Geophysical Research Abstracts
Vol. 17, EGU2015-11788, 2015
EGU General Assembly 2015

The high altitude stagnation region as a second source of cold ion outflow

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The Earth's magnetospheric plasma is believed to be significantly contributed by the ionospheric outflow. Ions with low energies traveling along the magnetic field lines are transported tailward due to the magnetospheric large scale convection driven by the dayside reconnection. In this paper, we use ten years data set of cold ion (total energy less than 70 eV) from two Cluster spacecraft and time shifted measurements of the solar wind to calculate the trajectories of the cold ions and to determine their source. We suggest that, the ion outflow from the ionosphere could be stagnated at high altitude cusp region, 2$\sim$8 Earth radii (Re) from the center of the Earth. In terms of number of observations, tailward flow from this region supplies $\sim$9% of the cold ions from the ionosphere. The cold ions in this region are found to be stagnated, i.e. their parallel velocities were zero because of gravitational drag. While the convection at high altitudes is higher enough to contribute the centrifugal acceleration, those cold ions start to move tailward and are observed by Cluster in the magnetotail. This outflow shows clear asymmetries for dawnward and duskward Interplanetary Magnetic Field (IMF).