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Building a modern, all-purpose hydrological forecasting system

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Abstract: Hydro Tasmania does not only generate enough renewable energy to power the island of Tasmania, but also trades it into the National Electricity Market, and takes care of Tasmania's unique nature and natural resources, including farmers and recreational users of the water ways. This means that lots of people with versatile, competing requirements rely on our inflow forecasting. In addition, downstream system optimisation tools that inform decisions within the business utilise forecasted inflows as key inputs. How can we provide accurate, local and timely inflow forecasting for all of these different end-users?

Our answer to the challenge is an all-purpose hydrological forecasting system. It consists of three timescales; short-term (0–10 days), outlook (1–3 months) and long term (3 months – 20 years), to respond the requirements of each end-user. It is calibrated at more than 80 streamflow gauges and storages, and goes through error correction, verification, and a review process before being released for the users. We aim for more accurate average and peak prediction than our existing inflow model, and instead of just one trace, our model provides a statistically reliable ensemble of possible traces which is required by the modern system optimisation tools as well as traders understanding better all likely inflow scenarios. Calibration of the different models is tied together by Matlab routines that call the underlying C++ modelling code, which makes the recalibration and verification processes smooth and relatively quick, which then makes it easy to update model parameters and adapt to any changes in forecast requirements. The models are operationalised within a Delft-FEWS forecasting system to automatically regenerate forecasts daily.

Currently our system generates short-term inflow forecasts, which are operational. Calibration and verification of the outlook forecasts is ongoing. The results show that the new rainfall-runoff model is able to capture mean and peak inflows better than the current model in use. The future goal is to have all three timescales working independently and providing reliable inflow estimates for the whole business.

Having an all-purpose hydrological forecasting model in place will improve our business's capability to optimise the operation with more accurate inflow forecasts. This in turn minimises the risks of spill or running out of water and maximises the profit we can make. Having a nearly automated calibration routine releases the work time of the hydrologists to tackle more urgent matters and still keeps our forecasting quality high and reliable.

Keywords: *Hydrological forecasting system, rainfall-runoff model, ensemble prediction, hydropower generation*