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A model-data comparison based on high-resolution, 3D glacier modelling from the Last Glacial Maximum to the Little Ice Age in the European Alps

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We present the first Alps-wide 3D glacier surface reconstruction for the maximum glacier extent during the Little Ice Age (LIA). This reconstruction was computed using a high-resolution modelling approach (50 m) based on the Instructed Glacier Model (IGM, Jouvet et al., 2023). The physically consistent glacier geometries presented are based on empirically mapped outlines used as modelling targets. By incorporating these outlines, we achieved an unprecedented model-data match at a high resolution across the entire Alps (Henz et al., 2025).

The next step in this model-data comparison process is to automate the comparison between geomorphological data and transient glacier simulations. Geomorphological data consist of dated moraines, ice margin positions, peat bogs, rockfall deposits, and bedrock exposure ages. All of these data are combined in the new AlpIce database, which spanns from the Last Glacial Maximum to the present day (Kamleitner et al., in prep). We exploit the AlpIce database by running transient glacier simulations during the Younger Dryas and the Holocene to model the glacial advance and retreat history for comparison with the database. The model-data comparison is automated by calculating an agreement score in time and space for each dated entry in the database. This automated scoring tool will faciliate ensemble and sensitivity analysis. Among other things, it allows for experiments involving the adaptive exploration of parameter configurations.

REFERENCES

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