a few months with the Principal Investigator (PI) teams to obtain expert knowledge on the instruments and to participate in the daily commanding of SWAP and LYRA. Each guest investigator will get reimbursed for travel, accommodation and living expenses. Details on the PROBA2 Guest Investigator Program can be found at

<http://proba2.oma.be/index.html/community/guest-investigator-program/>



On the SWAP image dating from May 02, 2010, we can clearly see a coronal hole in the northern hemisphere. The fast solar wind speed emanating from this hole was blowing over the Earth magnetosphere inducing a major magnetic storm on May 02 and 03. Solar wind velocities were close to 700 km/s. The magnetic field carried by the solar wind reached 20 nT on May 02. This magnetic field was oriented for a long period in such a way that it could couple with th