

# Development of an Autonomous Method for Equatorial Spread-F (ESF) Detection of SEALION Ionosonde Data

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Equatorial spread-F (ESF) is one of the most important features in space weather because of its significant effect on communication and navigation. Therefore, real-time information on the ESF occurrence will be useful to detect the degradation of radio propagation conditions. SEALION is an ionospheric observation network in the South East Asia that has been on operation since 2003. SEALION has 5 FMWC ionosondes installed in various locations; Chiang Mai (18.76°N, 98.93°E), Chumphon(10.72°N, 99.37°E), Phuket (7.90°N, 98.39°E), Bac Liu (9.30°N, 105.71°E), Cebu (10.35°N, 123.91°E) and Kototabang (0.20°S, 100.32°E). SEALION ionograms are often contaminated with various noises, such as stripes and random noises. Thus, a noise removal step is crucial before applying any detection algorithm. To remove the noises, we applied 4<sup>th</sup> degree polynomial fit to remove the stripes and 3x3 median filter to reduce the random noise. Following *Bhaneja et al., 2009*' method, the  $h' F$  and  $foF2$  trace are determined using an edge detection algorithm. Thresholds of non-spread F ionogram are determined by calculating the number of pixel within 100x100 pixel box from the edge of the  $h' F$  and  $foF2$ . The thresholds were calculated from ~1000 nighttime ionograms from different seasons. We identified the range type ESF when the pixel counts within the  $h' F$  box exceeded the threshold. The frequency type was identified when the pixel counts within the  $foF2$  box exceeded the threshold. The mixed type are identified when the pixel counts in both  $h' F$  and  $foF2$  boxes were exceeding the threshold. We have applied this method to 2013 Chiang Mai ionograms. The preliminary result shows ~88 % matching with the manual scaling. The application of this method to the data from other ionosonde stations is underway. The details of the method, result, possible improvement of the current method and the design for a real-time warning system will be discussed during the presentation.

Keywords: Equatorial Spread-F, Ionogram, Autonomous detection