Maximum tsunami height prediction using pressure gauge data by a Gaussian process at Owase in the Kii Peninsula, Japan

*Yasuhiko Igarashi[1], Shin Murata[1], Toshitaka Baba[2], Ken-ichiro SATO[3], Takane Hori[3], Masato Okada[1]

1.Graduate School of Frontier Sciences, The University of Tokyo, 2.Institute of Technology and Science, The University of Tokushima,, 3.Research and Development Center for Earthquake and Tsunami, Japan Agency for Marine-Earth Science and Technology

In Japan, the Dense Oceanfloor Network System for Earthquakes and Tsunamis (DONET) was recently developed in the Nankai trough (Kaneda et al., 2015). DONET1 is equipped with seismometers and ocean-bottom pressure gauges at 20 points on the sea floor and submarine data can be acquired in real time. We studied the relationship between offshore and coastal tsunami heights with the aim of using DONET1 ocean-bottom pressure gauges for early tsunami prediction.
Previous works focused on the average of maximum absolute values of the hydrostatic pressure changes during a tsunami (Baba et al., 2013). Although compressing time series of pressure gauges data, they revealed a clear relationship between the average waveforms of DONET and tsunami heights at the coast. However, since they assumed linear relationship and used only the average of the data at all the DONET stations, it may be inadequate to take accurate tsunami prediction.
Here, using a standard nonlinear regression method, Gaussian process (GP), we construct an algorithm to predict maximum tsunami height. We found a greatly improved generalization error of the maximum tsunami height by our prediction model. The error is about one third of that by a previous method. Moreover, by optimizing each sensor’s weight of GP, we investigate the contributions of each ocean-bottom pressures on the predictions, which enables us to take more accurate prediction of tsunami height and could provide the design criteria of ocean-bottom sensors in the future.

Keywords: Tsunami height prediction, Gaussian Process, DONET

