Geophysical Research Abstracts
Vol. 15, EGU2013-8454, 2013
EGU General Assembly 2013

Nonlinear Interaction of a Powerful Oblique Wave Beam with the Ionosphere Layer F2.

Barbara Atamaniuk (1), Hanna Rothkaehl (1), Ivan Anatolevich Molotkov (2), and Alexei Popov (2)

(1) Space Research Centre Polish Academy of Sciences, Warsaw, Poland , (2) Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, RAS

The presentation is devoted to modeling oblique sounding of the ionosphere layer F2 by powerful wave beams. Part of its energy propagates trough the ionospheric layer, the other part goes back along a downward trajectory. However, nonlinearity leads to further stratification of the ionospheric layer. A new feature, in comparison with the linear case, is appearing a narrow waveguide beneath the F2 layer maximum which traps a small part of the beam energy.

• We study the relationship between these parts of the wave field in a simplified model of parabolic F2 layer, with nonlinearity caused by thermal plasma expulsion from the high field intensity region.

• We model and analyze of the interaction of a powerful obliquely incident wave beam of decameter radio waves with the ionospheric layer F2.

Oblique propagation of a powerful HF wave beam in the ionospheric F2 layer leads to additional plasma stratification, in particular to the formation of an artificial waveguide controlled by the beam intensity. We show that formation of the artificial waveguide is a nonlinear effect. The problem of efficient feeding the artificial waveguide depends on the ability to create in the F2 layer high values of the HF electric field compared with the characteristic “plasma fields".

Analytical results are supplemented with numerical estimates of the effects. The proposed investigation can be used in Space Weather Services.