# SURFACE-WAVE FOCAL MECHANISMS, MAGNITUDES, AND ENERGIES FOR SOME EASTERN NORTH AMERICAN EARTHQUAKES WITH TECTONIC IMPLICATION

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## DIGEST

A new approach called "the null-centroids technique" is described in a framework of standard search methods to obtain surface-wave focal mechanisms for five earthquakes which occurred in eastern North America in January 1982. The focal mechanism, focal depth and seismic moment were determined for each event. The solutions obtained were constrained with P-wave first motions as well as amplitude spectra and predicted seismograms which show excellent agreement with the observed data. These solutions indicate thrust faulting with dip angles less than or equal to 45 degrees for the mainshocks of New Brunswick, New Hampshire and Arkansas. On the other hand, the aftershocks of the New Brunswick earthquake indicate greater-than-45-degree reverse faulting. Each event analyzed has a nodal plane striking in the south-southwest direction with a westward dip direction. The horizontal compressional axis of the New Brunswick aftershocks trends in the west-east direction at an oblique angle to that of the mainshock for the New Brunswick results. This observation is suggestive of a discriminant for mainshock-aftershocks. The results obtained in this study suggest that the current stress pattern reflects and supports the concept of a regional stress pattern which acts at the source zone on preexisting faults from the forces which may be due to the east-west spreading of the Mid Atlantic.

The studies are performed by using the current theory of surface-wave generation in a flat-layered elastic halfspace. The

data for analysis include both Rayleigh and Love wave amplitude spectra in the period range from 5 to 50 seconds. The earth models and anelastic attenuation model used are reasonable and appropriate for eastern North America.

Current systematic search techniques were coupled with newly developed procedures to obtain more precise solutions. Reformulation and reinterpretation consist of solving for the five source parameters in a manner that not only reduces the computation time but also correctly predicts the solution. The criteria used require the equality of the seismic moment estimates from the independent Love- and Rayleigh-wave data sets. Another reduction in computation time involves group velocity screening of raw spectral data so that noise can be removed and also involves narrowing the solution space for precise determination of the five source parameters.

A relocation analysis to obtain $P_n$-wave first-motion polarity and takeoff angles using New-England velocity model was performed to obtain a precise independent picture of the source for the New Hampshire earthquake of 19 January 1982. The results confirmed the solution which was obtained from the surface-wave study of the event and further demonstrated the enhanced applicability and reliability of the present technique for analyzing surface-wave data.

Furthermore, a test of the data for surface-wave focal mechanism of the New Brunswick mainshock of 09 January 1982 was performed using another compatible crustal model. The

result confirms and supports the proposed analyses.

Finally, computations for energy relations and other empirical relations are obtained using spectra of earthquake data. The suggestion given offers a simple but new approach for the purpose of understanding earthquakes in general and central-eastern United States earthquakes in particular.