Hydrological evaluation of the Canadian meteorological ensemble reforecast product

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Introduction and Motivation

It is the first time that the ensemble meteorological reforecast dataset available from the CCMEP has been assessed

Biases and dispersion errors need to be assessed and corrected through a pre-processing method

Pre-processing

Adjusted precipitation

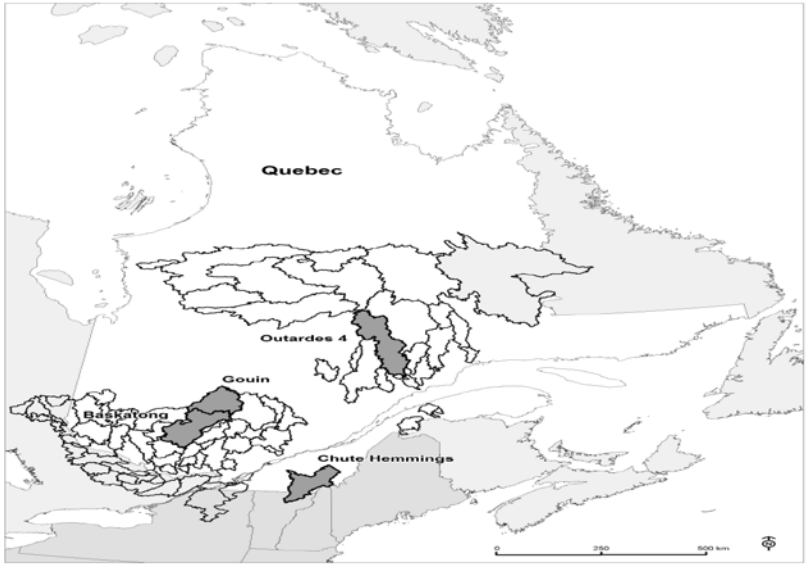
Hydrological model

Hydrological ensemble reforecasts

Evaluate the quality of ensemble hydrological reforecasts

Watersheds

- 4 Canadian watersheds are selected for the present study. They are located in the Province of Québec



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Reforecast products

- Numerical simulations of the past weather (or climate) using the same forecast model and assimilation system that (ideally) is used operationally

CCMEP →
- 4 members over 32 days for 18 years once a week for a given date at CCMEP operations
- The four members are non exchangeable (multi-physics ensemble)

GEFS v2 →
- 10 exchangeable members (plus 1 control) over 16 days and issued every day from December 1984 to the present
- It is exploited for comparison

What is the Distribution Based Scaling (DBS) ?

- The precipitation is described with one single gamma distribution

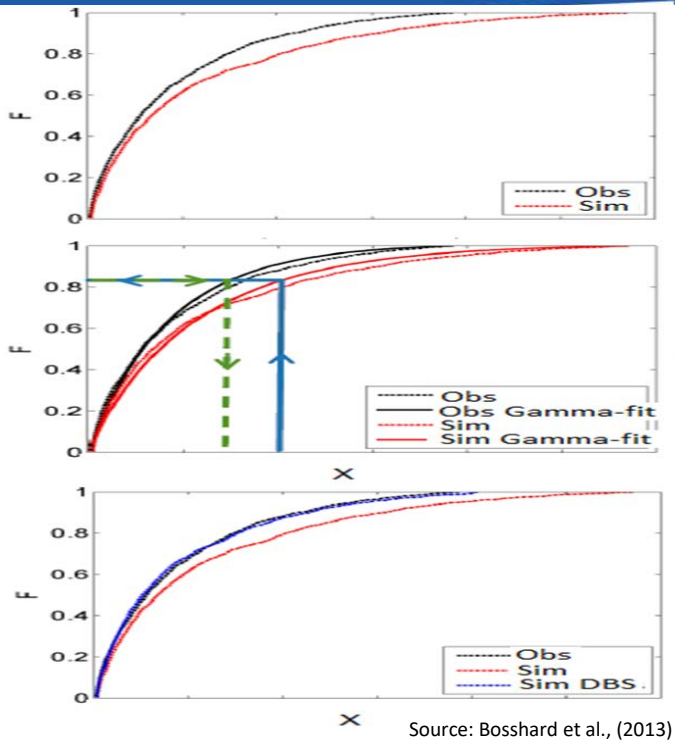
- Three steps:

1- Group and prepare data for scaling

2- Fit a probability distribution to observed and reforecast precipitation for rainy days

3- Scale reforecast data. The DBS correction function was defined as:

$$X_{\mathrm{Sim},DBS} = F_{\mathrm{Obs}}^{-1}\left(F_{\mathrm{Sim}}\left(X_{\mathrm{Sim}}\right)\right)$$



Source: Bosshard et al., (2013)

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Experimental set-up

- An ensemble reforecast data of 5 weeks was considered to fit the gamma distribution in the DBS approach

These dates are put together to build the training period for the prediction of the 21th of May (5 weeks X 18 years – 3 weeks = 87 weeks)

Year	7 may	14 may	21 may	28 may	4 june
2012	4 member	4 member	4 member	4 member	4 member
2011	4 member	4 member	4 member	4 member	4 member
…	4 member	4 member	4 member	4 member	4 member
1995	4 member	4 member	4 member	4 member	4 member

…for the forecast of this week

Pre-processing by the DBS

Hydrological model: GR4Jsnow

➢ Four scenarios were considered:

1- Open-loop
2- DBS
3- EnKF
4- DBS + EnKF

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Evaluation of the CCMEP ensemble meteorological reforecast

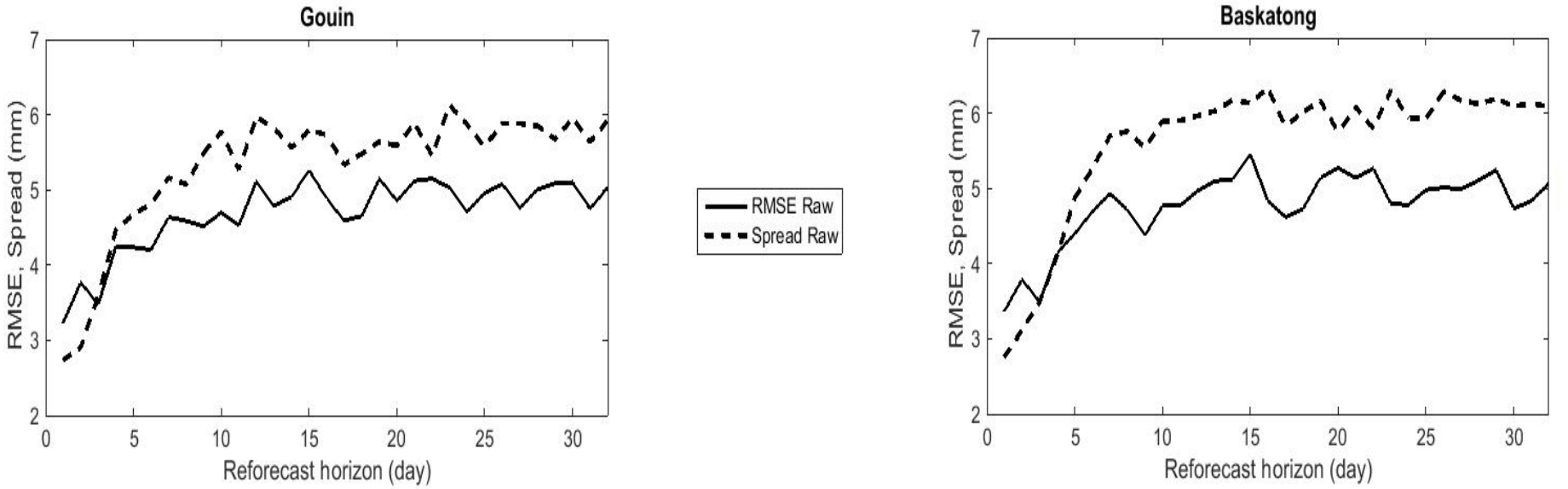

Fig. 4. RMSE and spread of the Raw and DBS precipitation rates as a function of the reforecast horizon

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Evaluation of the ensemble hydrological reforecasts

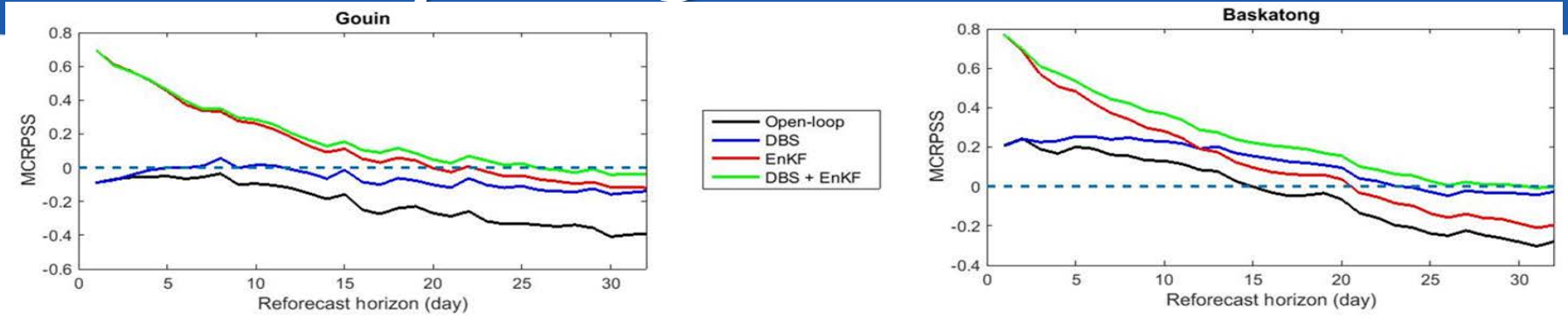

Fig. 6. MCRPSS of all four scenarios as a function of reforecast horizon

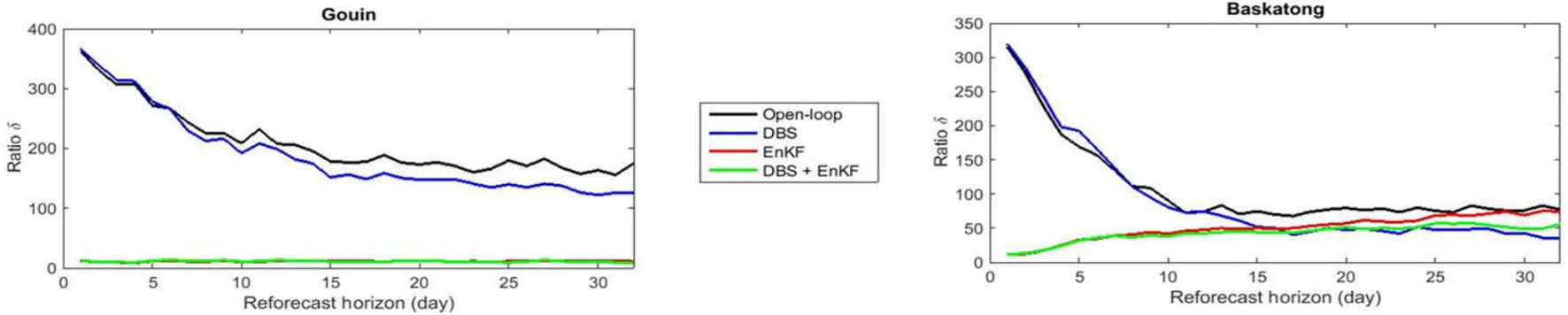

Fig. 7. Ratio δ of all four hydrological scenarios as a function of reforecast horizon

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Comparison with the GEFS v2 ensemble meteorological reforecast

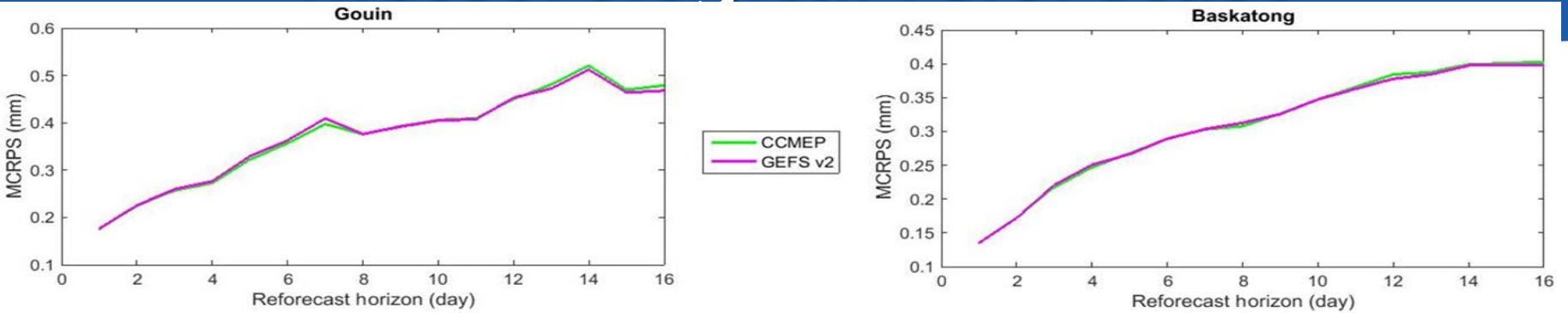

Fig. 9. MCRPS of the DBS+EnKF scenario for the CCMEP and GEFS v2 as a function of the reforecast horizon

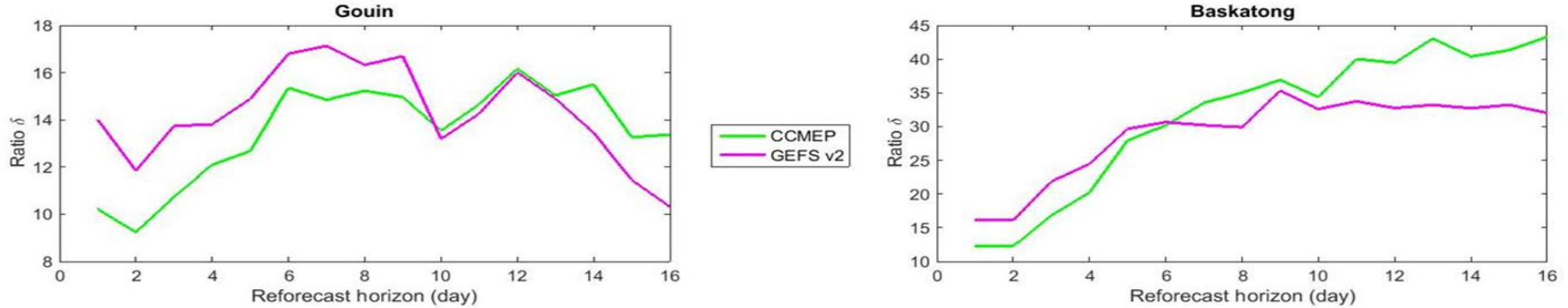

Fig. 10. Ratio δ of the DBS+EnKF scenario for the CCMEP and GEFS v2 as a function of the reforecast horizon

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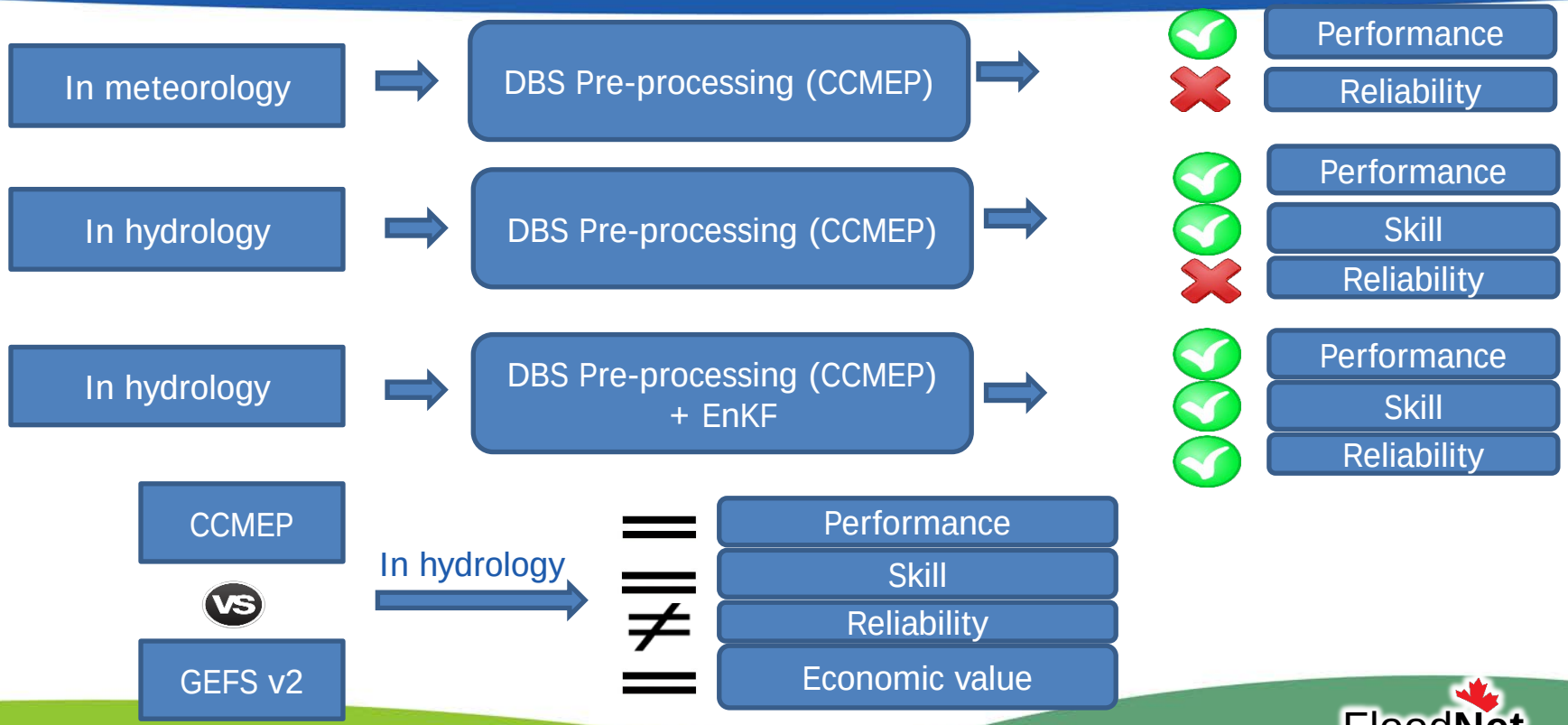
Conclusion



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Thank you for your attention

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