Geophysical Research Abstracts
Vol. 18, EGU2016-3155, 2016
EGU General Assembly 2016

Controls of seismogenic zone width and subduction velocity on interplate seismicity: insights from analog and numerical models

Fabio Corbi (1,2), Robert Herrendorfer (3), Francesca Funiciello (1), and Ylona van Dinther (3)

(1) Géosciences Montpellier Laboratory, University of Montpellier, Montpellier, France, (2) Dipartimento di Scienze, University "Roma Tre", L. S.L. Murialdo, 1, 00146, Rome, Italy., (3) Institute of Geophysics, ETH Zurich, Sonneggstrasse 5, CH-8092, Zurich, Switzerland.

Subduction megathrust earthquakes are one of the most destructive phenomena on Earth. Unraveling the role of parameters governing this process is difficult, mainly due to the short historical and instrumental observation period. To overcome this we run previously validated analogue and numerical seismic cycle models to study two of the most significant parameters; the width of the seismogenic zone W and subduction velocity Vs.

Both simplified, essentially 2D, models have a comparable setup representing a rigid, straight slab with a seismogenic zone subducting beneath a viscoelastic forearc. We create thousands of years long time series of stress build up and sudden release via frictional instabilities (i.e. analog earthquakes) to study the resulting statistics of these events. In particular, we analyze seismic rate τ, maximum magnitude Mmax and moment release rate MRR. We show that: a) τ is directly correlated with Vs and inversely correlated with W; b) Mmax is directly correlated with W and insensitive to Vs; and c) MRR is directly correlated both with W and Vs.

Wider seismogenic zones are associated to larger fault strength, which causes a longer recurrence time (due to the larger stress that must be reached for the rupture initiation) and larger seismic potential in terms of maximum size and release moment. Vs tunes the recurrence time and MMR. Similarly, in nature wider seismogenic zones are associated with the largest events and Vs tunes τ. Correlations in nature are however generally weaker than in our models, suggesting that other parameters (e.g., sediment thickness and trench parallel extent of the megathrust) may play a relevant role for the seismic behavior of subduction interfaces.