Assimilation of GOSAT XCO₂ Retrievals in CarbonTracker

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In this study, surface carbon dioxide (CO₂) fluxes were estimated by assimilating column-averaged dry air mole fraction (XCO₂) of satellite-based CO₂ measurements into the CarbonTracker (CT2013B) which is an inverse modeling system for estimating surface CO₂ flux based on an ensemble Kalman filter. The XCO₂ used was derived from Atmospheric CO₂ Observations from Space retrievals of the Greenhouse Gases Observing SATellite (ACOS-GOSAT). The inversion experiments were conducted with and without GOSAT XCO₂ retrievals in addition to conventional surface CO₂ concentration measurements.

Figure 1 shows the average biosphere and ocean CO₂ fluxes from July 2009 to May 2010. The results show that the global balance of sources and sinks of surface CO₂ fluxes was maintained for the experiments with and without GOSAT XCO₂, whereas the magnitudes of the optimized surface CO₂ fluxes in subcontinental regions were changed. The surface CO₂ uptake over Europe increased, whereas the surface CO₂ uptake in Eurasian Boreal (Northern part of Asia continent) decreased. These results are consistent with the previous studies using GOSAT XCO₂ retrievals to estimate surface CO₂ fluxes. The modeled XCO₂ simulated by the optimized surface CO₂ fluxes with GOSAT XCO₂ were more consistent with the GOSAT XCO₂ compared to the modeled XCO₂ without GOSAT XCO₂, which implies that data assimilation system developed for satellite observations performed appropriately.

**Figure 1.** Average biosphere and ocean CO₂ fluxes (gC m⁻² yr⁻¹) from July 2009 to May 2010 inferred from (a) only conventional surface CO₂ concentration observations and (b) GOSAT XCO₂ retrievals in addition to conventional surface CO₂ concentration observations.