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Fault creep and strain partitioning in Trinidad-Tobago: Geodetic measurements, models, and origin of creep

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We studied active faults in Trinidad and Tobago in the Caribbean-South American (CA-SA) transform plate boundary zone using episodic GPS (eGPS) data from 19 sites and continuous GPS (cGPS) data from 8 sites, then modeling these data using a series of simple screw dislocation models. Our best-fit model for interseismic fault slip requires: 12-15 mm/yr of right-lateral movement and very shallow locking (0.2 $\pm$ 0.2 km; essentially creep) across the Central Range Fault (CRF); 3.4 +0.3/-0.2 mm/yr across the Soldado Fault in south Trinidad, and 3.5 +0.3/-0.2 mm/yr of dextral shear on fault(s) between Trinidad and Tobago. The upper-crustal faults in Trinidad show very little seismicity (1954-current from local network) and do not appear to have generated significant historic earthquakes. However, paleoseismic studies indicate that the CRF ruptured between 2710 and 500 yr. B.P. and thus it was recently capable of storing elastic strain. Together, these data suggest spatial and/or temporal fault segmentation on the CRF. The CRF marks a physical boundary between rocks associated with thermogenically generated petroleum and overpressured fluids in south and central Trinidad, from rocks containing only biogenic gas to the north, and a long string of active mud volcanoes align with the trace of the Soldado Fault along Trinidad's south coast. Fluid (oil and gas) overpressure may thus cause the CRF fault creep that we observe and the lack of seismicity, as an alternative or addition to weak mineral phases on the fault.