

Questions for Working Group 4: Forecasting Magnetic Storms

Probabilistic Methods

Geometric properties of magnetic storms

- How do we define the occurrence of a magnetic storm?
- How does the probability of observing a magnetic storm change with season regardless of phase of solar cycle?
- How does the probability of observing a magnetic storm change with solar cycle regardless of season?
- What is the joint dependence of magnetic storm occurrence on both season and solar cycle?
- What is the probability of observing a magnetic storm as a function of strength and location of solar flares?
- What is the probability as a function of halo CMEs?
- What is the probability as a function of observing solar proton events?
- Are some solar cycles more likely to have geoeffective IMF

Relation to CIRs

- How does the CDF for Dst (Sym-H) change with time relative to CIR?
- How does this time dependent CDF change with B and V in solar wind?

Relation to CMEs

- Is there a “typical” CME magnetic storm profile in Dst?
- Do solar limb CMEs ever cause storms?
- What is the CDF of Dst for all halo CMEs?
- Is there an observable property of halo CMEs that correlates with the associated CDF of Dst? (e.g. initial velocity at Sun)
- For CMEs with shocks how do the CDFs for sheath and flux rope (bubble) compare?

Deterministic Methods

- What features of the Temerin-Li (TI) forecasting algorithm make it so effective?
- Does this algorithm really do as well for large events as it does for all data?
- What are the physical implications of the 34 terms in the TI algorithm?
- Can a simpler algorithm do nearly as well as TI?
- How well would small but adaptive ARMA filters do in the prediction?
- How can we model the two phase recovery of most storms?
- Does the Chapman-Ferraro correction change with intensity of storms as suggested by Siscoe?
- Why is there no evidence of polar cap potential saturation in the relation of the rate of ring current injection to solar wind electric field?

- What is the relative importance of the Russell-McPherron effect (tilt of dipole orthogonal to Earth-Sun line relative to solar equator) as compared to the equinoctial effect (tilt of the dipole in GSM x-z plane relative to the Earth-Sun line)?
- Does magnetospheric coupling depend on solar wind dynamic pressure, density, Alfvén Mach number? Such dependence could greatly change the amount of energy input to the magnetosphere and hence the strength of Dst in particular storms?
- Can the polar cap index (or its raw data) be used to infer the solar wind input to the magnetosphere?

General Questions the group might consider

- Who cares if we do a good job of forecasting Dst 30 minutes in advance?
- Why is the ring current so asymmetric during the storm main phase?
- Is there ever a storm main phase without substorms?
- What causes the two-stage storm recovery?

My emphasis on CDF is because they provide a means for specifying the probability that a measure of activity will exceed a specific value of the measure. Probabilistic forecasting is based on the idea that various properties of the solar wind are determined by the location of the measurement relative to some fiducial time in the wind such as a shock, flux rope, CIR, etc. As a consequence of such organization the coupling of the solar wind to the Earth is changed in a systematic manner and we can expect measures of internal activity to also be organized by the fiducial time. The goal then becomes the identification of control parameters in the solar wind and the determination of means of remote sensing these parameters.