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A Study on Equatorial Pc3-4 Pulsations in the Philippines: Toward Earthquake Prediction

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Pc3-4 (10-150s) geomagnetic pulsations are ultra low frequency magnetohydrodynamic (MHD) waves in the dayside magnetosphere. There are two known sources for the daytime Pc3-4 pulsations. One is the surface wave in the Pc3-4 range excited near the magnetopause and the other source is the upstream waves in the earth's foreshock (Yumoto and Saito, 1985). The shear in the flow across the magnetopause produces surface waves through Kelvin-Helmholtz instability.These surface waves excite field line resonance oscillations in the magnetosphere which are then observed as magnetic pulsations at higher latitudes. Pc3-4 pulsations from upstream waves that are transmitted as compressional waves propagate across the ambient field up to the inner plasmasphere. These compressional waves couple with various HM oscillations, which are then observed as magnetic pulsations at middle and low latitudes.

Recently, space-related ULF studies do not only enhance our understanding of magnetospheric processes but also provide useful information for studies of ULF associated with earthquakes (Hayakawa et al., 2000; Hattori et al., 2002; Yumoto et al., 2008). However, most ULF studies have been done using data from satellites and from low-mid-high latitude stations, while equatorial regions have received less attention. The generation and propagation mechanisms of equatorial Pc3-4 pulsations are not yet well understood. Therefore considering Philippines as an earthquake-prone country in the equatorial region, we studied the characteristics of equatorial Pc3-4 pulsations in the H and D components observed at Circum-pan Pacific Magnetometer Network (CPMN) stations, namely, DAV(L=1.02, Dip=-0.65), CEB (L=1.02, Dip=2.74) and MUT (L=1.03, Dip=6.79).

The results show that the equatorial Pc3-4 amplitudes are dependent on local time and season. The equatorial Pc3-4 amplitudes also showed peaks at the dip equator. But only the equatorial Pc4 showed the dayside equatorial enhancement. The Pc4 amplitude ratio of D-component (D) to the H-component (H) is smaller than that of Pc3. Furthermore, DAV Pc4 (H) showed a good correlation with the equatorial conductivity and the equatorial electrojet (EEJ) unlike Pc3 (H). Therefore, we conclude that the equatorial Pc3 maybe originated from the upstream region. On the other hand, the equatorial Pc4 maybe originated from Pc4 excited at mid latitudes and/or from Pi2 pulsations in nighttime.