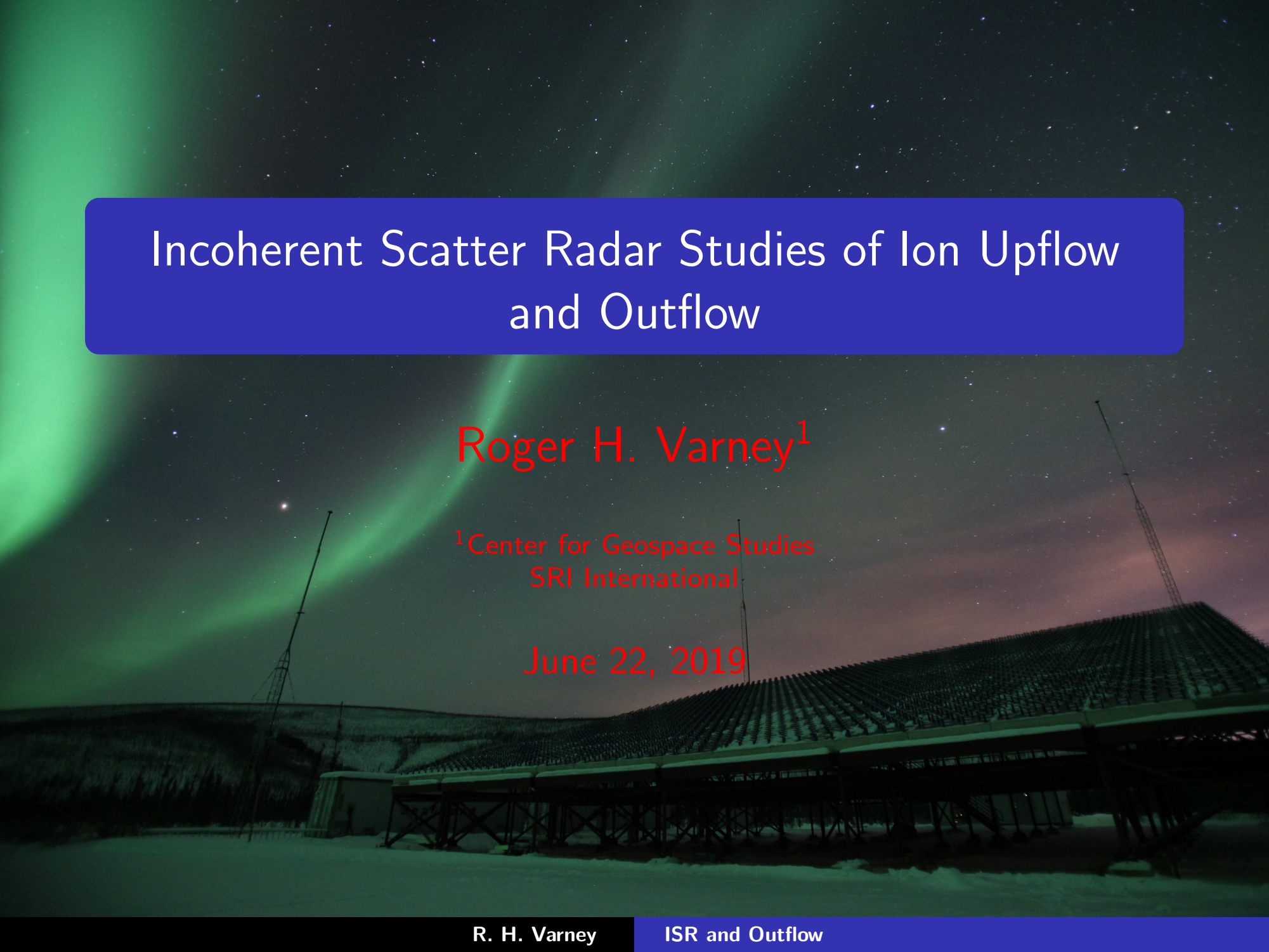

Incoherent Scatter Radar Studies of Ion Upflow and Outflow

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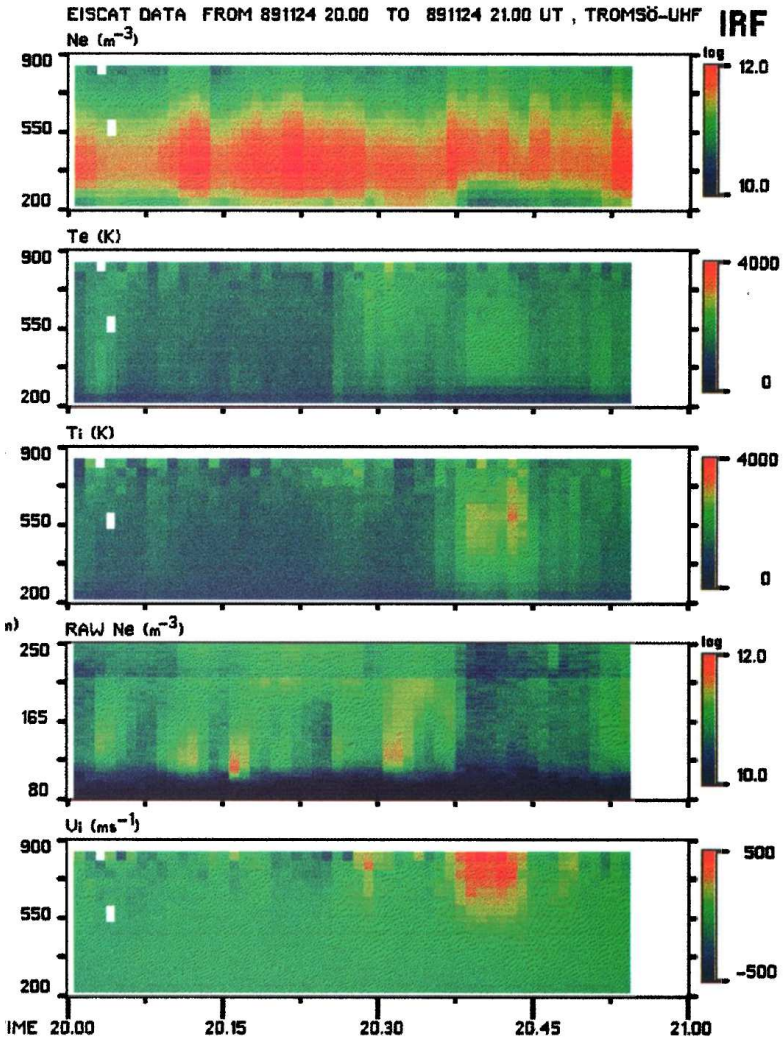
[1]Center for Geospace Studies
SRI International

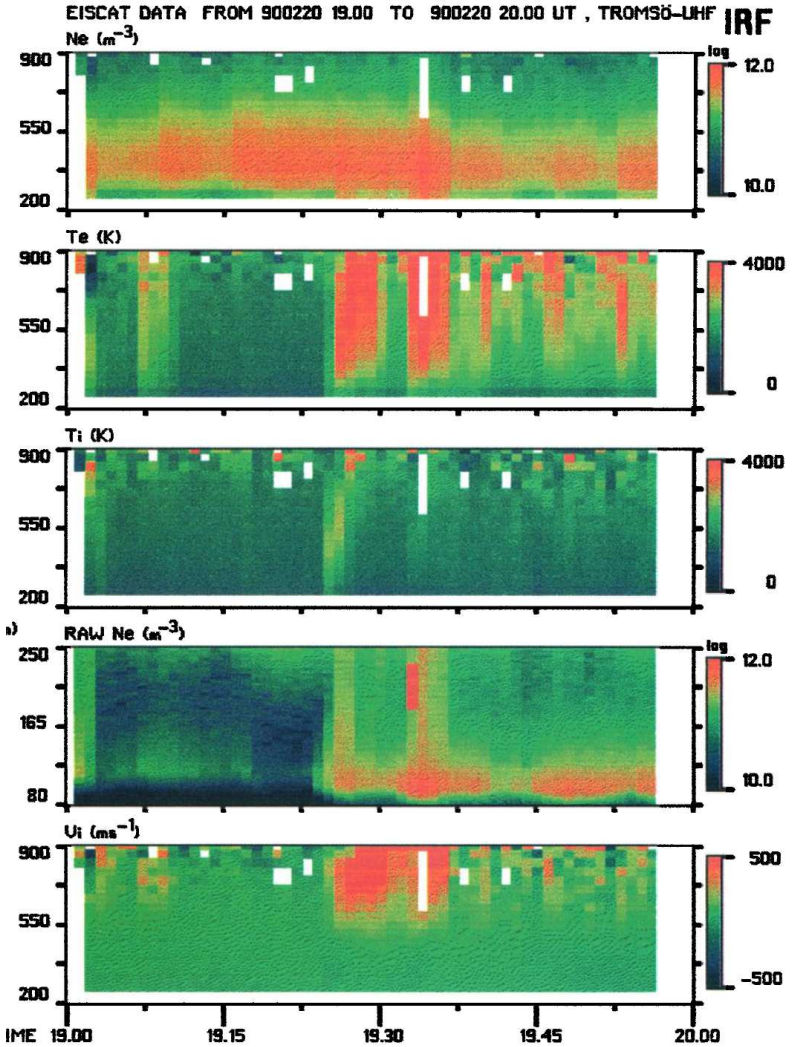
June 22, 2019

Signatures of Energy Input (Wahlund et al. 1992)

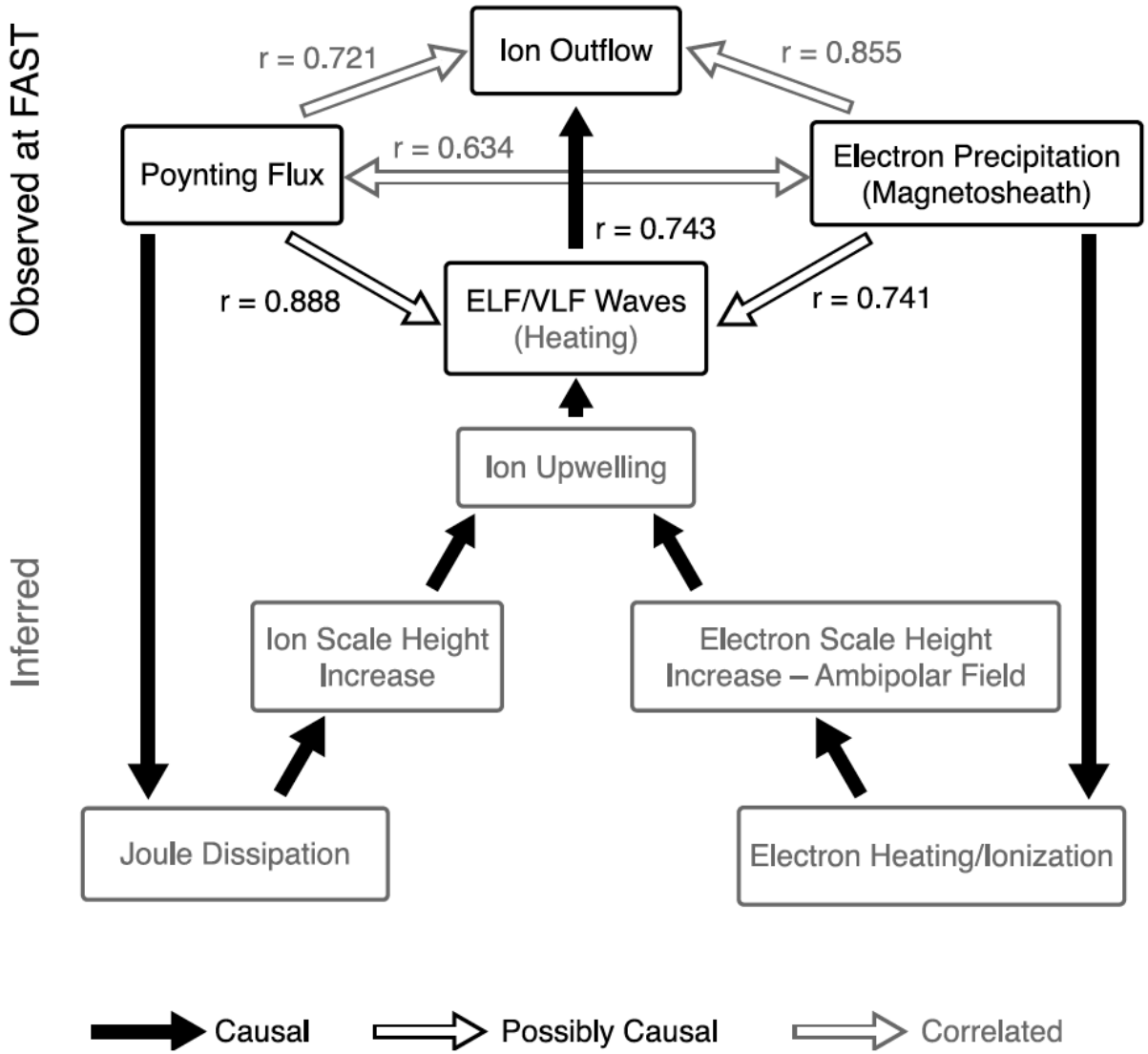
Type I (Enhanced T_i)



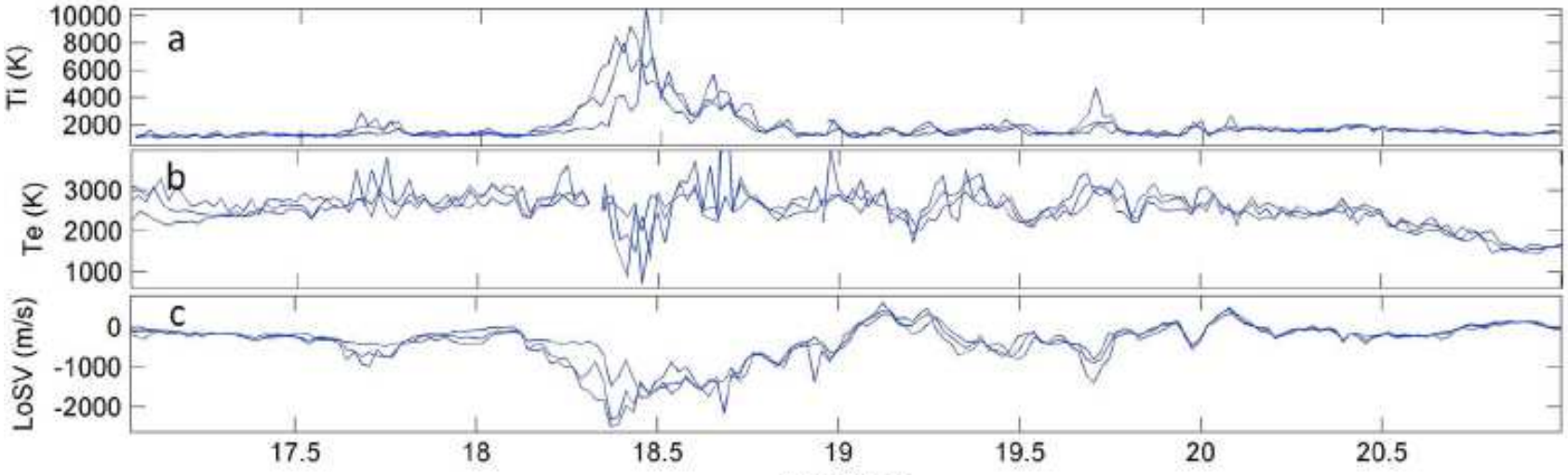
Type II (Enhanced T_e)

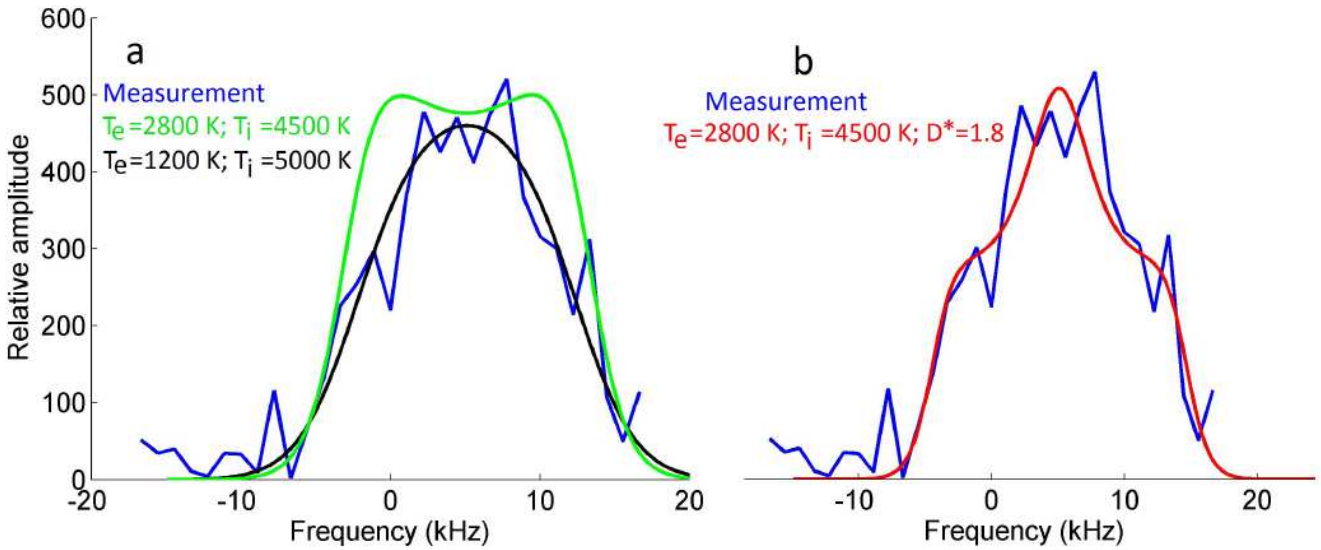


Upflow to Outflow Conversion (Strangeway et al. 2005)



Extreme Frictional Heating and Torodial Distributions

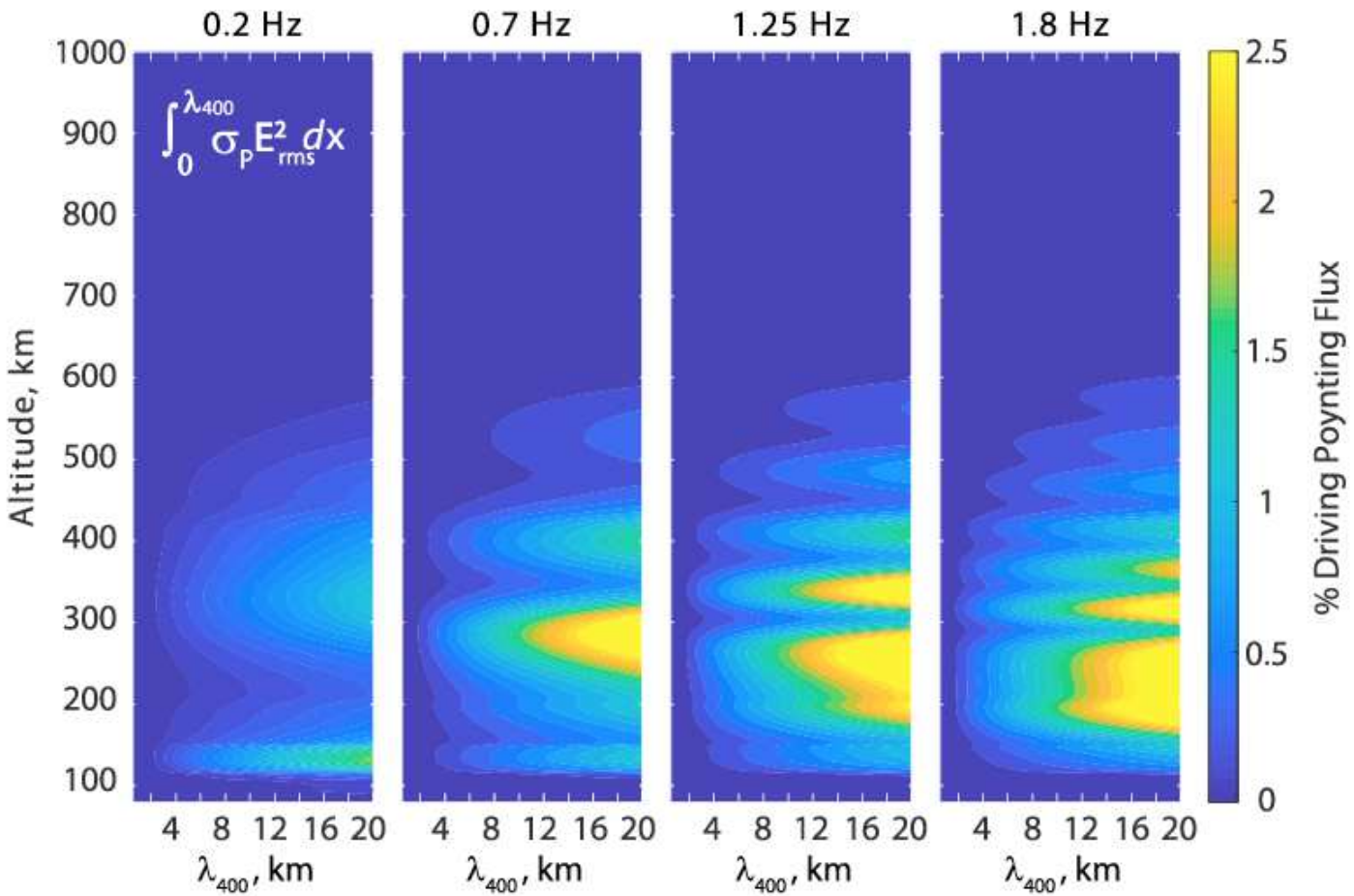




Akbari et al. (2017)

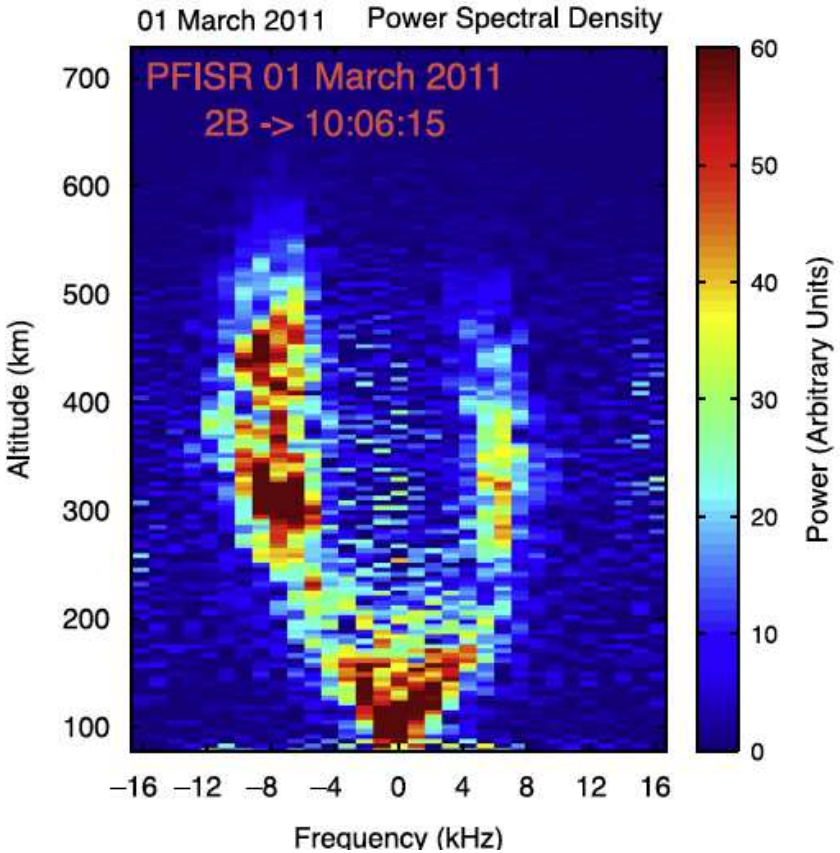
Small Scales and Alfven Waves

$$Q_J = \sigma_P \left| \mathbf{E}_{DC} + \mathbf{E}_{Wave} + \mathbf{u}_n \times \mathbf{B} \right|^2$$

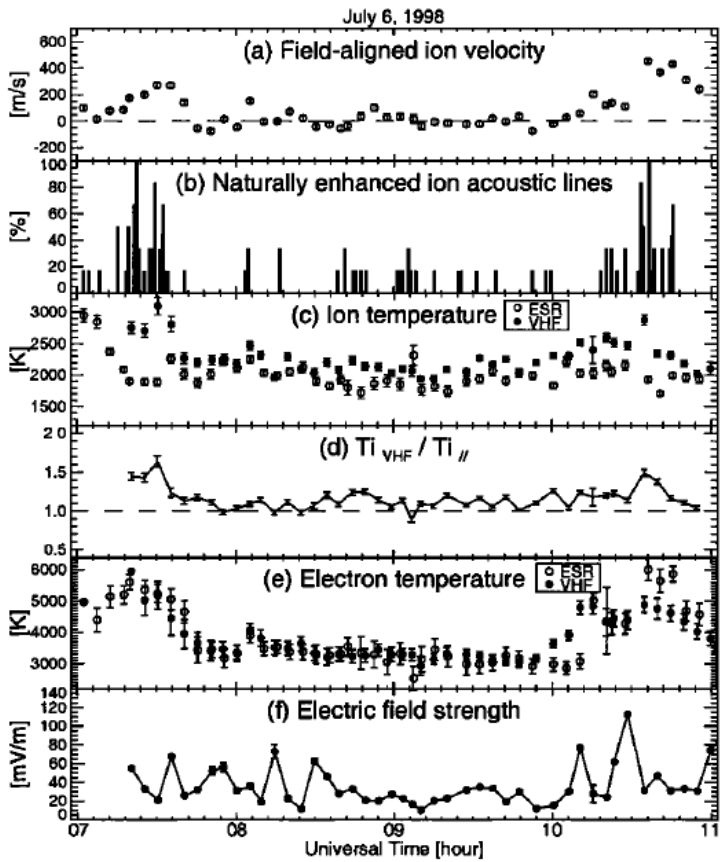


Lotko and Zhang (2018)

Naturally Enhanced Ion Acoustic Lines (NEIALS)



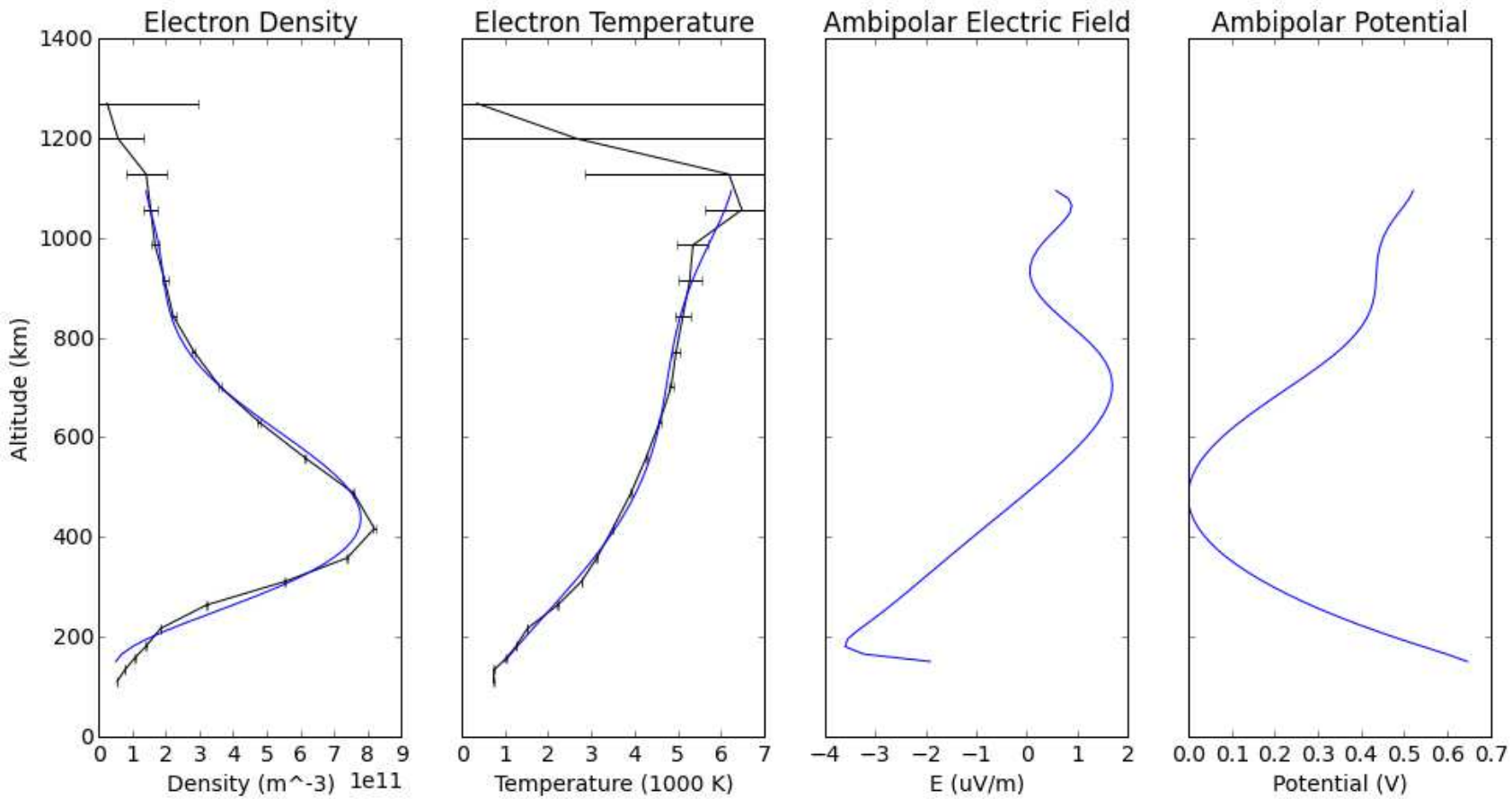
Michell and Samara (2013)



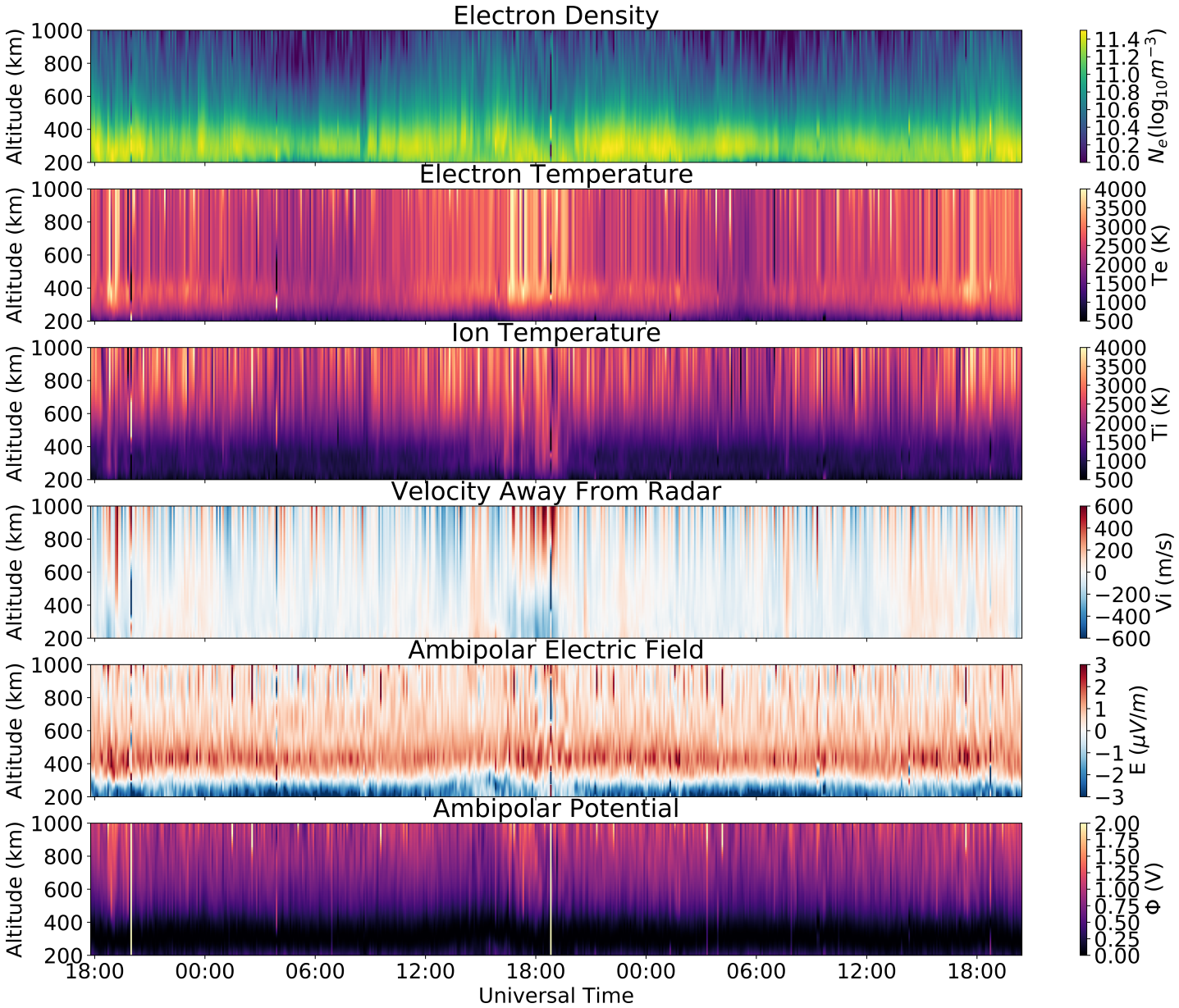
Ogawa et al. (2000)

Ambipolar Electric Fields

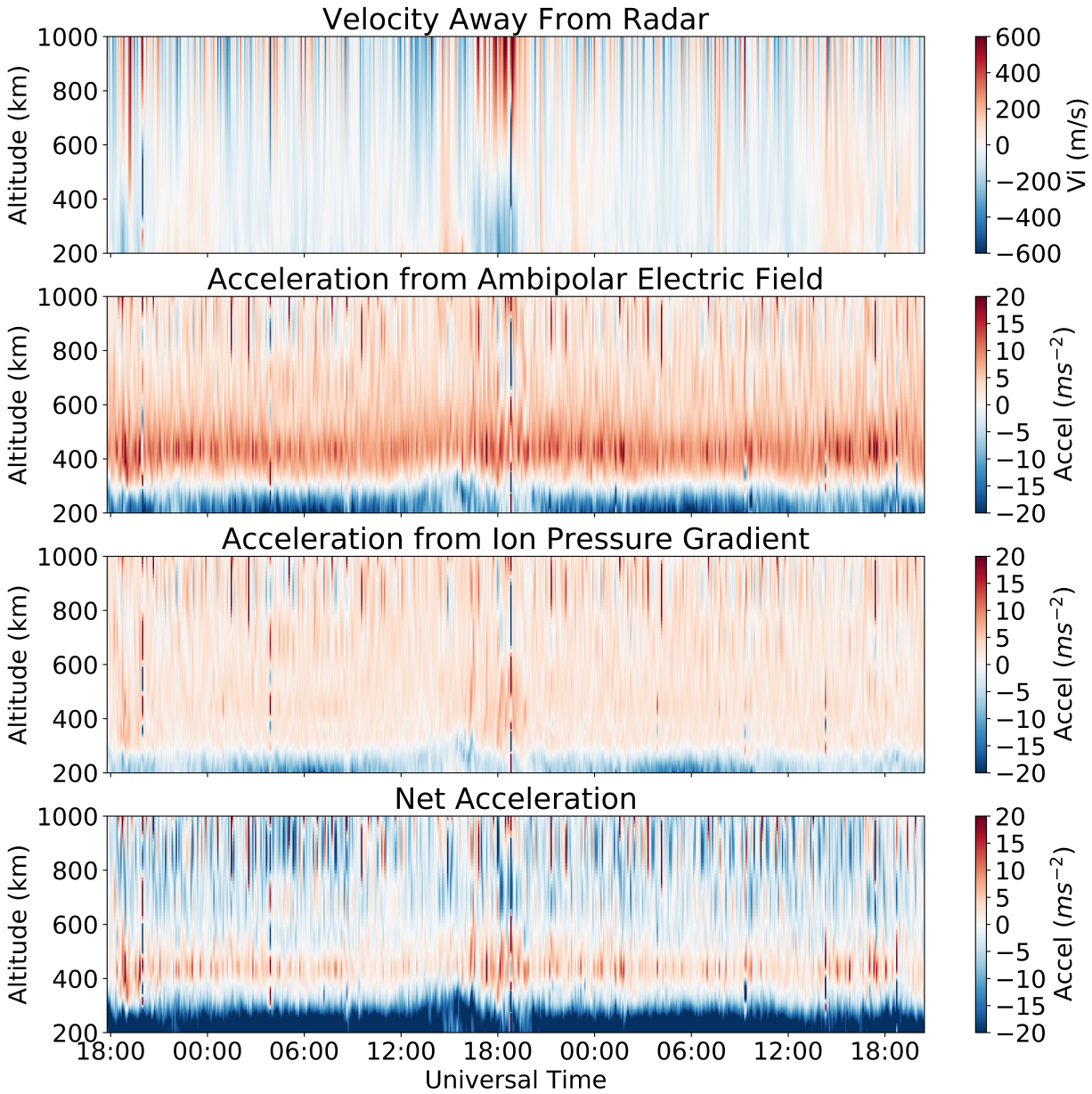
$$E_{\parallel} = -\frac{1}{eN_e}\nabla_{\parallel}\left(N_e k_B T_e\right)$$



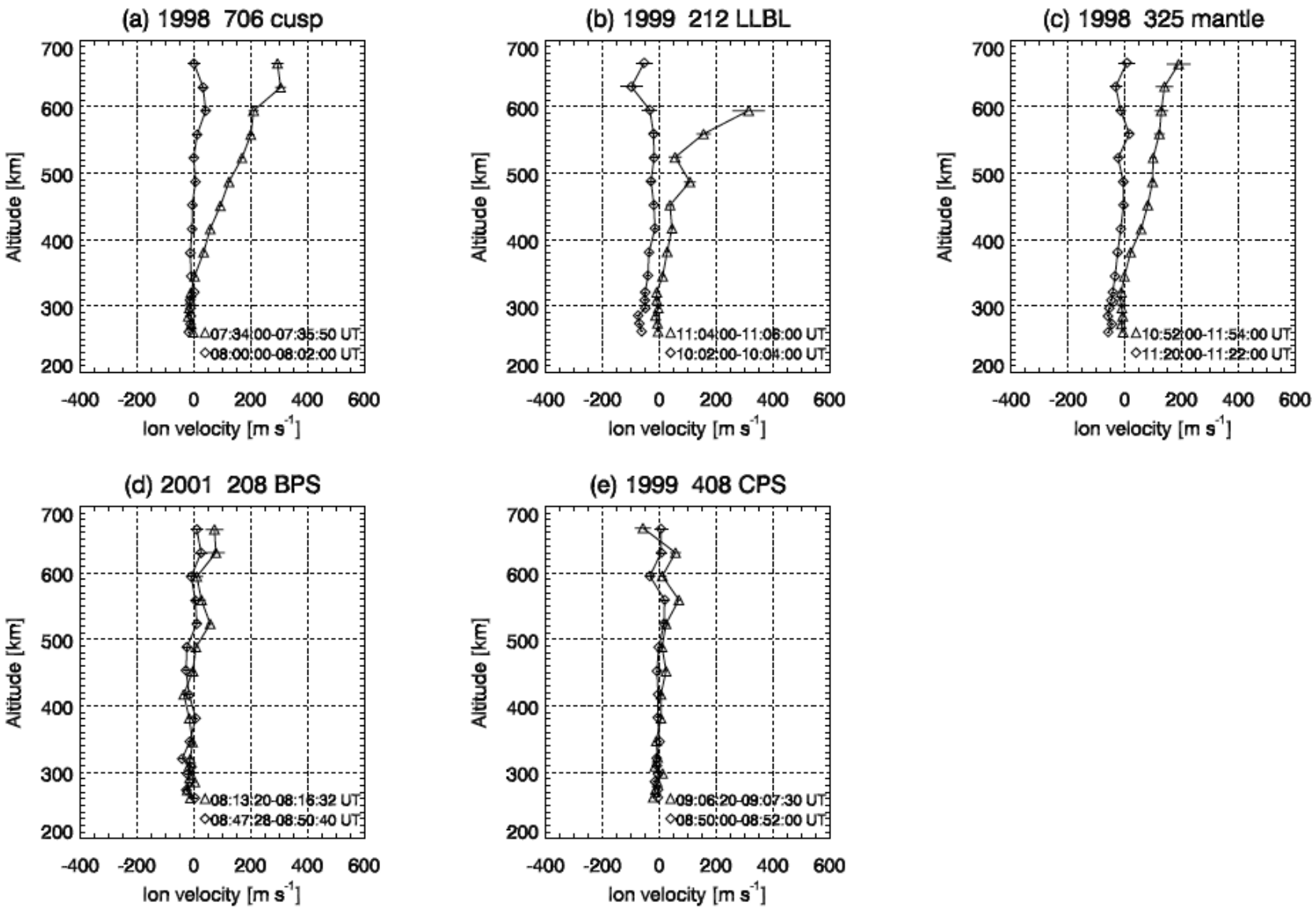
RISR-N Topside Examples



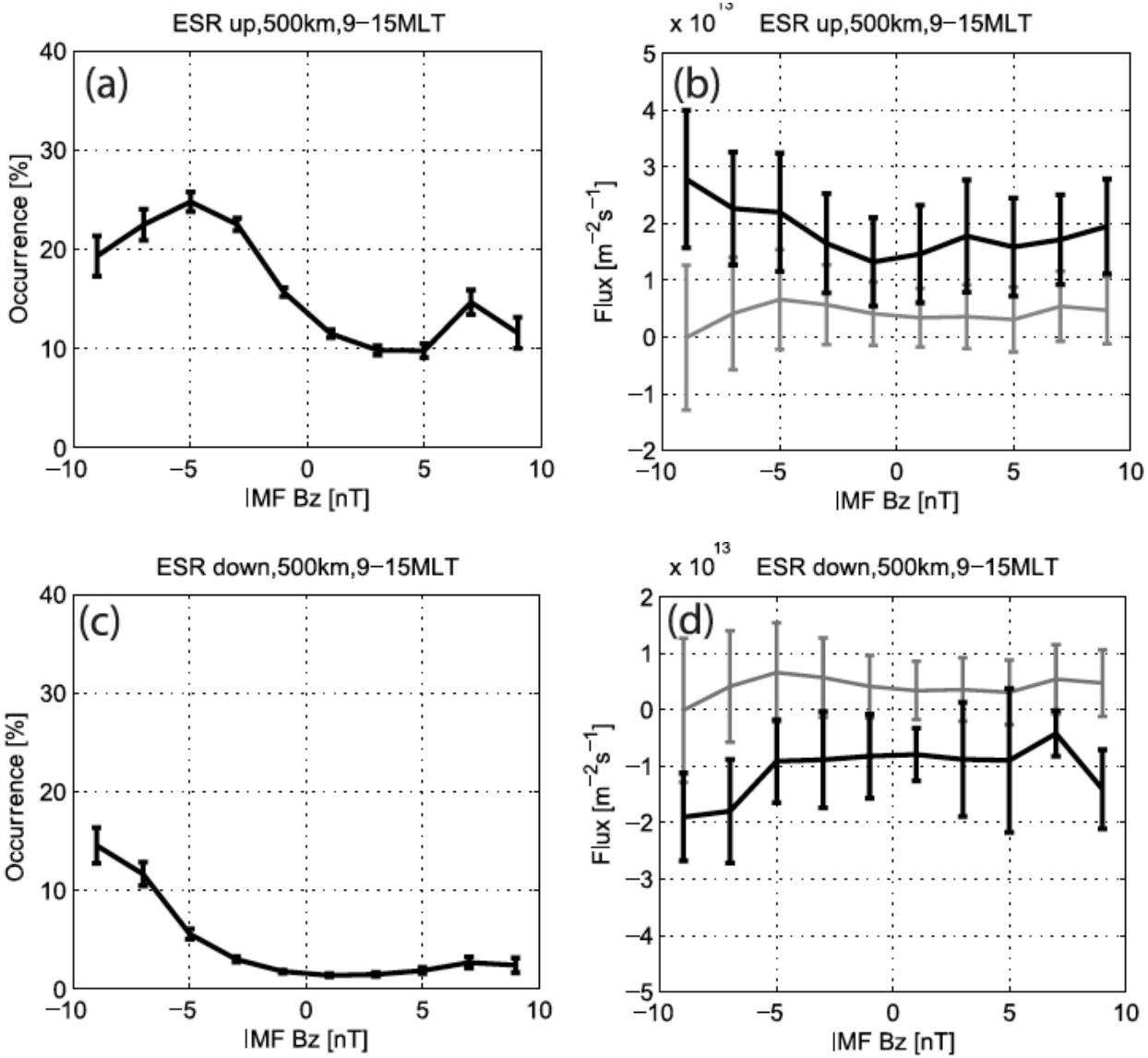
RISR-N Force Balance



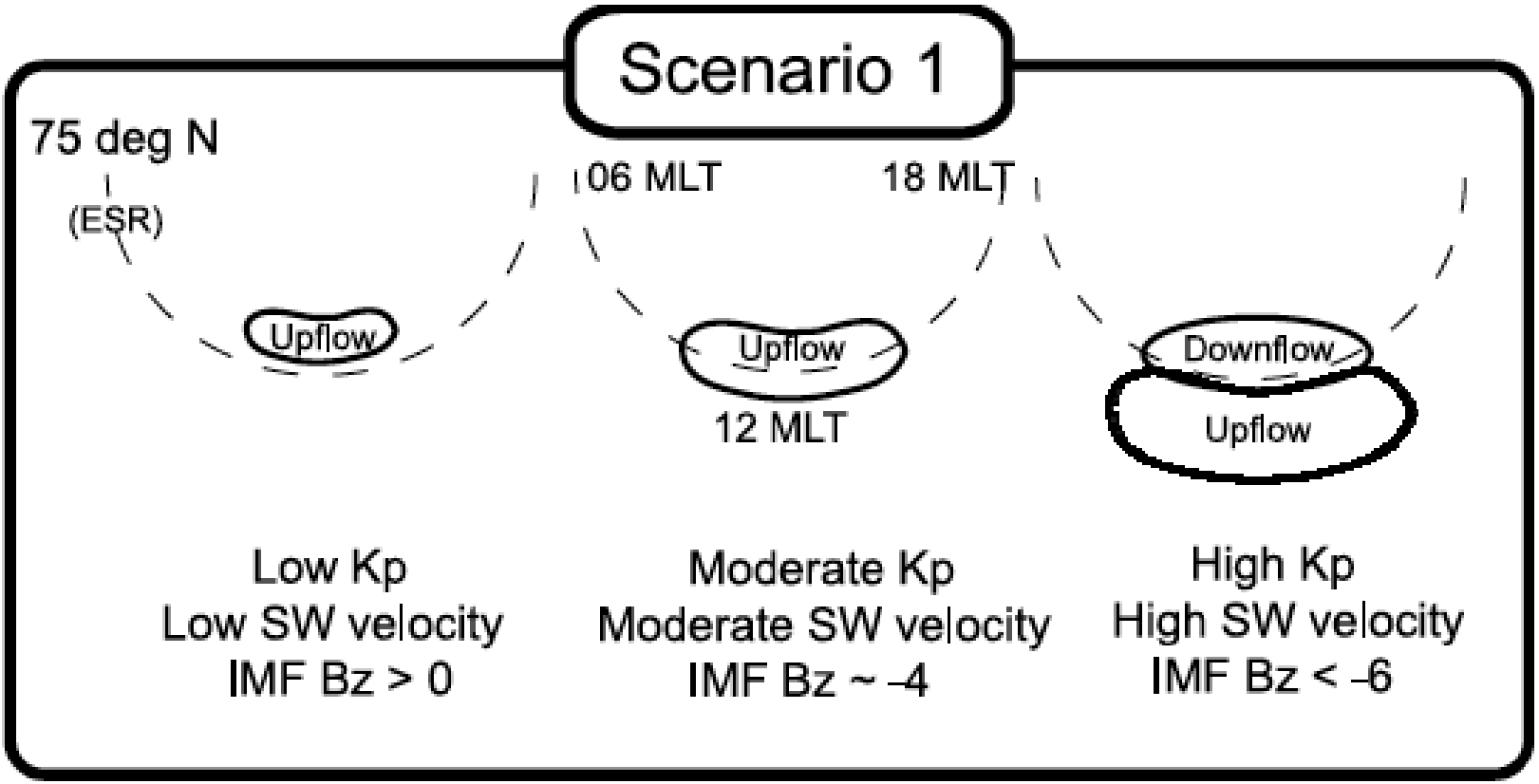
Different Precipitation Regions (Ogawa et al. 2003)



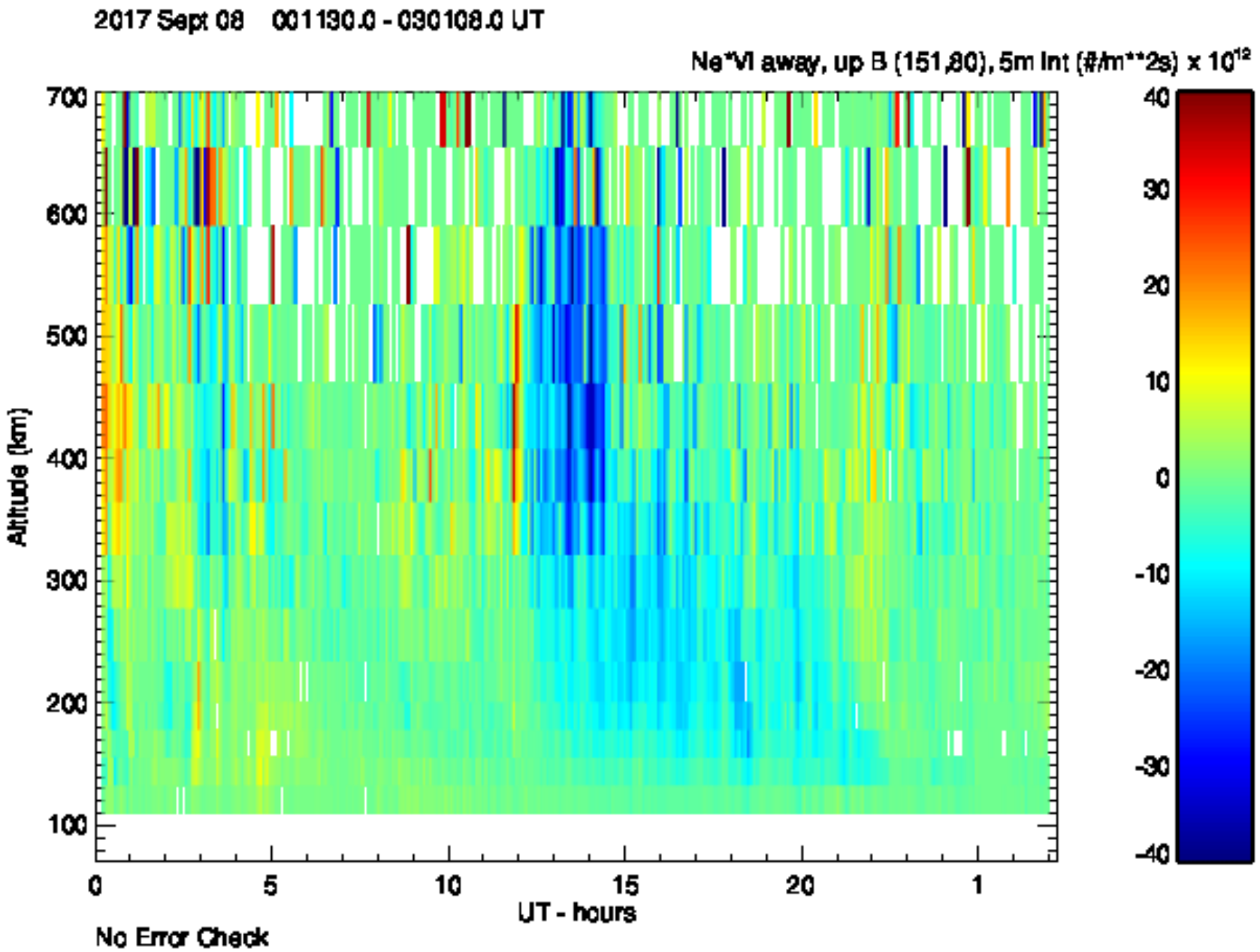
Statistics at ESR (Ogawa et al. 2009)



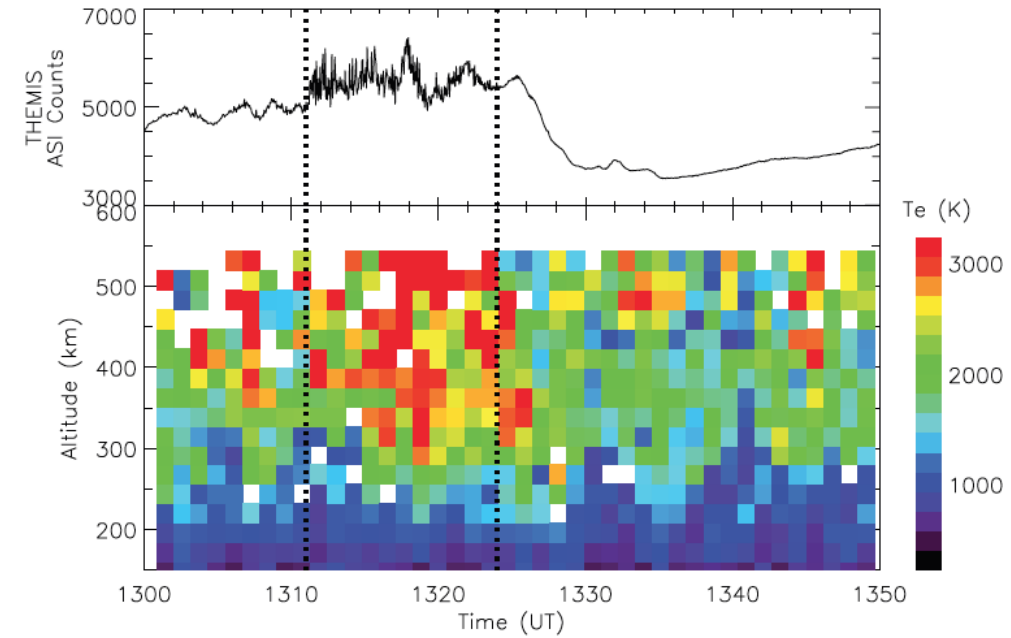
Downflow Poleward of Cusp

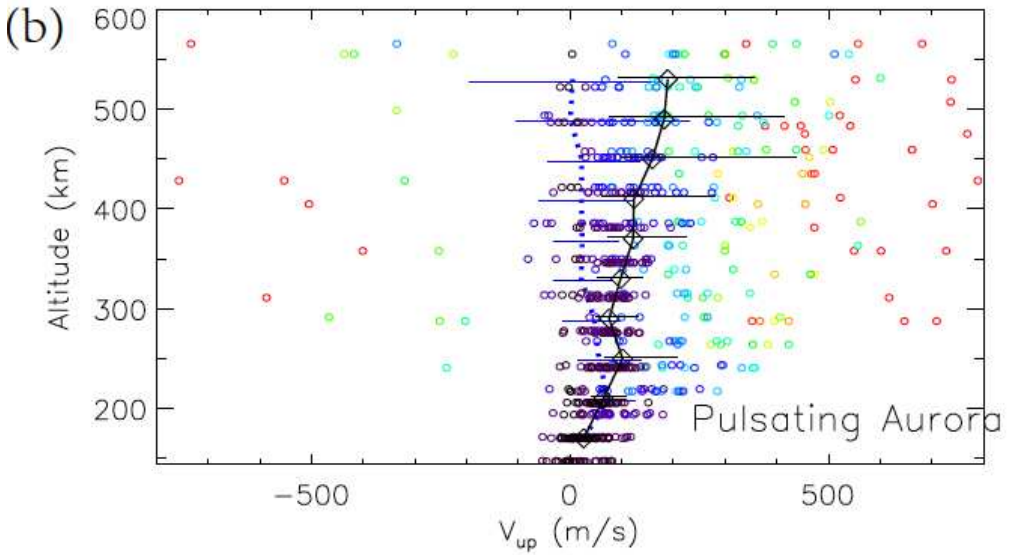


Extreme Downflow over Sondrestrom in September 2017

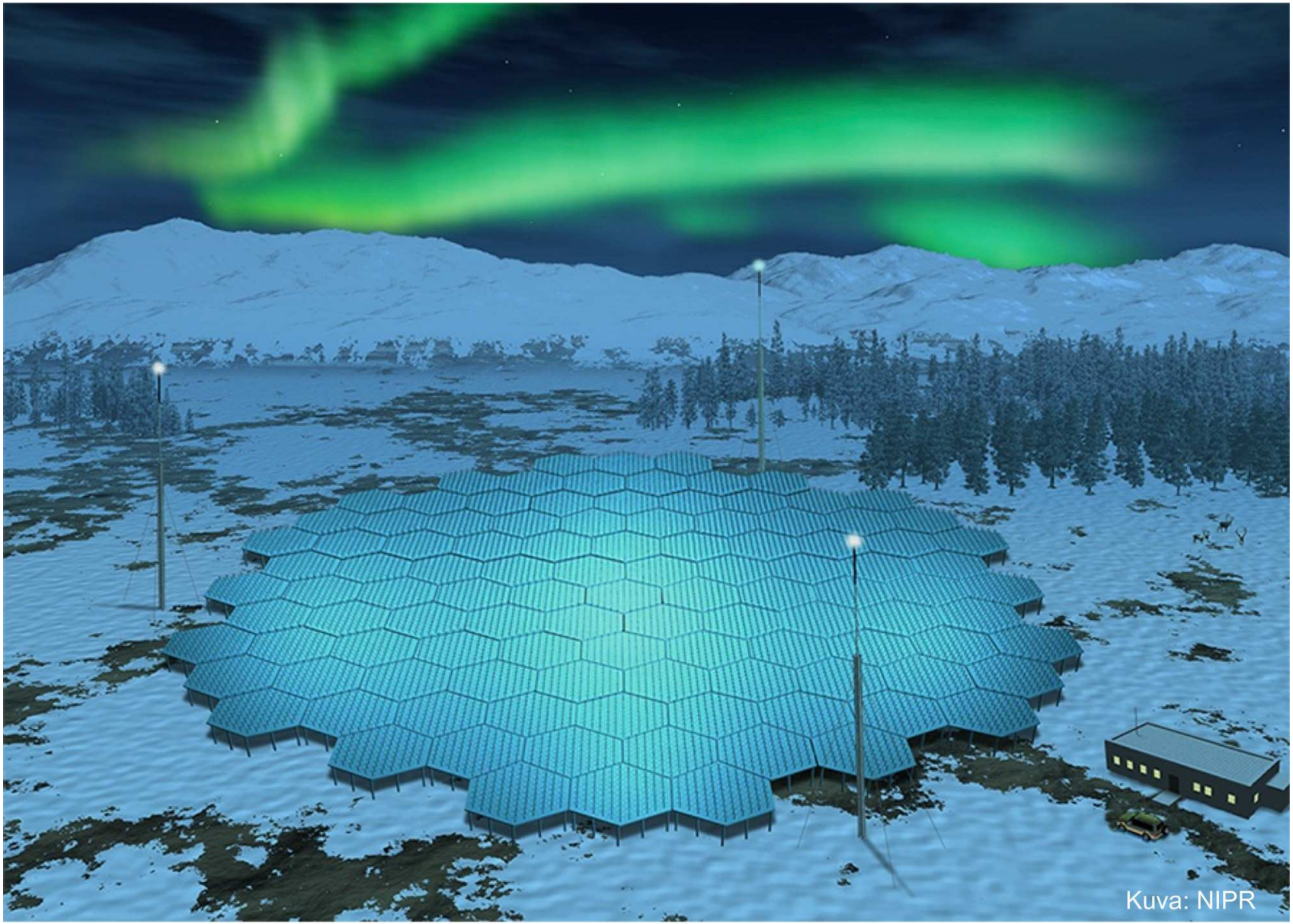


Electron Heat Flux Above PsA (Liang et al. 2018)





EISCAT_3D Science Begins in ∼January 2022



AGU Session: SA015 - Processes Driving Ionospheric Upflow and Outflow

Multiple ion energization processes act on ionospheric plasma, including Joule heating, particle precipitation, solar EUV, wave-particle interactions, parallel electric fields, and ion-neutral interactions. The interplay of these energization processes raises ionospheric plasma to higher altitudes and sometimes enables the escape of ions into the magnetosphere, where they contribute to plasma populations and affect magnetospheric dynamics. Over geologic timescales, ion escape can modify atmospheric density and composition. While a number of instruments have observed upflow and outflow processes in the aurora and polar cap, recent advances in theory and modeling of ion upflow and escape processes raise new questions and require new constraints.

This session will focus on analysis of satellite, rocket, and ground-based observations and future observations that are needed to shed light on the processes of ion escape, as well as theory, modeling, and validation of ionospheric energization and escape processes at Earth and other planets.

Conveners: Katherine Garcia-Sage, Roger Varney, Shasha Zou