

極冠域電離舌の光学観測

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Optical observation of polar cap tongue of ionization

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During intervals of the southward interplanetary magnetic field (IMF) conditions, enhanced anti-sunward plasma convection at the high-latitude carries dense solar-produced mid-latitude plasma into the polar cap through the dayside cusp region. This feature is known as a tongue of ionization (TOI) and has been studied with wide range of observational techniques such as incoherent scatter radar and total electron content derived from networks of GPS receivers. Past studies suggested that the TOIs are normally broken into the discrete polar cap patches by the transient bursts of magnetopause reconnection or reorientation of the dayside convection pattern associated with changes in the IMF polarity. During geomagnetic storms, however, the TOIs are sometimes seen to penetrate into the nightside auroral latitudes through the central polar cap as an elongated plume of dense thermal plasma.

In this paper, we present first optical observation of the TOI structure extending from the dayside to the nightside polar cap. This optical manifestation of TOI was detected with an all-sky airglow imager at Resolute Bay (74.73N, 265.07E; AACGM latitude 82.9) during a large geomagnetic storm on December 15, 2006. It is demonstrated that the TOI plume changes its shape very dynamically in close association with the polar cap convection streamlines as determined independently from the Super Dual Auroral Radar Network (SuperDARN). We also find that the TOI has some meso-scale structures whose horizontal scale ranges from 100 to 500 km, which is equivalent to the scale size of individual polar cap patch. The absolute optical intensity of the TOI feature was approximately 1000-2000 Rayleigh. These values are much brighter than that of non-stormtime polar cap patches. We will discuss differences of continuous TOI and discrete polar patches in terms of structuring of polar cap patches.