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STUDY OF MESOSCALE IRREGULARITIES OF THE REFRACTION COEFFICIENT OF RADIOWAVES IN THE TROPOSPHERE BY THE METHODS OF NUMERICAL SIMULATION

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We propose a model of the mesoscale irregular structure of the refraction coefficient of radiowaves and its dynamics in the real atmosphere at altitudes of up to 20 km. This model was verified according to multiyear continuous measurements. The obtained dynamics of the refraction coefficient shows considerable horizontal, vertical, and temporal variability of the mesoscale irregular structure as well as anisotropy of the horizontal spatial structure of the refraction coefficient, which is determined by the fields of wind speed and the synoptic gradient of atmospheric pressure. Dependences of the disturbance of the optical length of the radio paths on the path length, zenith angle, time of the day, and meteorological conditions are found.

1. INTRODUCTION

Comprehensive study of the disturbance that the irregular structure of the real atmosphere exerts on radio waves propagated on different paths is interesting for many problems of satellite radio sounding of the atmosphere and the Earth's surface. At present, the influence of the turbulent-scale irregularities is well known. Some papers also confirm the influence of large-scale irregularities on radio measurements [1–5]. In this paper, we consider the influence of mesoscale irregularities. Obtaining exact parameters of the mentioned disturbance requires retrieval of the actual irregular structure of the refraction coefficient over the entire radio-path length at the instant of the radio-wave propagation. The mesoscale irregular structure of the real atmosphere, including the refraction-coefficient field, is time-varied and depends on the local geo- and meteorological conditions.

Thorough analysis of the mentioned phenomena and processes requires three-dimensional data on the fields of the atmospheric parameters in the real atmosphere and their dynamics. Obtaining detailed data with sufficient resolution by experimental methods faces a number of practical difficulties and high expenses and sometimes is technically impossible. Increase in the computational power of modern distributed computer systems and the mentioned problems make it topical to study mesoscale atmospheric processes by combining experimental methods and numerical simulation techniques [6]. This removes part of the constraints of the pure experimental procedures.

2. NUMERICAL SIMULATION OF THE ATMOSPHERE WITH ALLOWANCE FOR MESOSCALE IRREGULARITIES

This paper is based on the combined use of numerical simulation techniques and full-scale measurement data. Numerical simulation is employed for calculation of the mesoscale nonstationary dynamics of

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