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Auroral electrodynamics in the Harang region

O. Marghitu (1, 2), T. Karlsson (3), B. Klecker (2), J. McFadden (4)

(1) Institute for Space Sciences, Bucharest, Romania
(2) Max-Planck-Institut für extraterrestrische Physik, Garching, Germany
(3) Space and Plasma Physics Group, Royal Institute of Technology, Stockholm, Sweden
(4) Space Sciences Laboratory, University of California at Berkeley, USA
(Contact: marghitu@venus.nipne.ro)

The Harang region plays a key role in the magnetospheric dynamics and is often the host of the auroral break-up. An accurate description of the auroral electrodynamics in the Harang region is important for the understanding of the magnetosphere–ionosphere coupling during the growth, onset, and expansion of the substorm. By using synthetic data and the recently developed ALADYN method we show that, on oval scale, the location of the convection reversal (CR) is controlled by the longitudinal component of the electric field, which is typically westward in the Harang region. Assuming a downward/upward field-aligned current (FAC) in the equatorward/poleward part of the oval, a westward electric field pushes the CR towards the field-aligned current reversal (FR). The profile of the CR depends on the conductance gradient near the FR, with a large gradient resulting in a sharp CR. The oval configuration in the Harang region, with an equatorward electric field over a good fraction of the large scale upward FAC, can prevent the standard closure of the arc curent system: Instead of having the upward FAC above the arc fed by Pedersen current normal to the arc and the electrojet along the arc divergence free, the upward FAC above the arc is fed by the electrojet. Experimental data sets from the FAST satellite, analyzed by ALADYN, are used to illustrate both the arc current system and the large scale oval configuration in the Harang region.