# Method for real-time estimation of tsunami sources using a network of dense ocean bottom pressure sensors

*Mayu Inoue[1], Yuichiro Tanioka[1], Yusuke Yamanaka[2]

1. Hokkaido University, 2. The University of Tokyo

After the 2011 hazardous tsunami, the Seafloor observation network for earthquakes and tsunamis along the Japan Trench (S-net) was installed by National Research Institute for Earth Science and Disaster Resilience in Japan (NIED). Various real-time tsunami-forecast methods using this S-net were developed by several researchers. The objective of this study is to develop a new method for real-time tsunami source estimation using S-net data, a simpler method than the previous methods. This study focuses on tsunami generated by great underthrust earthquakes at the plate interface off the Pacific coast of Hokkaido, Japan. First, we numerically computed tsunamis from fault models of M8.0 to M8.8 classes distributed along the plate interface along the Kurile Trench. Virtual observational waveforms at locations of sensors in S-net during each tsunami were estimated by converting the simulated tsunami waveform into a waveform of water pressure change. We tried to estimate a tsunami source area by classifying the virtual observational waveforms within 500 seconds after the origin time of the earthquake into the following three types. Type1 waveform goes down and stays down within 500 seconds. Type2 waveform includes one complete up-pulse waveform. All of the other waveforms were regarded as Type3. We found that a sensor with the type1 waveform is located in the initial uplifted area, and sensors with the type2 waveform is located not in the area but near the initial uplifted area, and the sensor with the type3 is located far from the initial uplifted area. After the tsunami source area was estimated, the magnitude of the earthquake can be estimated using the scaling relationship between the earthquake fault area and the magnitude of the earthquake. We tested four different scaling relationships suggested by previous studies to find the error of the magnitude estimation. The estimation error was found to be M ±0.08. Finally, this new method was applied to the 1952 Tokachi-oki earthquake and the 1968 Tokachi-oki earthquake source models. The tsunami source area and the magnitude of the earthquake were estimated well for both cases. Therefore, the new method should be useful for the rapid estimation of a tsunami source as a part of the tsunami early warning system.

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