



Title: Estimating the Kinetic Energy Budget of the Polar Wind Outflow

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Ionospheric outflow from the polar cap through the polar wind plays an important role in the evolution of the atmosphere and magnetospheric dynamics. Both solar illumination and solar wind energy input are known to be energy sources of the polar wind. However, observational studies of the energy transfer from these two energy sources to the polar wind are difficult. Because of their low energy, polar wind ions are invisible to regular ion detectors onboard a positively charged spacecraft. Using a new technique that indirectly measures these low-energy ions, we are able to estimate the energy budget of the polar wind. Our results show that solar illumination provides about 10^7 W of the kinetic energy of the polar wind, in addition to the energy transferred from the solar wind with a maximum rate of about 10^8 W. The energy transfer efficiency of solar illumination to the kinetic energy of the polar wind is about 6 to 7 orders of magnitude lower than that of the solar wind. Moreover, daily and seasonal changes in the orientation of the geomagnetic dipole axis control solar illumination over the polar cap, modulating both energies of the polar wind and energy transfer efficiencies from the two energy sources.