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Influence of differences in latest GOSAT XCO_2 products on surface CO_2 flux estimation

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Elucidating the distribution and temporal variability of surface CO_2 fluxes is an active research topic in the field of contemporary carbon cycle dynamics. The technique often applied to this effort is atmospheric inverse modeling with which surface CO_2 fluxes are inferred. Investigations in the past were carried out by utilizing CO_2 measurements collected in global networks of surface-based monitoring sites. Now, datasets of column-averaged CO_2 dry air mole fraction (XCO_2) retrieved from spectral soundings collected by the Greenhouse gases Observing SATellite (GOSAT) are available for complementing the surface-based CO_2 observations. Those datasets have been shown to reduce uncertainty associated with the surface flux estimates. Currently, there exists five XCO_2 retrieval algorithms developed by four research groups/institutes worldwide: the National Institute for Environmental Studies (NIES) GOSAT Project (two algorithms), the NASA ACOS (Atmospheric CO_2 Observations from Space) team, the Netherlands Institute for Space Research / Karlsruhe Institute of Technology, Germany, and University of Leicester, UK. All of these algorithms have gone through several updates so far but still are under continual refinement. The current versions of the five XCO_2 retrieval products were shown to agree reasonably well with reference data obtained at the ground-based observation sites of the Total Carbon Column Observing Network (TCCON). It was found, however, that the inter-product consistency was variable when the five retrievals were inter-compared at locations away from the reference sites. As part of an ongoing effort in inter-comparing multiple GOSAT-based surface CO_2 flux estimates, we evaluated the influence of such inter-product XCO_2 differences on surface flux estimates. We did so by inferring monthly CO_2 fluxes in 64 sub-continental regions using a single inverse modeling system, the Level 4 data processing system developed within the framework of the NIES GOSAT Project. The input to the modeling system are monthly-mean GLOBALVIEW CO_2 values and each of the five independent XCO_2 retrievals that are gridded to $5^\circ \times 5^\circ$ cells and averaged on a monthly time scale. We further simulated CO_2 concentrations in 3-D model space using the surface flux estimated. We herein report the degree of spread in the monthly flux estimates and the simulated CO_2 concentrations.