PREFACE

The current state of the art in the development of mesoclimatology and regional ecology is characterized by growing interest to the problems associated with statistical analysis and forecast of the 3D structure of mesometeorological fields (first of all, temperature and wind velocity fields influencing the spatial spread of technogenic pollutants from sources of their emission), estimation and reconstruction of the atmospheric pollutant concentrations within limited territories, determination of changes in the mesometeorological regime of large cities under the effect of anthropogenic factors, etc.

This topical issue of the journal *Atmospheric and Oceanic Optics* is the fourth topical issue devoted to the problem of climatic and ecological monitoring of the atmosphere over limited territories (the previous three issues were published in 1994, 1995, and 1996). This issue is mainly devoted to consideration of different aspects of the above-mentioned problems.

Thus, the first paper by V.S. Komarov and Yu.B. Popov considers the important problems of statistical analysis of spatial structure of the mesoscale temperature and wind fields in the boundary layer and in the free atmosphere and analytic approximation of the corresponding correlation functions, which are solved in the interests of objective analysis and 3D extrapolation of the mesometeorological fields that provide the basis for local weather forecast and estimation of short-range (up to 100–200 km) spread of technogenic pollutants.

The second paper by the same authors and A.V. Kreminskii deals with a refined method for spatial extrapolation of the mesoscale temperature and wind fields (up to distances of 250 km) with minimum initial information. The method is based on the procedure of optimal integration of the modified MCA and the method of optimal extrapolation (realized with new and original analytic approximations of the correlation functions of the corresponding physical parameters). The paper also presents the results of statistical estimate of the quality of extrapolation from the data of long-term aerological observations at five stations, which form the typical mesometeorological experimental site.

V.I. Akselevich in his paper studies the capabilities of the autoregression model in statistical temperature forecast at different altitude levels of the troposphere. He also gives the quality estimate of this forecast for different forecast periods.

The paper by P.N. Belov and I.S. Il'in describes the stationary Euler model applied to reconstruction of climatic concentration of pollutants in the atmosphere over different territories and presents the examples of model calculation of average monthly concentrations of sulfur dioxide for the European region.

The other paper by P.N. Belov and V.S. Komarov considers an efficient method for calculation of pollutant concentration under conditions of air stagnation (in the calm with ground inversion). This method is based on the use of the simplified equation of the pollutant balance solved for the stationary process for average (over the vertical mixing layer) parameters. In addition, this paper gives the results of application of this method for determination of the maximum level of air pollution with toxic substances (sulfur dioxide, nitrogen dioxide, carbon oxide, and hydrocarbons) in the atmosphere of some Siberian towns under conditions of air stagnation.

A number of papers in this issue are devoted to investigations into the problem of change of mesometeorological regime in large cities under the effect of anthropogenic factors.

In particular, in the paper by L.T. Matveev and Yu.L. Matveev, this problem is studied by an example of the climatic estimate (based on the data of 20-year observations) of characteristics of cloudiness over St. Petersburg and their comparison with those obtained for a rural locality.

Analogous problem, but for the precipitation field, is considered in the paper by Yu.L. Matveev.

The paper by L.N. Karlin and L.T. Matveev studies the same problem by an example of the recurrency of fogs and hazes calculated from the 20-year data sample for St. Petersburg and the site 80 km apart from it.

Presenting this topical issue, we hope that its materials will be of interest to scientists dealing with the problems of statistical analysis and forecast of mesometeorological fields, numerical simulation of spatial spread of atmospheric pollutants, and the problem of change of meteorological and ecological regime in large cities under the effect of anthropogenic factors.

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