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THE RELATIONSHIP OF SEA SURFACE TEMPERATURE (SST) TO RAINFALL IN THE WEST WATERS OF ACEH, INDONESIA

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ABSTRACT

Rainfall and sea surface temperature (SST) are closely linked in the global climate system. Sea surface temperature affects rainfall through water evaporation, which plays an important role in cloud formation and the hydrological cycle. As sea surface temperature increases, water evaporation also increases, increasing the chance of rainfall in certain regions, especially in the tropics. Conversely, in regions with cooler sea surface temperatures, evaporation decreases, resulting in lower rainfall. This internship aims to gain a deeper understanding of sea surface temperature and rainfall in the western waters of Aceh. This activity was carried out in August-November 2024, which took place at the Class I Sultan Iskandar Muda Meteorological Station office in Kuta Baro, Aceh Besar. The method used is descriptive analysis method, which is by collecting SST data and also rainfall. SST data is processed using GrADS until it can visualize the map. While data from rainfall is taken from BMKG data and processed using Excel. The results of the internship show that there are several factors for rainfall besides SST, in each region including latitude, altitude, wind patterns (trade winds and monsoon), land and water distribution, and mountains and high mountains. These factors greatly influence the variation and type of rainfall. Annual rainfall variations are influenced by global atmospheric behavior, tropical cyclones and others. Warm ocean temperatures in April and May increase air humidity which favors the formation of rain. However, the fluctuating rainfall shows that SST is not the only factor affecting rainfall. In June, while the SST remained high, rainfall was drastically reduced. This suggests that other factors, such as latitude, wind patterns and global atmospheric influences, play a significant role in rainfall variations.

Keywords : Sea surface temperature, Rainfall, BMKG, Aceh

INTRODUCTION

Aceh is a province located in the westernmost part of the Indonesian archipelago. Surrounded by waters and situated in the tropics, it receives some of the highest levels of solar radiation.

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Its mountainous and valley-filled terrain contributes to diverse and distinct rainfall patterns across the region (Ilhamsyah et al., 2023). These geographical and climatic characteristics make Aceh an ideal area for studying the dynamics of rainfall and its influencing factors.

While the relationship between rainfall and global sea surface temperature (SST) has been extensively studied, local SST variations—specific to smaller regions—have received less attention from researchers. This gap in research underscores the need to investigate the interplay between rainfall and localized SST in Aceh's waters, especially as such interactions may be influenced by spatial and temporal changes in SST anomaly patterns (Lestari et al., 2017). Existing studies, however, suggest that SST phenomena are closely linked to rainfall variability in specific regions (Hendon, 2003), emphasizing the importance of such investigations.

Rainfall and SST are inherently interconnected within the global climate system. SST influences rainfall through water evaporation, which plays a crucial role in cloud formation and the hydrological cycle. Warmer SST increases water evaporation, raising the likelihood of rainfall in tropical regions such as Aceh. Conversely, cooler SST reduces evaporation, resulting in lower rainfall levels (Trenberth, 2007). Therefore, understanding the relationship between SST and rainfall in West Aceh waters is very important. This study aims to explore this relationship, shedding light on how localized SST variability impacts rainfall patterns and contributes to the region's overall climate dynamics.

METHODS

Time and Location

This activity was carried out from August 19 to November 29, 2024, which took place at the Sultan Iskandar Muda Class I Meteorological Station office (5.522383° N, 95.4167527° E) with the address Sultan Iskandar Muda International Airport Complex, Cot Mancang, Kuta Baro, Aceh Besar (Figure 1). Activities are carried out on weekdays, namely every Monday - Friday, at 08.00 to 18.00 WIB. Location of Sultan Iskandar Muda Class I Meteorological Station.

Figure 1. Internship Location

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The method used in this internship uses a descriptive analysis method, which is by collecting SST data and also rainfall. SST data is processed using GrADS to visualize the map. While data from rainfall is taken from BMKG data and processed using Excel. The tools used in this research are Data Processing Application is an application for processing data into information so that it can be displayed better and as needed, Grid Analysis and Display System (GrADS) is an interactive desktop tool for easy access, manipulation, and visualization of earth science data, Computer devices in the form of Laptops, PCs or others. The data used in this study such as sea surface temperature data and rainfall data.

RESULTS AND DISCUSSION

Results

Sea Surface Temperature (SST)

The results of sea surface temperature (SST) distribution in April, May, and June 2024 are shown in Figures 2, 3, 4.

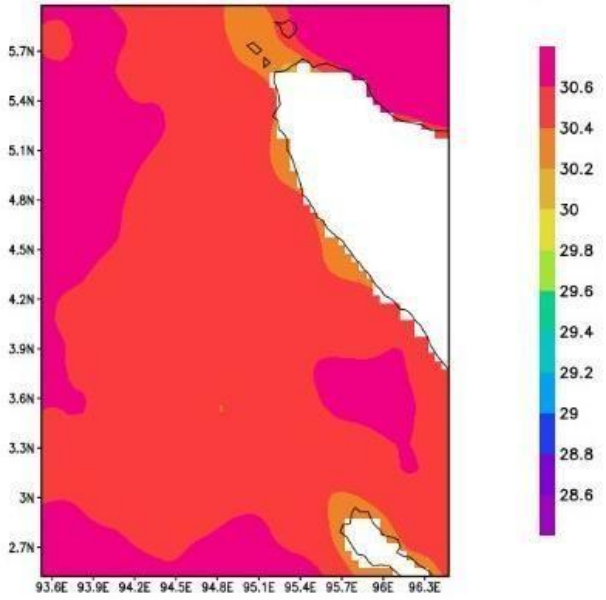

Figure 2. Sea Surface Temperature (°C) in April 2024

In April 2024, the sea surface temperature in the western waters of Aceh tends to be warm, with a temperature range between 30.2°C and 30.6°C. The red color that dominates the region indicates that the average temperature in these waters is around 30.4°C (Figure 2).

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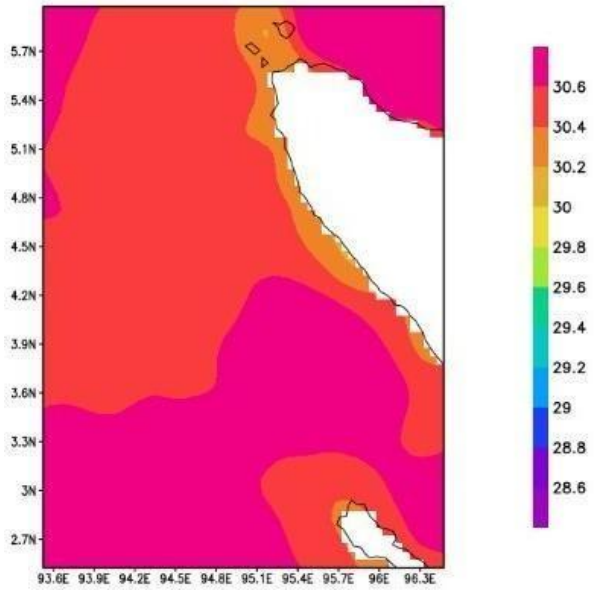

Figure 3. Sea Surface Temperature (°C) in May 2024

In May, sea surface temperatures (SST) still tended to be warm, marked by the red and ping colors that began to dominate the region. The red color indicates a temperature of around 30.4°C, while the ping color represents a slightly higher temperature of 30.6°C. There is also a small area with an ambient temperature of 30.2°C shown in orange, which is closer to land. This map shows that the sea air temperature is quite high in most areas, especially in the areas marked in red and purple (Figure 3).

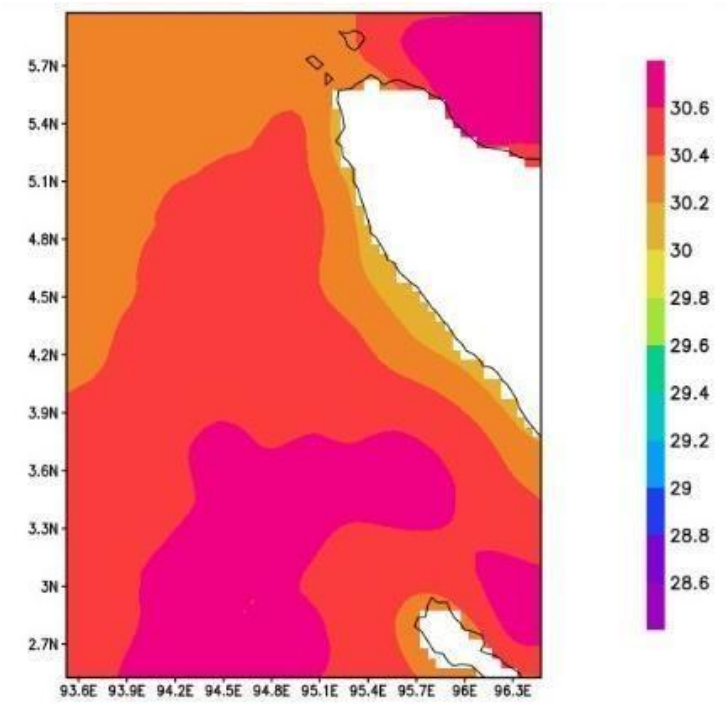

Figure 4. Sea Surface Temperature (SST) in June 2024

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In June, the sea surface temperature (SST) remained similar to previous months, although it decreased slightly. Temperatures ranged from 30°C to 30.6°C. On the map, it can be seen that the yellow-colored area, indicating a temperature of 30°C, expanded slightly compared to the previous month. Despite this, temperatures in most areas remained quite warm, although there was a slight decrease compared to May (Figure 4).

Rainfall

The results of rainfall distribution in April, May, and June 2024 are shown in Figures 5, 6, and 7.

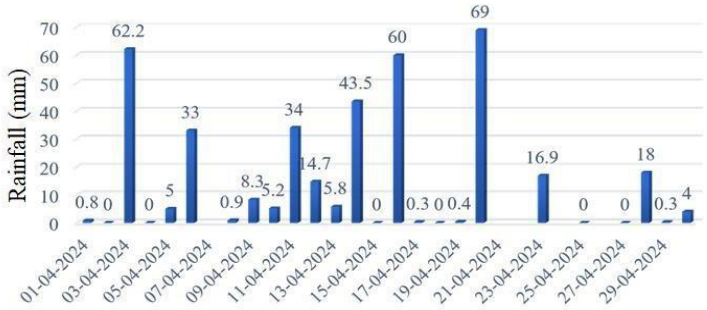

Figure 5. Rainfall (mm) in April 2024

In April 2024, rainfall with varying intensity (Figure 5). At the beginning of the month, the first rainfall occurs on April 1 with 0.8 mm. The next day on April 3, the rainfall increased dramatically to 62.2 mm, and became lighter on April 5 with only 5 mm. It rained again on April 6 with 33 mm of rainfall. However, rain fell again on April 9 with an intensity of 0.9 mm. After that, light rain on April 10 with an intensity of 8.3 mm, light rain again on April 11 with only 5.2 mm, but increased again on April 12 to 34 mm and on April 13 again light rain with an intensity of 4.7 mm.

In the middle of the month, light rain was recorded on April 14 with 5.8 mm of rainfall and the rain increased to 43.5 mm on April 15. The rain then increased again on April 17 to 60 mm, while on April 18 the rain decreased with an intensity of 0.3 mm, slightly increasing to 0.4 mm on April 20. Towards the end of the month, heavy rain fell on April 21 with 69 mm of rainfall, making it the first heavy rainfall of April.

On April 26, the rainfall decreased again to 16.9 mm. However, rainfall increased again on April 28 with an intensity of 18 mm, decreased again on April 29 with an intensity of 0.3 mm, before increasing again to light rain at the end of the month on April 30 to 4 mm. Overall, rainfall in April 2024 fluctuates, with heavy rainfall occurring at the beginning of the month, especially on April 3, and lighter intensity in the middle to end of the month.

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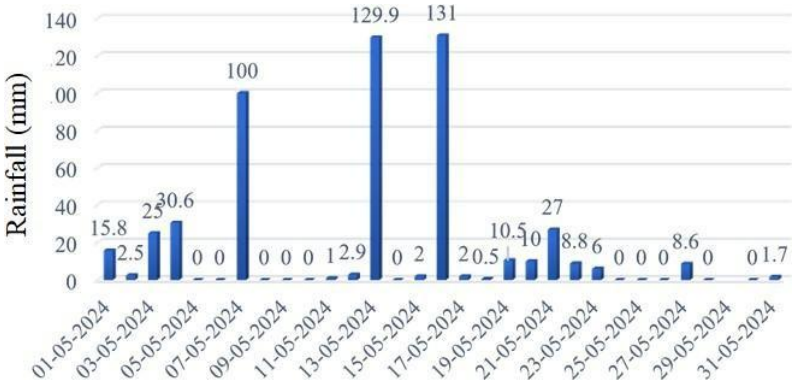

Figure 6. Rainfall (mm) in May 2024

In May 2024, it rained several times with varying intensities (Figure 6). The first rainfall occurred on May 1 with 15.8 mm of rainfall. Then it rained again on May 3 but was lighter at only 2.5 mm. The next day, May 4, the rain increased to 25 mm and continued to increase until May 4 with 30.6 mm of rainfall.

Heavy rains began on May 8 with rainfall reaching 100 mm, and dropped dramatically on May 11 with an intensity of 1 mm. Although it increased slightly on May 12 to 2.9 mm, the next day on May 13 it rained heavily with 129.9 mm of rainfall. Rainfall decreased on May 15 to 2 mm, on May 16 very heavy rain occurred with an intensity of 131 mm. Rainfall decreased further in the middle of the month.

On May 17 only 2 mm was recorded, and 0.5 mm on May 18. However, rain increased again on May 19 with 10.5 mm of rainfall, after which moderate rain fell on May 20 with 10 mm, heavy rain again occurred on May 21 with an intensity of 27 mm, after which moderate rain with an intensity of 8.8 mm on May 22, the next day decreased to 6 mm on May 23, and slightly increased to 8.6 on May 27, rain occurred again until the end of the month on May 31 to1.7 mm.

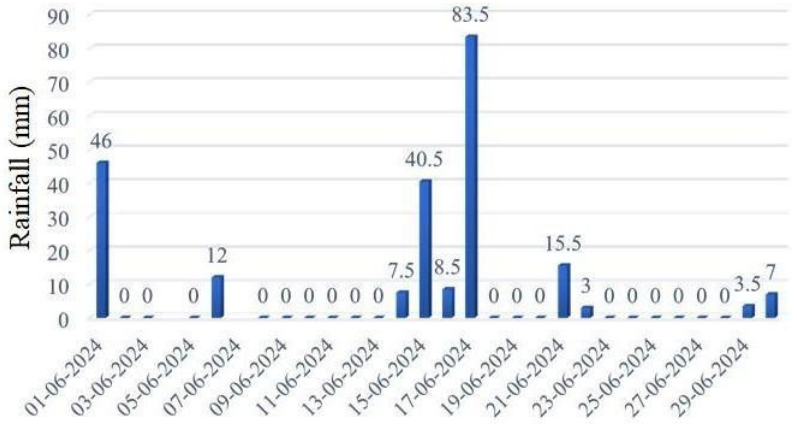

Figure 7. Rainfall (mm) in June 2024

In June 2024, it started raining early in the month (Figure 6). The first heavy rainfall occurs on June 1 with 46 mm of rainfall. Then, it rains again on June 6 with 12 mm of rainfall. On

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June 14, the rain intensity decreased to 7.5 mm. Heavy rain occurred again on June 15 with 40.5 mm and decreased on June 16 with an intensity of 8.5 mm.

In the middle of the month heavy rain fell on June 18 with an intensity of 83.5 mm, decreasing again to 15.5 mm on June 21, on June 22 light rain fell with an intensity of 3 mm, slightly increased to 3.5 mm on June 29 and at the end of the month moderate rain fell with an intensity of 7 mm. Overall, June was mostly dry, with only a few showers in the beginning and middle of the month.

Discussion

Based on the results of the analysis conducted in April, the average sea surface temperature ranged from 30.2°C to 30.6°C with the red color dominating the map, indicating a temperature of around 30.4°C. Rainfall this month fluctuated, with heavy rainfall occurring early in the month (47.5 mm on April 2), then decreasing to lighter in the middle to end of the month. In general, rainfall tended to decrease even though sea surface temperatures remained warm.

In May, sea temperatures remained warm, with some areas showing temperatures up to 30.4°C and 30.6°C (marked in red and ping). Rainfall during this month also fluctuated. Heavy rains occurred on several dates in the beginning and middle of the month, with the highest intensity of 31 mm on May 11, before declining again in the middle to end of the month.

In June, sea surface temperatures decreased slightly (around 30°C to 30.6°C), and the yellow and orange colors on the map show that areas with temperatures around 30°C to 30.2°C began to expand. The month was mostly dry, with rain only recorded late in the month, on June 21, 24, 27, and 30, with the highest rainfall of 7.3 mm on June 30.

CONCLUSION

Warm ocean temperatures in April and May increase air humidity which favors the formation of rain. However, the fluctuating rainfall shows that SST is not the only factor affecting rainfall. In June, while the SST remained high, rainfall was drastically reduced. This suggests that other factors, such as latitude, wind patterns and global atmospheric influences, play a significant role in rainfall variations.

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