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Perpustakaan Sultanah Nur Zahirah (UMT)
Universiti Malaysia Terengganu

PERPUSTAKAAN SULTANAH NUR ZAHIRAH
UMT

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Determination of Chlorophyll-a concentrations in the coastal waters of Kuala Terengganu using OCM (Ocean Color Monitor) satellite data / Nor Azlin Mokhtar.

PERPUSTAKAAN SULTANAH NUR ZAHIRAH
UNIVERSITI MALAYSIA TERENGGANU (UMT)
21030 KUALA TERENGGANU

1100054361		

Lihat sebelah

HAK MILIK
PERPUSTAKAAN SULTANAH NUR ZAHIRAH UMT

DETERMINATION OF CHLOROPHYLL-A CONCENTRATIONS IN THE COASTAL WATERS OF KUALA TERENGGANU USING OCM (OCEAN COLOR MONITOR) SATELLITE DATA

NOR AZLIN BINTI MOKHTAR

Department of Marine Science

Faculty of Maritime Studies and Marine Science

UNIVERSITI MALAYSIA TERENGGANU

2007

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DETERMINATION OF CHLOROPHYLL-A CONCENTRATIONS IN THE COASTAL WATERS OF KUALA TERENGGANU USING OCM (OCEAN COLOR MONITOR) SATELLITE DATA

By

Nor Azlin Binti Mokhtar

Research Report submitted in partial fulfillment of
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JABATAN SAINS SAMUDERA
FAKULTI PENGURUSAN MARITIM DAN SAINS MARIN
UNIVERSITI MALAYSIA TERENGGANU

RESEARCH PROJECT REPORT APPROVAL AND VALIDATION FORM I AND II

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

DETERMINATION OF CHLOROPHYLL-A CONCENTRATION IN THE COASTAL WATERS OF KUALA TERENGGANU USING OCM (OCEAN COLOR MONITOR) SATELLITE DATA by **NOR AZLIN BT MOKHTAR** No. Matrics: **UK 10037** has been read and all the alteration and correction recommended by examiners have been done. This report has been submitted and accepted as fulfillment of the requirement for **Bachelor of Science (Marine Science),** under the Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

Approved by:

.....

First Supervisor
Name: MOHD SUFFIAN IDRIS
Pensyarah
Institut Oseanografi
Universiti Malaysia Terengganu (UMT)
21030 Kuala Terengganu, Terengganu.

Date : 23/5/07

.....

Head of Marine Science Department,
Second Supervisor
Name: DR. RAZAK ZAKARIYA
Ketua Jabatan Sains Marin
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu
(UMT)

Date : 6/6/07

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LIST OF ABBREVATION AND SYMBOLS

SYMBOL	DEFINITION
OCM	Ocean Color Monitor
IRS-P4	Indian Remote Sensing Satellite-Project 4
SST	Sea surface temperature
TOA	Top of the atmosphere
$L_w(\lambda)$	Water leaving reflectance
R_{rs}	Remote sensing reflectance
R_{rs} (%)	Percentage Remote sensing Reflectance
Lwn	Normalized water leaving radiance
Ca	Chlorophyll-a
OCTS	Ocean Color and Temperature Scanner
SeaWiFS	Sea-viewing Wide field of view Sensor
MODIS	Moderate Resolution Imaging Spectroradiometer
MERIS	Medium Resolution Imaging Spectroradiometer
rpm	Revolutions per minute
RMSE	Root-mean-square error
SNR	Signal to noise ratio
nLw	Normalized water leaving radiance
IRS-P3	Indian Remote Sensing Satellite-Project 3
GPS	Global Positioning System

Temp	Water temperature, °C
HPLC	High-performance liquid chromatographic
Chl	Chlorophyll *a* concentration, mgm^{-3}
PP	Primary production, mg C m^{-3} d^{-1}
NTU	Nepholometric Turbidity Unit
VNIR	Visible/near infra-red
mg/m^3, mgm^{-3}	Miligram per cubic meter
nm	Nanometer
km	Kilometer
m	Meter
%	Percentage
m/s	Meter per second
µm	Micrometer
$MgCO_3$	Magnesium carbonate
µg/L	Microgram per liter
mL	Mililiter
V	Volume
ppt	Part per thousand
$\rho_r(\lambda_i)$	Rayleigh scattering in the absence of aerosols
$\rho_a(\lambda_i)$	Aerosols scattering in the absence of air
$\rho_{ra}(\lambda_i)$	Rayleigh and aerosol scattering
$t(\lambda_i)$	Diffuse transmittance for water leaving radiance

$\rho_w\ (\lambda_i)$	Water leaving radiance
L_λ	Measured radiance
F_0	Extraterrestrial irradiance
$cos\ \theta_0$	Solar zenith angle

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ABSTRACT

The field of remote sensing can be used to determine the distribution of different types of constituents in seawater such as chlorophyll-a, Colored Dissolved Organic Matter (CDOM) and Total Suspended Solids (TSS). In this research, IRS-P4, OCM satellite data was used to determine the chlorophyll-a concentration in the coastal waters of Kuala Terengganu. Twenty-two sampling stations were setup and data collections were conducted on the 14th of September 2006 and 17th of September 2006 concurrently with satellite overpass. The data from the satellite image were extracted to derive the empirical model of chlorophyll-a. The highest R^2 value was used to estimate surface water variables in the study area. Using the model maker, map of chlorophyll-a distribution were derived from the algorithm and the concentration of chlorophyll-a at the study area were determined and compared with actual data. The highest R^2 was found at band 4 (510 nm) with R^2=0.7739, ($y = 7.7352x^{1.8296}$) and the second highest R^2 was found at band 5 (555 nm) with R^2=0.7026, ($y = 4.3484x^{1.0117}$). Algorithm from band 4 indicates station 12 as the highest concentration while band 5 indicates station 21. These two stations were located near to the coastal area, and might be contain high concentration of phytoplankton. Band 4 and 5 algorithms were also indicated that station 17 has the lowest chlorophyll-a which located quite far from the coastal area. It can be concluded that the distance from coastal area and water turbidity have a great influence on the concentration of chlorophyll-a at the study area.

ABSTRAK

Bidang penderiaan jauh boleh digunakan untuk menentukan pelbagai konstituen-konstituen yang terdapat dalam air laut seperti taburan klorofil-a, Bahan Organik Terlarut (CDOM) dan Jumlah Pepejal Terampai (TSS). Dalam kajian ini, IRS-P4, OCM satellite data digunakan untuk menentukan kandungan klorofil-a di kawasan perairan Kuala Terengganu. Dua puluh dua stesen kajian telah dipilih dan pengambilan data dijalankan pada 14hb September 2006 and 17hb September 2006 serentak dengan lintasan satelit. Data daripada imej satelit diekstrak untuk mendapatkan 'empirical model' klorofil-a. Nilai R^2 tertinggi digunakan untuk melihat perubahan air permukaan di kawasan kajian. Menggunakan 'model maker', peta taburan klorofil-a dihasilkan daripada algorithm dan kandungan klorofil-a di kawasan kajian dibandingkan dengan data sebenar. Nilai R^2 tertinggi adalah pada jalur 4 (510 nm) iaitu R^2=0.7739, ($y = 7.7352x^{1.8296}$) dan R^2 kedua tertinggi pada jalur 5 (555 nm) iaitu R^2=0.7026, ($y = 4.3484x^{1.0117}$). Algorithm daripada Jalur 4 menunjukkan stesen 12 mempunyai kandungan klorofil-a tertinggi manakala jalur 5 pada stesen 21. Kedua-dua stesen ini terletak berhampiran dengan kawasan persisiran pantai dan berkemungkinan mempunyai kandungan fitoplankton yang tinggi. Algorithm daripada jalur 4 dan 5 menunjukkan stesen 17 mempunyai kandungan klorofil-a terendah kerana terletak agak jauh daripada kawasan persisiran pantai. Ini boleh disimpulkan bahawa jarak daripada kawasan persisiran pantai dan kekeruhan air banyak mempengaruhi kandungan klorofil-a di kawasan kajian.