

Chemistry exercises for YSSS-2011

Topic: Air quality sensitivity to temperature variability

Motivation: Temperature variability may cause changes in the rate of chemical reactions and lead to variations in the gaseous composition of atmosphere both in urban and rural areas. In turn, changes in the chemical composition may lead to variations in the atmospheric heating and cooling, temperature and circulation, giving rise to the possibility of positive or (and) negative feedbacks between chemistry, radiation and dynamics. The importance of such feedbacks at the regional scale may be studied with integrated NWP/Air Quality models.

Goal: To test the impact of observed and expected temperature variations on the chemical composition of the urban and rural regions.

Objectives:

- To study the impact of temperature changes on rates of temperature-dependent chemical reactions governing chemical composition in the urban areas;
- To test the impact of temperature variations on the photolysis rates through temperature-dependent cross-section variability;
- To define gases which are more sensitive to temperature variability;
- To compare gas composition temperature dependence in urban and rural areas.

Methodology of the exercises: Numerical experiments with chemical code prepared to be used in the integrated Enviro-Hirlam NWP/Air quality model. A baseline experiment will be run for background temperature specified for urban and rural areas taking into account differences in gas-phase chemistry for these regions. The sensitivity runs will be performed for forced temperature based on observation for extremely hot and extremely cold weather conditions. Additional experiments will be run to separate the role of temperature impact on the temperature-dependent chemical reaction rates and photolysis cross-sections.

Instructor: Dr. Sergei P.Smyshlyaev, Russian State Hydrometeorological University (RSHU), Malookhtinsky 98, St.Petersburg 195196, Russia. E-mail – smyshl@rshu.ru