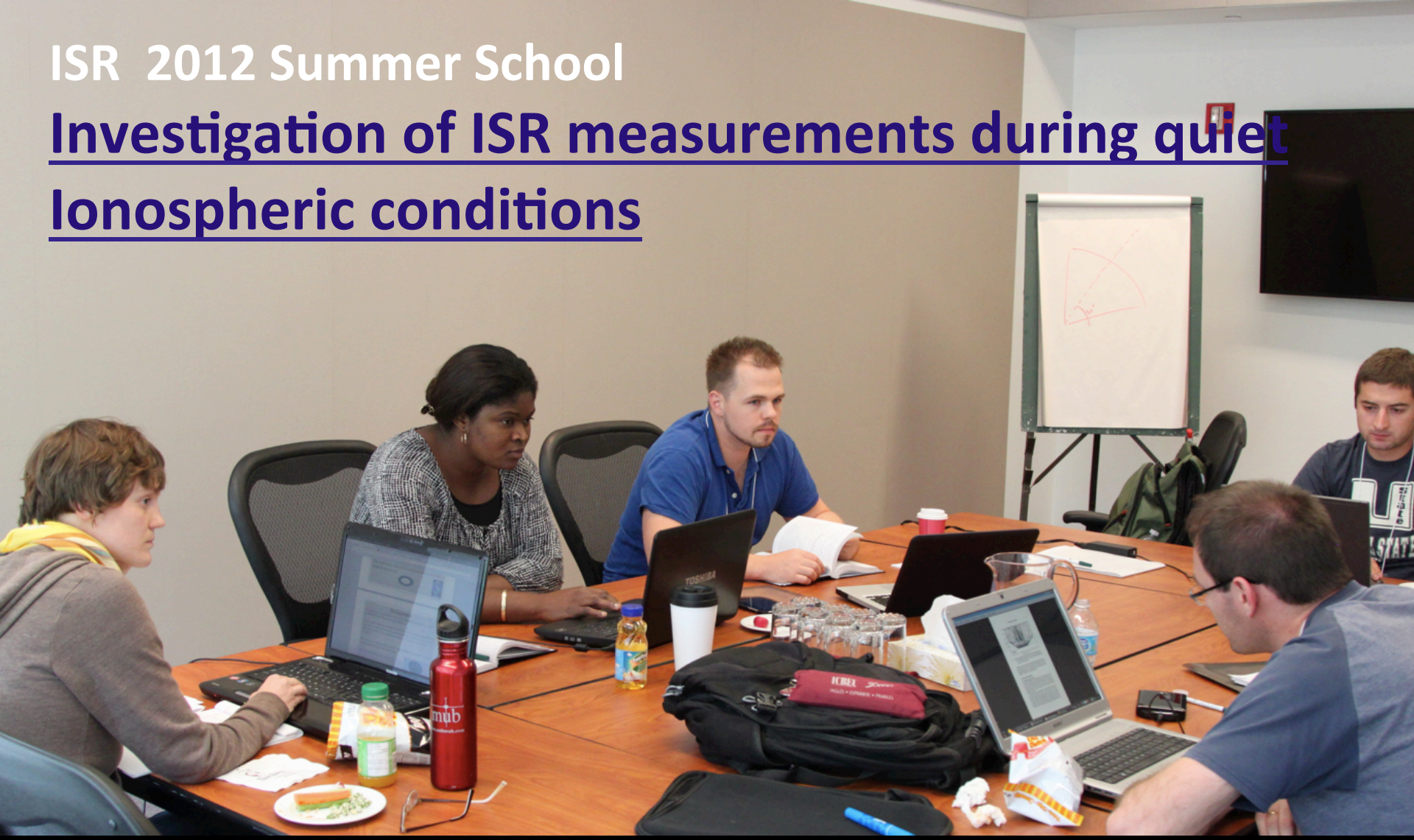
ISR 2012 Summer School

Investigation of ISR measurements during quiet Ionospheric conditions

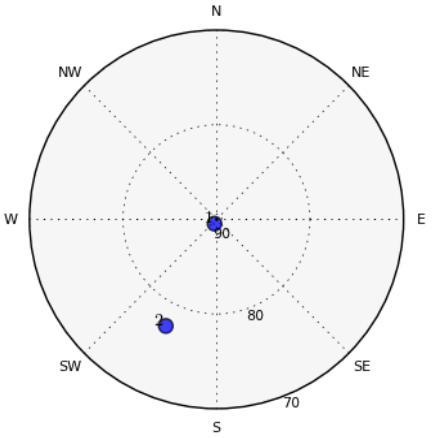


Levan Lomidze – Utah State University, USA
Juliano Moro – National Institute for Space Research, Brazil
Carol Weaver – University of New Hampshire, USA
Blessing Iserhienrhien - University of Saskatchewan, Canada
Patrick Perron – Royal Military College of Canada, Canada

Introduction and Scientific Goals

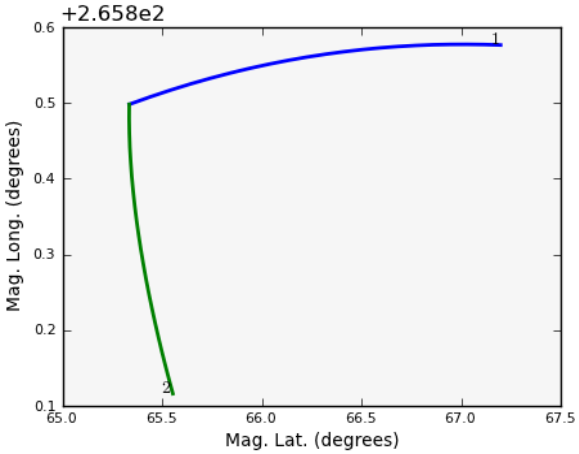
Original Goals

- To observe and study the following phenomena:
  - NEIALs;
  - Polar Mesosphere Summer Echoes;
  - Meteor showers or echoes and Sporadic Es;
  - Irregularities in the auroral zone;
  - Ion upflows; and
  - Compare ISR parameters with the empirical model.

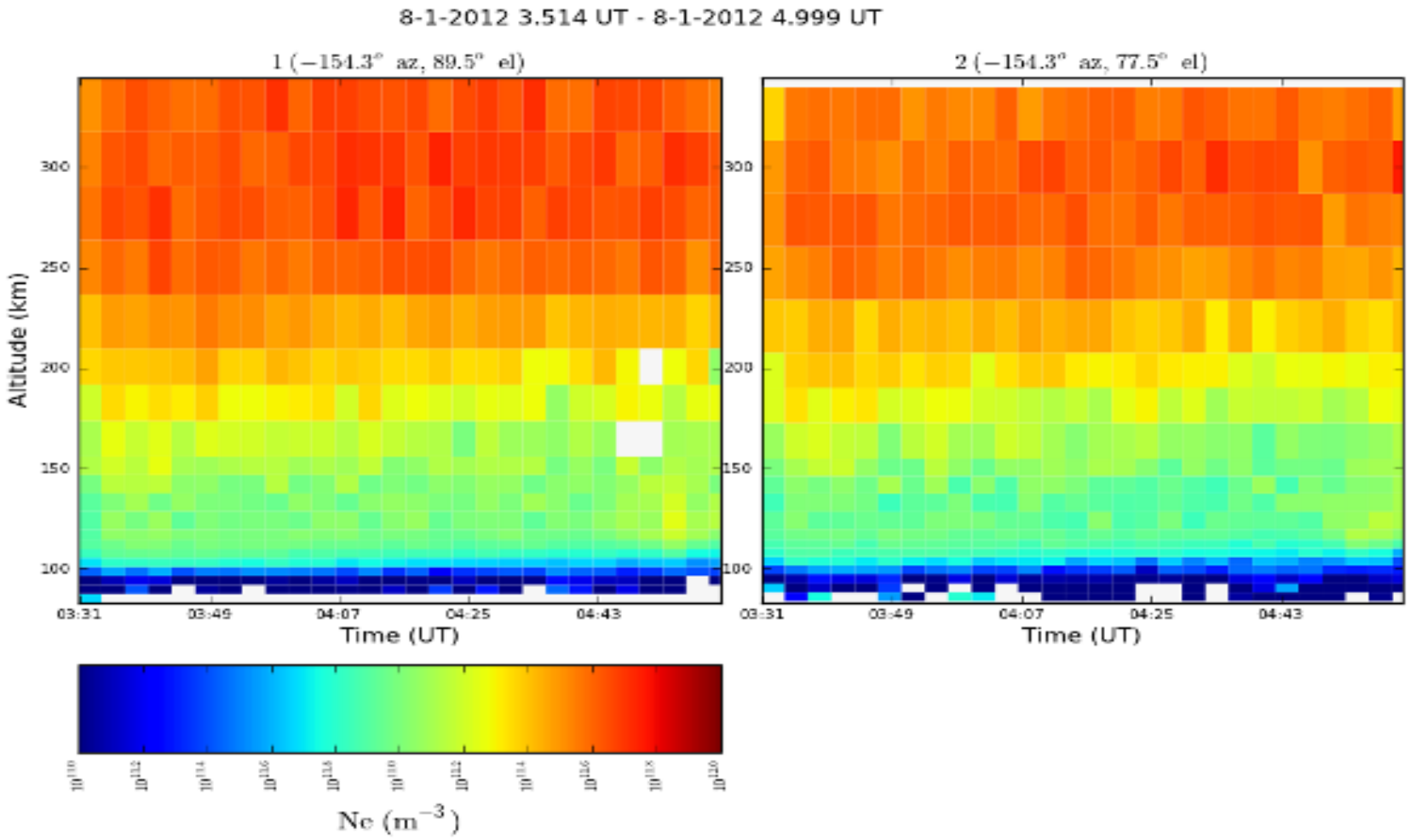


Experiment Parameters

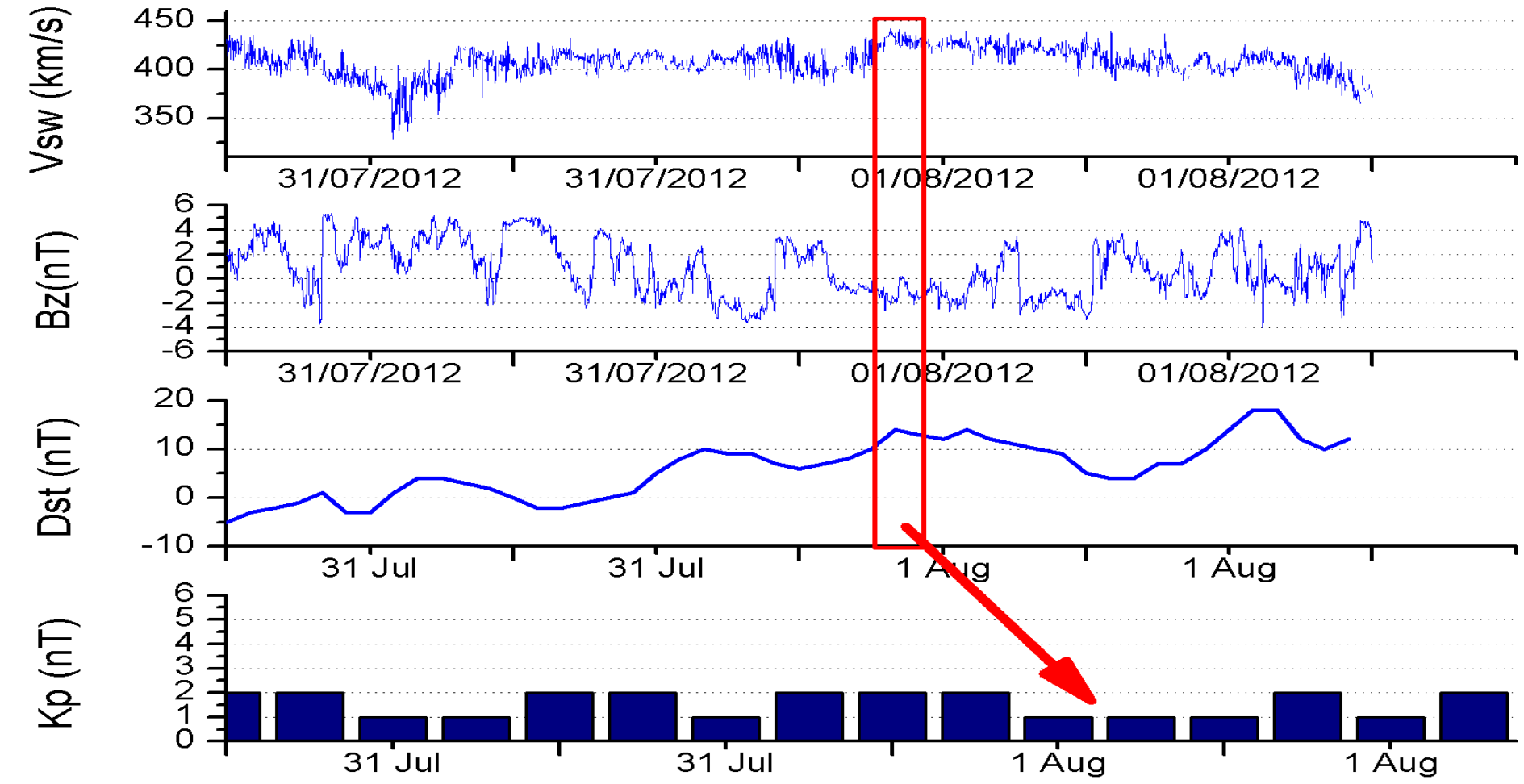
- Vertical beam and beam aligned along the magnetic field
- Az = [-154.3°, -154.3°]
- El = [77.5°, 89.5°]
- Time = 3:30 – 5:00 UT (17:30 - 20:00 LT)



Poker Flat August 1, 2012: Electron Density (Ne)

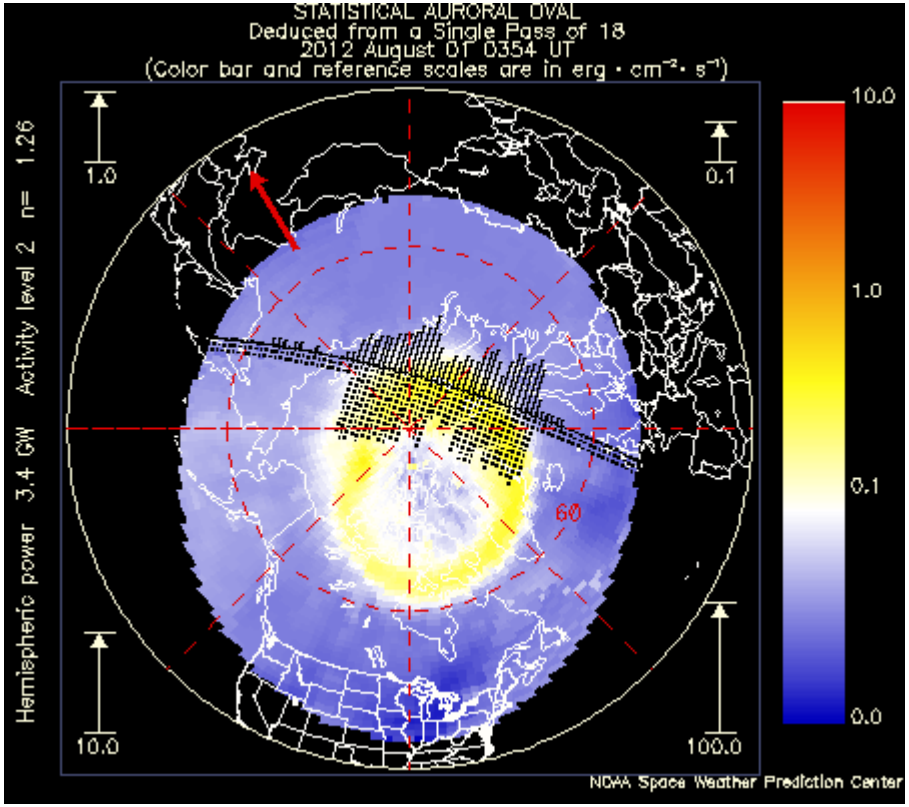


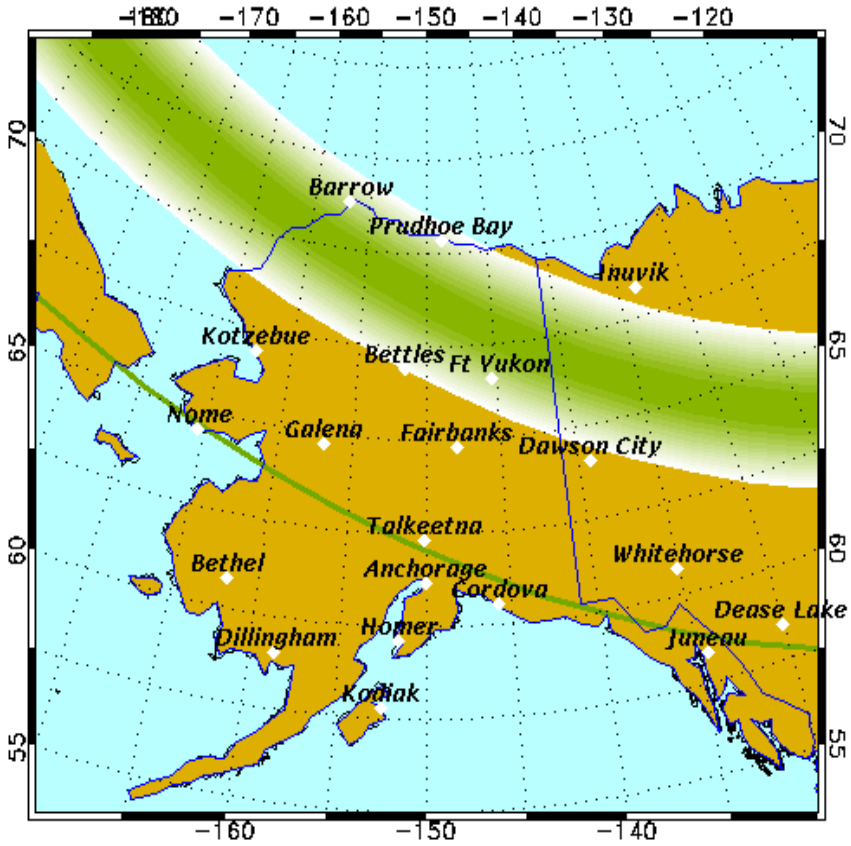
Space Weather Conditions



http://spidr.ngdc.noaa.gov

Auroral Oval Over Poker Flat?



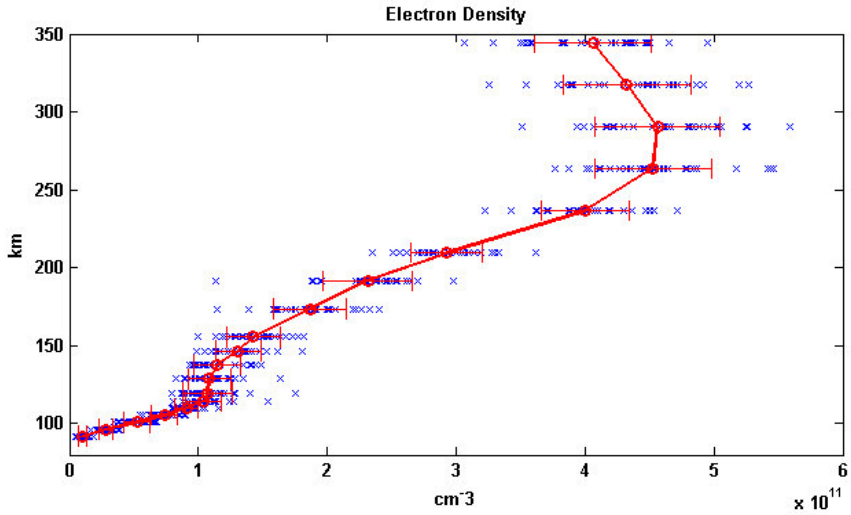


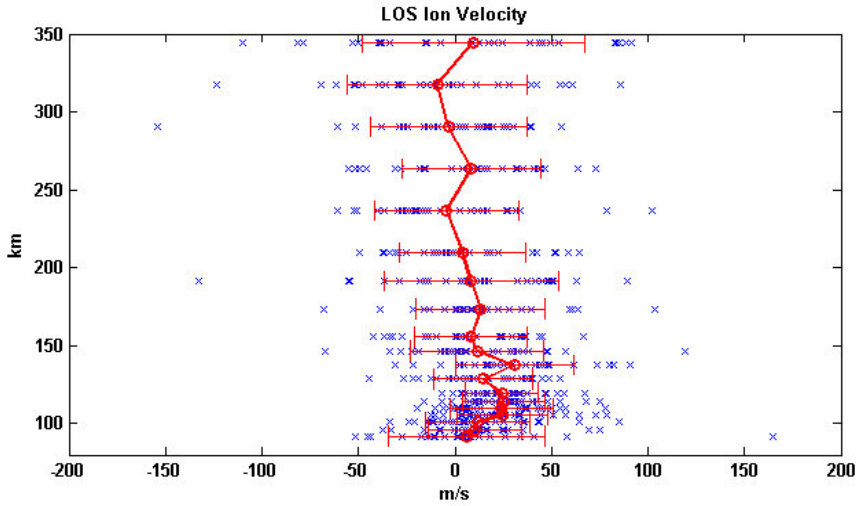
http://www.swpc.noaa.gov/ftpdir/lists/hpi/plots/pmap_2012_08_01_0537_N_3_46_111_18.gif
http://www.gi.alaska.edu/AuroraForecast

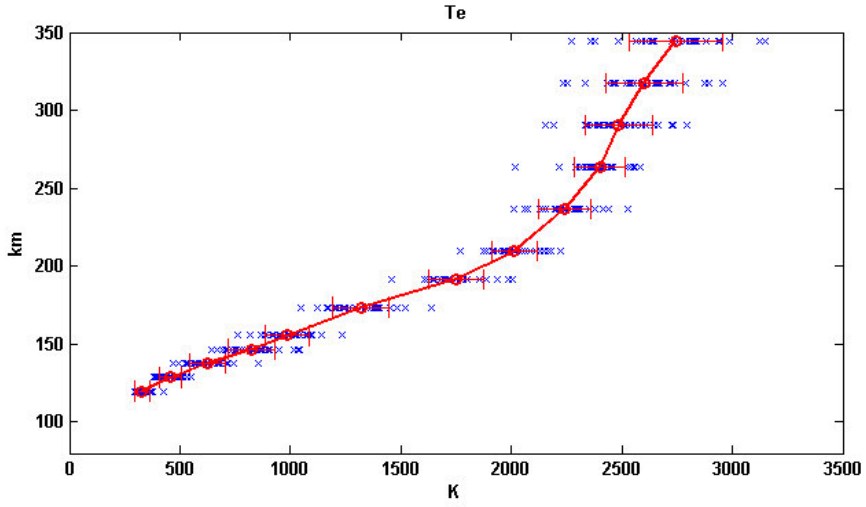
Data Analysis

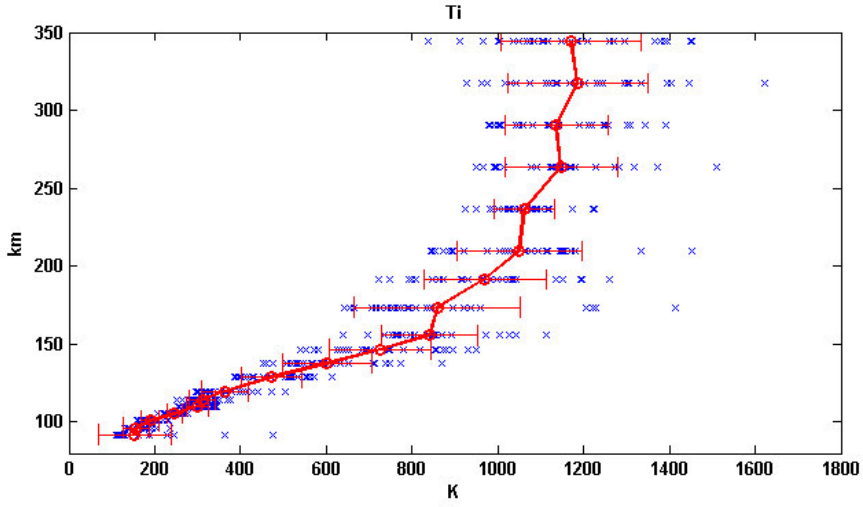
Average Ionospheric Parameters AC-Mode (El 89.5°, Az -154.3°)

PFISR data,
July, 31, 2012
UT=03:30-05:00





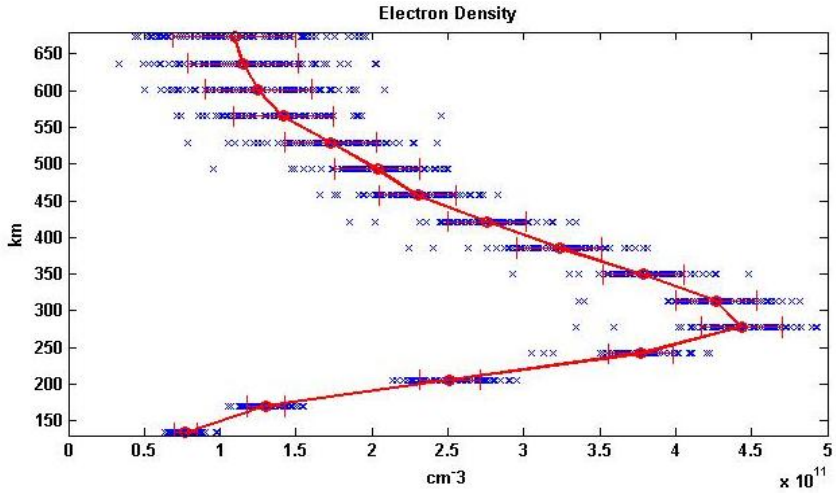


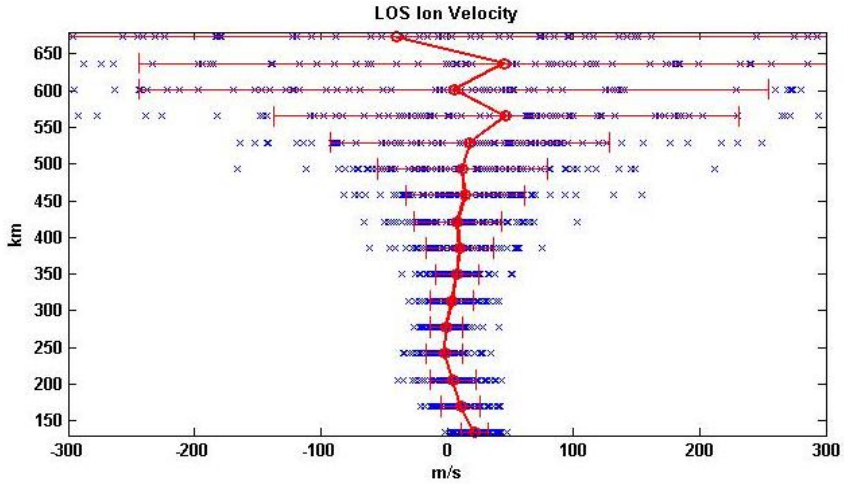


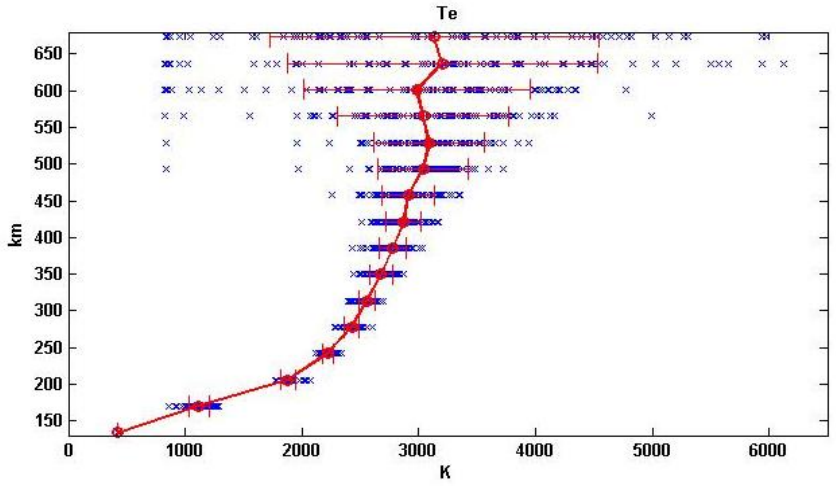
Average Ionospheric Parameters

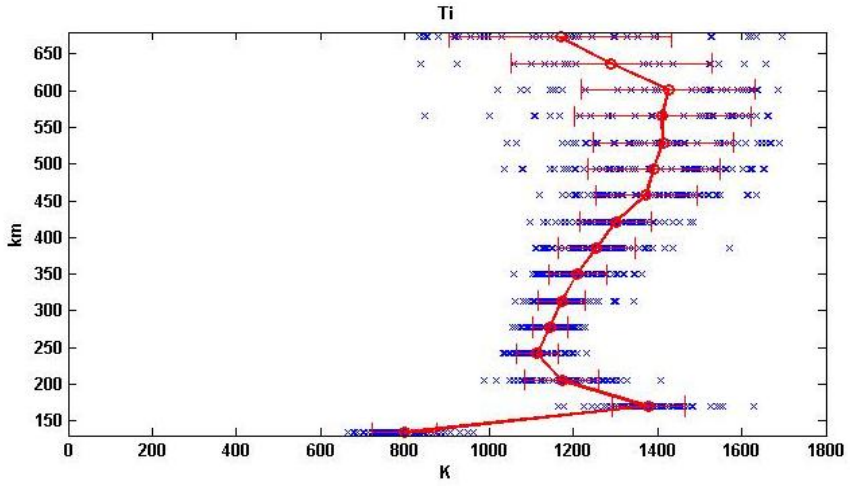
LP (El 89.5°, Az -154.3°)

PFISR data,
July, 31, 2012
UT=03:30-05:00

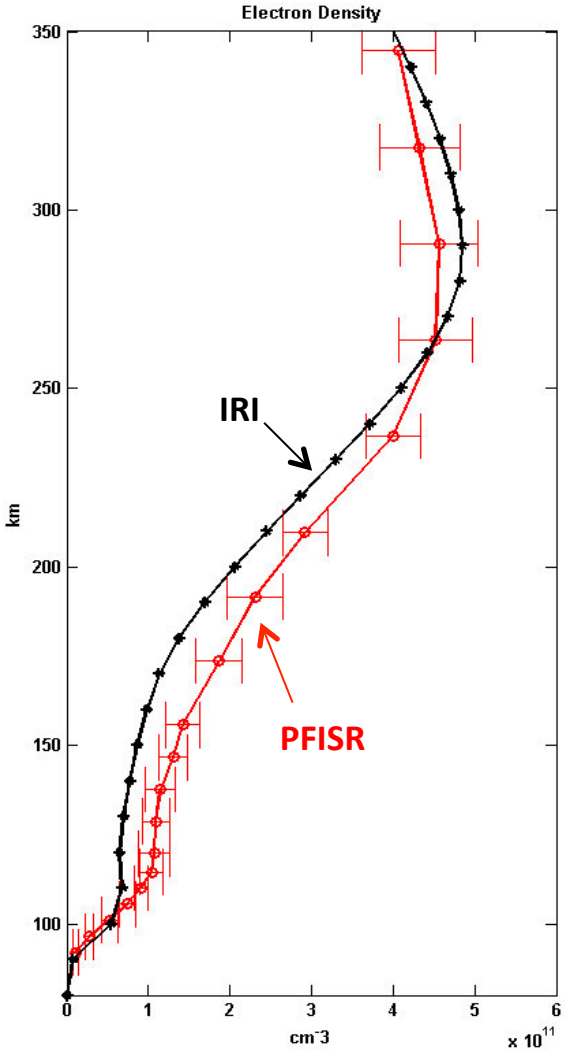


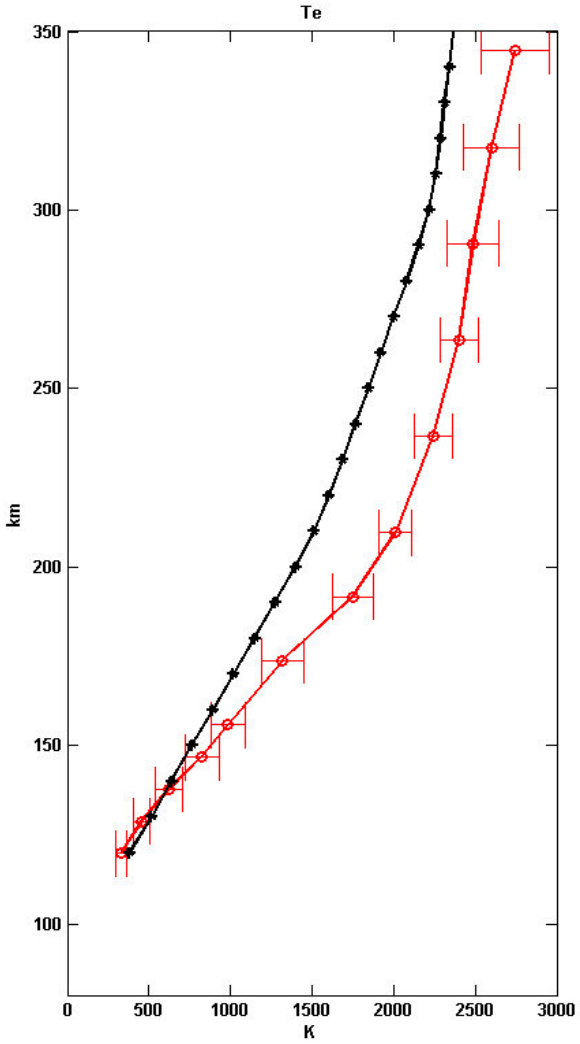


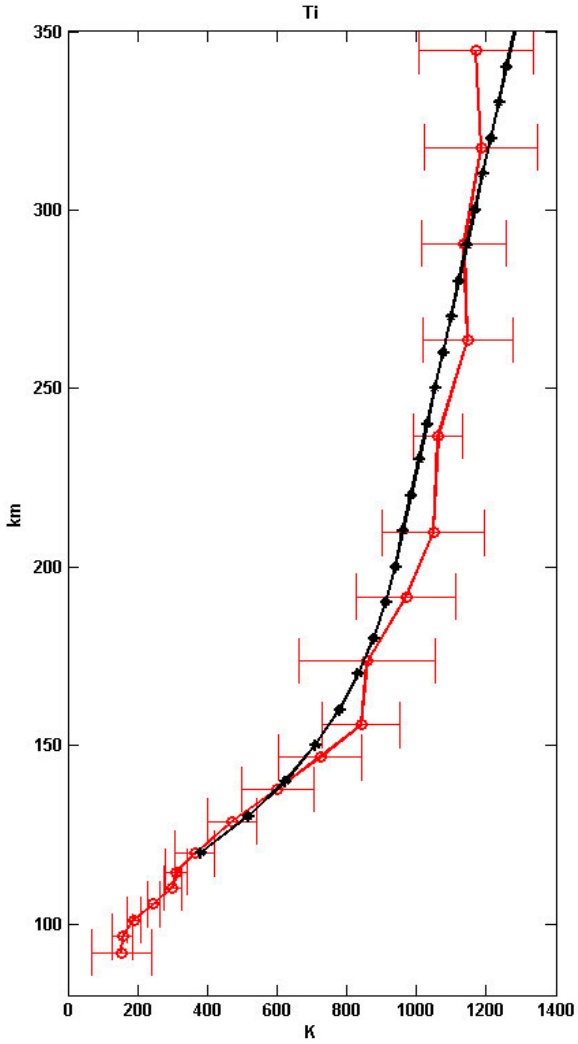




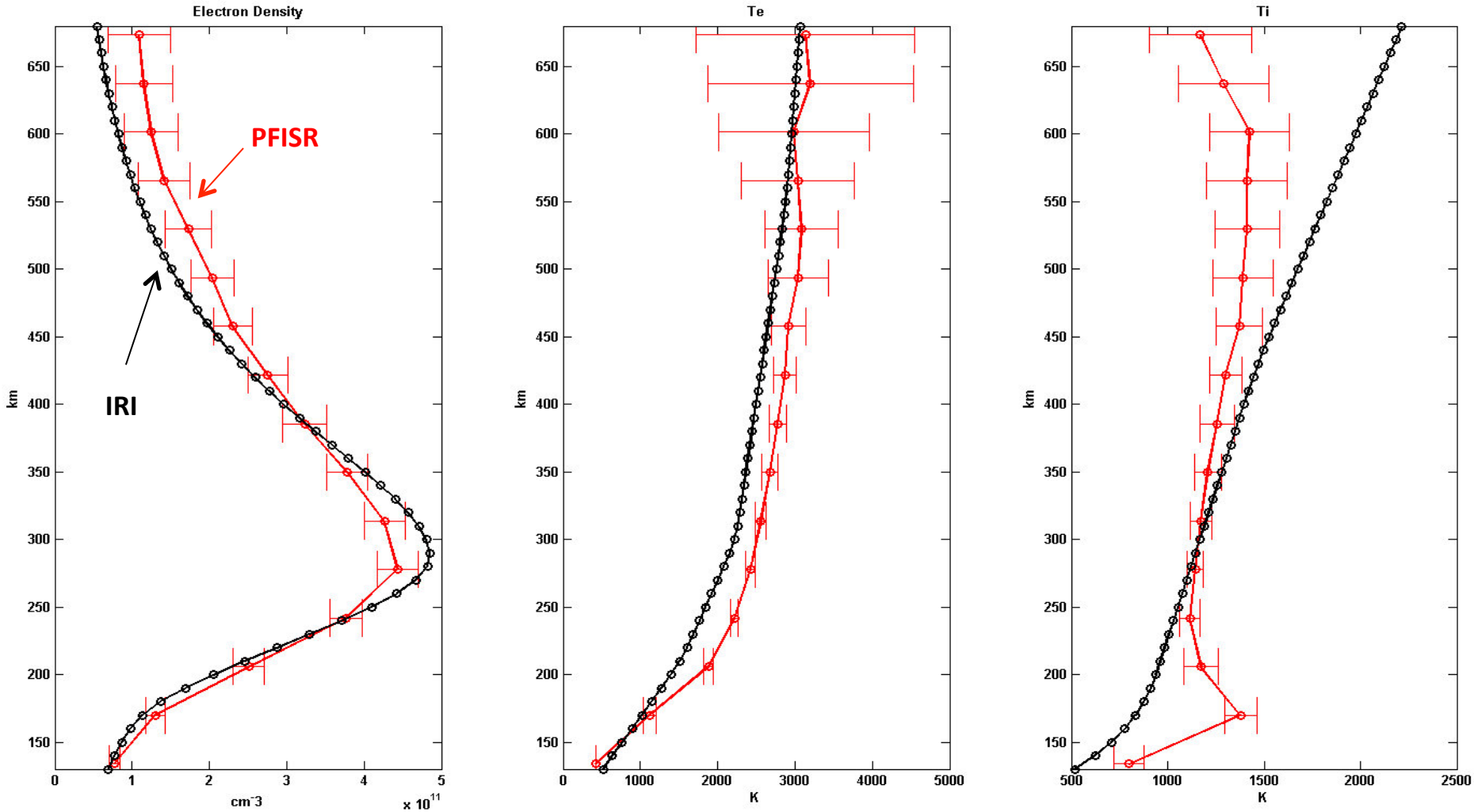
Comparison With Empirical Ionosphere Model (IRI_2007)







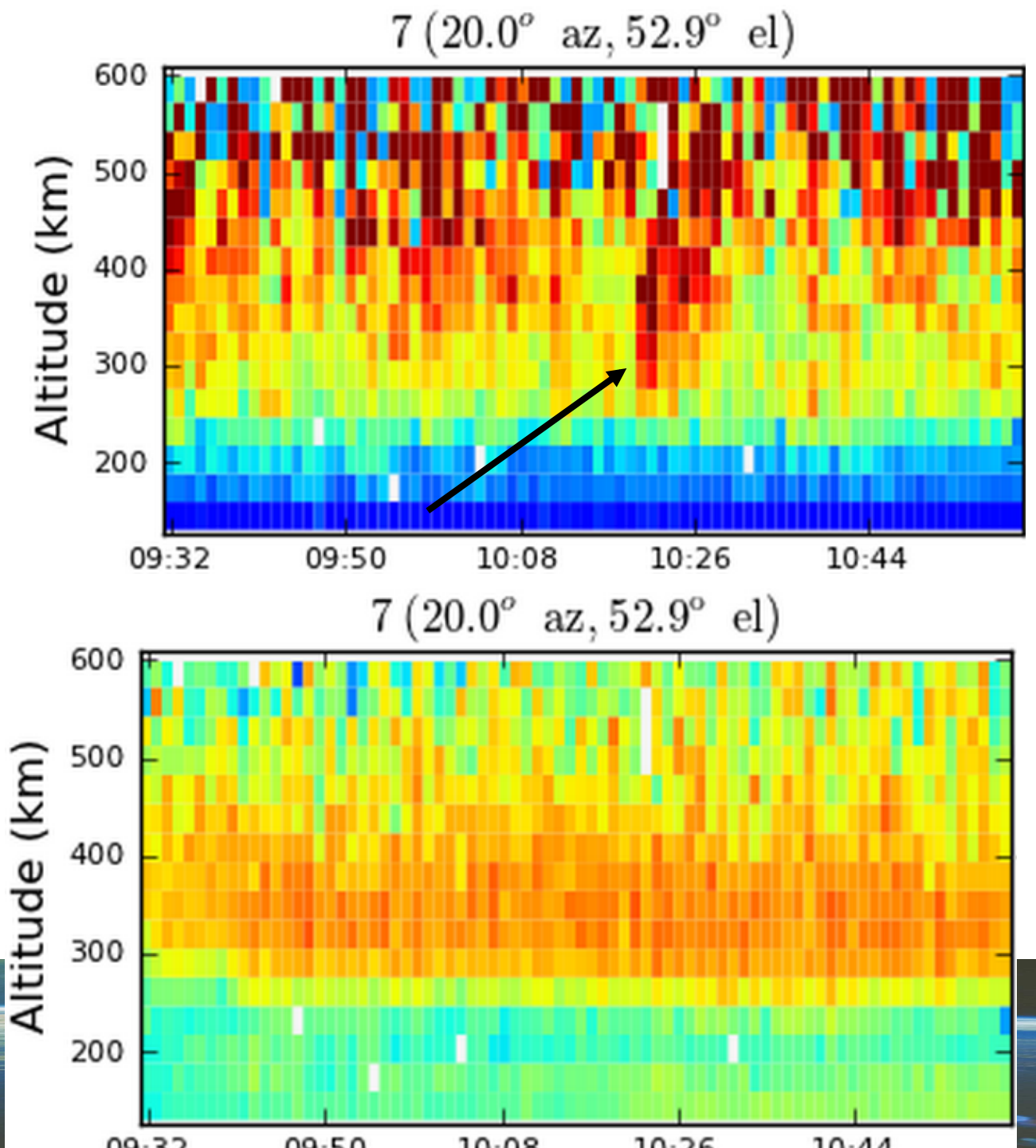
Comparison with Empirical ionosphere Model (IRI_2007)

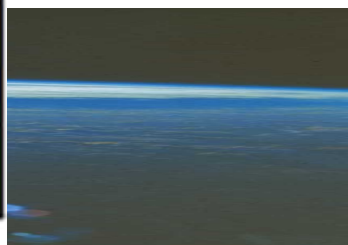


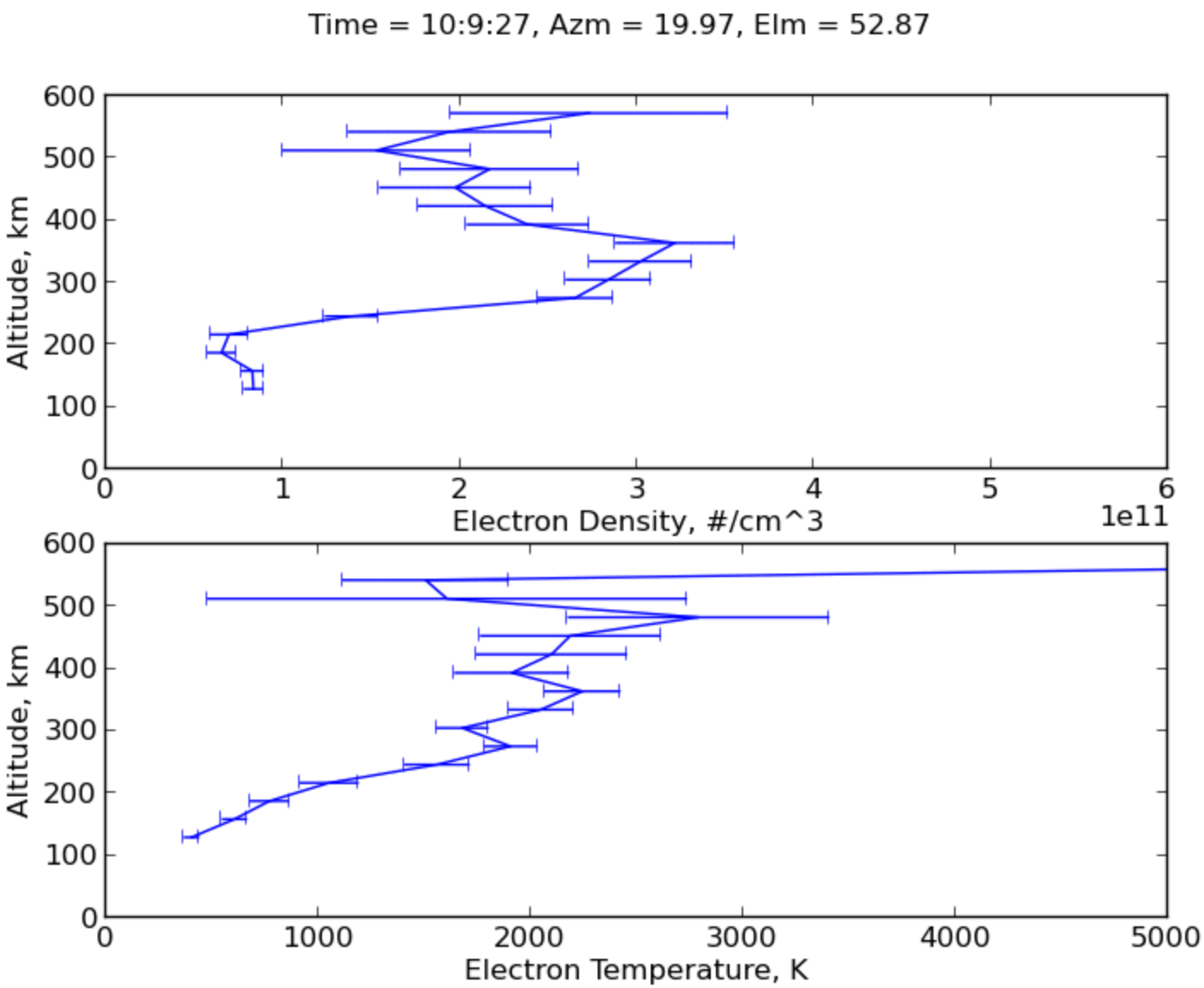
Investigating Our Neighbor
Student 7 Data

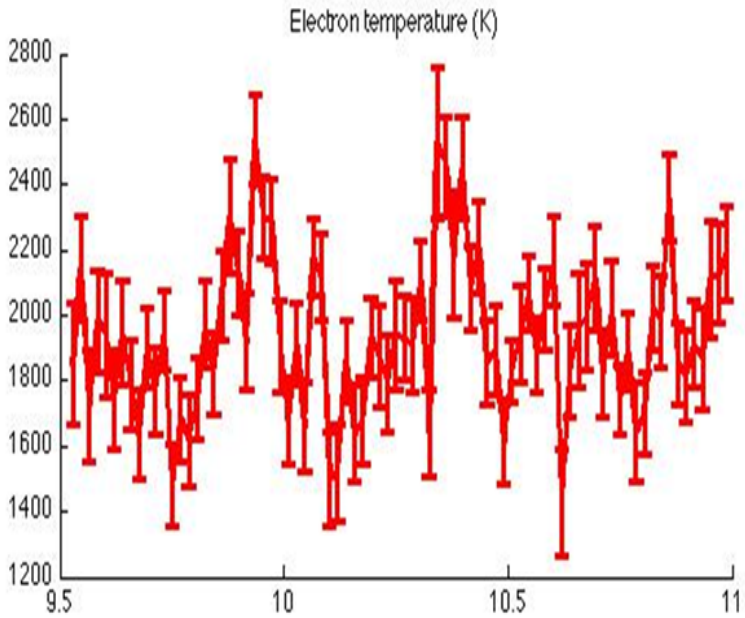
New Scientific Goals

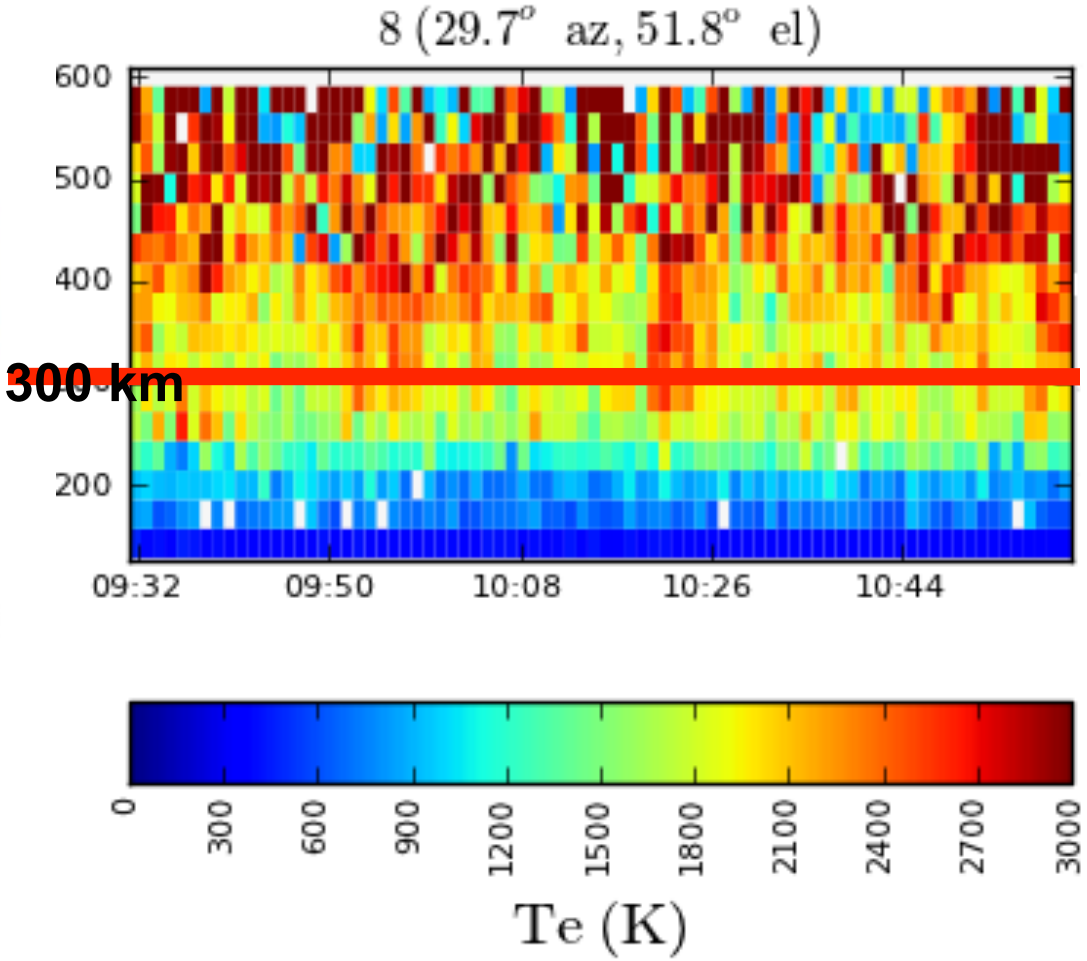
- Study features related to electron temperature increase;
- Investigate possible generation mechanisms for electron temperature increase;
- Investigate possible relationship between ion temperature increase with electric field; and
- Estimate F-region neutral temperature distribution from ISR data and compare with MSIS-90 model.


7 (20.0° az, 52.9° el)
Altitude (km)
600
500
400
300
200
09:32
09:50
10:08
10:26
10:44
7 (20.0° az, 52.9° el)
Altitude (km)
600
500
400
300
200



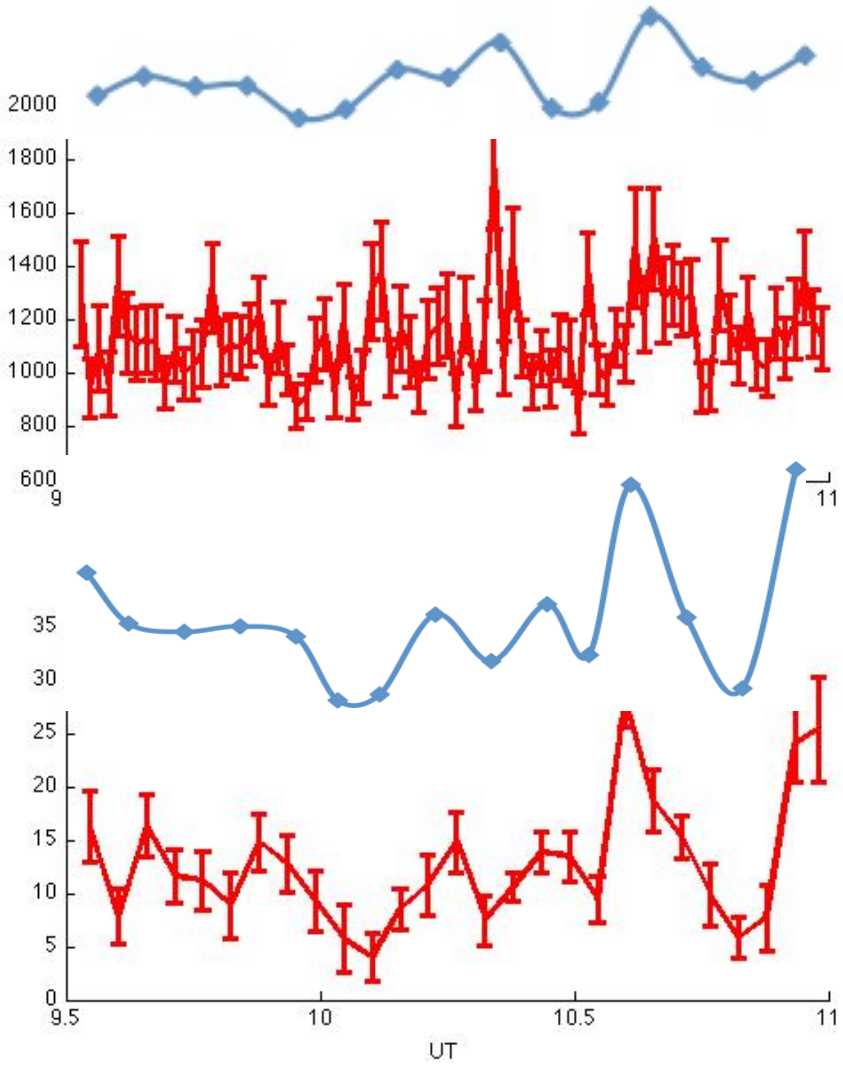

Time = 10:9:27, Azm = 19.97, Elm = 52.87
Altitude, km
Electron Density, #/cm^3
1e11
Altitude, km
Electron Temperature, K

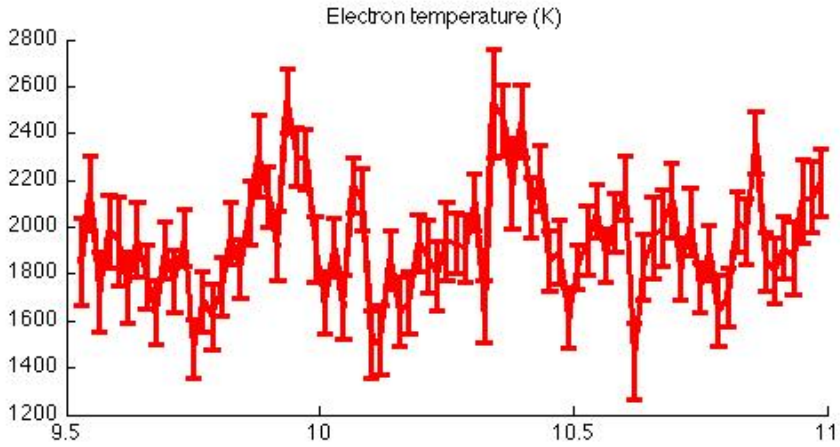


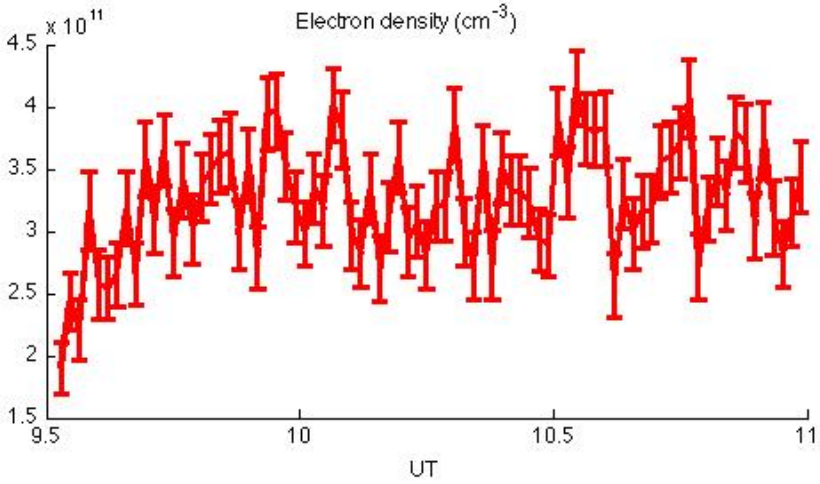


Altitude = 300 km
MLAT between 68° and 69°

Altitude = 300 km
MLAT between 68°and 69°



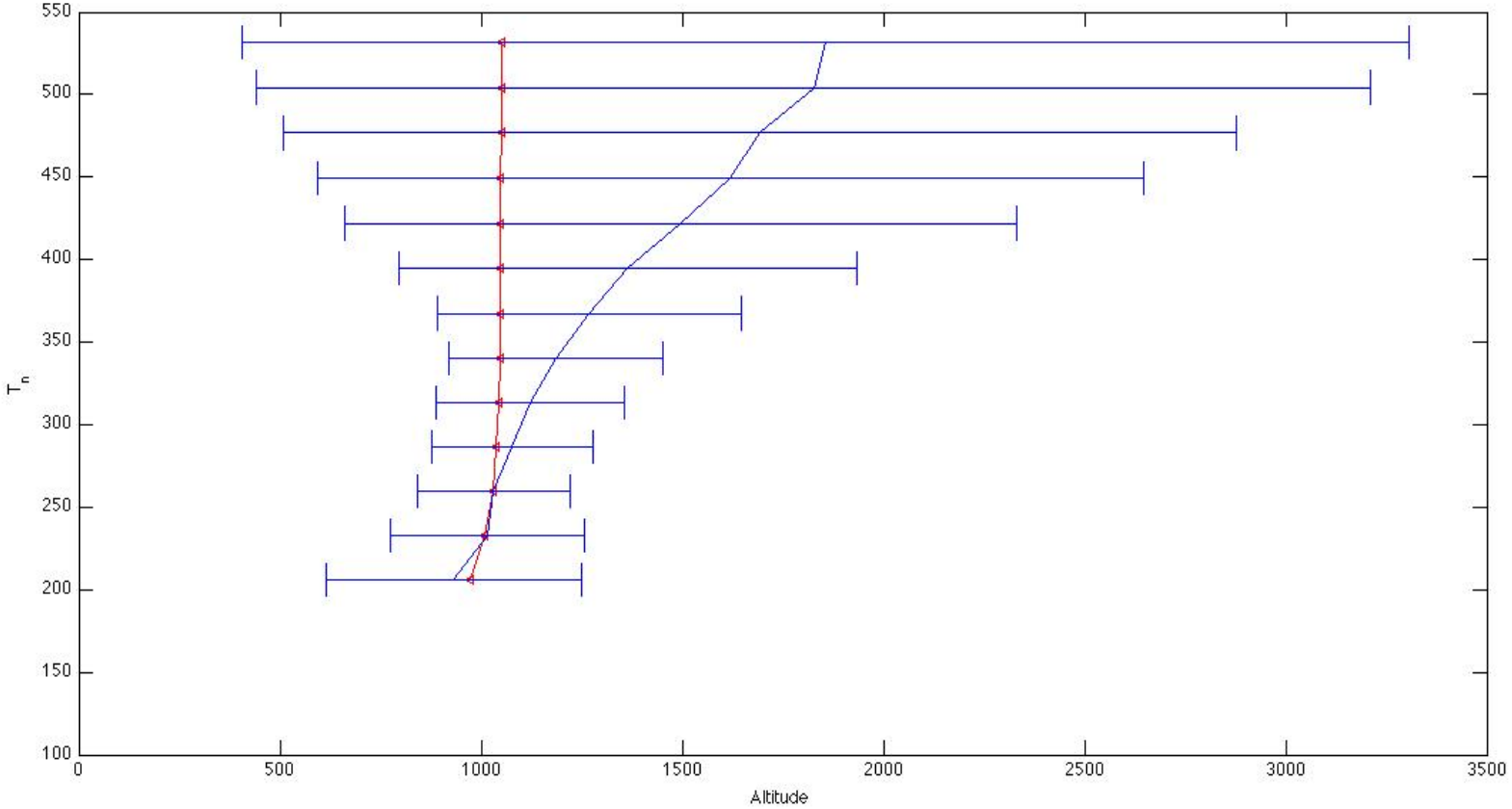




Neutral temperature estimation

$$T_i = T_n + m_n/3k_B\,(u_i - u_n)^2$$

$$T_i = T_n + m_n/3k_B\,(E/B)^2$$


550
500
450
400
350
300
250
200
150
100
T_n
0
500
1000
1500
2000
2500
3000
3500
Altitude

Conclusion

- Reasonable agreement between ISR and IRI;
- No sign of meteor echoes, sporadic E and PMSE;
- NEIAL's were not identified;
- In new data set, electron precipitation was identified as a possible cause for electron temperature increase; and
- No significant correlation between ion temperature and electric field was observed.

Acknowledgements

- We are grateful to NSF and SRI for ISR student workshop
- Thanks to all the instructors and speakers for their support
- Thanks to Group 5 for providing use of their data set


Ahhhhhhh…
ISR kids get off
my lawnnnn……

Parameters with measurement errors