Latitudinal Dependence of Pc 3-4 Amplitude in the African Sector using MAGDAS data

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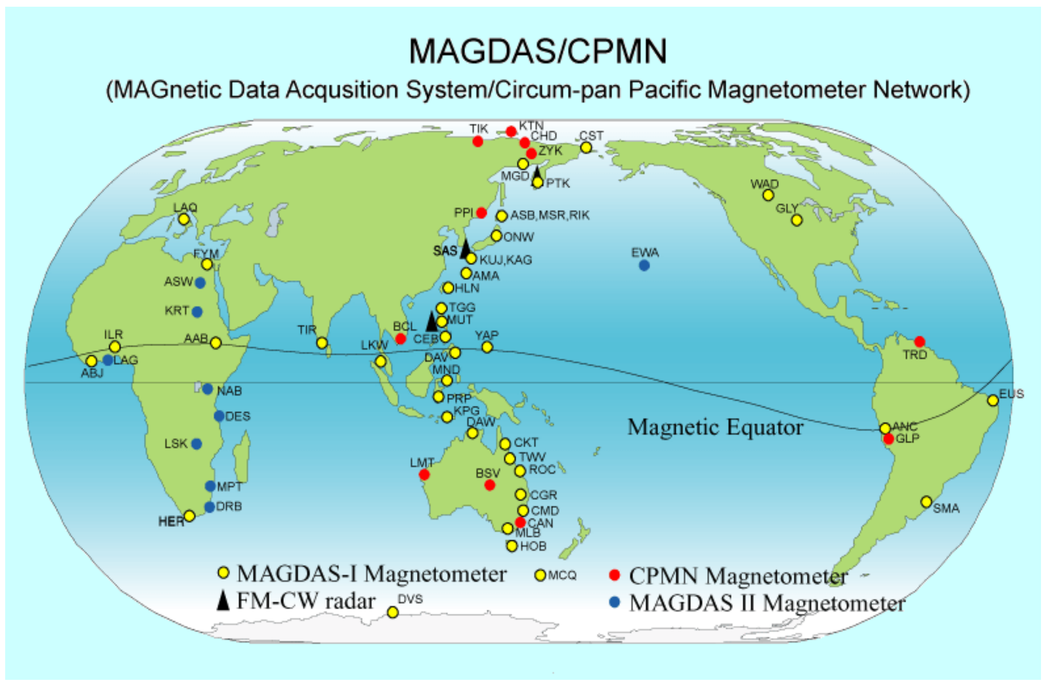
Abstract

Studying the latitudinal dependence of Pc 3-4 amplitudes at the equatorial and very low latitude regions is very important to identify the propagation mechanisms of the equatorial Pc 3-4 pulsations. Therefore, geomagnetic data simultaneously recorded at the MAGDAS African stations along the 96º Magnetic Meridian chain were analyzed in order to examine the latitudinal dependence of Pc 3-4 amplitudes at the equatorial and very low latitudes up to middle latitudes. During the period between October 2008 and October 2010, 75 Pc 3 events and 70 Pc 4 events were selected for studying the latitudinal dependence of Pc 3-4 amplitudes. The latitudinal profile of the Pc 3 amplitude ratio indicates attenuation in the Pc 3 amplitude at the dip equator. This attenuation may be due to the ionospheric shielding effect. On the other hand, the Pc 4 amplitude shows a peak at dip equator and decreases with increasing latitude up to middle latitudes as it revealed from the latitudinal profile of the Pc 4 amplitude ratio. According to the obtained results, the main source of the equatorial Pc 3 must be related to the compressional upstream waves, while the equatorial Pc 4 may be linked with the compressional upstream waves and/or the Pc 4 excited at higher latitudes.

Introduction

The characteristics of ULF waves observed on the ground contain information not only about the generation processes but also about the regions through which they have propagated. Most of the ULF wave studies have relied on data obtained from middle or high latitudes, while the equatorial and very low latitudes have received a little attention. Consequently, the source and propagation mechanisms of the equatorial and very low latitude pulsations are not fully understood and they might be related to either upstream waves or the mechanisms of pulsations at higher latitudes. In the present study, we investigate the latitudinal dependence of Pc 3-4 amplitudes at equatorial to middle latitudes using simultaneous geomagnetic observations across the dip equator through the MAGnetic Data Acquisition System (MAGDAS) at African stations in order to identify the generation and propagation mechanisms of the equatorial Pc 3-4.

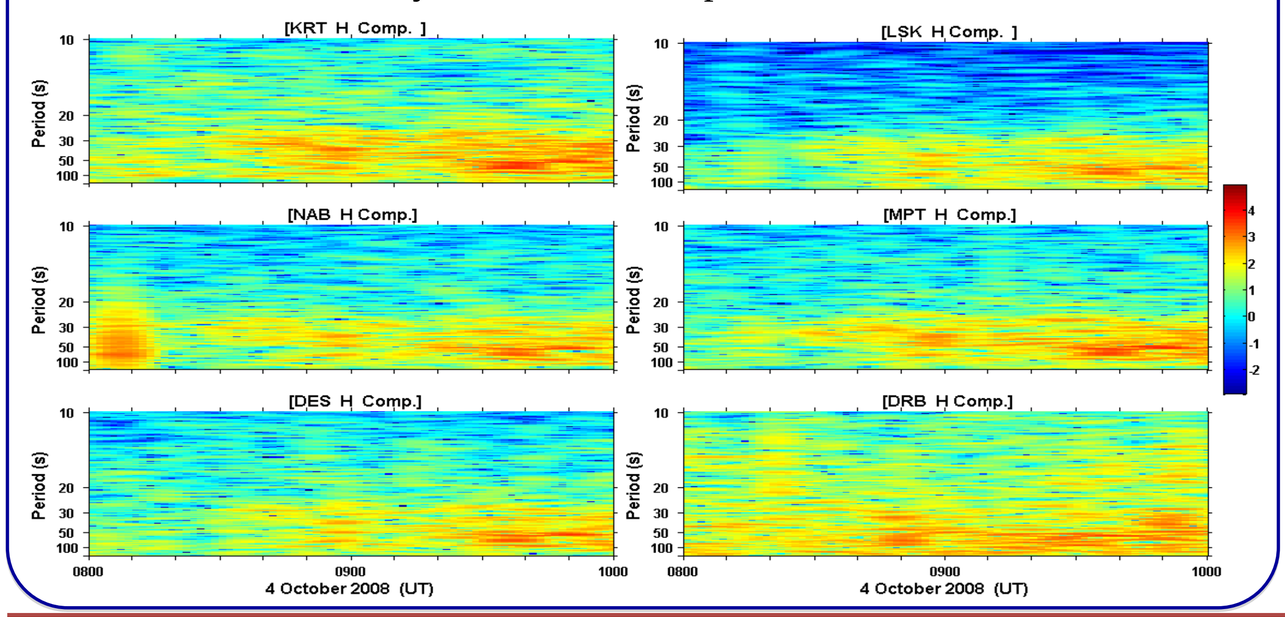
Data Acquisition



We analyzed one second geomagnetic data from 96º MM stations located from the dip equator to the middle latitudes. This profile extends from L' Aquila (LAQ) in Italy down to Hermanus (HER) in South Africa. This profile includes 11 MAGDAS stations (four MAGDAS stations: LAQ, FYM, AAB and HER; seven MAGDAS II stations: ASW, KRT, NAB, DES, LSK, MPT and DRB).

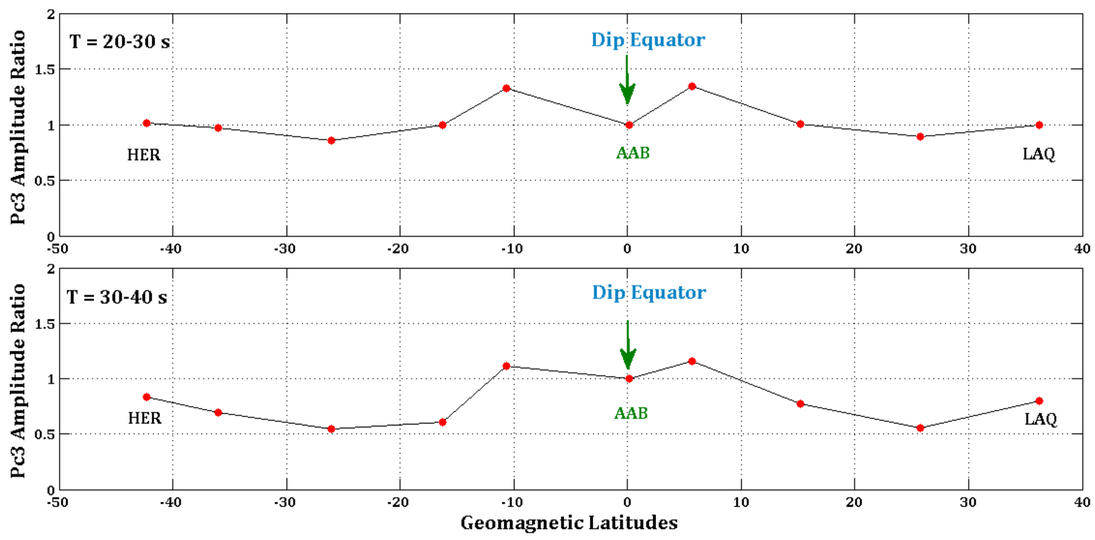
Events Selection

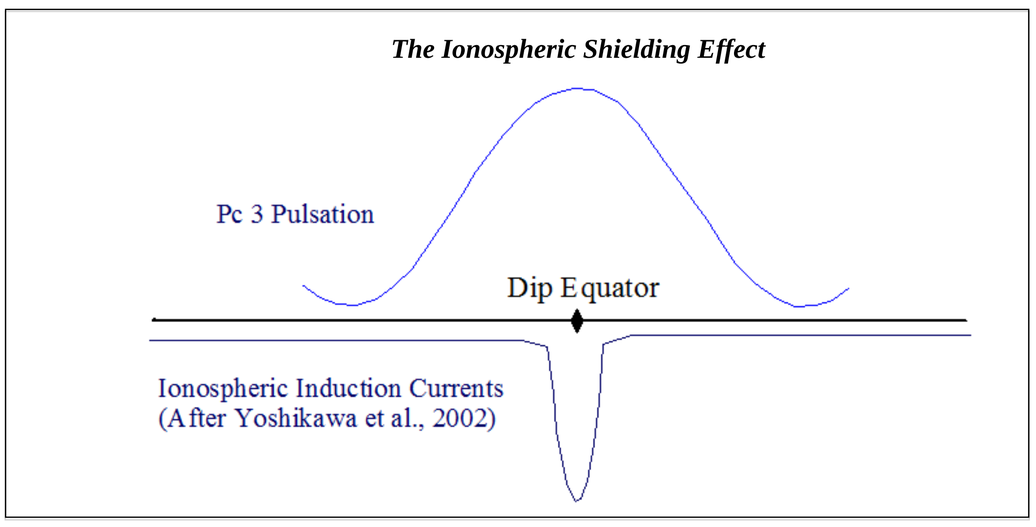
The selection of the Pc 3-4 events involved comparing the daily dynamic power spectra of the H-component recorded at each station. The selected events occurred in the daytime from 0600 up to 1800 LT.



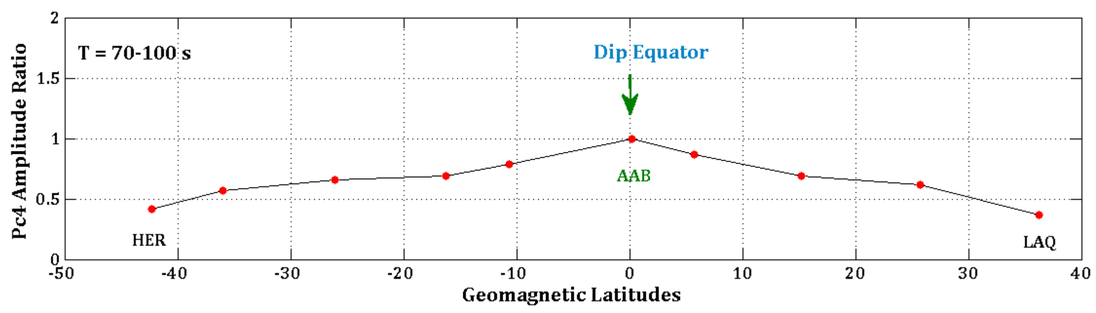
Data Analysis and Results

1. The Latitudinal Profile of the Pc 3 Amplitude Ratio





2. The Latitudinal Profile of the Pc 4 Amplitude Ratio



We also examined the solar wind velocity, the IMF magnitude and the cone angle during the selected Pc 3-4 events. We found that 85% of the Pc 3 events and 60% of the Pc 4 events occurred during solar wind velocity ranging between 400-650 km/s. Furthermore, the shorter period of the magnetic pulsation (Pc 3) tend to occur during IMF magnitude ranging between 4-6 nT. While, the longer period (Pc 4) pulsations occur during low IMF magnitudes (less than 2.5 nT). In addition, 80% from the Pc 3-4 events occurred during cone angle less than 45° .