Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., author comment AC1
https://doi.org/10.5194/hess-2021-153-AC1, 2021

Reply on RC1

Fergus McClean et al.

Author comment on "Intercomparison of global reanalysis precipitation for flood risk modelling" by Fergus McClean et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-153-AC1, 2021

RC1.1 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?

To address RC1.1, more detail will be added about the river gauges, including their ID numbers, location names, catchment areas, time step etc. The data was obtained via a Freedom of Information request to the Environment Agency.

RC1.2 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?

Additional detail about the hydrodynamic model, assumptions and data pre-processing will be added in response to RC1.2. The reanalysis datasets were used at their original resolution, as shown in Figure 2. Polygons were created for each reanalysis grid cell and the precipitation time series were converted into rates and inputted into the hydrodynamic model over each polygon. Further detail will be added to the description of this process on lines 104-106.

RC1.3 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.

Figure 2 currently shows a different event for each basin which we agree is the source of the confusion, as identified by RC1.3. This will be modified so that each event in each basin is shown within its own subplot (25 in total). Some plots may be moved to supplementary information if necessary.

RC1.4 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?

RC1.4 is correct in assuming that there is no observed building inundation data available, this will be stated in the text. It is reasonable to assume that CEH-GEAR1hr is closer to

reality as it is based on observations of rainfall at weather stations (Lewis et al., 2018). The response to RC2.1 also discusses this issue. However, no claims are made about the number of inundated buildings being more accurate due to the lack of observations, as is usual in these cases.

RC1.5 Pg 10, L247: What is the reason for "excluding JRA-55" here?

In response to RC1.5, JRA-55 is far outside the range of results produced by the other reanalysis products and was therefore excluded as an outlier. We will further clarify that in the text.

RC1.6 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 underlaying CEH-GEAR1hr ability to capture building inundation across the 5 flood events in reality. Please qualify.

As mentioned above, the underlying assumption is that gauge-based products are closer to the 'truth' than reanalysis products. Therefore, we argue that the fact that using reanalysis products caused fewer buildings to be inundated is a cause for concern and shows substantial variation between different rainfall products. However, as pointed out in RC1.6, it is unknown whether the CEH-GEAR1hr estimate is closer to the truth as there are no available observations of building inundation. This will be clarified and discussed further in the text.

RC1.7 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.

We agree that this statement "JRA-55 should not be used in flood risk modelling" will be moderated and the limited sample size acknowledged, as suggested in RC1.7.

RC1.8 Pg 4: L126-127: The main ERA5 paper is now published by Hersbach et al. (2020) and might be useful to add

Hersbach et al. (2020) (RC1.8) and Muñoz-Sabater et al. (2021) (RC1.10) will be referred to in the text.

RC1.9 Pg 6: Table 3: Missing "Building" in "Mean Absolute [Building] Inundation Error" in table column header?

Renaming "Mean Absolute Inundation Error" to "Mean Absolute Building Inundation Error" would add clarity and will be modified in Table 3 (RC1.9).

RC1.10 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!

Thank you, this looks like a good opportunity for further work and collaboration!

Lewis, E., Quinn, N., Blenkinsop, S., Fowler, H.J., Freer, J., Tanguy, M., Hitt, O., Coxon, G., Bates, P. & Woods, R. (2018) A rule based quality control method for hourly rainfall data and a 1 km resolution gridded hourly rainfall dataset for Great Britain: CEH-GEAR1hr. Journal of Hydrology. 564 (June), 930–943.