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Polar cap boundary and the reconnection electric field

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Magnetic reconnection on the dayside magnetopause and in the nightside magnetotail are the main factors controlling the solar wind energy transfer into the magnetosphere and the ionosphere. Reconnection on the dayside magnetopause creates open magnetic flux and moves the polar cap boundary in the equatorward direction. Reconnection in the magnetotail, either at the distant neutral line or at the near-Earth neutral line during substorm conditions, closes magnetic field lines and moves the polar cap boundary into the poleward direction. The combined effect of dayside and nightside reconnection determines finally the dynamics of the polar cap boundary. A quantity that is related to changes in the amount of open magnetic flux is the reconnection electric field.

In this talk, we will review some of the results obtained by using the EISCAT radar facility and supporting instruments (e.g. the MIRACLE magnetometers, the Cluster satellite, and global UVI imagers on Polar and IMAGE satellites) in estimating the motions of the polar cap boundary and the associated reconnection electric field. We have e.g. shown that the nightside reconnection close to substorm onset consists of a series of short-lived reconnection bursts and that isolated reconnection events may occur during the substorm recovery phase. We will also show, quantitatively for the first time to our knowledge, that intensifications in the local reconnection electric field have one-to-one correlation with the appearance of auroral poleward boundary intensifications (PBIs) within the same MLT location. These PBIs are observed by the Polar UVI instrument.