

Interactive comment on “Evaluating uncertainty in estimates of soil moisture memory with a reverse ensemble approach” by D. MacLeod et al.

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Review of MacLeod et al. 'Evaluating uncertainty in estimates of soil moisture memory with a reverse ensemble approach'

This paper illustrates the importance of particular hydraulic model parameters for the resulting simulated soil moisture memory. Large memory changes are found when varying these parameters within the range of the respective observed values.

General comments:

The paper addresses a relevant topic and should be of interest for HESS readers. Soil moisture memory has been shown to be of importance for weather and climate

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forecasting. It is known that memory estimates vary considerably across models, which might be related to the fact that there are only few available soil moisture observations.

I think the present study is useful in this context to better understand potential sources of uncertainty in simulated soil moisture persistence.

However, I think the analysis needs to be extended. The authors should show why and how the variations in soil moisture memory matter, i.e. for example how they impact the models' weather forecasts. One way to do this might be to link the simulated soil moisture memory and its variations with for instance temperature forecast skills. Such an analysis might reveal potential to improve the use of soil moisture information in HTESSSEL. In Orth and Seneviratne (2014) we found for example that at 4 weeks lead time better temperature forecasts can be derived from soil moisture (from another product) alone compared with the respective skill of the ECMWF system.

Furthermore you need to better motivate your analyses of the hindcasts initialized in November. As you mention, the memory results are dependent on snow cover. If the snow isolates the soil hydrology from the atmosphere and prevents any soil moisture-atmosphere interactions, then why should we worry about uncertainty in soil moisture memory in winter?

In view of the outlined problems, I recommend major revisions.

I do not wish to remain anonymous - Rene Orth.

Specific comments:

page 1 line 1: not clear what predictability you mean here line 9: double 'with' line 13: what does 'It' refer to? line 15: insert 'it' after low-pass filter line 17: soil moisture memory is linked to persistence in temperature and precipitation through its link with evapotranspiration persistence (Orth and Seneviratne 2013)

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page 2 line 9: double use of 'estimate' line 27: add 'such as' after 'forcing conditions'

page 3 section 2.1: discuss implications of uncoupled vs. coupled setting for soil moisture memory and its potential impact on surface weather line 10: 'comprises of three', please correct line 16: albedo and soil type are not exactly 'climatological data' lines 20-24: give more reasoning on why these particular parameters were chosen line 28: correct 'differs'

page 4 equation 2: this is a sum, not an average lines 21-23: I see what you mean, but please rephrase to clarify your point here

page 5 line 3: 'p' is used already on the previous page

page 6 line 8: please find a clearer expression for 'memory loss date' line 8: insert space after 'loss date' line 26: correct 'AGCMS'

page 7 lines 14-17: Orth et al. (2016) also shows how weather forecasts can be improved by accounting for land surface model parameter uncertainty line 18: remove 'that of' lines 18-22: either here or elsewhere in the paper, mention that despite the uncertainty found in soil moisture memory its overall magnitude in HTESSEL is comparable with estimates from soil moisture observations (Orth and Seneviratne 2012)

References:

Orth, R., E. Dutra, and F. Pappenberger, 2016 Improving weather predictability by including land-surface model parameter uncertainty. *Mon. Weather Rev.*, doi: 10.1175/MWR-D-15-0283.1, in press

Orth, R., and S.I. Seneviratne, 2014 Using soil moisture forecasts for sub-seasonal summer temperature predictions in Europe. *Climate Dynamics*, 43 (12), 3403-3418, doi: 10.1007/s00382-014-2112-x

Orth, R., and S.I. Seneviratne, 2013 Propagation of soil moisture memory to stream-flow and evapotranspiration in Europe. *Hydr. Earth Syst. Sci.*, 17, 3895-3911,

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doi:10.5194/hess-17-3895-2013

Orth, R., and S.I. Seneviratne, 2012 Analysis of soil moisture memory from observations in Europe. *J. Geophys. Res. - Atmospheres*, 117, D15115, doi:10.1029/2011JD017366

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