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Comparison of sporadic E layers obtained via modeling and measured by CHAIN ionosondes

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Sporadic E-layers are dense thin layers of metallic (Mg+, Fe+, Na+, Ca+) ions of meteoritic origin which may form at altitudes 90-150 km. These structures are important for radio communications and remote sensing applications because they significantly alter propagation of radio waves. A 3D numerical model of high latitude ionosphere has recently been developed at the University of Alberta. We apply the model to simulate ionosphere evolution during July 9-12, 2011. In this simulation, dense sporadic E-layers form at altitudes 100-120 km, mostly in the night sector, between MLT 10pm and 2am, for GEO latitudes between 70 and 80 degrees North. This matches the statistical data for high latitudes for the June-August season given in [Aylett et al (2025), JGR, 130, e2024JA033044]. The modelled density profiles are compared with ionosonde data from Cambridge Bay and Resolute Bay stations of the Canadian High Arctic Ionosonde Network (CHAIN). The time, altitude, and magnitude of sporadic E-layers calculated with the model for the Cambridge Bay show reasonable agreement with the measurements. The agreement with the Resolute Bay station, which is at a very high geomagnetic latitude of 82.61 degrees North, is not so good. Probable reasons for this may be the simplified tilted dipole configuration of the geomagnetic field used by the model and the absence of the vertical neutral wind in the simulation (the neutral winds are provided by the HWM model). This is a very recent work that we have just began to investigate. It demonstrates that while the 3D ionospheric model is capable of predicting sporadic E-layers, it requires extensive validation.

Keyword-1

Sporadic E-layer

Keyword-2

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Keyword-3

ionosonde

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