NRC Region-wide River Flood Model

Bertrand Salmi (presenter)
Principal Engineer, Water Technology (NZ) Ltd, Waipā, New Zealand
E-mail: bertrand.salmi@watertechnology.co.nz

Sher Khan
Rivers and Natural Hazards Engineer, Northalnd Regional Council, New Zealand
Email: sherk@nrc.govt.nz

Alvin MingJun Li
Engineer Water Technology, Melbourne, Australia
E-mail: alvin.mingjun.li@watertech.com.au

Lachlan Inglis
Senior Engineer Water Technology, Melbourne, Australia
E-mail: lachlan.inglis@watertech.com.au

Northland Regional Council (NRC) is making a concerted effort to infill gaps in its flood intelligence across the municipality. Water Technology was commissioned by NRC to undertake a region-wide flood modelling study encompassing the entire Northland Regional Council area, which covers an area of over 12,500 km^2. The aim of this project is to map flood hazard zones across the entire Northland region, update existing flood intelligence and provide design flood levels for use in planning and emergency management.

A 2D Direct Rainfall (also known as Rain on Grid) approach was adopted for the hydraulic modelling and will provide flood extents for a defined range of design storms. TUFLOW software was chosen, to take advantage of Sub-Grid Sampling (SGS), a recently released feature of the software. SGS allows a much richer description of the hydraulic behaviour of a DEM cell compared a traditional grid that has a single topographic elevation, without the need to compromise on model simulation time. By accounting for topographical variation within each cell, allows user to produce models with coarse grid resolution whilst still make use of the high detail LiDAR without the need for a finer grid resolution. This allows to reduce computation time without necessary compromising model accuracy.

The presentation will focus on the different tests undertaken to parametrise the hydraulic model for the calibration of catchments to gauged flood records. The calibration not only utilised streamflow and water level records, but was also validated against existing flood levels from several large flood events including 2011 and the recent July 2020 flood event. The presentation will explore how rainfall was modelled both spatially and temporally across the catchment, as well as how rainfall losses/infiltration were derived to represent land use types and soils. It will provide an overview of the calibration results for streamflow gauges, looking at water surface elevations, peak flows, flood volumes and timing of peak. It will also further broach on factors influencing the calibration, including uncertainty associated with existing rating curves. Current results have shown the hydraulic model is able to replicate the flood behaviour extremely well and will allow for the production of sounds design modelling outputs.

The calibration of these hydraulic models determined a range of model parameters (rainfall/infiltration losses, roughness) to be adopted for the validation of other catchments within the study area and design modelling. The presentation will provide an overview of how design events will be modelled for a range of AEP event across the Northland region. Calibration of catchment wide-modelling using rain-on grid is a relatively new approach across NZ. At the same time, design modelling through the use of specific rainfall IFD data for each automatic weather station being developed along with design temporal patterns is also being undertaken to produce fit-for-purpose hazard mapping across the entire NRC Region. We plan to running multiple durations for each catchment to resolve the issues around the different catchment sizes/Time of Concentrations.