中低緯度Pi2地磁気脈動に対する昼夜境界効果

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Solar terminator effects on middle- to low-latitude Pi2 pulsations

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In order to understand the propagation mechanism of Pi2 toward the dayside and the equatorial enhancement, it is important to study Pi2 pulsations observed in the dawn and dusk regions that mark the transition between nightside and dayside. One of the most notable features of the dawn and dusk regions is a strong longitudinal gradient of the ionospheric conductivity near the solar terminator. To clarify the effect of the dawn and dusk terminators on Pi2 pulsations, we statistically analyzed the longitudinal phase and amplitude structures of Pi2 pulsations at middle- to low-latitude stations (GMLat = 5.30-46.18) around both the dawn and dusk terminators. Although the H (north-south) component Pi2s were affected by neither the local time (LT) nor the terminator location (at 100 km altitude in the highly conducting E region), some features of the D (east-west) component Pi2s depended on the location of the terminator rather than the LT. The phase reversal of the D component occurred 0.5-1 h after sunrise and 1-2 h before sunset. These phase reversals can be attributed to a change in the contributing currents from field-aligned currents (FACs) on the nightside to the meridional ionospheric currents on the sunlit side of the terminator, and vice versa. The phase reversal of the dawn terminator was more frequent than that of the dusk terminator. The D-to-H amplitude ratio on the dawn side began to increase at sunrise, reaching a peak approximately 2 h after sunrise (the sunward side of the phase reversal region), whereas the ratio on the dusk side reached a peak at sunset (the antisunward side). The dawn-dusk asymmetric features suggest that the magnetic contribution of the nightside FAC relative to the meridional ionospheric current on the dusk side is stronger than that on the dawn side, indicating that the center of Pi2-associated FACs, which probably corresponds to the Pi2 energy source, tends to be shifted duskward on average. Different features and weak sunrise/sunset dependences at the middle-latitude station (Paratunka, GMLat = 46.18) can be attributed to the larger annual variation in the sunrise/sunset time and a stronger magnetic effect because of closeness from FACs. The D-to-H amplitude ratio decreased with decreasing latitude, suggesting that the azimuthal magnetic field produced by the FACs in darkness and the meridional ionospheric current in sunlight also decreased with decreasing latitude. These results are included in published papers by Imajo et al. [2015JGR (doi:10.1002/2013JA019691); 2016EPS (doi:10.1186/s40623-016-0514-1)].