Auroral Electron Precipitation Via Ground-Based and Rocket Measurements

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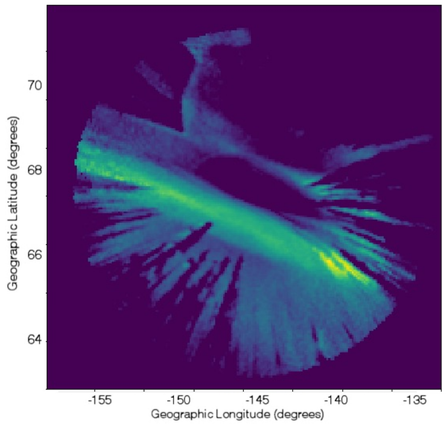
Motivation

- Two sounding rocket mission case studies flew through active aurorae: GREECE (2014) and ISINGLASS (2017).
- The combination of these missions, ground-based imaging, and an atmospheric transport model called the **GL**obal airgl**OW** model (GLOW) yield characteristics of auroral electron precipitation.
- Inverting this model predicts auroral emission characteristics from ground-based observations alone [1]
- This study can be used to shape the ground-based deployment of distributed arrays for current and future missions.



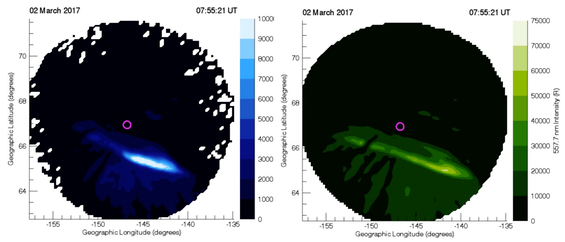
Sounding Rocket Missions

Credits: NASA/Terry Zaperach

- Sounding rocket missions provide insight to the electron precipitation characteristics of the aurora in-situ.
- GREECE was a campaign launched in 2014, and ISINGLASS was launched in 2017. Both missions enabled a better understanding of the structures and processes present in the aurora.

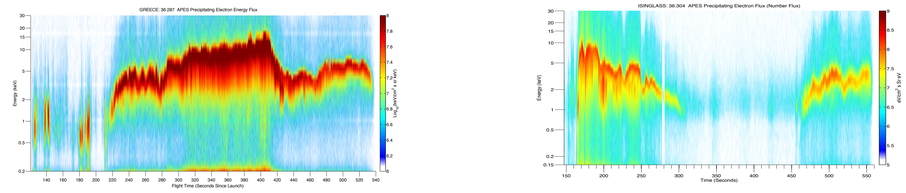
(Above) Image of the ISINGLASS sounding rocket launch from February 22nd, 2017 from the Poker Flat Research Range in Poker Flat, Alaska.

Ground-based Observations

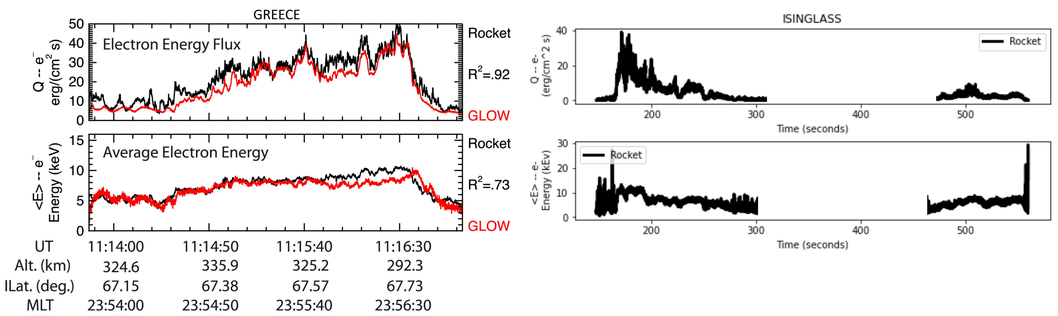


Observations of the aurora during the ISINGLASS mission from a ground-based imager in Alaska. (Left) The aurora is seen in green, and trees can be seen surrounding the field of view.

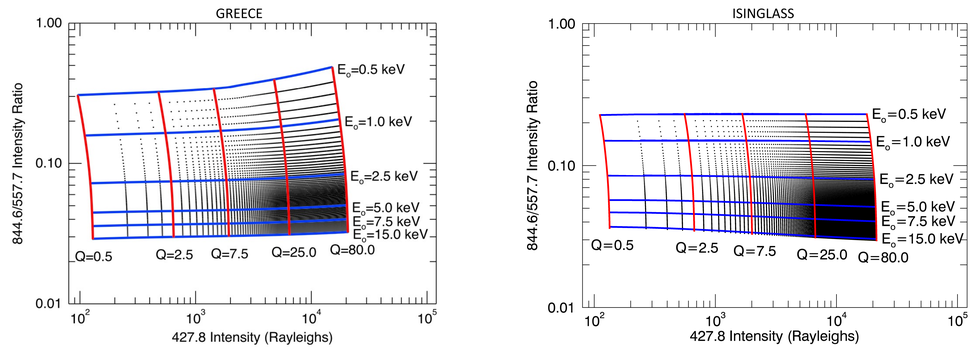
GLOW Model and Inversion



GLOW is a numerical electron transport model that has been widely used to predict auroral conditions [2]. By inverting this model, we are attempting to predict these features by using ground-based observations alone, allowing us to infer electron properties without in situ measurements.

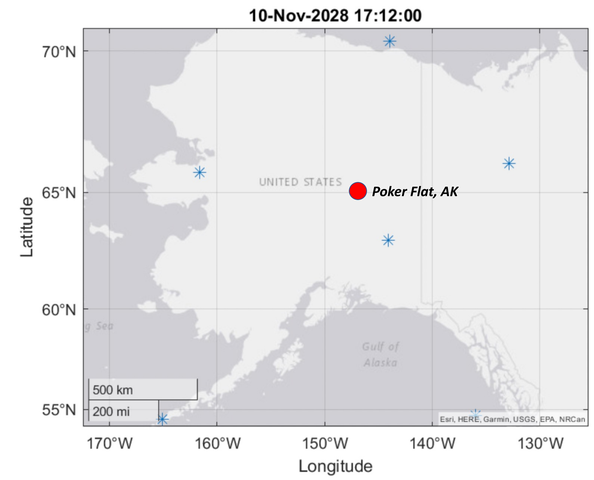


Inversion maps for the range of Q and E values from GLOW for the night of the GREECE (left) and ISINGLASS (right) missions. By running GLOW over a range of values for Q and E, we can estimate the electron properties of the aurora from three optical observations at different wavelengths.

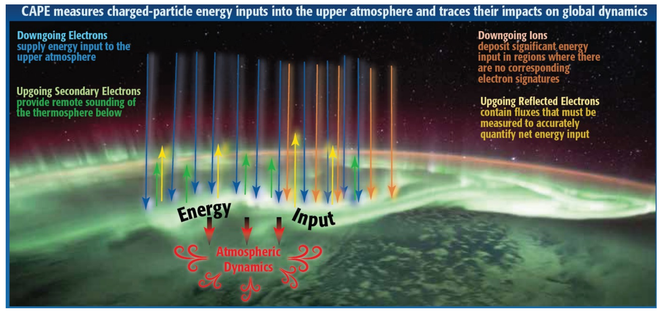


Big Picture: Broad Impacts

Heterogenous Distributed Measurements



- The upcoming GDC mission will study charged particle entry in the upper atmosphere and investigate global dynamics.
- The configuration highlighted here can be used in conjunction with ground-based observatories.



References

[1] Grubbs II, G. et al. *A Comparative Study of Spectral Auroral Intensity Predictions From Multiple Electron Transport Models.* JGR 2018.

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