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Detection of Potential Fishing Ground for Aceh Sea Water using Contour Map Technique

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Abstract: This study focused on potential fishing ground based on data sea surface temperatureand chlorophyll-a concentration Aqua and Terra MODIS satellites, especially using the contour map technique to classification of the values as well as the accuracy validation of their results. This experiment is aimed at interpolating images under the contour map technique. This includes image interpolation result for image of chlorophyll-a concentration and sea surface temperature coverage area of research is the north Aceh sea water with boundary coordinates 1°40' – 6° 30' N and 94° 40' – 98° 30' E.Our experimental result indicate that the accuracy by mapping the chlorophyll-a and sea surface temperature Aqua MODIS is higher than Terra MODIS.

Key words: SST · Chlorophyll-a Concentration · Contour Map · Fishing Ground

INTRODUCTION

A large volume of high quality data products derived from MODIS observations has been routinely distributed to and used by the science community and users worldwide for their studies of the Earth's system and short- and long-term changes of its key environmental parameters [1].Utilization of remote sensing technology for fishing ground potential detection is based on a study of sea surface characteristics and chlorophyll-a concentration distribution, where of the many sea surface characteristic detected by satellites in principle are the main elements used for the determination of potential fishing [2].

Interpolation is a method or a mathematical function for guessing value at locations where data is not available.The Inverse Distance to a Power gridding method is a weighted average interpolator and can be either an exact or a smoothing interpolator. This method is a simple average weighing method for calculating the grid spacing value.Contour map technique is used to construct a new data images for sea surface temperature and chlorophyll-a. The main propose of this study is to determine fishing ground at Aceh sea waters based on image observation and literature search data.

The ultimate goal of this paper is using the *Inverse Distance to a Power*of the gridding method to interpolate data satellite. This research is detected the potential fishing ground using image temperature and image chlorophyll-a and it is obtained from Aqua and Terra MODIS satellites.

To explore the Potential Fishing Zones (PTZs) is used three key environmental variables, that is sea surface temperature, sea surface height and chlorophyll-a concentration [3].Fishing aggregations and oceanography parameters (night-time sea surface temperature, chlorophyll-a concentration, diffuse attenuation coefficients of *downwelling* irradiance at 490 nm and bathymetry)can indicate the potential fishing zones were closely associated with water depth [4].The application of PGIS allows for collective resolution of appropriate mapping scales and relevant habitat classification schemes [5].

According to [6] is determined potential fishing ground by using SST and chlorophyll-a distribution with utilization Terra-MODIS satellite. The research [7] use an automatic method to computed resources estimation for coastal fishery was proposed by applying Information and Communication Technology (ICT) using real-time fishery information.

MATERIALS AND METHODS

Interpolation technique was used Surfer version 12. The surfer is a software developed by US Golden company and newest version 12.0 contains up to 12

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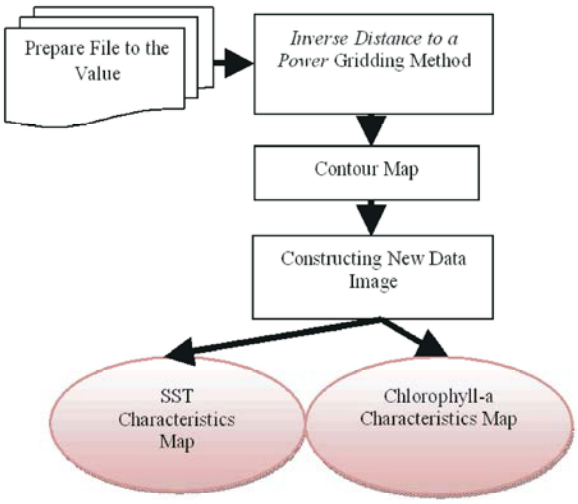

Fig. 1: Proposed Framework for Contour Map Technique using Surfer Application

interpolation methods to been free chosen for various needs. Surfer is a grid-based mapping program that interpolates irregularly spaced XYZ data into a regularly spaced grid. The grid is used to create new type maps including counter, vector, image, shaded relief, watershed, 3D surface and 3D wireframe maps. The *Inverse Distance to a Power* is the gridding method was used in this study. Figure 3.6 shows the proposed framework for interpolation technique.

Data: Data ASCII is prepared file to the value regularly of *x, y* and *z*using Microsoft Exceldue to data ASCII still contain other components (e.g. Pixel-X, Pixel-Y, Longitude, Latitude, sst, qual_sst, mask_ data_ water_ fraction and mask_data_water_fraction_smoothed).

Where *x* is the value for longitude which determines the coordinates of West Longitude to East Longitude, *y* is the value for Latitude which determines the coordinates of North Latitude to South Latitude and *z* is the value for the data (i.g. sst and chlor_a).

Methods: Based on the prepared data above, the data in this study used SST and Chlorophyll-a concentration that obtained from Aqua and Terra MODIS.

- Gridding Method

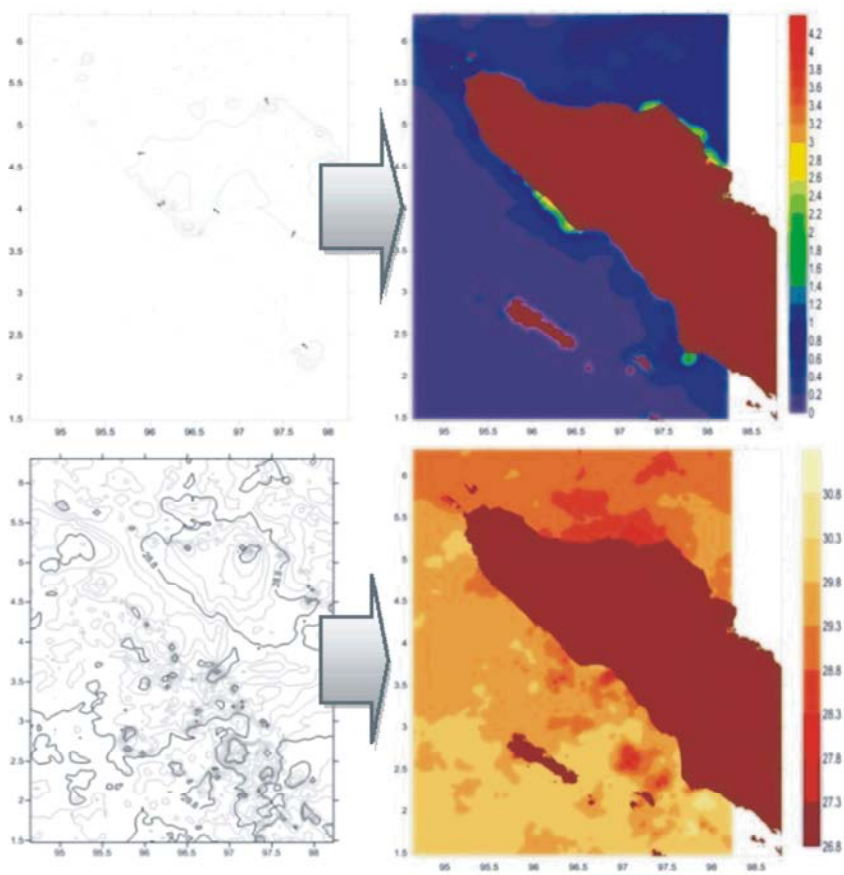

Fig. 2: Contour Map Technique of Chlorophyll-a Concentration and Sea Surface Temperature

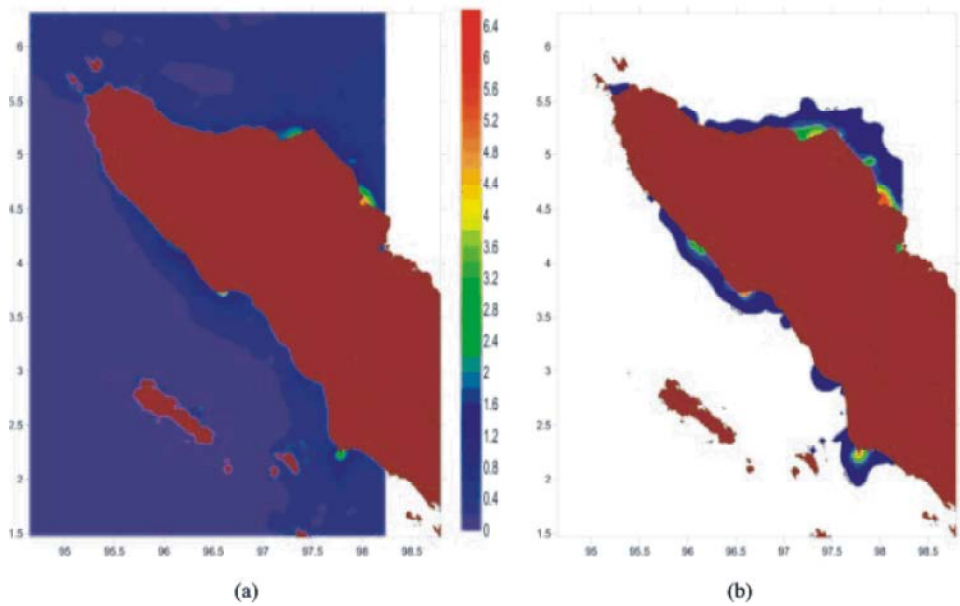

Fig. 3: Data Chlorophyll-a Concentration (a) with Data Limits (b) with Range Minimum Value

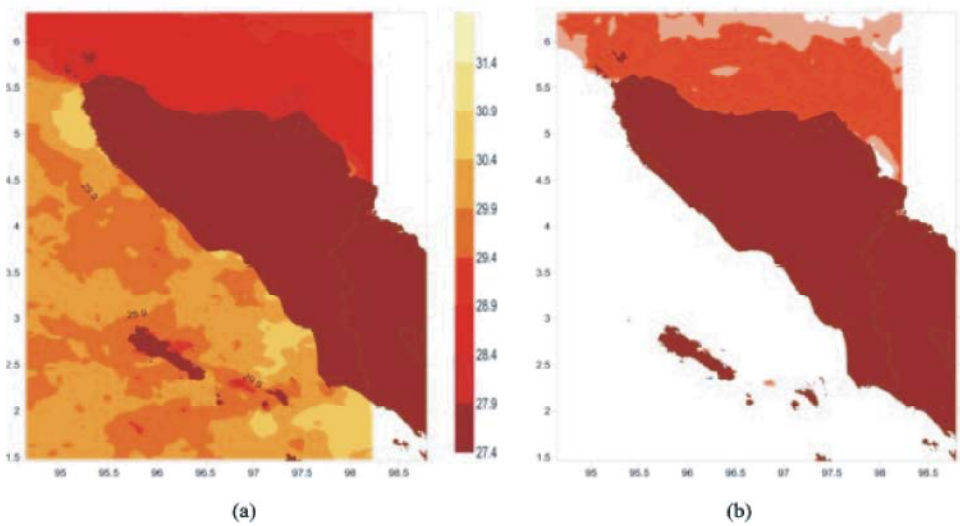

Fig. 4: Data Sea Surface Temperature (a) with Data Limits (b) with Maximum Contour up to 29 °C

Grid is a digital data structure used in an information system on the earth's surface. Grid using raster data to present the earth's surface shape with 3 dimensions (x, y and z). The Inverse Distance to a Power gridding method is a weighted average interpolator and can be either an exact or a smoothing interpolator.The equation used for *inverse distance to a power* gridding methodis see equation 1.

$$\hat{Z}_j = \frac{\sum_{i-1}^{n} \frac{z_i}{h_{ij}\beta}}{\sum_{i-1}^{n} \frac{1}{h_{ij}\beta}}$$

$$h_{ij} = \sqrt{d_{ij}^2 + \delta^2}$$

where (h_{ij}) means the effective separation distance between grid node “j” and the neighboring point “i”; ($\hat{z}_j$) means the interpolated value for grid node “j”; (Z_i) means are the neighboring points; d_{ij} is the distance between the grid node "j" and the neighboring point "i"; the weighting power (the Power parameter); â is is the weighting power (the Power parameter); and ä is the Smoothing parameter

- Contour Map

A grid file using to creates a contour map by command in the Contour Map section. Theimages would be export in *Jpg* or *Jpeg* format with 600 pixels per inch. In Figure 2 shows the images was combined by grid file *(*grd*) and shape file (*shp) land of Aceh and North Sumatera.

The fishing ground potential values is among 0.5 mg/ m^3 to 2 mg/ m^3 and the values over 2 mg/ m^3 [8]. So, the range minimum contour is set 0.5 mg/m^3 and maximum contour used data limits to view of data chlorophyll-a and the values below 0.5 mg/m^3 will not legible (e.g. Fig.3).

Figure 4 shows examples of minimum set value from contour image of sea surface temperature. The minimum set values the most important for detecting the potential fishing ground. During the grid file, each pixel has specific values of sea surface temperature. In these case is set the range maximum contour is 29 °C and minimum contour used data limits to view of data sea surface temperature.

RESULTS AND DISCUSSIONS

This experiment is aimed at interpolating images under the contour map technique. This includes image interpolation result for image of chlorophyll-a concentration and sea surface temperature coverage area of research is the north Aceh sea water with boundary coordinates 1°40' – 6° 30' N and 94° 40' – 98° 30' E.

Fig. 5 shows the mean values differences of several regions for the 12 months.February shows lower mean values of Chl-a Aqua and Terra MODIS. For January, March, April, June, July, August, September, October, November and December 2016 shows 4% - 18% of Chl-a for the mean values. In contrast, the higher mean values different for Chl-a Aqua and Chl-a Terra are less than 38% for May 2016.

Fig. 6 explains the mean value different of SST from Aqua and Terra MODIS instrument from 2016. Generally, the mean values different for SST Aqua and Terra are less than 1.8% for May 2016. February, June and August 2016 shows the mean values of SST are less than 0.

Fig. 7 gives the samples of image Chl-a Aqua and Terra MODIS in January, February, March and November 2016. The coastal of Aceh sea water detection the potential fishing ground based on distribution of Chl-a. In February and March2016 detected more Chl-a at North-East of Aceh sea water and less cChl-a at South- West coastal. In November 2016 was detected more chlorophyll-a concentration alongside Aceh sea water. Chlorophyll-a is detected of several areas in other months.

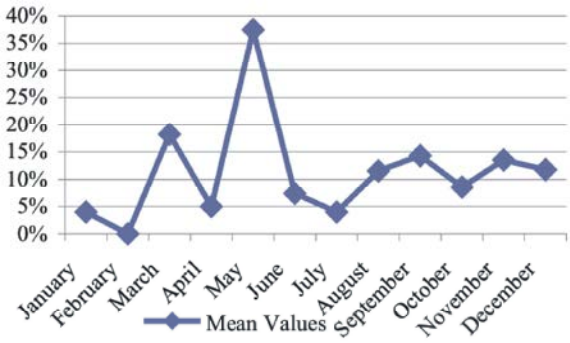

Fig. 5: Mean Value Different of Chl-a Aqua and Terra MODIS is expressed as (Aqua-Terra)/Aqua x 100%

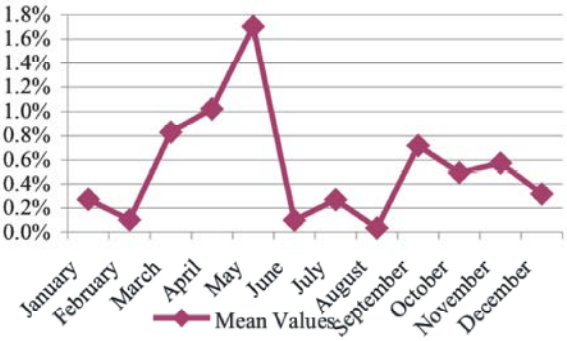

Fig. 6: Mean Value Different of SST Aqua and Terra MODIS is expressed as (Aqua-Terra)/Aqua x 100%

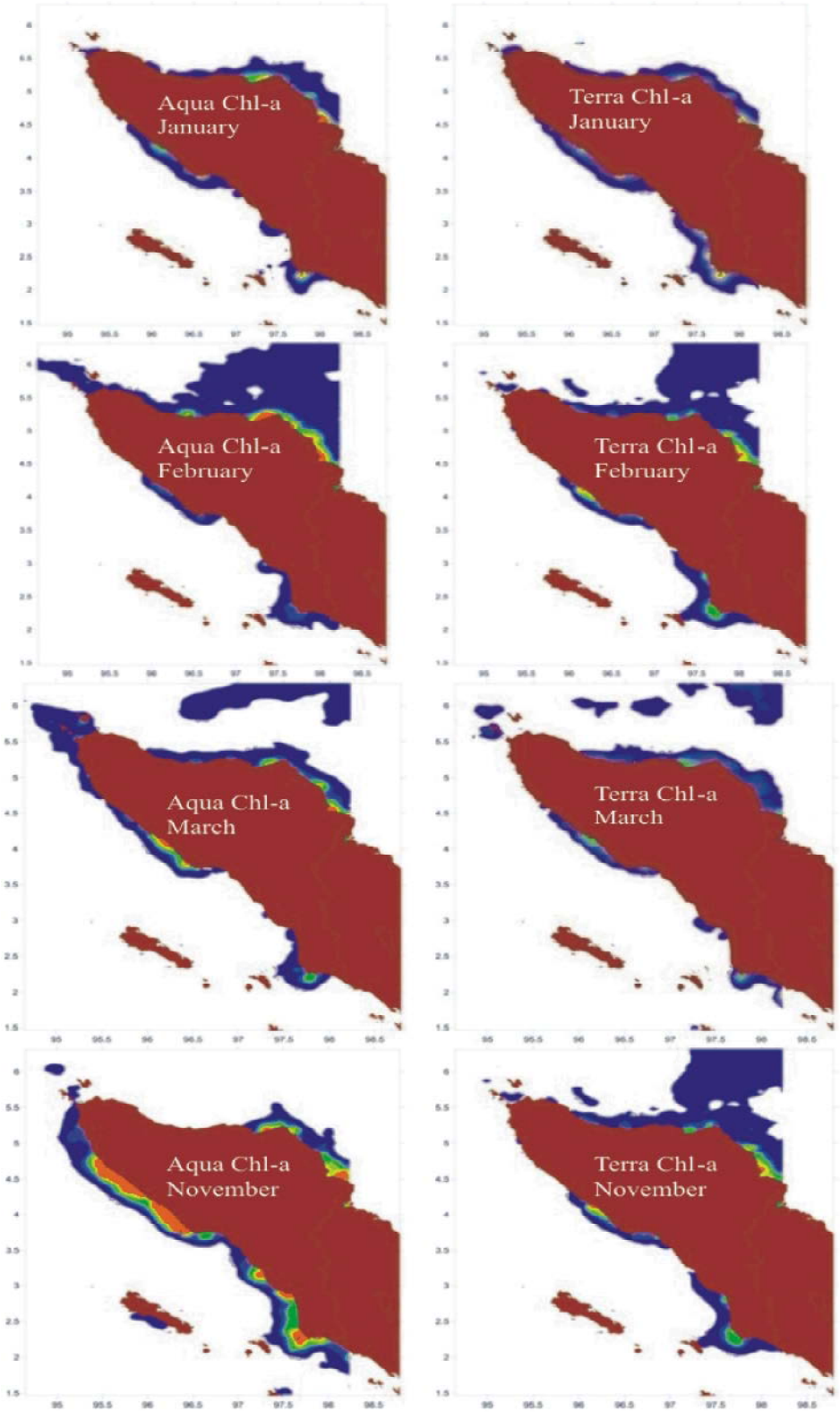

Fig. 7: Sample of Data Image Chlorophyll-a Concentration Aqua and Terra MODIS Satellite Interpolated Using Surfer version 12 Application

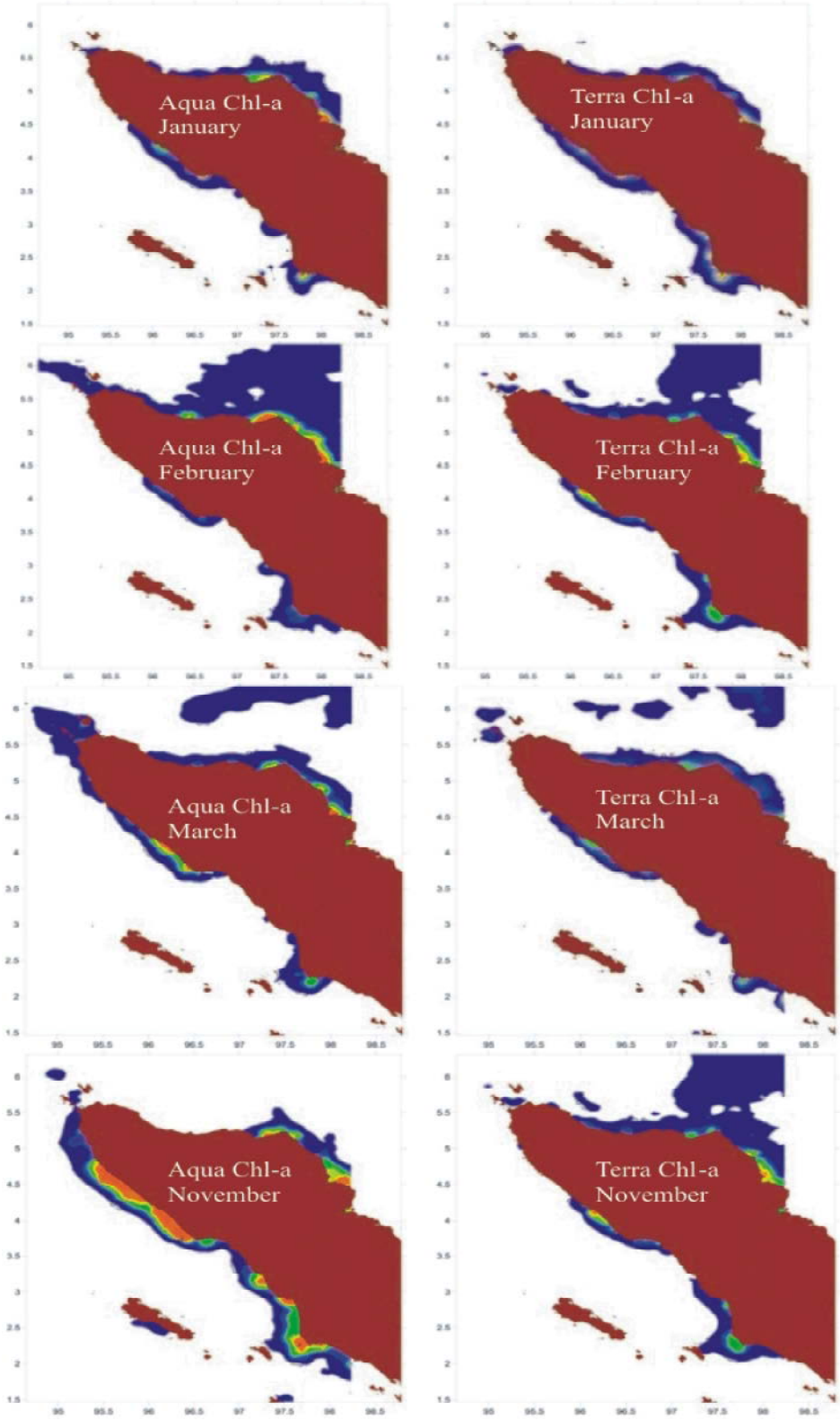

Fig. 7: Sample of Data Image Sea Surface Temperature Aqua and Terra MODIS Satellite Interpolated Using Surfer version 12 Application

Aqua satellite detects the area at night, while Terra detects the area during the day. In figure 7 it is seen that, the area of chlorophyll-a detection of Aqua is wider than Terra detection area. In figure 8 it is also clear that, the wider ocean surface temperature distribution is detected using Aqua satellites compared to terra satellites.

CONCLUSION

The contour map technique has been proved to be quite suitable for fishing ground monitoring and variation analysis. In this paper, several tests are designed to generate potential fishing ground based on Aceh's surface temperature data and chlorophyll-a content. The result of our test includes aspects. First, according to our experiment, we found that the distribution of a-chlorophyll of Aqua and Terra MODIS satellites values above 0.5 mg/m^3 is detected along the coastal water of Aceh. Second, sea surface temperatures below 29°C are detected almost throughout the Aceh sea surface, especially in the Wet season.The experimental results show that the accuracy byusing the contour map technique for mapping the chlorophyll-a and sea surface temperature Aqua MODIS is higher than Terra MODIS.Most importantly,the degree of mapping accuracy with values of chlorophyll-a distribution and sea surface temperature classification is determine the potential fishing ground in Aceh sea water.

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