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Complementarity between satellite derived vegetation characteristics and flux tower measurements to optimize ecosystem model parameters

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In the context of a foreseen climate change, improving our understanding of the role of the terrestrial biosphere in the carbon cycle remains a key scientific goal. Global terrestrial ecosystem models are used to simulate and predict the interactions between the Earth's surface and the atmosphere. Improvement of these models is commonly undertaken with assimilation techniques using measurements of energy and mass fluxes at a local scale, that is corresponding to particular vegetation and/or climate types. Additional use of satellite vegetation products in the assimilation system could help reducing the model parameterisation uncertainties more systematically and with an enhanced spatial representativeness.

We investigate here the complementarity between such *in situ* flux measurements and remotely sensed estimates of *fAPAR* (fraction of absorbed photosynthetically active radiation) to optimize some parameters of the ORCHIDEE vegetation model, related primarily to carbon assimilation, respiration and phenology. A four dimensional vari-

ational data (4D-var) assimilation system has been developped in order to assimilate synergistically these two pieces of information. ORCHIDEE is a state of the art mechanistic vegetation model that can be run at local or global scales, depending on the meteorological forcing and the biome composition of the considered ecosystem. Most of ORCHIDEE parameters usually derived from biome-specific measurements are still associated with large uncertainties. The assimilation system make use of half-hourly eddy covariance measurements of net CO_2 flux (NEE), sensitive heat flux (H), and latent heat flux (LE), as well as net radiation (Rn), together with weekly *fAPAR* estimates derived from the MERIS instrument (1 km resolution) for few tower sites. Special attention is given to the Fontainebleau (temperate broadleaf summergreen forest, France), and Le Bray (mainly temperate needleleaf evergreen forest, France), sites.

The study analyzes changes in ORCHIDEE's parameters and in optimized model outputs (CO_2 and energy fluxes, and *fAPAR*, time series) when assimilating 1) the flux tower data alone, 2) the satellite products alone, and 3) the flux and satellite data together. The compatibility between both satellite and *in situ* informations will be appraised, especially for the seasonal evolution of these constraints and for their spatial footprint. Several MERIS images in the vicinity of the flux tower will be considered for assimilation. Finally, uncertainty on the estimated model parameters will be evaluated as a function of the different type of data considered.