

Interactive comment on “Contributions of climate change and groundwater extraction to soil moisture trends” by Longhuan Wang et al.

Anonymous Referee #2

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The manuscript by Wang et al. used a set of land surface model simulations to quantify and analyze global soil moisture dynamics and the contributions of climate change and ground water extraction. In my opinion, the two factors identified by the authors represent the natural and human dimensions respectively, thus could result in very interesting outcomes and well-suited for publication at ESD. However, the presentation quality of this manuscript is relatively poor and I believe further polishing with more clarification should help it get published finally.

Line 59: Not accurate. Any evidence showing that the LSMs can represent the soil moisture trends? Line 59: "Recently" – Soil moisture has been simulated in LSMs over a few decades – not "recently" Line 68: "to 45%" -> "45% to" Line 71: Vague: What kind of remote sensing data and model? Line 82: Repeating sentence. I would delete

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it. Line 88-90: Is this part of the LS3MIP effort? Line 105: No idea on the "coarse resolution": You should clarify what spatial resolution was used in your study at/before this point. Line 137: Two Zeng et al., 2016 papers were found in the list of references. Double check it. Line 137-140: I have some serious concern about the assumption that the irrigation represents the level of water consumptions – any evidence? Line 184-185: Did "March-October" apply to grid cells in the Southern Hemisphere? Line 189: Some explanation of the "trajectory method" is necessary here. Readers need to understand what the method is and what the method can provide. Eq 3,4,5,6: I really had difficulty in understanding these equations. First, symbols in Eq 3,4 and 5,6 should not be the same, as they represent different terms. I did not quite get the rationale of Eq 3. It is very confusing. I suggest the authors re-design the variable names in these equations and made them easy to follow in the revised manuscript. Line 209: linear correlation of the time series? Clarify it. Line 211: These results only indicate whether the models captured the interannual variability of the soil moisture, if you were calculating the correlation coefficients of the time series. It's not about "soil dynamics" Line 214: How were the difference calculated? Is it the difference between the long-term means? Line 222-224: Not accurate. Better to say "GW extraction caused significant increase in ..." Line 226: You should explain how Fig 3 can show the model generally captured ... Line 229: when you use 'significantly', there must be some statistical evidence. I would delete it Line 242: "different methods" for doing what? Line 326: "negligible" or "not negligible"? Line 328: Again, I feel the metrics in Eq 3-6 are confusing. A good metric of contribution should be between 0 and 100%. Negative and >100% contributions are hard to follow. I strongly suggest the authors seek other metrics (if there is any) to indicated the relative contribution, which I believe will greatly improve the writing quality of this paper. Line 378-382: I am glad to see discussions about the implications, although I was expecting more suggestions on the regional groundwater extraction.

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