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Analysis of CO₂ content near Russian cities from OCO-2 satellite measurements

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The growth of greenhouse gases, primarily carbon dioxide, is the main cause of modern changes in the Earth's climate. At the same time, despite the relatively small area (~ 3%) of the territory of cities, they are responsible for more than 70% of anthropogenic emissions caused by energy supply systems. Therefore, studies of CO₂ distributions in cities and surrounding regions, as well as quantitative estimates of urban emissions are an urgent problem.

The paper presents a comparative analysis of CO₂ contents and their variations for a number of Russian cities (Moscow, St. Petersburg, Yekaterinburg, Magnitogorsk and Norilsk) on the basis of the OCO-2 satellite measurement data. The studies were carried out using satellite data sets that vary from high to average quality. These ensembles differ for all these cities in the number of measurement days, the total number of CO₂ measurements, and the spatial and temporal coverage. For example, a high-quality ensemble covers ~ 90% of the spring and summer months, i.e. provides an opportunity to study CO₂ variations in the warm season. The ensemble of measurements with average accuracy more evenly covers the entire year.

The paper studied various characteristics of the column averaged dry-air mole fraction of CO₂ (X_{CO_2}) for 5 cities, namely, minimal and maximal values, amplitudes of variations, daily average maximal and minimal values, standard deviations, etc. Possibilities of using the OCO-2 data for estimating of anthropogenic emissions in different cities are considered.