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Interseismic and coseismic deformation in a locked subduction zone context

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Improvement of seismic cycle understanding in a locked subduction zone needs the quantification of horizontal and vertical movements on the whole arc to constrain mechanical models and monitor the seismic strain accumulation.

The Vanuatu archipelago, located in the New Hebrides subduction zone (Southwestern Pacific), is an ideal natural laboratory for an insular arc deformation study. Collision of the d'Entrecasteaux Ridge with the subduction in front of the Vanuatu central islands yields arc island vertical movements estimated at several mm/year as well as strong recurring earthquakes (e.g. Ambrym, 1999, Mw = 7.5; Santo, 2000, Mw = 6.9).

A dense GPS network set up in the area since 1990 by IRD team already made possible to emphasize the arc segmentation and block rotations. In this study, we used all the available data and a state-of-the-art analysis strategy to estimate a consistent horizontal and vertical velocity field. The 15 year GPS time series we obtained allow us to isolate the coseismic signal related to 2 major earthquakes. Moreover, we estimate the interseismic rate to constrain strain accumulation model in the simple case of an elastic Earth model.

This comparison of geodetic results with deformation models allows us to characterize the main thrust zone locked along which many strong earthquakes occur.