



Tsunami Modeling on the Coast of Kwandang Bay, North Gorontalo District Using The Commit Application

Meilan Demulawa

Program Studi S1 Fisika Jurusan Fisika Fakultas MIPA Universitas
Negeri Gorontalo

Abstract

Received: 4 November 2023
Revised: 16 November 2023
Accepted: 28 November 2023

Modeling a tsunami measuring 8.5 SR using ComMIT software. The simulation results include data on wave arrival time, wave depth and maximum height at three coastal locations in North Gorontalo, namely Tomilito, Kwandang and Ponelo Islands Districts. In tsunami modeling in Kwandang Bay, there are differences in wave heights on three beaches in the North Gorontalo region, including Tomilito, Ponelo and Kwandang. On the coast of Tomilito District, the maximum tsunami height reached 11 meters. Meanwhile, on the coast of Kwandang District, the tsunami height reached 10 meters, and the lowest tsunami height occurred on the Ponelo coast with a height of 9 meters.

Keywords: tsunami modeling

(*)Corresponding Author: meilan.demulawa@ung.ac.id

How to Cite: Demulawa, M. (2023). Tsunami Modeling on the Coast of Kwandang Bay, North Gorontalo District Using The Commit Application. *Jurnal Ilmiah Wahana Pendidikan*, 9(24), 1103-1107. <https://doi.org/10.5281/zenodo.10727343>

INTRODUCTION

The northern arm of Sulawesi is located in a very active and complex tectonic area with great seismic activity. This is because the position of the North Sulawesi arm is controlled by the subduction activity of the Sulawesi Sea plate to the north of the Minahasa Peninsula and the Pacific plate to the east. Apart from that, there is an active fault in Gorontalo on land on the northern arm of Sulawesi. The Gorontalo Fault is located in the northern part of Sulawesi Island. Morphologically, there are four fault segments that can be seen in this area, as described by Hall and colleagues in 2000. The central part of the northern island of Sulawesi is divided into three small blocks. The Manado Block, which is located in the eastern part of the northern arm of Sulawesi Island, is an isolated block and is not affected by the North Sula Block. Therefore, geologically it is clear that there is a separation caused by the existence of the Gorontalo Fault. The Gorontalo Fault stretches from northwest to southeast, starting from the Sulawesi Sea, crossing Gorontalo, until it reaches the waters of Tomini Bay. The mechanism of the fault is right lateral slip or lateral slip (Hall, R., & Wilson, M. E. J. (2000), Pasau, G., & Tanauma, A. (2011).

These structural elements, as sources of tectonic earthquakes, largely determine the vulnerability of the region to earthquake zones. There have been many damaging earthquakes along the source line, such as the Gorontalo earthquake in (1941, 1990, 1991, 2009), the Manado earthquake in (1980, 1988), and the Tolitoli earthquake in (1983, 1996). Therefore, large cities



The data used in this modeling is the source of tectonic earthquakes with the assumption that earthquake parameters originate from the North Sulawesi megathrust zone (North Sulawesi Megathrust) with parameters based on research results from the Pusgen Team (2017) with a maximum magnitude of 8.5, earthquake location at 1.95 N, 122.9 E longitude with a depth 10 km, and the fault parameters are: Strike 92.0°, Rake 90.0°, Dip 30.0°, and slip 12.00 m. Then these parameters are included in the modeling grid as modeling area boundaries.

DISCUSSION

Tsunami modeling in Kwandang Bay obtained results in the form of a tsunami animation which presents data on wave arrival time, depth of inundation and maximum height of tsunami waves.

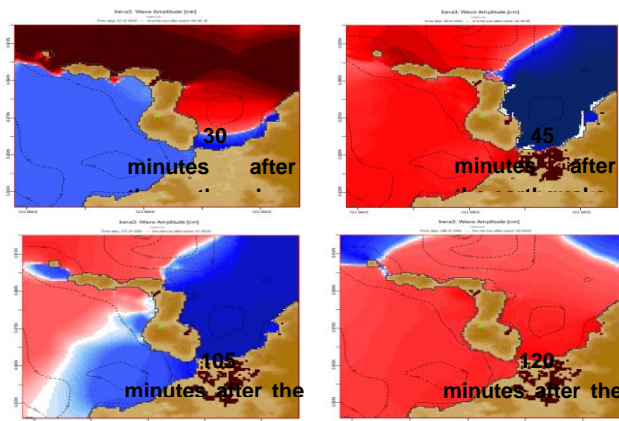


Figure 2: Animation footage of tsunami modeling 30 minutes, 45 minutes, 105 minutes and 120 minutes after the earthquake

The results of tsunami modeling in Kwandang Bay with the M 8.5 scenario can be seen in Figure 2 that the tsunami waves first arrived on the coast of Ponelo Islands District 30 minutes after the earthquake and first arrived on the coast of Kwandang District and Tomilito District 45 minutes after the earthquake. The arrival time for the tsunami in Ponelo Islands District was faster because the earthquake point was closer to the coast. Within 120 minutes the tsunami had inundated the entire Kwandang Bay area with an area of 6.22 km².

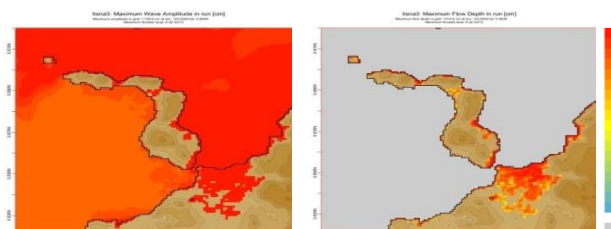


Figure 3: Maximum tsunami height and maximum tsunami submergence

Based on the modeling results in Figure 3a, it is found that the maximum tsunami height (maximum wave amplitude) is 11 m wave height above sea level.

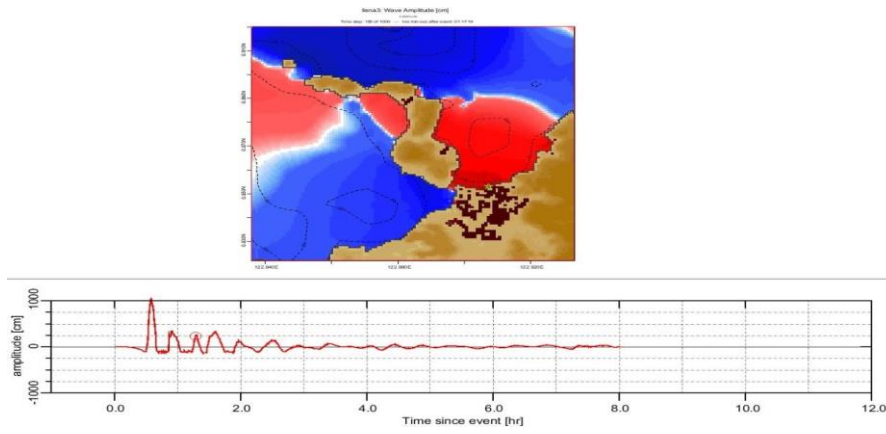


Figure 3b is the maximum tsunami immersion height (Flow depth) of 10 m from the ground surface.

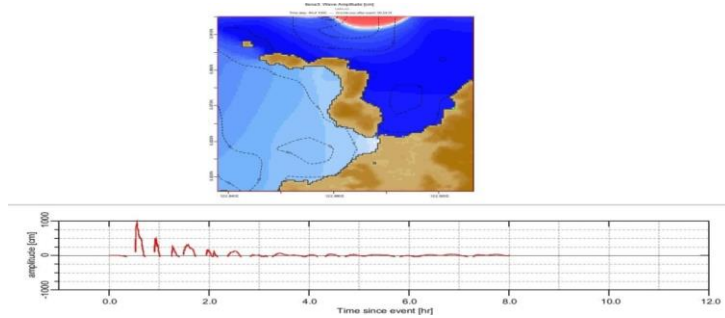


Figure 4: Tsunami height in Tomilito District

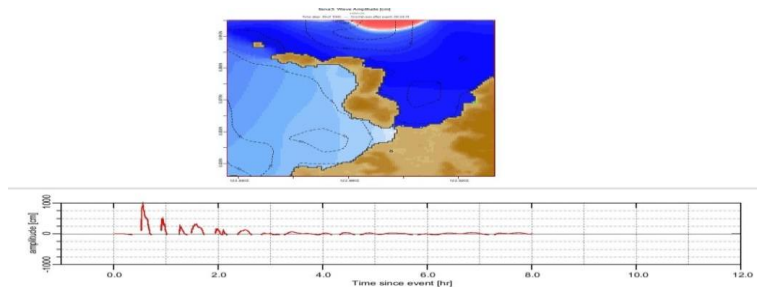


Figure 4: Tsunami height in Kwandang District

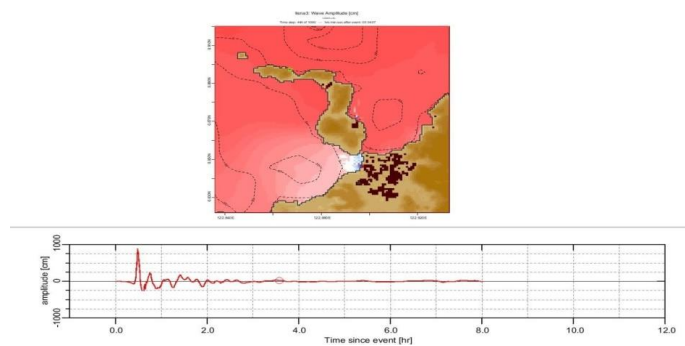


Figure 5: Tsunami height in Ponelo Islands District

From the Kwandang Bay tsunami modeling with the M 8.5 earthquake scenario, it produces graphs of different wave heights on three coastlines in the North Gorontalo region. These include Tomilito, Ponelo and Kwandang beaches. The maximum tsunami height resulting from the M 8.5 earthquake scenario for the Gulf coast was highest on the coast of Tomilito District (Figure 4) with a height of 11 m. The tsunami arrived on the Tomilito coast 45 minutes after the earthquake. Then on the coast of Kwandang District (Figure 5) the tsunami height in Tomilito was 10 m and the lowest tsunami height occurred on the Ponelo coast (Figure 6) with a height of 9 m.

CONCLUSION

Kwandang Bay tsunami modeling with the worst earthquake scenario of M 8.5 produces graphs of wave height and tsunami wave arrival time for 3 beaches in the North Gorontalo region, namely in Tomilito, Kwandang and Ponelo subdistricts with an area submerged by the tsunami of around 6.22 km². The maximum tsunami height on the coast of Tomilito District was 11 m. The tsunami arrived on the Tomilito coast 45 minutes after the earthquake. Then on the coast of Kwandang District, the tsunami height in Tomilito was 10 m and the lowest tsunami height occurred on the Ponelo coast with a height of 9 m.

BIBLIOGRAPHY

- Hall, R., & Wilson, M. E. J. (2000). Neogene sutures in eastern Indonesia. *Journal of Asian Earth Sciences*, 18(6), 781-808.
- Kurniawan, W., Bangun, E., & Prakoso, B. (2021). Estimasi Ancaman Tsunami di Zona Subduksi Sulawesi Bagian Utara Sebagai Upaya Mitigasi Bencana Tsunami. *PENDIPA Journal of Science Education*, 5(2), 204-209.
- Nomor, U. U. (24). tahun 2007 tentang Penanggulangan Bencana.
- Pasau, G., & Tanauma, A. (2011). Pemodelan sumber gempa di Wilayah Sulawesi Utara sebagai upaya mitigasi bencana gempa bumi. *Jurnal Ilmiah Sains*, 11(2), 202-209.
- Santoso, S., & Soehaimi, A. (2010). Analisis Bahaya Gempa Bumi Lengan Utara Sulawesi. *Jurnal Geologi dan Sumberdaya Mineral*, 20(6), 317-323.