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Comment on hess-2021-189

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Referee comment on "The value of satellite soil moisture and snow cover data for the transfer of hydrological model parameters to ungauged sites" by Rui Tong et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-189-RC2, 2021

General Comments

This manuscript aims to evaluate the efficiency of parameter several regionalization techniques applied to a hydrological model tested in several sites in Austria. The calibration procedure uses multi-objective functions. The authors expect to improve predictions of streamflow, soil moisture and snow cover in ungauged locations. This topic is an active area of research in hydrological and land surface modeling. This manuscript in its present status, however, is not suitable for publication in HESS. The major issues I have with this study is its lack of innovation compared with many past studies on this important subject. In addition to that, authors pay no attention to a sound analysis of uncertainty that is needed to be able to have conclusive evidence. The Authors have done also a poor job documenting the state of the art in this subject and do not compare their results against existing regionalization methods. Moreover, this study is not driven by a rigorous hypothesis and hence I cannot see a clear experimental design that would lead to significant conclusions that can be applicable somewhere else.

Specific Comments

This manuscript has the following major technical shortcomings:

- The work on Regionalization in hydrology and land surface modeling is quite substantial. In the work of Samaniego et al 2010 (WRR), for example, the following works were already mentioned: [Mosley, 1981], [Abdulla and Lettenmaier, 1997], [Seibert, 1999] [Hundecha and Bárdossy, 2004], [Götzinger and Bárdossy, 2007], [Pokhrel et al., 2008], [Kim and Kaluarachchi, 2008], [Fernandez et al. 2000], [Troy et al, 2008]. From these old works only [Parajka et al., 2005] is mentioned.
- The method proposed in [Samaniego et al. 2010] was called MPR. It uses regionalization or regularization equations (i.e., pedo-transfer functions derived from soil physics) and scaling operators (averaging rules), also proposed by soil scientists. The concept is clearly explained again in [Samaniego et al HESS 2017]. Now even exist a stand alone method to perform these tasks in any land surface model. See Schweppe et al 2021 GMD https://doi.org/10.5194/gmd-2021-103 code https://git.ufz.de/chs/MPR

- MPR, in other words, uses the same ideas that the authors are proposing in this study (see table 1). MPR has been applied in many papers and projects (not an exhaustive list), but none rfered by the authors:

- Samaniego et al. 2010: https://doi.org/10.1029/2008WR007695
- Kumar et al. 2010: https://doi.org/10.1016/j.jhydrol.2010.07.047
- Kumar et al. 2013: https://doi.org/10.1029/2012WR012195
- Wohling et al 2013: https://link.springer.com/article/10.1007/s12665-013-2306-2
- Livneh et al 2015: https://doi.org/10.1002/hyp.10601
- Nijzink et al. 2016: doi:10.5194/hess-20-1151-2016
- Zink et al. 2016 (German Drought Monitor) https://iopscience.iop.org/article/10.1088/1748-9326/11/7/074002
- Rakovec et al. 2016: https://doi.org/10.1175/JHM-D-15-0054.1
- Samaniego et al 2017: https://hess.copernicus.org/articles/21/4323/2017/hess-21-4323-2017.pdf
- Demirel et al 2017: https://hess.copernicus.org/preprints/hess-2017-570/hess-2017-570.pdf
- Zink el at https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017WR021346
- Zink et al 2017 https://hess.copernicus.org/articles/21/1769/2017/
- Mizukami et al. 2017 (MPR in VIC) https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017WR020401
- Samaniego et al 2018 https://www.nature.com/articles/s41558-018-0138-5
- Demirel et al. 2018 https://hess.copernicus.org/articles/22/1299/2018/
- Samaniego el al 2019: (C3S EDgE project) https://journals.ametsoc.org/view/journals/bams/100/12/bams-d-17-0274.1.xml
- Dembélé et al 2020: https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2019WR026085
- Lane et al. 2020 (in revision in WRR)
- Guo et al. 2021 (MPR and other regionalization techniques apllied in VIC) https://journals.ametsoc.org/view/journals/bams/102/5/BAMS-D-20-0094.1.xml
- Feigl et al 2021 https://link.springer.com/article/10.1007%2Fs00506-021-00766-

- It is sad that all works on this subject are not even mentioned. In my opinion, science is founded on previous knowledge. It could be that assumptions or parameterizations on these studies is obsolete or not adequate. Here is where the authors should provide hints on how to improve the state-of-the-art. Ignoring previous attempts is not a solution and not a good scientific practice.
- The regionalization of parameters of the equations 2 and 3 are similat to those proposed in Samaniego et al 2010a (WRR), and papers that follow.
- In consequence of all these remarks, I can conclude that this study is not innovative, and hence not suitable for publication as a research article. The authors do not analyze the state of the are (e.g. MPR applied to HTESSEL or Noah Schweppe et al 2021) or very innovative approaches like Function Space Optimization (FSO) (Feigl et al 2021). The methods applied here are already common practice in operational hydrology.
- I doubt that the ASCAT data can be used for SM evaluation. This product exhibits serious processing artifacts if a PCA is applied to the fields at large scale (This work was not published but presented at the EGU some years ago. I can provide the files if needed.) ASCAT, as far as I know is a passive signal and hence have a foot print that is too big to represent SM variability at the scale at which this process happens. In the

best case it gets a signal from 2-5 cm depth. This is not what any land surface model can determine well due to many factors well ocumented in the literature. There are better technique nowadays to get SM at the plot scale with a passive method (CNRS Schrön et al WRR). From my own experience, ASCAT did not perform well in Germany or in Europe. For this reason we selected the blended ESA-CCI product (http://www.esa-soilmoisture- cci.org; Liu et al. 2011; Dorigo et al. 2014), which was the best performing product. ESA-CCI SM, however, ended up as the worse in the evaluation made by Rakovec et al. JHM 2016. Here anchor points with a footprint of the eddy covariance station was used. In the Study of Zink et al. HESS, 2017. (figure 6) a footprint of 100x100 m was used to verify the model (with regionalized parameters for whole Germany) against actual soil TDR/FDR moisture measurements. The model is able to reproduce the anomalies. Therefore, authors should compare against other SM products and methods to demonstrate that ASCAT is performing well in these particular sites. Dembélé et al 2020 also tested simulated SM against ESA-CCA and showed acceptable results.