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Solar activity dependence of quiet-time photoelectron outflows and the field-aligned potential drop in the polar cap

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Counter-streaming photoelectrons with energies of about a few tens of electron volts are present on the open field lines in the polar cap, and the precipitating component is reflected photoelectrons by a field-aligned potential drop above the satellite [e.g., Kitamura et al., 2012]. To examine solar activity dependence of the photoelectron flows and the magnitude of the field-aligned potential drop, we statistically investigate photoelectrons in the polar cap using the data obtained by the FAST satellite in an altitude range of 3000-4200 km during geomagnetically quiet periods under small field-aligned current conditions. We selected 30 months when the apogee of the FAST satellite was located in the summer hemisphere from the months between July 1997 and January 2009. The geomagnetically quiet period is defined as the times when the *Kp* index is less than or equal to 2+ for the preceding 3 hours and when the *SYM-H* index ranges from -10 to 40 nT. The polar cap is defined by the lack of energetic ions [Andersson et al., 2004]. The typical magnitude of the field-aligned potential drop during geomagnetically quiet periods tends to decrease with decreasing solar activity (F10.7). Near the solar maximum, the typical magnitude of the field-aligned potential drop is 20-30 V, while it is about 10 V or smaller near the solar minimum. The flux of upgoing photoelectrons increases with increasing solar activity. In contrast, the median of the net escaping electron number flux in each month during geomagnetically quiet periods is almost unaffected by solar activity. This relation suggests that larger field-aligned potential drop prevents most of them from escaping.

Keywords: Polar wind, Ion outflow