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A database of Last Glacial Maximum transfluences and crosswise divides based on sub-kilometer Alpine ice flow modelling

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Palaeoglaciological model-data comparison is often limited to reconstructions of the former ice margins. On the other hand, direct validation of modelled ice thickness and thus volume is often impossible or debatable. Here, we explore a new way to validate model results in deglaciated mountain regions based on the modelled ice flow patterns.

Building on a previous simulation of the last glacial cycle ice dynamics in the Alps, we use the Parallel Ice Sheet Model (PISM) to refine horizontal and vertical model resolutions during the Last Glacial Maximum, and analyse the resulting modelled flow pattern. The modelled fast-flow regions generally occur along the main river valleys, while ice domes and ice divides are predominantly located over major reliefs. Nevertheless, the model results depict ice flow across mountain passes (transfluences) in 81 locations, ice divides above topographic lows (hereafter referred to as crosswise divides) in 30 locations (preliminary numbers), and self-sustained ice domes characteristic of ice caps in two locations over Flüelapass and Ötztal.

The method locally depends critically on model resolution. Nevertheless, in the Eastern Alps, modelled transfluences and crosswise divides are generally incompatible with geological reconstructions, indicating that climate deterioration was overestimated in the model input. In the Western Alps, however, transfluences generally occur where they have been documented by geologic evidence. Interestingly, crosswise divides are often found over valley bottlenecks where glacial erosion has apparently been less efficient. These model results depict the LGM Alpine ice complex as intermediate between ice fields and ice caps, bearing characteristics of both and perhaps no modern analogue.