Geophysical Research Abstracts,
Vol. 11, EGU2009-5336, 2009
EGU General Assembly 2009

A superposed epoch analysis of auroral evolution during substorm growth, onset, and recovery

S. E. Milan (1), A. Grocott (1), C. Forsyth (1,2), S. M. Imber (1,3), P. D. Boakes (1,4), and B. Hubert (5)

(1) University of Leicester, Physics and Astronomy, Leicester, United Kingdom (steve.milan@ion.le.ac.uk), (2) Mullard Space Science Laboratory, University College London, United Kingdom, (3) Heliospherics Division, NASA GSFC, USA, (4) British Antarctic Survey, Natural Environment Research Council, Cambridge, United Kingdom, (5) Laboratory of Planetary and Atmospheric Physics, University of Liege, Belgium

Auroral substorms represent the explosive response of the magnetosphere to energy accumulated through solar wind/magnetosphere coupling. Despite almost 40 years of intense research, the factors leading to substorm onset defy a quantitative or even qualitative understanding. One of the barriers to advancing the field is the lack of a clear picture of the auroral evolution before, during, and after substorm onset. Although many substorms have been studied on a case-by-case basis, the "average" substorm has not yet been determined. This talk will present results from a superposed epoch analysis of the auroral development during approximately 2000 substorms using global images of the aurora from the NASA Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) satellite. Some of the main conclusions of the study are that the intensity of the substorm increases dramatically as the latitude of the onset arc decreases, that is as the size of the polar cap prior to onset increases; the proton auroral evolution is primarily determined by pitch angle scattering in the stretched field of the growth phase magnetotail; electron aurora respond primarily during the expansion phase. We also show that there is a dawn-dusk offset in the location of the electron and proton aurora that mirrors the relative locations of the region 1 and region 2 current systems. Superposed epoch analyses of the solar wind, interplanetary magnetic field, and geomagnetic indices for the substorms under study indicate that dayside reconnection is expected to occur at a faster rate prior to low latitude (intense) onsets, but also that the ring current is enhanced for these events. We include in our discussion a comparison of our results with a similar superposed epoch study of the ionospheric convection flow during substorms.