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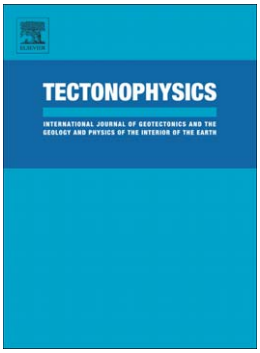

Sandbox Rheometry: Co-Evolution of Stress and Strain in Riedel– and Critical Wedge–Experiments

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Sandbox Rheometry: Co-Evolution of Stress and Strain in Riedel– and Critical Wedge–Experiments

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Abstract

Analogue sandbox experiments have been used for a long time to understand tectonic processes, because they facilitate detailed measurements of deformation at a spatio-temporal resolution unachievable from natural data. Despite this long history, force measurements to further characterise the mechanical evolution in analogue sandbox experiments have only emerged recently. Combined continuous measurements of forces and deformation in such experiments, an approach here referred to as "sandbox rheometry", are a new tool that may help to better understand work budgets and force balances for tectonic systems and to derive constitutive laws for regional scale deformation.

In this article we present an experimental device that facilitates precise measurements of boundary forces and surface deformation at high temporal and spatial resolution. We demonstrate its capabilities in two classical experiments: one of strike-slip deformation (the Riedel set-up) and one of compressional accretionary deformation (the Critical Wedge set-up). In these we are able to directly observe a correlation between strain weakening and strain localisation that had previously only been inferred, namely the coincidence of the maximum localisation rate with the onset of weakening.

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