Software implementation of a revitalised rainfall-runoff method for event-based design flood estimation

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The Flood Estimation Handbook (FEH), published by IH (1999), presented an event-based rainfall-runoff method for design flood estimation in the UK. The method was based on the unit hydrograph and loss model concept developed by NERC (1975) in the Flood Studies Report (FSR). A revitalised FSR/FEH rainfall-runoff method has been developed at the Centre for Ecology & Hydrology in 2005 with the aim of improving the existing FSR/FEH method. The revitalised method is based on a new lumped conceptual rainfall-runoff model, the Revitalised Flood Hydrograph (ReFH) model, which enables a more direct and transparent description of the flood-generating mechanisms. The associated method for design flood generation using the ReFH model introduces the concept of seasonal variation in design rainfall, initial soil conditions and initial baseflow.

Two software packages have been developed to support the dissemination of the new method to the user community. Firstly, a user-friendly version of the design method has been implemented in an EXCEL spreadsheet and made available free-of-charge. The spreadsheet guides the users through all the steps necessary to generate a design flood hydrograph of the required return period. Once the analysis is completed, the spreadsheet can produce an audit report in a standard format, detailing how the method was applied, the results and any deviations from the recommended standard procedure.

Secondly, a software package providing users with comprehensive access to the method was developed, including ReFH model parameter estimation from observed flood events (sub-daily data), flood event simulation and reservoir routing studies. The software allows users to build up an archive of observed flood events and estimation of the ReFH model parameters through analysis of the events. The baseflow model pa-

rameters can be estimated by analysing the recession part of the observed hydrographs and the remaining parameters (time-to-peak and soil depth) can be estimated through an autocalibration procedure comparing observed and simulated hydrographs for all events simultaneously. For each event in the optimisation, the initial soil moisture conditions are estimated based on continuous simulation of up to two years of antecedent soil moisture conditions at a daily time step. The software package is a generic tool for flood event analysis applicable also to catchments located outside the UK.

Institute of Hydrology (1999) *Flood Estimation Handbook*. Institute of Hydrology, Wallingford, UK.

Natural Environment Research Council (1975) *Flood Studies Report*. NERC, London, UK.