Hydrology and Earth System Sciences Discussions

Interactive
Comment

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

Anonymous Referee #3

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Review of "On the utility of land surface models for agricultural drought monitoring" by W. T. Crow, S. V. Kumar, and J. D. Bolten, submitted to HESS

The paper discusses skills of models/algorithms for drought monitoring: 3 land surface models, Noah, CLM, and CLSM included in NASA Land Information System (LIS), are compared to a simple drought indicators as the Antecedent Precipitation Index (API) The paper has high relevance, is quite well written and logically structured. I therefore recommend publication in HESS after careful consideration of the comments below.

I have 3 main concerns that can be addressed mostly by rewording (except comment n.3, but I still believe this could be addressed with minor revisions):

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Interactive Discussion

Discussion Paper

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 rainfall deficits and droughts. Yet API works for rain-fed crops areas, and it iswidely 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.

P5168L10: The sentence "A quasi-global evaluation of lagged VI/soil moisture cross-correlation suggests, when averaged in bulk across the annual cycle, little or no added skill (<5 % in relative terms) is associated with applying modern LSMs ..." is in my opinion misleading, especially because the sentence immediately after clarifies that there is skill in the extra-tropics. I suggest avoid "no added skill". This could be formulated differently, and should carefully limit the validity and generality of this results to the choices made. "While API and modern LSMs are almost comparable when considering annual averages (<5% added skill), focusing on the extra-tropical land reveals sizeable added skill from LSMs complexity...".

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). 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.

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. 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.

Minor comments: 5174: two things → two objectives.

P5177: reliability →reliably

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.

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