EVIDENCE FOR QUASISTATIONARY ACCELERATION OF AURORAL ELECTRONS AND IONS FROM CLUSTER-DMSP OBSERVATIONS AND KINETIC MODELING OF THE AURORAL GENERATOR

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Simultaneous observations on April 28, 2001 by Cluster and DMSP--F14 reveal a stable discrete auroral arc and fluxes of field-aligned accelerated electrons and ions coincident with a magnetospheric interface at an altitude of 4.5 R_E in the dusk sector. This conjunction, documented by Vaivads et al (GRL, 2003), raise interesting questions regarding the acceleration of auroral particles and formation of discrete arcs. We compare satellite data with a quasi-stationary magnetosphere-ionosphere coupling model based on a Vlasov solution for the magnetospheric generator. Cluster data reveal an interface between plasmas with different temperatures and densities. The kinetic model developed to describe this interface provides a self-consistent magnetospheric electric potential matching Cluster observations. It also gives a good estimation of the plasma density and of the spatial scale of the transition layer. The model also explains the formation of the density peak in the center of the transition. The ionospheric potential is derived from the current continuity equation and gives a field-aligned potential drop and a flux of precipitating energy in agreement with the DMSP electron data and Cluster ion observations. Sintetic data based on model results evidence an inverted-V spectrum of electrons, with spatial scale and spectral width in good agreement with DMSP observations. Model results and data analysis suggest a quasi-stationary field-aligned acceleration of down-going auroral electrons and up-going ions with a magnetospheric generator. We associate the generator with the convergent perpendicular electric field sustained by kinetic pressure gradients and shears of plasma bulk velocity. Data and model suggest two possible generator scenarios: (A) a generator extending along the interface of the plasma sheet boundary layer with the lobe or (B) a generator localized at the inner edge of the low latitude boundary layer.

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