ISR Summer School
Group 5

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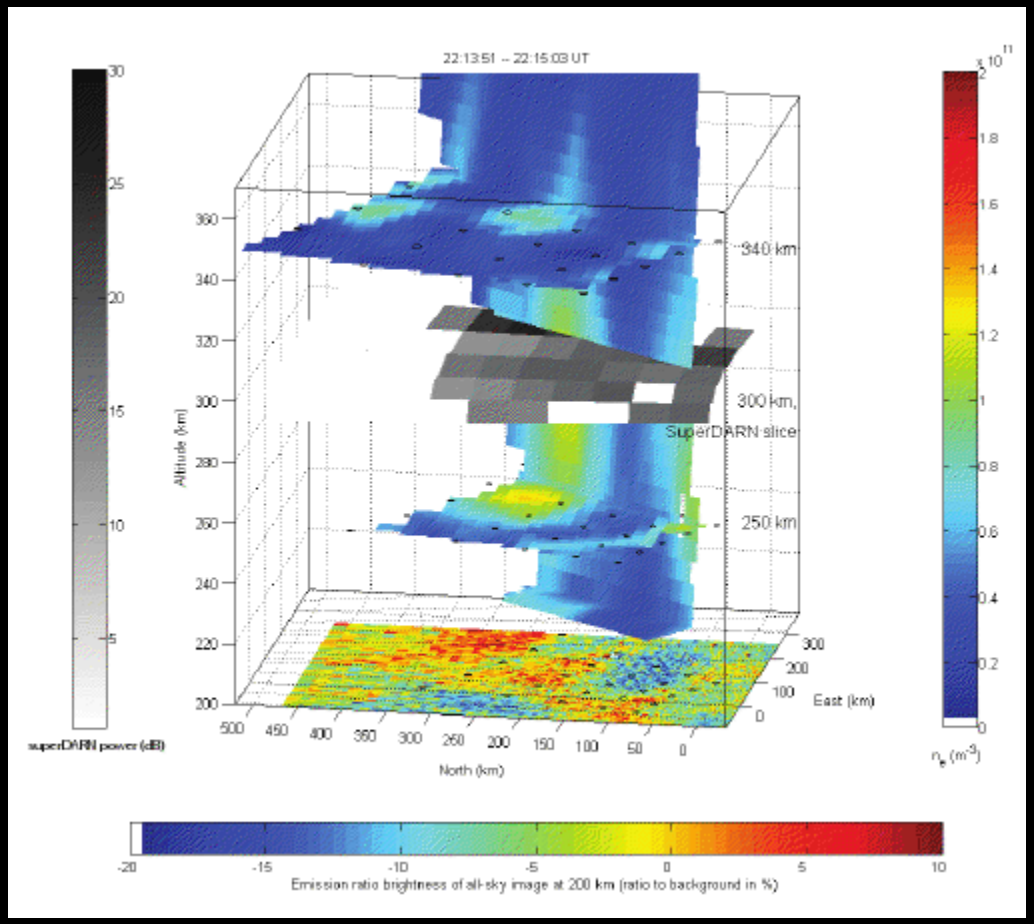
Outline

- Introduction: Experiment
  - What we wanted to see
  - How we were going to see it
- Data
  - What we actually saw
  - What we think we saw
- Conclusions

Experiment

What we wanted to see:

Polar Cap Patches



RISR, SuperDARN, and OMTI Data

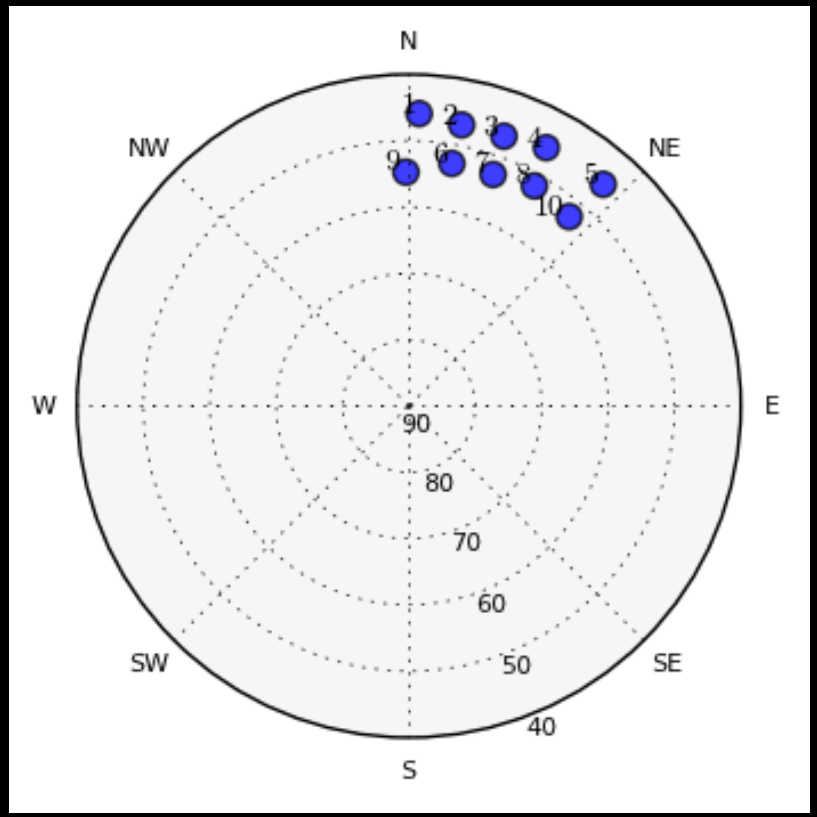
Experiment

Polar Cap Patch Characteristics:

- Density at least twice that of background
- Spatial dimensions on the order of 100 km
- Found in the F region
- Convect from dayside to nightside across the polar cap

Experiment

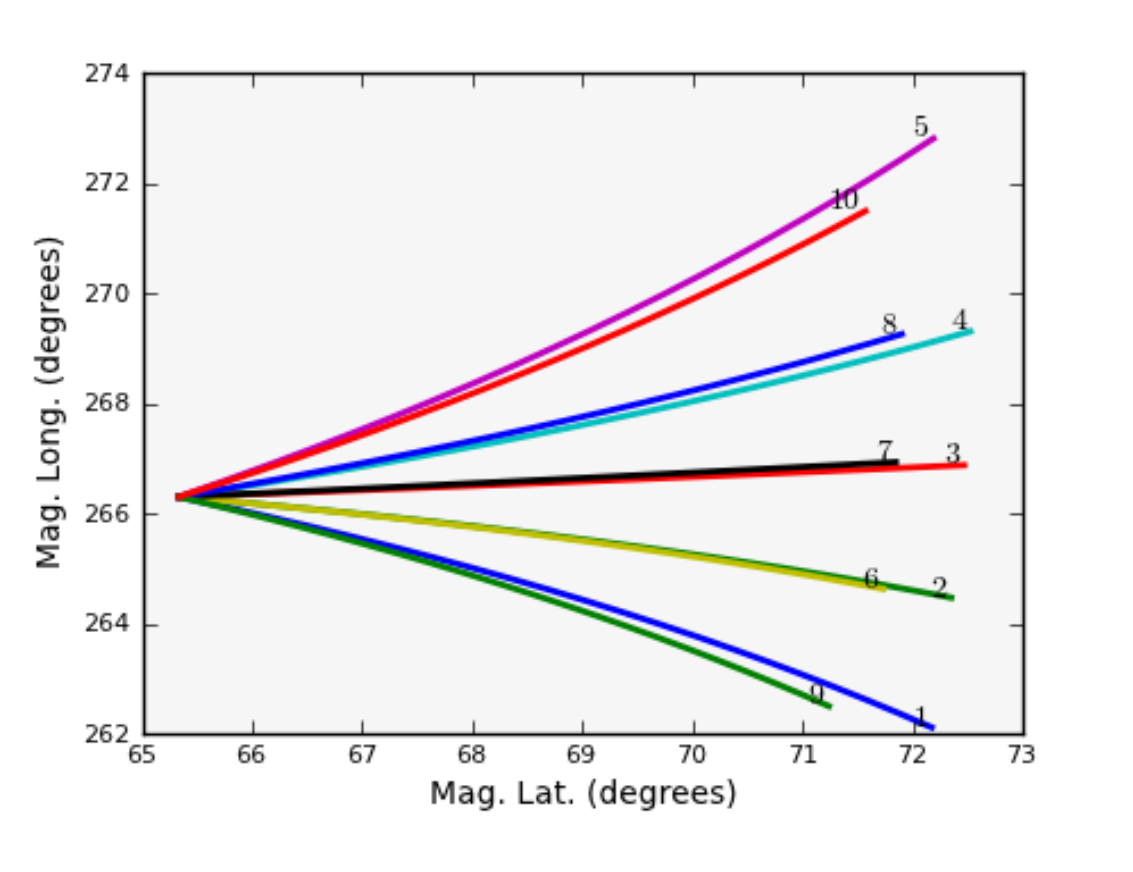
How we were going to see this:



Beam	Az (deg)	El (deg)
1	2.0	45.9
2	10.6	46.9
3	19.4	46.9
4	28.0	45.9
5	41.2	45.6
9	-0.7	54.7
6	10.0	52.9
7	20.0	52.9
8	29.7	51.8
10	40.2	52.6

Experiment

How we were going to see this:

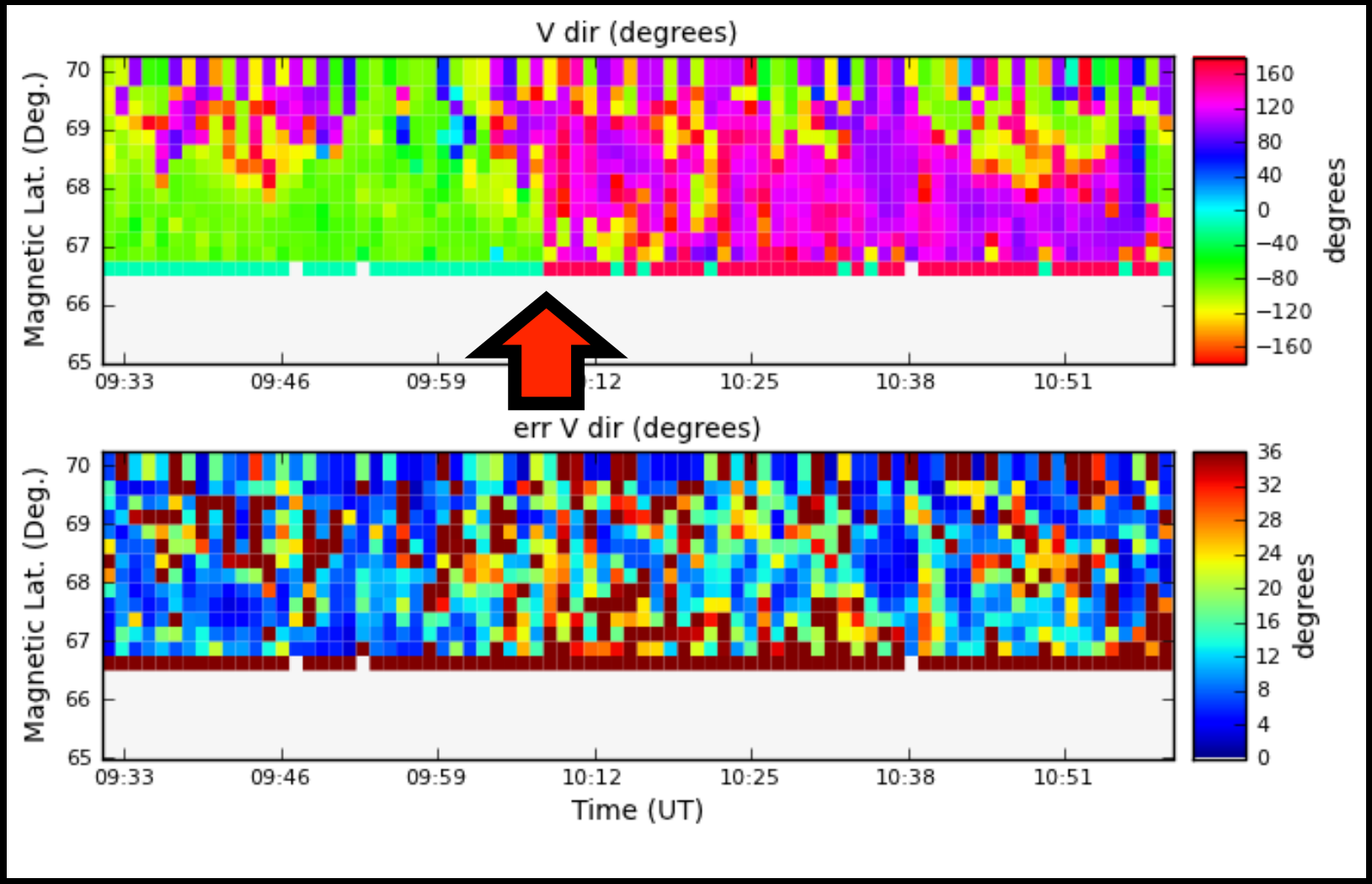


Data

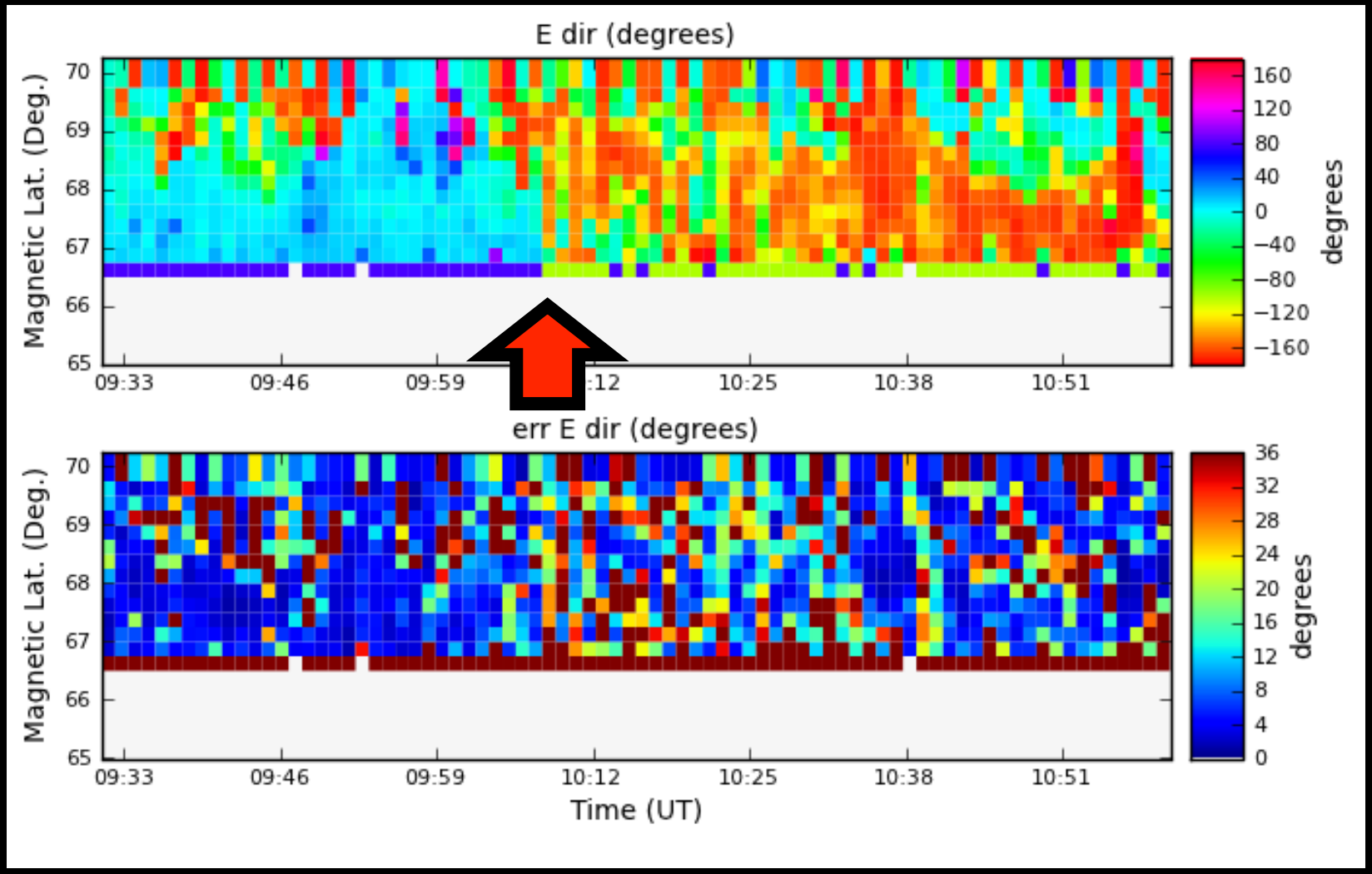
What we saw:

- Direction Flip
- Plasma Flow
- Aurora

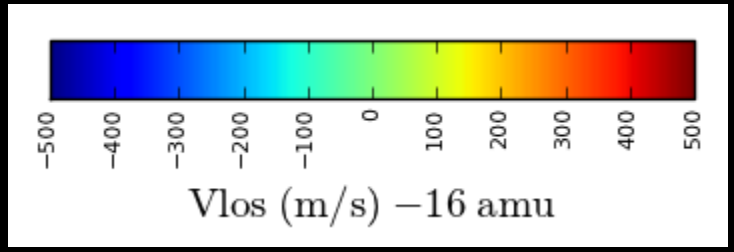
Data - Direction Flip



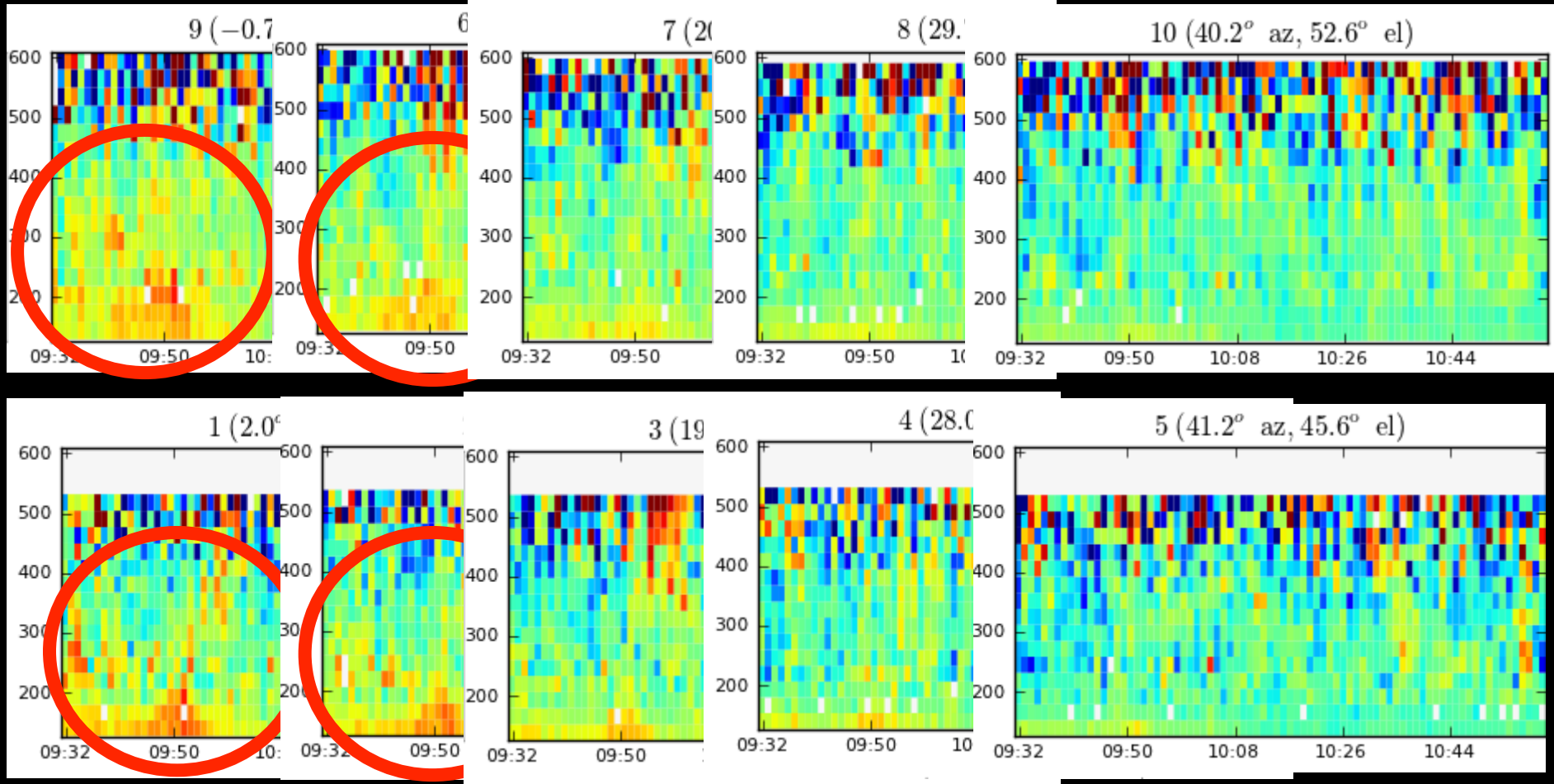
Data - Direction Flip



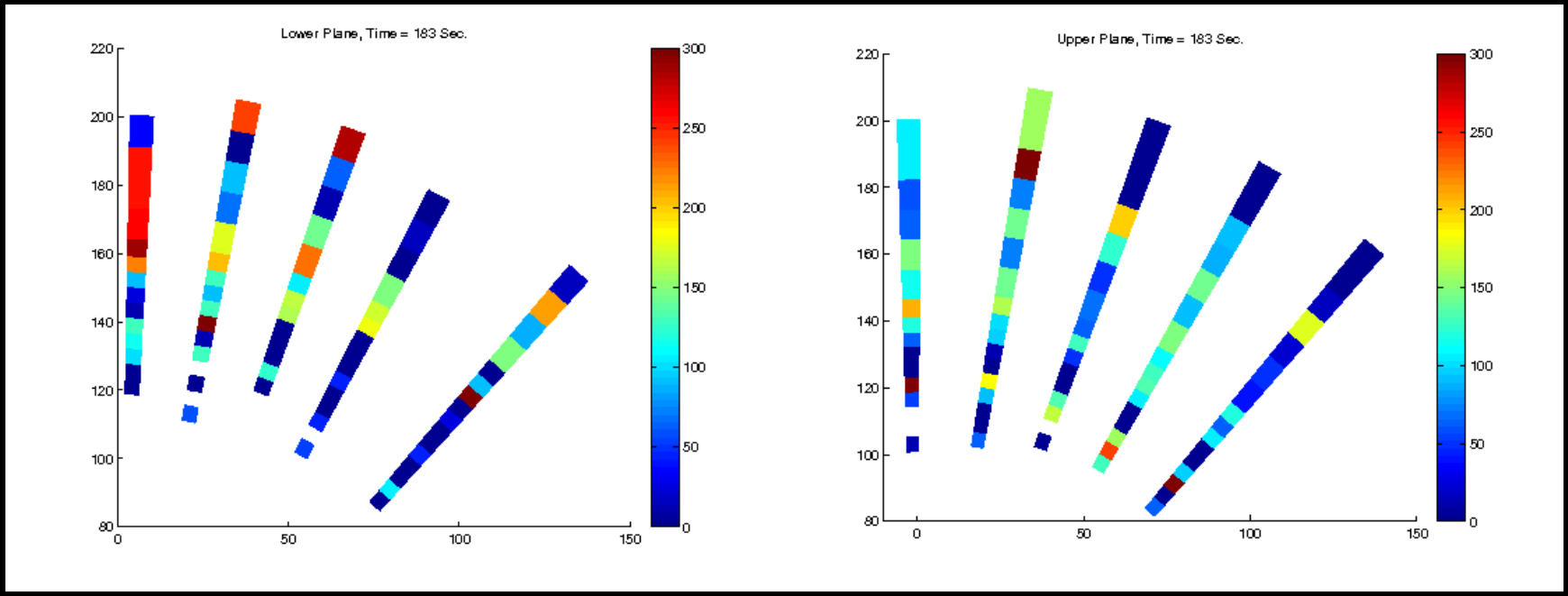
Data - Plasma Flow



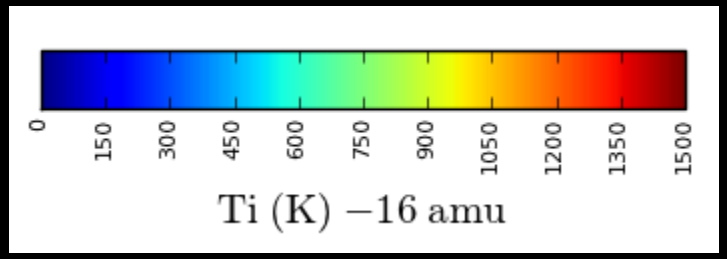
Line of Sight Velocities



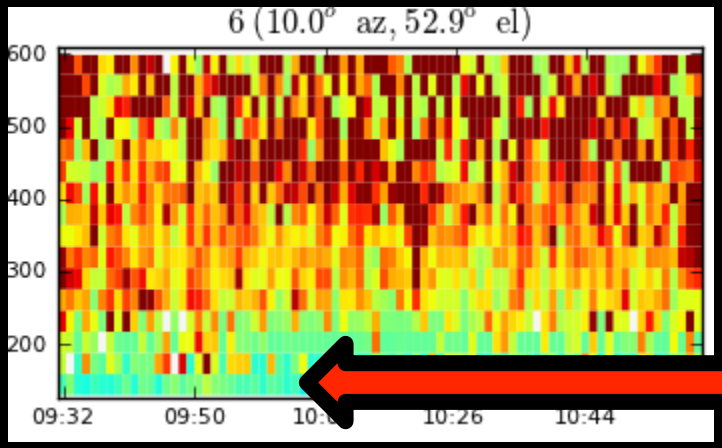
Data – Plasma Flow

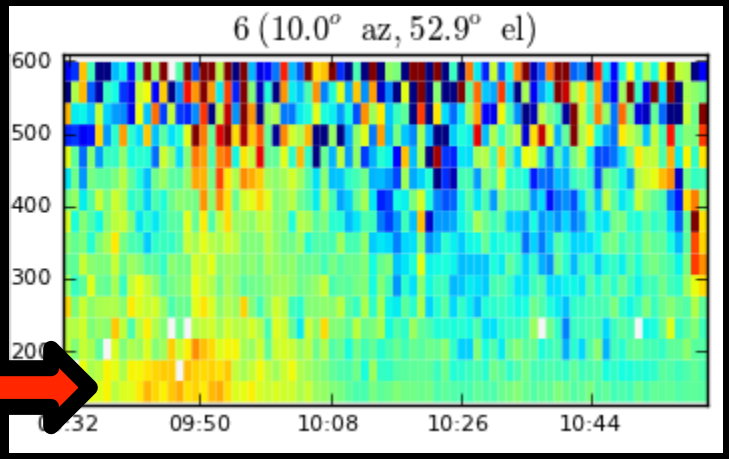


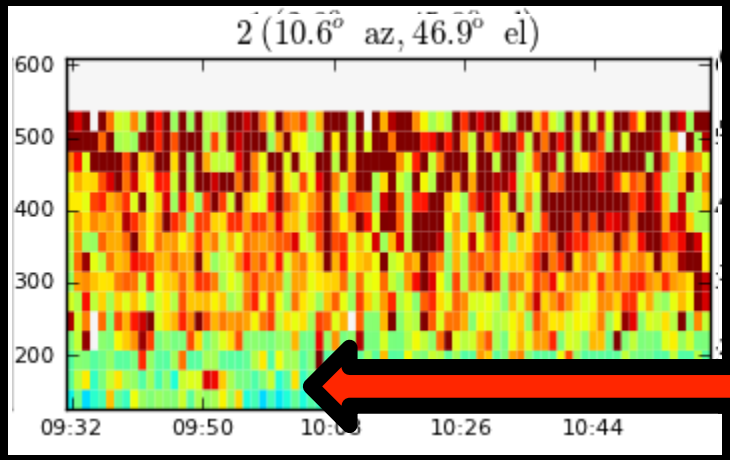
Data - Plasma Flow

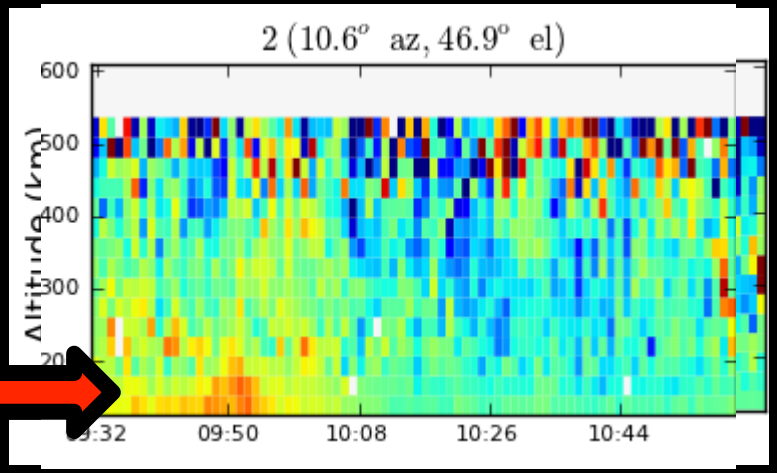


Ion Temperature



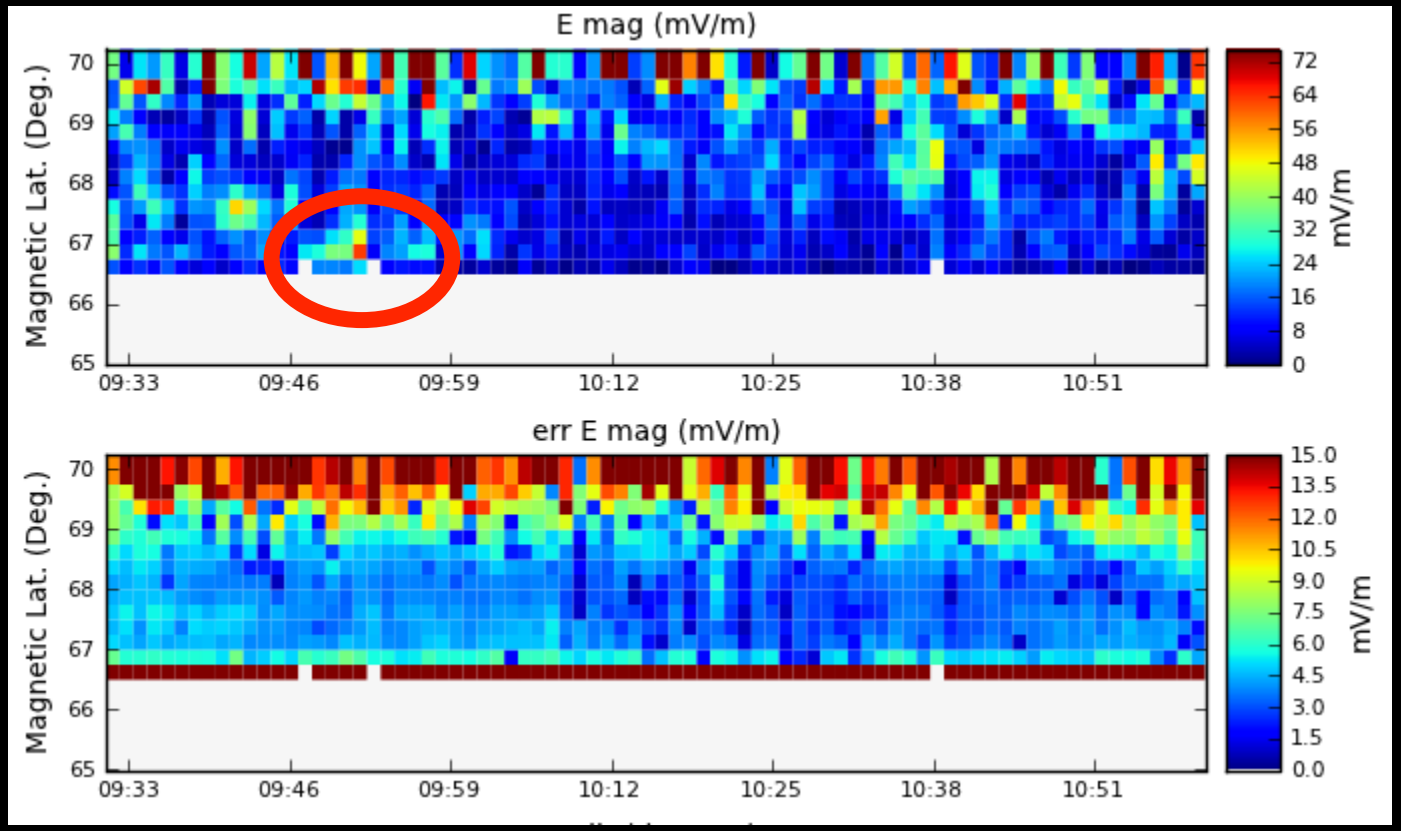






Data - Plasma Flow

Electric Field



Data - Plasma Flow

Solving inverse problem

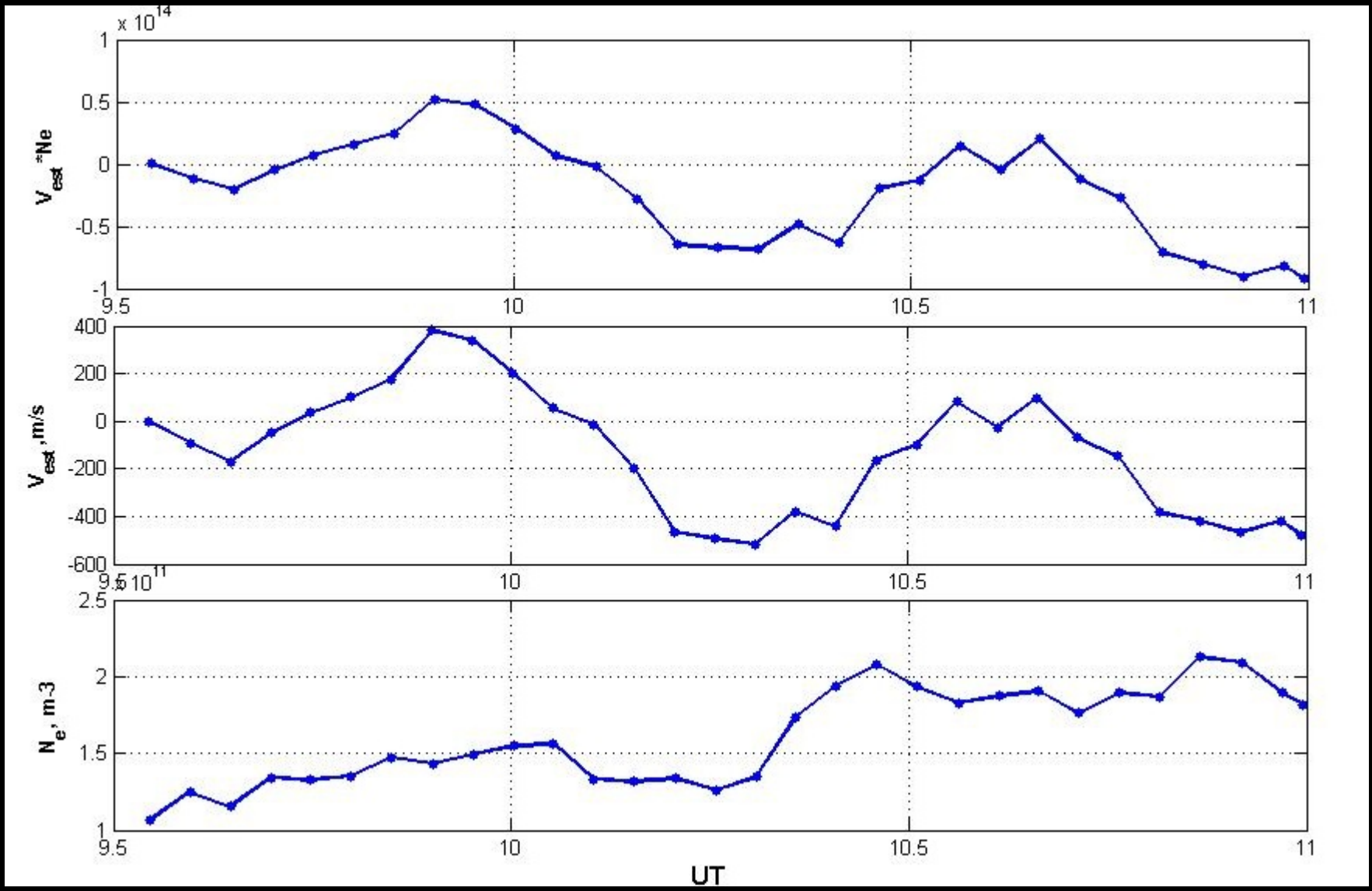
$$\begin{bmatrix} k_e^1 & k_n^1 \\ \dots & \dots \\ k_e^m & k_n^m \end{bmatrix} \begin{bmatrix} V_e \\ V_n \end{bmatrix} = \begin{bmatrix} V_{los}^m \\ \dots \\ V_{los}^m \end{bmatrix}$$

$$\begin{bmatrix} k_e \\ k_n \end{bmatrix} = \begin{bmatrix} \cos\theta \sin\varphi \\ \cos\theta \cos\varphi \end{bmatrix}$$

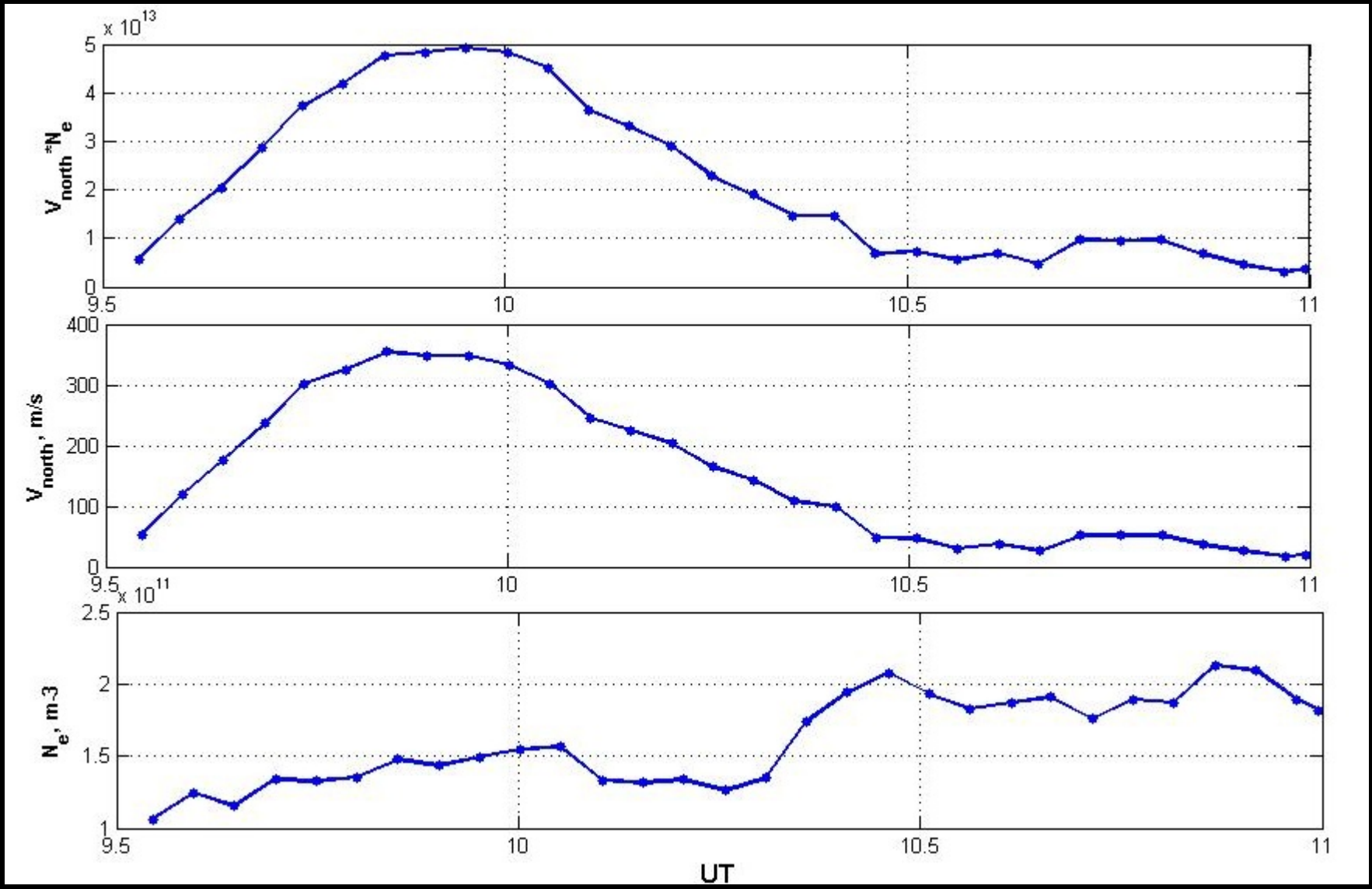
Chosen points

- azimuth, elevation, altitude1, altitude2
- 2.01, 45.89, 112.48, 115.77
- 10.61, 46.88, 113.17, 116.51
- -0.72, 54.74, 112.56, 116.27
- 10.03, 52.87, 112.39, 116.02

Eastward component of velocity

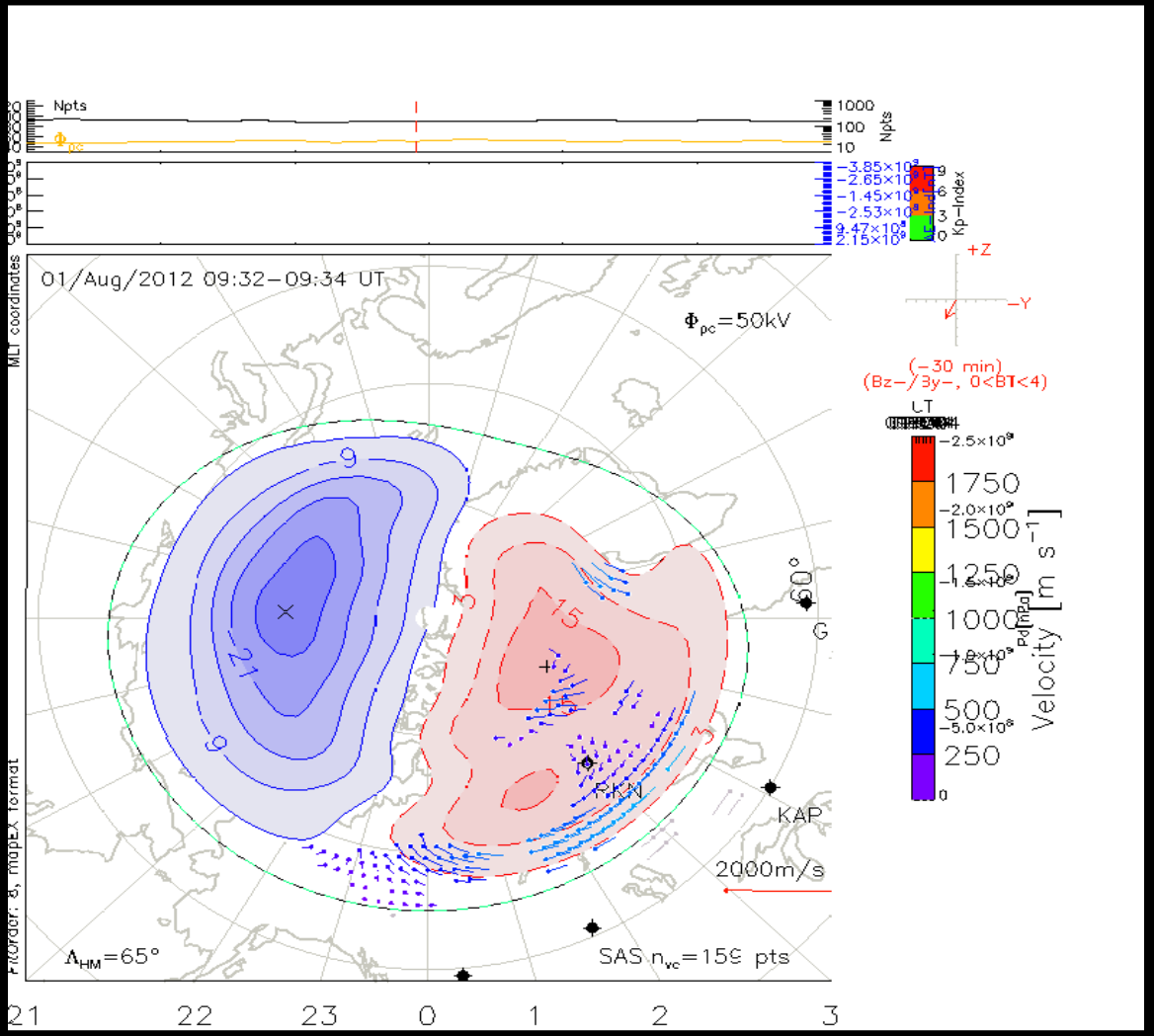


Northward component of velocity



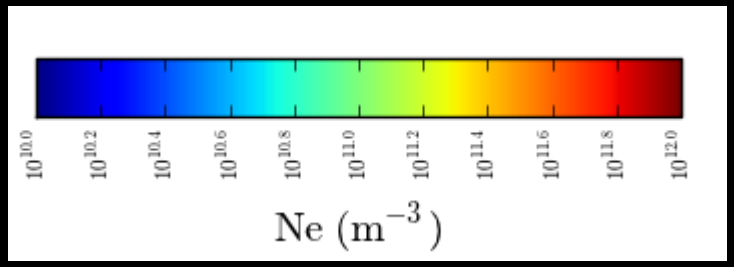
Data – Plasma Flow

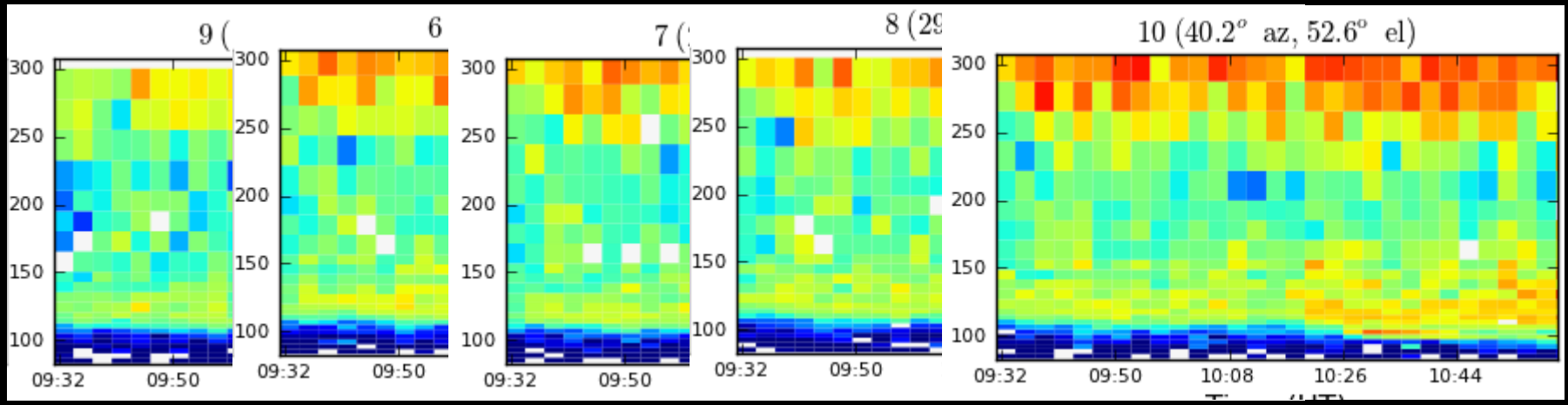
SuperDARN Convection Map

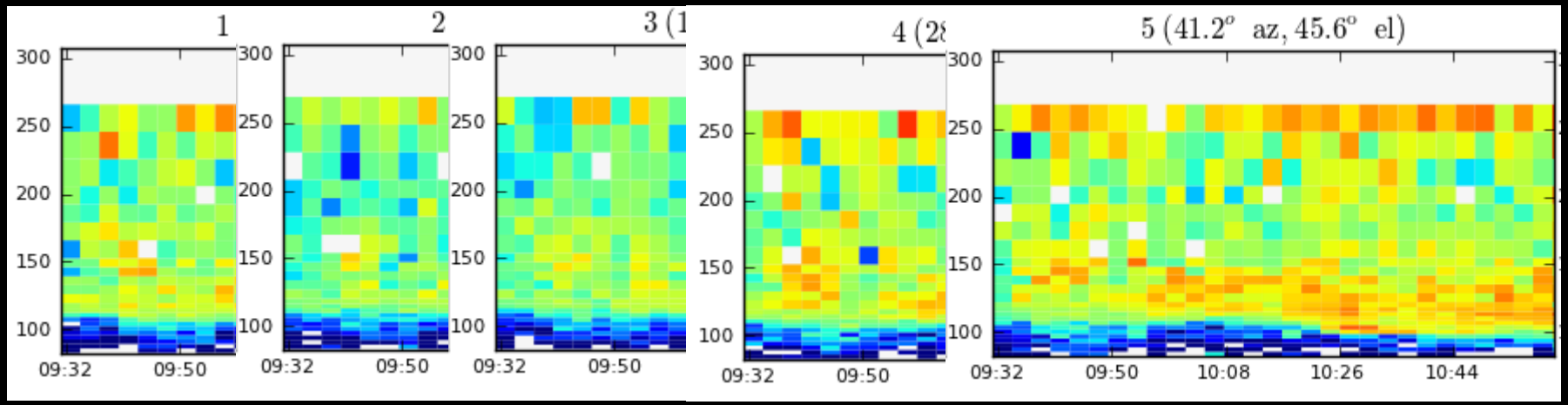


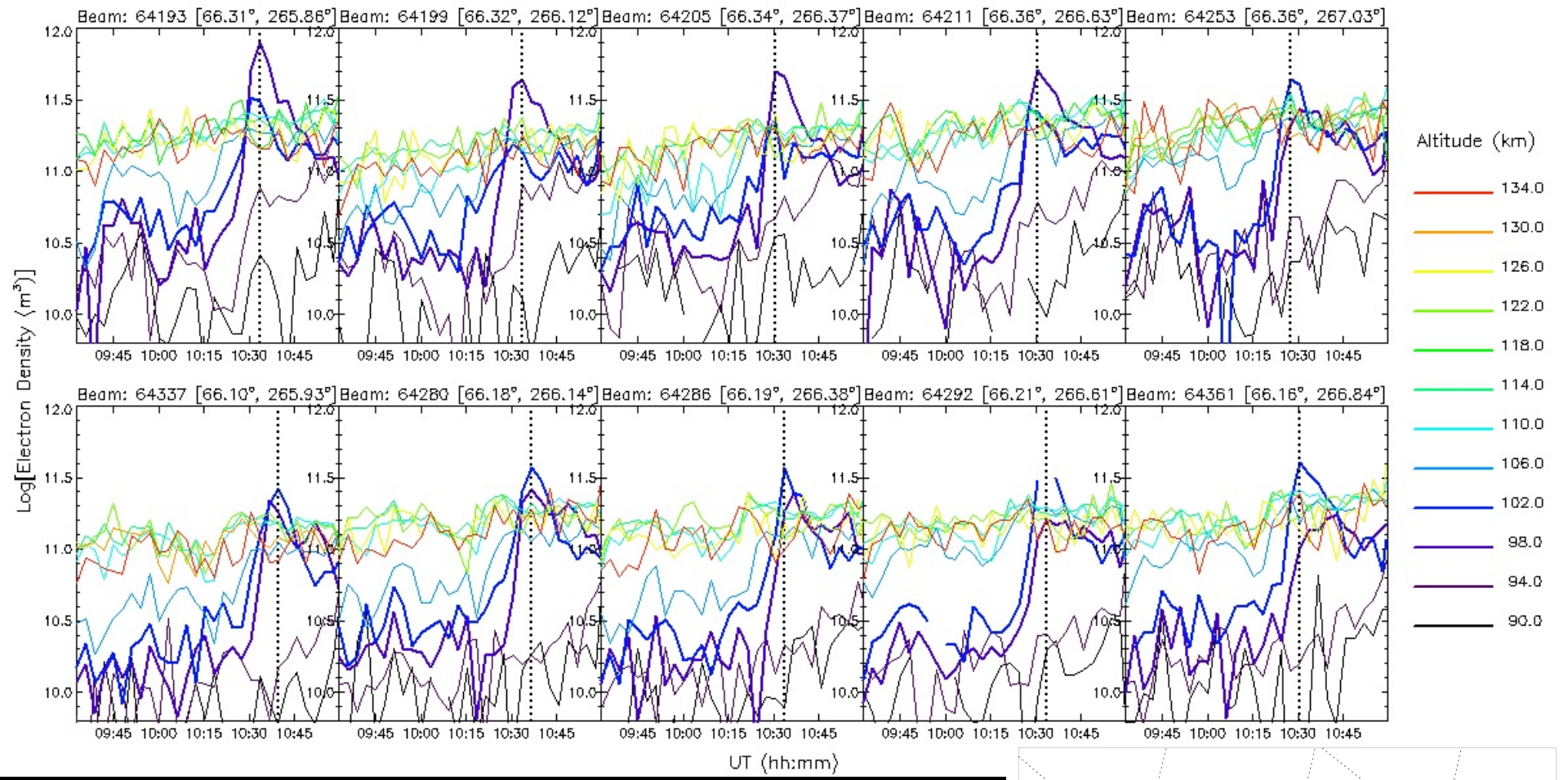
Data - Aurora

Electron Density



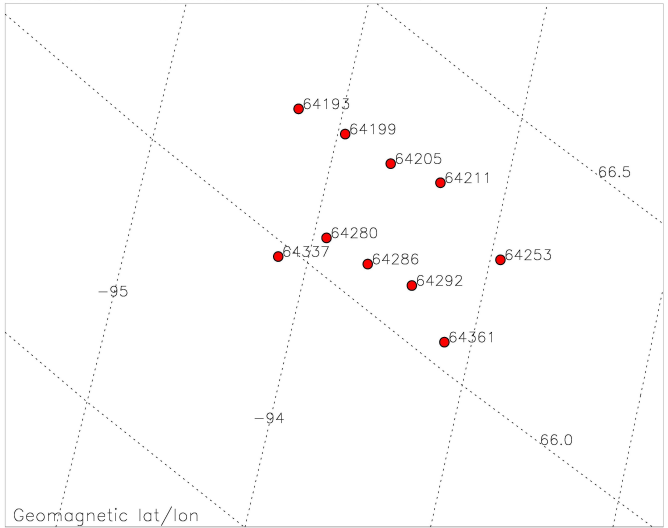


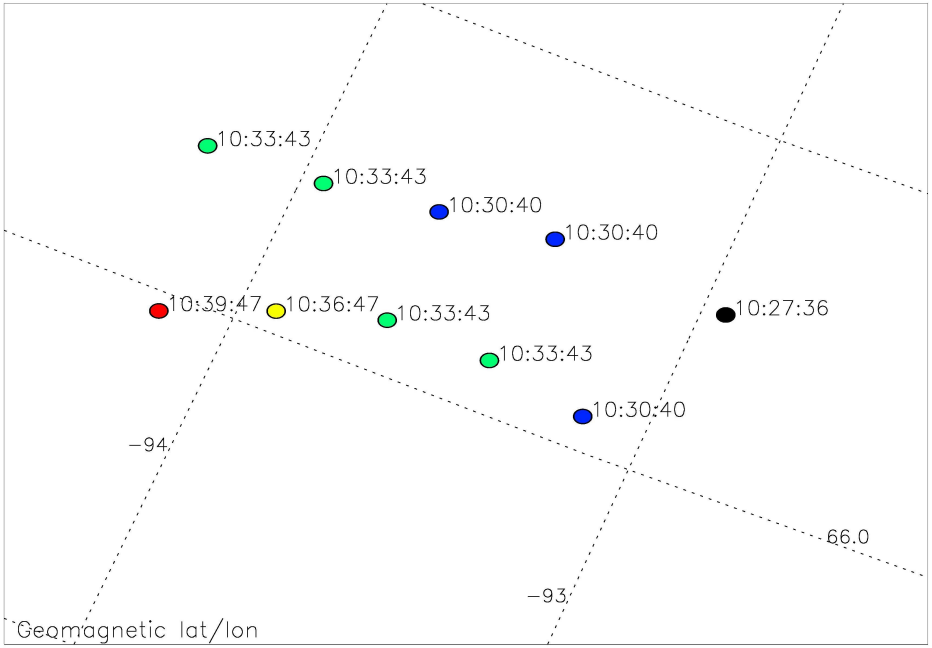


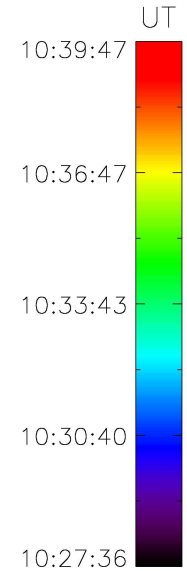


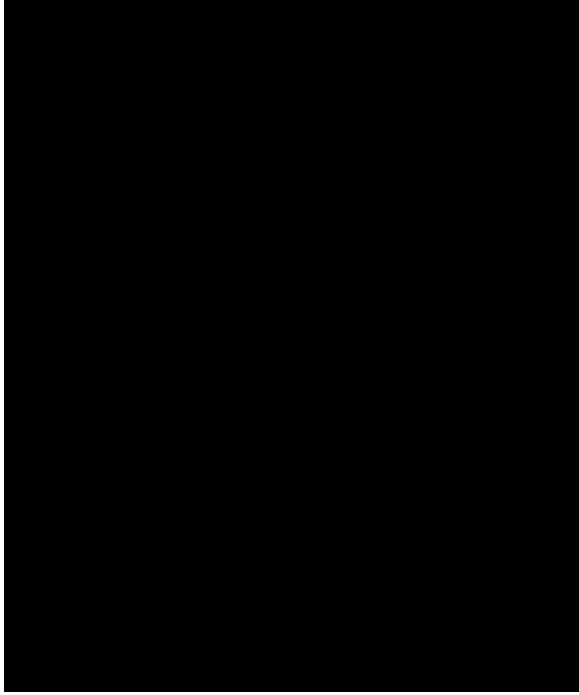
Data - Aurora

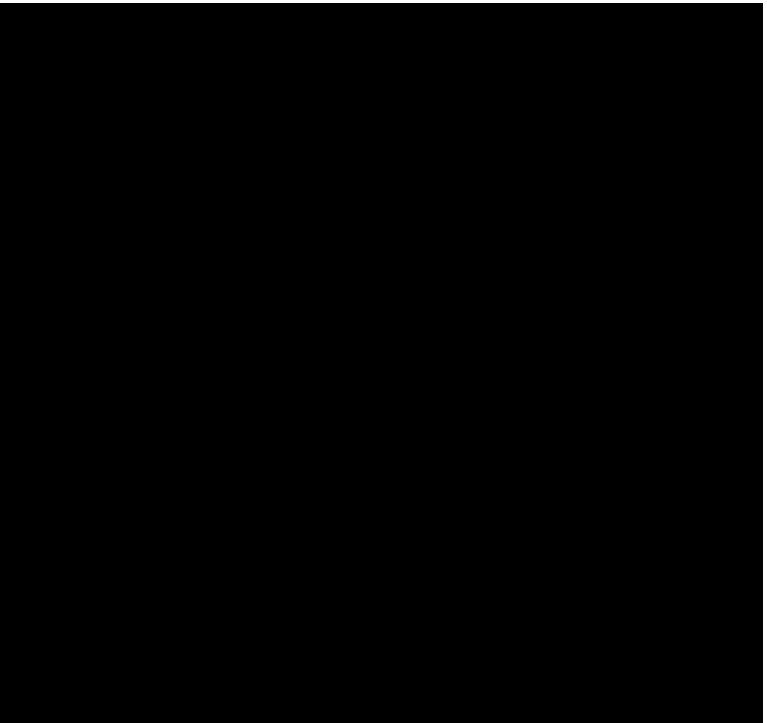
E Region Electron Densities

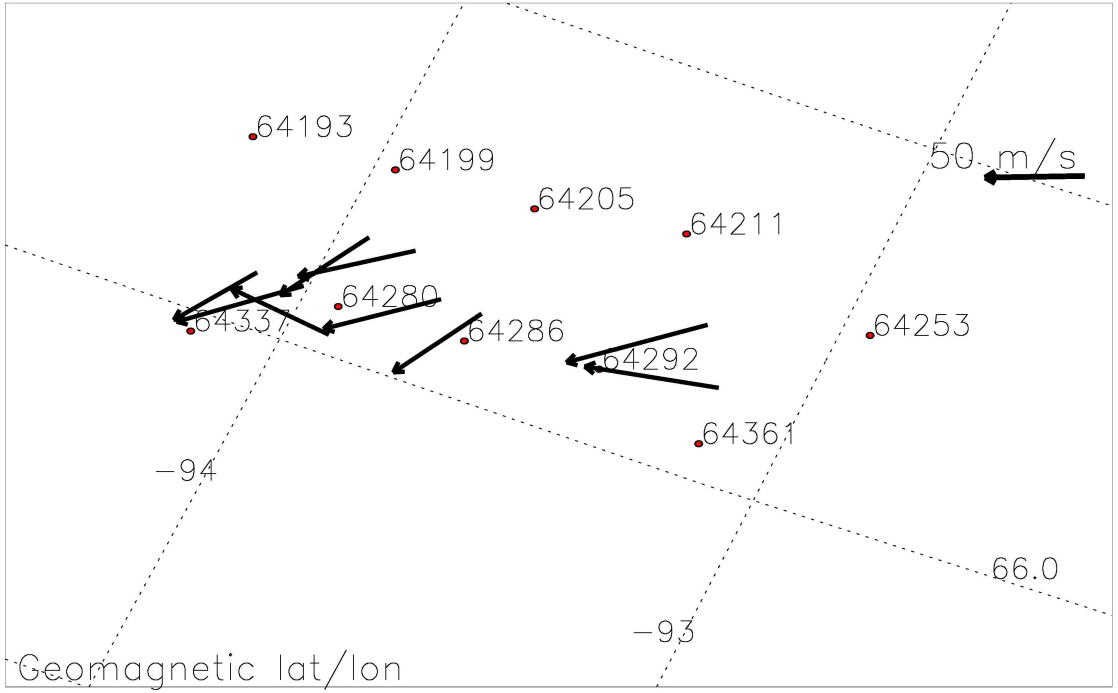



10:33:43
10:33:43
10:30:40
10:30:40
10:39:47
10:36:47
10:33:43
10:27:36
10:33:43
10:30:40
−94
66.0
−93
Geomagnetic lat/lon


UT
10:39:47
10:36:47
10:33:43
10:30:40
10:27:36

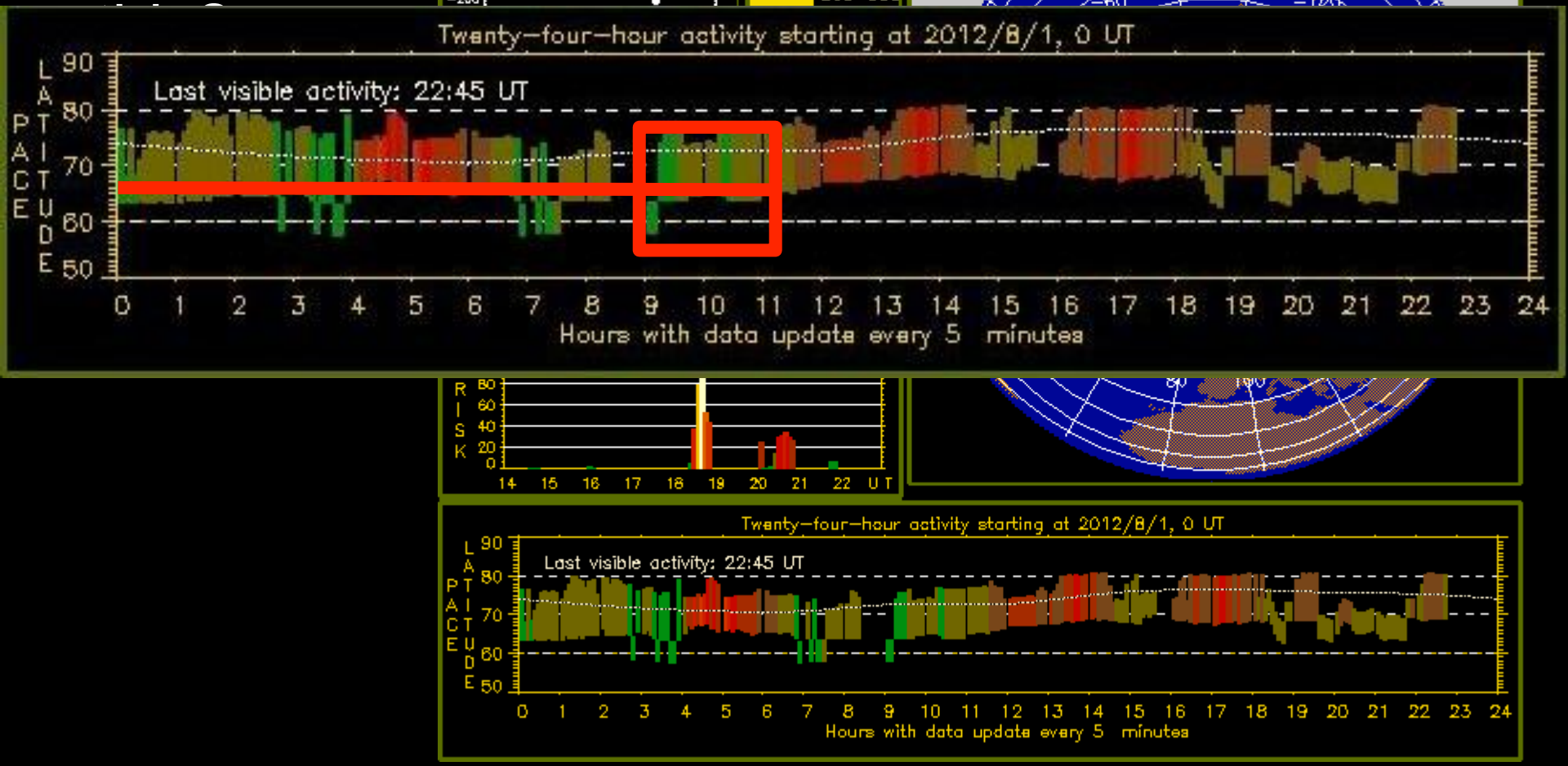





64193
64199
64205
64211
50 m/s
64280
64337
64286
64253
64292
64361
−94
66.0
−93
Geomagnetic lat/lon

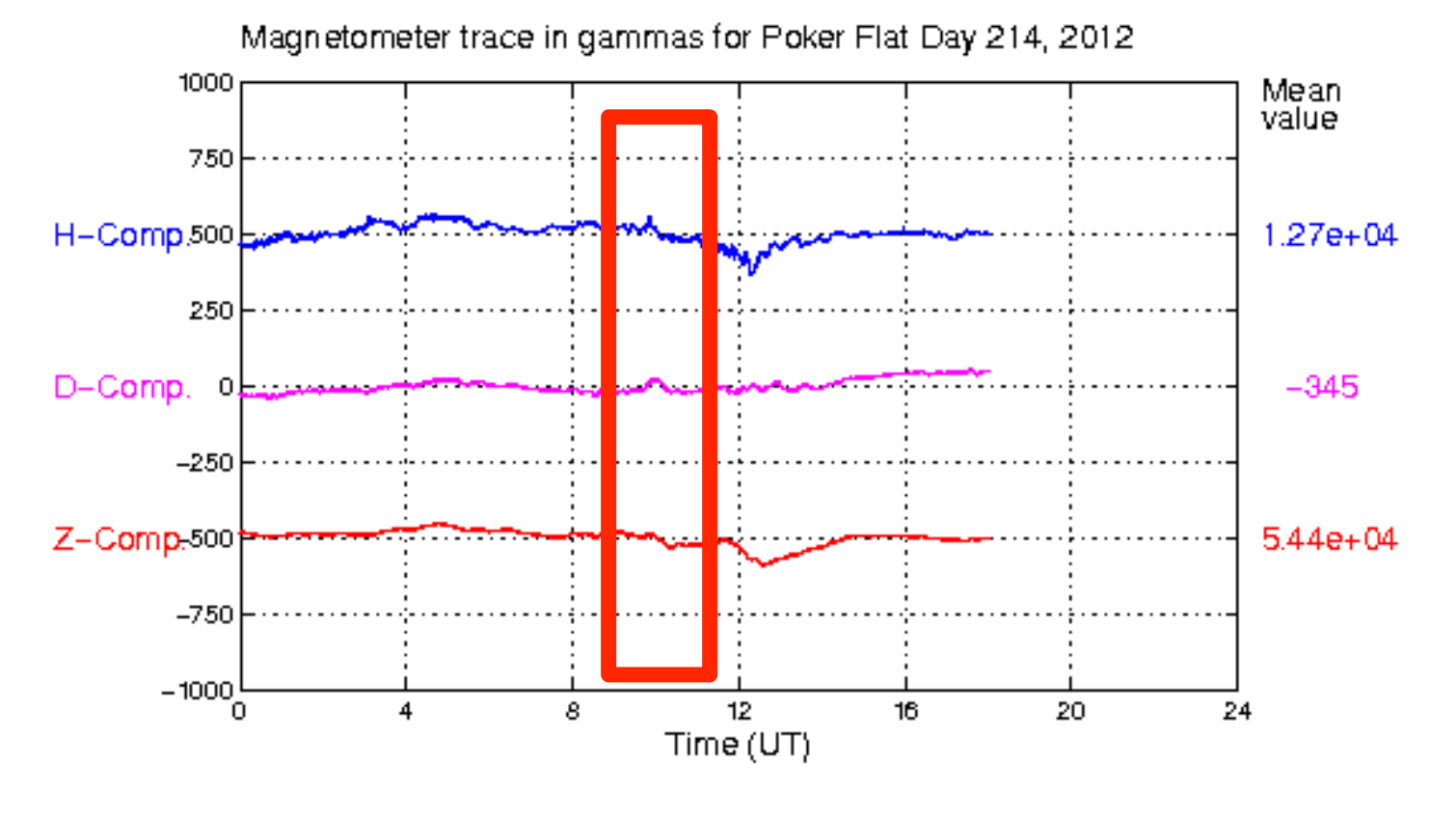
Data - Aurora

What is



Data - Aurora

What is this? -> Ground Based Magnetometer



Data - Aurora

What is this?

->

Ionogram

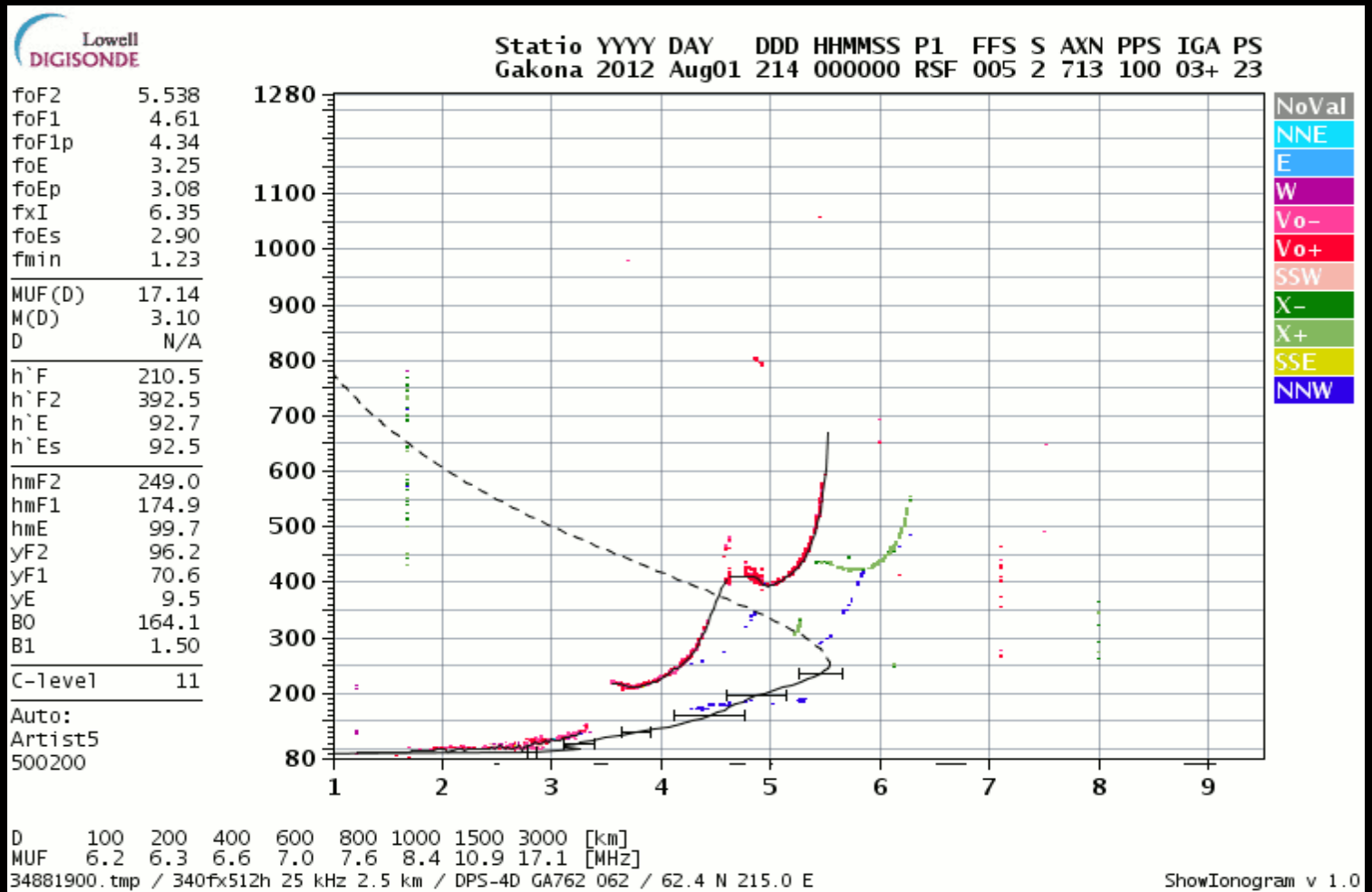
Data

Location:

Gakona, AK

Data - Aurora

What is this? -> Ionogram Data



Conclusions

- ISR is cool


I feel wiser after using PFISR!

References

- Student 7 Experimental Data from PFISR on August 1, 2012: http://isr.sri.com/madrigal/
- Google Maps: https://maps.google.ca/
- Real Time Auroral Oval: https://cssdp.ca/ssdp/app/static/related_projects/rt_oval.html
- SuperDARN Convection Maps: http://vt.superdarn.org/tiki-index.php?page=DaViT+Map+Potential+Plot
- Ionogram Data: http://ulcar.uml.edu/DIDBase/
- Polar Cap Patch Data: "Space-time variability of polar cap patches: direct evidence for internal plasma structuring" by H. Dahlgren and G. W. Perry
- Inverse Problem: “A Bayesian approach to electric field and E-region neutral wind estimation with the Poker Flat Advanced Modular Incoherent Scatter Radar” by Craig J. Heinselman and