URSI AP-RASC 2019, New Delhi, India, 09 - 15 March 2019

Improved whistler inversion algorithm: small scale structures in plasmapshere

János Lichtenberger*[1,2], Dávid Koronczay [1,2], Csaba Ferencz [1], Orsolya Ferencz[1], Péter Steinbach [3], Mark Clilverd [4], Craig Rodger [5] Dmitry Sannikov [6], Nina Cherneva [6] and Rustam Karimov[7]
(1) Department of Geophysics and Space Sciences, Eötvös University, Budapest, Hungary, lityi@sas.elte.hu
(2) Geodetic and Geophysical Institute, RCAES, Sopron, Hungary,
(3) MTA-ELTE Research Group for Geology, Geophysics and Space Sci., Budapest, Hungary,
(4) British Antarctic Survey, Cambridge, United Kingdom,
(5) Department of Physics, University of Otago, Dunedin, New Zealand,
(6) Institute of Cosmophysical Research and Radio Wave Propagation, Paratunka, Russia
(7) Institute of Cosmophysical Research and Aeronomy, Yakutsk, Russia

The whistler inversion algorithms [1,2,3] are based on the estimation of three parameters: 1) causative sferic time, 2) nose frequency/propagation L-value and 3) dispersion/equatorial electron density. The most difficult parameter to estimate is time of the causative sferic, this introduces the highest uncertainty. The improved method overcome on this difficulty bypassing the estimation of this parameter, that makes the inversion process not only more accurate, but faster as well.

The Automatic Whistler Analyzer (AWA) algorithm [4] assumed a smooth equatorial electron density profile, in the case of multiple-path propagation whistler groups, that had to be changed. Now the new method inverts the traces in the event individually and it led to higher precision and revealed small scale irregularities in the equatorial electron density profiles.

The method is implemented to AWA, where the original frequency-domain implementations has been changed to time-domain – to utilize the improved inversion algorithm. The new version is able to process higher number of whistler events successfully.

Here we present the first results on reprocessing of whistlers recorded by AWDANet [5] as well as examples on small scale irregularities in the plasmasphere.

1. Park, C. G. (1972), Methods to determine electron concentrations in the magnetosphere from nose whistlers, Technical report 3454-1, Radioscience Laboratory, Stanford Electronics Laboratories, Stanford University,Stanford, California

2. Tarcsai G. (1975), Routine whistler analysis by means of accurate curve fitting, J. Atmos. Terr. Phys.,37,1447

3. Lichtenberger, J. (2009), A new whistler inversion method, *J. Geophys. Res.*, 114, A07222, doi:10.1029/2008JA013799.

4. Lichtenberger, J., C. Ferencz, D. Hamar, P. Steinbach, C. J. Rodger, M. A. Clilverd, and A. B. Collier (2010), Automatic Whistler Detector and Analyzer system: Implementation of the analyzer algorithm, *J. Geophys. Res*., 115, A12214, doi:10.1029/2010JA015931.

5. Lichtenberger, J., C. Ferencz, L. Bodnár, D. Hamar, and P. Steinbach (2008), Automatic whistler detector and analyzer system: Automatic whistler detector, *J. Geophys. Res.,* 113, A12201, doi:10.1029/2008JA013467.