Geophysical Research Abstracts, Vol. 9, 04734, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04734

Surface processes and tectonics: forcing of continental subduction and deep processes.

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It is accepted that surface processes provide a critical feedback on the surface tectonic deformation. Yet, the idea that the influence of these processes may go below the crustal levels, is less common. In this study, we use thermo-mechanical numerical models to investigate the influence of surface processes on the styles of continental collision. We exploit our recent model of continental subduction at early stages of India-Asia collision. We show that the total amount of subduction may largely vary as function of denudation rate (controlled by the coefficient of erosion, k). Erosion provides a dynamic discharge of the hanging wall of the major thrust zone, whereas the sedimentation increases loading on the footwall and helps down-thrusting of the lower plate. Both processes reduce the resistance of the major thrust fault and subduction channel to subduction. However, very strong or very slow erosion/sedimentation enhance the possibility of plate coupling and promote whole-scale thickening or buckling. The maximal amount of subduction is achieved for some intermediate values of erosion rates when the tectonic uplift rate is fine-balanced by the denudation rate. In our case, the optimal balance is achieved for k ˜ 3000 m2/yr. We then extended our model beyond the conditions of India-Asia collision, in terms of the tested range of k and convergence rates. The experiments suggest that both extra slow (k $<$ 50-100 m2/yr) and extra rapid erosion (k $>$ 6000-8000 m2/yr) limit, by up to 50%, the total amount of subduction, if not totally prevent it. The model demonstrates the large capability of surface processes to adopt to different deformation styles: the orogenic building and subduction successfully develop (subduction number, S $>$ 0.5) in the range of k between 500 m2/yr and 6000 m2/yr at convergence rates ranging from 1 cm/y to 6 cm/y. Within this range, particular features of orogenic style such as the accretion prism geometry, amount of upper crustal subduction, horizontal progression of the mountain range/thrust fault and the amount of exhumation may be quite different.