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Nappe emplacement under lateral pressure gradient

Yury Podladchikov and Stefan Schmalholz
University of Lausanne, Institute of Earth Sciences, Lausanne, Switzerland (yury.podladchikov@unil.ch)

New thin viscous approximation is under development specifically targeted to model spontaneous initiation and tens of kilometers horizontal displacement of tectonic nappes. Nappes are few kilometers thing and tens of kilometers long rock units trusted towards foreland often preserving internal lithological consistency and laying at near horizontal position at the end of the emplacement. Significant shear stresses and deviation of principal stresses from vertical is required to explain this very peculiar strain localization style from mechanical point of view. There is also a need for the explanation of their common appearances in most collisional settings. Both pure shear thin sheet and flexural models kinematically eliminate nappes formation. Spreading viscous sheet models, such as used to model glaciers, are also not applicable as the direction of motion is upward, against gravity. The reason for this discrepancy is the hydrostatic pressure approximation of the gravity-driven spreading models. Actually, the thin sheet approximation is not sensitive to the assumptions made on pressure profile. Lateral non-lithostatic pressure gradient-driven viscous sheet model is appropriate for modeling of nappes. In turn, significant non-lithostatic pressure must be supported by flexural rigidity of overlying and underlying units. Lateral gradients of this non-lithostatic pressure are responsible for the significant shear stress and, therefore, deviation of principal stress from vertical.