Comparison of magmatic and amagmatic rift zone kinematics using full moment tensor inversions of regional earthquakes

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Temporary seismic networks deployed in the magmatic Eastern rift and the mostly amagmatic Western rift in East Africa present the opportunity to compare the depth distribution of strain, and fault kinematics in light of rift age and the presence or absence of surface magmatism. The largest events in local earthquake catalogs (ML > 3.5) are modeled using the Dreger and Ford full moment tensor algorithm (Dreger, 2003; Minson & Dreger, 2008) to better constrain source depth and to investigate non-double-couple components. A bandpass filter of 0.02 to 0.10 Hz is applied to the waveforms prior to inversion. Synthetics are based on 1D velocity models derived during seismic analysis and constrained by reflection and tomographic data where available. Results show significant compensated linear vector dipole (CLVD) and isotropic components for earthquakes in magmatic rift zones, whereas double-couple mechanisms predominate in weakly magmatic rift sectors. We interpret the isotropic components as evidence for fluid-involved faulting in the Eastern rift where volatile emissions are large, and dike intrusions well documented. Lower crustal earthquakes are found in both amagmatic and magmatic sectors. These results are discussed in the context of the growing database of complementary geophysical, geochemical, and geological studies in these regions as we seek to understand the role of magmatism and faulting in accommodating strain during early continental rifting.