

An aerial photograph of a large reservoir, likely a dam, with a prominent concrete structure in the water. The water is a deep blue-green color, and the surrounding land is dry and rocky. The title text is overlaid in a bright green color.

Secular vertical crustal deformation field in California and Nevada regions from GPS data analysis: hydrological and anthropogenic signals

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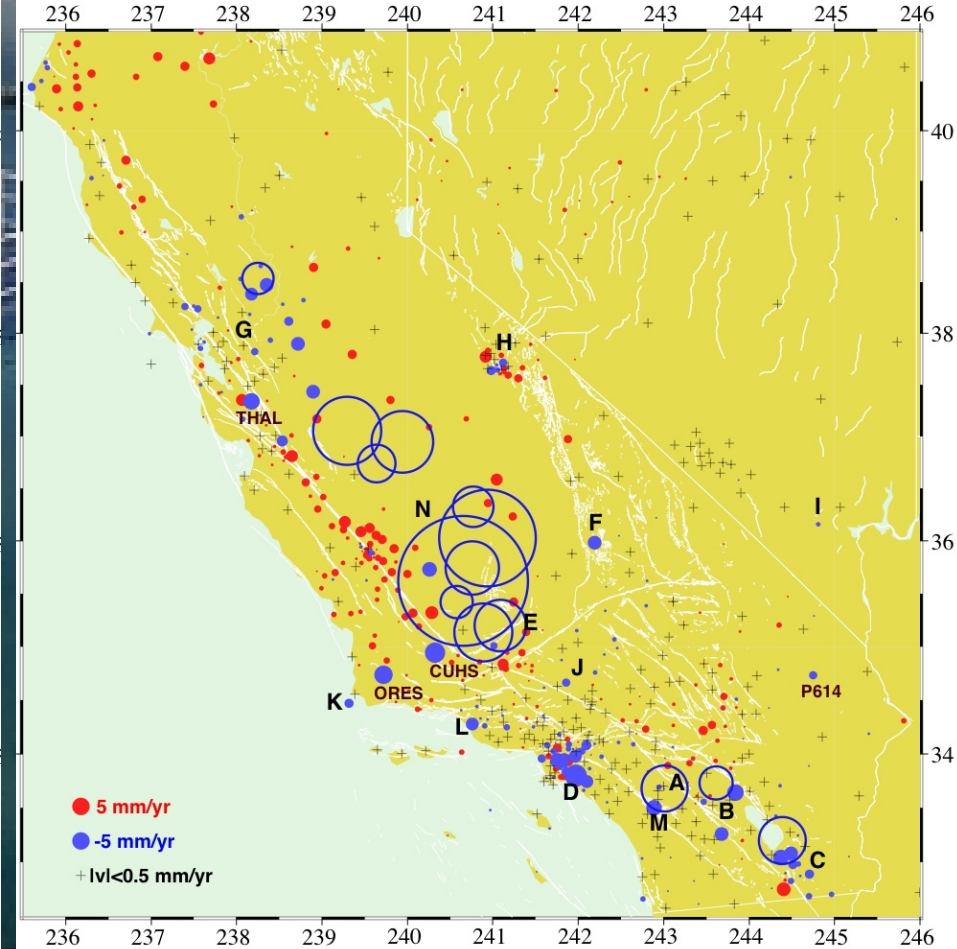
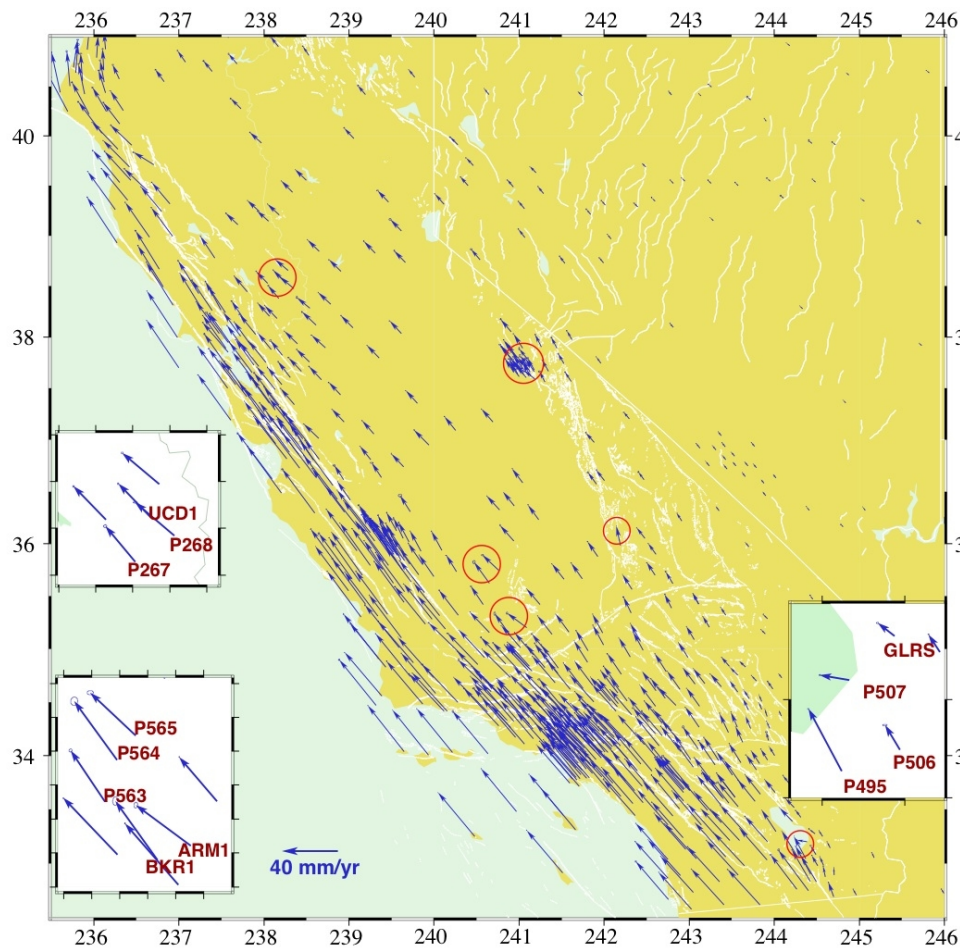
Peng Fang, Yehuda Bock

Scripps Institution of Oceanography

GPS data analysis

- Jan.1997-Apr. 2009 MEASURES GPS daily combination solutions
- California and Nevada regions from N32.5 to N41
- ITRF2005 reference frame
- Perform regional filtering using PCA
- Time series analysis for each station
- Estimate bias, velocity, seasonal terms, co-seismic jump and short term postseismic decay term
- 657 stations with longer than 3 years span
- Flick noise + white noise model, most uncertainties of vertical velocities are 0.1-0.6 mm/year

Secular velocity field

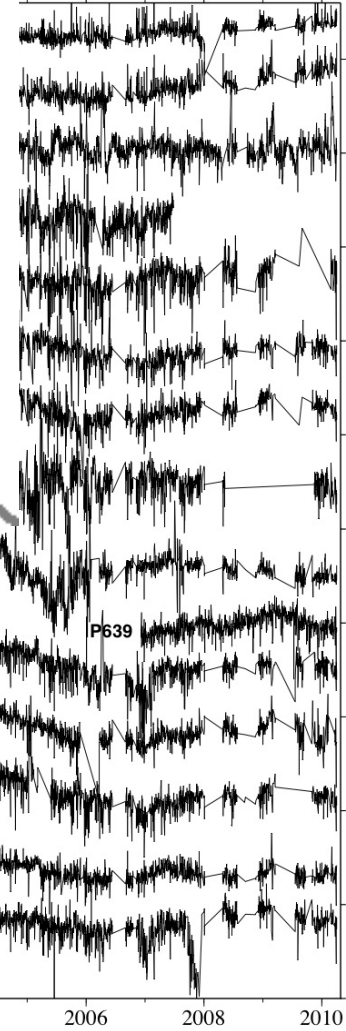
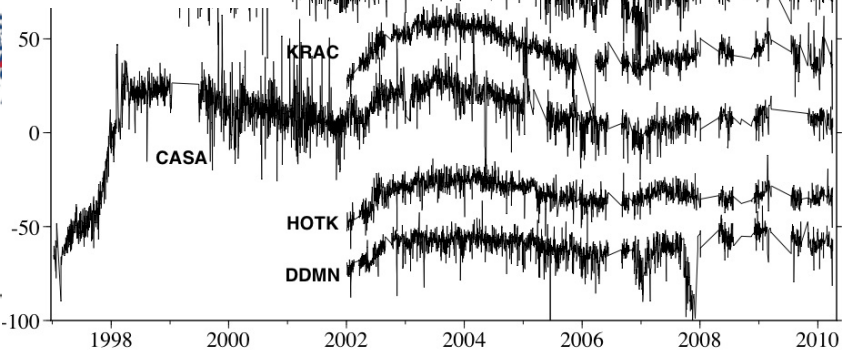
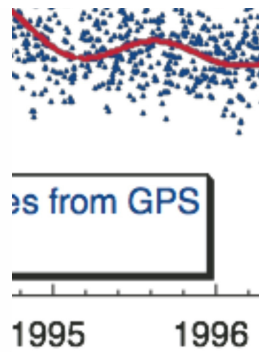
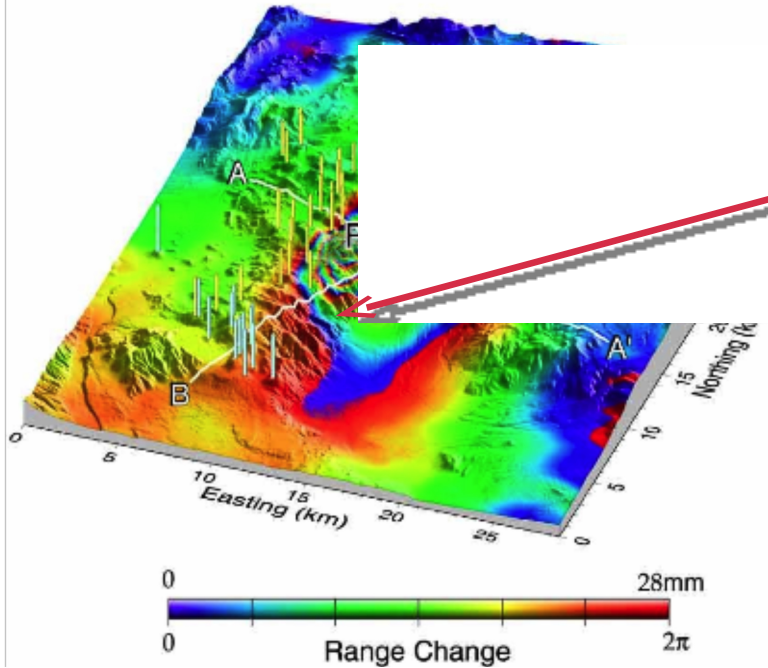
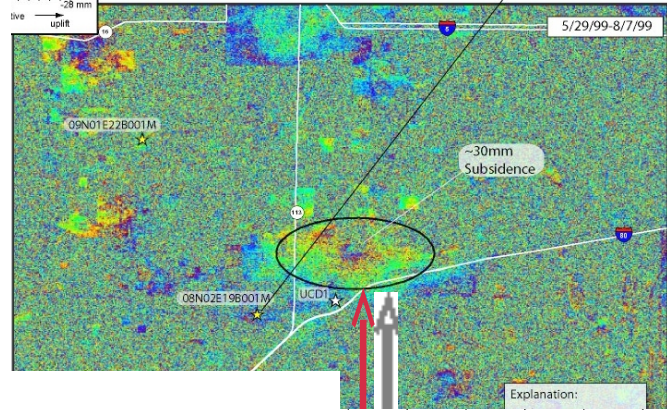
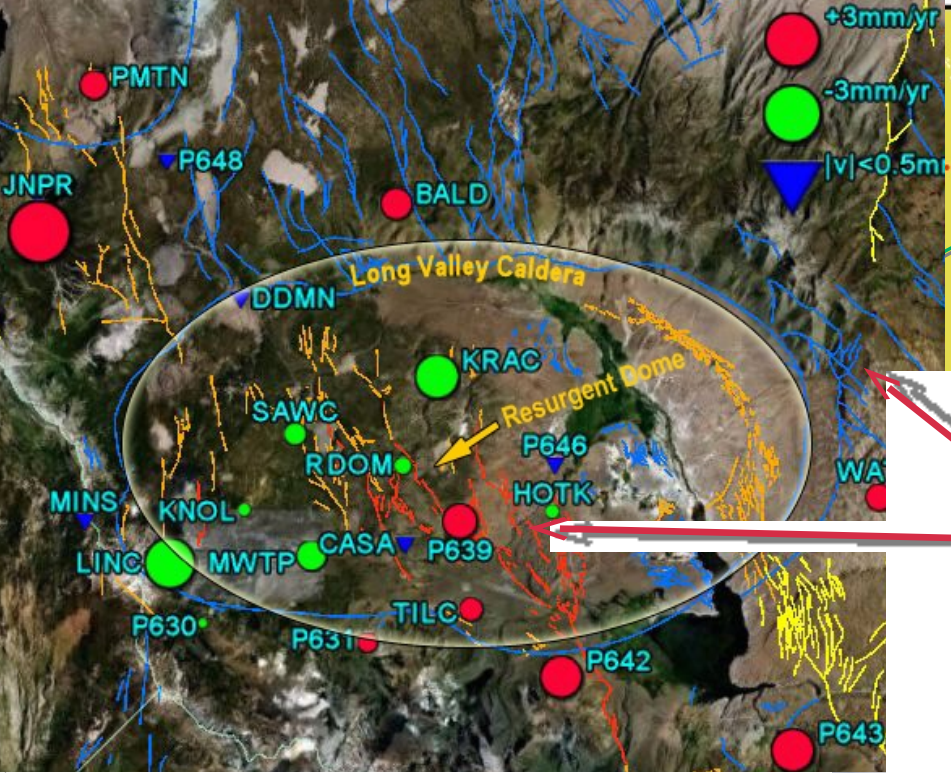


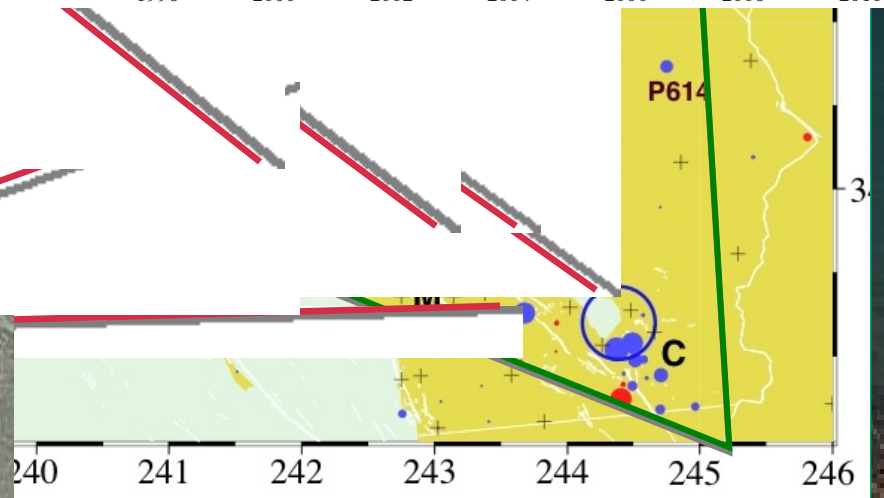
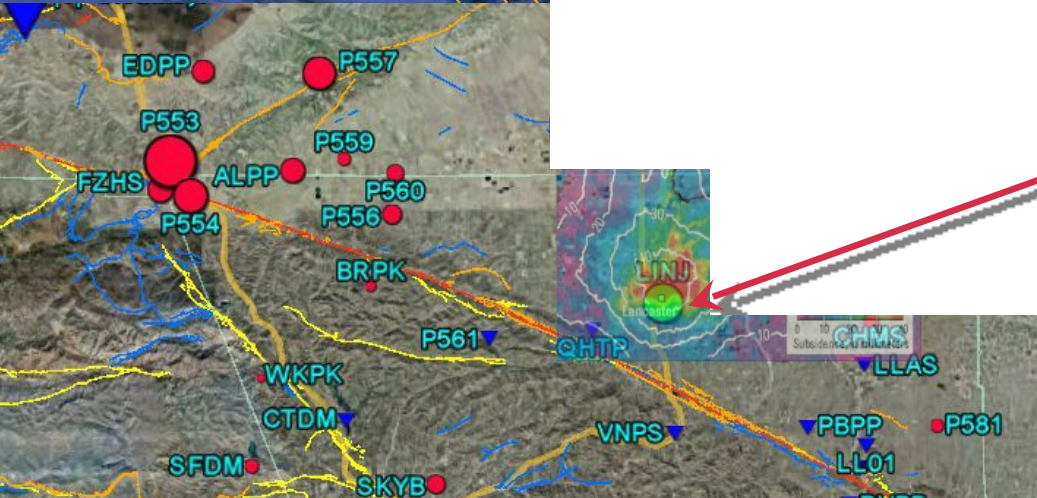
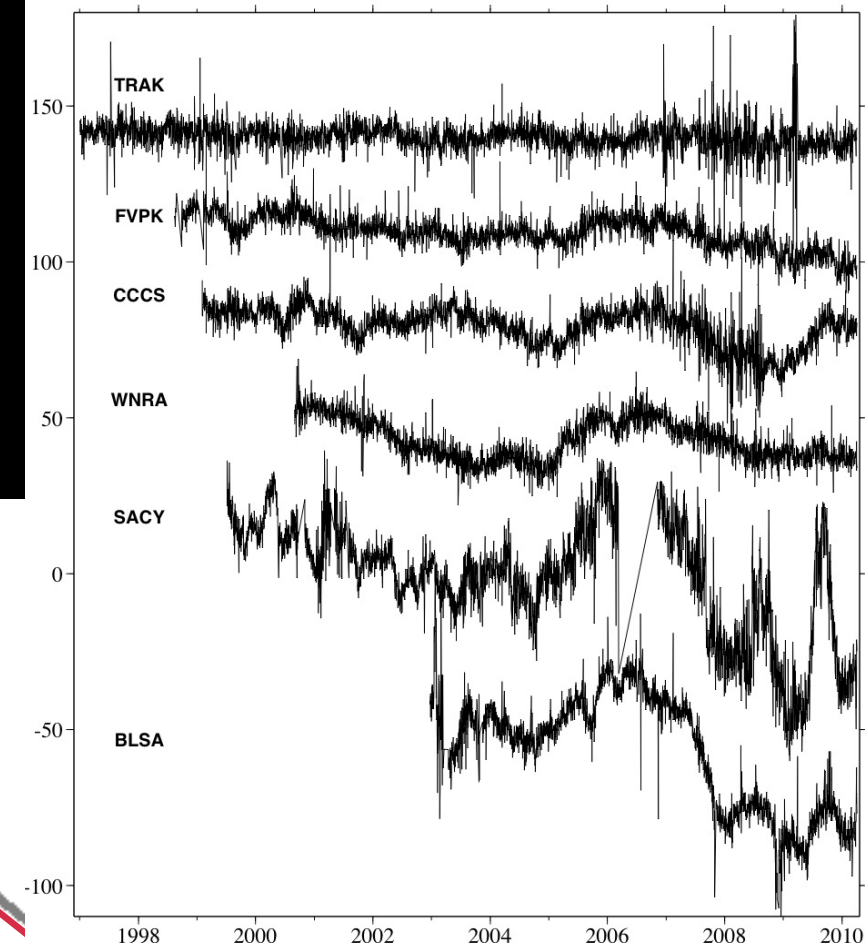
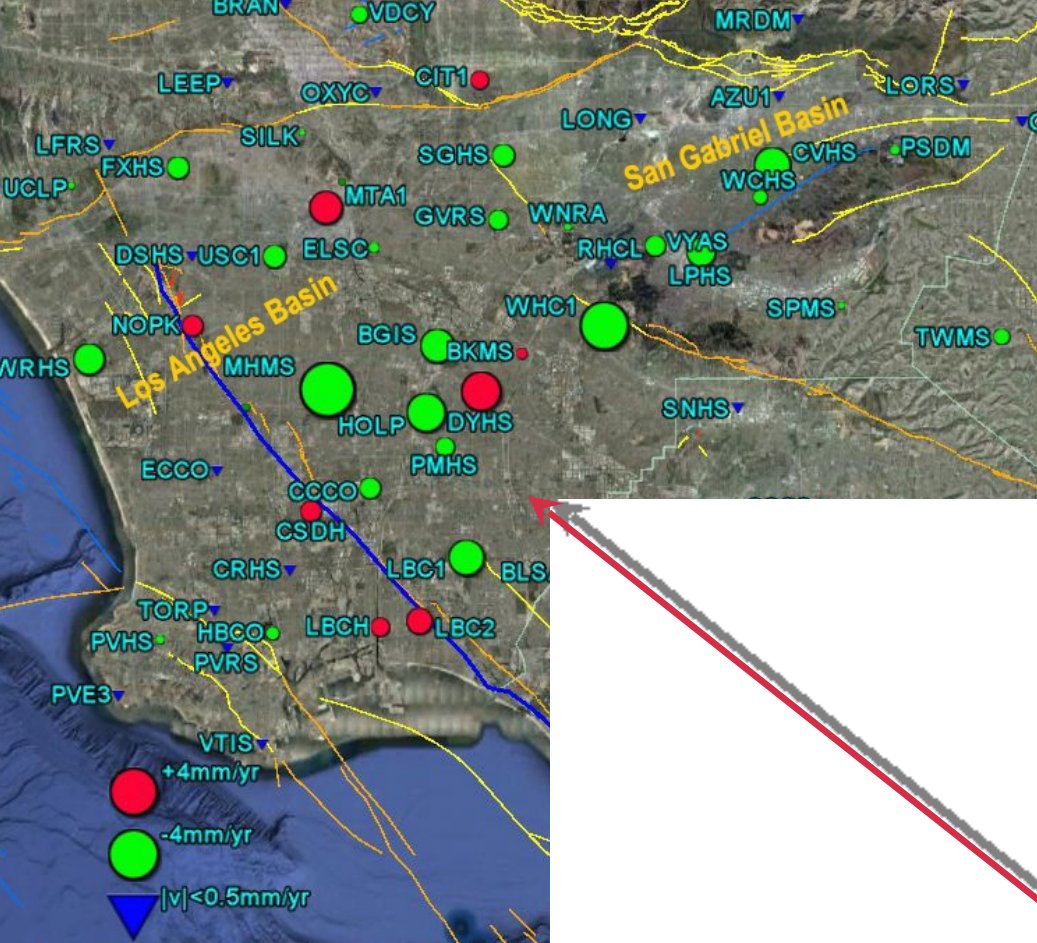
An aerial photograph of a large reservoir or dam. In the foreground, a large, rectangular metal structure, possibly a water treatment facility or a research platform, is situated in the water. The structure has a grid-like frame with railings. In the background, a dam structure is visible, with a few people standing on it. The water is a deep blue color, and the surrounding land is rocky and sparsely vegetated.

How reliable is the GPS derived vertical velocity field?

What is the nature of these abnormal vertical velocity solution?

Can GPS catch the non-tectonic vertical signals?





Summary

- Most of the GPS observed vertical abnormal velocity spots in California and Nevada are real hydrological and anthropogenic signals rather than artifact of errors.
- Hydrological and tectonic signals are superimposed on each other.
- Hydrological signals are typically occur in isolated areas. When these signals are identified and subtracted, the remaining vertical velocity field could reveal tectonic information.
- GPS vertical measurements are very sensitive to hydrological signals and can provide effective means to monitor underground fluid variations.