

Improving global glacier modelling efforts through observations



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Harry Zekollari
2024 EUROPEAN POLAR SCIENCE WEEK

Improving global glacier modelling efforts through observations



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CRYOSPHERE & SEA LEVEL

1928

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Fieschergletscher (CH)
swisstopo, Terra archive

Improving global glacier modelling efforts through observations



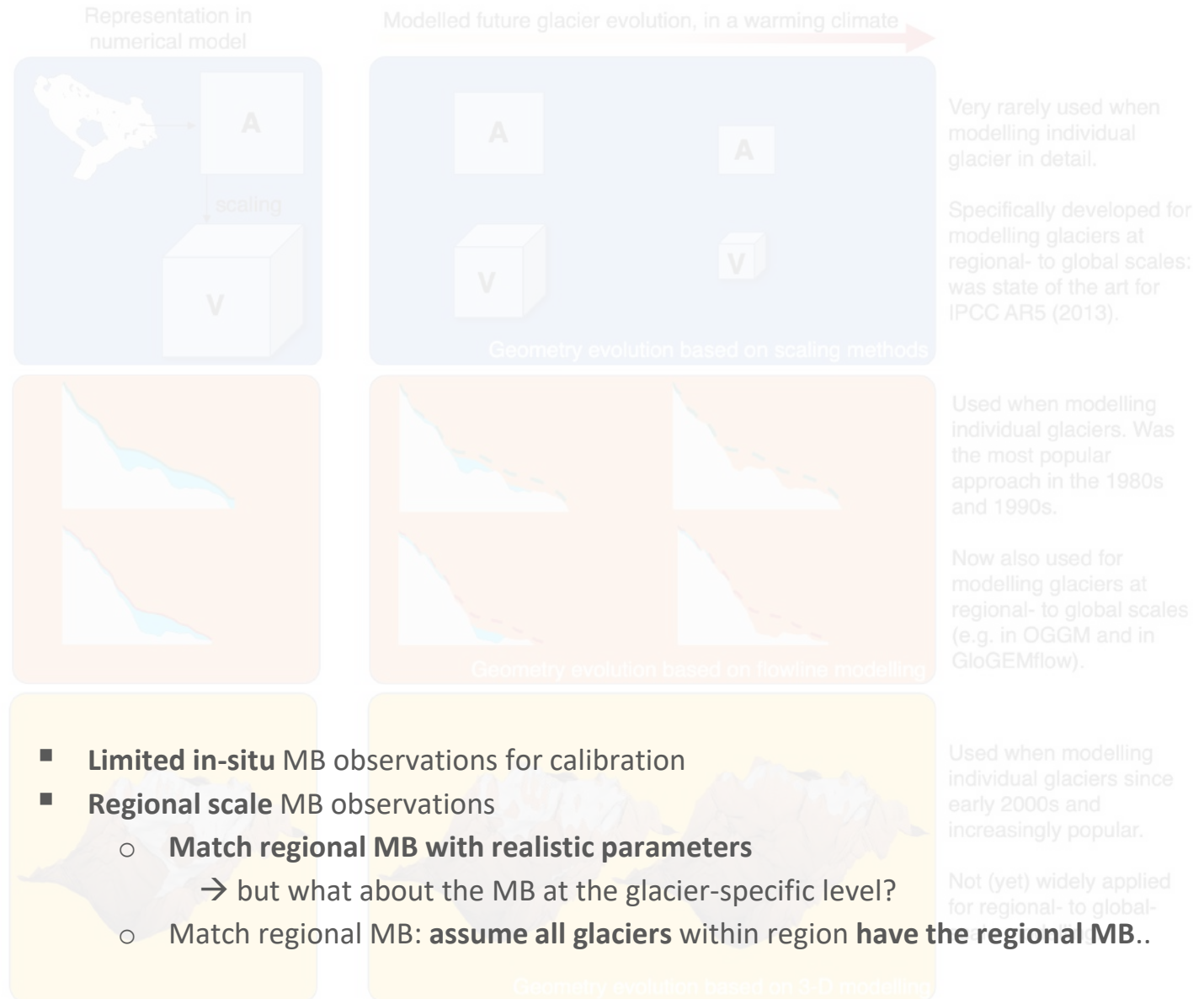
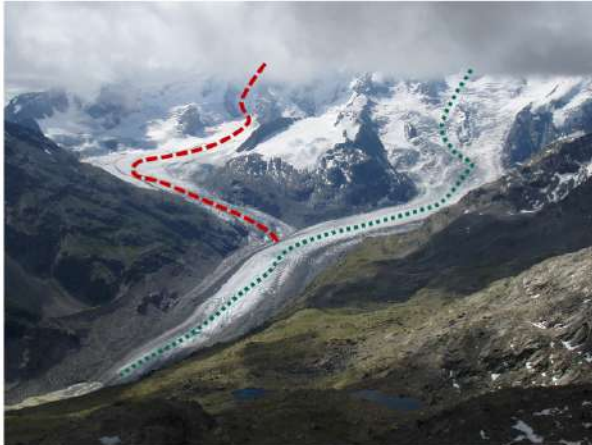
2021

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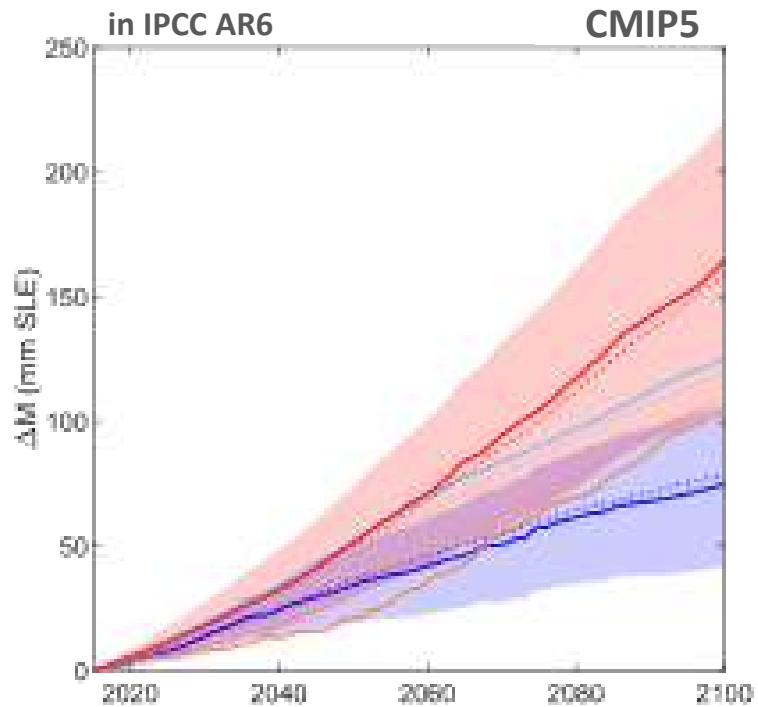
Fieschergletscher (CH)
VAW Glaciology, ETH Zurich

Modelling glacier evolution at regional- to global scales

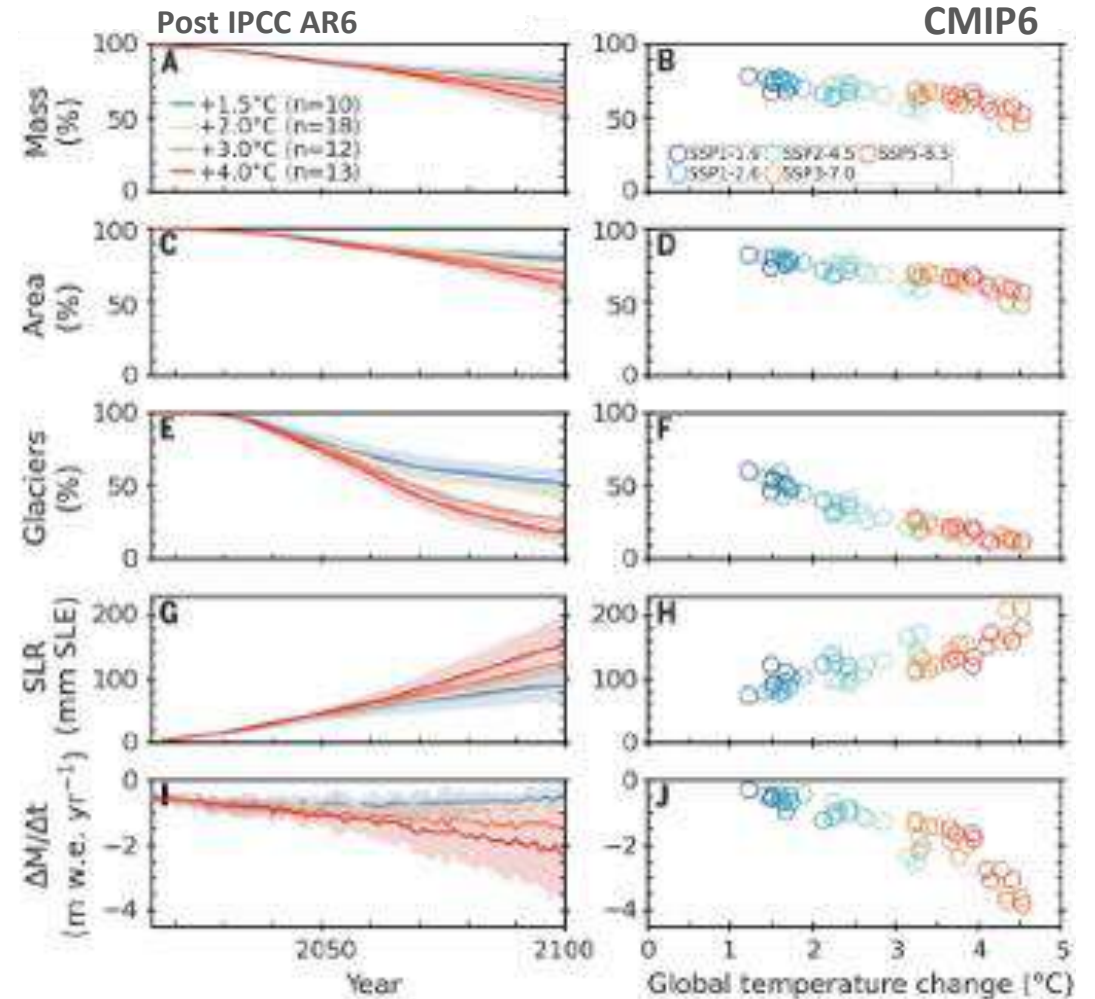
Glacier geometry at given date



Modelling glacier evolution at regional- to global scales

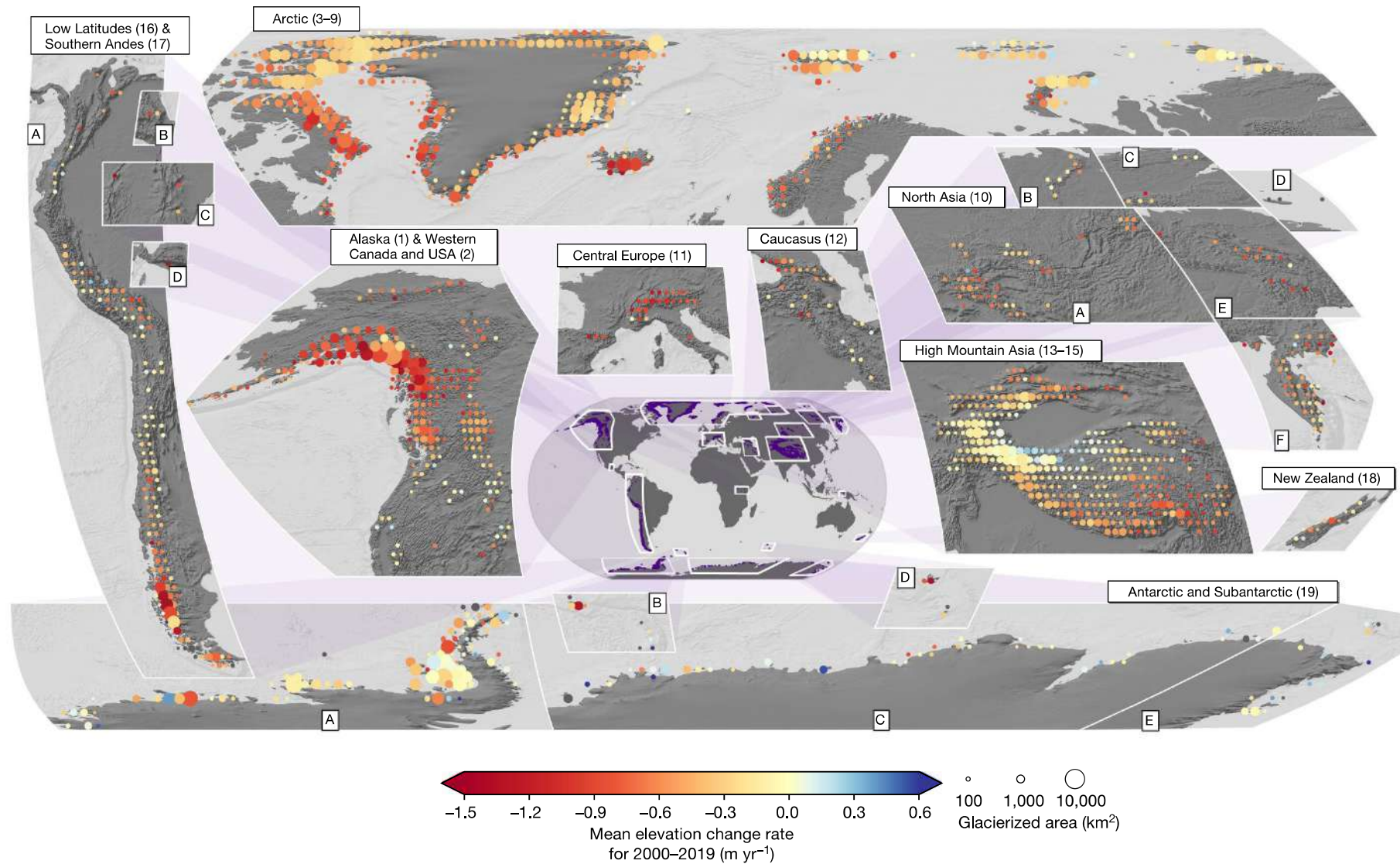


GlacierMIP2 (Marzeion et al., 2020, *Earth's Future*)



Rounce et al. (2023, *Science*)

One of the novelties in Rounce et al. (2023): Calibration based on glacier-specific MB observations



Modelling global glacier evolution under CMIP6 scenarios

Preprint

Preprints / Preprint egusphere-2024-1013

<https://doi.org/10.5194/egusphere-2024-1013>
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Abstract Discussion Metrics

06 May 2024

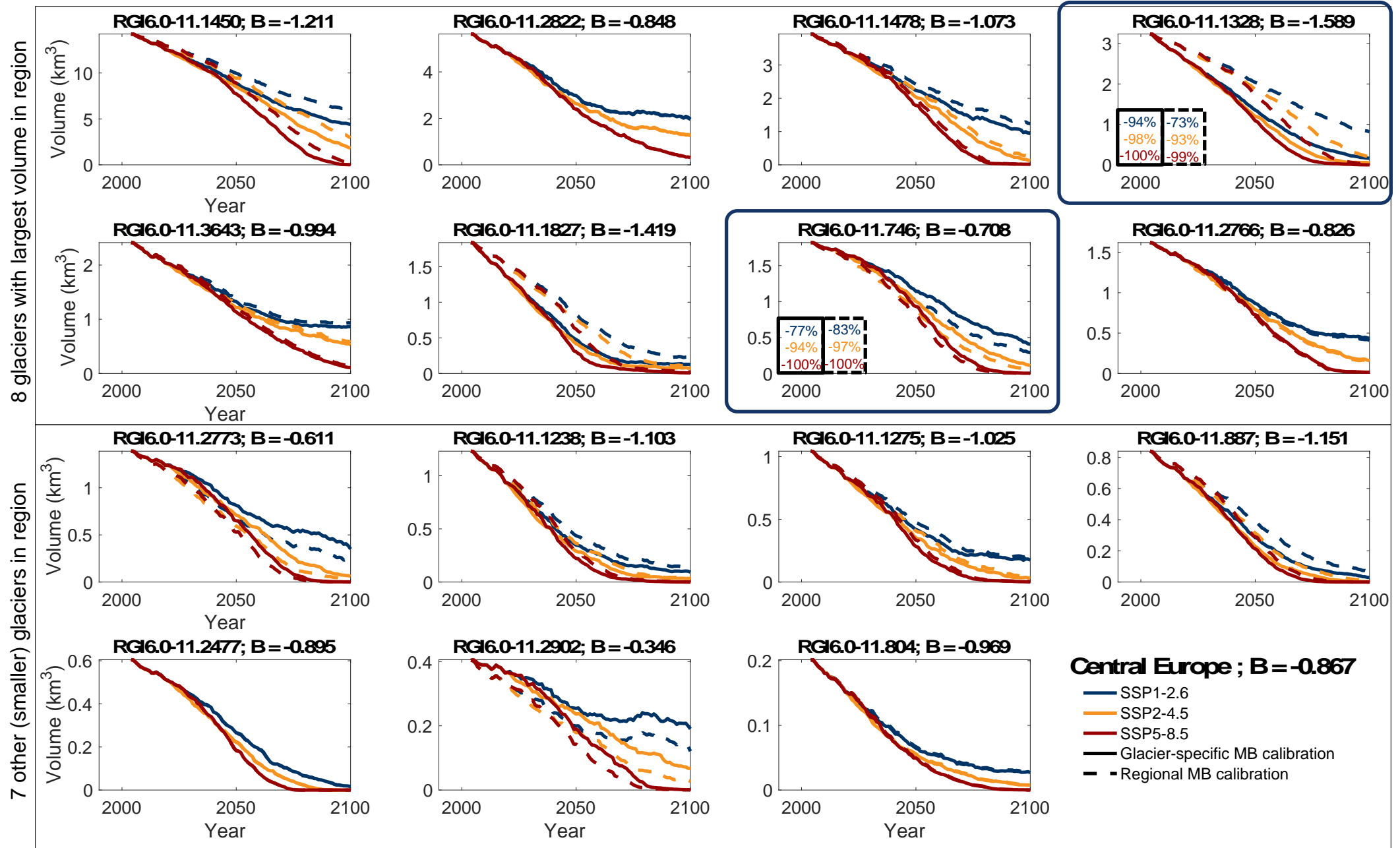
21st century global glacier evolution under CMIP6 scenarios and the role of glacier-specific observations

Harry Zekollari ✉, Matthias Huss, Lilian Schuster, Fabien Maussion, David R. Rounce, Rodrigo Aguayo, Nicolas Champollion, Loris Compagno, Romain Hugonnet, Ben Marzeion, Seyedhamidreza Mojtabavi, and Daniel Farinotti

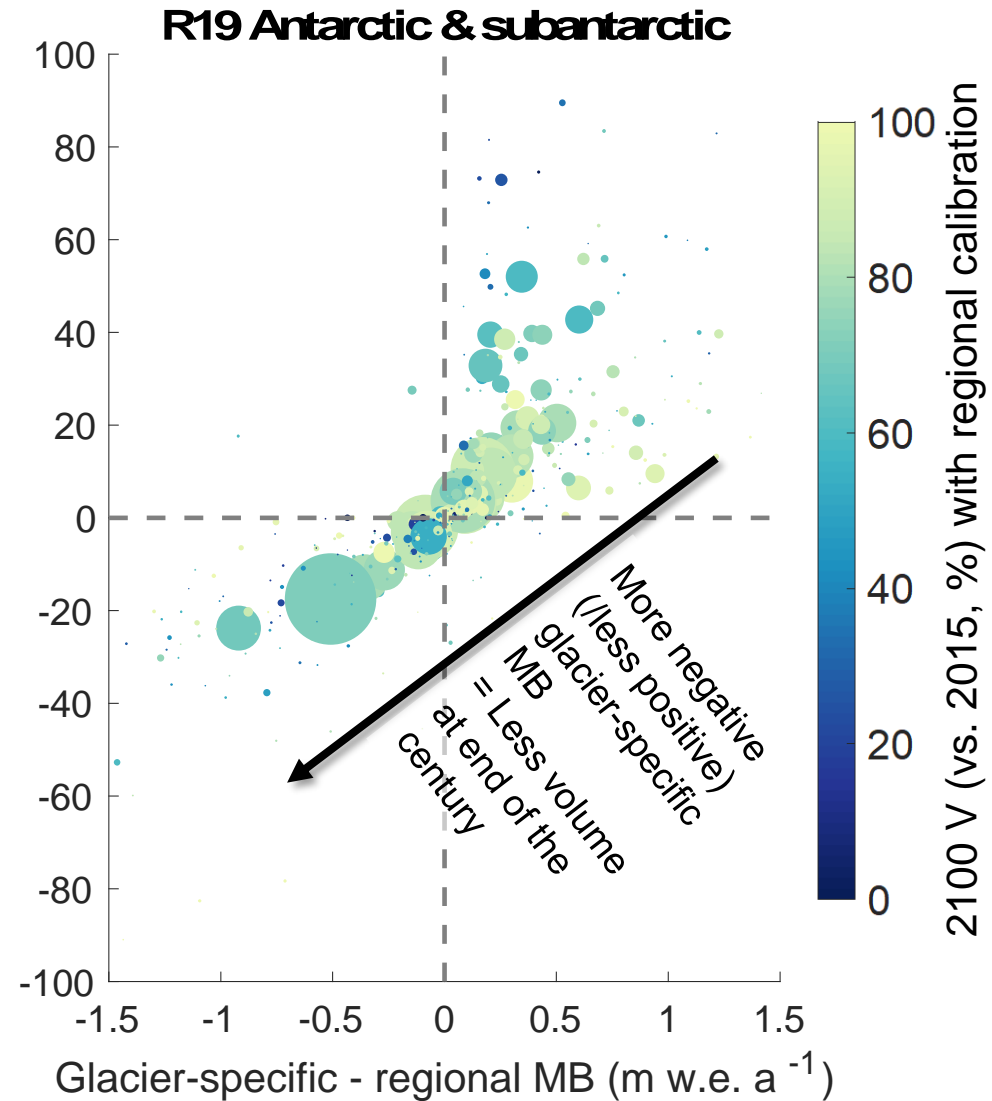
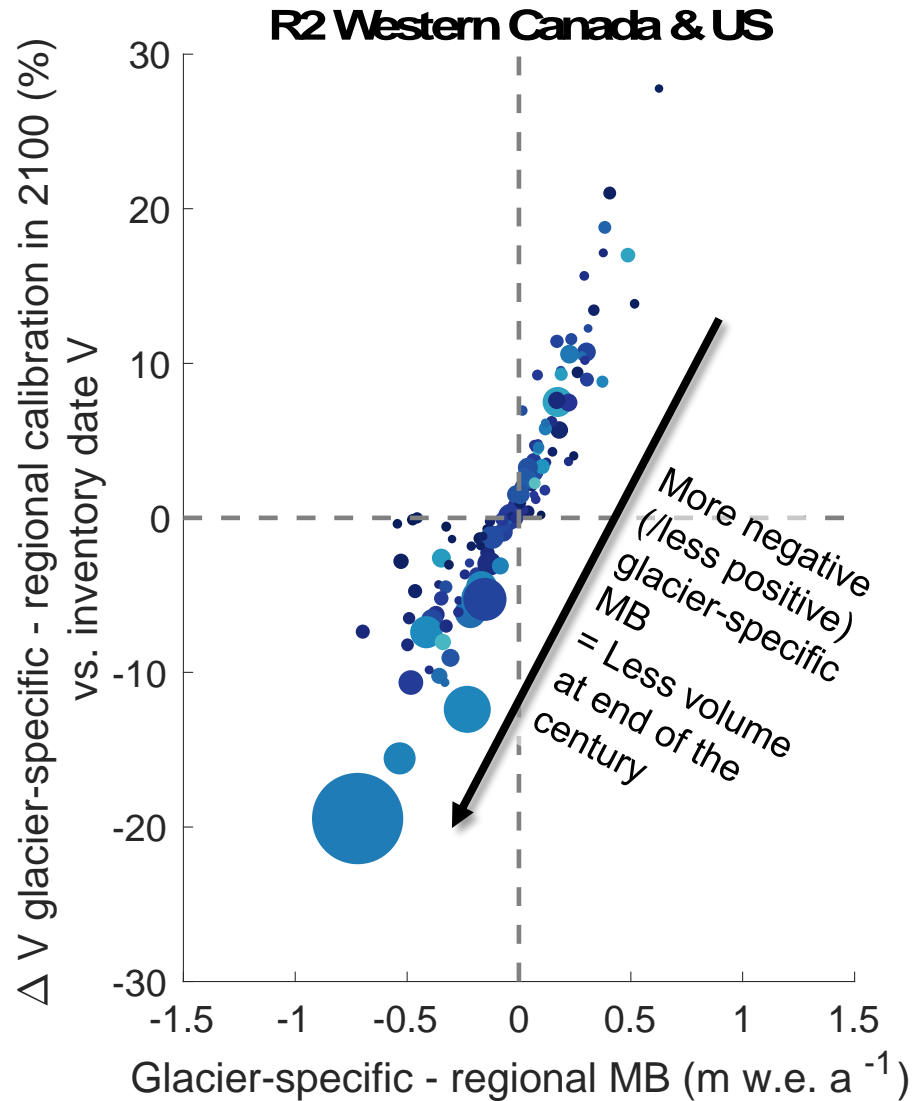
Two main goals:

- What is the **effect of calibrating to glacier-specific MB observations?** (vs. regional)
- **Create a CMIP6 ‘mini-ensemble’** (complement PyGEM with OGGM and GloGEM)

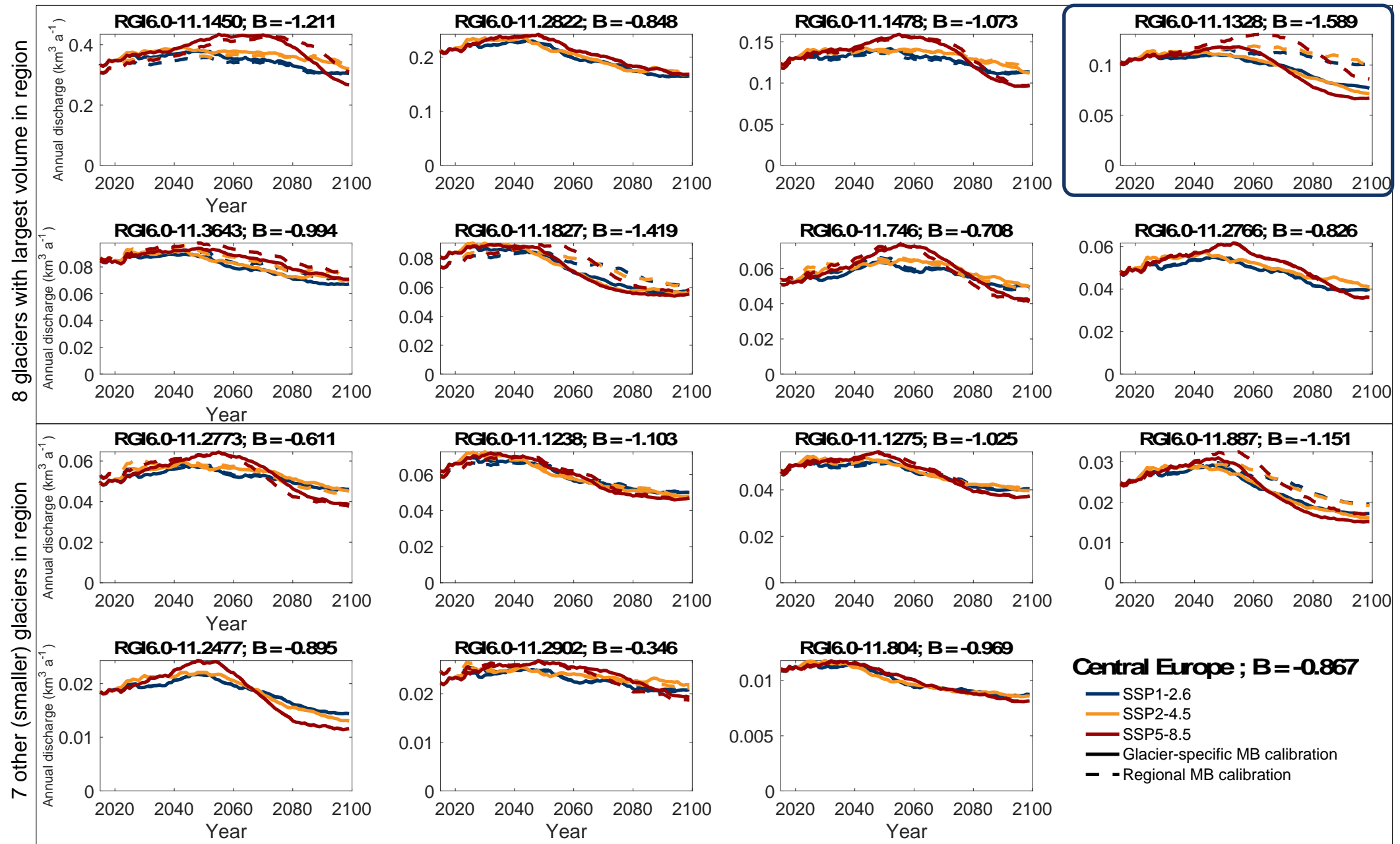
Calibrating with glacier-specific MB observations (vs. regional)



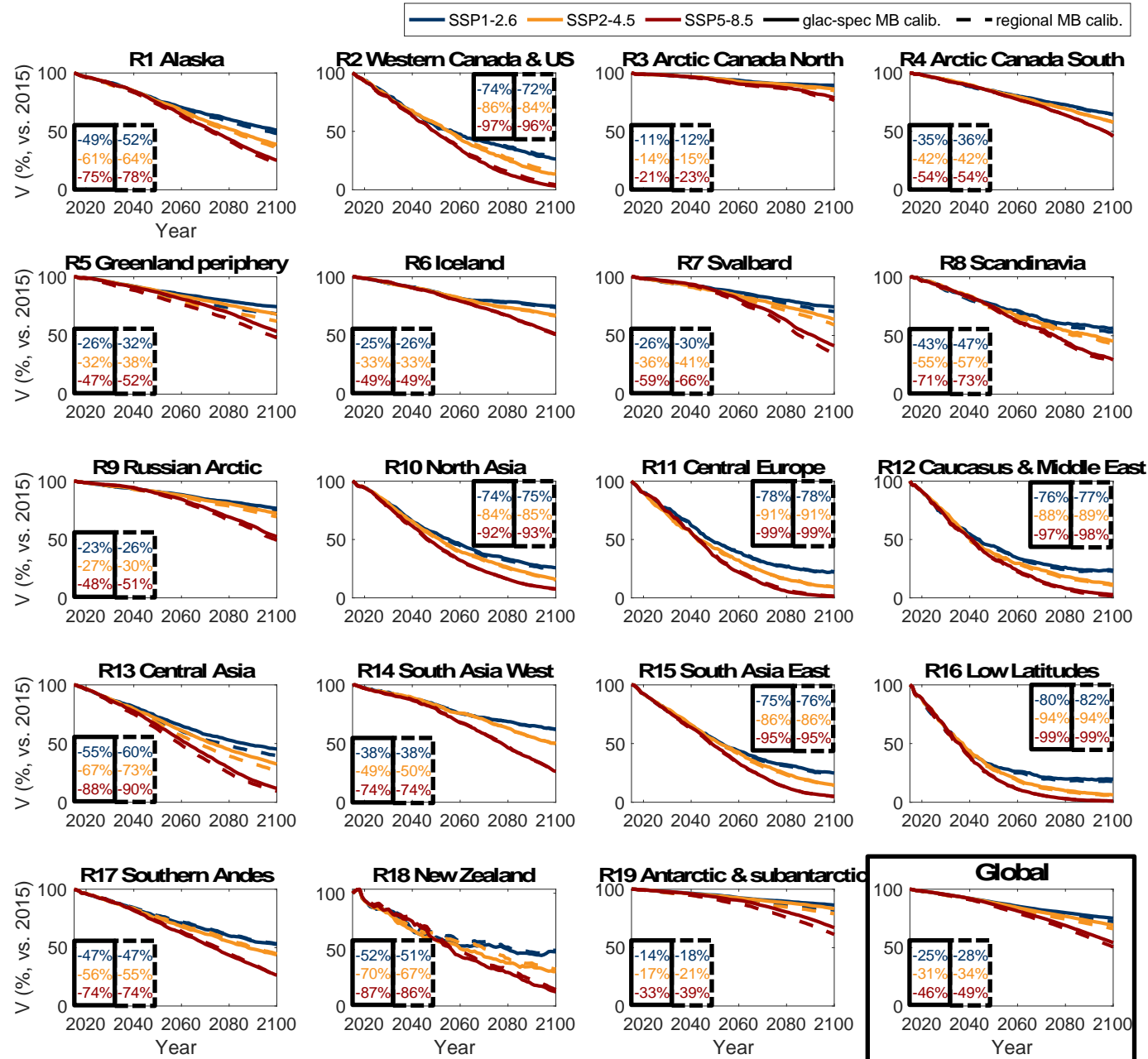
Calibrating with glacier-specific MB observations (vs. regional)



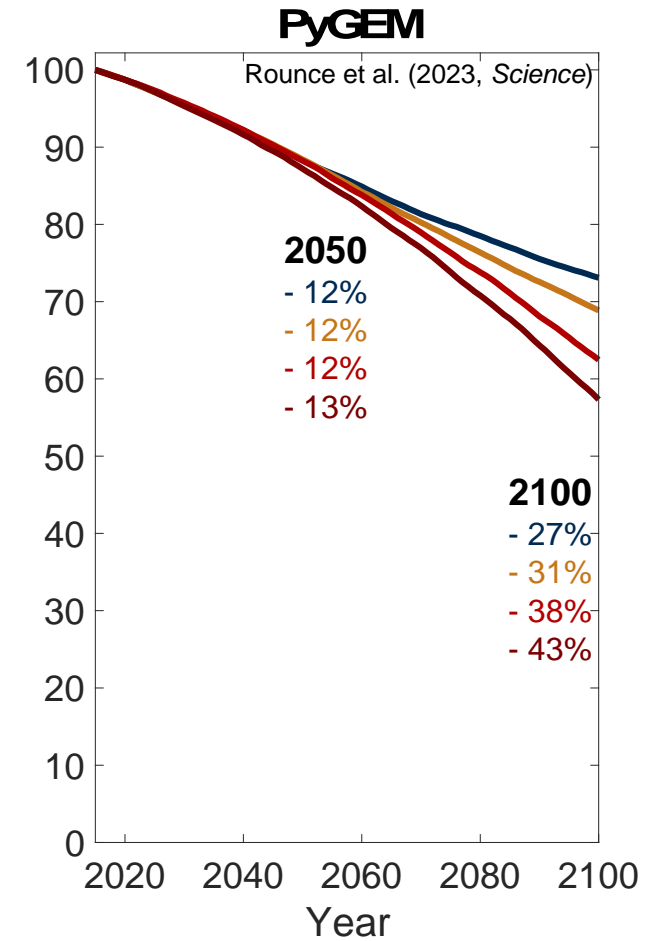
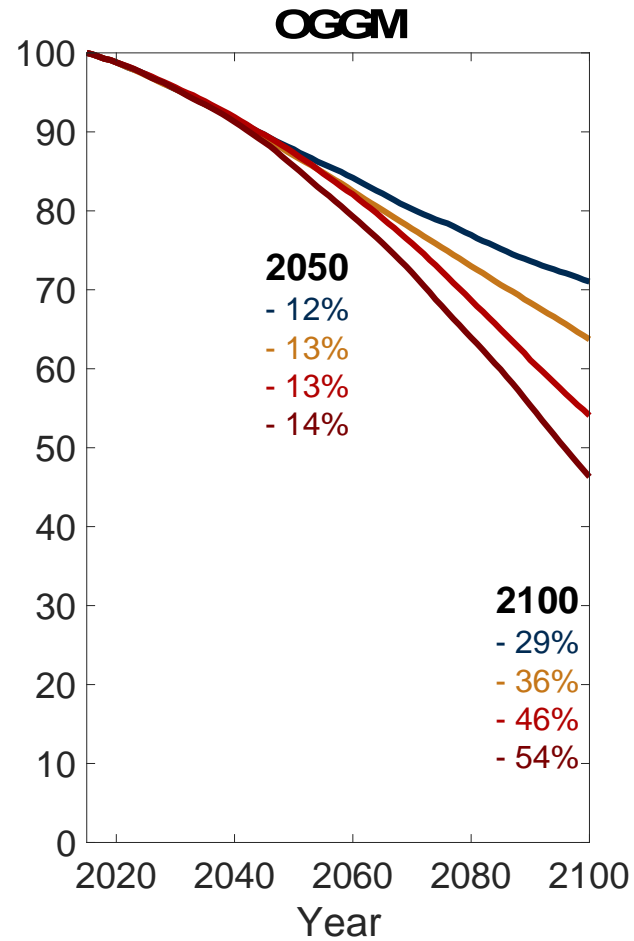
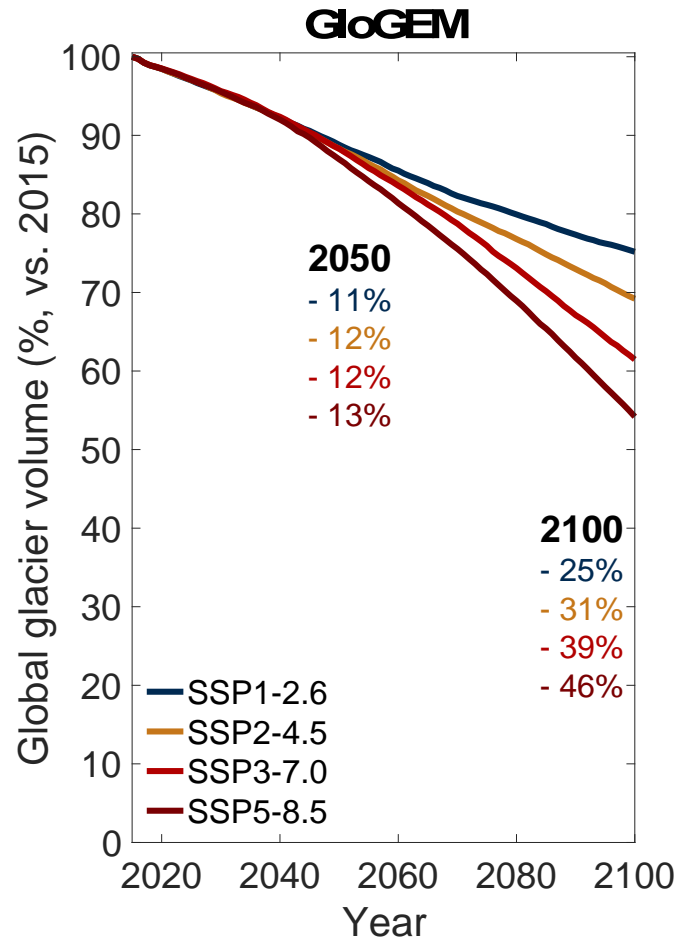
Calibrating with glacier-specific MB observations (vs. regional)



Calibrating with glacier-specific observations (vs. regional)

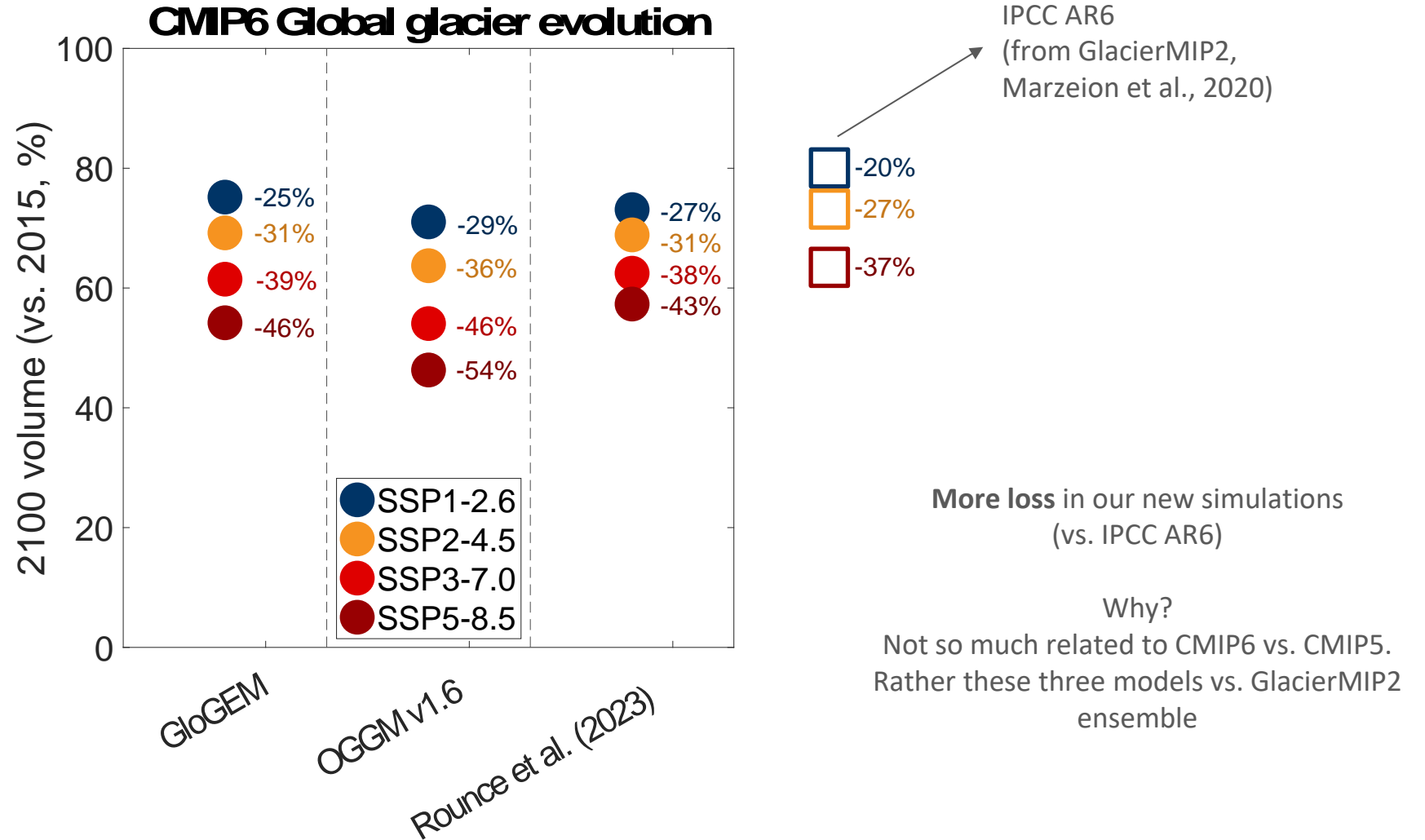


Towards a CMIP6 global glacier evolution ensemble



* here: all results are based on calibration with glacier-specific MB observations!

Towards a CMIP6 global glacier evolution ensemble



* here: all results are based on **calibration with glacier-specific MB observations!**

Importance observations for glacier modelling!

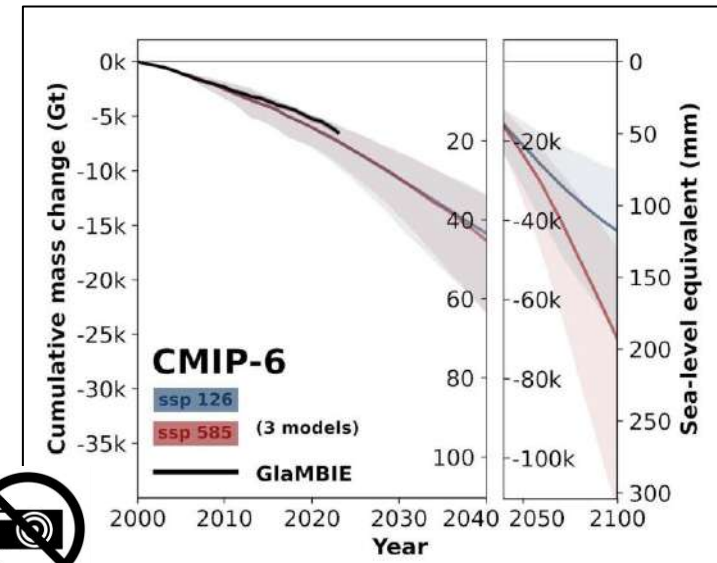
- **Glacier-specific vs. regional observations. Does it matter?**

- A lot at the local scale! Important for local impacts (e.g., hydrology, natural hazards)
- Less at the global scale (sea-level rise)



- **How to improve glacier modelling and projections?**

- More MB products at the **glacier-specific scale**. Currently: calibrate every glacier to match geodetic MB Hugonnet et al. (2021, *Nature*): a single number! (limitation: e.g., equifinality!)
 - Promising avenues: Dussaillant et al. (2024, *ESSDD*). In future phases of GlaMBIE?
- Higher **temporal resolution** MB observations (even if implies this is at regional scale!): GlaMBIE very valuable.
- Other types of observations:
 - For MB: Snowlines, albedo
 - For glacier dynamics: e.g., improved surface velocities
- Hybrid products at **interface between observations and modelling**
 - e.g., distributed MB within a glacier (e.g., Miles et al., 2021, *Nature Comms*; Van Tricht et al., 2022, *TC*, Kneib et al., 2024, *EGUsphere*)
 - Ice thickness: invert from surface velocities in modelling framework
 - Frontal ablation estimates: combining remote sensing and modelling



Sharing not permitted

GlaMBIE (under review)

Thank you!

