The seismic signature of basal accretion at subduction margins: insights from seismo-thermo-mechanical modeling

Armel Menant*[1], Luca Dal Zilio[2], Vasiliki Mouslopoulou[3], Onno Oncken[4], and Taras Gerya[2]

[1]Géoazur – Observatoire de la Cote d'Azur, Université Côte d'Azur, Centre National de la Recherche Scientifique, Institut de Recherche pour le Développement – France
[2]Institute of Geophysics [ETH Zürich] – Suisse
[3]National Observatory of Athens – Grèce
[4]German Research Centre for Geosciences - Helmholtz-Centre Potsdam – Allemagne

Résumé

The interrelation between Myr-scale tectonic processes and seismic activity along active subduction zones is poorly constrained, albeit critical for better evaluating the seismogenic potential of convergent margins. This is particularly true for mass fluxes that occur along the megathrust. Indeed, while they largely control the long-term shape of the forearc margin, their impact on earthquake timescales remains enigmatic. Here, we use 2D seismo-thermo-mechanical models of subduction to investigate changes in the seismic behavior of forearc systems in response to successive basal-accretion episodes at depths of 20-30 km. We find that, during each slab-striping event (_˜2-3 Myr long), the accreted slice transiently modifies the mechanical properties of the plate interface, resulting in significant variations in the seismic faulting style along the megathrust and within the deep forearc region. This large cadenced mass transfer also affects the force balance and the mechanical stability of the forearc wedge, promoting seismic normal faulting in the shallow forearc crust and within the curved slab during specific stages of the basal-accretion cycle. Interestingly, predicted coseismic displacements associated with seismic-slicing events have a higher potential to contribute to the long-term growth of a forearc cordillera than typical megathrust earthquakes. Our models, thus, shed light on the seismic and topographic signature of basal-accretion events, allowing recognition of active subduction segments worldwide, which currently experience different stages of their basal-accretion cycle (i.e., Hellenic, Chilean and Hikurangi margins). Finally, these results demonstrate that the accreting slices may act as transient asperities within the seismogenic zone, arresting and/or deflecting earthquake rupture.

Mots-Clés: Basal accretion, Earthquakes, Active subduction, Forearc margin, Numerical models

*Intervenant