Solar Influences Data analysis Center

Data Analysis Service supported by the FAGS

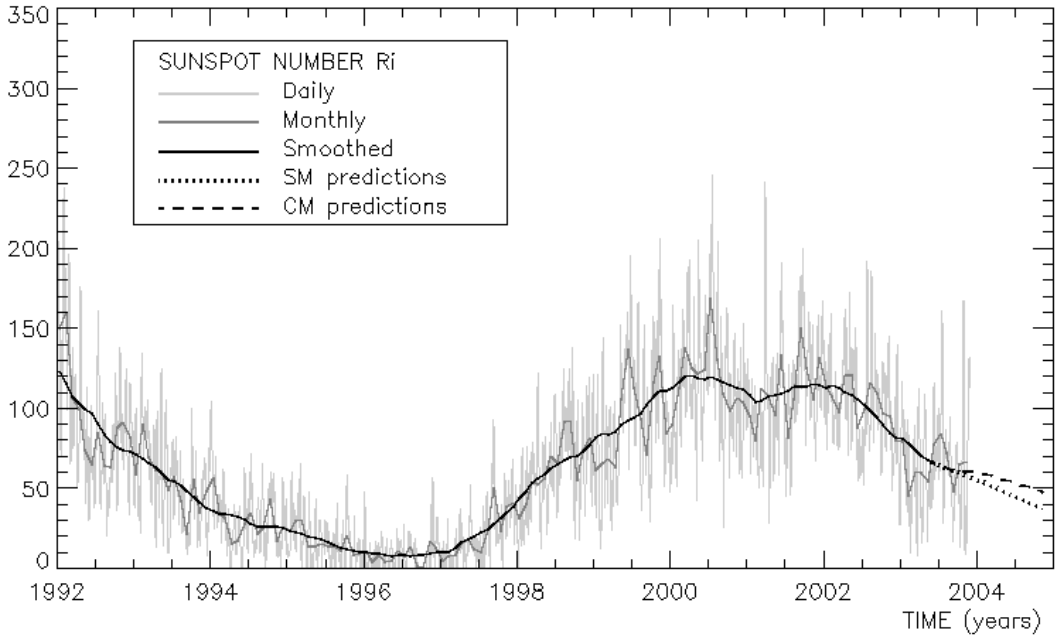
SUNSPOT BULLETIN

2003 n°11

Provisional international and normalized hemispheric daily sunspot numbers for November 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	106	42	64
2	112	40	72
3	72	31	41
4	52	26	26
5	12	0	12
6	9	0	9
7	12	0	12
8	21	0	21
9	39	0	39
10	39	0	39
11	30	0	30
12	11	0	11
13	21	21	0
14	23	23	0
15	33	33	0
16	42	42	0
17	34	34	0
18	52	36	16
19	70	37	33
20	90	44	46
21	97	45	52
22	91	45	46
23	109	46	63
24	107	54	53
25	131	54	77
26	119	49	70
27	132	53	79
28	121	34	87
29	113	29	84
30	116	29	87
Monthly mean	**67.2**	**28.2**	**39.0**
Cooperating stations	**39**	**34**	**34**



Predictions of the monthly smoothed Sunspot Number
using the last provisional value, calculated for May 2003 : 67.8 (± 5%)

	SM	CM		SM	CM		SM	CM
2003 Jun	64	66	2003 Dec	62	61	2004 Jun	52	55
Jul	66	65	2004 Jan	60	60	Jul	50	53
Aug	68	63	Feb	58	59	Aug	49	52
Sep	66	61	Mar	57	58	Sep	47	51
Oct	65	61	Apr	55	57	Oct	45	50
Nov	63	61	May	54	56	Nov	43	48

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

Brussels, December 1, 2003 11:28 UT

Ed. Pierre Cugnon, avenue Circulaire, 3 B-1180 BRUXELLES - BELGIUM
Fax 32-(0)2-373 02 24 Tel 32-(0)2-373 02 76
e-mail : arille@oma.be, pierrec@oma.be
ftp anonymous : omaftp.oma.be, directory dist/astro/sidcdata

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

Date	R'_i	PPSI	600	2800	COS	SFI	XI	Ak	SEA
31	160	616	61	249	////	12	2/0	40	
1	106	416	-	210	////	20	3/0	26	
2	112	296	-	190	////	106	2/1	21	
3	72	80	58	167	////	206	1/2	16	
4	52	26	53	168	////	101	3/1	30	
5	12	10	45	114	////	0	2/0	9	
6	9	4	42	98	////	0	0/0	22	
7	12	1	40	91	////	0	0/0	10	
8	21	4	39	93	////	0	0/0	9	
9	39	21	40	93	////	0	0/0	33	
10	39	28	39	95	////	2	0/0	26	
11	30	37	38	96	////	1	1/0	49	
12	11	7	39	99	////	0	0/0	34	
13	21	8	40	102	////	0	2/0	65	
14	23	14	39	99	////	0	0/0	31	
15	33	30	38	98	////	1	0/0	40	
16	42	50	41	104	////	2	0/0	43	
17	34	67	47	121	////	10	2/0	42	
18	52	81	51	144	////	103	4/0	28	
19	70	122	48	155	////	21	1/0	12	
20	90	150	48	175	////	113	3/0	82	
21	97	160	48	177	////	3	0/0	33	
22	91	188	53	176	////	3	0/0	34	
23	109	235	53	178	////	4	0/0	22	
24	107	280	53	177	////	2	0/0	15	
25	131	242	55	171	////	1	0/0	16	
26	119	220	57	171	////	2	0/0	12	
27	132	229	61	175	////	4	0/0	7	
28	121	158	56	168	////	1	0/0	5	
29	113	118	55	166	////	12	0/0	6	
30	116	71	53	153	////	0	0/0	18	

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 NOVEMBER 2003

DATE	UT	NUMBER OF GROUPS	NUMBER OF SPOTS	RELATIVE SUNSPOT NUMBERS TOTAL	NORTH	SOUTH	CENTRAL	PPSI 10-3 WM-2	QUAL	OBS
3	920	5	45	95	38	57	0	57.2	3	OB
4	1515	4	4	44	11	33	0	25.0	2	OB
5	940	2	2	22	0	22	0	11.1	2	OB
6	1010	1	1	11	0	11	0	6.6	3	OB
7	915	0	0	0	0	0	0	0.0	3	OB
8	1015	2	7	27	0	27	27	0.7	3	FC
9	1120	3	24	54	0	54	22	28.9	2	FC
10	935	3	21	51	0	51	0	23.8	2	RV
11	1105	4	59	99	52	47	24	82.9	3	OB
13	940	2	4	24	24	0	0	7.3	3	OB
15	940	3	16	46	35	11	0	31.7	3	OB
21	1105	4	59	99	52	47	24	83.8	3	OB
22	1200	3	64	94	57	37	40	106.6	2	ST
23	1425	5	106	156	60	96	46	126.0	2	ST
24	1020	8	70	150	54	96	100	136.7	3	OB

The relative mean sunspot number is 64.8.

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

K'= 0.876 (*)

1	***	7	0	13	21	19	***	25	***
2	***	8	24	14	***	20	***	26	***
3	83	9	47	15	40	21	87	27	***
4	39	10	45	16	***	22	82	28	***
5	19	11	87	17	***	23	137	29	***
6	10	12	***	18	***	24	131	30	***

The normalised relative monthly mean sunspot number is 57.

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

The Sun has been observed 15 days on 30 possible.

UCCLE OBSERVATIONAL MAJOR SUNSPOT GROUPS FOR NOVEMBER 2003
E AND F BRUNNER'S TYPE GROUPS

Uccle Nø	East Limb Date	Date and type 1st obs	CMP	Last obs	West Limb Date
3-2009	10 22.0	23 E	10 28.8	4 E	11 4.5
4-2009	10 24.6	25 B	10 31.3	4 C	11 7.1
6-2009	10 21.8	27 E	10 28.6	3 E	11 4.3
16-2009	11 7.8	71 E	11 14.5	11 E	11 21.3
17-2009	11 8.8	71 E	11 15.5	11 E	11 22.3
19-2009	11 12.8	13 E	11 19.5	24 C	11 26.3
4-2010	11 17.8	21 E	11 24.5	24 E	12 1.3
5-2010	11 18.7	21 E	11 25.5	24 E	12 2.2

PROBABLE RETURN OF MAJOR GROUPS FOR DECEMBER 2003

Nø	New East Limb	New CMP	New West Limb
3	11 19.1	11 25.8	12 2.6
6	11 18.2	11 25.0	12 1.8

http://sidc.oma.be

MONTHLY SUMMARY OF SOLAR AND GEOMAGNETIC ACTIVITY

I. Solar Activity

The past month was once again one with extreme variations in solar activity, reaching historically high levels at the start of the month, but also dropping to almost nothing during the second week. The most spectacular event was certainly the extremely large X-ray flare on Nov 04 from Catania sunspot group 70 (NOAA 0486) at the west limb of the sun. The flare actually saturated the GOES detector; its true X-ray class was estimated to be X28, making it the largest flare recorded since X-ray monitoring began.

Solar activity at the beginning of the month was still dominated by two of the main actors in October's stormy space weather, viz. Catania sunspot groups 70 (NOAA 0486) and 75 (NOAA 0488). While heading towards the western solar limb, these two very large sunspot groups with a beta-gamma-delta magnetic configuration again produced numerous M-flares and several X-flares (see the events list below), accompanied by many CMEs at the western solar limb. On Nov 01, proton fluxes were coming down from the very large proton storm at the end of October. The >10MeV proton flux decreased below the threshold early on Nov 01, but surpassed the threshold again around noon on Nov 02 due to an M1.8 flare in sunspot group 75. Just a few hours later, a strong increase in all proton fluxes was associated with an X8.3 flare produced by Catania sunspot group 70, peaking at 17:25UT. Coronal dimmings and an EIT wave due to this flare were observed by SOHO/EIT. Although this event occurred close to the western limb, the accompanying CME developed into a full halo with estimated plane-of-the-sky speed of about 2100 km/s. The >100MeV proton flux decreased below the threshold later on Nov 02, the >50Mev component followed in the early afternoon of Nov 03.

On Nov 03, Catania 75 produced two more X-flares (X2.7 and X3.9). The most buoyant day, however, was Nov 04. First, several M-flares were observed from sunspot groups 70 and 75. Some time later, sunspot group 70 generated the extremely large flare that was later estimated to have reached an X28 peak flux. It also produced a 20000sfu tenflare and a full halo CME, and generated a slow increase of the proton fluxes. The >50MeV flux very briefly reached the threshold on Nov 05, while the >10MeV flux, which had only briefly dipped below the threshold just before the flare, remained above threshold level until early on Nov 07. On Nov 05, although the two flaring regions had rotated behind the limb, two more M flares were recorded from sunspot group 70.

With the two culprits out of the way, and the decay of other sunspot groups, the solar disk became almost devoid of sunspots (in fact, for a few hours on Nov 07, not a single sunspot was observed), and solar activity suddenly dropped to very low levels. A few new active regions formed and started to grow, but they remained fairly small and simple. The only sunspot group worth mentioning from this period was the group with Catania number 86 (NOAA 0498). On Nov 11 it was responsible for an M1.6 flare. Together with this event, a full halo CME was reported. This CME was the second in a row of 4 plasma ejections giving nice LASCO movies. The first of these halo CMEs occurred earlier on Nov 11 and was linked with old Catania sunspot group 70. This CME was therefore back-sided. On Nov 12, another clear halo CME could be seen in LASCO/C3. The CME, which is really a 'school example' of a halo event, came out of the occulting disk at 11:18. This eruption was also back-sided, and believed to originate from the old sunspot group 75. A fourth halo CME was only partial. It was associated with a prominence eruption and M1.4 flare on Nov 13 in sunspot group 90 (active NOAA region 0501).

From Nov 11 on, flaring activity was observed from behind the east limb, where the return was expected of the first of the large sunspot groups responsible for the recent activity. Late on Nov 13, Catania sunspot group 90 (the return of group 65) finally crossed the east limb and made its entrance known with an M1.6 flare and the M1.4 flare associated with the prominence eruption and the partial halo CME mentioned higher. However, when this active region was getting more and more visible in the MDI/SOHO imagery, it seemed to have a far less complex structure than it had on its previous rotation. And indeed, flaring activity during the rest of the month remained limited to the M-class.

Apart from the two on Nov 13, 10 more M-flares were observed in the period Nov 17-20, all coming from sunspot group 90 (NOAA 0501). On Nov 18, a full halo CME was associated with the M3.2 and M3.9 activity of that sunspot group. On Nov 20, another full halo CME was associated with an M9.6 flare generated in sunspot group 90. This CME was a faint one.

Much was expected on Nov 18-19 from the returning old monster groups 70 and 75, renumbered now as 97 and 96 (NOAA 0508 and 0507) respectively, but solar activity became low after Nov 20, with C-class flares only. Sunspot group 97 was still complex initially with strong magnetic polarity mixing and some potential of large flaring activity, but just like for sunspot group 90, its complexity rapidly faded away. It was the most active sunspot group during the last week of November and released a large number of C-flares, including a C9.6 flare that erupted on Nov 27. Sunspot group Catania 96 (NOAA 0507) also had a beta-gamma-delta configuration but only flared occasionally at the C-class level.

II. Geomagnetic Activity

Early Nov 01 saw the end of the geomagnetic storm that began at the end of October, and the Kp index dropped to values of mostly 3 with an occasional 4 for the next few days. On Nov 04, at 05:53UT, a shock was recorded in the solar wind, which jumped to a speed of 680km/s, marking the arrival of the CME associated with the X8.3 flare of Nov 02. The interplanetary magnetic field pointed southward between 07:00 and 9:30 UT, which triggered a major geomagnetic storm (K=6 in Wingst) but only for a limited duration. Thereafter, the geomagnetic field remained quiet until the arrival of another shock on Nov 06, at 19:37UT, this time due to a glancing blow from the CME associated with the X28 superflare of Nov 04. This weak shock only led to a short minor geomagnetic storm on Nov 06. On Nov 07 and 08 the magnetosphere remained quiet.

At about 15:00 UT on Nov 08 the solar wind speed started to increase, with southward fluctuations of the interplanetary magnetic field (passage of a corotating interaction region). The geomagnetic field became active with minor storm episodes on Nov 09. This enhanced activity was associated with a high speed solar wind stream from the leading part of a large coronal hole with imbedded loop systems that rotated in a geo-effective position. This coronal hole continued to influence geomagnetic conditions for more than a week, resulting in minor geomagnetic storm conditions until Nov 18, with occasional periods of major storm conditions. The solar wind speed further increased to more than 550km/s on Nov 09. After a small decrease because of the imbedded loop systems, the solar wind reached the value of 700 km/s on Nov 11. Until Nov 19, the solar wind speed remained between 600 and 800km/s. In addition to the coronal hole influence, a push to higher values was given twice during this period by the arrival of a full halo CME (associated with the M1.6 flare on Nov 11) on Nov 13 at 10.00UT and of a partial halo CME (associated with the M1.4 flare on Nov 13) on Nov 15 at 05:18 UT. On Nov 13, this led to major storm conditions for a 12 hour period.

On Nov 19, the solar wind speed rapidly decreased to about 400km/s, and geomagnetic conditions became quiet on Nov 19 and early on Nov 20. On Nov 20, however, a severe geomagnetic storm was triggered by the arrival of the shock front of the powerful halo CME that left the sun around 07.45UT on Nov 18. The solar wind speed jumped suddenly from 430 to 750 km/s. The horizontal component of the interplanetary magnetic field was even measured to go down to -60nT. The local K-indices in Wingst and Izmiran and the estimated Kp index all reached the highest possible value of 9. This severe geomagnetic storm lasted until early on Nov 21, after which the geomagnetic conditions gradually became quiet.

A small impact of the faint full halo CME of Nov 20 could be seen in SOHO/CELIAS data at 10.00 UT on Nov 22. This led to minor geomagnetic storm conditions for the second half of Nov 22 and the beginning of Nov 23. From Nov 23 on, a small coronal hole caused the solar wind speed to increase to the level of 550 km/s leading to a mixture of quiet and active conditions for the next few days. After that, the solar wind decreased (to about 400km/s by Nov 27) and the geomagnetic condition remained quiet from Nov 26 to Nov 30.

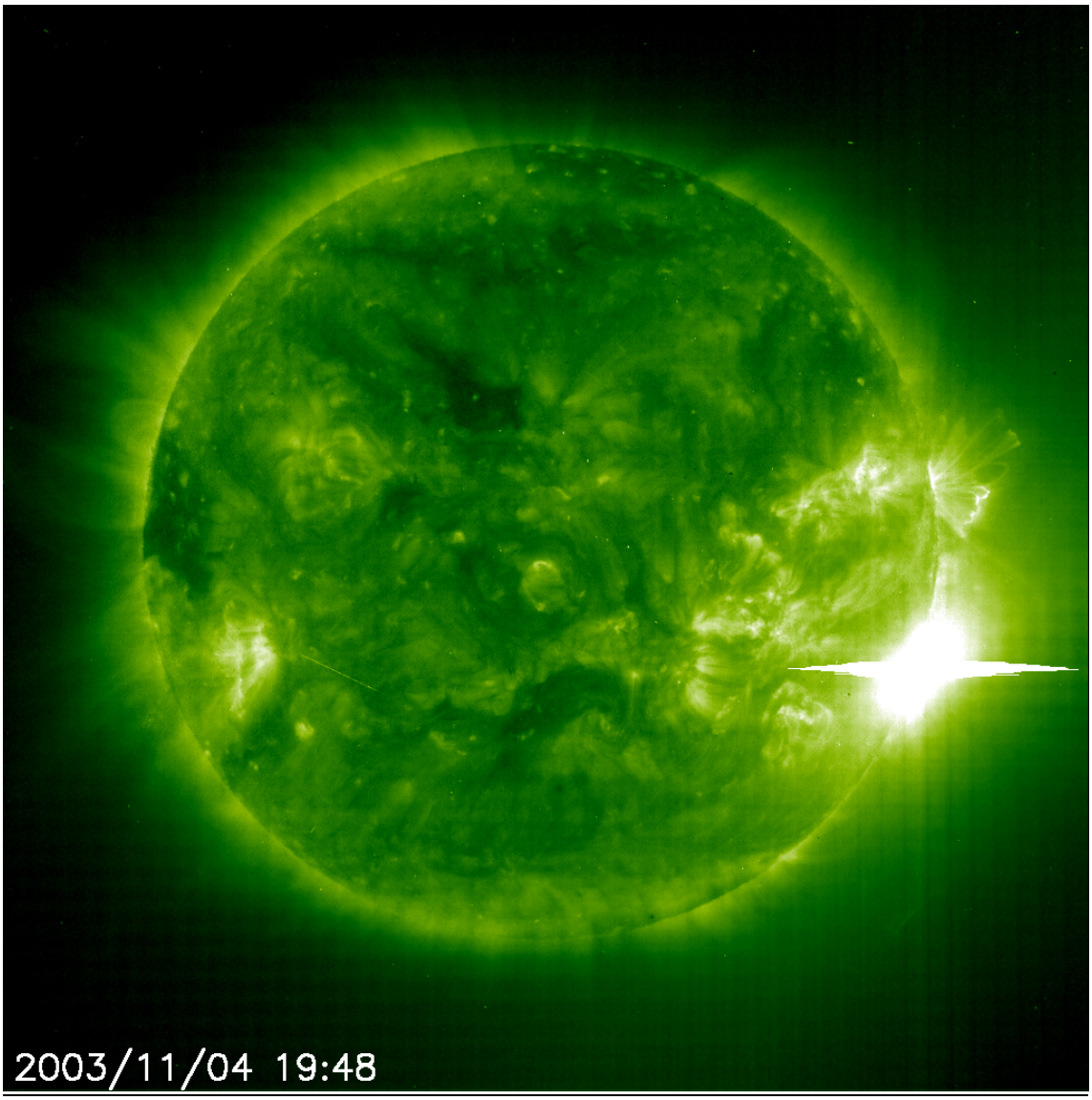
III. Noticeable solar events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO TYPE	600 (Humain)	Cat	NOAA	NOTE
01	0839	0851	0906		M1.3					75	0488	
01	1742	1751	1808	N09W50	M1.1	SF		III/1		75	0488	
01	2226	2238	2249	S12W60	M3.2	1N	95	III/1,II/2,IV/1		70	0486	
02	0659	0753	0812	S17W55	M1.0	SF				70	0486	
02	1230	1247	1312	N09W66	M1.8		22			75	0488	EIT derived location
02	1703	1725	1739	S14W56	X8.3	2B	7700	II/3,IV/3		70	0486	CME
03	0109	0130	0145	N10W83	X2.7	2B	240	II/1,III/1,IV/3		75	0488	
03	0943	0955	1019	N08W77	X3.9	2F	4400	II/2,III/2,IV/1, V/2		75	0488	
03	1526	1532	1543	S15W79	M3.9	SF	210			70	0486	
04	0543	0556	0607	S17W88	M2.6					70	0486	EIT derived location
04	1011	1022	1033	N08W90	M3.0					75	0488	EIT der. Loc.; CME
04	1343	1349	1401		M1.1					70	0486	
04	1929	1953	2006	S19W83	X28	3B	20000	IV/2,III/3,II/3		70	0486	halo CME;XRAY estimated
05	0237	0241	0245	S19W89	M1.6	SF				70	0486	
05	1046	1052	1056	S16W90	M5.3	SF				70	0486	
11	1321	1351	1417	S03W61	M1.6	SF	1100	II/2, III/2	1336	86	0498	halo CME
13	0454	0501	0506	N01E90	M1.6		100	III/2		90	0501	EIT derived location
13	0845	0929	1005	N04E81	M1.4		130	II/3	0910	90	0501	EIT derived location erupting prominence, partial halo CME
17	0128	0134	0139	N01E31	M1.2		64	III/1		90	0501	EIT derived location
17	0857	0905	0950	N01E32	M4.2	1N	700	II/1,III/3,V/2	0901,0924	90	0501	EIT derived location
18	0134	0139	0142	N01E20	M1.8		100	III/3		90	0501	EIT derived location
18	0722	0751	0815	N01E19	M3.2	2N	1900	IV/2,III/3,II/3		90	0501	EIT der. loc.; halo CME
18	0814	0830	0845	S02E18	M3.9			II/2	0825	90	0501	EIT der. loc.; halo CME
18	0926	1011	1101		M4.5		98		1009	90	0501	also contribution from simultaneous flare in Cat 95
19	0355	0401	0419	N01E06	M1.7	1N	130	III/1		90	0501	
20	0147	0212	0228	N03W08	M1.4	1N	190	III/3		90	0501	
20	0736	0747	0753	N01W08	M9.6	2B	9700	V/3,IV/1,III/3	0738	90	0501	
20	2342	2353	2358	N02W17	M5.8	2B	740	III/3		90	0501	

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

IV Picture of the month



An EIT image of the largest flare on record: the X28 (estimated) flare on Nov 04 from just behind the west limb. EIT is an instrument onboard the joint ESA/NASA mission SOHO.