Deconstructing Crustal Deformation Signals along the San Andreas Plate Boundary, CA from 7 years of integrated Sentinel-1 InSAR+GNSS time series

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InSAR time series have revolutionized the way we can visualize and measure crustal deformation signals, particularly in areas of short repeat observation times. In areas where InSAR measurements have captured observations of large-magnitude earthquake deformation, we can gain invaluable insights about the earthquake cycle process. Calculating the "interseismic", or long-term background, deformation stage of the earthquake cycle, however, becomes more challenging after an earthquake due to spatially- and temporally-varying co- and post-seismic displacements. This varying earthquake deformation additionally impacts estimates of long-term strain rates used to estimate seismic hazard. Moreover, in InSAR time series, this deformation is spread and broken up across multiple tracks of data, which each need to be handled and characterized separately.

Here, we utilize 7 years of integrated InSAR+GNSS time series observations across the San Andreas plate boundary that span the July 2019 Ridgecrest earthquake sequence to calculate interseismic surface velocities across nine total tracks, six of which have been affected by the earthquake events. We compare three methods for calculating coseismic and postseismic deformation from our time series: one that relies on estimating each deformation signal from every single pixel in the time series, one that relies on estimating the deformation in a user-defined masked area, and one that relies on a weighted inversion based on distance away from the event. To validate our results, we compare our new estimates to our pre-earthquake velocity estimates. Our early results for the first method show that fitting a deformation term for every pixel can inaccurately estimate earthquake deformation far from the epicenter of the event (especially in areas of large seasonal amplitude). While this work is in progress, we seek to use our final interseismic velocity field to calculate strain rates, in order to estimate geodetic moment accumulation rate and seismic hazard along the plate boundary.