Identification of ionogram signatures corresponding to different aspects of equatorial plasma bubbles

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Ionosondes continue to remain as an important tool for routine remote sensing of the ionosphere even after about eight decades from their inception. The low latitude nocturnal ionospheric instabilities are named as equatorial spread F (ESF), since the F-region traces in the ionograms spread when the instabilities occur. Later, the phenomenon is understood to be caused by Rayleigh-Taylor instability mechanism and often referred to as equatorial plasma bubbles (EPBs). Nevertheless, the exact reflection/scattering mechanism forming an ionogram trace during the times of ESF is still debated. In this work, we compare the OI 630 nm airglow observations of the EPBs with the collocated ionosonde measurements from two sites in the Indian sector. The ionosondes utilized are Canadian Advanced Digital Ionosonde (CADI) from dip equatorial site Tirunelveli and Lowell Digisonde from low latitude site Gadanki. The objective is to identify and attribute the different structural patterns of ionogram echoes to some particular characteristics of the EPBs and their surroundings. For example, from a series of vertical incidence ionograms, the EPB drift velocity can be obtained. We show that the clustering nature of the EPBs appear to get manifested as ‘patchy ESF’ in the series of ionograms. Further, we argue that the higher frequency reflections observed in the ESF traces during the passage of EPBs are not simply due to oblique reflections. If we could successfully attribute some particular patterns of ionogram ESF echoes to the characteristics of the EPBs, it will facilitate detailed studies on the evolution of EPBs from locations wherein only ionosonde measurements are available. We hope that some of the inferences obtained in this study will be applicable to the instabilities occurring in the mid- and high latitude zones as well.