Proton and electron fluxes in the plasma sheet transition region and their dependence on the solar wind parameters

Stepanov Nikita¹, Viktor Sergeev¹, Dmitry Sormakov², Stepan Dubyagin³, and Andrey Runov⁴

¹St. Petersburg State University, St. Petersburg, Russia (nekit098@gmail.com)
²Arctic and Antarctic Research Institute, St. Petersburg, Russia
³Finnish Meteorological Institute, Helsinki, Finland
⁴University of California, Los Angeles, USA

Proton and electron spectra in the plasma sheet usually consist of spectral core and high energy tail. These two populations are formed by different processes, driven by the various combinations of the solar wind parameters. These processes include different time delays and may act differently on protons or electrons. In this work we evaluate empirically the magnitude and the time delay of the impact of different solar wind parameter combinations on the protons and electrons with energies (30-300 keV) and reveal the mechanisms behind these impacts. To do this we build a model of the fluxes at different energy channels in the transition region (nightside central plasma sheet between 6 and 15 Re) for the THEMIS spacecraft observations in 2007-2018. We use normalized values of solar wind parameter combinations (incl. speed, density, pressure, electric field, etc) as inputs of the model, with regression coefficients indicating their impact magnitudes. We investigate different time delays up to 16 hours. The model obtained shows that protons and electrons are controlled differently by solar wind parameters: dynamic pressure is important for protons, whereas solar wind speed and VBs are important for electrons. Larger time delays are required to describe higher energy electron fluxes.