

Interactive comment on “Coupled hydrogeophysical parameter estimation using a sequential Bayesian approach” by J. Rings et al.

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Received and published: 11 February 2010

This is an exceptionally clearly written and informative paper. The authors present the concept of particle filters as applied to hydrogeophysics in a way that anyone can understand them, regardless of their background in model calibration. They also seamlessly incorporate the concept of coupled hydrogeophysical analysis. Finally, they put into practice the sequential Bayesian approach in a way that makes it clear that it is a very logical to use hydrogeophysical data. These three aspects of the paper alone make it worth reading. In addition, the authors open the door on a new way to look at time-lapse hydrogeophysical data. Their plots showing the evolution of parameter estimates with added measurements are particularly revealing.

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I only have a few questions that are intended to broaden the impact of the paper:

1. For Figures 7, 8, and 9 it would have been helpful to include the independently-determined parameter values. (Understanding that, in most applications, this information will not be available.)
2. It would have been ideal to show the evolution of the parameter values for TDR and ERT used jointly. At a minimum, I would have like to see how the weights would be calculated for more than one measurement type. That is, how should the mismatches be weighted?
3. Would it be possible to combine the TDR and ERT results even though the experiments are not identical? It may be cumbersome, but couldn't you somehow "inform" each model by the evolution of the parameter values from the other model? If you could do this, could you simultaneously consider multiple sections of a time series (e.g. rainfall followed by ET) without having to model the entire time series?
4. Do you need to add data sequentially in time? Specifically, I am thinking about the case where the geophysical model is much more computationally expensive than the hydrologic and you have supporting direct data. Could you run your approach for the direct data and then selectively add geophysical data?

Once again, I really enjoyed reading this paper. Great work!

Ty Ferre

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 6387, 2009.