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Modeling shock driving magnetic clouds with central solar source (E15 to W15) for solar cycle 23 1997-2005

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Abstract

for 17 out of 24 magnetic cloud events from the list of Gopalswamy et al. 2010 (ApJ): GS reconstruction - orientation, impact parameter, magnetic flux, axial currents, cross–section shape (approximate), central field strength assumption: invariant, time independent

to do: check ejecta in the list (another 35 events)

1. Definitions

GS code used is described in Hu and Sonnerup (2002, JGR).

Parameters and units:

- V_{HT}: deHoffmann-Teller velocity (just its norm) in km/s
- B_0: axial field strength in nT
- (θ, ϕ): latitude and longitude of MC axis. $\theta = 90°$ is defined northward and $\Phi = 90°$ is eastward.
- H: MC handedness, right or left.
- D: scale size of the MC, defined as the length of the trajectory in the GS map. This is perpendicular to the MC axis and thus corrected for orientation.
- p: impact parameter as fraction of D.
- Φ_t;Φ_p: axial and poloidal magnetic flux inside the map's white contours, in 10^{21} Mx.
- I_z: axial current in MA.
- SW: solar wind environment. Definitions, see below.

Solar wind environment classified as

- FS - ICME in front of the high speed stream (possible interaction)

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- BS - ICME in the back of a high speed stream
- S - Slow wind (< 500 km/s)
- F - Fast wind (> 500 km/s)

if front is > 500 and rear < 500 then F
if front is < 500 and rear > 500 then S
so it is important in which solar wind the cloud runs into.

2. Conclusions

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nr.	s/c	MC start	dur.	V_{HT}	B_0	(θ, ϕ)	H	D	p	Φ_t;Φ_p	I_z	SW
1997												
1	W	10-Jan 05:38	(17:00)	436	14.2	(-20,232)	R	0.148	0.06	0.54;1.47	560	FS
2	W	15-May 09:48	(12:50)	448	28.1	(-18,140)	L	0.091	0.59	0.33;1.30	425	FS
1999												
9	A	16-Apr 21:16	(18:40)	420	19.0	(-20,118)	L	0.173	0.03	0.20;0.62	407	S
12	W	09-Aug 12:38	(01:02:40)	345	10.5	(49,185)	L	0.170	0.02	0.09;0.19	130	FS
2000												
19	A	15-Jul 21:56	(18:00)	886	46.0	(44,110)	L	0.374	0.14	3.40;6.45	2931	F
23	A	12-Aug 03:56	(17:20)	594	31.6	(-10,93)	L	0.247	0.00	0.59;1.19	861	S
27	A	06-Nov 23:56	(17:20)	523	24.0	(27,90)	L	0.219	0.08	0.61;1.27	580	F
2001												
33	W	29-Apr 02:18	(11:00)	637	10.3	(6,154)	L	0.076	0.07	0.05;0.19	135	S
2002												
36	W	19-Mar 23:38	(12:00)	332	16.9	(27,72)	R	0.093	0.44	0.19;0.42	151	S
37	W	18-Apr 01:04	(06:26)	483	14.1	(-15,309)	R	0.272	0.21	0.94;1.31	716	S
43	W	01-Aug 13:18	(07:52)	450	15.1	(11,217)	R	0.056	0.21	0.04;0.24	119	S
2003												
44	A	18-Aug 09:16	(20:00)	445	19.8	(-58,304)	R	0.204	0.15	0.72;1.24	719	S
45	A	29-Oct 11:16	(08:40)	985	48.9	(-3,194)	L	0.050	0.24	0.10;0.66	505	F
2004												
48	W	27-Jul 02:18	(10:52)	957	26.1	(-20,94)	R	0.249	0.14	1.44;1.82	1003	F
49	W	09-Nov 23:28	(08:30)	775	31.0	(-31,254)	L	0.155	0.00	0.85;2.43	1029	F
2005												
53	W	15-May 06:12	(13:26)	828	54.9	(20,126)	L	0.218	0.07	1.67;2.95	2346	S
54	W	20-May 15:38	(13:16)	450	16.0	(35,238)	L	0.131	0.07	0.20;0.79	421	S