Short-term forecast of the carbon monoxide concentration over the Moscow megacity region by COSMO-ART

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Introduction. Atmospheric pollution in the cities is constantly increasing. It makes air pollution forecast extremely important for modern meteorology. Short-range spatial detailed forecast of air pollutants distribution should be done as a part of weather forecast.

A short-term forecast of city 'chemical weather' requires real daily data on pollutant emissions. For the operational daily forecast of pollutant concentrations, long-term emissions averages are usually used, which may differ significantly from real emissions on the particular day, especially in big cities.

Methodology. The method of calculation of pollutant emissions is described for the short-term forecast. An on-line coupled chemical transport model, COSMO-ART (https://www.imk-tro.kit.edu/english/3509.php), was applied for the Moscow megasity region, Russia. Because it is impossible to have real daily emissions values, the method of emission estimation on the basis of measurements of the concentrations of air pollutants is proposed. The method is based on the assumption that the pollutant concentrations reflect the intensity of emissions sources. The proposed method allows the hourly measurements of air pollutant concentrations to be transformed into emissions values as fast as the measurements can be done.

Results. This method is described and its application is shown for carbon monoxide (one of the most dangerous pollutant). Around 90% of CO in Moscow is emitted by traffic.

Conclusions. Verification of the COSMO-ART results demonstrates that the calculated emissions gave better results compared with the results from mean emission values (TNO emissions dataset) that were used previously. This approach provides the possibility of running an operational short-term pollutant concentration forecast with more detailed spatial structure.