High-Latitude Ionospheric Drivers and their Effects on Wind Patterns in the Thermosphere

Lucas Liuzzo

University of Michigan

12/8/13

Model

- Neutral winds are modeled using the Global Ionosphere-Thermosphere Model (GITM)
- Multiple high-latitude drivers are used to model the winds
- Resulting winds are compared to data from Scanning Doppler Imager (SDI) instruments located throughout Alaska
- Ion-neutral coupling is also considered

Inputs Considered

- High-latitude drivers varied in GITM:
  - Electric Potential
    - Weimer
    - SuperDARN
  - Auroral Precipitation
    - Fuller-Rowell and Evans (NOAA)
    - OVATION Prime
    - OVATION-SME
  - Ionospheric Dynamo

Select Runs

Run ID	Potential	Aurora	Dynamo	RMS	ABS
SdOs6mD50	SuperDARN	OVATION-SME	Yes˚	**103.43**	-13.181
SdOs[D]	SuperDARN	OVATION-SME	No	104.12	-12.764
WOs[1, D]	Weimer	OVATION-SME	No	107.70	46.243
SdOp[D]	SuperDARN	OVATION Prime	No	121.92	**5.5685**
SdOsD[D]	SuperDARN	OVATION-SME	Yes	150.67	57.924
WOsD[D]	Weimer	OVATION-SME	Yes	163.12	107.26
SdOpD50	SuperDARN	OVATION Prime	Yes˚	169.43	120.95
WN[1, D]	Weimer	NOAA	No	191.79	156.35
SdOpD[D]	SuperDARN	OVATION Prime	Yes	198.56	97.629
WND[D]	Weimer	NOAA	Yes	**281.19**	**239.69**

˚ Dynamo located at 50 degrees latitude.

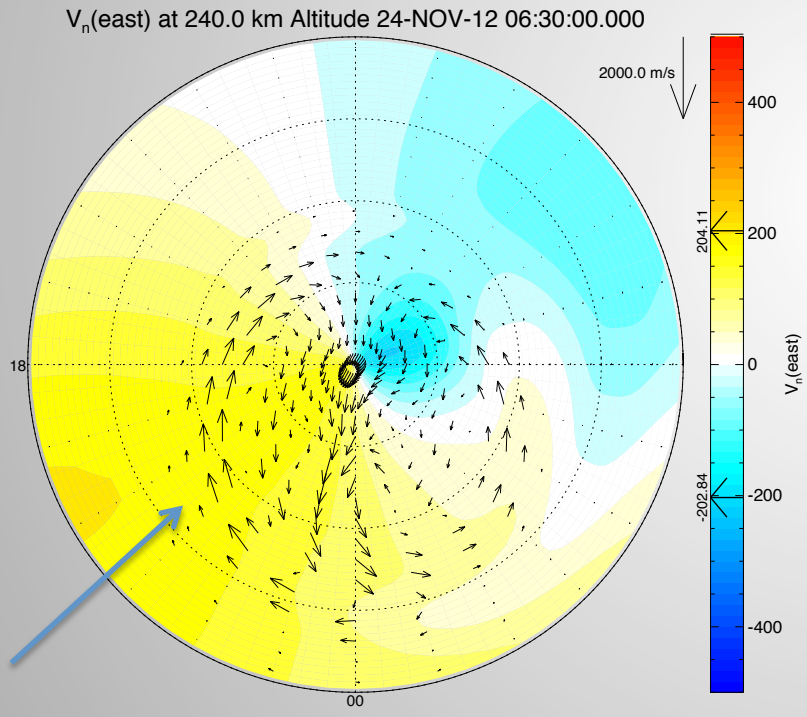
[1] Note the improvement in RMS and ABS errors by changing the auroral precipitation input.

[D] A dynamo located at 70˚ latitude significantly decreases the accuracy of the modeled winds.

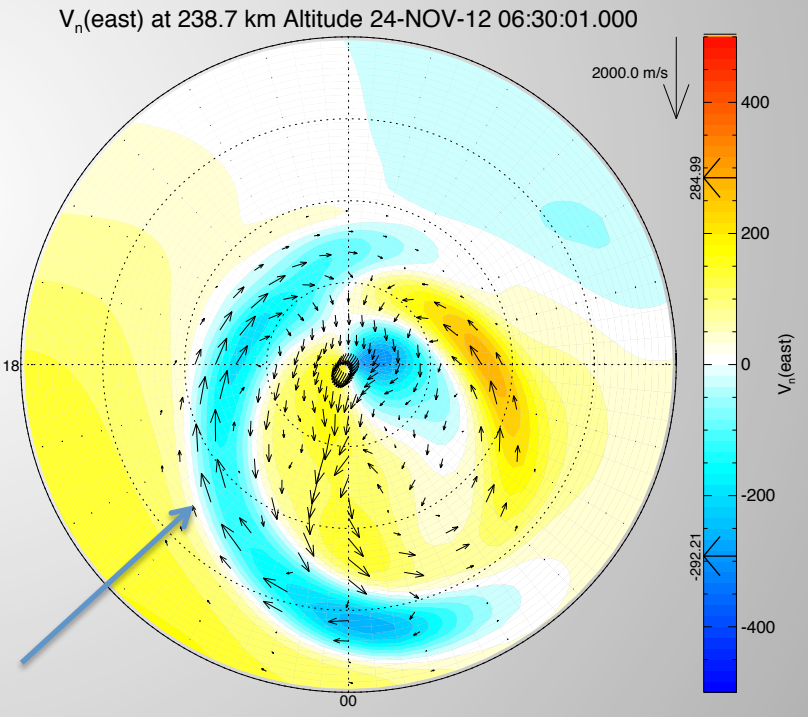
- Multiple runs using differing high-latitude ionospheric inputs as drivers
- Root mean square and absolute errors between GITM simulated winds and SDI observed winds

Neutral E-W Flow with Ion Flow Vectors

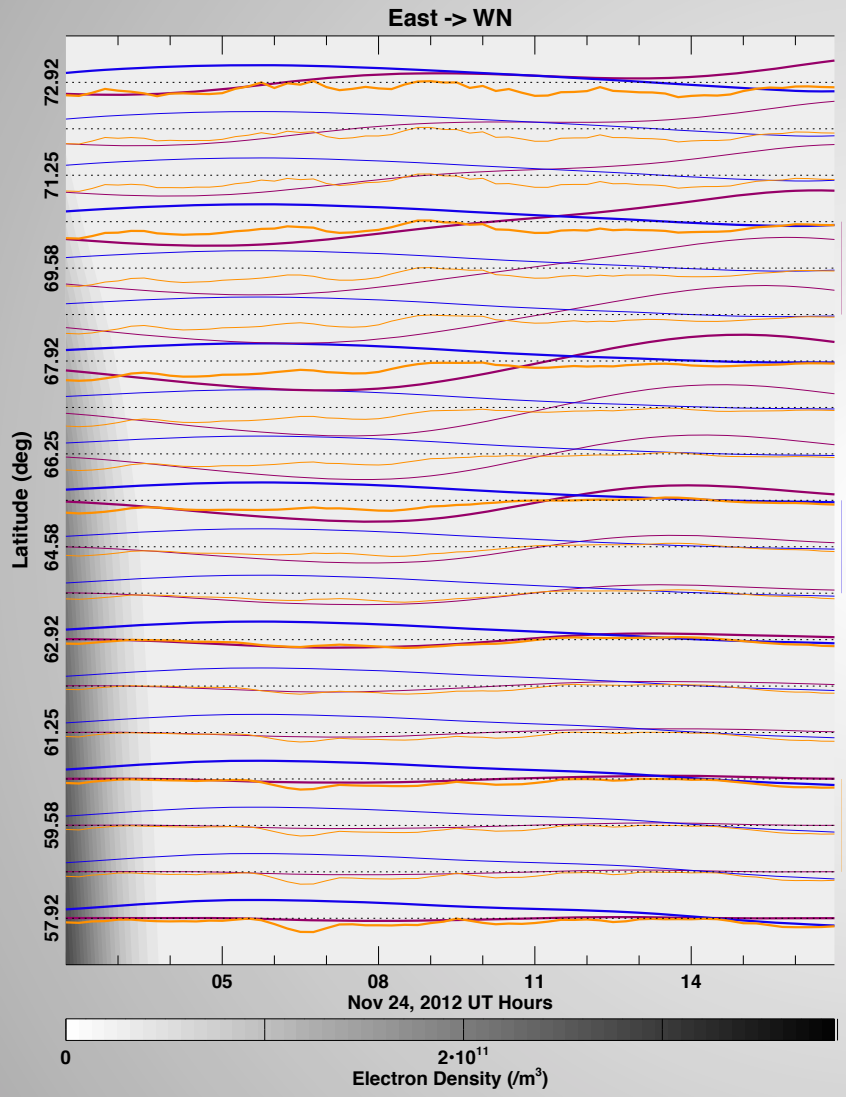
Weimer + NOAA



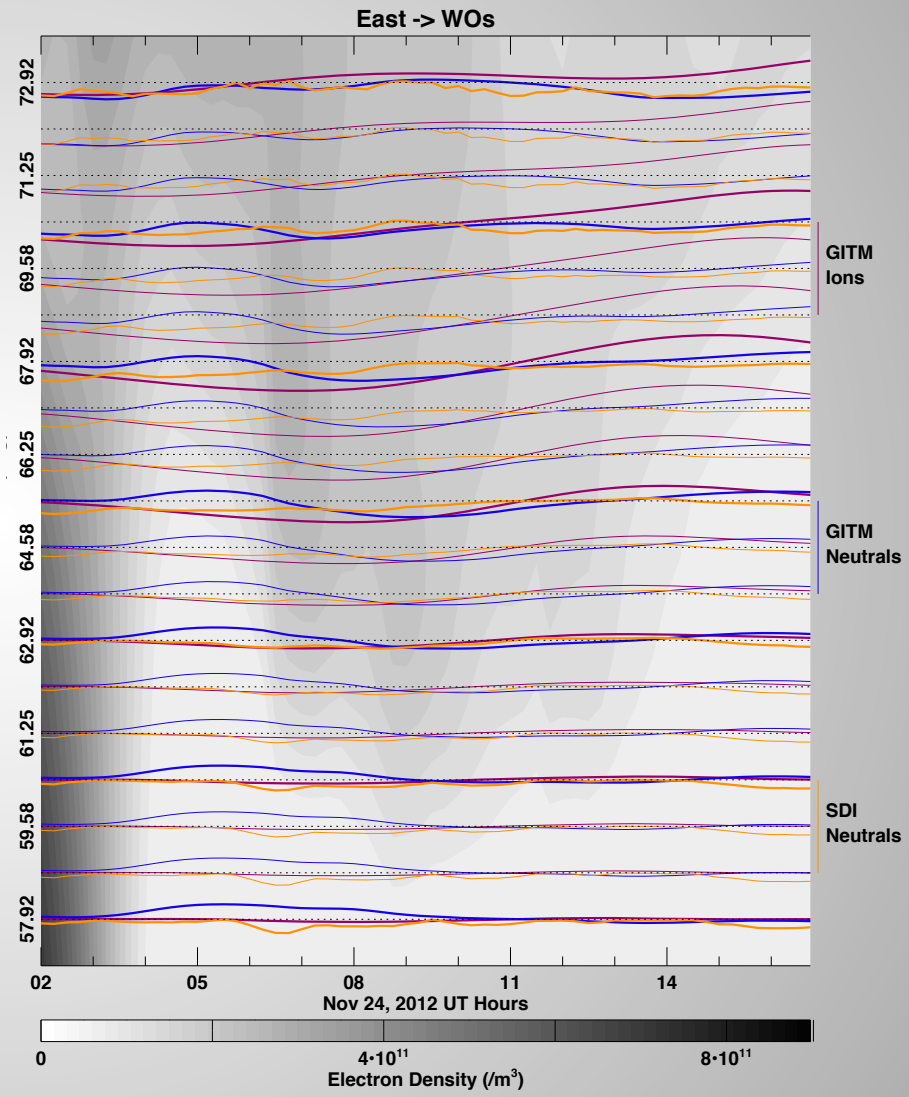
Weimer + OVATION-SME



Simulated and Measured Winds

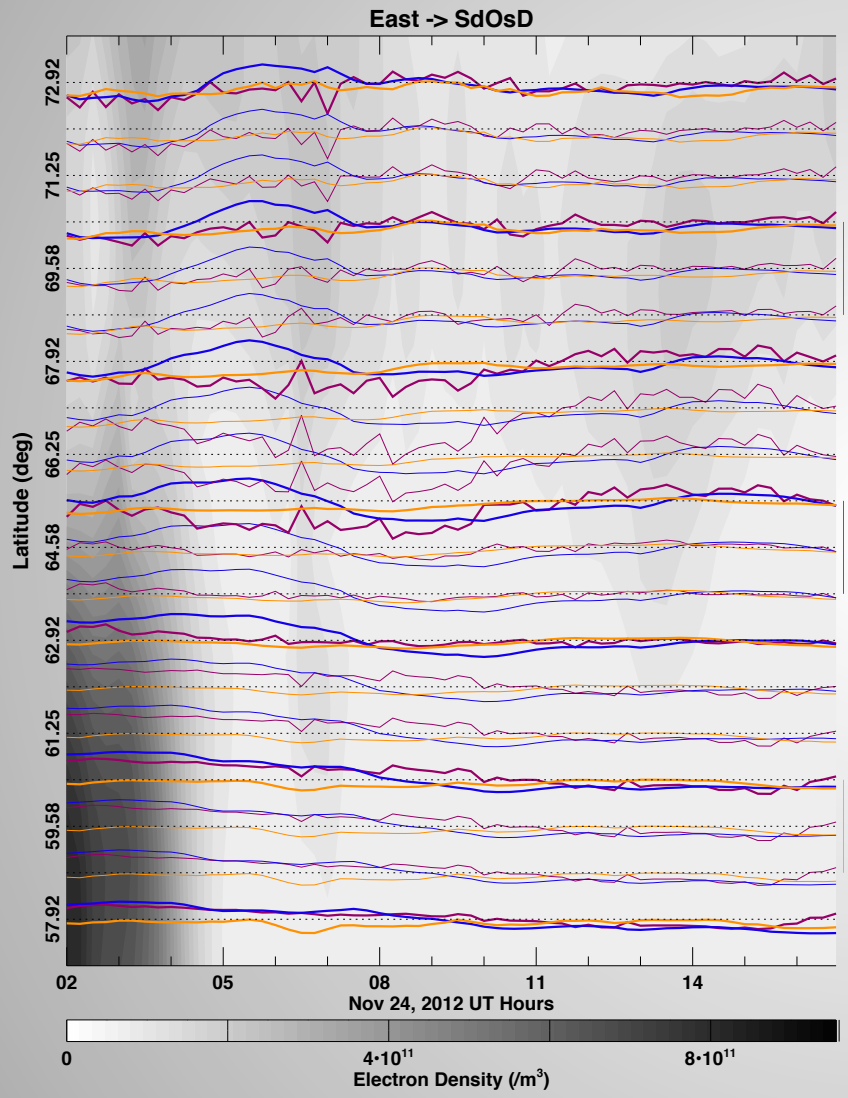


RMS = 191.791 ABS = 156.353



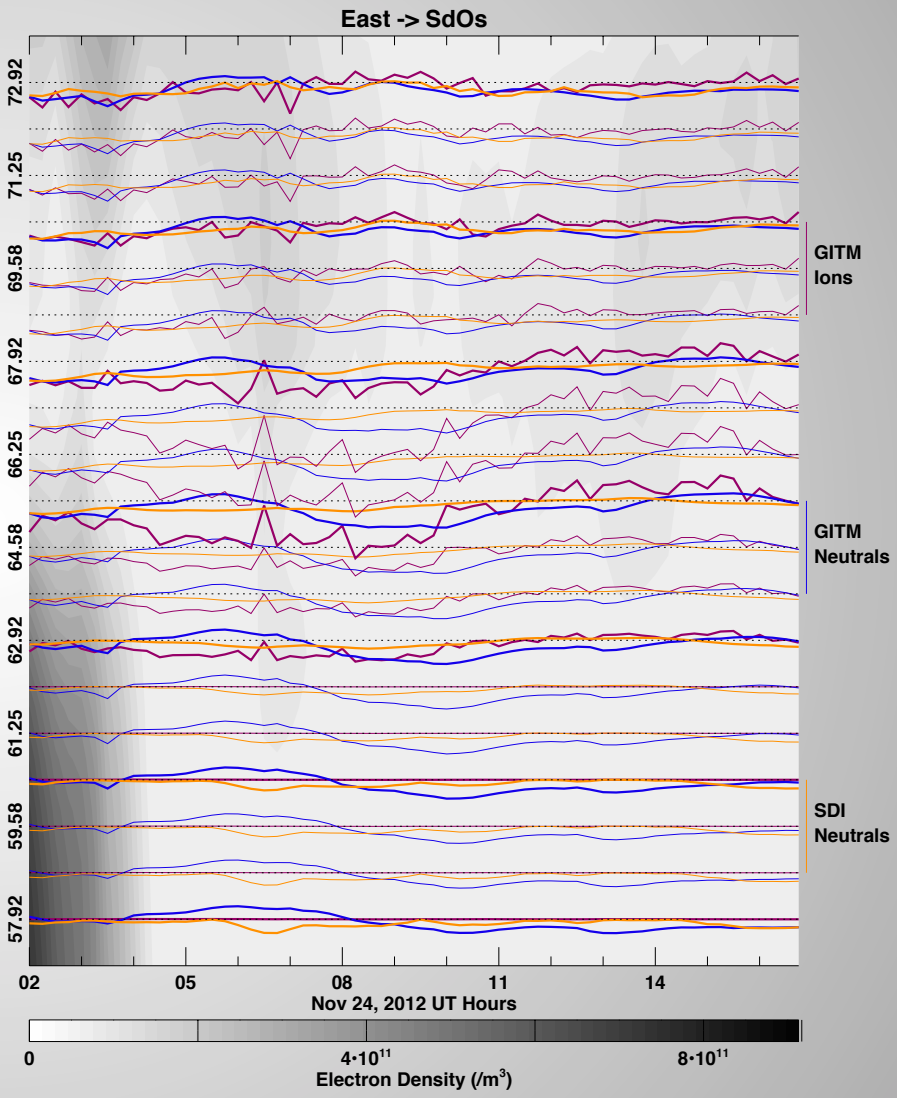
RMS = 107.703 ABS = 46.2432

Simulated and Measured Winds



RMS = 150.670

ABS = 57.9239



RMS = 104.115

ABS = -12.7436

COLLEGE OF ENGINEERING
ATMOSPHERIC, OCEANIC AND SPACE SCIENCES
UNIVERSITY OF MICHIGAN

Conclusion

- Use of different high-latitude drivers drastically affects resulting neutral winds
- An ionospheric dynamo at 70˚ prevents correct modeling of high-latitude neutral winds
- Accurate models of electric potential and auroral precipitation must be used to correctly model winds
- Poster presentation Wednesday, 8:00a-12:00p, Moscone South, ID # 1807823