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An energy-duration procedure for rapid and accurate determination of earthquake magnitude and tsunamigenic potential

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1. Introduction

The 26 December 2004, MS 9.1 Sumatra-Andaman earthquake caused a tsunami that devastated Indian Ocean coastlines. The global teleseismic data available in the first few hours after the event were characterized by large uncertainties. It is important to rapidly determine and monitor the energy (source duration, seismic moment, and moment magnitude, M0) and tsunami potential (source duration, seismic moment, and moment magnitude, M0) in order to provide timely assistance to the affected population. This paper presents a rapid energy-duration procedure for the rapid determination of energy and tsunami potential that can be calculated as rapidly as 15 minutes after the event origin time (OT) and updated as rapidly as 1 minute after the event begins.

2. Theory

Helmholz (1909) proposed a relationship between the peak ground velocity (Vp) and the seismic moment (M0), which states that the peak ground velocity is proportional to the seismic moment divided by the square of the epicentral distance.

\[ V_p \propto \frac{M_0}{r^2} \]

where \( V_p \) is the peak ground velocity, \( M_0 \) is the seismic moment, and \( r \) is the epicentral distance.

3. Methodology

For each earthquake, we require a hypocentre location and the magnitude. For each earthquake, we determine the energy (source duration, seismic moment, and moment magnitude, M0) and tsunami potential (source duration, seismic moment, and moment magnitude, M0) as quickly as possible after origin time.

4. Application to recent large earthquakes

We apply the energy-duration procedure to the 26 December 2004, MS 9.1 Sumatra-Andaman earthquake, the 26 December 2004 Sumatra-Andaman and 23 March 2005, MS 7.7 Java earthquake.

5. Discussion

The energy-duration analysis indicates that, when applied to a set of large earthquakes, the procedure is rapid and accurate. The results indicate that the energy-duration procedure can be used to determine the energy and tsunami potential of large earthquakes as rapidly as 15 minutes after origin time.

6. Conclusions

The energy-duration procedure can be used to rapidly determine the energy and tsunami potential of large earthquakes. The procedure is rapid and accurate, and it can be applied to large earthquakes as quickly as 15 minutes after origin time.

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References