

# Evaluation of critical storm duration rainfall estimates used in flood hydrology in South Africa

OJ Gericke\* and JA du Plessis

*Department of Civil Engineering, University of Stellenbosch, P/Bag X1, MATIELAND 7602, South Africa*

## Abstract

Design rainfall comprises of a depth and duration associated with a given probability of exceedance or return period. The purpose of the study was to evaluate and compare the methods used in flood hydrology to estimate depth-duration-frequency (DDF) relationships of design rainfall in South Africa based on the critical storm duration or time of concentration ( $T_c$ ) of a catchment. The influence of the type of rainfall, areal and temporal distribution of rainfall were also investigated to establish if a relationship exists between the catchment area,  $T_c$  and areal reduction factors (ARFs). The DDF relationships based on the least-square regression analyses of Log-Extreme Value Type 1 distributions, the modified Hershfield equation, the regionalised South African Weather Service (SAWS)  $n$ -day design rainfall data and the Regional Linear Moment Algorithm and Scale Invariance (RLMA&SI) approach were compared in 3 distinctive  $T_c$ -ranges. The results showed that the RMLA&SI approach can be considered as the preferred DDF relationship in future design flood estimations. The results also showed that a direct relationship exists between the catchment area and  $T_c$ , thus ARFs can be explicitly expressed in terms of only the catchment area.

**Keywords:** Rainfall, depth-duration-frequency, time of concentration, areal reduction factors, design flood