Study on the Relationship between the Characteristics of Equatorial Magnetic Field and Equatorial Spread F Occurrences

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The ionospheric irregularities including equatorial spread F (ESF) and equatorial plasm bubbles can destructively impact the development of cutting-edge technologies using satellite navigation and communications particularly. ESF is an ionospheric plasma density irregularity that normally occurs in the bottom-side F-region after sunset in the magnetic equatorial region. Due to the equatorial electrojet (EEJ) current, the features of the equatorial magnetic fields and the characteristics of the ionosphere near the magnetic equator are unique and they significantly vary in different longitude and time. Their relationships in other regions have been intensively investigated; however, there are only a few studies with the observed data in the South East ASIAN region. Therefore, this work examines the effect of the horizontal component of the equatorial magnetic fields on the occurrences of the equatorial spread F (ESF) in Thailand with the aim to find the precursor conditions of the occurrence of ionospheric irregularities. In this work, we use the data of ESF from the Frequency Modulated Continuous Wave (FMCW) ionosonde at Chumphon (CPN) station, Thailand (10.7° N, 99.4°E; magnetic latitude 3.3 N), and the ground-based magnetic fields data from the magnetometer at Phuket station (8.1°N, 98.3°E, magnetic latitude:1.07°N) collected during February and March of 2019 (the low solar activity year of the 24th solar cycle). Firstly, this work observes the features of the horizontal component of the equatorial magnetic field's changes during the daytime and analyzes them against the occurrence and duration of the ESF. The relationship between the ESF's duration in hours and the rise time of the horizontal magnetic field component (the time elapsed between the beginning and the end of the significant magnetic field enhancement during the morning) is illustrated in Fig. 1. From the result, the occurrence of the ESF or its duration are rare and less for the days with the short field's rise time (within 3 hours). Most of ESF occurrences are detected after the prolonged magnetic field enhancement in the morning. In this work, we also study the characteristics of EEJ related to ESF occurrences.

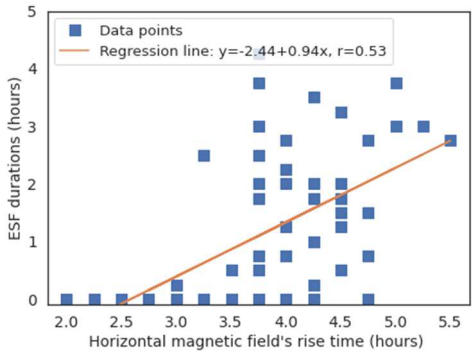

Figure 1. Ascension Island (7.9°S, 14.8°W showing the ESA Tracking Station which was the location of the fixed receiver and the road (shown in black) along which the mobile measurements were made.

References

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