Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

AAS001-05 会場: 201B 時間: 5月28日10:00-10:15

長期インバージョン解析におけるシベリア航空機データの効果

Effects of the Siberian aircraft data on estimated CO2 fluxes in a long-term inversion

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A long-term inversion of atmospheric CO_2during 1988-2007 has been conducted and contributions of Siberian aircraft data on the estimated surface CO_2fluxes are investigated. The Bayesian synthesis inversion method and an atmospheric tracer transport model based on Nonhydrostatic ICosahedral Atmospheric Model (NICAM) (Tomita and Satoh 2004; Satoh et al. 2008) are used for the time-dependent inversion. The model is nudged with interannualy varying wind fields of JRA/JCDAS (Onogi et al. 2007). Monthly mean regional CO_2fluxes are constrained by monthly mean observational data of GLOBALVIEW-2008 and the Siberian aircraft measurements at Surgut (61N, 73E), Novosibirsk (55N, 83E) and Yakutsk (62N, 130E). Net ecosystem production (NEP) data from two terrestrial biosphere models, Carnegie-Ames-Stanford Approach (CASA) ecosystem model (Randerson et al. 1997) and the Biosphere model integrating Eco-physiological And Mechanistic approaches using Satellite data (BEAMS; Sasai et al. 2005), are used for comparison of flux seasonal variations.
By adding the Siberian aircraft CO_2data to the surface data of existing ground network, summer uptake in Boreal Asia is adequately constrained and becomes rather consistent with that of CASA and BEAMS as a result. Furthermore, interannual variations of estimated flux in Boreal Asia show a few anomalies correlated with Siberian biomass burning events and a gradual increasing trend of summer uptake. The inversion flux in Boreal Asia is validated by forward simulation: the simulated CO_2concentrations from the inversion flux have been generally improved at the lowest level (500m) of the three aircraft measurements and 80m above at Berezorechka (56N, 84E), though more uptakes seem to be still needed at Novosibirsk and Berezorechka.
Thus, the aircraft data provide implications for the carbon cycle, even though the measurements are far from the ground. The changes in the estimated flux in summer indicate that upper-air observation is preferable to constrain summer fluxes within continents, signals of which are transported upward soon without being caught by surface measurements.

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キーワード:インバージョン,炭素循環,二酸化炭素

Keywords: inversion, carbon cycle, carbon dioxide