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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Hydrology

Overhauling flood determination methods in South Africa

This project was undertaken to review the current flood calculation methods and to provide some guidance on the research focus to improve, extend and update the Flood Determination Procedures.

Background

The main aim of this project was to review the current flood calculations methods and to provide some guidance of the research focus to improve, extend and update flood determination procedures. The intention of this project is to reflect the current state of flood determination methods used in South Africa, reflect the shortcomings in the existing methods. This will then provide the basis to identify the specific research areas and their priorities.

Flood calculation procedures used in SA

The procedures which were developed in South Africa for the estimation of design floods can be characterised as methods which relate to the analysis of observed floods and those methods which asses the rainfall data and catchment response. The development of most flood calculation procedures currently used occurred prior to 1990, while later contributions attempt to provide a calibrated standardised procedure for flood calculations, reviewed the relationship between peak discharge and volume of the runoff hydrograph and proposed a new statistical assessment of flood peak determination.

Shortcomings of the current flood estimation procedures

This project highlighted the following shortcomings in the flood estimation procedures. A general shortcoming of the current procedures is that the hydrological data sets which were used were short and in most cases excluded the severe weather incidences of the 1980s and the recent floods.

It is likely that in the case of rainfall-based methods, the relationships between catchment response and rainfall could change if longer data sets are used. The use of extended records might reflect:

- A different depth-duration frequency relationship for the determination of point rainfall;
- The procedure for the determination of the design storm rainfall might change if the record length is extended; and
- That for certain cases under consideration the antecedent moisture conditions in the catchment should be included.

Furthermore it is anticipated that the longer observed storm records might reflect:

- The number of catchments with similar hydrological response might have to be redefined; and
- The statistical relationship to quantify flood peaks and flood volumes in terms of recurrence interval could be extended.

Proposed research priorities

Based on the findings of this research it is recommended that the custodian positions of the departments and other institutions responsible for the maintenance and update of the hydrological database be reinforced. It is also recommended that the verification and update of the hydrological data bases be supported and that the sufficient career seeking individuals in the field be capacitated and trained.

Longer hydrological data bases should be used to review the design storm relationships for different recurrence intervals and duration and the number of homogenous flood regions in South Africa need to be reviewed. In addition, detailed

assessments of the catchment response on rainfall need to be undertaken by the implementation of continuous monitoring.

Regions and relationships for the extreme events (RMF) need to be reviewed; data of palaeofloods, where possible, should be included in the frequency estimation of the maximum flood peaks; and the application of the REFSSA procedure in different other K-flood regions need to be investigated.

Other recommendations include that the application of the JPV relationship on a more detailed regional qualification of the catchments be investigated; that the influence of antecedent conditions of catchment response be researched; that the influence of urban development on catchment response (runoff peaks and runoff volume) be reviewed; and that the regions of the SDF procedure and the re-calibration of the relationships for predicting the floods be reviewed.

Finally, in recognition of the importance of flood risk management in a period of economic growth and potential climate change, and noting the shortcomings of the methods currently used by practitioners, a National Flood Studies Programme should be developed to study and develop new methods which will significantly improve the quality and capability of flood estimation for flood risk management in South Africa.

The identification of research priorities will require the implementation of a coordinate research funding programme. This might require the identification of research focus areas from which a research programme, comprising a number if work-packages could be defined.

Concerns identified during the execution of this study

Based on the findings of this research, the following concerns have been identified:

- The number of flow gauging stations has decreased by more than 100 since 1990
- An analyses of the current number of rainfall stations indicate that there are now less stations used to collect data than were active in 1920;
- Whereas rainfall data is essential for further research there is a need for available records to be 'patched' before use; and
- Whereas stream flow data is essential for further research there is a huge backlog in the verification of raw data and conversion to accurate flows.

Further reading:
To order the report, ***Status review and requirements of overhauling flood determination methods in South Africa*** (**Report No. TT 563/13)** contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.