Analogue earthquakes: A test bed for physical and statistical models?

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Introduction

There is a lack of insight into the long-term record of earthquakes and deformation accumulation because of the limited availability of information from historical events. Current explanations for deformation accumulation in fault networks rely on rate and state dependent (RSD) friction models. We want to explore the scaling relationships of seismically active fault networks by combining mathematical, numerical and analogue modelling. The successful reproduction of interacting faults showing correlation with earthquake statistics, short- and long-term deformation patterns, and lithospheric properties is our main goal.

State of the art

- Analogue materials show RSD frictional behavior.
- Periodic stress drops in the analogue models, combined with periodic slip events, are analogue earthquakes.
- Scaled moment magnitudes range from $M_w=8 - 9.5$.
- Analogue earthquakes feature asseismic creep during loading and mimics of foreshock sequences.

Rheology of silicone oils

- Silicone oils show a reduction of effective viscosity as shear rate increases, similar to the bulk lithosphere.
- Maxwell relaxation times are in the order of $10^{-1}$ s.
- Additives could enhance the scaling behavior of silicone.

References


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