

# STUDY OF RAPID BROADBAND MOMENT MAGNITUDE DETERMINATION FOR TSUNAMI EARLY WARNING SYSTEM IN MALAYSIA

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## ABSTRACT

We studied several methods to determine the moment magnitude, focusing on broadband P wave moment magnitude for the purpose of tsunami early warning system in Malaysia. We determined  $M_{wp}^k$  based on the method by Kanjo et al. (2006). We also determined  $M_{wp}$  based on the original method of Tsuboi et al. (1999) for comparison. Next we determined  $M_{wpd}$  using the duration-amplitude procedure that was simplified from the original method by Lomax and Michelini (2008). Finally, we performed the moment tensor inversion using the program coded by Yagi to obtain  $M_w$ . We applied all these methods on 20 shallow earthquakes' data inside the region of  $30^\circ\text{N} - 15^\circ\text{S}$  and  $85^\circ\text{E} - 150^\circ\text{E}$  which occurred from 2005 to 2008 and  $M_w^{\text{CMT}} \geq 6.0$  plus one supplemental data of the December 26, 2004 Sumatra-Andaman earthquake. Then we compared our results with the moment magnitude from the Global CMT catalog ( $M_w^{\text{CMT}}$ ).

From the analysis, we found that for larger events ( $M_w > 8.0$ ),  $M_{wp}^k$  showed good estimation while  $M_{wp}$  results showed underestimation. On the other hand, for smaller events,  $M_{wp}^k$  showed overestimation while  $M_{wp}$  results showed good estimation. However, in general, both  $M_{wp}^k$  and  $M_{wp}$  estimates correlate well with  $M_w^{\text{CMT}}$ .  $M_{wpd}$  estimates produced very good results with large events. For  $M_w$  determination using moment tensor inversion method, the results were in good agreement with  $M_w^{\text{CMT}}$  although we found underestimations for tsunami earthquakes and great earthquakes such as the July 17, 2006 and December 26, 2004 events. All in all, this study has provided the base ground of improving the tsunami early warning system in Malaysia.

**Keywords:** Tsunami,  $M_{wp}$ ,  $M_{wpd}$ , Broadband P wave Moment Magnitude

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