Symposium 11: Quaternary environments: landscapes, climate, ecosystems and human activity during the past 2.6 million years

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AlpIce: a database of geo(morpho)logical and geochronological evidence of Alpine paleoglacier fluctuations

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A new generation of numerical models permits simulations at high resolution, over long time frames, and across large spatial scales. Leger et al. (2025) recently demonstrated the potential of physics-driven AI models to simulate past glacier evolution by producing 100 Alps-wide, 17 ka-long simulations of the Alpine Last Glacial Maximum (LGM) Ice Field at 300 m resolution. Faced with such large ensembles, robust empirical benchmarks for model evaluation are increasingly important. In the Alps, paleoglacier model validation has so far relied on mapped LGM ice extents and local trimlines, despite abundant studies offering additional field evidence throughout the Quaternary.

Inspired by work on the British, Fennoscandian, Patagonian, and Greenland ice sheets, we establish a standardized dataset of Alpine paleoglacier fluctuations for future model-data comparison. The AlpIce database compiles published geo(morpho) logical and geochronological markers (in)directly constraining build-up, culmination, and disintegration of the Alpine LGM glaciers, as well as subsequent Lateglacial and Holocene ice advances.

AlpIce integrates >4,200 surface-exposure and radiocarbon dates – all quality-controlled and assessed for paleoglaciological context – from 268 publications and over 1,270 sites. These data provide chronological constraints on more than 1,500 paleoglaciological events, including ice stabilization, ice advance, ice retreat, and ice-free conditions. A GIS catalogue of more than 260 dated landforms (e.g., moraines, rock glaciers, landslide deposits) complements the dataset. The AlpIce database is designed as an open-access resource for various applications, including model validation.

REFERENCES
Leger, T., Jouvet, G., Kamleitner, S., Mey, J., Herman, F., Finley, B.D., Ivy-Ochs, S., Vieli, A., Henz, A., Nussbaumer, S.U. 2025: A data-consistent model of the last glaciation in the Alps achieved with physics-driven AI. Nat. Commun., 16, 848.