On the remote sensing of space weather parameters using ground based observations of low-latitude Pc 5 pulsations

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Abstract

Ultra-low frequency (ULF) pulsations are phenomena frequently occur in magnetosphere environment. Their propagation characteristics into space allowed them to play an important role in prompting the conditions on the solar-wind magnetosphere interaction region and on the magnetosphere environment. Apparently recent studies have increased in terms of importance and utility focusing on the role of ULF in prompting space magnetospheric environment. This is well emphasized by the recent great attention paid for installation and sustainment of ground magnetometers chains around the globe. These magnetometers record the signatures of ULF pulsations which incident from different sources on solar-wind magnetosphere interaction region and magnetospheric layers. Previous studies showed that remote sensing using ULF pulsations is possible (Waters et al., 2006). As an example it is possible to remotely sensing and estimating the plasma mass density via the resonant frequency of a field-line resonance phenomenon (FLR), where the FLR produces recognizable portion of the ULF. Hence, remote sensing using ULF is a recent and important ongoing research topic which is far from being completely covered in terms of understanding all the phenomena involved within. On the recent research work the reliability of remote sensing some space weather parameters using ground observations of Pc 5 pulsation is checked. Ground data are used; these data are collected from a unique global chain of magnetometers: Magnetic Data Acquisition System and the Circum-pan Pacific Magnetometer Network (MAGDAS/CPMN) (Yumoto and the MAGDAS group, 2006) of Kyushu University. A global-mode low-latitude Pc 5 pulsation is defined as: those globally observed oscillations in the Pc 5 range that occur simultaneously at three low-latitude (MAGDAS/CPMN) stations. The relation between amplitudes of those global-mode Pc 5 pulsations and geosynchronous energetic electrons fluxes is then checked; it is found that and abrupt elevation on those electrons fluxes occurred between 12-20 hours following the onset of the global-mode Pc 5's, and also it is found that the derivative of the electron flux time series showed a peak also between 20-24 hours following the peak on a defined global-Pc 5 index (the full-width at half maximum (FWHM) ratio of the two peaks is ~1). Furthermore, the reliability of using a defined low-latitude Pc 5 pulsations index on remotely sensing solar-wind parameters (solar wind flow speed and pressure) is also checked. Both solar wind flow speed and dynamic pressure showed linear relations with the low-latitude Pc 5 index for values of Pc 5 index: $0 \leq Pc\,5_{INDEX} \leq 4$ (Amplitudes: 0.01000-1.32039 nT). The conclusion is that Pc 5 pulsations could be a reliable remote sensing tool for space weather parameters.