

Toward assimilation of CONTRAIL data to estimate surface CO₂ fluxes

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Inverse modeling is a powerful method to elucidate carbon dioxide (CO₂) fluxes at the earth surface. Using the Bayesian algorithm, an inverse model quantitatively estimates spatiotemporal variations of surface fluxes from observations of atmospheric concentrations with help of a priori information. In this study, we have developed a new inversion system based on a state-of-the-art assimilation technique of the four-dimensional variational (4D-Var) method. Differently from a conventional method, the 4D-Var method has no limitation in the number of observations and it has an ability to estimate model grid resolution fluxes, so that regionally limited CO₂ flux anomalies such as biomass burnings are detectable. Since 2005, the aircraft measurement program named CONTRAIL has observed atmospheric CO₂ concentrations worldwide. Using the developed 4D-Var system, it is expected that such numerous aircraft data could strongly constrain the surface flux estimation especially for Asian regions. In this study, we discuss appropriate data processing or assimilation technique which is required before using the aircraft data in the flux estimation. Furthermore, we present conceivable impacts and valuable information provided by CONTRAIL for estimating Asian carbon budgets.

Keywords: carbon cycle, data assimilation, aircraft observation