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Seasonal streamflow prediction using ensemble streamflow prediction technique for the Rangitata and Waitaki River basins on the South Island of New Zealand

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Streamflow forecasts are essential for making critical decision for optimal allocation of water supplies for various demands that include irrigation for agriculture, habitat for fisheries, hydropower production and flood warning. The major objective of this study is to explore the Ensemble Streamflow Prediction (ESP) based forecast in New Zealand catchments and to highlights the present capability of seasonal flow forecasting of National Institute of Water and Atmospheric Research (NIWA). In this study a probabilistic forecast framework for ESP is presented. The basic assumption in ESP is that future weather pattern were experienced historically. Hence, past forcing data can be used with current initial condition to generate an ensemble of prediction. Small differences in initial conditions can result in large difference in the forecast. The initial state of catchment can be obtained by continuously running the model till current time and use this initial state with past forcing data to generate ensemble of flow for future. The approach taken here is to run TopNet hydrological models with a range of past forcing data (precipitation, temperature etc.) with current initial conditions. The collection of runs is called the ensemble. ESP give probabilistic forecasts for flow. From ensemble members the probability distributions can be derived. The probability distributions capture part of the intrinsic uncertainty in weather or climate. An ensemble stream flow prediction which provide probabilistic hydrological forecast with lead time up to 3 months is presented for Rangitata, Ahuriri, and Hooker and Jollie rivers in South Island of New Zealand. ESP based seasonal forecast have better skill than climatology. This system can provide better over all information for holistic water resource management.