A Review of "Climatology of Medium-Scale Traveling Ionospheric Disturbances Observed by the Midlatitude Blackstone SuperDARN Radar"

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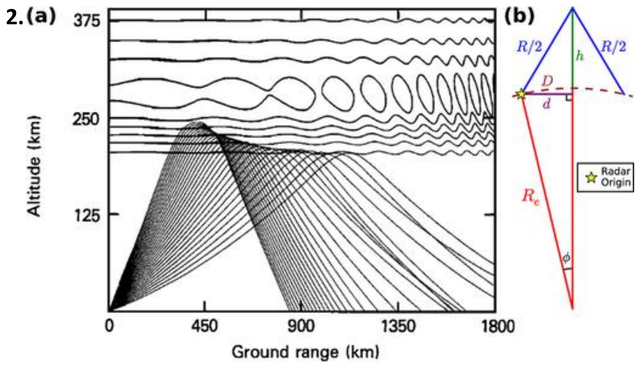
Abstract/Introduction

2. (a) (b)



- **This poster is a review of *Frissell et al. (2014)* by undergraduate students for the purpose of learning about SuperDARN and MSTIDs as part of a research project to study the differences between MSTIDs observed in the Northern and Southern Hemispheres.**
- MSTIDS (Medium-scale traveling ionospheric disturbances) are waves of ionospheric plasma that propagate through the upper atmosphere
- Associated with electrodynamic processes and atmospheric gravity waves(AGWs), which provide dynamic coupling during momentum and energy transfer between regions of the atmosphere.
- Seasonal and diurnal patterns are identified, and the sources of the MSTIDs are explored through correlations with the auroral electrojet index and reverse ray tracing of multiple types of gravity waves.
- MSTIDs can cause fluctuations in the ionospheric particle density, which can result in phase and amplitude distortions in radio signal
- While we have an idea of the possible causes of MSTIDs, and the effects on radio communication they have, this paper seeks to get a better understanding of the sources of MSTIDs by analyzing multiple occurrences that were recorded by the Goose Bay & Blackstone radars.

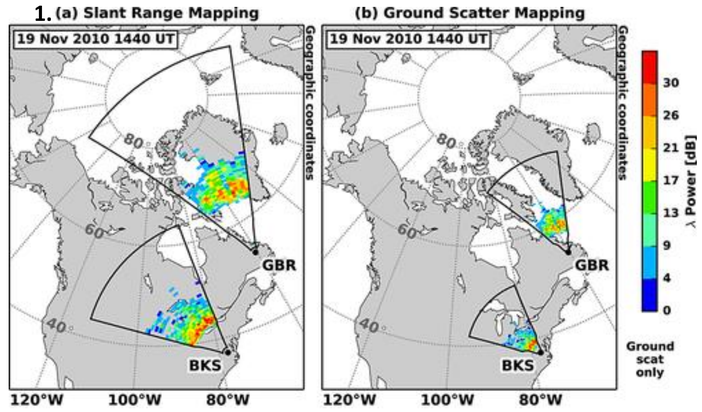
SuperDARN Radar, Blackstone, Virginia Google Earth 2008

Blackstone SuperDARN Radar

- Coherent Scatter Radar
- Measures - Doppler Velocity, Spectral Width, Signal-To-Noise Ratio
- 8-20 MHz Over the Horizon (OTH) Radar
- 16 Antenna Linear Phased Array
- 4 Antenna Interferometer Array
- 200 - 800 W per TX
- Multi-pulse sequence

Case Study

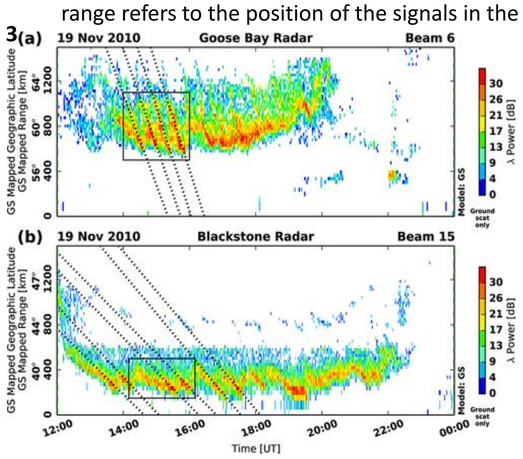
1. (a) Slant Range Mapping (b) Ground Scatter Mapping



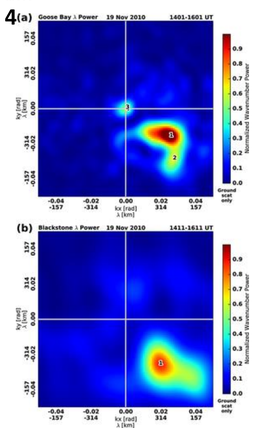
- This diagram shows variations in the reflected power of the Goose Bay Radar and Blackstone radar on November 19th 2010
- The area in which the scanners can scan is enclosed within the 2 areas outside the scanners.
- Only the spots colored in have a significant variation in expected power and thus are likely MSTIDs
- Slant range refers to the signals reflected off the ground while ground range refers to the position of the signals in the air.

3(a) 19 Nov 2010 Goose Bay Radar Beam 6

(b) 19 Nov 2010 Blackstone Radar Beam 15



4(a) (b)

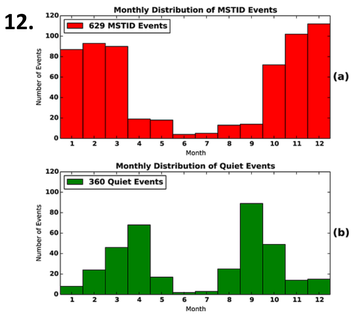


- Range-time-intensity plot showing MSTIDs observed by GBR & BKS to further analyze quantitative MSTID parameters.
- The slope and spacing of the dotted lines are used to calculate estimated average period, frequency, and phase velocity of MSTIDs.
- Figure (3a) and (3b) infers that the orientation of the radar beam look direction relative to the MSTID propagation direction does affect MSTID parameters.
- Figures (4a) and (4b) show MSTIDs propagating southeastward, which is consistent with the MSTIDs moving towards the radars in the RTI plots.

Climatology

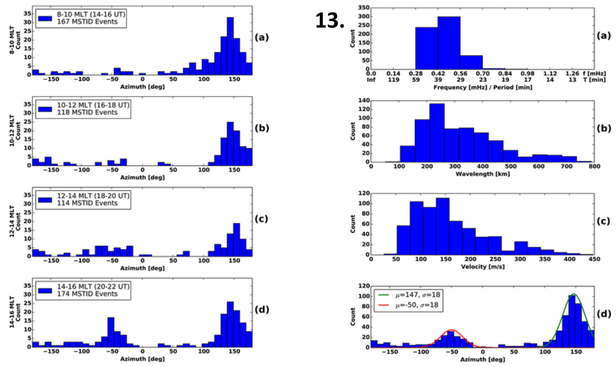
- 629 MSTID periods and 360 quiet periods were found.
- MSTID occurrences decrease substantially towards summer, with a dropoff in June & July and a sudden sharp increase in October.
- Predominant equatorward and eastward results are consistent with other midlatitude MSTID studies and attribute the equatorward MSTID observations to high-latitude sources.

12.



14.

13.



- The populations of MSTIDs observed along with all analysis infers that tropospheric & geomagnetic activity may contribute to MSTID production.
- Southeast-heading MSTIDs are likely to come from regions favorable to AGW production by both tropospheric and geomagnetic sources, while northwest heading MSTID populations are likely to come from a region over the Atlantic Ocean favorable to AGWs produced by tropospheric sources.

References

Frissell, N. A., Baker, J. B. H., Ruohoniemi, J. M., Gerrard, A. J., Miller, E. S., Marini, J. P., West, M. L., and Bristow, W. A. (2014), Climatology of medium-scale traveling ionospheric disturbances observed by the midlatitude Blackstone SuperDARN radar, *J. Geophys. Res. Space Physics*, 119, 7679–7697, doi:10.1002/2014JA019870.

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