Bayesian Optimization of NEE and NEP in Oregon Using a Dense CO_2 Observation Tower Network and the Community Land Model (CLM4.5)

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3-hourly estimates of net ecosystem exchange calculated with Community Land Model (CLM4.5) at 4 km horizontal resolution were optimized using a classical Bayesian inversion approach with observations from a dense tower network in Oregon. To provide climate data input for the high resolution CLM4.5 runs, historical meteorological data from Coupled Model Intercomparison Project Phase 5 (CMIP5) model Model for Interdisciplinary Research on Climate - Phase 5 (MIROC5) was downscaled from daily to sub-daily temporal resolution using multivariate adaptive constructed analogs method. We optimized Net Ecosystem Exchange (NEE) and Net Ecosystem Production (NEP) for the years 2012 through 2014 while also reducing the uncertainties of the prior flux estimates. The Weather Research and Forecasting - Stochastic Time-Inverted Lagrangian Transport (WRF-STILT) model was deployed to link modelled fluxes of carbon dioxide (CO_2) to the concentrations from 5 high precision and accuracy CO_2 observation towers equipped with cavity ring-down spectroscopy (CRDS) analyzers. NEE increases and decreases moderately depending on the ecoregion. To assess the uncertainty of the transport modeling component within our inverse optimization framework we use the data of 7 airborne measurement campaigns over the Oregon domain during the study period.

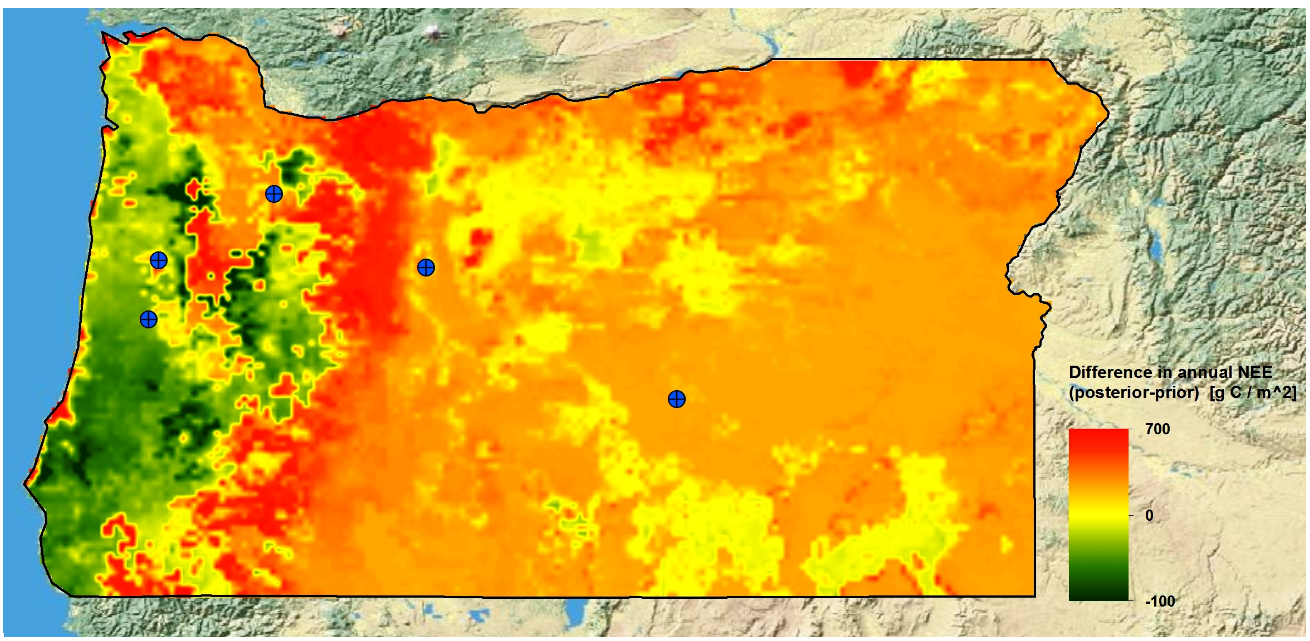

Figure 1. Differences between the prior and posterior flux estimates for 2013 over the various ecoregions in the Oregon domain. The tower locations are marked blue.