Project Details

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Project Title:
Magnetic Cloud Induced Magnetic Storm Intensity and Timing: Near Real Time Prediction for Optimum Future Years

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Summary:
A)Science Objectives/Strategy: The primary objectives of this investigation are fourfold:(1) to augment statistical studies of the relationships between interplanetary magnetic clouds (its IMF Bz in particular) and magnetic storms that we and others have found in the past for use in storm predictions from solar wind data, (2) to modify a force-free magnetic cloud model in two ways for future use in helping to predict, in near real time, what the trailing part of a cloud should be from data in the early part of the cloud (this part will require past WIND data and some IMP 8 data) and the development of the model's (``inverse'') use in identifying clouds, (3) to combine the two parts above to develop a prescription that connects observations of the early part of the clouds features to predict minimum Dst and its occurrence-time to give many hours predict time (_t) for standard size clouds, (4) to study the differences between magnetic storms caused by other than magnetic clouds and those that are. The two modifications of the cloud model will be to accommodate any "sample" rate of input field, besides the grossly averaged data used to date and to account for expansion by using the observed speed gradient across the cloud. The resulting prescription hopefully will be suitable to data from an upstream solar wind monitor, such as ACE (or perhaps WIND at some later date), but we stress that ACE data will not be needed for this study; then the predict time is _t + 1 hour, typically, if the spacecraft is indeed at L1. In the process of developing these relationships a greater understanding of the timing of interplanetary features in influencing the resulting storm is expected, especially for dual-phase magnetic storms which are not well understood. The next few years are an optimum time to employ such a prescription, because the north-to-south kind of cloud is most probable giving the added advantage of part (2)'s study above. South-to-north cases will occur and will also be studied. B) Recent Progress: It is well known that geomagnetic activity depends on the interplanetary magnetic field (IMF) Bz in the solar wind plasma interacting with Earth's magnetosphere. We have shown that there is an unusually high correlation between storm intensity (measured by minimum Dst) and Bz-minimum associated with magnetic cloud events [Wu and Lepping, 2001a]. And the correlation of Dst vs. Bz increases dramatically when the solar wind speed is faster than 600 km/s.

Publication References:

no references