INVESTIGATION OF REGIONAL TOTAL ELECTRON CONTENT (TEC) VALUES AT DIFFERENT IONOSPHERIC LAYERS

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AHMAD NIZAM BIN ABDULLAH
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM,
SELANGOR, MALAYSIA

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ABSRACT

The ionosphere plays a vital role in radio communication and have own characteristics depend on their region. This is dependent on the solar and geomagnetic activity of the earth. The purpose of this project is to investigate TEC parameter at different regional such as northern, equatorial and southern region based on different ionospheric layers. The measurements of TEC were extracted from GPS data supplied by Department of Survey and Mapping Malaysia (JUPEM), Australian Regional GPS Network and Northern California Earthquake Data Center which in RINEX format. The regional of TEC were analyzed in different time. The factors that influence the value of TEC are depending to the altitude, time and region (latitude). The TEC is proportional with altitude and inverse proportional with latitude. So that, it is vital to have different ionospheric propagate at different region. At November, the incoming solar radiation is more directly to Northern hemisphere surface and less at Southern hemisphere . So that the ionization process at northern region is more than the ionization at Southern region. The analysis TEC 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. GPS signals can be used to extract ionospheric parameters such as TEC. Several factors affect the quality of real-time ionospheric delay estimation, such as multipath, GPS satellite and receiver L1/L2 differential delays, cycle slips, etc. Dual frequency carrier-phase and code-delay GPS observations are combined to obtain ionospheric observable related to the slant TEC along the satellite receiver line of sight. This results in the absolute differential delay and the remaining noise is discarded. The TEC itself is hard to accurately determine from the slant TEC because this depends on the sunspot activity, seasonal, diurnal and spatial variations and the line of sight which includes knowledge of the elevation and azimuth of the satellite etc.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

In the recent years, the measurements of total electron content (TEC) have gained importance with the increasing demand for the GPS-based navigation applications in trans-ionospheric communications with space-borne vehicles, such as satellites, aircrafts and surface transportations. The TEC measurements are necessary for making appropriate range delay corrections introduced by the ionosphere, both during quiet and disturbed periods (space weather events), such as scintillations and geomagnetic storm periods. The TEC is one of the most important quantitative parameters of the Earth's ionosphere and plasmasphere, which is defined as the height integral of electron density along the ray path from the receiver to the satellite. The analysis TEC 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 country 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 less of TEC analyses over ionosphere over Malaysia. The ionosphere over Malaysia is unique because of it location near the equator line ,as we know the equatorial is absorb more solar radiation and ultra violet compare than Europe country. Below are the processes of project implementation:

1. Study and understand the fundamental of TEC and ionosphere layers.
2. Collect data GPS from Northern California Earthquake Data Center, JUPEM (Department Of Survey and Mapping Malaysia) and Australian Regional GPS Network .
3. Processing data using MATLAB.
4. Analysis result of TEC variation.
5. Make conclusion.