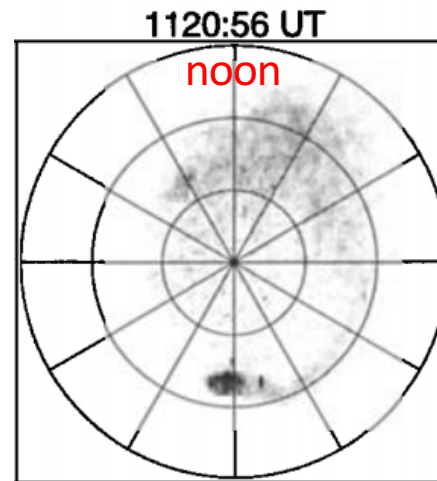
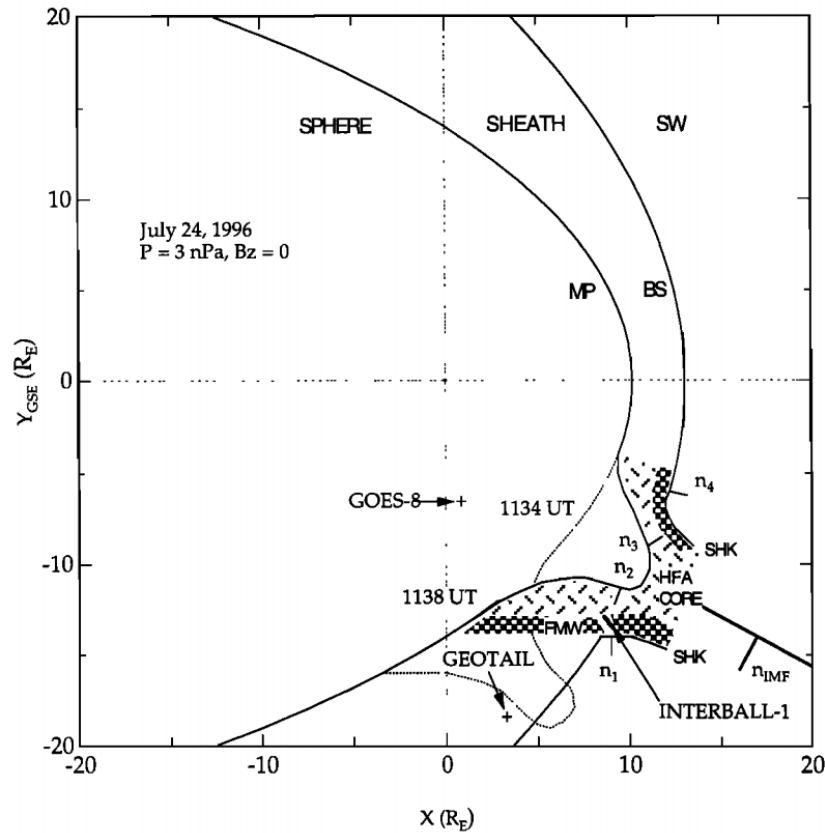


Magnetospheric signatures of dayside aurora on closed field lines and a possible solar wind driver

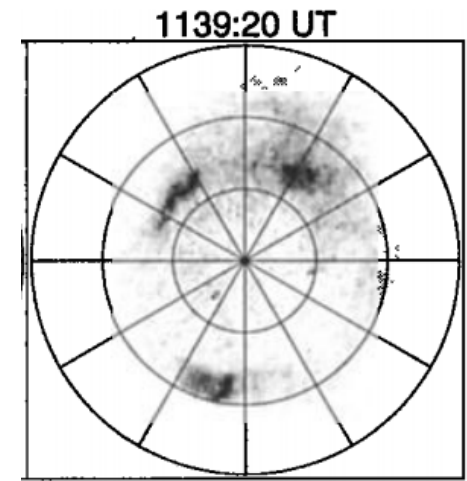
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1. Department of Atmospheric and Oceanic Sciences, University of California, Los Angeles, California, USA
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Variation of dayside aurora: Foreshock/shock driven



Before HFA



After HFA

[Sibeck et al., 1999]

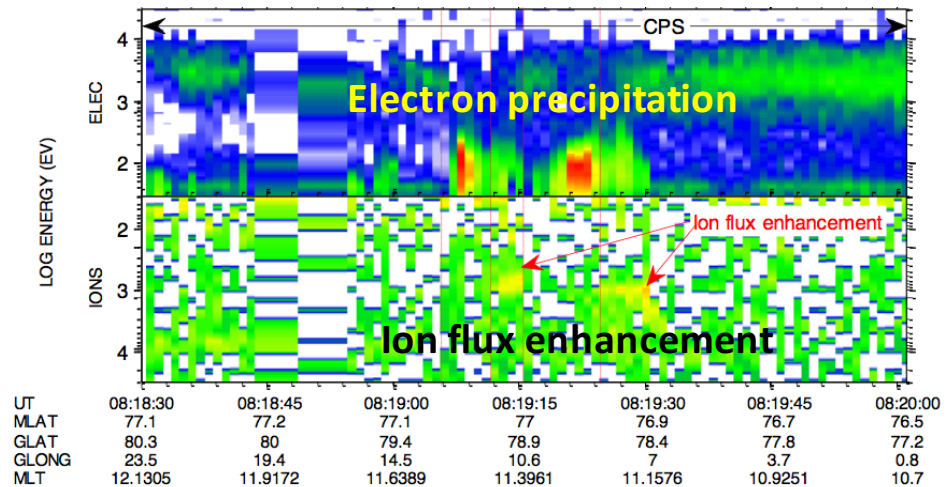
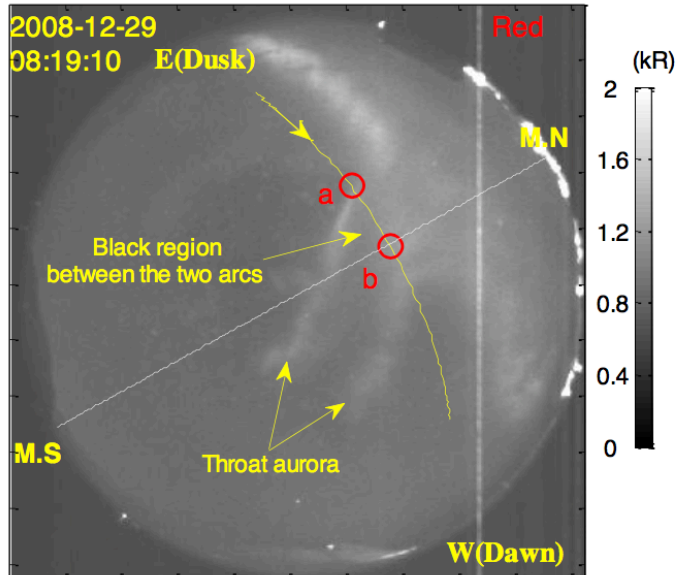
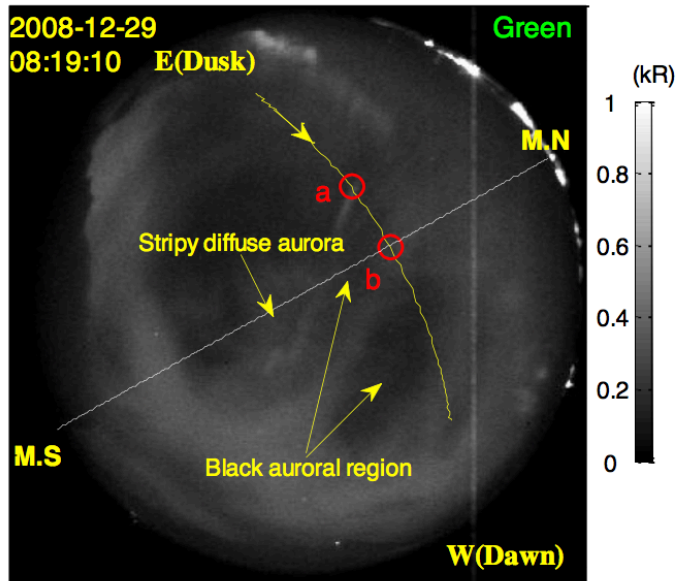
Hot Flow Anomaly (HFA) at ~1135 UT

→ Magnetopause deformation → Dayside auroral brightening

Space imaging has resolution limitation; Ground based imaging can identify aurora types and evolution.

Similar brightenings also occur during interplanetary shocks. [e.g., Zhou et al., 2009]

Variation of dayside aurora: Throat Aurora



[Han et al., 2016]

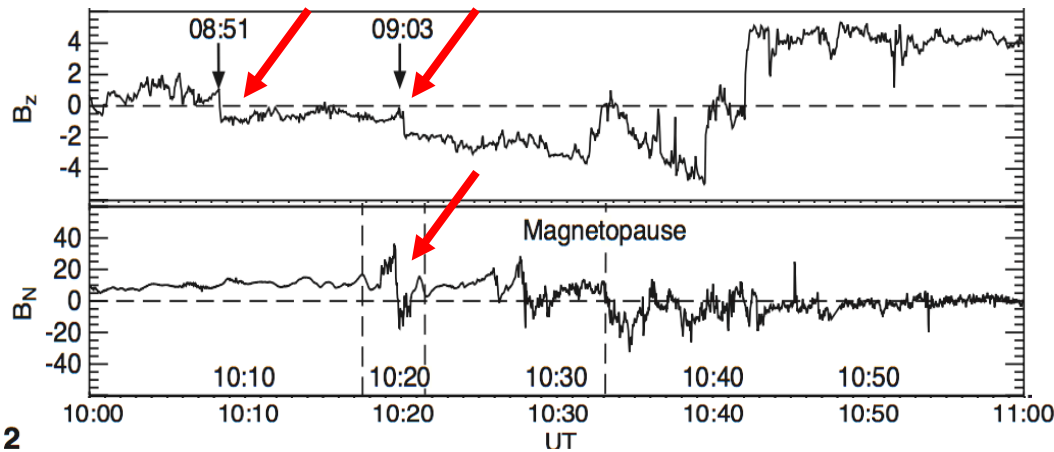
Throat aurora: transient discrete auroral brightening, with roughly north-south orientation, extending equatorward of discrete auroral oval

With DMSP conjunctions;

- Corresponding to low energy electron precipitation
- Reduction of plasma sheet electrons

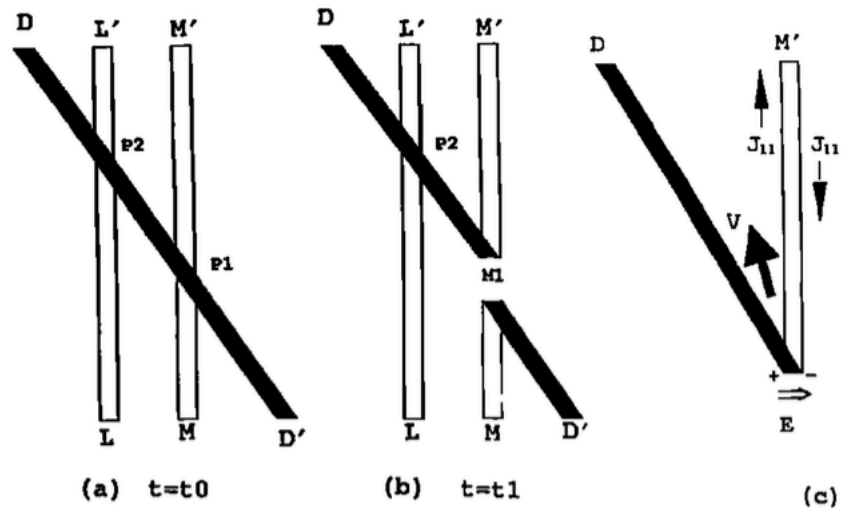
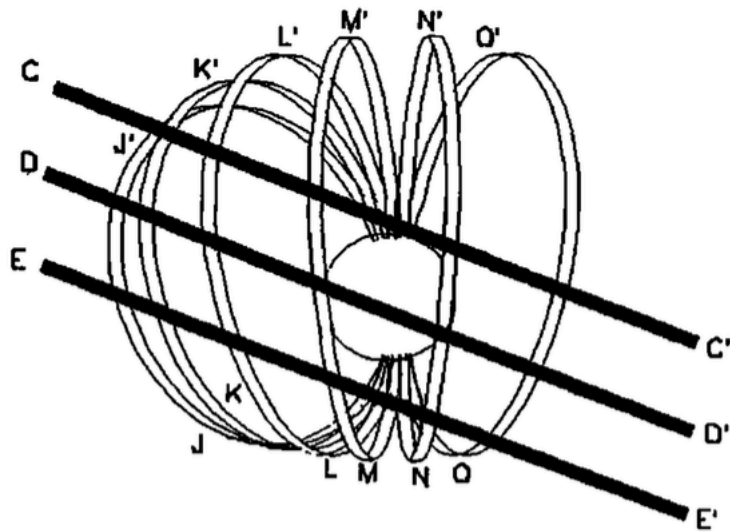
Indicating penetration of magnetosheath population

IMF southward turning and Flux Transfer Events



Previous papers show that FTEs follow IMF southward turnings [*Neudegg et al., 1999*].

2



FTE evolution after the reconnection with southward IMF [*Fasel et al., 1993*]. FTE has a poleward motion, which are considered to be associated with PMAFs.

Motivation

Questions

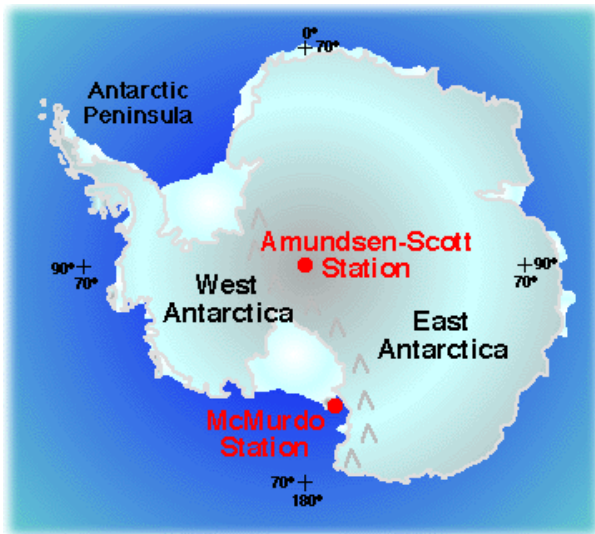
What are magnetospheric signatures of throat aurora and foreshock-driven aurora?

What drive such localized and transient feature near the dayside magnetopause?

To address those, we find conjunction events between THEMIS and South Pole all sky-imager.

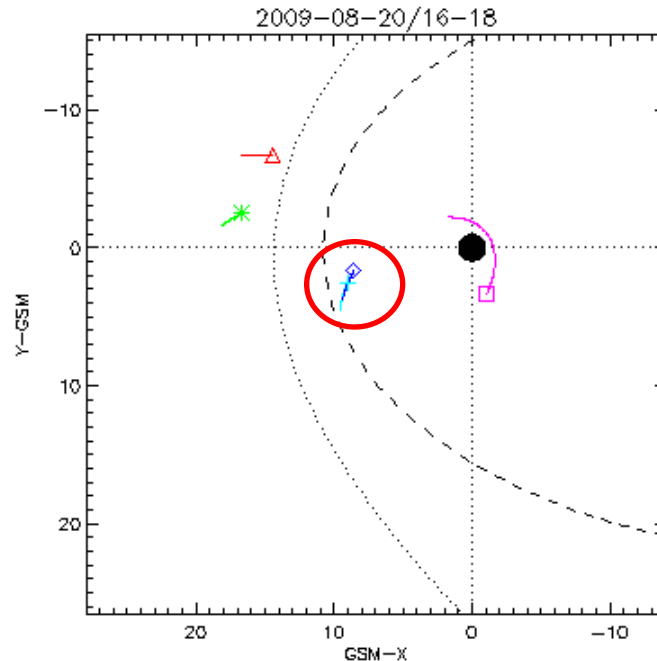
Advantages: TH-D and E had a conjunction per a day in 2008 and 2009. South Pole is under dayside diffuse aurora in nominal conditions.

Instruments



South Pole Station:

Located at Geophysical south pole or 74.3° S MLAT.



Final orbits:

THEMIS-P1 (B)

THEMIS-P2 (C)

THEMIS-P3 (D)

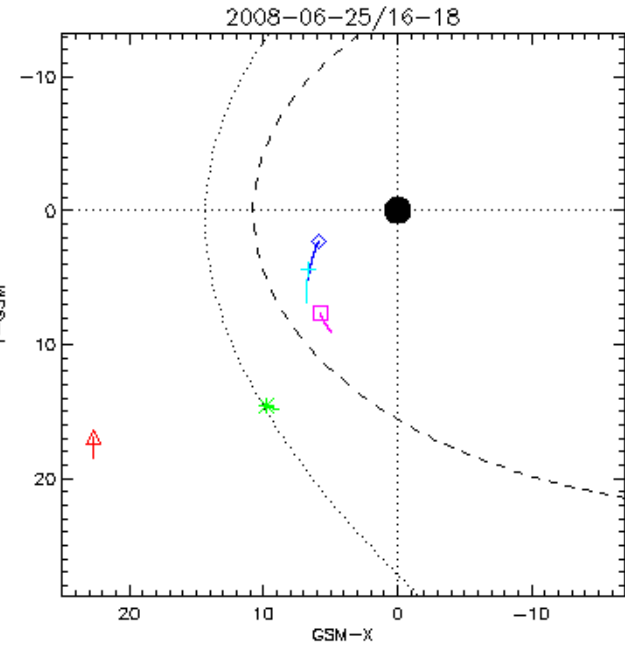
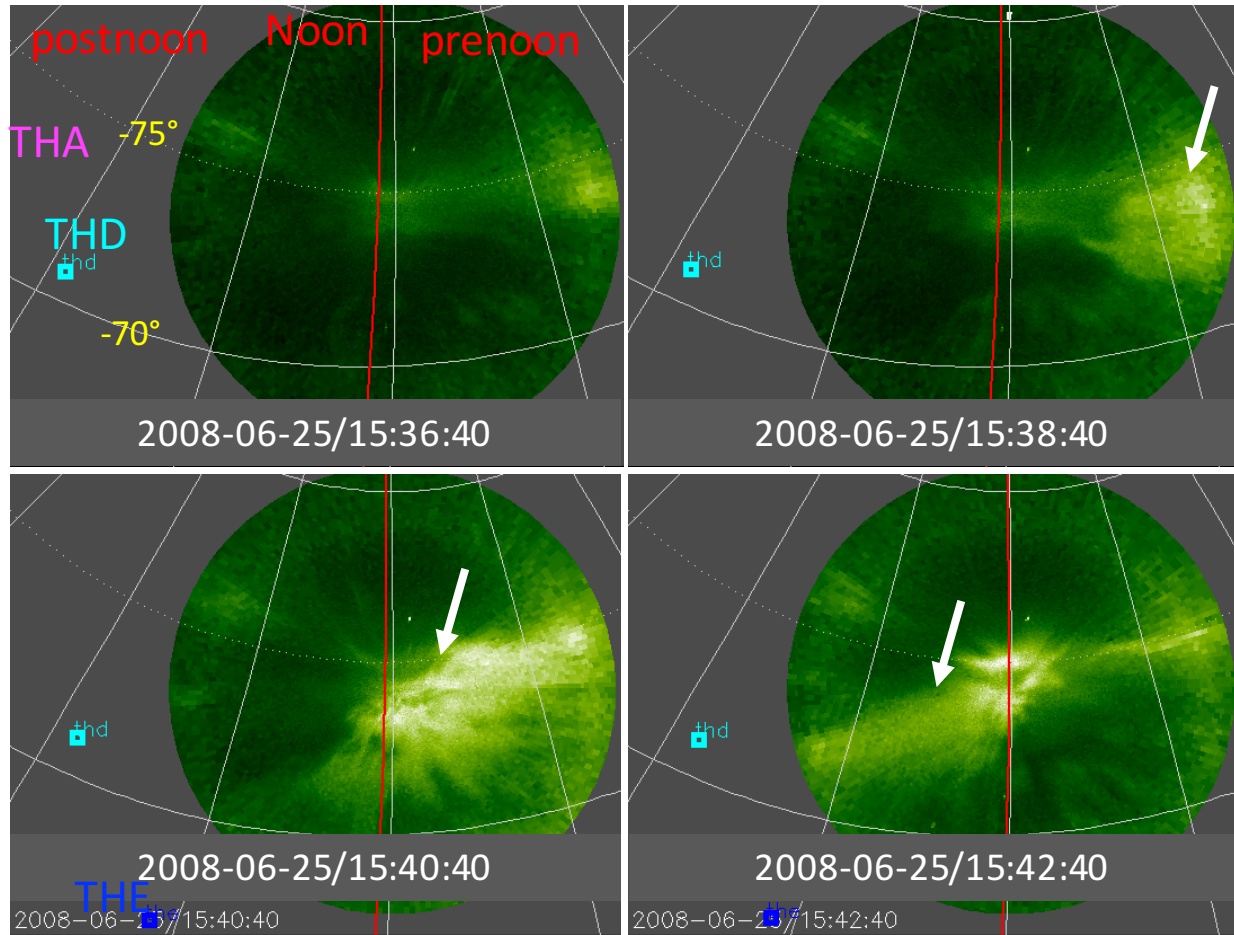
THEMIS-P4 (E)

THEMIS-P5 (A)

THEMIS D/E satellites:

Having possibilities to be closed to magnetopause in the dayside region.

Diffuse Aurora brightening: Ground Observation



Final orbits:

THEMIS-P1 (B)

THEMIS-P2 (C)

THEMIS-P3 (D)

THEMIS-P4 (E)

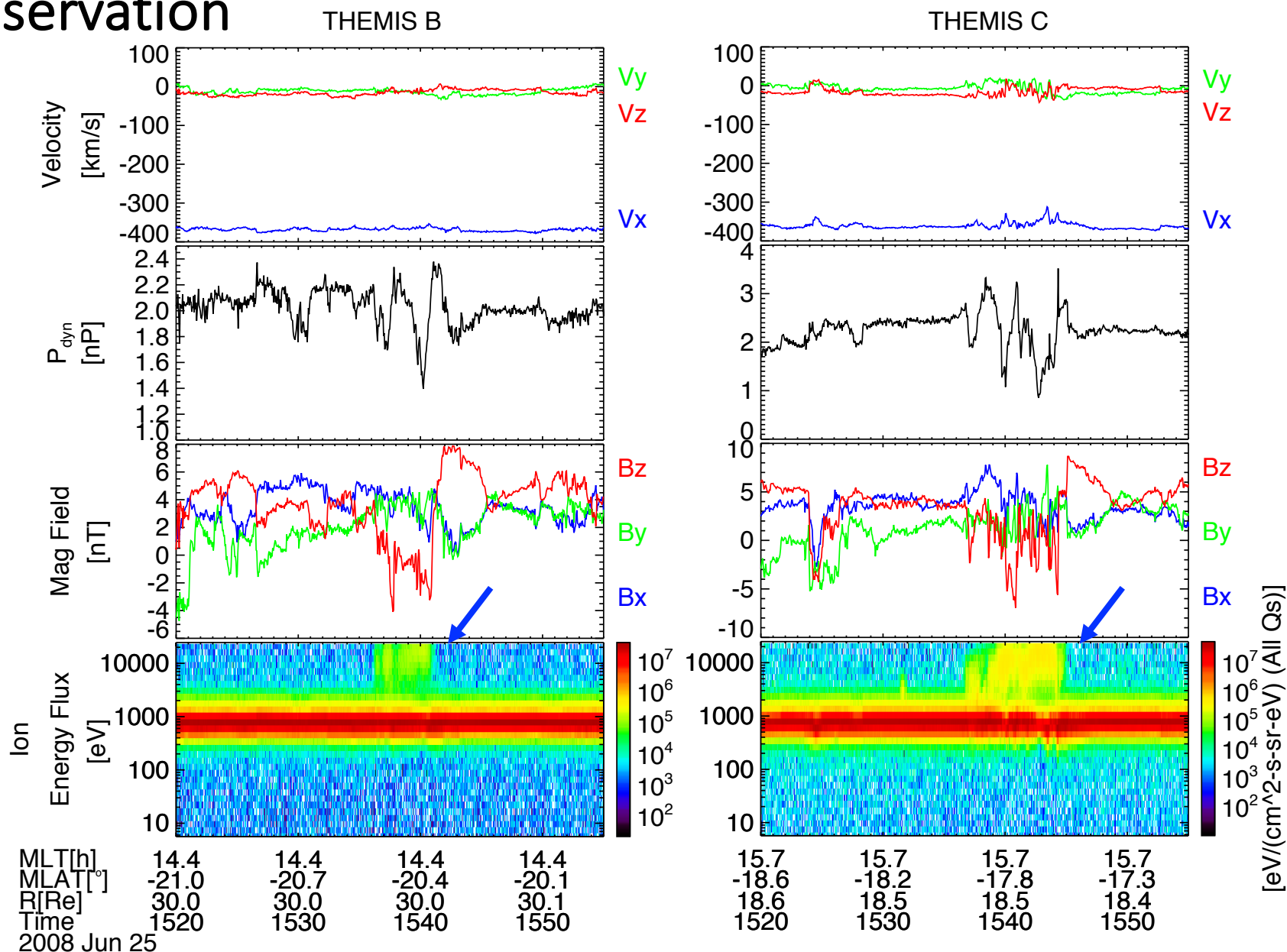
THEMIS-P5 (A)

Dayside diffuse aurora suddenly brightened.

A localized region of brightening propagated from pre-noon to post-noon toward THEMIS footprints.

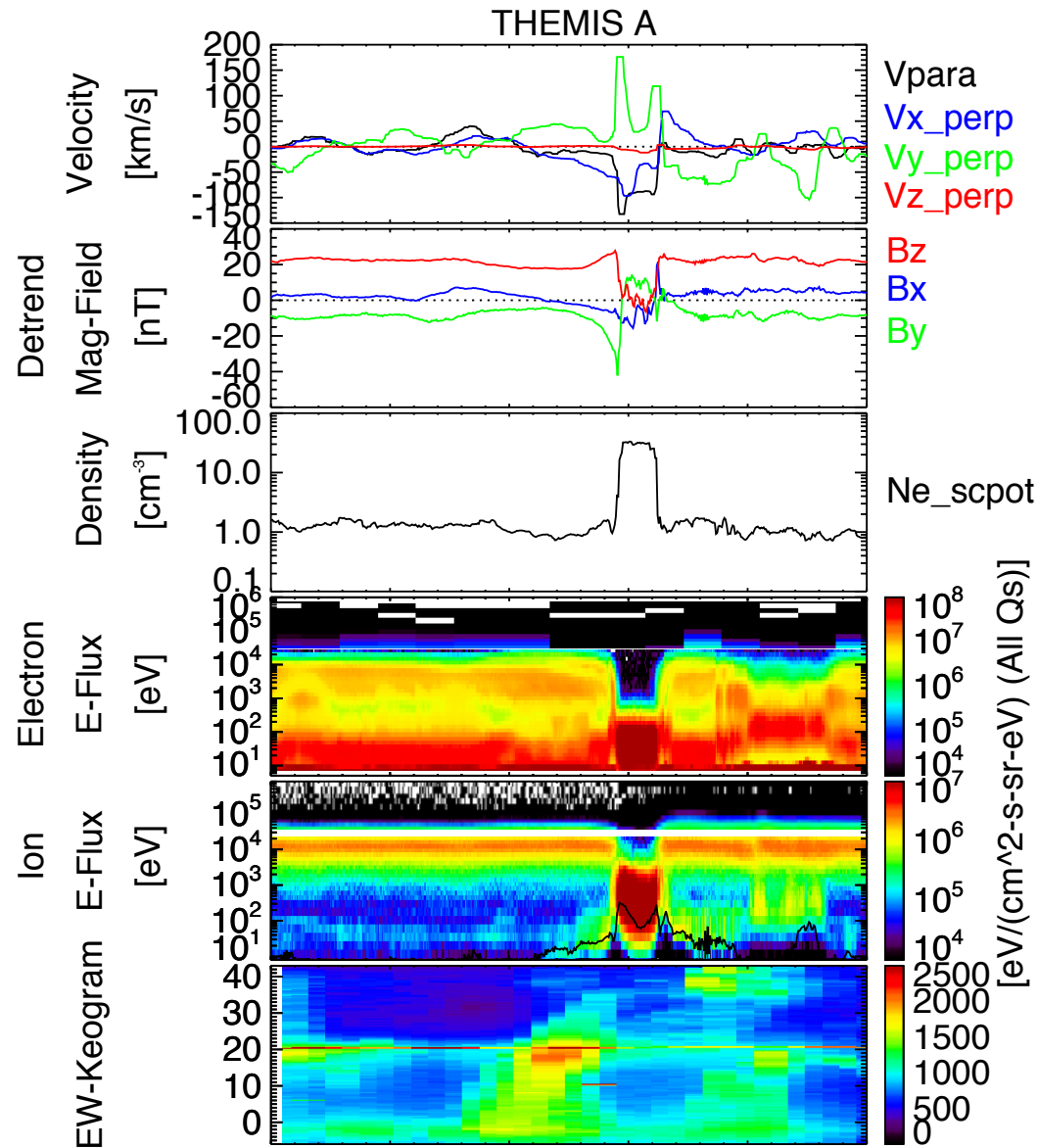
Diffuse Aurora brightening: Solar wind/foreshock

Observation



TH-B/C: Foreshock ions during IMF discontinuity

Diffuse Aurora brightening: Magnetopause crossing



Aurora: Duskward propagation toward TH-A footprint

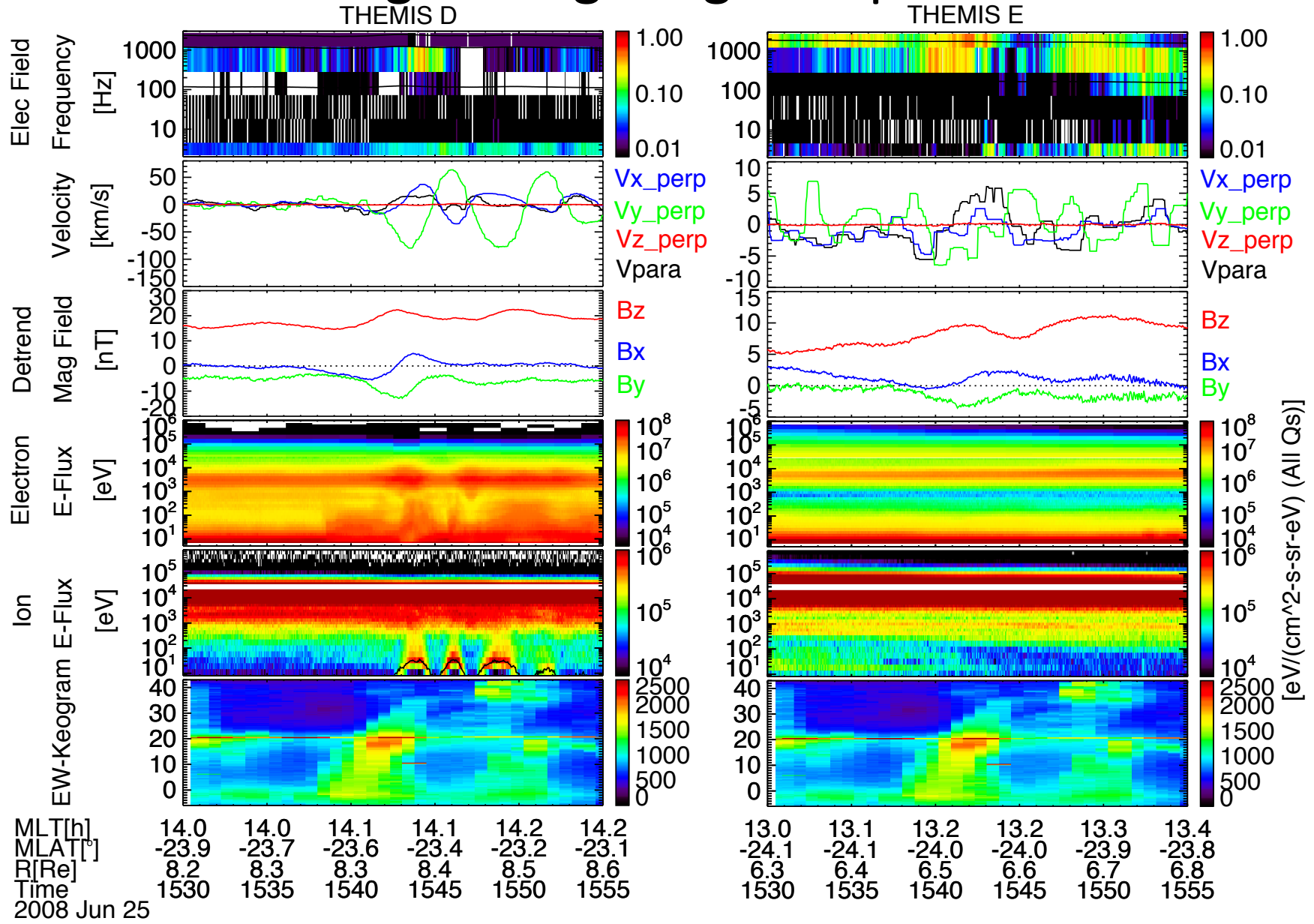
TH-A: Weak flow enhancement and then magnetopause crossing

Suggesting that a localized magnetopause compression propagated from pre-noon to post-noon and induced diffuse auroral brightening.

MLT[h]	15.4	15.4	15.4	15.4	15.5	15.5
MLAT[°]	-24.4	-24.2	-24.0	-23.7	-23.5	-23.3
R[Re]	10.3	10.3	10.4	10.4	10.4	10.4
Time	1530	1535	1540	1545	1550	1555

2008 Jun 25

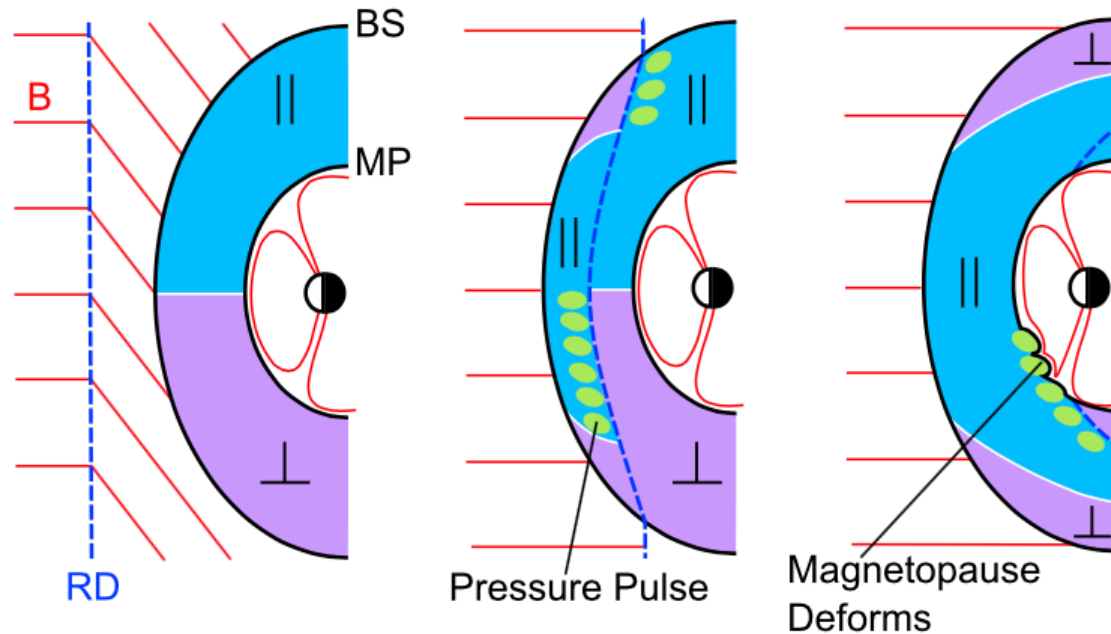
Diffuse Aurora brightening: Magnetosphere Observation



TH-D: ULF oscillations (consistent with *Hartinger et al.* [2013]), chorus intensification

TH-E: Much smaller than at TH-D – Not global but localized disturbance

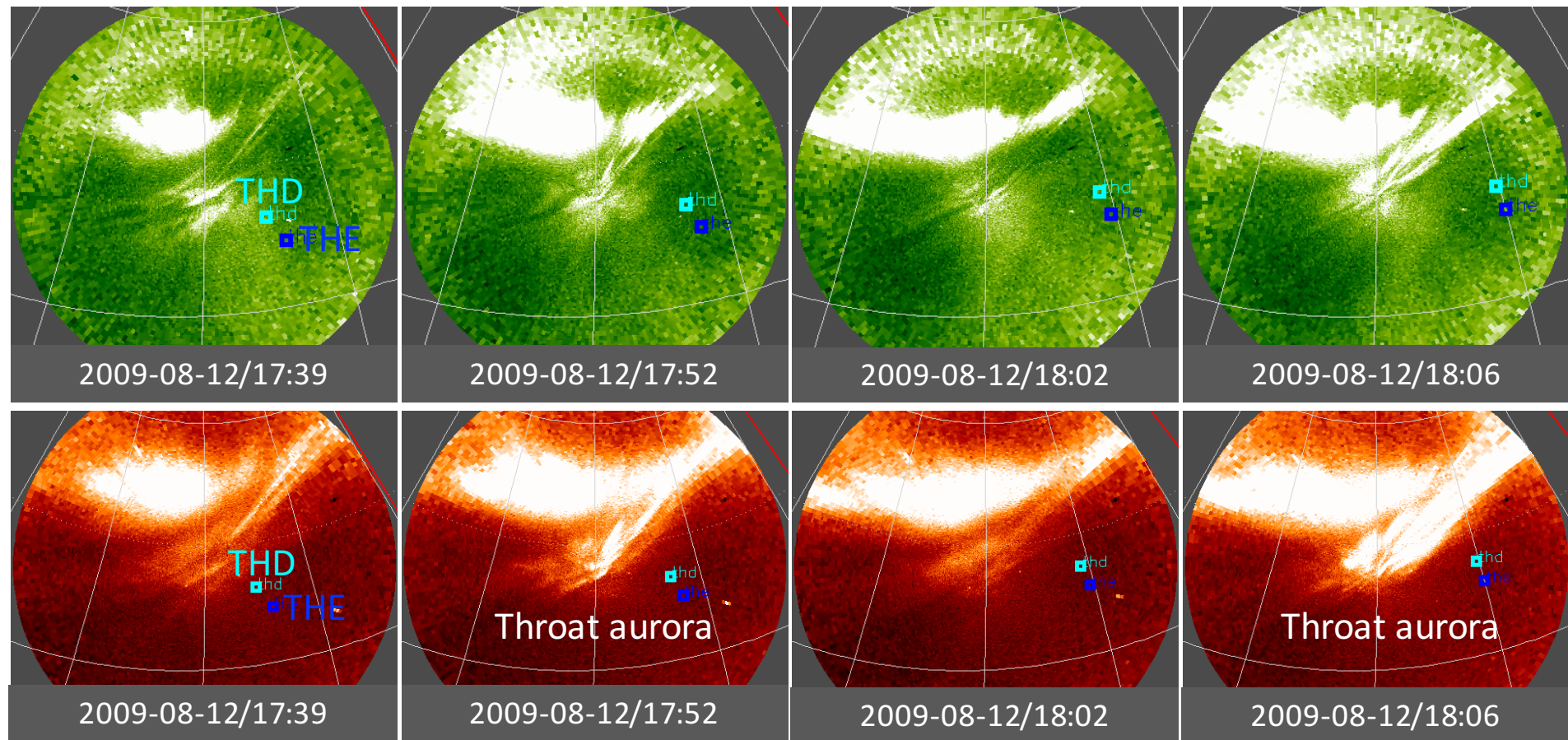
Discussion (1)



Foreshock transients play a role in driving sunward magnetosheath flows and magnetopause motion [Archer *et al.*, 2012; 2014].

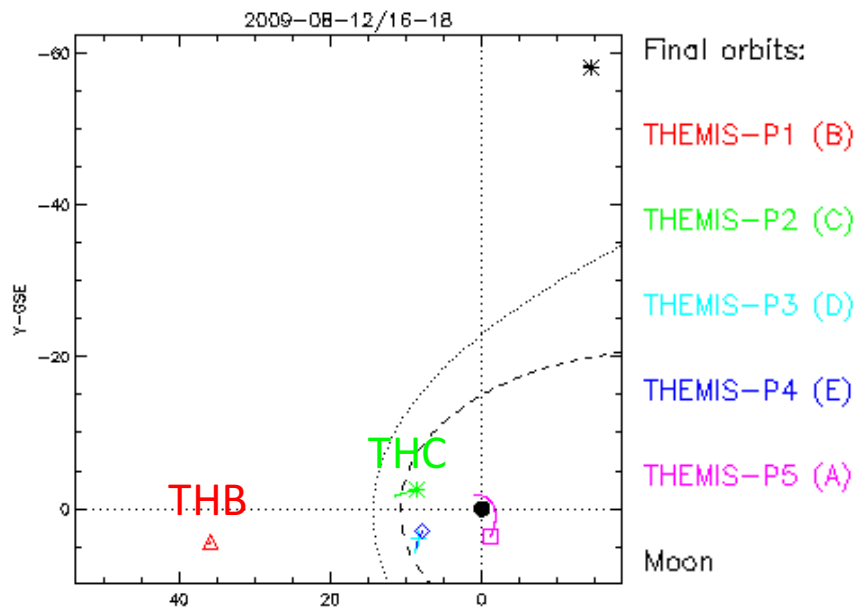
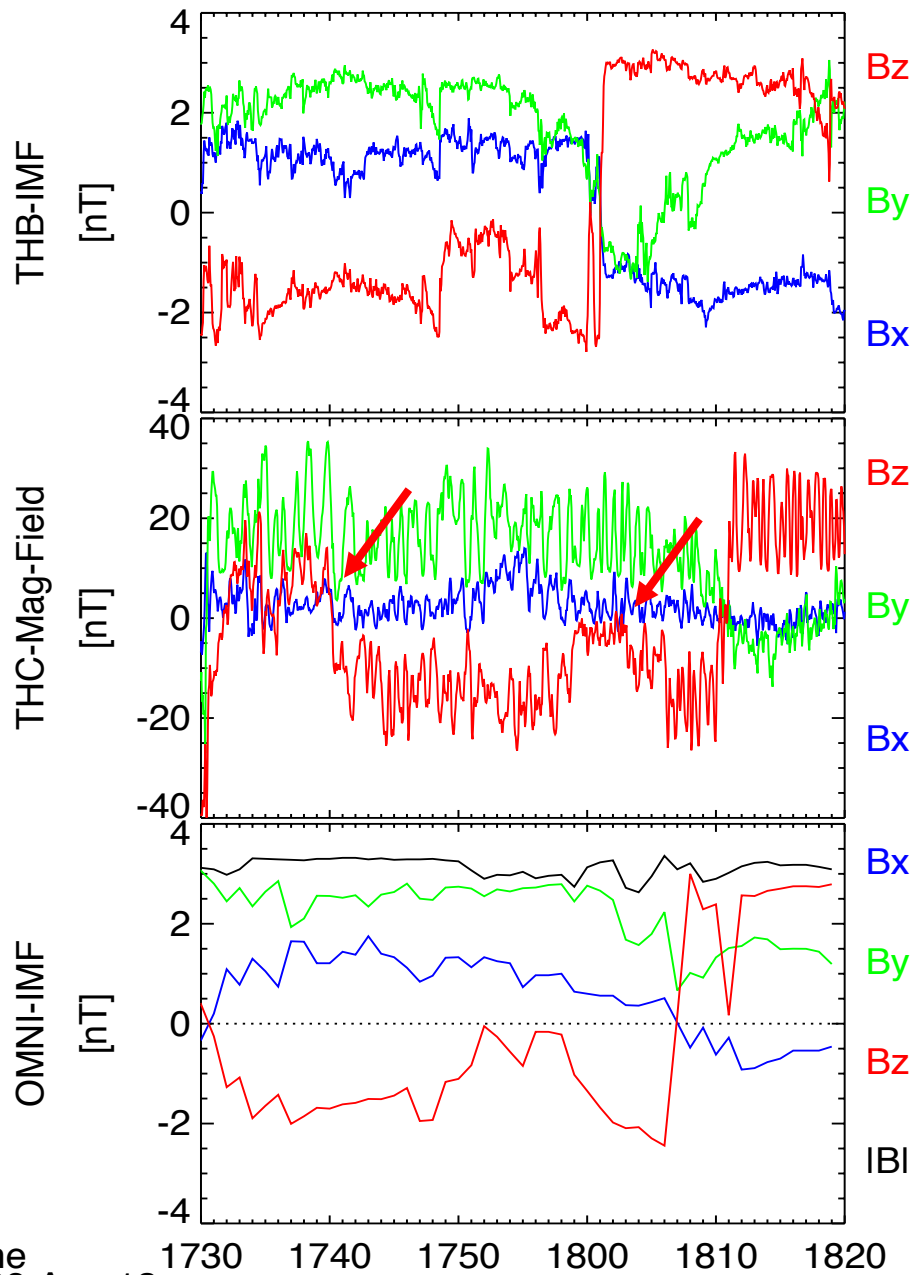
Indicating localized magnetosphere compression by foreshock effects and magnetosheath particle penetration to dayside outer magnetosphere for driving diffuse auroral brightening.

Throat Aurora: Imager Observation



Two groups of throat aurora are identified during
1742 UT - 1754 UT and 1804 UT - 1817 UT

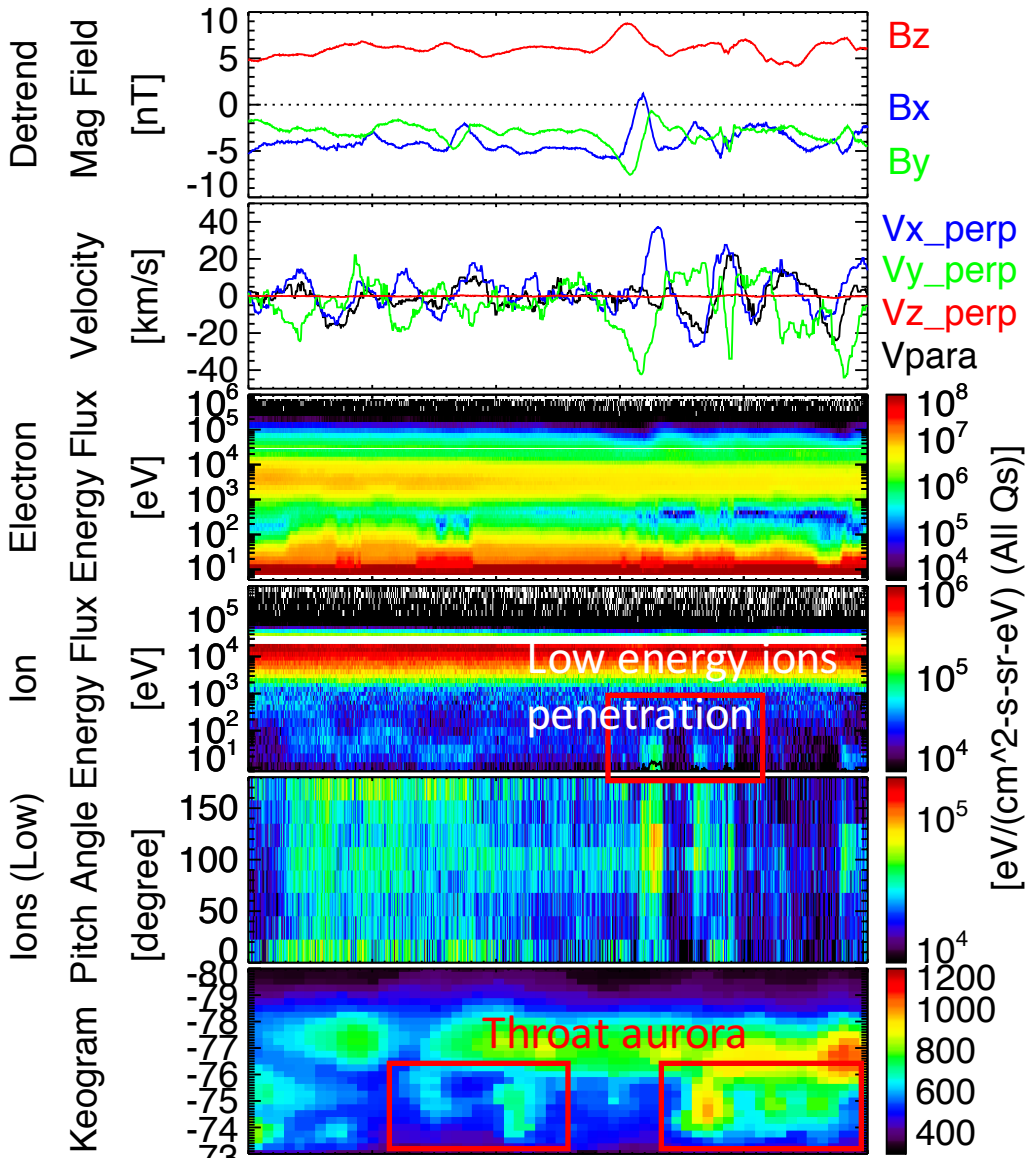
Throat Aurora: Solar wind/Magnetosheath Observation



THB: In solar wind
THC: In magnetosheath

IMF Southward turning:
1740 UT, 1803 UT

Throat Aurora: Magnetosphere Observation (1)



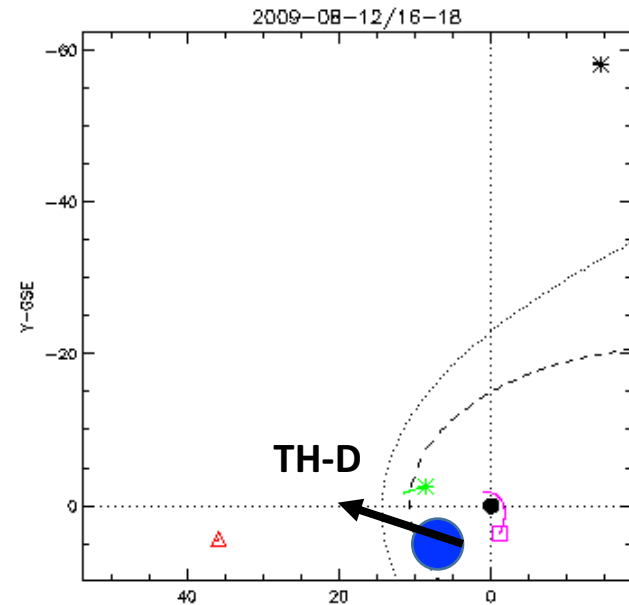
THD_MLT	13.9	14.0	14.0	14.1	14.1	14.2
THD_MLAT	-16.1	-15.8	-15.4	-15.1	-14.7	-14.4
THD_R[Re]	10.4	10.5	10.6	10.7	10.7	10.8
Time	1730	1740	1750	1800	1810	1820
2009 Aug 12						

THD:

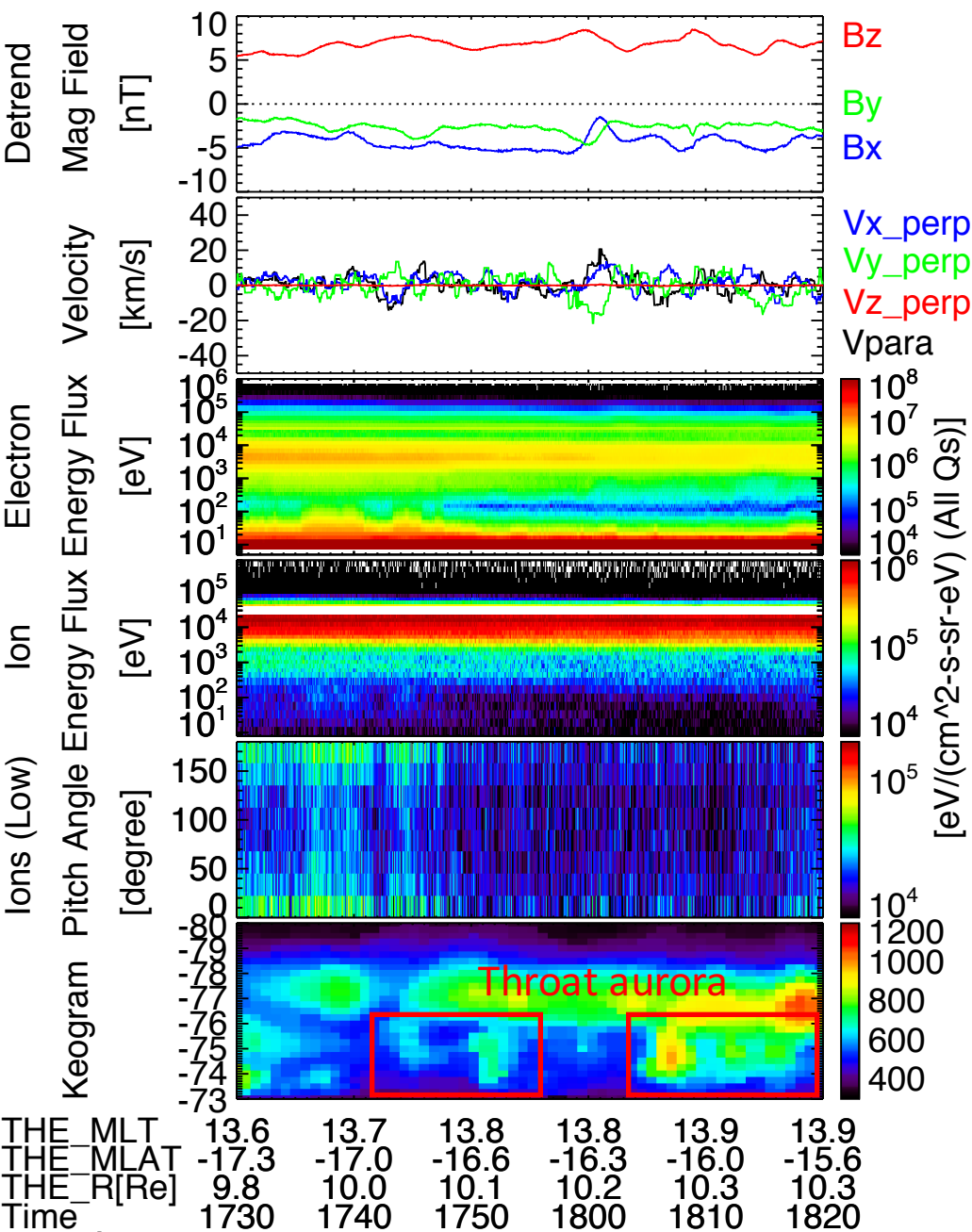
Enhancement of sunward flow;
Flow shears.

Low energy particles (both ions and electrons) enhancement. Associated with isotropic pitch angles.

Indicating these low energy ions may be from magnetosheath.

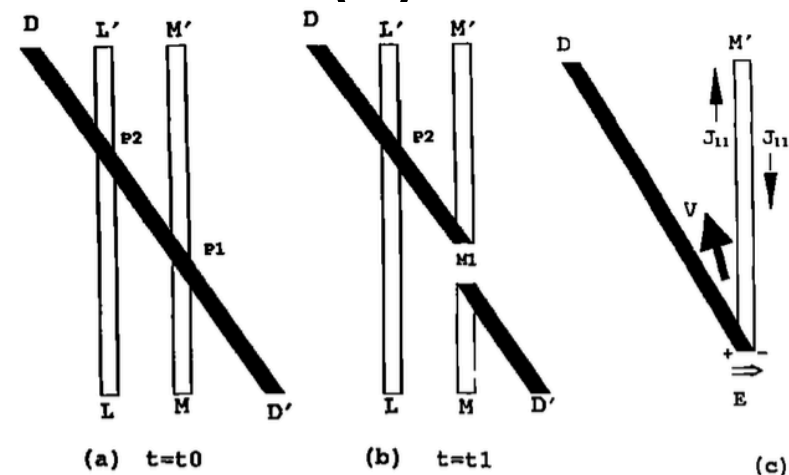


Throat Aurora: Magnetosphere Observation (2)



No enhancements of flows and low energy particles are observed by THE. Indicating these signatures are localized.

Discussion (2)



Based on our observation, IMF southward turnings may trigger FTEs, that are not only associated with poleward motion, but also induce magnetosheath particle penetration near the reconnection region. The flow shears generate the discrete aurora with equatorward motion.

Summary

Using a THEMIS-imager conjunction event, we investigated auroral responses on dayside closed field lines to foreshock phenomena.

Diffuse auroral brightening

- THEMIS in the solar wind detected foreshock ions during small IMF Bz.
- THEMIS in the dayside magnetosphere detected ULF and chorus waves and low-energy particle enhancements.
- Localized regions of diffuse aurora brightened and propagated azimuthally.

Indicating localized magnetosphere compression by foreshock effects and magnetosheath particle penetration to dayside outer magnetosphere for driving diffuse auroral brightening.

Throat aurora

- THEMIS in the dayside magnetosphere detected a flow enhancement, low-energy particle flux enhancement.
- Low-energy particle flux can be magnetosheath particle penetration or magnetospheric particle acceleration.
- Tilted discrete auroral arc brightened and penetrated to closed field line regions.

Indicating transient and localized reconnection (FTE) at magnetopause, magnetosheath particle penetration, and flow burst as a possible magnetospheric counterpart of throat aurora.

Future work

Using a THEMIS-imager conjunction event, we investigated auroral responses on dayside closed field lines to solar wind variations (diffuse auroral brightening and throat aurora).

In the future, we will:

- Continue survey about **the aurora response to foreshock** phenomena
 - Search all the events in 2009 to identify what are the conditions that drive diffuse aurora brightening by foreshock.
- Continue event survey about **throat aurora**
 - Search all the events in 2009
 - Identify how common IMF southward turning are associated with throat aurora.