

A comparison of modeled daytime E-regions from E-PROBED and PyIRI with ionosonde observations

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Thank you for providing the opportunity to review this paper. Please accept it after minor correction.

The authors evaluated two recently developed ionospheric models, PyIRI and E-PROBED, focusing on how accurately they represent the E-region of the ionosphere, which is important for radio wave propagation and ionospheric conductivity. They compared the models' predictions with ionosonde observations collected from three stations located at different latitudes: Fortaleza in Brazil (low latitude), El Arenosillo in Spain (mid latitude), and Gakona in Alaska (high latitude). The comparison covered the years 2009–2024 for El Arenosillo and Gakona, and 2015–2024 for Fortaleza.

The study analyzed two key parameters, foE (the critical frequency of the E-layer) and hmE (the peak height of the E-layer), using both manually scaled and automatically scaled ionograms processed by the ARTIST-5 software. In addition, the paper compared modeled and observed virtual heights using a numerical ray-tracer to evaluate how well the models reproduce altitude-dependent electron density structures.

Their results showed that both models generally agreed well with ionosonde data and successfully captured the solar cycle, seasonal, and diurnal variations of foE. However, E-PROBED tended to overestimate foE, with mean absolute relative errors (MRAE) reaching about 70% at dusk, while PyIRI showed close agreement with observations, with MRAEs around 10%. For hmE, E-PROBED consistently overestimated the height by about 15–20 km compared with auto-scaled ionograms, and PyIRI produced a constant value of 110 km for all times. When compared with manually scaled data, however, E-PROBED's hmE values matched more closely, indicating that auto-scaled data can be less reliable.

Finally, both models produced reasonable virtual height estimates, showing only slight biases relative to ionosonde observations. The direction of the bias differed between manual and auto-scaled datasets, suggesting uncertainties in the automatic scaling process. Overall, the authors concluded that E-PROBED and PyIRI provide reliable and practical representations of the E-region, suitable for applications that require modeled ionospheric parameters.

Here are some minor corrections:

- 1- In figures displaying **foE** or **hmE** separately for the ionosondes, PyIRI, and E-PROBED (e.g., Figure 1), it would be beneficial to extract the representative **median curves** from each panel and

present them together in an additional comparative panel. This approach would make direct comparisons clearer and reduce the reader's cognitive effort.

- 2- Please provide a brief explanation of the main differences between **PyIRI** and **E-PROBED** in the introduction or methodology section to help readers understand their respective modeling approaches and assumptions.