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Simultaneous observations of quasi-periodic ELF/VLF wave emissions and energetic-electron precipitation by DEMETER

M. Hayosh (1), D. Pasmanik (2), A. Demekhov (2), O. Santolík (1), E. Titova (3), and M. Parrot (4)

(1) Institute of Atmospheric Physics, Prague, Czech Republic (hayosh@ufa.cas.cz), (2) Institute of Applied Physics RAS, Nizhny Novgorod, Russia (pdl@aurora.appl.sci-nnov.ru), (3) Polar Geophysical Institute RAS, Apatity, Russia (lena.titova@gmail.com), (4) LPC2E/CNRS, 3A Avenue de la Recherche Scientifique, Orléans, 45071, France (Michel.Parrot@cnrs-orleans.fr)

One of the proposed explanations of the quasi-periodic (QP) VLF wave observed in the ionosphere is based on their generation by energetic electrons in the equatorial region of the magnetosphere. These electrons then precipitate into the ionosphere and their flux should be modulated with the same period as the QP emissions. The main attention in our study is paid to the correlation between both features. We use the DEMETER spacecraft data for this purpose. We have analyzed more than two hundred events of the QP wave measurements by DEMETER. In this large data set, we have found several cases where precipitated electrons are highly correlated with the QP wave bursts. To our knowledge, such observations made onboard satellites have not been reported earlier.
We have found the cases at both low ($L < 4$) and high ($L > 4$) McIlwain parameter, however characteristics of the QP emissions (the frequencies, the dynamic spectrums, the periods) differ for different latitudes. Energetic particle data from the DEMETER satellite are supplemented by data from the NOAA-17 satellite. The orbit of this spacecraft is very similar to the orbit of DEMETER. We discuss mechanisms of removal of energetic electrons from a generation region and we compare the parameters of the observed events with the cyclotron maser model of the QP emissions.