*URSI AP-RASC, Sydney, Australia, 17-22 August 2025*

# New observational modes to study the equatorial ionosphere

Danny E. Scipion* [(1)], Edwar I. Manay [(1)], Roberto Flores [(1)], Percy Condor [(1)], Karim Kuyeng [(1)], Juan C. Espinoza [(1)], John Rojas [(1)], and Kiara Rodriguez [(1)]
(1) Radio Observatorio de Jicamarca, Lima, Peru, e-mail: dscipion@igp.gob.pe; emanay@igp.gob.pe; rflores@igp.gob.pe; pcondor@igp.gob.pe; kkuyeng@igp.gob.pe; jespinoza@igp.gob.pe; jrojas@igp.gob.pe; krodriguez@igp.gob.pe

Studies of the equatorial irregularities has been conducted at the Instituto Geofísico del Perú's Radio Observatorio de Jicamarca (IGP-ROJ) from 1996 by using low power transmitters (20 kW) to characterize the Equatorial ElectroJet (EEJ), the 150 km echoes, and the Equatorial Spread-F (ESF) in the Jicamarca Unattended Low Investigations of the Atmosphere (JULIA) mode, as an addition to Incoherent Scatter mode to obtain ionospheric parameters like Electron density (Ne), composition (H+, He+, Te, Ti), and zonal and vertical drifts.

During the past 5 years, several upgrades were made to the radar system: ground plane replacement, automatic beam switching, new solid state (96 kW) transmitters, and 50 kW T/R switches, in order to keep the radar current to continue monitoring the equatorial ionosphere.

As part of the IGP-ROJ upgrades 2 new medium power transmitters (96 kW) were installed in 2023 to increase the observational capabilities by redefining the JULIA mode into a new JULIA-MP. This updated mode will include, to the traditional JULIA, the estimations of the zonal and vertical ionospheric drifts up to 600 km allowing IGP-ROJ to increase the ISR monitoring to more than 4000 hours a year.

Additionally to the JULIA-MP mode, a new high-power full-aperture "All-ISR" mode is being designed to use the full capabilities of the radar by switching the antenna pointing from perpendicular to off-perpendicular to magnetic field in intervals of 5 minutes to obtain all the ionospheric parameters "simultaneously". This new mode will take advantage of the antenna sensibility to obtain full ionospheric parameters.