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Spatio-Temporal Distribution of Chlorophyll-a In The Northern Waters of Central Java Using Aqua-MODIS

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Abstract. Chlorophyll-a is one of the most decisive parameters of the fertility waters. The dynamics of the distribution Chlorophyll-a concentration depends on the oceanographic condition, so it can change according to the circumstances of the environment and the season. This study aims to determine the distribution of Chlorophyll-a in the northern waters of Central Java temporally and spatially. This assessment was conducted based on Chlorophyll-a data from the Aqua MODIS (Moderate Resolution Imaging Spectroradiometer) satellite in 2010-2016. MATLAB R2014a was used in processing data to see the distribution of Chlorophyll-a. The distribution of Chlorophyll-a appears that there are difference patterns for monthly and seasonal ocean productivity in the northern waters of Central Java. The highest fertility occurs in May, during the dry season. These waters are more fertile on the coastal areas than offshore areas, because determined by nutrients from the foreshore.

1. Introduction

Characteristics of Indonesian waters depend on varietive oceanographic parameters, one of that is the Chlorophyll-a concentration. Chlorophyll-a is one of the parameters that indicate the fertility of a waters [1]. The waters of northern Java dominated by two water masses. It is the water masses from South China Sea and the Flores Sea which will affect the Chlorophyll-a distribution pattern of chlorophyll-a distribution in the waters. In addition, chlorophyll-a in the water influenced by runoff and nutrient from the land to the sea [2].

The waters of northern Java island has high potential on fisheries. It is necessary to optimize the fishing ground information in the waters of northern Java. The potential of fish in a waters can be seen from the Chlorophyll-a consentration contained in these waters. Chlorophyll-a in the sea has an important role to identificate the fertility in a waters. Chlorophyll-a consentration in the sea can be affected by several elements such as sea surface temperature, wind direction, and sea currents. All these three have an important role in the occurrence of upwelling and downwelling which can be used to identify Chlorophyll-a in the ocean [3]. Identification of Chlorophyll-a can

be done using remote sensing. Remote sensing is a technique using the Aqua-Moderate Resolution Imaging Spectroradiometer (MODIS) satellite.

Chlorophyll-a is an active pigment that important for photosynthesis and the formation of organic matter in the waters, so it can be used as an indicator of Water Fertility Level [4]. Further explanation said that chlorophyll-a in phytoplankton cells is very determining the regarding to continuity of the food chain in an ecosystem. Chlorophyll-a consentration has been used as measuring phytoplankton biomass in a waters [5, 6]. The fertility water can be determined by available concentration of Chlorophyll-a [7, 8]. Chlorophyll-a is a pigment contained in phytoplankton and has important role in photosynthesis. Phytoplankton that act as a major producer in the food chain in the waters affect other organisms in the higher level trophic, including fish.

Observation of Chlorophyll-a concentration in the sea can be done directly in the field by taking a sample of sea water, and measured the levels of Chlorophyll-a, but for large scale mapping can not be done by those inefficiency methods. Chlorophyll-a can be monitored constantly and continuously with a high degree of accuracy [9].

This study aims to determine the distribution of Chlorophyll-a in the northern waters of Central Java temporally and spatially and also to determine the effect of the season on its distribution.

2. Research Methods

The data used in this study is the image of the Aqua-MODIS satellite obtained from *www.oceancolor.gsfc.nasa.gov*. The Aqua-MODIS satellite is one of the Moderate Resolution Imaging Spectroradiometer (MODIS) satellites which are important sensor systems installed on the Terra & Aqua satellite. This system is an optical scanner with 36 channels with spatial resolution between 250 m to 1 km [10]. The data that is processed in the form of Chlorophyll-a value data in the northern waters of Central Java is from 2010-2016. After the downloaded data is filtered, it is retrieve only the required data. It is for the northern waters of Central Java, with coordinates of 5.5 ° - 7 ° LS and 108 ° -112 ° BT. Data is processed using Matlab R2014a, becoming a visualization spatial and temporal. Data are grouped by month so that the average is monthly Chlorophyll-a consentration. Chlorophyll-a distribution can be analyzed by averaging monthly Chlorophyll-a data from Aqua-MODIS satellite. Furthermore, it will be grouped based on the monsoon on the distribution of Chlorophyll-a in the northern waters of Central Java.

3. Result and Discussion

Based on the results of Aqua-MODIS satellite image processing using temporal visualization it can be seen that the Chlorophyll-a concentration in the northern waters of Central Java ranges between 0.4775-1.1849 mg/m^3. From on Figure 1, can be seen that spatially Chlorophyll-a concentration is higher in coastal areas and decreases when offshore. The high concentration of Chlorophyll-a on the coast is due to the accumulation of nutrients carried from land and human activities, so that high nutrient consentration stimulates phytoplankton growth [11]. According to the season, in the west and transition season 1 which the Chlorophyll-a concentration is quite high. This might be occurred due to the high rainfall in Indonesia, a lot of nutrients enter the sea waters through the river flow. In the other season, east season and transition 2 there was a decrease in Chlorophyll-a concentration in the Java Sea. The west season is a season of wind that carries a lot of rain while the east season brings little rain [12].

Pattern of chlorophyll-a based on the moon, Java Sea has sufficient Chlorophyll-a consentration to be the fertile waters (Figure 1). The high level of Chlorophyll-a in these waters because the waters of northern Java include shallow waters. Chlorophyll-a concentration has increased around the coast, this is due to run-off. Run off flow from the mainland to the sea carrying nutrients [3]. Other than that, the northern region of Central Java is an area that has many industrial and factory buildings and is a residential area of the community, so the nutrient

consentration increases coming with increasing activity from the mainland.

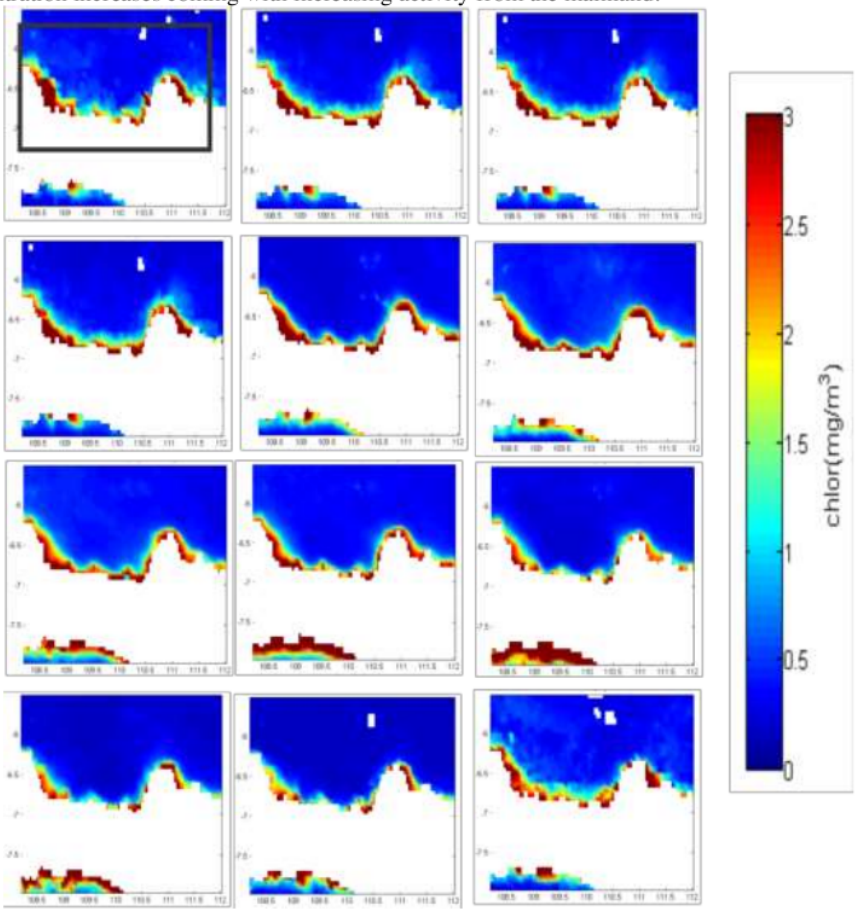

Figure 1. Monthly Climatology Map of Chlorophyll-a distribution in 2010-2016

Table 1. Monthly Chlorophyll-a concentration in 2010-2016 (Black box in Fig.1, January)

Month	Chl-a
1	0.8195 ± 0.17
2	0.7263 ± 0.15
3	0.6989 ± 0.09
4	0.8860 ± 0.2
5	1.1849 ± 0.3
6	1.1192 ± 0.12
7	0.9992 ± 0.1
8	0.8376 ± 0.05
9	0.7137 ± 0.05
10	0.5482 ± 0.11
11	0.4775 ± 0.15
12	0.7469 ± 0.28

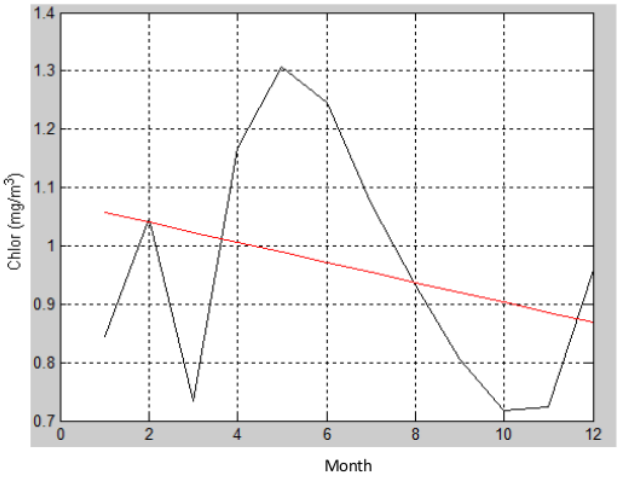

Figure 2. Graph of average monthly Chlorophyll-a values in 2010-2016

Chlorophyll-a consentration in the northern waters of Central Java was the highest Chlorophyll-a consentration in May, reaching for 1,1849 mg/m^3(Figure 2). The weste and the transition season 1 are seasons where the Chlorophyll-a concentration is quite high. This might be occurred due to the high rainfall that falls down in Indonesia, which causing a lot of nutrients entering into the sea waters through the river flow [11]. In contrast to the east season and transition 2 there was a decrease in Chlorophyll-a concentration in the Java Sea and the lowest consentration occurs in october. But in the processing of Chlorophyll-a data from 2010-2016. It was seen that the highest Chlorophyll-a concentration was May included in the east season.

Based on temporal visualization, the consentration of Chlorophyll-a in the waters is strongly influenced by the existance of phytoplankton, while phytoplankton easily carried by the currents because of its nature that floats on the surface of the water. Phytoplankton is a producer in the food chain in the sea cause a lot of herbivorous fish, then phytoplankton biomass will be reduced.

According to research,the distribution of Chlorophyll-a concentration shows that in the East Season the Chlorophyll-a concentration is not concentrated in upwelling areas only, but spreads out into other waters because it is strongly influenced by the Ekman transport carrying the water mass towards the southwest. Generally, the Chlorophyll-a consentration temporally affected by the monsoon winds blew, but anomalies occurred in May causing the highest Chlorophyll-a consentration in May.

Concentration of the chlorophyll-a in the ocean also influence by El Nino and La Nina. El nino can increase the concentration of chlorophyll-a, in the other side when La Nina occurs can cause decrease chlorophyll-a. El Nino cause sea surface temperature increase, can stir mixing the water in ocean so the concentration of chlorophyll-a increase. Otherwise in La Nina [13]

4. Conclusion

Chlorophyll-a distribution in the northern waters of Central Java is affected by monsoon wind moving throughout the year. The highest Chlorophyll-a consentration occurs in June in the west season, where anomalies occur led by Ekman. Chlorophyll-a consentration is relatively high throughout the east and transition season 1 also relatively low in the west and transitional season 2 and the distribution of chlorophyll-a in the coastal area is higher than the foreshore.

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References

[1] Kunarso SH, Hadi N S, Baskoro MS 2011 *Variability of temperature and chlorophyll-a in upwelling area in variations of ENSO and IOD in the southern waters of Java to Timor* Journal Marine Science **16 (3)**: 171-180
[2] Hadikusumah 2008 *Characteristics of physical parameters and chlorophyll-a content in the Java Sea*. (*In Indonesia) Jurnal Ilmu Kelautan* **13 (2)** 103-112.
[3] Mahagnyana, Limaran, G D, and Fadlan A 2017 *Effect of Monsoon on Fertility of North Java Waters by Using Modis Aqua Satellite* Unnes Physics Journal **6 (1)** 37-40
[4] Marlin N, Damar and Effendi 2015 *Horizontal Distribution of Phytoplankton Chlorophyll-a as an Indication of Water Fertility Level in Meulaboh Bay*. *West Aceh* Jurnal Ilmu Perikanan Indonesia **20 (3)** 272-279
[5] Gupta M 2014 *A New Tropic State Index For Lagoons*. *Journal of Ecosystem*. 8 p.
[6] Trevor W, Edward B and Burke H 1998 *Enviromental indicators for national state of the environment reporting Estuaries and the Sea, Australia*: State of the Environment (Environmental Indicator Reports). Canberra (AU): Departement of the Environment.
[7] Adnan 2010 *Analysis of sea surface temperature and chlorophyll-a sensory data is related to the catch of tuna (Euthynnus affinis) in East Kalimantan waters (in Indonesian)*. Amanisal **1(1)** 1 – 12.
[8] Rashidy, EA, Litaay M, Salam M M and Umar M R 2013 *Phytoplankton composition and abundance in the coastal waters of Tekolabbua Village, Pangkajene District, Pangkep Regency, South Sulawesi Province*. Jurnal Alam dan Lingkungan, **4(7)**12 – 16.
[9] Augusto-Silva, PB, Ogashawara I, Barbosa CCF, de Carvalho LAS, Jorge D S F, Fornari, C I and Stech, J L 2014 *Analysis of MERIS Reflectance Algorithms for Estimating Chlorophyll-a Concentration in a Brazilian Reservoir*. Remote Sensing **6 (12)** 11689-1170
[10]Prahasta E. 2008. *Digital Surface Model*.(Bandung : CV Informatika)
[11]Putra E, Gaol J L and Siregar VP 2012 *Relationship Chlorophyll-A Concentration and Sea Surface Temperature with Prima Pelagic Fish Catches in the Java Sea from MODIS Satellite Images*. In Indonesian. Jurnal Teknologi Perikanan dan Kelautan. ***3(2)1-10***

[12]Nontji A. 2005. *Laut Nusantara*. Cetakan Keempat. Djambatan. Jakarta.
[13]Anindya W I, B Prasetyawan, C D Triyono, Muslim, L Maslukah 2015 *Effect of ENSO on the variability of SST and Chlorophyll-a in Java Sea* 3rd International Conference on Tropical and Coastal Region Eco Development 2017 OP Conf Series : Earth and Environmental Science **116.**

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