Geophysical Research Abstracts
Vol. 15, EGU2013-2203, 2013
EGU General Assembly 2013

Directions of equatorial noise propagation determined using Cluster and DEMETER spacecraft

Frantisek Nemec (1), Zuzana Hrbackova (1,2), Ondrej Santolik (2,1), Jolene S. Pickett (3), Michel Parrot (4), Nicole Cornilleau-Wehrlin (5,6)

(1) Faculty of Mathematics and Physics, Charles University in Prague, Prague, Czech Republic (frantisek.nemec@gmail.com), (2) Institute of Atmospheric Physics, Academy of Sciences of the Czech Republic, Prague, Czech Republic, (3) Department of Physics and Astronomy, University of Iowa, Iowa City, IA, USA, (4) LPC2E/CNRS Orleans, Orleans, France, (5) Laboratoire de Physique des Plasmas, Ecole Polytechnique, CNRS, Palaiseau, France, (6) LESIA, Observatoire de Meudon, Meudon, France

Equatorial noise emissions are electromagnetic waves at frequencies between the proton cyclotron frequency and the lower hybrid frequency routinely observed within a few degrees of the geomagnetic equator at radial distances from about 2 to 6 Re. High resolution data reveal that the emissions are formed by a system of spectral lines, being generated by instabilities of proton distribution functions at harmonics of the proton cyclotron frequency in the source region. The waves propagate in the fast magnetosonic mode nearly perpendicularly to the ambient magnetic field, i.e. the corresponding magnetic field fluctuations are almost linearly polarized along the ambient magnetic field and the corresponding electric field fluctuations are elliptically polarized in the equatorial plane, with the major polarization axis having the same direction as wave and Poynting vectors.

We conduct a systematic analysis of azimuthal propagation of equatorial noise. Combined WBD and STAFF-SA measurements performed on the Cluster spacecraft are used to determine not only the azimuthal angle of the wave vector direction, but also to estimate the corresponding beaming angle. It is found that the beaming angle is generally rather large, i.e. the detected waves come from a significant range of directions, and a traditionally used approximation of a single plane wave fails. The obtained results are complemented by a raytracing analysis in order to get a comprehensive picture of equatorial noise propagation in the inner magnetosphere. Finally, high resolution multi-component measurements performed by the low-altitude DEMETER spacecraft are used to demonstrate that equatorial noise emissions can reach altitudes as low as 660 km, and that the observed propagation properties are in agreement with the overall propagation picture.