

Investigation of the Equatorial Ionosphere using the Radio Array of Portable Interferometric Devices (RAPID) at the Jicamarca Radio Observatory

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Extended Abstract

We present a study of observed irregularities in the equatorial ionosphere using data from two new prototype elements of the Radio Array of Portable Interferometric Devices (RAPID) system deployed in Peru. We focus on equatorial plasma processes, including observations of spread-F, the electrojet, and 150 km echoes, observed with the RAPID system. These equatorial phenomena are typically observed as coherent scatter with the Jicamarca Radio Observatory (JRO) 50 MHz radar. The spatial and frequency flexibility of RAPID to observe variations by location and wavelength greatly enhances our ability to study these phenomena. The two prototype field units were deployed in January 2017 at an optical observatory near JRO and Ancón, Peru separated by a 35 km baseline.

We have measured dual-frequency phase-coherent satellite beacon transmissions using RAPID by capturing the voltage-level radio signals of the beacons at 150 MHz and 400 MHz (see example in Figure 1a and 1b, respectively). We analyze a significant set (>30) of beacon satellite observations at the two RAPID locations to observe the total electron content (TEC) gradients and calculate scintillation statistics by comparing phase differences between 150 MHz and 400 MHz beacon signals. If present, ionospheric gradients are readily apparent in the relative TEC. The scintillation data correlates to the presence of ionospheric irregularities. We discuss these observations in terms of the observed scintillation drivers during active periods (e.g., equatorial spread-F conditions).

Figures 1a (left) and 1b (right) Waterfall plots of the Cassiope beacon satellite signals centered at 150 MHz (1a, left) and 400 MHz (1b, right) as recorded by RAPID on 14-January-2017.

