Geophysical Research Abstracts
Vol. 13, EGU2011-6859-1, 2011
EGU General Assembly 2011

Predicting thermochronological data from a fluvio-glacial surface process model

Vivi Kathrine Pedersen (1), David Lundbek Egholm (1), Jean Braun (2), Frédéric Herman (3), and Søren Bom Nielsen (1)

(1) Department of Earth Sciences, Aarhus University, Aarhus, Denmark (vivi.pedersen@geo.au.dk), (2) Laboratoire de Géodynamique des Chaînes Alpines, Université Joseph Fourier, CNRS, Grenoble, France, (3) Department of Geosciences, ETH Zürich, Zürich, Switzerland

Consistency between thermochronological parameters measured on rock samples and those obtained from physically based surface process models is a prerequisite for improving our quantitative understanding of long-term surface processes and to infer the long-term topographical evolution of an area under varying climate conditions.

Here we combine surface process model results with a thermal solver, in order to investigate the thermochronological responses to fluvial vs. glacial landscape evolution. We use iSOSIA, a higher-order ice-sheet model coupled with fluvial erosion and hillslope mass wasting, for simulating fluvio-glacial erosion.

In order to quantify the thermal effects of the predicted surface erosion, and calculate different thermochronological parameters, we use Pecube, a finite element code that solves the transient heat transport equation in three dimensions, including heat conduction, advection and production.

We investigate the predictions of two of the most low-temperature thermochronological methods: 1) apatite helium (AHe) ages, sensitive to temperatures in a range from 40-70^{o}C, and 2) optically stimulated luminescence (OSL) ages, with a closure temperature of about 30-35^{o}C. These two methods may potentially resolve the small exhumation differences caused by changes in dominant surface process.

In this study we focus on the thermochronological response of cyclic glacial erosion in steady-state fluvial orogens dominated by different rates of tectonic uplift. We show how the predicted AHe and OSL ages vary both spatially and temporally, and investigate how they each relate to the assumed efficiency of the erosional processes, as well as the climate forcing, in relation to the different uplift rates.