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A testbed to analyze the relationship between statistical scores and the economic performance of probabilistic hydrologic forecastsHajar Ashouri

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Hydrologists often rely on statistical scores like the continuous ranked probability score (CRPS), the normalized root-mean-square error ratio (NRR), the Nash-Sutcliff efficiency (NSE) to assess the reliability and accuracy of hydrological ensemble prediction systems (H-EPS). Although useful, a statistical characterization of the forecasts falls short of providing a measure of their utility to society, which is the ultimate metric for water managers and policy makers. If more reliable and accurate forecasts are desirable, it is often unclear to what extent the reliability and accuracy gains will translate into increased utility, which, depending on the characteristics of the water resources system, could be expressed in terms of flood damage reduction, increased hydropower generation, more reliable water supply, etc. We present a testbed to analyze the relationship between statistical scores and the economic performance of probabilistic hydrologic forecasts. The testbed comprises (i) 20 structurally-different hydrological models, (ii) two data assimilation techniques, (iii) one mid-term (weekly, monthly) and (iv) one short-term (daily) water resources allocation models, (v) hydro-meteorological, infrastructural and water demand data for the case study. Using the hydropower system of the Gatineau River basin in Quebec as a case study, 20 sets of ensemble streamflow forecasts are generated by the hydrological models from the 50-member meteorological forecasts issued by the ECMWF over a period of 6 years (2011-2016). Forecasts are updated daily and have a lead time of 14 days. They are processed in a rolling-horizon mode by the short-term water resources allocation model, which seeks to maximize the energy output over the 14-days period considering the expected future value of the system derived from the mid-term allocation model. Regressions are then developed to examine the relationship between the economic performance (here the production of hydroelectricity) and the scores characterizing the 20 H-EPS. The analysis also reveals where (for what power plant) and when (for what time of the year) the improvement of the forecasts should be prioritized as well as the potential for improvement of the 20 H-EPS.