TO Bownbag Seminar
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Sarah Stamps (UCLA)

An Investigation of Continental Rift-Parallel Surface Motions Along the East African Rift System

Abstract:

The East African Rift System (EARS) spans N-S ~5000 km and currently experiences ~E-W extension. Previous kinematic studies of the EARS delineated 3 relatively rigid sub-plates (Victoria, Rovuma, and Lwandle) between the Nubian and Somalian plates. GPS observations of these block interiors confirm the rigid plate model, but new observations within individual rifts are beginning to show deformation that does not conform to large-scale E-W extension. Here we present (1) a new velocity solution that includes GPS observations within the Main Ethiopian Rift and along the Western Branch of the EARS, (2) block kinematics of the northern Western Branch derived from earthquake slip vectors and GPS data, and (3) on-going numerical modeling experiments aimed at testing the role of mantle flow at the rift-scale. Our velocity solution indicates a component of along-rift surface motion is present in the Main Ethiopian Rift, northern Western Branch, and Virunga volcanic province after estimating and removing a volcanic signal. Sufficient data are available in the northern Western Branch to test for rotation of the Rwenzori block. We find GPS, earthquake slip vector, and structural data are consistent with a rotating Rwenzori block bounded by localized strain. Finally, we build a 3D regional numerical model to test the role of the thermal lithosphere in driving mantle flow beneath the Western Branch. Preliminary results suggest large-scale variations in lithospheric thickness generate upper mantle flow that does not correlate with surface velocities, however, rift-scale variations constrained by melting depths in the northern Western Branch generate along-rift motion consistent with surface observations.