Key features of the real-time forecast system for tsunami inundation developed by NIED

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We are developing a real-time forecast system for tsunami inundation as well as coastal tsunami heights for the Pacific coast of Chiba prefecture (Aoi et al., 2017), using the real-time ocean bottom pressure data observed by the Seafloor Observation Network for Earthquakes and Tsunamis along the Japan Trench (S-net; Kanazawa et al., 2012). The main purpose of the system is to provide the tsunami information that would help the local governments promote the evacuation and react the tsunami disaster. The information of tsunami inundation is highly important because the risk of the tsunami could be intuitively recognized. Therefore, we employ the database-driven system in order to forecast the inundation for relatively broad region, which requires a large cost for real-time computation.
The database is called as “Tsunami Scenario Bank (TSB)” and includes “tsunami scenario” composed of the possible tsunami source model, and the simulation results of the ocean bottom pressure data at S-net observation stations, coastal tsunami heights, tsunami arrival times, and flow depths for each source model. TSB is constructed considering interplate earthquakes along the Japan Trench, Sagami Trough, Nankai Trough, and outer-rise earthquakes along the Japan Trench. The ocean-bottom pressure data and coastal tsunami height data are pre-calculated for more than 10,000 source models. Among them, the inundation data are calculated for the source models with the maximum coastal tsunami height of 1 m or greater using the 10-m mesh terrain model with sea walls. Tsunami scenarios are created by appropriately associating these information in consideration of the resemblance of the simulation results.
The forecast system continuously searches for the tsunami scenarios whose pre-calculated pressure data reasonably explain the real-time observation data based on the multi-index method (Yamamoto et al., 2016). The method uses the correlation coefficient and two kinds of the variance reductions for the spatial distribution of the ocean-bottom pressure data to evaluate the degree of the matching. If all of the three indexes meet the criterion values, the tsunami scenarios are selected as candidates to generate the forecast information. The selection methodology is less sensitive to the perturbation of the timing because these indexes are calculated from the peak-hold value of the absolute value of the pressure change. In addition, the methodology could evaluate the scale of the tsunami appropriately using two kinds of the variance reductions that are sensitive to overestimation and underestimation respectively. Several kind of the tsunami forecast information can be created in this system from the selected tsunami scenarios according to the needs of users. The tsunami information related to the best-fit scenario for ocean-bottom pressure data is one of the useful forecast information. In order to prevent the system from the underestimation, the maximum values of all the selected scenarios is the possible forecast information. The system is in trial operation using the real-time observation data to see the stability and performance.
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