

Forecasting the day-to-day occurrence of equatorial spread F in Southeast Asia

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We used ionosondes in Chumphon (CPN) (10.72°N, 99.37°E; Mag. Lat: 3°N), Thailand; Bac Lieu (BCL) (9.30°N, 105.71°E; Mag. Lat: 1.5°N), Vietnam; and Cebu (CEB) (10.35°N, 123.91°E; Mag. Lat: 3.09°N), Philippines during equinox seasons from 2010 to 2016 to develop a forecast technique for equatorial spread F or plasma bubble generation. We considered that enhancement of vertical $\mathbf{E} \times \mathbf{B}$ drift after sunset in the equatorial region, so-called pre-reversal enhancement (PRE), is a primary factor for plasma bubble generation. We then used a "PRE threshold" to determine ESF whether generates or not. We collected 264, 121, and 206 nights for CPN, BCL, and CEB ionosondes, respectively. We used change of $h'f$ in time ($dh'f/dt$) during 18-19 LT from three ionosonde sites as a proxy for the vertical drift. The threshold is simply defined with a average value of vertical drifts obtained from all stations, and the value is 24 m/s. We defined the PRE ≥ 24 m/s and PRE < 24 m/s for the ESF on and off, respectively. We then compared our threshold method with the real occurrence of ESF for all stations, and the skill score is ~ 0.7 for each station. We have also analyzed the skill scores by changing the threshold, and we found that the skill score of ~ 0.7 is a maximum for each station. Thus, our study show that, using the average value of PRE as a threshold, it is enough to forecast ESF occurrence in Southeast Asian longitude with the maximum skill score in the "PRE threshold" method.

Keywords: Forecasting spread F, Pre-reversal enhancement, Threshold method, Space Weather