

SHALLOW WATER DEPTH DETERMINATION  
BY USING REMOTE SENSING AT  
LANG TENGAH ISLAND, TERENGGANU

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FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
UNIVERSITI MALAYSIA TERENGGANU

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**SHALLOW WATER DEPTH DETERMINATION BY USING REMOTE  
SENSING AT LANG TENGAH ISLAND, TERENGGANU**

**By**

**Aw Pei Rui**

**Research Report submitted in partial fulfillment of  
the requirement for the degree of  
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**DEPARTMENT OF MARINE SCIENCE  
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**DECLARATION AND VERIFICATION FORM**

**FINAL YEAR RESEARCH PROJECT**

It is hereby declared and verified that this research report entitled:

**Shallow Water Depth Determination by Using Remote Sensing at Lang Tengah Island, Terengganu** by **Aw Pei Rui**, Matric No. **UK 20363** has been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfillment towards obtaining the Degree of **Bachelor of Science (Marine Science)**, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

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## ABBREVIATIONS

1.	%	Percentage
2.	$\Delta\lambda_{\text{Band}}$	Effective bandwidth for a given band
3.	$B_1$	Band 1
4.	$B_2$	Band 2
5.	$d_a$	Actual depth
6.	$d_p$	Predicted depth
7.	$D$	Distance
8.	$D$	Depth
9.	$dc$	Draft correction
10.	$DN$	Digital Number
11.	$E'$	Sun elevation angle adjusted for refraction through seawater
12.	$E_d$	Down-welling irradiance entering the water
13.	$I$	Denote visible bands
14.	$IR$	Near-infrared band
15.	$k$	Attenuation coefficients
16.	$k_1$	Absolute radiometric calibration factor for Band 1
17.	$k_2$	Absolute radiometric calibration factor for Band 2
18.	$k_3$	Absolute radiometric calibration factor for Band 3
19.	$K_{\text{Band}}$	Absolute radiometric calibration factor for a given band
20.	$L_d$	Signal receive by sensor from deep water
21.	$L_o$	Signal receive by sensor from shallow water
22.	$L_w$	Water-leaving radiance
23.	$L_x$	Signal receive by sensor from water depth $x$
24.	$L_{\lambda \text{ Pixel, Band}}$	Top-of-atmosphere spectral radiance image pixels
25.	$m$	Meter
26.	$m.s.l$	Mean sea level
27.	$m_0$	Offset for a depth of 0m

- 28.  $m_1$  Tunable constant to scale the ratio depth
- 29.  $n$  Constant to assure the algorithm is positive under all circumstances
- 30.  $n$  Numbers of station
- 31.  $q_{\text{Pixel, Band}}$  Radio metrically corrected image pixels
- 32.  $R^2$  Correlation coefficient
- 33. RGB Red-Green-Blue
- 34. RMSE Root Mean Square Error
- 35.  $R_w$  Observed reflectance
- 36. SCS South China Sea
- 37.  $Y$  Constant to correct for spectral variation and depends on aerosol type
- 38.  $z$  Depth
- 39.  $\lambda$  Wavelength of the spectral band
- 40.  $\Sigma$  Sum
- 41.  $\sqrt{\quad}$  Square root

## ABSTRACTS

The traditional hydrographical surveys are conducted via shipboard echo sounding. This traditional method is able to generate accurate water depth but it is high operating cost, labor-intensive, time-consuming and inefficiency. To overcome this problem, the application of remote sensing in bathymetry study has been extensively explored in recent years. Compared to the traditional method, satellite remote sensing technique is more cost-effective, easier and quicker. Besides, bathymetric measurement via remote sensing also has the advantage that the data are collected synoptically over large areas. This study is discusses the determination of bathymetry of a shallow water area applying remote sensing techniques at Lang Tengah Island, Terengganu. There are two methods used in this study, which is linear method (Benny and Dawson method) and ratio method. Both methods require the same pre-processing process, included geometric correction, atmospheric correction, and masking. The results obtained were compared with ground truth data. The accuracy of the methods is discussed and the compared between the two methods. The result shows that Band 2 for Benny and Dawson method has the highest correlation coefficient,  $R^2$ , among the three bands, which is 0.9533. Ratio method has a higher  $R^2$  compared to the Band 2 for Benny and Dawson method as its  $R^2$  achieve 0.9607. Ratio method is better in deriving bathymetry from satellite imagery compared to linear method. Ratio method is more robust as it only needs two tunable parameters whereas linear method requires more than two tunable parameters.



# **Penentuan Kedalaman Air Kawasan Cetek Dengan Menggunakan Penderiaan Jauh Di Pulau Lang Tengah, Terengganu**

## **ABSTRAK**

Penyiasatan hidrografi secara tradisional adalah dijalankan melalui pemerum gema. Kaedah tradisional ini mampu untuk menjana kedalaman air yang tepat tetapi kaedah ini memerlukan kos operasi yang tinggi, memerlukan sumber tenaga manusia yang banyak, memakan masa dan kurang kecekapan. Untuk mengatasi masalah ini, aplikasi penderiaan jauh dalam kajian batimetri telah diterokai dengan luas pada tahun-tahun kebelakangsn. Berbanding dengan kaedah tradisional, teknik penderiaan jauh lebih berjimat, mudah dan cepat. Di samping itu, kajian batimetri melalui penderiaan jauh juga boleh mengumpul data di kawasan yang luas secara ringkas. Kajian ini membincang tentang penentuan batimetri di kawasan air cetek dengan menggunakan teknik penderiaan jauh di Pulau Lang Tengah, Terengganu. Terdapat dua kaedah yang digunakan dalam kajian ini, iaitu kaedah linear (kaedah Benny and Dawson) dan kaedah nisbah. Kedua-dua kaedah ini mempunyai pra-pemprosesan yang sama, termasuk pembetulan geometri, pembetulan atmosfera, dan penyolekan. Keputusan yang diperolehi dari dua kaedah akan dibandingkan. Hasilannya merujukan Kaedah nisbah (0.9607) mempunyai ketepatan yang lebih tinggi daripada kaedah linear (0.9533) sedangkan kaedah nisbah hanya memerlukan dua parameter boleh laras tetapi kaedah linear memerlukan lebih dari dua parameter boleh laras.