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Real-time Global MHD Simulations of Cassini T32 flyby

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Cassini Spacecraft made a special pass of Titan on June 13, 2007. This flyby, referred to as T32 flyby, is the first occasion that Titan was observed to be outside Saturn's magnetopause (Bertucci et al., 2007). During the flyby, Titan encountered an abrupt change in the magnetic field. Other plasma parameters such as electron density and temperatures also changed dramatically during the pass (Coates et al., 2007). In this presentation, we study Titan's ionospheric responses to such a sudden change in the upstream plasma flow, using a sophisticated multi-species global MHD model. As a first attempt, we simplify the condition to a thin current sheet (represented by a tangential discontinuity) crossing, and simulate in real-time the interaction process of Titan's ionosphere with such a current sheet. Our simulation results show that the interaction causes magnetic reconnection at the upstream region and subsequently at the distant tail. There is a good agreement between the observations and the magnetic field predicted by our model, especially for the outbound segment. We also show results based on upstream conditions constrained by the Cassini plasma observations, as well as data-model comparisons.