Relocations and Focal Mechanisms Determined from Waveform Cross-Correlation of Seismic Data from the Nicoya Peninsula, Costa Rica

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The Nicoya Peninsula in Costa Rica lies directly over the seismogenic zone of the Middle America Trench, making this an ideal location for geophysical investigations. As part of the collaborative Costa Rica Seismogenic Zone Experiment, a seismic transect consisting of twenty land and fourteen ocean bottom seismometers was operated across the Nicoya Peninsula from December, 1999, to June, 2001. Waveform cross-correlation and clustering techniques have been employed to examine event similarity and to compute adjustments for P-wave arrival times. The corrected picks were then used to determine cross-correlated relocations as well as more reliable focal mechanisms. Large-scale differences between the cross-correlated relocations and the previously-determined simultaneous inversion relocations were not observed. It is believed that since low-error events were used to begin with and since most of the P-wave shifts were small, the cross-correlated picks did not lead to regional-scale differences in earthquake locations. However, the focal mechanism determinations using the cross-correlated picks were significantly enhanced. For events believed to be interplate, over 95% of the focal mechanisms computed are consistent with underthrusting. Focal mechanisms were also computed for intraplate events in the overlying and subducting plates. In the overlying plate, evidence for dextral strike-slip motion is observed in the more northerly part of the peninsula while extensional, normal motion is seen at the southern tip of the peninsula. These motions are most likely associated with oblique convergence and seamount subduction, respectively. In the subducting plate, the steep P- and T-axes of events at depth are consistent with unbending of the slab.

