

**UNIVERSITI TEKNOLOGI MARA**

**GRAVITY FIELD AND STEADY-STATE OCEAN  
CIRCULATION EXPLORER GLOBAL  
GEOPOTENTIAL MODEL EVALUATION OVER  
PENINSULAR MALAYSIA**

**SITI NORIANIS BINTI AB. WAHAB**

Dissertation submitted in  
fulfillment of the requirements for  
the degree of  
**Bachelor of Surveying Science and Geomatics**

**Faculty of Architecture, Planning, and  
Surveying**

**August 2020**

## AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student : Siti Norianis binti Ab. Wahab  
Student's ID No : 2016656546  
Faculty : Faculty of Architecture, Planning and Surveying  
Programme : Bachelor in Surveying Science and Geomatics (Hons)  
Code Programme : AP220  
Project Title : Gravity Field and Steady-State Ocean Circulation Explorer  
Global Geopotential Model Evaluation Over Peninsular  
Malaysia  
Signature : *Siti Norianis*  
Date : August 2020

## ABSTRACT

Generally, geodesy is well defined as a science of accurately measuring and understanding the Earth's geometric shape, orientation in space, and gravity as well as the changes of these properties with time. Nowadays, GPS is used in increasingly and widely in all areas. However, the height information in GPS is not the actual height and they need to do the corrections (Abidin, 2007). In that case, the research study was carried out with the aim to evaluate a Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) Global Geopotential Model (GGM) over Peninsular Malaysia. While the objective is to evaluate the most accurate Gravity Field and Steady-State Ocean Circulations Explorer (GOCE) Global Geopotential Model (GGM). In order to achieve this research aim, sixteen of GOCE GGM was been used and it contain data satellite-only. Therefore, GNSS levelling also have been used as an input data to calculate the RMSE of the GGM. Based on the selected GOCE GGM that had been choose in previous objective, the second objective is to improve the accuracy of the best Gravity Field and Steady-State Ocean Circulations Explorer (GOCE) Global Geopotential Model (GGM) had been done. The data was analysed to evaluate and determine the GO CON SPW R2 is the most accurate GOCE GGM among the others GOCE GGM. This was been proved by computing the accuracy of the model by doing fitting geoid as the correction for the gravimetric geoid model.

# TABLE OF CONTENT

	<b>Page</b>
<b>CONFIRMATION BY PANEL OF EXAMINERS</b>	<b>i</b>
<b>AUTHOR'S DECLARATION</b>	<b>ii</b>
<b>ABSTRACT</b>	<b>iii</b>
<b>ACKNOWLEDGEMENT</b>	<b>iv</b>
<b>TABLE OF CONTENT</b>	<b>v</b>
<b>LIST OF TABLES</b>	<b>viii</b>
<b>LIST OF FIGURES</b>	<b>ix</b>
<b>LIST OF ABBREVIATIONS</b>	<b>x</b>
<b>CHAPTER 1: INTRODUCTION</b>	<b>1</b>
1.1 Research Background	1
1.2 Problem Statement	2
1.3 Aim of Study	2
1.4 Objective	2
1.5 Study Area	3
1.6 Data	4
1.6.1 Global Geopotential Model (GGM)	4
1.6.2 GNSS Levelling	5
1.7 Software	6
<b>CHAPTER 2: LITERATURE REVIEW</b>	
2.1 Introduction	7
2.2 Geodetic Surface	7
2.2.1 Topography Surface	8
2.2.2 Geoid Surface	9

2.2.3	Ellipsoid Surface	10
2.2.4	Mean Sea Level (MSL) Surface	10
2.3	Geodetic Height	11
2.3.1	Orthometric Height	11
2.3.2	Ellipsoidal Height	13
2.4	MyGEOID	14

### **CHAPTER 3: RESEARCH METHODOLOGY**

3.1	Introduction	16
3.2	Research Methodology	16
3.2.1	Preliminary Study	18
3.2.2	Study Area	18
3.2.3	Data Acquisition	19
3.2.3.1	Global Geopotential Model	19
3.2.3.2	GNSS Levelling	20
3.2.4	Data Processing	22
3.2.4.1	Assessment for GGM	22
3.2.4.2	Hybrid Geoid Model	23
3.2.4.3	Checking for New Hybrid Geoid Model	23

### **CHAPTER 4: RESULT AND ANALYSIS**

4.1	Introduction	24
4.2	Assessment for GGM	24
4.3	Hybrid Geoid Model by Using GRAVSOFT software	26
4.4	Final Geoid Model	27

### **CHAPTER 5: CONCLUSION AND RECOMMENDATION**

5.1	Introduction	29
-----	--------------	----