Geophysical Research Abstracts
Vol. 18, EGU2016-3854, 2016
EGU General Assembly 2016


# North-south asymmetries in cold ion outflow and lobe density

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A significant fraction of the plasma in the terrestrial magnetosphere is supplied by the high-latitude ionosphere. The filling process starts with ionization of atoms and gas molecules in the thermosphere, and is often accompanied by upflow due to thermal and electromagnetic forces. Some of this material can reach escape velocities and be further accelerated and eventually evacuated into space. Ions are governed by electromagnetic forces and their transport path from the ionosphere to the magnetosphere go through the magnetotail lobes. The transport is largely dictated by magnetospheric convection. External influences, such as daily and seasonal variations in the Earth's tilt angle, but also non-dipolar terms in the Earth's internal magnetic field introduce north-south asymmetries in the magnetic field and thus north-south asymmetries in the ion outflow and lobe filling. In this presentation, we show observational results of this asymmetry. The results are based on more than a full solar cycle of cold ion measurements from the Cluster constellation of spacecraft, and allows us to quantify the outflow, identify sources of asymmetry and estimate transport paths.