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Comment on hess-2021-402

Anonymous Referee #2

Referee comment on "High-resolution drought simulations and comparison to soil moisture observations in Germany" by Friedrich Boeing et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-402-RC2>, 2022

Review of "High-resolution drought simulations and comparison to soil moisture observations in Germany" This manuscripts analyses the relationship between soil moisture observations and estimations by models in Germany with focus on drought monitoring. The manuscript is well written and organised. Nevertheless, I would like to include some caveats related to the limitations of the validation approach and the usefulness of the new high spatial resolution data base in order to assess drought severity. I include specific details related to these issues (and others) below (numbers refer to the specific lines of the manuscript):

11- What is "vegetation period"? Is maybe "vegetative active period"?

Table 1- I would like to ask for a technical question. Do you think if the quality of the globcover map is sufficient for the modelling. How is considered the uncertainty of land cover information in the model? I find very high detail of information related to the improvement of the soil maps, map I have the impression that the land cover data is not considered so carefully and it can be strongly relevant to model soil moisture given different water consumption by ecosystem types (even at the scale of species), the role of root structure, root depth, etc.

150- I find very few information related to the meteorological data. There is not information on the number of stations used for each variable, the quality of the data, quality control processes, data gap filling, temporal homogeneity, etc., but also information related to the quality of resulting gridded data (e.g., cross-validation statistics would be useful). Meteorological data can be also an important source of uncertainty in the model outputs...

151-154- What about uncertainty of the Hargreaves-Samani equation to estimate

Potential Evapotranspiration? It is widely known that temperature based methods show uncertainties related to physically based models like the Penman-Monteith equation. For example, wind speed and relative humidity may have large importance on PET, even more in non-stationary scenarios characterised by decreased relative humidity over land and wind speed reduction.

172- Figure 1 > Figure 2.

231-235- The validation procedure is exclusively based on correlations. Nevertheless, if the main purpose of the manuscript is related to drought monitoring, I think more relevant to assess model outputs during periods of water deficits. For example, it would be useful to check the capability of models to identify duration and magnitude of the dry periods. High correlation could mask a poor goodness between observations and models during dry periods. I would suggest to include statistics focusing on the drought periods in addition to the non-parametric correlations.

170-210- The length of the observation series is not indicated in this section. This information is relevant to assess robustness of the relationship between observations and models. Have the series the same length? How is this considered in the assessment of the significance of the relationships? I think this issue is affecting the validation of the results over the entire section 3.1 since the length of the series affect the degrees of freedom of the correlation analysis. I see in table 3 that the length of the series is between 2 and 5 years, which is too low to provide a robust validation of the model outputs.

Figures 6 and 7. Under my opinion, I do not think that this information is providing an useful output to determine the goodness of providing additional spatial resolution to assess drought severity. Large scale statistics are aggregating the information, being normal that both databases at 4km and 1 km of spatial resolution provide similar results. I think the relevant information of the 1 km modelling approach is not the general large spatial pattern but the local differences that could emerge given higher spatial resolution. This is something interesting to be analysed (e.g. using spatial statistics: the variance between grid cells, the differences between areas characterised by diversity of land cover/soil characteristics) to determine if higher spatial resolution is providing relevant information for drought monitoring and management. Observing Figures 6 and 7 I would say that the higher spatial resolution is really not needed as it basically identifies the same patterns that 4 km grids.