Hydrology and Earth System Sciences Discussions

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Comment on hess-2021-263

Anonymous Referee #1

Referee comment on "Towards effective drought monitoring in the Middle East and North Africa (MENA) region: implications from assimilating leaf area index and soil moisture into the Noah-MP land surface model for Morocco" by Wanshu Nie et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-263-RC1, 2021

General comment:

Drought monitoring and early warning systems are valuable tools to enhance our understanding and better inform relevant authorities to act early and effectively to mitigate adverse effects that drought may bring to food security systems. Implementing strategies aimed at improving the reliability of Drought monitoring and early warning systems remains key. Authors of this manuscript have implemented an approach of assimilating remotely sensed data (LAI and soil moisture) to a land surface model (Noah-MP) to improve drought monitoring in the MENA region. The study is interesting and valuable not only for the MENA region but could also be applied in other regions experiencing drought challenges. Thus, the manuscript could contribute to valuable knowledge that this journal aims for. However, I have noted some scientific concerns (approaches and discussions) in the manuscript that could lower the quality of this manuscript at the current state.

Specific scientific comment:

1. Application of SMAP-DA must have failed due to assumptions taken in the model which were, highly likely, not representative of actual position on the ground. Model failure, especially from SSM-DA, was therefore almost certain. For this reason, the authors then focused on quantifying how data assimilation differentiates the categorization of drought and reproduces the evolution, duration, and intensity of past drought events as an indirect way to evaluate its impact on root zone soil moisture, which is good. However, the authors should first better highlight more on these assumptions, such as assuming soil is always irrigated to field capacity (lines 168 to 169) and uncertainty in irrigation

information (irrigation frequency/timing and amount), as possible reasons behind DA failure. Could better representation of actual ground information in the model lead to improvements in model simulation after implementing SSM-DA? So in my view the authors should explicitly state that the reasons behind model failure was due to missing or limited in-situ data and local information and the decision to set the model with conditions that may not be the actual position on the ground.

2. Authors should demonstrate or reference other studies on accuracy and uncertainty of the RS datasets, such as MODIS, used in this study.

3. In line 149 to 152, the authors relied on irrigation maps from global datasets. The study area is relatively small. Why couldn't they generate more accurate irrigation maps? Did they attempt to validate the irrigation map from global dataset?

4. In lines 306 to 310, the authors noted spatial variability of improvements in results obtained but failed to discuss the reasons behind these? Could they discuss this?

5. Authors have stated in lines 351 to 352 that overestimation of transpiration during summertime, especially for croplands, likely due to misrepresentation of the vegetation seasonality. Why were there no attempts to better represent the vegetation seasonality in the model?

6. Authors have stated in line 431 that limited in-situ soil data was available. what were the sources of soil moisture data? Can they also include these data in the manuscript? what about using rainfall data as proxy for soil moisture, standardised precipitation index? did they attempt to use this?

7. Why are all figures placed at the end of the manuscript rather than at their rightful positions? This approach makes it difficult for the reader to follow smoothly.

8. Line 411, authors are referring to the figure 2(b), representing the difference of correlation (R) – computed as DA minus OL for the period of 2015-2019 for LAI-DA in terms of transpiration? why specifically stratify this figure?

Technical corrections:

1. Line 65, separate DA and reference using separate brackets.

2. Line 191, state SSM-DA and SSM-DA_{irr} separately and not as SSM-DA (SSM-DA_{irr}). line 197 it is well stated LAI-DA and LAI-DA_{irr}.

3. Line 214, correct the superscript of degree in 0.05o

4. Line 256, SIF is not defined but then defined later in line 260. it should be defined at this point

5. Line 392, place irr as a subscript in LAI-DA_{irr}