Deformation kinematics in the Mendocino Triple Junction

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Abstract

The Mendocino Triple Junction (MTJ) is a rapidly deforming plate boundary at the intersection of the San Andreas fault, the Cascadia Subduction Zone, and the Mendocino Fault Zone. Deformation in this region includes complex patterns of horizontal and vertical land motion, on long time scales and short. For example, earthquake cycle deformation at the MTJ results in large present-day horizontal strain rates and seismicity rates. Additionally, the MTJ is known to have geologic uplift rates among the largest in the continental United States (up to 4 mm/yr). In order to better understand the interaction of plates at this triple junction, as well as to better constrain earthquake hazards, it is important to understand the relationship between the present-day earthquake cycle deformation and the long-term land motion evident in the MTJ's geologic record. In this project, we analyze the available continuous GPS in the region to provide better kinematic constraints on the current deformation field. We compute interseismic strain fields using a variety of commonly used modeling techniques, and compare the results for consistency. We show preliminary results from using Sentinel-1 InSAR data to augment the available GPS. We also construct a vertical velocity field with the GPS time series, correcting the seasonal loading patterns with a GRACE-derived loading model. We use this three-dimensional dataset to probe the nature and style of uplift at the MTJ. By comparing the GPS-derived interseismic strain fields with previously published geologic uplift rates, we assess whether the long-term vertical land motion may be earthquake-cycle or geodynamic in nature, and discuss tectonic implications of the deformation field.

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