Geophysical Research Abstracts, Vol. 7, 10509, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10509

Elaboration of decametric radio sounding techniques for studying of the near space objects

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In present time decametric wavelengths range is poorly used for radar investigations of the solar systems objects. At the same time it is very attractive to get additional information about these objects by use of the longest wavelengths, which can penetrate the Earth ionosphere. Of course various difficulties both technical and observational kind exist here for ground-based decametric instrument. First of all the various wave propagation phenomena, like as absorption, refraction and wave scattering in the ionosphere, which would appear there, must be taken into account. Also non-linear effects, mainly thermal self-focusing instability in the F-layer and defocusing of the sounding waves in lower ionosphere could arise due to a great power density of sounding wave in the experiments.

Good opportunity to study the wave propagation effects was given by experiments with reception of the SURA radiation at the NASA WIND spacecraft. Preliminary analysis of the experiments at a frequency 9 MHz, which were performed in 1996-2004 years, is presented now. It was found for different geophysical conditions that the ionosphere effects as linear and as well as nonlinear one are relaxing rapidly under ionospheric critical frequencies decreasing as one should expect from theory predictions. On average the power density of sounding wave after the ionosphere transit is comparable with one for vacuum case if critical frequency of F-layer is below one half of operating radar frequency.

Evidently the coming minimum of solar activity, which is characterized by global decreasing of the ionosphere electron content, is mostly favourable time for conducting

of radar experiments. We intend to take the occasion for radar investigations of near space objects including the Earth bow shock, solar wind, Moon crust, CME's and solar corona using Russian SURA transmitting facility (effective radiation power 15-160 MW) and Ukrainian UTR-2/URAN telescopes (total effective reception area 0.25 sq.km). In the report the perspectives to use other existing and-or developed decametric instruments in the investigation program (NDA, France and LOFAR-LOIS system, Netherlands-Sweden) are discussed too.

Authors are grateful for a support of the work by the INTAS grant N 03-51-5727.