Continuous Broadband Monitoring of Strain Changes near the San Andreas Fault

Annual Project Summary — Submitted October 1, 2001

Period: 10/1/2000 — 9/20/2001

Award Number: 00HQGR0016

Duncan Carr Agnew

Institute of Geophysics and Planetary Physics
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-0225
(858) 534-2590 (FAX 534-5332); dagnew@ucsd.edu

Program Element: II

Keywords: Strain Measurements

Investigations Undertaken, Results

This grant supports the operation of the long-base strainmeter at Durmid Hill (DHL), near the southern end of the San Andreas fault—and effectively within the fault zone; this instrument measures crustal deformation in Southern California for periods from seconds to years. The Durmid Hill strainmeter (DHL), by recording strain over this wide range of frequencies, provides a nearly unique bridge between seismology and geodesy that is rarely available so close to a fault.

The relevance of these measurements to NEHRP lies partly in their contributions to our understanding of the seismic cycle and how stresses accumulate on faults: for this, there is no substitute for a detailed time history. In addition, the DHL measurements continue to provide a check on any possible anomalies, with a sensitivity that depends on distance from the site. This sensitivity is especially high for the ''Coachella'' segment of the San Andreas fault, which poses the primary risk to the Coachella Valley—and perhaps to the San Bernardino/Riverside area; it was concern about this fault segment that originally led to the building of the DHL strainmeter. Together with the data from the long-base instruments at Piñon Flat Observatory (PFO), the DHL data provide unmatched monitoring of any unusual long-period activity on this fault or others nearby.

The award provides funding solely for operation of the strainmeter at DHL, and in the past year we have continued this operation. The most important result for this period is that the pattern of strain accumulation has returned to what we have observed during most of the period of operation (since 1995): the long-term rate, after a perturbation in the summer of 1999, and especially following the M 7.1 Hector Mine earthquake (1999:289:09) and the very-nearby M 5.1 and 4.6 triggered-events (and subsequent aftershocks), has headed back to its previous secular rate; we have not seen any additional ''strain events'' of the type we saw during the last half of 1999,

which we believe are related to local fault slip. In particular the strain rate remained unchanged during the Brawley seismic swarm that occurred in June 2000; the largest event in this sequence was M 4.5. The strainmeter has generally continued to operate well; the year has been largely free of operational problems, save for troubling, infrequent jumps in the observations this past Spring (2000).

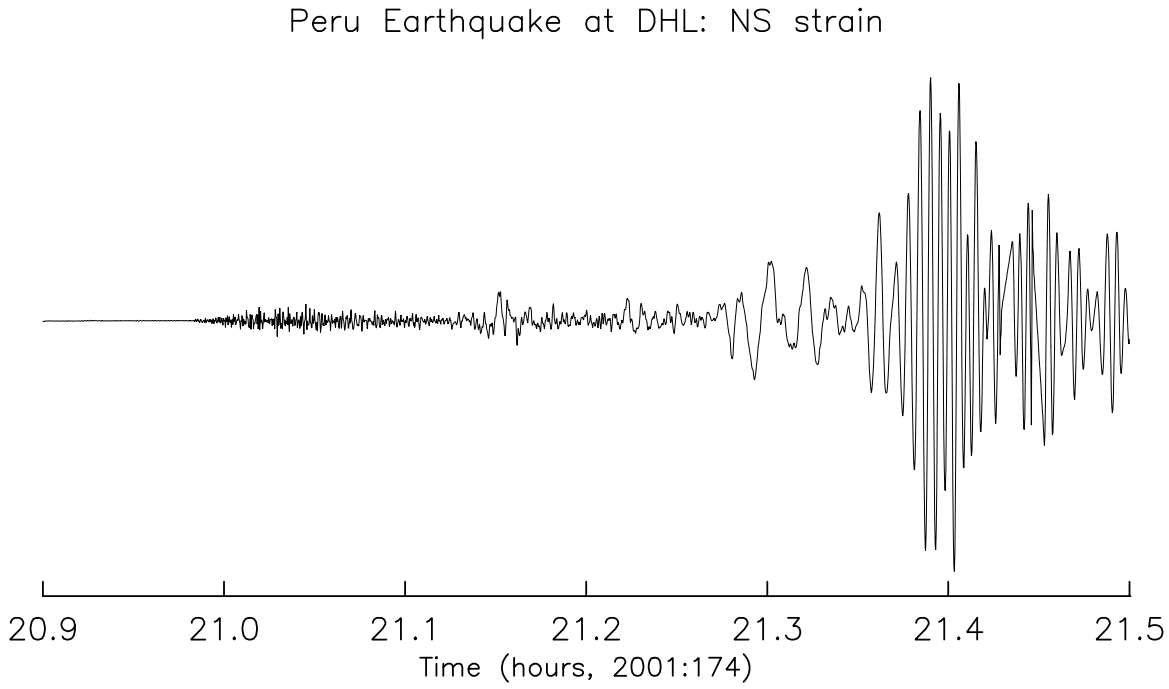

Figure 1

We have continued to operate a real-time high-speed telemetry link, courtesy of the Anza Seismic Network, which now has been upgraded to provide data at 100 samples-per-second for the two strainmeters at the site. As an example of such high-speed data, we show in **Figure 1** a portion of the strain seismogram for the recent large earthquake in Peru.

Non-Technical Summary

This grant supports the measurement of ground deformation at the southern end of the San Andreas fault using a long-base laser strainmeter. This enables us to see small changes in the motion of the ground over very long times (days and years), which may correlate with earthquakes. So far, the measurements close to the San Andreas have not shown any unusual motions except for induced by the Hector Mine earthquake in 1999 and some other small changes not accompanied by earthquakes.

Reports and Data Availability

We have not published any reports on the DHL measurements in the period covered by this report. Our digital data (5-minute sampling, and 1 Hz or 100 Hz for transients of interest) is available by contacting the PI's through the address above.