

# Forward Modeling of Sediment Transport due to the 2011 Tohoku-Oki Tsunami at a Coastal Lowland, Fukushima Prefecture

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The relation between tsunami source and tsunami sand deposit is studying from the numerical modeling of tsunami propagation and sediment transport. In this study, we tried to apply sediment transport simulation to the 2011 Tohoku tsunami deposits at the Idagawa lowland in Fukushima Prefecture, and to assess the validity of sediment transport modeling.

Our study area is a coastal lowland, located about 12 km north of Fukushima Daiichi Nuclear Power Station. The lowland extends about 4.5 km in the EW direction and 1.3 km in the NS direction. It locates behind a beach ridge which is about 3-4 m high and 100 m wide. The 2011 Tohoku tsunami deposit consists of medium to coarse sand with modern debris and agricultural soils in this study area. The observed sediment thickness ranges from 4 to 22 cm. The thickness gradually decreases with the distance between 500 and 1300 m from the shoreline. In contrast, it increases with the distance between 1300 and 2000 m from the coast (Kusumoto *et al.*, 2015, AGU).

Tsunami inundation and sand movement were computed with 1-dimesional numerical model developed by previous studies (e.g. Takahashi *et al.*, 2000; Gusman *et al.*, 2012; Sugawara *et al.*, 2014). The coefficients of non-dimensional bed load and exchange rates for grain sizes are interpolated/extrapolated from tsunami hydraulic experiments (Takahashi *et al.*, 2011). To consider the multiple-sized sediment transport, we defined the total sediment thickness as the sum of the computed thickness of three grain sizes (0.442, 0.374 and 0.032 mm), by assuming that the interference between different sand particles could be ignored.

Our results show that the simulated tsunami inundation area was consistent with the observation. The computed tsunami heights were also well-matched except for heights measured at some trees just behind the coastal ridge. The simulation shows that sediment is distributed between 250 and 4000 m inland with a maximum thickness of about 120 cm, which is close to the observations. The simulation shows that intense scouring occurs just behind the coastal ridge and on the shallow seabed, which indicated that the sand was transported from these locations.

Keywords: The 2011 Tohoku-oki earthquake, Tsunami deposit, Sediment transport modeling