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Equatorial Plasma Bubbles Observed by All-sky Images and Radio Waves over Mt. Lulin Astronomy Observatory in Taiwan during Nighttime of 1 November 2021

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All-sky images with 630.0 nm and 557.7 nm narrowband interference filters have been widely employed to study traveling ionospheric disturbances (TIDs) of equatorial plasma bubbles (EPBs) associated with Equatorial Spread-F (ESF) irregularities at equatorial/low latitudes [1]. On the other hand, full-band chromatic all-sky cameras at astronomy observatories have often been routinely monitoring the sky conditions. In this paper, an intense EPB event on 1 November 2021 is used to illustrate how the video streams from such an all-sky camera intended for routinely monitoring the sky conditions at Mt. Lulin Astronomy Observatory in Taiwan could be used to retrieve the airglow signatures corresponding to the plasma density variations by the EPB. The observations are compared with the total electron content (TEC) and Rate Of TEC (ROTI) estimated from the dense GNSS (1.2-1.6 GHz) receiving network, ionosonde (1-30 MHz) and Doppler shift (5.5 MHz) measurements, as well as FORMOSAT-7/COSMIC-2 (F7/C2) GNSS radio occultation (RO) electron density/S4 scintillation profiles [2] over Taiwan to find the possible factors that influence the generation of the EPBs in the low solar activity conditions. Results show that the full-band chromatic imager can offer a cost-effective alternative to investigate the EPBs usually detected in OI 630.0 and 557.7 nm airglow emissions. Coordinated observations reveal predominantly eastward drafting irregularities over 250-250 km altitudes, possibly by the early reversal of zonal electric field.

References

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