THE EFFECT OF FOCAL DEPTH ON THE SPECTRUM OF P WAVES

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Since the earth's free surface acts as a reflector, one may expect the spectra of seismic body waves to be influenced by the focal depth of an earthquake. The investigation concerns the effect focal depth plays on body wave spectra and whether, with this effect known, it is possible to determine the depth of focus from the spectra of seismic body waves.

We consider an earth model consisting of (n-1) homogeneous, isotropic, perfectly elastic layers overlying a half-space, the top of the layered medium being a stress-free surface. Inside the medium we consider that a system of forces acts at one particular level and at one particular point. We consider the elastic waves radiated from this source as a superposition of plane harmonic waves. We define the transfer function as the ratio of the amplitude spectrum of the plane waves propagating in a particular direction (inside the half-space) to the amplitude spectrum of the system of forces. This transfer function will give considerable information about the spectra of the body waves which one expects to record at a particular epicentral distance and at a particular azimuth for a spherical earth. We calculate the transfer function for few simple sources buried at different depths in the layered medium.

Our results show that the transfer function exhibits a few minima at different periods and that as the depth of the source increases the positions of the minima shift to longer and longer periods.

In order to investigate whether the effect of the focal depth is manifested in the observed P wave spectra, we examine the spectra of four earthquakes. Our results indicate that the minima of the transfer function appear in the spectra. This strongly suggests the possibility that the focal depth of an earthquake could be determined from the spectra of P waves.