

Estimating the kinetic energy budget of the polar wind outflow

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The ionospheric outflow from the polar cap through the polar wind plays an important role in the evolution of the atmosphere and magnetospheric dynamics. Both the solar illumination and the solar wind energy input are known to be the energy sources of the polar wind. However, observational studies on energy transformation between the two energy sources and the polar wind are difficult. Because the low-energy ions consisting of the polar wind are invisible to regular ion detectors onboard a positively charged spacecraft. With a new technique indirectly measuring these low-energy ions, we are able to estimate the energy budget of the polar wind. Our results show that the solar illumination provides about 10^7 W to the kinetic energy of the polar wind, in addition to the energy transformed from the solar wind energy input into the magnetosphere. The energy transformation efficiency between solar illumination and kinetic energy of the polar wind is about 6 to 7 order of magnitude lower than that between solar wind energy and kinetic energy of the polar wind. The daily and seasonal changes in geomagnetic dipole axis modulate solar illumination over the polar cap, giving us a clue to assess the polar wind outflow during evolution of the geomagnetic field.