Volcanic Eruption-induced Tsunami at Anak Krakatau Volcano, Sunda Strait, Indonesia

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INTRODUCTION

On 22 December 2018, a volcanic eruption occurred at Anak Krakatau, Sunda Strait, Indonesia, which induced a tsunami. At the coastal area in the Sunda Strait, the destructive tsunami destroyed many structures and killed more than 400 people approximately 30 to 40 min after the eruption. In this event, it has been reported that many residents start to evacuate after seeing tsunami because alert of tsunami was not occurred. It is difficult to escape from a tsunami after seeing it waves, so early evacuation become important. Previously, many studies which handle Krakatau volcanic eruption induced tsunamis have been conducted. Pakoksung et al. (2019) conducted its simulation, but it was reported that the observed run-up heights and inundation depths were underestimated. Moreover, there were few studies which handle evacuation from non- seismic tsunami. The purpose of the study is to reveal the actual evacuation action from the tsunami induced by the 2018 volcanic eruption.

STUDY AREA

Table-1 shows the numbers of evacuees and deaths in the coastal areas of Sunda Strait during the event reported by National Disaster Management Agency (BNPB). It was indicated that mortality in the western coast of Java, Pandeglang and southeastern area of Sumatra, Lampung Selatan were higher than other areas. Especially, the severe damage was reported in Tanjung Lesung, Kalinada and Rajabasa area where inundation depths reached approximately 3 to 4 m.

METHOD

We used the 2-layer model (Pakoksung et al., 2019) which are composed of the nonlinear shallow water equation and the movement of sand materials. They assumed sliding mass volume was 0.182 km^3 based on the optimization algorithm and the initial water level rise was 0 m. For conducting the evacuation simulation, we used the multi-Agent model developed by Arikawa et al. (2015) based on the simulation results of 2-layer model. The tsunami arrival time were indicated to 30 to 45 min in the calculation areas based on Pakoksung et al. (2020), so evacuation start time is assumed as ranging from 0 to 2800 s with 200 s interval. For simulating tsunami propagation, we obtained the bathymetric and topographic data with a spatial resolution of 180 m and 8 m from BATNAS. It was indicated that tidal level was 1-1.5 m (http://tides. big.go. id:8888 /dash/prov/Banten.html) in the coastal area of Sunda Strait during the event. Thus, we also conducted the tsunami simulation using 2-layer model with initial water level of 0-1.5 m, and investigated the variation of inundation area and mortality rate.

CONCLUSION

Based on our simulations, we indicated the hazard risk of non-tectonic tsunami and suggested the suitable evacuation action in the coastal area of Sunada Strait at the moment of volcanic eruption. We also need to use more precise topographic data to evaluate the landslide tsunami hazard properly. In the future, 3D fluid calculation should be used to reproduce mass movement and run-up heights and simulate evacuation action properly.

Area	(a) Number of evacuation	(b) Number of deaths	b/a (%)
Lampung Selatan	7,617	116	1.52
Serang	4,399	20	0.45
Pandeglang	28,139	288	1.02
Pesawaran	231	1	0.43

Table-1 Number of evacuees and deaths in each area.

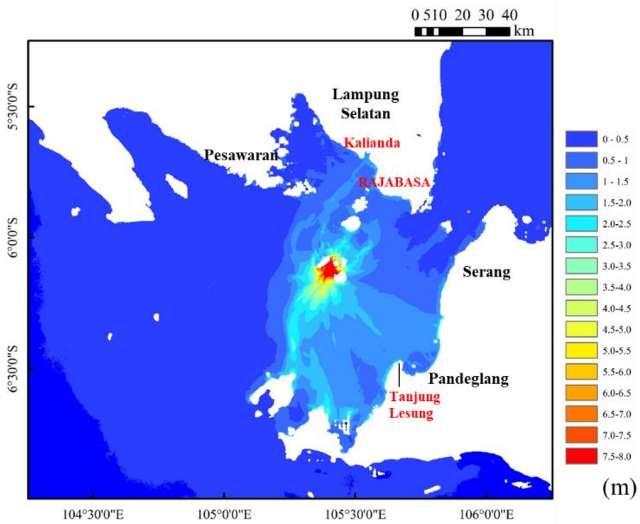

Figure-2 Maximum water level and the damaged locations. Black letters indicate districts shown in Table-1 and red letters indicate the study areas.

REFFERENCES

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