



Inter-annual variability in CO₂ exchange in Northern Eurasia inferred from GOSAT-XCO₂

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The monthly CO₂ fluxes for three regions in Northern Eurasia (north of ~60°N), East Europe, West Siberia and East Siberia, were estimated for three consecutive growing seasons from 2009-2011 using the Greenhouse Gases Observing Satellite (GOSAT) column-averaged dry-air mole fraction of CO₂ (XCO₂) and Observation Package (ObsPack) products of surface atmospheric CO₂ concentration, and examined the inter-annual variations of estimated CO₂ fluxes in terms of the regional climate variability. The results show the anomalies of CO₂ fluxes are overall reasonably correlated with the anomalies of surface temperature, shortwave radiation, and Normalized Difference Vegetation Index (NDVI). In particular, the estimated CO₂ fluxes using GOSAT XCO₂ along with ground-based observations show strong correlations with surface temperature in July and August, while no correlation is found in the estimated CO₂ fluxes using ground-based observations only. This indicates that GOSAT XCO₂ reflect the changes in terrestrial biospheric processes responding to the climate anomalies. In 2010, large part of Eurasia experienced an extremely hot and dry summer, while lower temperature was recorded in Northern West Siberia. The estimated CO₂ fluxes with GOSAT XCO₂ show reduced net CO₂ uptake in East Europe and East Siberia, but enhanced net CO₂ uptake in West Siberia. These opposite anomalies of estimated CO₂ flux can be explained by the opposite temperature anomalies among the Northern Eurasia. Thus we conclude that GOSAT XCO₂ compensates for the lack of observational coverage by ground-based measurements so as to better capture the varying atmosphere-terrestrial biosphere CO₂ exchange in a regional scale.