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# Sensitivity of Simulated Ecosystem Fluxes to Meteorological Forcings : A case study for 6 eddy covariance sites in France

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Process oriented terrestrial biosphere models (TBM) are useful tool to predict carbon stocks and fluxes of the land on regional to global scales. Global or regional gridded meteorological fields, e.g. calculated by Numerical Weather Prediction models, are commonly used to drive TBMs for spatially explicit applications. The uncertainties on carbon, water and energy fluxes caused by uncertain meterology drivers have rarely been investigated in a systematic way. To tackle this problem, we use in this study eddy-covariance continuous measurements of CO2, H2O and heat fluxes at six sites in France, chosen to represent the regional diversity of ecosystems, and a process based TBM called ORCHIDEE. Four relatively high time-space resolution modeled meterological forcing datasets, from SAFRAN (8 km) to ECMWF products (EC-OPERA and ERA-I; 80 km) and REMO (25 km), are used in this study. The modeled meterological variables, i.e. air temperature (Tair), air humidity (Qair), rainfall (Rain), shortwave and longwave downwelling radiations (SWD, LWD), are examed against measured meteorological data on time scales going from hourly to multi-year. SAFRAN appears to be the best model in terms of both variability and bias while REMO has the lowest performances. All models faithfully reproduce the seasonal cycle of Tair, Qair and SWD. The largest systematic bias is found for LWD. Considering interannual variability, Tair is the best reproduced variables while SWD is the worst. The mountain site is most difficult to simulate even for the high resolution model such as SAFRAN. The sensitivity of ORCHIDEE fluxes to meteorological drivers is investigated for each site and each time scale; it appears to be significant, with interannual time scale being the most problematic. We found that the best model fit to the measured NEE is obtained for SAFRAN at all time scales. The mountain site tends to have the largest discrepancy between modeled and measured NEE in terms of seasonal course. Overall this study indicates that the forcing error is a significant source of uncertainty, compared to the random model error due to imperfect process parameterizations (up to 56% depending on the site and time scale).