Geophysical Research Abstracts
Vol. 18, EGU2016-9947, 2016
EGU General Assembly 2016

The potential role of real-time geodetic observations in tsunami early warning

Stefano Tinti and Alberto Armigliato
University of Bologna, Dipartimento di Fisica e Astronomia (DIFA), Bologna, Italy (stefano.tinti@unibo.it)

Tsunami warning systems (TWS) have the final goal to launch a reliable alert of an incoming dangerous tsunami to coastal population early enough to allow people to flee from the shore and coastal areas according to some evacuation plans. In the last decade, especially after the catastrophic 2004 Boxing Day tsunami in the Indian Ocean, much attention has been given to filling gaps in the existing TWSs (only covering the Pacific Ocean at that time) and to establishing new TWSs in ocean regions that were uncovered.
Typically, TWSs operating today work only on earthquake-induced tsunamis. TWSs estimate quickly earthquake location and size by real-time processing seismic signals; on the basis of some pre-defined "static" procedures (either based on decision matrices or on pre-archived tsunami simulations), assess the tsunami alert level on a large regional scale and issue specific bulletins to a pre-selected recipients audience. Not unfrequently these procedures result in generic alert messages with little value.
What usually operative TWSs do not do, is to compute earthquake focal mechanism, to calculate the co-seismic sea-floor displacement, to assess the initial tsunami conditions, to input these data into tsunami simulation models and to compute tsunami propagation up to the threatened coastal districts. This series of steps is considered nowadays too time consuming to provide the required timely alert. An equivalent series of steps could start from the same premises (earthquake focal parameters) and reach the same result (tsunami height at target coastal areas) by replacing the intermediate steps of real-time tsunami simulations with proper selection from a large archive of pre-computed tsunami scenarios. The advantage of real-time simulations and of archived scenarios selection is that estimates are tailored to the specific occurring tsunami and alert can be more detailed (less generic) and appropriate for local needs. Both these procedures are still at an experimental or testing stage and haven't been implemented yet in any standard TWS operations. Nonetheless, this is seen to be the future and the natural TWS evolving enhancement.
In this context, improvement of the real-time estimates of tsunamigenic earthquake focal mechanism is of fundamental importance to trigger the appropriate computational chain. Quick discrimination between strike-slip and thrust-fault earthquakes, and equally relevant, quick assessment of co-seismic on-fault slip distribution, are exemplary cases to which a real-time geodetic monitoring system can contribute significantly. Robust inversion of geodetic data can help to reconstruct the sea floor deformation pattern especially if two conditions are met: the source is not too far from network stations and is well covered azimuthally. These two conditions are sometimes hard to satisfy fully, but in certain regions, like the Mediterranean and the Caribbean sea, this is quite possible due to the limited size of the ocean basins.
Close cooperation between the Global Geodetic Observing System (GGOS) community, seismologists, tsunami scientists and TWS operators is highly recommended to obtain significant progresses in the quick determination of the earthquake source, which can trigger a timely estimation of the ensuing tsunami and a more reliable and detailed assessment of the tsunami size at the coast.