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Assessment of an Uncalibrated Hydrological Model of New Zealand.

We report recent progress on a long-term hydrological modelling project whose goal is to make reliable estimates of all water fluxes and storages of New Zealand, and reliable estimates of potential changes in those water resources. This is an ambitious scientific project, with many practical implications for water use, water planning and hazard forecasting. The focus in this study is on model performance using only *a priori* parameter estimation.

The TopNet semi-distributed time-stepping hydrological model is fully described in Clark et al (2008); it takes as input time series of spatially-distributed climate data, and GIS data which are available for all of New Zealand (260,000 km^2). It produces output every hour for every model sub-catchment and river reach, for many hydrological variables. For this study, we ran the model for all 3rd-order catchments (~8 km^2 or bigger) in New Zealand, at hourly timesteps from 1972-2011.

Experience with practical applications of parameter estimation have shown that the two parameters of TopNet which lead to the greatest source of uncertainty in river flows are TOPMODF and HYDCON0. These describe the rate of change of saturated soil hydraulic conductivity with depth, and the saturated soil hydraulic conductivity at the ground surface, respectively. For this study we made *a priori* estimates of TOPMODF using the results of a recession analysis for more than 500 New Zealand rivers, which was mapped onto the national river network, combined with soil porosity data. We also made a priori estimates of HYDCON0 using soil texture and land use/land cover information.

Tests against more than 200 river flow records over most of NZ showed that using the new estimate of TOPMODF was markedly better than using a constant TOPMODF (the default approach). The results obtained do not use any model calibration. Due to the voluminous model output, we can only show a small selection of results. In our presentation we will show results for all regions of New Zealand, and assess the model performance against measured soil moisture and snow storage, as well as measured streamflow. The main intended application of this model is for regional and national operational hazard forecasting systems, and for modelling studies on the potential impacts of change in climate, land use and water management. The results shown here also provide a sound start for catchment-specific model calibration.

There are opportunities to improve on these results through improved mapping of recession characteristics, improved use of recording raingauge data, and selection of model structure to match the spatial variations in hydrological processes which are not captured by a fixed model structure.