DEVELOPMENT OF TEC MEASUREMENT AND CALCULATION MODULE: DIFFERENT MODELS (SLM, M-SLM, KLOBUCHAR MODEL)

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ABSTRACT

The parameter of ionosphere that contributes severe effects on radio signals is the total number of electron content or total electron content (TEC). TEC can be estimated from the code and phase measurements based on the extracted Global Positioning System (GPS) data. Information of TEC reflects the relationship to the ionospheric layers due to high density of electron concentration at F region. At equatorial region (geographical latitude: 25° S to 25° N), the peak electron density height region varies from 275 km to 575 km and varies marginally from 300 km to 350 km at and beyond the anomaly crest region. It is vital to use suitable mapping function at equatorial region so that TEC value can be obtained precisely. The equatorial's ionosphere is unique due to the exposure of ultraviolet (UV) radiation from the sun at this region is much higher. This paper clarify the characterization of TEC mapping based on Single Layer Model (SLM) and Modified Single Layer Model (M-SLM) in order to determine the appropriate TEC value in equatorial region. TEC is extracted using RINEX format GPS dual frequency data that supplied by JUPEM (Department Of Survey and Mapping Malaysia). This paper investigates the TEC parameter covered the period of 4 hours duration (day and night) on 8 November 2005 from two different GPS receiver stations, located at Wisma Tanah Kuala Lumpur, KTPK and at Universiti Sains Malaysia, USMP.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

The Global Positioning System (GPS) has become a powerful tool for ionospheric studies. The accuracy of coordination data for the GPS receiver by the GPS monitoring station should be increased. The accuracy can be increased by determining the sources of the disturbances that have been produced by all of ionospheric effects. One of the disturbances that contribute severe effect on radio signal is caused by the parameter of ionosphere known as the total number of electron content or total electron content (TEC).

This project discussed on three different mapping functions; Single Layer Model (SLM), Modified Single Layer Model (M-SLM) and Klobuchar Model that can be used to estimate the appropriate TEC value using the GPS data. These mapping functions provide different level accuracy of TEC value based on different conditions of ionosphere.

TEC measurements from GPS receiver to GPS satellite provide a rich source of information about the Earth's ionosphere through a linear combination of GPS range and phase measurements observed on two carrier frequencies by terrestrial-based GPS receivers. The analysis and evaluation of TEC value is important to monitor behavior of the ionosphere as well as for practical application like satellite tracking, satellite to satellite communication, satellite to ground communication and all communication system by using satellite like satellite TV and satellite telecommunication.

Other countries like Europe, Japan and China are already have been done of TEC analysis over their own ionosphere region to improve satellite communication. In Malaysia, there are only a small number of TEC analyses had been done over the Malaysia's ionosphere. The ionosphere over Malaysia is located near the equator line. The equatorial's ionosphere is unique due to the exposure of ultraviolet (UV) radiation from the sun at this region is much higher compare than European country.