

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1  
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## Comment on hess-2021-153

Anonymous Referee #1

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Referee comment on "Intercomparison of global reanalysis precipitation for flood risk modelling" by Fergus McClean et al., Hydrol. Earth Syst. Sci. Discuss.,  
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**Review of McClean et al.** McClean et al. compare how 4 commonly used global precipitation reanalysis datasets (ERA5, MERRA-2, CFSR and JRA-55) compare to the high-resolution national gridded observation dataset (CEH-GEAR1hr) in reproducing 5 flood events in Northern England. They run each of the 5 precipitation datasets through the CityCAT hydrodynamic surface water flood model and extract flood stage at gauged catchments and flood inundation across 5 basins. The topic of how far we can push the use of these global reanalysis datasets in local hydrological applications is very important. Reanalyses are not observations and can have significant errors, but the authors do a good job of summarising their advantages and highlight some caveats that must be considered (i.e. error of flood peak magnitude, flood peak timing errors and errors in inundation depth/area). The aspect of the number of buildings flooded is a good addition, but as you will see from comments below, some moderation on the conclusions that can be made is needed. Overall, I found this paper nice and succinct and an interesting intercomparison. It's well written and presented. In some places it is too succinct and would benefit from more detail on data and methods used (as highlighted below). My main concern is that some of the conclusions are quite strong and as being based on a sample of just 5 flood events, together with the limited detail on the modelling methods and assumptions, need to be moderated. However, changes to the text should be relatively minor and I recommend McClean et al. be published in HESS.

### Main comments

- **Pg 2 "Study Area" section:** manuscript would benefit from a little more information on the hydrological data used. For example, what is the source, what is the time step (i.e. 15-min aggregated to hourly?), what are the areas of gauged catchments in Figure 1?
- **Pg 2 and 3 "Model Setup" section:** There is very little detail given on the CityCAT model and experimental set-up for the reader. Additional detail on the basic model structure, model assumptions, and how the different precipitation datasets were pre-processed to run through it would be useful. For example, how were the reanalysis grids downscaled to the respective catchments?

- **Pg 5 “Figure 2”:** is a little confusing what is shown. Is it the average of the 5 events shown in Table 2 for each of the 5 datasets? Please confirm and expand in the main text.
- **Pg 8, Figure 5:** Am I correct to assume it cannot be concluded which dataset has the most accurate number of buildings inundated? I.e. there is no true estimate from e.g. insurance claims for these 5 flood events? Should the reader assume CEH-GEAR1hr is closest to reality as by nature it is based on observations and is higher resolution?
- **Pg 10, L247:** What is the reason for “excluding JRA-55” here?
- **Pg 10, L260-262:** “(...CFSR only inundated on average 14.4 % fewer buildings than CEH-GEAR1hr), caution should be used when interpreting outputs from any models based on them”. I think it’s difficult to jump to such a conclusion based on the fact that we do not know the underlying CEH-GEAR1hr ability to capture building inundation across the 5 flood events in reality. Please qualify.
- **Pg 10, L265-266:** “JRA-55 should not be used in flood risk modelling”. This is a very strong conclusion and given your assessment is only over 5 flood events, I would argue it’s too strong. Please moderate recognising the limited sample set of events used.

## Technical comments

- **Pg 4: L126-127:** The main ERA5 paper is now published by Hersbach et al. (2020) and might be useful to add
- **Pg 6:** Table 3: Missing “Building” in “Mean Absolute [Building] Inundation Error” in table column header?
- **Pg 10: L251-252:** Progress has already been made with the new land version of ERA5, ERA5-Land (Muñoz-Sabater et al., 2021), now at 9km horizontal resolution. It would be interesting to see if this leads to improvements over ERA5 based on the spatial resolution increase. Not required in this paper, merely interested to see in future if there is much (any) benefit!

## References

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Muñoz-Sabater, J., Dutra, E., Agustí-Panareda, A., Albergel, C., Arduini, G., Balsamo, G., Boussetta, S., Choulga, M., Harrigan, S., Hersbach, H., Martens, B., Miralles, D. G., Piles, M., Rodríguez-Fernández, N. J., Zsoter, E., Buontempo, C., and Thépaut, J.-N.: ERA5-Land: A state-of-the-art global reanalysis dataset for land applications, 1–50, <https://doi.org/10.5194/essd-2021-82>, 2021.

