Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
https://doi.org/10.5194/hess-2021-553-RC1, 2022

Comment on hess-2021-553

Anonymous Referee #1

Referee comment on "Advancing stream classification and hydrologic modeling of ungaged basins for environmental flow management in coastal southern California" by Stephen K. Adams et al., Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2021-553-RC1, 2022

Advancing stream classification and hydrologic modeling of ungaged basins for environmental flow management in coastal southern

California

Thank you for the opportunity to review this paper, it was an engaging exercise. Overall this is a well-written paper that presents a seemingly novel approach to stream classification based on hydrologic model error. My remaining concern lies in the lack of literature/background on the physical hydrology and stream classification of flashy and ephemeral streams. While the authors covered the recent classifications of CA including their region of interest, given the focus of this journal and their study aims (specifically the connection they try to make with the PUB initiative), I encourage the authors to include some discussion of the distinct hydrologic processes and rapidly increasing research focus on ephemeral streams more broadly. Further, while modeling ungaged basins and facilitating development of e-flow criteria are related, the aim of the models and specific flow characteristics / processes handled may differ and this should be clearly articulated. At this point the selection of the 2 flow metrics used in the inductive classification feels insufficiently justified as 'best current practices', given the numerous metrics that have been successfully used to describe various aspects of ephemeral/flashy stream flow regimes (See Merrit et al 2021 and references therein as a starting point). This then sets up a somewhat uneven comparison, although I am convinced by the end that the HMC approach is complementary. I would also like to see some background and discussion on past studies tacking hydrologic model error and parameter clustering/regression techniques as a way to handle data limitations and infer watershed similarities and differences to place this method in context (e.g. Ehret et al 2020; De Vos et al 2010; Knoben et al 2020; Beven et al 2020). In summary, this paper would be more compelling if framed in terms of the existing literature on arid stream hydrology and hydrologic modeling/ flow regionalization and the study region were introduced later on in the context of an application, rather than as a singular case study.

Specific comments:

L55: Not quite accurate. Suggest to change to: Lane et al. (2017) grouped unimpaired gages based on their natural streamflow regime before using watershed characteristics to predict the flow type of ungaged reaches.

L60 – Define acronyms (CA, So. CA) before using; Change separate to separation.

Fig 1 – the county delineations in this map seem unnecessary, and it may help to instead add a few major cities as landmarks for the gage locations. Furthermore, to be accessible to a non-CA or -US audience, having the inset map above just show a floating CA rather than the western US seems confusing.

L153 – Suggest to specify that these studies used 'daily average streamflow'

L155 – This paragraph could benefit from some description of what each of these methods/codes actually do, and why this approach was selected. Simply stating a list of indices and packages feels insufficient, as multivariate data analysis is a complex and nuanced process. I also recommend to remove mention of the specific R packages used and simply share a link to the code repository at the end of the paper to support repeatability, a critical part of hydrologic modeling, and make the paper easier to read.

L160 – Similarly to the above comment, ‘removing highly correlated metrics’ is a subjective undertaking and some discussion of how this was done would increase transparency/repeatability.

Figure 2 – I challenge the authors to try to develop a more intuitive flowchart to visually depict this somewhat complex process, including a visual of the example provided in the text below. See Figure 1 in Ehret et al 2020 as one example.

L320 – Do you provide the model performance values to justify ‘successful calibration’

Merritt, A. M., Lane, B., & Hawkins, C. P. (2021). Classification and prediction of natural streamflow regimes in arid regions of the USA. *Water*, 13(3), 380.

Knoben, W. J., Freer, J. E., Peel, M. C., Fowler, K. J. A., & Woods, R. A. (2020). A brief analysis of conceptual model structure uncertainty using 36 models and 559 catchments. *Water Resources Research*, *56*(9), e2019WR025975.

Ehret, U., van Pruijssen, R., Bortoli, M., Loritz, R., Azmi, E., & Zehe, E. (2020). Adaptive clustering: reducing the computational costs of distributed (hydrological) modelling by exploiting time-variable similarity among model elements. *Hydrology and Earth System Sciences*, *24*(9), 4389-4411.

Beven, K., & Smith, P. (2015). Concepts of information content and likelihood in parameter calibration for hydrological simulation models. *Journal of Hydrologic Engineering*, *20*(1), A4014010.