An automatical method for identification of polar cap boundary and patchesby using in situ plasma measurements and its application

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We have developed an automatical method to identify the polar cap boundary (PCB) and polar cap patches by using the in-situ plasma observations. Based on the difference of the typical source regions of the high-energy plasma, this method makes a double-Gaussian-like curve fitting to the integral energy flux with an energy range of 1392eV-30KeV for electrons and 4400eV-30KeV for ions, and then identifies the PCB by determining the poleward boundary of the regions where the energy flux are less than ±1.5 times of the variance above the mean fluxes. Finally, we find the patch in the identified polar cap region by seeking the region where the plasma number density are more than twice larger than the average plasma density of the polar cap region. Applying this method, we automatic identified 15486 polar cap boundaries and more than 3000 patches from 2010-2014 passes of the polar region by the Defense Meteorological Satellite Program (DMSP) F16 and F17 satellites. We further differed dayside plasma blobs from patches by using the field-aligned current and precipitation energy flux observations, We Analyzing the in-situ plasma features inside these plasma irregularities and confirmed that rapidly moving patches are clear associated with ion upflow, and find the Poynting flux, associated with frictional heating, plays the dominated role for accelerating the ion upwelling at the center of polar cap region, while the field-aligned current, associated with electron heating, was mainly contributed to ion upflow in the dayside plasma blob.

Keywords: Identification of polar cap boundary from integral ion and electron energy fluxes, ionupflow associated with polar cap patch and dayside plasma blob

