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How ice shapes topography

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The Plio-Pleistocene glaciations brought along big changes to the topography of most mountain ranges. As ice sheets and glaciers waxed and waned, they eroded bedrock and left their distinct footprint on the surface of Earth. Overdeepened valleys, U-shaped troughs, and steepened headwalls are some of the landforms that developed in many places in response to the glaciations.
Because the mass balance and the flow of glaciers depend on the local distribution of topography, we can expect that topographic feedbacks played a major role for the long-term temporal evolution of ice dynamics and the associated rates of erosion. These feedbacks have been studied using computational landscape evolution models, but their importance for limiting mountain range elevations, and for forming fjords and plateaus, remain debated. Also, we still know very little about how the topographic feedbacks influenced the million-year evolution of past and present massive ice sheets in Antarctica, Greenland, North America, and Scandinavia.
In this lecture, I present examples of how glacial landscape evolution models can be used to integrate ice dynamics, climate, and erosion over million-year time scales, and in this way help us to understand how ice contributed to the shaping of Earth's surface. I furthermore discuss strategies for how we can learn more from the models by integrating them more closely with field-based empirical studies using, for example, cosmogenic nuclides and thermochronometry.