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Coherence and phase structure of compressional ULF waves at low-Earth-orbit observed by the Swarm satellites

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Different types of ultra low frequency (ULF waves), such as dayside compressional Pc3-Pc4 waves, Pc2 and Pc1 waves, Pc3-Pc4 field line resonances, night side and day side Pi2s, etc. have been successfully identified in the topside ionosphere. ULF observations in this region can help us to understand the wave structure in the magnetosphere, wave propagation, and also the effects of the ionosphere (transmission, reflection, mode conversion). Because of the fast orbiting of the LEO satellites Fourier analysis is not applicable, special techniques (wavelet analysis, maximum entropy method) are needed to resolve ULF signals, as well as to discriminate between spatial and wave structures. In this paper we present results of a study of Pc3 compressional waves observed at low-Earth-orbit (LEO) by the Swarm satellites. The particular emphasis has been to investigate the distribution of wave coherence and phase difference as functions of magnetic latitude and local time. This is the first time that a study of this nature has been carried out using magnetic field data from multiple LEO satellites. We believe that our study provides the first observational evidence to support the prediction by the inductive thin ionosphere model that incident Alfvén mode waves are partially converted into compressional mode waves by the ionosphere.