Hydrology and Earth System Sciences Discussions

Interactive Comment

Interactive comment on "Potential and limitations of multidecadal satellite soil moisture observations for climate model evaluation studies" *by* A. Loew et al.

Anonymous Referee #2

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Overall Evaluation

The paper thoroughly compares the multidecadal satellite soil moisture dataset (ECVSM) to ERA reanalysis and offline simulation from JSBACH. Global scale analysis is performed in terms of rank correlation, partial correlation (with rainfall as the third controlling variable), trend, etc. More detailed analysis is carried out over the Sahel region. The topic is interesting for HESS readers and the study is well designed and carried out. The paper itself is well organized and clearly articulated. I recommend its publication with the following comments addressed.

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Major Comments

It is not very clear to me why the partial correlation analysis is performed against precipitation or how to interpret the partial correlation values. Precipitation is the major driver for soil moisture dynamics and if the information from precipitation is completely removed, there won't be much left. I have some doubts on how effectively the removal is (see specific comments). Even the precipitation factor can be well removed in partial correlation, neither ERA-interim nor JSBACH uses GPCP precipitation – so what is exactly removed from them? Or the authors are looking for the "added" value of ECVSM on top of precipitation products?

I think the authors should perform time breakdowns for some of the correlation and trend analyses to show how different satellites, though somehow homogenized, agree (or disagree) with each other and how those differences affect (or contribute) to the overall conclusions. For example, break it down to the periods where SMMR, SSM/I and AMSR-E tend to be the major contributor at the time. Multiple satellites may create artifacts in the long-term analysis so this is especially important for studying the potential for "climate model evaluations".

There are too many figures and a lot of them contain multiple sub-figures. Please consider condensing the results (try to stress on those leading to major conclusions of the paper) and delivering the messages in a more powerful way.

Specific Comments

P3543, L27: spell out the acronym ECVSM if possible.

P3545, L8-9: ". . . statistics . . . resembles . . . dynamics . . ." consider rephrasing it.

P3545, L10: what is "percentile distribution"? I thought the percentile distribution is always uniform. Can you clarify?

P3545, L17: is RMSE 0.05 [$m^3 m^{-3}$] calculated at daily or monthly scale? Besides RMSE, any correlation number reported against ground observations?

P3545, L6: spell out JSBACH if possible. There are similar cases elsewhere.

P3551, L11-15: the rainfall-soil moisture relationship at short time scale (e.g. daily) is definitely not a linear correlation but much more of an impulse-response (i.e. Laplace transform). At monthly scale, this is probably less a concern, but I'm still not quite sure how well the partial correlation analysis can remove the effect of rainfall dynamics. Instead of conditioning the correlation on rainfall time series itself, a slightly better way to remove rainfall effect is to feed the rainfall series into a simple autoregressive model like the Antecedent Precipitation Index (API) and condition it on the resulted time series.

P3552, L1: "percentile correlation" is usually referred as "Spearman's rank correlation" or "Spearman's ρ" in other literatures.

P3553, L10: 1980ies -> 1980's

Fig 1, 6, and 9: maps too small and hard to read. Suggestions – the text font can be a little smaller, white gaps in between maps can also be reduced, no need to repeat and same color bar 3 times and reduce the number of color bars from 6 to 2, part of the map captions can be labeled within the map over the ocean part, ...

Fig 8: text is very hard to read.

Fig 8, 11, and A1: colors reverted? According to the color bar, correlation values on the maps are mostly in the negative range?

Fig 9: should "Soil moisture percentile $[m^3 m^{-3}]$" be "Volumetric soil moisture $[m^3 m^{-3}]$"?

In all related figures, ECVSM is labeled as ECV_SM. Please make it consistent throughout the paper.

In all related figures and discussion, the letter "p" is used for both "soil moisture percentile" and "p-value in significance test". I suggest the authors spell out "p-value" in

full.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 3541, 2013.

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