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Interactive comment on "A Bayesian decision approach to rainfall thresholds based flood warning" *by* M. L. V. Martina et al.

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Comments on 'A Bayesian decision approach to rainfall thresholds based flood warning'

By M L V Martina, E Todini and A Libralon

This is a good, well-presented paper which places on a sound scientific footing a challenging problem in real-time flood warning, namely how to extract and present the minimum information needed by non-technical decision-makers from technically-complicated flood-forecasting models. In this respect, the authors have come up with a desirable solution in the form of two sets of graphs which can be used operationally by the non-technical decision-maker. However, the overall approach as implemented by the authors raises a number of issues which require some further clarification and

discussion in the paper to ensure that the limitations of the approach as presented are fully appreciated, particularly by those who might be interested in using it operationally.

Before raising some specific issues, it is pertinent to discuss why it is necessary to pursue this approach. In some countries, the responsibility for issuing flood warnings rests with professionals who have the appropriate technical background to interpret all of the information provided by real-time measurements of rainfall, river level etc as well as the forecasts provided by meteorological and hydrological models. However, in other cases, the responsibility rests with non-technical users, such as a mayor, to make the decision to issue the warning. There are many circumstances in other fields where non-technical decision-makers rely on highly-qualified technical personnel to interpret ALL the available information and give them best advice concerning the decision to be taken. One of the worrying consequences of the approach espoused here is that it seeks to reduce the available information to a level which the non-technical person can interpret directly and make the decision. There are a few worrying consequences of this. Firstly, valuable information may be lost in the information reduction process. Secondly, it implies a failure on the part of the organisation concerned to put in place the technical services and personnel needed to support the decision-maker. It must be clarified by the authors that the proposed technique is not an alternative to the present tendency of using the chaining: QPF-Hydrological Model-Predictive Uncertainty Model, but rather a simplified technique to be used mainly for flash floods and in any case as a preliminary rough guidance prior to the use of the above mentioned forecasting chain. The authors do refer to the use of their approach as a back-up in the event of failures during an emergency event, eg electricity failure (no rainfall data available!), model instabilities (models which suffer from this problem should not be used in real-time in any case), which may be justifiable, but the feeling conveyed by the paper is that the approach is being proposed as an operational approach in its own right. The authors are encouraged to discuss this issue and to elaborate on the circumstances in which their approach might be used.

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Interactive Comment

The following specific issues merit some attention by the authors:

(i) the reviewer had some difficulty with the treatment of rainfall forecast uncertainty in the paper. Although there are passing references to this, no account is taken of it in equation (2), and only by deduction does one arrive at the conclusion that perfect knowledge of future rainfall is being assumed before this is suddenly announced towards the end of the case study! This is far too late in the paper for a critical assumption like this to be introduced, and it also means that the results are of theoretical rather than practical value. This is okay provided it is made very clear at the outset, and also in the abstract.

(ii) The authors use of a utility function approach to determining the best decision is perfectly valid from a theoretical point of view, but, given the rationale for the paper, there is no discussion whatsoever as to how one might go about parameterizing the utility cost function given by equation(1). This is likely to be a difficult exercise with a non-technical stakeholder/user. Methods of deriving utility functions are described in the literature, but it is not clear to what extent they would work for the case under consideration here.

(iii) It is rather surprising that the skill of the approach drops of so quickly after six hours when perfect knowledge of rainfall is being assumed. This suggests that there is some failure in the method/loss of information for longer duration storms, and it is not obvious why this should be. It would be helpful if the authors could provide some insight into why this happens, as it will clearly have an important bearing on how the approach performs when uncertain rainfall forecasts are used.

(iv) The final conclusion concerning the relative importance of the different uncertainties is little more than a plausible value judgement at this stage. Their relative importance will vary with lead time, the response time of the catchment etc, and so some qualification of this statement is therefore needed. The final approach will need to take account of all these uncertainties, and, as is the case with real-time flood forecasting

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models, this will not be a trivial exercise.

Some specific comments:

Title: Since the whole exercise is model-based, a more appropriate title (with some re-wording) might be:

'A model-based Bayesian decision-making approach to flood warning based on rainfall thresholds'

P 2671: T, the rainfall accumulation time, is shown as Tr in Fig 3

P 2672: The percentiles are 33% and 66% - also later. Section 2.3, Step 2: the sentence at the end of the first para needs amplification. As I understand it, there is a different pdf for each duration (f(q,v/T))and each AMC category, not just each duration (eg see Fig 2, but this implies that there are just 3 pdfs?) P 2673 Qc in Fig 5; Q* in Eq 1? Also, Eq 1 should be conditional on AMC?? Also Eq 2. Is there a different Fig 6 for each duration and AMC - this should be made clear in the caption. See also Fig 2 Section 3: It should be made clear here that the procedure requires foreknowledge of both the total rainfall and the duration. One gets the impression from the text that the storm is forecasted. Section 4: Title: 'Framework' rather than 'Frame'. This title is misleading, as it is not the forecasting performance that is being evaluated, but the ability of the procedure to capture the information from the full model. They are not the same!

Section 6: Second para: assuming perfect knowledge of future rainfall is not the same as a deterministic forecast, since the performance of the latter in the proposed frame-work would be much worse than reported here!

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 2663, 2005.