A FREQUENCY DOMAIN STUDY OF LOVE WAVES

FROM THE ILLINOIS EARTHQUAKE OF NOVEMBER 9, 1968

Bireswar Bhattacharya
B.Sc.(Hons.), M.Sc.

DIGEST

Seismic surface-wave amplitude spectra contain information about various seismic parameters, such as anelastic attenuation, focal depth and focal mechanism. Independent knowledge of the values of one or more of these parameters leads to a more unique evaluation of the remaining parameters from a study of the amplitude spectra.

In this thesis we principally are concerned with evaluating the frequency-dependent parameter, γ, called the coefficient of anelastic attenuation. This parameter depends upon the state and composition in the interior of the earth. We shall restrict ourselves to the evaluation of this parameter for Love waves for paths from the central United States to the western and northeastern United States and northern Canada.

A surface wave theory is employed which predicts the dependence of Love wave spectra upon the various physical parameters of an earthquake. By comparing the theoretical Love wave spectral values with the observational data, we can estimate the focal depth and seismic moment of the Illinois earthquake of November 9, 1968, as well as study the attenuation of Love waves.

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In this study, seismograms of the Long Range Seismic Measurements (LRSM) network and Canadian network were digitized and Fourier analyzed to obtain the amplitude spectra as a function of period at each station. The amplitudes were corrected for instrument response and geometrical spreading and then these reduced amplitude vs distance data were fitted by a function in which the amplitude decreases exponentially with epicentral distance. Such a fitting gave average values for the anelastic attenuation as a function of period in the period range of 3 to 50 sec.

In addition to determining values of γ for Love waves of periods 3 to 50 sec, the present study of the amplitude spectra of the November 9, 1968 Illinois earthquake indicates a focal depth of 20 to 25 km and a seismic moment of $(2 \pm 1) \times 10^{24}$ dyne-cm. The love wave spectral data also are consistent with the body-wave focal mechanism solution of Stauder and Nuttli (1970).