May 2024 Auroral Electron Characteristics from GOLD

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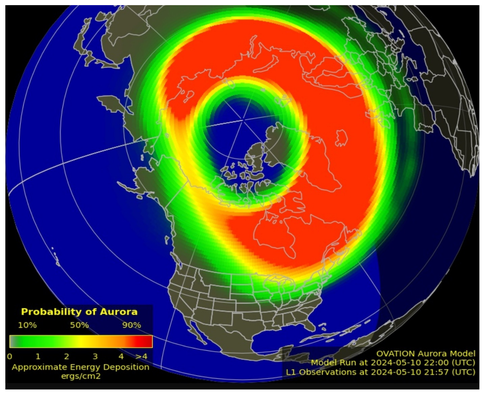
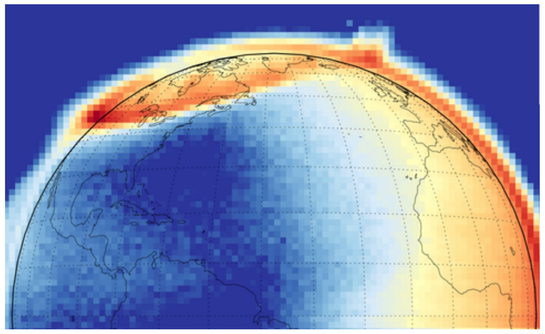
Motivation

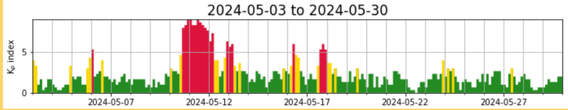
- The average electron energy, E, and total electron flux, Q, are two parameters used to better understand the aurora. These have been estimated in optical wavelengths from ground-based data and validated using sounding rocket data.
- GOLD is a UV imaging spectrograph observing Earth from a geostationary platform, therefore long time series of auroral characteristics are possible using GOLD data.
- The May 2024 “Gannon” storm is useful for this analysis, as we can compare the high intensity aurora to other storms observed by GOLD.



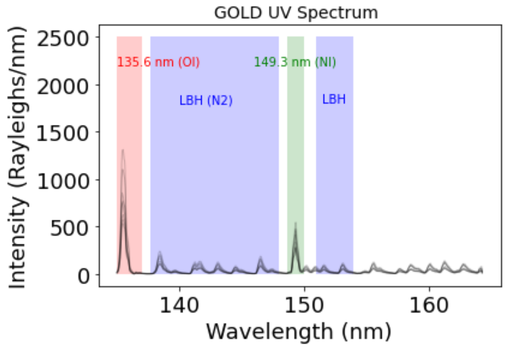
NOAA Auroral Forecast

May 2024 “Gannon” Storm

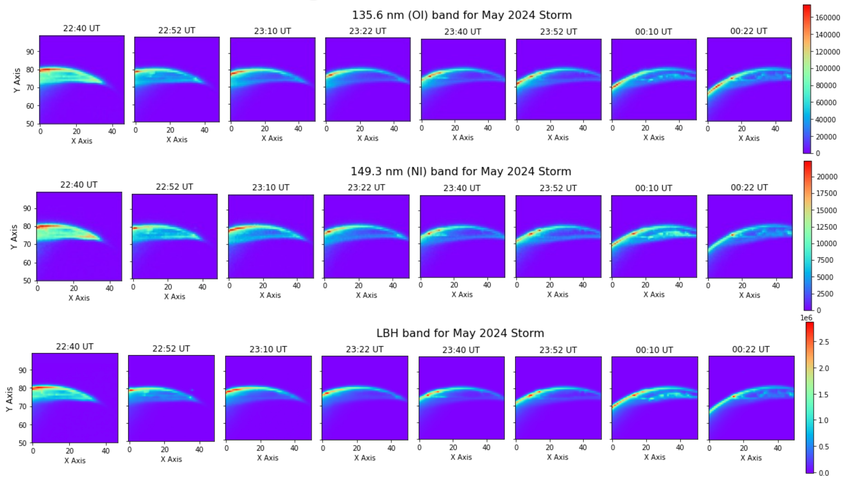


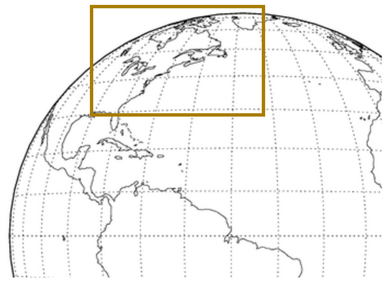


GOLD Observations



The full spectrum of GOLD observations spans the the shortwave UV band and contains the atomic oxygen emission at 135.6 nm (marked by red), the atomic nitrogen emission at 149.3 nm (marked by green) and the LBH bands from molecular nitrogen (marked by blue).

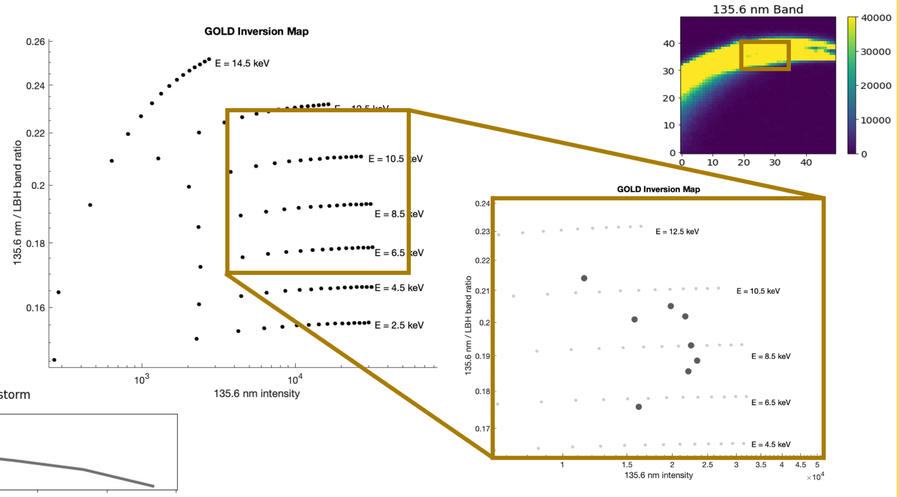


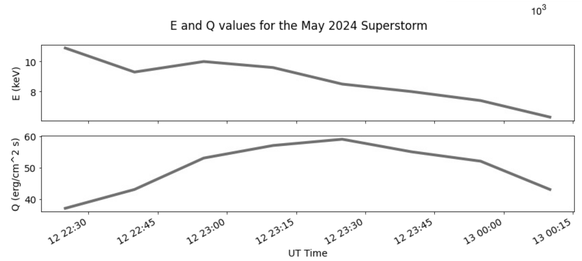


(Left) Time series of GOLD observations for the three wavelength bands above, over two hours from May 11th, 2024

GLOW Model and Inversion

GLOW is a transport model that has been widely used to predict auroral conditions [1]. By inverting this model, we attempt to estimate characteristics such as average energy, E, and total electron flux, Q, by using GOLD imaging alone, allowing us to infer electron properties without in-situ measurements.



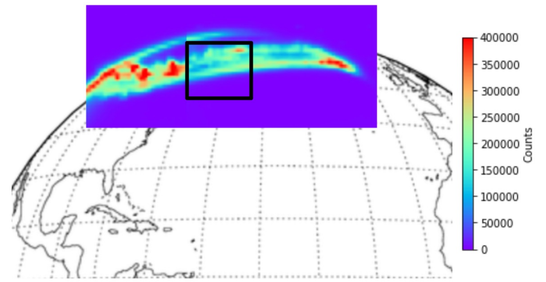


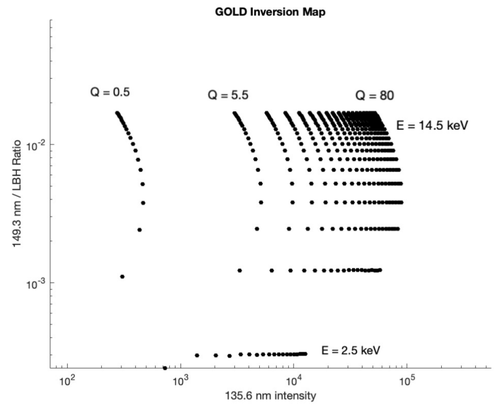
We can also estimate E and Q for a longer time series, following the procedure in [2], during the geomagnetic storm using GOLD observations.

Conclusion and Future Work

- This storm is a good test case for this analysis, as strong aurora typically reach lower latitudes which makes for a better viewing geometry from the geostationary perspective of GOLD.
- This analysis can be compared to previous work studying the March and April storms from 2023, comparing auroral intensity and total electron energy input into the atmosphere over the course of these storms.

March 2023 Storm





References

[1] Solomon, S. C. Auroral particle transport using Monte Carlo and hybrid methods, JGR 2001. 106, pp. 107– 116.

[2] Grubbs II, G. et al. *Predicting Electron Population Characteristics in 2-D Using Multispectral Ground-Based Imaging, GRL 2017*