研究課題名 : 大気輸送モデルとインバースモデルによる温室効果ガス収支量の推定とその高精度化に関する研究（Application of the Transport Models for Inverse Modeling of Greenhouse Gas Fluxes）

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1. Objective

We study the global and regional distributions of CO_2 and methane surface fluxes with the ground-based, aircraft observations and satellite observation data.

2. Research plan

Our current research focuses on the use of the CO_2 and methane observations of the whole troposphere as observed by monitoring programs and GOSAT satellite. Numerical simulation of the carbon dioxide and methane is used to explain seasonal and interannual variations of the greenhouse gases and other relevant tracers along with observations by NIES monitoring programs over Siberia, East Asia, by JAL aircraft and Pacific. To provide more accurate estimation of the surface fluxes with inverse modeling, estimates of the surface fluxes, atmospheric transport model and inversion algorithms have to be improved.

3. Progress

To improve tracer transport model algorithms we implemented 2^{nd} order scheme as well as 2^{nd} order moments scheme for global tracer transport model. In order to resolve impact of high resolution emissions of anthropogenic origin, our coupled Lagrangian-Eulerian transport model has been adapted to using surface fluxes of 5-10 km resolution globally. Corresponding fossil fuel emission dataset was developed based on population distribution and large point source emissions. With an ocean pCO_2 data assimilation system we completed simulation of the surface ocean pCO_2 fields from 1996 to 2008, using assimilated ocean currents from GFDL and OCCO reanalyzes. The inverse modeling algorithm was tested with updated set of surface fluxes and chemical sinks. JMA GPV meteorological data at 0.5 degree resolution were tested for use in tracer transport model with several valuable tracer transport algorithms. Improved treatment of the cloud convection was developed using operational forecast of the convective precipitation fields and vertical limits of convection. A multiyear set of the response CO2 functions to pulse tracer emissions has been simulated for inverse modeling studies. Optimized climate drivers for VISIT model are now available for simulation of the terrestrial carbon cycle (Fig. 1).

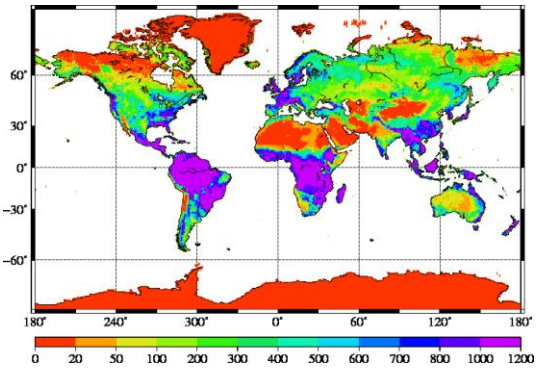

Fig. 1 Global distribution of the VISIT NPP with optimized precipitation.

4. Future plan

We started developing a dataset of mass-conserving winds suitable for realistic modeling of long-lived tracer transport in the upper troposphere and stratosphere. A global distribution of the seasonally varying regional CH_4 surface fluxes will be studied with inverse model. Correction of the transport model simulated biases with observed climatology is under development in order to improve the reference data for retrieval of GOSAT concentration form spectroscopic data. Terrestrial biospheric model VISIT will be adapted for parameter tuning to optimize a seasonal cycle simulation in global scale, and high resolution spatial fluxes are under development.

5. CPU use in the current year (from April to September 2009)

13users, CPU hours <1 node: 8,875 hours,

1 node: 254 hours, 2 node: 2,045 hours, total: 11,173 hours