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Analysis and verification of vertical profile of atmospheric temperature for Kazan area according to radio occultation in satellite-to-satellite communication line

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Abstract

The altitude temperature dependences in the atmosphere, measured in the period from 2007 to 2010 in the area of Kazan by meteorological radiosondes and radio occultation method are compared. Radiosonde measurements of the atmosphere were conducted twice a day at 0 and 12 UTC, i.e. at 4 and 16 h local time. The radio occultation experiments were carried out using radio waves emitted by GPS navigation satellites in the decimeter range and received on low Earth orbit satellites Formosat-3 when they entered the Earth's limb relative to the satellite-transmitter. Despite the fact that the radio occultation method provides about 2,000 atmospheric soundings per day for different regions of the Earth, when analyzing the accuracy in the measurements of the vertical temperature profiles for a particular small climatic region, it is possible to obtain only one radio sounding in two, three days, at an arbitrary local time. When comparing the experimental dependencies, a strict restriction of not more than one hour has been introduced on the difference in the time of meteorological and radio occultation soundings. The distance between the radiosonde and the area of radio sounding of the atmosphere was chosen to be less than 250 km. The data of 43 sessions of the radio occultation soundings of the temperature altitude profiles obtained by two ways in different seasons of the year are given in the altitude range from 0.5 to 25 km were compared. It is shown that under such conditions at altitudes of more than 6 km the difference in the values of the temperature measured by the two methods does not exceed ± 2 °C. At low humidity in the winter season, radio occultation and meteorological data at altitudes of 1 to 3 km differed by not more than 4 °C. At altitudes below 4 km the radio occultation method gives an underestimate of the temperature because of the influence of air humidity. The results of determining the vertical temperature gradients in the middle troposphere differ by no more than ± 0.6 °C/km, and the height of the tropopause - by ± 0.5 km.

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Keywords

Atmosphere, Formosat, GPS, Radio occultation, Satellites, Temperature

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