

Review of studies on estimates of the maximum magnitude of earthquakes

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The estimate of the maximum magnitude of earthquakes that occur in a specified seismic region is critically important from the viewpoints of disposal of radioactive waste. Recently I studied literatures on estimates of the largest magnitude of earthquake and consider that its brief summary may contribute to the discussion of this session.

In Japan, this kind of researches has been done mainly from the viewpoints of geomorphology and geology such as Kakimi et al. (2003). However, there are a wide variety of studies with different approaches from geomorphology and geology. In this review, I introduce some of them.

In fact, many studies have been conducted since at least 1980s in the world mainly base on engineering demands (probably construction of nuclear power plants). According the Wheeler (2009), more than 10 approaches have been proposed, but they have merits and demerits. They are categorized into (1) use of the maximum magnitude of earthquake previously observed, (2) statistical method such as estimate using seismicity or extrapolation of G-R law, (3) estimate based on tectonics, (4) estimate based on physical principles, and (5) estimate based on coda Q of Lg wave. Statistical studies are predominant recently. McCafrey (2008) estimated maximum magnitude of subduction zone earthquakes assuming whole segment of a specified subduction zone ruptures simultaneously. His estimate for the Japan trench was Mw 9.0. Studies by Kagan, Jackson and Bird, and Zöller et al. fit tapered or truncated G-R law to seismic catalog. Both groups concluded that corner magnitude or truncate magnitude should be Mw 9 - 10. All of them insisted that the length of data is critical for good estimate and longer datasets may give larger maximum magnitude.

According to the above studies, we are forced to conclude that there is no scientific validity on the estimate of maximum magnitude in the earthquake science community. Therefore we should sincerely discuss what and how to disseminate this difficulty to society under the pressure of demand of the maximum magnitude of earthquake.

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