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Paper number .
0148-0227/05/$9.00

Table 1. Characteristics of CMEs observed during the 2003 October-November period

		CME				Flare			NOAA
#	Date/Time	V	W	M	KE	Time	Class	Location	AR
1	2003/10/18 05:54	707	10	1.1e+14	2.8e+29	05:31	C2.0	N05E80	484
2	2003/10/18 07:31	397	24	2.0e+14	1.6e+29	—	—	Backside	—
3	2003/10/18 09:07	778	12	1.8e+14	5.6e+29	08:49	C3.3	N05E75	484
4	2003/10/18 15:30	627	360	7.2e+15	1.4e+31	—	—	SE90b	486-
5	2003/10/18 20:59	652	54	2.5e+15	5.3e+30	20:26	C3.3	N06E70	484
6	2003/10/18 21:30	309	85	4.0e+14	1.9e+29	—	—	Backside	—
7	2003/10/18 21:30	509	136	6.0e+15	7.8e+30	—	—	SE90b	486-
8	2003/10/18 23:55	544	114	5.9e+15	8.8e+30	—	—	E90b	486-
9	2003/10/19 06:54	798	38	2.7e+14	8.7e+29	06:08	M1.9	N07E65	484
10	2003/10/19 08:30	469	53	8.6e+14	9.5e+29	—	—	N06E64?	484?
11	2003/10/19 17:08	472	150	7.2e+15	8.1e+30	16:29	X1.1	N06E61	484
12	2003/10/19 19:52	799	113	1.3e+15	4.2e+30	—	—	SE90b	486-
13	2003/10/19 22:30	469	23	3.2e+14	3.5e+29	—	—	W90b	—
14	2003/10/21 03:54	1484	360	1.2e+16	1.3e+32	—	—	SE90b	486-
15	2003/10/21 16:06	533	24	7.7e+14	1.1e+30	—	—	SE90b	486?
16	2003/10/21 19:54	720	47	5.9e+15	1.5e+31	19:22	M1.?	S16E90	486
17	2003/10/21 20:58	602	75	6.5e+15	1.2e+31	21:50	M1.?	S17E90	486
18	2003/10/21 23:30	824	39	8.3e+14	2.8e+30	23:00	M2.4	S17E90	486
19	2003/10/22 01:31	666	54	3.8e+15	8.3e+30	01:25	C9.?	S13E90	486
20	2003/10/22 03:54	1163	101	5.8e+15	3.9e+31	03:28	M3.7	S13E88	486
21	2003/10/22 08:30	719	267	1.1e+16	2.8e+31	—	—	N07E25?	484?
22	2003/10/22 15:30	1054	18	—	—	15:06	M1.4	N04E29	484
23	2003/10/22 16:30	1040	23	—	—	15:57	M1.2	N05E29	484
24	2003/10/22 20:06	1085	134	9.7e+15	5.7e+31	19:47	M9.9	S17E88	486
25	2003/10/23 03:06	656	46	6.4e+14	1.4e+30	02:35	M2.4	N03E15	484
26	2003/10/23 07:31	1090	20	—	—	07:02	M3.2	N04E13	484
27	2003/10/23 08:54	1406	236	1.2e+16	1.2e+32	08:19	X5.4	S18E88	486
28	2003/10/23 13:54	511	36	8.1e+14	1.1e+30	—	—	S11W90	—
29	2003/10/23 20:06	1136	95	1.1e+16	7.2e+31	19:50	X1.1	S17E88	486
30	2003/10/24 02:54	1055	123	1.2e+16	6.9e+31	02:27	M7.6	S17E72	486
31	2003/10/24 05:30	1233	44	1.0e+15	7.9e+30	05:04	M4.2	S24E74	486
32	2003/10/24 16:30	384	88	2.1e+15	1.5e+30	15:23	C8.9	S19E60	486
33	2003/10/24 20:06	399	38	1.0e+15	8.2e+29	18:42	M1.3	S19E68	486
34	2003/10/25 05:18	685	113	4.4e+15	1.0e+31	04:17	M1.2	S14E45	486
35	2003/10/25 08:30	235	51	1.4e+14	3.8e+28	—	—	Backside	—
36	2003/10/26 01:31	419	75	2.8e+15	2.4e+30	—	—	S17W62	483
37	2003/10/26 05:30	684	86	7.2e+15	1.7e+31	—	—	S01W60	483
38	2003/10/26 06:54	1371	207	1.2e+16	1.2e+32	05:57	X1.2	S15E43	486
39	2003/10/26 08:30	258	96	1.4e+16	4.5e+30	—	—	Backside	—
40	2003/10/26 10:34	929	27	1.0e+14	4.4e+29	—	—	Backside?	—

Talbe 1: Continue

		CME				Flare			
#	Date/Time	V	W	M	KE	Time	Class	Location	NOAA
41	2003/10/26 17:54	1537	171	2.0e+16	2.4e+32	17:21	X1.2	N04W43	484
42	2003/10/27 04:30	481	48	2.4e+15	2.8e+30	04:12	M1.2	N00W44	484
43	2003/10/27 05:06	323	24	2.0e+14	1.1e+29	—-	—-	S15E30?	486?
44	2003/10/27 08:30	1322	144	4.5e+15	3.9e+31	07:51	M2.7	N00W48	484
45	2003/10/27 13:31	1005	45	4.1e+14	2.1e+30	12:27	M6.7	N06W45	484
46	2003/10/27 20:30	990	43	9.5e+14	4.7e+30	19:48	C9.0	N06W49	484
47	2003/10/28 05:54	602	17	——-	——-	05:07	C7.7	N06W53	484
48	2003/10/28 06:30	684	15	1.6e+14	3.8e+29	—-	—-	N06W51	484
49	2003/10/28 07:31	394	16	——-	——-	—-	—-	S17E19?	486?
50	2003/10/28 09:30	853	22	1.5e+15	5.5e+30	—-	—-	E90b	—
51	2003/10/28 10:54	1054	147	1.1e+15	6.1e+30	10:18	M8.?	S16E15	486
52	2003/10/28 11:30	2459	360	4.0e+16	1.2e+33	11:00	X17.	S20E02	486
53	2003/10/29 10:16[a]	922	114	1.6e+17	7.0e+32	—-	—-	——	486?
54	2003/10/29 20:54	2029	360	1.6e+16	3.4e+32	20:37	X10.	S19W09	486
55	2003/10/31 04:42	2126	50	7.1e+14	1.6e+31	04:26	M2.0	N06W90	484
56	2003/10/31 07:02	62	44	7.5e+14	1.4e+28	—-	—-	——	—
57	2003/10/31 17:30	309	34	8.8e+14	4.2e+29	16:44	C5.3	S17W47	486
58	2003/10/31 20:30	605	10	6.7e+13	1.2e+29	—-	—-	N01E63	—
59	2003/11/01 12:30	246	68	1.6e+15	4.7e+29	—-	—-	——	—
60	2003/11/01 14:54	334	55	7.5e+15	4.2e+30	—-	—-	——	—
61	2003/11/01 21:30	413	143	4.9e+15	4.2e+30	—-	—-	W90b	484+
62	2003/11/01 23:06	899	93	8.9e+15	3.6e+31	22:26	M3.2	S12W60	486
63	2003/11/02 09:30	2036	360	4.5e+16	9.3e+32	—-	—-	Backside	484?
64	2003/11/02 17:30	2598	360	4.9e+15	1.6e+32	17:03	X8.3	S18W59	486
65	2003/11/03 01:59	827	65	6.6e+15	2.3e+31	01:09	X2.7	N08W73	488
66	2003/11/03 10:06	1420	103	1.3e+16	1.3e+32	09:43	X3.9	N08W78	488
67	2003/11/03 19:31	641	26	2.0e+14	4.2e+29	—-	—-	E90b	—
68	2003/11/04 12:06	1208	360	1.1e+16	8.3e+31	—-	—-	Backside	—
69	2003/11/04 12:54	605	72	2.3e+15	4.2e+30	—-	—-	S21W88	486
70	2003/11/04 19:31	327	52	3.5e+15	1.9e+30	—-	—-	Backside	—
71	2003/11/04 19:54	2657	360	1.7e+16	6.1e+32	19:29	X28.	S18W88	486
72	2003/11/05 16:54	1075	12	3.0e+14	1.7e+30	—-	—-	W90b	491+
73	2003/11/06 03:54	532	12	7.9e+13	1.1e+29	—-	—-	SE90b	—
74	2003/11/06 04:06	643	23	3.9e+14	8.0e+29	—-	—-	W90b	—
75	2003/11/06 04:30	301	21	3.8e+13	1.7e+28	—-	—-	W90b?	486?
76	2003/11/06 07:31	749	11	2.0e+14	5.7e+29	—-	—-	SE90b	—
77	2003/11/06 17:30	1523	360	1.3e+16	1.6e+32	—-	—-	Backside	—
78	2003/11/07 15:54	2237	360	9.9e+15	2.5e+32	—-	—-	W90b	486+
79	2003/11/08 06:54	656	71	3.4e+14	7.4e+29	—-	—-	E90b	—
80	2003/11/08 09:30	703	44	7.7e+14	1.9e+30	—-	—-	SW90b	495

[a] It was possible to measure the speeds of all but 1 of the 80 CMEs. The 2003 October 29 at 10:16 UT (probably from AR 486) occurred when the "snow storm" caused by the big halo CME on October 28 was in progress. The CME was not seen in the C2 images, but was seen in C3 images. The speed was estimated to be about 922 km s^{-1}, but the value is not reliable.

Table 2. Shocks near the Sun and at Earth inferred from Radio and in situ observations

	CME				Flare			Metric		DH		Earth		
#	Date/Time	V	W	Time	Class	Location	NOAA	Time	Freq.	Time	Freq.	Date/Time	Dst	T
9	2003/10/19 06:54	798	38	06:08	M1.9	N07E65	484	—–	——-	07:15	5000-2000	—– —–	—–	——
11	2003/10/19 17:08	472	150	16:29	X1.1	N06E61	484	16:54	030-180	—–	———-	—– —–	—–	——
14	2003/10/21 03:54	1484	360	—–	—	SE90b	486-	03:47	040-110	04:10	5000-1000	10/24 14:47	-23nT	60.7h
21	2003/10/22 08:30	719	267	—–	—	N07E25?	484?	09:48	025-043	—–	———-	—– —–	—–	——
27	2003/10/23 08:54	1406	236	08:19	X5.4	S18E88	486	08:27	033-109	—–	———-	10/26 07:49	-72nT	82.7h
29	2003/10/23 20:06	1136	95	19:50	X1.1	S17E88	486	—–	——-	—–	———-	10/26 18:35	-72nT	70.5h
–	2003/10/24 11:06?	365	33	10:31	C9.1	N04W02	484	10:47	040-065[a]	—–	———-	—– —–	—–	——
34	2003/10/25 05:18	685	113	04:17	M1.2	S14E45	486	04:27	030-050	—–	———-	—– —–	—–	——
–	2003/10/25 06:30?	—	—	05:44	M1.7	S12E49	486	05:52	025-180	—–	———-	—– —–	—–	——
38	2003/10/26 06:54	1371	207	05:57	X1.2	S15E43	486	06:16	057-330	07:00	8000-1500	—– —–	—–	——
41	2003/10/26 17:54	1537	171	17:21	X1.2	N04W43	484	17:35	030-070	17:45	14000-1500	10/28 01:30	-42 nT	31.8h
52	2003/10/28 11:30	2459	360	11:00	X17.	S20E02	486	11:02	025-180	11:10	14000-40	10/29 06:00	-363 nT	18.9h
54	2003/10/29 20:54	2029	360	20:37	X10.	S19W09	486	20:42	060-430	20:55	11000-500	10/30 16:20	-401 nT	19.7h
62	2003/11/01 23:06	899	93	22:26	M3.2	S12W60	486	22:34	033-180	22:55	14000-2000	—– —–	—–	——
63	2003/11/02 09:30	2036	360	—–	—	Backside	—	09:16	040-085	09:23	14000-630	—– —–	—–	——
64	2003/11/02 17:30	2598	360	17:03	X8.3	S18W59	486	17:14	025-180	17:30	12000-250	11/04 05:53	-68nT	36.8h
65	2003/11/03 01:59	827	65	01:09	X2.7	N08W73	488	01:24	025-180	01:15	3000-1500	—– —–	—–	——
66	2003/11/03 10:06	1420	103	09:43	X3.9	N08W78	488	09:51	025-180	10:00	6000-400	—– —–	—–	——
71	2003/11/04 19:54	2657	360	19:29	X28.	S18W88	486	20:03	020-090	20:00[b]	10000-200	11/06 18:56	-27nT	47.2h

Table 3. Historical fast-transit shocks compared with those of the 2003 October-November period

#	Flare Date	UT	Location	area	SC Date	SC UT	T	V_{inf}	Ref.[h]
01	Sep/01/1859	11:18	N20W12	2300	Sep/02	04:48	17.5	2356	N
02	Jul/15/1892	17:00	S31E32	829	Jul/16	12:30[e]	19.5	2144	H,N
03	Sep/10/1908	05:36	S21W22	494	Sep/11	09:47	28.2	1605	H
04	Sep/24/1909	10:06	S05W08	605	Sep/25	11:43	25.6	1728	H,N
05	Nov/10/1916	15:42	N24E18[c]	142	Nov/11	19:12	27.5	1636	N
06	Feb/14/1917	16:06	S23E44[c]	110	Feb/15	12:00	19.9	2108	N
07	Jan/25/1926	20:00	N21W17	3285	Jan/26	16:48[f]	20.8	2033	N
08	Jul/31/1937	16:42	N24E67[d]	634	Aug/01	21:36	28.9	1575	N
09	Jan/16/1938	00:40	N17E31	3179	Jan/16	22:35	21.8	1958	CS,N,Ca
10	Apr/15/1938	08:30	N27W12	1098	Apr/16	05:42	21.2	2002	Cb
11	Feb/28/1941	09:30[a]	N12W14	683	Mar/01	03:54	18.4	2253	CS,Ca,N1
12	Sep/17/1941	08:36	N11W09	1896	Sep/18	04:48	19.8	2117	N,CS,Ca
13	Feb/28/1942	12:42	N07E03	1865	Mar/01	08:12	19.5	2144	N, Ca
14	Feb/06/1946	16:28	N27W19	4799	Feb/07	10:18	17.8	2320	Ca,Cb
15	Jul/25/1946	15:04	N21E16	4279	Jul/26	18:42	27.6	1631	Cb,NGDC
16	Jan/20/1957	11:00	S30W18	557	Jan/21	12:54	25.9	1712	Cb,NGDC
17	Feb/09/1958	21:08	S12w14	756	Feb/11	01:24	28.3	1600	Cb,NGDC
18	May/10/1959	21:02	N18E47	1552	May/11	23:24	26.4	1688	Cb,NGDC
19	Jul/14/1959	03:25	N17E04	1314	Jul/15	08:00	28.6	1587	Cb,NGDC
20	Jul/16/1959	21:14	N16W31	1981	Jul/17	16:42	19.5	2144	Cb,NGDC
21	Nov/12/1960	13:15	N28W01	1740	Nov/13	10:23	21.2	2002	CS,Ca,E
22	Aug/04/1972	06:20	N04E08	1140	Aug/04	20:54	14.6	2847	Ca,Cb
23	Jul/14/2000	10:24[b]	N22W07	490	Jul/15	14:17	27.9	1670[g]	G,NGDC
24	Oct/26/2003	17:41[b]	N04W43	1420	Oct/28	01:30	31.8	1537[g]	T,NGDC
25	Oct/28/2003	11:06[b]	S20E02	2110	Oct/29	06:00	18.9	2459[g]	T,NGDC
26	Oct/29/2003	20:41[b]	S19W09	2680	Oct/30	16:20	19.7	2029[g]	T,NGDC

[a] Based on a crochet in the Abinger magnetic traces [*Newton*, 1941]

[b] Time of CME onset at 1 Rs

[c] The area of the associated active regions is rather small, so the level of confidence on the flare associations is low

[d] The flare longitude makes the association questionable, although one cannot rule out intense storms from off-center CMEs [see, e. g., *Gopalswamy*, 2002]

[e] *Hale* [1931] gives a second more violent storm at 17:30 UT, which would have resulted in a longer transit time (24.5 h) and hence a smaller inferred CME speed (1788 km/s)

[f] *Newton* [1943] gives the transit time as 24 h, even though the difference between the listed flare and geomagnetic storm onsets is only 20.8 h

[g] Events 23-26 are from the SOHO era. 23 is the Bastille Day event; 24-26 are from Table. 1

[h] Ca - *Cliver et al.* [1990a]; Cb - *Cliver et al.* [1990b]; CS - *Cliver and Svalgaard* [2004]; E - *Ellison et al.* [1961]; G - *Gopalswamy et al.* 2005b; H - *Hale* [1931]; N - *Newton* [1943]; N1 - *Newton* [1941]; NGDC - National Geophysical Data Center for active region area (Greenwich for 1946-1959 and USAF_MWL for 2000-2003) from `ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/SUNSPOT_REGIONS/`; T - Table 1

Table 4. List of SEP events with intensity $\geq$ 1000 pfu in the > 10 MeV channel

Date/Time	SEP intensity (pfu)	CME Time	AR
1998/04/20 14:00	1700	10:21	8194
1998/09/30 15:20	1200	DG	8340
2000/07/14 10:45	24000	10:54	9077
2000/11/08 23:50	14800	23:06	9212[a]
2001/04/02 23:40	1110	22:00	9393
2001/09/24 12:15	12900	10:30	9632
2001/10/01 11:45	2360	05:30	9628
2001/11/04 17:05	31700	16:35	9684
2001/11/22 23:20	18900	23:30	9704
2002/04/21 02:25	2520	01:27	9906
2003/10/28 12:15	33600	11:30	0486
2003/10/29 22:00	3850	20:54	0486
2003/11/02 18:00	1210	17:30	0486

[a] Complex eruption involving two other active regions (AR 9213 and 9218).

Table 5. Energy characteristics of the three active regions

AR	Area (msh)	Ep (erg)	Max KE (erg)
AR0484	1750	3.66E+33	2.4e+32
AR0486	2610	4.57E+33	1.2e+33
AR0488	1750	2.76E+33	1.3e+32