EFFECTS OF THE EARTHQUAKE SOURCE MECHANISM ON P WAVE MAGNITUDE DETERMINATION

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The mechanism at the focus of an earthquake is an important factor in determining the energy radiated in different directions and its distribution into different wave types. The purposes of this study are to provide a quantitative estimate of the effect of the earthquake radiation pattern on the recorded body wave amplitudes, and to develop a routine procedure for obtaining body wave magnitude estimates corrected for focal mechanism. A closely related problem of developing criteria for sorting out those earthquakes whose focal mechanisms are not adequately represented by the assumed dominant one also is considered.

In order to accomplish these objectives, the published focal mechanism solutions of 88 earthquakes in the Aleutian Islands, Kurile Islands-Kamchatka region and the mid-Atlantic Ocean have been compiled. These seismically active areas have been divided into eight subregions, on the basis of the similarity of the focal mechanism of earthquakes in each of these subregions. The prevailing or dominant focal mechanism parameters have been calculated, by taking the

average of the focal mechanism parameters of the earthquakes forming each subregion.

On the basis of the dominant focal mechanism, selection of seismograph stations which will record relatively large P wave amplitudes (larger than the average amplitude at the focal sphere) from earthquakes in each subregion has been carried out. Regional corrections, to account for the radiation pattern of the predominant focal mechanism in the hypocentral region, have been established. Our calculations indicate that the number of stations expected to record relatively large P wave amplitudes is maximum when the dominant focal mechanism corresponds to the B axis being almost horizontal, and minimum when the B axis is almost vertical. In these cases, by disregarding the effect of focal mechanism, body wave magnitudes will be overestimated or underestimated by about 0.2-0.3 magnitude units, respectively.

The validity of the proposed method has been tested using the first arriving, long period P wave amplitude data of ten earthquakes in various subregions. A comparison of the average m_b value obtained by using the P wave amplitude data of all the stations, with the corresponding m_b value obtained using data at only the selected stations, indicates

that the second set of m_b value shows less scatter than the first set in all cases studied.

A method of sorting out the earthquakes or events whose focal mechanism does not correspond to the dominant mechanism has been developed. This method has been tested using the P wave amplitude and period data of seven earthquakes. It was possible to establish the validity of the calculated dominant mechanism in six cases. In the seventh case the prevailing mechanism was found to differ from the actual mechanism, which was determined independently.