

TOP SIDE IONOSPHERIC MODIFICATION DIAGNOSED BY HF WAVE MEASUREMENTS

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ABSTRACT

The level of electromagnetic noises detected at the ionospheric altitude depends on the properties of geophysical conditions, the magnetic field topology, influences from the Earth surface and the interaction of the satellite and the surrounding plasma. On the other hand, the Earth ionosphere is modified by human activity, and only a few processes are connected with controlled experiments in the ionosphere and these are transient. Most of them are to do with industrial activity and they have intensified in the recent years. The most important power sources are broadcasting transmitters, power stations, power lines and heavy industry. The perturbation of Earth plasma environment seems to be very complex and is described by indirect impact, therefore the scope of our investigations should cover a wide range of physical processes in space.

Observations of HF emission in the topside ionosphere from the of low orbiting satellites: INTERCOSMOS-19; COSMOS-1809, ACTIVE and APEX, CORONAS-I reveal the same features, i.e. a significant increase in emission intensity over the populated areas of Europe and Asia. The examinations of the wave data gathered on ARCAD-3 satellite proved the enhancement of emissions in the VLF frequency range, correlated it with broadband HF noises detected over the Euro-Asia region. This remarkable intensity enhancement was observed even in the frequency range below the critical foF2 frequency, mainly at local night time. The HF diagnostics, performed on the low orbiting satellite, detected the enhancement of radiation, particularly over the Euro-Asia region. Thus over the Euro-Asia area enhancements of background radiation were detected in the whole frequency band, which is connected with natural plasma radiation, and, for frequencies greater than the plasma frequency at maximum F2 layer triggered by artificial ground-based origin noises. The observed broadband HF emissions are driven by natural plasma emissions and man-made noises. The artificially modified top-side ionospheric plasma regions are located over ground-based HF transmitters and are correlated with the outer radiation belts structure. Thus this activity can create, in the top-side ionosphere, ion-acoustic turbulence or local Langmuir turbulence. Moreover, theoretical considerations indicated that the generation of ion-acoustic turbulence is far more effective. The radiation belts can be a natural source of hot electrons, furthermore, the permanent pumping of strong electromagnetic waves into the atmosphere can drive the increase flux precipitating energetic particles. As a consequence, the scattering of super-thermal electrons on ion-acoustic or Langmuir turbulence was proposed as a mechanism of generation of broadband HF emissions. On the other hand, the turbulent area of ionospheric plasma triggered by human activity can lead to occurs different dimension plasma irregularity.

The aim of this presentation is to review the previous observation of electromagnetic emissions detected in VLF and HF frequency range and

discuss discuss the morphological properties and origins of the
observed HF and VLF wave activity generated by human activity as well.