

Polar cap tongue of ionization during magnetic storm on December 14-15, 2006

Keisuke Hosokawa[1]; Takuya Tsugawa[2]; Kazuo Shiokawa[3]; Nozomu Nishitani[3]; Yuichi Otsuka[3]; Tadahiko Ogawa[2]

[1] Univ. of Electro-Communications; [2] NICT; [3] STELAB, Nagoya Univ.

We report an event of unusually elongated, bright airglow plume, which is considered as an optical manifestation of tongue of ionization (TOI) in the central polar cap. This optical structure was detected with an all-sky airglow imager at Resolute Bay (74.73N, 265.07E) during a large magnetic storm on December 15, 2006. The absolute optical intensity of the plume was approximately 1 kR, which is much brighter than that of non-stormtime polar cap patches. Two-dimensional imaging capability of the all-sky imager demonstrates that some meso-scale structures (250-600 km) were embedded within the plume. Simultaneous ion density and drift measurements with the DMSP spacecraft strongly suggest that the plume was extending from the dayside as a narrow stream of dense plasma and thus is an optical manifestation of polar cap TOI. The DMSP data also implies that the possible source of the plume is a narrow stream of storm enhanced density (SED) transported from lower latitudes. The DMSP auroral particle observation demonstrates that the polar cap extremely expanded equatorward during this interval. This extreme expansion allowed the anti-sunward convection to capture plasmas within the SED and deliver them deep into the polar cap as a luminous airglow plume. We combine the measurements from GPS-TEC and SuperDARN with the current data set, and discuss why the TOI plume was observed as a discrete feature without being broken into polar cap patches. Temporal variation of the IMF orientation and extent of polar cap area will be examined in more detail. This kind of study contributes to clarify what kind of physical process can break tongue of ionization into smaller parts and generate polar cap patches.