Geophysical Research Abstracts
Vol. 15, EGU2013-11951, 2013
EGU General Assembly 2013

Optimization of the process-based global model, ORCHIDEE, using multiple data streams (in-situ FluxNet NEE, LE and biomass, satellite NDVI, and atmospheric CO_2 data)

Philippe Peylin (1), Natasha Macbean (1), Cedric Bacour (2), sebastien Leonard (1), Fabienne Maignan (1), sylvain Kuppel (1), Frederic Chevallier (1), Philippe Ciais (1), and Tea Thum (3)

(1) LSCE, Gif sur Yvette, France (peylin@lsce.ipsl.fr), (2) Noveltis, Ramonville-Saint-Agne, France, (3) Finnish Meteorological Institute, Helsinki, Finland

Global land models are used to predict the response of Earth's ecosystems to environmental changes. However, the estimated water and carbon fluxes remain subject to large uncertainties, partly because of unknown or poorly calibrated parameters. Assimilation of in-situ data, remote sensing data, and/or atmospheric trace gas concentrations into these models is a promising approach to optimize these parameters.
So far most of the efforts have focused on using a single data stream; most studies have used either FluxNet (net CO_2 flux (NEE) and latent heat flux (LE)) data at specific sites to constrain mainly the hourly to seasonal time-scale processes in the model, or remote sensing of the vegetation activity (fAPAR or NDVI) to constrain the phenology of these models. However, the combination of these data streams, with additional measurements such as in-situ forest biomass data and atmospheric CO_2 concentrations (through the use of a transport model), should provide a much larger constraint on the different processes controlling the carbon budget of terrestrial ecosystems.

In the context of the EU-funded CARBONES project, we have investigated the use of several data streams (MODIS NDVI observations, FluxNet NEE, LE, Biomass data and atmospheric CO_2 flask measurements) within a variational data assimilation framework that allows the optimization of the major parameters of the global land surface model, ORCHIDEE. The main objectives are i) to provide a global carbon flux and stocks coherent re-analysis over the past 20 years and ii) to assess the complementarity of each data stream to constraint the parameters of a process-based model.

The results of the parameter optimization using a step-wise approach, where each data stream is assimilated sequentially, will be presented and compared to a more complex optimization, in which all data streams are assimilated in one step. The potential of each data stream to highlight model deficiencies (after assimilation) will be discussed through the analysis of the model-data fits and the parameter values. The optimized fluxes will be evaluated globally against independent datasets and approaches, including classical atmospheric inversions or forward simulations of process based models.