Real time tsunami inundation forecast method developed for Central America Region

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In 1992, the Nicaragua tsunami earthquake generated a large tsunami which caused a significant disaster along the coast. In Central America, it has been an issue to develop a tsunami warning system which can manage a tsunami earthquake such as the 1992 Nicaragua earthquake. Recently, the Intergovernmental Oceanographic Commission of UNESCO (IOC/USESCO) decided to make the Central America Tsunami Advisory Center (CATAC) in Nicaragua. Therefore, Japan International Cooperation Agency (JICA) with Japan Meteorological Agency (JMA) run a technical program to support the establishment of CATAC. In this paper, we develop a tsunami inundation forecast method for CATAC which can manage a tsunami earthquake.

First, we previously developed the method to appropriately estimate the source model (Tanioka et al., 2017). The technique was tested for four large earthquakes, the 1992 Nicaragua tsunami earthquake (Mw7.7), the 2001 El Salvador earthquake (Mw7.7), the 2004 El Astillero earthquake (Mw7.0), and the 2012 El Salvador-Nicaragua earthquake (Mw7.3), which occurred off Central America. At first, fault parameters were estimated from the W-phase inversion. Then the fault length and width were determined from scaling relationships. To estimate a slip amount, we constructed a depth dependent rigidity curve, similar to that suggested by Bilek and Lay (1999). The curve with a central depth estimated by the W-phase inversion was used to calculate the slip amount of the fault model. Using that slip amount, the tsunami numerical simulation with inundations was carried out. The result indicated that the observed tsunami heights, run-up heights, and inundation areas for the 1992 Nicaragua tsunami earthquake were well explained by the computed one. The other tsunamis from the other large earthquakes were also reasonably well explained by the computed ones.

In this paper, we applied the near-field tsunami forecast method (NearTIF) using a data base (Gusman et al., 2014) by computing a tsunami from the appropriate fault model which estimated in the above. First, we built a data-base which contained tsunami waveforms at several reference points for each region and inundation results at 6 regions, Gulf of Fonseca, Corinto, Puerto Sandino, El Transito, Masachapa,El Astillero, along the Pacific coast of the Central America. We put source models of Mw7.0, 7.2, 7.4, 7.6, 7.8, 8.0, 8.2 along the subduction interface. Totally, 135 source models are in the data base. The best tsunami inundation distribution for the forecast will be chosen by comparing the tsunami waveforms at the reference points computed in a real time with the tsunami waveforms at those points in the data base. Nest, the method is applied for the 1992 Nicaragua tsunami earthquake case. The source model for the 1992 Nicaragua earthquake was previously estimated from the W-phase inversion with the scaling relationship. The slip amount is estimated using the depth dependent rigidity curve. The tsunami forecast result shows that the observed tsunami heights, run-up heights, and inundation areas are reasonably well explained by the tsunami forecasted inundation map. The method developed in this paper should be useful for the tsunami early warning system at CATAC.

Keywords: Real time tsunami inundation forecast, Nicaragua, CATAC

