

## **Lithosphere dynamics and strain localisation**

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Strain localisation is an essential ingredient of plate tectonics that fosters mechanical decoupling and relative motion of tectonic plates. Understanding strain localisation is thus necessary to unravel processes such as the initiation of subduction, the growth of orogenic wedges, or the opening of rift basins.

However, strain localisation in tectonics is reported on a wide range of spatio-temporal scales, occurs in both the brittle and ductile regions of the lithosphere and is hence attributed to a variety of mechanisms. In general, strain localisation can result from both dynamic and kinematic processes. While dynamic causes involve different kinds of material softening (e.g. thermal softening, grain size evolution, fluid flow and mineral reactions), kinematic strain localisation arise from specific initial material configuration and strength variations (e.g. tectonic inheritance).

Here, I will first discuss fundamental properties of ductile strain localisation processes, with emphasis on thermal softening and tectonic inheritance.

Then, I will demonstrate the role of both kinematic and dynamic strain localisation, as well as their interplay based on different examples of tectonic processes (orogenic wedge growth, rifting) and using numerical simulations.

Finally, I will further discuss current physical and technical challenges related to modelling lithosphere-scale strain localisation and will highlight some future perspectives.