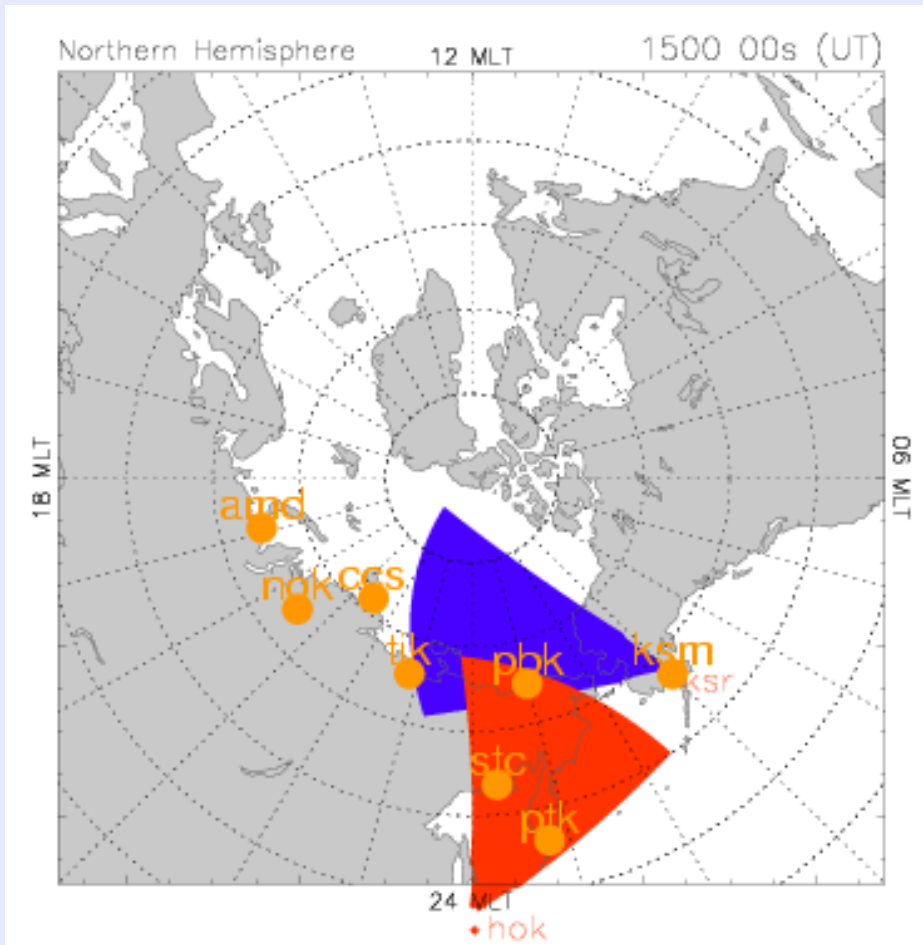


# DP2 variations observed by King Salmon HF radar and NICT Siberian magnetometers

---

T. Hori, T. Kikuchi (STEL),  
K. Ohtaka, M. Kunitake, and S. Watari (NICT)

# Field-of-view of KSR and HOK over NICT-SWN magnetometers



Forms an extensive observation network in the Japanese meridian

KSR: LATmag > 62 deg, E-W flow

HOK: LATmag < 70 deg, N-S flow

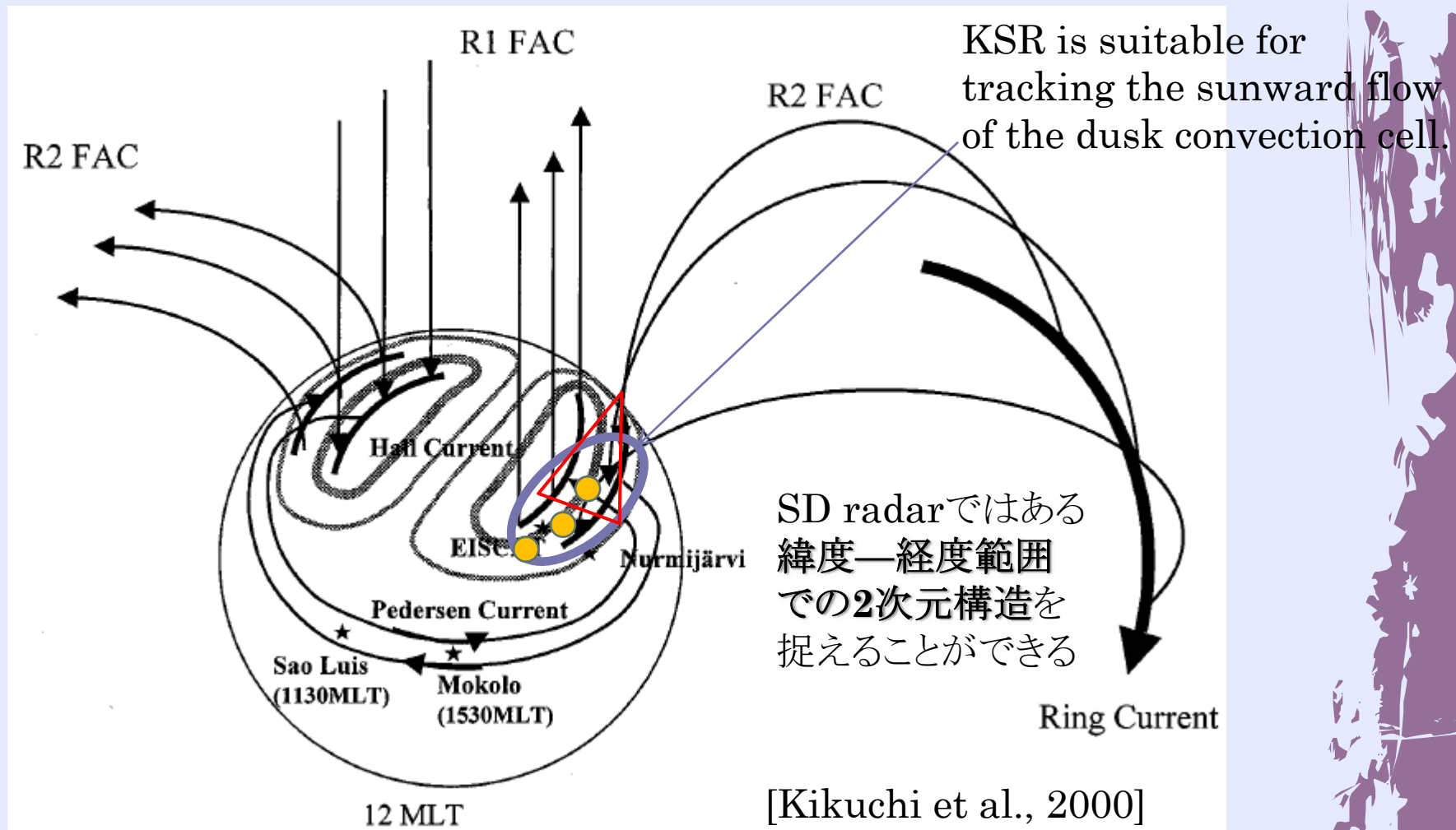
(110 range gate: ~ 83 deg.)

NICT-SWN stations:

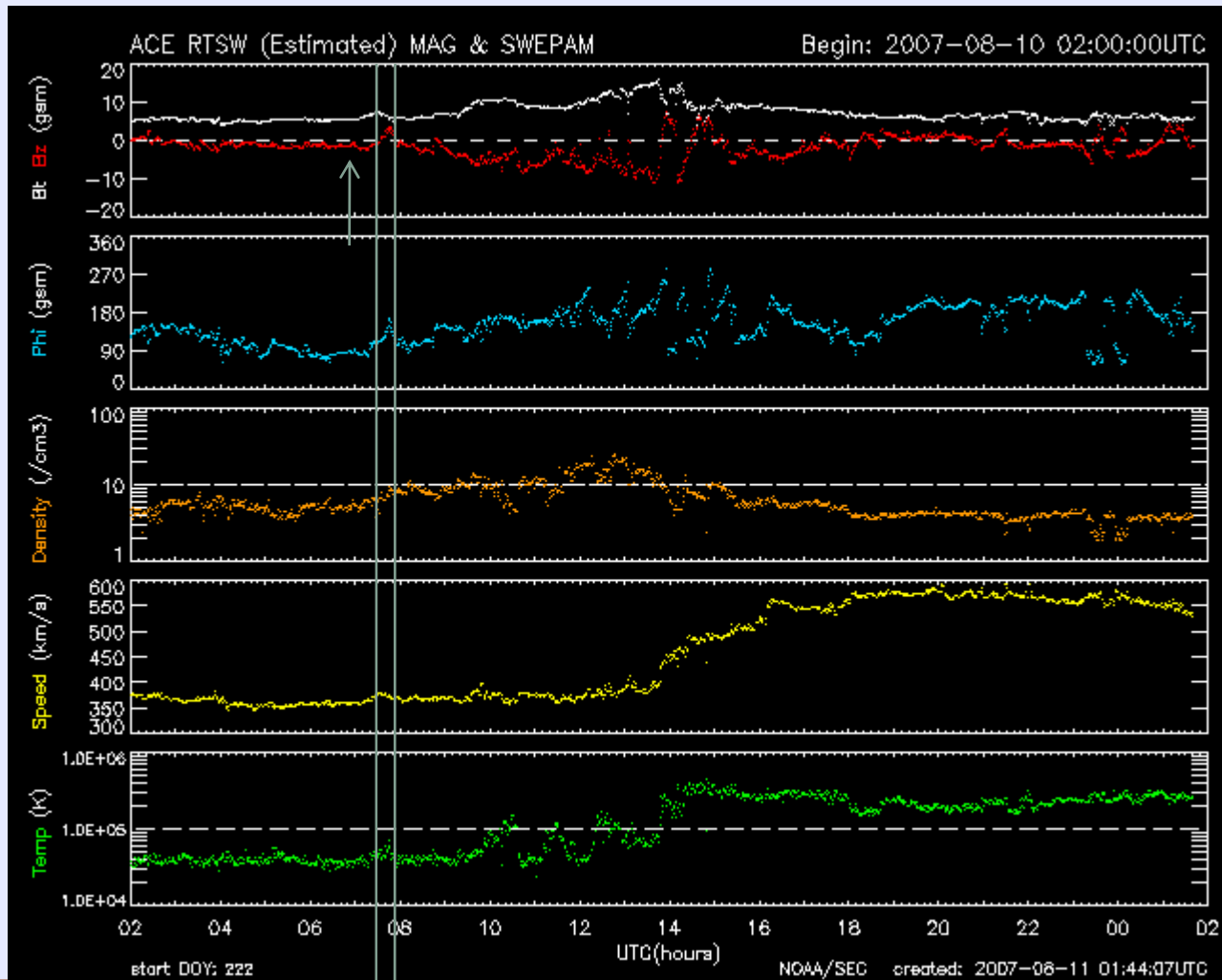
The auroral latitudes along the north Russia

STC, PTK (LATmag ~ 50-55 deg.)

# DP2 convection cell and R1 and R2 FAC



# Solar wind and IMF by ACE



$V_{sw} \sim 350$  km/s (220 Re / 350 km/s  $\sim$  67 min)

A weak storm (min Dst  $\sim$  30 nT) developed after  $\sim$  11 UT

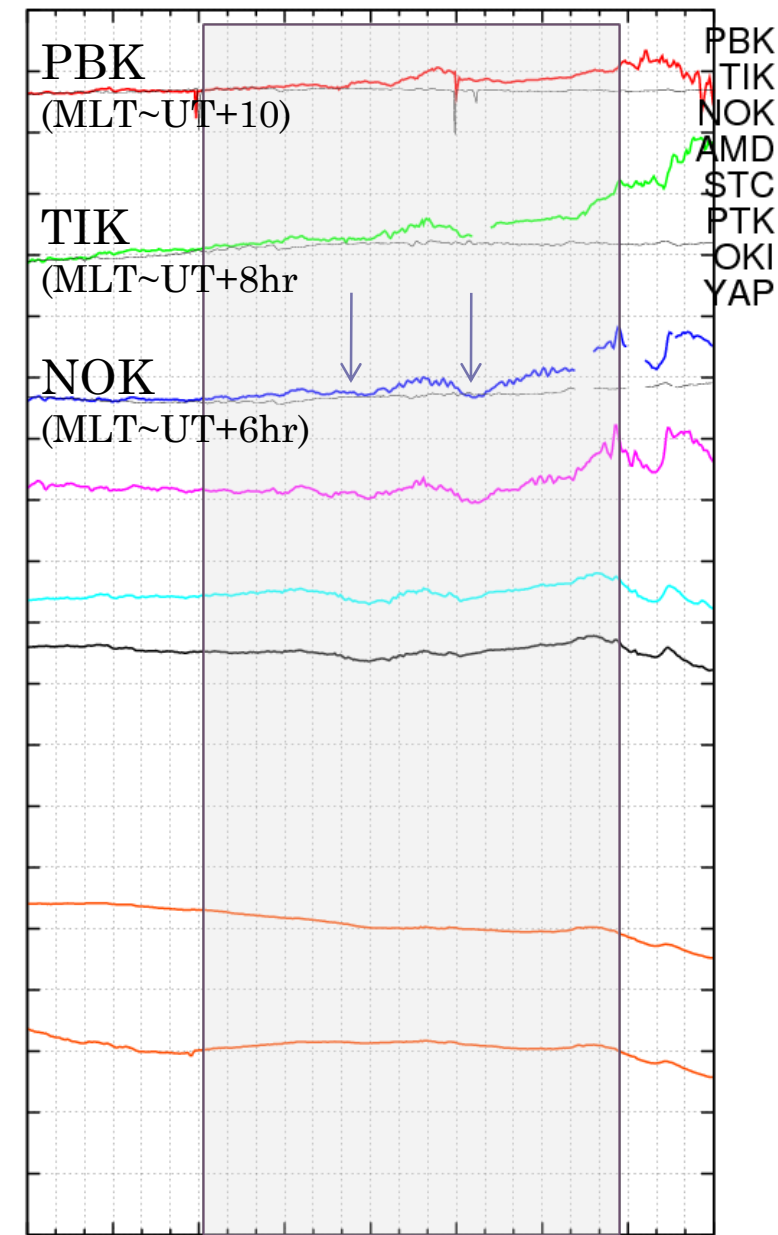
# NICT-SWN

geomag.

stations during

4-12 UT

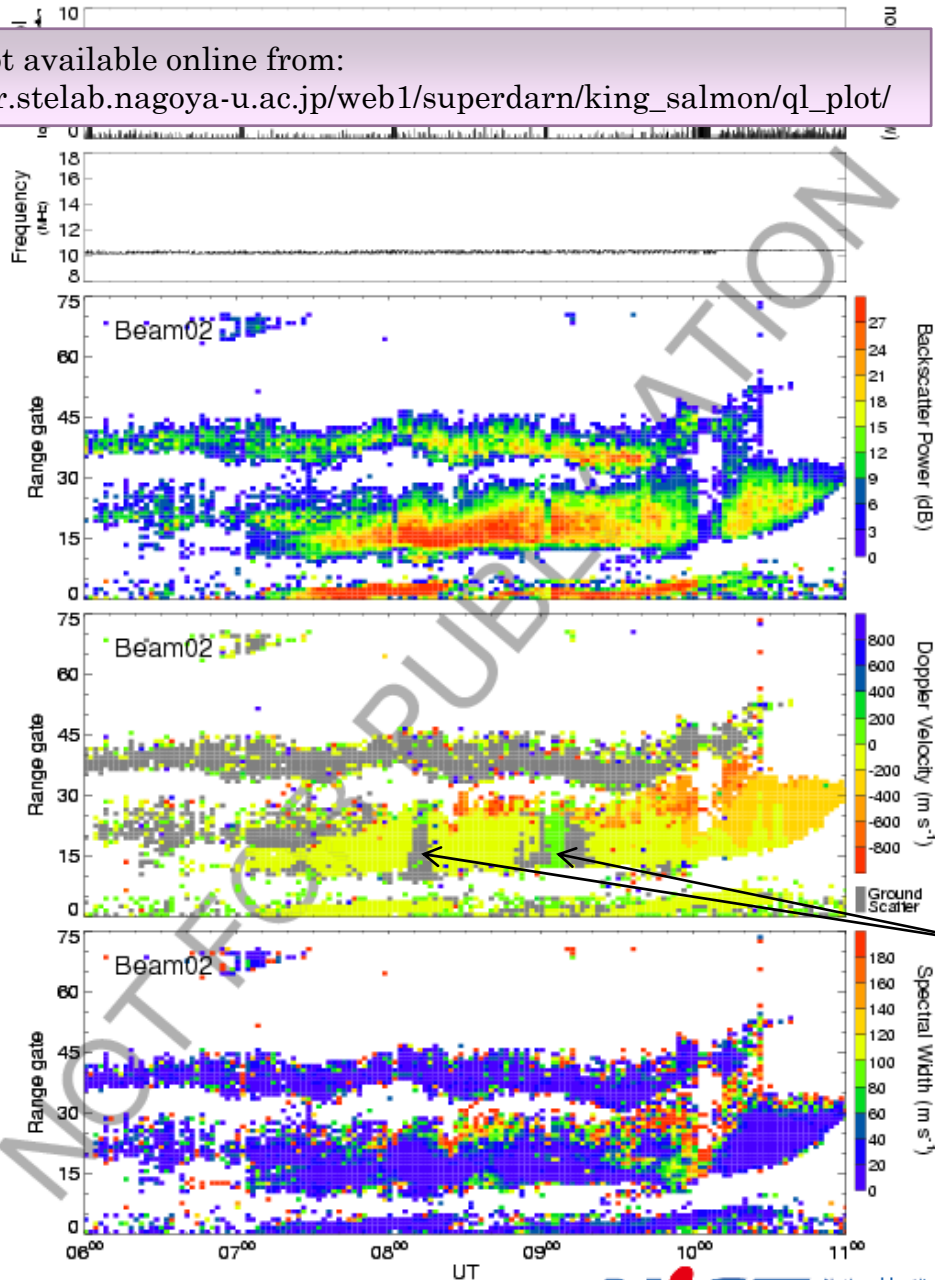
H-component (100 nT/div for PBK, TIK, NOK, 50 nT/div for others)



6 UT以降では基本的にオーロラ帯(PBK, TIK, NOK, AMD)ではH成分が増大している  
 Eastward current (DP2 current)増大  
 → westward convection増大

南向きIMFが弱まる or Northward turningに対応してH成分が一時的に減少に転じている

KSR QL plot available online from:  
[http://center.stelab.nagoya-u.ac.jp/web1/superdarn/king\\_salmon/ql\\_plot/](http://center.stelab.nagoya-u.ac.jp/web1/superdarn/king_salmon/ql_plot/)



# King Salmon 20070810 06-11 UT

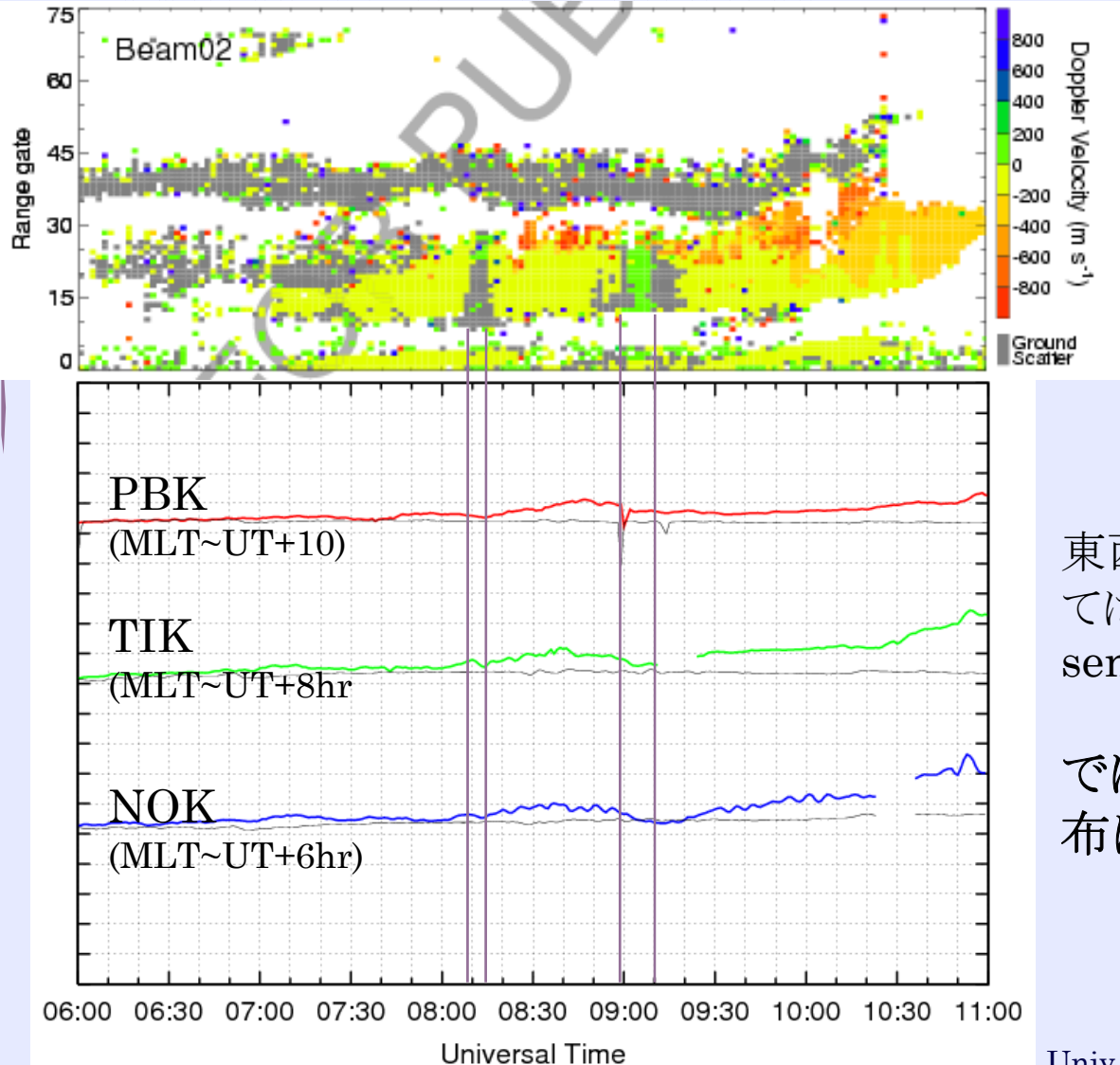
午後-夕方のオーロラ帯の東西方向の対流  
 → DP2 dusk cellのsunward flow (西向きflow)領域

この時は基本的に弱い南向きIMFが続くが、たまに北向き。

対流はほとんど西向き(暖色系)だが北向きIMFに対応して東向き(緑)に変わっているのが見える！



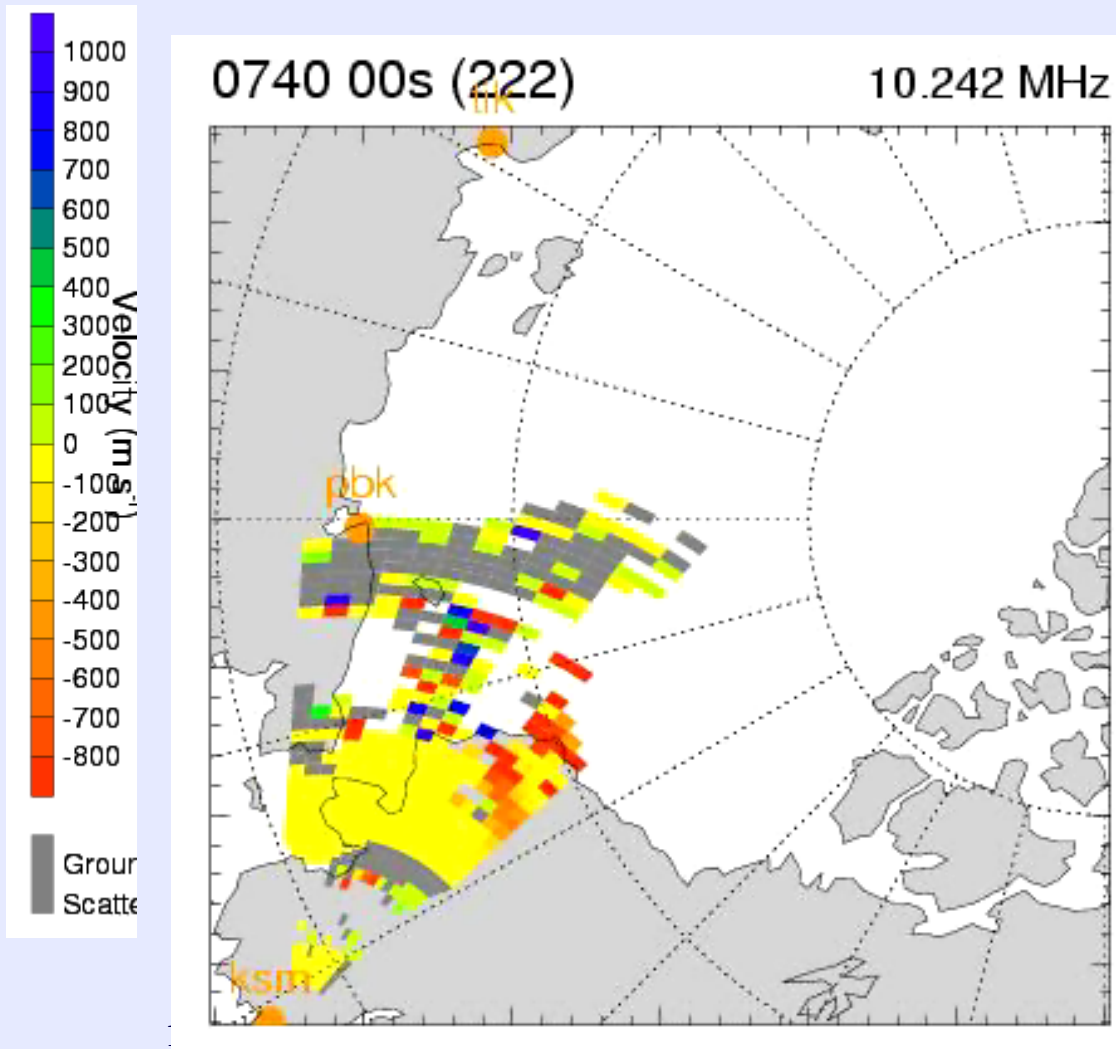
# East-westward ionospheric drift and DP-2 field



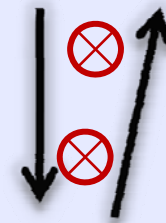
東西方向の速度のpolarityについては、地上磁場と電離圏ドリフトのsenseは合っている

では2次元(緯度—経度)での分布はどうか？

# 2-D structure of the Ionospheric convection observed by KSR radar



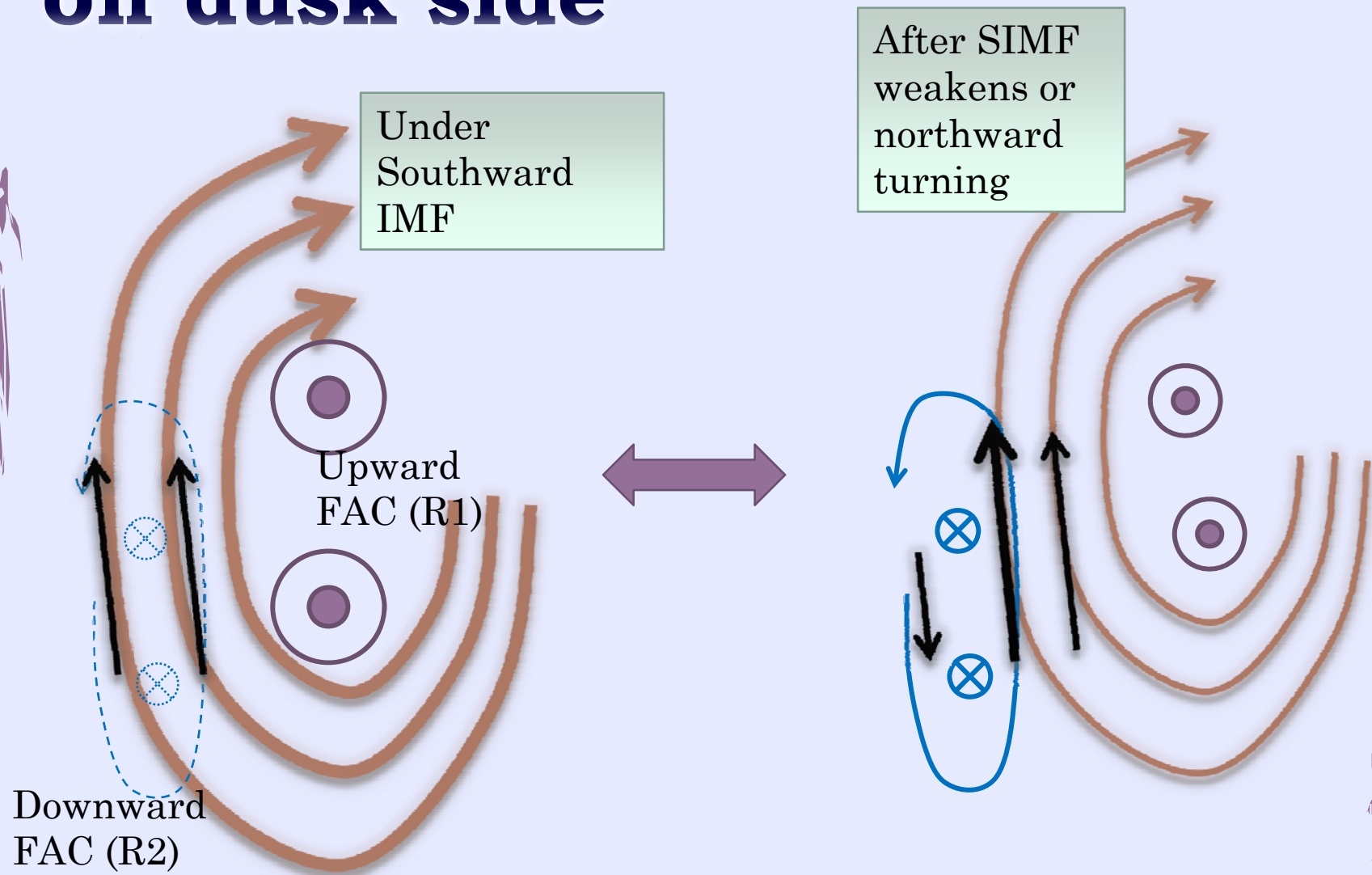
ほとんどの時間、視野内では西向き(away-from-radar) flowだが、8 UT頃、9 UT頃に低緯度側で東向き(toward-radar flow)に方向が変わり、西向きflowの領域は高緯度側のみになるのが見える



Downward FAC  
(R2 sense on dusk side)



# Evolution of R1-R2 system on dusk side



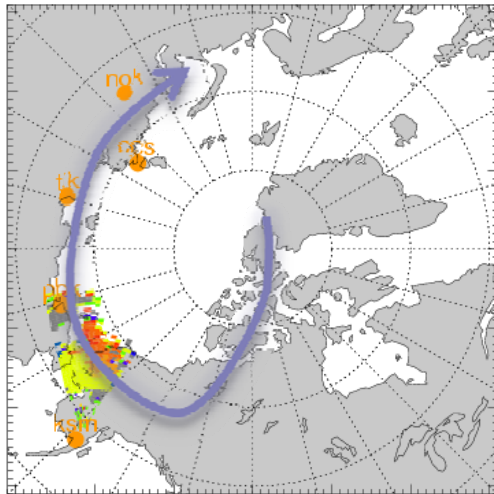
# Variation of DP2 convection

under SIMF

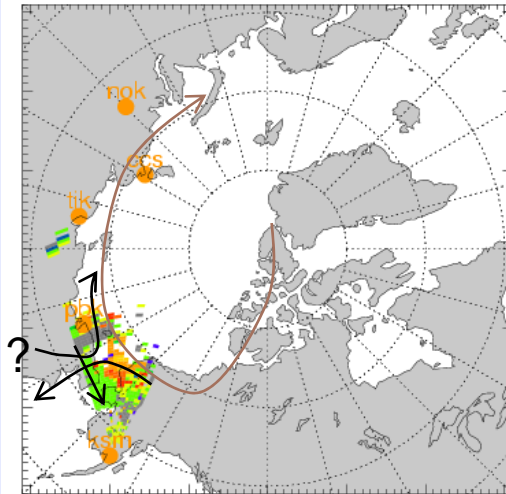
SIMF weakens or  
northward turning

under SIMF again

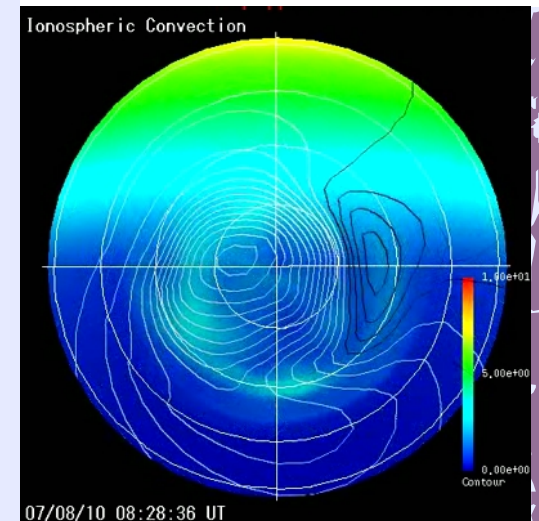
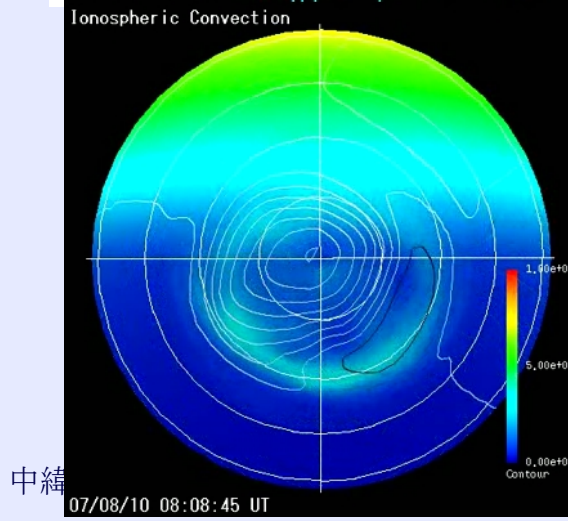
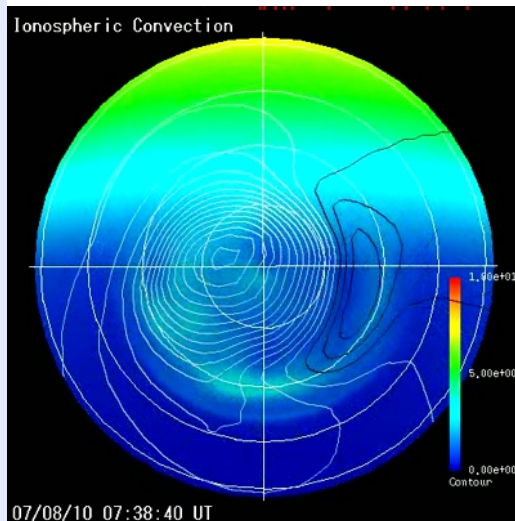
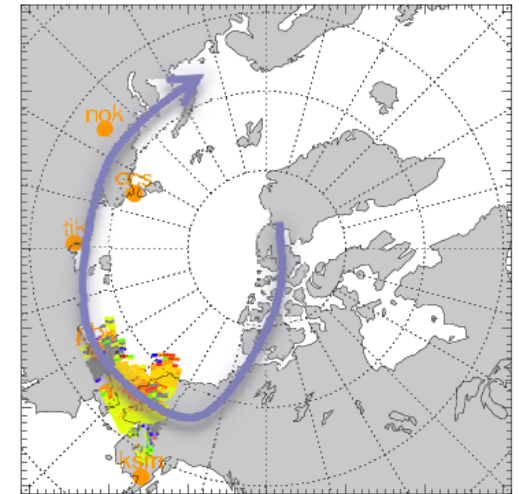
0844 00s (222) 10.308 MHz



0906 00s (222) 10.339 MHz

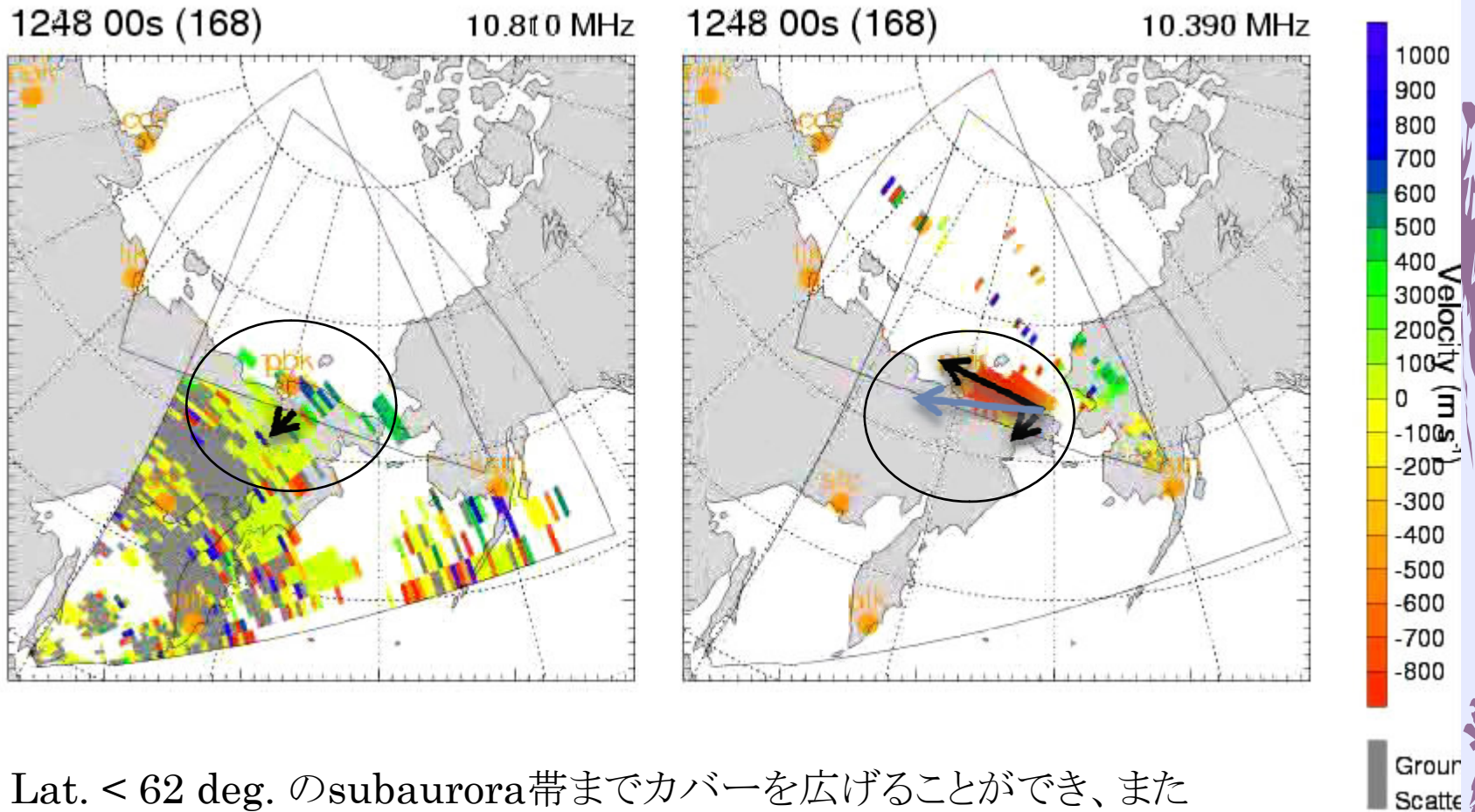


0940 00s (222) 10.343 MHz



中緯

# KSR-HOK joint view



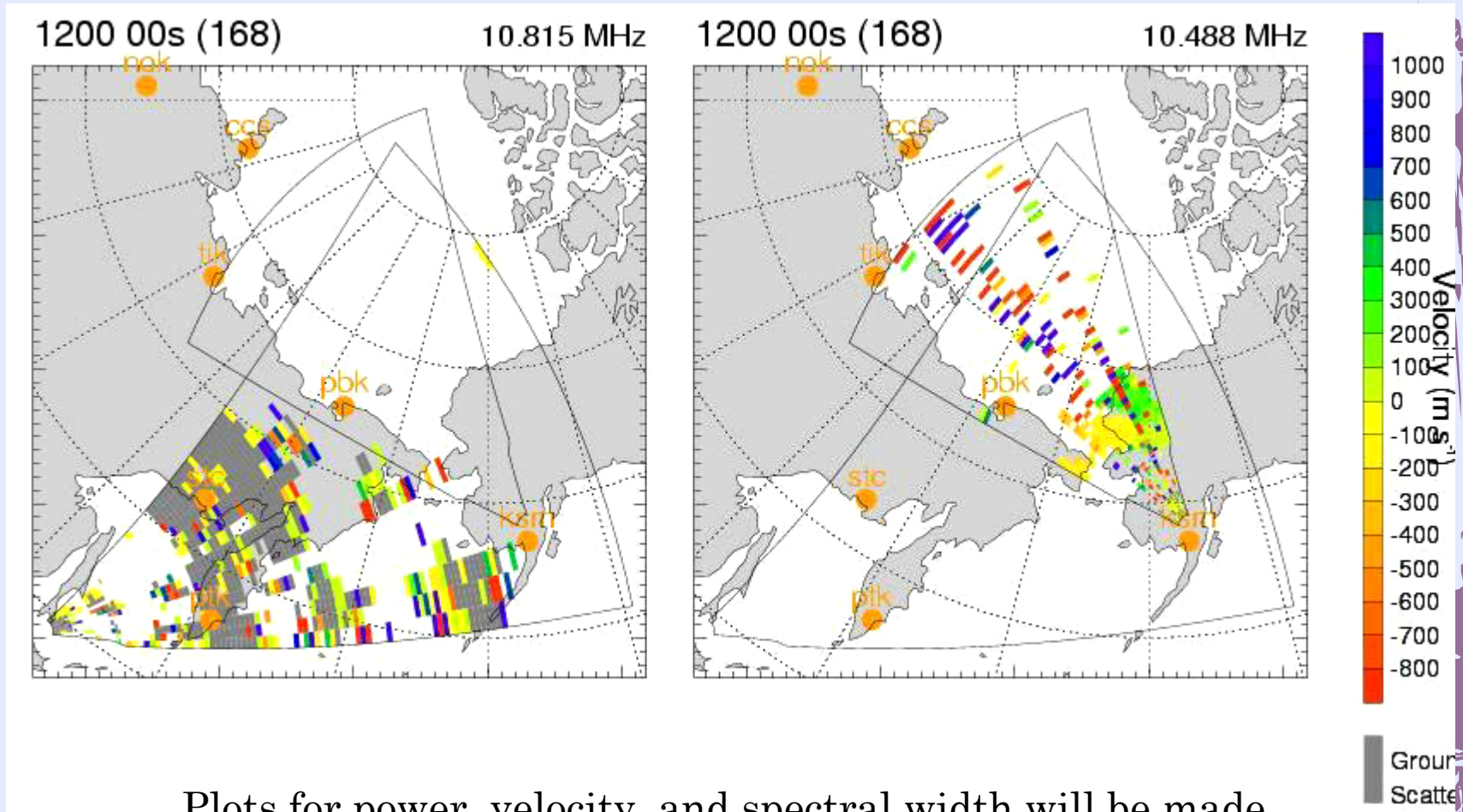
Lat. < 62 deg. のsubaurora帯までカバーを広げることができ、また Merge vectorが得られる(こともある)

# Conclusions

- ◆ DP2 current/convection responds to IMF-Bz variations very sensitively.
- ◆ Both of the R1 and R2 system develop during SIMF. However the R1 FAC-DP2 convection dominates the R2 one.
- ◆ As the SIMF ceases, the DP2 cell rapidly contracts toward high lat., instead the R2 convection cell emerges at lower latitudes. The R1 cell dominates again if IMF turns southward.
- ◆ These changes in spatial structure of convection/FAC occurs on the time scale of ~ mins to ~ 10 min.



# Movie of KSR-HOK joint QL plot will be available online soon ...



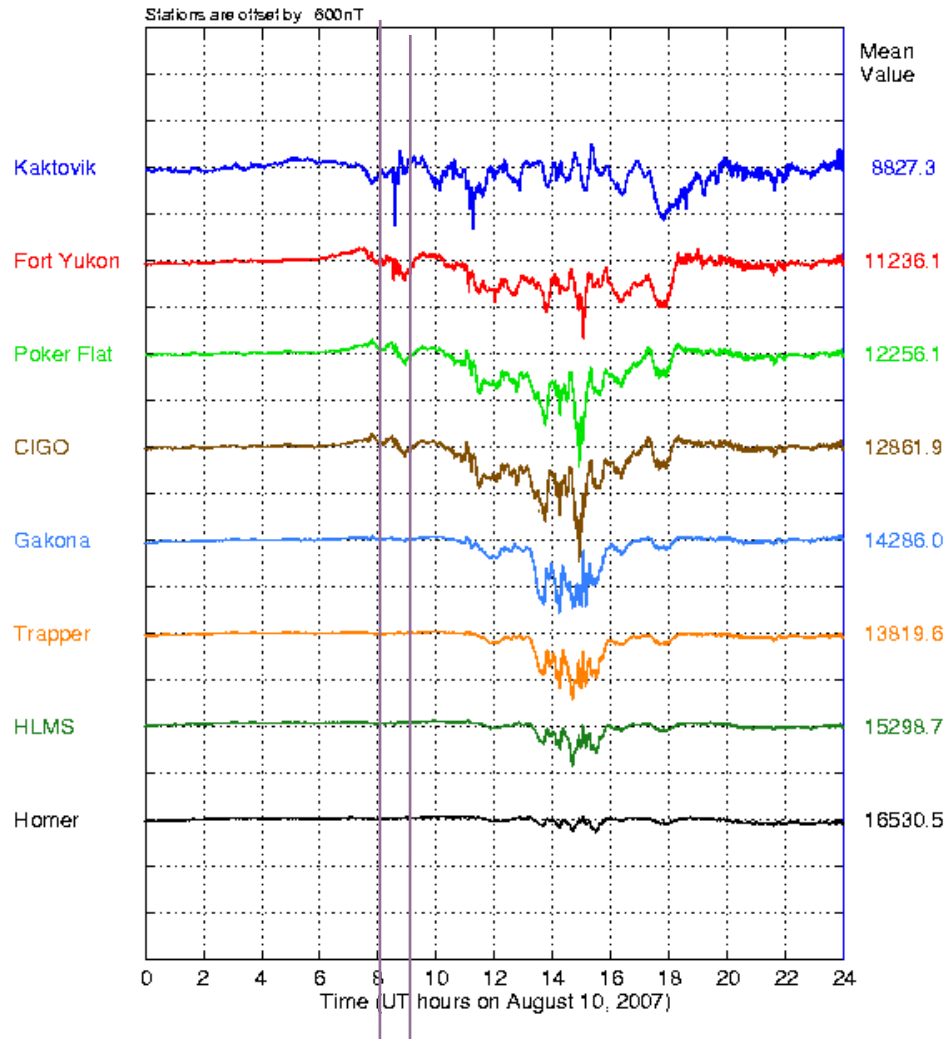
Plots for power, velocity, and spectral width will be made and uploaded every day as the new data arrive.



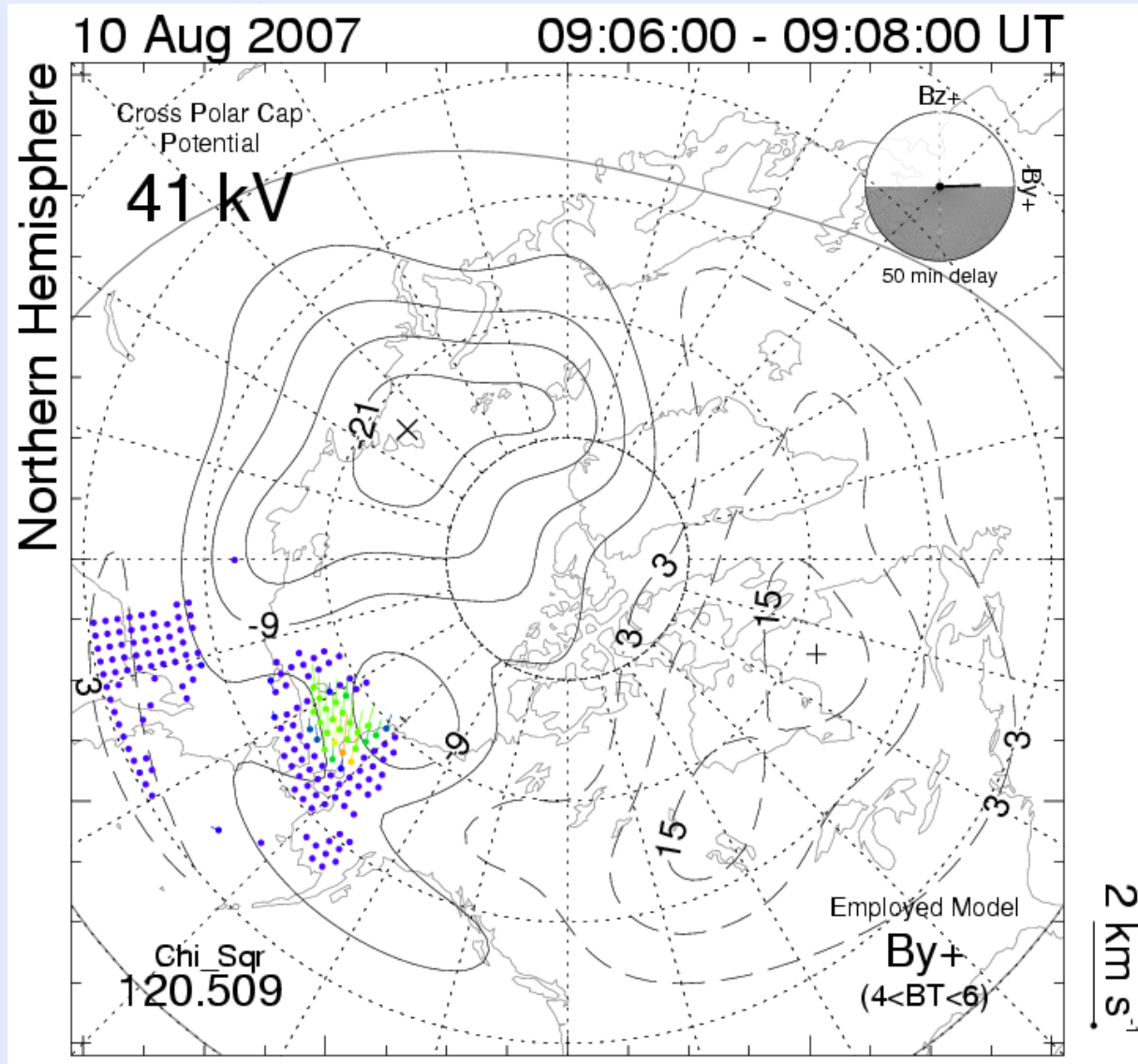




Magnetometer trace, H-comp, in gammas for Day 222, 2007



# Mapped potential with KSR (and HOK)



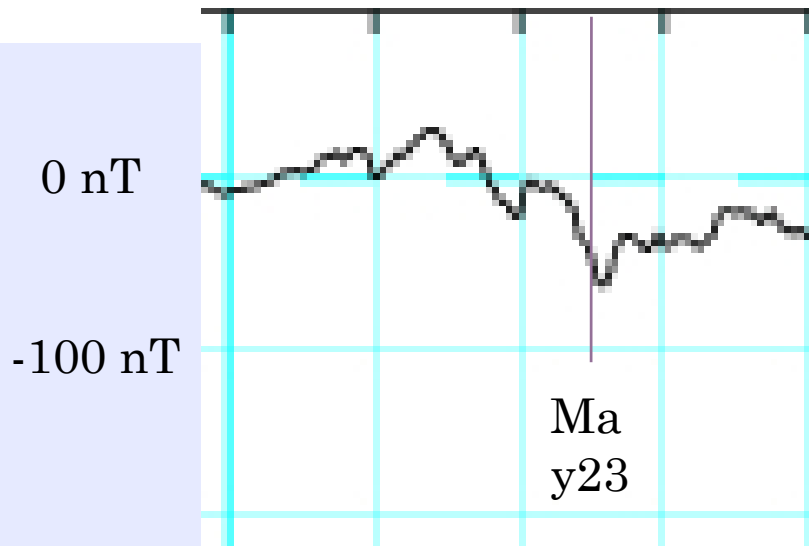
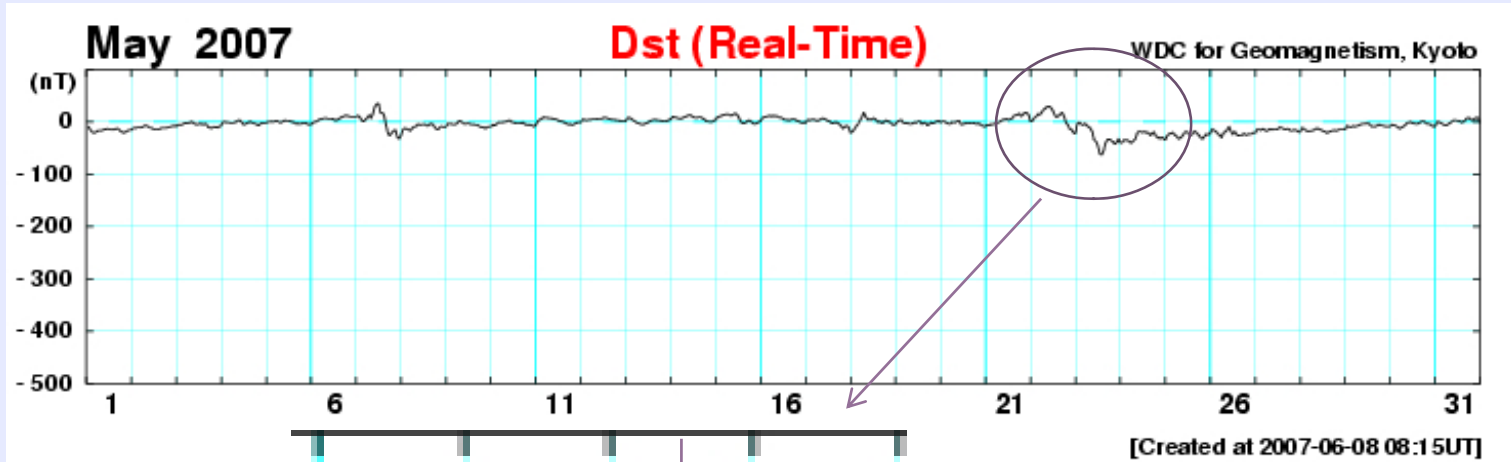




# 23 May 2007 stormの主相序盤で 起こったDP2変動

地磁気とSuperDARNの向きが合わない例？

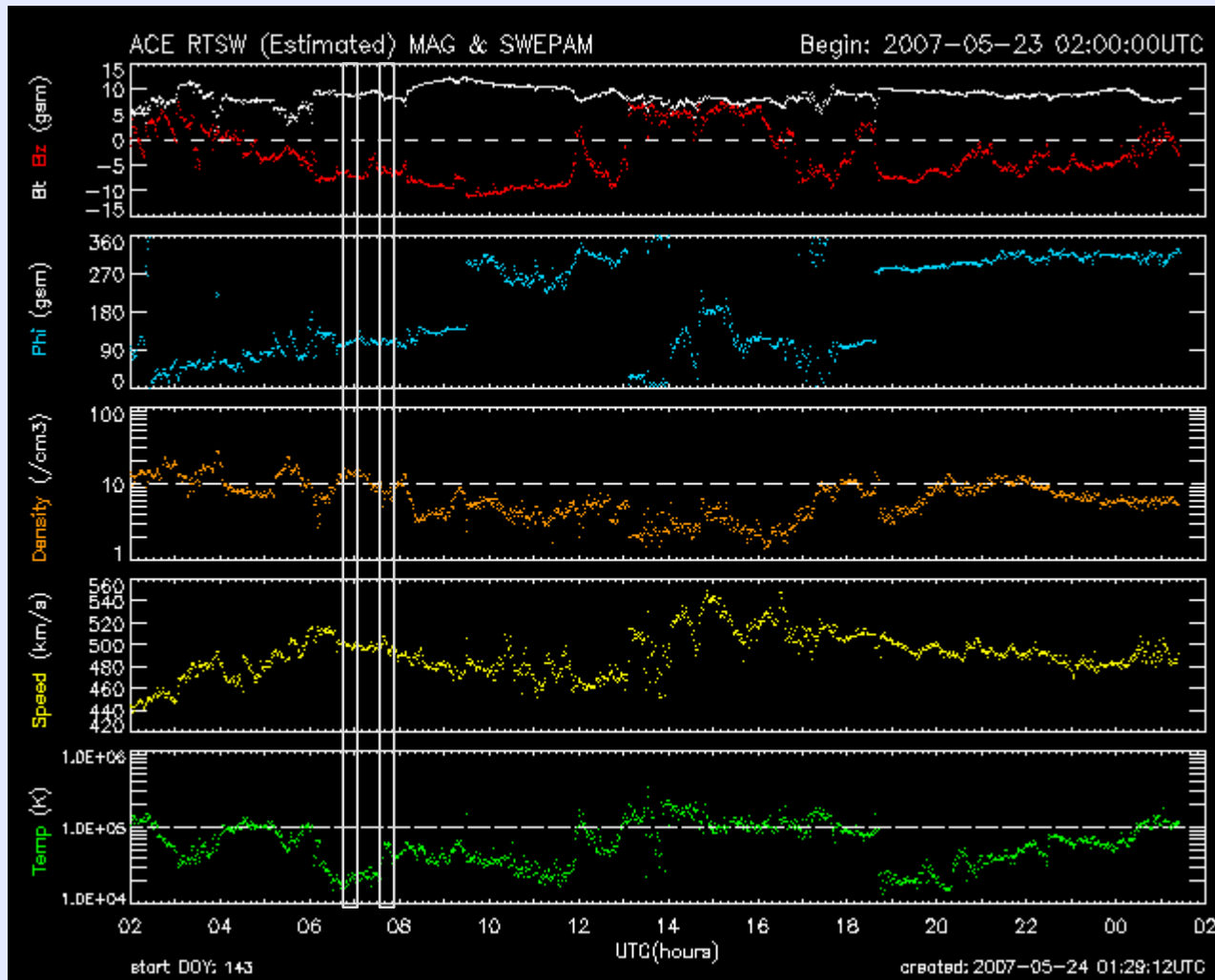
# Dst variation during the storm



Storm start: about 5 UT

Dst peak  $\sim$  -63 nT at 13 UT

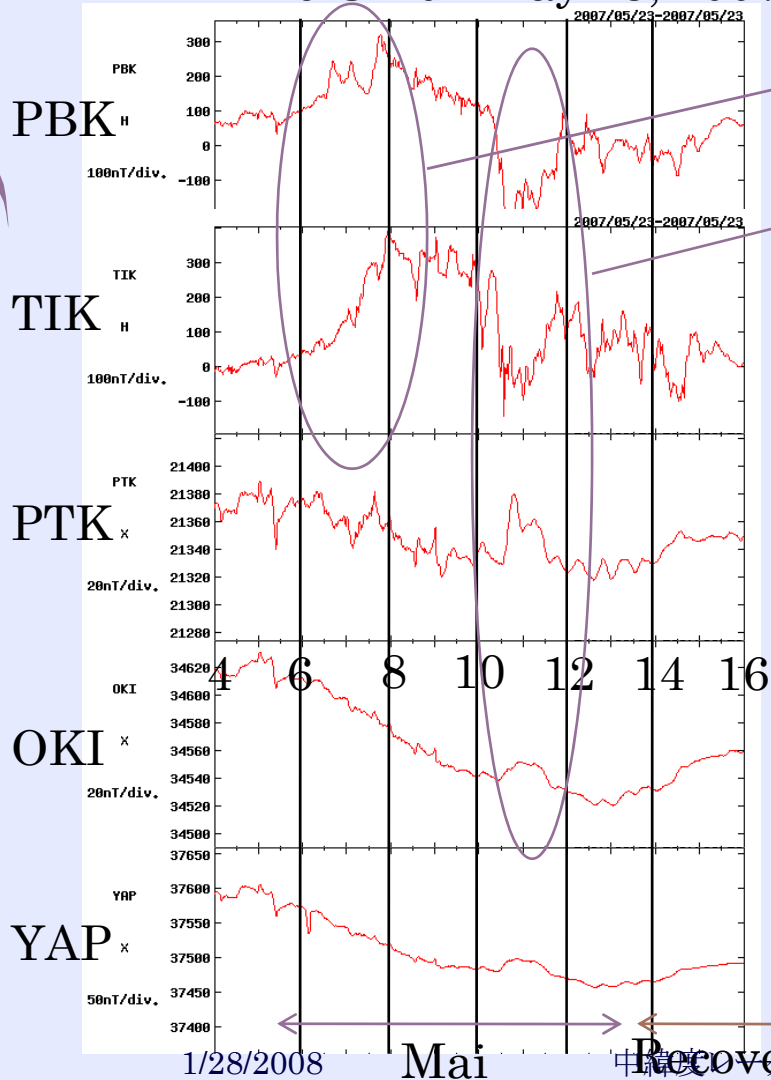
# Solar wind and IMF



0730—0750 UT on the Earth → 0643—0703 UT at ACE

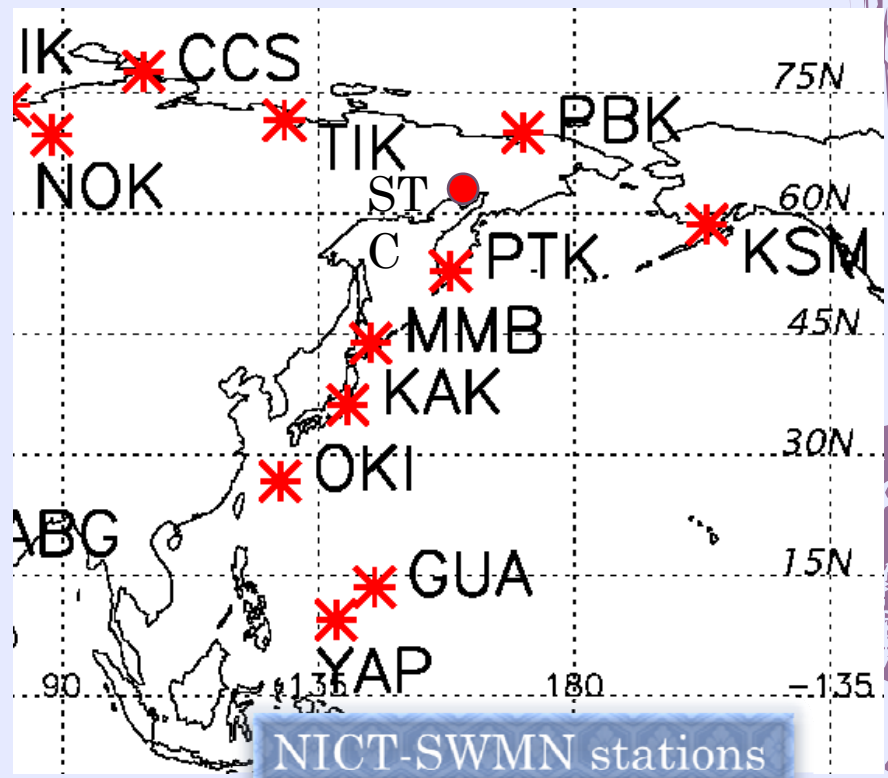
# NICT-SWMMN stations

4—16 UT on May 23, 2007



DP2  
enhancement

Storm-time substorm



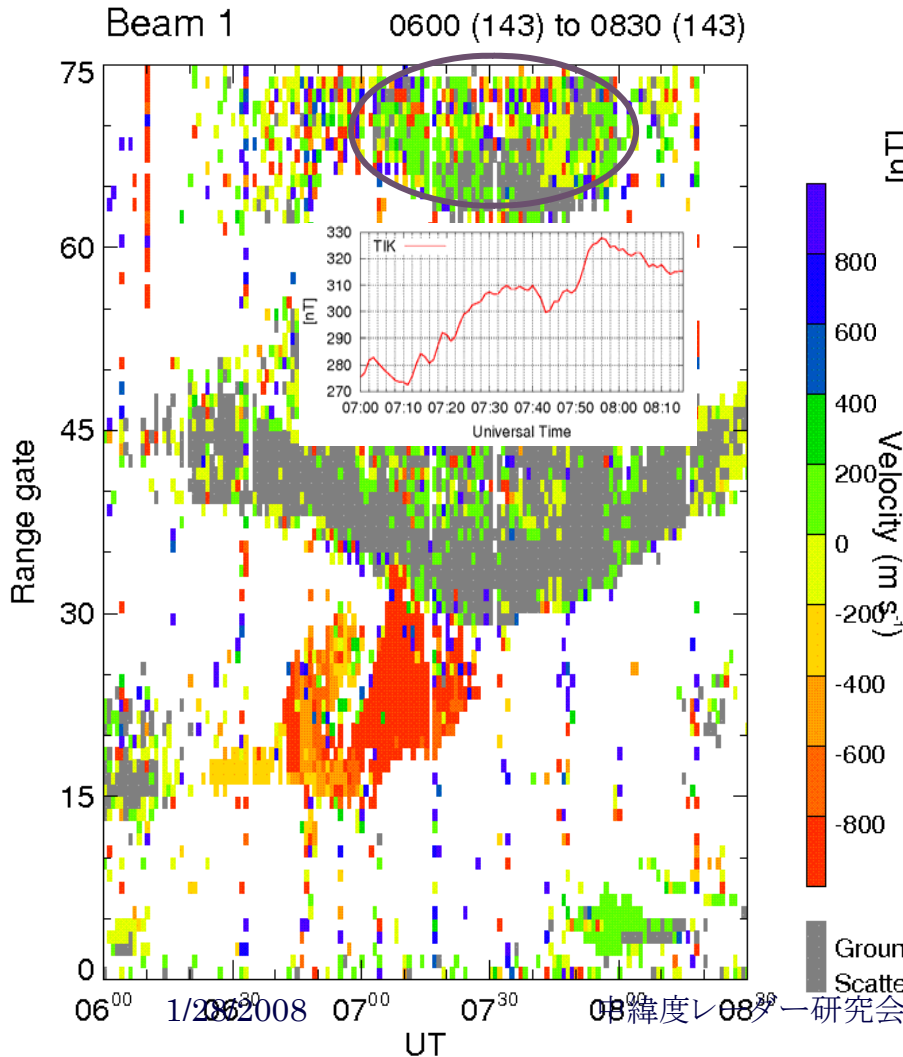
# KS radar for 0600—0830 UT

## SUPERDARN PARAMETER PLOT

23 May 2007<sup>(143)</sup>

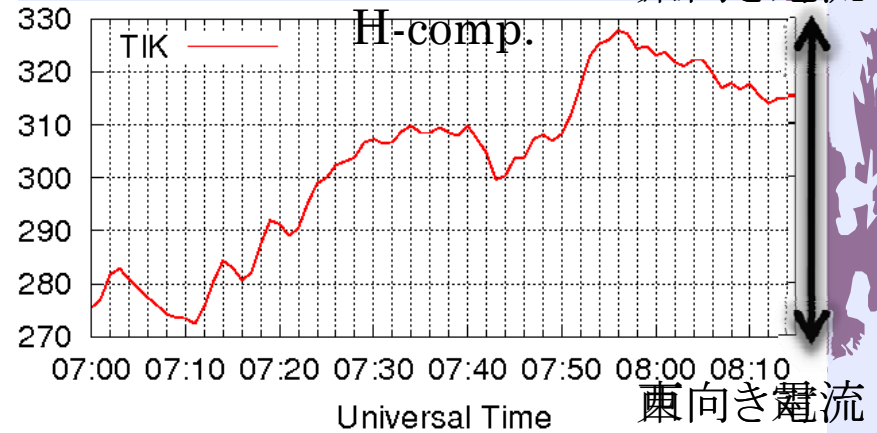
King Salmon: vel

fast normal sound (cw) scan mode (157)



TIK: MLT~15.5-16.5

東向き電流



KS line-of-sight velocity

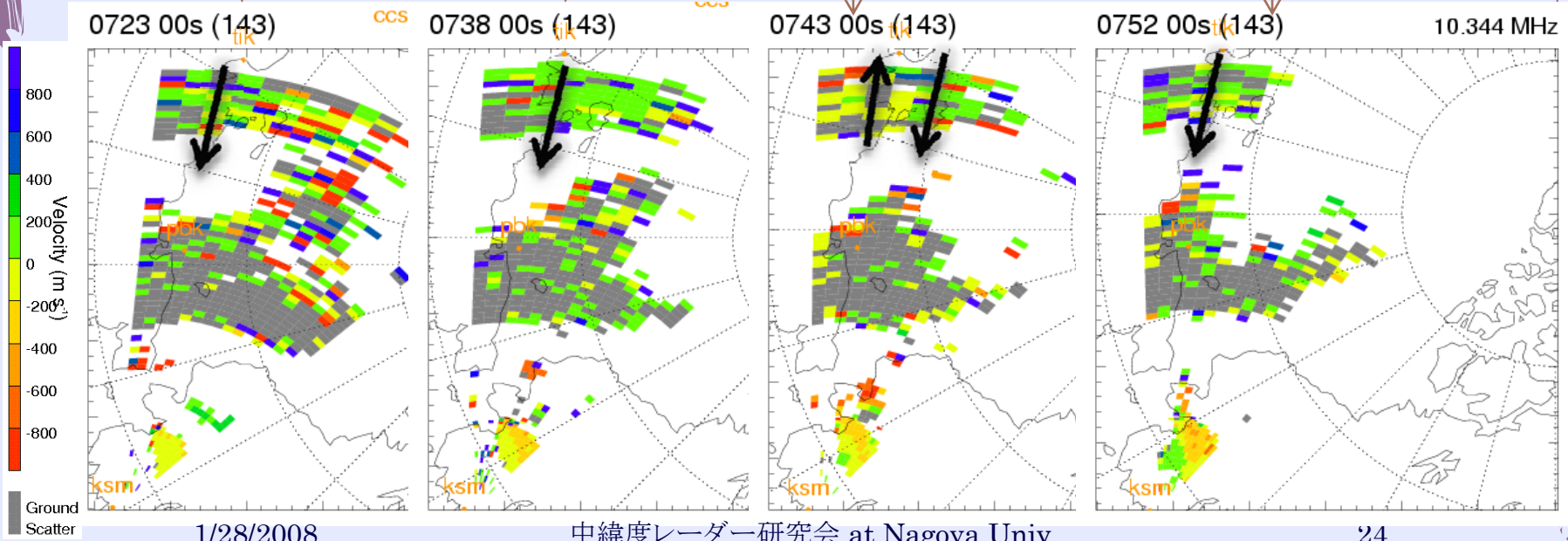
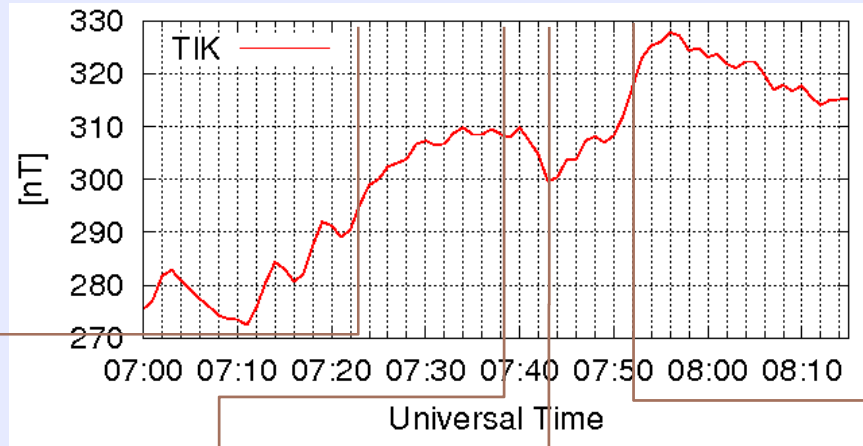
緑: 東向き対流 (toward radar)

黄: 西向き対流 (away from radar)

実際のSD-observed 対流は、Hall current assumptionによる対流の向きと反対！



# KS radar during 0700-0815 UT



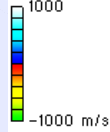
1/28/2008

中緯度レーダー研究会 at Nagoya Univ.

24

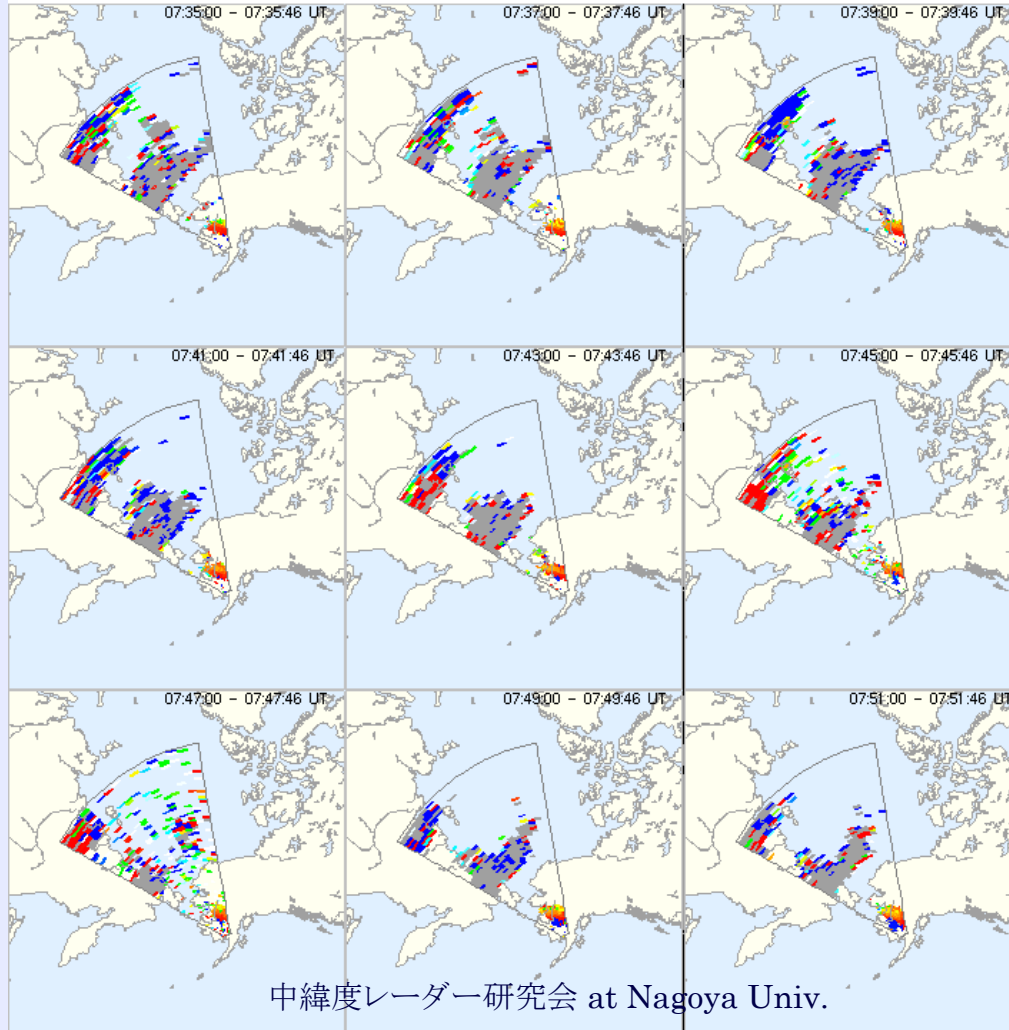
# Pacemap generated on JHU/APL/UD

SuperDARN  
JHU/APL Software by R.J.Barnes

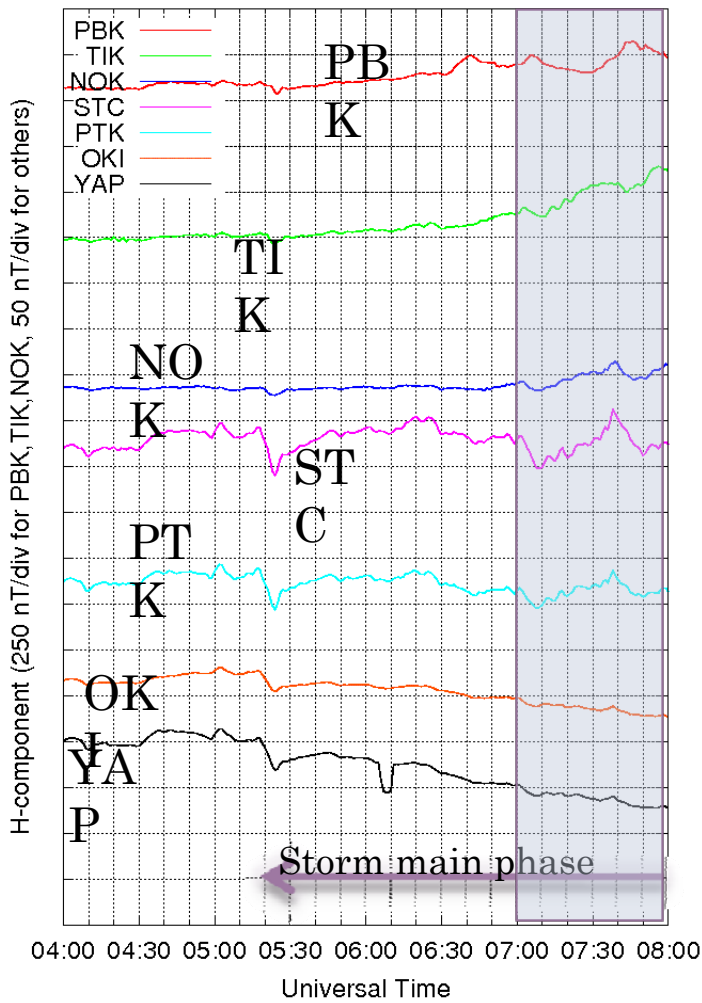


Geographic

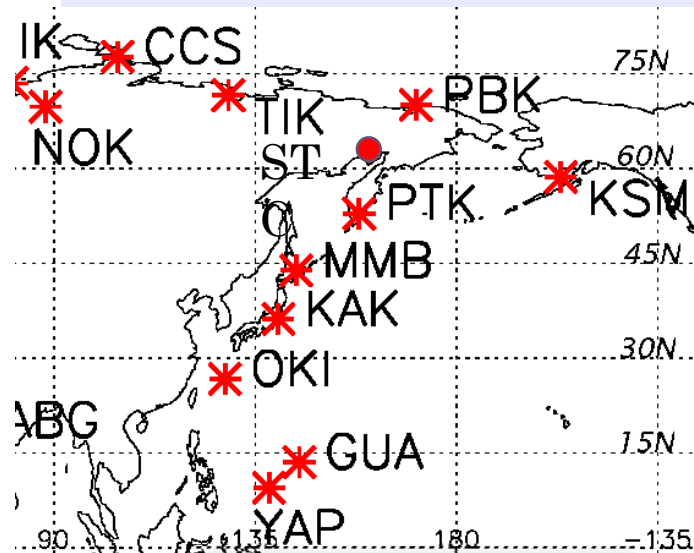
<http://superdarn.jhuapl.edu>  
23 May 2007 20070523 07:35:00 - 07:53:46 UT  
Station: King Salmon (ksr)  
Operated by: CRL  
Program ID: 157  
Parameter: Velocity  
Revision: 1.1



# KS and TIK during 0700—0815 UT



Mid-latitudesのSTC, PTKでもかすかにDP2 enhancementに対応する $\Delta H(>0)$ が見えている(0710-0740)  
 →TIK辺りがdusk cellのsunward convection部分に対応するはずなのだが...



# 問題を整理

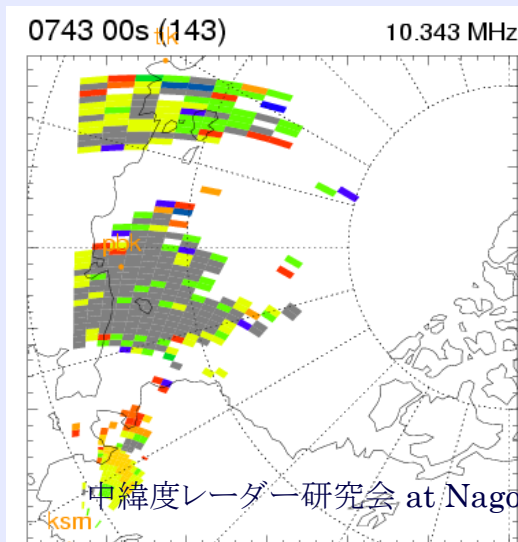
Storm main phaseでDP2 currentが発達中であり、TIKではそれに対応するeastward current (from geomag.)が見えていた。しかしTIK上空の電離圏対流も基本的には同じ向きのeastward convection (from SuperDARN)だった。

→Hall current assumption is not valid??

07:43 UT前後の数分間のみDP2 currentが弱まっている。それに呼応するようにconvectionはshear構造となり、TIK辺りでは高緯度側でeastward convection, 低緯度側でwestward convection

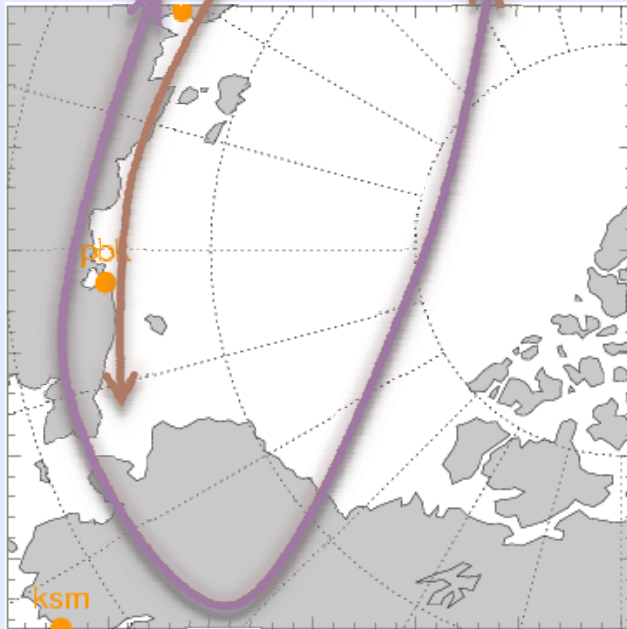
→R1-dusk cell(upward FAC)的な構造が短時間ではあるが形成

→What is this?



# 問題を整理

DP2 Eastward current  
current (dH > 0) convection



Convection  
observed by SD

