Biogeosciences Discuss., 5, S533–S535, 2008
www.biogeosciences-discuss.net/5/S533/2008/


Biogeosciences Discussions



# *Interactive comment on* "Influences of observation errors in eddy flux data on inverse model parameter estimation" *by* G. Lasslop et al.

**G. Lasslop et al.**

Received and published: 14 May 2008

We would like to thank the referee Luigi Renzullo for his positive comments and for pointing towards an interesting extension of our work. In the following we discuss parts of his comments, whenever the referee is cited, the text has been written inside quotation marks.

1. L. Renzullo questioned " why Levenberg-Marquardt (LM) was applied to the simpler models and Markov chain Monte Carlo (MCMC) to the more sophisticated BETHY model" and suggests to "use MCMC for all models, especially since it provides all the information about the parameter uncertainty-eliminating the need for bootstrapping".
   We used the MCMC for the complex model with more parameters, since the cost



Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

function for the optimization of complex models is more likely to show multiple local minima. For the same reason prior information about the parameters was included for the BETHY model.
The LM is suitable for simpler models, as the shape of the cost function does not show many local minima and is then computationally much more effective. This allows using the bootstrapping approach, which infers multidimensional parameter distributions as the MCMC, but with the additional advantage of being a non-parametric method. However, the interpretation of the full multidimensional parameter space was not the focus of this paper and we focused on simple measures of parameter uncertainty, the 95% confidence interval and the uncertainty reduction, respectively. In other words, we don't think that it is advantageous to "eliminate the need for bootstrap" as we see bootstrapping as a powerful tool in the uncertainty analysis: it is nonparametric and it derives the uncertainty of the parameter estimate only based on the data. We discuss this in more detail in the manuscript now.

2. Further, an extension to our work is proposed that "would be to use MCMC to estimate the probability density function (pdf) of the observation errors directly". While we do not see the necessity of such approach in the context of the flux data, since error distributions are quite well defined a priori (see Richardson et al., 2006, Hollinger et al., 2005, Richardson et al., 2008 and this study), we agree that it would be interesting to compare the results with our study. However, the proposition "a likelihood function, L, comprised of Gaussian pdf's (suitable for a cost function of the type given by Eq. (3)) with constant error variance" needs to be modified, since the error variance is not constant but scales with the flux magnitude. Hence, at least two parameters defining the linear dependence of the variance on the flux magnitude would have to be estimated. We achknowledge



BGD
5, S533–S535, 2008

this possibility in the discussion now.

## References


[1] Hollinger, D. and Richardson, A.: Uncertainty in eddy covariance measurements and its application to physiological models, Tree Physiol., 25, 873–885, 2005.

[2] Richardson, A. D., Hollinger, D. Y., Burba, G. G., Davis, K. J., Flanagan, L. B., Katul, G. G., Munger, J. W., Ricciuto, D. M., Stoy, P. C., Suyker, A. E., Verma, S. B., and Wofsy, S. C.: A multi-site analysis of random error in tower-based measurements of carbon and energy fluxes, Agr. Forest Meteorol., 136, 1–18, 2006.

[3] Richardson, A. D., Mahecha, M. D., Falge, E., Kattge, J., Moffat, A. M., Papale, D., Reichstein, M., Stauch, V. J., Braswell, B. H., Churkina, G., Kruijt, B., and Hollinger, D. Y.: Statistical properties of random CO2 flux measurement uncertainty inferred from model residuals, Agr. Forest Meteorol., 148, 38–50, doi:10.1016/j.agrformet.2007.09001, 2007.



Interactive comment on Biogeosciences Discuss., 5, 751, 2008.