Strain localization in accretionary prisms.

*Arthur Bauville[1]

1.Department of Mathematical Science and Advanced Techology, JAMSTEC

Plate motion varies smoothly (over ~100 km) but results in localized (m to km scale) deformation near plates interface. Strain localization is caused by local stress variations and/or the response of the material to it. Generally, the localization of strain can have two different causes:
(1) A rheological cause, here termed dynamic strain localization. Thereby, strain in a homogeneous material becomes localized because the material softens in certain regions during the deformation (strain softening) due to processes such as grain size reduction, brittle precursor controlled fluid-rock interaction or shear heating.
(2) A structural cause, here termed kinematic strain localization. Thereby, the initial strength of the deformed region is heterogeneous and strain localizes due to initial differences in mechanical strength and/or due to particular geometries. Such localization of strain can occur in linear viscous materials.
Kinematic strain localization is still incompletely understood and may have a major importance (1) in subduction zones, where high sea floor topography is correlated with low plate coupling, i.e. large magnitude earthquakes are less likely to happen; (2) in fold-and-thrust belts where the geometry of the former margins can control the distribution and emplacement of tectonic nappes.
Here I present the results of 2D numerical simulations that demonstrate the importance kinematic strain localization on the structure of fold-and-thrust belts and accretionary prism. Early results towards a scaling law between sea floor topography, stress concentration and strain evolution are also presented.

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