

ASSESSING THE POTENTIAL OF MODIS ON ESTIMATING
CHLOROPHYLL-A ALONG TERENGGANU COASTAL AREA

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ASSESSING THE POTENTIAL OF MODIS ON ESTIMATING CHLOROPHYLL-*a*
ALONG TERENGGANU COASTAL AREA

By

AIMI FARHANA NOOR BINTI AHMAD ZAINI

Research Report submitted in partial fulfillment of the requirement of the degree of
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**DEPARTMENT OF MARINE SCIENCE
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**RESEARCH PROJECT FINAL YEAR FINAL DRAFT APPROVAL AND
VALIDATION FORM I AND II**

I certify that the report of this year project entitled as:

Assessing the Potential of MODIS on Estimating Chlorophyll- *a* along Terengganu coastal area, by Aimi Farhana Noor Bt Ahmad Zaini, Matric. No UK 9992 has been read and all the alteration and correction recommended by examiners have been done. This final draft submitted to Marine Science Department has been accepted as fulfillment of the requirement for Bachelor of Science (Marine Science) under the faculty of Maritime Studies and Marine Science, University Malaysia Terengganu.

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LIST OF ABBREVIATIONS

MODIS	Moderate Resolution Imaging Spectroradiometer
$^{\circ}\text{C}$	degree Celsius
Chl-a	chlorophyll-a
mg	milligram
m^3	meter cube
m	meter
g	gram
L	liter
mg/m^3	milligram per meter cube
ppt	part per thousand
vs	verses
DNs	digital number
NTU ⁺	turbidity
DO	dissolved oxygen
TDS	total dissolved suspended

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ABSTRACT

The amount of chlorophyll-a depend on the amount of algae and can also be used as an indicator of phytoplankton abundance and biomass in coastal water. The concentration of chlorophyll-a also could be general measured of water quality. The objective of this study is to determine the chlorophyll-a density and it distribution along Terengganu coastal area. Secondly to identify chlorophyll-a using MODIS data and lastly to define the potential of MODIS data on estimating concentration of chlorophyll-a in seawater. Sampling was also done on 17 September 2006 at Merang coastal area and Kuala Terengganu coastal area. The result shows that the concentration of chlorophyll-a is between 1.1-3.4 mg/m³. A series of Moderate Resolution Imaging Spectroradiometer (MODIS) data on 17 September 2006 was used in this study. Regression analysis was done between in-situ data and water-leaving radiance from MODIS. The best regression is between in-situ data and water-leaving radiance from band 12 which is R² of 0.7656. This best regression then was used to developed a map of chlorophyll-a. The result from the map shows that the chlorophyll-a concentration at the study area is between 1.4-2.04 mg/m³. Then, the data from in-situ was compared with MODIS data through simple statistics analysis, correlation between them was determined. The R² value between model chlorophyll-a concentration and in-situ chlorophyll-a concentration is 0.3744. Besides that, two existing algorithms also tested which is Gordon's algorithm and Clark 3-bands algorithm. Gordon's algorithm shows that the best regression were between in-situ data and water-leaving radiance derive from band 9 and band 12 which is R² of 0.7602. The result for Gordon's algorithm shows that the chlorophyll-a concentration is between 1.3-2.4 mg/m³. The correlation of Gordon's algorithm

with in-situ data was measured which is R^2 of 0.488. Clark 3-bands algorithm was utilize from band 9, band 11 and band 12. The R^2 values from in-situ and the *water-leaving radiance* algorithm is 0.7659. The result for Clark 3-bands algorithm shows that the chlorophyll-a concentration is between 0.8-2.5 mg/m^3 . The correlation of Clark 3-bands algorithm with in-situ data was measured which is R^2 of 0.2414.

ABSTRAK

Jumlah kandungan klorofil-a adalah bergantung kepada jumlah kandungan alga dan ianya juga boleh digunakan untuk mewakili fitoplanton di kawasan air. Taburan klorofil-a juga dapat digunakan sebagai salah satu cara dalam penentuan tahap kualiti air. Objektif kajian ini dilakukan adalah untuk mengetahui kepadatan klorofil-a dan taburannya di kawasan perairan Terengganu. Kedua, adalah untuk mengenalpasti taburan klorofil-a menggunakan MODIS dan akhir sekali adalah untuk mengetahui potensi MODIS dalam menganggarkan kepekatan klorofil-a di perairan. Sampling telah dilakukan pada 17 September 2006 di kawasan perairan Merang dan Kuala Terengganu. Keputusan menunjukkan bahawa kepekatan klorofil-a adalah di antara 1.1-3.4 mg/m³. Satu siri data *Moderate Resolution Imaging Spectroradiometer* (MODIS) bertarikh 17 September 2006 telah digunakan dalam kajian ini. Analisis regresi telah dijalankan antara in-situ data dan *water-leaving radiance* daripada MODIS. Regresi terbaik adalah di antara data dari lapangan dengan *water-leaving radiance* daripada band 12 iaitu R² ialah 0.7656. Regresi ini kemudiannya digunakan untuk membina peta klorofil-a. Keputusan daripada peta menunjukkan kepekatan klorofil di kawasan kajian adalah di antara 1.4-2.04 mg/m³. Data daripada lapangan kemudian di bandingkan dengan data MODIS melalui analisis statistik yang ringkas di mana kolerasi antara keduanya dikenalpasti. Nilai R² antara klorofil-a yang dikira dengan klorofil-a lapangan adalah 0.3744. Selain daripada itu, dua algoritma yang telah wujud bagi klorofil-a juga diuji iaitu algoritma Gordon's dan algoritma Clark 3-bands. Gordon's algoritma menunjukkan bahawa regresi terbaik adalah antara data dari lapangan dan *water-leaving radiance* daripada kombinasi band 9 dan band 12 iaitu R² adalah 0.7602.

Keputusan daripada Gordon algoritma menunjukkan bahawa kepekatan klorofil-a adalah antara 1.3-2.4 mg/m³. Kolerasi antara Gordon's algoritma dengan in-situ dikira iaitu R² adalah 0.488. Clark 3-band algoritma pula menggunakan kombinasi band 9, band 11 dan band 12. Nilai R² daripada regresi Clark 3-band algoritma dan data *water-leaving radiance* tersebut adalah 0.7659. Keputusan daripada algoritma Clark-3 bands menunjukkan bahawa kepekatan klorofil-a adalah antara 0.8-2.5 mg/m³. Kolerasi antara data dari lapangan dengan Clark 3-band R² adalah 0.2414.