Application of Global Three-Dimensional Current Model for Dayside and Terminator Pi2 Pulsations

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We tested the magnetospheric-ionospheric current system for Pi2 magnetic pulsations on the dayside and near the terminator using a numerical model. We estimated the spatial distribution of the ground magnetic field produced by the three-dimensional magnetospheric-ionospheric current system for Pi2 consisting of field-aligned currents (FACs) localized in the nightside auroral region, the magnetospheric closure current flowing in the azimuthal direction, and horizontal ionospheric currents produced by the FACs in the electrostatic approximation. The calculated magnetic field reproduced the observational features reported by previous studies; (1) the sense of the H component is not changed over the wide local time sectors in low latitudes; (2) the amplitude of the H component on the dayside is enhanced at the equator; (3) D-component magnetic fields are reversed near the dawn and dusk terminators; (4) the meridian of the D-component phase reversal around the dusk terminator shifted more sunward than that around the dawn terminator; (5) the amplitude of the D component in the morning was larger than in the early evening. The separation of contributions to magnetic fields produced by each current part provides information on what contributes to these features. The phase reversals of the D component around dawn and dusk terminators are explained by a change in the contributing currents from the FACs on the nightside to the meridional ionospheric currents on the sunlit side of the terminator, and vice versa. The contribution of the ionospheric current on the dayside at middle-to-low latitudes is about 90%, suggesting that the spatial pattern of equivalent currents, which are magnetic field vectors rotated by 90 degrees, reflects that of ionosphere currents on the dayside. The different features between dawn and dusk regions can be attributed by the skewed dayside ionospheric current that has more intensive meridional currents in the morning than in the early evening. The model results indicated that the oscillation of the magnetospheric-ionospheric current system is a plausible explanation of Pi2 pulsations on dayside and near the terminator.

Keywords: Pi2 pulsation, magnetospheric-ionospheric current system, solar terminator, numerical model

