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## Ionospheric Plasma Flows Associated with the Formation of the Distorted Nightside End of A Transpolar Arc

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## Introduction

Scales and orientations of Field-aligned Currents (FACs) beneath and in close proximity to the regions of growth of the "J"-shaped TPA (nightside distorted TPA), whose closed flux is formed by nightside magnetic reconnection, clarify whether or not growth of nightside distorted TPA to the dayside depends on reconnection-generated FACs. Further FAC structures near the distorted part of the TPA nightside end elucidate significant differences in the electric current profiles between nightside distorted TPA and double auroral oval. This FAC system profile is obtained based on the distributions of equivalent ionospheric current (EIC), which was deduced from geomagnetic field perturbations measured at the ground geomagnetic observatories.



Figure S1: Equivalent ionospheric current (EIC) distributions on 9:26 UT (panel a), 10:00 UT (panel b), and 10:10 UT (panel c), projected onto the IMAGE FUV-WIC data in geomagnetic coordinates, are shown to estimate the orientation and scale of field-aligned current (FAC) system around the growing "J"-shaped TPA. The EIC vectors (red bars) are derived by rotating the horizontal magnetic field components (local magnetic north – south and east – west components) 90 degrees clockwise using the same calculation techniques, proposed by Glassmeier et al. (1989), Moretto et al. (1997), Motoba et al. (2003), and references therein. The geomagnetic field was measured at the ground magnetic observatories from the SuperMAG ground observatory network (Gjerloev, 2012). Each panel is oriented such that the right, bottom and left sides are corresponding to dawn (6h), midnight (24h), and dusk (18h) in MLT, respectively. The major directional trend of the EIC vectors in close proximity to the regions of growth of the "J"-shaped TPA is shown with magenta thick and curved arrows. The white circles show the MLat values from 60 degrees to 80 degrees as they go inward. The color codes are assigned according to unit of Rayleigh.

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