EGUsphere, author comment AC1
https://doi.org/10.5194/egusphere-2022-829-AC1, 2022

Reply on RC1

Paul D. Bates et al.

Author comment on "A climate-conditioned catastrophe risk model for UK flooding" by Paul D. Bates et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-829-AC1, 2022

Response to reviewer RC1

We are very grateful to the reviewer for their supportive comments and the suggestions for improvement.

The reviewer makes a good point regarding the title and abstract and suggests further highlighting how this work address the lack of transparency in 'official' flood maps. This is a problem not only in the UK, but also elsewhere to the best of our knowledge. In a revised version of the paper we will make changes as suggested to address this point and better emphasise this aspect of our contribution.

We also agree that future work should more fully develop the climate change analysis and look at projecting flood risk using ensembles of climate models and different emissions scenarios. This would be a substantial task and one that would need to build on the work presented here. As the current paper is already 23,000 words long (main text plus supplementary information) we think this would need to be as a separate contribution. We will however modify our paper to acknowledge the limitations of the basic climate change assessment undertaken in this proof-of-concept work and discuss what a robust assessment of climate uncertainty might look like.

The comment regarding the role of local knowledge in national scale models is also extremely pertinent. Whilst, national scale models need to be built from available and standardized data sets, there is a need to incorporate local knowledge in a consistent and traceable way that does not lead to local over-fitting for locations where validation data exists. Local over-fitting can give validation studies the appearance of rigour but may mean that this apparent level of skill cannot be generalised to other places.

Instead, we need to find ways to: (i) recover and assemble local data (e.g. on river bathymetry, flood defences and validation data) into consistent national databases and (ii) replicate the decision making of skilled local modellers in automated frameworks. The goal should be to create national models with local knowledge and skill, but, as we have seen in the US, doing this whole process manually is not a scalable solution. For example, the Federal Emergency Management Agency's national flood mapping program is based on a patchwork of local models however the total cost from its inception in 1969 to 2020 was $10.6 billion, while covering only 33% of the rivers and streams in the country (Association of State Floodplain Managers, 2020).

In the revised paper we will add text to the conclusion to discuss this important issue and thank the referee for drawing our attention to this point.

Detailed comments will be addressed as follows (referee comments in italics):

Line 88: Bloeschl et al. (2019, https://doi.org/10.1038/s41586-019-1495-6) show a significant increase of river flood magnitudes over the UK, specially the northern part,which is one of the clearest hotspots in Europe for that matter.

Thanks. This is a useful reference which we will add to the paper.

Line 212: under the RCP8.5 scenario only? Are therefore the different worming levels correspondent to different future times?

The UKCP 12km regional model simulations we use for the climate projections represent 20-year time slices centred on 2030, 2050 and 2070 under RCP8.5 only. These are the 'official' UK climate projections produced by the UK Met Office and therefore an obvious choice and starting point for our work. We interrogate these simulations to find the points when particular specific global warming levels are crossed and then present the loss results based on the changed climate to this date. The different warming levels do therefore represent different future times, but an advantage is that the approach gives a degree of scenario-independence. Whilst the RCP8.5 trajectory is increasingly considered unlikely we only use this scenario to extract results at specific warming levels so are make no judgements about its probability.

It might also be useful to note that, at least until mid-century, the differences over the UK amongst the different emissions scenarios are relatively small. Because we consider near-future projections of flood risk, the impact of climate scenario choice is hopefully minimized. We will add further text to make these points clear.

Line 216: uncertainty in hydrological modelling is accounted for. How? What are the regionalised "results"? How regionalised?

We simply relate change factors to catchment physical characteristics in different UK regions to extrapolate the set of hydrological model outputs to basins that we have not explicitly modelled. We will add further text to make this point clear.

Line 220: for how many years are the stochastically generated events simulated over the UK? How many events per year are generated on average? (PS. at page 16 I see it is 10000 years)

The event rate is determined from an empirical distribution fitted to the annual event counts in the historic gauge data. For each year of the 10,000-year simulation, the number of events to be generated was sampled from this distribution. This resulted in ~343,000 events, ~170,000 of which have a >1 in 5-year magnitude event in at least one catchment (so ~17 per year). This is already detailed in the Supplementary Information on lines 432-439.

Table 1: it would be very informative to also stratify the results by river flooding, pluvial flooding, and coastal flooding.

This would indeed be nice to do, but the data sets we summarize rarely report the information in this way so this unfortunately cannot be done. We can however split our model results by flood hazard type and will add this to the revised manuscript.

Line 267: labelled 2, in "red"?

Good spot, this is a mistake and will be corrected.

Table 2: for "ABI" and "This paper" one could report also other statistics for the annual damages (not only the mean but, for example, the 25% and 75% quantiles, or more) which would show whether the distribution of "observed" annual damages is captured by the model, and that "This paper" is much more informative than NaFRA and CCRA3.

This is a good idea; we will add this.

Line 479: for past changes, see e.g., Bertola et al. (2020, https://doi.org/10.5194/hess-24-1805-2020).

Thanks for drawing our attention to this very useful reference. We will add this to the paper to support the point made here.

References

Association of State Floodplain Managers: Flood Mapping for the Nation: A Cost Analysis for Completing and Maintaining the Nation's NFIP Flood Map Inventory, Madison, WI, 2020.