

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

Anonymous Referee #4

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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.

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

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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.

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.

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.

TECHNICAL CORRECTIONS

Please, see 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-RC4-supplement.pdf>

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

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