Biogeosciences Discuss., 6, C1912–C1915, 2009
www.biogeosciences-discuss.net/6/C1912/2009/

Biogeosciences Discussions

Interactive comment on "Modeling the impact of drought on canopy carbon and water fluxes through parameter optimization using an ensemble Kalman filter" *by* W. Ju et al.

Anonymous Referee #1

Received and published: 9 September 2009

General comments

Ju et al. analyse the impact of drought on the variability of parameters when modeling carbon and water fluxes. It is an interesting and important subject that can lead to improvement of the representation of drought effects in land surface models. The manuscript is well structured and clear. Ju et al. use eddy covariance data and an ensemble Kalman filter to derive the temporal variability of three parameters of their model. They use the derived parameter time series to improve the modeling of carbon and water fluxes and claim that efforts are needed to describe these parameter variations. I miss a more detailed discussion on causes for the variability of the pa-

rameters to agree with this last statement. The parameter variations can be caused by model structural errors (Carvalhais et al., 2008), in this case the model structure should be improved. Furthermore only three parameters were optimized, due to this restriction there could be variations of other parameters that were mapped into these three parameters. A big advantage of process based models is that they can be used in prognostic mode. Including empirical models of parameters in process based models is questionable if the model is to be used for extrapolation, the cause of the estimated variability of the parameter may be in a different module. The study shows, that it is important to include the soil water content in an appropriate way into the model, but the study does not convince that parameter itself needs to be replaced by an empirical model.

Specific comments

p. 8280 l. 11, 12: two years are not enough to characterize interannual variability, I would prefer if you write "between the two years"

l. 18,19: the variations in the parameters need to be split up into variations caused by the estimation method, model structural errors and a real variability of the parameter that can be parameterized and included in the model

p. 8281, l. 26: and some parameters are not constant as you assume in your study.

p. 8283, l. 2-4: this is also found by Gu et al.? please clearify or add an appropriate reference if not.

p.8284, l. 11: please make clear that a measured LAI is also used to drive the model, the correct LAI value is very important for the time series of the parameters you estimated. If there are any concerns that the seasonality of LAI could be wrong, for instance due to representativity issues, please discuss. This would directly influence the parameters seasonality as LAI is directly related to GPP (eq.1).

p. 8287, l. 9: there are methods to estimate the uncertainty also with one tower

(Lasslop et al., 2008, Richardson et al., 2008).

p. 8289, l.5: 60% of what?

p.8190, l. 14: the vcmax estimate is itself uncertain how much of the variance can you expect to explain and how much of the variation is due to the uncertainty of the estimate.

p.8291, l.3: what means manually optimized? Please clarify.

l.21,22: please quantify.

p.8292, l. 21-25: see Lasslop et al. 2008 for further characterization of the random error. The double exponential distribution is mostly due to the superposition of normal distributions with varying standard deviation. Errors of LE and NEE are independent.

p.8293, l. 5-10: please discuss a scale dependency of the parameters, do you find systematic errors for your model output when applying the parameters estimated with daily data for half hourly model runs?

l. 13: yes! There are many possible mechanisms, please discuss further.

l.14-15: the variations need to be accounted for at the right place according to their cause. Variations due to wrong model structure needs model structure improvement, variations due to a variable parameter need a model for the parameter, stochastic variations (due to the estimation method) don't need to be accounted for. This should be in the conclusion part.

p.8294, l.5-6: please, discuss the other factors that cause variation in the parameters during wet season.

Technical comments

p. 8280, l. 24,25: please add a reference

p. 8288, l. 18: please add units

p. 8291, l. 4: please add units

p.8300, table 2: exchange, observed should be y as it contains the measurement noise and for normal regressions the x-variable is assumed to have no noise with the consequence that only the deviations in y direction are minimized, this leads to biased regression parameters if the x-variable contains noise, like observations do.

p. 8302: add parameter uncertainty

p.8305: you could add lagged correlations in a table or the lag with maximum correlation

Figure 6: please add uncertainties of vcmax.

Figure 7: exchange x and y variables, modeled should be x. add left for 2003 right for 2004 in the caption.

Figure 8: might be better to plot residuals or at least to plot both modeled values in one plot, as observations are the same. Lower left panel: 2004 missing

References

Carvalhais N, Reichstein M, Seixas J, et al. (2008) Implications of the carbon cycle steady state assumption for biogeochemical modeling performance and inverse parameter retrieval. Global Biogeochemical Cycles, 22, GB2007, doi:2010.1029/2007GB003033.

Lasslop G, Reichstein M, Kattge J, Papale D (2008) Influences of observation errors in eddy flux data on inverse model parameter estimation. Biogeosciences, 5, 1311-1324.

Richardson AD, Mahecha MD, Falge E, et al. (2008) Statistical properties of random CO2 flux measurement uncertainty inferred from model residuals. Agricultural and Forest Meteorology, 148, 38-50.

Interactive comment on Biogeosciences Discuss., 6, 8279, 2009.