IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Interactive Presentations - IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (IP)

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DIURNAL AND SEASONAL VARIATIONS OF GNSS BASED IONOSPHERIC SLAB THICKNESS OVER ARABIAN PENINSULA

Abstract

The Earth's ionosphere is a dynamic and highly variable section of the upper atmosphere. It affects radio communication by reflecting or refracting radio waves when they pass through it. A major consequence of this ionospheric influence is the introduction of errors in the positioning calculated by Global Navigation Satellite Systems (GNSS). To mitigate such errors, the ionosphere is routinely studied by researchers worldwide to develop accurate models that attempt to predict the condition of the ionosphere at any time and above any geographical location. The variability of the ionosphere demands the constant improvement of such models periodically. Unfortunately, most ionospheric models do not perform accurately in the Arabian Peninsula region due to scarcity of monitoring instruments. However, since establishing the Space Weather and Ionosphere (SWI) laboratory at the Sharjah Academy for Astronomy, Space Sciences, and Technology (SAASST) in 2018, the regional ionosphere is now being studied thoroughly.

This study aims to analyze the diurnal and seasonal variations of the ionospheric slab thickness () to recognize different patterns that could help develop highly accurate ionospheric empirical models. Three years of data from the Global Navigation Satellite System (GNSS) receiver and ionosonde radar station installed at Sharjah (25.3oN,55.5oE) have been used for this study. The experimental data were then compared with the NeQuick2 empirical electron density model. Hourly averages of seasonal data show that NeQuick2 has a very good agreement with the experimental data in the peak hours (local midday) of the day in all seasons. However, NeQuick2 fails to calculate variations in the early and late hours of the day. The NeQuick2 data didn't show any real diurnal variation. Generally, NeQuick2 seems to be largely

underestimating the calculations over the Arabian Peninsula, which can be observed from the data of winter, spring, and autumn seasons. However, in summer, the NeQuick2 overestimates , specifically, in the early hours of the day.