Re-evaluation of the relation between various magnitude scales

*Nobuo HAMADA¹

1. none

After Richter(1935) proposed an instrumental earthquake magnitude(ML), various magnitude scales(mB, mb, Ms, Mj and Mw etc.) were proposed by several authors and have been adopted to indicate earthquake size in the earthquake catalogs published by seismological centers. Moment magnitude(Mw) proposed by Kanamori(1977), that is based on the physical parameters of earthquake faulting process, is now widely accepted as the scale to represent accurate size of earthquakes and has been included in many earthquake catalogs. Relations of Mw with conventional magnitudes have been well studied by several authors such as Kanamori(1983) and Utsu(1999). However, changes of seismographs, ways of observation practice, the station distribution etc. would possibly affect the relation between magnitudes for a long years as discussed by Borman and Dewey(2014). Periodical or occasional re-evaluation of the magnitude relation must be desirable to make sure the consistency of magnitude in the catalogs.

Using bulletin of the International Seismological Centre(ISC), I studied relations among Mw and other magnitudes reported by several agencies(ISC, NEIC, JMA and NIED etc.) for earthquakes occurring in and around Japan and some other regions. The result of the study shows that Mws reported by different agency agree well with each other showing universality and robustness of Mw as a scale for earthquake size. Deviations of conventional magnitudes from Mw are generally similar to those reported by Utsu(1999). However, among conventional magnitudes, Mj (Tsuboi(1954), Katsumata(2004)) shows minimum deviation from Mw within the range from Mw=4.0 to 7.0. Mj will be better substitute of Mw when it is not available. Several other interesting results are also to be presented.

Reference

Richter C. F.(1935) An instrumental earthquake magnitude scale, Bull. Seis. Soc. Am. ,25,No.1,1-31.

Kanamori H.(1977)The Energy Release in Great Earthquakes, J. Geophys. Res.82,No20,2981-2987.

Kanamori H.(1983) Magnitude scale and quantification of earthquakes, Tectonophysics, 93, 185-199.

Utsu, T.(1999) Representation and analysis of the earthquake size distribution: A historical review and some new approaches, Pure Appl. Geophys., 155, 509-535.

Borman P. and Dewey J.W.(2014)The new IASPEI standards for determining magnitudes from digital data and their relation to classical magnitudes, Information Sheets 3.3, New Manual of Seismological Observatory Practice 2 (NMSOP2), G.F.Z.

Keywords: Magnitude, Moment magnitude(Mw), JMA magnitude(Mj)

