I. Introduction

Indonesia is prone to tsunamis disaster since its location in the line of the Ring of Fire, which is a major series of active volcanoes in the world with approximately 83 active volcanoes [**?**]. Indonesia is indeed potential to possibly many volcano eruptions. Large numbers of fatalities may possibly be expected since Indonesia has many active volcanoes, especially in highly populated areas [**?**]. Tsunamis that are caused by volcanic activity in Indonesia are actually less frequent compared to the tsunami caused by the movement of tectonic plates, so this event is scarce.

Gunung Anak Krakatau (GAK), an active volcanic island located in the Sunda Strait between Java and Sumatra island, was formed from the Gunung Krakatau that has erupted in 1883 [**?**], [**?**], [**?**]. The GAK is currently an archipelago with the volcanically active Anak Krakatau that are surrounded by Sertung, Panjang, and Rakata island [**?**].

At the end of 2018, 21 December 2018, the Volcanological Survey of Indonesia (PVMBG) recorded an increase of Anak Krakatau's eruption activity lasting more than two seconds and producing ash clouds about 400 meters high above the mountain. This eruption causes a massive tsunami on 22 December 2018 ranged in height from 0.27 to 1.40m [**?**]. The tsunami impacted the coast of Western Java and Southern Sumatra island, see Fig. 1, without any warnings and caused the deaths of 431 people, injured a further 7,200 people and displaced 46,646 people [**?**].

Very different from the previous tsunami, i.e. the 2004 Aceh Tsunami and the 2006 Pangandaran Tsunami that were caused by the movement of tectonic plates, the 2018 tsunami by GAK was caused by the collapse of the amount of volcanic material and landslide ([**?**], [**?**], [**?**]).

To date, the generation mechanism of the 2018 tsunami GAK is still unclear as to whether it was generated by single large caldera collapse or by retrogressive failures [**?**]. Meanwhile, for future tsunami mitigation especially in the affected areas along the coast of Sunda Strait, accurate reconstruction of tsunami events by GAK is needed. Reconstruction is needed also for building future scenarios for coastal protection along the affected area.

In this research, we propose a tsunami inversion method by using a soft computing approach, i.e. the Artificial Neural Network (ANN) approach. The inversion here means the initial surface elevation of the tsunami can be estimated based on given corresponding measured sea level data in the surrounding area. During the event, sea level data were available at four locations in the Sunda Strait, measured by tide gauges from the Indonesian Spatial Agency or BIG. Before the inversion procedure, numerical simulation of various initial conditions is performed using SWASH model. These simulations are done to create a training dataset for the inversion of ANN. The dataset is surface elevation measured in the tide gauge locations and several points near GAK, the main source of the tsunami event.

The rest of this paper is organized as follows. In Section II, we discuss some literature reviews of the tsunami, especially related to the Krakatau's tsunami. It is then followed by a description of the methodology that is used in this paper in Section III. We describe the results of the tsunami inversion in Section IV. Finally, we close the paper with some conclusions in the final section.

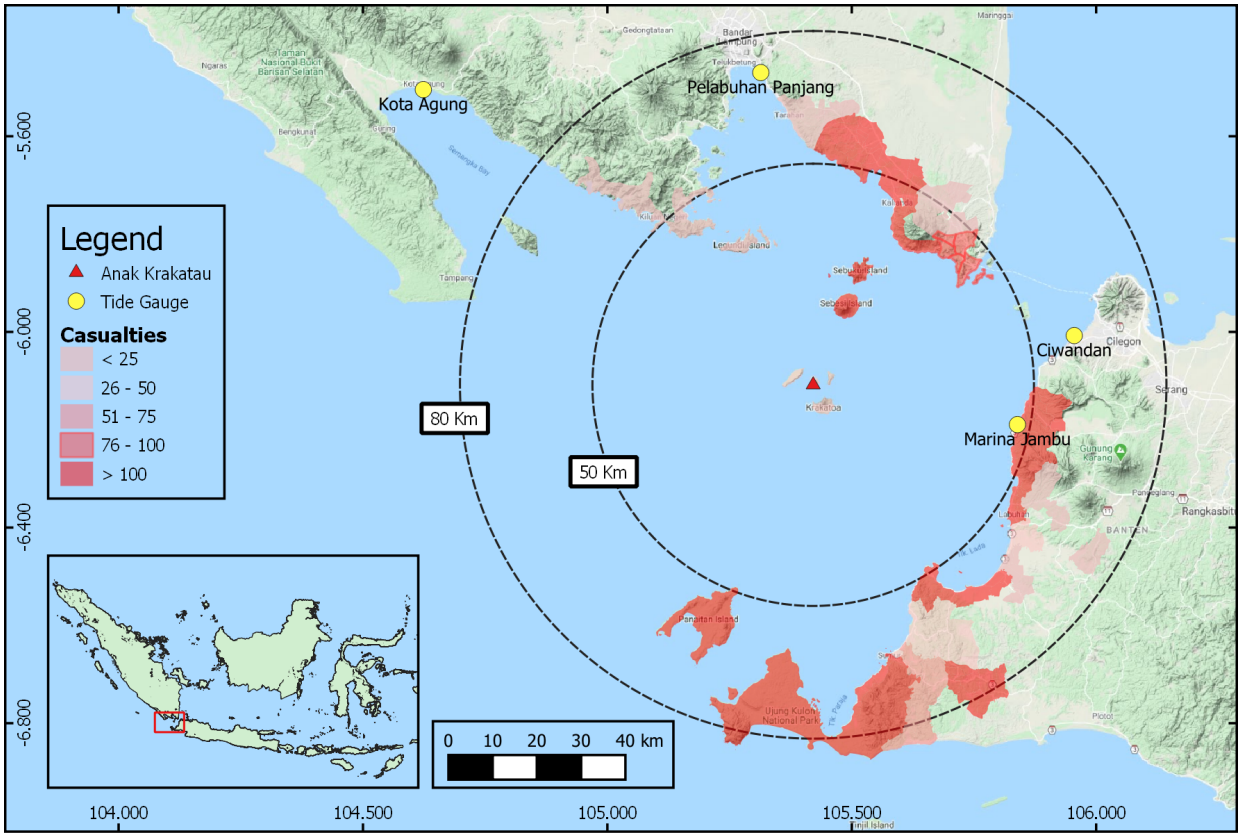

Fig. 1. Affected area and casualties by the impact of Anak Krakatau's tsunami. Adapted from the map of the Final Infographic of Tsunami Selat Sunda created by Indonesia Ministry of Health dated 14 January 2019. Casualties area is covered in radius 80 Kilometres.