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# Incorporation of seasonal climate forecasts in the ensemble streamflow prediction system

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A technique for incorporating 0–3 months lead temperature and precipitation forecasts from two Canadian numerical weather prediction (NWP) models into the ensemble streamflow prediction (ESP) system
is presented. The technique involves downscaling monthly NWP forecast outputs to station locations using the model output statistics (MOS) approach and then temporally disaggregating the monthly forecasts
into daily input weather data suitable for driving a hydrologic model. The daily weather sequence for a desired month is generated by a nearest neighbor re-sampling of one of the years in the historical record, and then modifying the daily weather data for the same month of the re-sampled year so as to reproduce the MOS-based monthly forecast value. Streamflow forecasts from the MOS-based scheme are compared to pre-ESP and post-ESP re-sampling schemes without seasonal climate forecast guidance. In the pre-ESP scheme, daily weather inputs for the hydrologic model were conditionally re-sampled from historical records. In the post-ESP scheme, streamflow traces produced by the climatic ESP system were conditionally re-sampled. The three schemes were applied to the Bow and Castle rivers, both located in the headwaters of the South Saskatchewan River basin in the province of Alberta, Canada. Correlations between the MOS-based median forecast and observed flow for the Castle River were consistently higher than those based on the pre-ESP and post-ESP schemes. Other skill measures showed mixed results, with the MOS-based forecasts being more skillful in some cases and less skillful in others. All three schemes exhibited better skill for above-normal flow categories than for below-normal categories. It is also shown that considerable improvement in the ESP forecast skill could be achieved through more accurate simulation of streamflow, particularly for forecast issue dates late in the water year.