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Maps of foF2 and hmF2 obtained from a high-latitude all-sky airglow imager

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Discrete high density plasma structures in the Earth's ionosphere that convect across the polar cap from the dayside to nightside are known as polar cap patches. This high-latitude phenomenon can interfere and disrupt satellite and HF communications, and therefore, accurate modeling and forecasting of such events would be greatly beneficial.

All-sky airglow imagers are one technique used to observe patches as they traverse the polar cap. Patches appear as variations in 630.0 nm airglow intensity, often extending across the entire field of view (FOV). It is known that 630.0 nm airglow intensities are proportional to the peak F-region densities (foF2) and inversely proportional to the altitude of the peak densities (hmF2). Therefore, all-sky airglow observations would make an excellent dataset for high-latitude data assimilative polar cap patch reconstructions.

Previous studies by [1] and [2] demonstrated the ability to convert airglow intensities to maps of foF2 and hmF2. The study by [1] utilized 630.0 nm and 777.4 nm airglow intensities to calculate foF2 and hmF2, while [2] developed an expression relating foF2 and hmF2 to 630.0 nm airglow intensities. In this study, we extend the methods of [1] and [2] into the high-latitudes and investigate their applicability when polar cap patches are present.

We apply the methods of [1] and [2] to the Resolute Bay Optical Mesosphere Thermosphere Ionosphere (OMTI) all-sky airglow imager and compare the results to hand-scaled foF2 and hmF2 values from a collocated Canadian High Arctic Ionosphere Network (CHAIN) vertical ionosonde. To investigate off-zenith results, we employ observations from the northward facing Resolute Bay Incoherent Scatter Radar (RISR-N). Our results indicate that a combination of both methods of [1] and [2] yield information that can be used to constrain a data assimilative model.

References

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