

Seismotectonics of the Charleston, South Carolina Region

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Neotectonics, GPS-Campaign, Strain Measurements, Regional Seismic Hazards

Investigations

Eighteen of the twenty GPS sites occupied in the meizoseismal area of the 1886 Charleston earthquake in 1993-1994 were reoccupied in February 1999. Field work was subcontracted to the South Carolina Geodetic Survey, who provided us data for processing. Preliminary processing of the data is complete and revealed some glitches and need for reoccupation of a selected subset of stations.

Results

The initial GPS/triangulation strain study in the meizoseismal area of the 1886 "Charleston" South Carolina earthquake determined, by simultaneous reduction, a maximum shear rate of 0.041 ± 0.017 microrad/yr with a direction of maximum compression of $N66^\circ E \pm 11^\circ$ (Talwani et al., 1997). The direction of maximum compression agrees with the inferred direction of SHmax, $N60^\circ E$, for the area. Although not significant at the 95% confidence level, the measured strain is significant at a slightly lower significance level ($\approx 93\%$). In order to reduce the uncertainties in the assessment of seismic hazard in the Charleston, South Carolina area in particular and the SEUS in general, a second set of GPS observations were obtained in the meizoseismal area of the 1886 event. These data were collected with the expectation that reoccupation of GPS sites after about five years would allow us to determine the rate of strain accumulation accurately and also to determine the spatial pattern of strain accumulation.

During reoccupation eighteen sites were reoccupied. Two sites (ACKR and MEGI, Figure 1) were not occupied because one was destroyed and the other had a structure built over it. These two sites were important as they lie within a 50 km radius of the epicentral area of the 1886 Charleston earthquake and also the location of current seismicity. One site (MNKS), Figure 1, of the eighteen reoccupied appears to have been observed on a different mark or the mark has been significantly non tectonically moved and did not provide useful data for our analysis.

Initial processing of the data gathered in February 1999 reveal that the occupation times by the South Carolina Geodetic Survey were inadequate to discern a tectonic signal with the required level of accuracy. Reoccupation of a selected subset of stations is planned.

Reports

None

References

P. Talwani, D.C. Amick and W.T. Schaeffer, 1999. Paleoliquefaction Studies in the South Carolina Coastal Plain. *Final Project Report, U.S. Nuclear Regulatory Commission, NUREG/CR-6619*, 109 pp.

Non-Technical Project Summary

Seismotectonics of the Charleston, South Carolina Region

The occurrence of the 1886 Charleston earthquake attests to the build-up of tectonic strain in the area. To determine the rate and spatial extent of strain accumulation, a GPS survey in 1993-94 revealed that strain was accumulating in the Charleston region at a rate of 0.041 ± 0.017 microradians/year with the direction of compression $N66^\circ E \pm 11^\circ$. To improve and verify the original results, in February 1999 eighteen of the twenty GPS sites surveyed in 1993-94 were reoccupied by the South Carolina Geodetic Survey. Due to inadequate occupation times, meaningful data were not obtained. Reoccupation of selected stations for longer durations is planned.