

## Response to Reviewer 1

We thank reviewer 1 for the excellent comments and suggestions, which are very constructive below is a point by point response.

Dear authors,

first of all thank you for your paper, I like it. Congratulations for the vision of bringing code to data, instead of data to code and for open the possibility for AI. Here are my notes, hopefully helpful ones:

corrections:

- Paragraph 35, line 4 "form cars" > from cars;

Changed

- Paragraph 45, line 1 "significant research challenge" > a significant research challenge;

Changed

- Paragraph 45, line 1 to 2 "This is closely linked to the challenge of how" > This is closely linked to questions such how to";

Changed

- Paragraph 45, line 3 to 4 "Initialising the snowpack on a global scale which is important for flood forecasts is an example of such a challenge." > maybe just "initialising the snowpack on a global scale which is important for flood forecasts"

Agreed and changed

suggetion:

- Paragraph 40, line 2 "does not conserve mass" > the mass in the system does not remain constant (principle of mass conservation);

Excellent suggestion for improved readability - done

- Paragraph 45, line 3 to 4 "Initialising the snowpack on a global scale which is important for flood forecasts is an example of such a challenge." > maybe snow calculation module?

Not sure that would be the right term – will be reworded to “Providing the initial conditions of the snowpack “ which hopefully addresses the reviewers comment

- Paragraph 50, line 3 to 4 "which will allow domain experts (natural hazard scientists)" > maybe just natural hazard scientists

Included a 'such as ' to qualify as not all domain experts are natural hazard scientists.  
Thank you for pointing this out

- Paragraph 50, lines 4 to 5 "GPU based architectures are particularly suited to be used by artificial intelligence and machine learning" > well also FGPAs and ARM-based systems this will require you to rephrase the subsequent statements about GPUs...

Excellent point – rephrased to “GPU based Novel architectures (i.e. GPU/FGPU etc) are particularly ...”

- Paragraph 50, line 3 to 5 and Paragraph 60, line 1 "Other novel ways need to be found to address the need of increasingly compute and storage hungry forecasts and simulations and should therefore also include computing solutions beyond supercomputers" > maybe just forecast that are increasingly demanding in terms of computing and storage... computing solutions beyond supercomputers? OpenIFS@home example not familiar and I did not clearly understand your explanation.

This is a good point, removed storage hungry as it is misleading & expanded the explanation of OpenIFS@HOME slightly

- Paragraph 70, Line 2 "provide maximum benefits to user" > maybe just provide maximum benefits

Done

- Conclusion is ok, but I would be more bold and incisive in this section.

OK we have tried to be more bold and incisive by extending into additional areas such as CO2 monitoring and the future digital twin 😊

- rephrase:

- Paragraph 40, lines 2 to 4 "It is also essential to capture and represent in our predictions as many of the model and other uncertainties as necessary: for example, we know that many parts of the Earth system are inadequately observed (Beven et al 2020). However, finite computing and requirements to produce timely forecasts will only allow a limited number of ensemble members to represent these uncertainties." > "model and other uncertainties", maybe just uncertainties? > how does "many parts of the Earth system are inadequately observed", better link to the previous statement about uncertainties > "finite computing and requirements", maybe just requirements (or even resources)? > "ensemble members", maybe just complete set of forecasts;

Deleted the observation constrain paragraph and addressed the issues regarding ensemble member differently (see comments from reviewer RC1)

- Paragraph 45, line 5 and Paragraph 50, lines 1 to 2 "The compute and storage power of novel HPC architectures is required to improve the representation of processes and 50 uncertainties, however existing large code bases to model

and forecast natural hazards are ill equipped to scale for such novel architectures." > maybe like this: Novel HPC architectures, both for computing and storage, are required to... at the same time, existing codes and algorithms need to be adapted so that they can take advantage of these new resources (speedup and scaleup of parallel processing);

Thank you adapted the rephrasing above

- Paragraph 80, lines 3 to 5 and Paragraph 85, lines 1 to 2 "Computer, whilst the other tasks are more suited to be executed in a cloud environment, although these different technologies will converge in the future. Research into the efficient managing and orchestrating of workflows spanning these different compute environments will crucially improve the overall performance of a forecast and model change and thus allow a larger proportion of limited human and compute resources to be used to improve natural hazard forecasts and models." > too long, please rephrase

Done – thank you