

# Dynamics of the ionosphere observed by the SuperDARN HOkkaido Pair of (HOP) HF radars during the 4 November storm event

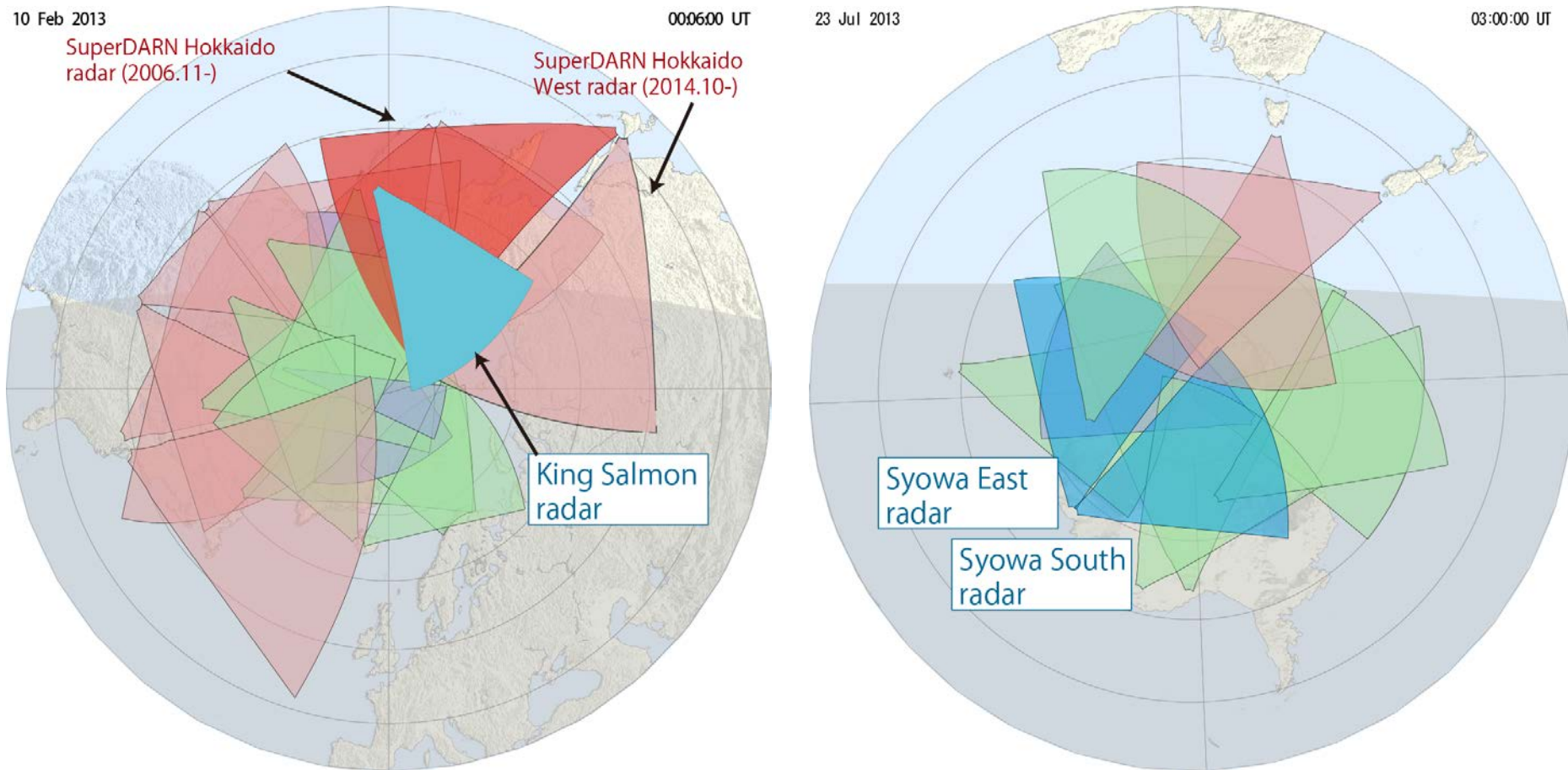


SuperDARN HOP West radar(2014.10-)

N. Nishitani\* and T. Hori (STEL, Nagoya Univ.)

SuperDARN HOP radars group

# Super Dual Auroral Radar Network (SuperDARN)



Number of operating HF radars: 34 (23 in the northern and 11 in the southern hemispheres) as of Oct 24, 2014

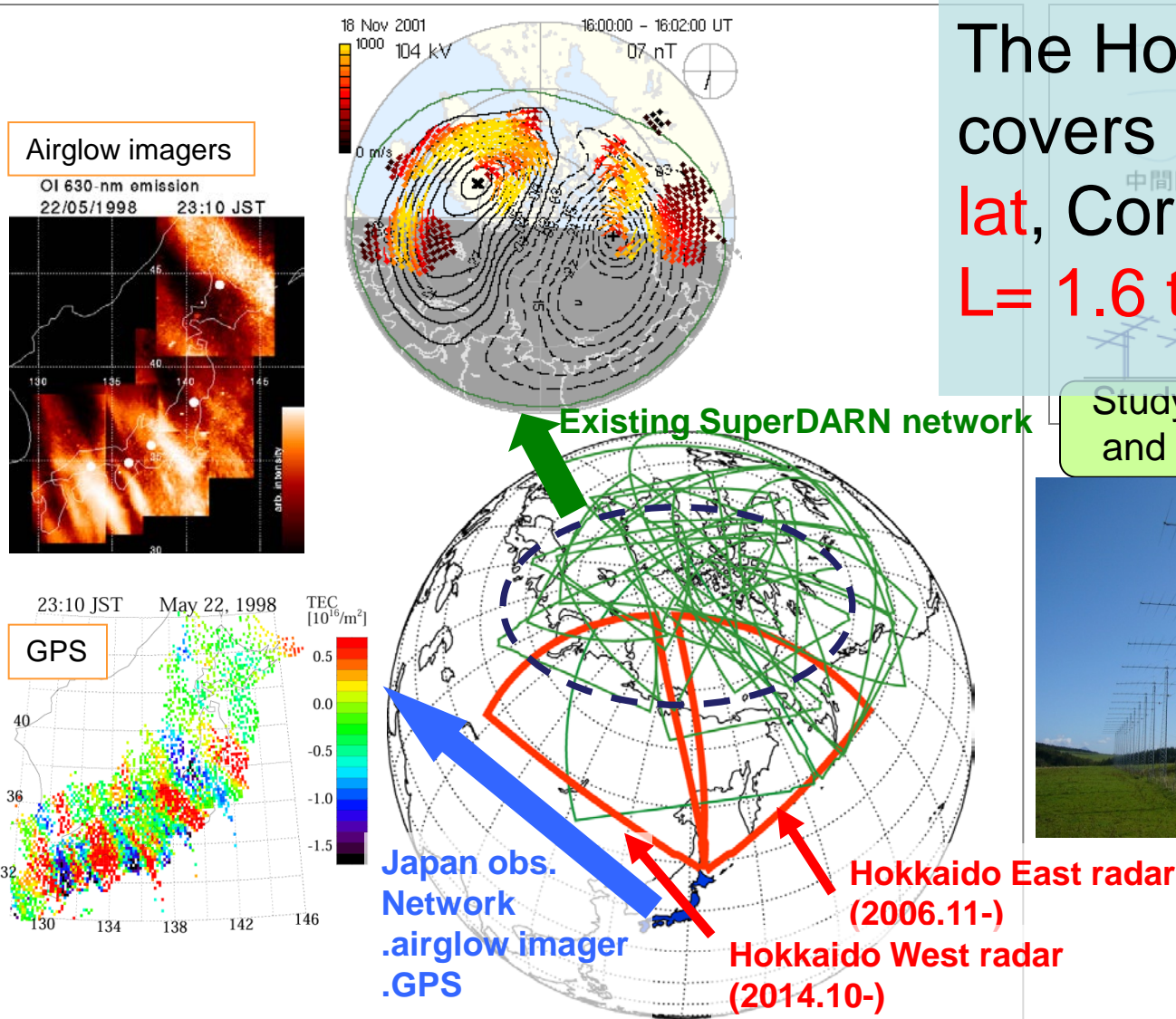
Standard temporal resolution: 1-2 min



# SuperDARN Hokkaido radar (2006.11-) # of papers: 25

The Hokkaido radar covers **38-80 geomag. lat**, Corresponding to **L= 1.6 to 33**

Study of ionosphere, thermosphere and upper mesosphere



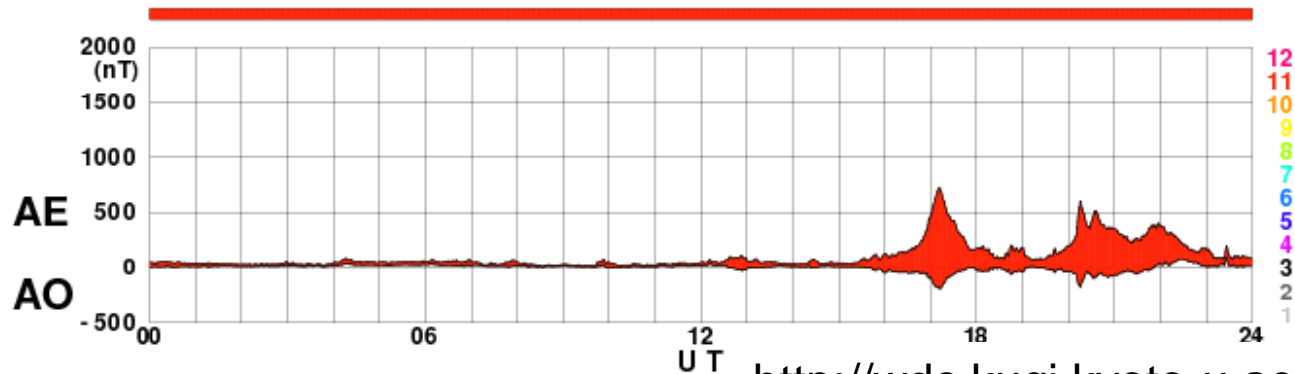
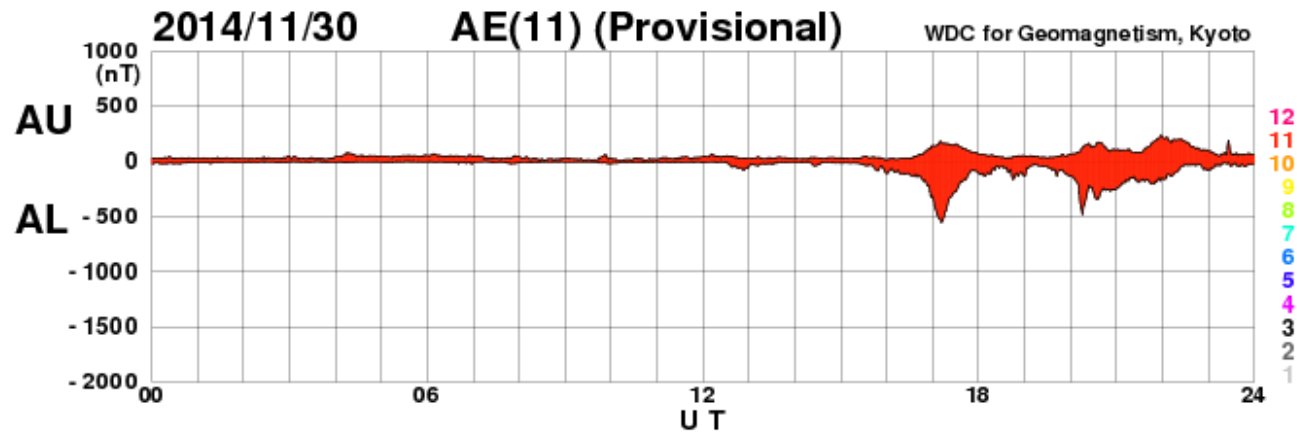
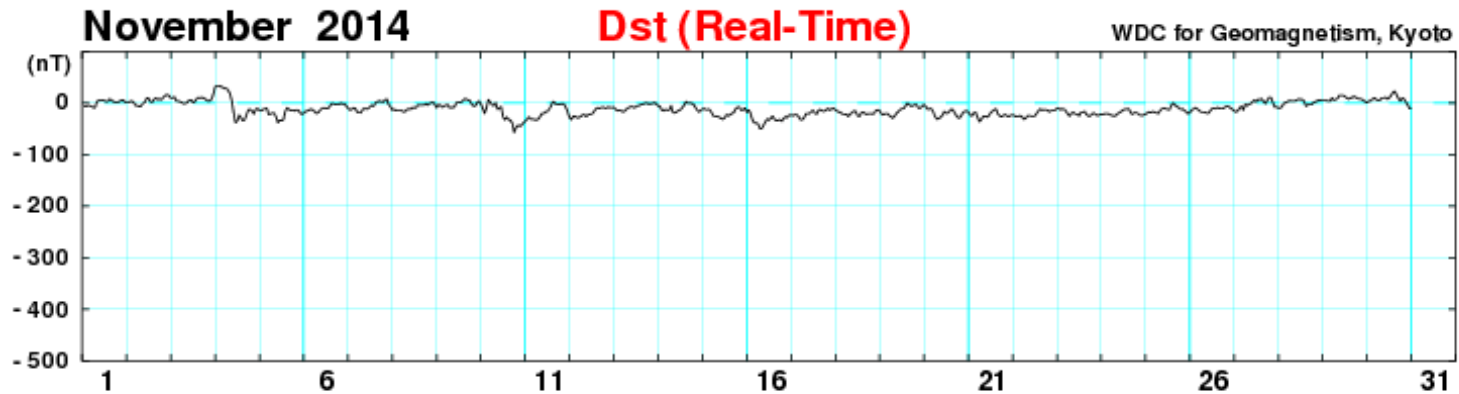
Unified understanding of the dynamics of the high- to mid-latitude upper atmosphere

# Summary of STE events observed by the SuperDARN HOP radars

- A. 27-30 Aug 2014
  - Weak SAPS on 27 (10-13 UT) and 29 Aug (10-11 UT)
  - SWF on 8 Sep (~24 UT)
- B. 8-13 Sep 2014
  - Weak SAPS on 11 (11-13 UT) and 12 Sep (11-12 UT)
- C. 19-27 Oct 2014
  - SAPS activity on 28 (10-11 UT) and 29 Oct (10-11 UT)
  - SWF on 19 Oct (~04 UT)
- D. 1-4 Nov 2014
  - SAPS on 4 Nov (13-16 UT)

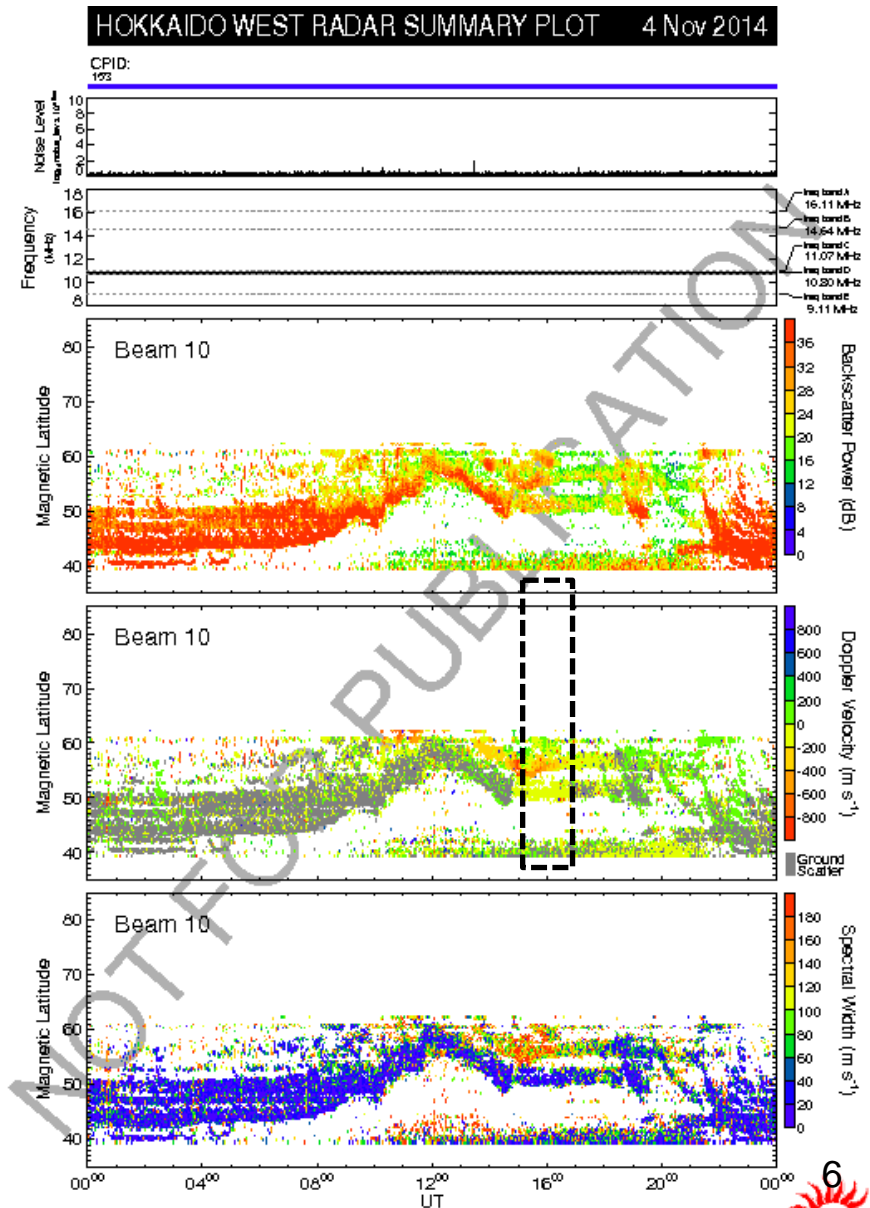
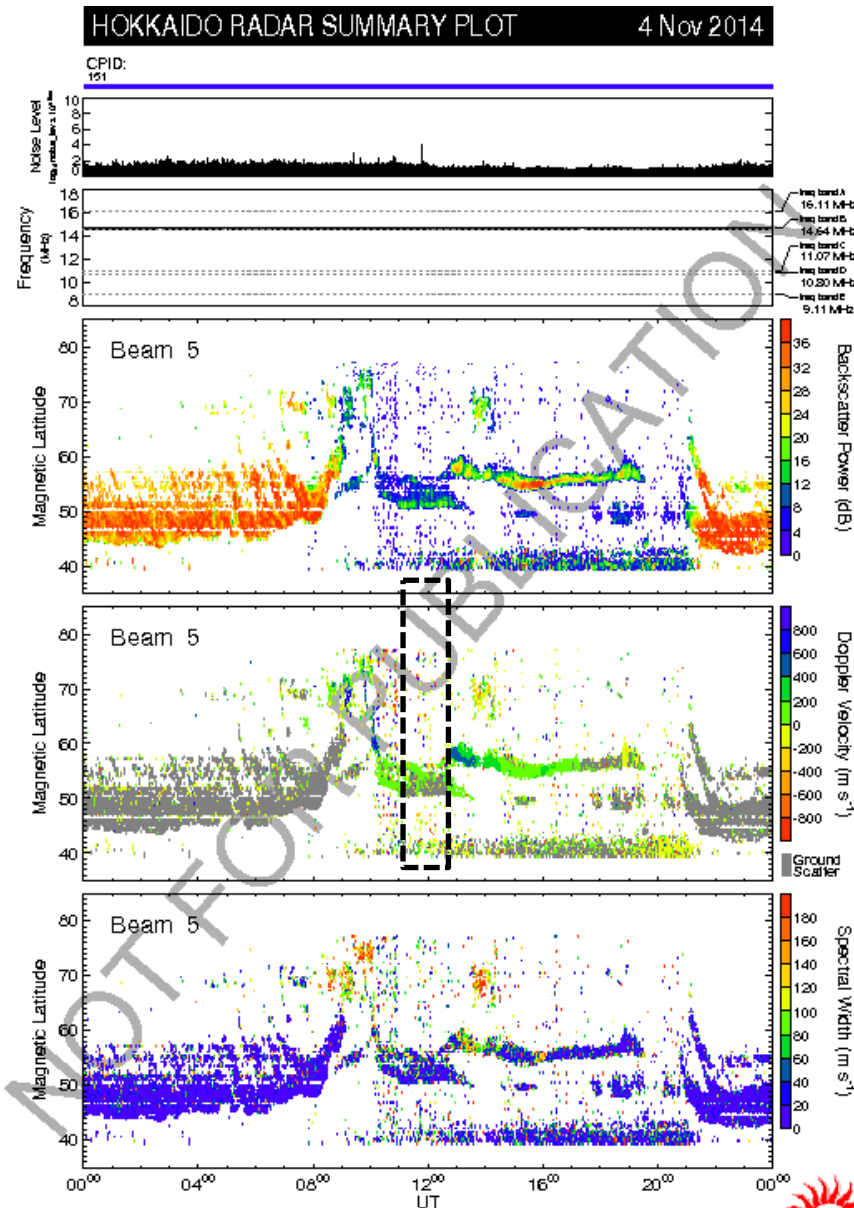


# Event study: 04 Nov 2014



# SD HOP East / West radar data on 4 Nov 2014

Quicklook plot accessible at: <http://center.stelab.nagoya-u.ac.jp/hokkaido/>



# 04 Nov 2014 HKW/HOK movie (weak storm, Dst $\geq$ -30 nT)

Movie made using the ERG-SC TDAS / IUGONET SPEDAS software

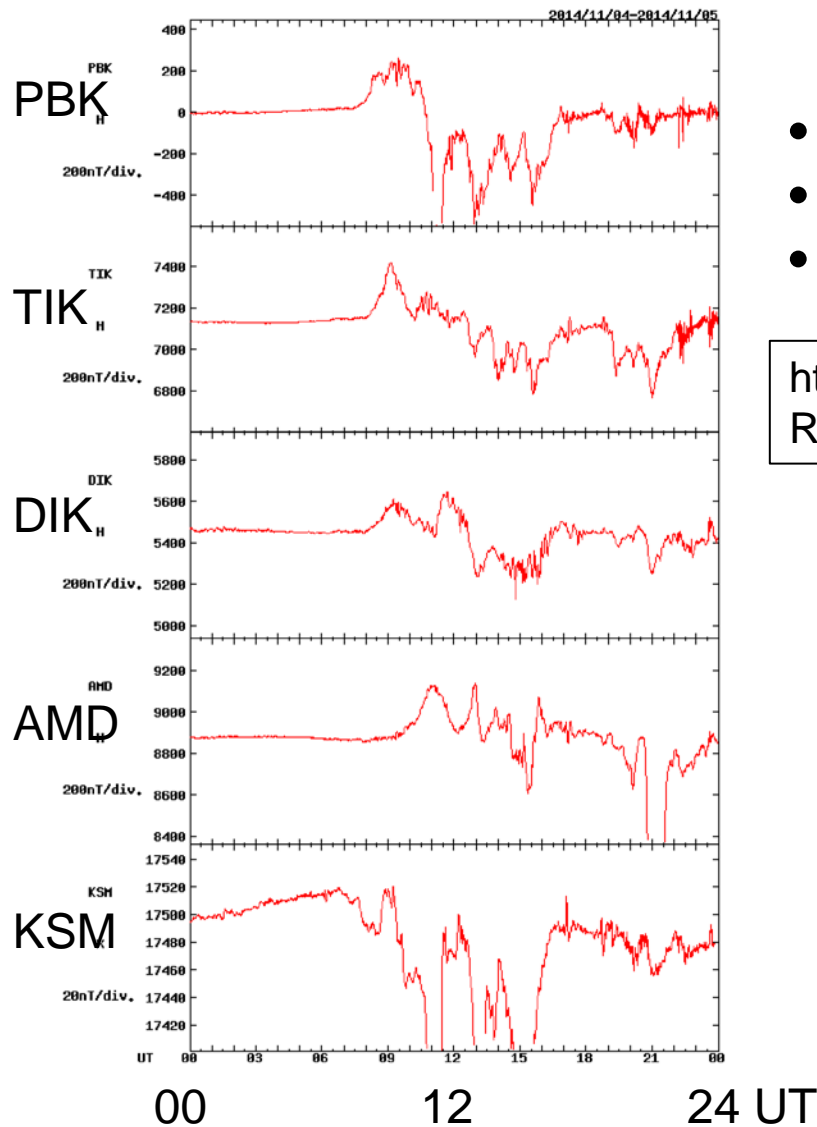




# NICT near real time data (4 Nov 2014)

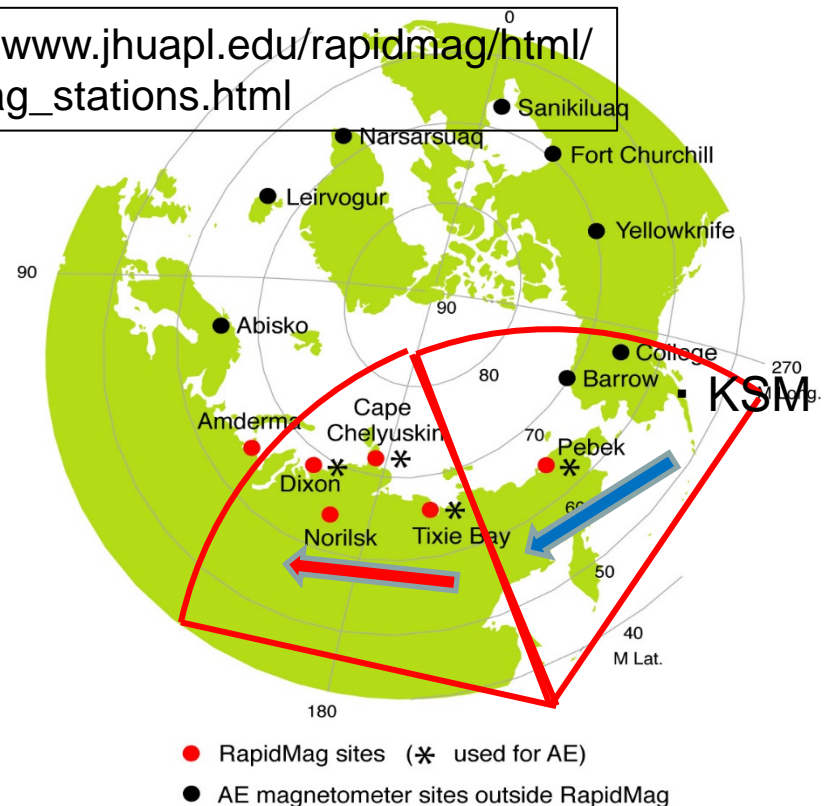
<http://kogma.nict.go.jp/cgi-bin/geomag-interface-j/>

X or H component



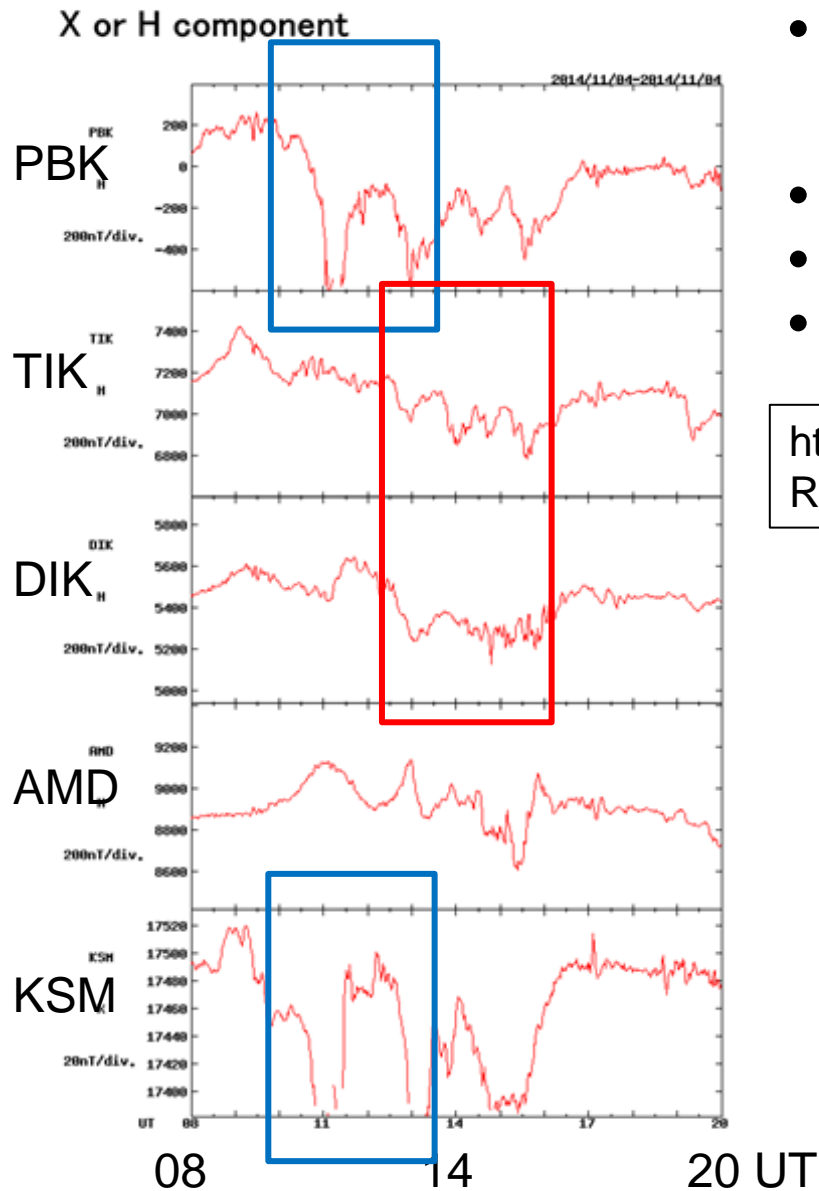
- Geomagnetic X or H component variations at PBK, TIK, DIK, AMD and KSM
- Before ~1400 UT westward jet near PBK
- After 1400 UT westward jet near TIK, DIK
- Seem to be associated with the westward motion of SAPS structure

[http://sd-www.jhuapl.edu/rapidmag/html/RapidMag\\_stations.html](http://sd-www.jhuapl.edu/rapidmag/html/RapidMag_stations.html)



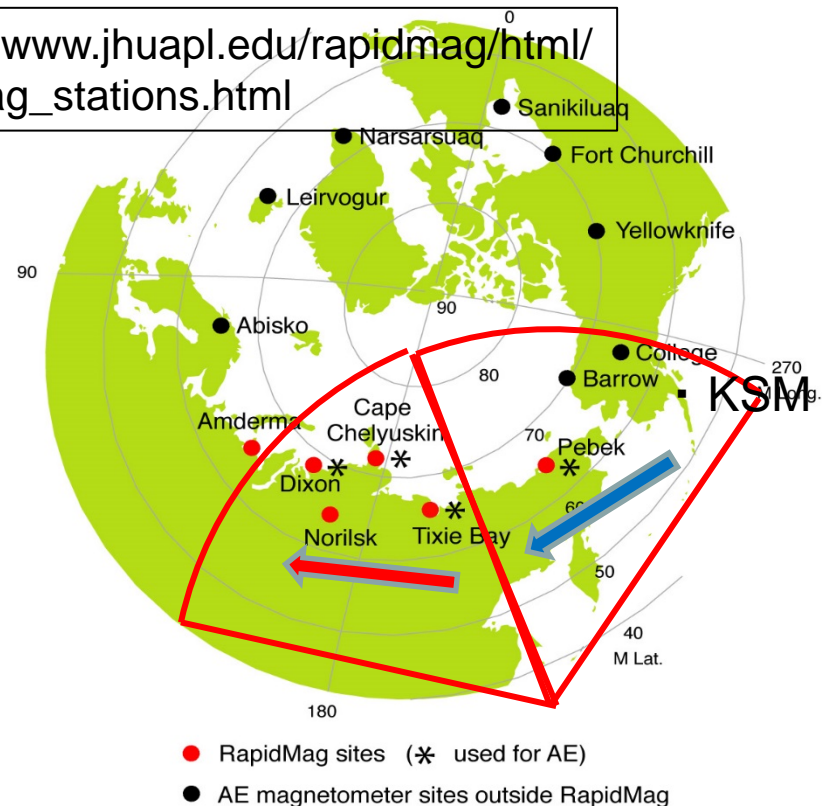
# NICT near real time data (4 Nov 2014)

<http://kogma.nict.go.jp/cgi-bin/geomag-interface-j/>

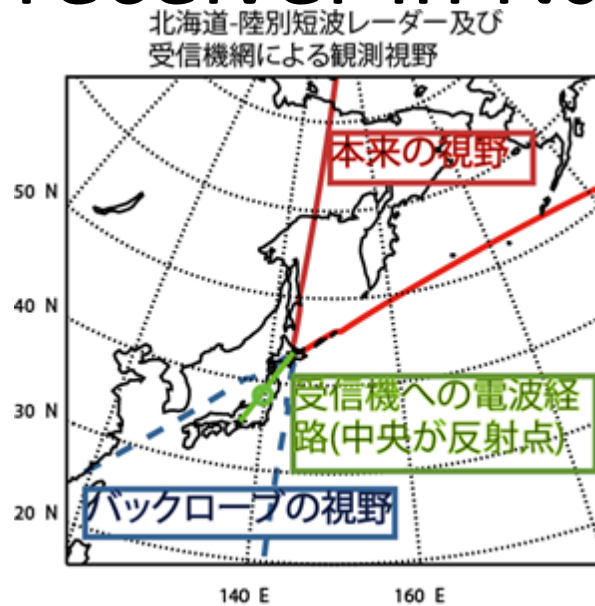


- Geomagnetic X or H component variations at PBK, TIK, DIK, AMD and KSM
- Before ~1400 UT westward jet near PBK
- After 1400 UT westward jet near TIK, DIK
- Seem to be associated with the westward motion of SAPS structure

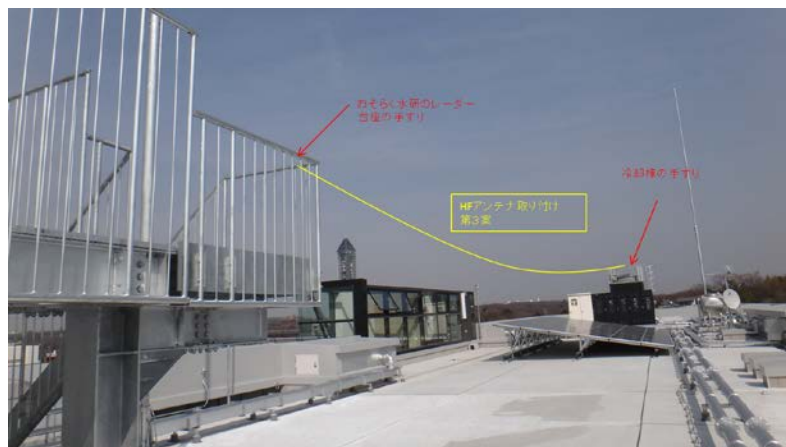
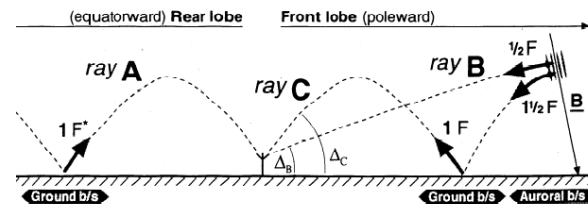
[http://sd-www.jhuapl.edu/rapidmag/html/RapidMag\\_stations.html](http://sd-www.jhuapl.edu/rapidmag/html/RapidMag_stations.html)



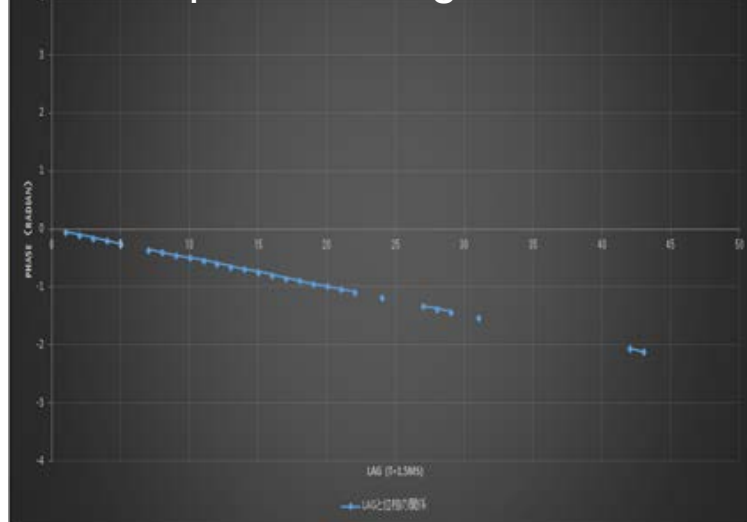
# Installation of HF radar wave remote receiver in Nagoya (since Aug 2014)



- Observing backlobe beam signals in Nagoya to measure the vertical motion of the ionospheric reflection point
- Initial results have been obtained



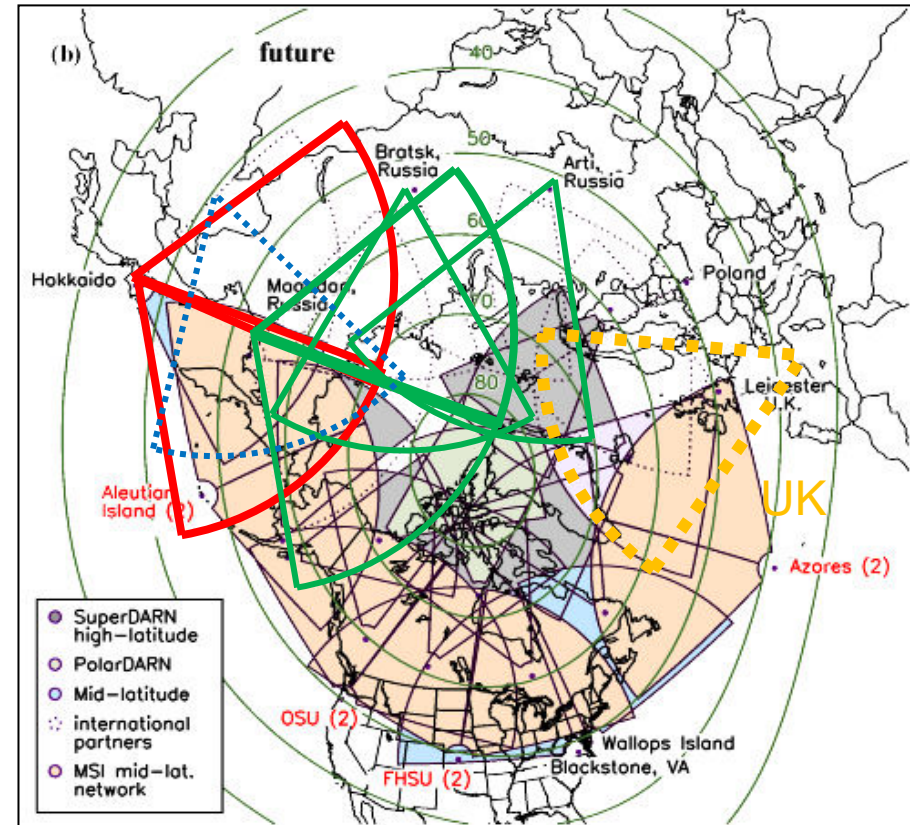
## ACF phase vs lag number





# SuperDARN Hokkaido East / West radars and international collaboration

- Japan-USA collaboration
  - Trans North America subauroral region (50-60 geomag. Lat.)
  - Will be completed in 2013 FY
- Japan-Russia collaboration
  - Siberian SuperDARN (JSPS-RFBR, H24-25)
  - Ekaterinburg radar started in Feb. 2012, other 3 radars will be operational within 2 years
  - Collaboration with other observation (HF Doppler, IS radar etc.)
- Japan-Australia collaboration
  - TIGER 3 will be operational soon
  - Conjugate study in subauroral and midlatitude regions
- Japan-UK collaboration (European midlatitude SuperDARN radar funded)
- Japan-China collaboration (Chinese mainland radar funding in application)



— Japan  
— Russia

# Summary

- SuperDARN Hokkaido West radar began its operation on 24 Oct 2014, to form the SuperDARN Hokkaido Pair of (HOP) radars system.
- 1-4 Nov 2014 STE event is a good one to demonstrate the capability of the SuperDARN HOP system, i.e., to clarify the longitudinal variation of SAPS structure.
- As there are increasing number of midlatitude SuperDARN radars, international collaboration is getting more and more important for the study of the magnetosphere, ionosphere and thermosphere in the subauroral and midlatitude region on a global scale.
- Remote HF radar wave receiver in Nagoya have been operating since Aug 2014, trying to demonstrate the capability of monitoring the ionospheric dynamics equatorward of SuperDARN radars, with relatively low costs (~350,000 JPY per one set). We are looking for scientists interested in joining this project.