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Rapid and Accurate Tsunami Forecast Method Using Tsunami Data Assimilation with Real-time Source Estimation.

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After the dense observation network for earthquakes and tsunamis along the Japan trench (S-net) was available, the tsunami data assimilation became a powerful technique to compute tsunamis in real-time. However, a problem exists for this technique to forecast tsunamis in real-time because the observation data near the source area are always unstable as shown in the 2016 Fukushima earthquake. Therefore, the data near the source area may not be available for real-time tsunami forecast.

In this paper, we try to solve this problem by combining the tsunami data assimilation with the source estimation using real-time GNSS observation such as REGARD. We tested our method for two cases, the 2016 Fukushima earthquake case and the 1896 Sanriku earthquake case. We first computed the tsunamis from the source models estimated by Kubota et al. (2021) for the 2016 Fukushima case and that estimated by Satake et al. (2017) for the 1896 Sanriku earthquake case as reference tsunamis. We used those commuted data at stations of S-net as observation data without the stations near the source area. Then the tsunami data assimilations with and without the rectangular fault model are performed.

The result of the 2016 Fukushima case shows that the tsunami data assimilation worked well although the quickly estimated rectangular fault model using the GNSS observation data was not acceptable for the tsunami simulation. The result of the 1896 Sanriku case shows that the tsunami data assimilation with the estimated rectangular fault forecast the acceptable tsunami waveforms along the coast about 20 minutes faster that that without the rectangular fault. This improvement is significant, so our method can be used as a real-time tsunami forecast technique even the tsunami data near the source area will not be available.

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