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Determining the incident directions of whistlers recorded on board of the DEMETER LEO satellite - a geomagnetic latitude dependent wave propagation character in the ionosphere

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Three component magnetic field (IMSC) waveform data, recorded in the ELF frequency range on board of the DEMETER satellite was used to calculate the incident directions of numerous whistlers at LEO orbit altitudes. After automatic whistler detection with AWDA procedure [Lichtenberger et al., 2004] calculation of accurate, instantaneous amplitude, phase and arriving time of selected signal traces was performed at different frequencies using matched filtering and subsequent statistical parameter estimation algorithm [Ferencz et al., 2006]. Based on the widely used plane wave approximation, thus supposing that field vector B and propagation factor k are orthogonal, direction of the latter one (wave normal) was possible to estimate in case of several tens of short path fractional hop whistlers, acquired at different magnetic latitudes in the topside ionosphere, globally. The resulted incident azimuth and elevation angles exhibit clear, reliable dependence on geomagnetic latitude and declination. According to the determined incidents at the receiving sensors whistler propagation may occur in the local magnetic meridional plane in the anisotropic lower plasmasphere. The impulses most likely reach upward the satellite altitude obliquely, their path fall between the vertical (shortest but large angle) and the field aligned (longer

but longitudinal) directions. This topology of whistler propagation in the ionosphere ensures the minimum propagation time of the signals and corresponds well with, thus confirms the results of our earlier UWB oblique propagation study on this field [Steinbach et al., 2006] based on DEMETER VLF burst ICE data. Furthermore, DEMETER three component burst magnetic recordings provided excellent basis to study the propagation properties of long path, one hop whistlers at the satellite, often observed at ELF frequency range as well. Our preliminary investigation aimed to characterize their guided or oblique behavior, supporting the studies of the L-discrepancy of one hop whistlers.

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