Seismological Consequences of Plate Tectonics

D. Davies

The presence of descending plates of high velocity material in many seismically active regions of the world has substantial consequences on the location problem. At the same time careful spherical analysis of residuals can give a very clear picture of the nature of such plates. In this paper techniques for delineating plates from single events will be demonstrated, and given this information the events will be relocated. The effect of plates on the construction of travel-time tables will be discussed.

Department of Geodesy and Geophysics,
University of Cambridge.

The full text of this paper is published in Geophys. J. R. astr. Soc., 18, 51, as ‘Seismic travel time residuals and plates’, by D. Davies and D. P. McKenzie.

Influence of the Observation Period on the Statistical Prediction of Largest Earthquake Magnitudes

Z. Schenková and V. Kárník

In agreement with the Gumbel theory of largest values, the earthquake magnitude \( M = x \) is taken as a random variable described by the negative exponential distribution. Then the probability \( F(x_m) \) of the \( m \)-th largest annual magnitude is obtained by linear interpolation between the probability of the most probable smallest observation and the probability of the most probable largest observation. Return periods of earthquakes having magnitude equal or greater than a given threshold value are calculated as reciprocals of the expression \( 1 - F(x_m) \).

The original data are taken from the catalogue of European shocks and only shallow-focus earthquakes (\( h < 60 \text{ km} \)) are involved. From the total number of 39 European seismic regions 15 regions with the highest number of observations are selected.

Statistical theory of largest values is applied to three periods of observation 1901–1930, 1901–1955, 1901–1967. The distribution of points \([x_m, F(x_m)]\) plotted on the extremal probability paper fit well a straight line for all periods of observation. Extrapolated lines yield the possibility of estimating \( F(x_m) \) for the largest magnitudes.

The influence of the duration of observation period on the determination of the magnitude, which will be exceeded with a given probability \( P = 1 \text{ per cent} \) is investigated. For each region the relationship \( \delta M_{k \text{ per cent}}^{(67)} = M_{k \text{ per cent}}^{(67)} - M_{67 \text{ per cent}} \) is defined. It represents the difference between the magnitude, which will be exceeded with the probability \( P = 1 \text{ per cent} \) determined from the periods \( k \) years and the magnitude determined from the period 67 years. With regard to the validity of the inequality

\[
M_{30 \text{ per cent}} \geq M_{55 \text{ per cent}} \geq M_{67 \text{ per cent}}
\]