

Statement of confidence in the NaFRA probability bandings

Report Provided to the Environment Agency

Supplement to HR Wallingford Report EX 5953

Technical Note MCR4368-01



Address and Registered Office: HR Wallingford Ltd. Howbery Park, Wallingford, OXON OX10 8BA
Tel: +44 (0) 1491 835381 **Fax:** +44 (0) 1491 832233

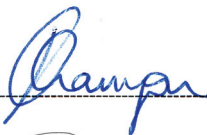


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1. *Introduction*

This paper aims to give an indication of the level of confidence that the reported *flood probability* category is correct and, if incorrect, the likelihood that the true value lies within either of the other two probability bands.

2. *Background*

During NaFRA 08 an initial investigation into the uncertainty within the NaFRA 08 outputs for three pilot catchments was undertaken and reported within the HR Wallingford Report EX5953.

The results presented in the 'uncertainty' report are not directly useable for the stated purpose of expressing the confidence in the reported NaFRA 08 probability bandings without some re-working (firstly the report focuses on the five likelihood categories used internally within Environment Agency rather than the three bands made publicly available; and, secondly, the summary results within the report do not allow a direct estimate of the confidence in the assignment of a particular banding to be made.

3. *Approach*

The RASP-MC analysis tool used within the uncertainty analysis provides a probability of flooding at a range of confidence levels for each Impact Zone within the three trial catchments (used in the uncertainty analysis project). These are defined at intervals of 1%ile (i.e. providing an 100 potential flood probability distributions for each Impact Zone). The range of values obtained represents the uncertainty in probability of flooding for that Impact Zone.

This approach is best illustrated by way of an example. Consider an Impact Zone that has, for example, been categorised as Significant through the “traditional” NaFRA 08 process. The number of times a Significant, Moderate or Low banding is obtained for this Impact Zone based on the 100 potential results from the uncertainty analysis are then summed to give the percentage chance of a given Impact Zone being correctly categorised or, if not, the chance of the true result lying within either of the other categories. By summing across all the Impact Zones within each of the three pilot catchments an ‘on average’ view as to the likelihood that the flood probability within any given Impact Zone will be correctly reported (as either Significant, Moderate or Low) can be obtained. The associated chance of the true value lying within either of the other two categories can also be obtained.

4. *Assumptions and limitations*

In reviewing the results the following key assumptions should be considered:

- The results are “on average” across a large number of Impact Zone - they do not reflect the local context of a specific Impact Zone.

- The assignment of a flood probability category to an Impact Zone is based on the lowest Impact Cell within that Zone. The category applied to the Impact Zone is then considered representative of all Impact Cells within that Zone.
- The analysis deals with many of the main uncertainties in the input data (crest level, water level source etc) and some model parameters (the uncertainty introduced through the use of the RFSM compared to a fully hydrodynamic model). These have been discussed more fully in the uncertainty analysis report EX5953 (and associated joint Challenge Workshop in December 08). The uncertainty analysis does not however represent gross data error (missing or incorrect data) or systematic model errors. These errors, could significantly modify the results within a given Flood Area – the impact of this additional uncertainty is in part mitigated via the Area review of input data, however in some locations gross data errors, not captured here, are likely to persist. It is therefore important to note that these results are provided as indicative of the “on average” results at a national scale.
- The category reported through the “traditional” NaFRA process is assumed to be represented by the 90tile confidence interval from the uncertainty analysis. By adopting the 90tile confidence interval (rather than a median or mean value) a degree of conservatism is introduced that can be used as a proxy for the “unknown” uncertainties not captured directly within the formal uncertainty analysis.
- Only three catchments have been analysed (3000, 3904 and 4300). The combined results from these catchments are assumed to represent the national picture.
- At a local scale, considerable variation from the reported confidence levels can be expected. The variation from the national “on average” values will reflect the quality of the local input data as well as the skill of the model in specific circumstances. In future years locally specific reporting of uncertainty could be included (as discussed in EX5953). The results provide here, however, focus on the national “on-average” values.
- The uncertainty analysis does not include the Area output reviews (the RASP-MC analysis, that forms the basis of the figures presented here, is based on the input data and unmodified output from the NaFRA 08 model). The process of Area Output Review, that takes place prior to publication of results, can be considered to reduce the impact of both systematic model and residual gross data errors.

5. Results

The following three figures show the level of confidence in the assignment of each of the three flood probability categories. These results can be described as follows:

Significant flood probability category – where an Impact Zone has been assigned a “*Significant*” flood probability there is a 90% that this is correct. There is a 10% chance that the true category is “*Moderate*” and a <1% chance that it is “*Low*”.

(Note: Based on Area Output review, of the Impact Cells defined as *Significant* within the three trial catchments <5% where change to *Moderate* and <5% to *Low*.)

Moderate flood probability category – where an Impact Zone has been assigned a “*Moderate*” flood probability there is a 50% that this is correct. There is a 25% chance that the true category is “*Significant*” and a 25% chance that it is “*Low*”.

(Note: Based on Area Output review, of the Impact Cells defined as *Moderate* within the three trial catchments <5% where change to *Significant* and <5% to *Low*.)

Low flood probability category – where an Impact Zone has been assigned a “*Low*” flood probability there is a 60% chance that this is correct. There is a 20% chance that the true category is “*Significant*” and a 20% chance that it is “*Moderate*”.

(Note: Based on Area Output review, of the Impact Cells defined as *Low* within the three trial catchments 35% where change to *Significant* and 10% to *Moderate*)

Note: Within any local area the uncertainty within the assigned probability category may be considerably higher than these “on-average” values, and hence in all circumstances local data quality should be considered and local staff consulted.

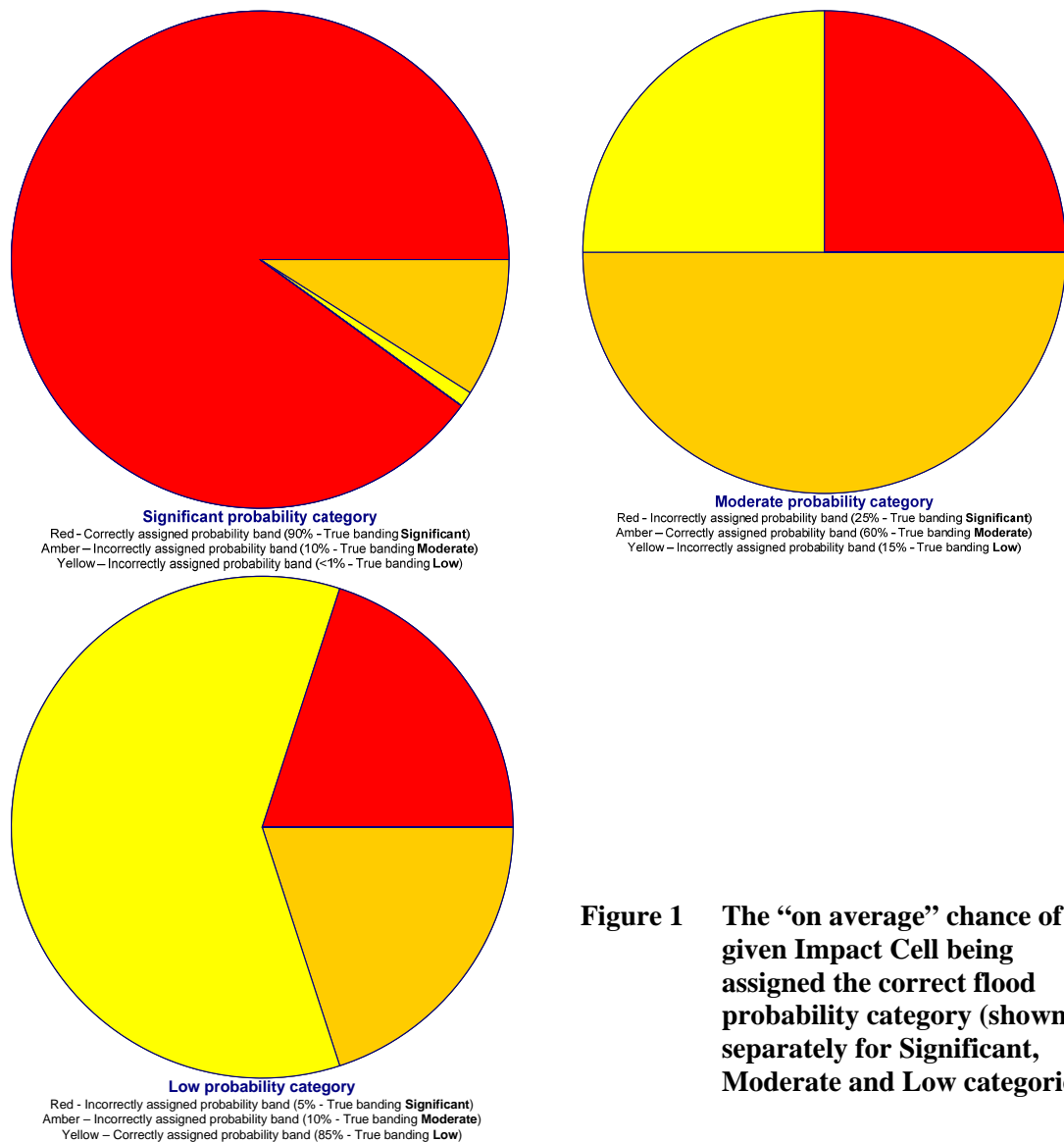


Figure 1 The “on average” chance of a given Impact Cell being assigned the correct flood probability category (shown separately for Significant, Moderate and Low categories)

6. *Recommendations*

Further trial the uncertainty analysis and report at a local scale (Impact Cell specific) the uncertainty within the results from further NaFRA studies (allowing aggregation to a range of scales of interest).

7. *References*

HR Wallingford EX5953 Confidence in the NaFRA 08 Outputs – A trial application.