



Establishing the benchmark: five methods for estimating mean annual runoff of New Zealand catchments

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We compare five methods for estimating the mean annual runoff from New Zealand river catchments. The five models each make spatially-distributed predictions for New Zealand with a resolution of approximately 10 square kilometers; they can be described as (i)-(iii) empirical, (iv) similarity index, (v) time-stepping. All five methods are effectively uncalibrated, but may use *a priori* estimates of parameter values that are based on physical attributes of the catchments.

One of these empirical methods is the current benchmark method for estimating mean annual runoff for ungauged catchments in New Zealand: based on data from over 500 catchments, 87% of the total tested catchment area had modelled runoff within $\pm 25\%$ of the measured runoff.

It is possible that the similarity index and time-stepping methods may out-perform the empirical methods in future, but at present the main motivations for developing them are: (i) to gain understanding of the underlying processes (ii) to make predictions at shorter timescales (iii) to make predictions which are outside the calibration conditions (e.g. impacts of land use change and climate change on catchment hydrology).

As a future contribution to PUB, we propose to evaluate whether the more physically-based methods are able to be developed so that they provide improved accuracy and/or

reduced uncertainty in the predictions of runoff, relative to current methods.