Benchmark experiments on extension: Towards understanding the role of normal faulting earthquakes in the subduction zone seismic cycle.

Iverna Creton

(iverna.creton@gfz-potsdam.de)

Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Potsdam, Germany

Edoseghe Edwin Osagiede
University of Bergen

Ehsan Kosari
Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Potsdam, Germany

Michael Rudolf
Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Potsdam, Germany

Matthias Rosenau
Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Potsdam, Germany

Onno Oncken
Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Potsdam, Germany

Normal faulting earthquakes are an integral part of the subduction zone seismic cycle. They occur interseismically in the slab due to bending and slab pull, and postseismically due to relaxing coseismic extension of the upper plate and slab during megathrust earthquakes. Additionally, normal faulting occurs in some forearcs without clear relation to the seismic cycle (for example, Northern Chile). In order to better understand the relation of normal faulting earthquakes to the megathrust seismic cycle in subduction zones and their role in shaping active margins, we develop an original experimental design able to mimic seismotectonic evolution in extensional tectonic settings. Here, we present first results of benchmark experiments aimed at validating the experimental setups. We apply the experimental approach, data analysis and visualization workflow on two setups: foam base and rubber base. We perform simple generic
models at crustal scale for both one-(brittle-only) and two-(brittle-ductile) layer models. We tested different techniques to localize deformation by either means of a basal velocity discontinuity or zones of weakness (seeding, structural disturbance). The study highlights the need for proper quantification of boundary effects (transversal contraction and peripheral localization), and effective extensional strain in order to realistically simulate extension across time-scales.