

Radio-Holographic Location of Internal Waves in the Ionosphere and Atmosphere

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A new radio-holographic method is introduced to locate layers in the propagation medium based on simultaneous observations of radio wave temporal amplitude and phase variations in satellite-to-satellite links. The method determines position of a tangent point on the ray trajectory where gradient of refractivity is perpendicular to the ray trajectory and influence of a layered structure on radio wave parameters is maximal. An estimate of the location of a layer can be obtained from a radio-holographic analysis of the phase and amplitude variations. This new technique was applied to measurements provided during CHAMP GPS radio occultation (RO) mission. For considered RO events the locations of the inclined plasma layers in the ionospheric E- and F- layers have been found and the electron density distributions in the layered wave structures have been retrieved. The new technique can be used to determine the ionospheric or atmospheric nature of the phase and amplitude variations of radio waves in the trans-ionospheric satellite-to-satellite or satellite-to-Earth links, and to establish the origin and physical parameters of the internal waves in the middle atmosphere and lower ionosphere. The method is checked by measuring location of the tangent point on the ray trajectory in the neutral gas in the lower stratosphere for considered RO events, the results of checking showed a fairly good agreement with estimations made by use of the standard RO technique. The application of this new technique will generate a more extensive body of information on plasma structures and natural processes in the ionosphere and their connection with processes in the atmosphere, magnetosphere and in interplanetary space.