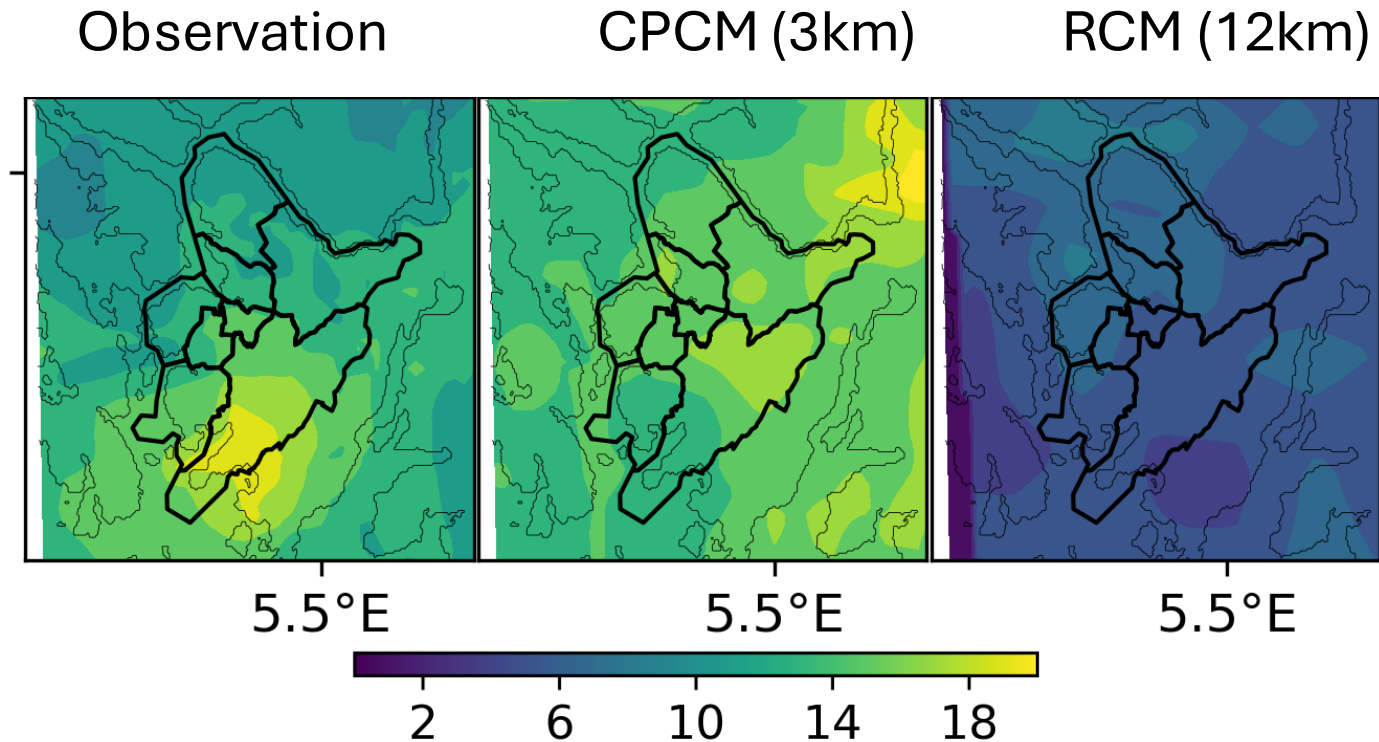


Is bias correction necessary for CPCM-driven flood simulation in mountainous region?

Lu Li, K. Xie, H. Chen, S. Sobolowski, Ø. Passche, C.Y. Xu

6th May, 2026

CPCM matters for extreme: better but bias remains



Maximum-1hour Precipitation in Bergen (mm/hr)
(2010-2018)

(Xie, K., Li, L., et al., HESS, 2025)

- RCM: traditional Regional Climate Model (10-50 km);
- CPCM: also named km-scale climate model (<4km), which resolves convection & terrain -> better extremes;
- But systematic biases remain.

Does bias-correction still help (or harm) flood simulation when driving by CPCM?

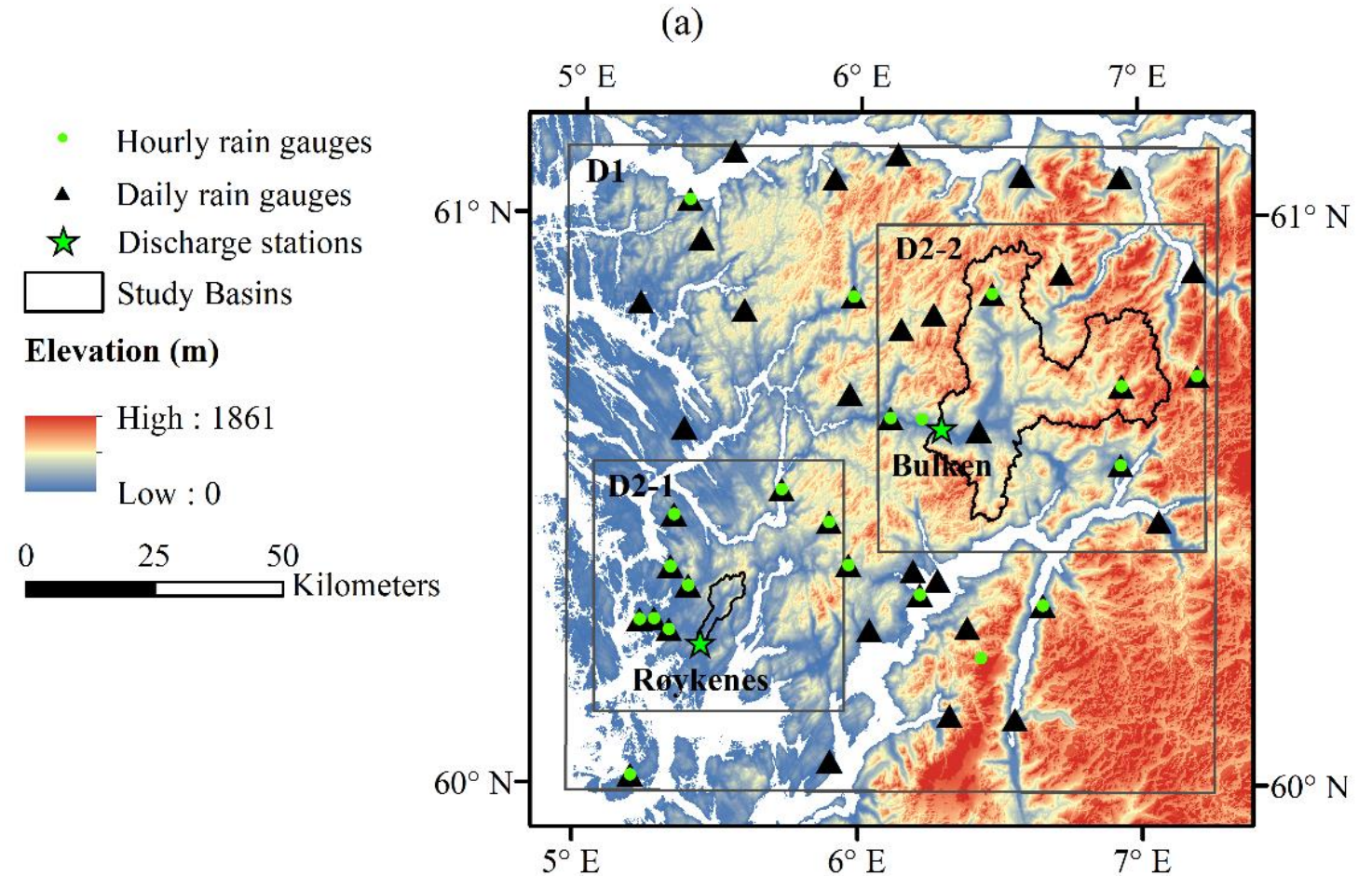
Study basins and data

Two flood-regime basins in Western Norway:

- Røykenes (coastal, rain-dominated)
- Bulken (mountainous, snowmelt influenced)

Data:

- HCLIM3 (3km CPCM), 1999-2018
- SeNorge2: 1km gridded observation dataset. (daily 1957-2018, hourly 2010-2018)
- Discharge observation (NVE)



Experimental design

Experiments	Forcing
Raw	Raw CPCM without bias-correction
BC-ed P	Precipitation bias-correction only
BC-ed T	Temperature bias-correction only
BC-ed P&T	Both precipitation and temperature bias-correction

- **Hydrological Model:** WRF-Hydro v5.2 (offline mode, calibration driven by SeNorge)
- **Bias correction methods:** Quantile Mapping (QM) and Distributed Delta Mapping (DDM)
- **Flood analysis:** Peak-Over-Threshold (POT) method

Bias correction reduces mean biases

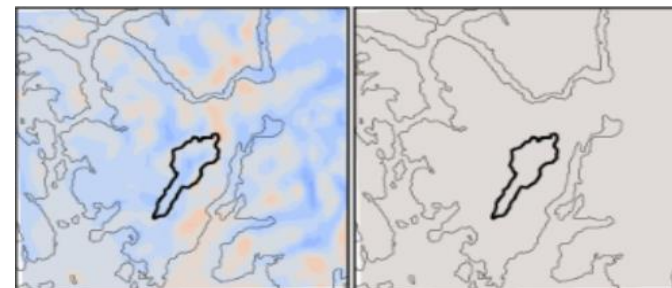
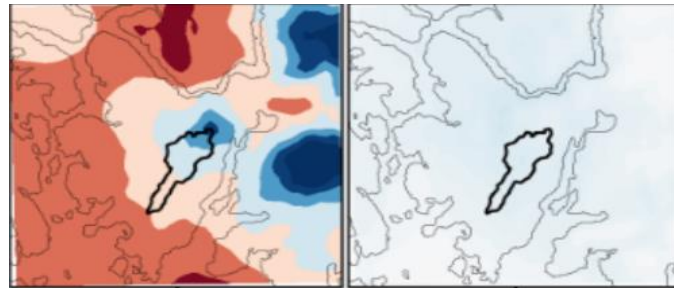
Precipitation

Temperature

Raw CPCM Bias-corrected

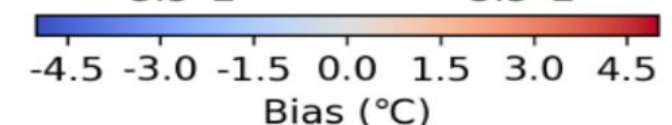
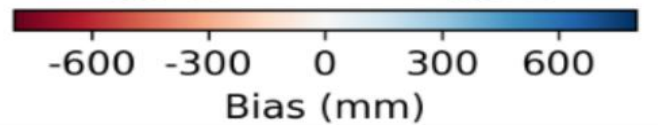
Raw CPCM Bias-corrected

Røykenes



5.5°E 5.5°E

5.5°E 5.5°E

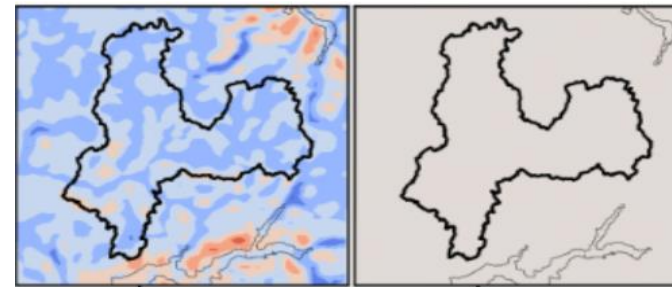
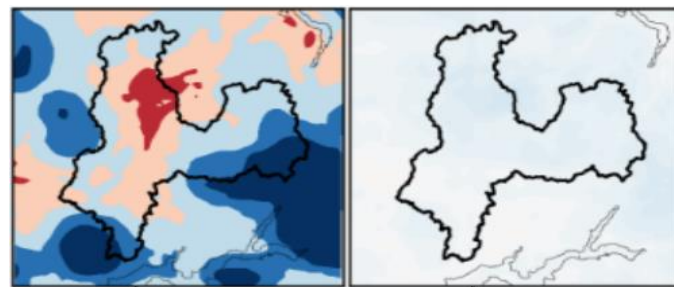


Spatial
variation

Raw CPCM Bias-corrected

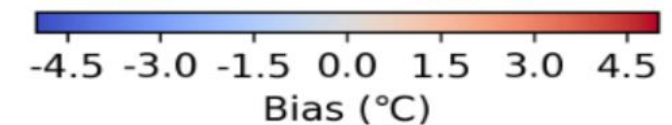
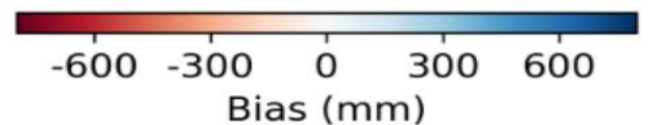
Raw CPCM Bias-corrected

Bulken



6.5°E 6.5°E

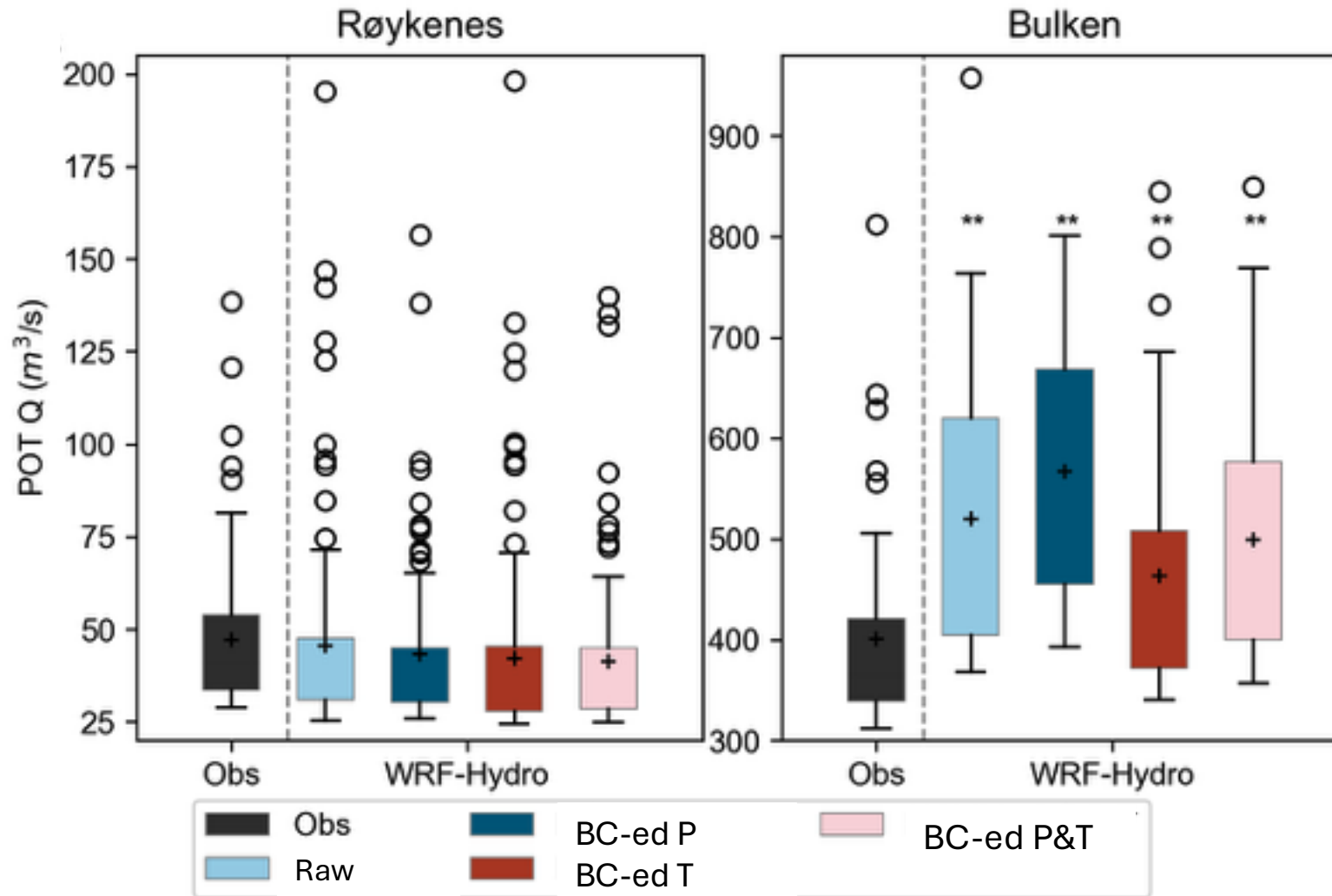
6.5°E 6.5°E



Cold bias
~ 1 °C

(Based on QM)

What happens to the flood peaks?



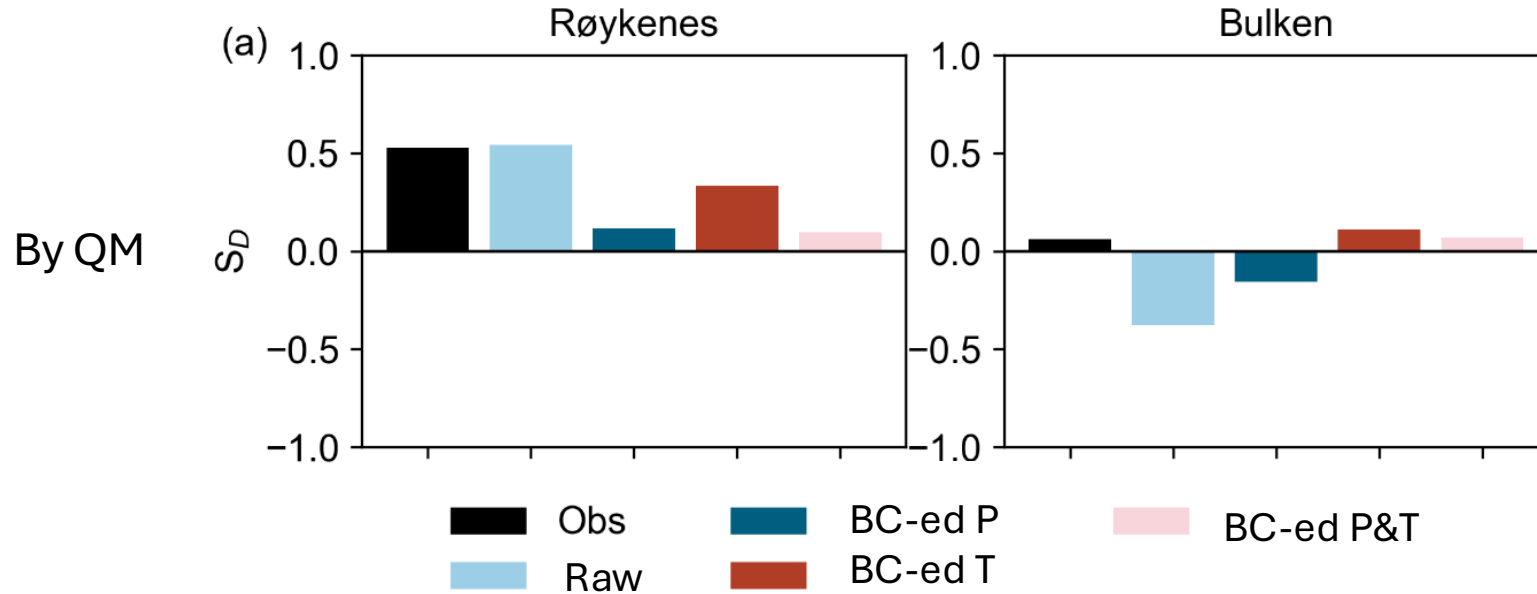
Røykenes: BC-ed P degrades flood peak simulation compared to raw CPCM;

Bulken: BC-ed T alone improves the most on flood peak estimates, reducing overestimation.

(Based on the QM)

(Xie, K., Li, L., et al., *J. Hydrol.*, 2026, under review)

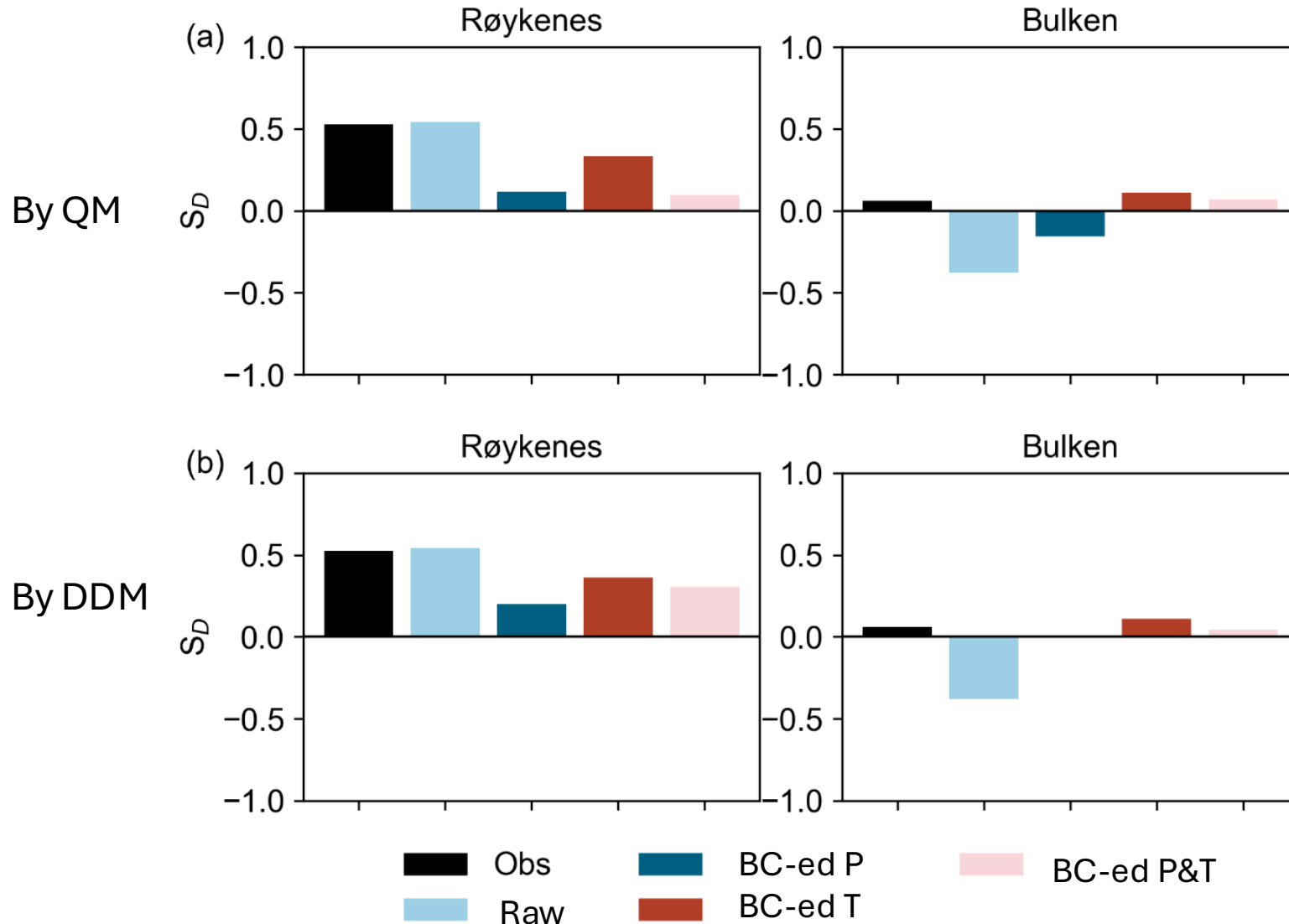
Flood seasonality



- **SD > 0**: autumn-winter floods dominated
- **SD < 0**: spring-summer floods dominated
- A cold bias of $\sim 1^\circ\text{C}$ reverses the flood season in a snowmelt-influenced mountain basin.

(Xie, K., Li, L., et al., JOH, 2026, under review)

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Summary

Flood sensitivity to
CPCM biases is
flood-regime
dependent:

- Raw CPCM is already reliable for the rainfall-driven flood basin: bias correction of precipitation introduces more uncertainty than it removes.
- A $\sim 1^\circ\text{C}$ cold bias reverses the simulated flood season in the mountainous snowmelt basin; temperature correction is essential .

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