

Joint Defra / EA Flood and Coastal Erosion Risk Management R&D Programme

SCHO0307BMES-E-P

Rainfall-runoff and other modelling for ungauged/low-benefit locations

Science Summary SC030227/SS

Across England and Wales, the Environment Agency provides only a general Flood Watch service at locations that are ungauged and associated with low benefit from flood warning. Providing an improved, more targeted flood warning service is possible. CEH Wallingford has produced strategic and operational guidance on the technical possibilities available: both now as “best practice” and, through the identification of research opportunities, in the future.

The Science Report provides an overview of approaches for modelling at ungauged locations. The emphasis is on the types of modelling problem commonly encountered and the general approaches that can be considered when addressing them. Whilst rainfall-runoff models are the main focus of attention, broader discussion encompasses hydrological channel flow routing models and hydrodynamic river models; simpler empirical models including level-to-level correlation methods are also considered.

Even for specific rainfall-runoff model types, it is unusual for a methodology to be sufficiently well established for its application to be routine for ungauged forecasting purposes. The overview first focuses on the nature of the ungauged problem and the modelling approaches available when considered at a generic level. Subsequent discussions of specific model types serve to illustrate how some of these approaches have been applied and their shortcomings. Possible opportunities for improvement are identified.

An important aspect of ungauged modelling is the ability to utilise digital spatial datasets on properties of the terrain, land cover, soil and geology that will influence the hydrological response. The more useful datasets for use in modelling are identified. Although not a natural choice for application to ungauged locations, the scope for using purely statistical (empirical) modelling approaches, such as level-to-level and structure function methods, is considered. Similarly, the application of real-time updating techniques at ungauged locations is not immediately

obvious, but a number of methods of transferred-error updating are considered as deserving of future attention. More broadly, the opportunities for improved flood warning for ungauged locations relating to advances in monitoring and uncertain triggers for warning are considered. Topics addressed encompass improved methods of areal rainfall estimation, remote sensing of land surface properties and river height and width, stage-discharge curve derivation, and flood warning trigger mechanisms incorporating uncertainty and costs of alternative actions.

The Report closes with an overview of the operational guidelines for modelling at ungauged locations, providing a convenient synthesis of the main issues and approaches. It also provides, through reference to a more detailed appendix, case study illustrations of selected methods of model transfer to ungauged locations. A set of specific conclusions and recommendations are then identified. Some closing remarks highlight ongoing national and international research activities of relevance to flood forecasting and warning for ungauged locations.

The project has also produced an Operational Guidelines document. This document provides an overview of approaches for modelling at ungauged locations to guide operational practice both now and in the future. It also serves as a “roadmap” to the accompanying Science Report where more detail can be found. The emphasis is on the types of modelling problem commonly encountered and the general approaches that can be considered when addressing them.

The Science Report constitutes the main output from the project. It presents technical information and a review of current practice and aspirations for modelling of ungauged and low benefit locations. This provides a background against which to categorise and prioritise practices, model data sources etc, and to recommend improvements. It will be of interest to all involved in operational real time flood forecasting

modelling. The Operational Guidelines document is intended to assist Environment Agency staff in developing flood forecasting services. The intention is that the Operational Guidelines should be followed in considering forecast provision at ungauged and low benefit locations.

This summary relates to information from Science Project SC030227, reported in detail in the following outputs:-

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Title: Rainfall-runoff and other modelling for ungauged/low-benefit location.

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Research Contractor: CEH Wallingford, Maclean Building, Crowmarsh Gifford, Wallingford, Oxford, OX10 8BB Tel: 01491 838800

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