# Factors Influencing Magnetic Reconnection at the Magnetopause

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# Abstract

We used existing models for magnetosheath flow, density and magnetic field strength to construct a model which predicts whether (steady-state) reconnection may occur for given input solar wind conditions. The subsequent motion of reconnected flux tubes along the magnetopause and into the magnetotail is determined. Results are shown for a range of cases. The model has applications for hypothesis testing, predicting likely sites for the location of reconnection events on the dayside or near-nightside magnetopause, IMF $B_Y$ effects and so forth. In particular, the rôle of sub-Alfvénic flow and the orientation of the reconnection line in allowing steady-state reconnection poleward of the cusps for northward IMF is highlighted.

Next, we carried out a broad survey of magnetosheath parameters using Geotail and Wind data. We compared our results with the predictions of existing numerical models and found general agreement, though lower values, for velocity and number density. We analysed our data for a range of effects and found some evidence for a dawn-dusk effect for velocity and density ratios, and an Alfvén Mach number influence on the magnetic field. We also found evidence of an aberrated stagnation area in the sub-solar region.

We constructed empirical models for the magnetosheath parameters and compared predictions for the extent of sub-Alfvénic flow using the existing and our empirical models. We found that there are solar wind conditions under which the existing models will predict sub-Alfvénic flows extending poleward and tailward of the cusps. The empirical models predict a wider range of conditions, including higher velocities, at which extensive sub-Alfvénic flow may be present.

Our data samples are in the ecliptic plane. If we further assume cylindrical symmetry, then we may broaden our conclusions to say that a range of solar wind conditions exists in which the existing numerical models predict steady-state reconnection poleward of the cusps. Our empirical models predict a wider range of conditions under which such reconnection may occur.

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