



Location of plasma layers in the ionosphere of Venus by use of the radio occultation intensity-eikonal acceleration technique

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After forty years of radio occultation (RO) investigations it is clear now that the phase acceleration of radio waves has the same importance as the Doppler frequency for radio imaging the plasma layers in the atmosphere and ionosphere of the Venus and Earth. Eikonal variations may be converted into the refractive attenuation variations, which allows the total absorption to be determined with the refraction effect on the radio-wave intensity cancelled out. This is necessary for measurements of the water-vapor density and gas minorities during multi-frequency radio-occultation sounding of the planetary atmospheres. The obtained results can be of common value for other remote-sounding paths, as well. This was shown by use of analysis of radio-holograms registered during RO investigation of the Earth and Venus ionosphere during the CHAMP, FORMOSAT-3/COSMIC, MIR/GEO, and "Venera-15, 16" space missions [1-3]. The variations in refractive attenuation were shown to be directly proportional to the variations in the derivative on time of the signal frequency due to the influence of the medium being sounded. A method is elaborated for locating layered structures in the planetary ionospheres and atmospheres, which is based on simultaneous observations of time variations in intensity and phase of radio waves. Method determines a position of the turning point, where the gradient of the refractive index is perpendicular to the RO ray trajectory. The layer position is estimated by joint analysis of the variations in the phase and intensity of radio waves. The method was used to analyze the experimental data obtained by the RO missions CHAMP and "Venera-15, 16". The elaborated eikonal acceleration/intensity technique has been applied to separate the influence of layered structures from contributions of irregularities and turbulence in the medium. The altitude, horizontal displacement and inclination angle of the plasma layers in the Earth and Venusian ionosphere were determined and the electron density distribution was found for the considered radio occultation sessions. It was shown that the eikonal acceleration/intensity technology is perspective for radio-imaging of layers in the planetary atmospheres and ionospheres. The work was partly supported by grant of Russian Fund of Basic Research No. 10-02-01015-a.

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