

Interactive comment on “Multi-variable, multi-configuration testing of ORCHIDEE land surface model water flux and storage estimates across semi-arid sites in the southwestern US” by Natasha MacBean et al.

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We are grateful to anonymous reviewer 2 for their detailed review and for raising inconsistencies or points to further consider. Here, we briefly respond to some of the major issues raised by reviewer 2 in the hope of some further discussion before the interactive public discussion period ends on 23rd February. We will then provide a detailed response to reviewer 2 along with a revised manuscript.

We agree with all points raised by reviewer 2 and will address all of these in our de-

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tailed comment-by-comment response and revised manuscript after the interactive discussion period has closed.

At this point, we would like to further discuss the main point that reviewer 2 raised, which relates to the comparison between the 2 vs 11-layer hydrology schemes. We agree that the way it was presented leads to some confusion and difficulty in comparing the two schemes – for example, why we do not compare the 2-layer version to observations. As reviewer 2 stated, we did provide the reasoning behind why we only compare the 11-layer version to observations (and why we perform the CDF matching). However, reading what we wrote in Section 2.3.2 again we realize that perhaps we have not gone into enough detail as to why we did not compare the 2-layer to observations. In the 2-layer scheme, the top layer depth is variable. It can be a maximum of 10cm and it can also disappear completely if the water empties into the bottom layer that makes up the rest of the 2m soil column. Therefore, despite any of the other issues that prevent a comparison of the absolute modeled and observed soil moisture values (and why we use CDF matching), for the 2-layer version we also have the issue that the depth at which we are simulating the upper soil moisture in the 2-layer version is changing over time. Therefore, it makes the comparison to moisture observations extremely difficult – and crucially – this feature of the 2-layer version means our 2-layer model-obs comparison will be different to the 11-layer model-data comparison in which we can at least match the model layer to the depth at which the observations were taken. Therefore, we are still hesitant to compare the upper layer soil moisture simulated by the 2-layer version to observations, even after CDF matching. We did have a version where we normalized the 2-layer model and observed upper layer moisture to just compare their temporal dynamics, but it becomes very confusing when we use a different processing method to compare the 11-layer model to observations. Instead, we chose to have a separate initial results section where we just described the differences between the 2-layer and 11-layer version soil moisture and only discussed the model performance in relation to ET observations. We acknowledge however that the statement that soil moisture appears to be more realistic is unwarranted. We will

change the text so that we only say that the ET is more realistic (given that both versions of the model ET can be directly compared to ET observations). We welcome reviewer 2's thoughts on not including a comparison of the 2-layer model upper layer soil moisture to observations (for reasons given above) and on our proposed changes to the text related to only discussing performance in relation to ET.

Finally, on this point, we have provided a detailed explanation for why we include the 2 vs 11-layer comparison in our initial informal response to reviewer 1 and we would welcome reviewer 2's thoughts on this justification as well. Does reviewer 2 think the manuscript would be vastly improved if we were to remove the comparison between the 2- and 11-layer versions of the model and only examine the 11-layer model? Or would it be enough to de-emphasize this comparison and instead emphasize more the second part in relation to the 11-layer comparison and remaining model-data discrepancies?

We thank reviewer 2 again for their detailed review and we apologize for not leaving much time in the interactive discussion period to reply to this initial informal response to their review. We will provide a much more detailed comment-by-comment response to their review after the interactive discussion period has closed that will take all points raised into account.

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