研究課題名：CO_2 の地球的及び地域的収支のインバースモデル化研究のための輸送モデルの応用（Application of the transport model for inverse modeling studies of the regional and global budgets of CO_2）

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実施年度：平成 16 年度～平成 19 年度

1. Objective

The purpose of this research is to estimate the global and regional distributions of CO_2 fluxes with the available ground-based and aircraft observations as well as forthcoming satellite observation data.

2. Research plan

Inverse model of the atmospheric CO_2 transport is used for the analysis of the global and regional carbon budget. Our current research focuses on the use of the CO_2 data of the whole troposphere as observed by ongoing aircraft measurements and future satellite missions such as GOSAT (Greenhouse gases Observing SATellite). Observational data are used with an inverse model to produce optimal distribution of surface CO_2 fluxes that fits the atmospheric CO_2 data. The inverse model is also used for evaluation of the utility of the future observations.

3. Progress

A global inverse model was used to estimate the optimal set of parameters for CASA terrestrial biosphere model, by first calculating sensitivities of the CO_2 seasonal cycle to model parameters, and then finding the set of parameters that provides best fit to the observed CO_2 vertical profile seasonality (Fig. 1). For this purpose, the data from several continuous ground-based observations were used in addition to the vertical profiles from airborne measurements and GLOBALVIEW dataset.

Also, based on GOSAT orbit data coupled with the results of transport model, the satellite observations and data uncertainties were simulated. Our results show that, when relatively low biases are present in the observation, the forthcoming GOSAT data can reduce the uncertainties of monthly regional surface-CO_2 fluxes by up to 60% in comparison with the case when the same prior flux uncertainties are assumed but without satellite observations. Map of flux uncertainty reductions shown on Fig. 2.

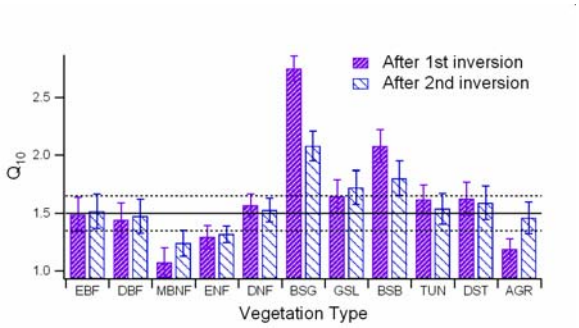

Fig. 1 Optimal ecosystem model parameters (Q10 for each vegetation type and after 1st and 2nd iterations) that provide best fit to observed seasonal cycle of CO_2 concentration.

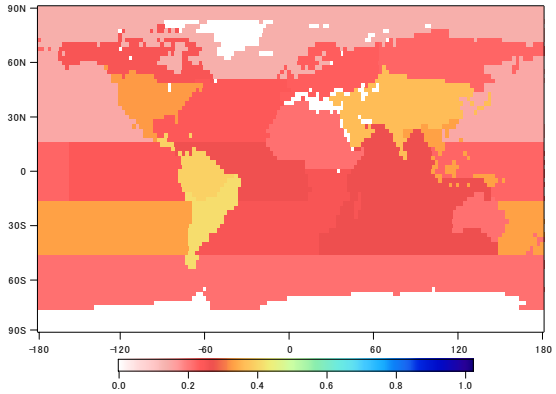

Fig. 2 CO_2 flux uncertainty map (GtC/year/region) after adding satellite observations.

4. Future plan

Simulation of the CO_2 variation observed on JAL aircraft over Narita will be conducted at high resolution. The evaluation of the flux uncertainty with GOSAT CO_2 data will be improved. The data of the airborne observations of CO_2 vertical profiles, along with a global inverse model, will be used for the estimation of the optimal set of parameters for CASA terrestrial biosphere model.

5. 計算機資源の利用状況（2007 年 4 月から 10 月まで）

実行ユーザ数：3　CPU 時間：854 hours
ベクトル化率（平均）：95%