

## Simulation of CO<sub>2</sub> and CH<sub>4</sub> in Siberia using coupled Eulerian-Lagrangian model

\*Dmitry Belikov<sup>1,2,3</sup>, Shamil Maksyutov<sup>1</sup>, Alexander Ganshin<sup>3,4</sup>, Ruslan Zhuravlev<sup>3,4</sup>, Motoki Sasakawa<sup>1</sup>

1.Center for Global Environmental Research National Institute for Environmental Studies, 2.National Institute of Polar Research, Tokyo, Japan, 3.Tomsk State University, Tomsk, Russia, 4.Central Aerological Observatory, Dolgoprudny, Russia

Siberia is an extensive geographical region with large amounts of plant biomass and soil organic carbon, so this region has a substantial sources and sinks of CO<sub>2</sub> and CH<sub>4</sub>. The magnitude and distribution of CO<sub>2</sub> and CH<sub>4</sub> fluxes are still uncertain, so accurate estimation of carbon fluxes and study of CO<sub>2</sub> and CH<sub>4</sub> seasonal cycles in the subarctic regions are essential.

In this work, we use forward simulation employing the Global Eulerian-Lagrangian Coupled Atmospheric (GELCA) model in order to estimate CO<sub>2</sub> and CH<sub>4</sub> seasonal cycles in the subarctic. GELCA consists of an Eulerian National Institute for Environmental Studies global Transport Model (NIES-TM) and a Lagrangian particle dispersion model (FLEXPART). This approach utilizes the accurate transport of the Lagrangian model to calculate the signal near to the receptors, and efficient calculation of background concentrations using the Eulerian global transport model. We setup a long simulation period to obtain a better understanding of the role of emissions (using a set of CO<sub>2</sub> and CH<sub>4</sub> emissions scenarios), and transport model characteristics, such as the stratosphere/troposphere exchange and tracers concentration variations in the troposphere. We also analyzed modeled and observed long and short-term trend, seasonal cycle of CO<sub>2</sub> and CH<sub>4</sub>.

Model results were compared with observations from the World Data Centre for Greenhouse Gases (WDCGG 2015) and the Siberian observations obtained by the Center for Global Environmental Research (CGER) of the National Institute for Environmental Studies (NIES) and the Russian Academy of Science (RAS), from six tower sites (JR-STATION).

The analyses have shown that CELGA is effective in capturing the seasonal variability of atmospheric tracer at observation sites strongly influenced by local emissions and global transport at the same time.

Keywords: atmospheric transport model, carbon cycle, carbon dioxide, methane