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Prediction of forearc deformation based on limit analysis theory

Nadaya Cubas (1), Jean-Philippe Avouac (1), Yves M. Leroy (2), and Pauline Souloumiac (3)

(1) Geological and Planetary Sciences, Caltech, Pasadena, USA (cubas@caltech.edu), (avouac@caltech.edu), (2) Laboratoire de Géologie, ENS, Paris, France (leroyy@geologie.ens.fr), (3) Laboratoire Sisyphe, UPMC, Paris, France (souloumiac@geologie.ens.fr)

Some recent studies have pointed out to a possible correlation between forearc topography and seismic asperities on megathrust. This correlation suggests that the morpho-tectonic zones could reveal spatial variations in frictional properties of megathrusts of relevance to their seismic behavior : a seaward accretionary prism thought to overly a shallow aseismically creeping portion of the megathrust; a forearc basin thought to correlate with seismic asperities and the coast above the transition between the seismogenic and the deep creeping zones.
In this study we investigate how varying basal friction could lead to such a morpho-tectonic segmentation of the forearc. The objective is to predict forearc deformation and the resulting morphology in function of the spatial variations of frictional properties of the megathrust. Our approach relies on the limit analysis theory combining the conditions for mechanical equilibrium and the theory of maximum rock strength. The theory is composed of two approaches : the external approach predicting faults positions and their evolutions, and the internal approach providing the stress distribution at each step of the evolution. Our model predictions are compared to analogue experiments, for validation of our approach, and to natural examples to infer frictional properties of natural faults.