Statistics of the energy transfer between the solar wind and the magnetosphere

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Diploma work, 20p at the Department for Astronomy and Space Physics of Uppsala University

Introduction

Our planet is strongly influenced by the Sun. Intense and time varying magnetic fields embedded in the outflowing solar wind can couple with the terrestrial magnetic field leading to energy transfer between the solar wind and our magnetosphere. The variability of this energy coupling is reflected in rapid variations in the direction and intensity of the Earth magnetic field in the form of geomagnetic storms and substorms. One of the main tasks in space physics research is to increase the knowledge of the spatial and temporal variation of this coupling and its influence on solar wind parameters and the interplanetary magnetic field. Previously the energy input to the magnetosphere has been estimated with various coupling functions derived from solar wind measurements. However, with the multi-spacecraft mission Cluster there are improved techniques to determine the local energy transfer directly by observational means at the magnetopause.

The aim of this diploma work is to utilise the large data base of Cluster data to investigate the dependence of the local energy input from the solar wind on the spatial location on the magnetopause. Furthermore, we will investigate the dependence on the variation of solar wind and interplanetary parameters such as the solar wind velocity, density, interplanetary magnetic field orientation and so on. We will also take into account the status of the magnetosphere in terms of geomagnetic activity.

Work plan

1. The first task is to study the background of energy coupling, geomagnetic activity and the techniques for multi-spacecraft data processing.
2. The second task is to search the large data base of Cluster data for appropriate magnetopause crossings which will be used in the statistical database.
3. The third task is to implement software to estimate the local energy input from the database found in task 2 and gather the corresponding solar wind, interplanetary and geoeffective parameters for each event.
4. The forth task is to compile and analyse the results from task 3 and compare it to empirical coupling functions which might lead to a new improved empirical relation.

Schedule

Start June 13, 2006. End before January 18, 2007.

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