



Imprint of VLF transmitter signals in HF waveband in DEMETER satellite data

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Ground HF e.m. waves of natural or man-made sources are observed in satellite wave records. We present a systematic analysis of HF (3-3300 kHz) electric field signals measured by the LEO DEMETER satellite. Global maps of monthly averaged intensity values in selected bands with 100 kHz steps (frequency band) were calculated and analyzed for the 6 year period (09.2004-12.2010), covered by the DEMETER data. Wave propagation conditions were given using IGRF and IRI models.

According to preliminary expectations (as pointed out by Lefeuvre et al. (2013)) due to VLF heating, modified plasma temperature and collision frequency in certain bands decreased intensity can be observed above VLF transmitters, compared to the unperturbed background. However, in other frequency ranges increased HF intensity values can be seen in the heated region. Enhanced and suppressed HF intensities were analyzed according to daytime, season and geographic location. Medium characteristics (e.g. local gyro-, plasma- and collision frequency, magnetic field inclination) rule the transmission, yielding spatial and temporal varying, increased or decreased observed HF intensity pattern in the topside ionosphere in different bands.

Major sources of HF waves leaking out related to VLF transmitters are thought to natural lightnings, however, we identified several anomalous, high intensity patches not linked to known transmitters above different locations globally, that show seasonal variance and their source is still unclear.

Lefeuvre, F., Pinçon, J.L., Parrot, M. (2013) : Midlatitude propagation of VLF to MF waves through nighttime ionosphere above powerful VLF transmitters. JGR 118, 1210-1219.