

26 April 2021

Session HS4.3 :Ensemble and probabilistic hydro-meteorological forecasts: predictive uncertainty, verification and decision making

Evaluation of a short-term ensemble water level forecasting system: case of the Chaudière River

Mohammed Amine Bessar^a, François Anctil^a, Pascal Matte^b

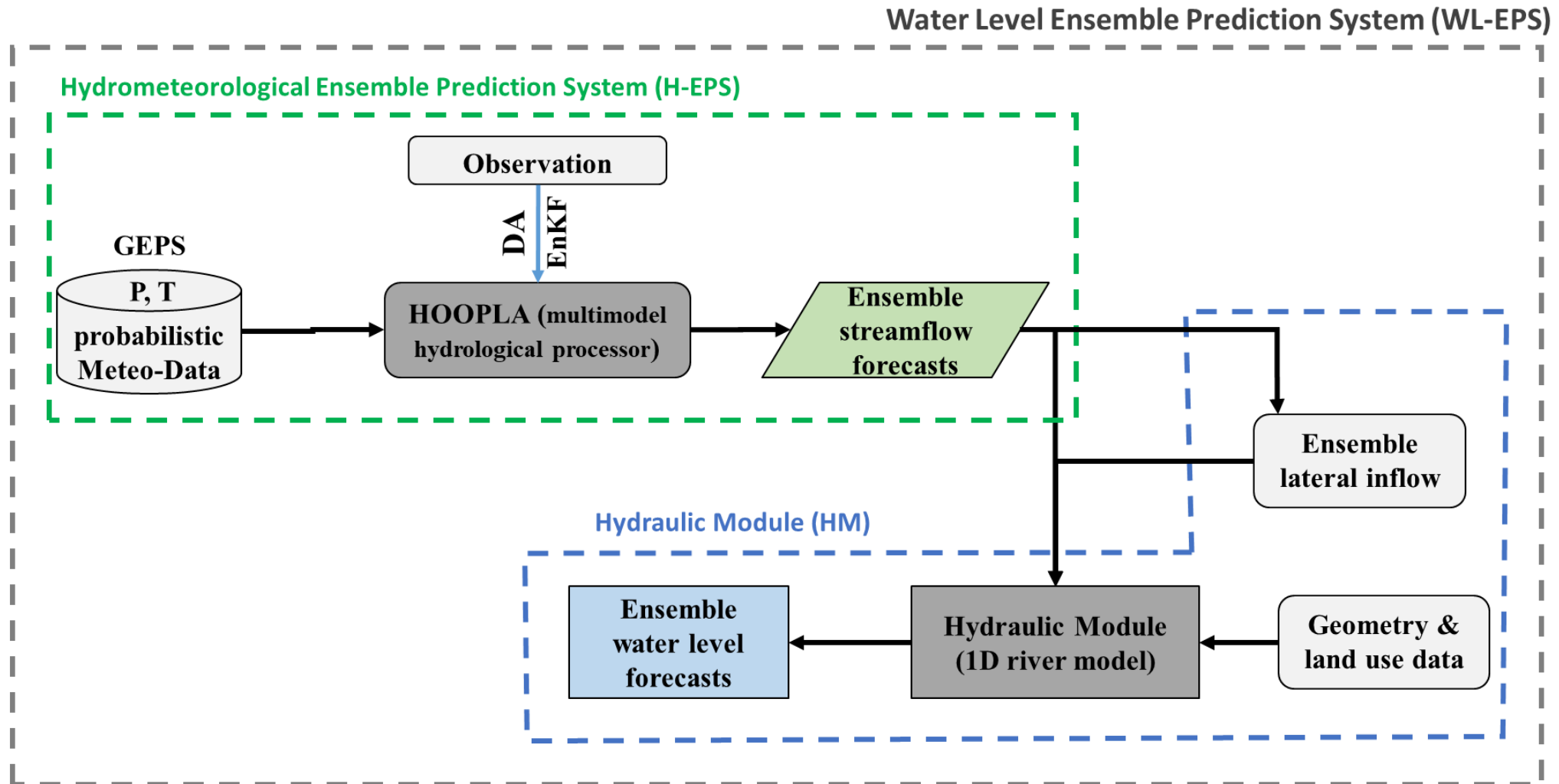
^a Université Laval, Department of Civil and Water Engineering, Québec, Canada, ^b Environment and Climate Change Canada (ECCC), Québec, Canada



Objectives

- Explore and assess, in an operational context, the uncertainty propagation of forcing data in a water level ensemble prediction system (WL-EPS)
- Evaluate the accuracy and reliability of the forecasts at each predictive layer:
 - Hydrometeorological Ensemble Prediction System (H-EPS)
 - Hydraulic Module (HM)

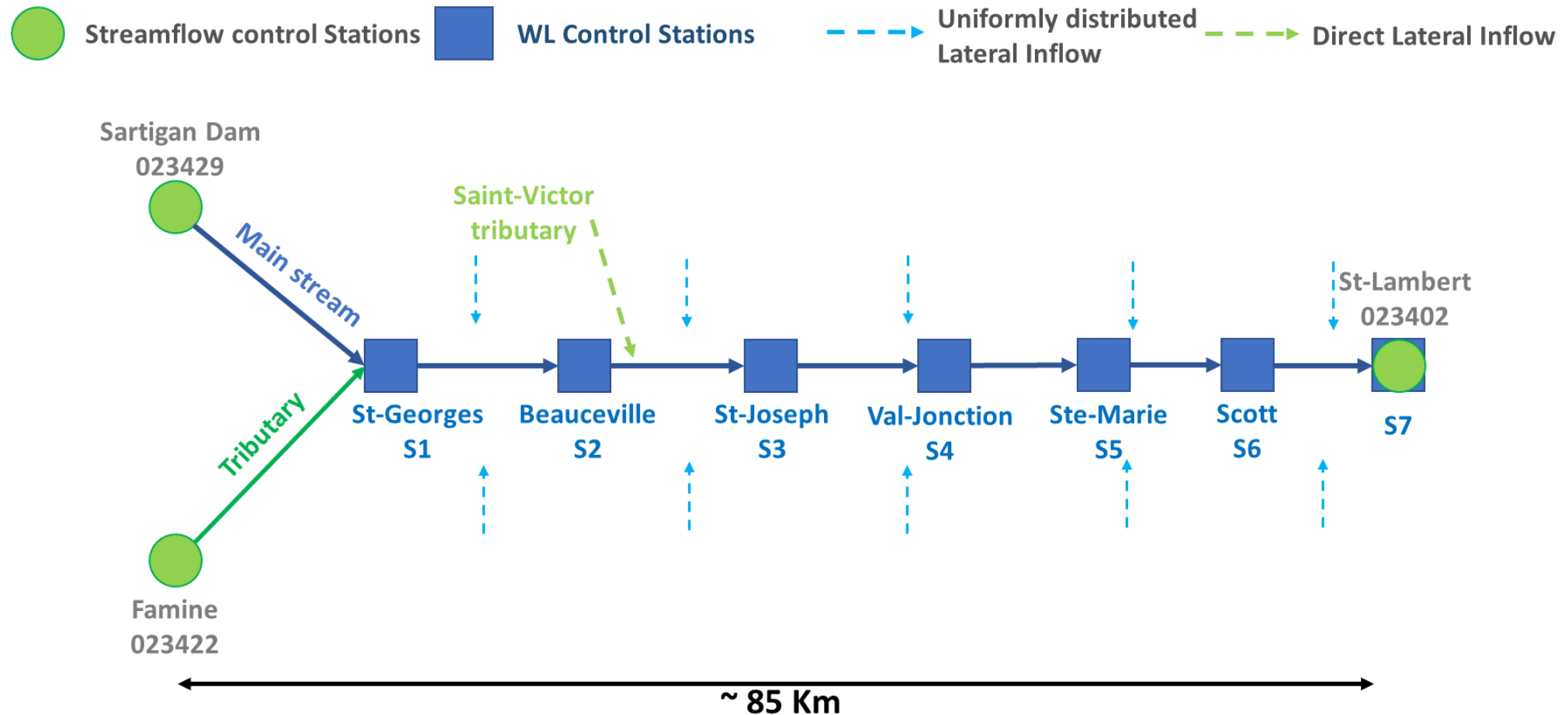
Forecasting framework



Hydrometeorological Ensemble prediction system (H-EPS)

- 3 catchments : Famine, Sartigan and Saint-Lambert
- Meteorological forecasts : 20 members of the GEPS
- Hydrological processor: 20 lumped models
- Data assimilation : ensemble Kalman filter – EnKF

Hydraulic module (HM) – 1D river model



Analysis period - flood events over monitoring threshold

	Start date	End date	Max (m ³ /s)	Nbr. of Forecasts
Event 1	10-Aug-16	26-Aug-16	950	16
Event 2	15-Oct-16	7-Nov-16	1 085	23
Event 3	22-Apr-18	9-May-18	1 910	17
Event 4	15-Apr-19	2-May-19	2 488	17
Event 5	28-Oct-19	5-Nov-19	1 837	9
Event 6	10-Apr-20	17-Apr-20	1 035	8

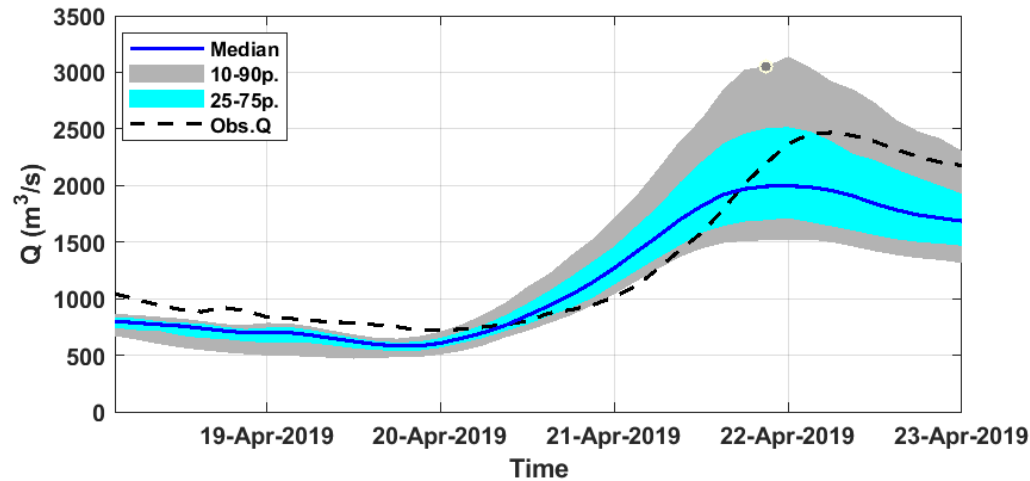


Max 90 days

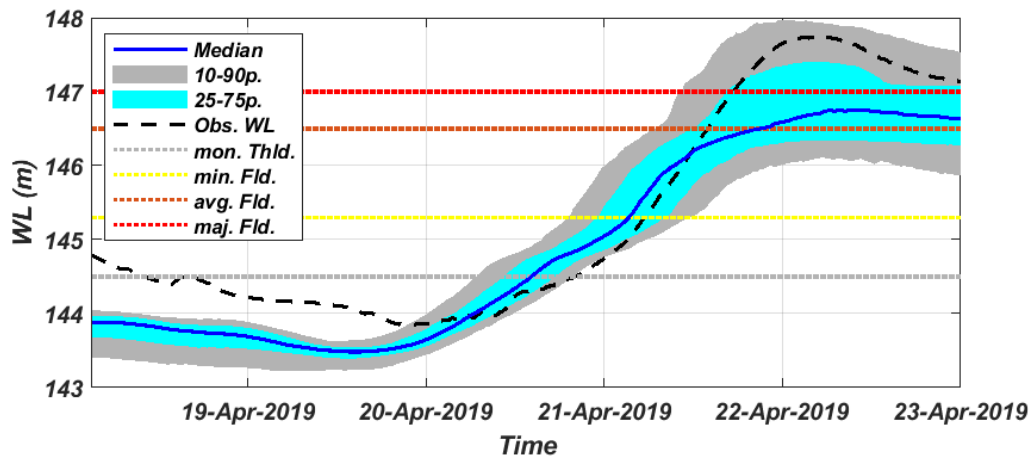
Preliminary results - uncertainty quantification (spread)

Streamflow

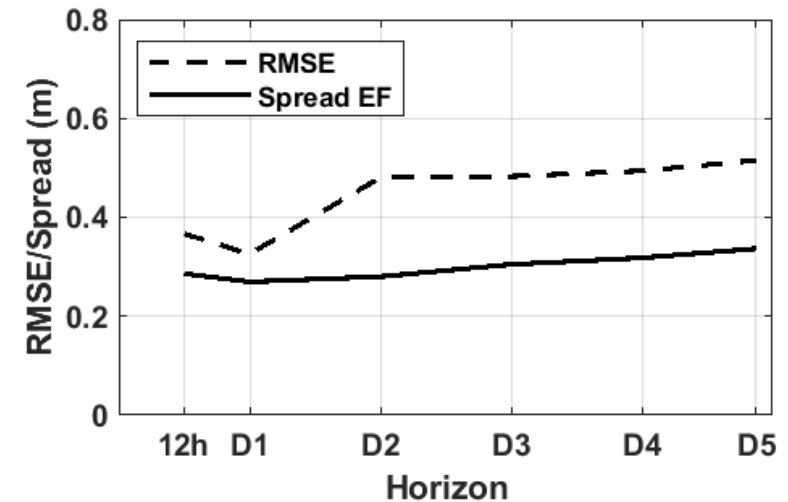
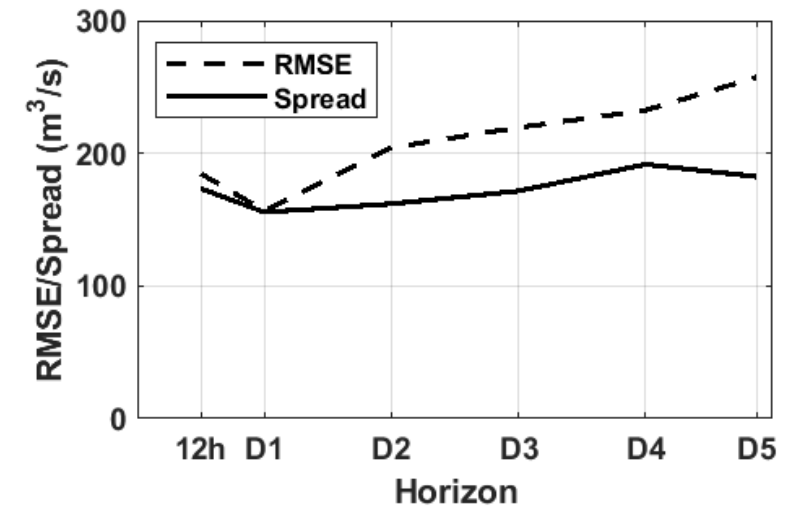
Sample ensemble forecasts



Water level

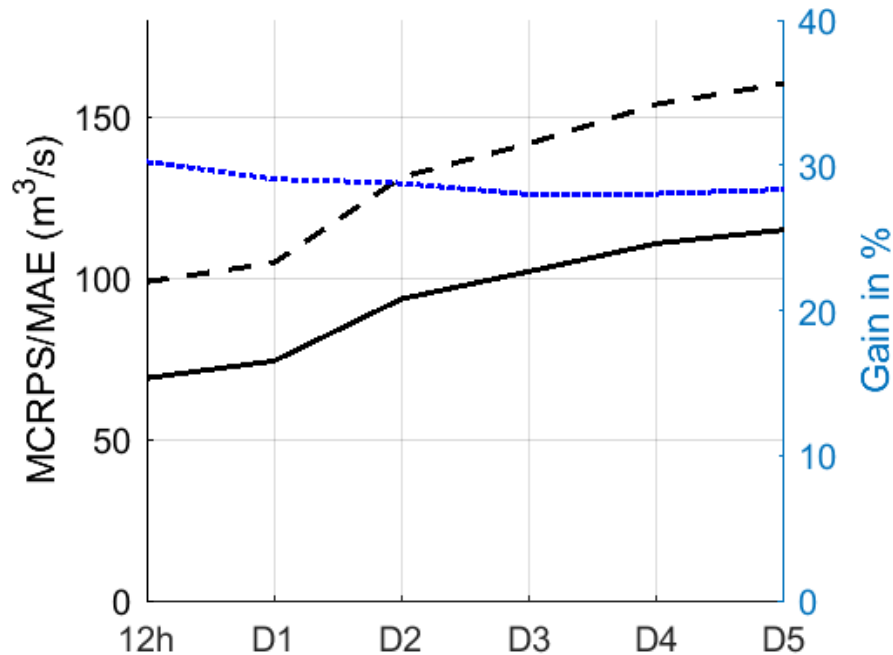


Spread skill plots (SSP) at Saint-Lambert Station

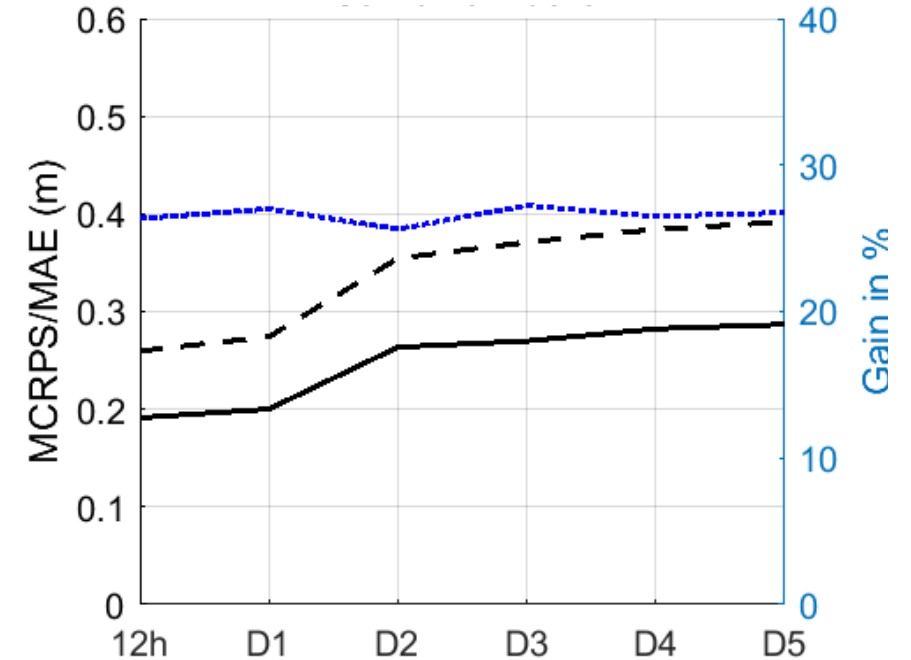


Preliminary results - Ensemble forecasts accuracy

Streamflow



Water level

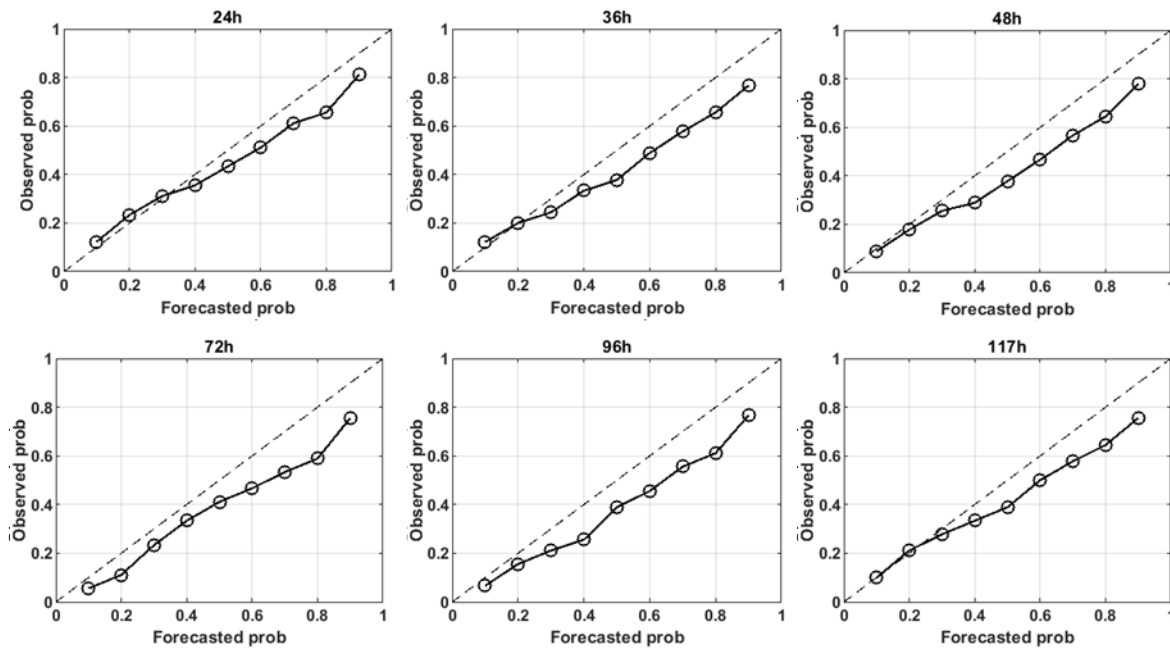


Mean CRPS gain vs. MAE over LT* at Saint-Lambert station

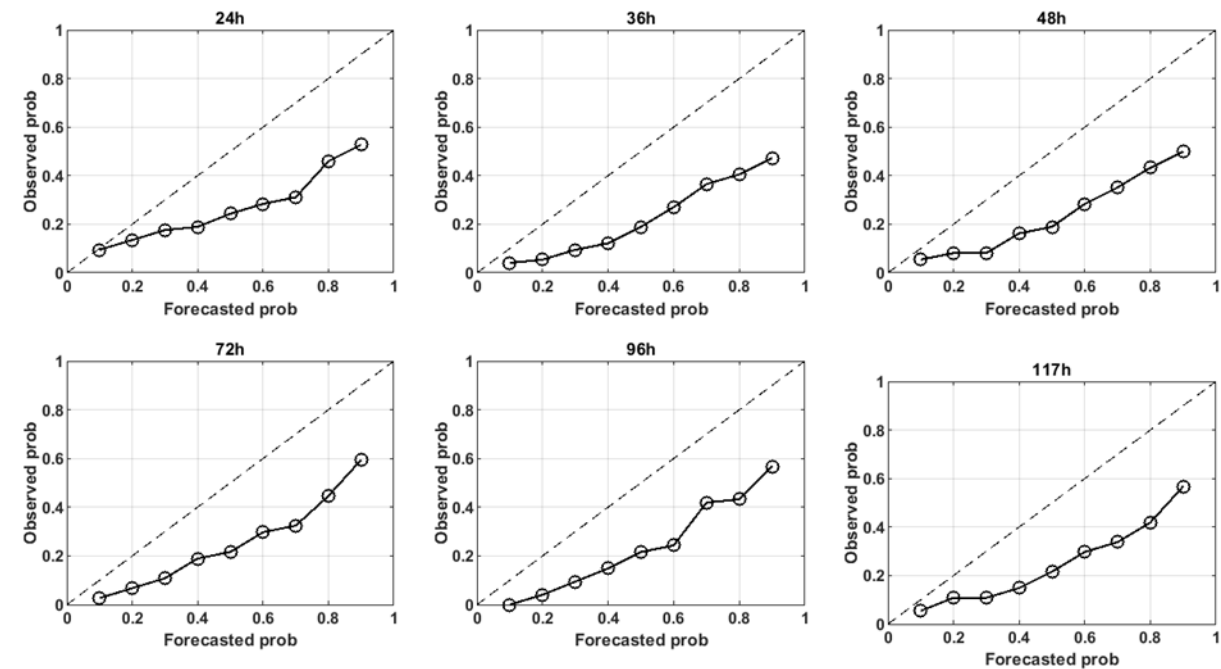
*LT: Lead time

Preliminary results - Ensemble forecasts reliability

Streamflow



Water level



Reliability diagrams at Saint-Lambert station

Conclusions

- Flow uncertainty quantification is key for a reliable water level prediction
- Accounting of the main sources of uncertainty of forcing data improves substantially the quality of water level forecasts over deterministic counterpart
- Even if they are strongly linked, water level forecasts are more under-dispersed than streamflow showing the need to investigate more the impact of hydraulic modeling uncertainty in the prediction system

Thank you

