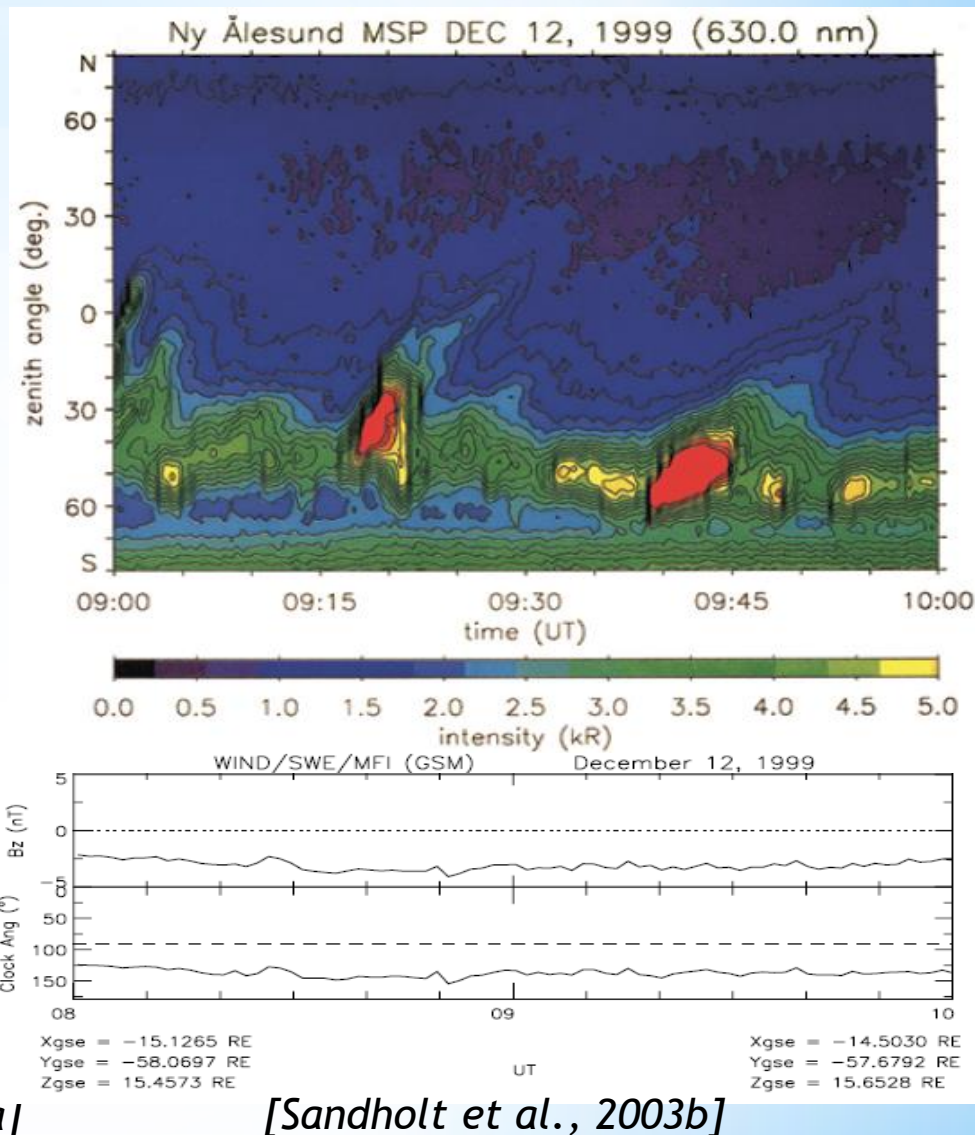
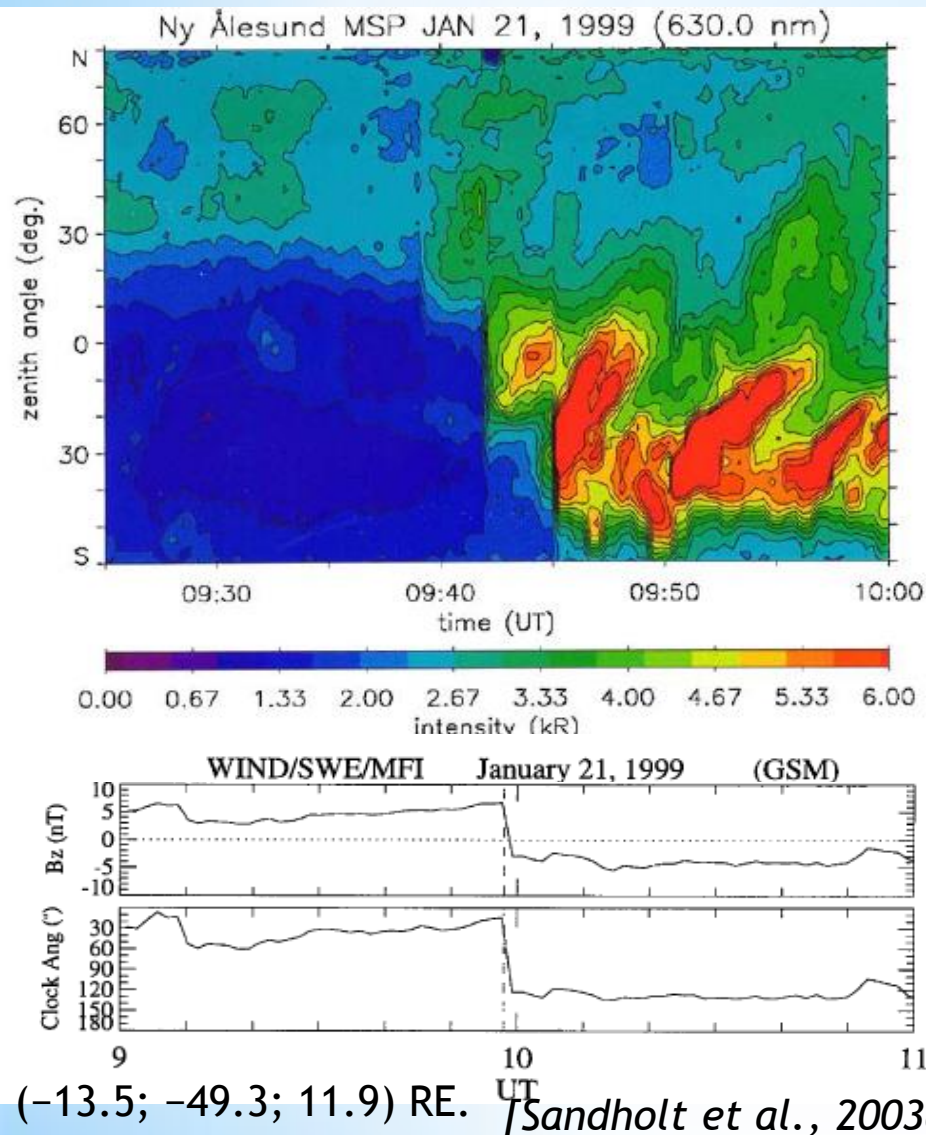


# **Identifying possible drivers of poleward moving auroral forms (PMAFs) by using THEMIS B/C and imager conjunctions**

**Boyi Wang (UCLA), Toshi Nishimura, Larry Lyons, Vassilis Angelopoulos, Harald Frey, and Stephen Mende**

# Triggered and Spontaneous PMAFs



Triggered PMAFs

Spontaneous PMAFs

Observations need satellites more closed to the bow shock

# Possible drivers of Dayside PMAFs

We examine the possible driver(s) of PMAFs by using THEMIS B, C and Antarctic ground-based imager (AGO ASI) conjunctions. THEMIS B, C are much closer to the bow shock in 2008 and 2009 than WIND and ACE, which easily miss small scale structures (e.g. foreshock phenomena and IMF disturbances) near the bow shock. And they could have conjunctions with ground based imagers.

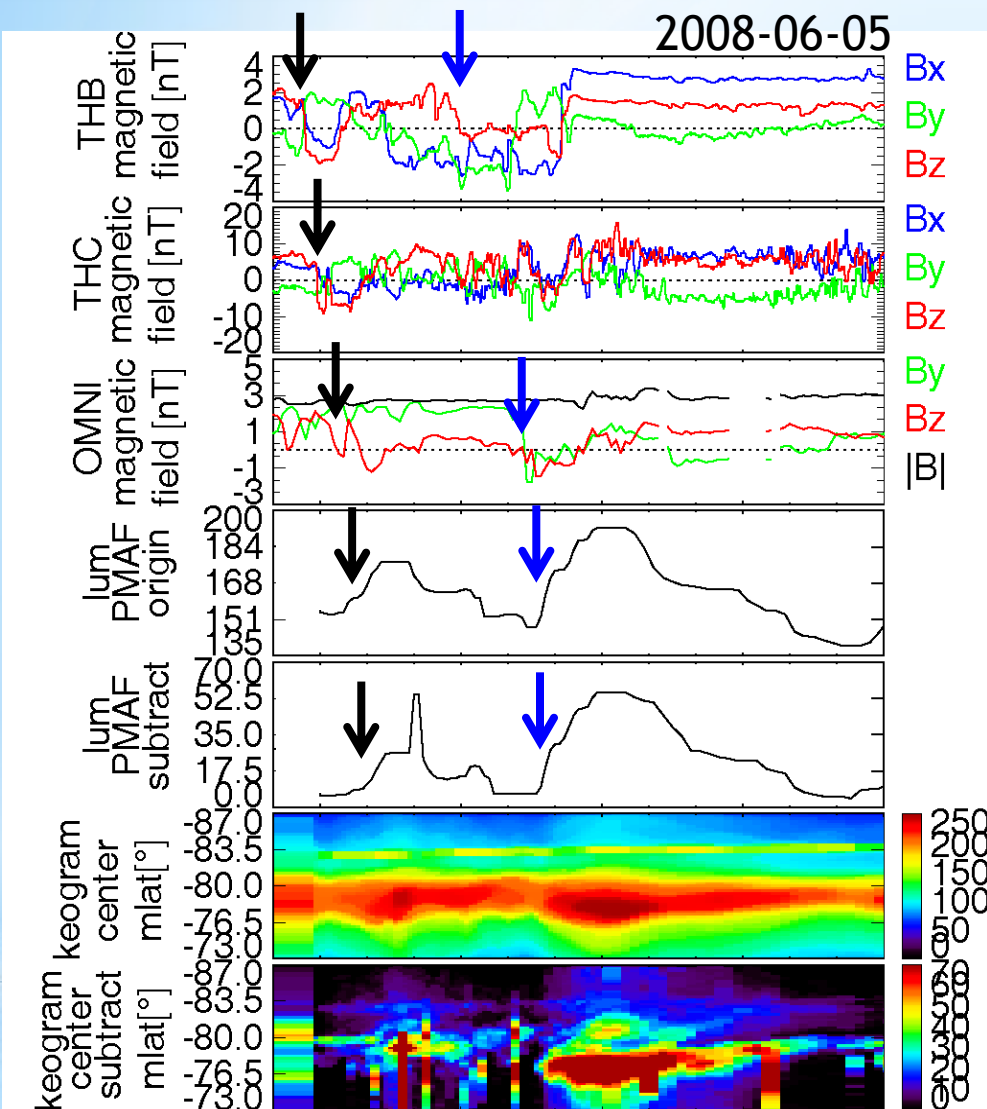
## Possible drivers

1. IMF Bz structures
2. Reflected ions

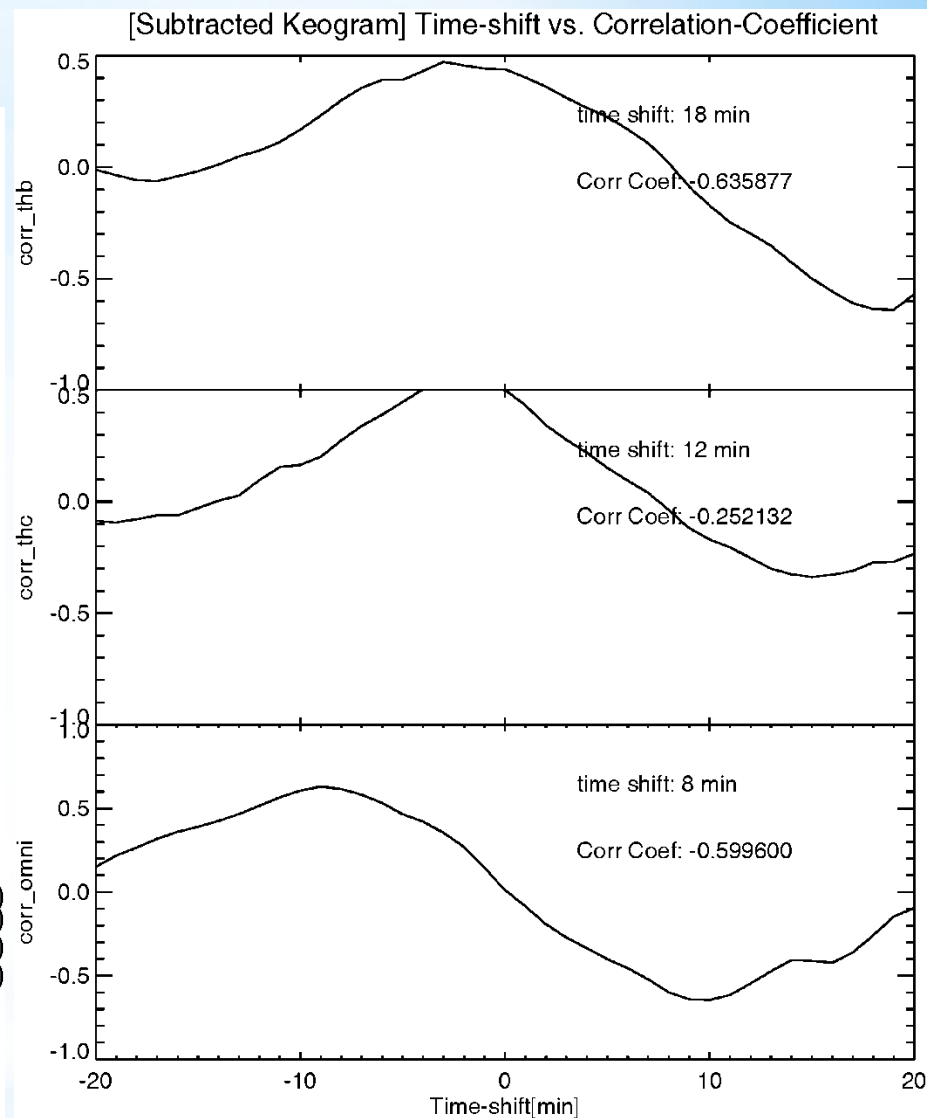
## Criteria

- Clouds present similar shapes to aurora, thus clear sky is a requirement.
- THEMIS B and C should be located in the dayside region (8-16 MLT).
- THEMIS B and C should be within  $\pm 3$  h MLT around the center of AGO ASI FOV.
- THEMIS B and C should have magnetic field data or ions energy flux data.

# Case 1: IMF Bz - PMAFs

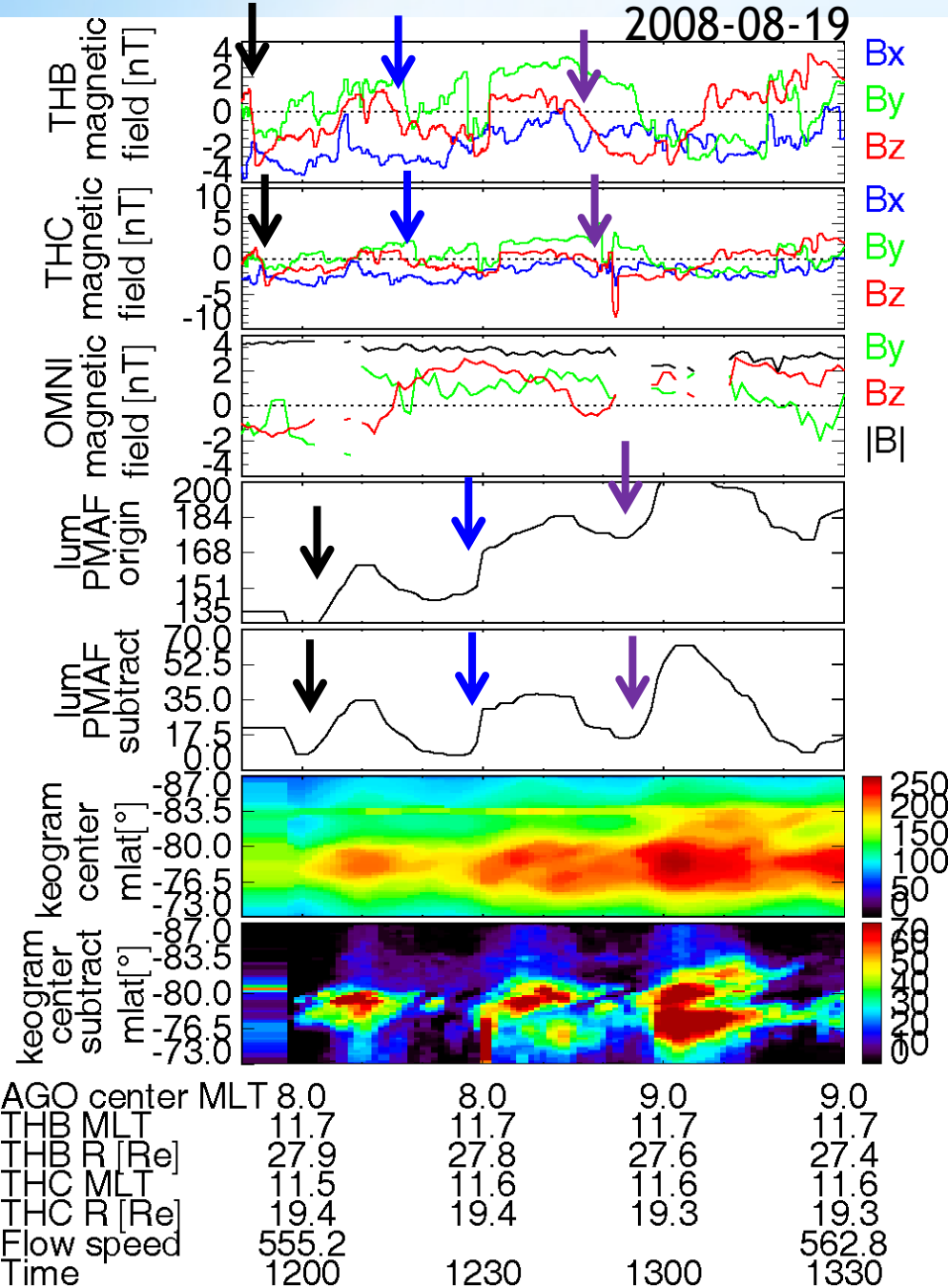


AGO center MLT	12.0	12.0	13.0	13.0	14.0
THB MLT	15.5	15.5	15.5	15.6	15.6
THB R [Re]	26.9	27.1	27.3	27.5	27.7
THC MLT	16.6	16.6	16.7	16.7	16.7
THC R [Re]	19.3	19.2	19.2	19.1	19.1
Flow speed	367.4	358.5	369.7		374.5
Time	1600	1630	1700	1730	1800



- 2 southward IMF turnings in both THEMIS B and OMNI correlate with 2 auroral oval brightening;
- THEMIS C is in the sheath, showing more fluctuations.

# Case 2: IMF Bz - PMAFs



## Background-Subtracted Keogram:

Peak	Correlation Coefficient	Time Shift [min]
THB	-0.57	11
THC	-0.57	9
OMNI	-0.19	-12

Substantial differences between THEMIS and OMNI IMF Bz  
→ the importance of small IMF structures

- 2008-2009 Data Set:
- Good conjunctions: 27 cases
  - Good correlation between IMF structures and PMAFs: **17 cases (63%)**
    - Correlated with similar IMF Bz between THEMIS and OMNI (14)
    - Correlated with different IMF Bz between THEMIS and OMNI (3)

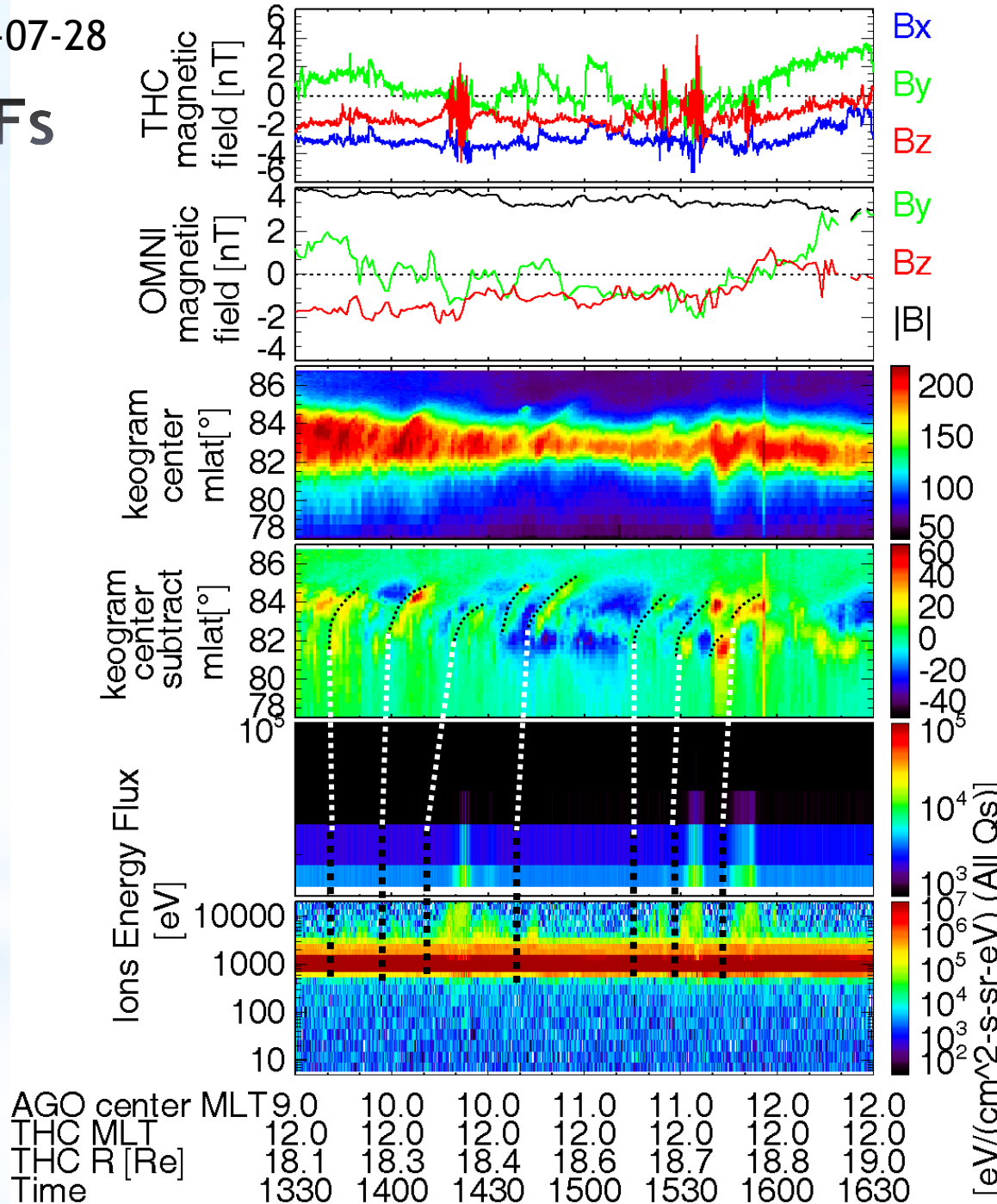


# Case 3: 2008-07-28

## Reflected Ions - PMAFs

➤ We also examine the correlation between foreshock phenomena and PMAFs by using THEMIS B/C 2008-2009 Data Set:  
 Good conjunctions: 26 cases  
 Good correlation: 4 cases

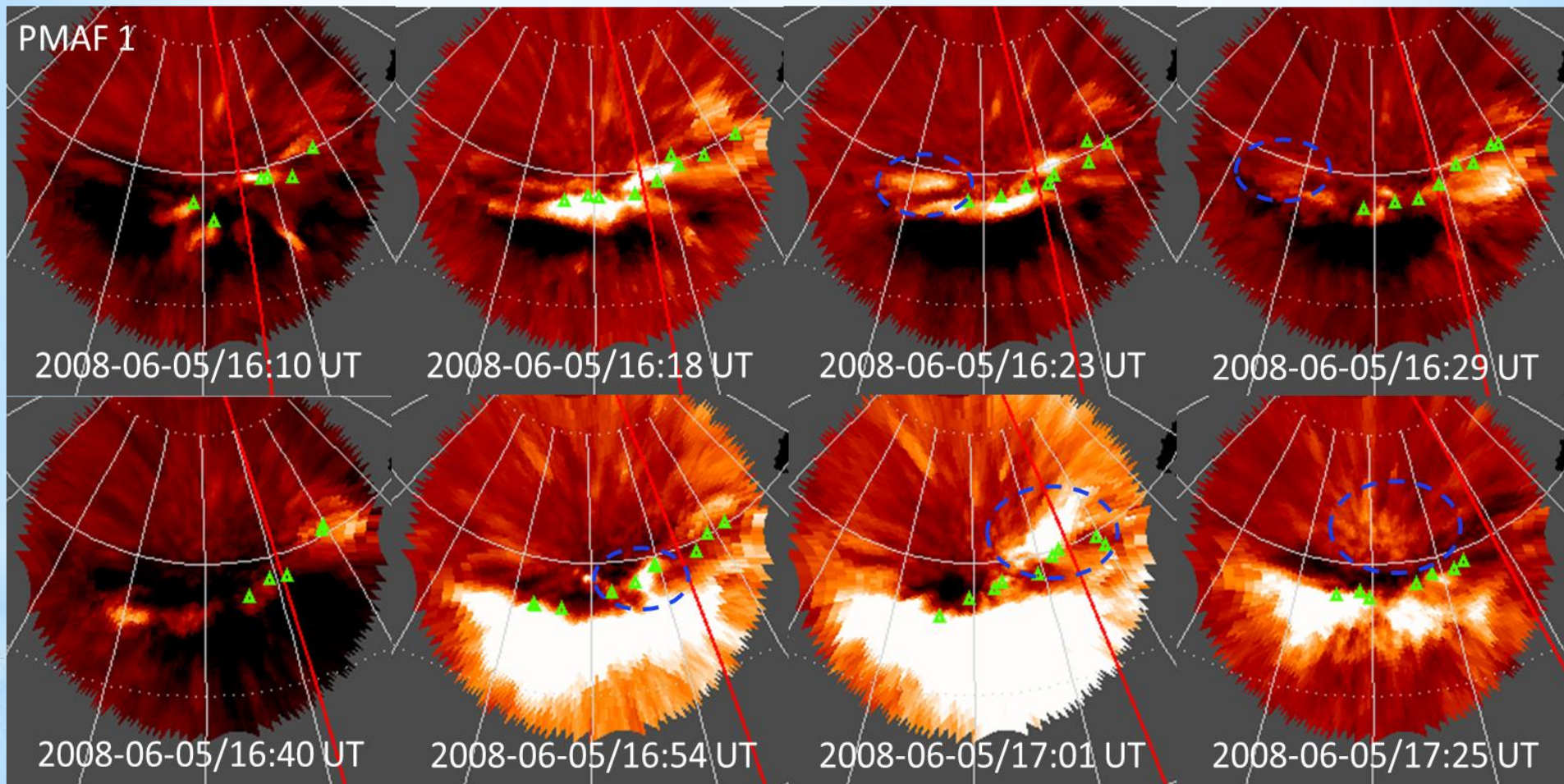
➤ However, there are many PMAF events without correlating with foreshock activity (only 4 out of 26 correlated). **Foreshock phenomena are geoeffective but may not be a major driver.**



# Discussion and Summary

1. We examine the correlation between IMF Bz and PMAFs by using THEMIS B and C, which are much closer to the bow shock than WIND and ACE. **We found 28 cases in 2-year data and 16 cases with good correlation between IMF Bz and PMAFs** (2 of them presented).
2. Out of 16 cases, there are 3 cases with substantial differences between THEMIS and OMNI, indicating the importance of small IMF structures to dayside PMAFs. And this may explain some uncorrelated cases in previous papers that used solar wind data far away from the sub-solar point.
3. However, there are many PMAF events without correlating with foreshock activity (only 4 out of 26 correlated). **Foreshock phenomena are geoeffective but may not be a major driver.**
4. There are 11 uncorrelated cases (uncorrelated with neither IMF Bz structures or foreshock phenomena), some of which are under steady northward IMF. It is possible that internal instabilities (e.g., K-H) may play a role to create PMAFs.

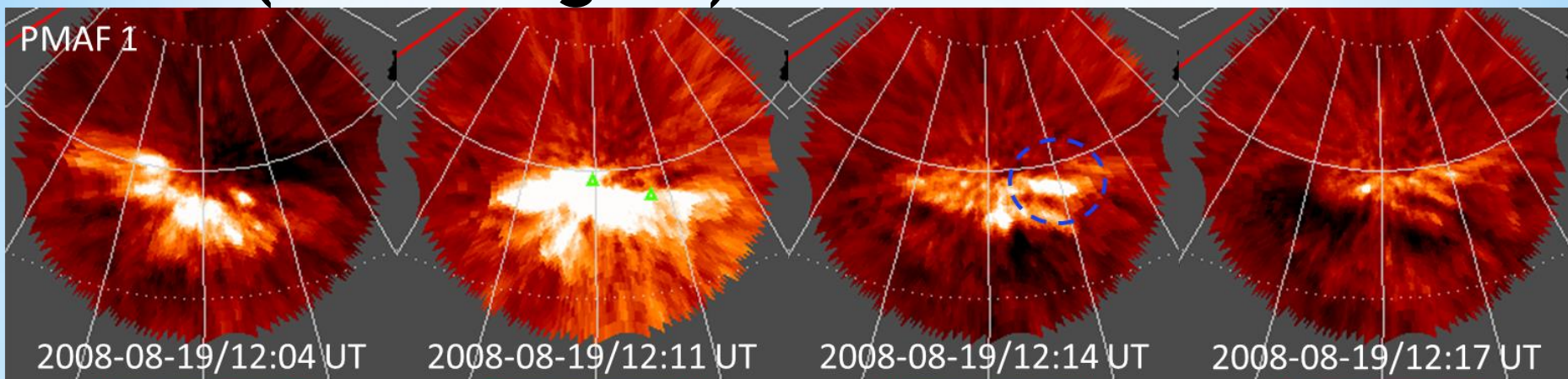
# Case 1 (2008-June-05)



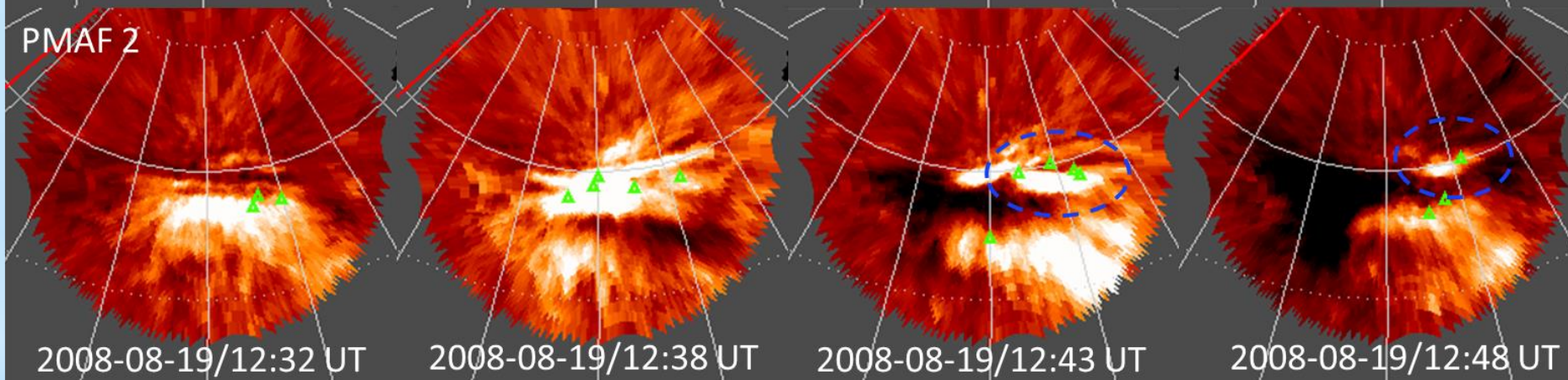


# Case 2 (2008-Aug-19)

PMAF 1



PMAF 2



PMAF 3

