Cause and consequences of a prolonged IMF-B_z and solar wind density pulses observed at 1 AU.

Janardhan, P.

Astronomy & Astrophysics Divn.

Physical Research Laboratory



Ahmedabad - 380 009

India.

Collaborators: Susanta Kumar Bisoi; Chakraborty, D., Tokumaru, M., and Fujiki, K.

Science for Space Weather – 23-29 January 2016, Goa, India

CME Magnetosphere Interaction – extreme events



Long Duration Southward IMF Bz Events



✓ Southward IMF Bz intervals > 2 hours.

✓ The arrows mark events lasting > 8 hours with both ACE and Geotail data.

Tanskanen et al., JGR, 2005.

The magnetic storms on May 02-04, 1998: 44 Hrs Southward Bz

Dynamic Pressure and Dst Index

1979 – 1981



Hourly Dst index Vs. the square root of the hourly averaged values of the solar wind dynamic pressure (P).

- The upper envelope increases linearly with increase of P^{0.5} implying a minimum level of the ring current intensity and thus, dependence of the ground magnetic field upon the dynamic pressure (P) of the solar wind.
- ✓ When the ring current develops, the data points will go down from this level.
- Dynamic pressure dependence of the Dst is essentially controlled by the density (Araki et al., GRL, 1993).

May 02 – 04 1998 Event



The magnetic storms on May 02-04, 1998 have been well studied and reported and were associated with a HALO CME on April 29 and a second CME on May 02.

Gloeckler et al. [1999]; *Skoug et al.* [1999]; *Chen and Fritz* [1999, 2001]; *Bamert et al.* [2002]; *Malandraki et al.* [2002]; *Posch et al.* [2003]; *Ganushkina et al.* [2005]).

ICME 02 May, 0500UT - 04 May, 0100 UT, 1998



- ✓ The ICME contained a well-defined magnetic cloud (Osherovich and Burlaga, 1997) from 1300 UT, May 02 to 1200 UT, May 03.
- ✓ The magnetic field structures within the ICME and its embedded magnetic cloud were still anchored at the Sun when they arrived at ACE (Malandriki et al., JASTP, 2002).

Ung Duration Southward Bz





Space and Ground Based Observations

03 May, 1998



Magnetic Stations









Interplanetary Conditions at 1 AU





Active Region Locations

• The ACTIVE REGION is found located close to the central meridian on Apr 29 29 Apr 1998



01 May 1998



CR 1935 (CMP 128°)



POTENTIAL FIELD COMPUTED CORONAL MAGNETIC FIELD



Southward IMF



Conclusions

 Interplanetary cause of the 44 hour southward IMF: An expanding magnetic cloud in an ICME associated with a CME eruption.

✓ Solar cause of the prolonged southward IMF: The magnetic footpoints associated with the ICME originate in an AR lying north of the neutral line. The region shows open magnetic field structures and no change in their configuration during the period of prolonged IMF.

 Multiple peaks in density and SYM –H: This is the clearest signature yet of the effect of density on ground magnetic measurements.