北海道-陸別短波レーダーで観測された SAPS/SAID構造中の長・中・短周期変動

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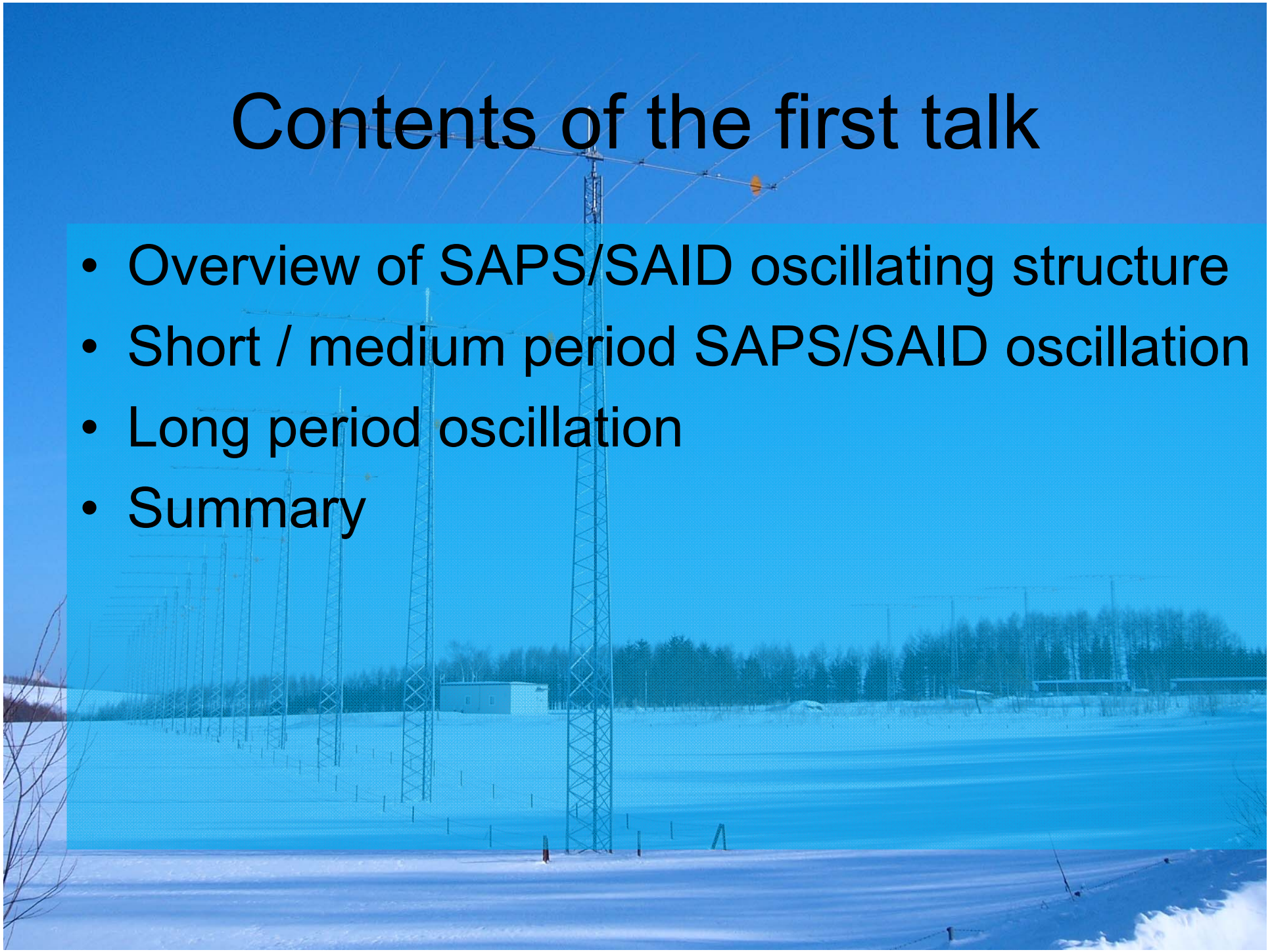
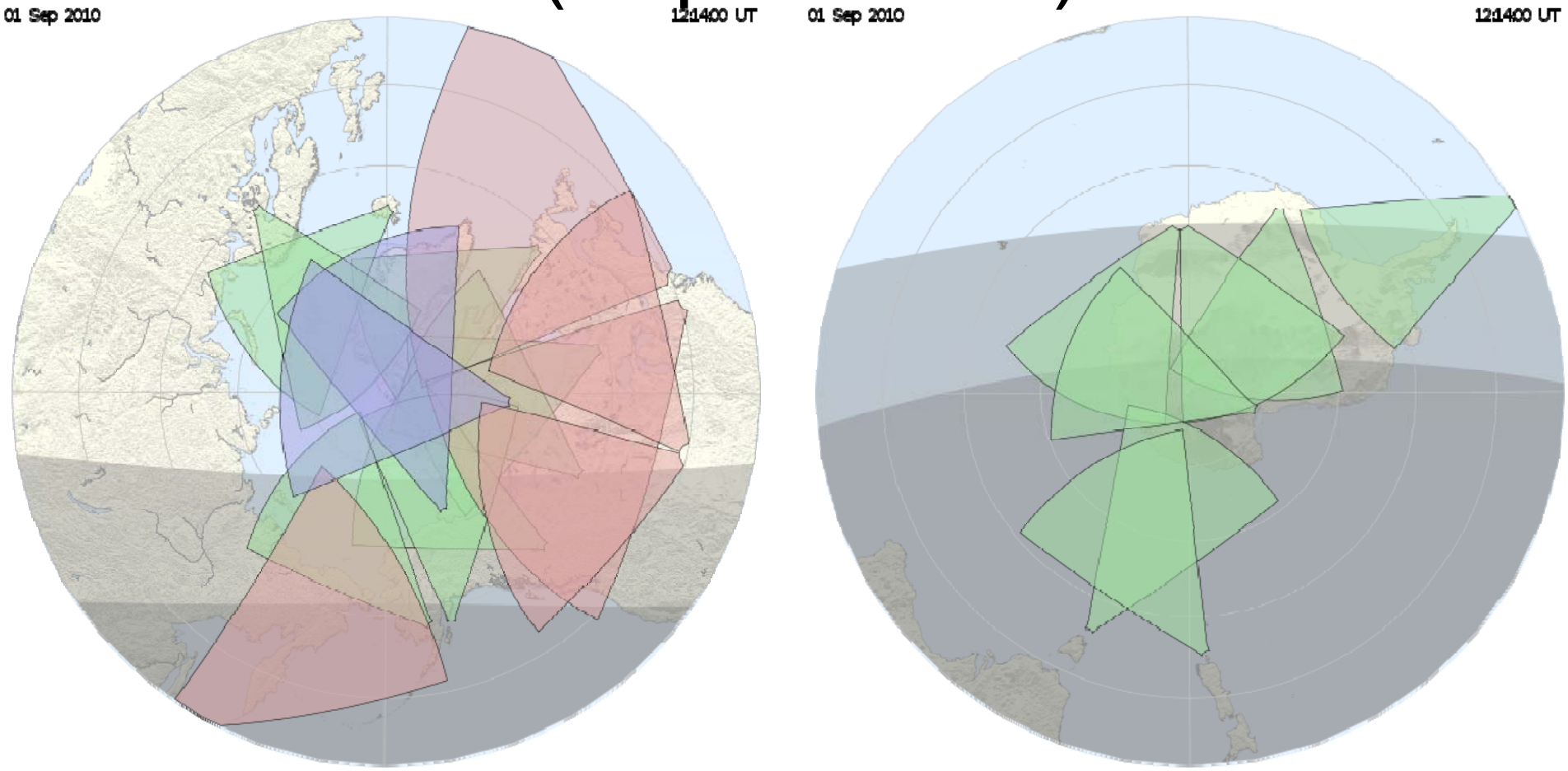
Contents of the first talk

- Overview of SAPS/SAID oscillating structure
- Short / medium period SAPS/SAID oscillation
- Long period oscillation
- Summary

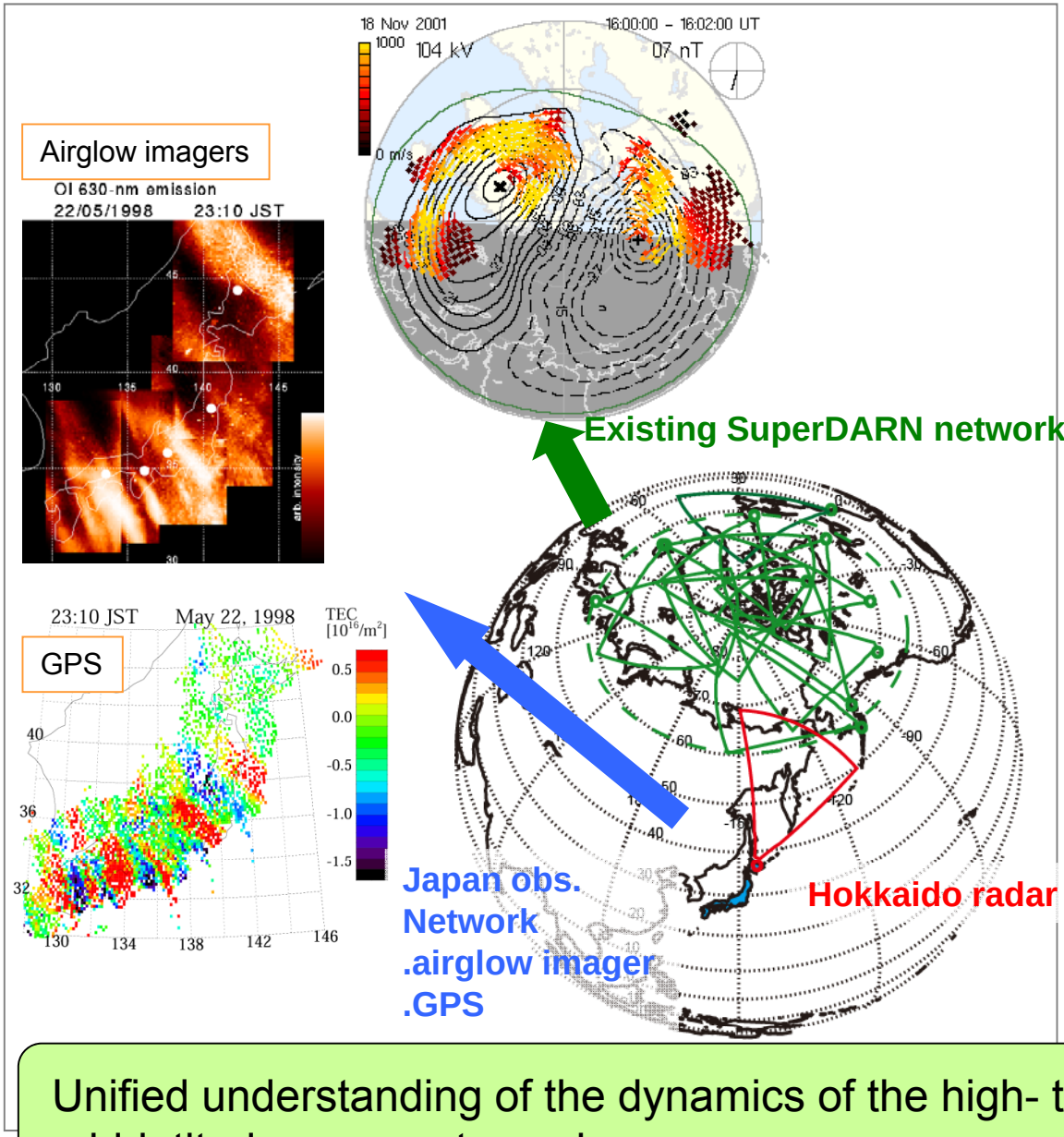


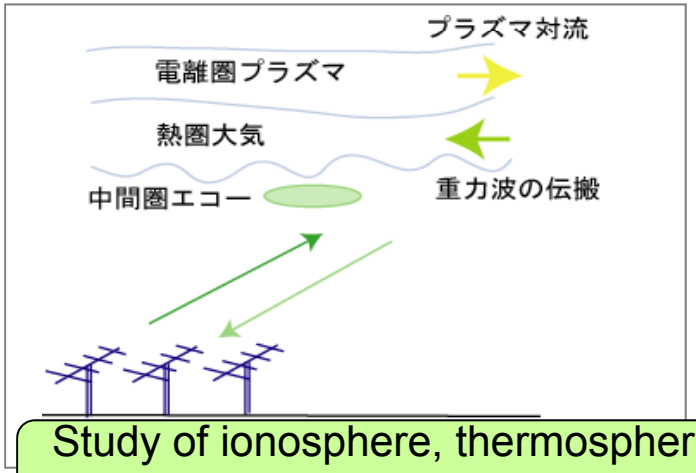
Super Dual Auroral Radar Network (SuperDARN)



Number of operating HF radars: 25 (17 in the northern and 8 in the southern hemispheres) as of December 1, 2010

SuperDARN Hokkaido radar (2006.11-)





Study of ionosphere, thermosphere and upper mesosphere

Unified understanding of the dynamics of the high- to mid-latitude upper atmosphere

SAPS (Sub-Auroral Polarization Stream) and SAID (Sub-Auroral Ion Drift)

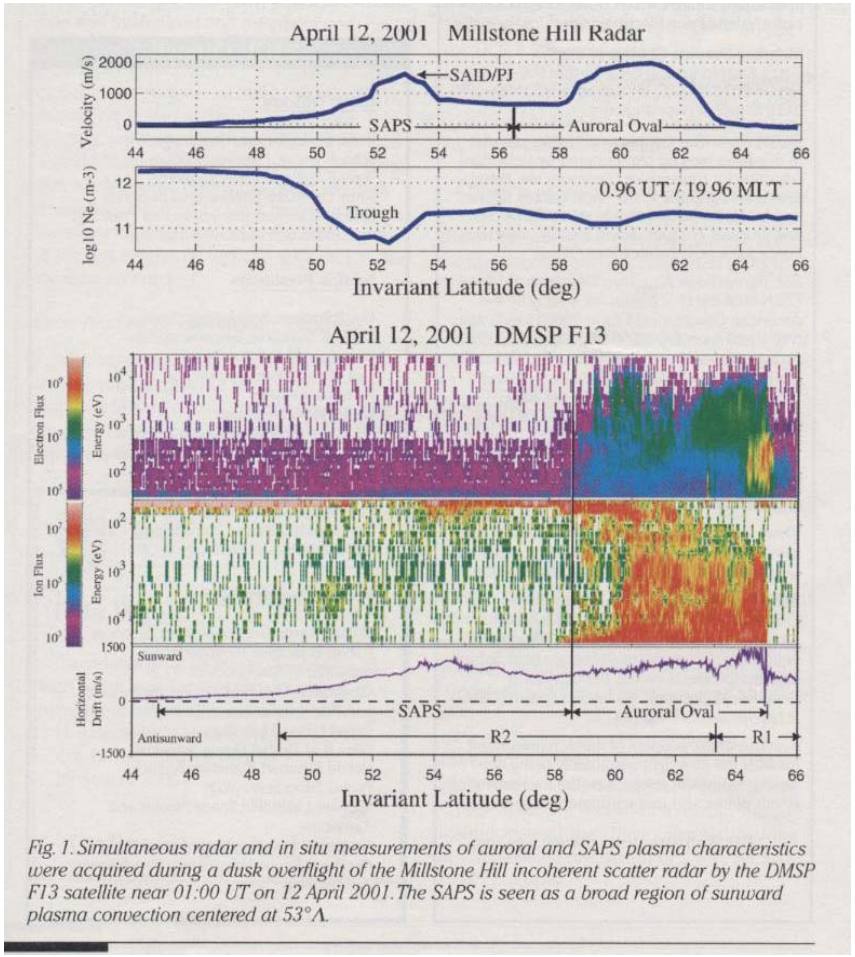


Fig. 1. Simultaneous radar and in situ measurements of auroral and SAPS plasma characteristics were acquired during a dusk overflight of the Millstone Hill incoherent scatter radar by the DMSP F13 satellite near 01:00 UT on 12 April 2001. The SAPS is seen as a broad region of sunward plasma convection centered at 53° Λ.

(Foster and Burke, EOS, 2002)

- SAPS: located equatorward of the auroral oval, broadly distributed
- SAID: located inside SAPS, localized in latitude (sometimes SAID coincides with SAPS)
- trough: plasma density depletion region

Periodical Oscillation of SAPS/SAID electric field variability observed with the Millstone Hill UHF radar (Foster et al., 2004)

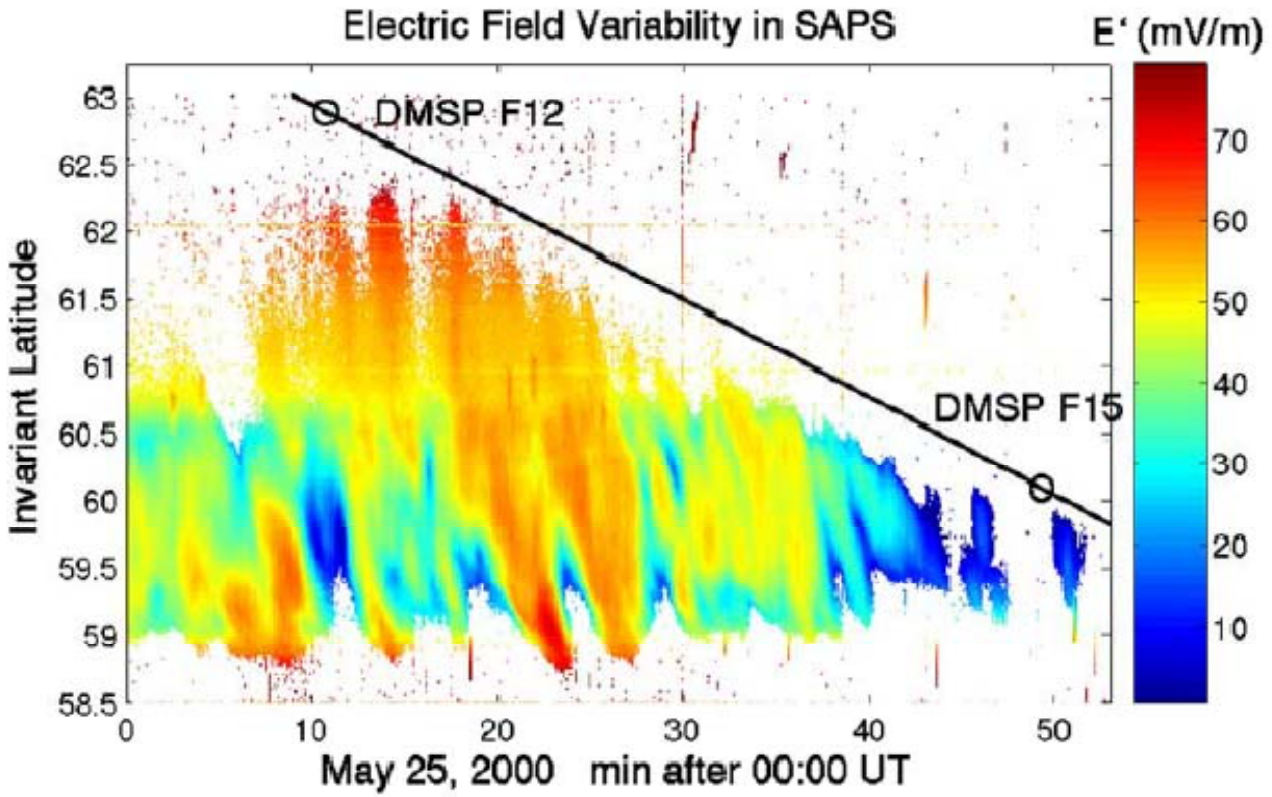


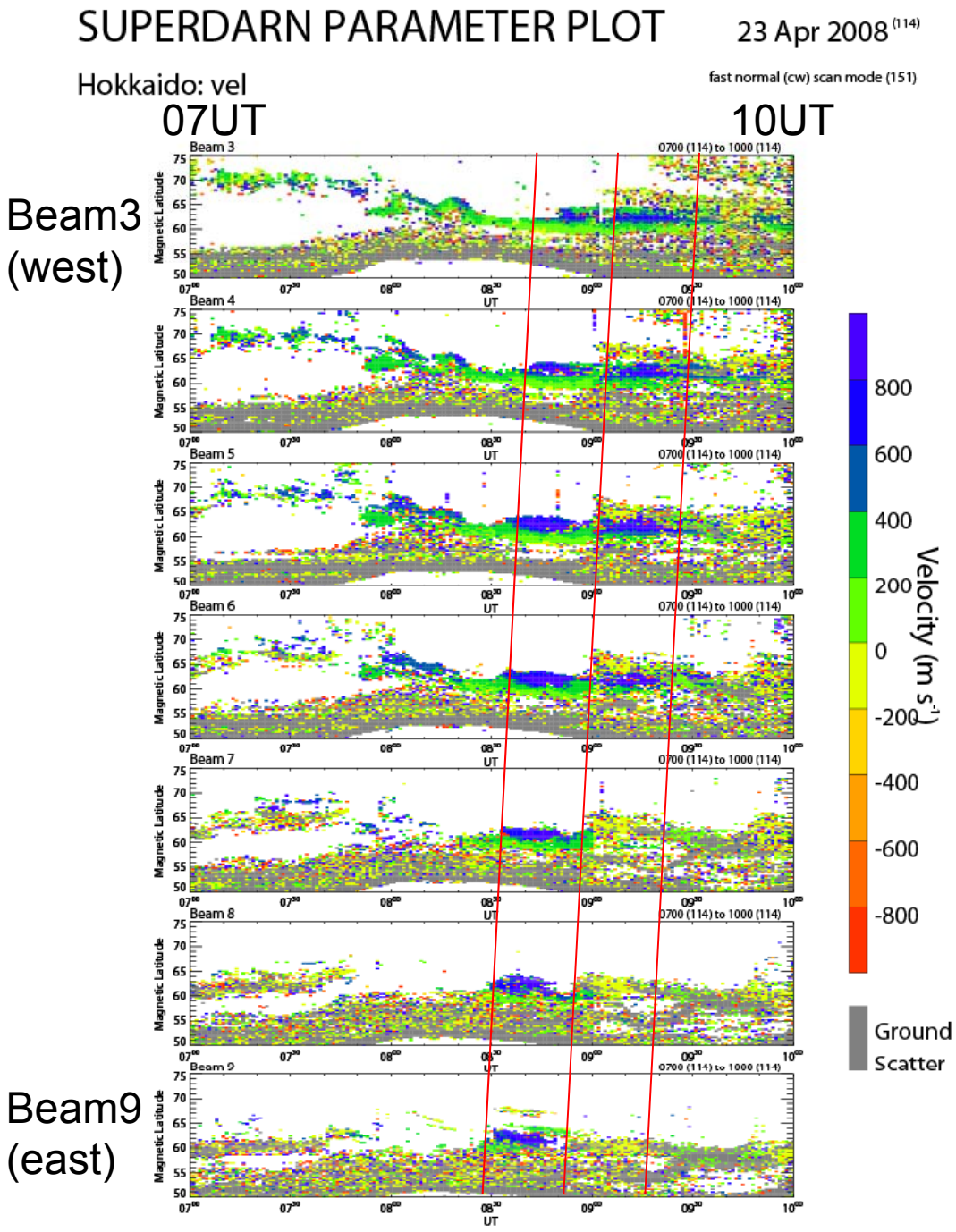
Figure 1. High resolution coherent scatter observations of electric field variability with the Millstone Hill UHF radar reveal periodic wavelike structures within the SAPS channel. The line indicates DMSP observations of the equatorward extent of auroral electron precipitation.

Oscillation of the electric field structure with period ~ 5 minutes was observed.

Since it is 1-D observation, it is impossible to discuss the 2-D structure.

Possible factors affecting SAPS/SAID oscillations / changes

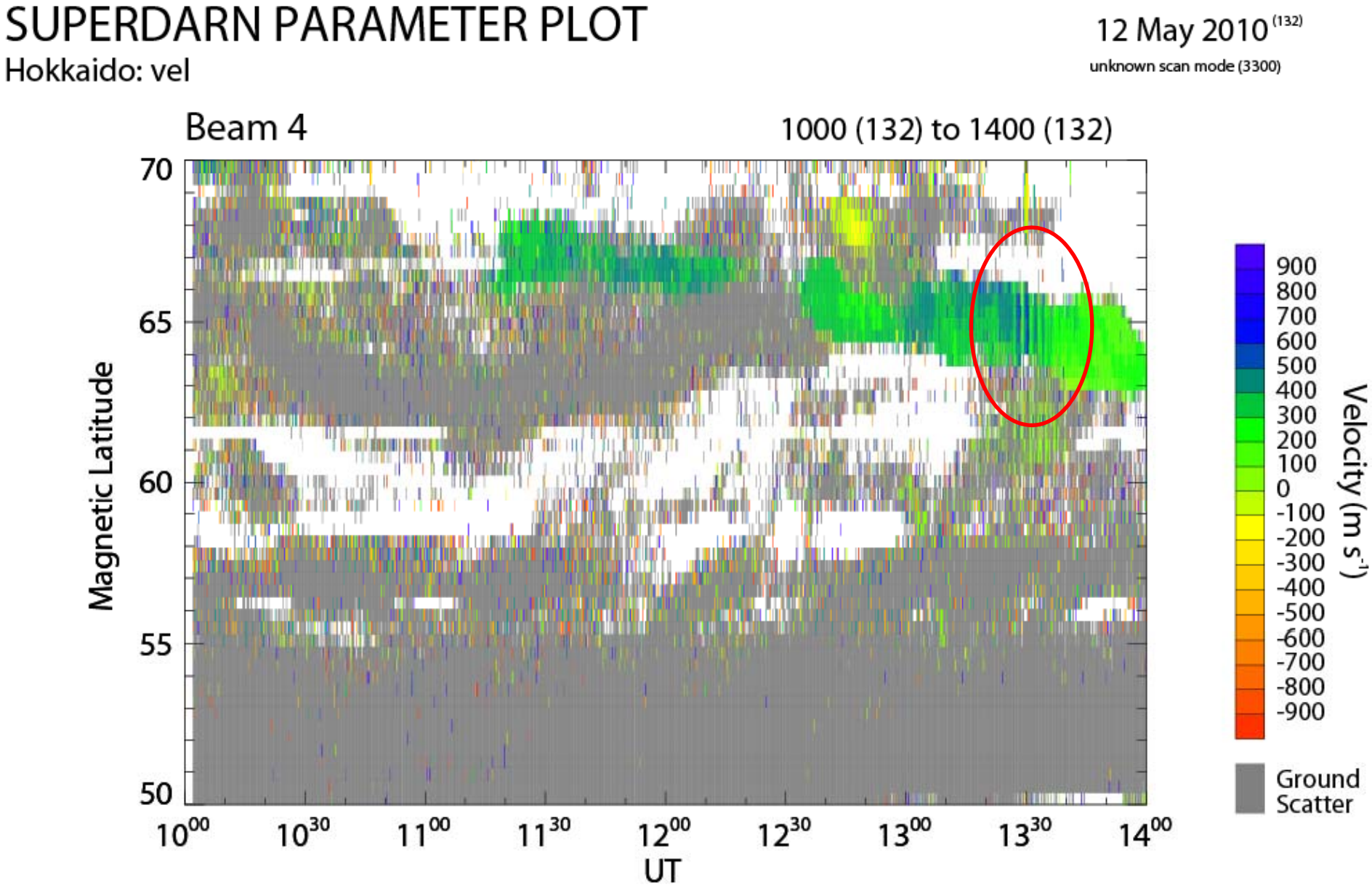
- Development of ring current
  - Ebihara et al. (2009): Hokkaido radar
  - Kataoka et al. (2009): Hokkaido radar
- Southward IMF
  - Oksavik et al. (2006): Wallops radar
- Substorm effects
  - Koustov et al. (2008): Hokkaido radar
- Instabilities in the inner magnetosphere – ionosphere system→several time scales



Medium-period SAPS/SAID oscillation

period:
~30 min
velocity:
~700m/s in geog. coords.
(~460m/s in the ML-MLT coords.)
wavelength:
~1200 km (1.5h MLT)
latitudinal span:
~ 200 km

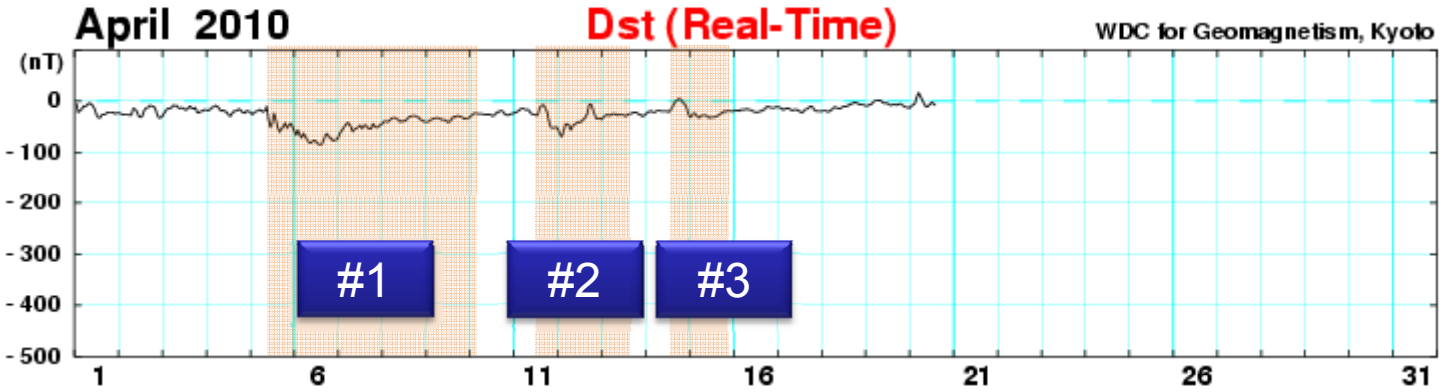
Short-period SPAS/SAID oscillation: Pi2 2010/5/12 event (10-14 UT)



2010/4/5-9 magnetic storm

Dst variation

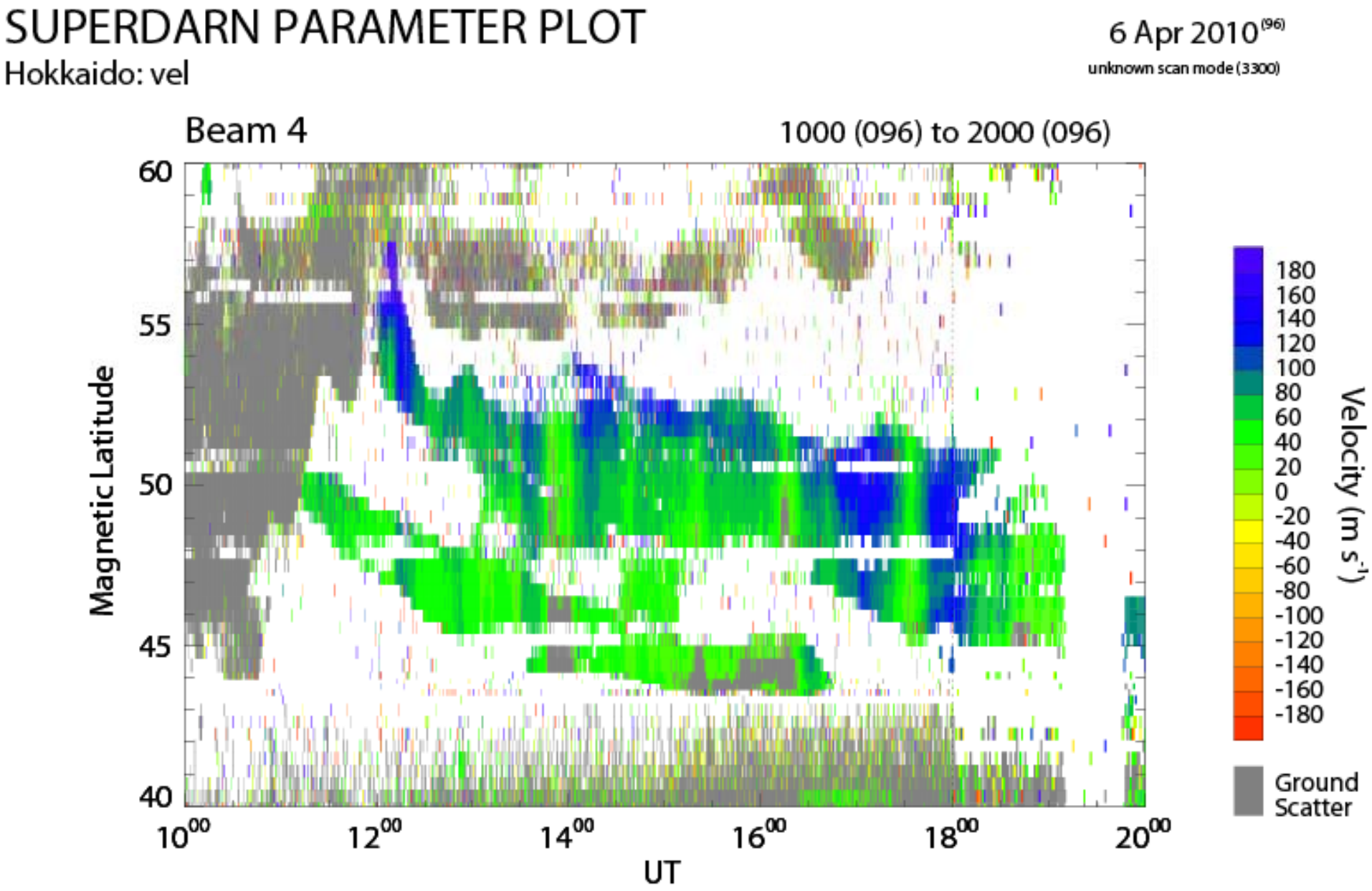
Courtesy of Y. Ebihara



- 4/5-9 storm
  - ★Minimum Dst -84 nT (lowest since Dec. 2006)
  - ★main phase for 1 day
- 4/11-12 storm
  - ★Minimum Dst -69 nT
- 4/14-15 storm
  - ★Minimum Dst -32 nT

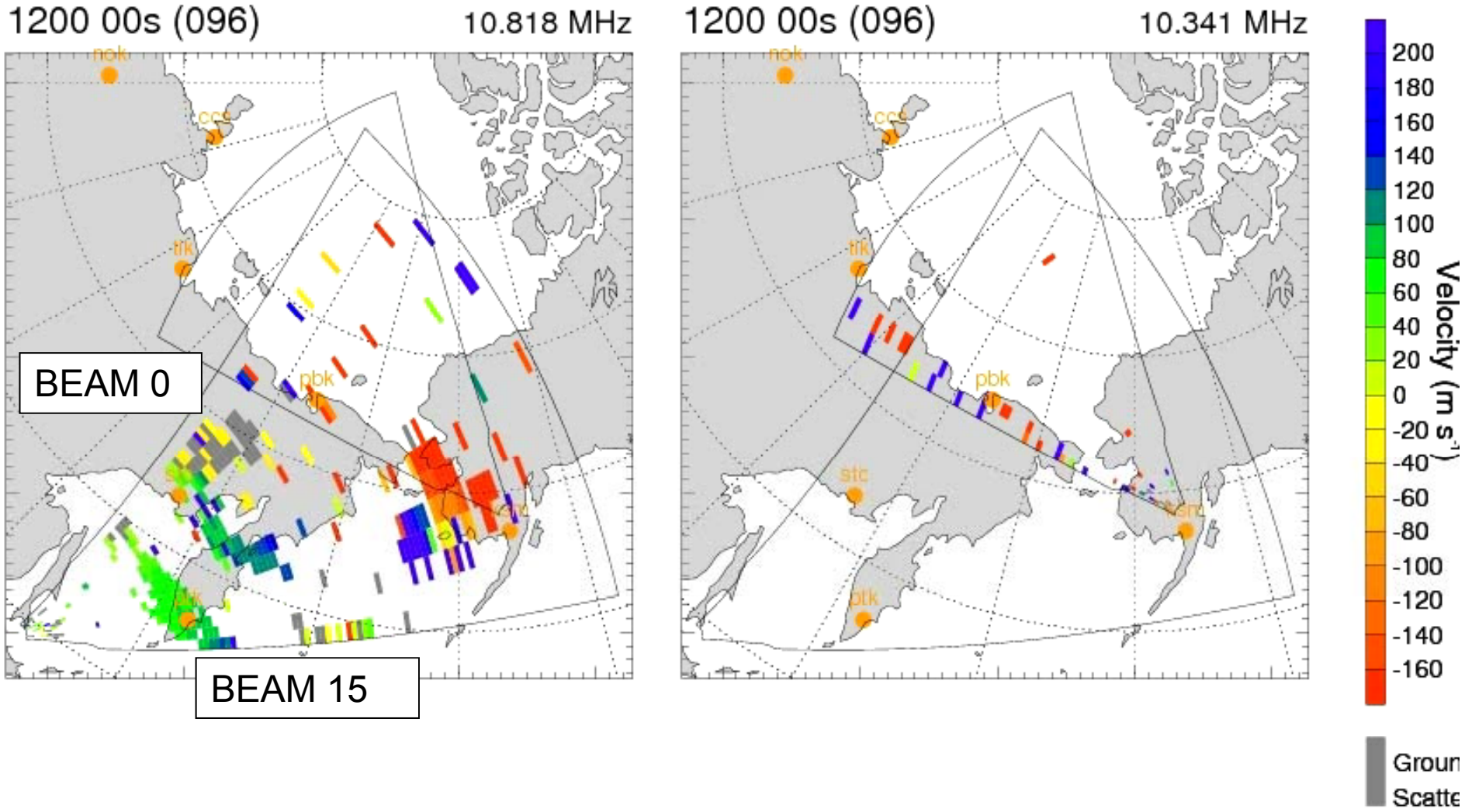
Ring current

2010 April 6, 1000-2000 UT

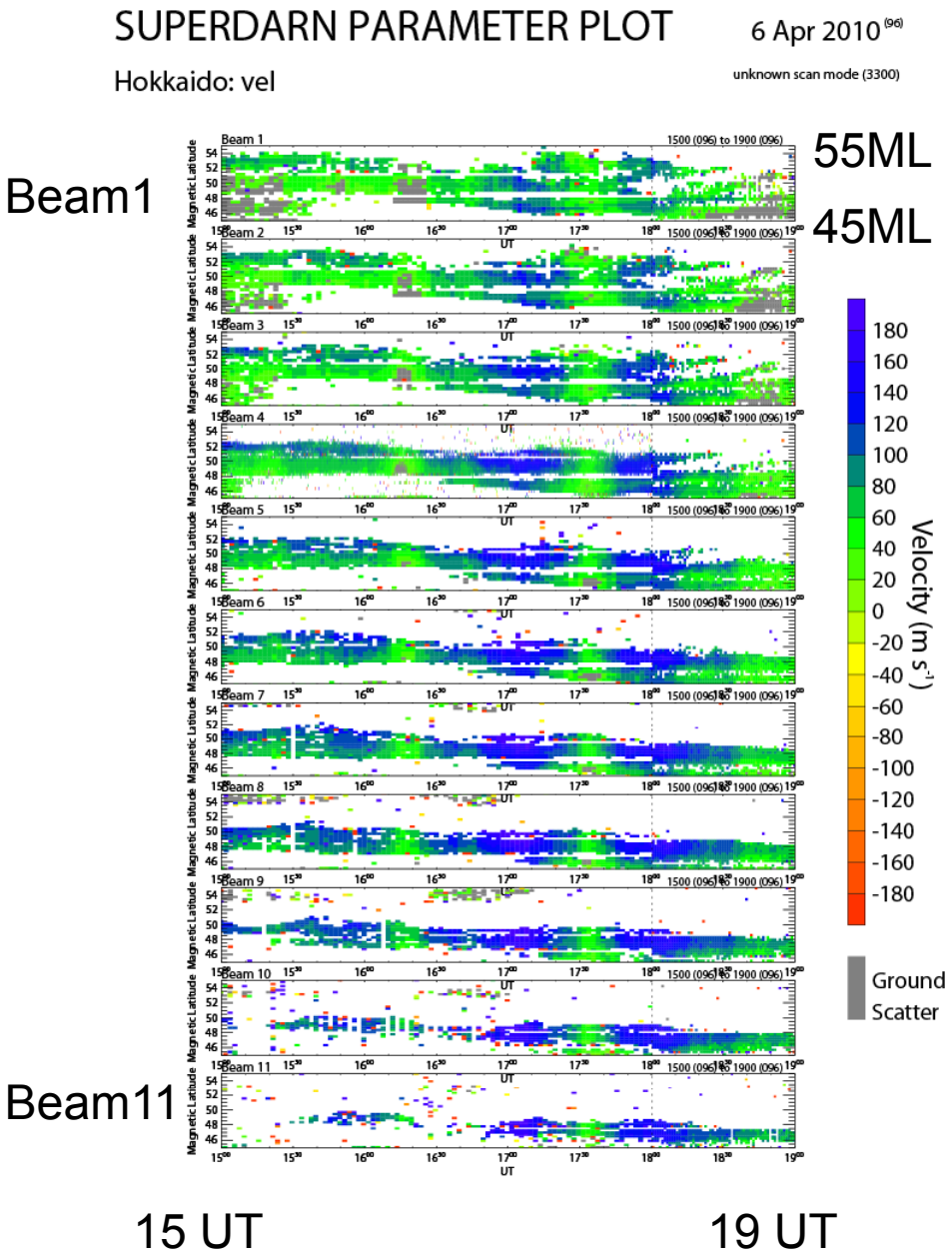


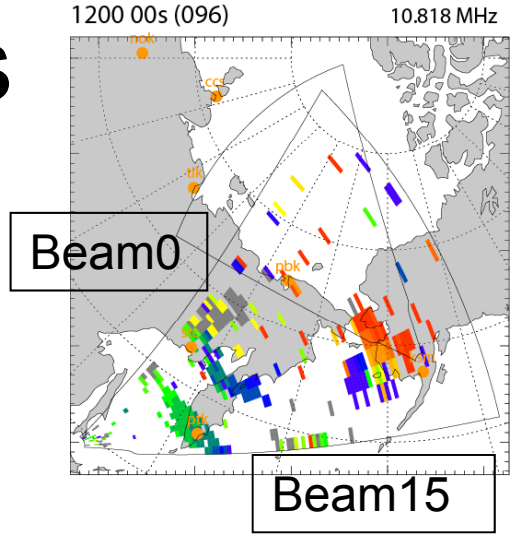
LOS velocities (HOK, KSR)

2010/04/06 1200-1800 UT



RTI plots for multiple beams





- Quite similar signatures for all the beams
- Does not look like propagating structures
- Oscillation due to the forced large-scale electric fields?
- No clear relationship with substorm / geomagnetic activity (will be shown in the next slides)

OMNIDB

Bx

By

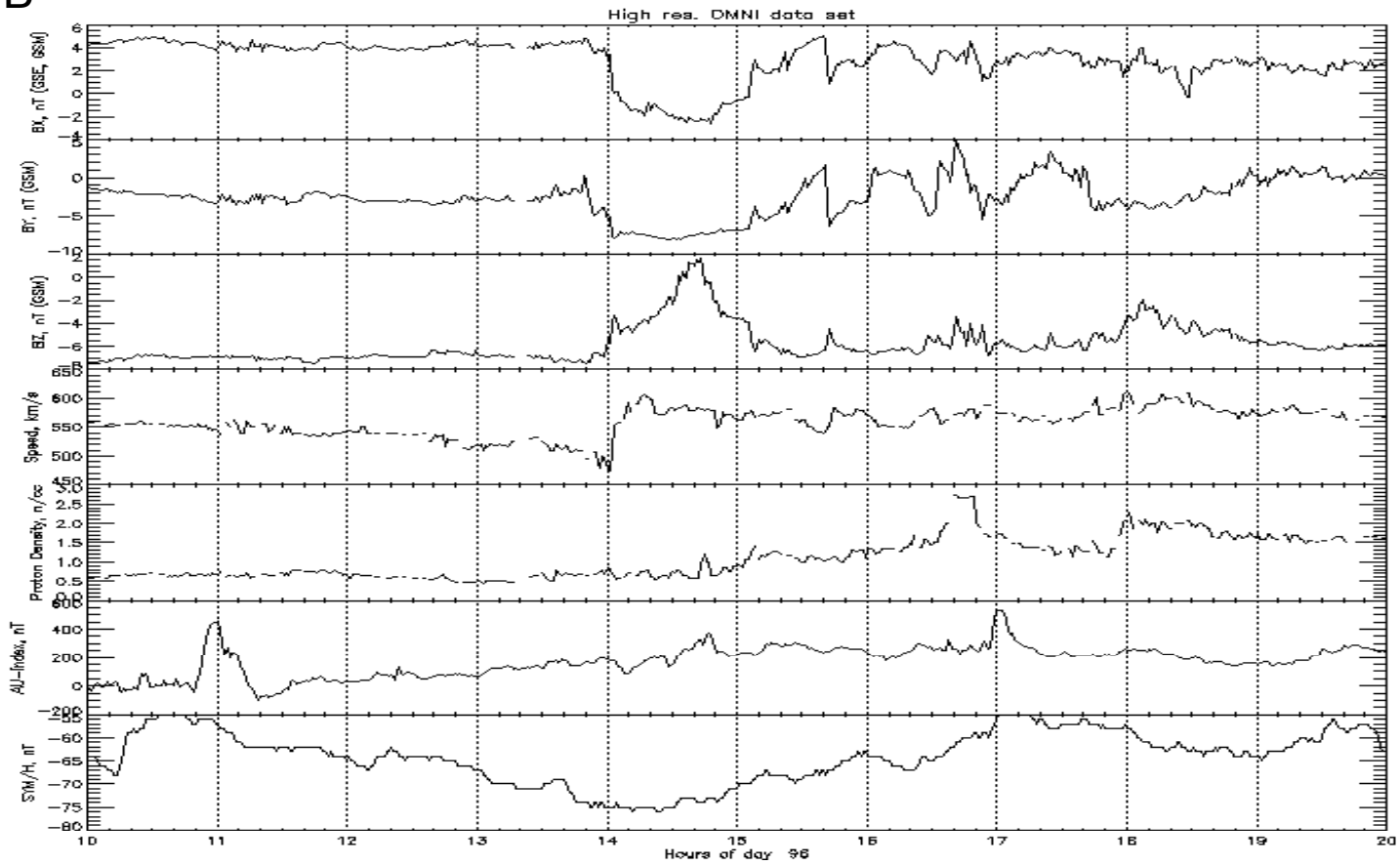
Bz

Vel.

Dens.

AL

SYM/H

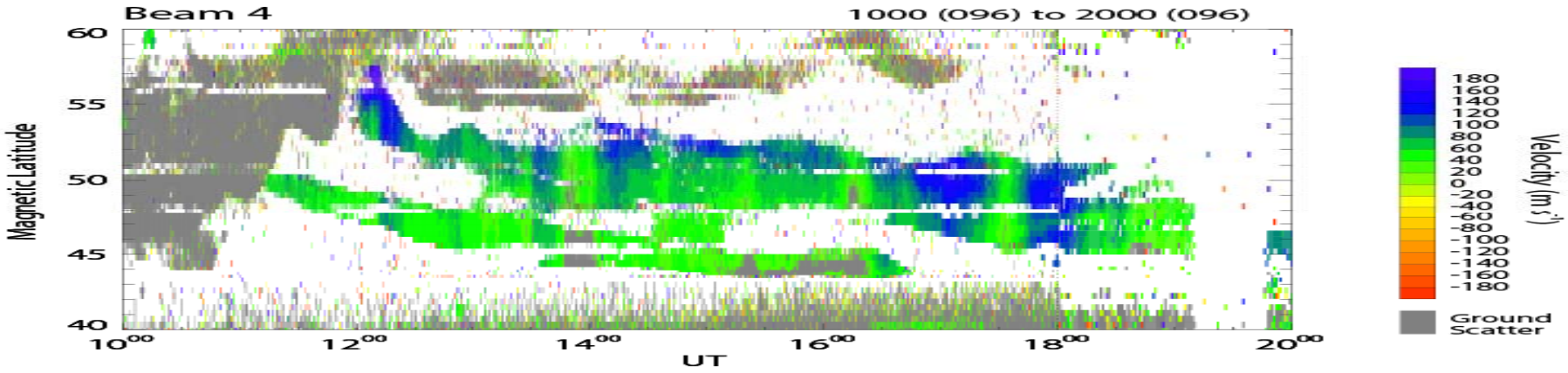


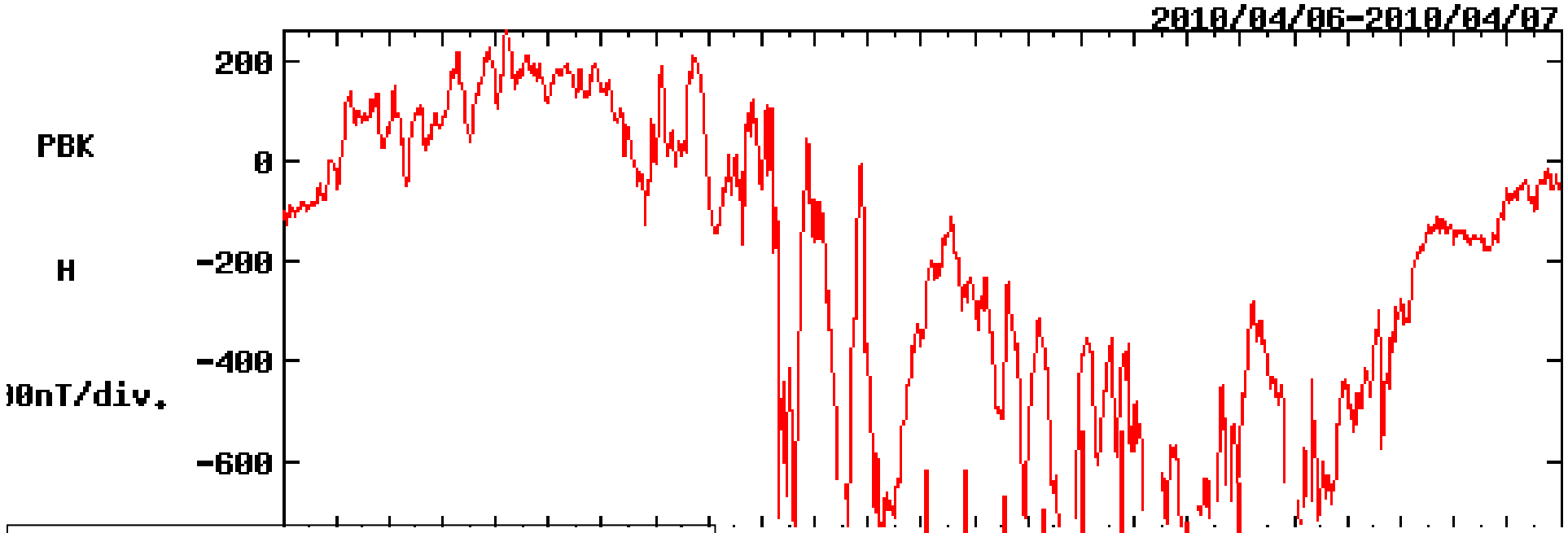
SUPERDARN PARAMETER PLOT

Hokkaido: vel

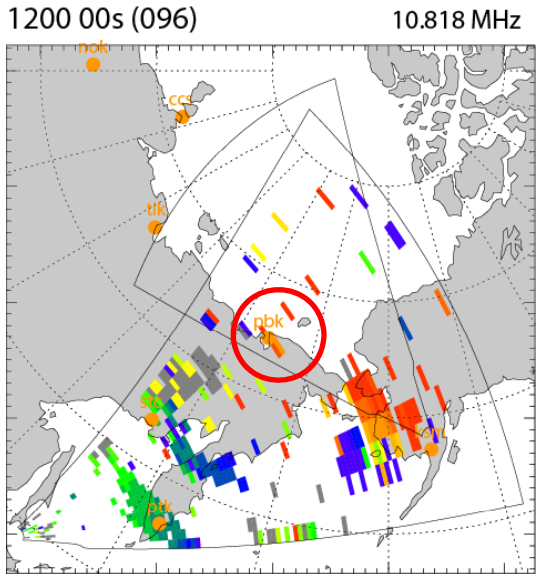
6 Apr 2010 (96)

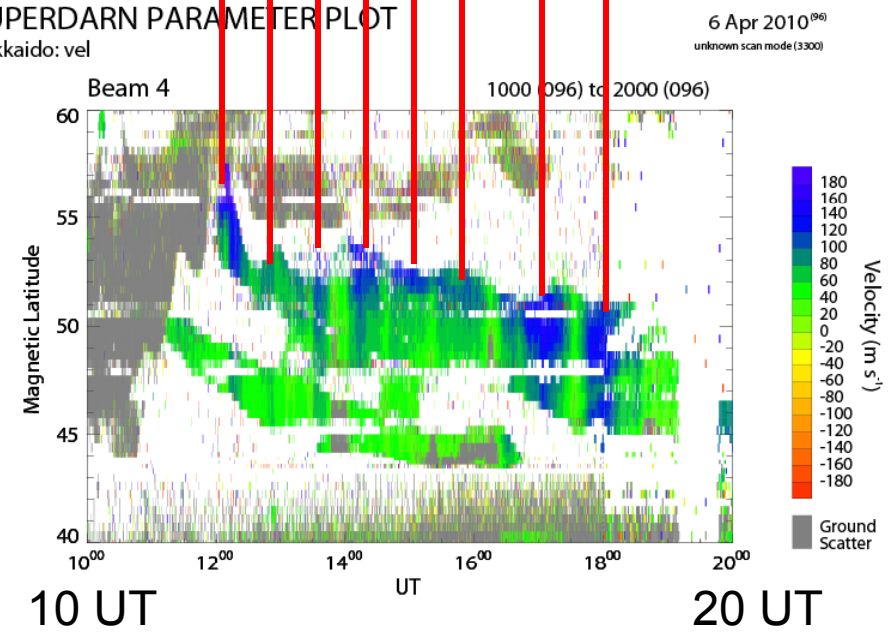
unknown scan mode (3300)





Geomagnetic data provided by NICT





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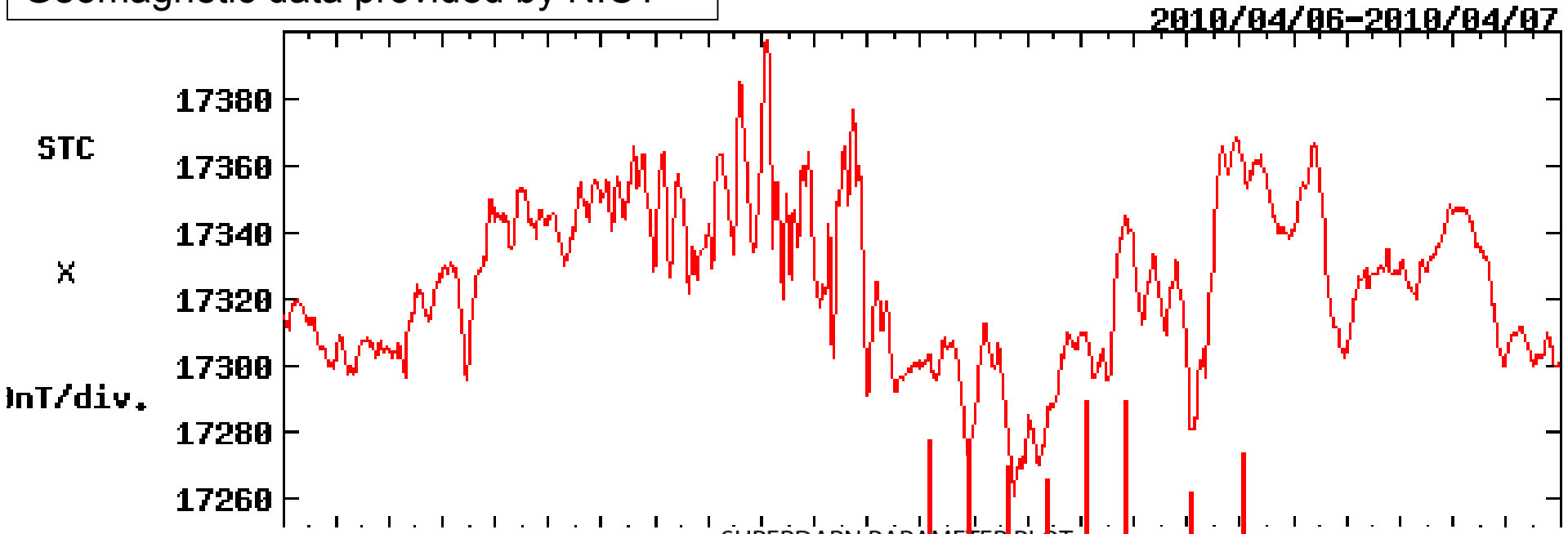
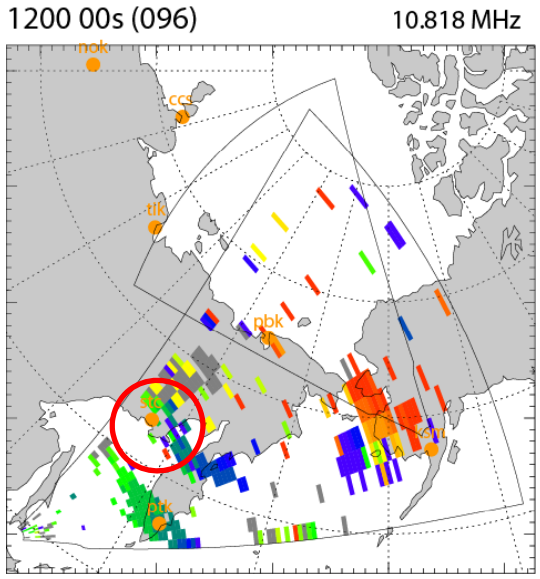
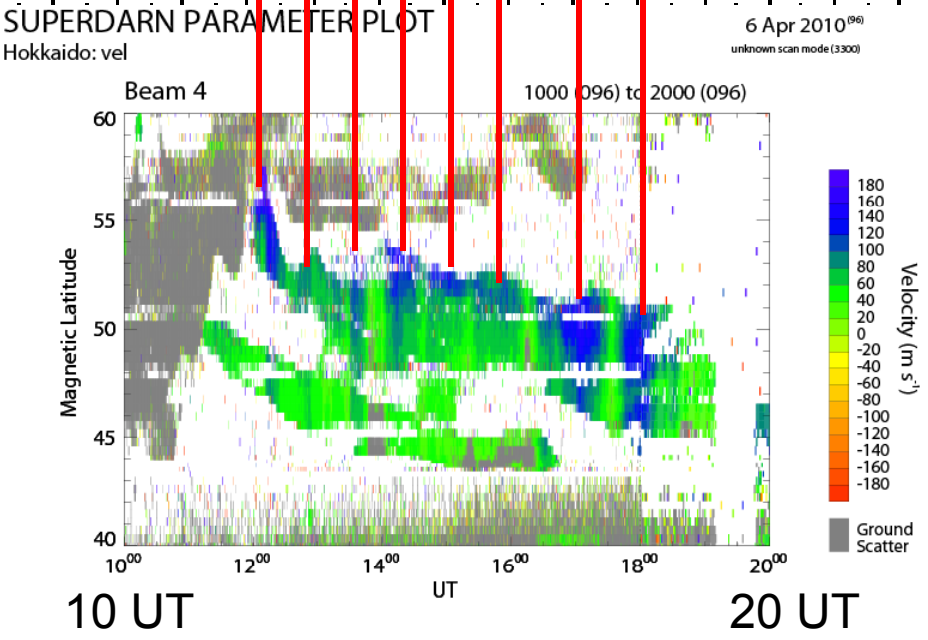
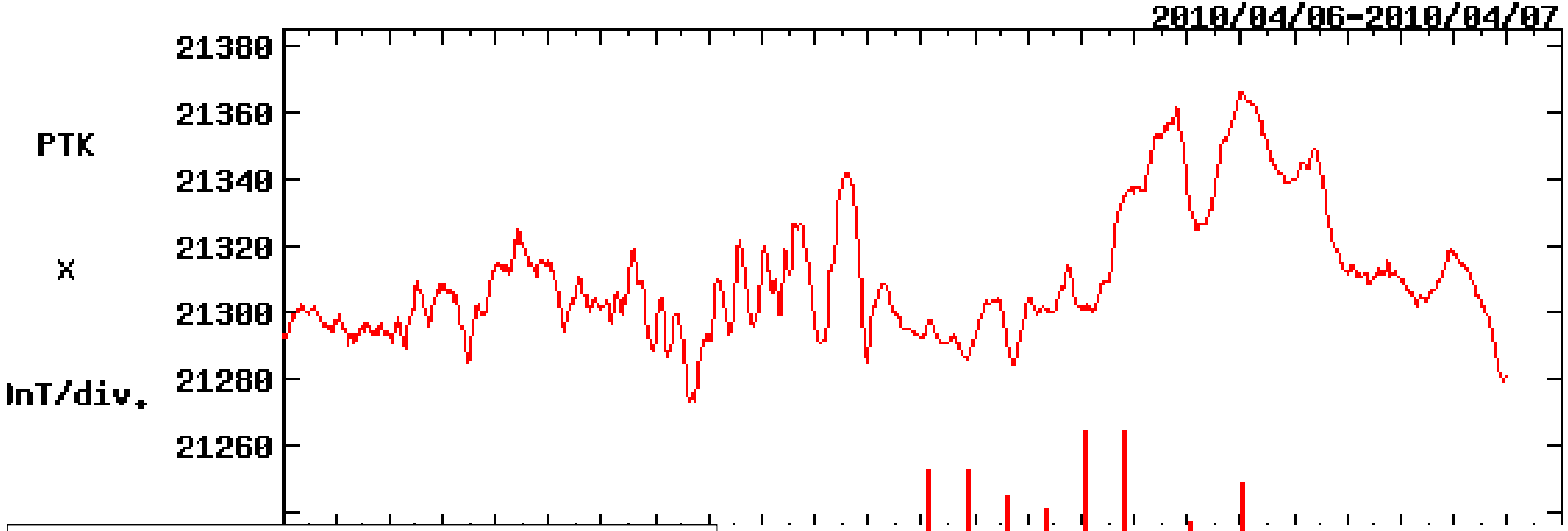






10 UT

20 UT



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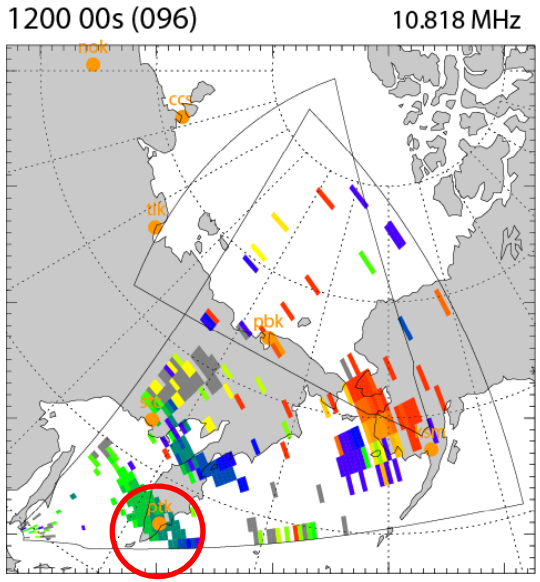
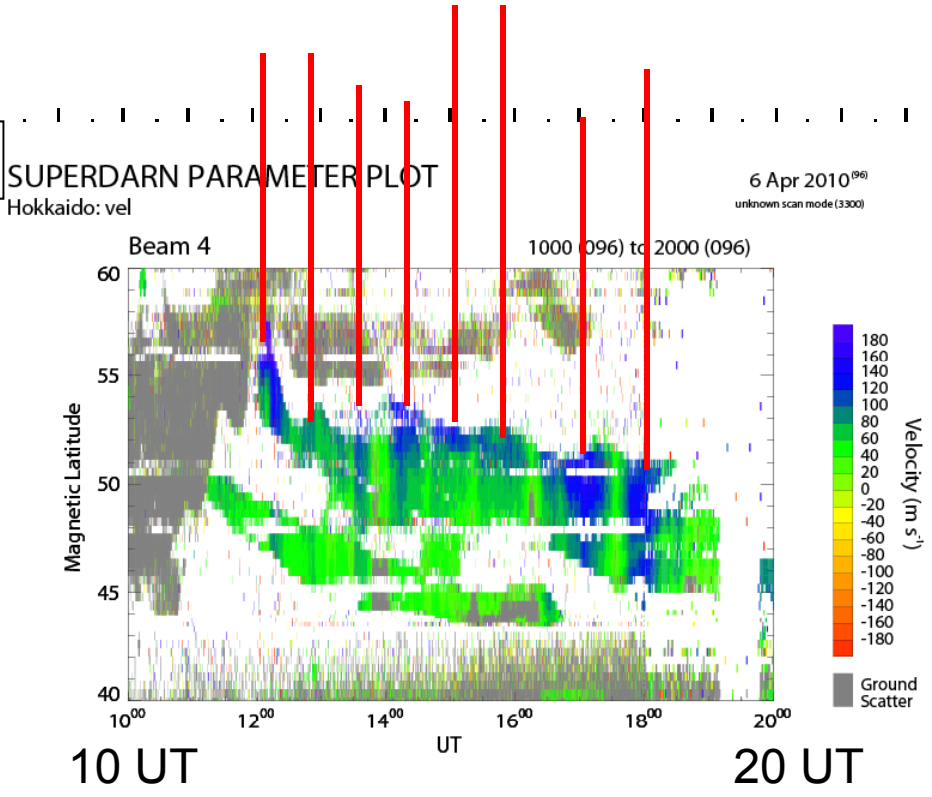
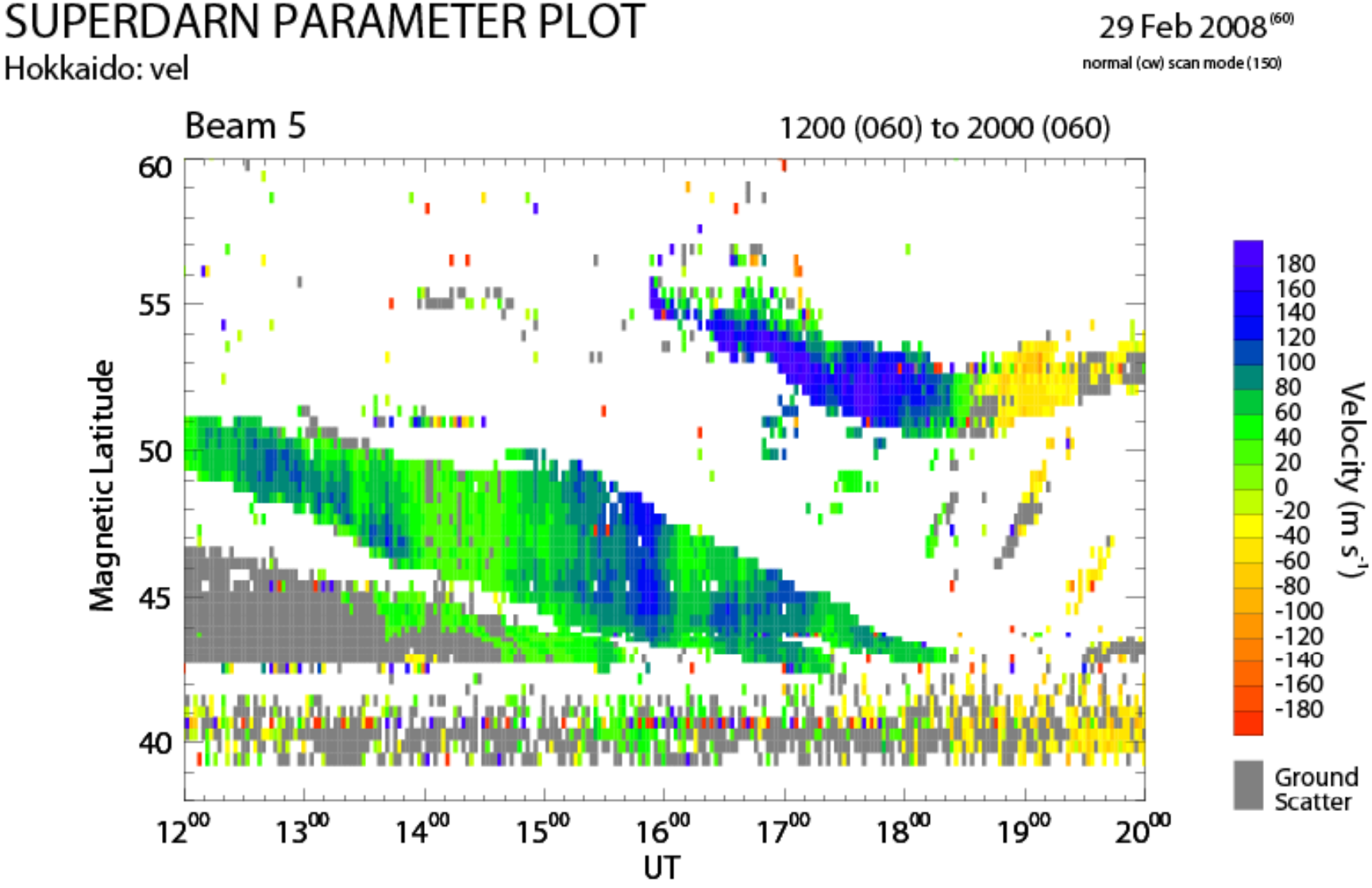
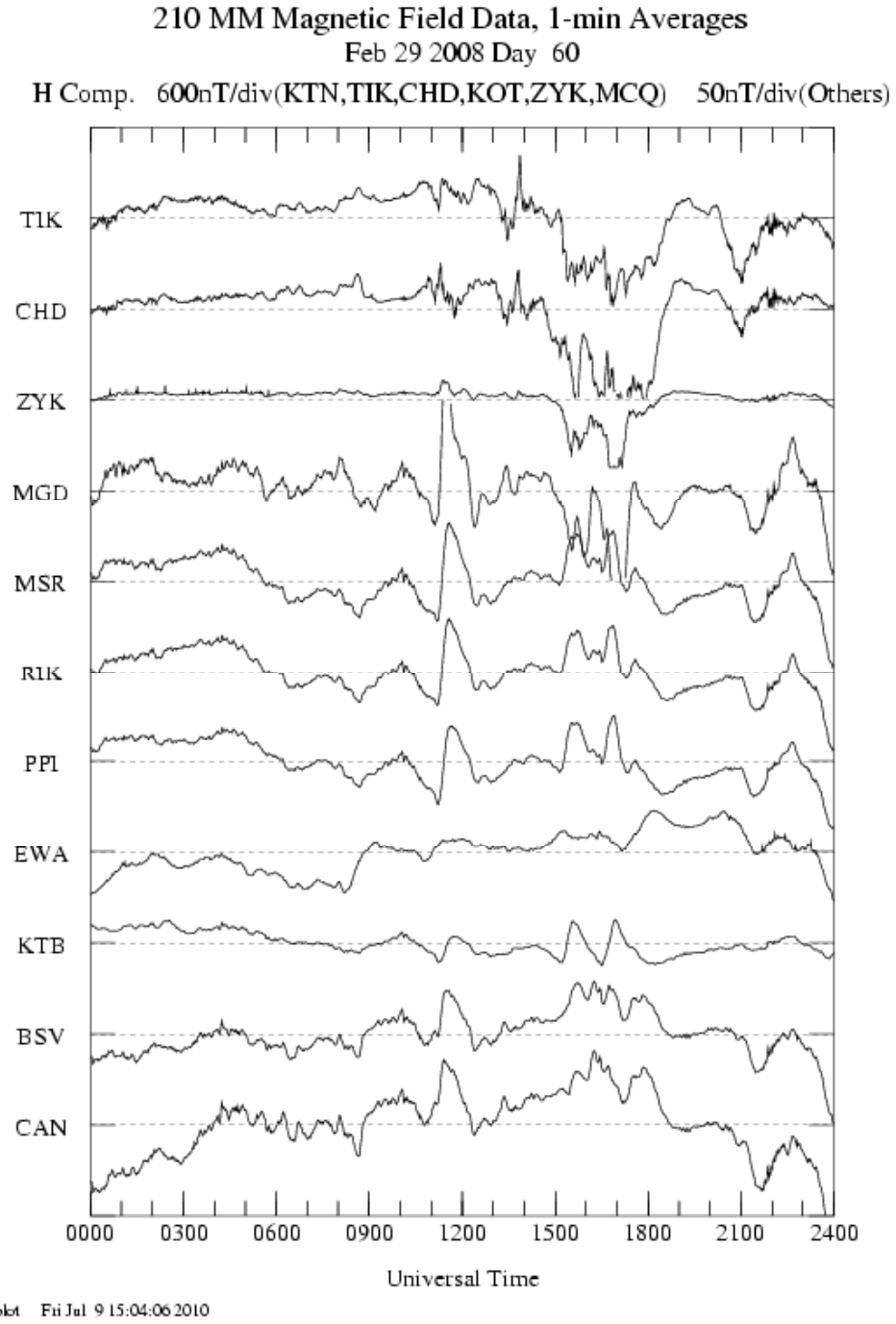




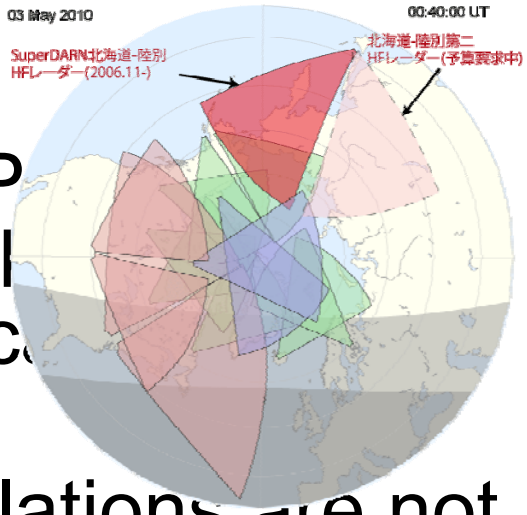
Feb. 29, 2008 event





210 MM geomagnetic field data

Conclusions



- Periodic oscillations of SAID/SAP observed by the SuperDARN Hok have a wide range of temporal sca from a few min to 1 hour.
- Long time scale (~ 1 hours) oscillations are not directly correlated with solar wind parameter changes or global geomagnetic activity although local geomagnetic activity have similar periods (not 1 to 1 correspondence). Further investigation is necessary to understand their generation mechanisms.
- In order to accumulate more examples we need:
  - Radar operation under higher solar activity
  - Deployment of more mid-latitude radars