Case	Latitude	Longitude	Dist (km)
Epicenter	36.7527	-121.4627	4
PGA	36.80	-121.53	10
PGV	36.80	-121.50	10
WAS	36.80	-121.53	10
PGA	36.05	-122.70	67
PGV	36.75	-121.75	67
WAS	36.80	-121.70	67

Table 8.3: Centroid locations obtained from peak ground acceleration (PGA), peak ground velocity (PGV), and Wood-Anderson amplitudes (WAS) from BDSN stations. For each amplitude type, the centroid is estimated with and without the nearest station, SAO. The centroid estimate is strongly dependent on the station distribution.

we use the Wood-Anderson amplitudes to estimate local magnitude, but we use the Nordquist nomograph rather than this analytic relationship. The TriNet project is also using Wood-Anderson amplitudes to determine the strong-motion centroid (*Wald et al.*, 1999).

We have found that this procedure is strongly dependent on the distribution of stations. The case of the 8/12/1998 M5.3 earthquake in San Juan Bautista illustrates this effect (Figure 8.7). The centroid estimation procedure works well for the San Juan Bautista earthquake (since the nearest BDSN station is within a few kilometers). However, if the data from the closest station is removed, then a significant degradation is observed (Table 8.3). In this example, the PGA estimate of the centroid is within 2 km of the high-frequency location, while the PGV and WAS estimates are closer to the end of the aftershock zone, approximately 8 km to the northwest. When the closest station is removed, however, all three estimates move west, with the PGA estimate moving over 135 km.

Similar behavior has been observed in other recent events, such as the 08/18/1999 Bolinas earthquake where the nearest BDSN station was over 35 km away and the distribution of stations was rather one-sided. As a result, a poor estimate of the centroid is obtained.

We are currently adding the centroid estimation procedure to the existing REDI stage of strong-ground motion processing. However, the results of this alogrithm need to be treated judiciously, depending on the distribution of stations. As the density of digital instrumentation increases in the San Francisco Bay Area, this sensitivity will be reduced. However, this is likely to remain a problem in less populated areas where the density of instrumentation may not significantly increase.

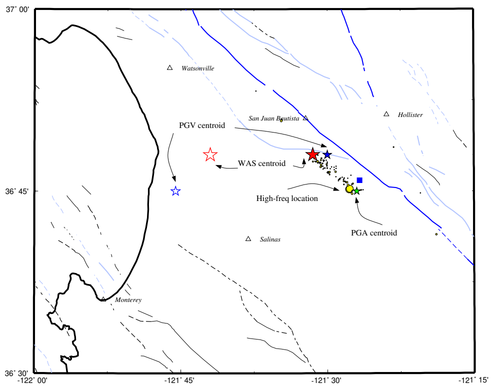

Figure 8.7: Map displaying different centroid locations for the San Juan Bautista earthquake (circle) determined from WAS, PGA, and PGV. The filled stars are solutions obtained using data from SAO (square) while the open stars are solutions with data from SAO. Note that the PGA solution without SAO does not locate on the map. *Courtesy of L. Gee.*

Finite Fault Parameterization We have made progress toward the goal of expanding REDI processing to include the estimation of finite-fault parameters. When completed, this development will add two new stages to the REDI processing structure with the goal of automatically estimating the distribution of slip on a finite-fault plane from regional-distance seismograms.

As the first step in this development, we are automating the existing codes (*Dreger and Kaverina*, 1999 - described in detail in the research section). Programs developed for interactive use in a research environment require significant effort to structure and harden for an operational environment and our recent efforts have focused in this direction. We have divided the finite-fault estimation procedure into 2 REDI stages. In the first stage, BDSN regional waveform data are prepared for inversion and preliminary or initial estimates of the rupture parameters are derived using empirical scaling relationships.

These empirical estimates are then checked by testing a line-source rupture either along the rake or in the horizontal plane. Studies of the Landers and Northridge earthquakes (*Dreger and Kaverina*, 1999) suggest that the horizontal line source may work better. The line source calculation can be computed quite rapidly and it is possible to test a range of rupture velocities as well as both possible fault planes in order to identify the causative fault.