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Analysis of Sea Surface Temperature Distribution and Its Relation to Rainfall in Pariaman City

Analisis Sebaran Suhu Permukaan Laut dan Kaitannya dengan Curah Hujan di Kota Pariaman

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Abstract

This research was conducted in February 2024. The research locations of Pariaman City waters include Angso Duo Island, Tangah Island, Ujung Island, and Kasiak Island. The research objectives were to determine the distribution of sea surface temperature, average rainfall, and the relationship between sea surface temperature and rainfall. The survey method, direct observation at the research location, was used. The results of this study indicate that the sea surface temperature in the study area in the western season (December - February) ranges from 30.70- 30.43^{0}C. The sea surface temperature in the first transitional season (March-May) ranges from 30.06-31.09^{0}C. The sea surface temperature in the east season (June - August) ranges from 30.46- 30.90C. The sea surface temperature in the second transitional season (September - November) ranges from 30.08-30.12^{0}C. The maximum rainfall in Pariaman City is in the form of rainfall. The maximum rainfall in Pariaman City occurs in November, with an average rainfall of 444 mm, while the minimum rainfall occurs in February, with an average rainfall of 235 mm. The results of the correlation analysis of sea surface temperature with rainfall are weak and strong correlation categories. In March, it produces an "r" value of 0.303, a weak category, and a coefficient of determination (R^2) of 0.092 or 9.2%. In October, it produces an "r" value of o.686, a strong category, and a coefficient of determination (R^2) of 0.470 or 47%.

Keywords: Sea Surface Temperature, Rainfall, Correlation.

Abstrak

Penelitian ini dilaksanakan pada bulan Februari 2024. Lokasi penelitian perairan Kota Pariaman diantaranya adalah Pulau Angso Duo, Pulau Tangah, Pulau Ujung dan diantara Pulau Kasiak. Tujuan penelitian adalah untuk mengetahui sebaran suhu permukaan laut, curah hujan rata-rata, dan hubungan antara suhu permukaan laut dengan curah hujan. Metode yang digunakan adalah metode survey yaitu pengamatan langsung di lokasi penelitian. Hasil dari penelitian ini menunjukkan bahwa suhu permukaan laut di daerah penelitian pada musim barat (Desember - Februari) berkisar antara 30,7-30,43^{0}C. Suhu permukaan laut pada musim peralihan I (Maret - Mei) berkisar antara 30,06-31,09^{0}C. Suhu permukaan laut pada musim timur (Juni – Agusutus) berkisar antara 30,46–30,9^{0}C. Suhu permukaan laut pada musim peralihan II (September – November) berkisar antara 30,08– 30,12^{0}C. Curah hujan maksimum di Kota Pariaman terjadi pada bulan November dengan rata-rata curah hujan 444 mm sedangkan curah hujan minimum terjadi pada bulan Februari dengan rata-rata curah hujan 235 mm. Hasil analisis korelasi suhu permukaan laut dengan curah hujan terdapat kategori korelasi lemah dan kuat.

Pada bulan maret, menghasilkan nilai "r" sebesar 0,303, kategori lemah dan koefisien determinasi (R^2) sebesar 0,092 atau 9,2%. pada bulan oktober menghasilkan nilai "r" sebesar o,686, kategori kuat dan koefisien determinasi (R^2) sebesar 0,470 atau 47%.

Kata kunci: Suhu Permukaan Laut, Curah Hujan Korelasi

1. Introduction

Tilapia Indonesia is an archipelago and is located between the Pacific Ocean and the Indian Ocean. Changes strongly influence rainfall in Indonesia and surrounding sea surface temperatures. Sea surface temperature (SST) in the tropics and subtropics influences the atmosphere, weather, and seasons, as well as the ENSO (El Nino Southern Oscillation) and IOD (Indian Ocean Dipole) phenomena (Tampubolon et al., 2016). The interaction between the ocean and the atmosphere is because Indonesia has a large ocean area compared to land areas, so climatic conditions in the Indonesian region, especially rainfall, are strongly influenced by the interaction of the ocean and the atmosphere.

Sea surface temperature (SST) is essential to controlling Indonesia's weather and climate. Along with the issue of climate change, which is characterized by an increase in global temperature, SST is also allegedly changing. One of the consequences of SPL changes in the tropics is the change in rainfall patterns in a place. Weather and climate are two conditions that are similar but have different meanings, especially over time. Weather is the initial form associated with interpreting and understanding the physical condition of the air at a location and at a time. The climate is an advanced condition that is a collection of weather conditions, which are then compiled and calculated in the form of average weather conditions and a specific time (Priyahita, 2016).

Climate change is statistically defined as a change in the upward or downward trend of climatic elements accompanied by daily, seasonal, or cyclical variations that remain valid for an extended period. Climate change is measured based on changes in the main components of climate, namely temperature or temperature, season (rain and dry), humidity, and wind. Of these variables, the most widely proposed variables are temperature and rainfall (Susilokarti, 2015).

Research on sea surface temperature has been conducted by Azmiada et al. (2024). However, the research is focused on a global and regional scale, while it is still relatively lacking in smaller areas such as cities or districts. Based on this, researchers are interested in conducting this research. Sea surface temperature is an essential factor for the life of marine organisms because temperature can affect the metabolism and reproduction of marine organisms. Sea surface temperature is critical to know because the distribution of sea surface temperature can provide information about upwelling, currents, weather, climate, and fish catch areas (Yuniarti, 2013). Ocean temperature also varies with depth. Surface water masses in tropical regions tend to be hot throughout the year, ranging from 20 to 300 degrees Celsius, while surface water masses in temperate zones are warm in summer (Satrioajie, 2012).

The purpose of this study was to determine the seasonal distribution of sea surface temperature, rainfall intensity, and the relationship between sea surface temperature and rainfall in the waters of Pariaman City seasonally.

2. Materials and Methods

2.1. Time and Place

This research was conducted in February 2024. in Pariaman Waters, West Sumatra. The research location of point I is considered to represent the waters of South Pariaman, points II, III, and IV (on Angso Duo Island, Tangah Island, and Ujung Island) are considered to represent the waters of Central Pariaman and points V and VI on Kasiak Island are considered to represent the waters of North Pariaman.

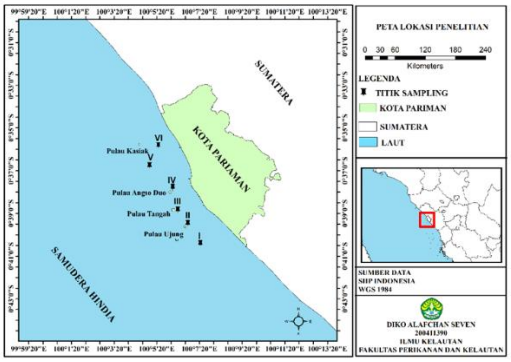


Figure 1. Location map

2.2. Methods

Determination of observation locations and sea surface temperature data collection using purposive sampling method, namely sampling that is carefully selected so that it is relevant to the research structure with the consideration that the location taken is considered to represent the research study area. Sea surface temperature data were taken in Pariaman waters, namely Angso Duo Island, Tangah Island, Ujung Island, and Kasiak Island.

2.3. Procedures

Data collection consists of primary data and secondary data. Primary data is obtained from measuring sea surface temperature in the field using a Thermometer. Secondary data were obtained by downloading Aqua Modis monthly SPL data from the website http://oceancolor.gsfc.nasa.gov and rainfall data from the Meteorology, Climatology and Geophysics Agency (BMKG).

After data validation, sea surface temperature data was correlated with rainfall data on a seasonal basis. Then, regression analysis was performed using SPSS 21.0 software. The formula for using Pearson correlation for normal distribution data (Pratisto, 2009):

$$rxy = \frac{n\sum XY - \sum X\sum Y}{\sqrt{[n\sum X^2 - (\sum X)^2][n\sum Y^2 - (\sum Y)^2]}}$$

Whereas for non-normal distribution data using Spearman correlation (Pratisto, 2009): $r_s = \frac{1-6\sum d^2}{n(n^2-1)}$

The relationship between sea surface temperature and rainfall was analyzed using a linear regression model based on latitude (x) and longitude (y). Coordinate transformation and spatial resolution of sea surface wind data were performed. The regression formula used to analyze the relationship between rainfall and sea surface temperature is :

$$Y = a + bX$$

Information:

Y = Sea Surface Temperature

X = Rainfall

a = Constant

b = Regression coefficient

Through the linear regression test, the coefficient of determination (R2), correlation coefficient (r), and standard error (SE) are used to determine the accuracy of the reanalysis data used. The closeness of the relationship between the dependent variable and the variables is determined based on the value of r. To see the interpretation of the correlation between two variables, the following are the criteria for the calculation results, quoting Sugiyono (2007), namely: 0,00– 0,199: very low; 0,20 – 0,399: low; 0,40 – 0,599: medium; 0,60 – 0,799: strong; and 0,80 – 1,000: very strong.

3. Result and Discussion

3.1. General Conditions of the Research Location

Pariaman City is geographically located between 00º 33' 00" - 00º 40' 43" LS and 100º 10' 33" - 100º 10' 55" East. Pariaman City has four sub-districts: South Pariaman, Central Pariaman, East Pariaman and North Pariaman. This region directly faces the Indian Ocean and has quite varied natural potential in coastal areas, including tourism, fisheries, and forestry (Mazidah et al., 2016).

Pariaman City is one of the islands in West Sumatra, with sea and coastal areas and four small islands, namely Angso Duo Island, Kasiak Island, Tangah Island, and Ujung Island. The total land area is 73.54 km^2, the ocean area is 282.69 km2, and the coastline is 12.7 km^2. The area is an ecosystem rich in biodiversity, including coral reefs, mangroves, seagrass beds, estuaries, and lagoons. The coastal areas and small islands of Pariaman City are also landing sites and nesting habitats for several species of sea turtles (Aryanti et al., 2015). The area of the cluster of islands economically has rich potential for relatively large land, marine resources and tourism. If successfully developed optimally and sustainably, these small islands will not only be a source of new economic growth but will also reduce the development gap between fishing and non-fishing communities in Pariaman City.

3.2. Validation Test

Data validation tests are conducted to determine the level of accuracy between field sea surface temperature values and Aqua modis sea surface temperature data. The following is a regression test of the field sea surface temperature with the surface temperature of the aqua Modis image. From these results, it can be concluded that the SPL values from field data and aqua modis imagery can be used in this study because the accuracy of the processed data is high enough to represent the actual SPL value of the water area under study.

3.3. Sea Surface Temperature

The results of processing the surface temperature distribution of MODIS satellite images are visualized using ArcGIS software. The results displayed are in (Figure 3).

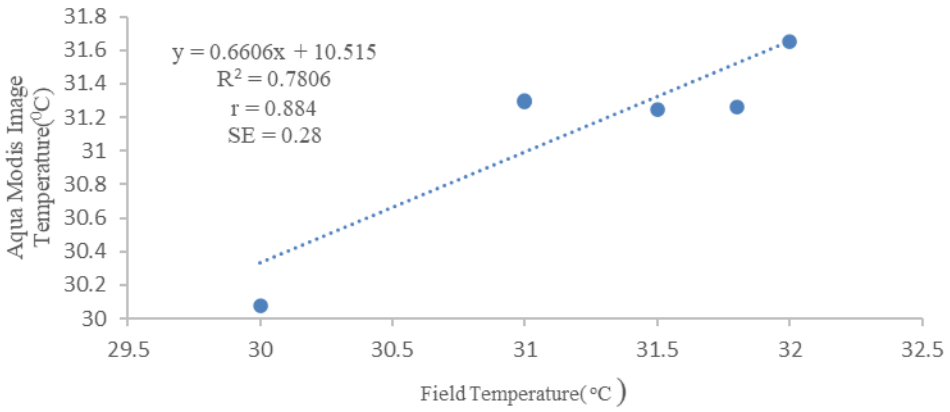


Figure 2. Regression test of field SPL with aqua modis imagery

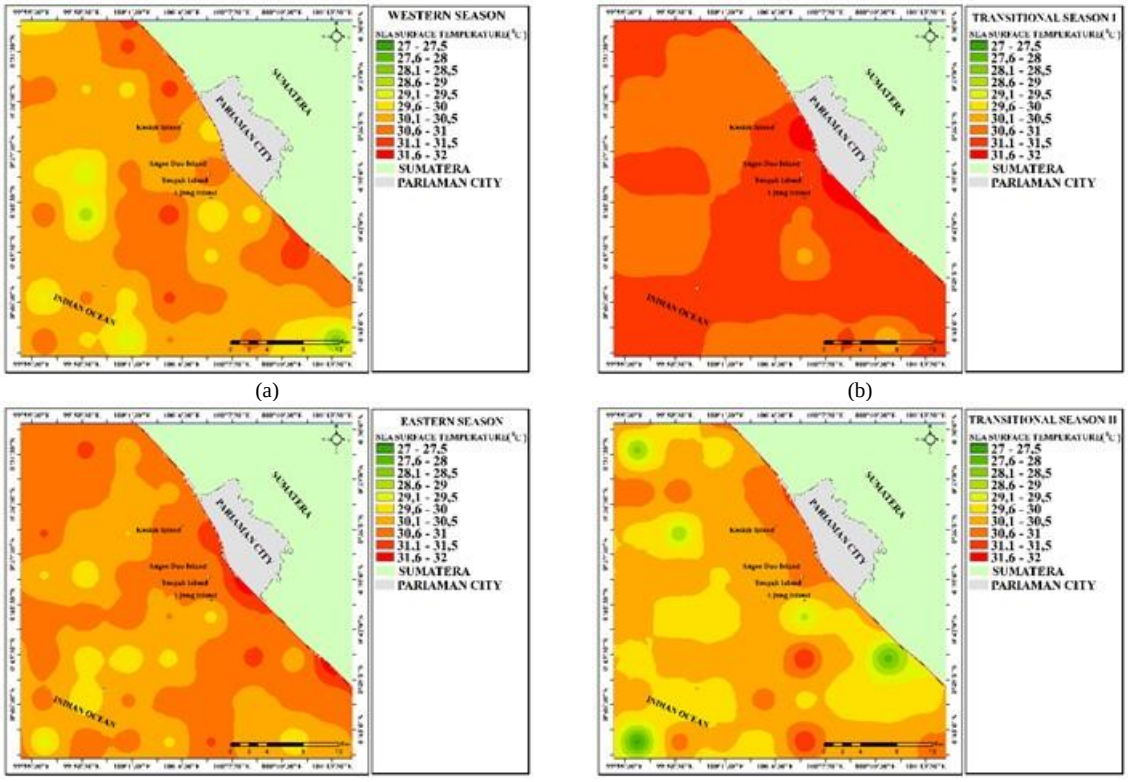


Figure 3. Sea surface temperature: (a) Western Season (b) Transitional Season I (c) Eastern Season (d) Transitional Season II

Pariaman city in December has an average rainfall of 376 mm, in January has an average rainfall of 306 mm, and in February has an average rainfall of 235 mm (Figure 4a). In March, it has an average rainfall of 356 mm; in April, it has an average rainfall of 290 mm. In May, the average rainfall was 263 mm (Figure 4b). June had an average rainfall of 239 mm, July had an average rainfall of 247 mm, and August had an average rainfall of 291 mm (Figure 4c). September had an average rainfall of 340 mm, October had an average rainfall of 355 mm, and November had an average rainfall of 444 mm (Figure 4d).

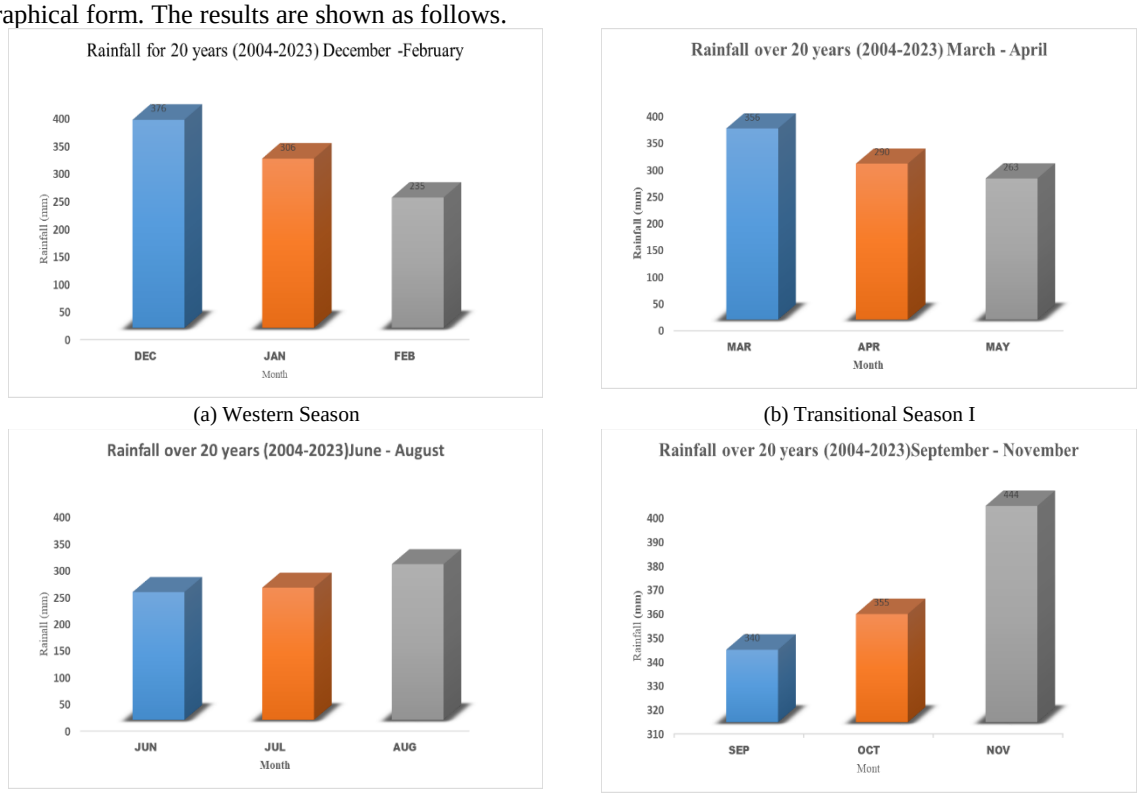
Rain comes from clouds, clouds from vapour condensing in the air, and water vapour from water. Water is most abundant in the sea. The role of the sea as a producer of water vapour is vital and plays a significant role in the process of rain formation (Syaifullah, 2010). Rainfall in Indonesia is influenced by monsoons, which are caused by high-pressure and low-pressure cells that crisscross the continents of Asia and Australia. This is due to Indonesia's location between the two continents, Asia and Australia and two oceans, India and the Pacific (Hermawan & Komalaningsih, 2010). Some factors that cause the high intensity of rainfall in this area are the wind direction, which has a higher average speed, which causes easy movement of clouds for rainfall, and sea surface temperatures, which are also dominantly higher. High rainfall significantly impacts activities at sea such as tourism, crossing, and fishing.

The climatological distribution pattern of SPL in West Sumatra waters near the coast has a higher temperature than the value of sea surface temperature in waters near the Indian Ocean. The high value of SPL in West Sumatra

waters close to the coastal area is thought to be caused by the high influence of land so that the temperature value tends to increase, while in Indian Ocean waters, the SPL value tends to be lower due to the lack of land influence on these waters (Wahyuningrum et al., 2011).

3.4. Rainfall

The results of rainfall records obtained from the Padang Pariaman climatology station are tabulated in graphical form. The results are shown as follows.



(a) Western Season (b) Transitional Season I

(c). Eastern Season (d) Transitional Season II

Figure 4. Rainfall : (a) Western season (b) Transitional season I (c) Eastern season (d) Transitional season II

3.5. Correlation of Sea Surface Temperature with Seasonal Rainfall

Linear regression is a statistical method used to establish a pattern or relationship between one or more independent variables X and response variable Y (Sugiyono, 2007). The correlation between sea surface temperature and western monsoon rainfall can be seen in Table 1.

Table 1. Correlation of sea surface temperature with west monsoon rainfall

Month	R	R square
December	0.620	0.385
January	0.585	0.343
February	0.441	0.194

From the processing results, Table 1 shows that in December, with a correlation value (r) of 0.620, which means it has a strong relationship or correlation level, and the R^2 value is 0.385, which means that the variation that occurs in rainfall in Pariaman City is 38.5% caused by sea surface temperature and other factors influence the remaining 61.5%. In January, it was known that the correlation value (r) was 0.585, meaning it had a moderate relationship or correlation level. The R^2 value is 0.343, which means that the variation that occurs in rainfall in Pariaman City is 34.3% caused by sea surface temperature, and other factors influence the remaining 65.7%. In February, the correlation value (r) was known to be 0.441, meaning it has a moderate relationship or correlation level. The R^2 value is 0.194, which means that the variation that occurs in rainfall in Pariaman City is 19.4% caused by sea surface temperature, and other factors influence the remaining 80.6%.

Table 2. Correlation of sea surface temperature with transitional season I rainfall

Month	R	R^2
March	0.303	0.092
April	0.554	0.307
May	0.507	0.257

From the processing results, Table 2 shows that in March, with a correlation value (r) of 0.303, which means it has a relationship or low correlation level, and the R^2 value is 0.092, which means that the variation that occurs in rainfall in Pariaman City is 9.2% caused by sea surface temperature and other factors influence the remaining 90.8%. In April, it is known that the correlation value (r) is 0.554, which means that it has a moderate relationship or correlation level, and the R^2 value is 0.307, which means that the variation that occurs in rainfall in Pariaman City is 30.7% caused by sea surface temperature and other factors influence the remaining 69.3%. In May, it is known that the correlation value (r) is 0.507, which means that it has a relationship or a moderate level of correlation and an R^2 value of 0.257, which means that the variation that occurs in rainfall in Pariaman City is 25.7% caused by sea surface temperature and other factors influence the remaining 74.3%.

Table 3. Correlation of sea surface temperature with east monsoon rainfall

Month	R	R^2
June	0.610	0.372
July	0.643	0.414
August	0.507	0.257

From the processing results, Table 3 shows that in June, with a correlation value (r) of 0.610, which means it has a strong relationship or correlation level, and the R^2 value is 0.372, which means that the variation that occurs in rainfall in Pariaman City is 37.2% caused by sea surface temperature and other factors influence the remaining 62.8%. In July, it is known that the correlation value (r) is 0.643, which means that it has a strong relationship or correlation level, and the R^2 value is 0.414, which means that the variation that occurs in rainfall in Pariaman City is 41.4% caused by sea surface temperature and other factors influence the remaining 58.6%. In August, it is known that the correlation value (r) is 0.507, which means that it has a relationship or a moderate level of correlation and an R^2 value of 0.257, which means that the variation that occurs in rainfall in Pariaman City is 25.7% caused by sea surface temperature and other factors influence the remaining 74.3%.

Table 4. Correlation of sea surface temperature with transitional season II rainfall

Month	R	R^2
September	0.534	0.286
October	0.686	0.470
November	0.406	0.165

From the processing results, Table 4 shows that in September, with a correlation value (r) of 0.534, which means it has a moderate relationship or correlation level, and the R^2 value is 0.286, which means that the variation that occurs in rainfall in Pariaman City is 28.6% caused by sea surface temperature and other factors influence the remaining 71.4%. In October, it is known that the correlation value (r) is 0.686, which means that it has a strong relationship or correlation level, and the R^2 value is 0.470, which means that the variation that occurs in rainfall in Pariaman City is 47% caused by sea surface temperature and other factors influence the remaining 53%. In November, it is known that the correlation value (r) is 0.406, which means that it has a moderate relationship or correlation level, and the R^2 value is 0.165, which means that the variation that occurs in rainfall in Pariaman City is 16.5% caused by sea surface temperature and other factors influence the remaining 83.5%

4. Conclusions

Based on the research that has been done, sea surface temperature increases in the first transitional season and decreases in the second transitional season. The highest sea surface temperature in Pariaman city waters occurs in March, while the lowest sea surface temperature occurs in November. Meanwhile, rainfall in Pariaman city ranges from 235 to 444 mm. The correlation between sea surface temperature and rainfall in Pariaman city waters has a weak to strong relationship level ranging from 0.303 - 0.686.

5. References

Aryanti, D. (2015). *Laporan Akhir Masterplan Pulau Angso Duo, Pulau Tangah, dan Pulau Ujung, Kota Pariaman*. PT. Inasa Sakha Kirana. Padang.

Azmiada, Z., Elizal, E., & Mulyadi, A. (2024). *Hubungan Sebaran Suhu Permukaan Laut dengan Curah Hujan dan Angin di Sumatera Barat.* Universitas Riau. Pekanbaru.

Hermawan, E., & Komalaningsih, K. (2008). Karakteristik Indian Ocean Dipole Mode di Samudera Hindia Hubungannya dengan Perilaku Curah Hujan di Kawasan Sumatera Barat Berbasis Analisis Mother Wavelet. *J. Sains Dirgantara*, *5*(2): 109-129.

Mazidah, N., Nugroho, F., & Bathara, L. (2016). The Multiplier Effect of the Gandoriah Beach Marine Tourism to the Coastal Community of Kelurahan Pasir, Central Pariaman District, Pariaman City West Sumatra Province. *Jurnal Online Mahasiswa Fakultas Perikanan dan Ilmu Kelautan Universitas Riau*, 3(2): 1-12.

Pratisto, A. (2009). *Statistik menjadi mudah dengan SPSS 17*. PT. Elex Media Komputindo. Jakarta.

Priyahita, F., Sugianti, N., & Aliah, H. (2015). Analisis Taman Alat Cuaca Kota Bandung dan Sumedang Menggunakan Satelit Terra Berbasis Python. *ALHAZEN Journal of Physics*, 2(2): 28-37.

Satrioajie, W.N. (2012). Teknologi Citra Satelit Modis untuk Pengukuran Suhu Permukaan Laut. *Jurnal Oseana*, 37(3): 189-202.

Sugiyono, S. (2007). *Statistik untuk Penelitian.* CV Afabeta. Bandung.

Susilokarti, D., Supadmo, S.A., Susanto, S., & Sutiarso, L. (2015). Identifikasi Perubahan Iklim Berdasarkan Data Curah Hujan di Wilayah Selatan Jatiluhur Kabupaten Subang, Jawa Barat. *Agritech*, *35*(1): 98-105.

Syafik, A., Kunarso, K., & Hariadi, H. (2013). Pengaruh Sebaran dan Gesekan Angin Terhadap Sebaran Suhu Permukaan Laut di Samudera Hindia (Wilayah Pengelolaan Perikanan Republik Indonesia 573). *Journal of Oceanography*, 2(3):318-328.

Syaifullah, M.D. (2010). Analisis Suhu Muka Laut Selatan Jawa dan Pengaruhnya Terhadap Curah Hujan DAS Citarum. *Jurnal Sains & Teknologi Modifikasi Cuaca*, 11(2):11-19.

Tampubolon, A.B., Gustin, O., & Chayati, S.N. (2016). *Pemetaan Suhu Permukaan Laut menggunakan Citra Satelit Aqua MODIS di Perairan Provinsi Kepulauan Riau.* Jurusan Teknik Informatika, Politeknik Negeri Batam. Batam.

Wahyuningrum, P.I., Simbolon, D., & Rizkawati, R. (2011). Pengaruh Suhu Permukaan Laut Terhadap Hasil Tangkapan Ikan Tenggiri di Perairan Indramayu, Jawa Barat. *Buletin PSP*, *19*(2).

Yuniarti, A.L., Maslukah, M., & Helmi, M. (2013). Studi Variabilitas Suhu Permukaan Laut berdasarkan Citra Satelit Aqua MODIS tahun 2007-2011 Perairan Selat Bali. *Journal of Oceanography*, 2(4): 416-421