

Proposal for a FLUXNET Synthesis publication

Title:

Evaluation and estimation of biogeochemical flux model error on multiple time scales, based on La Thuile eddy-covariance flux measurements

Initial coordinators:

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Proposing group:

LSCE and PKU

Collaborators needing access to data:

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Outline:

Terrestrial biosphere models need to be evaluated against a variety of data. Flux data are particularly attractive for that task, but apart from initial very promising work (Abramovitz et al. 2008) we still lack a simple and coherent metrics to compare a model of fluxes with observations from such a large dataset as the La Thuile dataset. In addition, the flux data are rich in information about processes on different time scales, which can be used to falsify models, and modellers should be encouraged and stimulated to go beyond simple correlation or RMSE statistics for assessing the performance and shortcomings of their models.

This task will carry out an evaluation of the ORCHIDEE terrestrial biosphere model by decomposing the model-data misfit on various time scales, using the SSA method (Ghil et al. 2002), in a model-data comparison framework developed by Mahecha et al. (2010) in order to identify the main shortcomings of this particular model. We propose to use ORCHIDEE because it resolves hourly variability of fluxes and calculates latent, sensible and CO₂ fluxes. Further, this model is currently used by the proposers. But the expected results from this

analysis will be (hopefully) generic enough to be applied to other models as well, and provide elements for designing model-benchmarking activities.

If successful, this analysis could be used for evaluation of other terrestrial biosphere models in forthcoming international evaluation programmes, in particular the I-LAMB program that will be launched to evaluate IPCC AR5 terrestrial carbon models.

This time scale decomposition will be coupled to a modelling of error, using empirical algorithms. The main question addressed is the ‘portability’ of empirical error modelling from a vegetation type to another and from one time scale to another. For instance, can we model the errors on short time scales and use this knowledge to improve models on longer time scales ?

References:

Abramowitz, G., Leuning, R., Clark, M., and Pitman, A. (2008) Evaluating the performance of land surface models. *Journal of Climate* 21, 5468-5481.

Ghil, M., Allen, M. R., Dettinger, M. D., Ide, K., Kondrashov, D., Mann, M. E., Robertson, A. W., Saunders, A., Tian, Y., Varadi, F., and Yiou, P. (2002) Advanced spectral methods for climatic time series. *Review of Geophysics* 40, 1003.

Mahecha, M.D., Reichstein, M., Jung, M., Seneviratne, S.I., Zaehle, S., Beer, C., Braakhekke, M.C., Carvalhais, N., Lange, H., Le Maire, G. and Moors, E. (2010, in press) Comparing observations and process-based simulations of biosphere-atmosphere exchanges on multiple time scales. *JGR-Biogeosciences*, doi:10.1029/2009JG001016.

Proposed sites to be involved:

All sites containing more than three years of flux and meteorological data may be considered for this analysis.

Proposed Rules for Co-Authorship:

The rules as proposed in the La Thuile policy will be applied.