Ocean-bottom Pressure Signals as Potential Identifiers of Tsunami Earthquakes in the Near Field

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The real-time detection of "tsunami earthquakes" remains a challenge, especially in the near field. These events are characterized by an anomalously slow seismic rupture, with their true long-period seismic moment, and hence, tsunami potential, deceptively concealed from short-period waves and in particular felt accelerations. In the context of the deployment of long-period ocean-bottom sensors in epicentral areas, we explore simple but robust ways to quantify source parameters which could potentially lead to the real-time identification of tsunami earthquakes in the near field. We use records of 2011 Tohoku aftershocks on the JAMSTEC stations deployed off the coast of Japan in the wake of the mainshock. Because seismic phases are not resolvable at short distances, we simply consider an integrated measurement Ω of the square of pressure variations, sharing the philosophy of Boatwright and Choy's (1986) seismic energy, and compare this parameter, scaled to seismic moment, with other discriminants, such as Newman and Okal's (1998) energy-to-moment ratio, Θ, Okal et al.'s (2002) T-wave parameter Γ, or Okal's (2013) parameter Φ combining (in the far field) body-wave duration and energy. We also consider the duration of the pressure signal, and examine its relation to Ω.