

Comprehensive study of low-latitude Pi2 pulsations using multi-point ground and Swarm satellite observations

*Neethal Thomas¹, Kazuo Shiokawa¹, Geeta Vichare²

1. Institute for Space-Earth Environmental Research, 2. Indian Institute of Geomagnetism

Pi2 pulsations are the transient oscillations of the Earth's magnetic field with periods 40 –150 sec and are commonly observed at the onset of substorm expansion phase. At low to equatorial latitudes, Pi2 pulsations are often observed during daytime in association with their nighttime counterparts. The present study investigates the Pi2 oscillations using multipoint observations from longitudinally-distributed Swarm satellites when they were simultaneously located at day and night LTs together with a dense network of ground stations (within $\pm 50^\circ$ magnetic latitude) distributed over all LT sectors. The data set comprising satellite and ground observations from different LT sectors provide a unique opportunity to simultaneously observe day and night Pi2 oscillations from both space and ground. The magnetic field data represented in H, D, Z components (geomagnetic coordinates) at the ground and the residual magnetic field at Swarm satellites (obtained by subtracting CHAOS5 geomagnetic field model) represented in compressional, toroidal and poloidal components (field-aligned coordinates) are used in this study. As the energy source of Pi2 resides on the night side, we considered H oscillations from midnight ground as the reference. The spectral characteristics of Pi2 signatures such as coherence, amplitude, and cross-phase at both satellite and ground are estimated with respect to midnight ground H. Present study proposes that, the low-latitude Pi2 pulsations are the manifestation of the dynamical coupling of the ionosphere-magnetosphere system through substorm currents, with oscillating substorm current wedge FACs (field-aligned currents) in the night side and the meridional ionospheric currents in the dayside as the possible source mechanism responsible for low-latitude Pi2 oscillations observed at night and day LTs respectively. The observations will be presented and discussed in view of this model.

Keywords: Pi2 pulsations, Substorm current wedge FAC, Daytime Pi2, Ionospheric currents