Multisatellite observation of Pi2 pulsations in the inner magnetosphere

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The plasmaspheric cavity mode has been proposed for an excitation mechanism of Pi2 pulsations observed at low- and mid-latitude ground stations. This mode is a standing fast mode wave that is trapped in the plasmasphere and is excited at substorm onset. Therefore satellites in the low L shell (mostly less than L~5) observe the geomagnetic field oscillations predominantly in the compressional and radial components when substorms occur. Comparative study between the low-latitude ground station and a satellite staying inside the plasmasphere revealed the radial structure of the plasmaspheric cavity mode on the nightside. A recent study using the ETS-VI satellite and ground stations confirmed the similar radial structure of the fundamental cavity mode even on the morningside (0600-1000 geomagnetic local time (MLT)). The radial structure of the plasmaspheric cavity mode has been described by a number of studies, though its longitudinal structure is not well understood yet. There have been no studies employing satellites separated in longitudinal direction to examine magnetic field variations in the inner magnetosphere inside the geosynchronous orbit.

In this study we investigate the longitudinal structure of the plasmaspheric cavity mode, using magnetic field measurements by the DE-1 and AMPTE/CCE satellites. The apogee of DE-1 and AMPTE/CCE is ~4.6 Re and ~8.8 Re geocentric distance, respectively. We also used geomagnetic field data from Kakioka (27.2 degrees geomagnetic latitude (GMLAT), 208.5 degrees geomagnetic longitude (GMLON)), Crozet (-51.5 degrees GMLAT, 111.5 degrees GMLON), and Hermanus (-33.9 degrees GMLAT, 82.2 degrees GMLON). It was found that when Pi2 pulsations were detected on the ground, similar magnetic field variations were observed by both satellites located at radial distance of 4-6 Re. The magnetic field variations were dominant in the compressional component and had no clear phase delay between satellites even if they are separated by more than several hours in longitude. We will discuss the longitudinal structure of the cavity mode wave deduced from these observations.