

Interactive comment on “Investigating soil moisture-climate interactions with prescribed soil moisture experiments: an assessment with the Community Earth System Model (version 1.2)” by Mathias Hauser et al.

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General remarks

This manuscript carries out a timely analysis of the consequences of perturbing the land surface soil moisture budget as carried out in earlier experiments and proposed in LS3MIP. It compares various methodologies (with/without ice, with/without prescribing shallow top layer, using mean/median), concluding that the use of the median liquid is a more conservative method than when using means and including ice. It is well written and addresses an outstanding issue, and is thus worth publishing subject to

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some minor comments:

- P4, L4-L8: the algorithm uses a soil temperature threshold of zero degrees to trace the occurrence of soil ice. However, algorithms exist that allow a gradual fraction of soil water to be frozen in between a temperature range that may well include temperatures exceeding 0 degrees. How to deal with these parameterizations?
- P4, L23: when is there “too much variability”?
- P5, L18: it may be worth spending a few words explaining (or speculating) why the soil moisture distribution shows a negative skewness and a median lower than a mean. Is it because soil moisture is more persistent in drier conditions due to lower values of hydraulic exchange coefficients? Or is there another reason behind this asymmetry?
- P5, L28: it’s not the strength of the seasonality that is at play here, but the occurrence of a short sharp peak in that climatology, that causes these rounding errors
- P6, L16: suggest to add “when comparing the median to the mean” at the end of this sentence
- P6, L17: the fact that the results in 2070-2099 are similar is surprising. You are not comparing the REF temperature in 1970-1999 to the simulated temperature by the end of the century I presume (otherwise we should have seen a major climate change signal). But also the GLACE-CMIP5 exp by Seneviratne et al (2013) did show an effect on net warming when prescribing a climatological soil moisture. Why is this effect gone in this set-up?

- P7, L11: Koster et al (2004, 2006) did evaluate all perturbations under present climate conditions, which makes the effect of changing frozen soil water also smaller than in climate change set-ups
- P7, L18: I misread this sentence a few times. I would make the statement of 650 mm/yr for the addition of SM first, and then state that a similar amount is associated with removals of soil water. Now it looks like 650 mm/yr is the net effect
- Figures: they are generally pretty small, and stippling is difficult to see

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