研究課題名：GOSATによる濃度データの高精度モデル予測と温室効果ガスの地表面吸収排出量の推定（High resolution transport modeling for GOSAT retrieval and inverse modeling of surface greenhouse gas fluxes）

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実施年度：平成 25 年度～平成 27 年度

1. Objective

Developing high resolution transport modeling algorithm for improving GOSAT data analysis, increasing resolution of the tracer transport model. High resolution transport is needed for analysis of the intense emissions from megacities, power plants and forest fire.

2. Research plan

This study aims at generation and application of global high resolution meteorological fields simulated by the Non-hydrostatic Icosahedral Atmospheric Model (NICAM) to make simulation resolving high frequency variability of CO_2 concentrations using Lagrangian Particle Dispersion Model FLEXPART and high resolution CO_2 flux fields (1 km and 10 km). The surface CO_2 flux datasets include the three major individual components of terrestrial, oceanic and fossil fuel fluxes. The background concentrations of CO_2 are provided by an off-line global atmospheric tracer transport model (NIES-TM). High resolution meteorological fields are generated by NICAM at 28 km spatial resolution using nudging to NCEP Final Analyses data.

3. Progress

We have used NCEP meteorological fields in nudged simulation of high resolution NICAM at horizontal resolution 28 km with 40 vertical layers, and 2 min time step. In this modeling setup we use an Eulerian Tracer Transport model NIES-TM and Lagrangian Particle Dispersion Model FLEXPART. We have prepared a setup for 28 km nudged simulations of NICAM and analysis meteorology conversion scripts.

Fossil fuel CO_2 emission fields are from Open source Data Inventory of Anthropogenic CO_2 emission (ODIAC), (1 × 1 km). The biospheric fluxes were simulated using VISIT at 0.50 degree daily time step and MODIS 1 km land-cover map was used to regrid this flux to 1 × 1 km grid. Air-Sea CO_2 fluxes by OTTM model were remapped
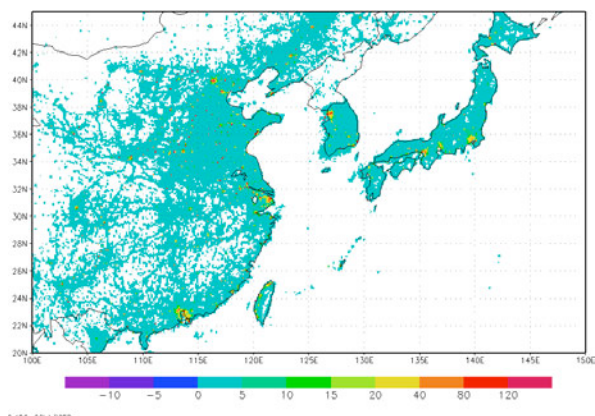

Fig. 1. Fossil CO_2 emission (g C m^{-2} day^{-1}) over East Asia by ODIAC.

to 1 × 1 km and extended to coastal regions by land-sea mask from MODIS (~ 1 km). Transport simulation of CO_2 for the station Edberg and Neuglobsov for July 2009 using high resolution fluxes show clear improvements in the simulated mixing ratio. Simulation of transport using highly resolved (spatial and temporal) flux fields is improved by the use of comparably resolved atmospheric flow fields and other meteorology. Simulation setup was tested on K-computer on 160 nodes with 8 CPU each, aiming at porting to NIES SX-Ace in 2015.

4.   Planned development

The NICAM setup will be ported to NIES SX computer, with plan to use SX for NICAM simulation and scalar computer for Flex part.

5. Record of supercomputer use （1st April ～ 30th November 2014）

Number of users: 13

CPU hours   v_deb: 0 hours, v_cpu: 0 hours, v_8cpu: 0 hours, v_16cpu: 0 hours, Total: 0 hours