A STUDY ON THE METEOROLOGICAL INFLUENCES TOWARD THE PHYSICAL CHARACTERISTICS OF COASTAL WATER IN BIDONG ISLAND

KOK POH HENG

FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

2012

A Study on the meteorological influences towards the physical characteristics of coastal water in Bidong Island / Kok Poh Heng.

Lihat sebelah

This project report should be cited as:

Kok, P.H. 2012. A study on the meteorological influences toward the physical characteristics of coastal water in Bidong Island. Undergraduate thesis, Bachelor of Science In Marine Science, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu, Terengganu. 68p.

DEPARTMENT OF MARINE SCIENCE
FACULTY OF MARITIME STUDIES AND MARINE SCIENCE
UNIVERSITI MALAYSIA TERENGGANU

DECLARATION AND VERIFICATION FORM

FINAL YEAR RESEARCH PROJECT

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

A Study on the Meteorological Influences toward the Physical Characteristics of Coastal Water in Bidong Island by **Kok Poh Heng**, Matric No. **UK 20856** has been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfilment towards obtaining the Degree of **Bachelor of Science (Marine Science)**, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

Verified by:

.....

Principal Supervisor

Name: Dr. Mohd Fadzil Mohd Akhir

DR. MOHD FADZIL MOHD AKHIR
Pensyarah
Jabatan Sains Marin
Fakulti Pengajian Maritim dan Sains Marin
Universiti Malaysia Terengganu (UMT)
21030 Kuala Terengganu.

Official stamp: Date: .....

.....

Second Supervisor (where applicable)

Name:

Official stamp: Date: .....

.....

Head of Department of Marine Science

Name: Prof. Madya Dr. Rosnan Yaacob

Official stamp: Date: .....

ACKNOWLEDGEMENT

First and foremost, I would like to deliver my gratitude to my research supervisor, Dr. Mohd Fadzil Mohd Akhir on his passionate support, endless guidance, and patience in developing me throughout the study. I am indeed appreciating his help, informative data while I face difficulties.

Special thanks to Petronas Carigali Shd Bhd for their support throughout this research. Without their contribution, this research might not be successful. Thank you so much for the precious contribution.

I also would like to thank Dr. Nor Antonina Abdullah, the coordinator of Final Year Project for support and advices. Not forgetting Nur Hidayah Roseli for the knowledge sharing regarding Matrix Laboratory (MATLAB) applications, and also all lecturers and supporting executives of Marine Science Department, Faculty of Maritime Studies and Marine Science that hardly cooperated to help us to complete our Final Year Project.

My heartfelt gratitude goes to my beloved family who always concern and support me throughout my life by upholding me in their prayers and for their love and encouragement.

Last but not least, I would like to thank all those who had in one way or another contributed to the success of this study and overall to everyone who were there for me at any point of time beginning from the time I started to do this Final Year Project until the day I completed it.

TABLE OF CONTENTS

CONTENT	PAGE
DECLARATION AND VERIFICATION FORM	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF SYMBOLS AND ABBREVIATIONS	xi
LIST OF APPENDICES	xiii
ABSTRACT	xiv
ABSTRAK	xv
CHAPTER 1: INTRODUCTION	
1.1 Introduction	1
1.2 Problem Statement/Justification	5
1.3 Objectives	7

CHAPTER 2: LITERATURE REVIEW

2.1 Bidong Island 8

2.2 Physical Characteristics

2.2.1 Temperature Distribution 9

2.2.2 Salinity Distribution 10

2.2.3 Current Circulation 11

2.3 Relationship between Meteorological Properties and Physical Characteristics of Sea Water

2.3.1 Solar Radiation 12

2.3.2 Precipitation 14

2.3.3 Wind 14

CHAPTER 3: METHODOLOGY

3.1 Sampling Description

3.1.1 Sampling Stations 18

3.2 Material and Method

3.2.1 Distribution of Data 19

3.2.2 Data of Sea Water Salinity and Temperature 20

3.2.3 Data of Current Circulation 20

3.2.4 Data of Wind Speed and Direction 20

3.2.5 Data of Weather Condition 21

CHAPTER 4: RESULTS

4.1 Temperature Distribution 22

4.2 Salinity Distribution 28

4.3 Temperature/Salinity Diagram 34

4.4 Current Circulation 36

CHAPTER 5: DISCUSSION

5.1 Temperature Distribution 40

5.2 Salinity Distribution 46

5.3 Temperature/Salinity Diagram 50

5.4 Current Circulation 51

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS 57

REFERENCES 59

APPENDICES 66

CURRICULUM VITAE 68

LIST OF TABLES

TABLE		PAGE
5.1	Weather condition of all transects.	42
5.2	Average wind speed of all transects.	43
5.3	Comparison of wind speed between current speed at surface and subsurface in the period of falling tide and rising tide.	55

LIST OF FIGURES

FIGURE		PAGE
1.1 (a)	Wind stress pattern of Southwest Monsoon (Akhir, 2010).	4
1.1 (b)	Wind stress pattern of Northeast Monsoon (Akhir, 2010).	4
1.2 (a)	Surface current circulation of Southwest Monsoon (Wyrtki, 1961).	4
1.2 (b)	Surface current circulation of Northeast Monsoon (Wyrtki, 1961).	4
2.1	Location of Bidong Island.	8
2.2	Temperature depth profile (Garrison, 2007).	9
2.3	Salinity depth profile (Garrison, 2007).	10
2.4	Ekman spiral at Northern Hemisphere (Garrison, 2007).	16
2.5	Current at sea breeze condition (Werner *et al.*, 1993).	17
3.1	Location of sampling stations.	18
3.2	Location of sampling stations according to time.	19
4.1	Temperature depth profile for morning.	23
4.2	Temperature depth profile for early afternoon.	24
4.3	Temperature depth profile for late afternoon.	25
4.4	Temperature depth profile for late afternoon at first 10 m.	26

4.5	Comparison of temperature depth profile between morning, early afternoon and late afternoon.	27
4.6	Salinity depth profile for morning.	29
4.7	Salinity depth profile for early afternoon.	30
4.8	Salinity depth profile for late afternoon.	32
4.9	Comparison of salinity depth profile between morning, early afternoon and late afternoon.	33
4.10	T/S diagram for morning, early afternoon and late afternoon.	35
4.11	Quiver plot for surface current.	37
4.12	Quiver plot for subsurface current.	38
4.13	Quiver plot for comparison between surface and subsurface current.	39
5.1	Comparison of salinity depth profile result from precipitation and without precipitation.	48
5.2	T/S diagram in Northeast Monsoon and Southwest Monsoon (Saadon and Camerlengo, 1996).	50
5.3	Tidal graph of Transect 1 on 7th July 2011 (National Hydrographic Centre, 2011).	52
5.4	Tidal graph of Transect 2, 3, 4 and 5 on 8th July 2011 (National Hydrographic Centre, 2011).	52
5.5	Tidal graph of Transect 6, 7 and 8 on 9th July 2011 (National Hydrographic Centre, 2011).	53
5.6	Wind direction according to date and Transect.	54

LIST OF SYMBOLS AND ABBREVIATIONS

′ / °	: Degree
″	: Minute
°C	: Degree Celsius
E	: East
km	: Kilometre
KT	: Kuala Terengganu
m	: metre
MATLAB	: Matrix Laboratory
ms^{-1}	: Metre per second
N	: North
NE	: Northeast
NW	: Northwest
ppt	: Parts per thousand $^{0}/_{00}$
SCS	: South China Sea

SE : Southeast

SEA : Southeast Asia

SST : Sea Surface Temperature

SW : Southwest

T/S Diagram : Temperature Salinity Diagram

LIST OF APPENDICES

APPENDIX		PAGE
A	Sampling sites coordinate for each station.	66
B (1)	Instrument that used in this study, Hydrolab Data Sonde 4a.	67
B (2)	Instrument that used in this study, Valeport 106 Current Meter.	67

ABSTRACT

This investigation is aimed to determine the physical characteristics and also to determine the meteorological effects on the physical characteristics of coastal water in Bidong Island. Study on water temperature showed low albedo of sea water caused higher water temperature in late afternoon than in the morning and early afternoon. Nonetheless, strong wind decreased sea water temperature. While salinity distribution analysis showed evaporation result from solar radiation and strong wind increased sea water salinity. However, precipitation declined sea water salinity through dilution factor. When there is sunny daylight, sea water salinity and water temperature recorded higher. Mixed layer depth increased when the strong wind blows across sea water. The Temperature/Salinity (T/S) diagram has shown that, in July, the sea water in Bidong Island shared common characteristics with sea water in South China Sea (SCS) during the Southwest Monsoon. The analysis revealed that the current circulation near Bidong Island was influenced by tide. Costal water in Bidong Island flowed toward coastal area of Kuala Terengganu (KT) during rising while flowed away from coastal area near KT during falling tide. Nevertheless, strong wind is able to alter the current direction generated from tidal effect. Current speed is higher during rising tide if compare to falling tide.

ABSTRAK

Kajian ini bertujan untuk menentukan ciri-ciri fizikal dan untuk menentukan kesan meteorologi pada ciri-ciri fizikal air pantai di Pulau Bidong. Kajian mengenai suhu air menunjukkan bahawa albedo rendah air laut telah menyebabkan suhu air pada lewat petang mencatat lebih tinggi dari pagi dan awal petang. Walau bagaimanapun, angin kencang dapat menurunkan suhu air laut. Analisis mengenai taburan kemasinan air laut menunjukkan bahawa penyejatan daripada kesan sinaran suria dan angin kencang dapat meningkatkan kemasinan air laut. Tetapi, pemendakan daripada awan menyebabkan kemasinan air laut menurun melalui faktor pencairan. Pada hari yang cerah, kemasinan air dan suhu air adalah tinggi. Kedalaman lapisan campuran meningkat jika angin kencang bertiup atas permukaan air. Gambarajah Suhu/Kemasinan pada Julai telah menunjukkan bahawa air laut di Pulau Bidong mempunyai ciri-ciri yang sama dengan air laut di Laut China Selatan semasa Monsun Barat Daya. Analisis ini mendedahkan bahawa peredaran arus di Pulau Bidong adalah dipengaruhi oleh air pasang surut. Air pantai Pulau Bidong mengalir ke kawasan pantai Kuala Terengganu (KT) semasa air pasang manakala air mengalir dari kawasan pantai Pulau Bidong semasa air surut. Walau bagaimanapun, angin kencang mampu untuk mengubah arah arus yang dijana daripada air pasang surut. Kelajuan arus adalah tinggi ketika air pasang dan rendah ketika air surut.