Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM09-11 Room:302 Time:May 27 15:10-15:25

Effect of escaping photoelectrons on the polar wind outflows

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A statistical analysis using a long-term (over one solar cycle) photoelectron dataset obtained by the Fast Auroral SnapshoT (FAST) satellite (3000-4200 km altitude) during geomagnetically quiet periods demonstrates that the polar wind ion flux estimated from electron outflows does not change with increasing photoelectron production due to increasing solar activity, while the magnitude of the field-aligned potential drop (~15-25 V), which reflects low-energy photoelectrons back to the ionosphere, increases with increasing solar activity. The magnitude of the field-aligned potential drop is likely developed by photoelectrons themselves so as to equilibrate electron fluxes with the ion fluxes. Another statistical analysis using the thermal ion data obtained by the Akebono satellite at solar maximum implies that contribution of O^+ ions to the total ion flux in the polar cap is small owing to almost zero upward bulk velocity at least below ~7000 km altitude during geomagnetically quiet periods. Thus, the polar wind ion flux is dominated by H^+ ions, and the H^+ ion flux has been predicted to be regulated by the production rate in the topside ionosphere. The combination of these results indicates that it is the source region of H^+ ions in the topside ionosphere and not the photoelectron flux that control the polar wind outflow.

Keywords: Polar wind, Ion outflow