



## **Comparing Equatorial F-Region Ionospheric Irregularities From Swarm and Jicamarca**

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In this paper, we present concurrent observations of ionospheric irregularities by the Jicamarca Unattended Long-term Investigation of the Ionosphere and Atmosphere (JULIA) radar, the Langmuir Probes (LPs) on board the Swarm satellites, Digisonde, and Global Positioning System (GPS). Results from this study show that in situ density fluctuations observed by Swarm on magnetic flux tubes that pass over (or near) Jicamarca Radio Observatory (JRO) can be used as an indicator of spread F and scintillation over (or near) JRO. A simple classification procedure basing on the presence or absence of structures was carried out specifically for Swarm and JULIA for the years 2014-2017 when both data sets were available. For the majority of Swarm passes, there was a good agreement between the observation of ESFs by JULIA and the depth of electron density perturbations. Cases where ESFs were seen without clear variation in electron density or vice versa suggest that irregularities can be effective quite locally, horizontally or in height. The seasonal dependence of occurrence of ionospheric irregularities as obtained from Swarm and JULIA were also compared. Similar patterns were observed with highest percentage occurrence in December Solstice and Equinoxes and low occurrence in June Solstice. Using vertical drift measurements from the incoherent scatter radar (ISR), the seasonal dependence of the occurrence of topside ionospheric irregularities was explained in terms of the pre-reversal enhancement of the vertical drift.