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Coupling Numerical Modeling and Low-T Thermochronology to Study the Evolution of Alpine Glaciated Landscapes

P. Sternai and F. Herman

Geologisches Institut - Earth Surface Dynamics - ETH Zürich, Sonneggstrasse, 5 CH-8092 Zürich, Swizzerland

Tectonic activity increases erosion and thus sediment yield. To quantify the relationship between tectonic and sediment yield it is necessary to know how relief evolves. However it is not obvious since it involves several processes that are poorly understood. Surface process models provide a means to investigate these processes.
Glacial processes present a particular challenge as, although these have been recently included in surface process models [e.g. Tomkin and Braun, 2002], there remain serious limitations to both the ice dynamics and erosion components of these models. Using the Alps as a natural laboratory, we improve an existing code in order to build an efficient tool that will enable us to simulate the evolution of landforms under different climatic conditions (i.e. glacial and interglacial climates) and with diverse surface processes (fluvial, glacial, hillslope, etc.). The code is improved through a better description of the physics involved in glacial and fluvial erosional processes. This is obtained by (1) studying in depth how the transition between fluvial and glacial domains, on different timescales and at different topographic wavelengths, affect the landscape evolution and (2) coupling the code with a 3D thermal model to compute thermochronological ages derived by (U-Th)/He and He3 /He4 methods for the long term timescale and OSL-thermochronology for the short term timescale, that will ultimately be compared to existing data.