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Analysis of Sea Surface Temperature Using Terra Modis Satellite Imagery 2021 Case Study: Ujungpangkah Coastal Gresik

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ABSTRACT

Sea Surface Temperature (SST) is one of the parameters used to measure water quality. Measurement of Sea Surface Temperature (SST) is based on water and ultimately affects the photosynthesis process in the waters. Too much Sea Surface Temperature (SST) can also reduce the availability of dissolved oxygen in the water. Based on the nature of the data which is composite data and ready to use, the SST data requires a geometric correction step. This study aims to analyze Sea Surface Temperature Using the Terra Modis Satellite Imagery Case Study on the coast of Ujungpangkah Gresik. The equipment needed in this activity is a unit of computer equipment and Seadas 4.7.3 software. Remote sensing is very appropriate to be used as a solution to analyze the Coastal Sea Surface Temperature (SST) Ujungpangkah, Fast, cheap and efficient use of image data has been proven in this activity. The results obtained the distribution of sea surface temperature (SST) in the entire coastal area of Ujungpangkah, Gresik Regency. Identification results show a range between 29.18 ° C - 35.58 ° C. Algorithm model of sea surface temperature (SST) Ujungpangkah coastal area, Gresik Regency $y = 543.31x + 29.827$ and the degree of determination $R^2 = 0.3911$ obtained from the wavelength/reflection Rrs_667. Hypothesis test re- results, the t-test gives the results t stat / t count < critical t / t table or $0.000499432 < 0.499803359$ means: that the inside temperature is the same as the 2021 satellite image temperature. In other words, there is no difference between the inside temperature and temperature satellite image 2021.

Keywords: Sea Surface Temperature (SST), Terra modis satellite, Ujungpangkah Coastal Gresik

Introduction

Gresik Regency is located northwest of Surabaya City which is the capital of East Java Province, while the area is 1,191.25 km² which is divided into 18 sub-districts and consists of 330 villages and 26 sub-districts. Geographically, Gresik Regency is located between 112° to 113° east longitude and up to 7° to 8° south latitude. One of the areas that became the research area is the Ujungpangkah District, which is included in the northern part of the Gresik Regency. Approximately one-third of the Gresik Regency is a coastal area, namely Kebomas District, Gresik District, Manyar District, Bungah District, and Ujungpangkah District (Atmajawati et al., 2018).

Sea Surface Temperature (SST) is one of the parameters used to measure water quality (Garajeh & Feizizahdeh, 1991). Measurement of Sea Surface Temperature (SST) is based on water and ultimately affects the photosynthesis process in the waters (Bilotta & Brazier, 2008). Too much Sea Surface Temperature (SST) can also reduce the availability of dissolved oxygen in the water. Based on the nature of the data which is composite data and ready to use, the SST data requires a geometric correction step.

This study aims to analyze Sea Surface Temperature Using Terra Modis Satellite Imagery. Case Study on the coast of Ujungpangkah Gresik. Download the image from http://ocean-color.gsfc.nasa.gov. The equipment needed in the activity is a computer equipment unit and Seas

Software 4.7.3. With a very wide reach, of course, it is an important requirement considering the vast ocean area owned by the Unitary State of the Republic of Indonesia so that it is useful for management both regionally and nationally or internationally.

The remote sensing is very appropriate to be used as a solution for the identification of Ujungpangkah Coastal Sea Surface Temperature (SST), Fast, cheap and efficient use of image data has been proven in this activity to observe and analyze sea surface temperature as one of the important parameters in oceanographic processes. To manage the marine and fisheries sector, efficient andeffective sources of data and information supported by cheap and fast data types (Wibisana et al., 2018).

This study discusses several problems that need to be known, including:

1. How do identify areas to get the distribution of sea surface temperature (SST) throughout theUjungpangkah coastal area of the Gresik Regency?
2. How to know the estimation of sea surface temperature (SST) in the Ujungpangkah coastal area, Gresik Regency?
3. Is there a difference between in situ sea surface temperature (SST) and sea surface temperature (SST) from Terra Modis satellite imagery in the Ujungpangkah coastal area, Gresik Regency2021?

Material and Methods

Download images with http://oceancolor.gsfc.nasa.gov. The equipment needed in this activity is a computer unit and Seadas 4.7.3 software, with the variable being studied is the sea surface temperature (SST) in the coastal area of Ujungpangkah, Gresik Regency.

The first step is to do image cropping to reduce the image display area according to the coordinates of the desired area. This aims to make the file size smaller so that the processing process becomes faster. For data processing, observations are made by creating an Area of interest (AOI) by determining the coordinates. The coordinates of the research location are 112.367 ^{o} East Longitude – 113.048 ^{o} West Longitude and -6.729 ^{o} North Latitude – 113.048 ^{o} South Latitude (Figure 2). The average surface temperature distribution data were extracted from the Terra Modis image in 2021. SST data can already be cut and processed on Seadas for further use in visualization (display) and analysis (raw data) for sea surface temperature (SST) observation activities. Specifically for raw data analysis, the surface temperature data is converted into ASCII format for further processing in MS Excel into a graphical representation (chart) of the distribution of sea surface temperature (SST).

Comparing the Insitu sea surface temperature with the sea surface temperature of the 2021 TerraModis Image data, whether there is a difference is carried out by testing the t hypothesis. The software used is excel data analysis.

Source: Wikipedia

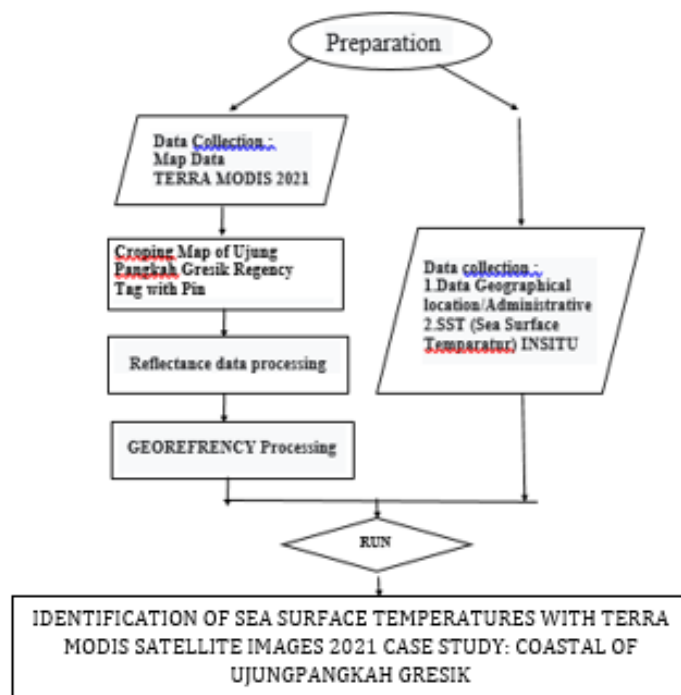Figure 1. Map of Gresik Regency and the research area

Figure 2. Research flowchart

Results and Discussion

Data processing is divided into two parts. Image data processing / remote sensing and in situ data analysis processing with wavelengths/reflectance Rrs_488, Rrs_547, and Rrs_667.

Image data processing/ remote sensing.

Download images with http://oceancolor.gsfc.nasa.gov. Selected Image / Terra Modis image withT20211110250000.L2_LAC_OC_nc.

The first step is to do image cropping to reduce the image display area according to the coordinates of the desired area. This aims to make the file size smaller so that the processing process becomes faster. For data processing, observations are made by creating an Area of interest (AOI) by determining the coordinates. The coordinates of the research location are 112.367º East Longitude – 113.048 º West Longitude and -6.729 º North Latitude – 113.048 º South Latitude (Figure 2). The average surface temperature distribution data were extracted from the Terra Modis image in 2021. The map that has been cut is marked with 20 sample points for taking sea surface temperatures and getting the reflectance. for the next process, georeference is carried out to match the coordinates with UTM WGS 84 (automatic).

Reflection data analysis processing

The map that has been cut is marked with 20 sample points for taking sea surface temperatures and getting the reflectance. The reflectance of waves Rrs 488, Rrs_547, and Rrs_667 aims to obtain an Algorithm Model which is expected to map the distribution of sea surface temperature in the Ujungpangkah coastal area, Gresik Regency. In this study, it was determined the four models of the algorithm are Linear, Exponential, Logarithmic, and Power. and Equipment needed in this activity is a unit of computer equipment and software Seas 4.7.3. The results of composite processing (image) and SST raw data analysis were analyzed using MS Excel software, to obtain an algorithm model using regression. The results of the analysis shown in table 1 are represented in the form of the SST distribution pattern shown in Figures 6 and 7. The processed

data covers the surrounding Ujungpangkah Coastal area, it can be seen that the results of raw data analysis are in the form of SST values in degrees Celsius (Co).
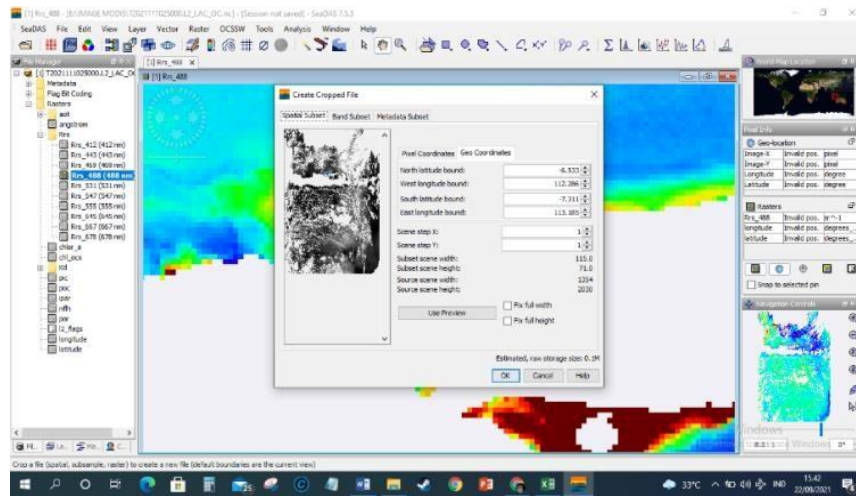

Figure 4. Crop Research Location Ujungpangkah Gresik Regency
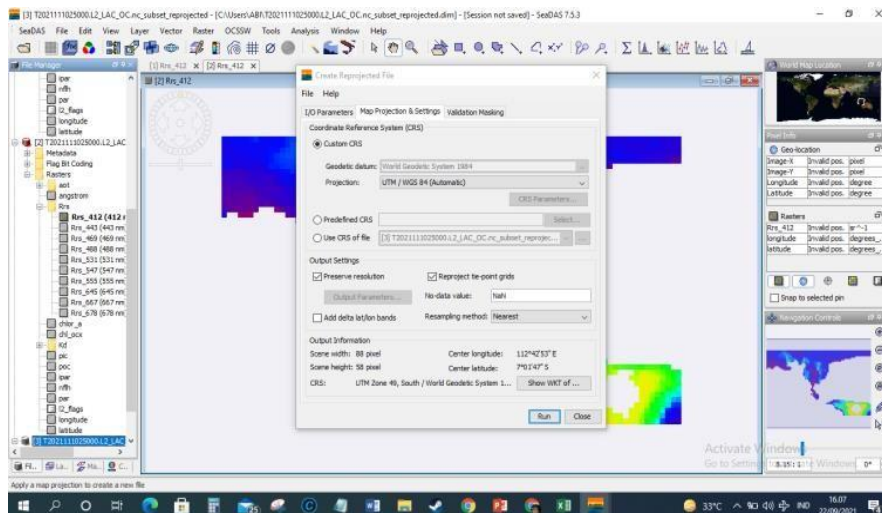

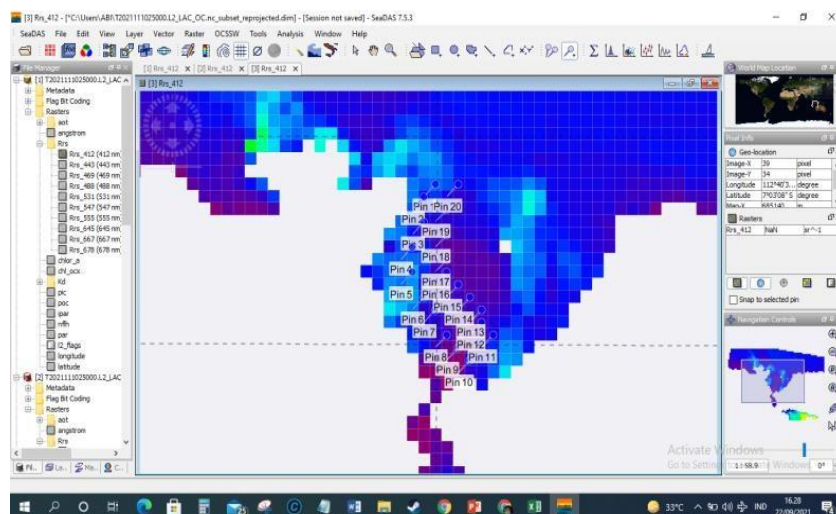Figure 5. Map of Ujungpangkah research area Georeference process

Figure 6. Map of Ujungpangkah research area pin

Below is shown the results of the analysis of the four reflectances using Terra Modis images. The results of the recapitulation show that the best model is the Linear Algorithm Model $y = 543.31x + 29.827$ and the degree of determination $R^2 = 0.3911$ obtained the wavelength/reflection Rrs_667. Several factors that affect the surface temperature include; seasonal conditions (climate), wind, and phenomena that occur in the sea such as upwelling, currents, and others. If it is connected with the observations in this study, it can be observed that the seasonal phenomenon affects the temperature of the surface waters of the Ujungpangkah Coast.

In general, the rate of photosynthesis of phytoplankton increases with increasing water temperature but will decrease drastically after reaching a certain temperature point. This is because eachspecies of phytoplankton always adapts to a certain temperature range. As the water in the tropics and right on the equator, throughout the year, generally, the surface temperature conditions of Ujungpangkah coastal waters tend to be warm (29.87 ° – 35.58 ° C).

Table 1. Calculation of the reflectance Algorithm Rrs _488, Rrs_ 547, and Rrs_ 667

No.	Reflektan	Regresi	Model Algoritma	Derajat Determinasi
1	**Rrs 488**	Linier	$y = 527{,}53x + 29{,}286$	$R^2 = 0{,}1789$
2		Power	$y = 29{,}841e^{13{,}864x}$	$R^2 = 0{,}1639$
3		Logaritmik	$y = 3{,}595\ln(x) + 51{,}049$	$R^2 = 0{,}1387$
4		Power	$y = 52{,}823x^{0{,}0943}$	$R^2 = 0{,}1266$
1	**Rrs 547**	Linier	$y = 428{,}48x + 27{,}735$	$R^2 = 0{,}2236$
2		Power	$y = 28{,}68e^{11{,}18x}$	$R^2 = 0{,}2019$
3		Logaritmik	$y = 3{,}595\ln(x) + 51{,}049$	$R^2 = 0{,}1387$
4		Power	$y = 52{,}823x^{0{,}0943}$	$R^2 = 0{,}1266$
1	**Rrs 667**	Linier	$y = 543{,}31x + 29{,}827$	$R^2 = 0{,}3911$
2		Power	$y = 30{,}261e^{14{,}317x}$	$R^2 = 0{,}3604$
3		Logaritmik	$y = 3{,}201\ln(x) + 49{,}882$	$R^2 = 0{,}2189$
4		Power	$y = 50{,}936x^{0{,}0828}$	$R^2 = 0{,}1945$

The results of the t-test hypothesis test using MS excel software, where the results show t stat / t count < critical t / t table means: that the inside temperature is the same as the 2021 satellite image temperature. In other words, there is no difference between the inside temperature and the temperature satellite image 2021. Below have been tabled the results of the t-test hypothesis test using MS excel software, where the results show t stat / t count < critical t / t table or 0.000499432 < 0.499803359 means: that the in situ temperature is the same as the temperature 2021 satelliteimagery. In other words, there is no difference between in situ temperature and the 2021 satellite image temperature.

Table 2. T-Test results between insitu temperature and image temperature 2021

| Variabel	*Insitu Temperature*	*Citra Temperature 2021*
Mean	33,33855417	33,33826
Variance	11,37443377	4,4488692
Observations	20	20
Pearson Correlation	0,625387012	Correlation
df	19	Degrees of freedom
t Stat	0,000499432	t-count
P(T<=t) one-tail	0,499803359	One-sided probability
t Critical one-tail	1,729132812	one-sided test t-table
P(T<=t) two-tail	0,999606717	Two-sided probability
t Critical two-tail	2,093024054	double-sided test t-table
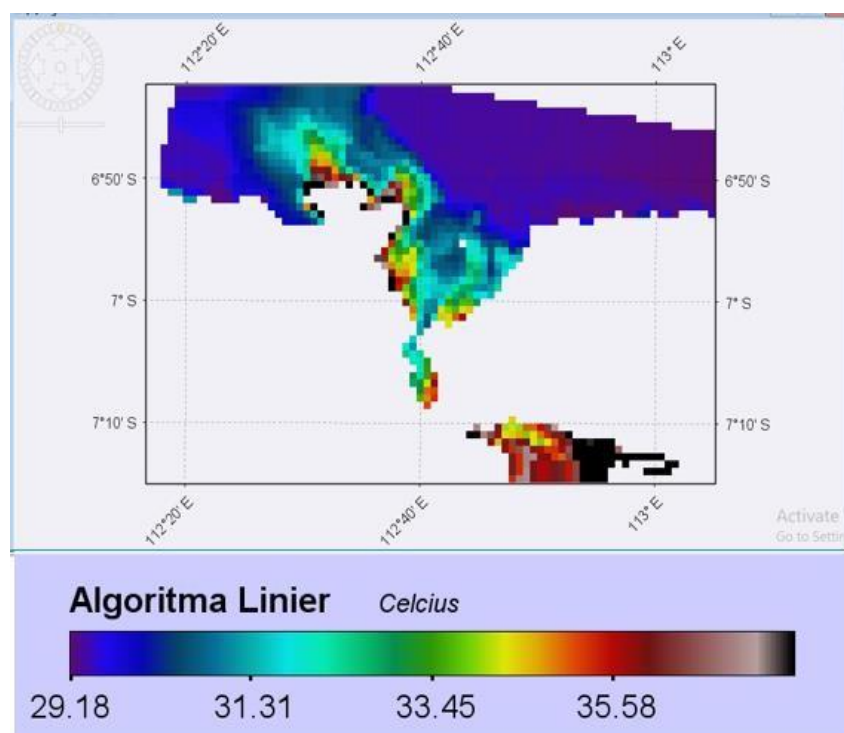
Figure 7. Identification image of sea surface temperature with terra Modis satellite image case study: Ujungpangkah Coastal Gresik

Conclusion
1. The distribution of sea surface temperature (SST) in the entire coastal area of Ujungpangkah, Gresik Regency. The identification results show a range between 29.18 º C - 35.58 º C.
2. Algorithm model of sea surface temperature (SST) in Ujungpangkah coastal area, Gresik Regency y = 543.31x + 29.827 and the degree of determination R^2 = 0.3911 obtained from the wavelength/reflection Rrs_667.
3. Hypothesis test results, the t-test gives the results t stat / t count < critical t / t table or 0.000499432 < 0.499803359 means: that the inside temperature is the same as the temperature of the 2021 satellite image. In other words, there is no difference between the temperatures in situ with the temperature of the 2021 satellite image, while the correlation is 0.625387012, which means that it is quite positive.

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