

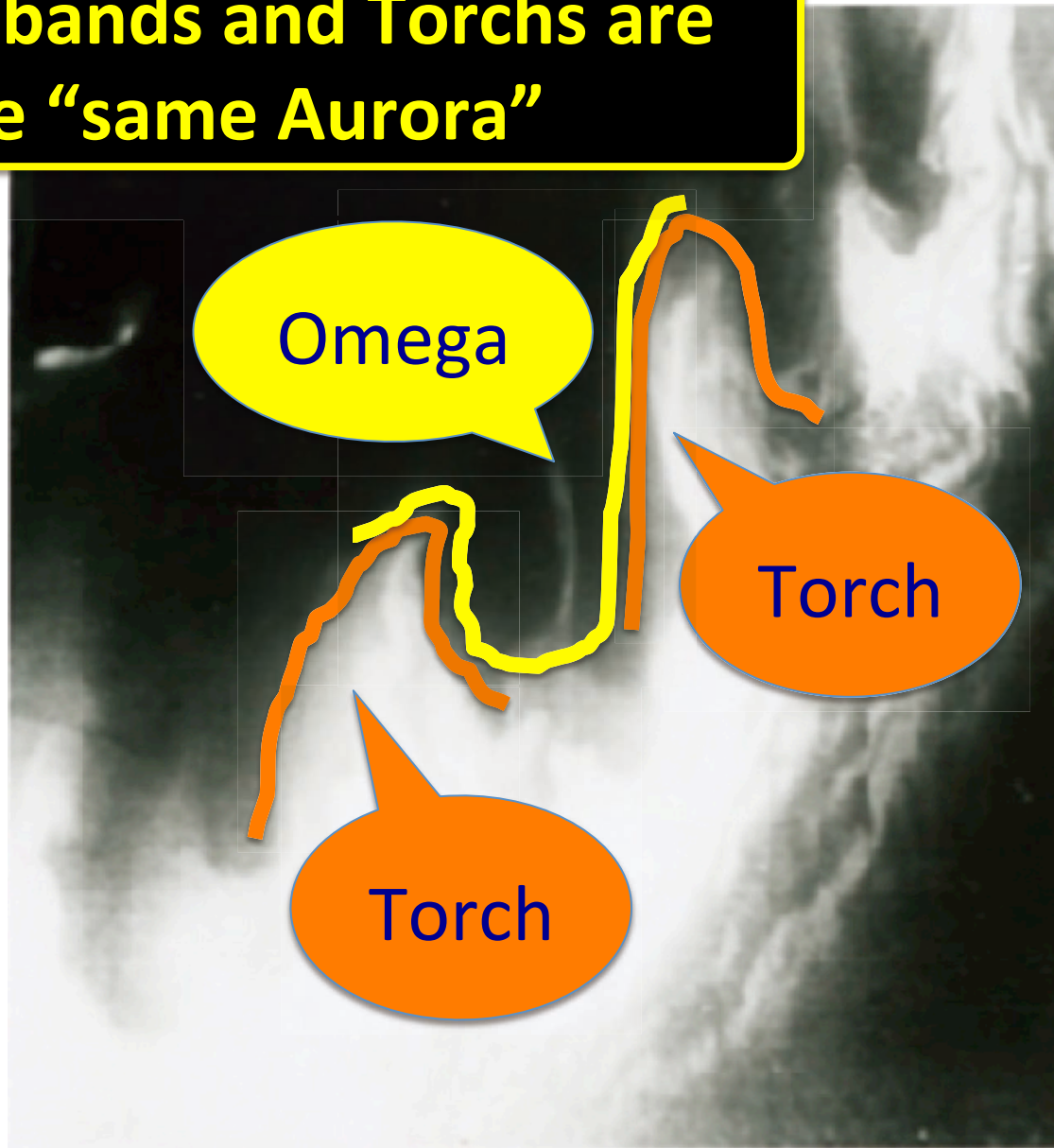
# ***SPEEDAS*を用いた オメガバンドオーロラ のダイナミクスと統計的特性**

佐藤夏雄(極地研)、行松彰(極地研)、  
田中良昌(極地研)、堀智昭(ISEE研)

# Definition of Omega Bands and Torches

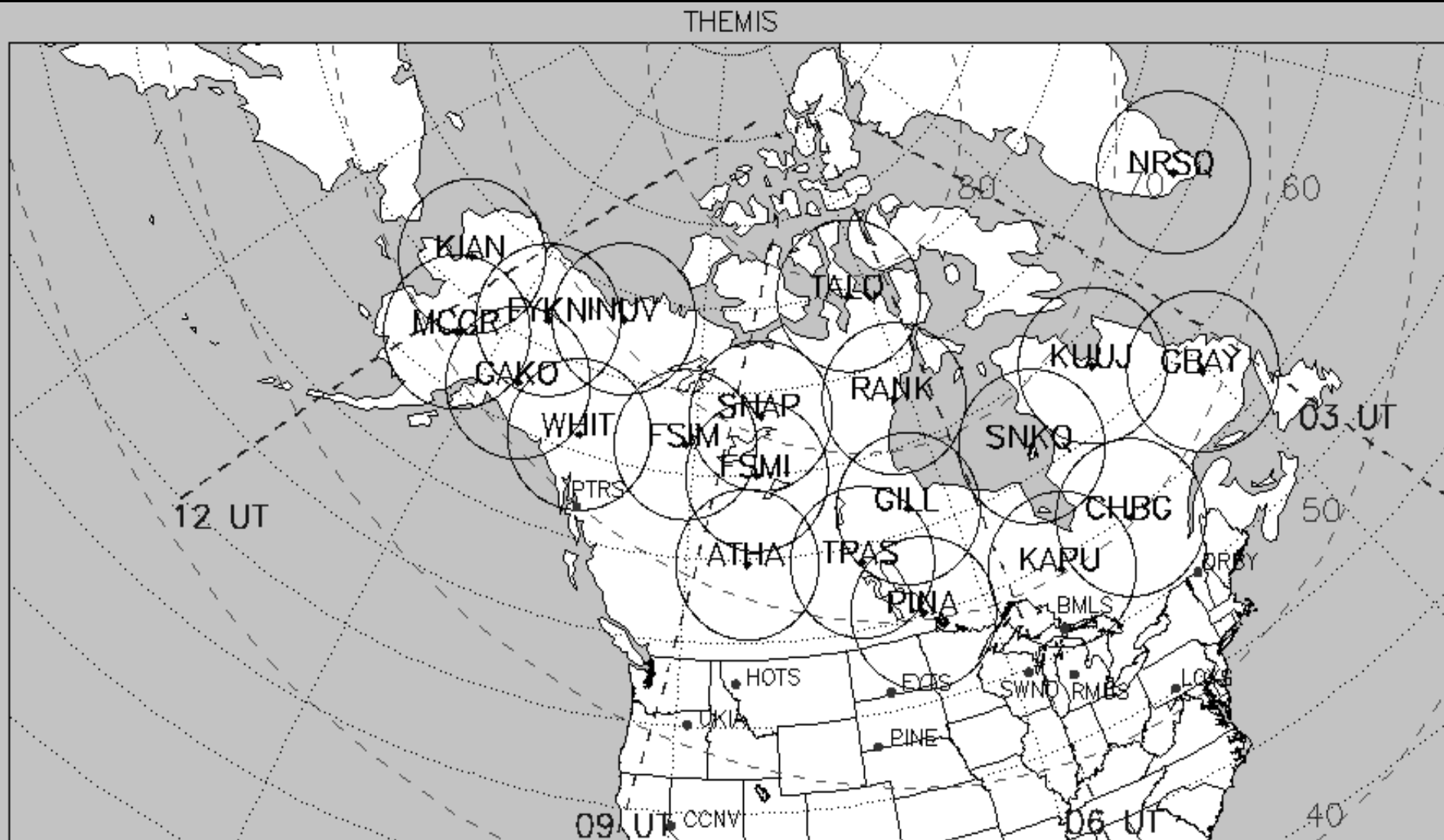
**Omega bands and Torches are  
the “same Aurora”**

*by DMSP  
spacecraft*



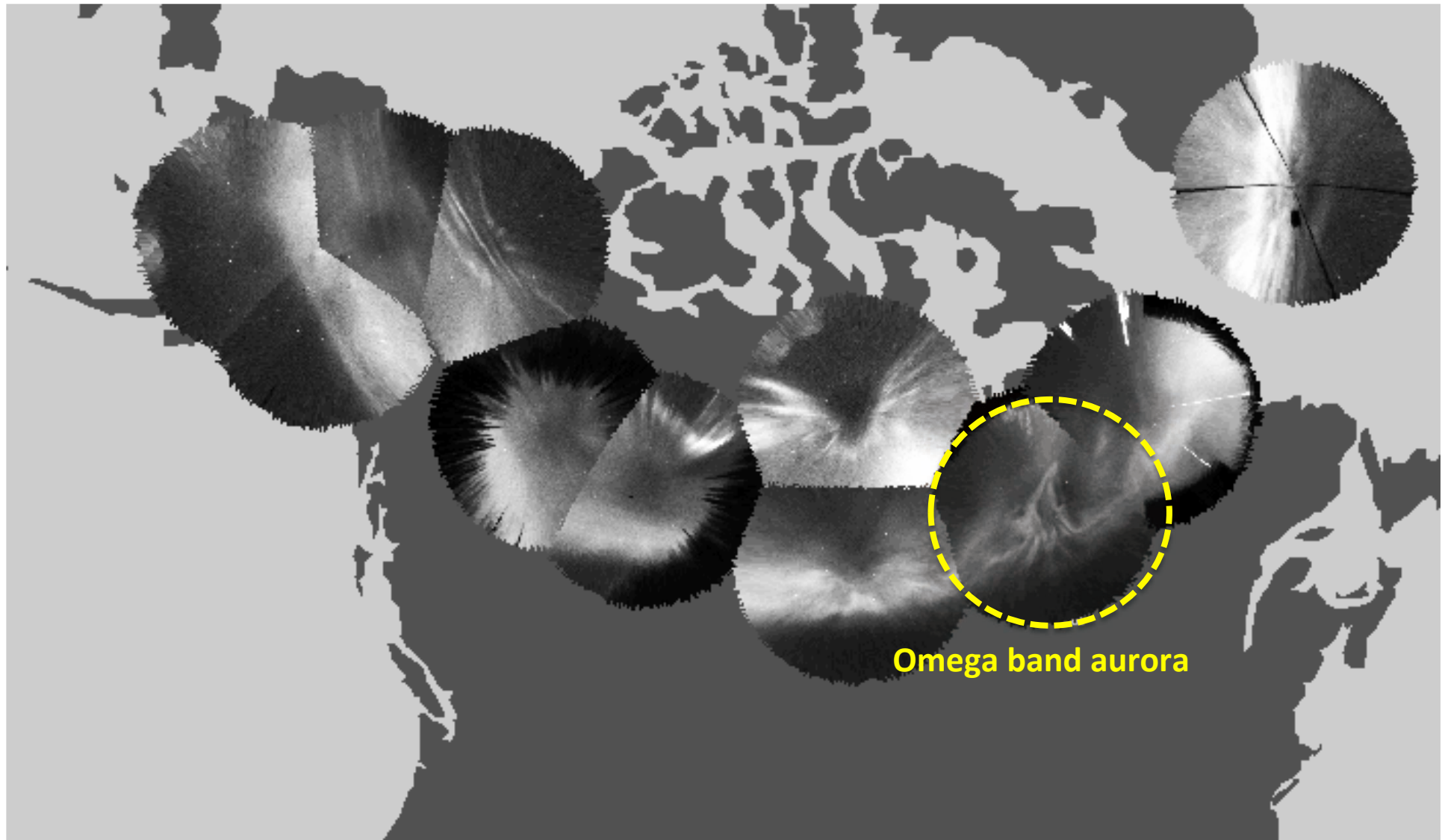
## THEMIS: Coordinated space and ground observation

### THEMIS All-sky Imager network



# THEMIS: Coordinated All-sky imager network

2011.03.01.0736:06UT



# Event survey using THEMIS ground-base All-sky Imager network

*Selection of Omega event using THEMIS GBO summary  
plots for 8 years data from Jan. 2007*



**Picked up ~ 330 events**



*Morphology using Movie data*



*Statistical characteristics*

# Classification of Omega band aurora

**Classified into 3 sub-type**

**1. Classical Omega band (O-type)**

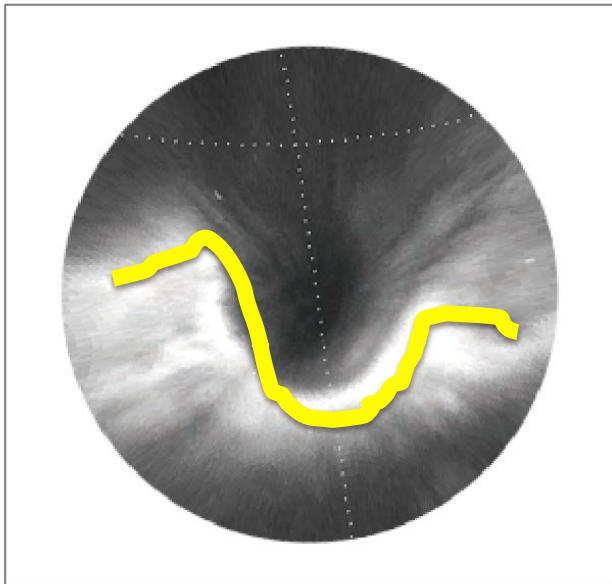
**2. Torch or Tongue (T-type)**

**3. Omega and Tongue (O/T-type)**

# Classification of Omega band aurora

## Classical Omega band

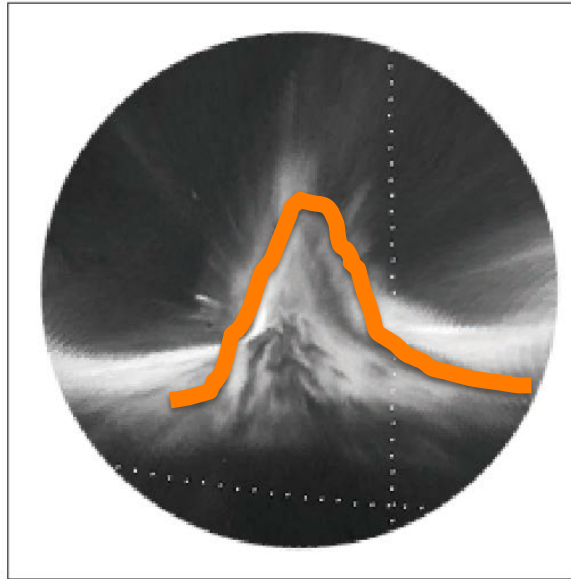
O-type  
(Classical Omega band)



2009.02.27\_GILL 1012:30 UT

## Tongue (Torch)

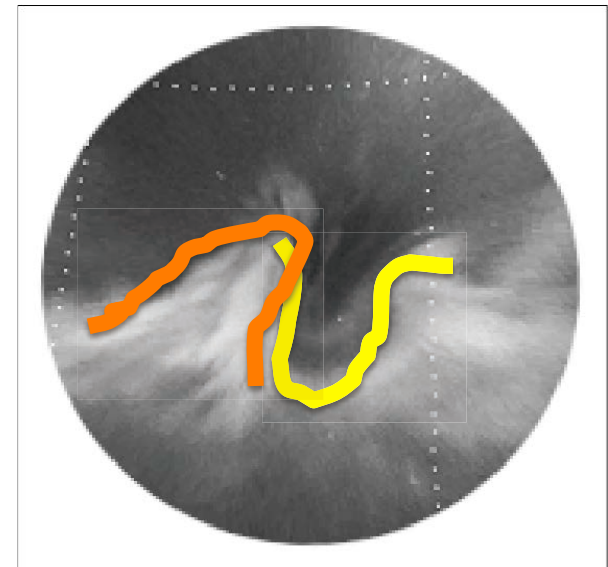
T-type  
(Torch)



2011.03.01\_GAKO  
1427:00 UT

## Omega and Tongue

O/T-type  
(Omega and Tongue )

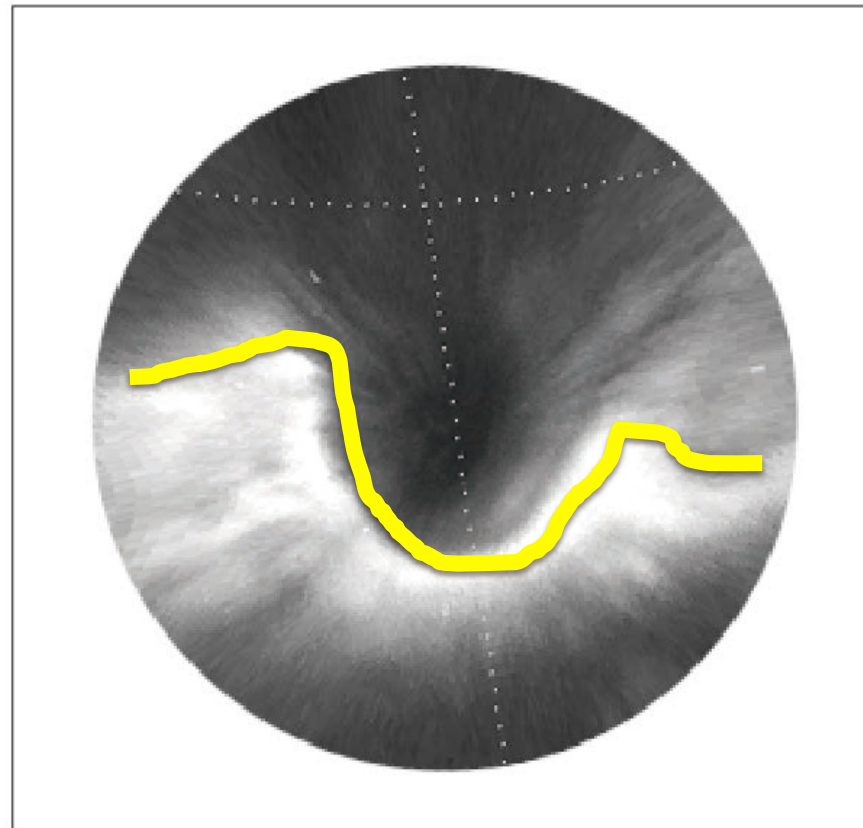


13.02.07\_SNKQ 0847:00 UT



# Example of O-type (*Classical Omega*)

O-type  
(*Classical Omega band*)



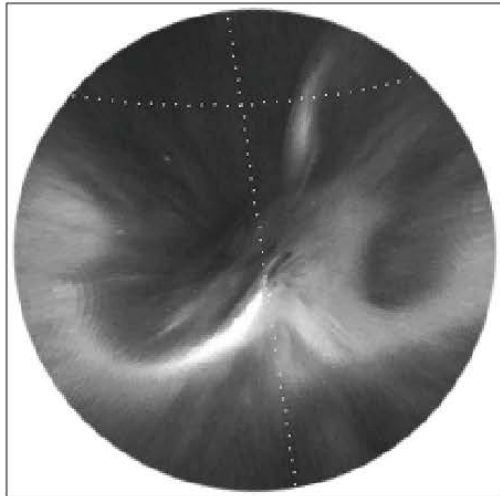
2009.02.27\_GILL 1012:30 UT



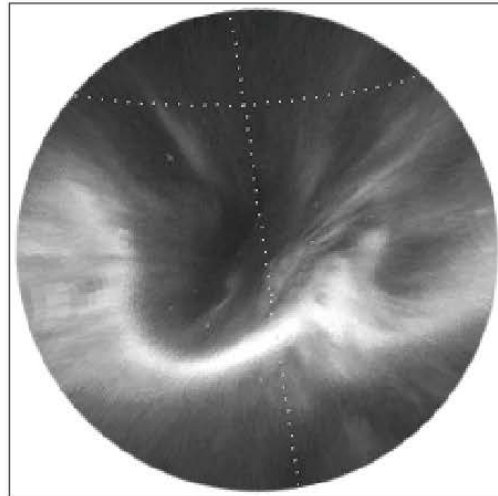
# Example of O-type (*Classical Omega*)

## Growth signature of Torch

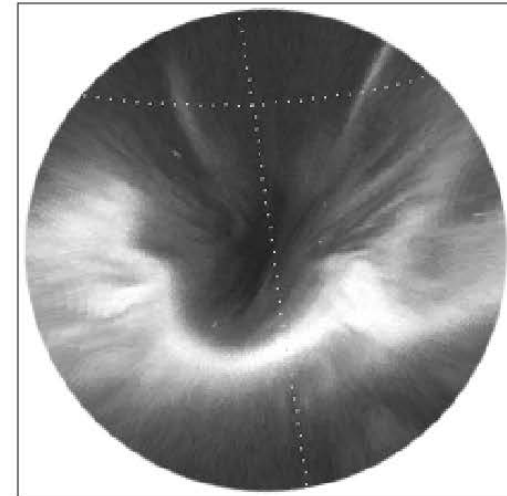
2009.02.27\_GILL



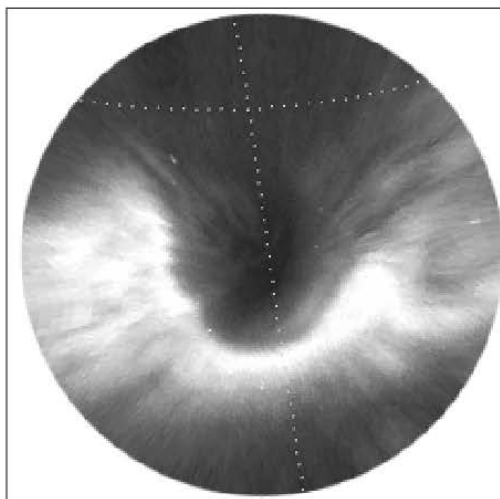
1006:00 UT



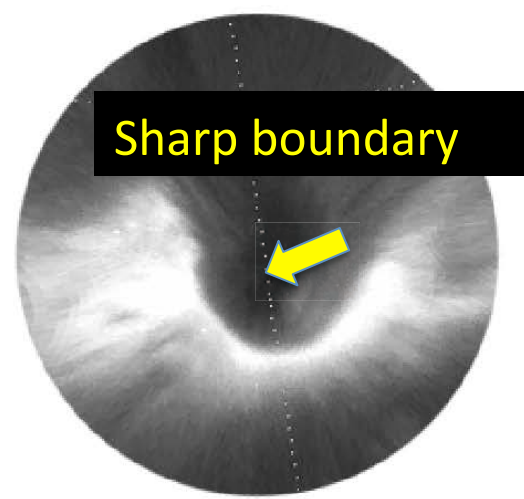
1008:00 UT



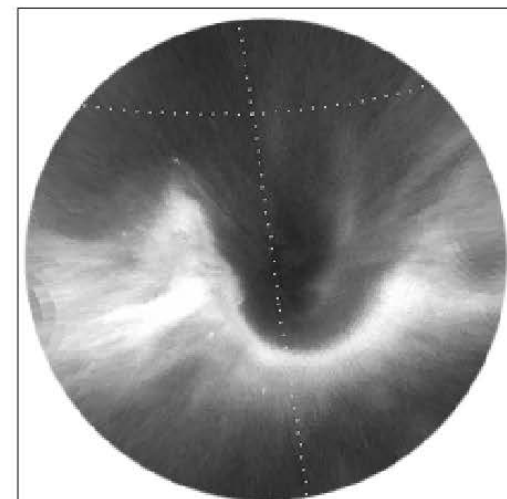
1010:00 UT



1012:00 UT



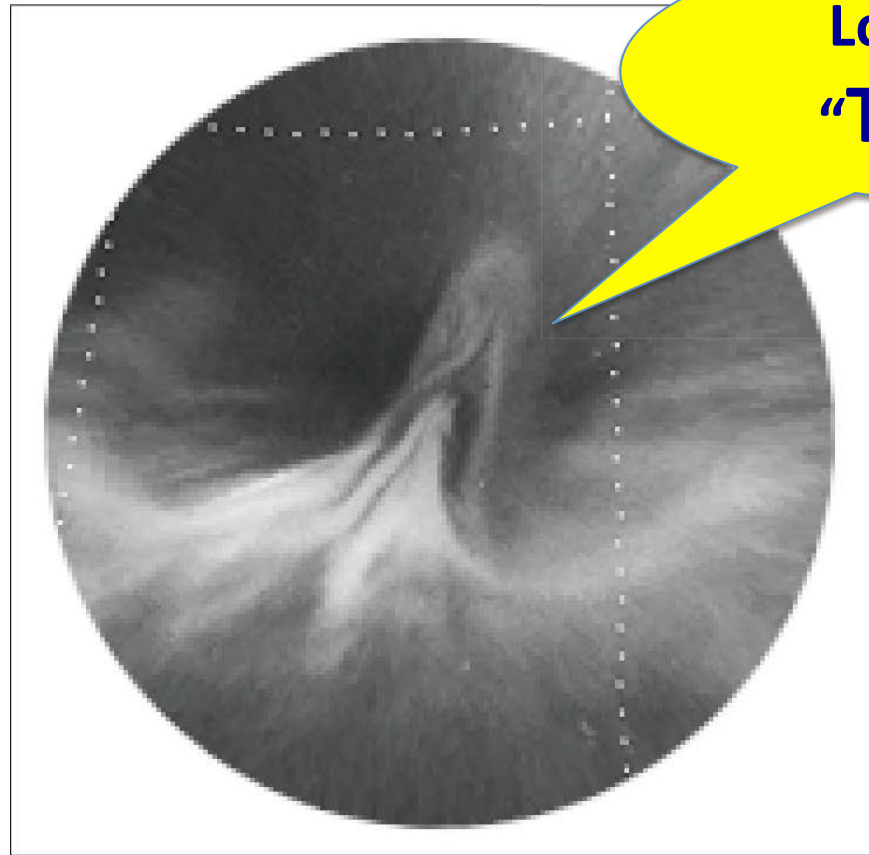
1014:00 UT



1016:00 UT

# Example of T-type *(Tongue)*

T-type  
(*Tongue*)

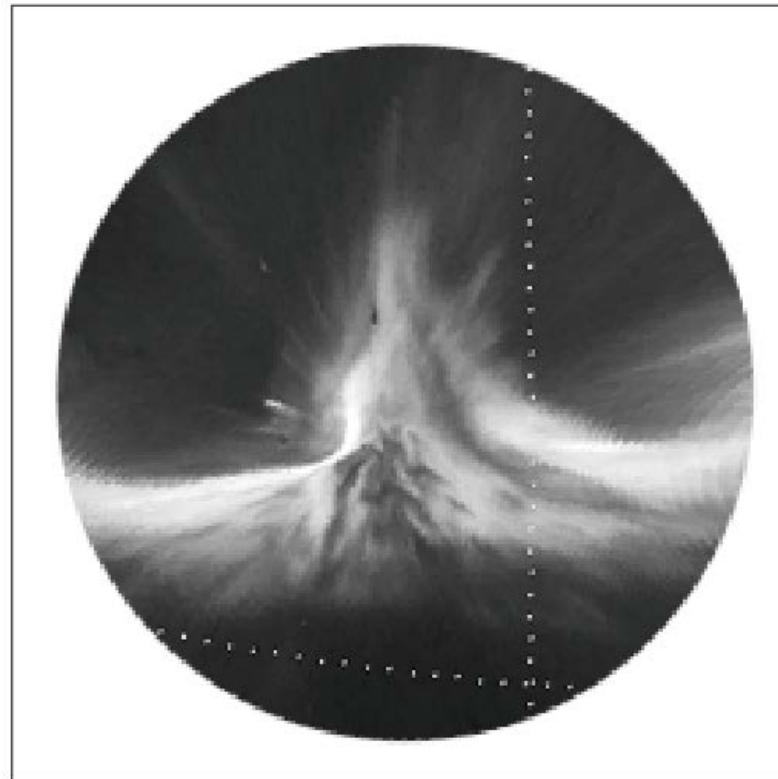


Looks like a  
“Tongue”

13.02.07\_SNKQ  
0850:00 UT

# Example of T-type *(Torch)*

T-type  
*(Torch)*

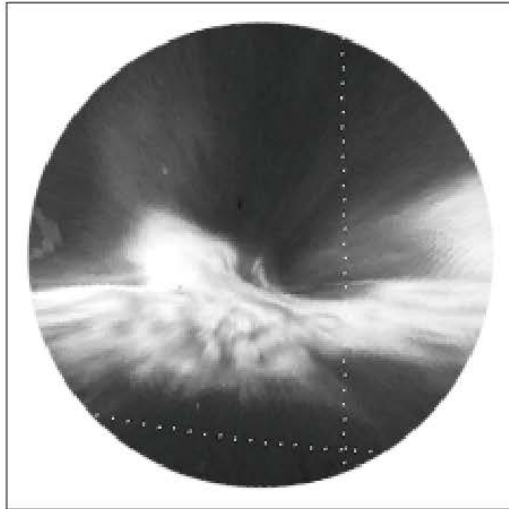


2011.03.01\_GAKO  
1427:00 UT

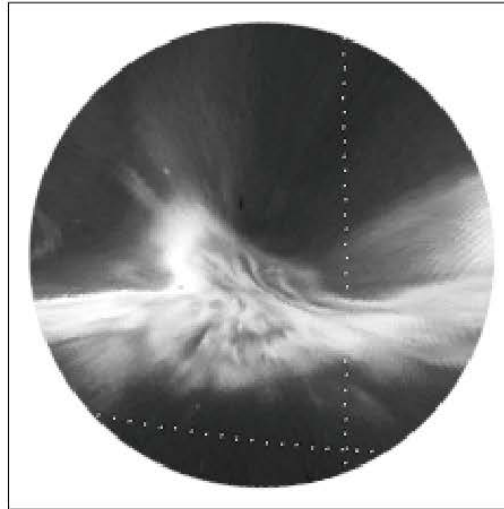
# Example of T-type (*Torch*)

## Growth signature of Torch

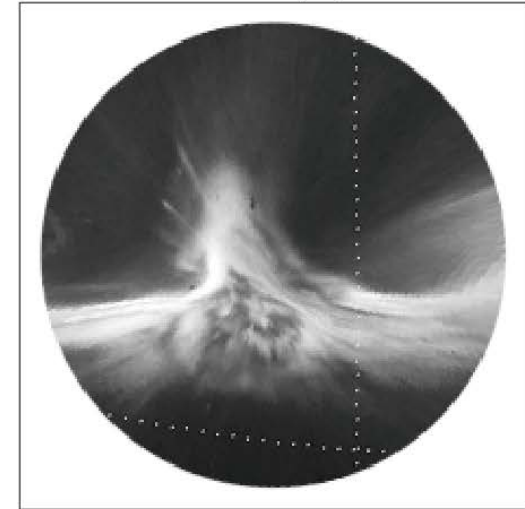
2011.03.01\_GAKO



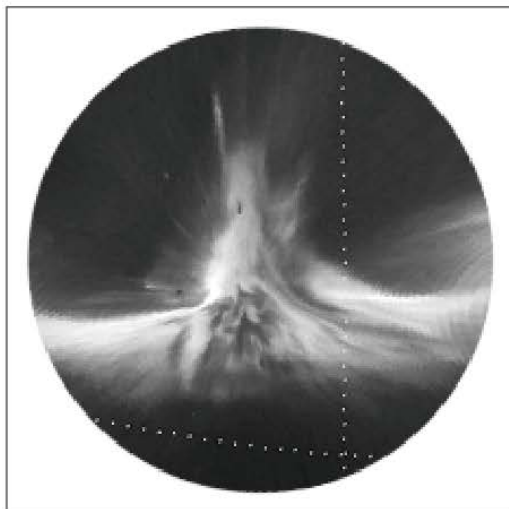
1422:00 UT



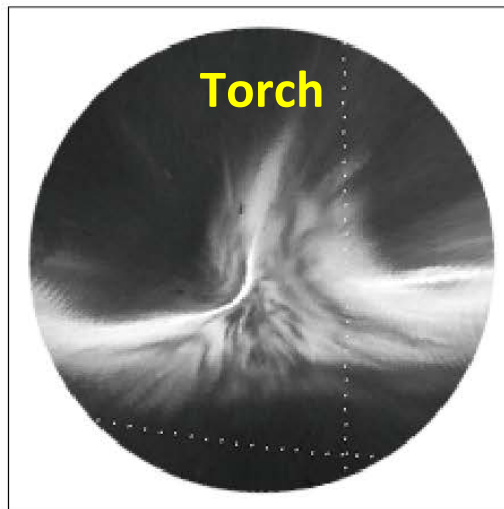
1423:30 UT



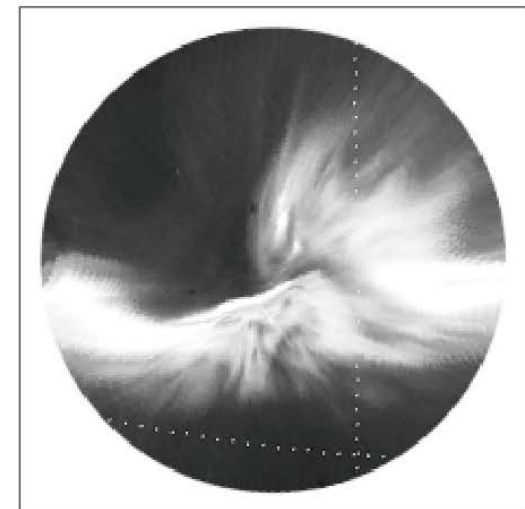
1425:00 UT



1426:30 UT



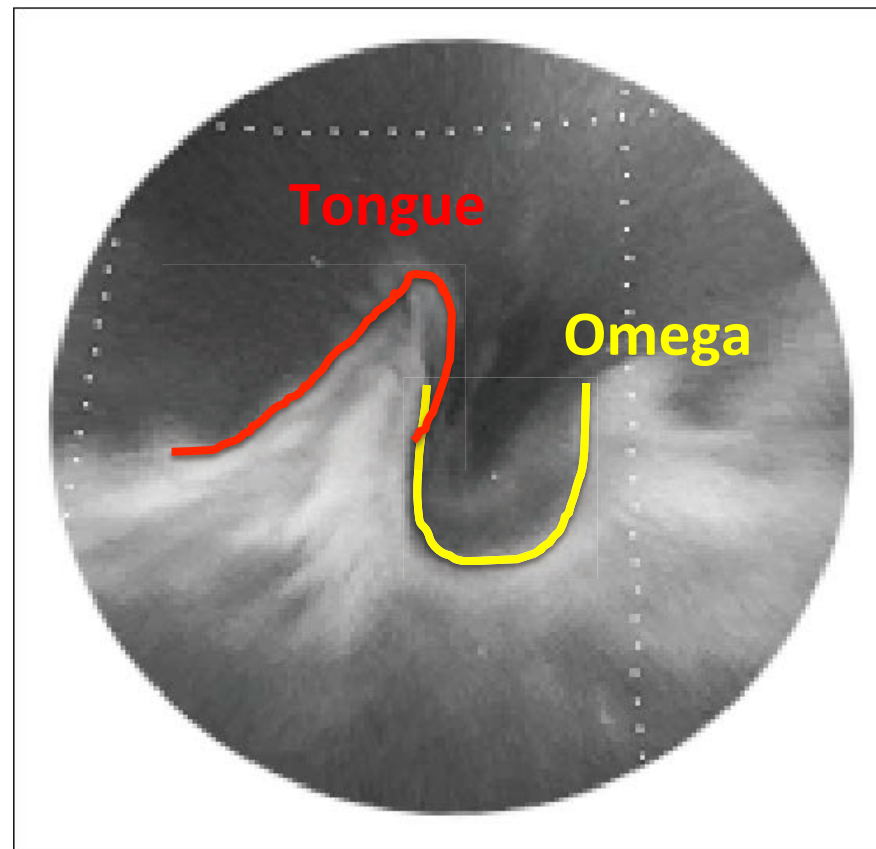
1428:00 UT



1429:30 UT

# Example of O/T-type (*Omega and Tongue*)

O/T-type  
(*Omega and Tongue*)

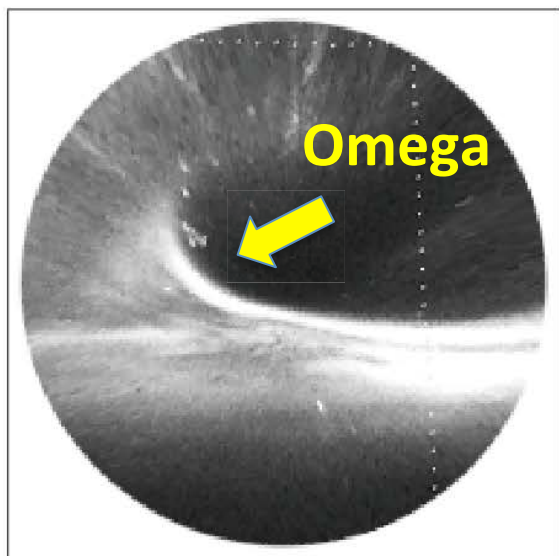


13.02.07\_SNKQ 0847:00 UT

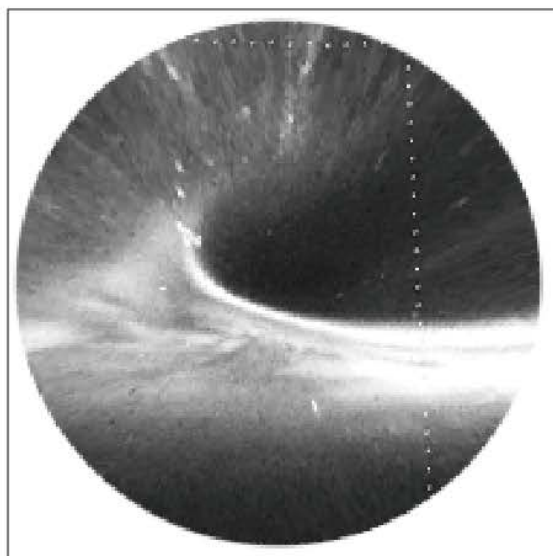


O/T-type形成に時間発展

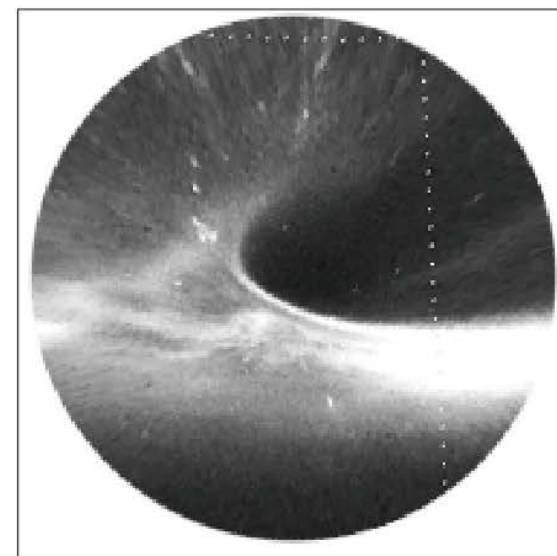
11.10.02\_KIAN



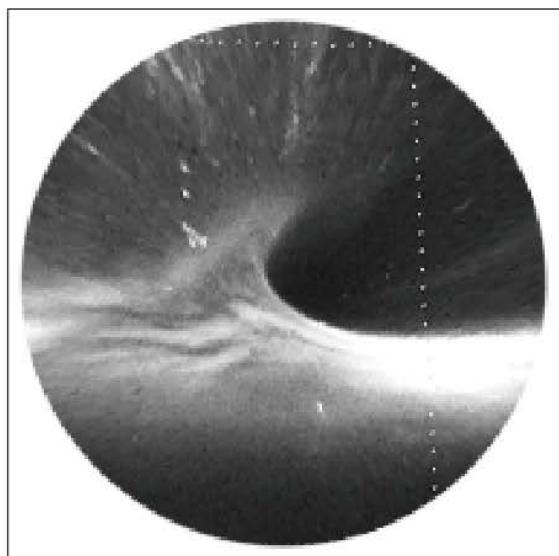
1213:00 UT



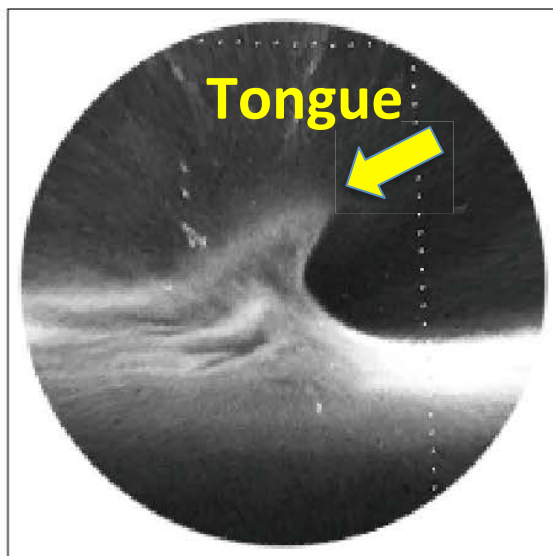
1214:00 UT



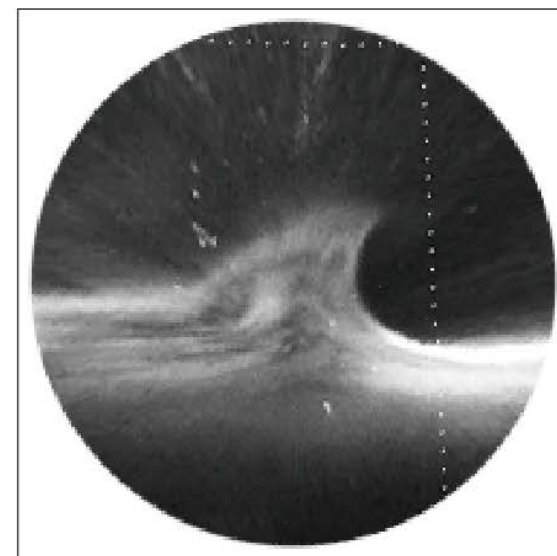
1215:00 UT



1216:00 UT



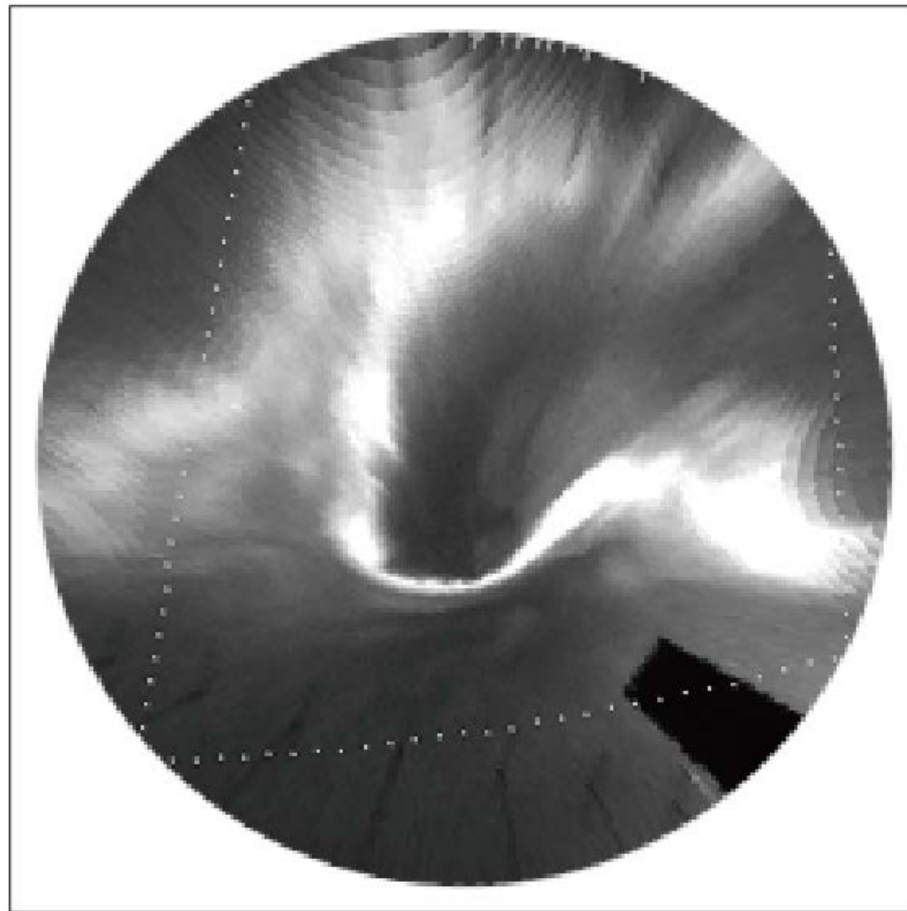
1217:00 UT



1218:00 UT

## Example of O/T-type (*Omega and Torch*)

O/T\*-type  
(*Omega and Torch*)



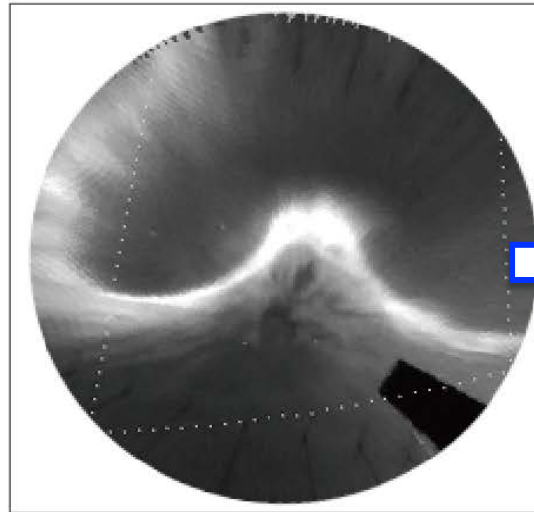
2008.03.09\_GBAY 0510:00 UT



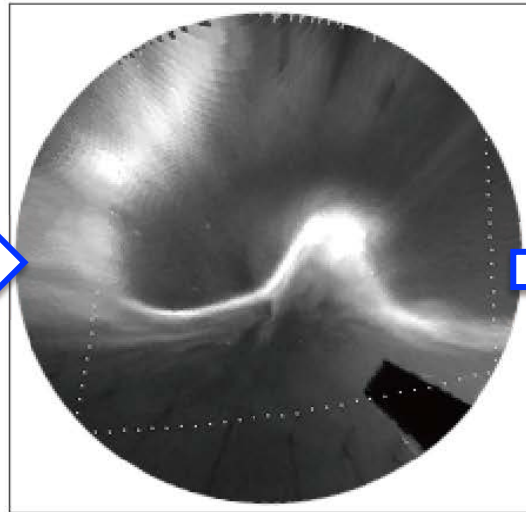
# Example of O/T-type (*Omega and Torch*)

## Growth signature of Omega and Torch

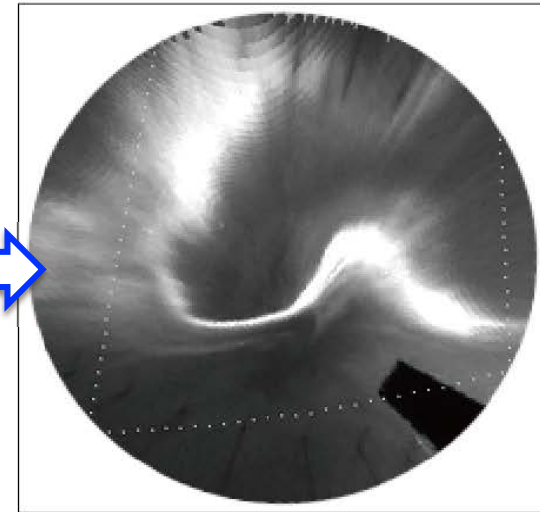
2008.03.09\_GBAY



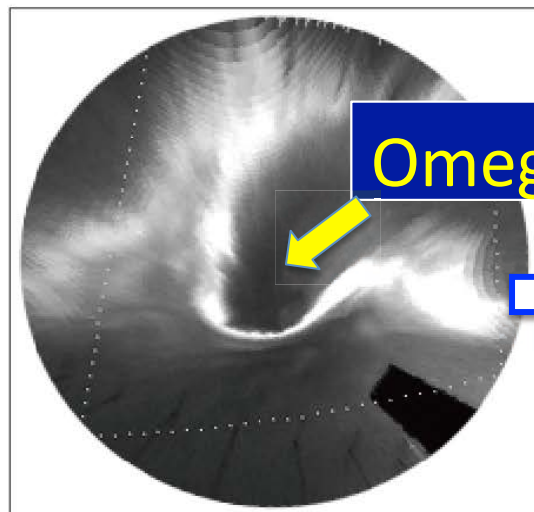
0504:00 UT



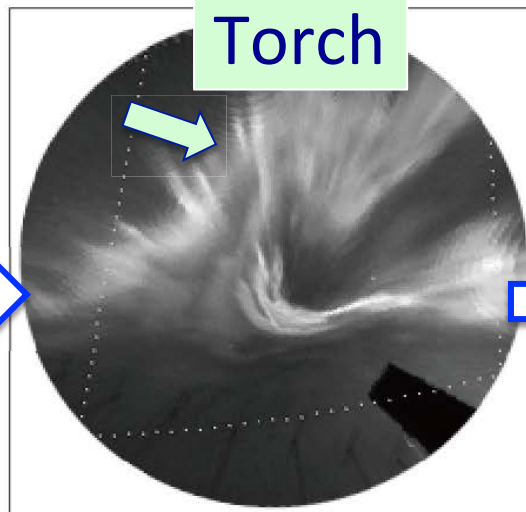
0506:00 UT



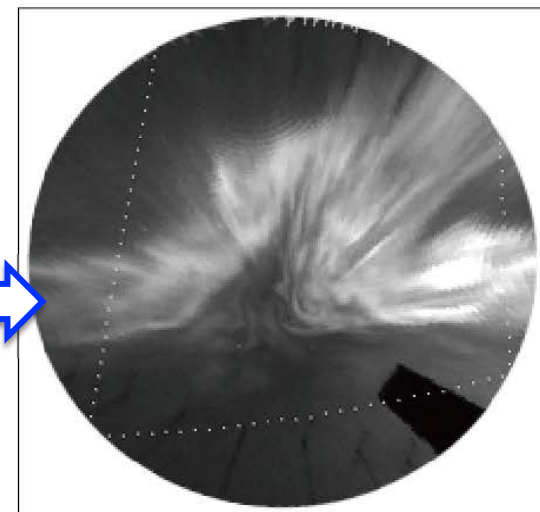
0508:00 UT



0510:00 UT



0512:00 UT

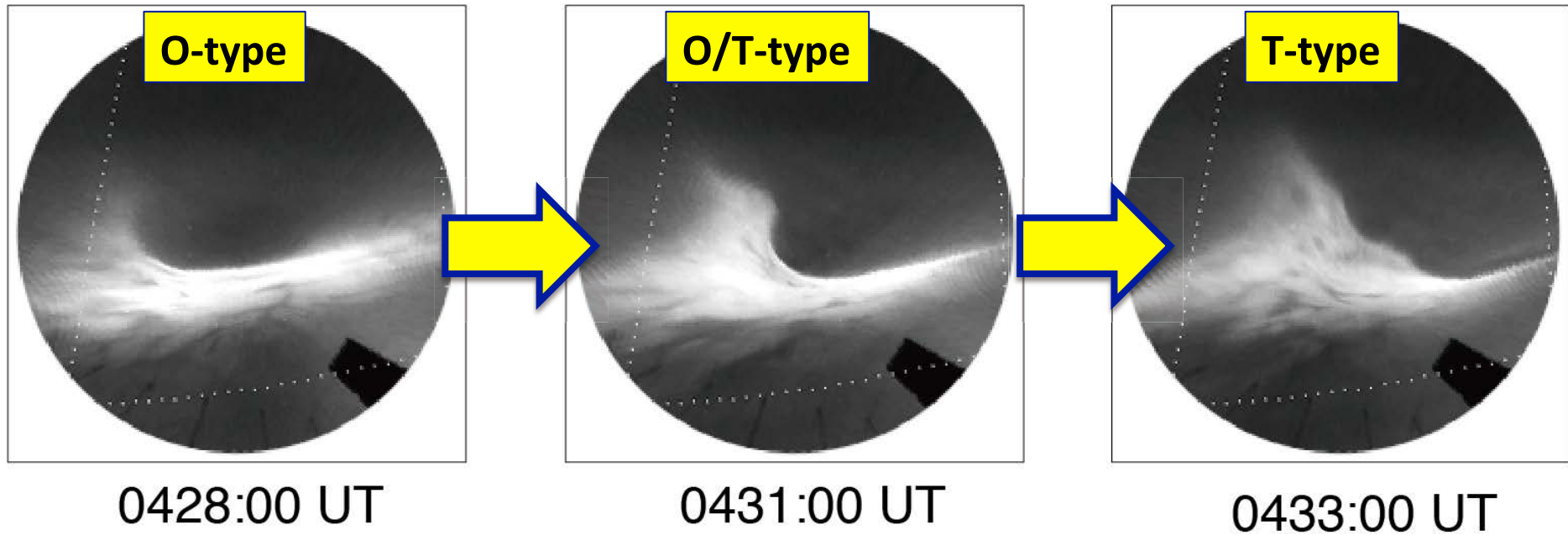


0514:00 UT

# 3 different types appeared within one event

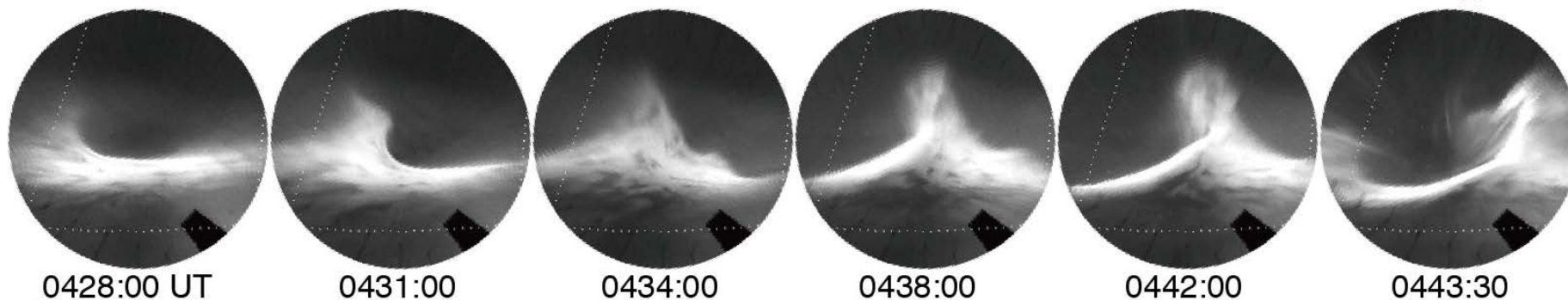
**O, O/T, then T-type**

2008.03.09\_GILL

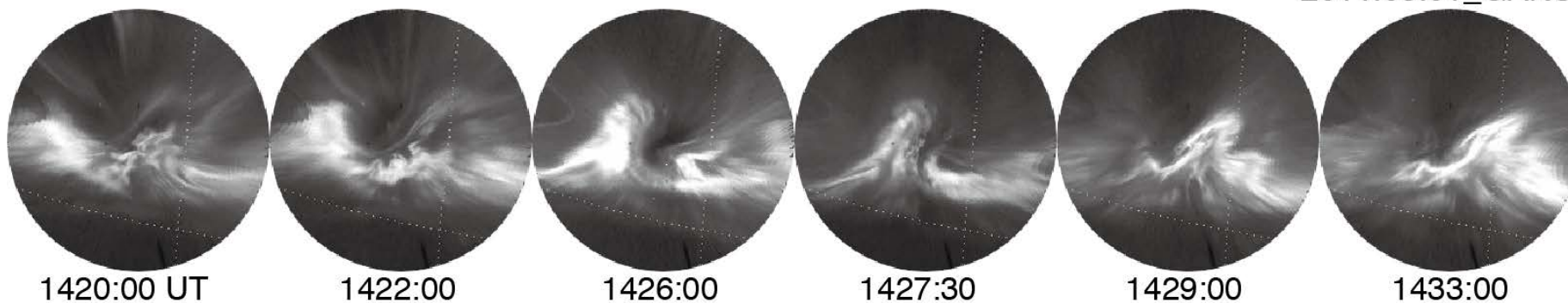


## 発達過程の典型例

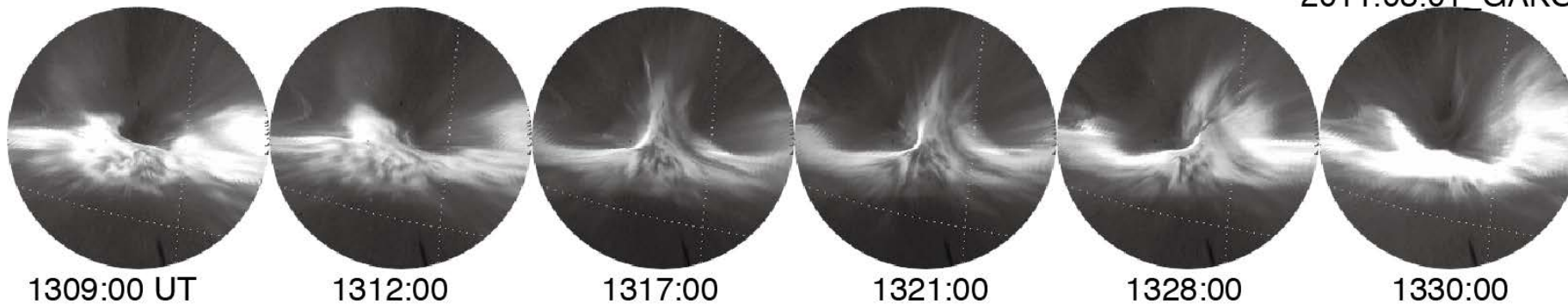
2008.03.09\_GBAY



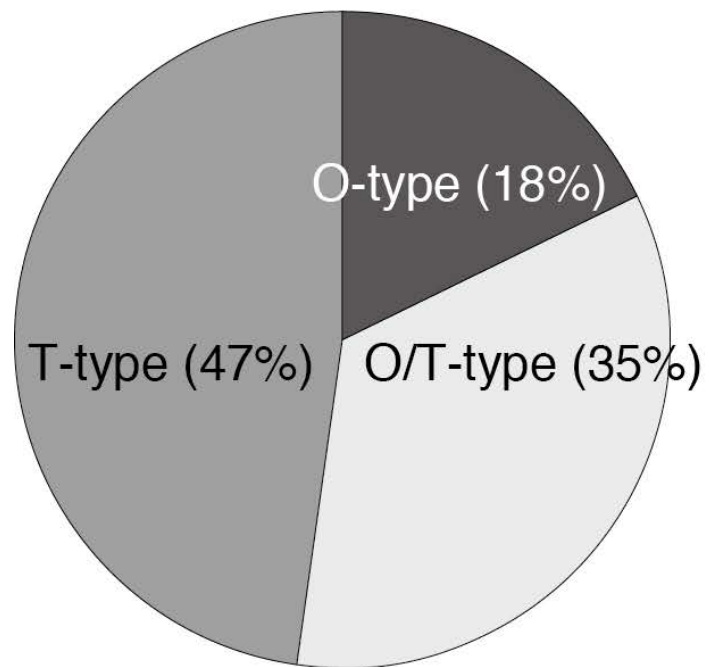
2011.03.01\_GAKO



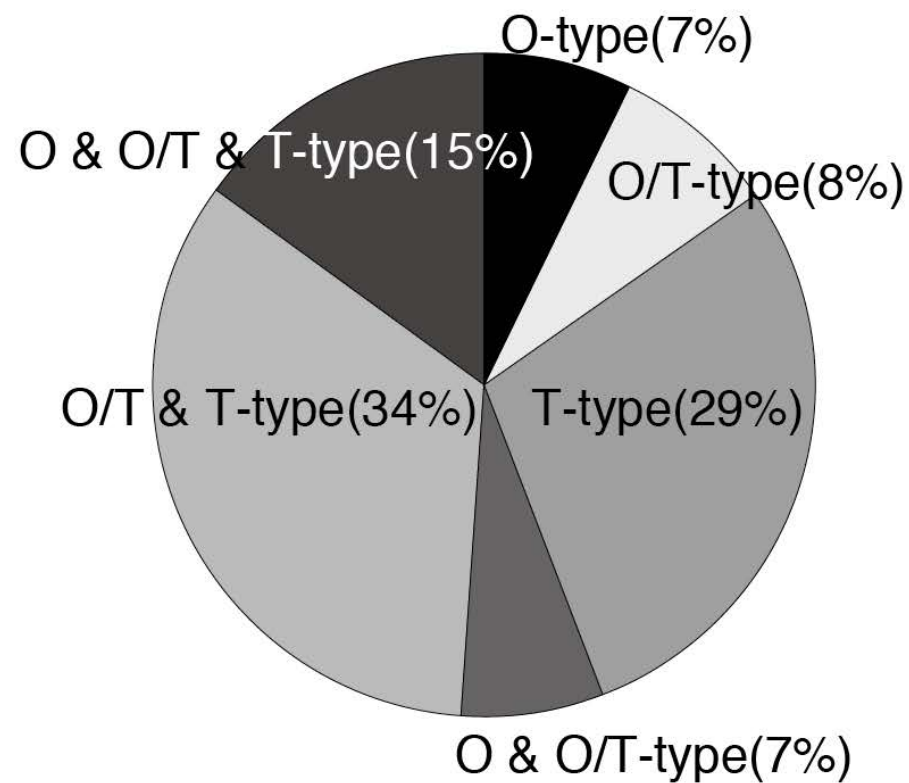
2011.03.01\_GAKO



## タイプ別けの統計結果 (330イベント)

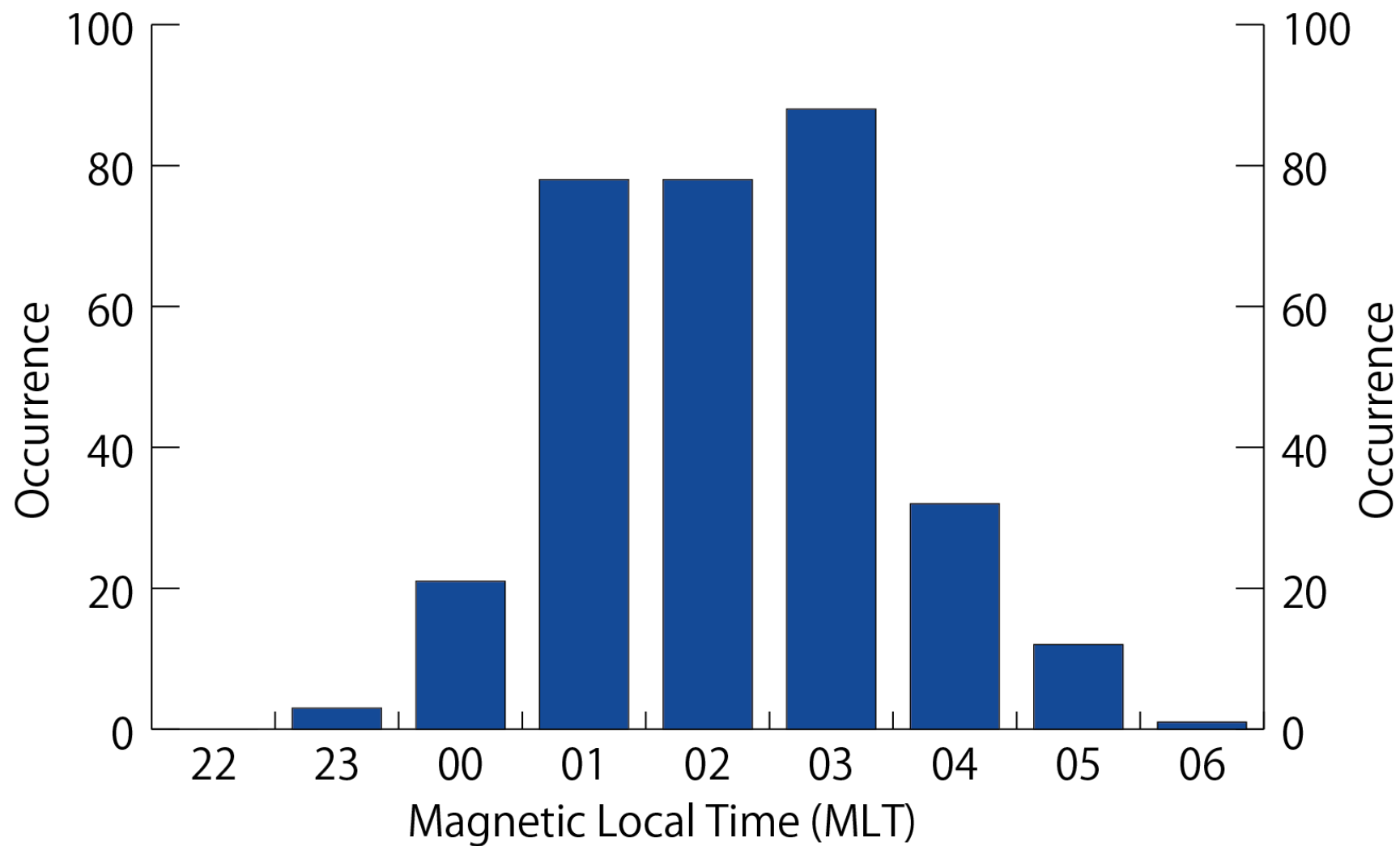


3タイプのイベント数  
(イベントが重なる場合がある)



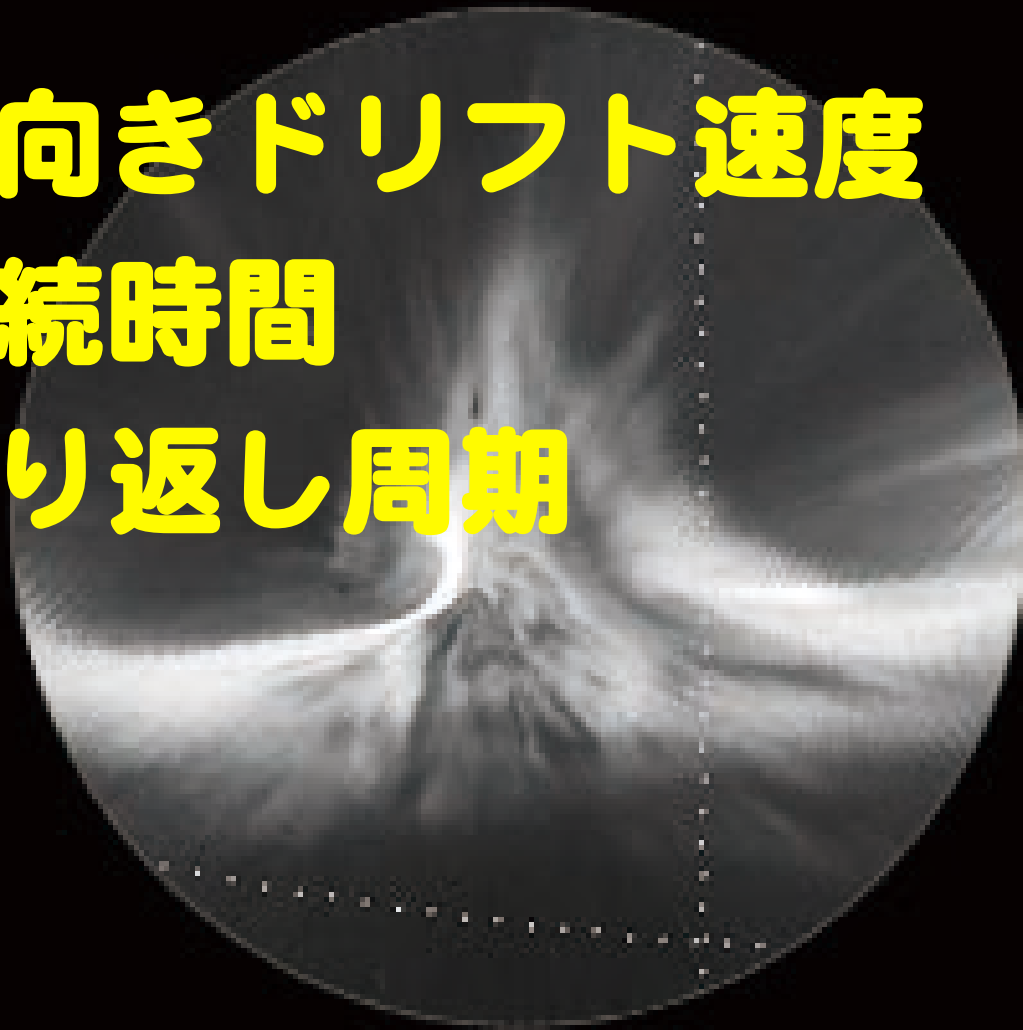
各々のイベントのタイプ

## 統計特性: Magnetic Local Time (MLT)



# 統計的特性

- 東向きドリフト速度
- 継続時間
- 繰り返し周期

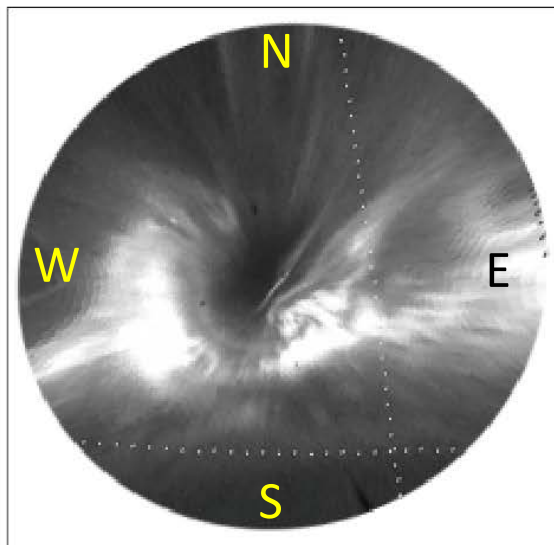




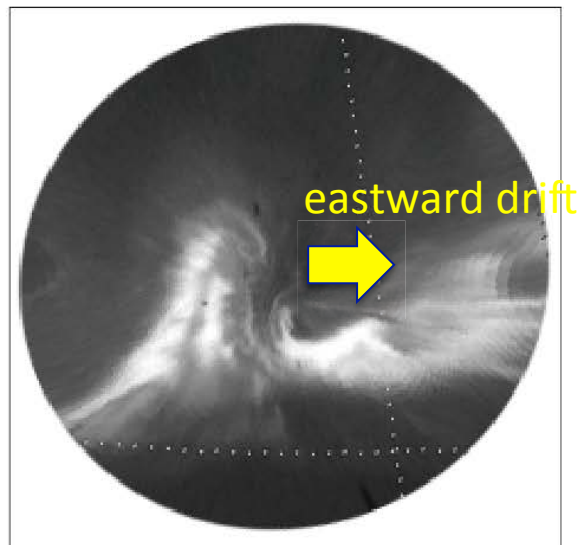
# Eastward Drift speed

Eastward Drift speed  $\sim 400$  m/sec

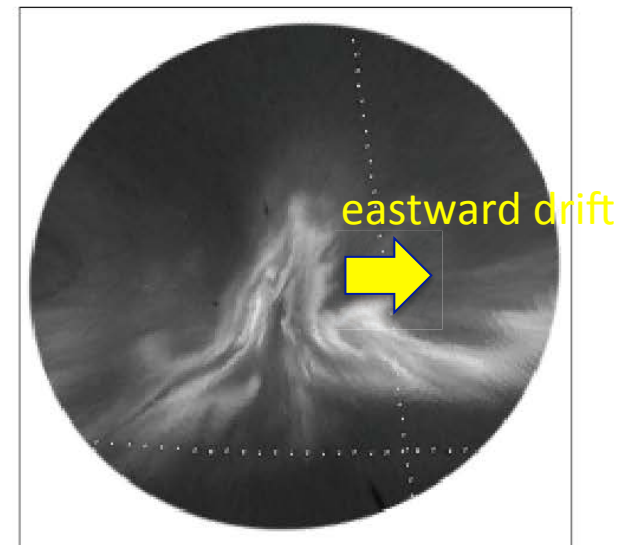
2011.03.01\_GAKO



1315

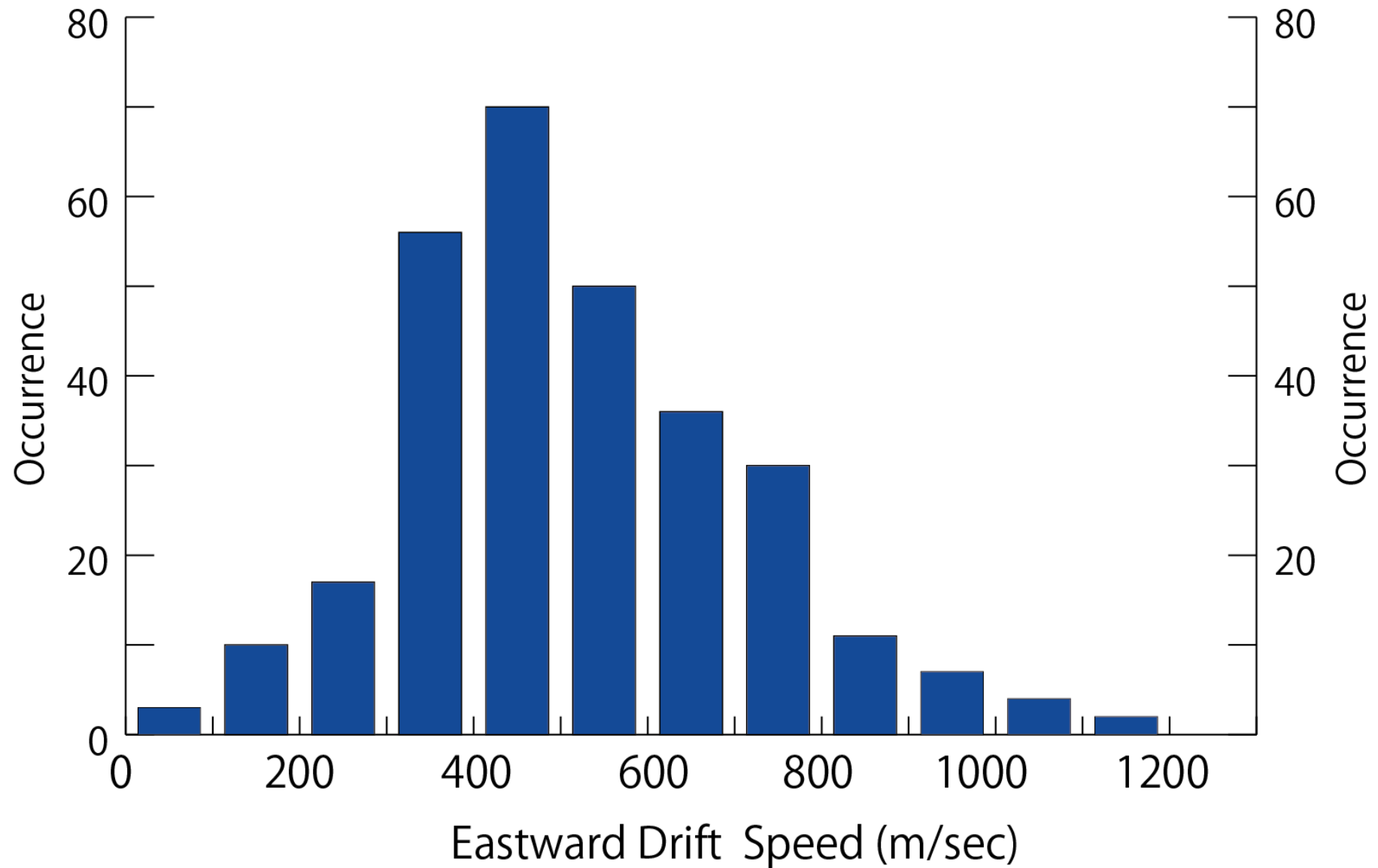


1320

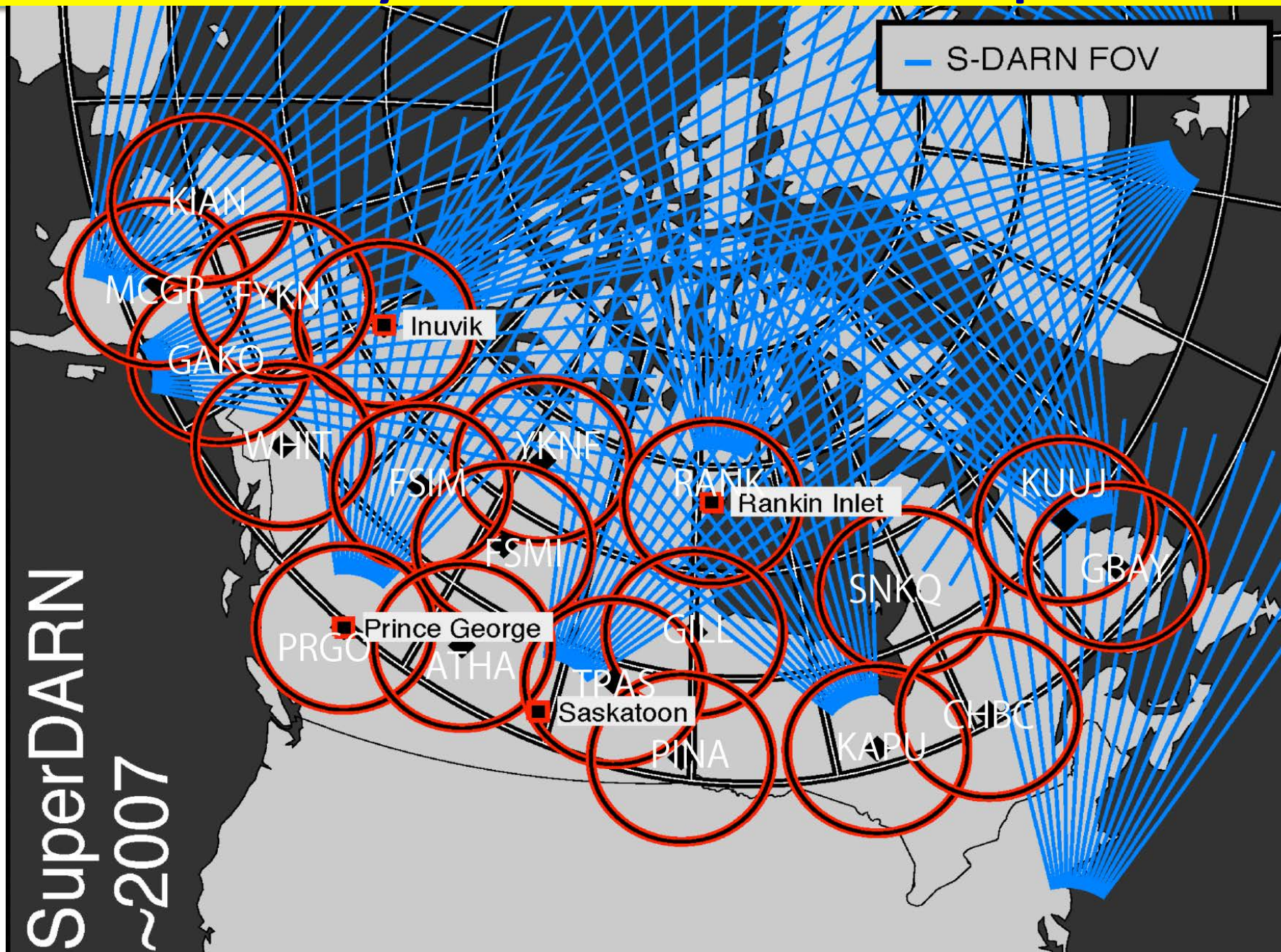


1325

## 統計特性: Drift speed (eastward)



# THEMIS all-sky camera network and SuperDARN





FOV of  
Mcgrath (MCRR), Alaska

FOV of  
Gakona (GAKO), Alaska

# SuperDARN observation and Omega band aurora

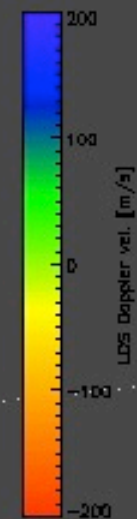
King  
Salmon

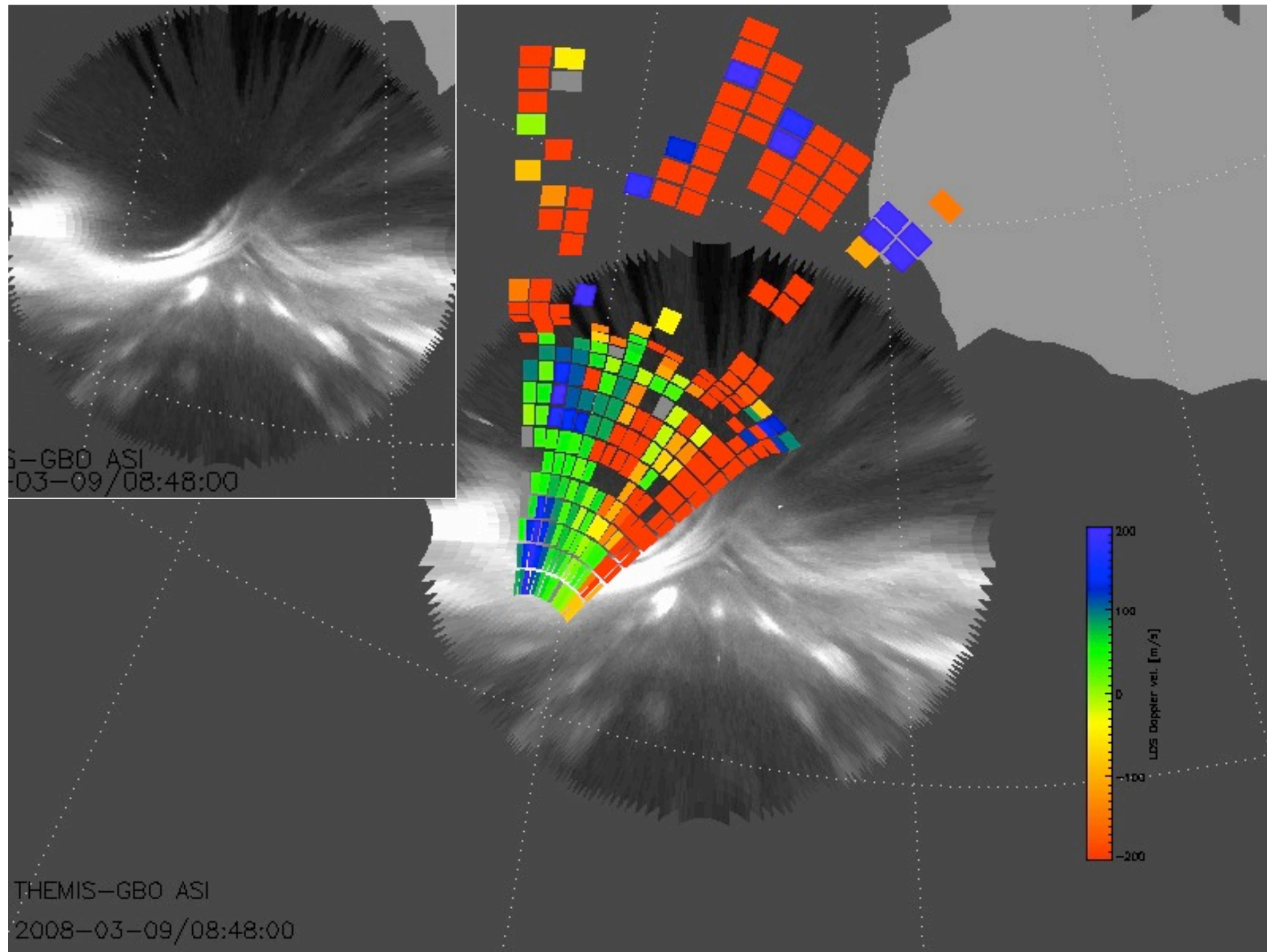
Kodiak

2008.03.09 event

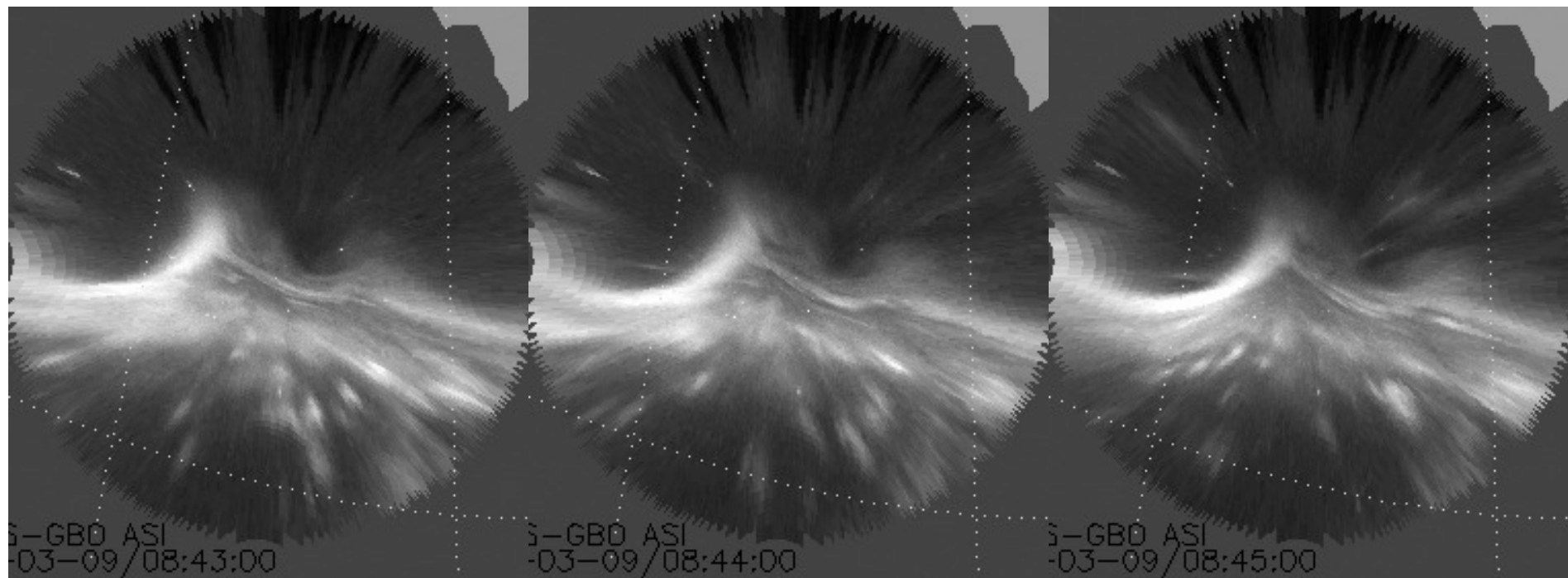
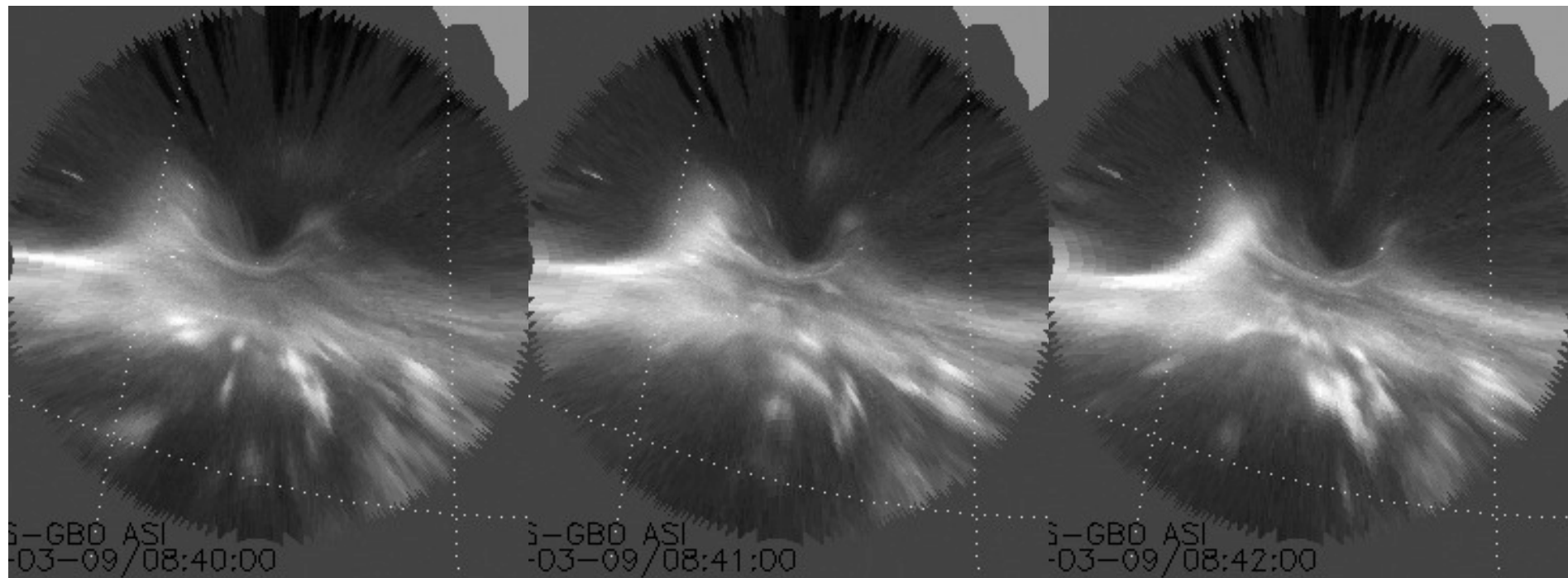
THEMIS-GBD ASI  
2008-03-09/08:40:00

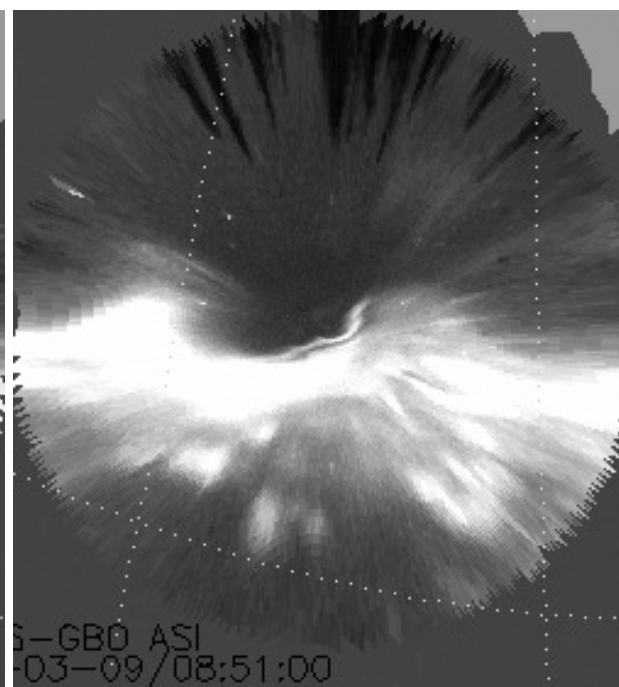
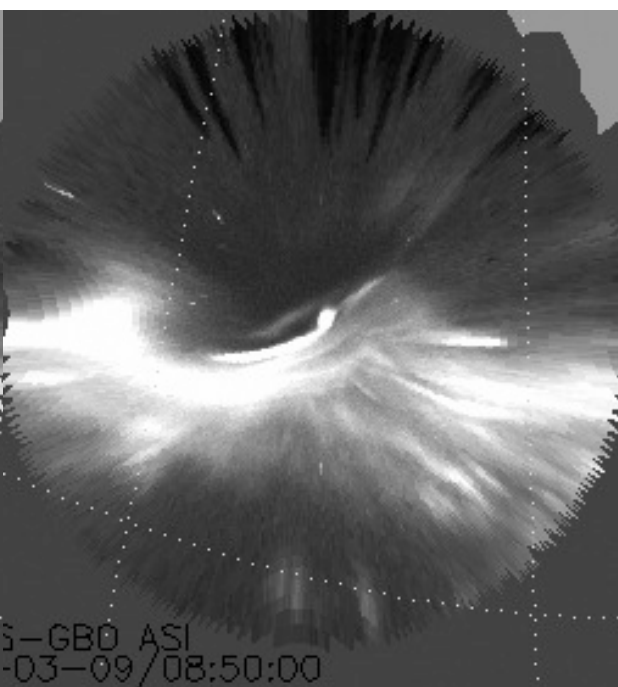
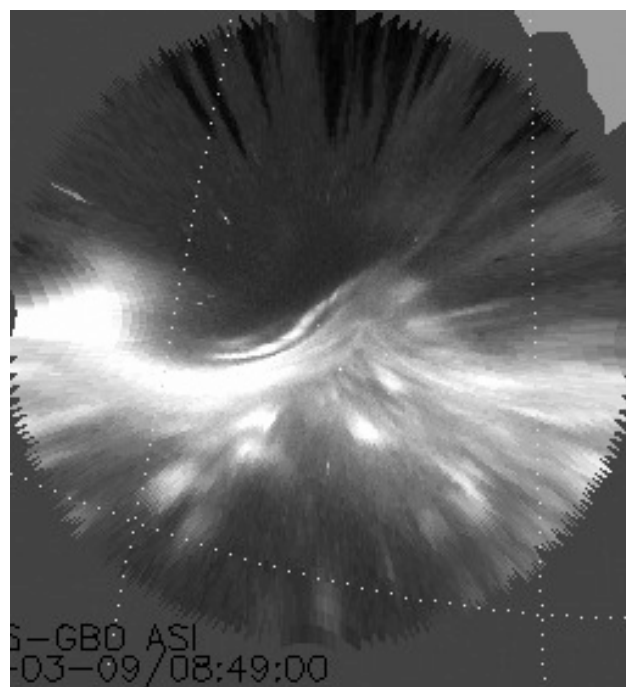
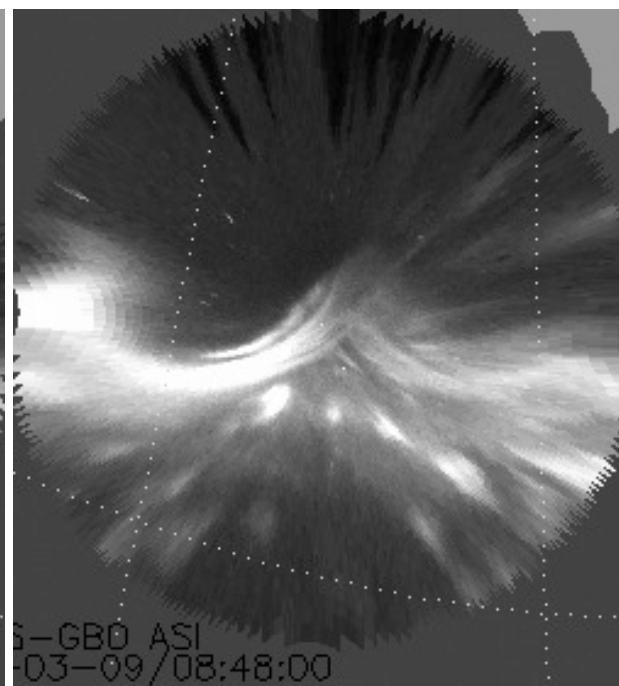
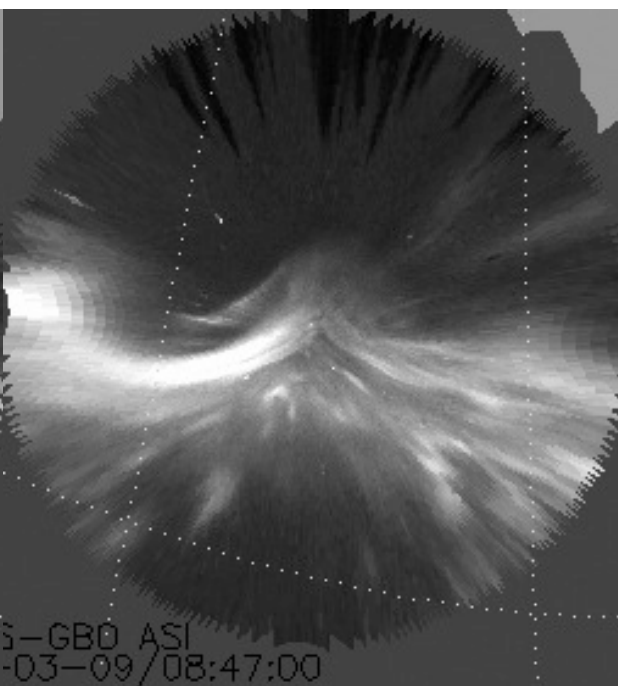
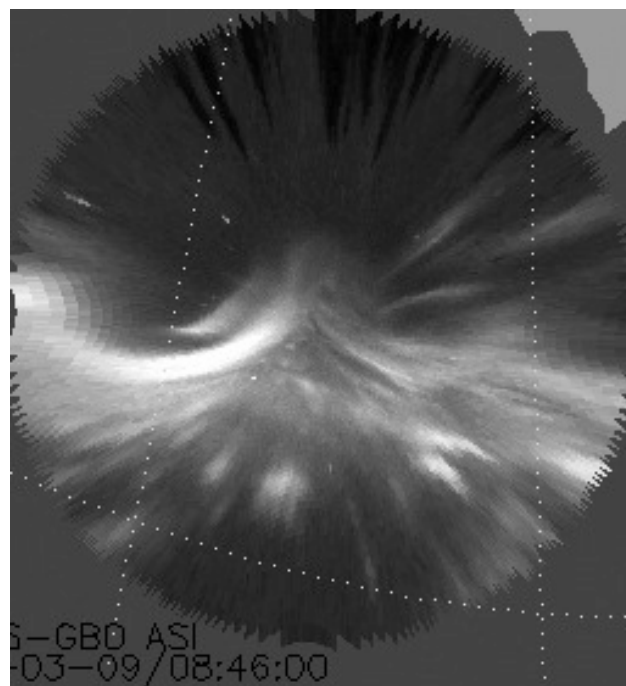
THEMIS-GBD ASI  
2008-03-09/08:40:00



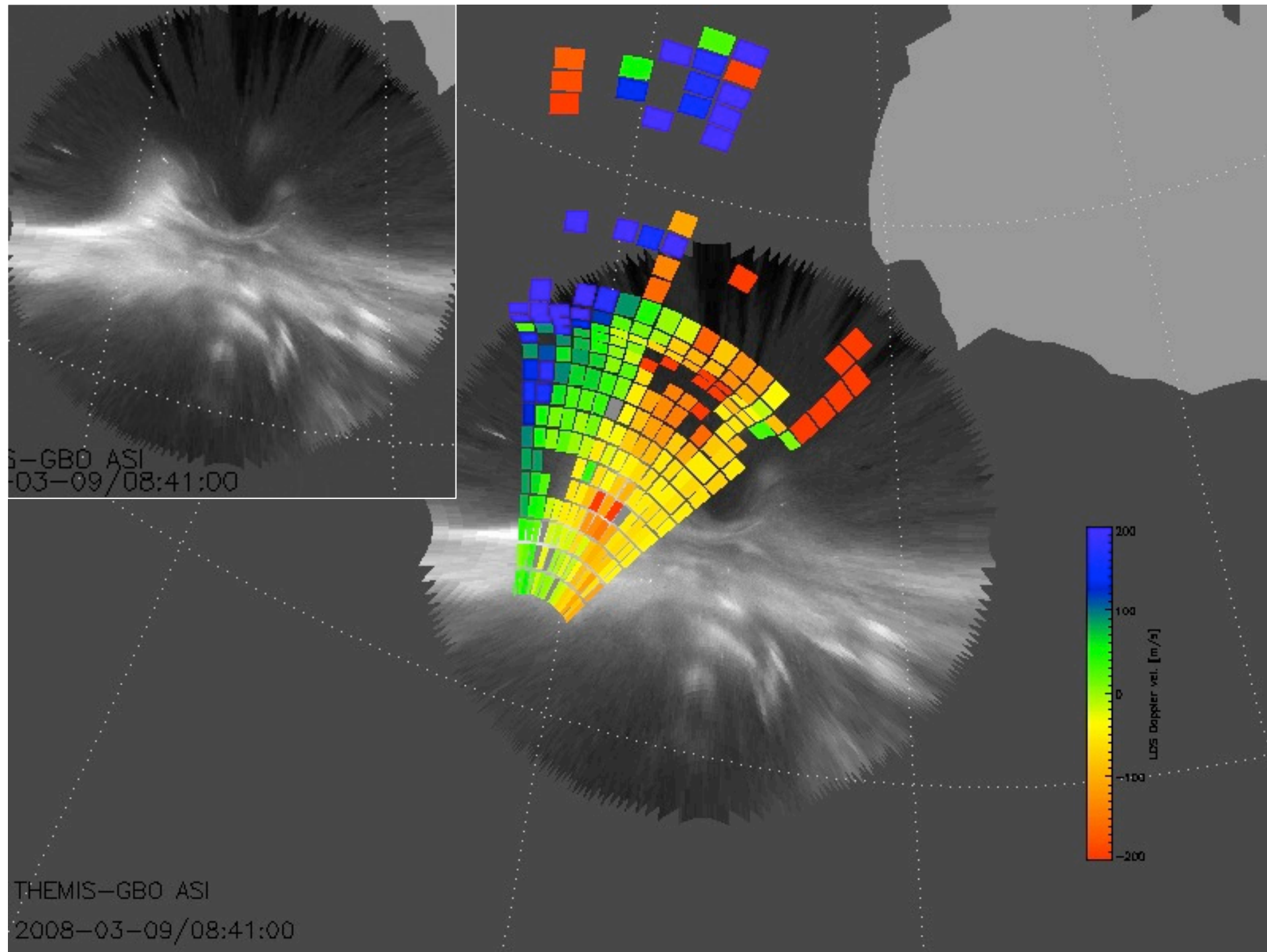


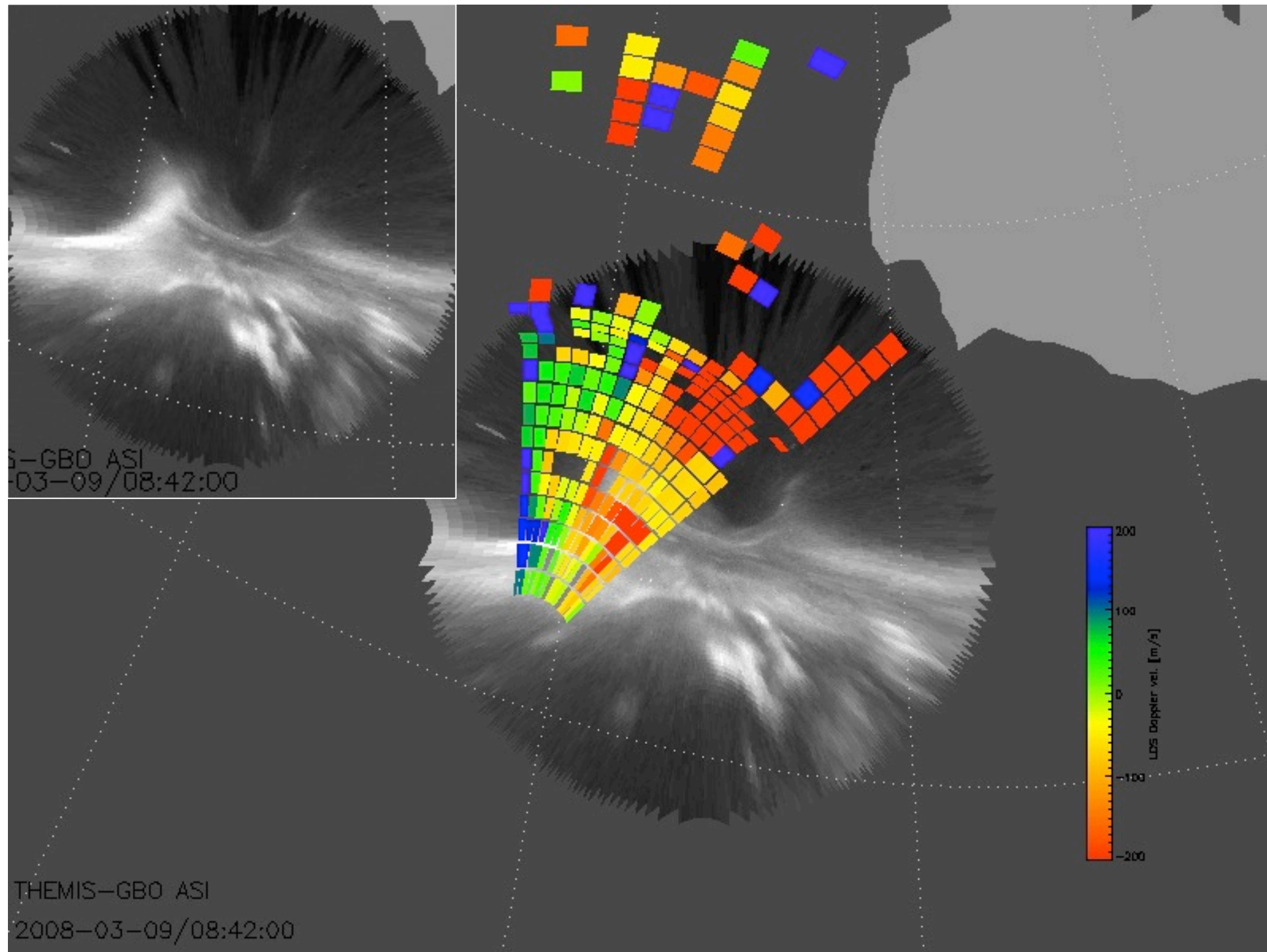




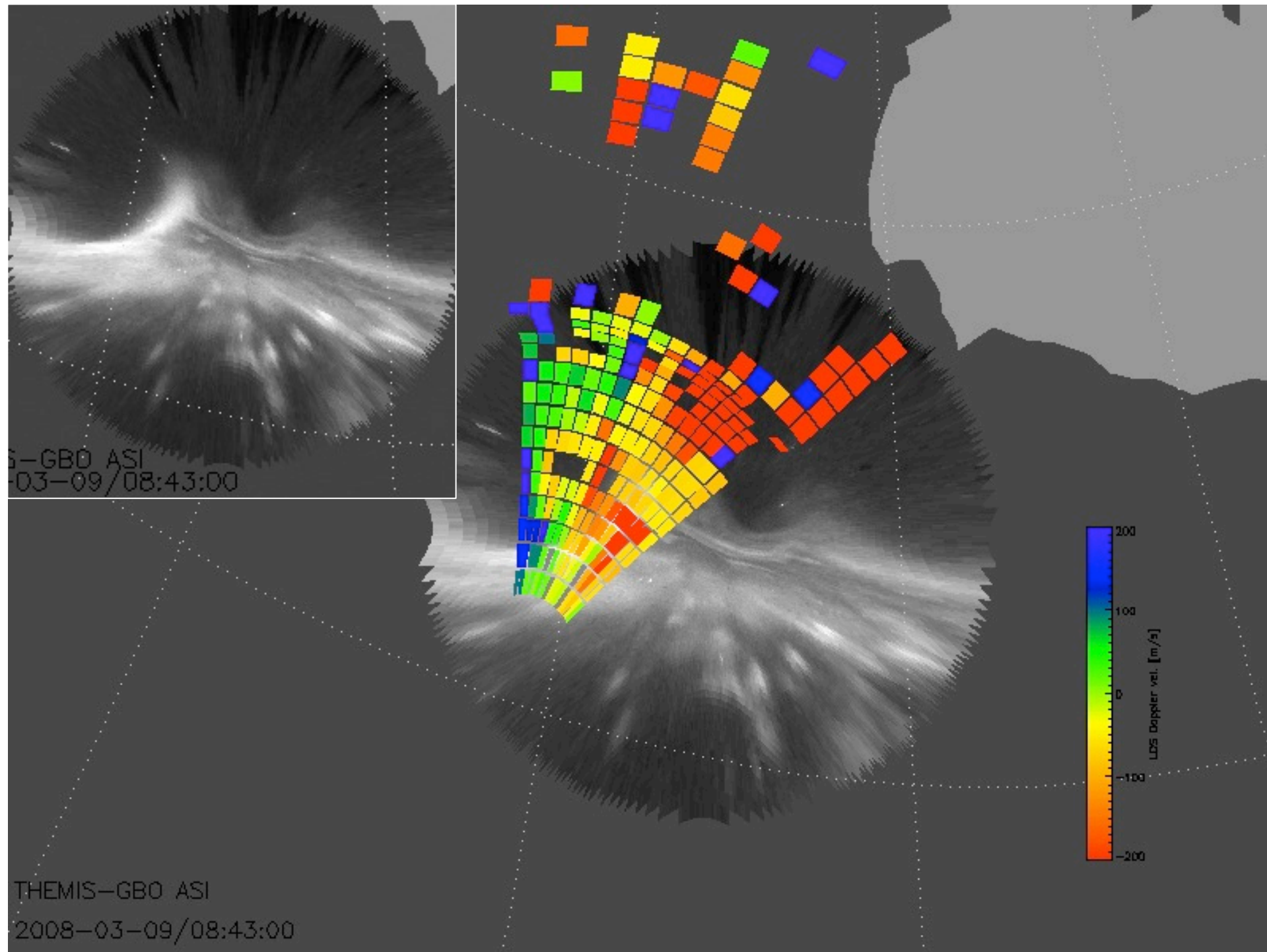


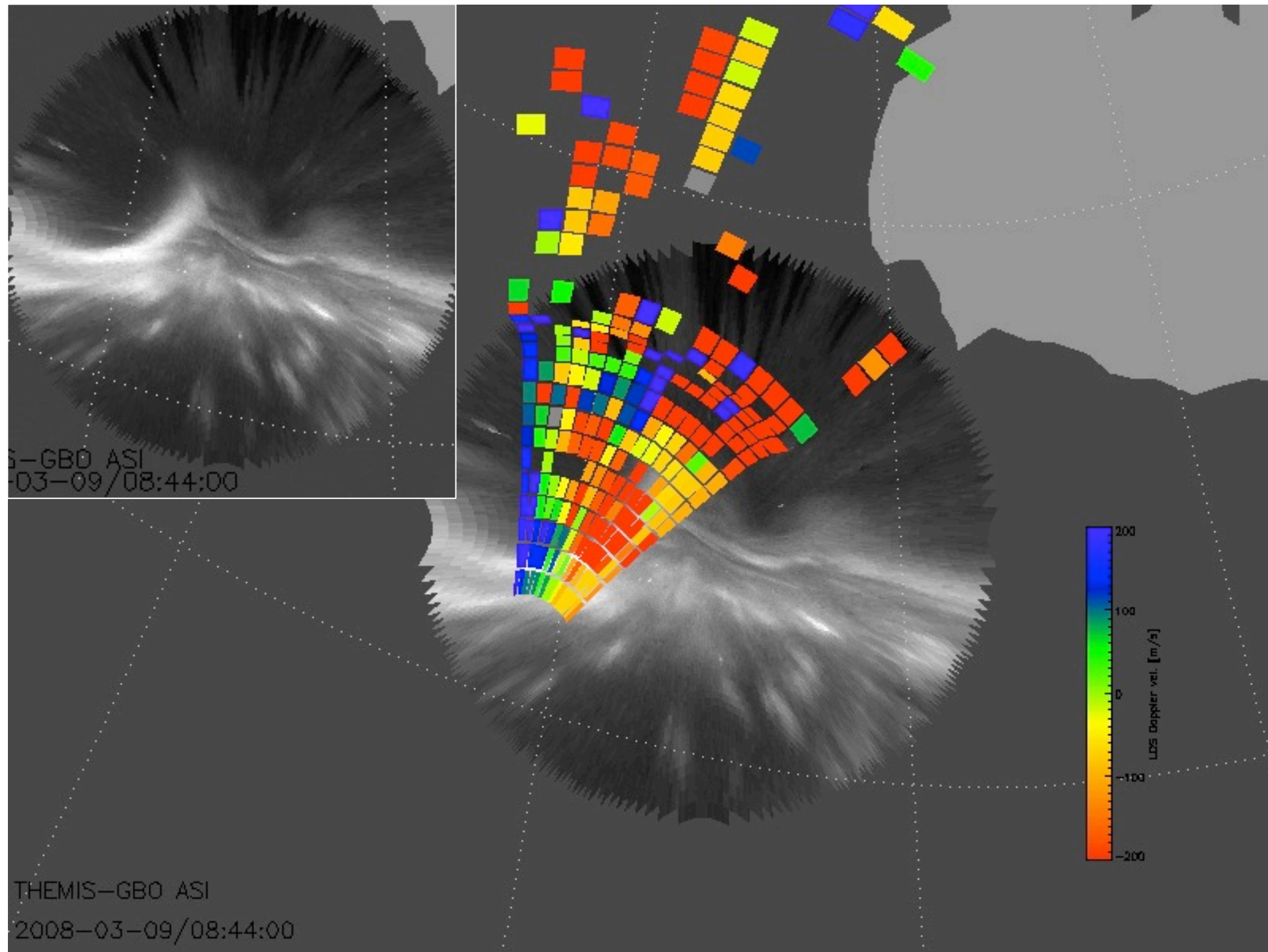
# 連続記録

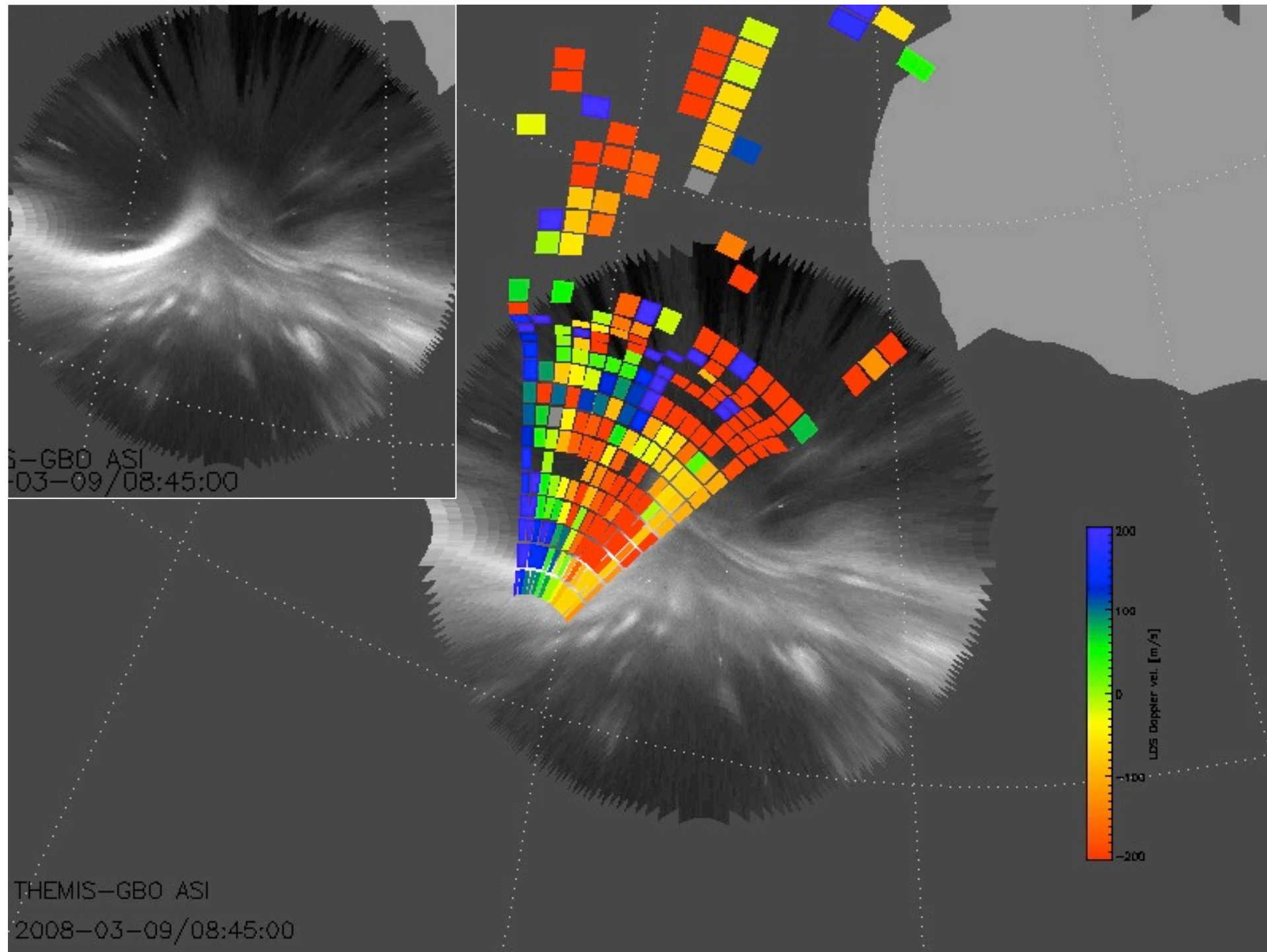




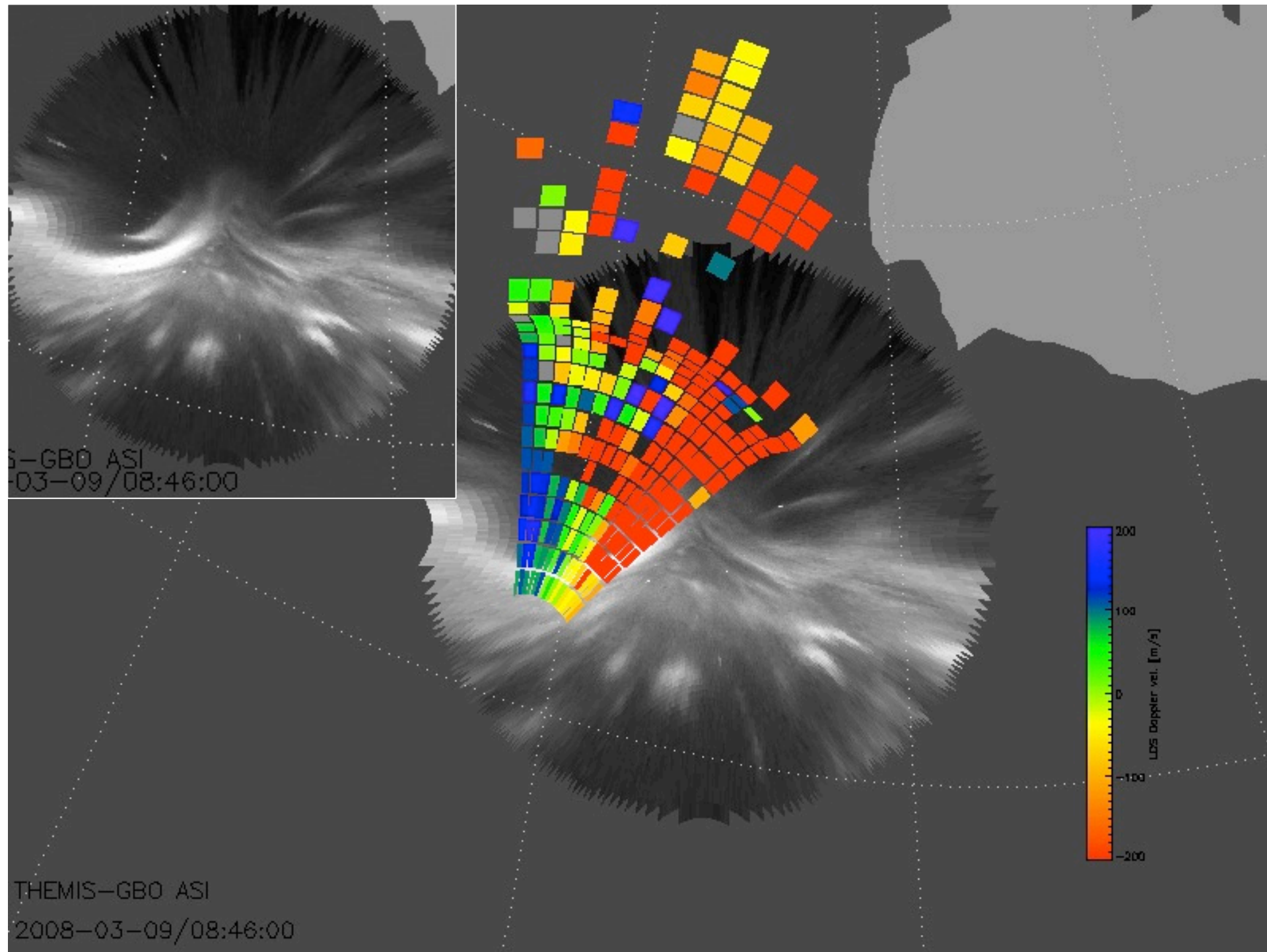




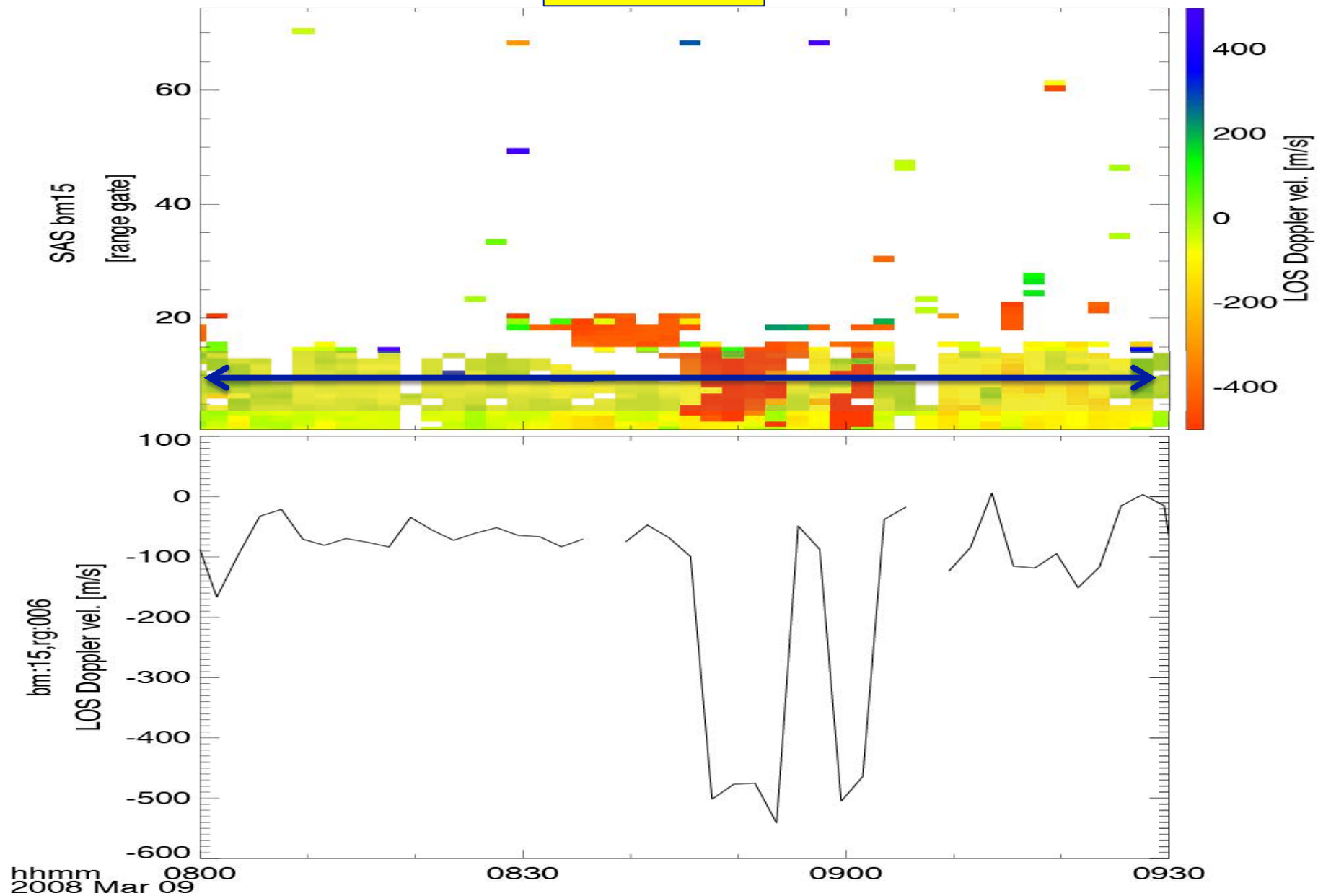




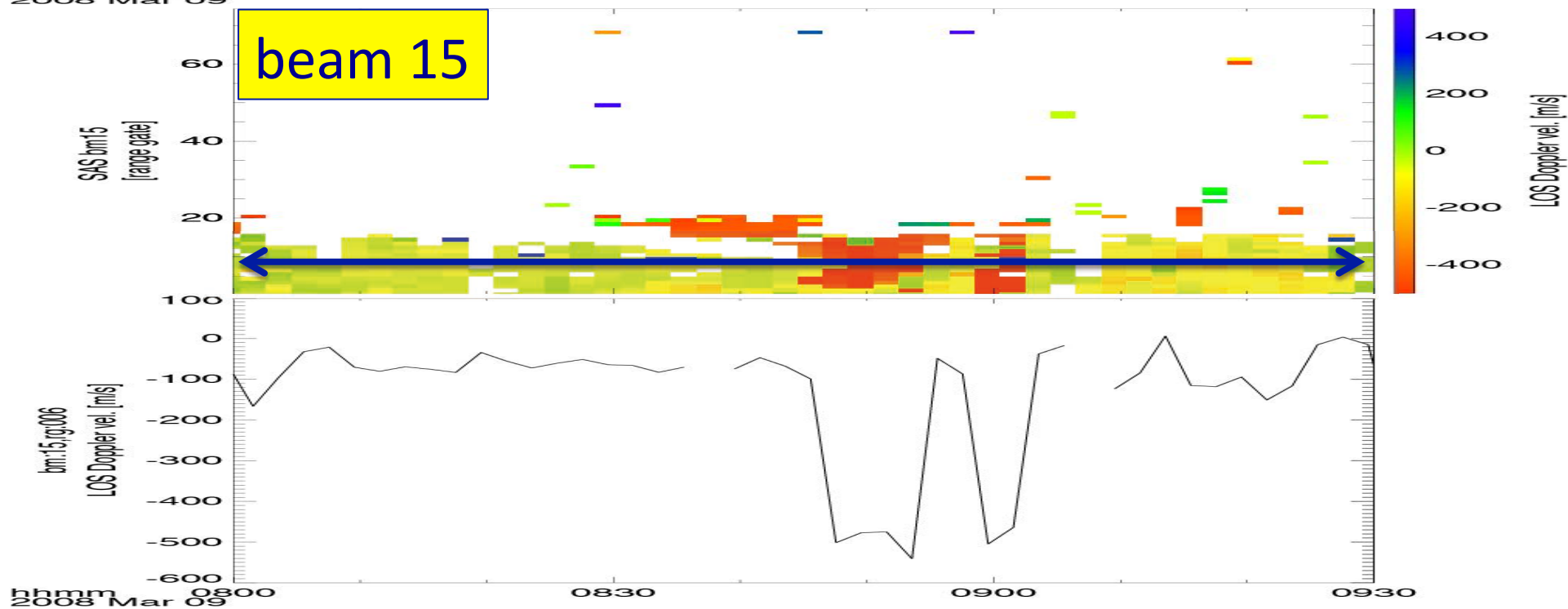
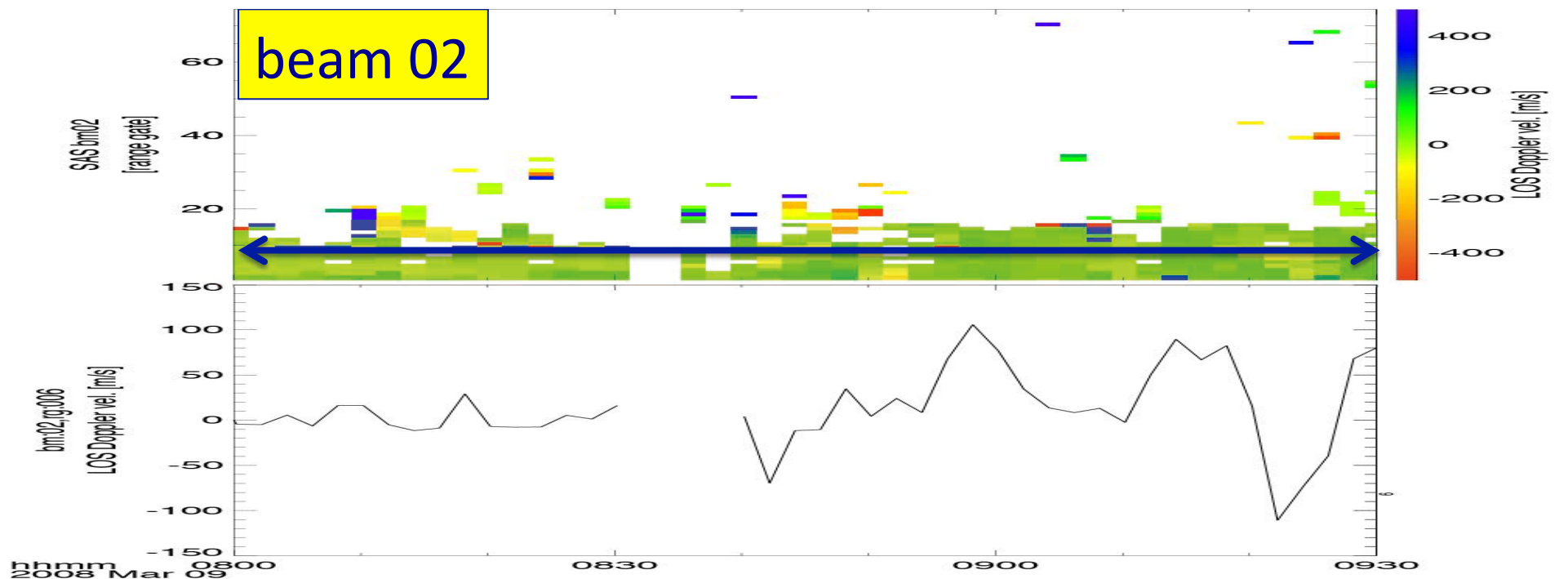




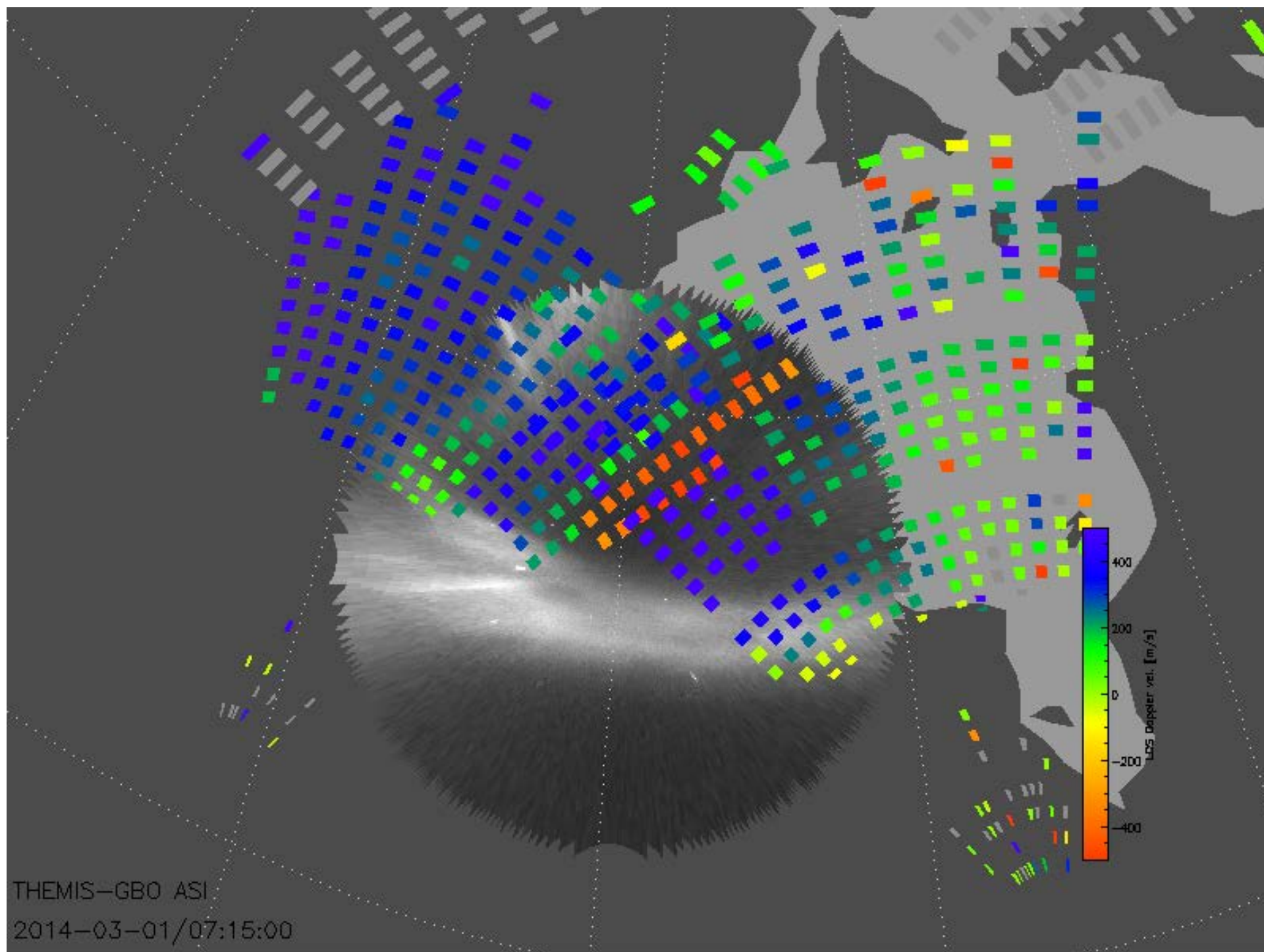
beam 15

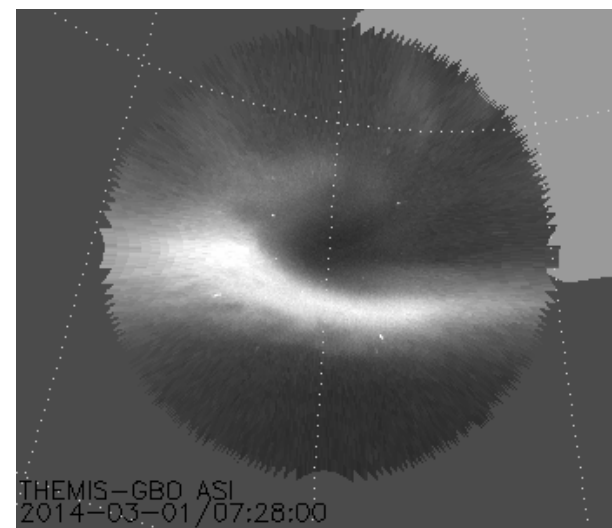
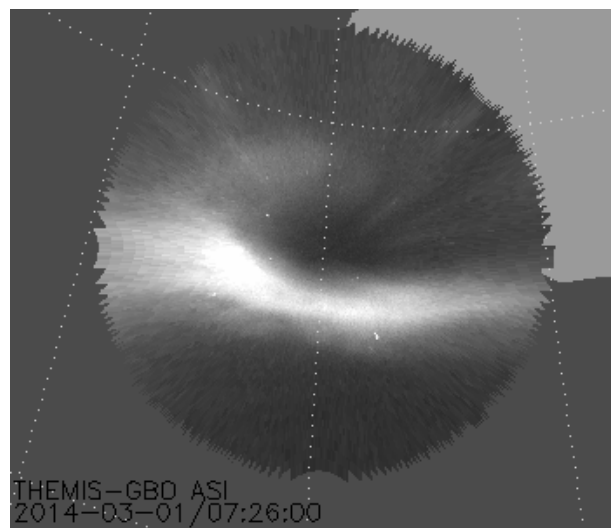
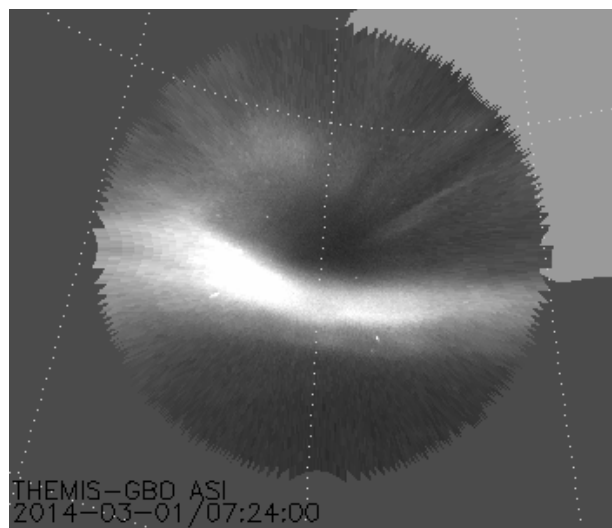
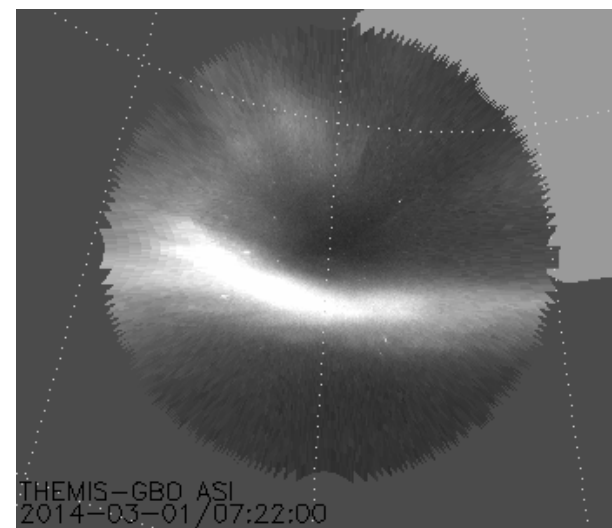
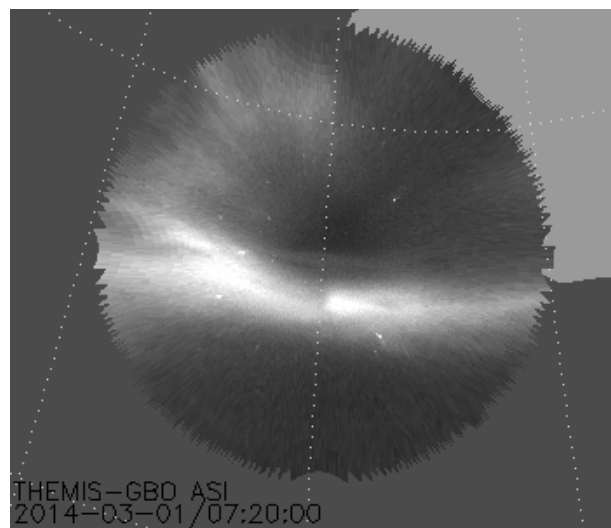
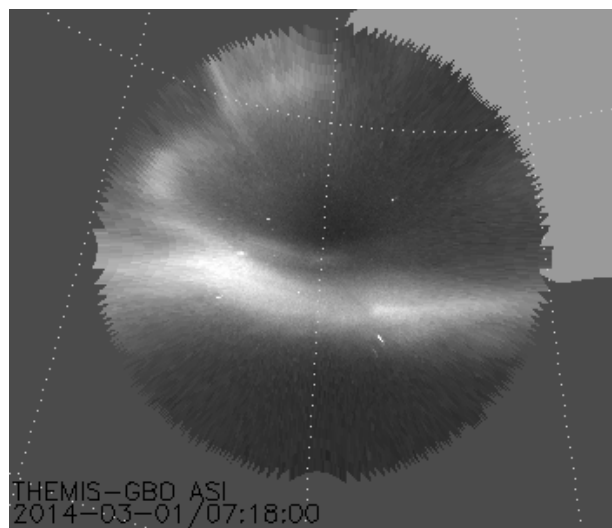






2014.03.01 event





THEMIS-GB0 ASI  
2014-03-01/07:14:00

LOS Doppler vel. [m/s]

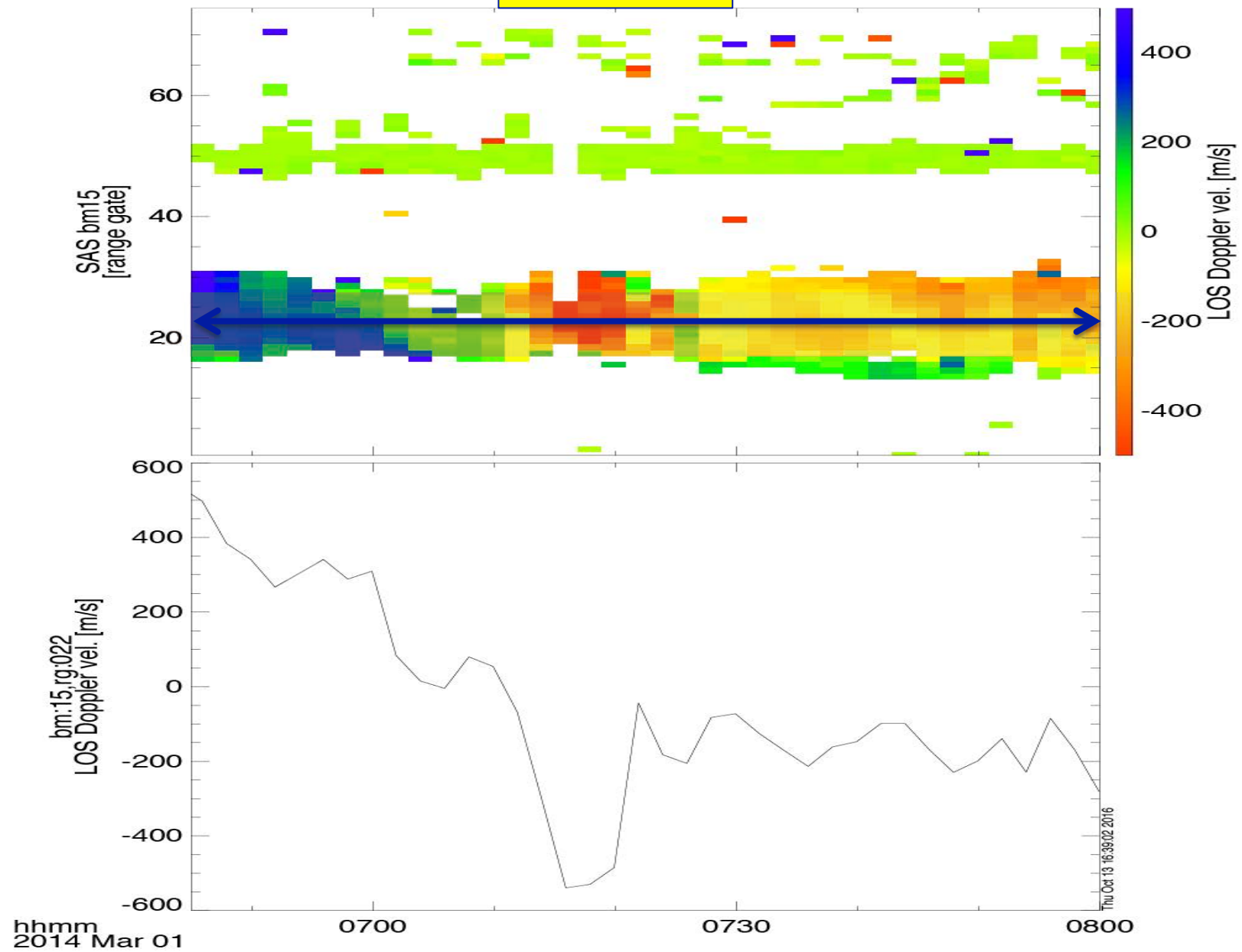
400  
200  
0  
-200  
-400

激しい逆向きの流れ

THEMIS-GB0 ASI  
2014-03-01/07:14:00



beam 15



# 継続時間 : Duration within the field of view

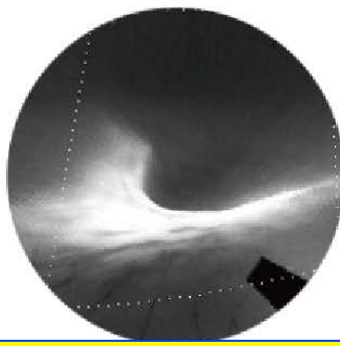
2008.03.09\_GILL



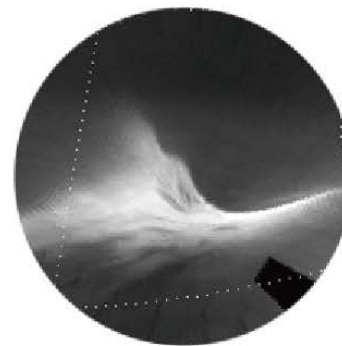
0426



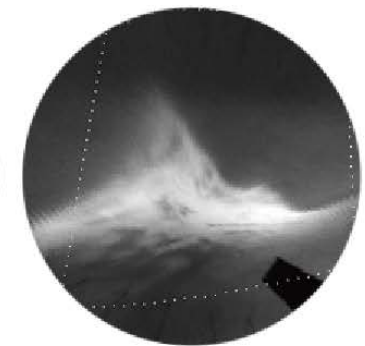
0428



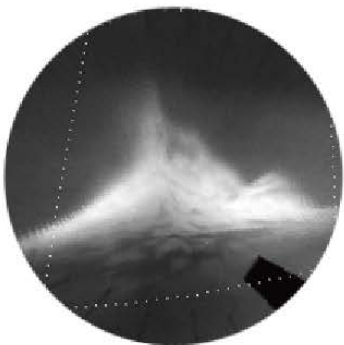
~ 18 sec



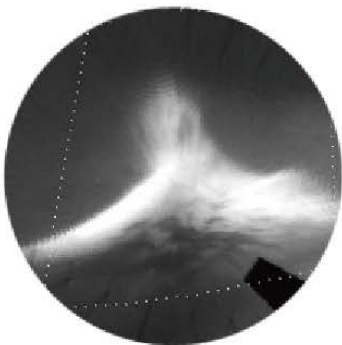
0432



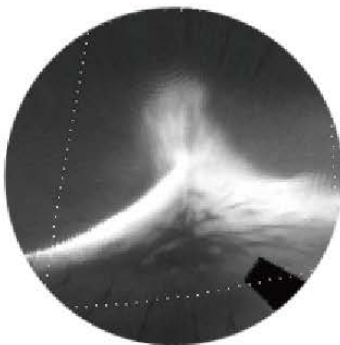
0434



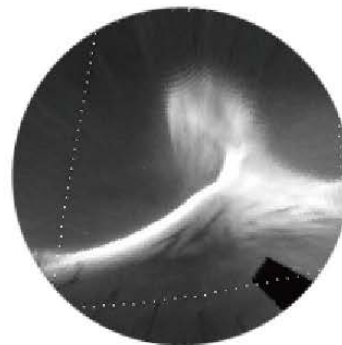
0436



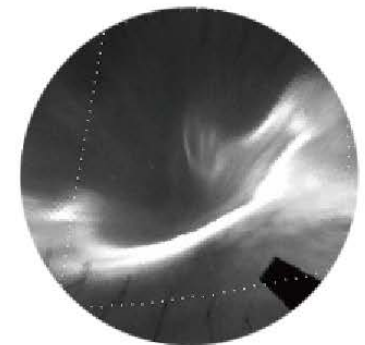
0438



0440

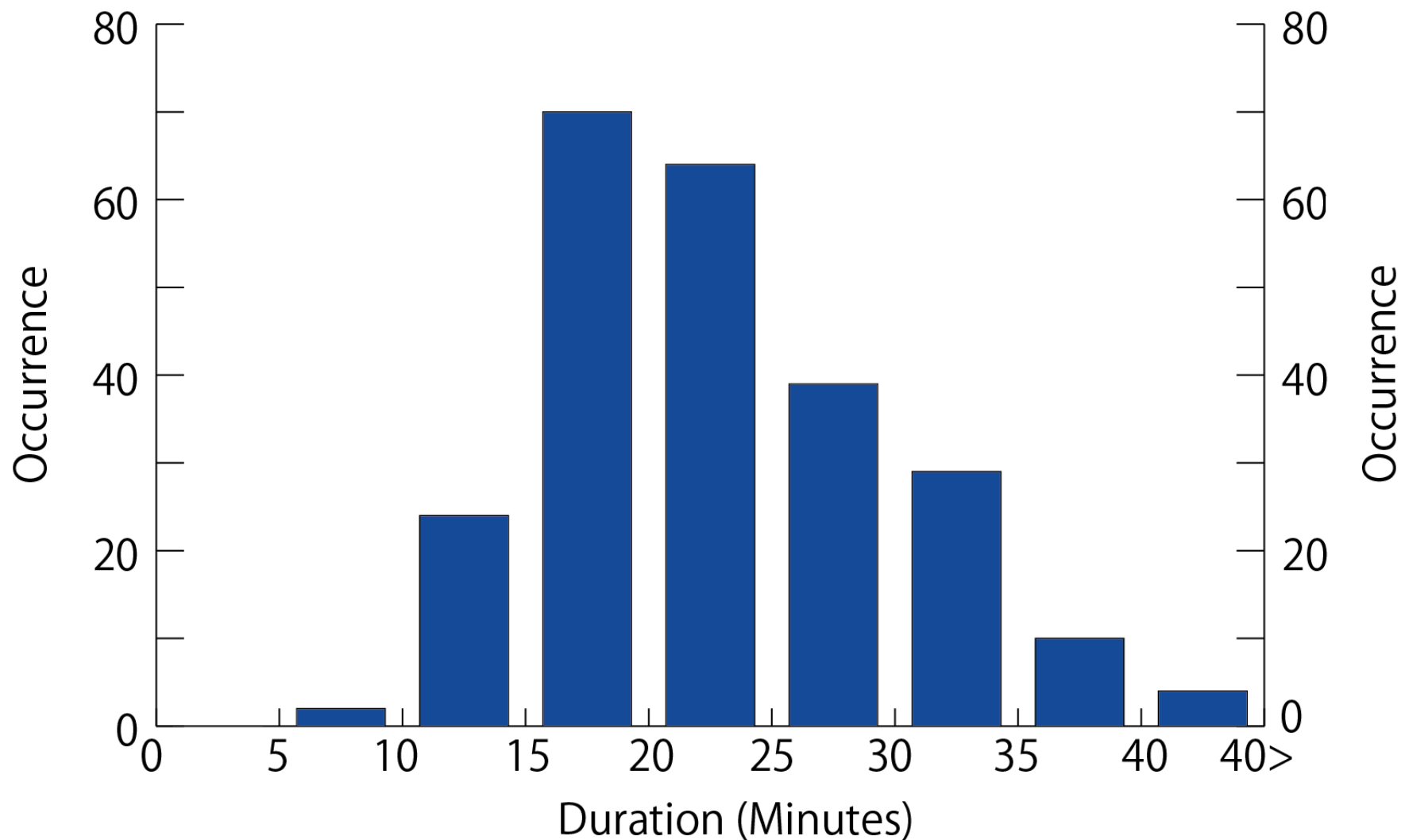


0442

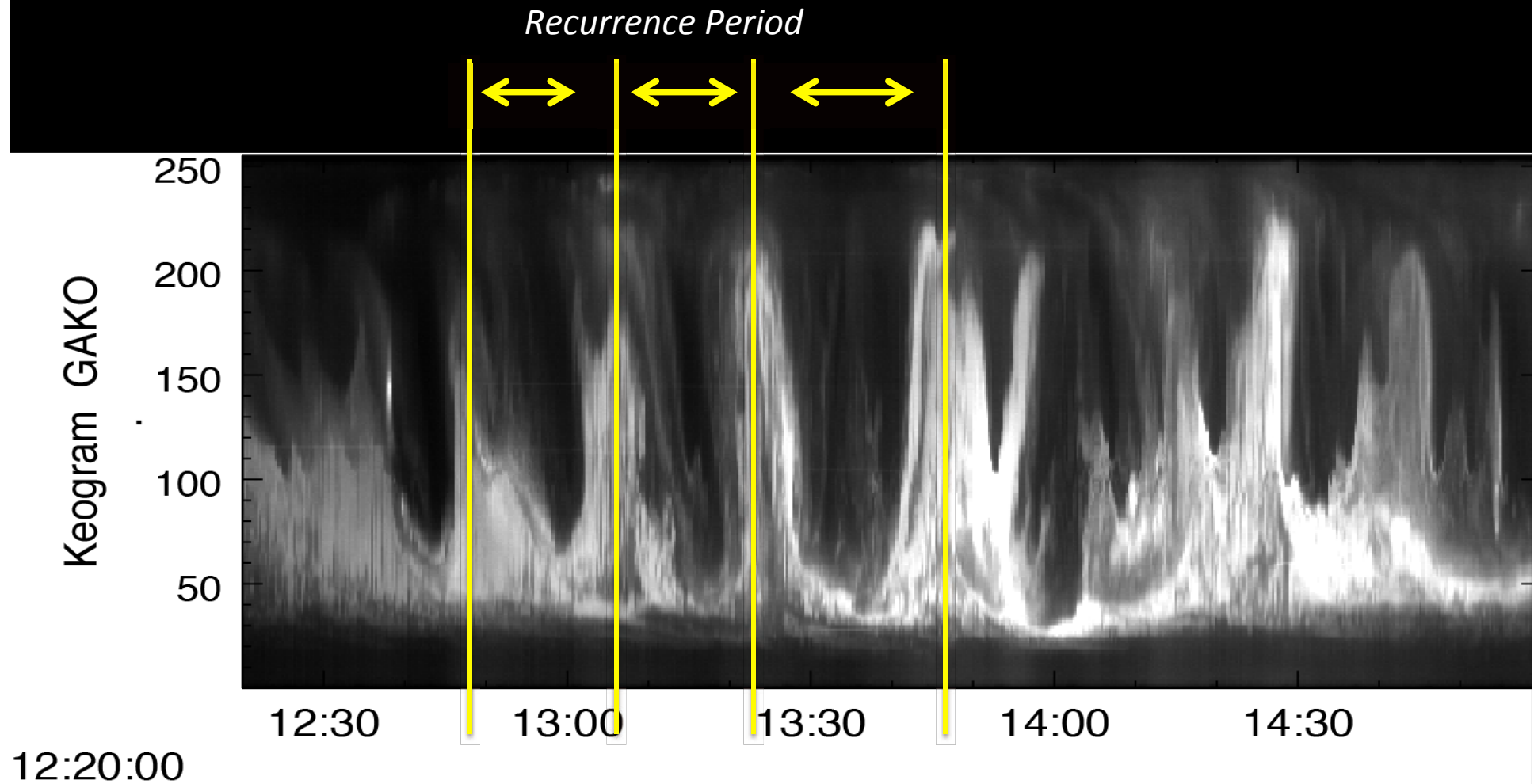


0444

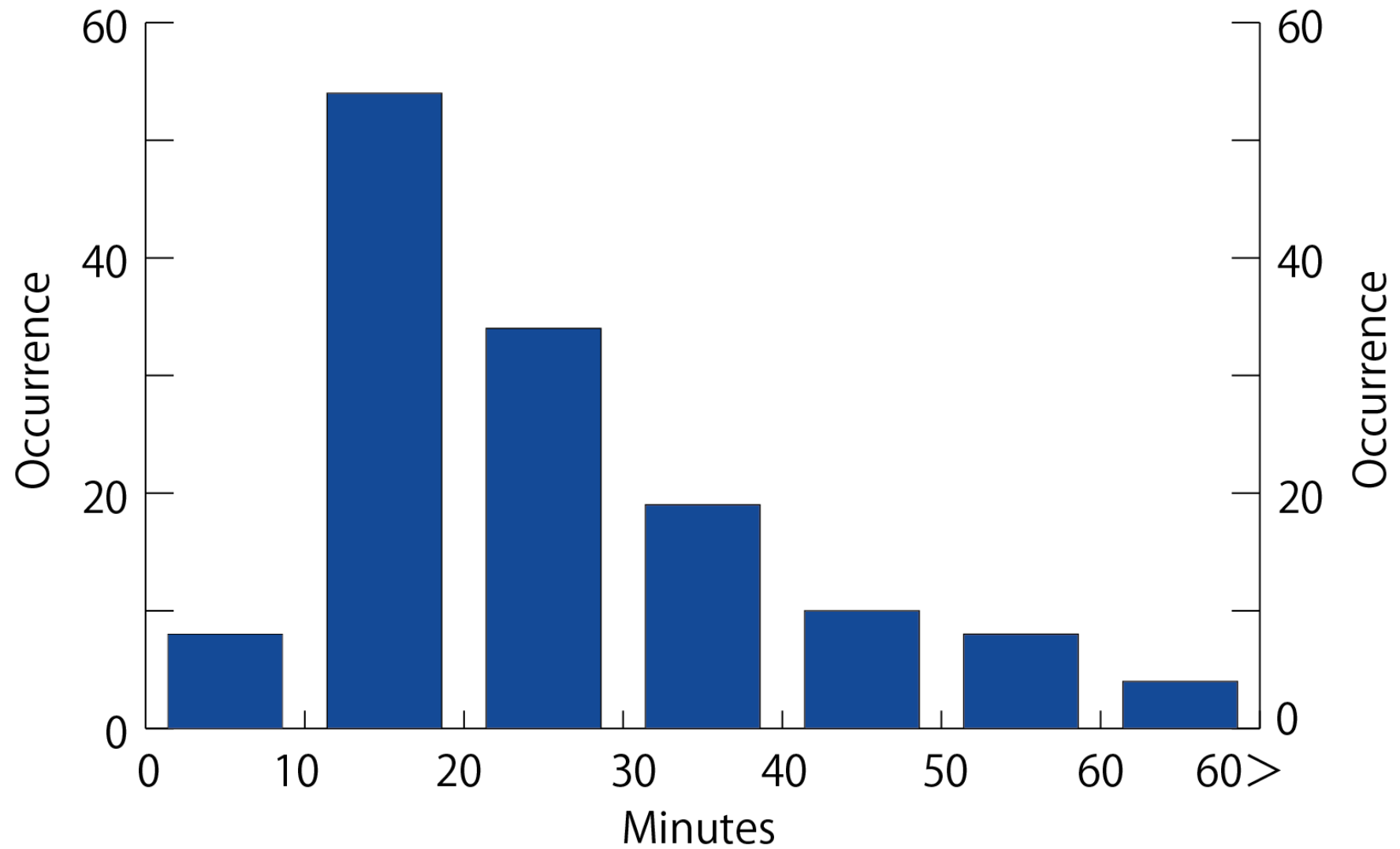
# 統計特性: Duration within a field of view



# 繰り返し周期：Recurrences of Omega aurora

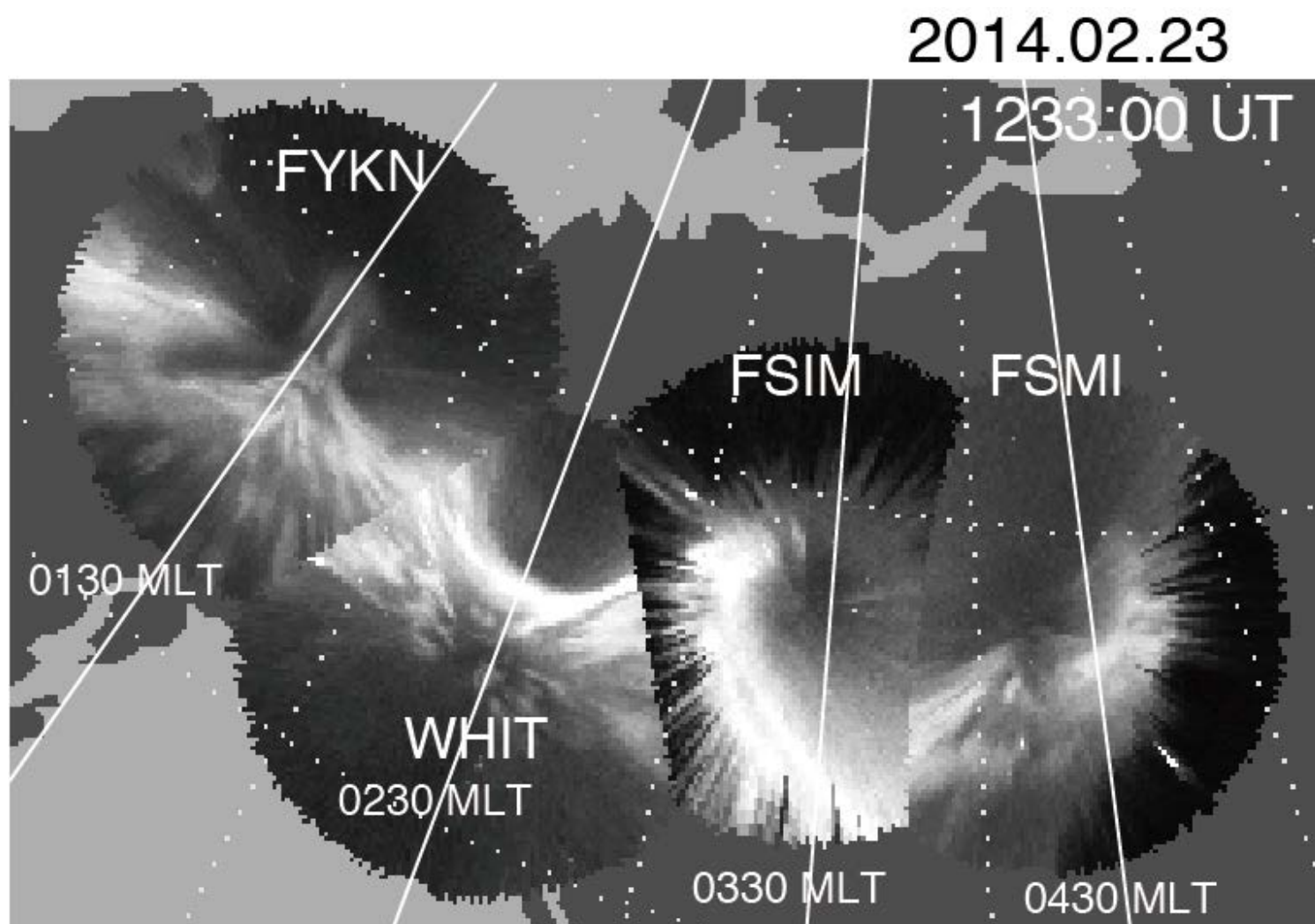


## 統計特性: Recurrence period

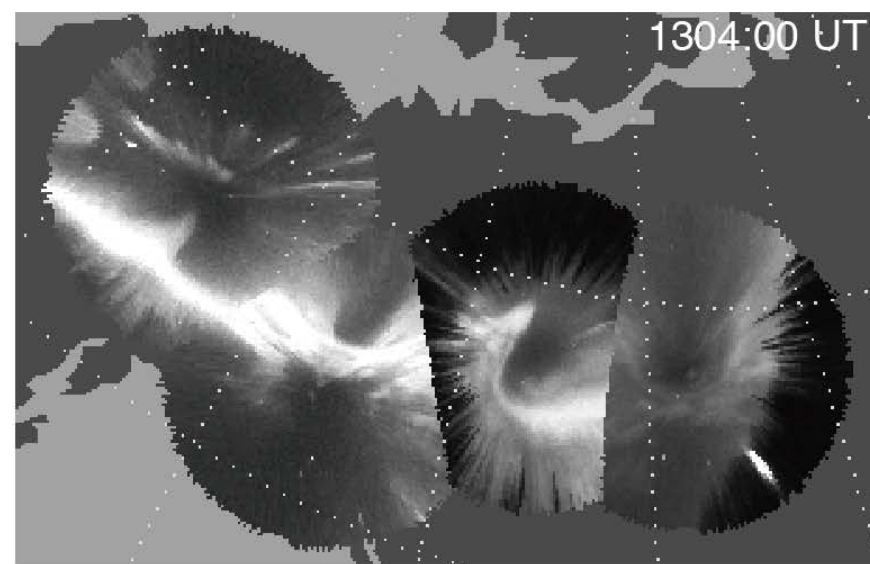
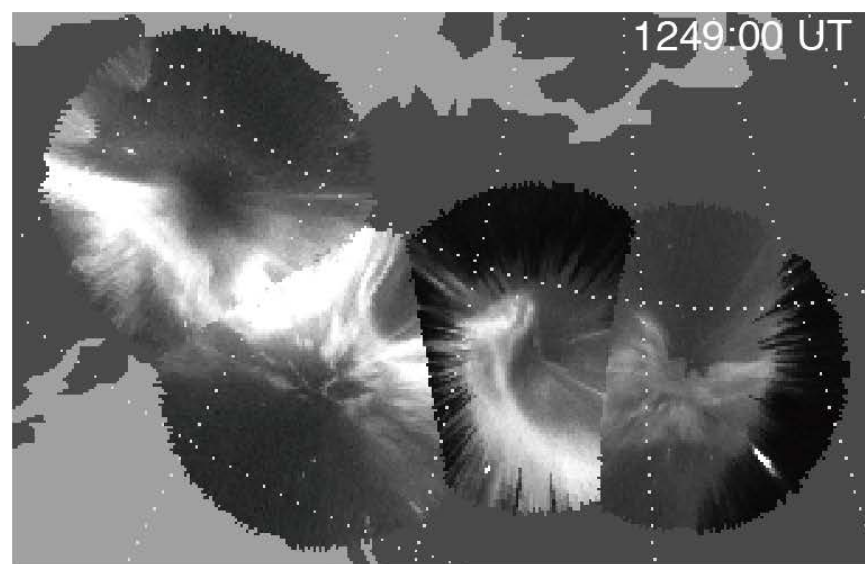
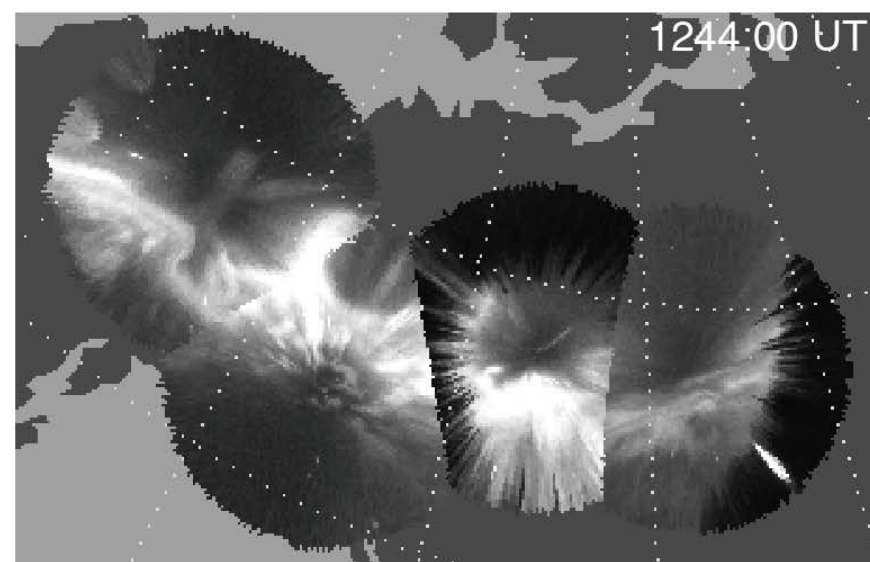
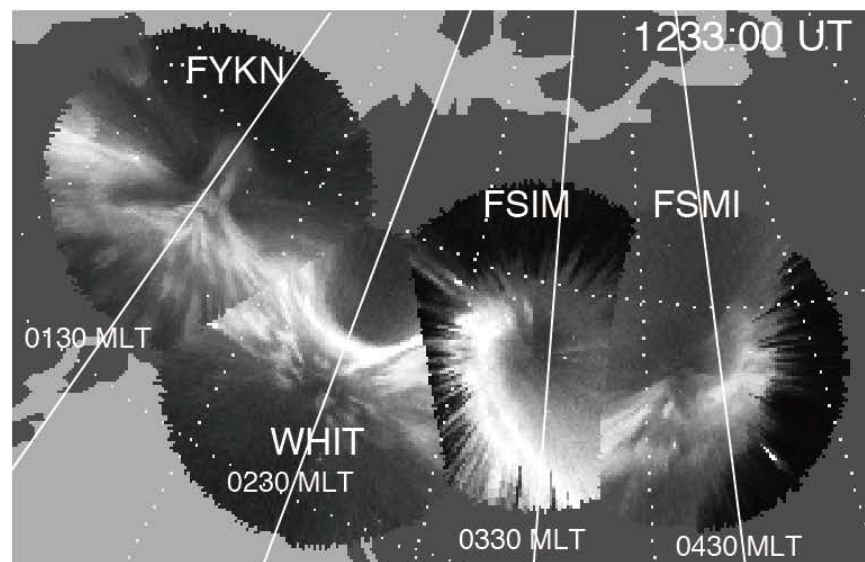




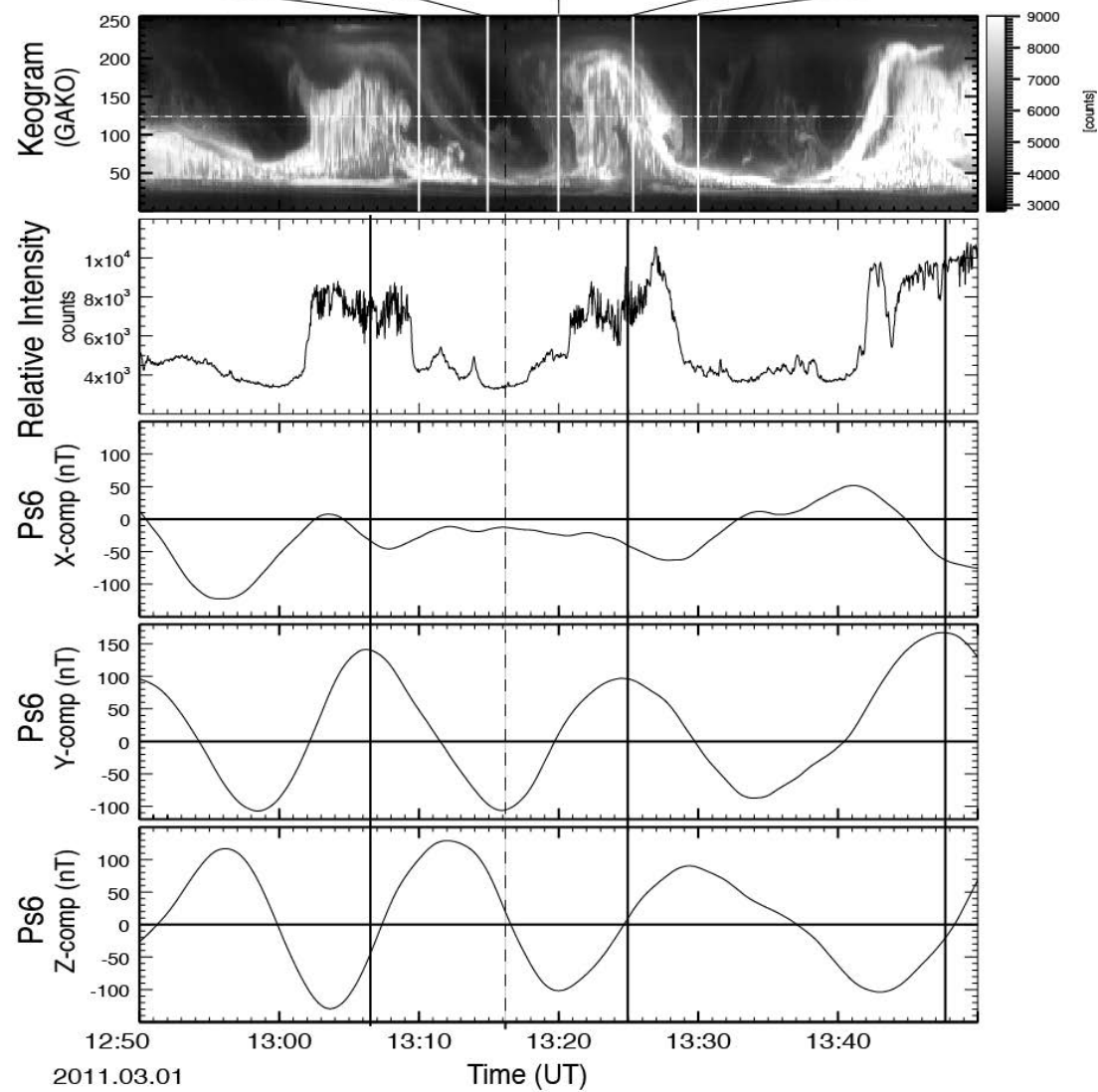
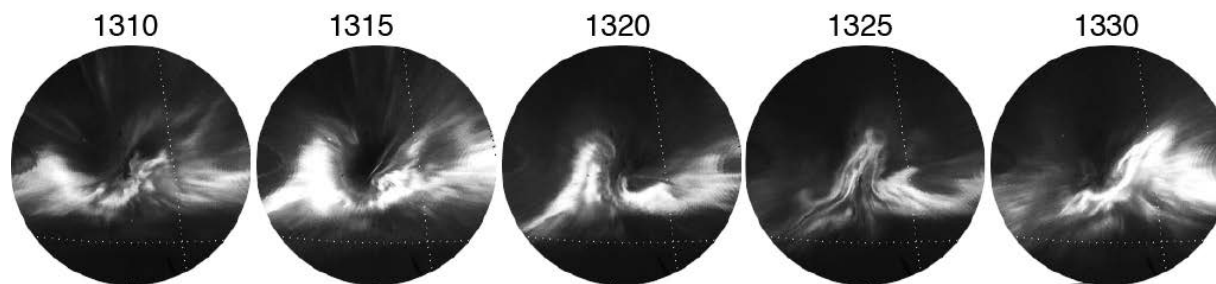
# 多点同時觀測

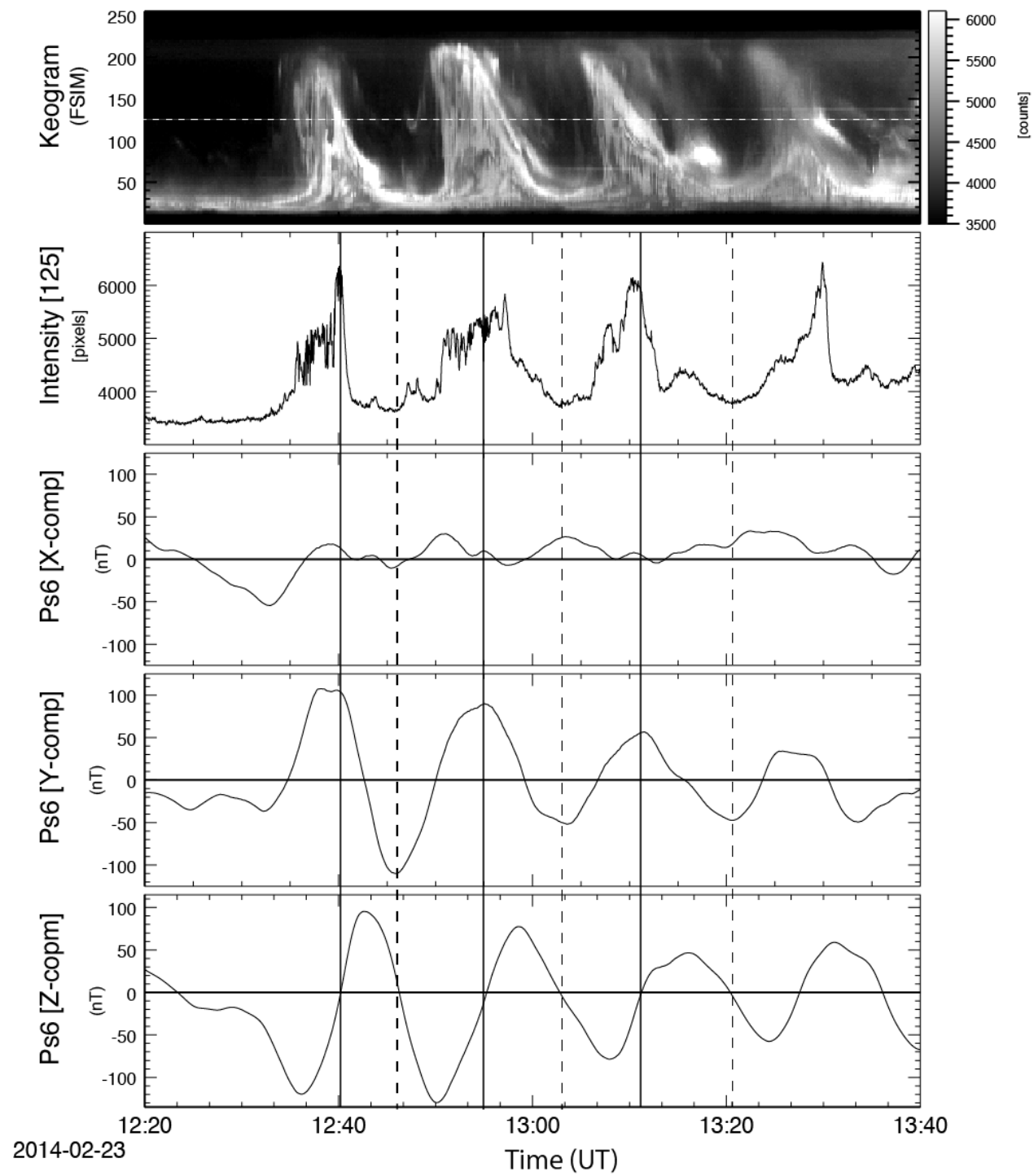


## 多点同時観測例\_オメガオーロラの重なり場面



# Relation between Omega band auroras and Ps6 Magnetic pulsations







# Summary

## *Analyzed Data*

*Picked up ~ 330 Omega event from THEMIS GBO All-sky imager*

## Morphology

- Omega bands and Torches are the same aurora
- Classified into 3 sub-types, O-type, T-type, O/T-type
- Occurrence probability is T-type > O/T-type > O-type
- Growth process is from O-type, O/T type ,then to T-type
- Dynamics of growth signature is not Vortex but Extending

## Statistics

- Eastward drift speed is ~ 400-600 meter/sec
- Duration within the field of view is ~15-25 minutes
- Recurrence period is ~ 10-30 minutes

## Acknowledgements

\* THEMIS Science Support team

**\* IUGONET 開発チーム**

\* ERG-Science Center team



**NiPR**  
National Institute of Polar Research