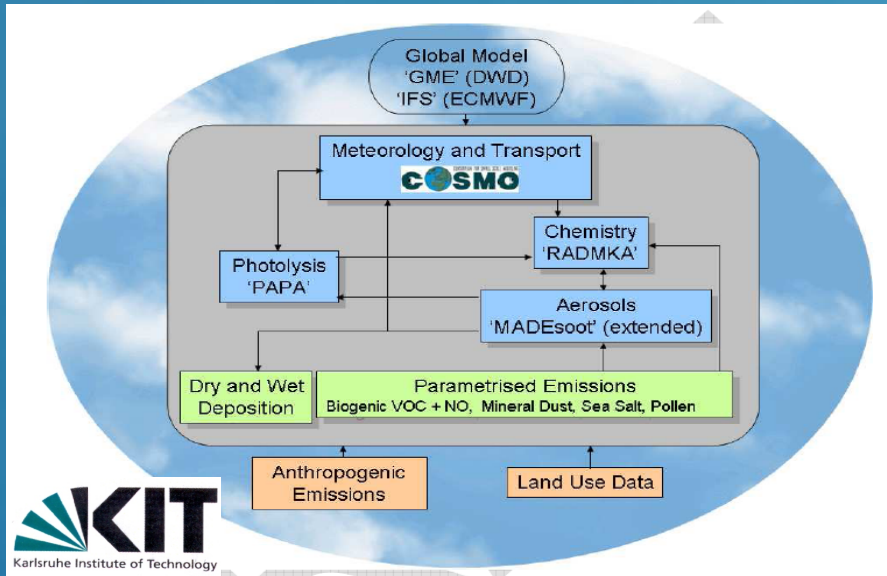


Abstract

To predict the air pollutants' concentration over the centre of the European part of Russia we consider the possibility of using a state-of-the-art chemical-transport model which includes a meso-scale nonhydrostatic meteorological model as well as a model system describing chemical processes in the atmosphere. We have run model over the European part of Russia and compare our results with observations. The results of the numerical experiments show that the model is able to simulate adequately the spatial-temporal features of concentration fields.

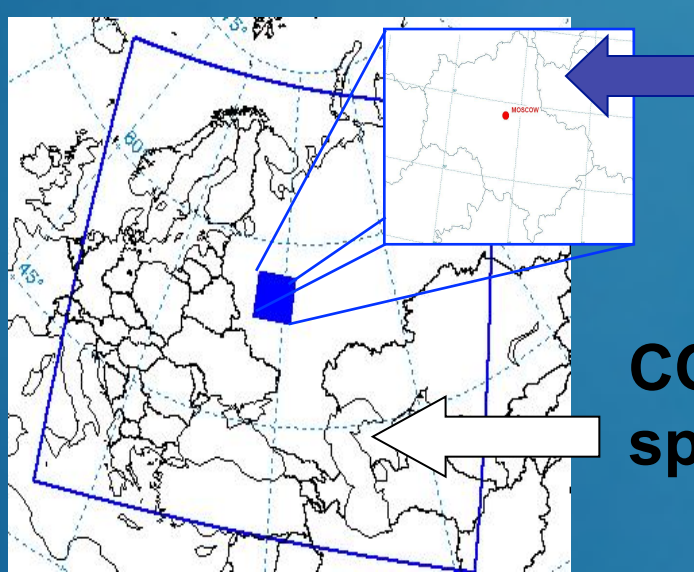
COSMO_ART



Structure of the COSMO-ART [Vogel et al., draft of the model description]

COSMO_ART is a fully online coupled regional model system consisted of the non-hydrostatic model COSMO (Consortium for Small-scale MOdelling) [http://www.cosmo-model.org/] combined with the chemical unit ART (Aerosols and Reactive Traces Gases) [Vogel et al., 2009]. A distinctive feature is the joint COSMO_ART calculation of meteorological variables and chemical transformations at each time step. Thus, the effect and feedback of aerosols and gases on the meteorological and radiation regime, is considered. COSMO_ART includes a number of model blocks, each of them is responsible for the calculation of a certain process.

Area



COSMO-ART, Moscow region
spatial resolution
7x7 km (64x64 grid cells)

COSMO (RU) – Europe and part of Russia
spatial resolution 7x7 km (700x620 grid cells)

Our numerical experiments:

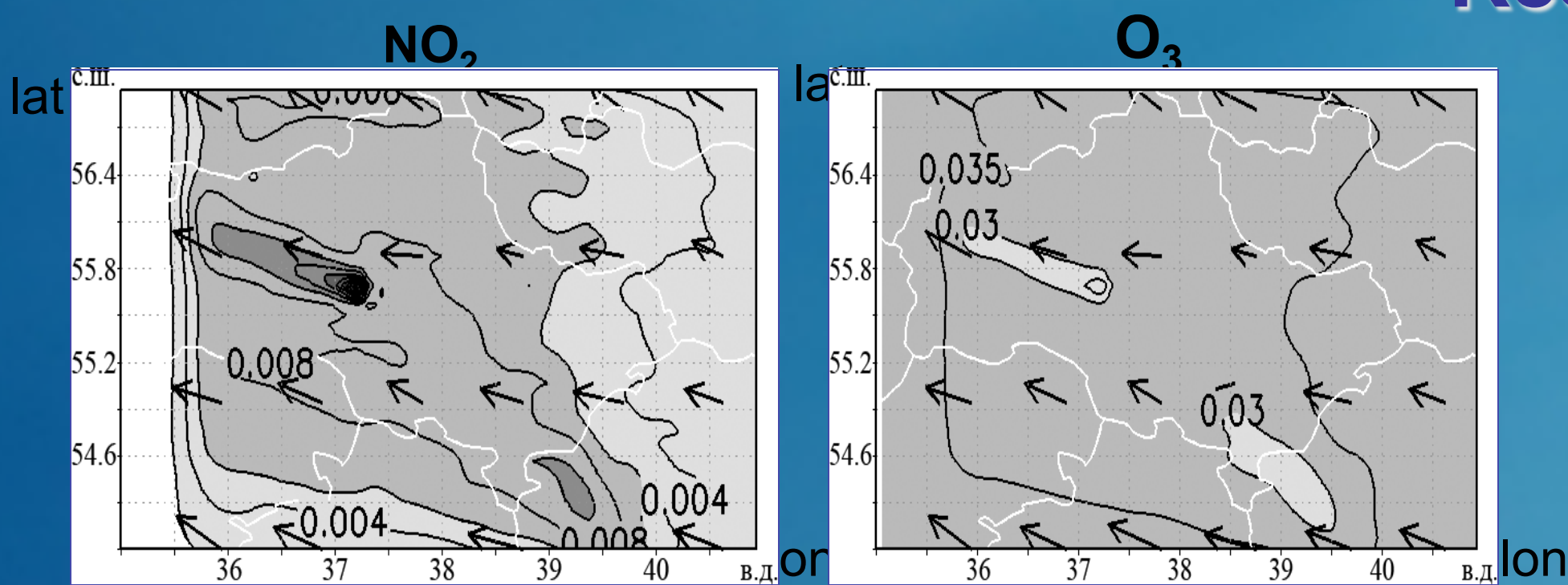
Emissions

For the first run of COSMO_ART we decided to use mean value of emissions of all gases and aerosols. It means that for each gas and aerosol we have mean data with hourly resolutions. This data coincide with climate features of chemical compounds distribution over Europe.

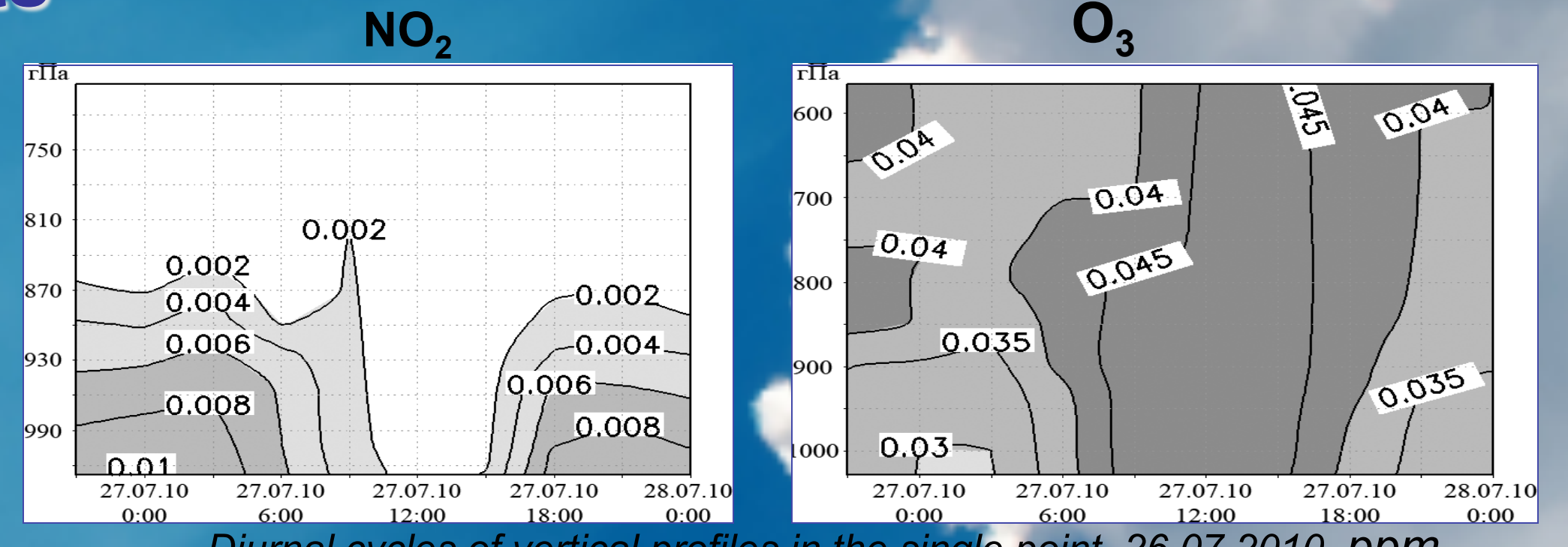
Point Source

In order to assess model response on emissions data and to check the ability of model to simulate chemical reactions and spatial-temporal features of concentration fields we add for our emission data a point source of NO₂. This source was located in the centre of out domain, near Moscow.

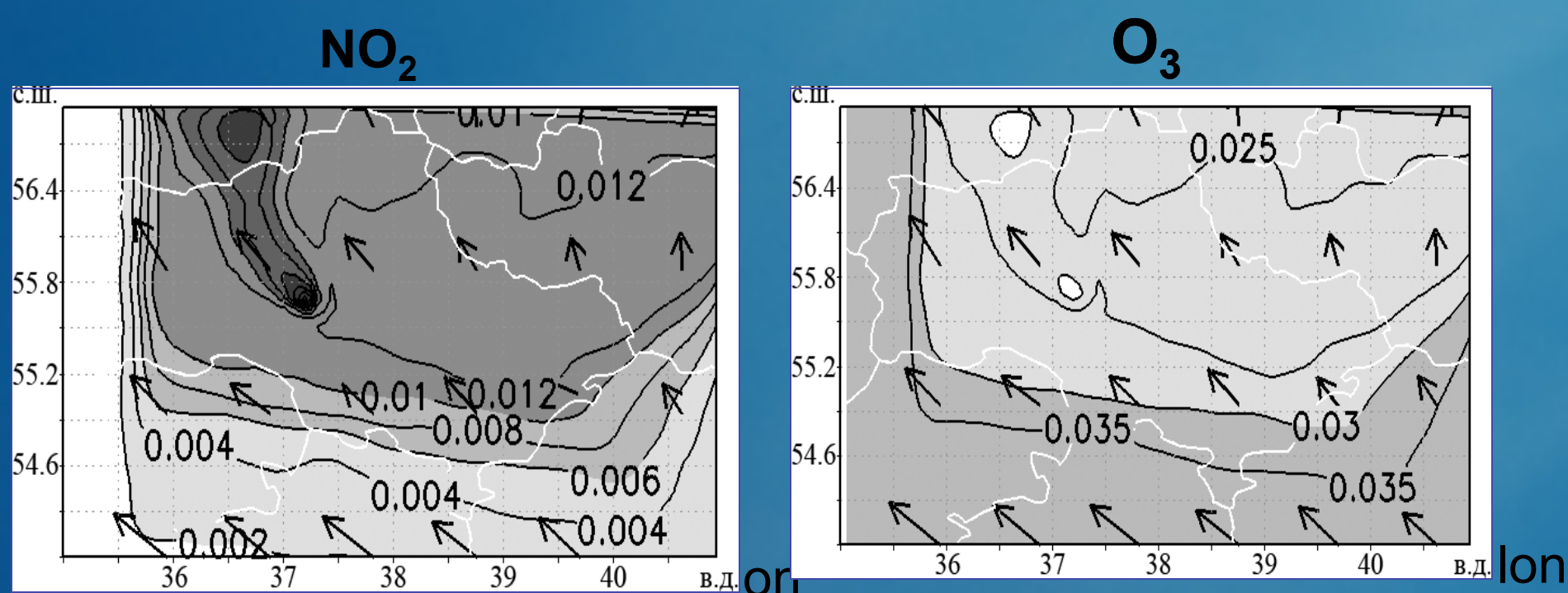
Results



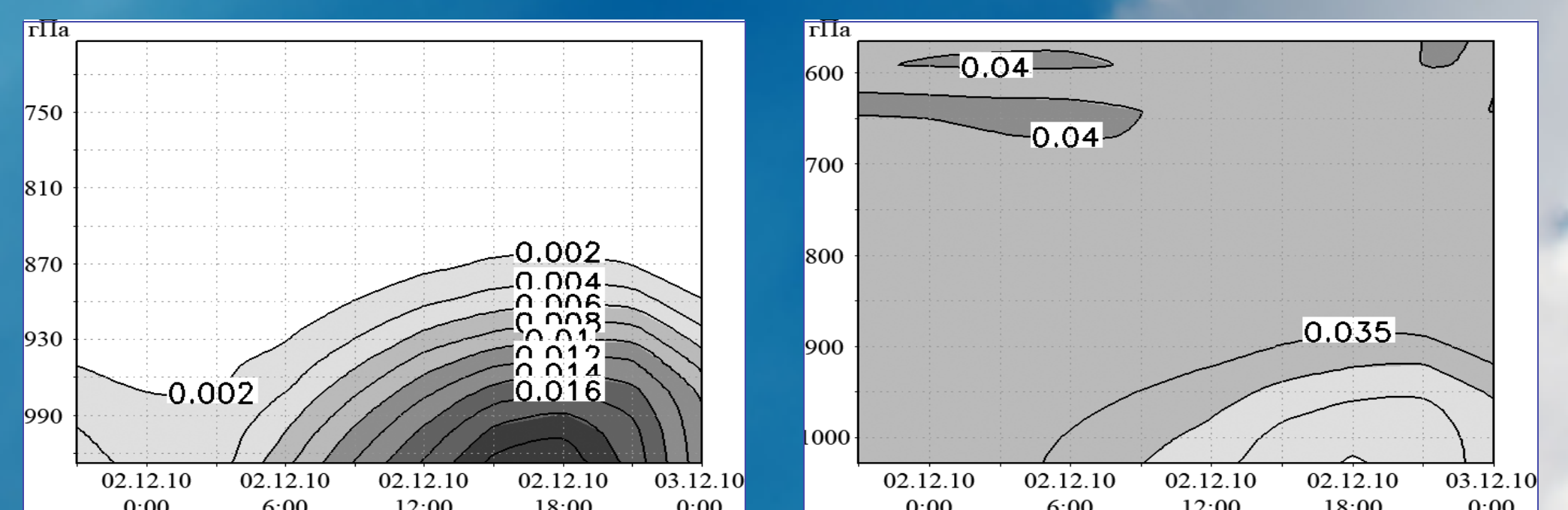
The distribution of the NO₂ and O₃ concentrations, 48 hour forecast, COSMO_ART, 26.07.2010, ppm



Diurnal cycles of vertical profiles in the single point, 26.07.2010, ppm

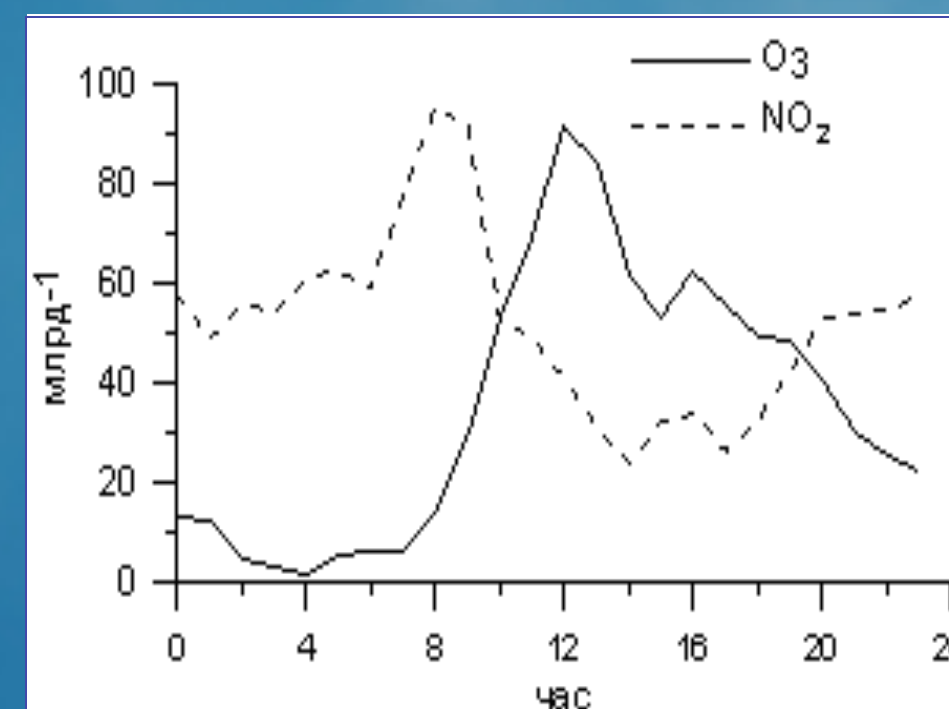


The distribution of the NO₂ and O₃ concentrations, 48 hour forecast, COSMO_ART, 02.12.2010, ppm

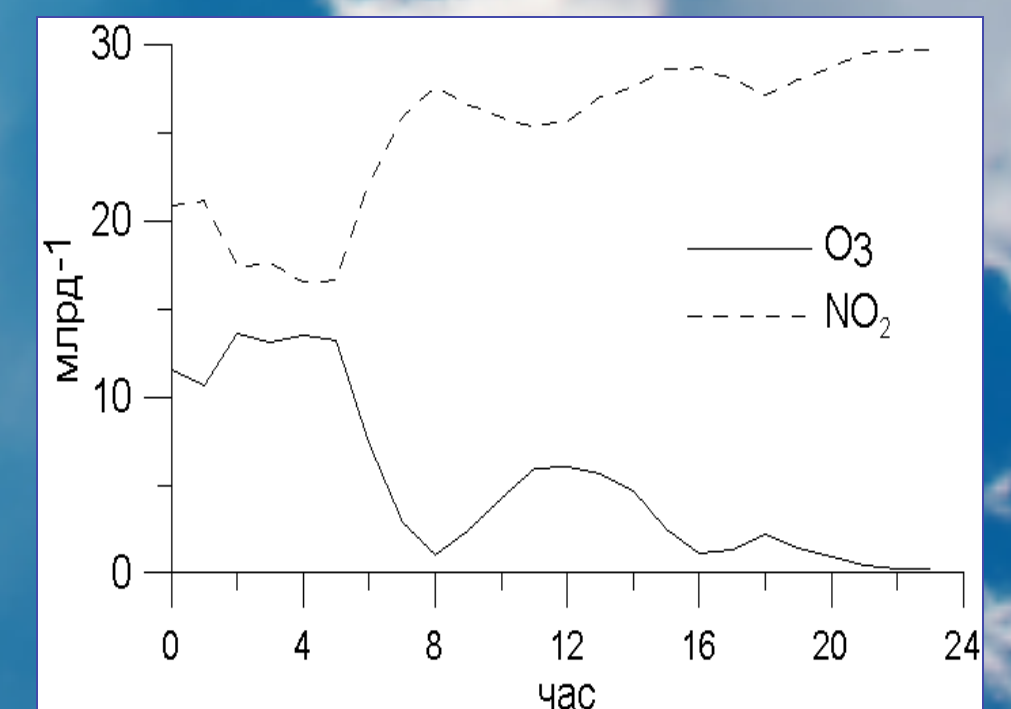


Diurnal cycles of vertical profiles in the single point, 02.12.2010, ppm

Comparison with observations



26.07.2010



2.12.2010

Observations data, ppb

Conclusions:

The model shows realistic results. Changes of gas and aerosols concentration reflect influence of wind field. With the single emission source distribution of pollution concentration transforms according to the wind field and atmospheric chemistry. First results give the perspectives to simulate the conditions of pollution of the Moscow megalopolis, taking into account natural and anthropogenic sources under real weather conditions, to carry out case study on assessing the impact of special pollution sources.

References

Vogel B., Vogel H., Bangert, M., Lundgren, K., Rinke, R., Stanelle T., Tröndle T. COSMO-ART documentation. Draft. Institute of Meteorology and Climate Research Karlsruhe Institute of Technology

Acknowledgements

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