

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
<https://doi.org/10.5194/hess-2021-263-RC2>, 2021
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Comment on hess-2021-263

Claire Michailovsky (Referee)

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-RC2>, 2021

General Comments:

This manuscript analyses the impact of assimilating LAI and soil moisture data from remote sensing (separately) on the water and carbon fluxes simulated by a land surface model (Noah-MP) and how drought categorization is affected as a result. The impact of irrigated areas is also included in the analysis through a simple irrigation module. This is a very relevant topic as early drought warning can help implement mitigation measures to reduce adverse impacts. Irrigation is often not included in LSMs, and its inclusion here is valuable in bringing focus to the difficulties encountered in its inclusion in models, in particular in data scarce regions.

The work is well written and the evidence is clearly and convincingly presented.

Specific Comments/Questions:

There is no description of the downscaling of the SMAP/upscaling of the MODIS LAI data. A discussion on the spatial resolution of the datasets is also missing: what could be its impact relative to 1. the model grid and 2. the landscape fragmentation (in particular size of irrigated areas)?

The parameterization of the irrigated areas and module deserves more discussion: what could be the impact of the uncertainty of the global datasets used? How about irrigation amounts which assume reaching of field capacity? I also do not see a mention of matching the irrigated areas to the land use map, were irrigated areas only applied to pixels identified as cropped/partially cropped?

There is a brief mention of loss of information due to the rescaling of the soil moisture product to the model climatology but I think this deserves further discussion. What is the impact of rescaling the SSM to a model run which does not include irrigation? In particular when there is also an attempt to use the SSM to improve the irrigation run. A comparison of the SMAP cdf over an irrigated vs. non-irrigated pixel would be an interesting starting point.

Was a simultaneous assimilation of LAI and SSM tested? If not, why not? Do you see any

potential for the inclusion of both to improve the results?

Technical Comments

l.268: 'for the' should be removed (or rephrase sentence, unclear)

l.300: 'with the percent change over 20%' is awkward. Suggestion: 'with a relative improvement of over 20%'

458-460: I assume the higher LAI leads to increased transpiration. The sentence structure implies the opposite effect. Add 'for LAI-DA' for clarity at the end of the sentence