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

ANIS FARHANA MOOR BINTI AHMAD ZAIMI

DEPARTMENT MARINE SCIENCES
FACULTY OF SCIENCE AND TECHNOLOGY
UNIVERSITY MALAYSIA TERENGGANU

2007

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 Bachelor of Science-Marine Science

Department of Marine Science
Faculty of Maritime Studies and Marine Science
UNIVERSITI MALAYSIA TERENGGANU
2007

This project report should be cited as:

Aimi, F.N.A.Z. 2007. Assessing the Potential of MODIS on Estimating Chlorophyll-*a* along Terengganu Coastal Area. Undergraduate thesis Bachelor of Science in Marine Science, Faculty of Maritime Studies and Marine Science, University Malaysia Terengganu. p 67.

DEPARTMENT OF MARINE SCIENCE

FACULTY OF MARITIME STUDIES & MARINE SCIENCE

UNIVERSITY MALAYSIA TERENGGANU

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.

Approved by:

.....

Main Supervisor

Name: Dr. Razak Bin Zakariya

Date: 31/5/07

DR. RAZAK ZAKARIYA
Ketua Jabatan Sains Marin
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu
(UMT)

.....

Head of Marine Science Department

Name: Dr. Razak Bin Zakariya

Date: 31/5/07 .

ACKNOWLEDGEMENT

Alhamdulillah. In the name of Allah and bless of Him, I have finished my final year project on estimating chlorophyll-a using MODIS data. Throughout of a year doing this project, I have faced a lot of problems and challenges which taught me that a winner never quit.

In preparing this study, I was in contact with many people, researchers, and academicians. In particular, I wish to express my sincere appreciate to my supervisor, Dr.Razak Zakariya for encouragement, advice and motivation. I also thankful to Mr. Suffian Idris and Miss Nurul Adilla for giving advice and guidance. I would like to thank to all lab assistances and science officers for always assist me and also to Malaysia Centre for Remote Sensing (MACRES) for giving the data for this project.

I want to take this opportunity to express my appreciation to my parent, Mr. Ahmad Zaini Alias and Mrs. Hasnah Abu Hassan, also my beloved sister Aimi Fadhilah Hazwani. They gave me the encouragement from the beginning until the completion of the study. The appreciation is also goes to all my friends who willingly and graciously shared their opinions and knowledge especially Muna, Ah, Ct, Dada, Erin, Nik, Ekeen, Rina, Huda, Afiq and Sabrina. Finally, appreciations go to my beloved Mohd Hamdan Abdul Hamid for his love, support and understanding.

Thank you very much.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

MODIS	Moderate Resolution Imaging Spectroradiometer
^0C	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

LIST OF APPENDICES

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/m^3. 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 R^2 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/m^3. Then, the data from in-situ was compared with MODIS data through simple statistics analysis, correlation between them was determined. The R^2 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 R^2 of 0.7602. The result for Gordon's algorithm shows that the chlorophyll-a concentration is between 1.3-2.4 mg/m^3. 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 bleh 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 kloropfil-a dan taburannya di kawasan perairan Terengganu. Kedua, adalah untuk mengenalpasti taburan kloropfil-a mengunakan 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 kloropfil-a adalah di antara 1.1-3.4 mg/m^3. 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 R^2 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/m^3. Data daripada lapangan kemudian di bandingkan dengan data MODIS melalui analisis statistik yang ringkas di mana kolerasi antara keduanya dikenalpasti. Nilai R^2 antara klorofil-a yang dikira dengan klorofil-a lapangan adalah 0.3744. Selain daripada itu, dua algoritma yang telah wujud bagi kloropfil-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 R^2 adalah 0.488. Clark 3-band algoritma pula menggunakan kombinasi band 9, band 11 dan band 12. Nilai R^2 daripada regerasi Clark 3-band algoritma dan data *water-leaving radiance* tersebut adalah 0.7659. Keputusan daripada algorima Clark-3 bands menunjukkan bahawa kepekatan klorofil-a adalah antara 0.8-2.5 mg/m^3. Kolerasi antara data dari lapangan dengan Clark 3-band R^2 adalah 0.2414.