



Assessing Flood Hydrology in Data Scarce Tropical regions: a Congo (ROC) case study

Francis Smith and David Carruth
United Kingdom (fsmith@srk.co.uk)

A robust hydrological assessment can be a challenging task in regions where a lack of data, of a sufficient quality, is available to fully validate both hydrological and hydraulic assessments. This level of uncertainty is heightened in studies of flood hydrology for tropical regions, where spatio-temporal variation in rainfall can be significant and the associated timing of fluvial flood propagation can be challenging to determine, both from a hydrological and hydraulic standpoint.

The Tchivouba catchment, situated within the Coastal Plain of the Republic of Congo, was used as a basis for the study of flood hydrology in tropical regions, and the methods presented in this paper aim at reducing uncertainty in instances of data scarcity in similar settings. Fundamental to this study, was the evaluation of the influence of convective storms on localised rainfall variation, hydrological characterisation to determine accurate rainfall-runoff relationships under differing climate conditions, and the evaluation of the optimum modelling methodology to simulate the study areas response to extreme rainfall events.

A bottom up approach was applied, with the baseline hydro-meteorological monitoring network reviewed and improved, to establish a stronger representation of rainfall-runoff response in the area. A detailed review of climatic influences, both at a regional and local scale was performed, with remotely sensed TRMM data used to support the analysis. A hydrological model was built utilising the HEC-HMS platform and the ModClark transform and SCS-CN loss methodologies, requiring the development of design hyetographs, using a time-distribution method, which allowed determination of the most adequate shape for the hyetograph. Further refinement of the model resulted from validation of simulated outputs in response to measured events, utilising a stage monitoring device installed during the study period. Model outputs were used directly as inputs to a 1D-hydraulic model, which considering the semi-braided planform typology presented multiple challenges.

This study highlighted the many issues associated with hydrological and hydraulic analysis in areas with a paucity of data, and explores solutions to what is a common problem for many studies in Tropical regions. It is by no means a definitive study, however it explores the application and limitations of techniques available for hydrologists working in consultancy with limited time and resources, to determine the magnitude, timing and impacts of flooding events. It also highlights the importance of detailed sensitivity analysis of parameterisation both in a hydrological and hydraulic modelling context, to account for the uncertainty associated with using limited data.