Supplement of

Prior biosphere model impact on global terrestrial CO_2 fluxes estimated from OCO-2 retrievals

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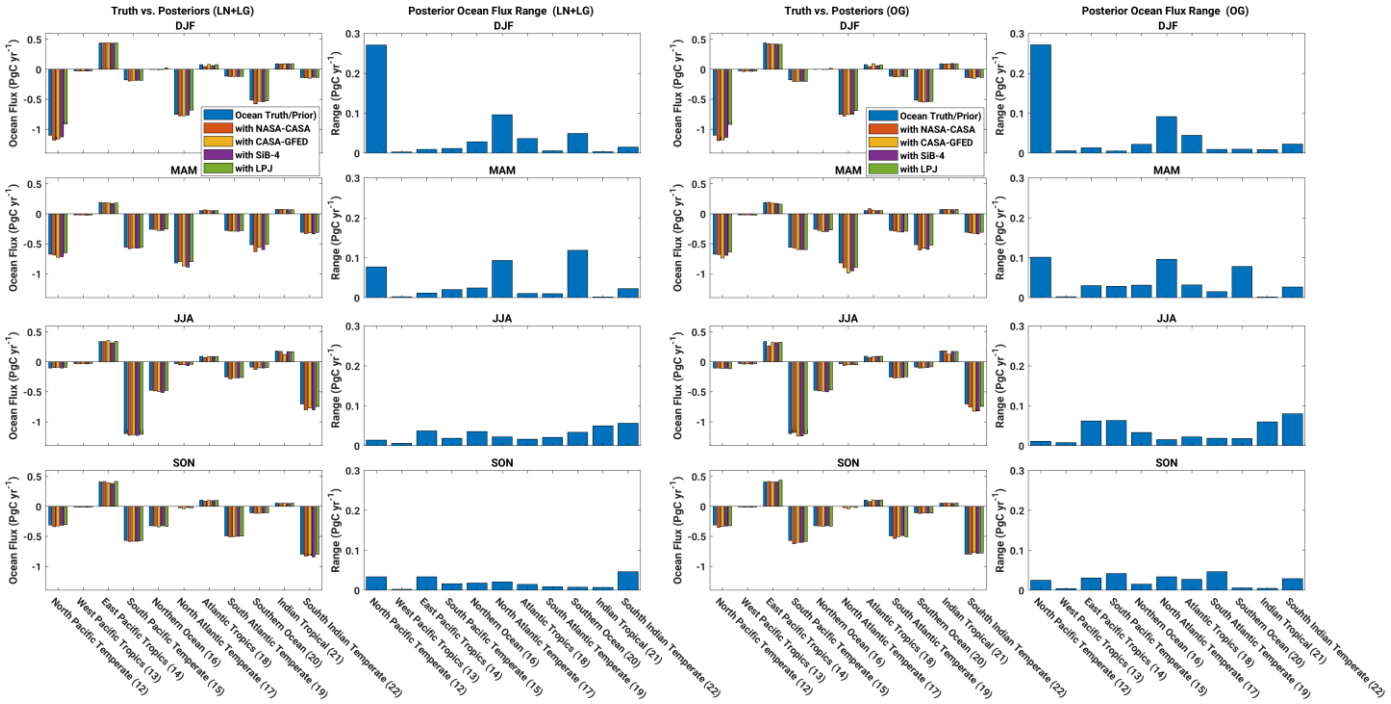

Figure S1: Seasonally-averaged oceanic CO_2 flux (PgC yr^{-1}) over the 11 TransCom-3 oceanic regions from the CarbonTracker 2016 model output ("truth" and prior) and the posterior oceanic flux estimates from four OSSEs (with prior NEE fluxes from the NASA-CASA, CASA-GFED, SiB-4 and LPJ biosphere models) (first and third columns) and the corresponding range of posterior oceanic CO_2 flux (second and fourth columns). The synthetic observations in the OSSE simulations correspond to the OCO-2 LN+LG (two columns on the left) and OG (two columns on the right) observing modes.

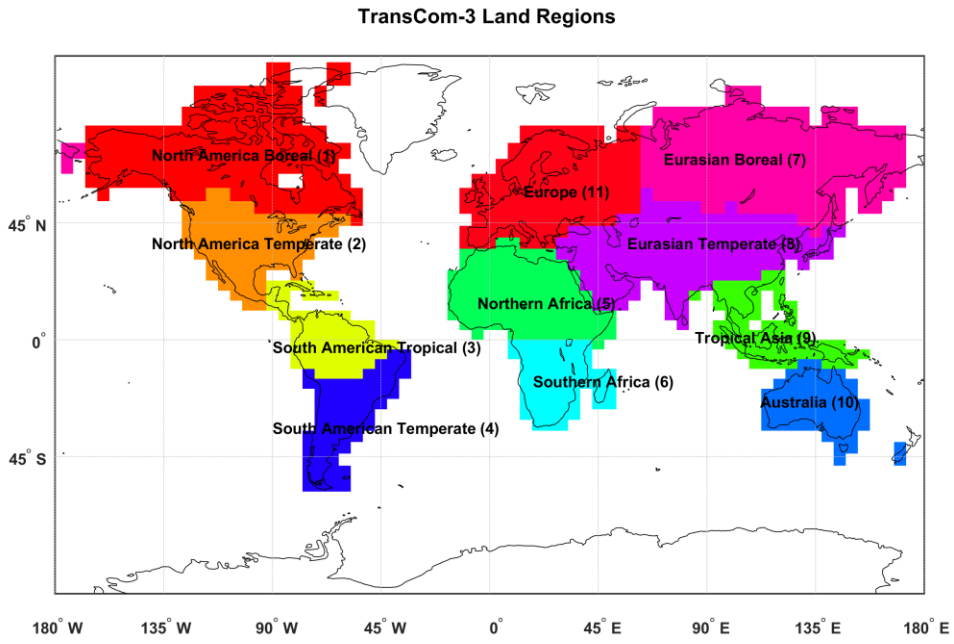

Figure S2: The TransCom-3 land region boundaries.

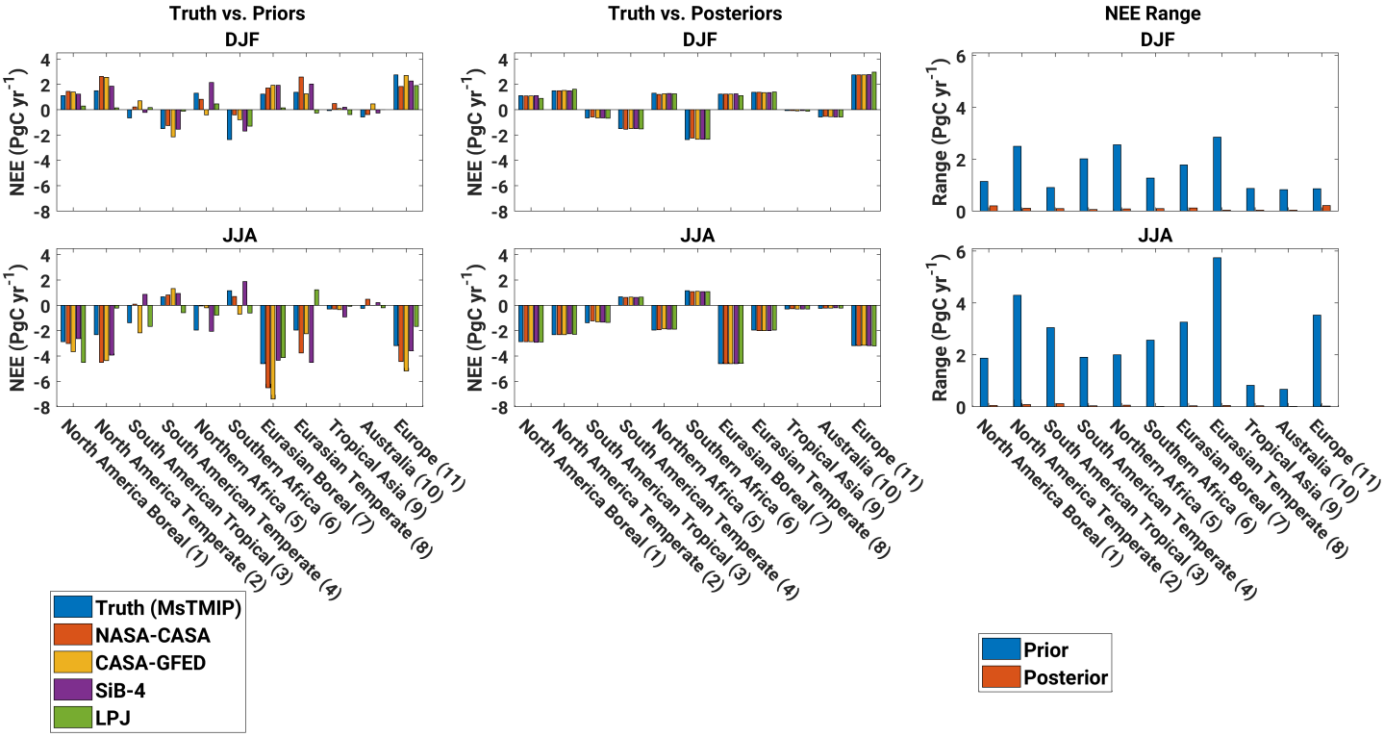

Figure S3: Seasonally-averaged NEE (PgC yr^{-1}) over the 11 TransCom-3 land regions from MsTMIP ("truth") versus the prior biosphere models (NASA-CASA, CASA-GFED, SiB-4 and LPJ) (left column), posterior estimates (middle column) from the "pseudo" data assimilations (refer Sect. 2.4.8) and the corresponding range of prior and posterior NEE estimates (right column). The "pseudo" observations in these OSSE simulations are the simulated hourly surface CO_2 concentrations for all grid boxes of the GEOS-Chem model.

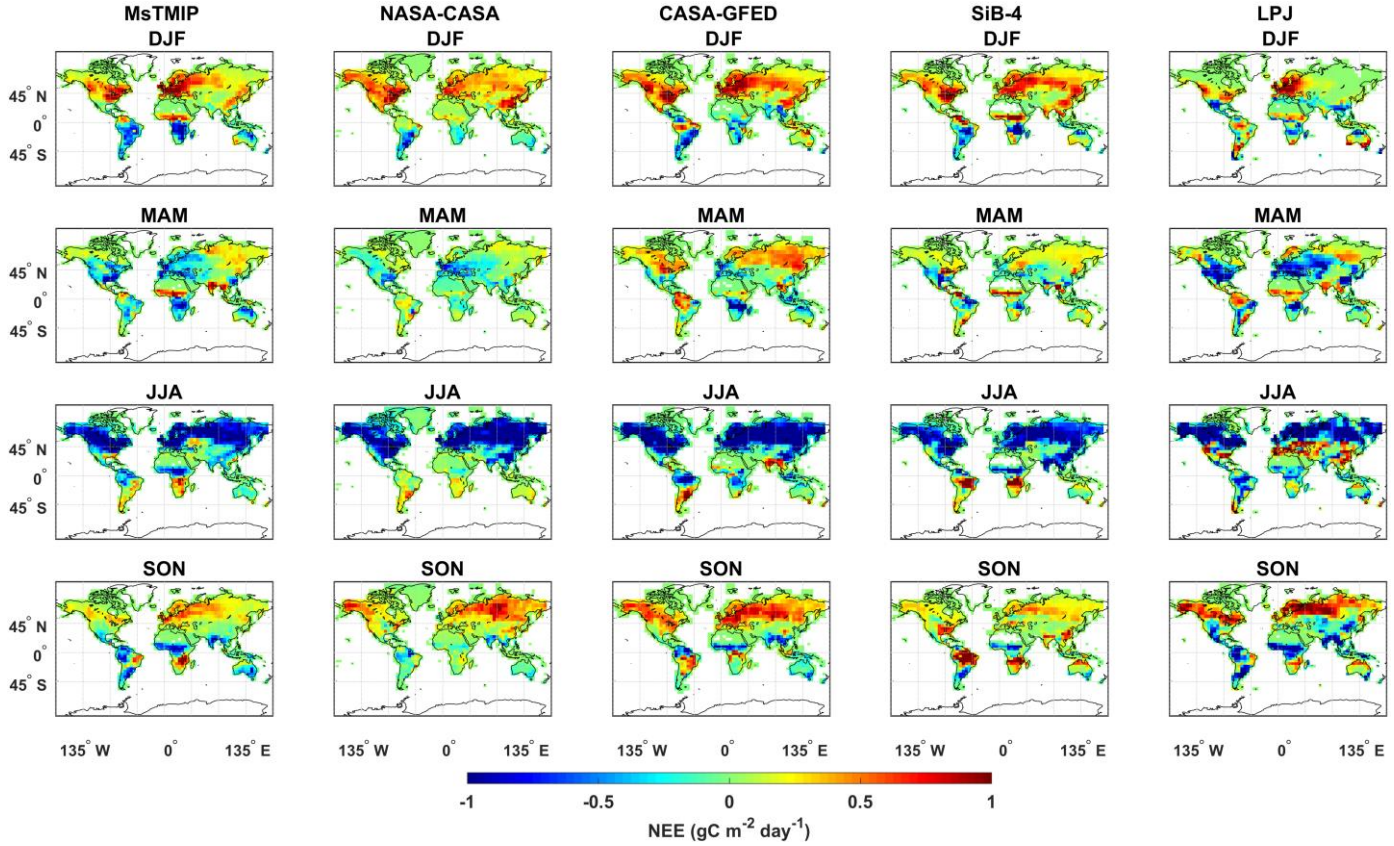

Figure S4: Seasonally-averaged NEE (gC m^{-2} day^{-1}) flux for MsTMIP ("truth" in OSSEs), NASA-CASA, CASA-GFED, SiB-4 and LPJ prior biosphere models for the year 2015.

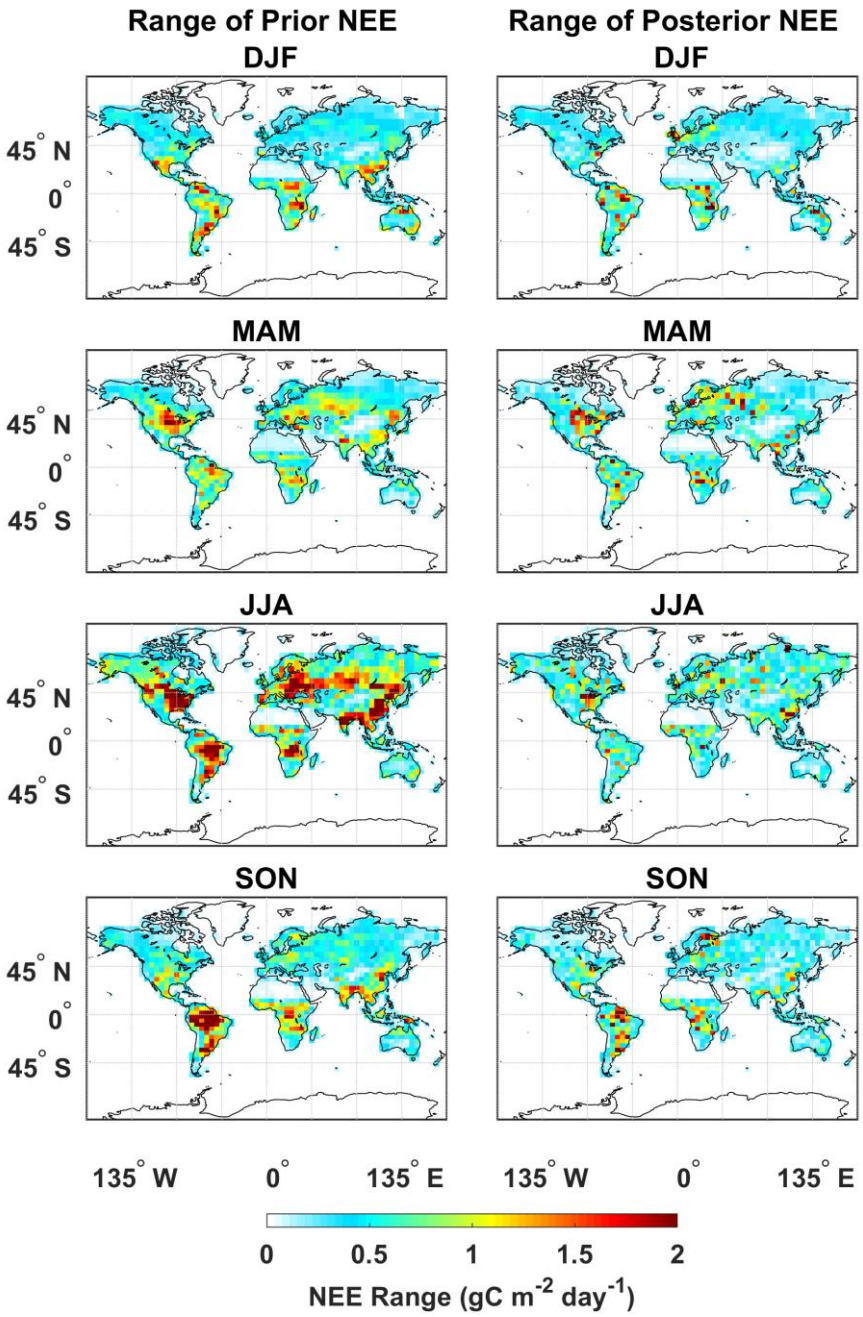

Figure S5: Seasonally-averaged NEE range (gC m^{-2} day^{-1}) of the four prior biosphere models (NASA-CASA, CASA-GFED, SiB-4 and LPJ) (left) and posterior estimates (right) from the OSSE simulations. The synthetic observations in these OSSE simulations correspond to the OCO-2 LN+LG observing modes.

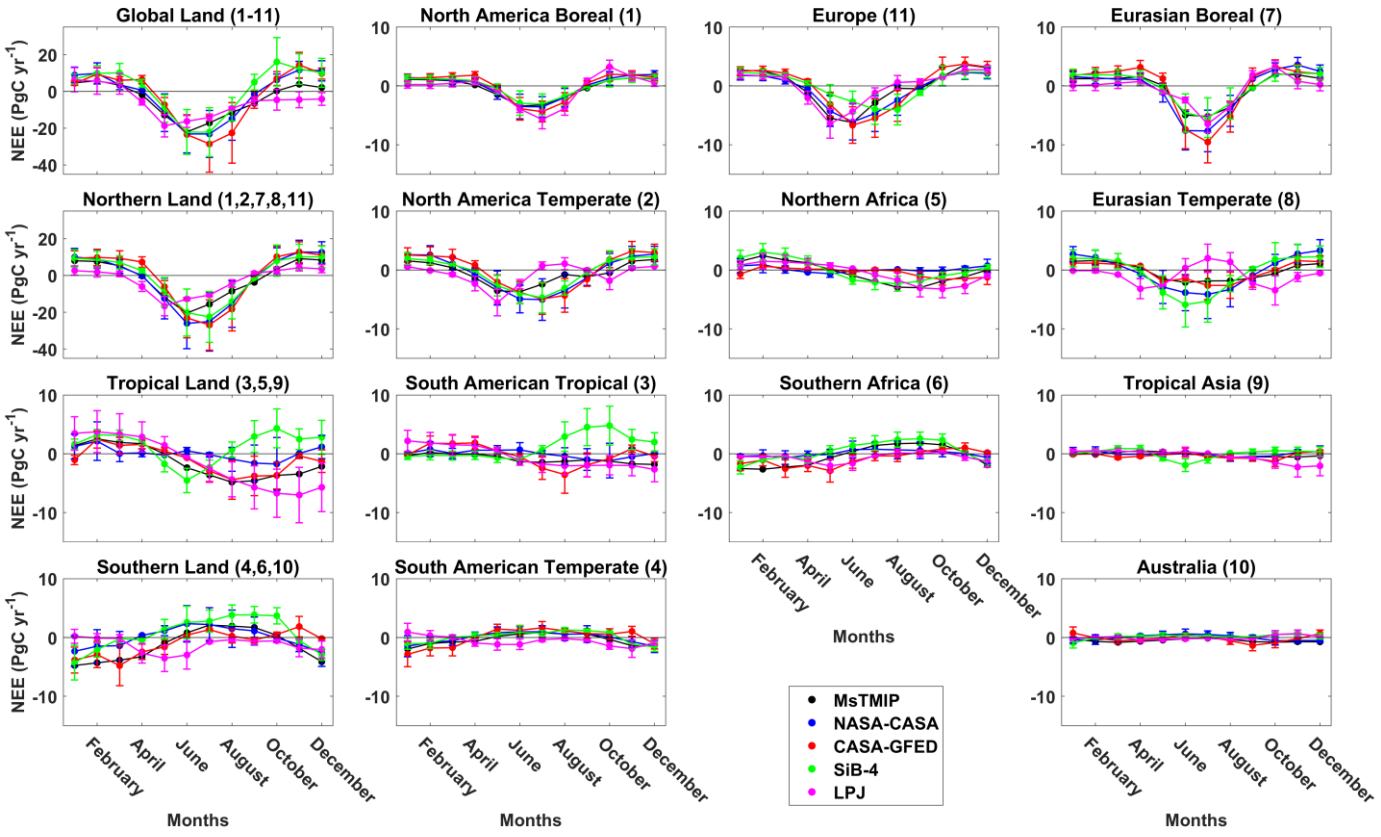

Figure S6: Monthly-mean NEE (PgC yr^{-1}) (dots) averaged over the TransCom-3 land regions (Global land, three hemisphere-scale land regions and 11 individual land regions) from MsTMIP ("truth" in OSSEs) and the prior biosphere model NEE and 1σ prior uncertainties (error bars) used in the OSSEs (NASA-CASA, CASA-GFED, SiB-4 and LPJ). Note that the y-axis is different for Global Land and Northern Land (top two panels in the left column).

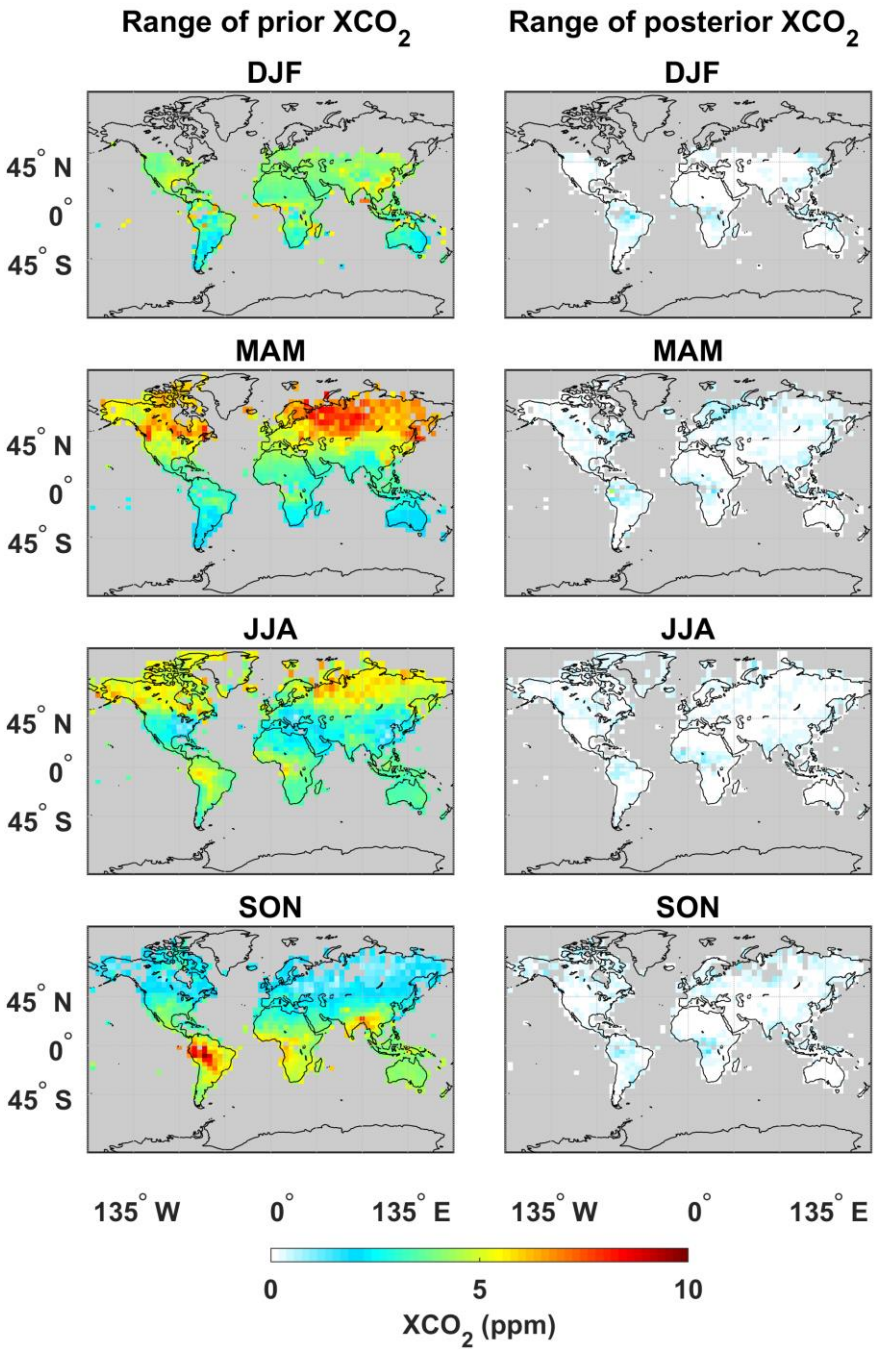

Figure S7: Seasonally-averaged XCO_2 range (ppm) from GEOS-Chem forward model simulations using the four prior biosphere models (NASA-CASA, CASA-GFED, SiB-4 and LPJ) (left) and the corresponding posterior estimates (right) from the OSSE simulations. The synthetic observations in these OSSE simulations correspond to the OCO-2 LN+LG observing modes.

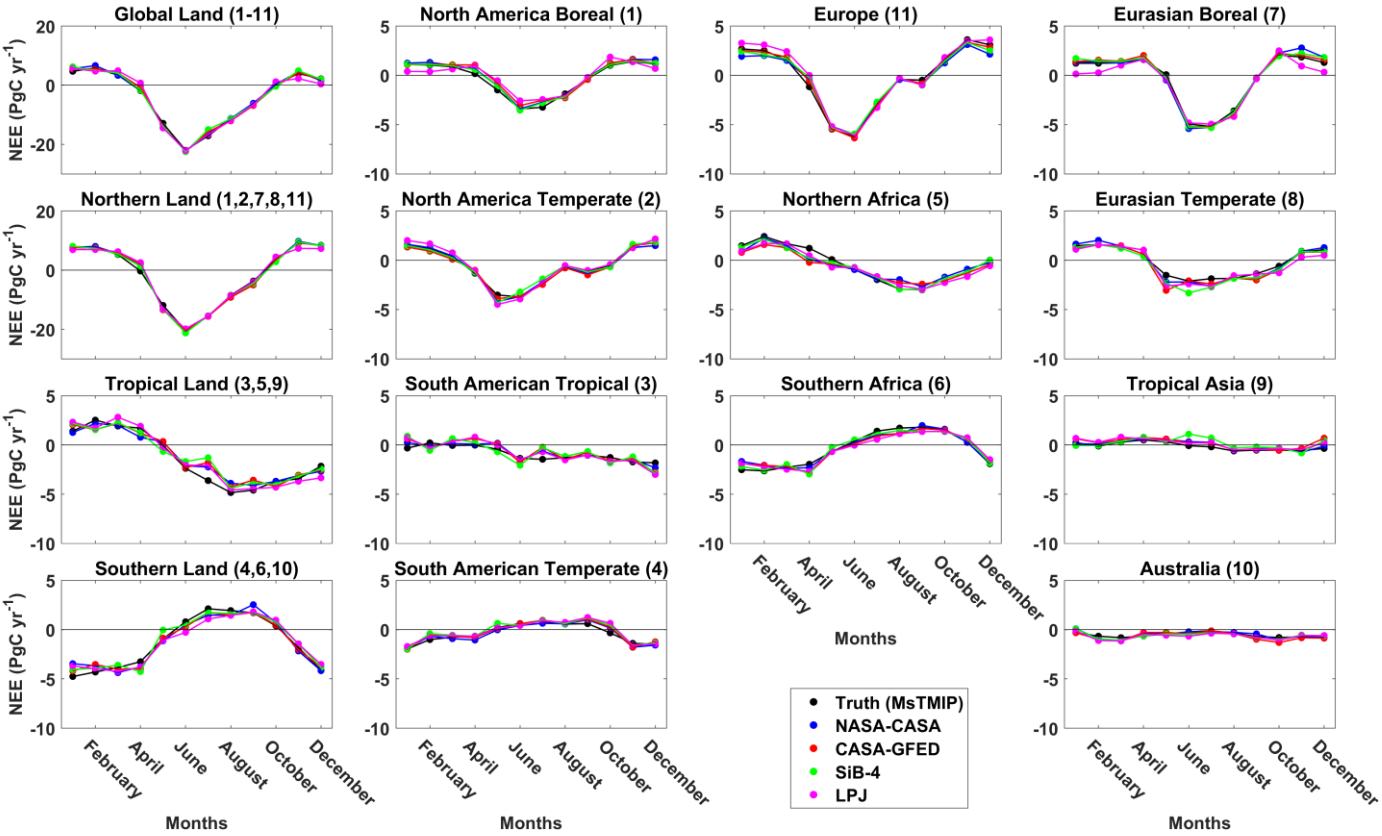

Figure S8: Monthly-mean NEE (PgC yr^{-1}) (dots) averaged over the TransCom-3 land regions (Global land, three hemisphere-scale land regions and 11 individual land regions) from MsTMIP ("truth") versus posterior estimates using different prior biosphere models in the OSSEs (NASA-CASA, CASA-GFED, SiB-4 and LPJ). Note that the y-axis is different for Global Land and Northern Land (top two panels in the left column). The synthetic observations in these OSSE simulations correspond to the OCO-2 LN+LG observing modes.

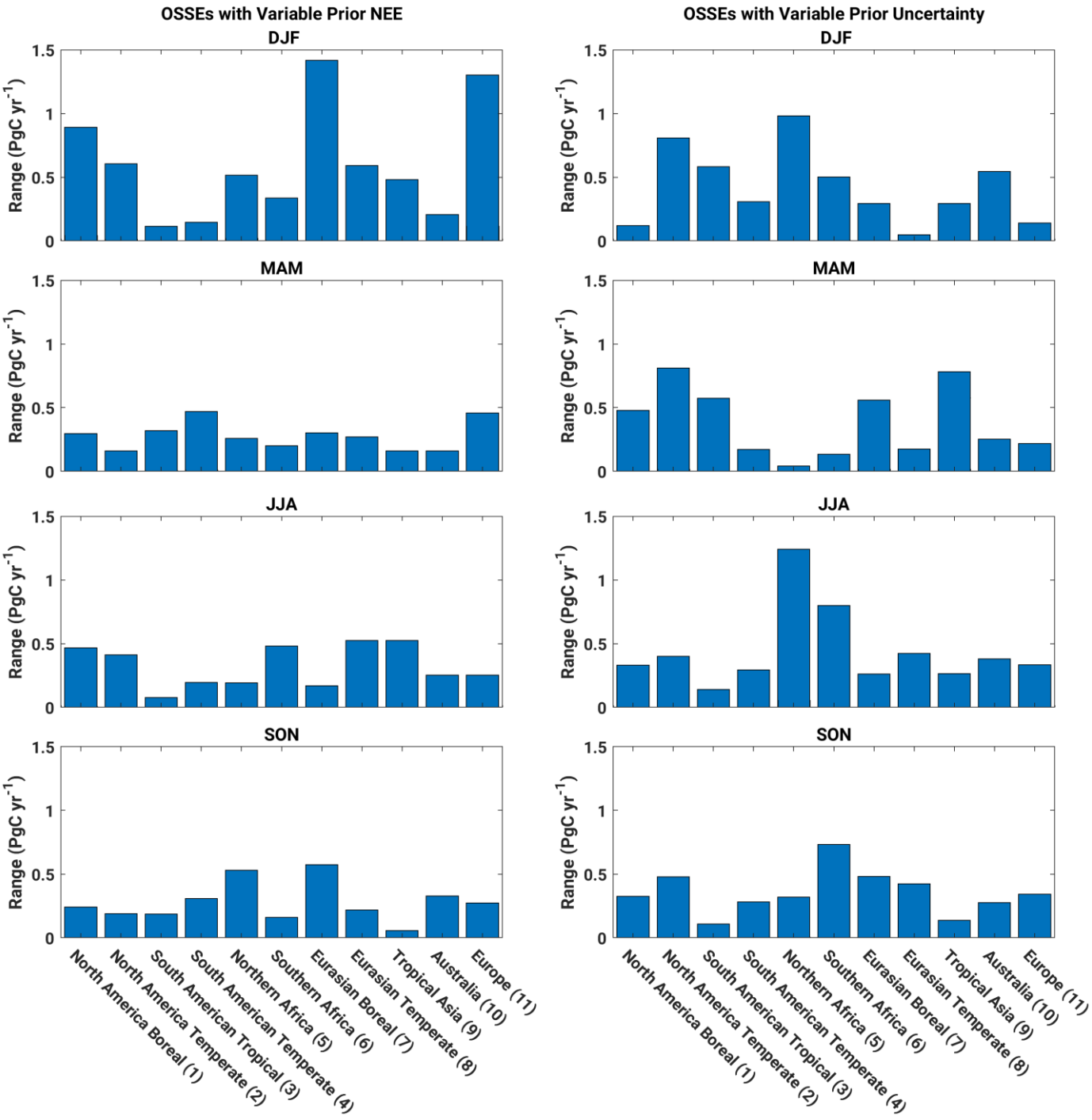

Figure S9: Seasonally-averaged posterior NEE range (PgC yr^{-1}) averaged over the 11 TransCom-3 land regions from OSSE simulations with variable prior NEE fluxes considered (left column) and from OSSE simulations with variable prior uncertainty assumptions (right column). The synthetic observations in OSSE simulations correspond to the OCO-2 LN+LG observing modes.