Using geodesy to assess magmatic and anthropogenic deformation of western North America

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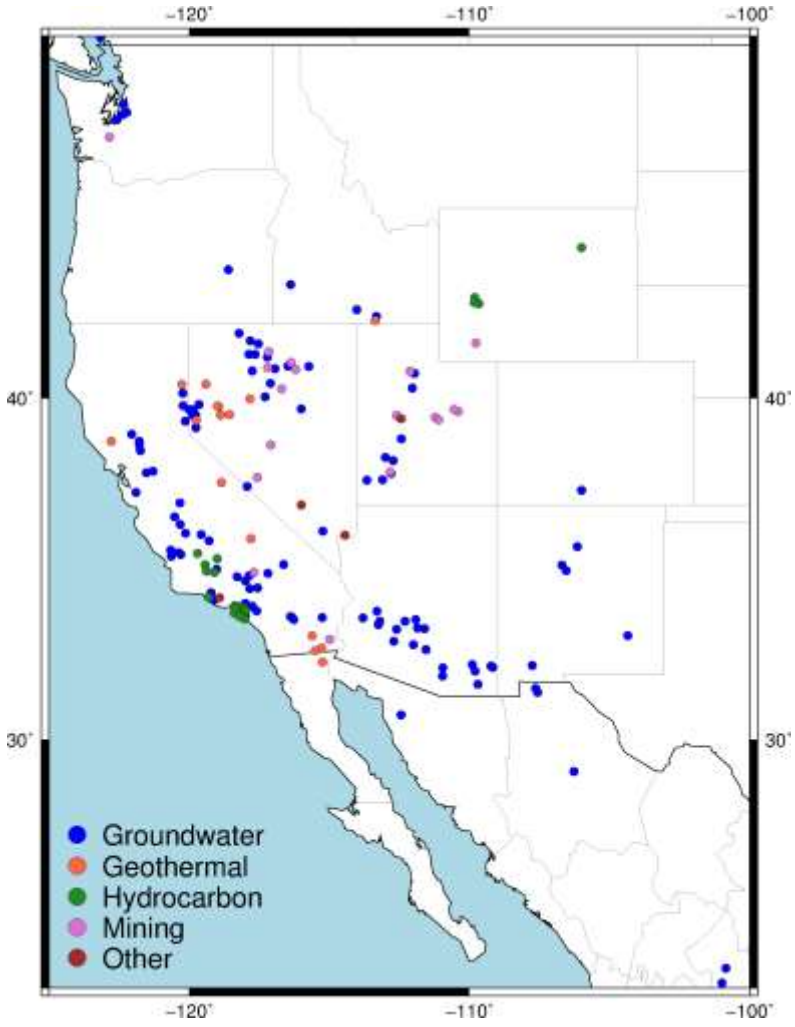
Volcanoes in western North America have a history of Holocene volcanism yet at least a dozen of the Alaskan volcanoes are not well monitored, thus subtle deformation in these areas would not necessarily be noticed. In addition to the surface volcanic features, several potential magma bodies have been seismically imaged at depth—so-called seismic bright spots (i.e. Death Valley, Basin and Range). We investigate the existence of local magmatic activity at these otherwise unmonitored volcanoes and seismic bright spots by performing a comprehensive satellite Interferometric Synthetic Aperture Radar (InSAR) survey. We synthesize data from the ERS-1, ERS-2, Envisat, and ALOS satellites to complete this survey, which collectively provide images from 1992 to 2011. However, in addition to the magmatic signals, there are many anthropogenic deformation signals across the western U.S, the exact number, locations, and magnitudes of which are not well known. It is plausible that the anthropogenic deformation may contaminate magmatic signals. Here, we identify anthropogenic deformation signals in the western U.S. and Mexico in order to separate this motion from motion potentially associated with the volcanism of the region. We catalogue 204 anthropogenic deformation signals, including 42 that are not previously reported. In particular, we categorize the anthropogenic deformation signals according to source and find that 66% can be attributed to groundwater extraction, 8% to geothermal activity, 13% to hydrocarbon extraction, 11% to mining activity, and 2% to other sources such as lake loading. Locations and sources of these anthropogenic deformation signals are shown in the figure to the right.



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