EGU25-20933, updated on 20 Mar 2025
https://doi.org/10.5194/egusphere-egu25-20933
EGU General Assembly 2025

Seismotectonics of the Oriente Transform Fault revisited

Eric Calais[1,4], Sylvie Leroy[2], Jeffrey Poort[2], Jean-Frédéric Lebrun[3], Bernard Mercier de Lépinay[4], O'Leary Gonzalez[5], Bladimir Moreno[5], Jose-Luis Granja-Bruna[6], Walter Roest[7], Boris Marcaillou[4], Chastity Aiken[7], and Frauke Klingelhoefer[7]

[1]Ecole normale supérieure, Dept. Géosciences, Paris, France
[2]Sorbonne Université, CNRS, Paris, France
[3]Université des Antilles, Pointe-à-Pitre, Guadeloupe
[4]Université Côte d'Azur, CNRS/IRD/OCA, Nice, France
[5]CENAIS, Santiago de Cuba, Cuba
[6]Universidad Complutense de Madrid, Madrid, Spain
[7]Ifremer, Plouzané, France,

Transform faults are often considered to be geometrically simple, nearly linear, vertical structures that localize crustal deformation within a narrow zone surrounding the fault. The deformation kinematics are typically purely strike-slip, parallel to far-field plate motion, with seismic slip above the brittle-ductile transition, near the 600 °C isotherm, which is well predicted by thermal models. Although deviations from these simplified features have been described, much remains to be learned about the seismogenic behavior of transform faults, for example, why they release much less seismic moment than predicted by plate motion models, or why they so rarely produce earthquakes of magnitudes as large as would be expected given their geometric segmentation (>M7).

The Oriente Transform Fault (OTF) along the southern margin of eastern Cuba, at the boundary between the Caribbean and North American plates, is a particularly relevant example to inform on the seismogenic behavior of transform faults for at least 5 reasons: (1) the OTF geometry changes from a nearly continuous trace along the Cayman Ridge to a highly segmented one westward along eastern Cuba, (2) the geometrically continuous segment was the location of a magnitude 7.8 supershear earthquake in January 2020, (3) GNSS-derived strain measurements indicate that this segmentation variation corresponds to a transition from very shallow (<5 km) mechanical coupling —perhaps creep— of the fault, to complete coupling across the entire crustal thickness (20 km), (4) earthquake hypocenters offshore eastern Cuba locally reach subcrustal depths, (5) earthquake focal mechanisms and offshore geological observations show fault-normal compressional deformation along this purely strike-slip segment.

Here we revisit the offshore trace and seismotectonics of the OTF in light of recent data. We benefit from several oceanographic campaigns in the northern Caribbean, in particular the recent Haiti-TWIST campaign of the Pourquoi Pas? R/V, during which new high-resolution bathymetric and seismic reflection data were acquired, filling several important gaps. We also benefit from recent

deformation results from GNSS measurements in Cuba, as well as a new compilation of earthquake moment tensor solutions.