Impacts of uni- and multivariate bias adjustment methods on simulations of hydrological signatures in high latitude catchments

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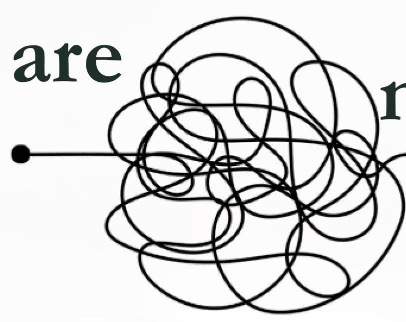
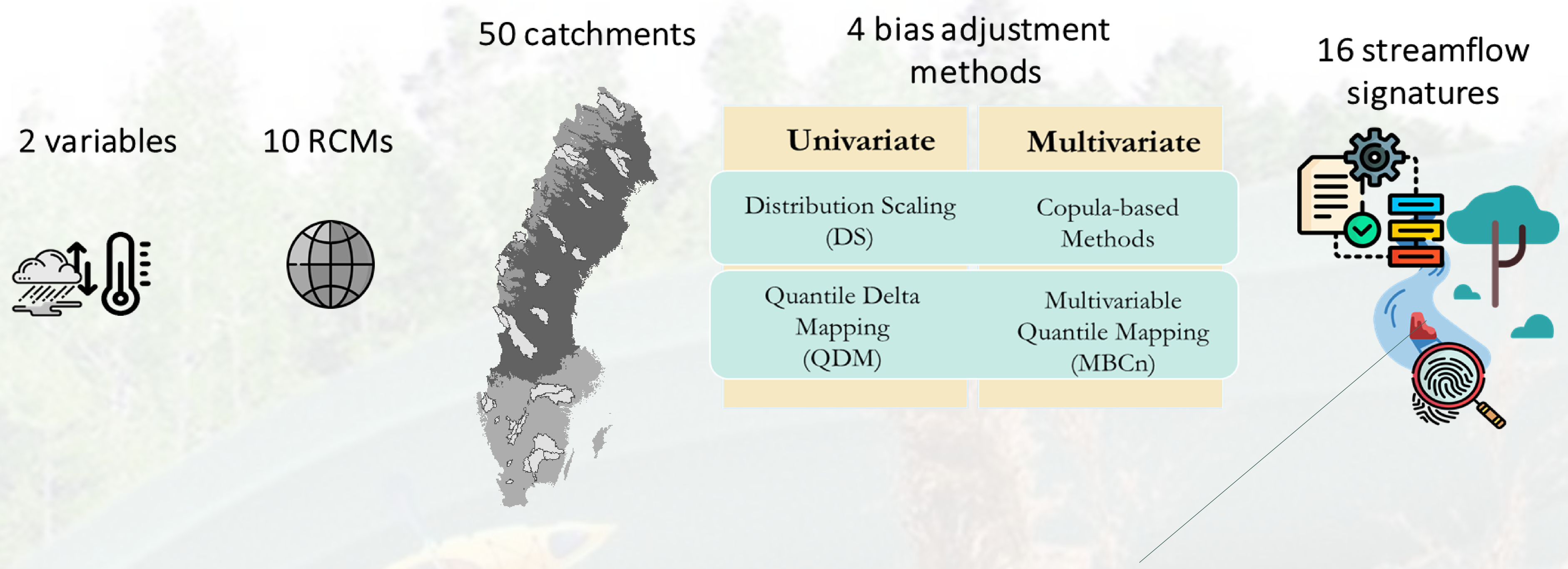
1. Motivation:

Bias-adjustment (bias correction) methods are becoming more complicated



How can impact modelers decide on what approach to choose from?

2. Data and Methods

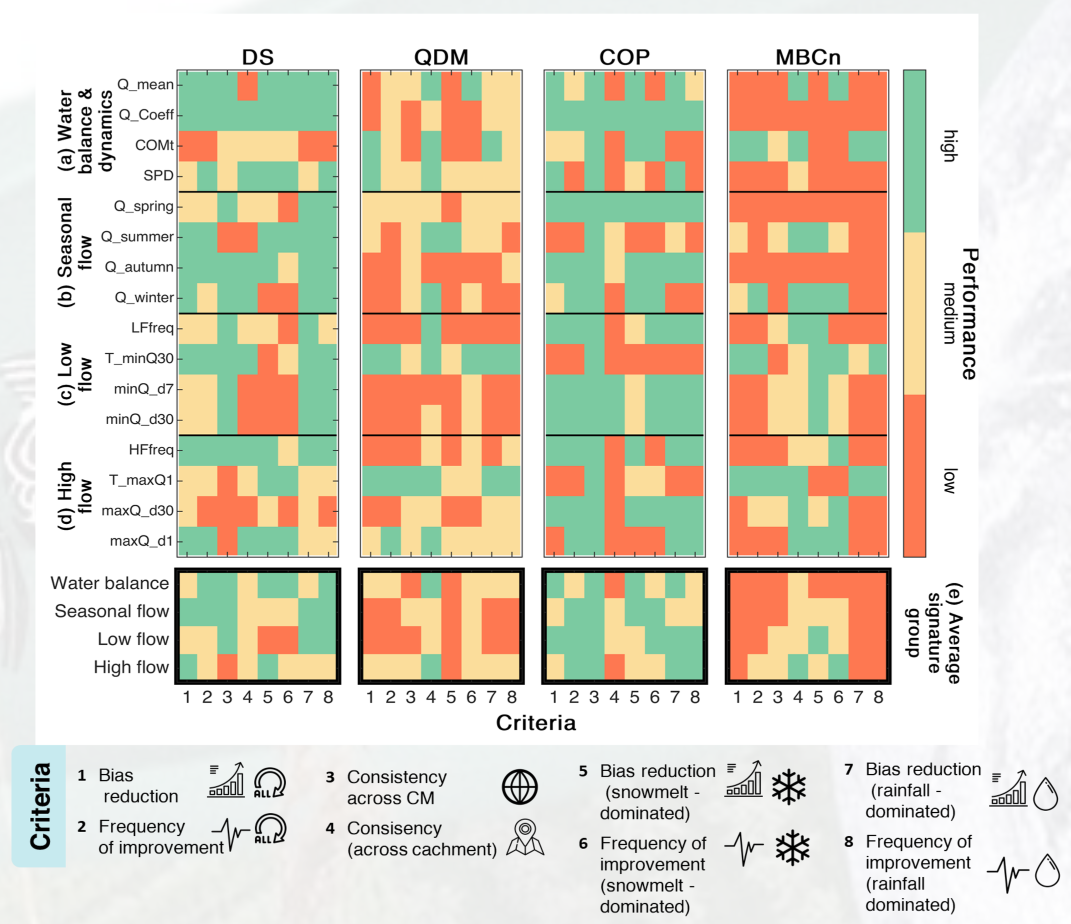


2.1 Streamflow signatures

Group	No.	Signature	Abbreviation	Unit
(a) Wate balance & Runoff Dynamicas	1	Mean Flow	**(Q mean)**	[mm·day^{-1}]
	2	Runoff coefficient	**(Q Coeff)**	[-]
	3	Center of the mass	**(COM)**	[day of the year]
	4	Spring pulse day	**(timSPD)**	[day of the year]
(b) Seasonal Flow	5	Spring flow	**(Qmean spr)**	[mm·day^{-1}]
	6	Summer flow	**(Qmean sum)**	[mm·day^{-1}]
	7	Autumn flow	**(Qmean aut)**	[mm·day^{-1}]
	8	Winter flow	**(Qmean win)**	[mm·day^{-1}]
(c) Low Flow	9	Low flow frequency	**(LFfreq)**	[number of days]
	10	Timing of 30-day low flow	**(Tim minQ30)**	[day of the year]
	11	7-day low flow	**(minQ d7)**	[mm·day^{-1}]
	12	30-day low flow	**(minQ d30)**	[mm·day^{-1}]
(d) High Flow	13	High flow frequency	**(HFfreq)**	[number of days]
	14	Timing of 1-day high flow	**(Tim maxQ1)**	[day of the year]
	15	30-day high flow	**(maxQ d30)**	[mm·day^{-1}]
	16	1-day high flow	**(maxQ d1)**	[mm·day^{-1}]

3. Result:

- In the northern catchments, initial raw biases were consistently reduced with all BA methods in all 16 signatures.
- In southern catchments, the difference was rather between distribution-based and distribution-free methods.



- On average, there were slight differences between univariate and multivariate methods, which were often overshadowed by the strong differences between distribution-free and distribution-based methods.
- Noticeable differences between uni- and multivariate methods only emerged for the snowmelt-driven catchments (located above 60°N), where advanced multivariate methods resulted in frequently better performance compared to their univariate counterparts.

4. Highlights:

- Bias adjustment improves accuracy and consistency of simulated hydrological signatures.
- Not a single bias adjustment method enhances performance in all analyzed signatures.
- Univariate distribution scaling (DS) performs well specifically in rainfall-driven catchments.
- Multivariate methods perform better for low-flow signatures in snowmelt-driven catchments.

Want to read more?

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