

Role of the magnetosheath in the interaction of magnetic clouds with the Earth's magnetosphere

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Magnetic clouds are among the most geoeffective solar events capable to trigger strong magnetic storms in the terrestrial magnetosphere. However, their characteristics and those of the surrounding media are not always capable to explain their high level of geoeffectivity. From observations and simulations, we investigate here the role of the bow shock and of the magnetosheath. Conjugated observations upstream (ACE) and downstream (CLUSTER) of the bow shock show that the magnetic clouds' magnetic structure in the magnetosheath can strongly depart from their pristine structure upstream of the bow shock. This modification depends on the shock configuration (quasi-perpendicular, quasi-parallel). We also discuss this question from hybrid simulations of the interaction of magnetic clouds with the bow shock. We show that this interaction may produce unexpected characteristics in the magnetosheath, such as asymmetric distributions of magnetic field, density, temperature, velocity. They thus lead to interactions with the magnetosphere which were not expected from the pristine characteristics of the magnetic clouds in the solar wind upstream of bow shock. We here discuss the effects of such an asymmetric magnetosheath on key parameters for the interaction with the magnetopause (reconnection, instabilities), responsible in turn for the development of geomagnetic activity inside the magnetosphere.