Geophysical Research Abstracts
Vol. 14, EGU2012-6326, 2012
EGU General Assembly 2012

Combining stochastic weather generation and ensemble streamflow predictions for short to medium term flow forecasting over Quebec, Canada

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Probabilistic streamflow forecasting has been an important research avenue over the past decade and such approaches are now more commonly being incorporated into operational forecasting systems within government agencies and industries dealing with water management. This work details a prototype for a streamflow forecast operational system in southern Quebec, Canada. The system uses ensemble meteorological forecasts for short term (less than 10 days) forecasting, switching to a stochastic weather generator for the period exceeding 10 days all the way to a three-month lead time. Precipitation and temperature series are then fed to one (or many) hydrological models to produce streamflow forecasts.

The ensemble weather forecasts are corrected for biases and under dispersion using logistic regression. Results show that the ensemble streamflow forecasts resulting from the ensemble meteorological forecast have more skill than the deterministic forecasts. Preliminary results indicate that ensemble meteorological forecasts displayed skill for a period up to 5 days for precipitation and up to about 10 days for temperature. Past ten days, probabilistic streamflow forecasts are based on multiple synthetic times series obtained from a stochastic weather generator. The use of stochastic time series result in better forecasts then resampling the historical record and allows for better evaluation of extreme events. The weather generator can easily be linked to large scale seasonal global predictors, is such links exist. Over the tested basins (continental climate), the system forecast has skills up to a lead time of 4 weeks in the best case. For a lead-time between one and three months, using the forecast prototype yielded no better results than using the historical streamflow record.

This work also investigated the uncertainty linked to the choice of one hydrology model and the ability of a multi-model approach to improve streamflow forecasting. Preliminary results showed that the multi-model approach resulted in significant but modest improvements over the use of one well-performing hydrology model. The uncertainty linked to the choice of a given model is however dwarfed by the meteorological uncertainty.