Geophysical Research Abstracts, Vol. 9, 10191, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10191

Recent results on fine structure analysis of whistlers recorded onboard of LEO satellites

D. Hamar (1), J. Lichtenberger (1), P. Steinbach (1,2), Cs. Ferencz (1), J.J. Berthelier (3), F. Lefeuvre (4), M. Parrot (4)

(1) Space Research Group, Institute of Geography and Earth Sciences, Eötvös University, Budapest, Hungary (spacerg@sas.elte.hu / Fax: +36 1 3722927 / Phone: +36 1 2090555 6651), (2) Research Group for Geology, Geophysics and Space Sciences, Hungarian Academy of Sciences, Budapest

(2) MTA-ELTE Research Group for Geology, Geophysics and Space Sciences, Hungarian Academy of Sciences, Budapest

(3) CETP/CNRS St. Maur, France

(4) LPCE/CNRS Orléans, France

Whistlers, recorded by the DEMETER and Compass-2 satellites in the topside ionosphere, appeared on the burst VLF data of ICE (electric) and IMSC (magnetic) experiments of the DEMETER mission, and contemporal electric and magnetic component waveforms acquired with our SAS2 instruments on board of the Compass2 satellite were detected and analyzed by MFPE (matched filtering and parameter estimation technique) [*Lichtenberger et al.*, 2003]. These whistlers typically exhibit higher signal-to-noise ratio as ground measurements usually do, supporting our detailed investigation. This method enabled us to derive high accuracy frequency-time-amplitude patters of the investigated signals. The time of arrival of the instantaneous frequency of the recorded whistlers can be determined with accuracy of a few ms. The closely spaced traces can even be identified, if their temporal separation is only around 5-10 ms. This accuracy can be further increased with applying least squares estimation method on the matched filter output.

Previous investigations of ground-measured one-hop whistlers proved that these signals consist of several closely spaced signal traces, with a characteristic separation of 3-8 ms [*Hamar et al.*, 1990]. The recently obtained fine structure of short-path

fractional-hop whistlers exhibit less complex picture of the signal composition as one-hop whistlers recorded on the ground showed. Series of these small dispersion ($D_0 < 5\ s^{1/2}$) whistlers have highly similar frequency- and amplitude- vs. time pattern. Clear indication of effect of long subionospheric guided spheric propagation as modal trace splitting at $\sim$ 1.8 kHz and its harmonics was possible to observe on the fine structure pattern of these whistlers. This finding helps us to better interpret results of earlier MFPE analysis on large set of one-hop whistlers. On board recorded long-path or obliquely propagated whistlers [*Steinbach et al*, 2006] seem more compounded signals, showing a stronger effect of the crossed plasma medium and propagation characteristics along the longer path on the signal shape. Remarkably, more complex whistler impulses with larger dispersion exhibit different fine structure on recorded electric and magnetic components in case of DEMETER and Compass-2 wideband VLF recordings.

References:

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