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CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
8 SEPTEMBER ONLINE DAY
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Potential tsunami disaster from volcanoe in Indonesia (Case Mount Gamalama)

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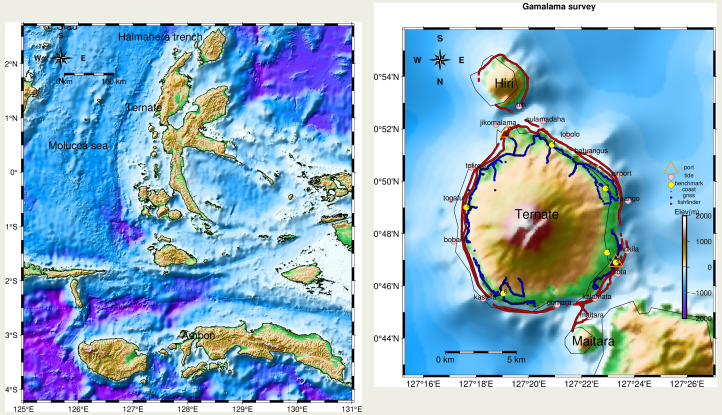
Introduction

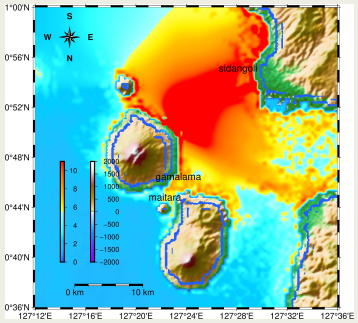
Indonesia has some non-seismic tsunamis caused by landslides and volcanic collapses. Based on VSI-ESDM (2024), a dozen active volcanoes were found on the coast and under the sea. Mount Gamalama is an active volcano in the Ternate region, North Maluku. The last erruption was in 2011, 2012, and 2015 (Hidayat et al, 2020) where lava flows headed east. To carry out tsunami modeling, numerical modeling techniques can be used. We use the Cornell Multi-grid Coupled Tsunami (COMCOT, Wang and Power, 2009) for tsunami model and the national bathymetric (BATNAS) and topographic (DEMNAS) maps with medium resolution. We took benchmark GPS stations and initial tide stations.



(Left) Map showing Molucca islands. (Right) Mount Gamalama is in Ternate, North Molucca. Bathymetric and topographic survey routes are depicted in red and blue dots.

Methods/Data

We make some correction using bathymetric survey, and tide gauge data in Ternate.We explored the coast around the Ternate Island from 12 to 16 August 2023 using a boat and simple sensors which are often used by fishermen for navigation and knowing the depth of sea water. This sensor is quite useful for adding bathymetric data which we then assimilate with DEMNAS data.



The maximum sea volume deformation from tsunami modeling that generated lava flow from Mount Gamalama.

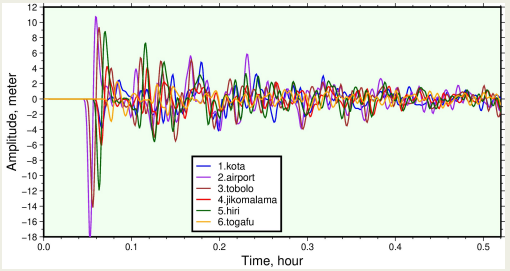
References:
- Hidayat, et al, 2020, The 2015 eruption of Gamalama volcano Geojournal,Volume 87, pages 1–20.
- Wang, X., & Power, W. (2011). Comcot: GNS
- Magma VSI-ESDM, https://magma.vsi.esdm.go.id

Thanks to GMT and COMCOT application, we can present this tsunami model.

Results

Based on information from Gamalama Volcano officer, the tendency of lava movement is towards the North East. Therefore, we use this direction as the start of a potential tsunami landslide. We apply the worst scenario of a subaerial landslide then continuing towards the coast causing ocean deformation, causing a tsunami as high as 11 meters. This research needs to be continued with field surveys to produce high resolution data so that better model approach results can be obtained.

GPS measurements around Mount Gamalama increase the resolution of topographic data



The marigrams model show the height and arrival time of the tsunami. The points closest to the source of the tsunami landslide experienced the maximum height and fastest time. Points number 2, 3, and 5 (Airport, Tobolo, and Hiri) show an initial height of 9 to 11 meters with a fastest time of 0.05 hours (3 minutes). Meanwhile, the points behind numbers 1, 4, and 6 (Ternate City, Jikomalama, and Togafu) are 2 to 4 meters high with the fastest time of 0.06 hours (less than 4 minutes)

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