Forecasting Spring Reservoir Inflows in Churchill Falls Basin in Québec Canada

Óli Grétar Blöndal Sveinsson[1]
The National Power Company (Landsvirkjun), Reykjavík Iceland

Upmanu Lall
International Research Institute for Climate Prediction of Columbia Univ., Palisades, NY, USA

Abstract. Results from diagnostic analyses to understand the seasonal evolution of the large scale climatic state responsible for the development and melt of the winter snowpack, and spring-early summer precipitation in the Churchill Falls region on the Québec-Labrador peninsula, Canada, are presented in the context of the development of an empirical model for seasonal to annual streamflow forecasting, with a special emphasis on the May-July spring freshet. Teleconnection indices and gridded global measures (SST, SLP, Geopotential, Winds) of atmospheric circulation inferred from the NCEP/NCAR Reanalysis are used as climatic indicators. Composite analyses and correlation analyses are applied to the climatic indicators conditioned on the spring streamflow for identification of potential predictors. Meridional and zonal atmospheric fluxes over the Atlantic and the Pacific Oceans emanating from regionally persistent SST/SLP modes are identified as potential carriers of information. We speculate on the ocean-atmosphere and regional hydrologic mechanisms that may be involved in lending multi-seasonal predictability to streamflows in the region. The performance of different models and procedures for forecasting aggregated May-July streamflow for the Churchill Falls basin on the Québec-Labrador peninsula is compared. The models compared include an AR model using only past streamflow data, an ARX model utilizing both past streamflow and precipitation, and a linear regression model using the principal components of exogenous measures of atmospheric circulation. The predictors have different lead times and include past streamflow, and precipitation over the basin, along with gridded measures (SST, SLP, Geopotential, Winds) of atmospheric circulation from the NCEP/NCAR Reanalysis project. The forecast skills of the different approaches are compared using a variety of measures of performance. The results indicate that relatively accurate forecasts using only measures of atmopheric circulation can be issued as early as in December of the prior year. A multi-model combination approach is found to be more effective than the use of a single forecast model. In addition, it is concluded that forecasting models utilizing atmospheric circulation data are useful, especially for basins where hydroclimatic observations are scarce and for basins where flows and other hydroclimatic variables are not strongly autocorrelated (do not depend on their past).

[1] The National Power Company
Research and Surveying Division
Háaleitisbraut 68
103 Reykjavík
Iceland
Tel: (+354) 552-2533
e-mail: olis@lv.is