Transient Motions in the Basin and Range from BARGEN GPS Data

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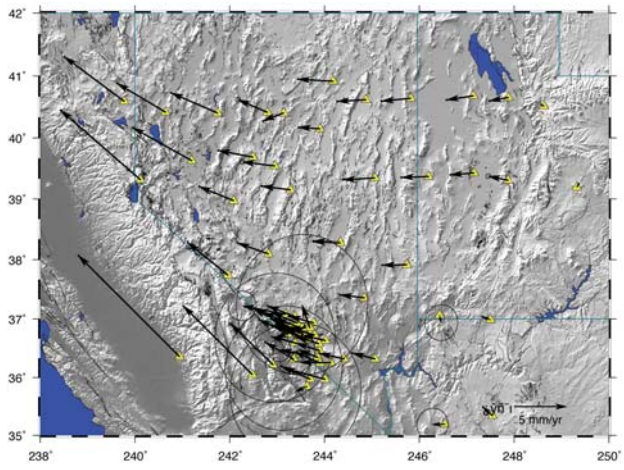

Figure 1. Velocity solution for the BARGEN network as of September 2006.

We have been examining transient motions on a range of spatial and temporal scales using the Basin and Range Geodetic Network (BARGEN). The network currently consists of 70 GPS sites (Figure 1) installed at various times beginning in 1996. The accuracy of the velocities for the longer-running sites is ~0.2 mm/yr [Davis et al., 2004]. Comparison of the present-day geodetic rates across the Wasatch fault with geologic displacement rates over the last few kyr, ~100 kyr, and 10 Myr implies that measurements of strain accumulation and strain release may be strongly timescale-dependent [Friedrich et al., 2003]. If, however, local strain accumulation and release are influenced by the viscoelastic diffusion of stress, then we might expect a significant difference between displacement rates inferred from geologic evidence and geodesy. Elósegui et al. [2004] showed that transient deformation at GPS sites near Great Salt Lake is caused by crustal loading associated with lake-level changes. In addition to seasonal variations, the level of Great Salt Lake between 1996–2002 had a slow variation of ~1.5 m that caused a loading signature of ±1.5 mm radial and ±0.7 mm horizontal in the GPS time series. Large-scale transients have also been identified. Sites of the northern transects of BARGEN located generally to the west of 146° W longitude display an eastward velocity change in late 1999 [Davis et al., 2006]. The change in velocity for these sites, and the constant velocities for sites in the east, are evident from the time series (e.g., Figure 2). The velocity changes may be evidence for an episodically creeping detachment horizon ~500 km wide at or near the base of the crust in the western part of the network.

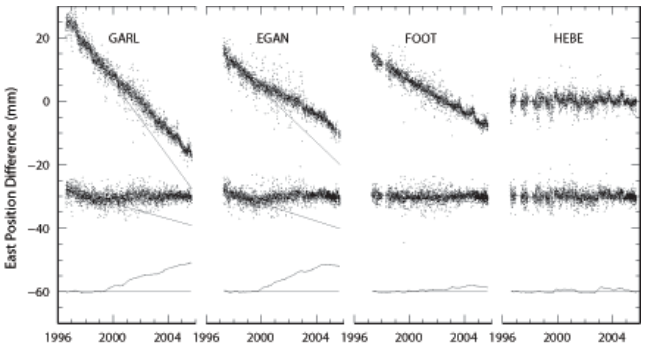

Figure 2. Top: "Raw" time series of east position relative to North America. The straight line is the best-fit straight line using position estimates from the first 2.5 years. Middle: Residuals of the raw time series from a best-fit model consisting of a straight line and time-variable seasonal terms. Bottom: Smoothed residuals relative to the 2.5 yr fit. The final time series indicates deviation from temporally linear motion. Site w. longitudes: GARL, 119° 21'; EGAN, 114° 56'; FOOT, 113° 48'; HEBE, 111° 22'. Davis et al. [2006].

References

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