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Multi-site assimilation of a terrestrial biosphere model (BETHY) using satellite derived soil moisture data

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We investigated the importance of soil moisture data on assimilation of a terrestrial biosphere model (BETHY) for a long time period from 2010 to 2015. Totally, 101 parameters related to carbon turnover, soil respiration, as well as soil texture were selected for optimization within a carbon cycle data assimilation system (CCDAS). Soil moisture data from Soil Moisture and Ocean Salinity (SMOS) product was derived for 10 sites representing different plant function types (PFTs) as well as different climate zones. Uncertainty of SMOS soil moisture data was also estimated using triple collocation analysis (TCA) method by comparing with ASCAT dataset and BETHY forward simulation results. Assimilation of soil moisture to the system improved soil moisture as well as net primary productivity(NPP) and net ecosystem productivity (NEP) when compared with soil moisture derived from in-situ measurements and fluxnet datasets. Parameter uncertainties were largely reduced relatively to prior values. Using SMOS soil moisture data for assimilation of a terrestrial biosphere model proved to be an efficient approach in reducing uncertainty in ecosystem fluxes simulation. It could be further used in regional an global assimilation work to constrain carbon dioxide concentration simulation by combining with other sources of measurements.