



University of  
New Hampshire

Magnetosphere Ionosphere  
Research Lab



# Ion Upflow Associated with Pulsating Aurora

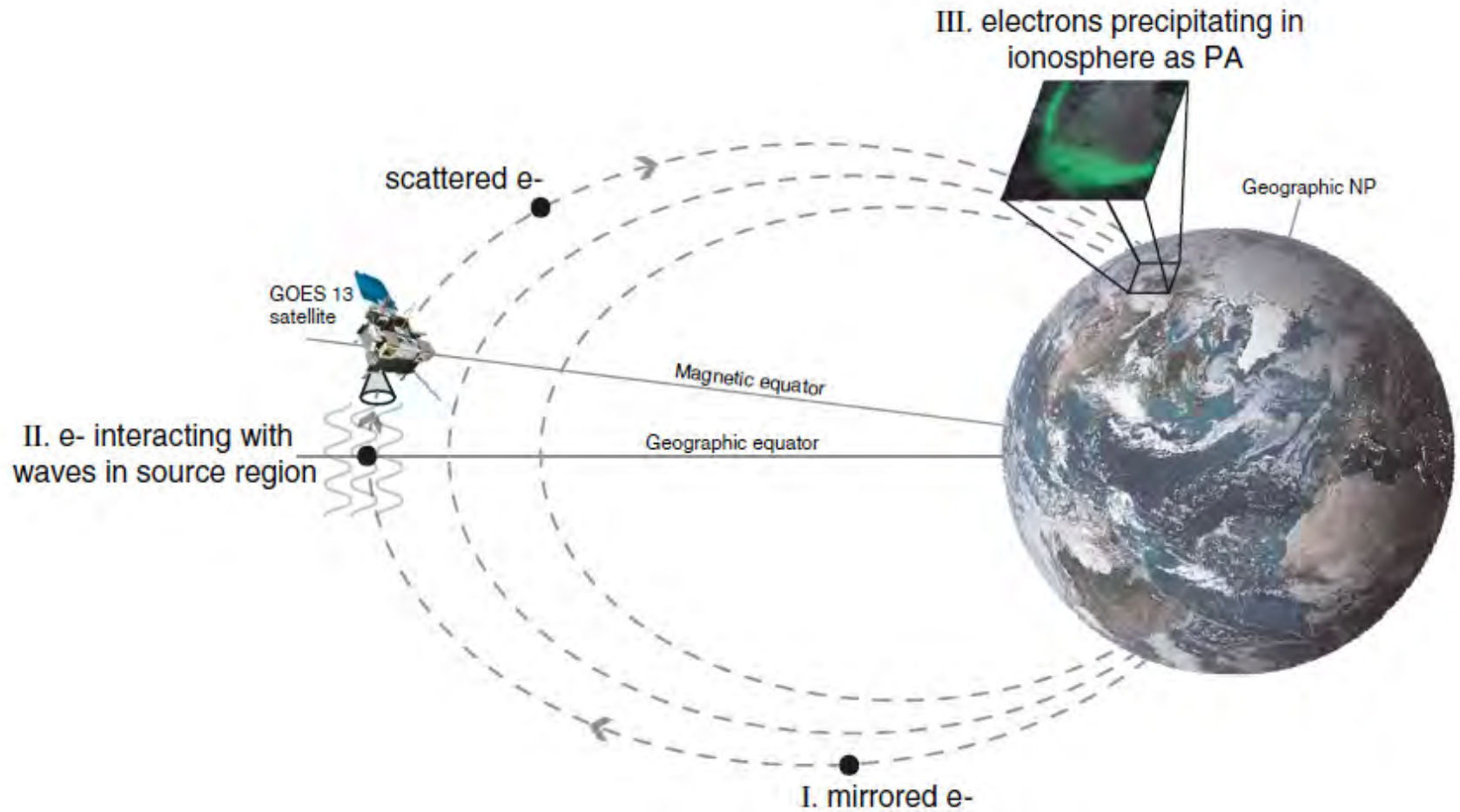
Bruce Fritz, David Kenward, Marc Lessard  
University of New Hampshire

Roger Varney, Ashton Reimer  
SRI International

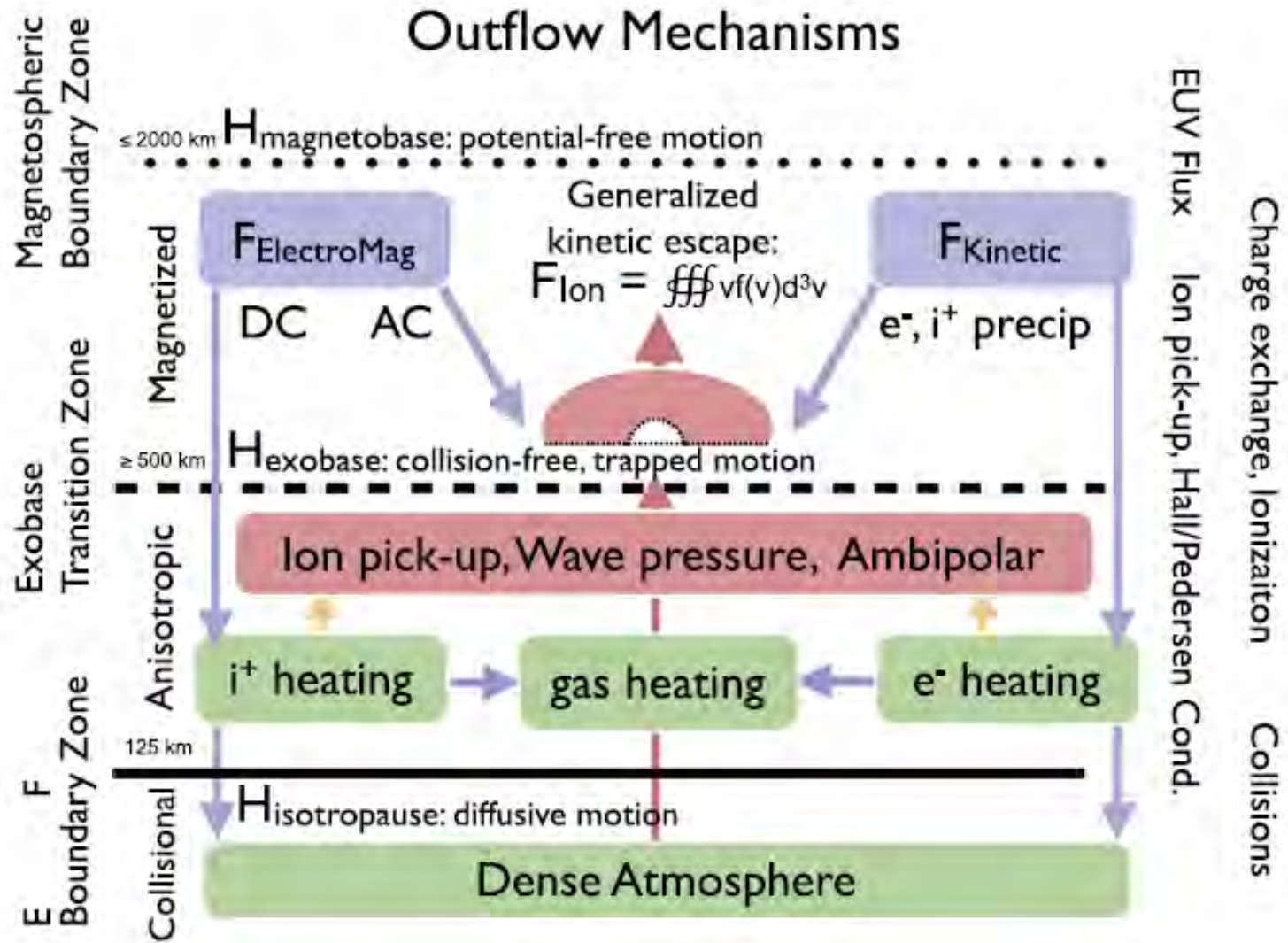
Robert Michell  
University of Maryland

- Background
  - Pulsating Aurora
  - Ion Outflow
- Experimental Results
  - ISR results
  - Imager results









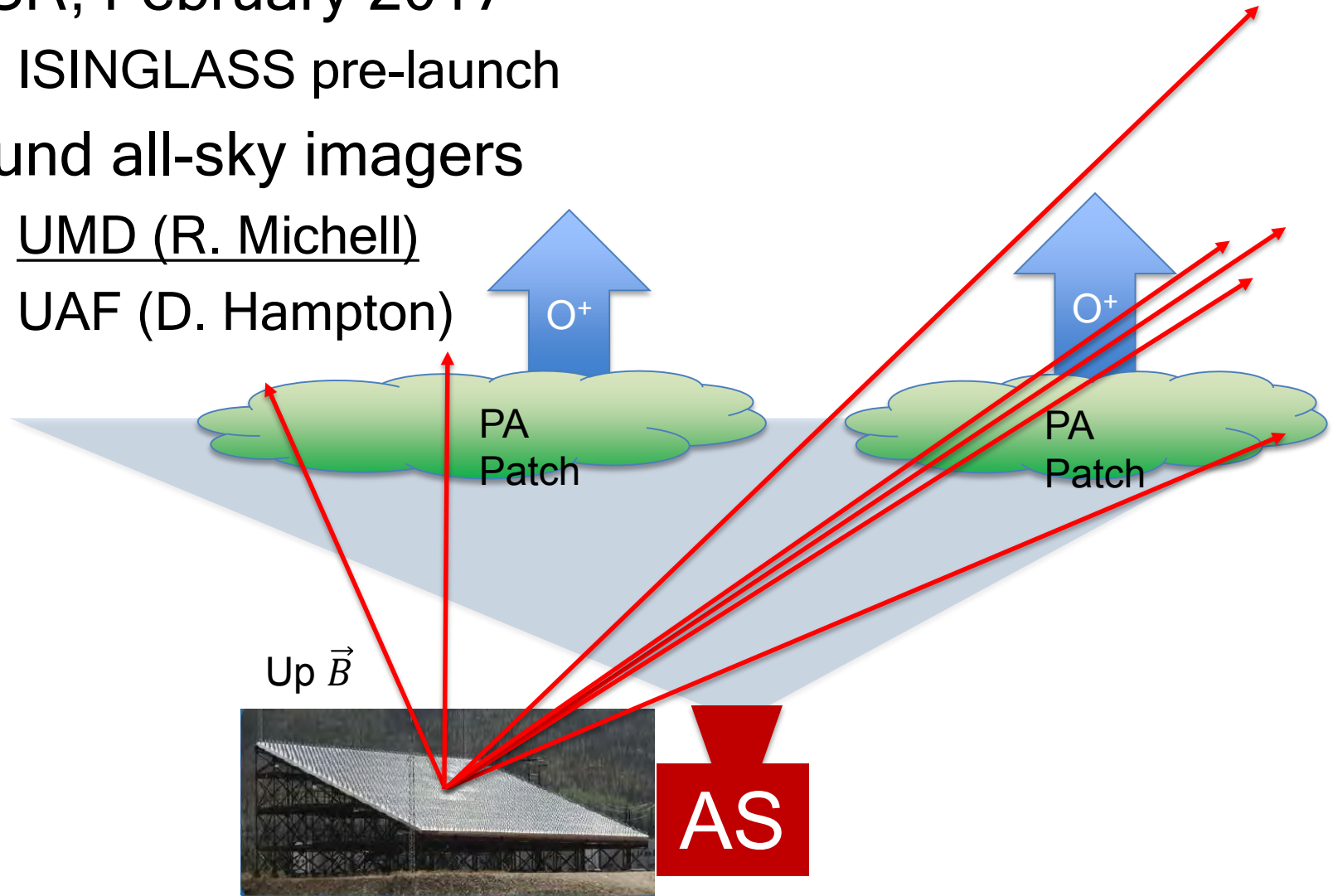
Moore *et al* [2014]

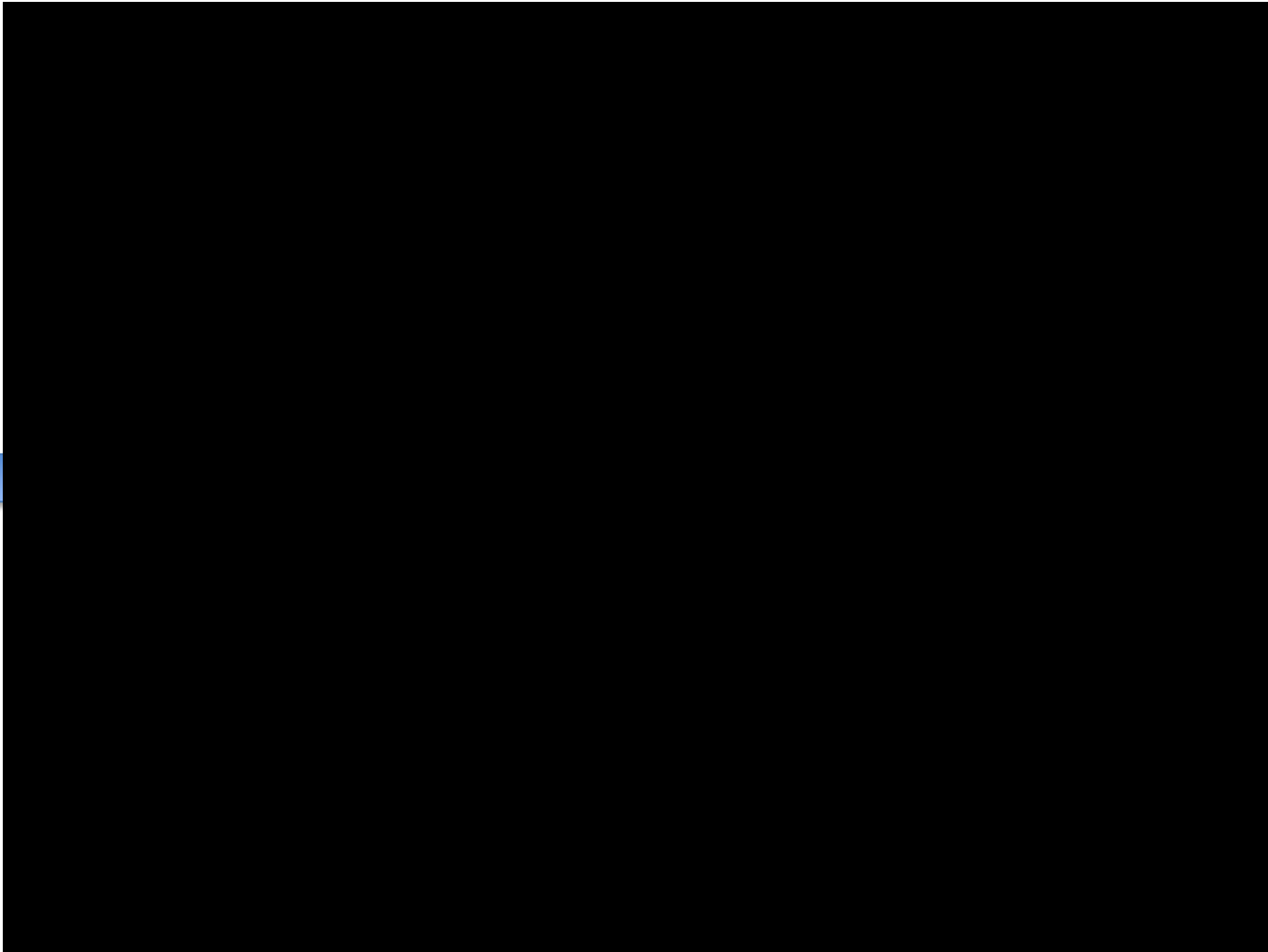
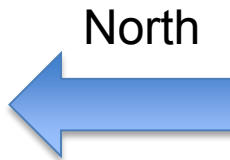
## PFISR, February 2017

- ISINGLASS pre-launch

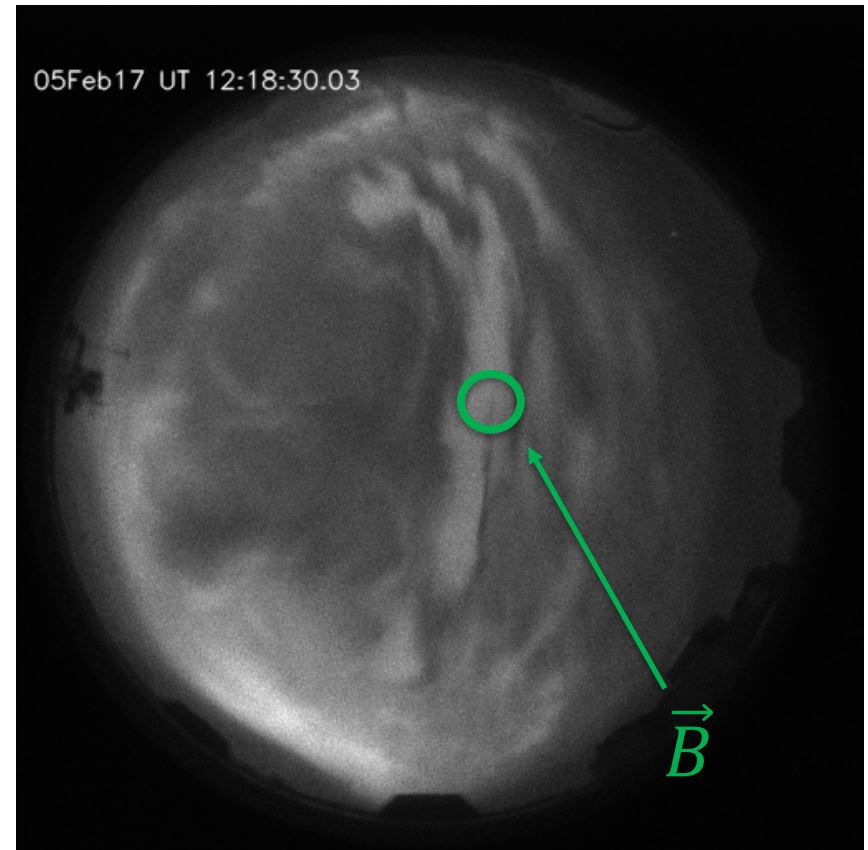
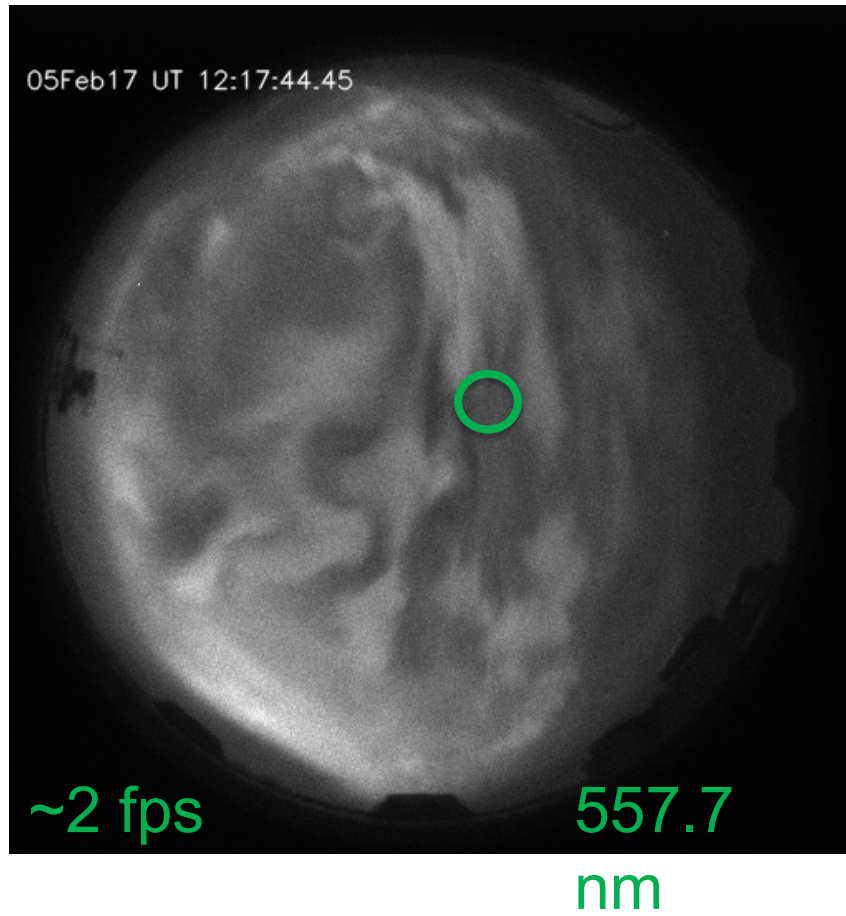
## Ground all-sky imagers

- UMD (R. Michell)
- UAF (D. Hampton)



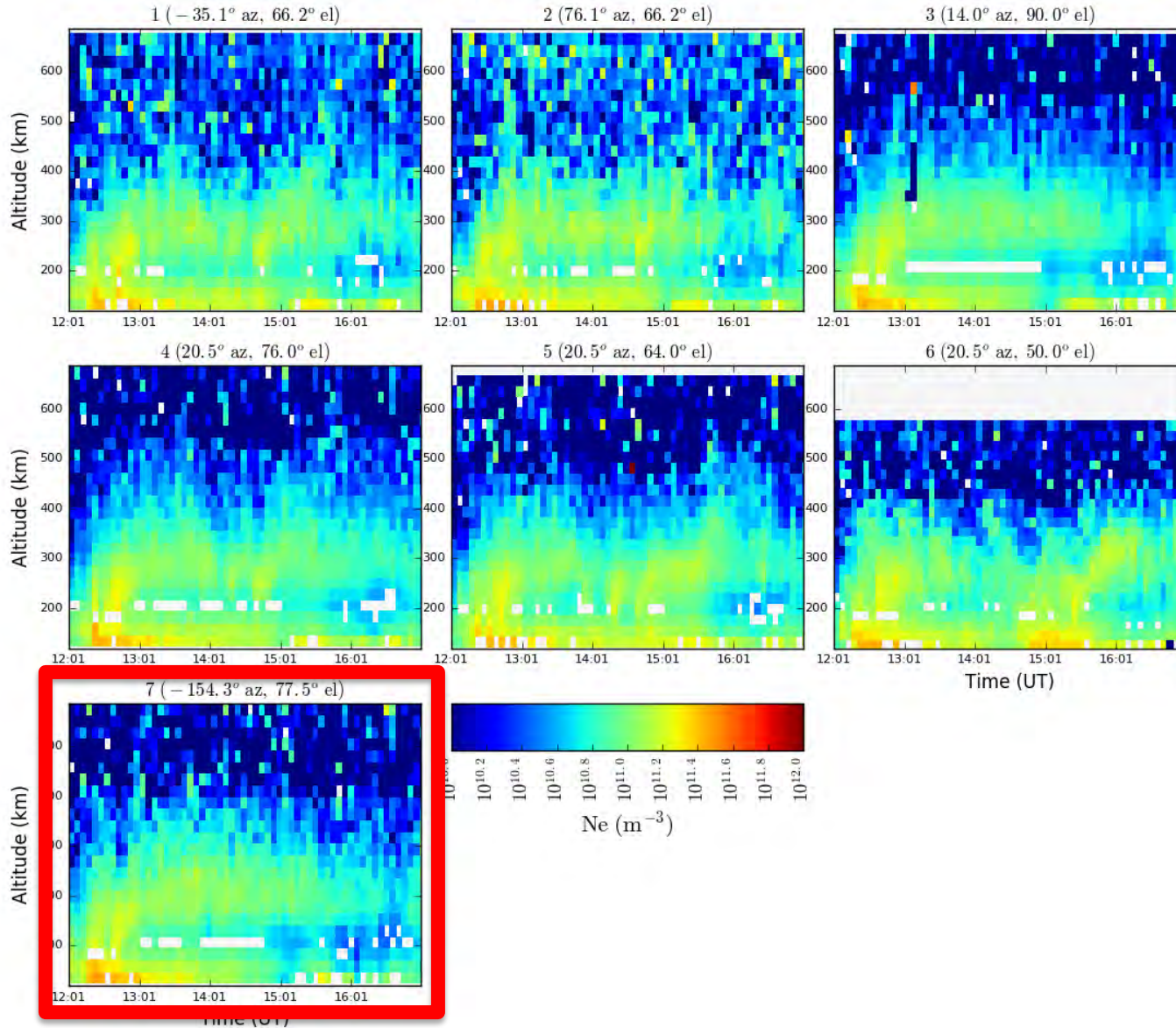


<https://youtu.be/bg4BWakbB>  
Sk



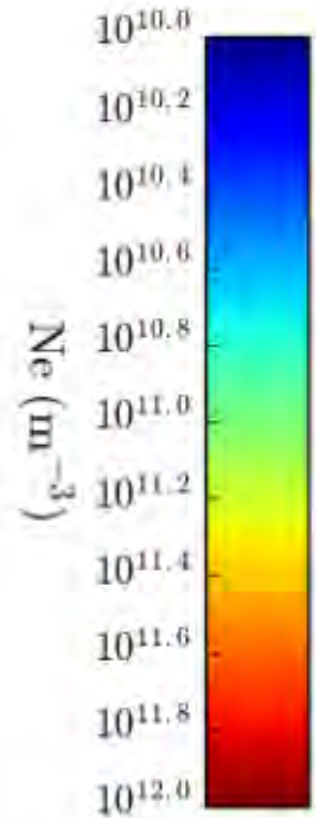
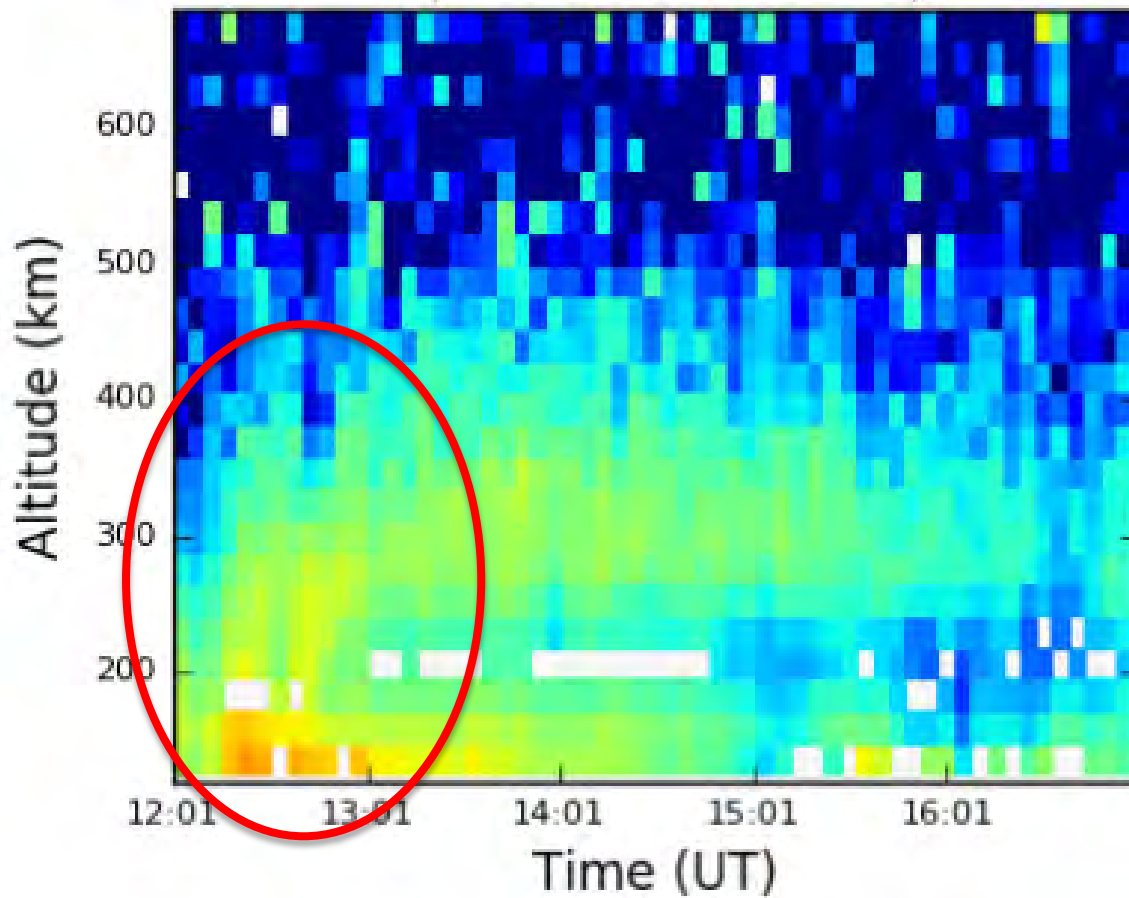


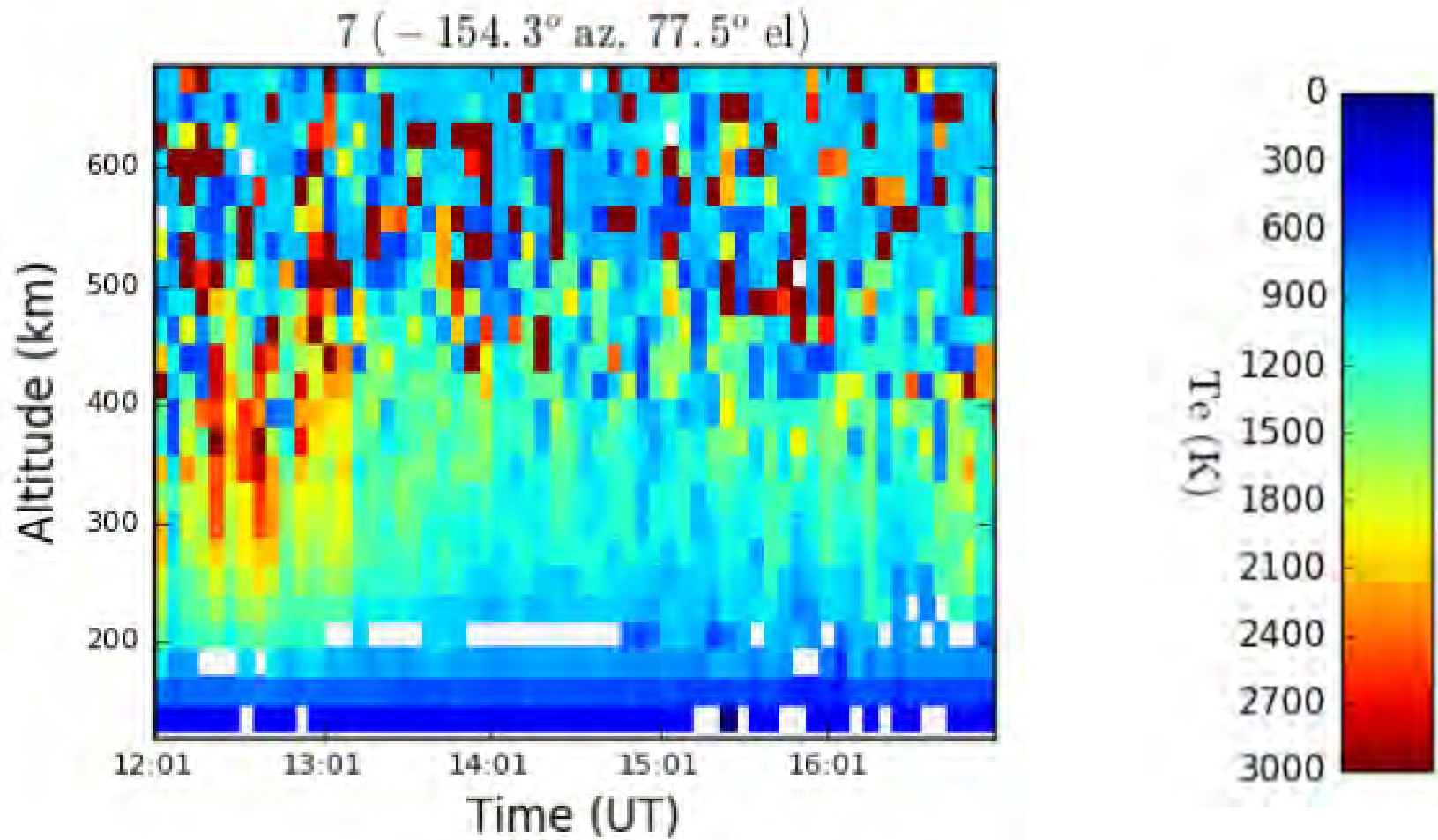
2-5-2017 12.013 UT - 2-5-2017 17.000 UT



Up  $\vec{B}$

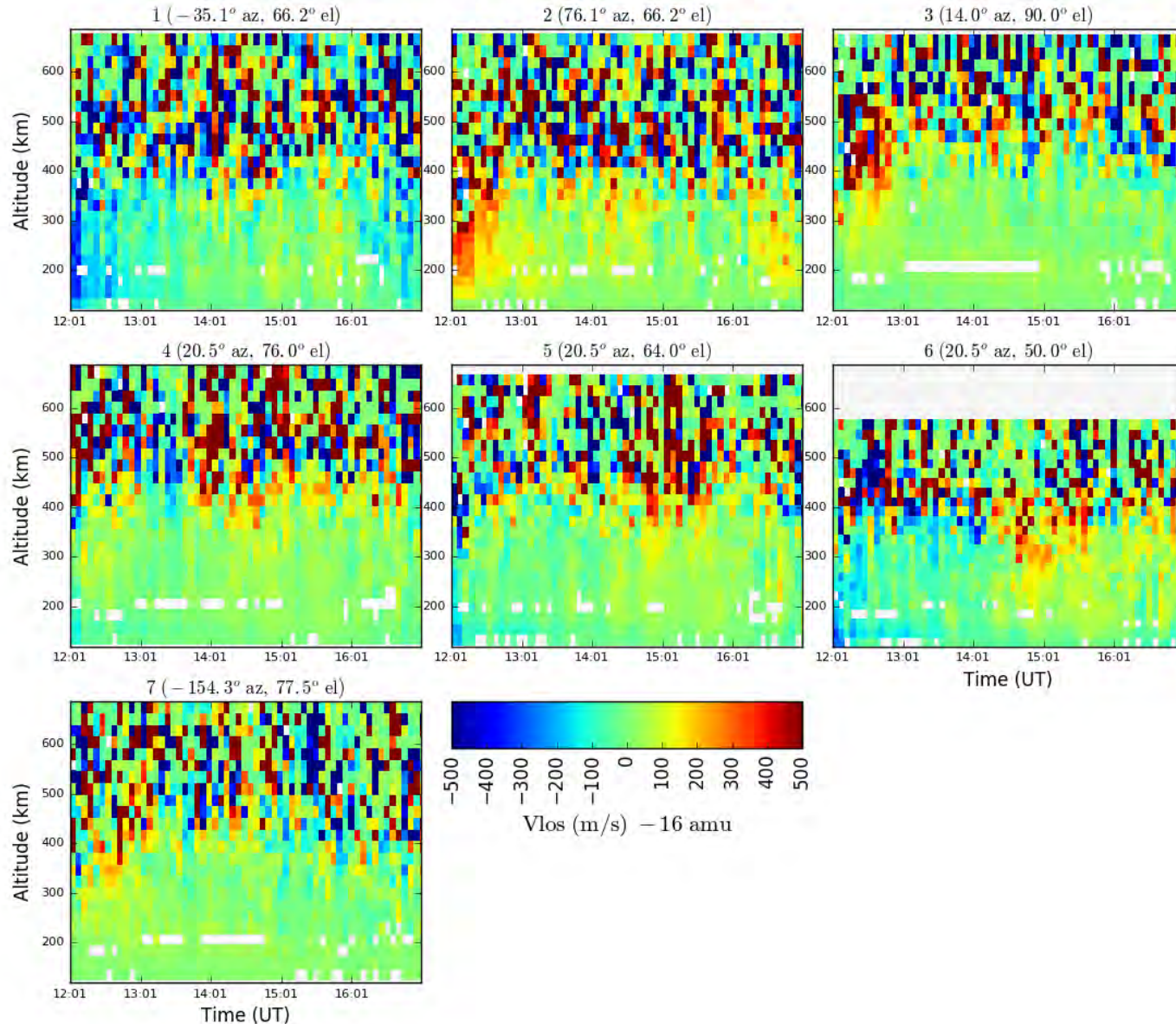
7 ( -154.3° az, 77.5° el)



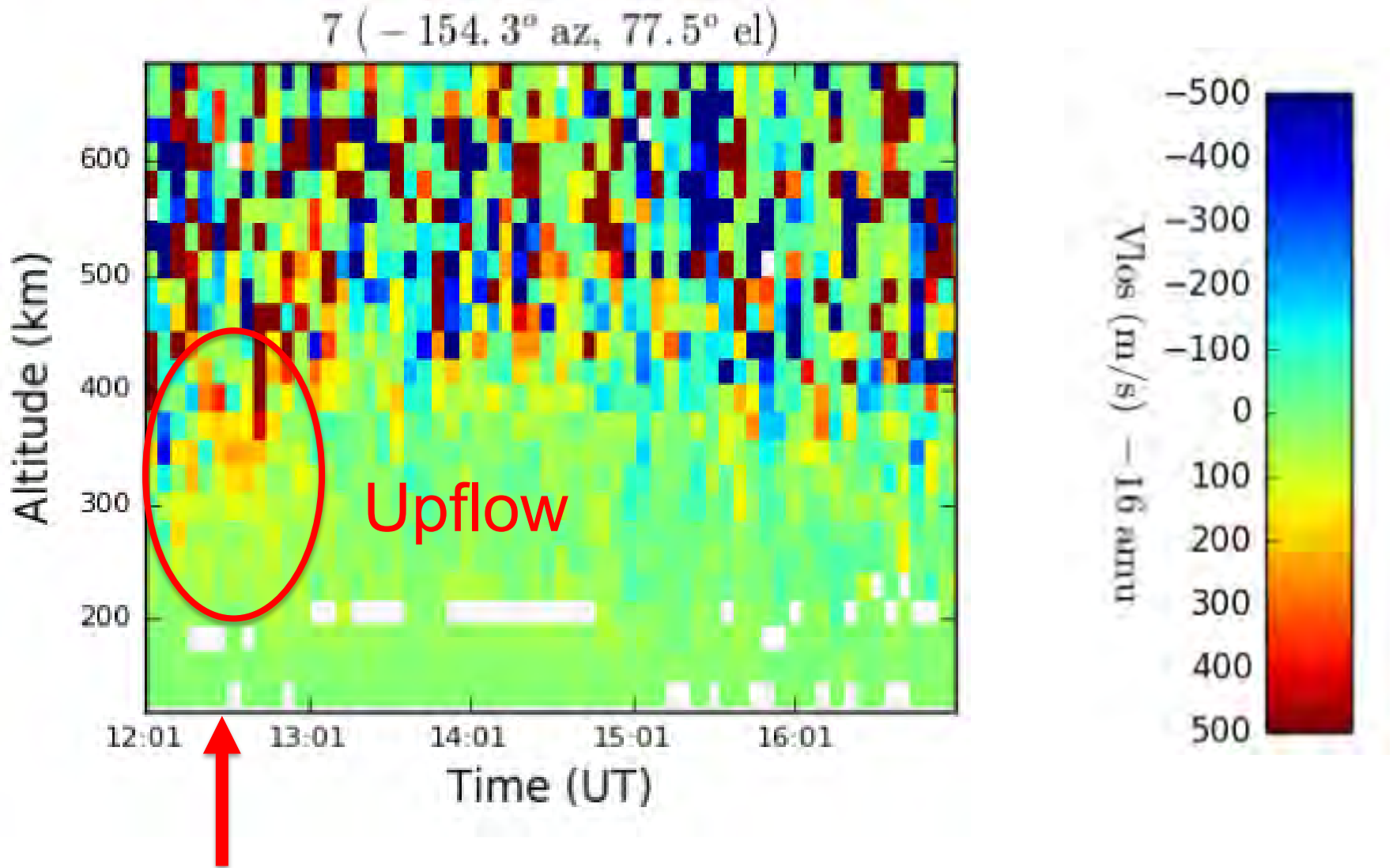




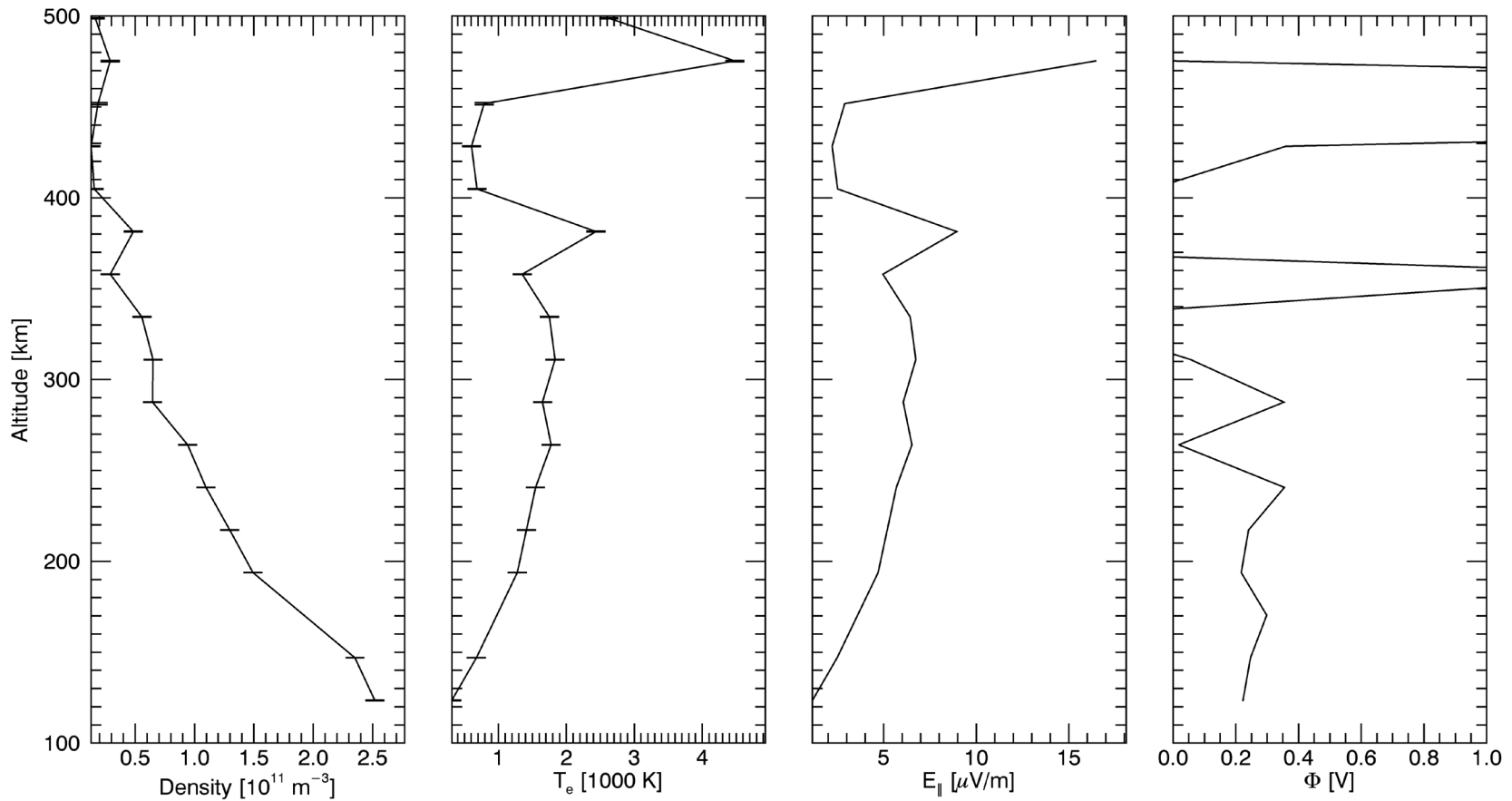
2-5-2017 12.013 UT - 2-5-2017 17.000 UT







PFISR Measurement ( $-154.3^\circ$  az,  $77.5^\circ$  el)  
5 February, 2017, 1218 UT



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

- Initial results show ion upflow in close proximity to pulsating aurora
- Additional analysis to consider:
  - Time history of pixels along ISR beam
  - Energy deposition of pulsating aurora from both ISR and imager data
- Nov. 2017 follow on experiment

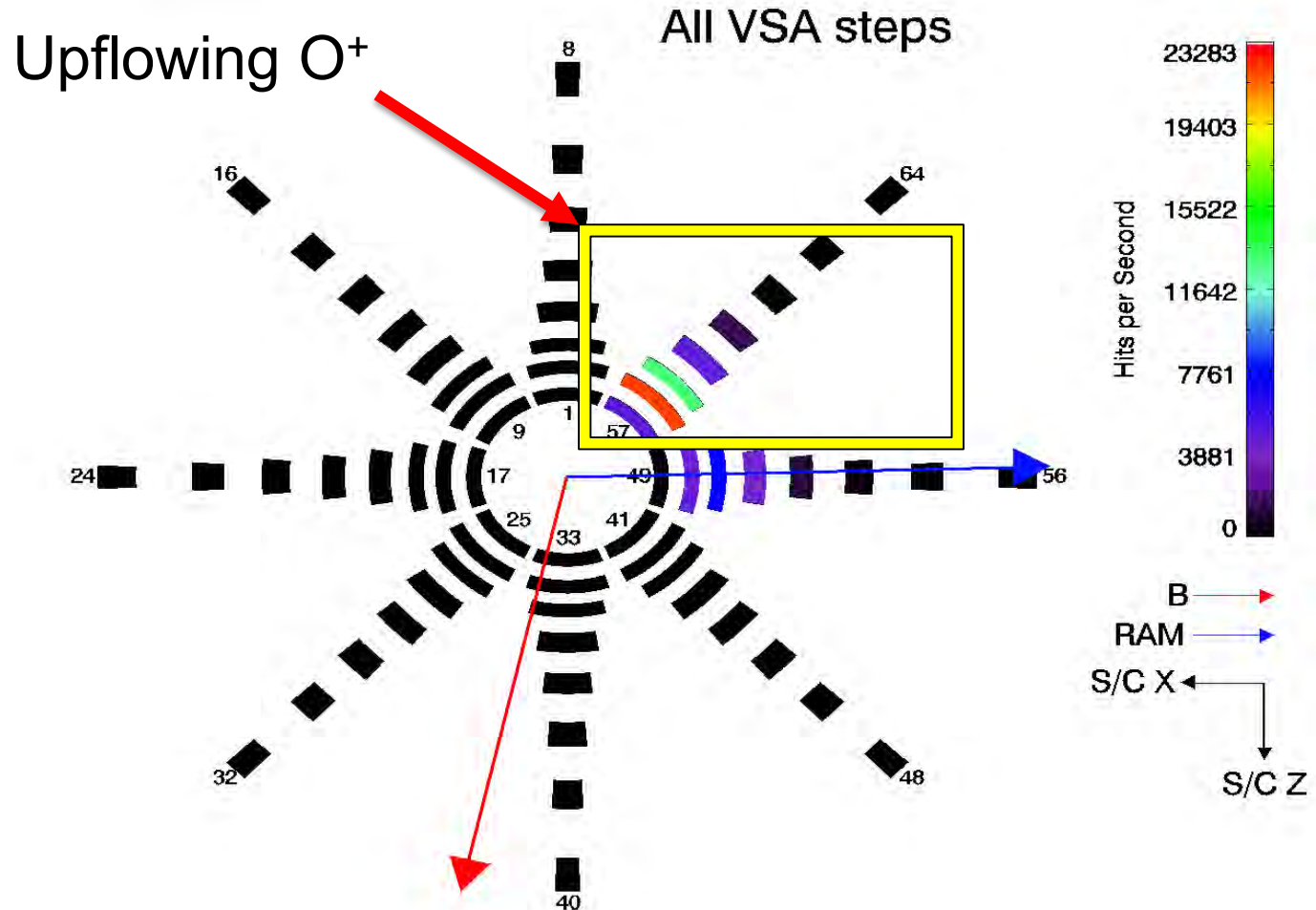


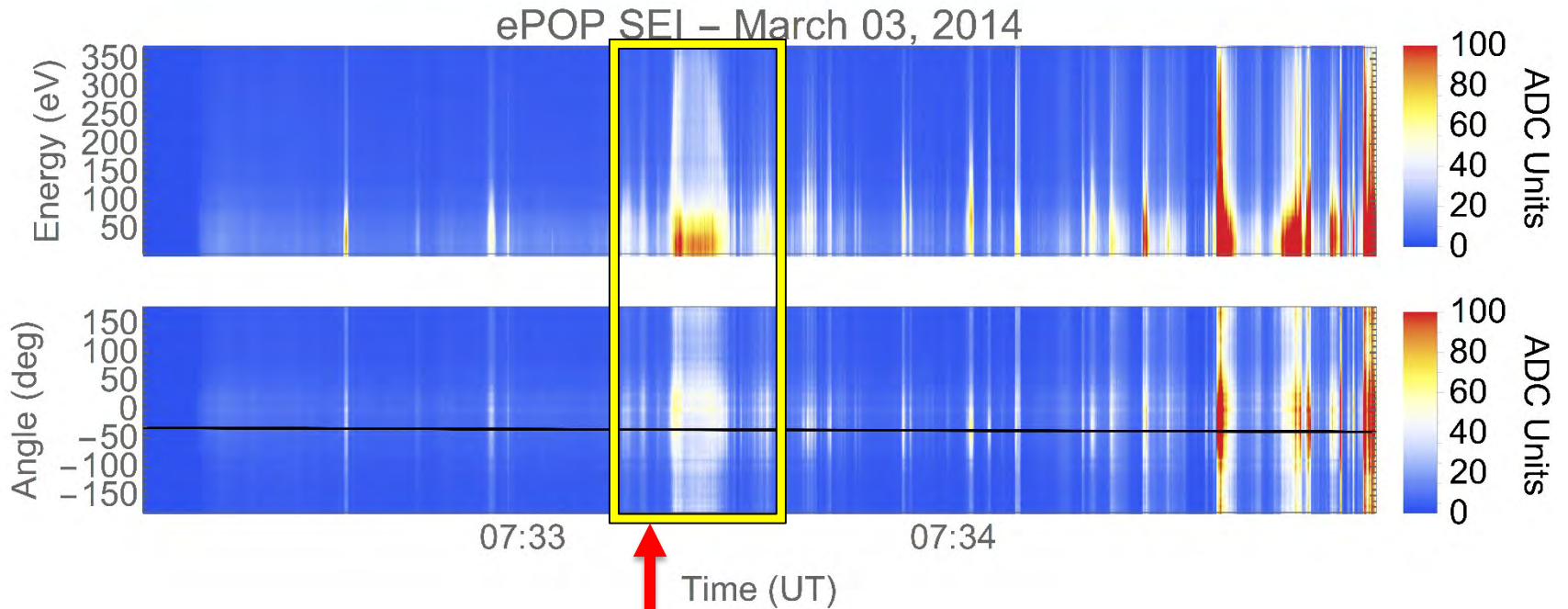
# Backup





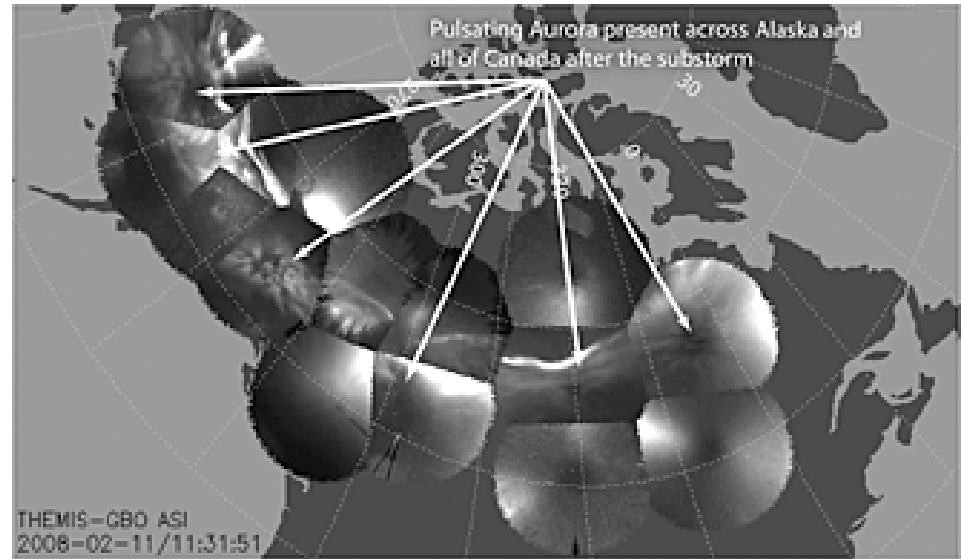
e-POP IRM March 03, 2014  
07:33:30.17 - 07:33:31.11 UT



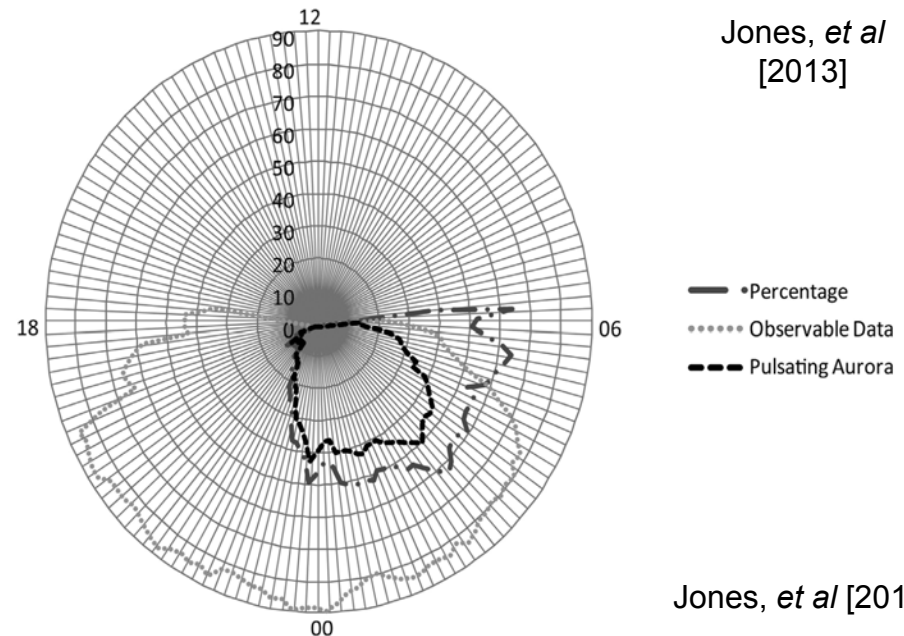


Backscatter electrons

- Widespread temporally and geographically
- Jones, *et al* [2011] statistical study:
  - Most probable duration 90-120 min
  - 31% clear optical data exhibit PA
  - 69% of PA occur post substorm
  - 54% probability to occur after magnetic midnight



Jones, *et al* [2013]

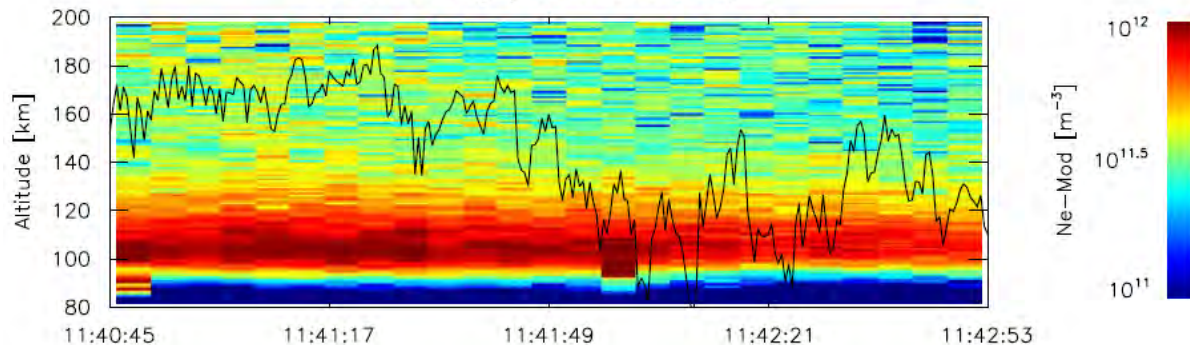


Jones, *et al* [2011]

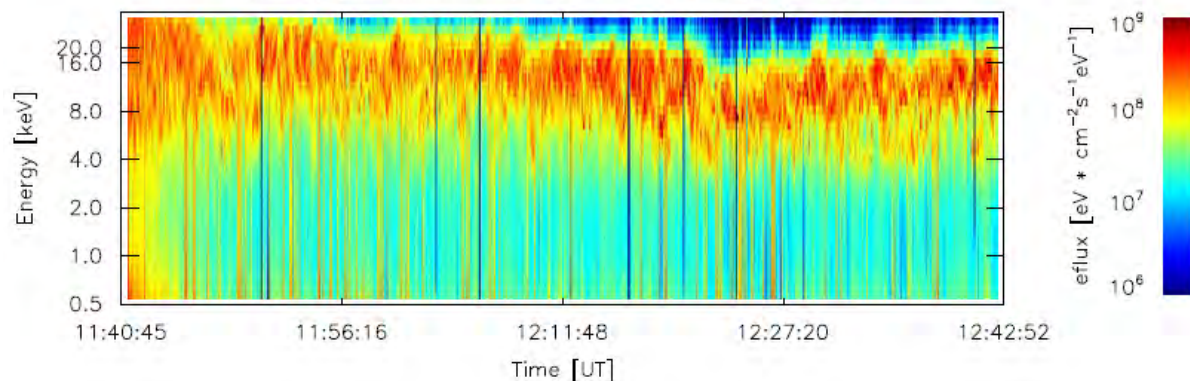


- First PFISR campaign
  - Spatial resolution: 1 km
  - Temporal resolution: 5 s
  - 480  $\mu$ s long pulse interleaved with a 13 baud (10  $\mu$ s) Barker code on two frequencies
- Invert electron density profile to determine energy distribution

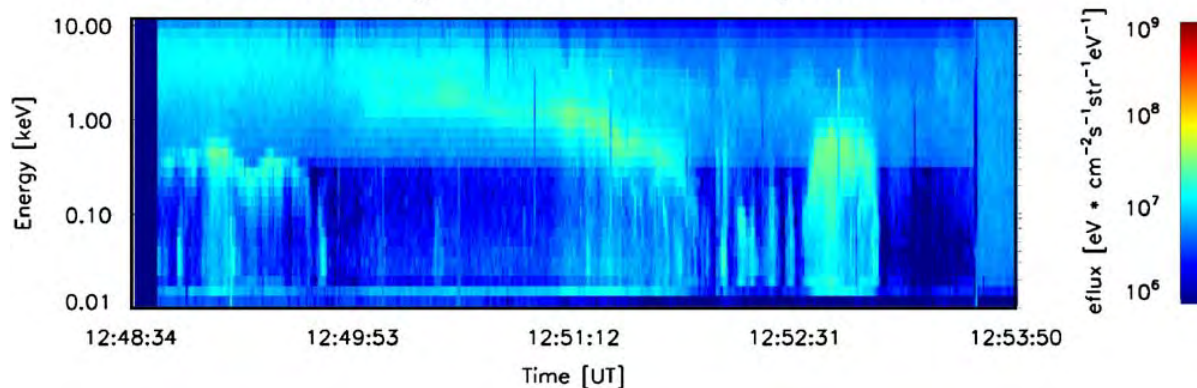
PFISR density profile: 2007/02/12



Energy distribution from PFISR density inversion



Differential Energy Flux from ROPA Main Payload HEEPS





## Chatanika, AK

- Foster *et al* [1978],  
Sears and Vondrak  
[1981]

## EISCAT

- Miyoshi *et al* [2015]  
(fig.), Hosokawa  
and Ogawa [2015],  
Turunen *et al*  
[2016]

## AMISR

- Jones *et al* [2009],  
Cosgrove *et al*  
[2010]

