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Pi2 current system at polar to equatorial latitudes

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It has been reported that the Pi2 appears at the dayside geomagnetic equator with an enhancement in amplitude (Shinohara et al. GRL 1997; Tokunaga et al., GRL 2007). The Pi2 at the dayside equator is explained by means of electrojets driven by an electric field transmitted from the polar ionosphere (Shinohara et al. GRL 1997). Simultaneous ground and spacecraft observations show that the relationship between the Pi2 on the ground and above the ionosphere is in phase on the nightside and out of phase on the dayside (Han et al., JGR 2004). These observations indicate that the dayside Pi2 is caused by ionospheric currents extending from high latitude to the equator, while the nightside Pi2 is attributed to cavity resonance of MHD waves in the plasmasphere. On the other hand, the period of the Pi2 does not depend on the latitude at around the plasmopause, which may not match the cavity resonance model (Tokunaga et al., GRL 2007). In this paper, we show that the equatorial Pi2 is well correlated with the nightside Pi2 with no time shift greater than several seconds and that the amplitude of the nightside Pi2 is larger at higher latitude. This local time and latitudinal features are similar to those of the main impulse (MI) of sudden commencement (SC), which is explained by means of Region-1 type field-aligned currents generated during the compression of the magnetosphere (Araki et al., EPS 2006; Shinbori et al., JGR 2009). We also show that the Pi2 at nightside auroral latitude is out of phase with the equatorial Pi2. We suggest that the Pi2 is explained by means of Region-1 type field-aligned currents which flow into the auroral ionosphere and further to the dayside equatorial ionosphere. The relationship of the equatorial Pi2 and substorm current wedge should be clarified to identify the source of the Pi2 currents.

Keywords: Pi2 pulsation, substorm, magnetic equator, ionospheric currents, field-aligned currents