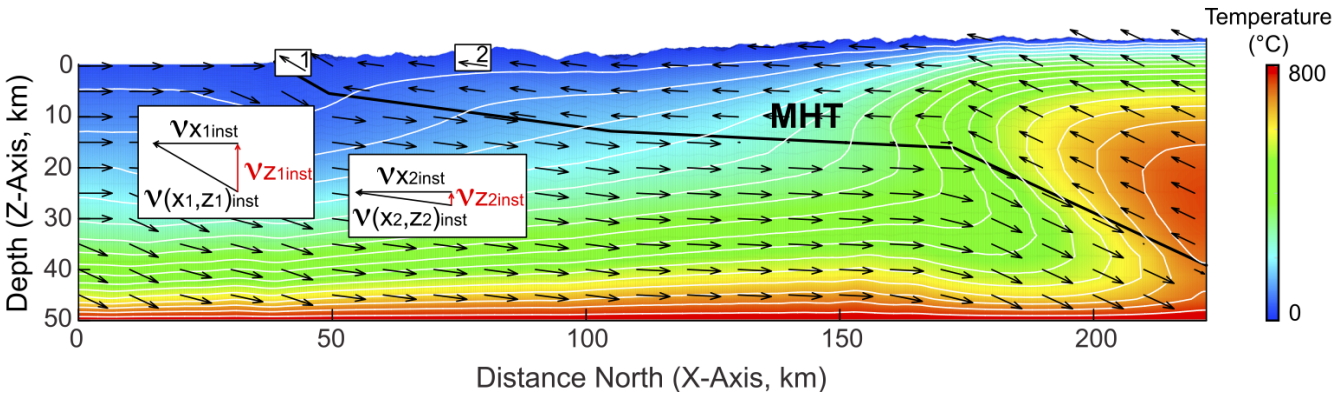
Pecube



Cross section through a Pecube model of the Bhutan Himalaya from Coutand et al., 2014.

Pecube is a numerical modelling program used to simulate heat transfer in the lithosphere and to predict thermochronometer ages. Pecube uses the finite element method to calculate time-dependent temperatures in 3D including the effects of heat conduction, advection, and production. What is somewhat unique with Pecube is that the surface topography can evolve freely with time and there is a fairly flexible kinematic model built in, which allows users to define fault geometries and slip rates within their model domain. Pecube is open source, and available directly from Jean Braun or through the HUGG GitHub.

Useful Pecube links

- Pecube-HUGG GitHub
- Pecube documentation
- Pecube model design guidelines

Relevant journal articles

Crustal thermal processes

- Ehlers, T. A. (2005). Crustal Thermal Processes and the Interpretation of Thermochronometer Data. Reviews in Mineralogy and Geochemistry, 58, 315–350.
- Hamza, V., Cardoso, R., & Ponte Neto, C. (2008). Spherical harmonic analysis of earth's conductive heat flow. *International Journal of Earth Sciences*, *97*(2), 205–226.
- Mancktelow, N. S., & Grasemann, B. (1997). Time-dependent effects of heat advection and topography on cooling histories during erosion. Tectonophysics, 270(3-4), 167–195.
- Pollack, H. N., Hurter, S. J., & Johnson, J. R. (1993). Heat flow from the Earth's interior: Analysis of the global data set. *Reviews of Geophysics*, *31* (3), 267–280.
- Stüwe, K., White, L., & Brown, R. (1994). The influence of eroding topography on steady-state isotherms; application to fission track analysis. Earth and Planetary Science Letters, 124(1-4), 63–74.
- Tester, J., Anderson, B., Batchelor, A., Blackwell, D., DiPippo, R., Drake, E., Garnish, J., et al. (2006). *The Future of Geothermal Energy; Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century* (No. INL/EXT-06-11746) (p. 372). Idaho Falls, Idaho: Idaho National Laboratory.

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- Braun, J. (2002). Estimating exhumation rate and relief evolution by spectral analysis of age-elevation datasets. *Terra Nova*, *14*(3), 210–214.
- Braun, J. (2002). Quantifying the effect of recent relief changes on age-elevation relationships. *Earth and Planetary Science Letters*, *200*(3-4), 331–343.
- Braun, J. (2003). Pecube; a new finite-element code to solve the 3D heat transport equation including the effects of a time-varying, finite amplitude surface topography. *Computers & Geosciences*, *29*(6), 787–794.
- Braun, J., der Beek, van, P., Valla, P., Robert, X., Herman, F., Glotzbach, C., Pedersen, V., et al. (2012). Quantifying rates of landscape evolution and tectonic processes by thermochronology and numerical modeling of crustal heat transport using PECUBE. *Tectonophysics*, *524–525*(0), 1–28.
- Whipp, D. M., Jr, Ehlers, T. A., Braun, J., & Spath, C. D. (2009). Effects of exhumation kinematics and topographic evolution on detrital thermochronometer data. *Journal of Geophysical Research-Earth Surface*, *114*.