Application of the eikonal acceleration/intensity technique to study radio-meteorological characteristics of the atmosphere by use of GPS occultation data

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High-stable radio signals emitted from navigational satellite systems (GPS, GLONASS, GALILEO etc.) are effective tools for remote sensing of the atmosphere and ionosphere and for establishing conditions of the radio waves propagation in the trans-ionospheric telecommunication links. In this report an application for studying changes in the radio-meteorological parameters at different altitudes in the atmosphere and ionosphere with global coverage is provided. Comparative analysis of variations of the bending angle and refractive attenuation are investigated for period 2006-2010 in Moscow, Orenburg and Kamchatka regions at the altitudes in the interval 0.5-20 km by use of radio occultation data obtained during CHAMP and FORMOSAT-3 missions. We use the eikonal acceleration/intensity technique to determine with high accuracy the bending angle and refractive attenuation from the Doppler frequency of radio waves and its derivative on time. Therefore the refractive angle and refractive attenuation are very informative radio-meteorological parameter for estimation physical characteristics of the atmosphere including the total absorption of radio waves in water vapor. An analytical approximation of the average vertical profile is obtained, and the long- and short-term seasonal and diurnal variations of the bending angle are investigated. The radio climate in the investigated regions is connected with influence of typical meteorological processes in the troposphere and stratosphere, including effects of clouds and water vapour vertical distributions. It is shown that seasonal and regional variations of radio meteorological parameters are very sensitive to the weather influence and can be used for revealing the climate changes in the investigated regions. The extended data-base and planned in near future new radio occultation have a fundamental importance for obtaining new significant contribution in the radio-meteorological theory and applications.The work is partly supported by RFBR grant No. 10-02-01015-a.