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Simulation study of a magnetospheric signal propagation

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Study of interplanetary shock events is important in order to understand the entire process of their propagation through the Earth's magnetosphere and the effects they have in the geospace. Our statistical analysis of a set of fast forward shocks shows that the shock speed in the solar wind and the solar wind dynamic pressure play an important role for the geomagnetic activity. In particular, our results show that higher interplanetary shock speed causes a higher response in the AE indices, and that the response is larger when the interplanetary magnetic field is southward. The GUMICS-4 global MHD simulation is used to calculate signal propagation and evolution in different regions of the magnetosphere. Several methods to derive the propagation speeds and directions are used: Rankine-Hugoniot, velocity coplanarity, and minimum variance analysis. Furthermore, we examine the wave modes of the signal originating at the shock-magnetopause interaction, which is not possible from the actual point measurements made by satellites.