Interseismic fault loading in California's North Coast constrained by geodetic data

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The forearc of the southern Cascadia subduction zone, just north of the Mendocino triple junction, is home to a sequence of quaternary-active crustal faults that accumulate strain due to the interaction of the North America, Juan de Fuca/Gorda, and Pacific plates. Previous estimates suggest that these faults accommodate a third of the plate convergence rate in the region. These faults, including the Little Salmon and Mad River fault zones, are located near the most populated parts of California's North Coast and show paleoseismic evidence for meter-scale slip events in the past few thousand years. However, the present-day geodetic slip rates of these faults are poorly constrained. In this work we analyze a compilation of interseismic geodetic velocities from GNSS, leveling, and tide gage data to constrain slip rates on the upper plate faults near the Mendocino triple junction. We construct Green's functions for steady-state interseismic strain accumulation (i.e., backslip) for faults embedded in a thin elastic plate over a viscoelastic mantle of very high viscosity, equivalent to assuming that the mantle relaxation time is long compared to the earthquake recurrence interval. We then use a constrained, non-negative inversion technique to determine best-fitting slip rates on the major faults and we investigate slip rate tradeoffs between faults. Initial results indicate that the Little Salmon fault system is an important part of the slip budget in this area. Our work has implications for slip partitioning in oblique subduction settings and for the quantification of seismic hazard in the southern Cascadia forearc.

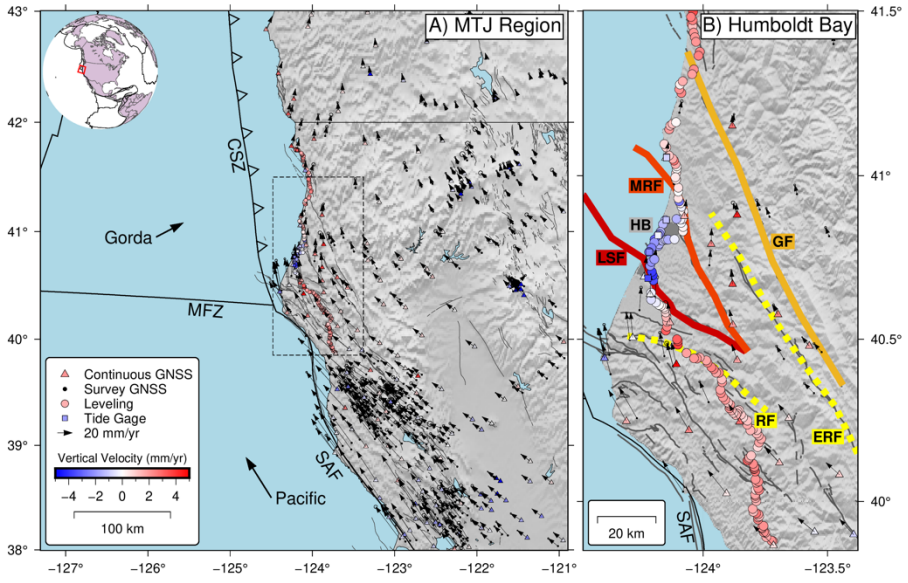

Figure 1: Tectonic setting of the Mendocino Triple Junction (MTJ) with the dataset of geodetic velocities used in this study.