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Challenges and rewards of multimodel ensemble hydrological forecasting

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Adequately representing all major sources of uncertainty while tapping into all major sources of information is one of the main challenges encountered when developing an ensemble hydrological forecasting system. This is critical in order for the probabilistic forecasts derived from the ensemble members to be reliable and sharp at the same time. Multimodel ensemble forecasting, i.e. combining forecasts obtained from multiple atmospheric and/or multiple hydrological models, can improve both reliability and skill, but is definitely more challenging than single-model ensemble forecasting. In this presentation, we argue that the rewards are definitely worth the trouble, at least in the case of experimental ensemble forecasting systems being developed for flood forecasting and water management purposes in Québec, Canada, as well as in the Laurentian Great Lakes watershed. The presentation focuses on short-range forecasts, which is when the representation of uncertainty in initial conditions of the land surface and hydrological model really pays. Multiple atmospheric forecasting systems are also typically available for short-range forecasting, from high-resolution, limited area models providing deterministic forecasts, to low-resolution, global ensemble forecasting systems. We assess the sensititivity of the hydrological forecasts to the horizontal resolution of the meteorological forcing, to the choice and parameterization of the land-surface and hydrology model, and discuss techniques for minimizing the number of models included in an ensemble while maximizing reliability and sharpness.