

Interactive comment on “Life time of soil moisture perturbations in a coupled land-atmosphere simulation” by T. Stacke and S. Hagemann

Anonymous Referee #2

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General comments:

The manuscript “Life time of soil moisture perturbations in a coupled land-atmosphere simulation ” by T. Stacke and S. Hagemann evaluates the memory of initial soil moisture perturbations using a global coupled land-atmosphere-ocean model. This is an interesting modeling study. The manuscript is well written. However, it is not clear how realistic are the results, particularly re-occurrence of soil moisture memory. The results are purely model based and no observational data are used in order to support any of the findings, which is the weakest point of the manuscript. Following are the comments/concerns. I recommend for publishing this manuscript, provided following concerns are addressed properly.

specific comments:

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- 1) Use of observed soil moisture or other land surface parameter (available for some European and north American stations), will make the results more acceptable to the research community rather than relying only on the model simulation.
- 2) Figure 12, 13 suggests that initial soil moisture perturbation is too strong, perhaps far away from the real level ? I am wondering if the perturbations are too strong in some regions, despite authors have chosen a good method to do so. Is there any particular region (climatic condition), where re-occurrence of memory, as evident in leaf carbon content (Fig. 12) is very large ? This appears to me the middle and high latitude region, where strong seasonal effect persists. Any observational evidence/reference of previous observation finding ?
- 3) In section 4. “The largest impact of soil moisture perturbation is expected for surface and soil moisture ” Figure 9: this is simplified assumption. There are strong non-linearity in the atmospheric state variable, which is evident in the spread of surface air temperature anomaly. Are the found anomalies are statistically significant ?
- 4) As mentioned, this model does not have freezing/thawing of soil moisture, how reliable are the found memory over high latitude/permafrost region ? Some discussion is required.
- 5) Many coupled model show drift, which last for several years/decade. As this experiment used only two years of spin-up, the results may be affected by the model drift.

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