

Identification of Flood Indicators

R&D Technical Summary E1-119/TS

The Environment Agency has a set of about 70 environmental indicators, which help to show how the Agency is contributing to its objective of sustainable development. It is recognised that some of the indicators are not ideal and a programme of work has been started to extend improve the quality of these indicators. As part of this programme the Agency needs to replace the indicator for Major Flooding Incidents because there is no clear definition of what is a major flooding incident and it is difficult to update. An alternative indicator based on hydrological and particularly extreme event data is considered more appropriate to analyse patterns of flood behaviour over time. The aim of this project was to develop this flood indicator.

A number of catchments were identified by the Agency as being suitably representative of UK conditions and the application of a set of criteria allowed the two most appropriate gauging stations in each Region to be selected. The selection criteria are based on:

- Catchment Size > 50 km²
- Length of digital record > 20 years of record
- Must be currently recording (i.e. not decommissioned)
- Flood flows should not bypass the measurement structure or channel

Two gauging stations were selected from each Agency Region (i.e. 16 gauging stations in total). However due to the groundwater dominated response or limited record availability of the selected catchments in the Thames area no suitable gauges were adopted from this Region.

For each gauging station the analyses involved:

- Extraction of flood peaks above a specified level from the digital records – usually held on the Agency's 15 minute flow and level archive (Hydrolog)

- Checking the independence of these flood peaks according to the criteria given in the Flood Studies Report (FSR) and Flood Estimation Handbook (FEH).
- Definition of Peaks over Threshold n level (POT_n), where n is the average number of flood peaks per year in the length of record, for a common 20 year period between 1 Jan 1981 to 31 Dec 2000
- Creation of POT₃ and POT₅ data sets for the full period of digital record at each station based on these thresholds
- Merging of Hydrolog POT_n data with POT series given in the FEH, checking similar POT thresholds apply and using the appropriate ratings to convert FEH flows to levels
- Analyses of the POT series in terms of the number of flood peaks per year
- Analyses of the POT series in terms of the periods of high water levels as defined by the number of hours above the POT_n threshold each year.
- Analyses of the Annual Maximum (AMAX) series in terms of the maximum recorded level each water year (October to September).
- Examination of the trend or cycles in the size of flood peaks (AMAX series) and the number of flood peaks per year based on linear regression and moving averages.
- Recommendations on the most suitable flood indicator
- Development of an aggregated Indicator

The main results from this study are:

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- Positive regression gradients exist for the number of flood peaks per year and these trends are significant at eight of the 16 stations studied.
- The regression gradients are less steep at stations with longer records indicating that the cyclic nature of flood frequency could suggest short term records and gradients are influenced by these cyclic trends.
- The increase in the size of floods (AMAX series) does not appear to exhibit a significant trend at 14 of the 16 stations.
- The number of hours of high water levels per year shows a periodic fluctuation at many stations. Many stations show an increase in the number of hours of flooding in 2000 and 2001 although greater periods of high water have been recorded at stations with longer records. These patterns may be influenced by the short term trends and the relatively dry periods in the mid 1970s and early 1980s.
- It is recommended that a flood indicator threshold should be the POT3 level for the same period of record (e.g. 1 Jan 1980 to 31 Dec 2000) at each station.
- Various combinations of stations have been tested to develop an aggregated indicator with geographical location and altitude being the most appropriate indices for aggregation.

This R&D Technical Summary relates to information from R&D Project E1-119 contained in the following output:-

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