Geophysical Research Abstracts, Vol. 9, 07520, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07520

On the degree of ionospheric contribution to high-altitude auroral potentials using Cluster data

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Cluster data are used to determine the degree by which high-altitude potential structures extend down to the ionosphere, or equivalently, the degree of ionospheric contribution to the high-altitude auroral potentials. For the case of quasistatic aurora, this can be done by comparing the characteristic energy of upward ion beams, which provides an estimate of the parallel potential drop, with the perpendicular (to **B**) potential across the structure. This ratio, k, which normally is less than or equal to one, reveals whether the potential extends completely (k=0), is isolated from (k=1), or, which is most common case, partly extends ($0 < k < 1$) to the ionosphere. For the downward current region, a similar comparison can be made, between the characteristic energy of upward electron beams and the perpendicular (to **B**) potential. In a recent study of FAST data by Hwang et al (JGR, 2006 a, b), focusing on the downward current only, potentials associated with curved structures, such as spirals and folds, were shown to be relatively isolated from the ionosphere ($0.5 < k < 1$) whereas potentials associated with sheet-like structures, such as stable arcs, were shown to partly extend down to the ionosphere ($0 < k < 0.5$). They also found that the Poynting flux was typically directed downward for the curved structures and upward for the sheet-like structures. We present preliminary results on this topic based on a selection of intense electric field events identified from the Cluster data. In addition to the multi-point measurement capability of Cluster, the use of Cluster data benefits from the fact that the acceleration regions are located well below the Cluster orbit. From this follows that both perpendicular (to B) components of the electric field can be derived and used for this ansalysis.