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Abstract

This study aims to observe the seasonal variation of wave height in the waters of Seram Island. The software used in this research are Arcgis and SeaDAS. Numerical and spatial processing tools used in this study using SeaDAS software. The monthly average is then taken using GIS software as a geographic information system processing that will offer an overview of the state of the study area, present research results, and interpolate between parameters.

Keywords

ArcGIS; waves and wind; spooky sea; seaDAS

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I. Introduction

Indonesia is a maritime country which is one of the important means of transportation to get to or connect from one island to another using the sea route. Maluku Province is an area that has four seasons, including the west monsoon, east monsoon, transitional season 1 and transitional season 2, where each region has different seasons. Matrutty (2020) argues that changing seasons result in areas where fishing can change both temporally and spatially. This makes fishermen who go fishing so that they can adjust to the seasons that will occur every month. Organization must have a goal to be achieved by the organizational members (Niati et al., 2021). The success of leadership is partly determined by the ability of leaders to develop their organizational culture. (Arif, 2019).

Activities carried out at sea are very dependent on the maritime climate, namely on the wind and ocean waves. According to Habibie et al. (2018), knowledge of the safety factors and efficiency levels of all human operations at sea, such as transportation, tourism, and even offshore structure construction projects, are strongly influenced by weather and ocean climate. Windwaves-05 is a model that is used to capture wave heights. From this study that waves in Indonesia are influenced by wind speed and waves are closely related to wind speed.

Wind is air that has the ability to move and travel to various locations (Nugraha, 2021). In addition to wind, the movement of the earth's plates, ships, tides, and ocean currents all contribute to wave height. Every year, significant waves occur in the west monsoon in January and east in August. Significant waves in the Karimata Strait can reach 1.5 to 3 meters, and 0.5 to 2.5 meters in the Java Sea at the height of the west monsoon.

According to Rahman (2019), oceanographic metrics are an indication of the productivity of a water. Remote sensing technology is used to calculate one of the oceanographic characteristics, especially chlorophyll and sea surface temperature, to estimate fishing grounds. One of the remote sensing methods used to determine the fertility scale of a waters is aqua satellite photography. The Moderate Resolution Imaging

Spectroradiometer (MODIS) sensor, which monitors sea surface temperature and chlorophyll-a concentrations, is affected by satellite photography.

The implementation of fishing business by fishing vessels in Indonesia, the majority of which still use traditional methods, is closely related to the sustainable use of fishery resources in the Seram Sea. As a result, most of the fishing operation time will be dedicated to finding potential fishing grounds. Traditional fishing methods are not effective and efficient, and can add to high operational costs in addition to taking a long time. The problem of fishermen guessing fishing areas with potential catches causes uncertainty in the catch.

The abundance of plankton as a food source and dynamic oceanographic water conditions can affect the presence of fish. Fish distribution studies should be carried out to assess the potential of fishing grounds so that fishermen can utilize fish distribution information rather than experience or guesswork to obtain the best and most efficient catch during fishing operations. As a result, all information related to fishing grounds will be very useful for fishermen to help them improve the effectiveness of their fishing operations. To increase the contribution of the fisheries business sector, it is important to provide information in the form of accurate fishing area profiles and marine dynamics.

From the background, the aim of this research is to analyze the variability of wave height based on seasons in the waters of Seram Island.

II. Research Method

In this study, SeaDAS software, a numerical and spatial processing application, was used. The monthly average is then extracted using GIS software as a geospatial information processing system that will provide an overview of the health of the search area and display search results and interpolate between settings.

III. Result and Discussion

According to the research findings, there are four seasons: western, transitional season 1, winter, and transitional season 2. Season 1 lasts from March to May, while Season 2 lasts from December to January and February. Transition season 2 is September, October, and November, while transition season 1 is June, July, and August.

The relationship between fish, fishing grounds and oceanographic parameters is complex. Environmental parameters that affect fish include chemical factors, physical factors and biological factors. Parameters that are easily observed are physical parameters such as sea surface temperature, waves, chlorophyll. Fish have a way of life that is inseparable from environmental conditions, ranging from fish distribution, fish habits, fish metabolism and fish migration, this is also influenced by local oceanography, such as temperature, salinity, surface currents, dissolved oxygen and many other oceanography. The average wave and wind data can be seen in the following table:

Bulan	max_hs	ave_hs	max_angin	ave_hs
DEC	1.3	0.4	12.4	5.2
JAN	1.5	0.6	16.6	8.6
FEB	1.7	0.7	12.1	7.4
MAR	1.6	0.5	12.2	6.8
APR	1.4	0.5	10.3	5.4
MAY	1.2	0.4	9.8	4.6
JUN	1.8	0.5	17.0	6.7
JUL	1.8	0.6	16.8	7.9
AUG	1.5	0.5	15.3	7.7
SEP	1.2	0.4	15.0	6.9
OCT	0.9	0.3	9.1	4.7
NOV	1.3	0.3	13.0	6.0

Table 1. Variation of Waves and Winds in the Seram Sea

The wind speed in June to July ranges from 16 to 17 knots and the lowest wind speed occurs from April to May around 4 to 6 knots while the highest waves occur from June to July around 1 to 2 m/s and the lowest waves occur in the month of June. April to May is around 0.3 m/s from the data above, many factors affect wave changes, including wind speed in the ocean. According to Jalil in Wardhani (2021) from April to May there is a transitional season where the wind speed decreases so that it greatly affects the waves, while from June to July the wind speed tends to increase so that the wave turbulence is very fast.

3.1 Musim Barat

In Indonesia, the west monsoon occurs in December, January and February, with no strong waves in December, the waves are evenly distributed with a value of 0 to 0.5m, the maximum waves in January are 0.5m to 1.25m. Existing visualization. While in February the biggest waves were 0.5m to 1.25m, the highest waves occurred in the north of Obi and east of Sulawesi. In December, January and February, Indonesia experienced heavy rainfall, resulting in strong but still within tolerable waves.

The appearance of waves is strongly influenced by the direction and speed of the wind. The wind in the Banda Sea has a uniform direction towards the Seram Sea and the Maluku Sea. The bigger the wave, the more consistent the wind direction in the region. This happens because the same wind direction induces the production of building waves that reinforce each other, so that wind energy can be collected (Wardhani, 2021).



Figure 1. Map of West Monsoon Wave Height Variability in the Seram Sea



Figure 2. Map of West Monsoon Wind Direction and Speed Variability in the Seram Sea

During the westerly monsoon in Indonesia, the wind speed over the Seram Sea ranges from 2,712 m/s with a northwest to southeast wind direction in December. In January, the wind speed varies from 1.4 to 11 m/s, with the dominant wind direction maintaining northwest to southeast. Meanwhile, the wind speed down in February ranged from 1.76 m/s to 1.76 m/s, with the dominant wind direction being northwest to southeast.

3.2 Transition Season 1

Transition Season 1 takes place in March, April, and May. After the Asian monsoon, this month will enter the transition season which is characterized by low wind speeds and irregular directions (Habibi et al., 2018). Significant wave heights in March are in the range of 0.5 to 1.25 m. In April, the highest waves only occur in the waters of Seram, north of the island of Sulawesi, with an average value of 0.5 to 1.25 m. while in May the waves occurred on the island of Buru in the southwest with values ranging from 0.5 to 1.25 m.



Figure 3. Map of Transitional Wave Height Variability 1 in the Seram Sea



Figure 4. Variability Map of Transition Season 1 Wind Direction and Speed in the Seram Sea

In March, April, and May, the wind direction and speed are the same as in the transition season 1. The wind speed ranges from 1.9 to 9.0 m/s in March, with the dominant wind direction from northwest to southeast, southwest to the north, and southeast to the east. In April the wind speed ranges from 0-9 m/s, while in May the wind speed drops to 0-4 m/s.

3.3 East Season

Significant wave heights occur in the Banda Sea during the East Season throughout June, July, and August, with the largest wave values of 0.5 m to 1.25 m. While the wave height in the Seram Sea ranges from 0 to 0.5 meters. Compared to the sea in the Seram Sea and the Maluku Sea, the wind direction in the Banda Sea is quite consistent. The bigger the wave, the more consistent the wind direction in an area. This happens because the direction of one stroke results in the production of constructive waves that reinforce each other, allowing wind energy to accumulate (Kurniawan, 2011).



Figure 5. Map of East Monsoon Wave Height Variability in the Seram Sea



Figure 6. Variability Map of East Monsoon Wind Direction and Speed in the Seram Sea

In June, July, and August, Indonesia is affected by the east monsoon. The Australian Monsoon blows from the southeast across the Molucca Sea to the northwest in July, when the East Season begins in the Indonesian Territory. Seram Sea breeze blows from the northwest at a speed of 1.5 to 13 m/s in June. In July, the wind generally blows from southeast to northwest across the Seram Sea, with wind speeds ranging from 1 to 13 m/s. In August there was a decrease in wind speed, with wind speeds ranging from 0.5 to 13 m/s.

In most parts of Indonesia, the coefficient of variation tends to decrease in June, July, and August, both in the high seas and in the deep seas. This indicates that the sea conditions are somewhat consistent compared to the previous season. The steady development of the waves is caused by the wind that constantly crosses the Indonesian mainland.

(Habibie dkk, 2018).

3.4 Transition Season 2

September, October and November are transition season 2 in Indonesia. In October the wave heights that occur in the Seram Sea range from 0.5-1.25 m which occur in the Banda Sea which is close to Seram Island and Buru Island. While in October there was a wave with a value of 0.5-1.25 in the southwest of Buru Island and in November there was no significant wave.



Figure 7. Map of Transitional Wave Height Variability 2 in the Seram Sea



Figure 8. Map of Variability of Wind Direction and Speed of Transition 2 in the Seram Sea

Transition 2 takes place throughout September, October, and November. In September, the wind speed varies from 0-12.9 m/s, with the main wind direction from southeast to northwest; in October, the wind speed drops to 0.4-8 m/s, with the dominant wind direction from south to north, west to north. In November, the wind speed ranges from 0.9 to 10 m/s, with the dominant direction from west to north. The dominant wind blows from the southeast when the Transition II season begins. The East Season has ended. Changes in wind direction and speed have little effect on surface currents during the transition season (Rifai et al, 2020).



Figure 9. Seasonal Fluctuation of Wave Height



Figure 10. Fluctuation of Average Wave Height

Seasonal vibrations in wave height, as seen in the graphic representation, vary. The waves are often larger in the west and east monsoons than during the transitional seasons. Similarly, when waves are seen in the Transitional Season, although the wind variance at the time of measurement tends to increase in the afternoon, the resulting wave height tends to follow the same pattern as the waves recorded in the East Season. Thus, it can be concluded that the wave heights observed in February and the other two seasons swelled completely (Labania et al., 2018).



Figure 11. Seasonal Fluctuation of Wind Speed



Figure 12. Average Fluctuation of Wind Speed

In the visual diagram, it can be seen during the west and east seasons, the wind speed is high, while during the transition season, the wind speed is low. According to Tjasyono in Wardhani (2021), this happens because during the west monsoon there is high pressure on the Asian continent and low pressure on the Australian continent so that the wind moves at high speed and in a steady direction from the Asian continent so that the wind moves at high speed.

The stability index in each region is closely related to marine activity. Wind and wave variability index can be used as a reference for maritime activities. The monsoon cycle affects the general condition of wave climatology in Indonesia. Monsoon is a wind that blows back and forth following the position of the sun, especially in the Indian Ocean and waters in South Asia (Wang et al., 2017).

IV. Conclusion

Extreme waves occur due to the influence of the east monsoon from June to July which brings very high wind speeds. Meanwhile, due to the transition season, the wave speed is quite low in April and May.

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