

## **Authors' responses to interactive comment RC3 from Jan Verkade**

### Overall impression

The manuscript describes the 'transition' of the Environment Agency towards using probabilistic fluvial flood forecasts. The topic is very relevant and worthy of analysis indeed.

We thank the reviewer, Jan Verkade, for his very constructive feedback, which will help improve this manuscript for its final publication.

Having said that, I think the manuscript would benefit from (i) a better description of what it aims to achieve (ii) additional analysis that would justify the recommendations that are made.

Re (i). The research, through the interviews, provides data that documents the view of various individuals at a single point in time, regarding a change in an organization's processes and procedures. I like to make the analogy with "observations" in the quantitative sciences. Observations can be used to provide evidence of the plausibility of some hypothesis - or of the absence thereof. Such a 'hypothesis' element would greatly improve the quality of the manuscript - and provide a response to the "So What?" question that, post reading the manuscript, continues to linger in my mind.

We will rewrite the Introduction and Context, which, combined, will provide a better framing for this paper. This new Introduction section will highlight the EA's current policy and objectives with regards to undertaking/implementing probabilistic forecasts in practice. This will form a basis for the "hypothesis" element and a framework for the objectives of this paper. We will additionally clarify why these interviews were undertaken and why they are important to help capture and document this significant transition. Because this paper should be of wider benefit to the geoscience communication community, we will also answer the "So what?" question more clearly in the Discussion, highlighting what we have learnt from these interviews for other geoscience communication situations.

Re (ii). Based on the interview data, recommendations are phrased. While some of these may be very worthwhile indeed, I think recommendations can only be made based on an analysis where objectives are offset with achievements or projected achievements. Ergo, I think recommendations can only be made if the agency's objectives (with respect to the production and use of probabilistic forecasts) are described. Have these objectives been described in the 2016 National Flood Resilience Review that is cited, maybe? Or are documented elsewhere?

This is partly answered in the response to the comment above. We will rewrite the Introduction and Context into one Section which lays out the landscape in which this work finds itself. We will refer to policy documents about the forthcoming transition, as well as about the transition to 2 scenarios, as both of these transitions are part of a wider move.

Maybe the above issues could be resolved through the following:

We thank Jan Verkade for this step by step help into improving the paper's context and rationale. We will adapt the Introduction and Context sections, as well as the Discussion, as per the comments below.

- There is a document that says that the EA should be moving towards probabilistic forecasting. (NFRR but also the 2008 Pitt review?)  
And the report by Dale et al. (2013). We will expand on statements and findings from these documents (and others) in the paper.
- This overall objective has been adopted by the agency and existing projects/policies (evidence, please!) are in place to try and achieve that objective. As an aside, I wonder if this is indeed the case.  
While these are internal documents, we will work with the EA paper co-authors to find citeable EA current and future practice documents to make this context more tangible in the Introduction.
- Specifically, this means that EA will have to do this-and-this ('specific objectives'). If these specific objectives have been described in a policy document, great - use these in your manuscript. If not described, make them up - what could be plausible objectives?  
We will tackle this point to clarify the context and objectives of this paper in the Introduction. We will provide evidence for the UK government's and the EA's policy to move towards probabilities. While the new probabilistic flood forecasting system is currently being developed at the EA, there is lack of clarity about how this will affect the decision-makers, who are key players in the system and will ensure that it is successful in practice. This is the rationale for our paper.
- To meet those specific objectives, the agency will have to do this-and-this. This would be the description of your organizational transition.  
See response to comment above.
- We've gathered some data to try and identify where in that process the EA currently is, what pitfalls they see and where they think the challenges are.  
One of the pitfalls which we will identify is the lack of clarity about how this will affect the decision-makers, who are key players in the system and will ensure that it is successful in practice. This is the rationale for our paper (see response above).
- Offsetting specific objectives versus these 'observations', we note that . . . agency is well on its way / straying from its path . . . either way, recommendations are. . .  
These interviews provide the basis for the recommendations we make, which will be rephrased to link more clearly with the interview results/"observations". We will however not be able to comment on the EA's overall progress on the transition, as this depends on many other elements which we are not tackling in this paper. We will clarify this in the paper.
- It's useful to publish this in the scientific literature so that (i) scientists may comment on implementation of science in a public organizations; (ii) other organizations may benefit from this; (iii) in assessing the progress of their transition, the EA can benefit from this analysis.  
And (iv) useful for the geoscience community, within the wider topic of communicating complex science for decision-making within operational organisations.

So overall - I think this manuscript is a rough diamond that needs polishing. I am very much interested in seeing the end result - and would be happy to help out through additional reviews if these would be considered helpful.

## Other points

I think the above would require fairly significant restructuring of the manuscript and I don't think it's worthwhile to, at this stage in the review process, point out any minor issues.

Some scattered observations though:

- The citation in the title does not pertain to the theme of the manuscript. I also find that the manuscript tends to use language that, at times, can be a little more 'dramatic' than required. This is exemplified by the title's "front line perspectives" (a change in processes and procedures is not a war!) and the reference to "Armageddon" (which, by the way, is a settlement on top of a hill - the 'Ar' originates from the Hebrew 'har' which means mountain - and not prone to flooding and hence reference thereto is somewhat unfortunate - but I am digressing now). Additional examples: "the chaotic and far from certain world we live in", "urgently required", "high priority recommendations".

We will tone down some of the language. However, where language has been used in quotes or there is precedent in the current policy in this area we will leave it. For example, "front line" is language often used by the EA. We think that the title captures the paper's content very adequately. Indeed, the question raised by the interview and used in the title: "Are we talking just a bit of water out of bank? Or is it Armageddon?" reflects the binary perspective of duty officers on this decision-making problem. This is a challenge at the heart of this paper and at the heart of the probabilistic forecast-lead decision-making process. The title will be explained in the paper abstract and introduction.

- A glossary is, I think, unnecessary, and I find the asterisks a little distracting. We disagree and think this is very helpful for readers outside of this field of expertise, who are interested about geoscience communication.
- The manuscript's theme is the 'transition to probabilistic forecasting'. The amount of text that is dedicated to that theme, however, is relatively small. For example, the Results sections spans lines 190 through 464 - yet only as of line 425 are the probabilistic forecasts discussed. Similar observations can be made to the manuscript as a whole. In my view, the reader is distracted a lot from the main points. We agree and will restructure the paper to highlight its main points more clearly. Section 4.2 will be merged with 4.1. Section 4.3 (highlight result section) will be reformatted into the same format as the other result sections, with a mix of text and supporting quotes. Table 1, Fig. 5 and Appendix C will all be expanded on in the text. In order to link more clearly the interview results and recommendations, we will:
  - Link Table 1 topics with 1 or 2 recommendations.
  - Rewrite Discussion section to combine Sections 5.1 and 5.2, where each paragraph will present: interview finding – literature finding – recommendation.
- The language used to describe the somewhat technical aspects of predictive uncertainty could be a little more precise. Some examples:
  - It's not forecasts themselves that are uncertain. What's uncertain is the future water levels, streamflows, etc. - also even if an estimate of those future values is made through a forecast. When that residual uncertainty is quantified or expressed, we have available 'estimates of uncertainty', rather than 'uncertainty'.

We will make sure that this is clarified throughout the paper: the forecasts display the uncertainty in our estimates of the future water levels, streamflows, etc.

- Uncertainty estimates and probabilistic forecasts are not the same thing. Hopefully the level of uncertainty can be expressed as a probability, but very often it cannot. I wouldn't want to use the terms interchangeably in a manuscript.

We will be careful to rephrase relevant misleading parts of the paper and will clarify this in the Glossary.

- In a manuscript that discussed 'uncertainty', you have to be a little careful with using the word 'certain' ('certain decisions', 1609). In most of those cases, the word 'certain' can be either safely omitted, or replaced by 'various'.

We agree and will find synonyms.

- Minor, minor issue: In author contributions, why not simply reference first names? "Hannah, Louise and Susan posed the original question" is a lot easier to read than "H.L.C., L.An. and S.M. posed the original question".

This is the convention and we will keep this author contributions format.