Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-432-AC4, 2016

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Evaluating the value of a network of cosmic-ray probes for improving land surface modelling" *by* Roland Baatz et al.

Roland Baatz et al.

r.baatz@fz-juelich.de

Received and published: 19 October 2016

Q: GENERAL COMMENTS OVERALL QUALITY The paper by Baatz et al. (2016-432) describes an effort to use soil moisture data from nine closely-spaced (2000 km2) cosmic-ray probes (CRPs) with data assimilation scheme to improve the assessment of soil moisture in land-surface models. The goal is worthy and the execution is thorough. The results are significant: (1) the joint state (soil moisture) and parameter (soil properties, like sand percentage) estimation within data assimilation scheme produces better results than just state estimation; (2) in absence of soil data and meteorological data, CRPs alone can improve data assimilation results. On that account, the paper is suitable for publication in HESS.

A: Thank you for the positive overall evaluation of the manuscript. We appreciate your

Printer-friendly version

Discussion paper

effort in reviewing the manuscript. In the forthcoming revision we will consider each of your suggestions and expand the discussion to answer the questions raised.

Q: However, I am less certain about the significance of these results in light of the finding that the parameters change in time and in many cases never converge. This is only possible if the parameters are fitting parameters rather than physical parameters. So we end up with better results, but possibly only by statistical manipulation rather than by improved understanding of the physics. Is this progress? I would like to see at least some discussion of this issue in the paper in its final form.

A: We will expand the discussion on this issue in the revised version of the manuscript. This is a standard procedure in data assimilation and we can refer to numerous papers where this strategy was followed. We will provide additional motivation in the revised version of the manuscript. Notice also that simulations were made for a verification period with constant parameters (estimated in the assimilation period).

Q: SPECIFIC COMMENTS Why are RMSE and bias discussed separately if they are essentially the same information? One is computed on squares of differences and therefore has a positive sign; the other is computed on differences and therefore has a sign. Wouldn't the bias suffice? If you keep both, please explain why they are both needed and how they are different.

A: We will add some clarifying remark on the differences and the advantage of using both measures, RMSE and bias.

Q: How are the results evaluated? What is the gold standard for soil properties? Pedotransfer functions? What is it for soil moisture? At some of the sites extensive networks of TDR probes exists. Would it be possible to include TDR data in the evaluation? While TDRs are hardly the gold standard in soil moisture measurements, they would provide independent soil moisture data. By the same token, have soil properties been measured at some of the sites? Using the pedotransfer functions to derive unsaturated hydraulic conductivities is hardly the gold standard, and hard to defend. I suggest that

the authors make at least some effort to provide independent data on soil moisture and hydraulic properties.

A: Thank you for the suggestions. TDR probes work on a scale of few dm3 which is significantly smaller than the scale of the land surface model (1 km2). Hence, TDR probes are not suitable for a direct evaluation whereas cosmic-ray neutron sensors (CRNS) measure soil moisture at an equivalent scale. We note that soil moisture measurements by CRNS were already independent from the prediction of the land surface model during the verification period. Soil hydraulic properties at the desired scale were not measured. However, we will provide additional data on latent heat flux observations for comparison with predicted latent heat flux.

Q: TECHNICAL CORRECTIONS Please, see the annotated pdf manuscript.

A: Technical corrections were addressed in the annotated pdf manuscript.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-432/hess-2016-432-AC4-supplement.pdf

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-432, 2016.

Printer-friendly version

Discussion paper