High resolution InSAR time series of transient creep on the Concord Fault, Eastern Bay Area

Ekaterina Tymofyeyeva[1], Piyush Agram[1], Heresh Fattahi[1], David Bekaert[1]

The study of shallow creep on continental faults demands high measurement accuracy, frequent data acquisitions, and observations at fine spatial resolution. Advances in SAR data acquisition allow the modern satellite missions to provide surface displacement measurements in areas where data from other geodetic instruments may be sparse or unavailable. The PSInSAR technique is often used for estimating displacement time series with high precision and at full SAR resolution, by confining the analysis to the most stable pixels. However, it is limited by its restriction to coherent targets, and the assumptions required to identify them. Our newly-developed InSAR time series analysis toolbox mitigates some of these limitations by allowing for the combined processing of both permanent and distributed scatterers. We apply our method to the study of shallow fault creep on the Concord Fault in the Eastern San Francisco Bay Area, where continuous GPS stations and other geodetic instruments are not available close to the fault to provide consistent spatiotemporal coverage. We use data from the European Sentinel-1 mission to observe a transient shallow creep event on the Concord fault. To mitigate the impact of atmospheric noise on the high-precision deformation measurements, we apply the CANDIS atmospheric correction approach, developed by Tymofyeyeva and Fialko (2015). Observations from two overlapping satellite tracks with distinct look geometries (descending track 42 and ascending track 35) allow us to separate the surface displacements into fault-parallel and vertical components of motion, assuming that fault-perpendicular surface motions are negligible. We present cumulative displacements over the time period of available Sentinel-1 observations, from 2015-2018, as well as relative displacement time series for points on opposite sides of the fault.

Author affiliations:

1. Jet Propulsion Laboratory, California Institute of Technology