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Dynamic changes of the magnetopause shape and location

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Prediction of the magnetopause location in a broad range of upstream parameters can be considered as a test of out understanding of the solar wind - magnetosphere coupling. Present magnetopause models describe the magnetopause location as a function of the solar wind dynamic pressure and IMF Bz component. However, the crossings observed by spacecraft are often far away from the predicted locations and it suggests that other IMF components and/or other factors can be important under particular circumstances.

We have collected more then 6000 crossings of the subsolar low-latitude magnetopause observed by five Themis spacecraft in course of the 2007-2008 years and analyzed the deviations of observed magnetopause locations from those predicted by the Shue et al. (1998) model. The data propagated from the L1 point as well as the measurements of the near-Earth solar wind monitors (whenever available) were used as a model input. We discuss the influence of upstream parameters like the IMF cone angle, the angle between the normal to the model bow shock just upstream of the observed crossing, and solar wind speed as well as the parameters describing an internal magnetospheric state - geomagnetic indices and the magnetic pressure downstream of the magnetopause. Our analysis suggests that the prediction of the magnetopause location is a complex problem that cannot be reduced to one or two input parameters. Among parameters analyzed in the present study, the IMF direction exhibited a dominant influence on the magnetopause location.