

Interactive comment on “On the utility of land surface models for agricultural drought monitoring” by W. T. Crow et al.

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We thank Reviewer #3 for their very helpful review of our manuscript. They point out a couple of important instances in which the writing of the manuscript needs to be improved.

1) The abstract is understating the added value of modern LSMs with respect to API for droughts monitoring. While having practical advantages the API has a very modest intellectual investment, it cannot improve predictive skill over time, it does not enable data assimilation of observations, and it is highly based on tuning with little understanding of the bio-physical processes connecting rain-fall deficits and droughts. Yet API works for rain-fed crops areas, and it is widely

used in agricultural practice. Therefore, while the comparison to API is interesting, appropriate and necessary, I recommend rewording of some of the sentences following the above considerations. It could be mentioned that LSMs are evolving towards more complete physically-based schemes that can take into account irrigation and yield cut practices. Modern agriculture is beyond rainfed natural crops (for which API applies). Complexity alone is not a good strategy as shown by Abramovitz et al. (2008) and need to be supported by a variety of observations. Drought are complex processes because are in the category of extreme events and one should not give the impression that simple methods are already fulfilling the societal needs.

Response: We fully agree with this comment and recognize that our original abstract was poorly-worded in this regard. The purpose of this analysis is not to argue that an API formulation can replace more complex modern LSMs. As the reviewer points out, this is obviously untrue since LSMs retain a range of functionality that cannot be matched by an API model. Instead, our purpose is to critically evaluate the performance of complex LSMs via comparisons against an obviously over-simplified conceptual model. Our original manuscript did not adequately convey this important distinction. The abstract/introduction of the revised manuscript will be modified to clarify the intent of our analysis.

P5168L10: The sentence “A quasi-global evaluation of lagged VI/soil moisture crosscorrelation suggests, when averaged in bulk across the annual cycle, little or no added skill (<5

Response: Agreed, this sentence was poorly worded. It will be carefully reworded along the lines suggested by the reviewer.

2) Three land surface models are considered but while NOAH LSM is used in a version that encompass development of the last 10 years, CLM considers version 2 not including the more recent releases improvement (e.g version 3.5 or 4.0).

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The use of “CLM2” or “CLM2.0” as label is therefore recommended throughout the text. It is worth checking recent literature of these 3 schemes.

Response: All references to “CLM” will be changed to “CLM2.0” to clarify that we are not using the latest version of the model. In addition, we will review the literature and clarify the distinction between CLM2.0 and later CLM versions.

3) Ensemble of 3-4 members cannot possibly represent the natural spread of land surface variable such as soil moisture. In presence of a larger ensemble the present results and conclusion may differ and this should be emphasised in the conclusions.

Response: Agreed. More ensembles would likely help. This will be emphasized in the revised manuscript.

Adding the API to the ensemble members is of limited interest with respect to the LSMs and it would be interesting to evaluate results only based on LSMs (that can be applied in predictive mode when coupled with GCMs). While this remarks will involve computational work I think it may increase the utility provided by this study.

Response: Good point. As noted in our response to Reviewer #1, the “ensemble” results in the revised manuscript will be modified to contain only the three modern LSMs (and not the API model).

Minor comments:

5174: two things ! two objectives.

Response: Agreed. Suggested change will be made in the revised manuscript.

P5177: reliability !reliably

Response: Agreed. Suggested change will be made in the revised manuscript.

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Figure 4: Is there a panel missing here? API is mentioned in the caption. If no panel is missing then the caption is somehow misleading.

Response: No panel was missing; instead the caption was misleading. All results shown are differences calculated relative to an API baseline (therefore API itself was not shown). The figure caption will be rewritten in the revised manuscript.

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