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Tsunami Ready Community Facilitator Certified Internship at the Banjarnegara Geophysical Station

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Abstract
Cilacap Regency is one of the regencies that serves as a disaster supermarket/laboratory. This means that Cilacap is at risk of disasters, including earthquakes, floods, landslides, and tsunamis. The objective is to assess community preparedness, specifically in the villages of Banjarsari and Nusawungu, and to prepare for earthquakes and tsunamis involving all components of society, both the government and the community itself, to achieve zero victims. This research was conducted from August to December 2023. Observations were made at the Banjarnegara Geophysical Station on Jalan Raya Banjarmangu Km. 12, Kalilunjar Village, Banjarmangu District, Banjarnegara Regency, Central Java. The method used in model the earthquake source mechanism was the P-wave first-impulse. The input to this system was waveform data from the InaTEWS network, which was entered via the internet using the Seedlink Protocol and then processed to enable automatic picking. The results were then used as input to determine the earthquake parameters and source mechanism in just a few seconds. Lightning observations are conducted using real-time recordings of atmospheric electrical events by the Lightning/2000 software, which are recorded in the format of atmospheric electrical event reports for one day, calculated from 00:00 to 24:00 local time. This is used to archive lightning event data for further processing in lightning mapping. The Tsunami Ready Community is a program to enhance community capacity in facing tsunami threats based on 12 indicators established by UNESCO-IOC. The hope is that the community will always be prepared and not be caught off guard in facing earthquake and tsunami threats

1. INTRODUCTION

Cilacap Regency is one of the regencies that serves as a disaster supermarket/laboratory. This means that Cilacap is at risk of disasters, including earthquakes, floods, landslides, and tsunamis (Badharudin, 2018). Cilacap Regency is one of the regencies with a very high tsunami risk, as its coast lies in the subduction zone between the Indo-Australian Plate and the Eurasian Plate, which has the potential to trigger a major earthquake capable of generating a tsunami (Al Mughozali et al., 2017).

Cilacap also has the province's longest coastline, stretching 201.9 kilometers, and an active coastal area with various community activities, including beach tourism, power plants, and Pertamina facilities.

The Banjarnegara Geophysical Station was established in 1999, but officially began operating on April 1, 2000, and was included in the National Seismological Station network with the code BJI. The Banjarnegara Geophysical Station was built as a follow-up to the 1982 Minister of Transportation's decision under the name Wonosobo Geophysical Station. However, because the Wonosobo Geophysical Station was located in Banjarnegara Regency, it was renamed the Banjarnegara Geophysical Station starting in the 2003 fiscal year (Mulsandi et al., 2018).

Currently, Cilacap Regency also has vital objects that support the economic activities of the regency and even the nation, such as the Pertamina International Refinery RU IV Cilacap, which supplies 60% of the fuel needs in the Java region; Four (4) thermal power plant investments, including the Adipala Thermal Power Plant, Cilacap 1 and 2 Thermal Power Plants, and the Sumber Segara Primadaya (S2P) Thermal Power Plant; there is also PLN infrastructure and other highly influential infrastructure. It also has vital government facilities on Nusakambangan Island, which has an active prison. The objective is to assess community preparedness, particularly in the villages of Banjarsari and Nusawungu, and to prepare for earthquakes and tsunamis involving all community components, both government and community, towards zero victims.

2. RESEARCH METHODS

Time and Place

This research was conducted from August to December 2023. Observations were made at the Banjarnegara Geophysical Station on Jalan Raya Banjarmangu Km. 12, Kalilunjar Village, Banjarmangu District, Banjarnegara Regency, Central Java. The research location is shown in Figure 1.

Figure 1. Research site map

Method

The method used in model the earthquake source mechanism was the P-wave first-impulse. The input to this system was waveform data from the InaTEWS network, which was entered via the internet using the Seedlink Protocol and then processed to enable automatic picking. The results were then used as input to determine the earthquake parameters and source mechanism in just a few seconds.

Procedures

The Banjarnegara Geophysical Station has installed an earthquake monitoring system using the Indonesia Tsunami Early Warning System (InaTEWS) network, which can automatically and manually determine earthquake parameters and source mechanisms. The program is called JISView (Badharudin, 2018).

3. RESULTS AND DISCUSSION

Topography of Cilacap

Lightning observations were conducted using real-time recordings of atmospheric electrical events by Lightning/2000 software, which were recorded in the format of atmospheric electrical event reports for one (1) day from 00:00 to 24:00 local time. This was used to archive lightning event data for further processing for lightning mapping. Lightning observations at this station began in September 2008. Rainfall observations were made using OBS-type rain gauges and Hellman-type rain gauges (Badharudin, 2018). Temperature observations were made using four thermometers, namely wet bulb, dry bulb, minimum, and maximum. Then, to measure the duration of sunlight, a device called the Campbell-Stokes device was used. There is also an anemometer used to measure wind direction and speed.

The technical implementation unit of the meteorology, climatology, and geophysics agency provides earthquake and lightning information, and also conducts climatological observations such as temperature, humidity, rainfall, and the duration of sunshine. Alluvial plains and beaches dominate the southern region, stretching from west to east. This is shown in Figure 2.

Figure 2. Phytochemical screening of *L. racemosa* leaves

Cilacap Regency is one of the regencies with diverse disaster potentials. Data on disaster events in Cilacap Regency, Central Java Province, show year-to-year changes. Changes in trends can be seen in the event frequency over the data range. Data showing the overall increase/decrease in events can be seen in Figure 3.

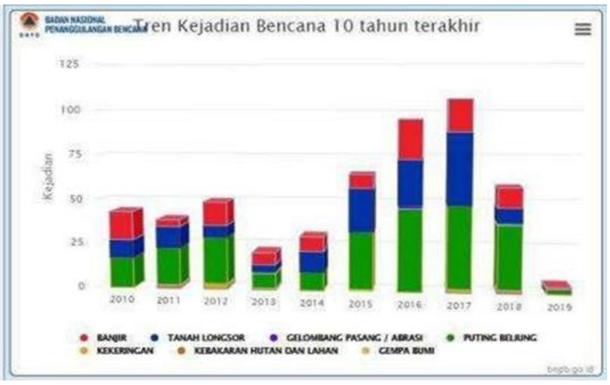

Figure 3. Trend of disaster occurrences in the last 10 years in Cilacap Regency

Tsunami Ready Community is a program to increase community capacity in facing tsunami threats based on 12 indicators set by UNESCO-IOC. The hope is that the community will always be prepared and not panic when facing the threat of earthquakes and tsunamis. In Indonesia, the Tsunami Ready Community was initiated by BMKG and has been successfully implemented in Bali, taking place in Tanjung Benoa Village, South Kuta District, Badung Regency. IOC-UNESCO conceptualizes twelve (12) Tsunami Ready Community indicators. The following explains the twelve indicators resulting from field verification in Banjarsari Village (Handika & Madlazim 2020).

Tsunami Hazard Map

The tsunami hazard map for Banjarsari Village is a BMKG product. Based on the tsunami hazard map, Banjarsari Village, Nusawungu District, Cilacap Regency, is generally classified as in tsunami-prone area with a high level of vulnerability. According to Badharudin (2018), this is because the village is directly adjacent to the megathrust zone in the Indian Ocean. In 2021 and 2022, the Banjarnegara Geophysical Station produced a map of the results of tsunami modeling analysis with a magnitude M8.7 scenario originating in the Central Java megathrust. The modeling results show the potential for tsunami heights reaching up to 6 meters on land. This is shown in Figure 4.

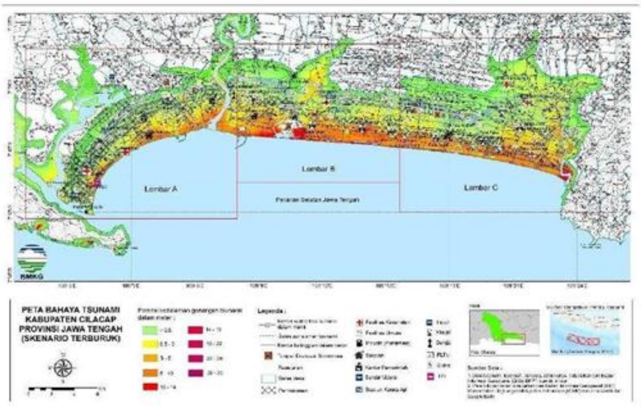

Figure 4. Tsunami hazard map

Based on the Tsunami Hazard Map, which is based on Tsunami Wave Propagation Modeling for earthquakes in this scenario, it is estimated to reach 10-14 meters, with an arrival time at the coast of 49-50 minutes. The impact of the earthquake is estimated to reach VII-VIII MMI, which means it will be a strong to very strong tremor and could cause moderate to severe damage (Susanti et al., 2024). According to this modeling, the Tsunami Hazard Map shows that up to 1 km from the coastline north of the Banjarsari Village area is a high-vulnerability area with an estimated tsunami height of 6-10 m (if an earthquake occurs under the above scenario). In this situation, there are quite dense residential areas along the coast (Handika & Madlazim, 2020). The height of the tsunami could damage small boats, push large ships ashore, damage houses, and deposit sand and debris on the beach, resulting in severe damage (Safril et al., 2020).

Then, approximately 2 km further north, the estimated tsunami height is around 0.5-3 m (if an earthquake occurs with the scenario described above) (Supriyana, 2021). This tsunami height could sweep small boats away and cause them to collide, resulting in severe damage to houses. The Tsunami Hazard Map has been disseminated to the local community.

4. CONCLUSIONS

The Lomanis Village community has met 12 (twelve) indicators of a Tsunami-Ready Community (UNESCO-IOC), although some indicators require further refinement. Several indicators of the UNESCO-IOC Tsunami Ready Community that still need refinement for Lomanis Village are: The absence of public information boards containing information on disaster mitigation education and other relevant information. There is still a lack of evacuation support facilities and infrastructure, such as platoon tents and public kitchen equipment. The means of disseminating disaster warning information still use classic instruments such as kentongan (wooden percussion instruments). There is no Early Warning System (EWS) for disseminating information such as EWS sirens. There is still a lack of educational activities and routine disaster preparedness drills for earthquakes, tsunamis, and technological failures. The suboptimal use of social media as a means of distributing entertainment and educational material.

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