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Seismic records of the 2010 and 2011 tsunamis

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We examine records of the 2010 Maule and 2011 Tohoku tsunamis obtained on
horizontal components of seismometers deployed in the vicinity of coastlines,
in particular on small oceanic islands. We have shown (Okal, 2007) that such records
can be interpreted by simply assuming that the instrument functions as an OBS
(if its distance from a deep basin is small with respect to the tsunami
wavelength), recording the horizontal motion of the solid Earth induced by the
continuation of the tsunami wave in the solid medium, modified by terms
representing the tilt of the ocean floor, and a change in the gravity potential associated with the passage of the wave, as theorized 30 years ago by J.F.
Gilbert for classical spheroidal modes.
Following the Tohoku tsunami, we report the first observation of a tsunami
by an OBS in the farfield, as part of the Neptune Canada project, and
use a detection on a nearby station at Forks, Washington, to
confirm the validity of this interpretation by inverting their
spectral amplitudes
into the moment of the earthquake within 15% of its CMT value, this experiment justifying a posteriori our 2007 model.
We use extended datasets obtained throughout the
Pacific Basin to recover the seismic moment of the two events of 2010 and 2011,
and conclude that neither shows growth at ultra-long periods, confirming that
neither of the two shocks features a hidden long-period component, in contrast
with the three super-mega events (1960 Chile, 1964 Alaska, 2004 Sumatra).
Results at higher frequenices (5 mHz) are much more scattered and suggest a non-linear response of small island edifices, which can reach spectacular
characteristics (such as at Pitcairn in 2010).