

# Simultaneous Observations for Ion Drifts and Neutral Winds at Jang Bogo Station (JBS), Antarctica

Geonhwa Jee, Young-Bae Ham, Changsup Lee, Eunsol Kim, Jeong-Han Kim,  
Hyuck-Jin Kwon

*Korea Polar Research Institute (KOPRI), Incheon, Korea*

Qian Wu

*High Altitude Observatory, NCAR, Boulder, Colorado, USA*

Nikolay Zabolotin<sup>1</sup>, Terence Bullett<sup>2</sup>, Justin Mabie<sup>2</sup>

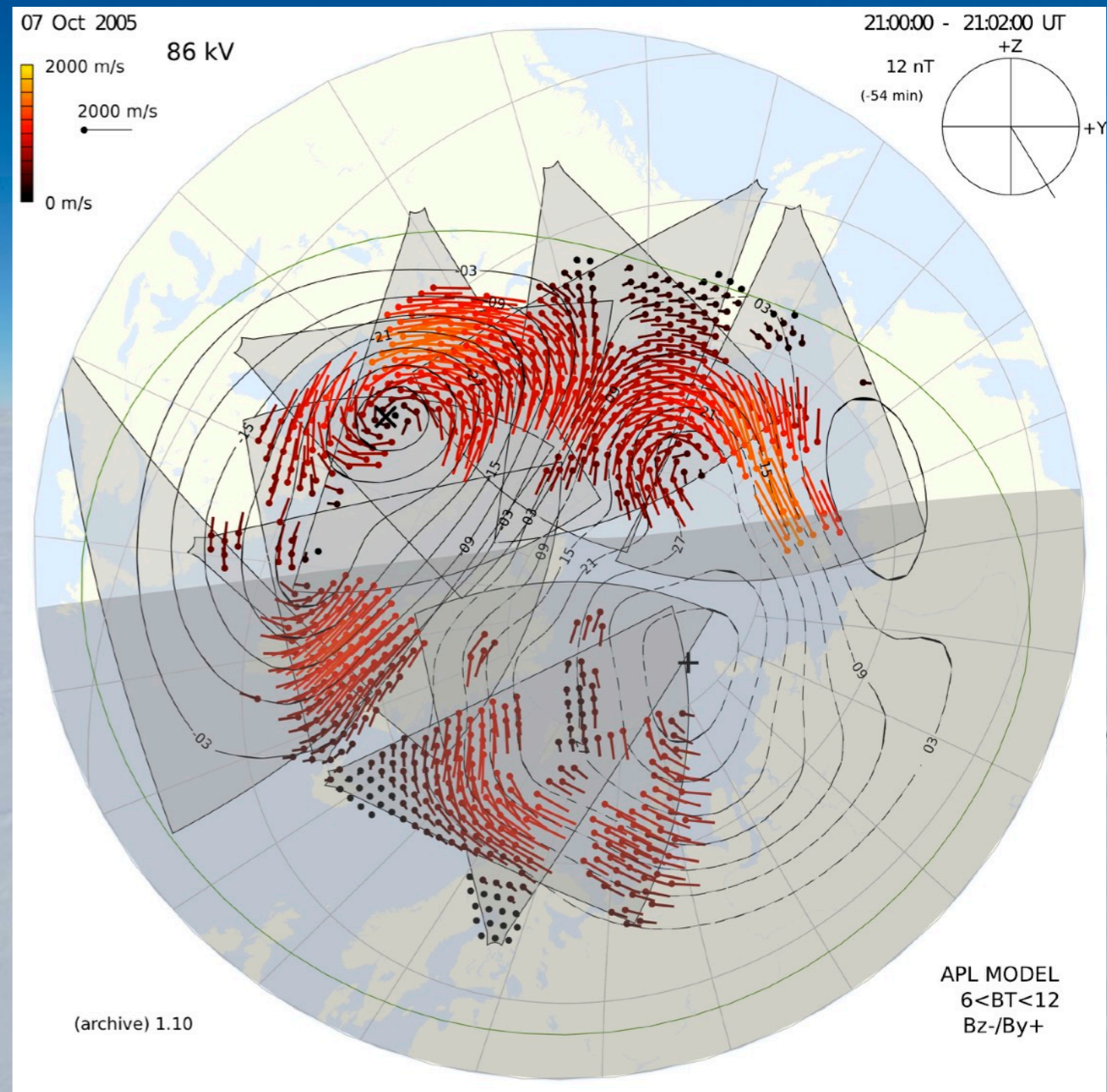
<sup>1</sup>*Department of Electrical and Computer Engineering, University of Colorado, Boulder, Colorado, USA*

<sup>2</sup>*Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, Colorado, USA*



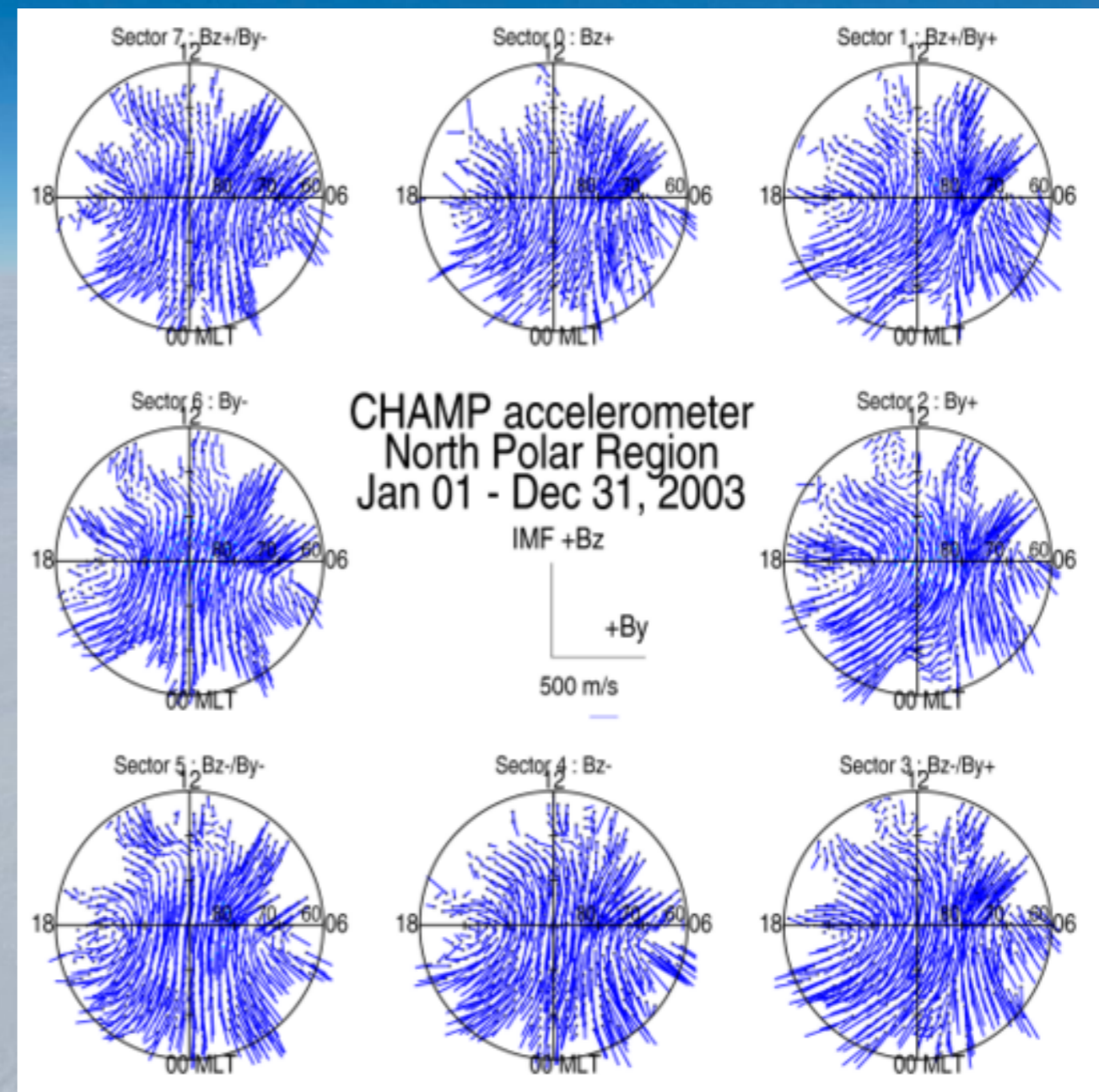
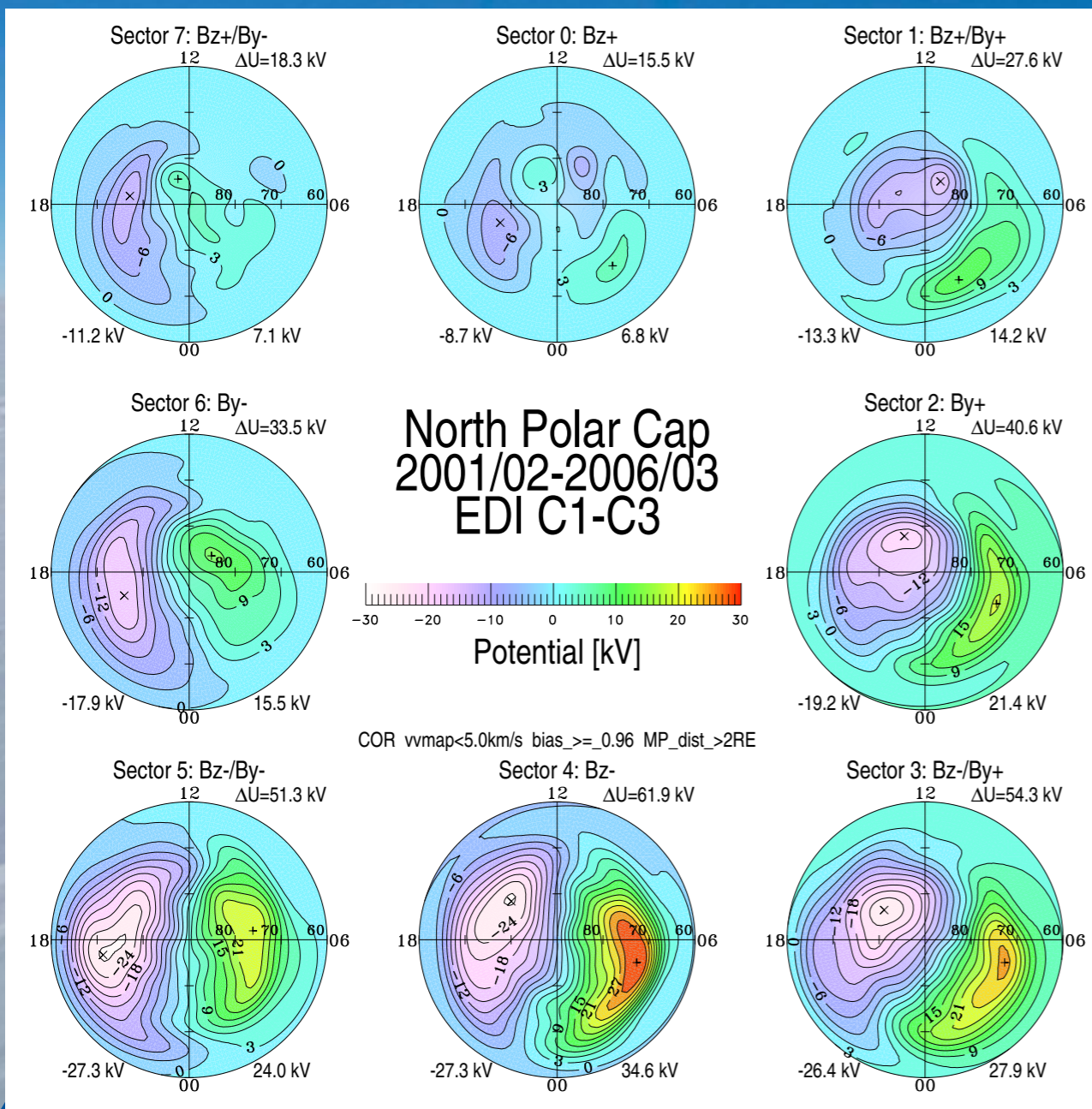
# Ion motions in the polar region

- Interactions of the solar wind with the magnetosphere
- Resulting electric field drives ion motions
- Two cell plasma convection



# Neutral motions in the polar region

- Neutrals are accelerated and heated via collisions with convecting ions in addition to being driven by pressure gradient from solar heating on the dayside.

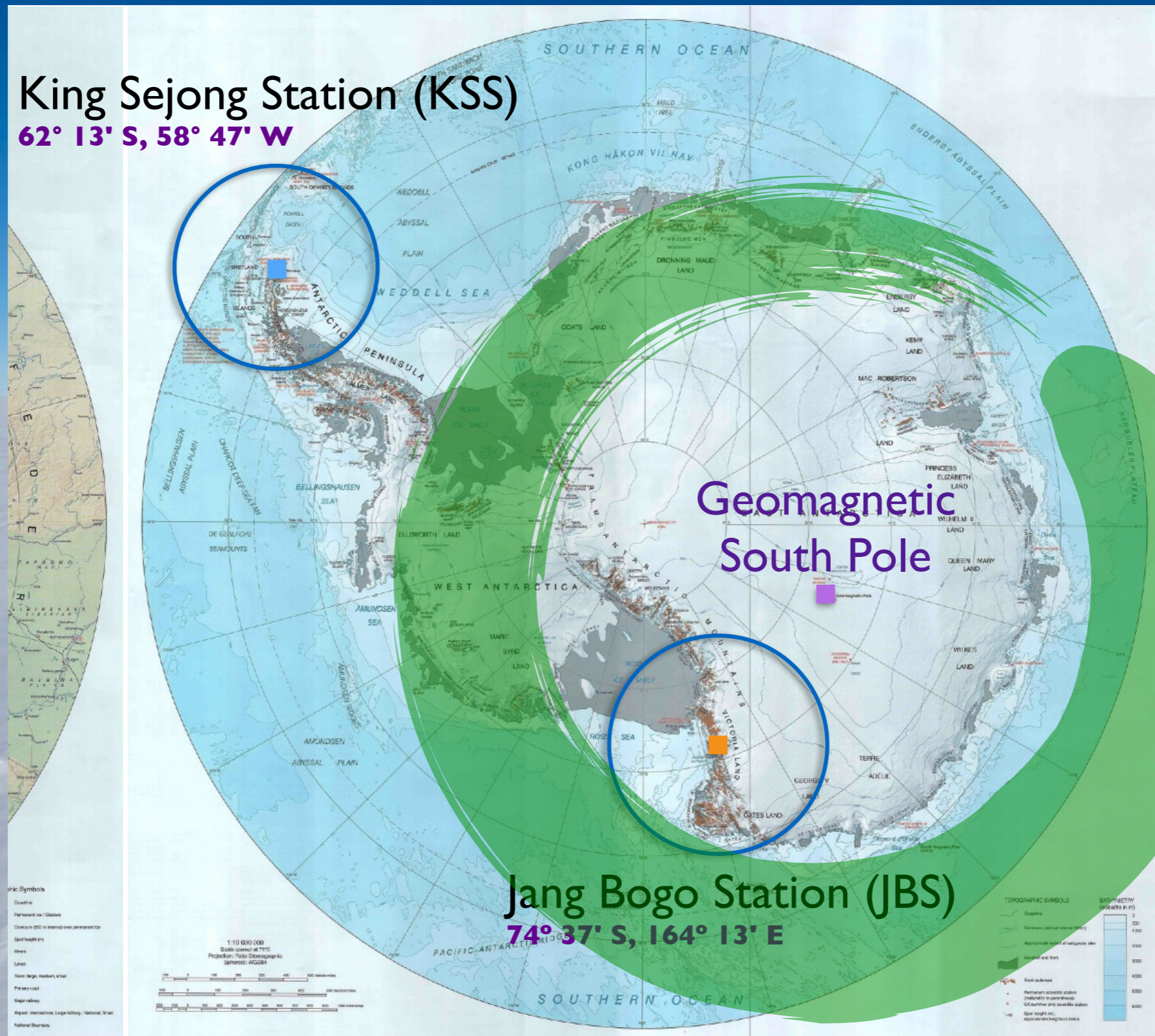


# Ion-neutral coupling in the Polar Region

- Neutral motions are predominantly determined by ion drifts in the polar region.
- By simultaneous observations for ion and neutral motions, we attempt to answer the following questions:
  - How much do the states of ions (e.g., ion drifts & ion density) affect the neutral motions? or vice versa (flywheel effect)?
  - How fast do the neutrals respond to the changes of ion motions?

# Jang Bogo Staton

King Sejong Station (KSS)  
62° 13' S, 58° 47' W



# Simultaneous observations for ion and neutral motions



**FPI**

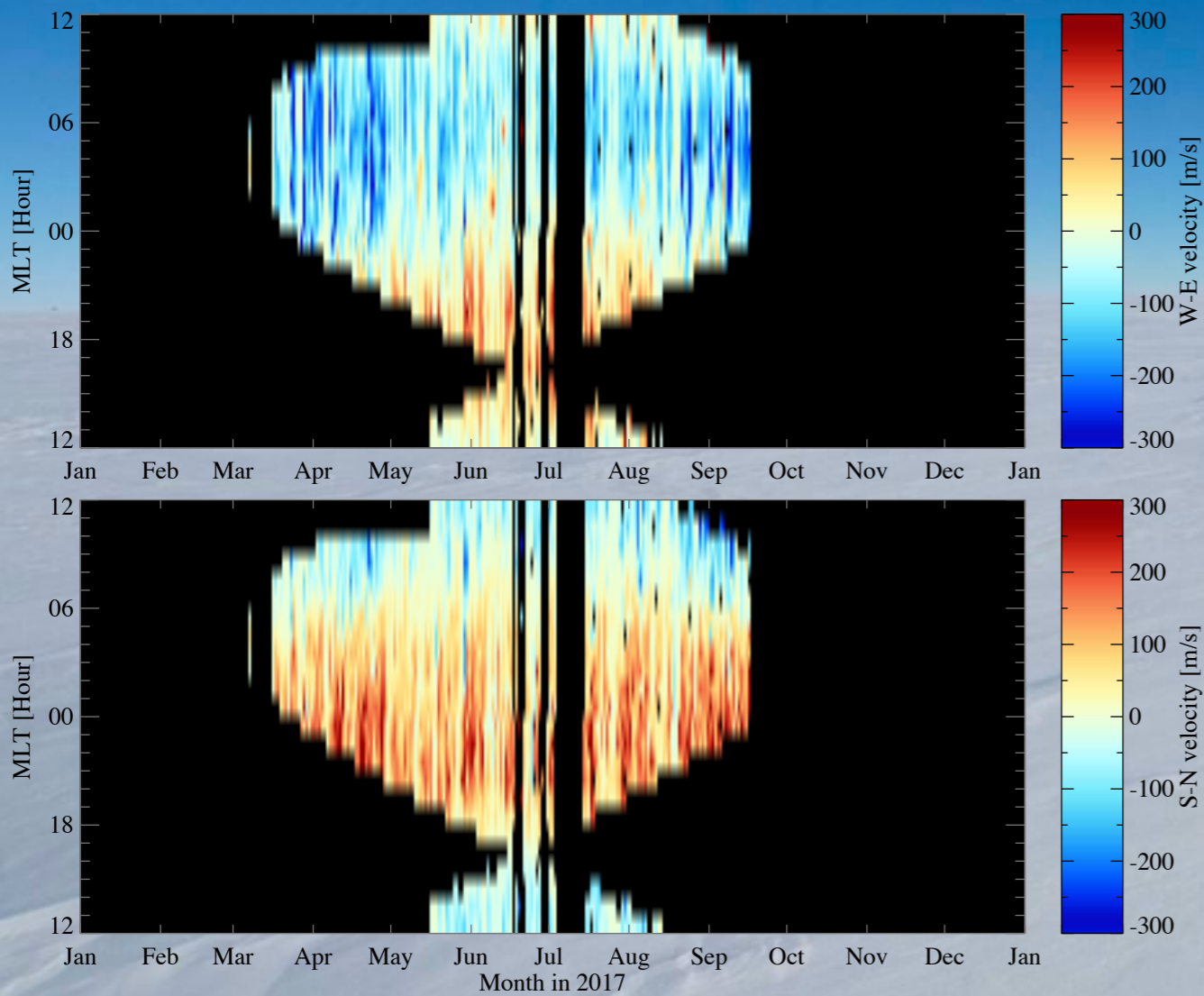
- FPI neutral winds from OI-630.0nm emission every 55 min. during winter in 2017
- VIPIR-dynasonde Doppler velocity every 2 min. in 2017

**VIPIR**

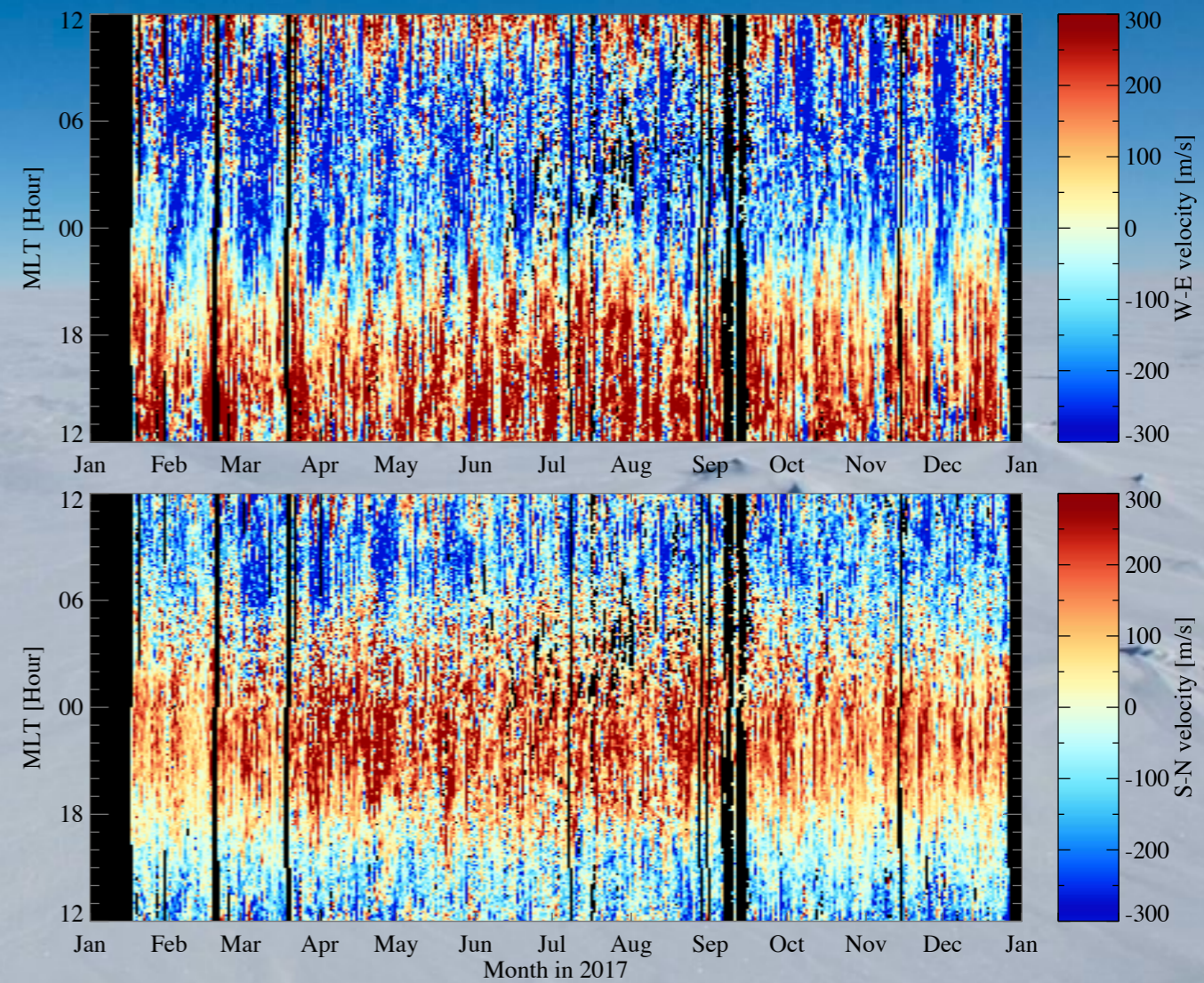


# Winds vs. Ion drifts at 250 km

FPI 250 km Horizontal Neutral Winds (Geomagnetic coord.)

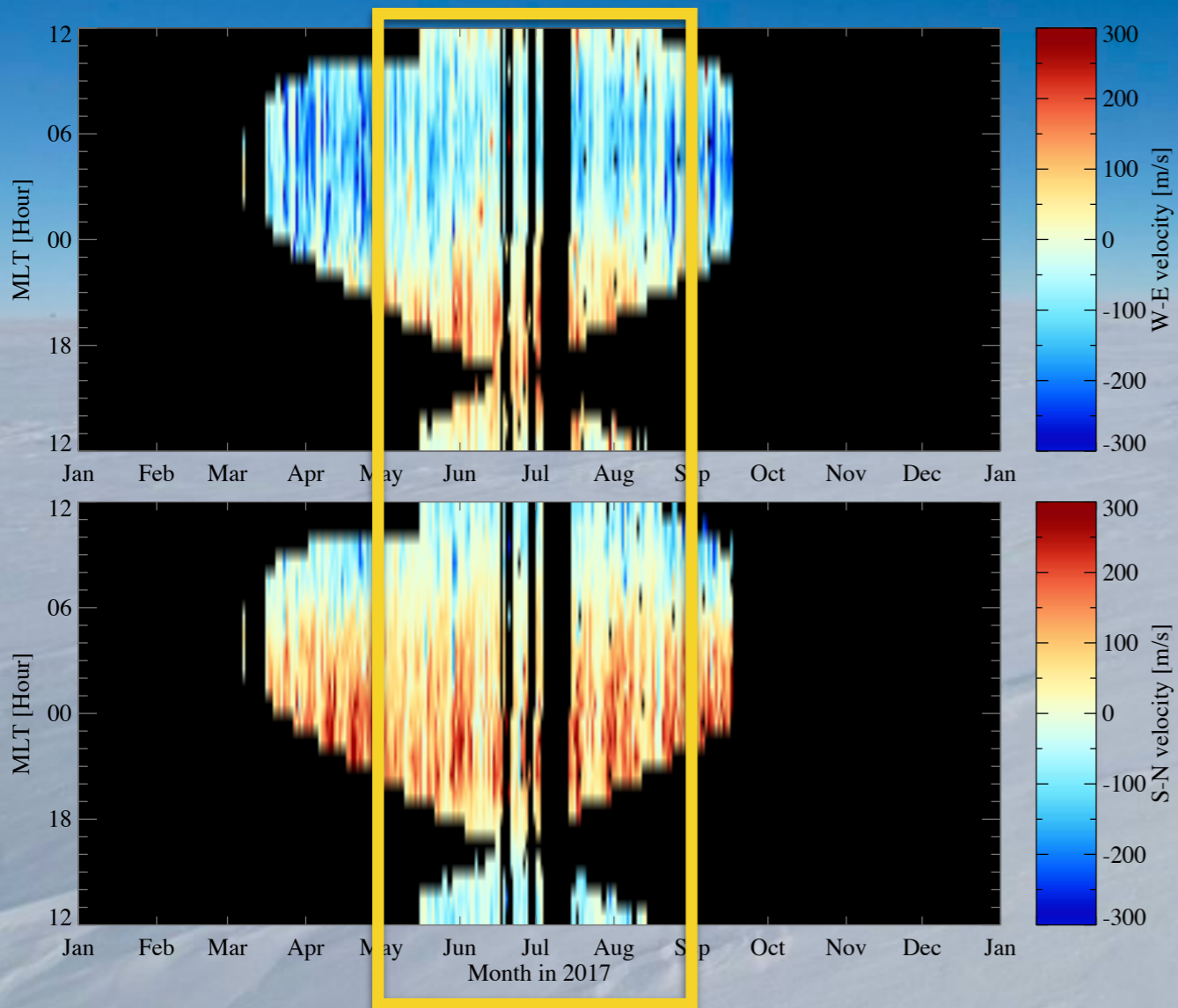


Dynasonde F-region Horizontal Ion Drifts (Geomagnetic coord.)

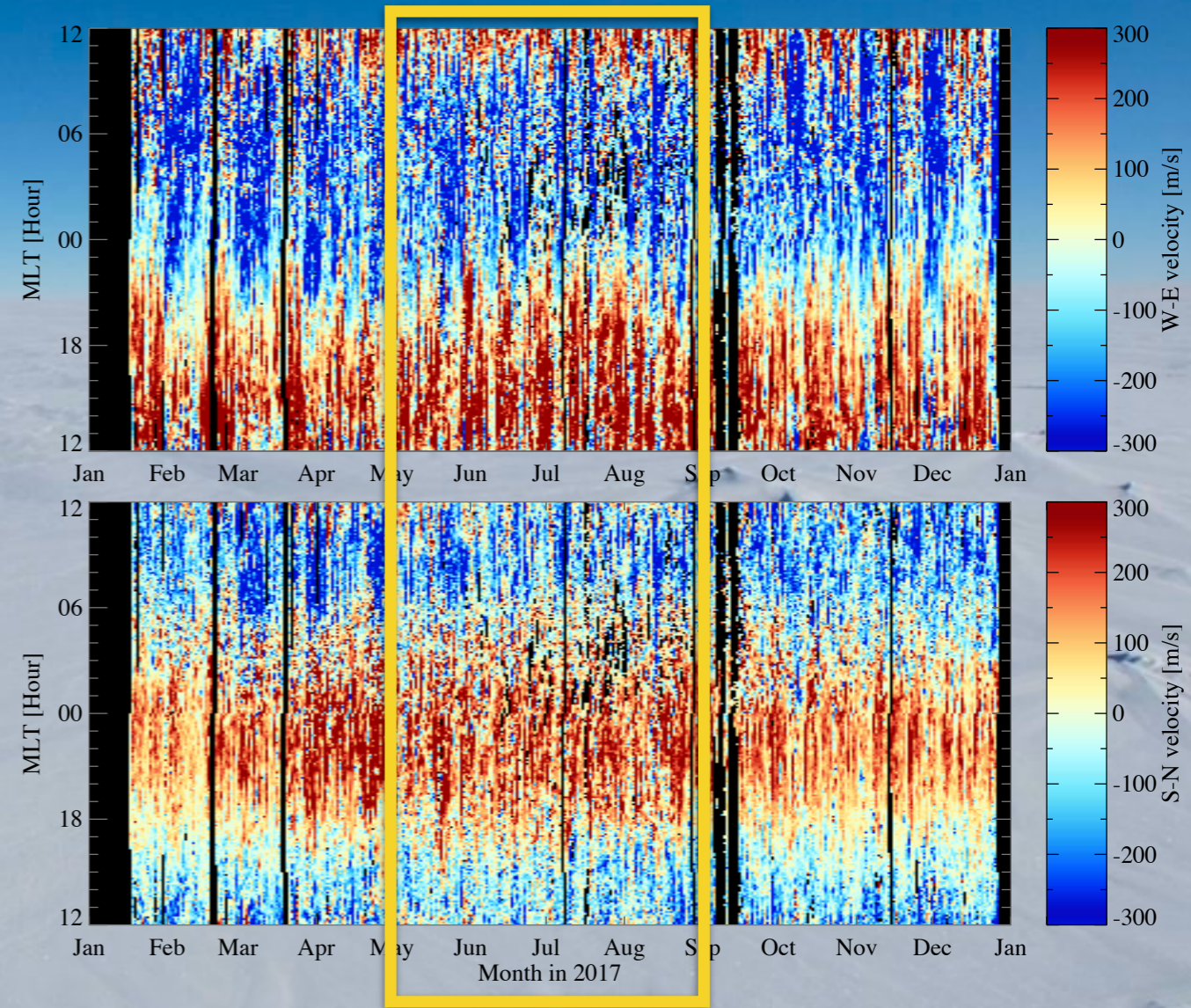


# Winds vs. Ion drifts at 250 km

FPI 250 km Horizontal Neutral Winds (Geomagnetic coord.)



Dynasonde F-region Horizontal Ion Drifts (Geomagnetic coord.)

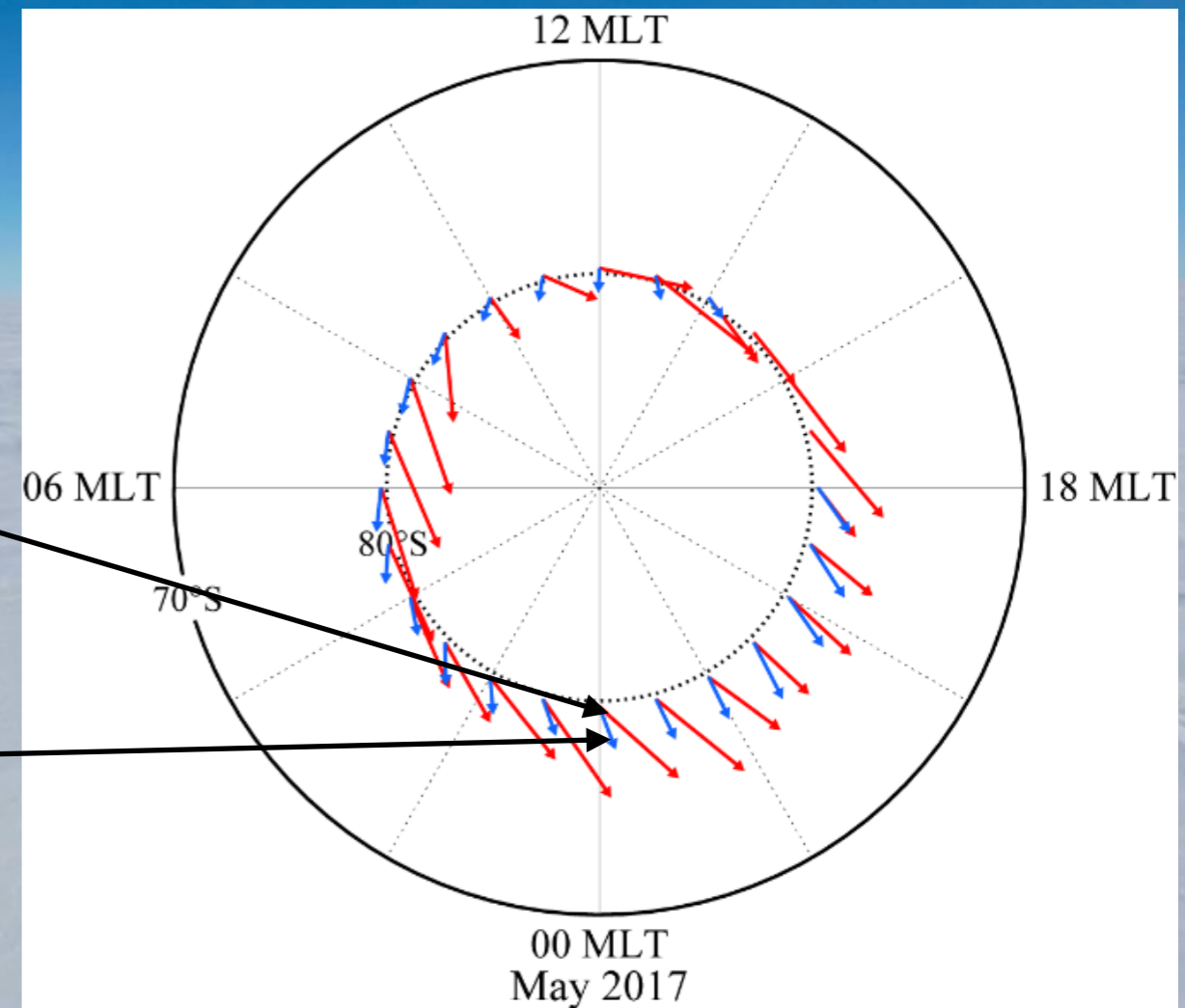
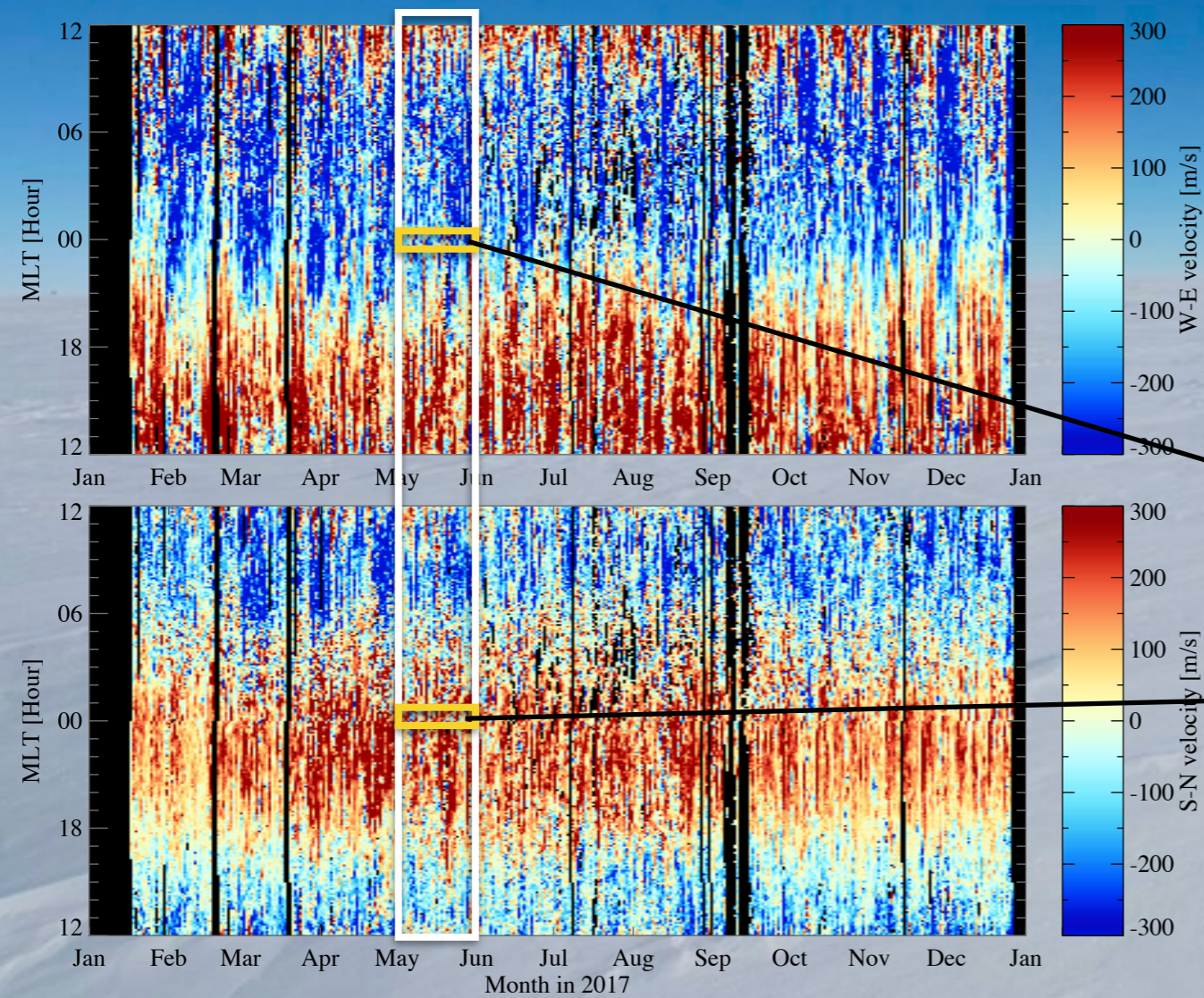


Winter-time observations

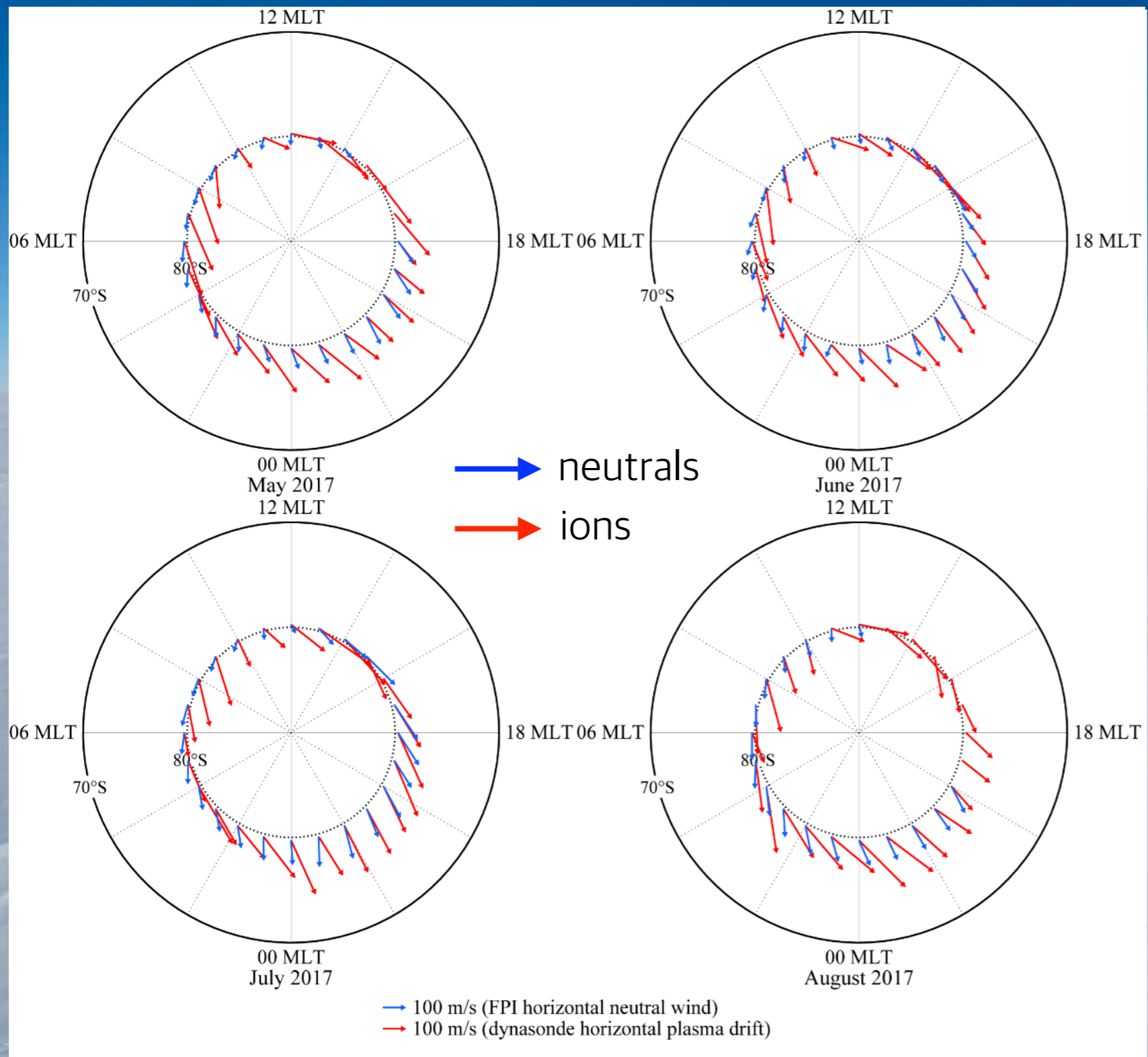


# Monthly mean vectors

Dynasonde F-region Horizontal Ion Drifts (Geomagnetic coord.)



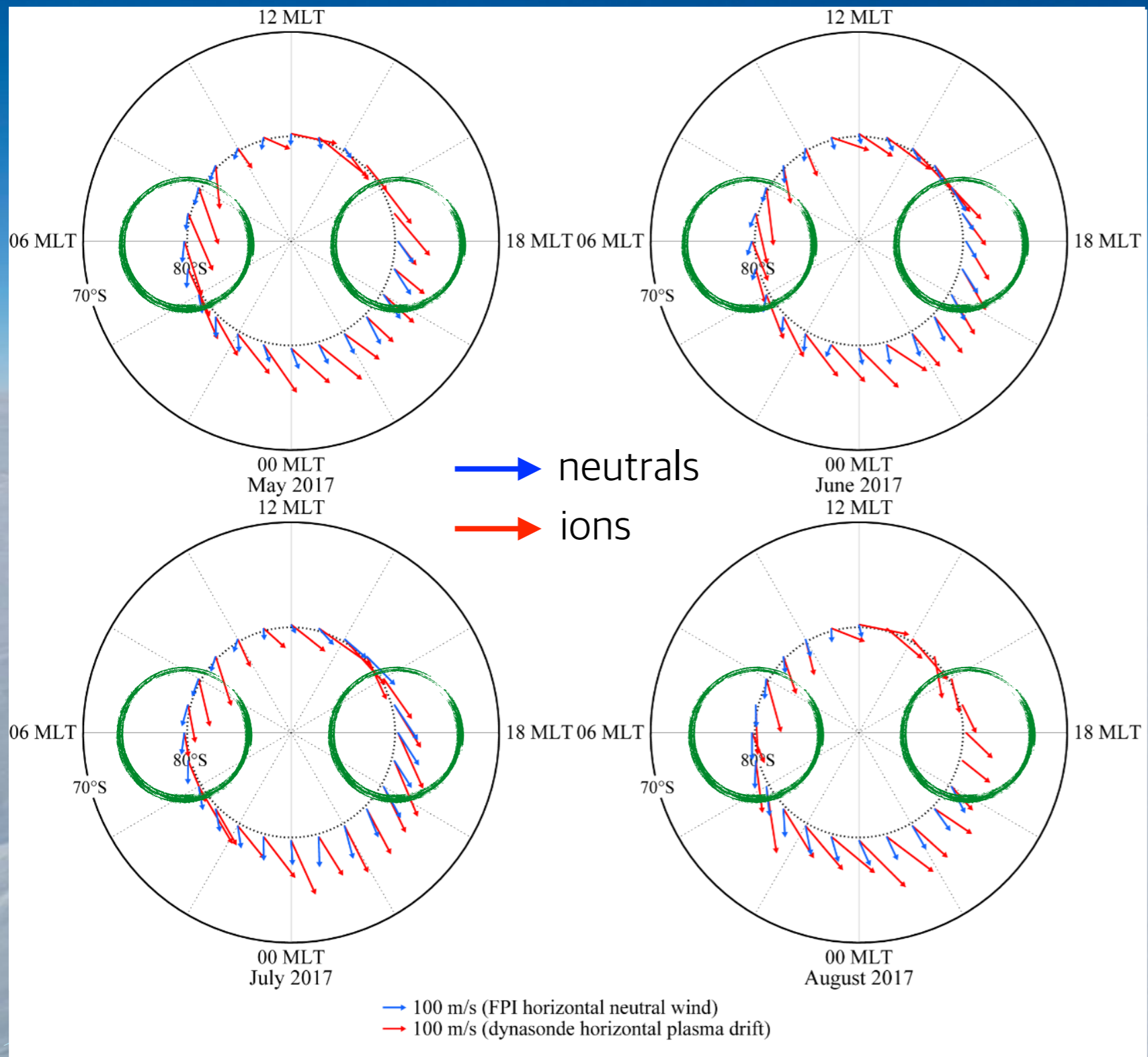
# Neutral winds vs. Ion drifts



- Magnitude of ion drifts is larger than neutral winds
- Systematic differences also exist in their directions

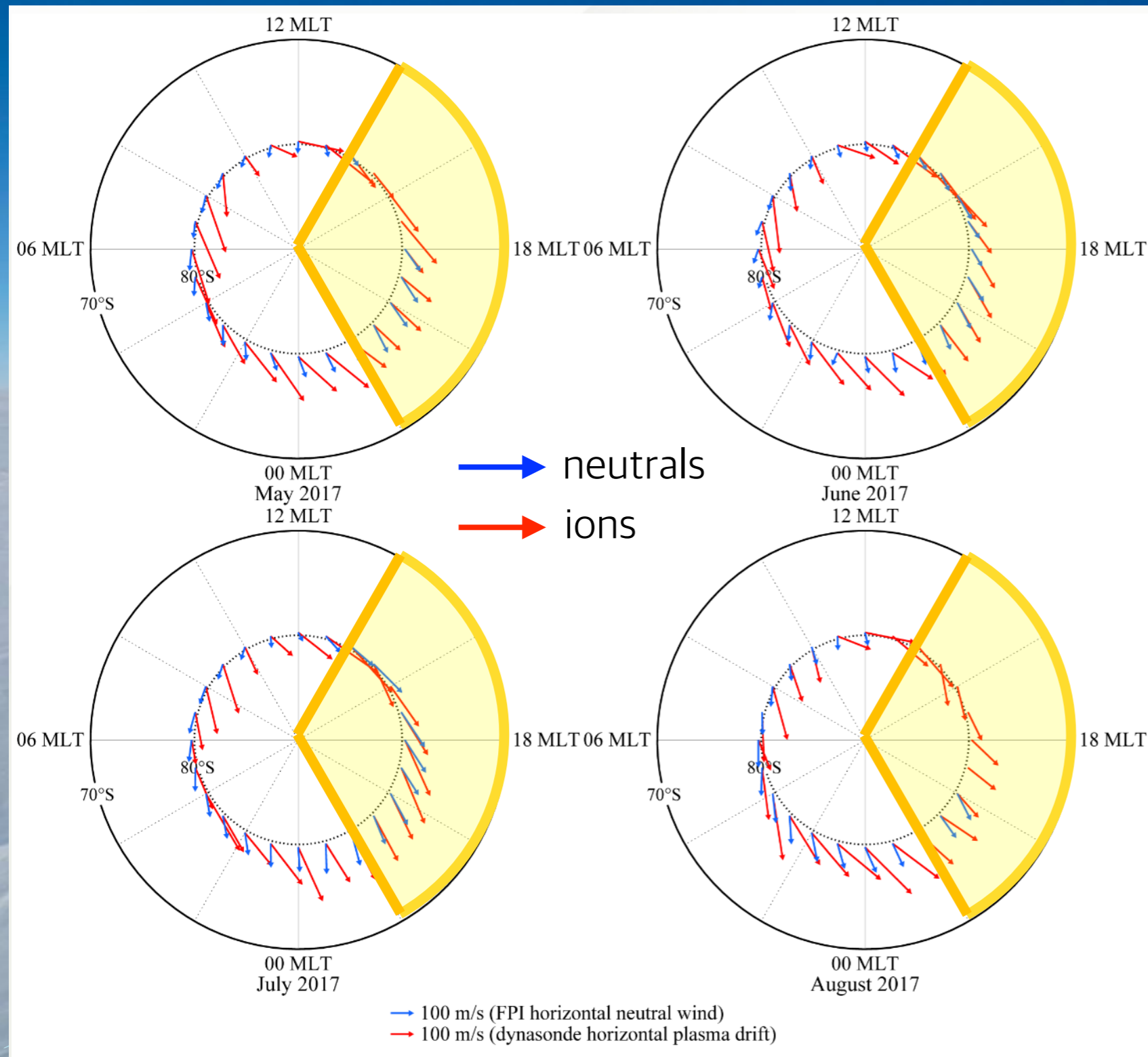


# Neutral winds vs. Ion drifts



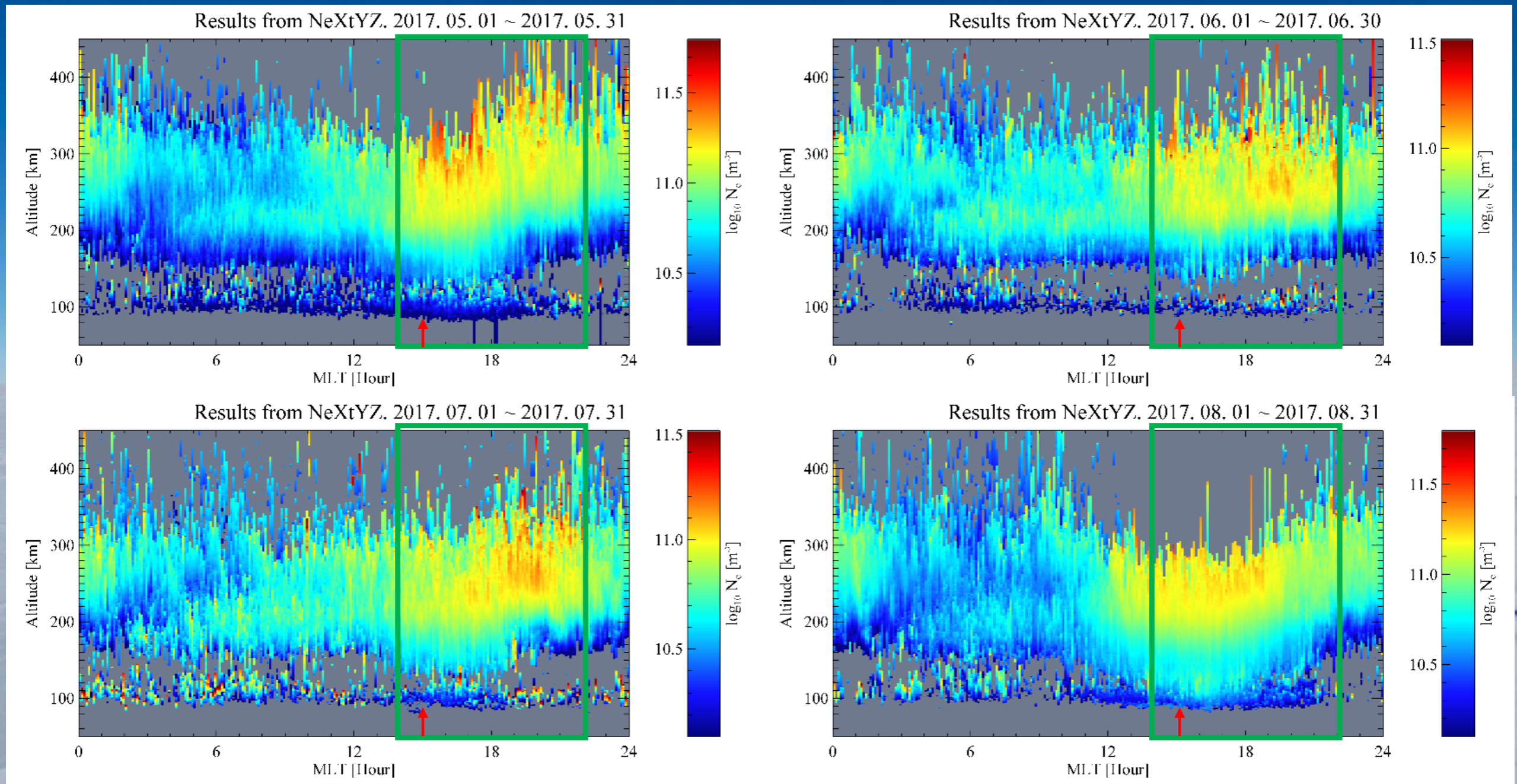
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- Strong dawn-dusk asymmetry in the neutral winds: closer to ion drifts at dust sector

# Neutral winds vs. Ion drifts



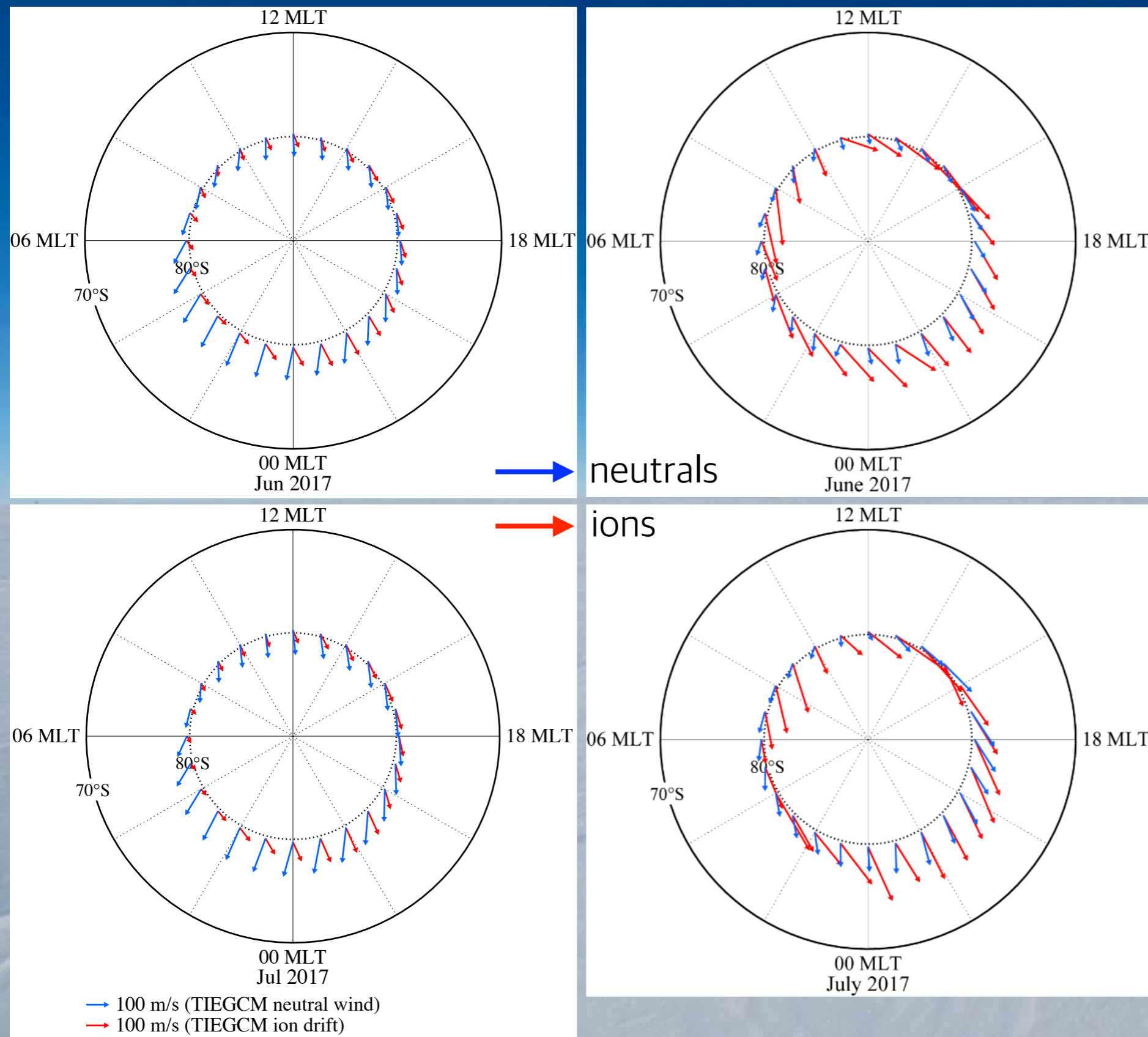
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# Mean plasma densities are greater in the afternoon and evening



Larger density  $\rightarrow$  larger ion-neutral collisions  
 $\rightarrow$  Neutral winds become closer to ion drifts

# TIEGCM Observation



- There is a significant discrepancy in the ion drifts from model and observations.

- Model substantially underestimates ion drifts; even smaller than neutral winds!

# Summary

- Jang Bogo Station (JBS) is located mostly in the southern polar cap region
- Simultaneous observations for the ion drifts and neutral winds are performed by VIPIR and FPI at JBS, respectively
- There exists significant and rather systematic differences between them
- Effect of ion drift seems to show a strong dependence on ion density
- TIEGCM greatly underestimates ion drifts

# Future works

- Time resolution of FPI wind measurements will be improved from 55 min. to 15 min.
- Continuously operate FPI and VIPIR for a long-term observation to further investigate the ion-neutral couplings for various geophysical conditions such as IMF, F10.7, K<sub>p</sub>, auroral activity etc.



# Thank you!



POLA-05 “Comparison of neutral winds and ion drifts observed at Jang Bogo station, Antarctica”,  
presented by Ham, Young-bae



JBS