

Spatial variations of the maximum earthquake magnitude under Japan. -(I) Max. M maps derived from geothermal gradient data. -

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We estimated the spatial variation of the maximum earthquake magnitude in the crust under Japan. The maximum width of faults in the crust, which gives the maximum magnitude of earthquakes, should be determined by the thickness of the brittle layer in the crust. The thickness itself, in turn, should be generally related to the geothermal structure in the upper crust. Therefore, it is expected that the geothermal gradient in the upper crust can be used to estimate the maximum magnitude of earthquakes. In order to verify this inference, we examined a relationship between the maximum magnitude of earthquakes and the geothermal gradient in the crust. Two data sets of large earthquakes ($M > 6.5$) which occurred in the inland area of the Japan Islands are used: (1) earthquakes occurring in 1927- 2005 and (2) historical earthquakes in 1500-1927. The spatial distribution of the geothermal gradient is estimated by low ($L > 100\text{km}$)-pass-filtering of the gradient data observed in deep ($D > 1000\text{m}$) boreholes. For the earthquakes of the two groups, we obtain curves which clearly confine the upper-limits of the magnitude distributions as a function of the geothermal gradient. Combining these curves and the spatial distribution of the geothermal gradient, we depicted the maximum magnitude maps over the Japanese Islands for time ranges of about 100 and 500 years.