

TEC measurements over the Peruvian sector using space and ground-based instrumentation

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ABSTRACT

The low latitude ionosphere is a highly dynamic region where diverse phenomena occur such as spread F, scintillations, equatorial ionization anomaly, seasonal and day-to-day variability of plasma densities, drifts and electric fields. Ground-based beacon receivers have been used to investigate ionospheric plasma density variability and the occurrence of irregularities by measuring the phase difference of radio waves transmitted by Low Earth Orbit (LEO) satellites at different frequencies and calculating the total electron content (TEC) [1], [2], [3]. However, the number of LEO beacon receivers is still limited in the Peruvian sector to obtain density maps with high temporal and spatial resolution after applying tomographic techniques from these satellite instruments.

At the Jicamarca Radio Observatory, we are developing a dual-frequency ground-based receiver system and a nanosatellite radio beacon for measuring the total electron content in the low latitude ionosphere over the Peruvian sector. The aim of this effort will be to contribute to the deployment of more instruments in space and ground for ionospheric observations. The receiver station will be capable of detecting not only the nanosatellite radio beacon signals but also other radio beacons currently in operation that orbit above the Jicamarca Radio Observatory. Therefore, an extended coverage of measurements will allow us to investigate ionospheric characteristics in the area surrounding the Jicamarca Radio Observatory.

In this paper, we describe the scientific mission concept of using radio beacon receivers based on software-defined radio to study the ionospheric behavior in the Peruvian sector by obtaining TEC measurements. We present preliminary receiver measurements of current satellite beacon signals when they orbit at low latitudes over the Peruvian sector near the Jicamarca Radio Observatory. In addition, ionospheric measurements from other ground-based instruments at Jicamarca such as radar and GPS receivers will be shown to compare to the beacon receiver preliminary observations. The data provided by these instruments have the potential to be utilized by tomographic and ionospheric models in order to improve the specification of the ionosphere.

Key words: TEC, Receiver, Radio beacon, Ionosphere, Nanosatellite

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