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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The role of improved soil moisture for the characteristics of surface energy fluxes in the ECMWF reanalyses" *by* Wilhelm May

Anonymous Referee #2

Received and published: 12 January 2018

This manuscript investigates the differences between ERA/Int and ERA/Int-Land seasonal mean regional soil moisture and surface fluxes, and attempts to link these back to the difference in precipitation between the two systems. While this topic is certainly of interest, the manuscript does not reveal any new findings and the author seems unaware of relevant literature and well established physical relationships.

MAJOR COMMENTS:

The main findings of the manuscript, as represented in the abstract and the conclusions, are i) soil moisture depends strongly on precipitation, and ii) soil moisture affects the partition of incoming radiation into sensible and latent heating, but does not affect the total incoming radiation. Both of these are basic features of land surface physics, and so do not represent a significant finding.

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2. If the manuscript were to focus on relationships between different variables in the two systems, then these relationships would need to be shown quantitatively, rather than by qualitatively from comparing maps. Again, it is not enough to show that precipitation affects soil moisture, and soil moisture does not affect the incoming radiation. We know this.

3. All differences between ERA/Int and ERA/Int-Land are attributed to the different precipitation forcing, yet there are other major differences between the two systems. In particular, ERA/Int-Land includes a major update to the land model, ERA/Int-Land is a land-only replay while ERA/Int was coupled land/atmosphere system, and ERA/Int included a screen-level based land analysis which was not included in ERA/Int-Land. As such, the differences between the two systems cannot necessarily be attributed to the precipitation. The above differences need to be discussed, and the fact that the differences between ERA/Int and ERA/Int-Land output cannot be attributed to any one cause needs to be discussed in detail. For an example of how this issue could be addressed more thoroughly see:

Draper, C.S., R.H. Reichle, and R.D. Koster,Âă2018:ÂăAssessment of MERRA-2 Land Surface Energy Flux Estimates.ÂăJ. Climate,Âă31,Âă671–691,Âăhttps://doi.org/10.1175/JCLI-D-17-0121.1Âă

SPECIFIC COMMENTS

P1, L18, and throughout the manuscript: the word ‘diverges’ is used, where ‘differs’ is more appropriate.

P1, L10: this is only one mechanism through which soil moisture can interact with the atmosphere. See Seneviratne et al (2010) for a discussion of this.

P2, L25: This is incorrect. GLACE used coupled land/atmosphere models, not offline simulations.

P2, L30: MERRA-2 has replaced MERRA, and should be referenced here.

P3, L5. Balsamo et al, 2015 also evaluated the land surface fluxes. Their results should be summarized here.

P4, L9: Three hours is the output resolution, not the “time step” or “temporal resolution”.

P5, L 9: Limiting the domain to 60 degrees is an inefficient way to screen out snow and ice (in particular, there will be large snow covered areas equator-ward of 60 degrees).

Why not just screen these out directly? Also, does ERA/Int-Land use observed precipitation in the high latitudes? If not, this needs to be mentioned.

P5 last paragraph: Here it is assumed that the precipitation in ERA-Int/Land is necessarily more accurate than that in ERA/Int. While it is likely that the observation-informed precipitation in ERA-Int/land is overall more accurate, this cannot be assumed to always be the case. There are serious issues with the observed data sets too, particularly in regions that aren’t well observed. This needs to be re-written to not assume that ERA/Int-Land is the truth, ie, ERA/Int should be described as being “lower than ERA/Int-Land”, not as underestimating the precipitation / soil moisture”.

P6 second paragraph: same comment as above. Here Africa and the Amazon are highlighted as having relatively large precipitation differences between the two systems. These regions are both very poorly observed, and these differences could be due to errors in the precipitation observations. Re-write as suggested above, and acknowledge the additional uncertainty in these regions.

P6 - P7 paragraph: I can’t figure out what the author is trying to say here.

P7, L7: the use of “seasons” for a three month moving average is confusing. Just call it a three month moving average.

P9, L2: define “non-centered correlations” . Is “seasonal” true seasons, or your 3 month moving average ?

P9, L6: “coupling” has a specific meaning, and is not the right word here.

P9, paragraph starting L5: which system is being discussed here?

P9: there is no need to present both EF and Bowen ratio. They contain the same information, only one should be shown.

P12: 20 -25. I can't make sense of this paragraph. ERA-Int is already a coupled land/atmosphere system.

P12, L30: "They may also have remote effects by altering sea level pressure and, by this, the large scale circulation patterns". This is a very broad assertion, and needs to be discussed fully, and cited. Otherwise, delete it .

Figure 1-2: The color bars are saturated at the high end, so that any differences present are not evident. Please revise. You may want to use a non-linear scale for precipitation

It is not clear what is plotted in Figure 1f. The difference between the seasons, or between the reanalyses?

The labels on the top and bottom of the difference color bar don't match. Put all labels on the bottom.

Figure 6: is this for ERA/Int or ERA/Int-Land? Also include a better description of how the correlation is calculated (what exactly is the time series being used? A single JJA value for each year?)

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