

Real-Time Mw Estimation Strategy Using Nationwide Strain Meter Observation Network Data

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The 2011 Tohoku earthquake tsunami killed a lot of residents. One of the reasons why the number of victims was increased seemed to be due to the underestimation of tsunami height by JMA tsunami warning. JMA could not capture size of the Tohoku earthquake at earthquake early warning. This huge disaster suggests that proper estimation of magnitude (M) in the real time is essentially important for tsunami disaster reduction. This study proposes a strategy to estimate Mw in the real time using the nationwide strain observation network data.

Strain represents physical value directly, and the strain meter can measure static and dynamic strain due to fault motion. Strain sensor does not require instrumental response and correction operation and has no mechanical saturation. So it is expected that the real-time Mw estimation using strain data is more effective than that using GPS or broadband seismographs.

We consider following strategies from real-time strain observation data ; 1) The estimating Mw from fault length L using the scaling law (Wells et al., 1996, F.O.Strasser et al., 2010). Spatial distribution of static strain changes may provide rupture spreading in real time. 2) Estimating Mw from source time duration Tau (e.g. Kasahara and Sasatani, 1986) and fault length L derived from real-time epoch-to-epoch principal strain analysis proposed by Okubo (2005). This method can provide information of location and absolute value of moment releasing due to earthquake faulting. Real-time tracking of above trajectory give fault length L and duration time Tau. Mw estimation will be done using scaling relation between Mw and L and Tau. Real-time live broadcasting of Mw growth using above strategies gives conclusive information for near-field tsunami warning with quantitative criterion. Nationwide real-time crustal deformation data exchange system can provide practical facility to be doing this experimental study.

In this study, we target the earthquake which generates huge tsunami every 500 years along the Pacific coast of Hokkaido (Hirakawa, 2000). We are making inspection about usefulness and problems of these proposed techniques using the real observed strain record of 2003 Tokachi-oki earthquake.

Keywords: strain, real-time