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Interactive Comment

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

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Lasslop, Reichstein, Kattge and Papale are to be commended for tackling an important and often overlooked topic, namely the characteristics of error statistics and their impact on parameter estimation in biophysical modelling. The investigation was based on synthetic data generated from real eddy covariance data from European flux tower sites. With synthetic data the authors' ensured that model error was not an issue and could address the impacts of random and systematic errors. Most of the article focuses on the generation of these errors, interpretation of their statistics, and their impact on parameter retrievals for three models for carbon dioxide and water vapour fluxes.

Choice of optimisation strategy was not a focus of the investigation. Trudinger et al. 2007 were inconclusive with regards to which (if any) was the standout strategy for all

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circumstances. It was, therefore, unclear as to why Levenberg-Marquardt was applied to the simpler models and Markov chain Monte Carlo (MCMC) to the more sophisticated BETHY model. My first thought was why not use MCMC for all models, especially since it provides all the information about the parameter uncertainty—eliminating the need for bootstrapping—and it is very much aligned with the aims of the work, namely characterising the distribution of parameters and errors.

Indeed I believe an interesting extention of the current work would be to use MCMC to estimate the probability density function (pdf) of the observation errors directly. A relatively simple demonstration would be to consider 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. The objective would be to construnct the posterior distribution of the model parameters, ϕ, and error variance, σ^2, given the observation, x. In this case, we assume the conjugate priors of inverse gamma pdf for σ^2 defined by shape, α, and scale, β parameters. Application of Bayes' rule results in the posterior pdf,

$$p(\phi, \sigma^2, \alpha, \beta | x) \propto L(x|\phi, \sigma^2, \alpha, \beta) p(\phi) p(\sigma^2|\alpha, \beta) p(\alpha) p(\beta).$$

It would be intersting to see if by exploiting the full potential of Bayesian statistics one was able to achieve similar results as those in the paper, but have the added advantage of not being site specific, which by the authors' own admission may be a problem with their approach.

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