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# Statistical modeling of high latitude sporadic-E climatology for E-CHAIM

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Sporadic-E, thin metallic ion layers in the lower ionosphere compressed via neutral wind shears or externally imposed electric fields, pose considerable challenges for High Frequency (HF) radio propagation modeling. As their name suggests, these layers can appear to be quasi-stochastic, requiring both an abundance of metallic ions and a mechanism through which to compress them into thin, dense layers; as such, modeling Sporadic-E has been a persistent and long-standing challenge in ionospheric modeling. With new physics-based models now beginning to develop the capability to capture the processes that produce these structures, we will here revisit empirical modeling of Sporadic-E and examine the capability of existing measurements to adequately constrain an empirical model. Using Radio Occultation (RO) measurements of these Sporadic-E layers from all available missions (3.5 million observations), we have constructed a probabilistic model of Sporadic-E, its altitude, and its intensity over high latitude regions. This presentation will provide an overview of this model and examine its performance via independent validation against both other RO and ground-based observations. We will furthermore examine the modeled behaviour and use the model to understand the climatological dynamics of Sporadic-E at high latitudes. Further discussion will explore how to implement this model within the existing Empirical Canadian High Arctic Ionospheric Model (E-CHAIM) [1,2,3].

**References:**

[1] Themens, D.R., P.T. Jayachandran, A.M. McCaffrey, B. Reid, and R.H. Varney (2019). A bottomside parameterization for the Empirical Canadian High Artic Ionospheric Model (E-CHAIM), Radio Sci., doi: 10.1029/2018RS006748

[2] Themens, D.R., P.T. Jayachandran, I. Galkin, and C. Hall (2017). The Empirical Canadian High Arctic Ionospheric Model (E-CHAIM): NmF2 and hmF2, J. Geophys. Res. Space Physics, doi: 10.1002/2017JA024398

[3] Themens, D.R., et al. (2018), Topside Electron Density Representations for Middle and High Latitudes: A Topside Parameterization for E ‐ CHAIM Based on the NeQuick, Journal of Geophysical Research: Space Physics, 123, 2, 1603-1617.

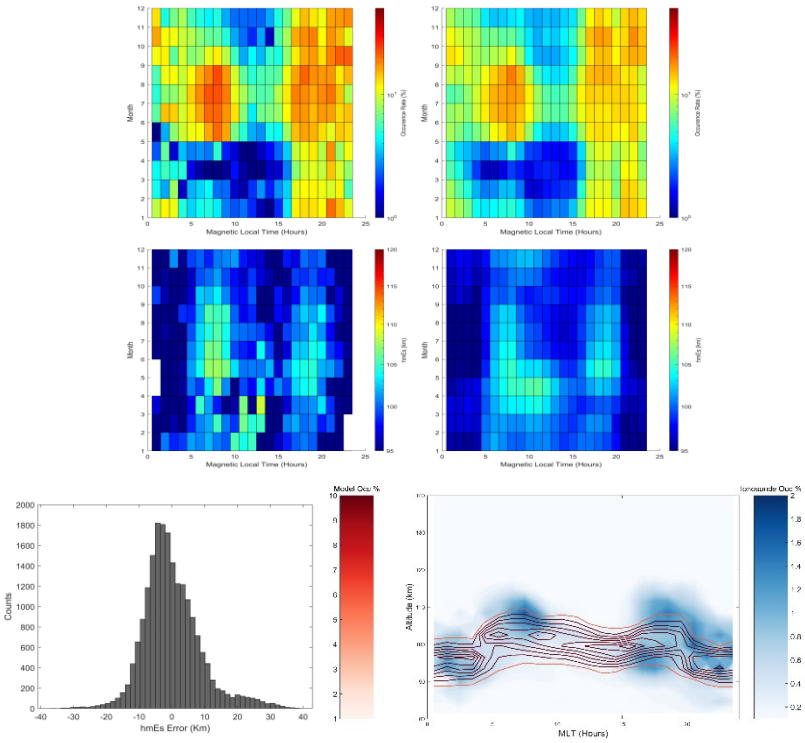


**Figure 9.** (top) TerraSAR-X-derived (left) and modelled (right) Sporadic-E occurrence rates against month and Magnetic Local Time (MLT). (middle) Corresponding hmEs distributions in month and MLT. (bottom) Height distribution of Sporadic-E layer occurrence against MLT from the TerraSAR-X (blue) and the model (red).