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Rapid estimate of earthquake source duration: application to tsunami warning.

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We present a method for estimating the source duration of the fault rupture, based on the high-frequency envelop of teleseismic P-Waves, inspired from the original work of (Ni et al., 2005). The main interest of the knowledge of this seismic parameter is to detect abnormal low velocity ruptures that are the characteristic of the so called 'tsunami-earthquake' (Kanamori, 1972).

The validation of the results of source duration estimated by this method are compared with two other independent methods : the estimated duration obtained by the Wphase inversion (Kanamori and Rivera, 2008, Duputel et al., 2012) and the duration calculated by the SCARDEC process that determines the source time function (M. Vallée et al., 2011).

The estimated source duration is also confronted to the slowness discriminant defined by Newman and Okal, 1998), that is calculated routinely for all earthquakes detected by our tsunami warning process (named PDFM2, Preliminary Determination of Focal Mechanism, (Clément and Reymond, 2014)).

Concerning the point of view of operational tsunami warning, the numerical simulations of tsunami are deeply dependent on the source estimation: better is the source estimation, better will be the tsunami forecast.

The source duration is not directly injected in the numerical simulations of tsunami, because the cinematic of the source is presently totally ignored (Jamelot and Reymond, 2015). But in the case of a tsunami-earthquake that occurs in the shallower part of the subduction zone, we have to consider a source in a medium of low rigidity modulus; consequently, for a given seismic moment, the source dimensions will be decreased while the slip distribution increased, like a 'compact' source (Okal, Hébert, 2007). Inversely, a rapid 'snappy' earthquake that has a poor tsunami excitation power, will be characterized by higher rigidity modulus, and will produce weaker displacement and lesser source dimensions than 'normal' earthquake.

References:

CLément, J. and Reymond, D. (2014). New Tsunami Forecast Tools for the French Polynesia Tsunami Warning System. Pure Appl. Geophys, 171.

DUPUTEL, Z., RIVERA, L., KANAMORI, H. and HAYES, G. (2012). Wphase source inversion for moderate to large earthquakes. Geophys. J. Intl.189, 1125–1147.

Kanamori, H. (1972). Mechanism of tsunami earthquakes. Phys. Earth Planet. Inter. 6, 246-259.

Kanamori, H. and Rivera, L. (2008). Source inversion of W phase : speeding up seismic tsunami warning. Geophys. J. Intl. 175, 222-238.

Newman, A. and Okal, E. (1998). Teleseismic estimates of radiated seismic energy : The E=M0 discriminant for tsunami earthquakes. J. Geophys. Res. 103, 26885-26898.

Ni, S., H. Kanamori, and D. Helmberger (2005), Energy radiation from the Sumatra earthquake, Nature, 434, 582.

Okal, E.A., and H. Hébert (2007), Far-field modeling of the 1946 Aleutian tsunami, Geophys. J. Intl., 169,

1229-1238.

Vallée, M., J. Charléty, A.M.G. Ferreira, B. Delouis, and J. Vergoz, SCARDEC : a new technique for the rapid determination of seismic moment magnitude, focal mechanism and source time functions for large earthquakes using body wave deconvolution, Geophys. J. Int., 184, 338-358, 2011.