



Center

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SUNSPOT BULLETIN

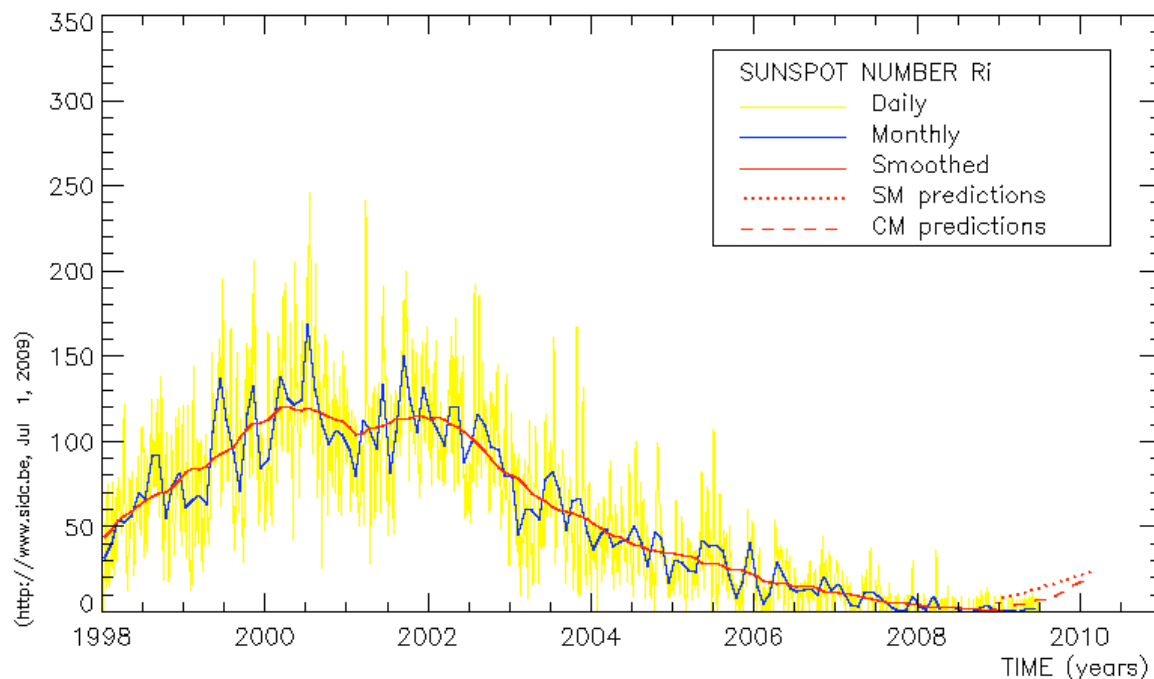
2009

n° 6

Provisional international and normalized hemispheric daily sunspot numbers for June 2009

computed at the *Royal Observatory of Belgium* using observations from an international network with the *Locarno Specola Solare* as reference station.

Date	R' ₁	R' _N	R' _S
1	11	11	0
2	11	11	0
3	10	10	0
4	9	9	0
5	8	8	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
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	0	7
22	8	0	8
23	7	0	7
24	8	0	8
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0
Monthly mean	2.6	1.6	1.0
Cooperating stations	65	56	56



Predictions of the monthly smoothed Sunspot Number
 using the last provisional value, calculated for December 2008 : 1.7 ($\pm 5\%$)

	SM	CM		SM	CM		SM	CM			
2009	Jan	2	2	2009	Jul	12	8	2010	Jan	19	19
	Feb	2	3		Aug	13	9		Feb	20	21
	Mar	2	4		Sep	14	10		Mar	22	23
	Apr	9	5		Oct	15	12		Apr	23	26
	May	10	6		Nov	17	15		May	25	28
	June	11	7		Dec	18	17		June	27	32

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	11	3	-	69	////	0	0/0	4	
1	11	9	-	73	////	0	0/0	3	
2	11	7	-	72	////	0	0/0	3	
3	10	10	-	73	////	0	0/0	7	
4	9	10	-	71	////	0	0/0	6	
5	8	4	-	70	////	0	0/0	6	
6	0	///	-	69	////	0	0/0	4	
7	0	///	-	69	////	0	0/0	8	
8	0	3	-	69	////	0	0/0	4	
9	0	3	-	69	////	0	0/0	2	
10	0	///	-	69	////	0	0/0	5	
11	0	///	-	69	////	0	0/0	4	
12	0	2	-	69	////	0	0/0	2	
13	0	///	-	68	////	0	0/0	5	
14	0	///	-	68	////	0	0/0	8	
15	0	0	-	67	////	0	0/0	4	
16	0	0	-	68	////	0	0/0	5	
17	0	1	-	68	////	0	0/0	2	
18	0	///	-	68	////	0	0/0	6	
19	0	///	-	67	////	0	0/0	4	
20	0	///	-	67	////	0	0/0	6	
21	7	2	-	67	////	0	0/0	11	
22	8	6	-	68	////	0	0/0	4	
23	7	5	-	68	////	0	0/0	6	
24	8	8	-	67	////	0	0/0	21	
25	0	3	-	68	////	0	0/0	9	
26	0	///	-	67	////	0	0/0	4	
27	0	///	-	67	////	0	0/0	6	
28	0	0	-	67	////	0	0/0	14	
29	0	///	-	69	////	0	0/0	7	
30	0	///	-	68	////	0	0/0	5	

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 : $1 \times \text{Sn} + 10 \times \text{"1"} + 100 \times \text{">1"}$).
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 JUNE 2009

DATE	UT	NUMBER		RELATIVE SUNSPOT NUMBERS			PPSI 10-5 WM-2	QUAL	OBS	
		OF GROUPS	OF SPOTS	TOTAL	NORTH	SOUTH				CENTRAL
1	855	1	12	22	22	0	0	0.9	3	OB
2	740	1	10	20	20	0	0	1.2	3	OB
3	655	1	12	22	22	0	22	1.3	3	FC
5	1130	0	0	0	0	0	0	0.0	3	OB
6	1050	0	0	0	0	0	0	0.0	3	OB
8	740	1	3	13	13	0	13	0.3	2	SV
9	800	1	2	12	12	0	12	0.3	2	SV
10	1150	0	0	0	0	0	0	0.0	2	SV
11	745	0	0	0	0	0	0	0.0	1	SV
12	1120	1	1	11	11	0	0	0.2	2	OL
13	930	0	0	0	0	0	0	0.0	3	SV
16	725	0	0	0	0	0	0	0.0	3	OL
17	700	1	1	11	0	11	0	0.1	3	OL
18	805	0	0	0	0	0	0	0.0	2	OL
19	725	0	0	0	0	0	0	0.0	3	OL
20	720	0	0	0	0	0	0	0.0	3	OL
21	1220	1	2	12	0	12	0	1.2	2	OL
22	615	2	6	26	0	26	12	1.3	3	AE
23	730	1	2	12	0	12	0	1.2	3	AE
24	730	1	5	15	0	15	15	1.3	3	AE
25	730	1	2	12	0	12	12	1.3	2	AE
26	745	0	0	0	0	0	0	0.0	3	AE
27	900	0	0	0	0	0	0	0.0	3	AE
28	800	0	0	0	0	0	0	0.0	3	AE
29	835	0	0	0	0	0	0	0.0	3	OB
30	810	0	0	0	0	0	0	0.0	3	OB

The relative mean sunspot number is 7.2.

NORMALISED UCCLE OBSERVATIONAL SUNSPOT NUMBERS $U'=K'U$ FOR JUNE 2009

$$K' = 0.741 (*)$$

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

The normalised relative monthly mean sunspot number is 5.

(*) 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 JUNE 2009
E AND F BRUNNER'S TYPE GROUPS

NONE

PROBABLE RETURN OF MAJOR GROUPS FOR JULY 2009

NONE

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

The overall flaring activity was low, although the Estimated International Sunspot Number was not zero for several days.

From June 1 to June 6, active region NOAA AR 11019 was visible in the images of SOHO/EIT. From June 7, it degraded to a plage. The active region was linked to the sunspot group Catania 08, spotted on June 3, 4 and 5. Several A and a few B flares could be linked to this magnetic structure.

On June 16, a prominence disappeared around 02:30UT. GOES/X-ray monitor did not observe any flaring activity around that time. The CACTus software detected a CME with a front speed of only 297 km/s.

Two active regions were visible in the southern hemisphere in the period from June 22 to June 25: NOAA AR 1022 and 1023. AR 1023 was linked with the sunspot group Catania 12. No noticeable flaring activity was caused by these magnetic structures.

Only two coronal holes (CH) were visible in June 2009:

- A small CH, located in the northern hemisphere. The right boundary crossed the central meridian (CM) on June 21.
- A faint equatorial CH. The right boundary crossed the CM on June 25.

II. Geomagnetic Activity

The solar wind was very slow. Before June 24, the speed didn't exceed the value of 400 km/s. From June 24 onwards, some coronal hole influences were detected.

Until June 24, the geomagnetic conditions were very quiet: Kp did not exceed the value 3.

The co-rotating region associated with the first hole mentioned in the previous section arrived on June 24. The solar wind speed increased to 500 km/s on June 25. The Kp index became one period 4 and one period 5 on June 25.

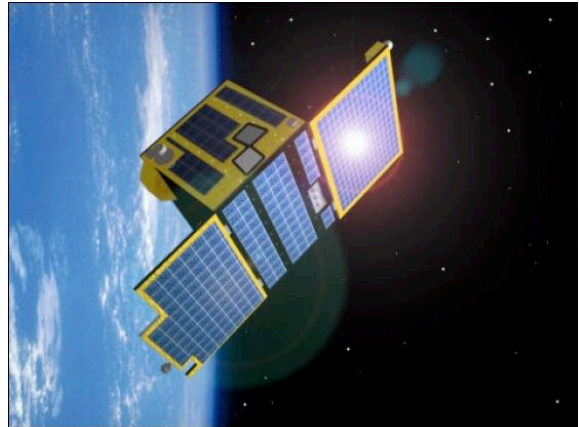
The influence of the second coronal hole was limited. The Bz was mainly positive. The Kp did not increase considerable.

III. Press Release: PROBA2 on its way to space

Destination: Earth orbit

Object of observation: Sun

The ESA satellite PROBA2 was carefully packed for shipping this month by Verhaert Space. The satellite will be transported to Russia where it will be mounted in the rocket and undergo the final tests. The launch of the mini-satellite with a Rockot launcher is foreseen for November 2, 2009. Two instruments onboard are in the hands of the SIDC. The development of the instruments was funded by the PRODEX programme.



Scientists and industry bundled their forces. The result is PROBA2, Project for On-Board Autonomy, a jewel of innovating space technology made in Belgium.

PROBA2 will be launched from Plesetsk, Russia, onboard of a Russian Rockot launcher. PROBA2 is a secondary passenger next to the ESA SMOS satellite. The orbit has a height of 728 km; the orbit time will be around 100 minutes. This orbit configuration admits uninterrupted solar observations during 9 months. Since PROBA2 was built, the satellite was stored in the clean room of Verhaert Space in Kruibeke (Belgium) in attendance of the launch. Because of the problems with the Russian Rockot, the launch was several times delayed. At the moment, the satellite is packed for transportation to Russia. Once in Russia, Verhaert will run extensive tests. Finally, PROBA2 will be mounted on the launcher ready for launch.

The PROBA2 platform gathers several improvements compared to the first PROBA: increased instrument capacity, a new board computer developed by Verhaert Space, a propulsion system to keep track of the correct orbit, unfolding solar panels for a higher power supply. This new generation satellite is better equipped to fulfill complex missions. The Belgian instruments are compact and the electronics don't need much energy to function. A first analysis of the data is done onboard. Thanks to efficient compression, more data can be sent to Earth through the limited telemetry.

SWAP films the Sun in extreme ultraviolet. In this way, it can make pictures of the invisible solar eruptions with a camera in the EUV band. Scientist of the STCE picked the most suitable wavelength in the EUV and an optimal spatial and time resolution. It became finally 17.5 nanometers, 1 image/minute of the solar disc plus a part of the surrounding space. SWAP is capable to follow a plasma cloud leaving the Sun and travelling through space.

The radiometer named LYRA measures the solar UV irradiance. LYRA will use diamond detectors for the first time in space for a solar physics instrument. The Sun radiates mostly in the visible light. But thanks to this diamond technology, the instrument can 'see' the UV radiation while not being affected by the overwhelming visible light. There is another advantage linked to diamond. This material and therefore the detectors made out of it and the whole LYRA instrument are less prone to particle radiation, as compared to classical silicon diodes. The Centre Spatial de Liège, CSL, built LYRA and SWAP.

Besides solar physics research tools, the two instruments are also helpful in the space weather context. Forecasters can watch the Sun at any moment and anticipate solar radiation, particle events and plasma storms. Space weather is an exciting new discipline, but at the same time it is also a threat, for e.g. satellites. Radio communication and navigation like GPS are influenced strongly by space weather. All kinds of companies, commercial and non-commercial entities, radio amateurs, air companies, satellite operators, electric power companies, offshore drilling for oil/gas surveys, ... they want space weather alerts, information in real-time and reliable forecasts.

PROBA2, itself under influence of space weather, will help ensure the security and safety against space weather. PROBA 2 has yet the advantage that it is protected by the magnetic field of the Earth.

Institutes involved

Verhaert Space is the Belgian specialist in high-technological space systems. The company develops advanced space technology like mini-satellites. PROBA1, the first success story of a satellite made in Belgium.

The **Solar-Terrestrial Centre of Excellence**, the STCE is a Belgian expertise centre focused on the relation Sun-Earth. It provides solar and solar-terrestrial research and services known by the international space weather and solar physics community.

The PROgramme for the Development of scientific EXperiments (PRODEX) is a programme of the European Space Agency (ESA) to which Belgium, as Member State of ESA, has been participating since June 1988. The purpose of PRODEX is to provide (co-)funding for the development and exploitation of scientific instruments and experiments in the framework of the scientific space programmes of ESA, as well as of other space institutions.

Information cards

PROBA2 - Project for On-Board Autonomy

- ESA mission
- Mini-satellite
- Built by Verhaert Space
- Launch Sept-Nov 2009

LYRA - Lyman Alpha Radiometer

- Onboard of PROBA2
- Measuring Solar UV
- Space weather application
- <http://lyra.sidc.be>

SWAP - Monitoring the solar corona

- Onboard of PROBA2
- EUV imager
- Space weather application
- <http://swap.sidc.be>

