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Methods

We test the title question using inverse hydrological modeling in two synthetic experiments. From 5000 prior snow water equivalent (SWE) + streamflow (Q) scenarios, we select the top 1% scenarios that best match observed Q as the **posterior**. We then evaluate whether these runs also reproduce the true SWE, across multiple snow metrics. The Fully Synthetic experiment tests the theoretical constraining power of Q on SWE. The Semi-synthetic experiment quantifies the decrease in constraining power under partial uncertainty.

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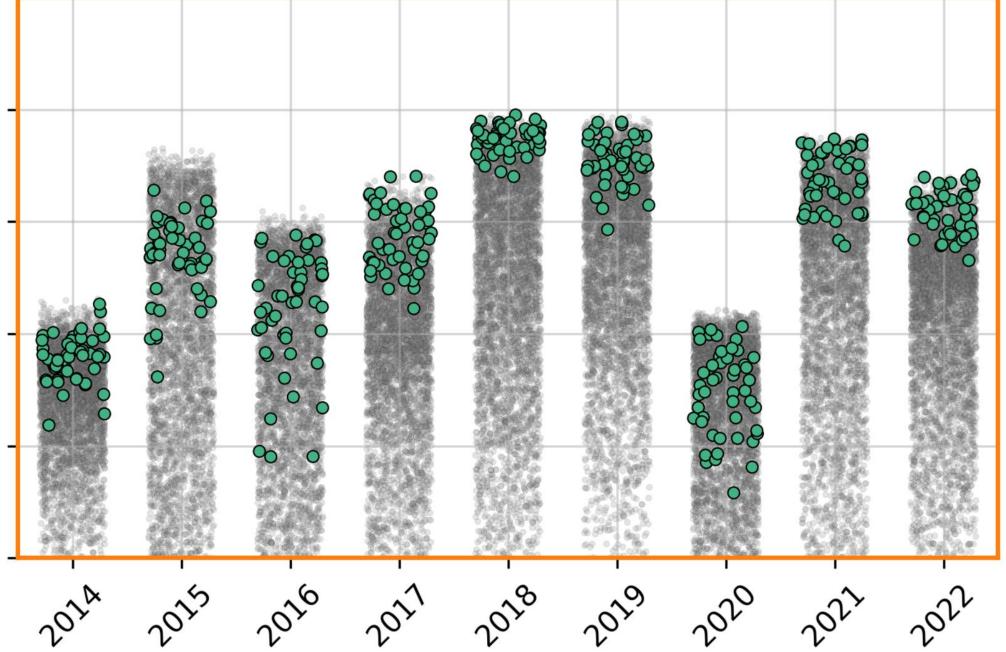
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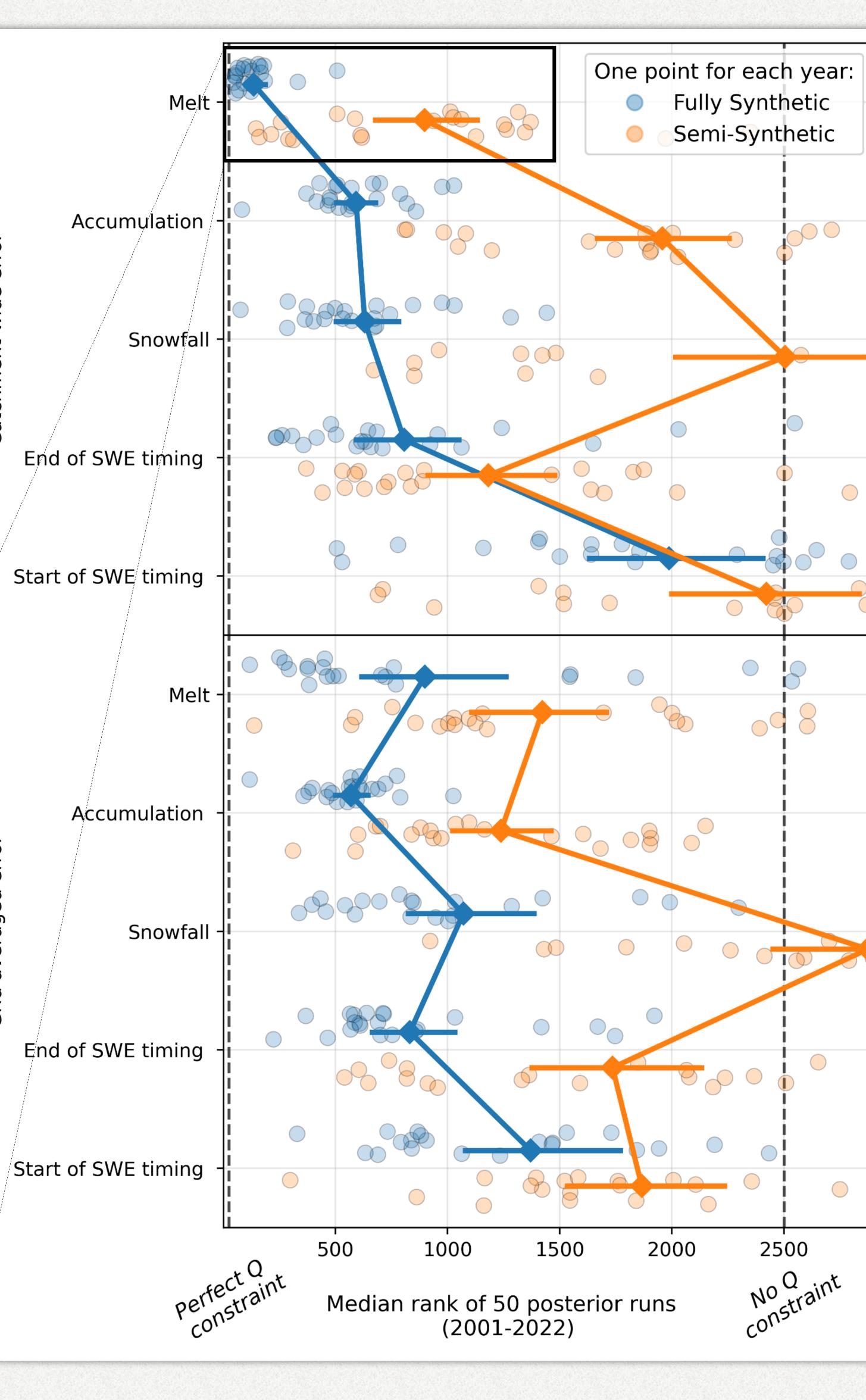
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Can streamflow observations constrain snow mass reconstructions? **Pau Wiersma¹**, Nadav Peleg¹, Bettina Schaefli², Jan Magnusson³, Grégoire Mariéthoz¹ ¹University of Lausanne, ²University of Bern, ³ WSL Institute for Snow and Avalanche Research SLF

Soil model *True* θ_{soil} **Q**_{prior} *True* θ_{soil} *Q*synthetic thetic $d(Q_{prior}, Q_{obs})$ $Q_{synthetic}$ True θ_{soil} ernal Uncertain Uncertain $Q_{posterior}$ terio Semi-synthetic Streamflow results Posterior = 50 best runs σ σ rid G

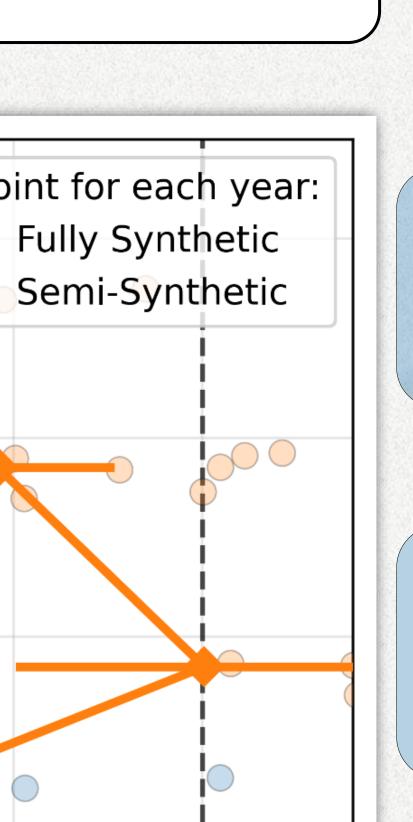
Evaluation of posterior SWE scenarios





Conclusions

In theory **yes**, but the constraining power depends on: • What the target snow metric is • On what spatial scale that metric is calculated • The amount of uncertainty in the inversion







Streamflow has the most constraining power on catchment-wide melt error

For other metrics the streamflow constraint is better than random, but not perfect either

Melt rate error is better constrained on the catchment scale, Accumulation error is better constrained on the grid scale

Already under partial uncertainty, streamflow has no constraining power on snowfall rates

Meteorological + snow model uncertainty decrease the constraining power of streamflow across all snow metrics

These conclusions are drawn in absence of soil model and streamflow observation uncertainty. Future work will explore the constraining power of streamflow on snow mass reconstructions under real-world uncertainty.

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