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Combining in-situ data from Cluster with UV images from TIMED to improve the knowledge of polar cap arcs

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During prolonged periods of northward IMF, the Cluster spacecraft can detect upflowing polar cap ion beams (PCIB). Accelerated upwards by quasi-static electric fields, they are associated with downward accelerated electrons, which can in turn produce polar cap arcs (Maggiolo et al., 2010).
For one particular event on 1st April 2004, we have been able to model the optical emission associated with a PCIB detected by Cluster. Cluster observations at high altitude are used as input to a quasi-stationary magnetosphere-ionosphere (MI) coupling model, which computes the energy spectrum of precipitating electrons at the top of the ionosphere. This energy flux is used as input into the TRANS4 ionospheric transport model, a 1-D model based on Boltzmann's kinetic formalism taking into account photoionisation, electron precipitation, and auroral optical/UV emissions.
We compare the modeled brightness of OI line at 135.6 nm with that of a polar cap arc observed by the imager GUVI onboard TIMED, a few minutes before Cluster detected a PCIB. Model and observations are in good agreement yielding similar arc width, orientation and intensity confirming that PCIB and polar cap arcs are different signatures of the same phenomenon. Detailed in-situ measurement by Cluster can thus be combined with large scale images from TIMED.
We will discuss new insight given on the magnetospheric configuration linked to the appearance of polar cap arcs during prolonged periods of northward IMF.