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Space-Based Navigation Systems and Services (4)Author: Mr. VICTOR JOSE GATICA-ACEVEDO
IPN, Mexico

TOTAL ELECTRON CONTENT (TEC) MONITORING SYSTEM BASED ON GNSS

Abstract

Signals from Global Navigation Satellite System (GNSS) are delayed when they travel through the ionosphere, affecting the performance of the GNSS positioning service. In order to correct this delay on GNSS applications, the use of Total Electron Content (TEC) maps are necessary. Several agencies around the world generate TEC maps using GNSS receiver networks and physics-based ionospheric models. Development of monitoring systems that report TEC in real-time is a major concern for aerial navigation based on GNSS. This work presents a proposal for a prototype of a TEC monitoring GNSS-based system for the Mexican territory. First, we present a brief research about the ionospheric techniques based on observations from GNSS receivers. Furthermore, some tests of measurements of TEC applying these GNSS techniques over the Mexican territory are presented in order to identify the behavior of the ionosphere. Next we describe the components of the TEC monitoring system prototype and their functions: TEC monitor, communication network, frame format and server data-base. Data generated by the TEC monitoring system will be presented in both regional TEC maps and an ASCII format file. These TEC data will be applied for the correction of single GNSS positioning and the assessment of these improved results for their use in aerial navigation based on GNSS. This evaluation is done considering technical regulation statements of the International Civil Aviation Organization (ICAO). Currently, the National Oceanic and Atmosphere Administration (NOAA) of the USA through the system named US-TEC put available TEC maps for the North America region. However, this system includes an annotation that says that these TEC estimations should be avoided for regions outside the CONUS as the uncertainty in the modeled TEC is expected to be large in those regions. US-TEC maps are generated using a dense network of GNSS receivers as sources of data which are located inside the US territory. Although TEC values are reported for Mexico, the US-TEC GNSS network does not include receivers located in this territory. With this prototype, we intend to generate the basis for a system which reports the TEC over this not monitored region, in order to be applied on accurate GNSS applications.