Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on essd-2022-40

Anonymous Referee #2

Referee comment on "The enhanced future Flows and Groundwater dataset: development and evaluation of nationally consistent hydrological projections based on UKCP18" by Jamie Hannaford et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-40-RC2, 2022

Review of "eFLaG: enhanced future FLows and Groundwater. A national dataset of hydrological projections based on UKCP18" by Hannaford et al.

This manuscript deals with a dataset of multimodel hydrological projections across the UK. It presents in a detailed way how this dataset has been produced, but it lacks a description of the dataset itself. I would therefore recommend a major revision for the authors to bring in an overview of what's actually in this (otherwise important) dataset. I would therefore also appreciate more detailed comments on how to use it, notably for interpreting hydrological projections where models have been calibrated against anthropogenically disturbed streamflow observations.

Main comments

- *Calibration period*: Despite (too) long descriptions of hydrological model set-ups, there are important missing information on the calibration of conceptual models. First, I haven't seen the calibration period explicitly mentioned in the text. I assume that is the complete historical 1961-2018 period covered by simobs simulations, but this is to be made explicit.
- *Parameter transferability*: the previous comment calls for another question on the transferability of parameters of conceptual models, which has been shown for some time as an important issue when dealing with climate change (see e.g. Thirel et al., 2015). This issue is unfortunately completely absent from the manuscript, even in the discussion part. This issue is often dealt with by using more or less advanced split-sample set-ups, but many alternative propositions have been made over the recent years (e.g. TodoroviÄ□ et al., 2022). This issue should therefore be dealt with in the manuscript, at the very least as a comment in the discussion part.
- *Calibration on catchments with anthropogenic disturbances*: This issue is seemingly considered as a rather light one in the manuscript (L604-615). I rather disagree here,

as the main underlying hypothesis is not even mentioned here: models calibrated on influenced data will deliver hydrological projections of influenced streamflow in which the amount and seasonality of anthropogenic disturbances (abstractions, reservoir management and so on) is equal to those during the calibration period. Which is clearly an unrealistic feature of the future. This makes the understanding and the use of such projections quite difficult for water managers and stakeholders. I hope that communication around the EFLaG dataset can handle this issue, but it is definitely not convincing in the manuscript.

- *Description of dataset*: as already pointed out by Anonymous Referee #1, this manuscript describes how the eFLaG dataset has been built (which is definitely commendable), but it does not describe the dataset itself. Indeed, there is no e.g. (1) overall summary statistics (temporal or spatial) of present-day-period simulated streamflows or groundwater levels, (2) overall summary statistics of projected evolution or changes over the UK, and (3) no case study example of the numerous time series produced. All these features are essential to get a grasp of what's in the dataset and are therefore in my view a required feature of a data paper.
- *Length of model descriptions*: I guess that the manuscript is currently quite lengthy because of the extent to which hydrological model set-ups are described, at the expense of the more general and important issues listed above. A new balance should be reached in the revised version of the manuscript.

Specific comments

- Table 1: I disagree with the partitioning of uncertainties here: "model structure" or "model choice" (or here "hydrological models" like "climate models") are equivalent. GR4J and GR6J are indeed different models, probably a bit similar to each other than to PDM for example, but "model structure uncertainty" is commonly used as opposed to "model parameter uncertainty" in common uncertainty decomposition of hydrological projections (see e.g. Christierson et al., 2012 for the UK). This relates to one of my main comment on parameter temporal transferability.
- L178-189: Please recall a reference for UKCP18
- L190-196: This issue with Hadley Centre models has been around for the last 15 years at least… But here it means that simrcm streamflow series also have 360 days per year? This is what I can see from the data files, but this is not discussed or even mentioned in the manuscript. I wonder what a water manager would say when looking at those files… It would therefore be necessary to rise the issue in the manuscript and also provide some advice for water managers and stakeholders on how to use such unusual time series, in order to prevent any misuse of even rejection based on lack of credibility.
- L215-217: This spatial disaggregation step is not clear enough. Plus, what is the standard-period in SAAR? And why is HadUK-Grid not used here? All these choices are not enough commented and justified.
- L228-236: Could you give here a simple description of the PET formula (e.g. "Penman-Monteith-like")? Indeed, the choice of PET formula may have strong consequences especially for low-flow changes (see e.g. Lemaitre-Basset et al., 2022). This choice would also deserve a comment in the manuscript.
- Figure 2: The bias-correction factors are quite high for some month/model. This should also deserve a comment, especially with the somewhat overlapping issues of model weighting versus internal variability.
- L291-294: In relation to one of my main comments, I could not find in the eFLaG_Station_Metadata.xlsx file any flag indicating a near-natural catchment (e.g.

belonging to UKBN2) or borehole that would help identifying locations where streamflow/groundwater projections are natural streamflow/groundawater projections. This lack of flag (I noted the FARL field, but this is far from being the only relevant source of disturbances) makes me uncomfortable with this definitely rather non-homogeneous dataset.

- Figure 3: The text is very small and makes maps difficult to read.
- L395: The CHESS version cited here has been superseded.
- Table 3: It is necessary to have this table in the main text?
- L555-559: How is SGI used for evaluation? This is unclear until Figure 5 a few pages later when we learn about the NSE_SGI.
- L634: already written above.
- Figure 5, caption: "NSE_SGI"
- Figure 7: This figure is definitely too small for it to be correctly read and interpreted (see e.g. L698-700). What about using instead a metrics (or a very few metrics) based on the correspondence between FDCs? This would allow showing all locations in the main text.
- Figure 9: This is a poor choice of color scale which makes contrasts much too difficult to read. I would highly recommend using one of the scales available at https://colorbrewer2.org and recommended by the IPCC (2018), and reserve high values for darker colors, for them to be emphasized. Plus, the legend is repeated.
- Figure 10: Same comments as above. Impossible to distinguish between 2-5, 5-10, and 10-20 classes.

Technical corrections

- L105: "EdgE"
- L126: "a,b,c"
- Table 1: Please define "PPE" (Perturbed Physics Ensemble)
- L274: Please define "EIDC"
- L644: missing "models"
- L694: "re"?

References

Christierson, B. v., Vidal, J.-P. and Wade, S. D.: Using UKCP09 probabilistic climate information for UK water resource planning. J. Hydrol., 424-425, 48-67, https://doi.org/10.1016/j.jhydrol.2011.12.020, 2012.

IPCC WGI Technical Support Unit: IPCC Visual Style Guide for Authors. https://www.ipcc.ch/site/assets/uploads/2019/04/IPCC-visual-style-guide.pdf, 2018

Lemaitre-Basset, T., Oudin, L., Thirel, G., and Collet, L.: Unraveling the contribution of potential evaporation formulation to uncertainty under climate change, Hydrol. Earth Syst.

Sci., 26, 2147–2159, https://doi.org/10.5194/hess-26-2147-2022, 2022.

Thirel, G., Andréassian, V., Perrin, C., Audouy, J.-N., Berthet, L., Edwards, P., Folton, N., Furusho, C., Kuentz, A., Lerat, J., Lindström, G., Martin, E., Mathevet, T., Merz, R., Parajka, J., Ruelland, D. & Vaze, J. : Hydrology under change: an evaluation protocol to investigate how hydrological models deal with changing catchments. Hydrolog. Sci. J., 60, 1184-1199, https://doi.org/10.1080/02626667.2014.967248, 2015.

TodoroviÄ□, A., Grabs, T. and Teutschbein, C.: Advancing traditional strategies for testing hydrological model fitness in a changing climate. Hydrolog. Sci. J., https:// 10.1080/02626667.2022.2104646, 2022.