


SuperDARN HOPLレーダーにより観測された  
低緯度オーロラに伴う電離圏対流


SuperDARN HOP radars observations of convective  
flows associated with low-latitude auroras



Low latitude aurora behind the SuperDARN  
HOP East radar (2015.3.18 0110 JST)

西谷 望、堀 智昭 (名大ISEE)、  
SuperDARN PIs

SuperDARN HOPLレーダーにより観測された  
低緯度オーロラに伴う電離圏対流  
SuperDARN HOP radars observations of convective  
flows associated with low-latitude auroras

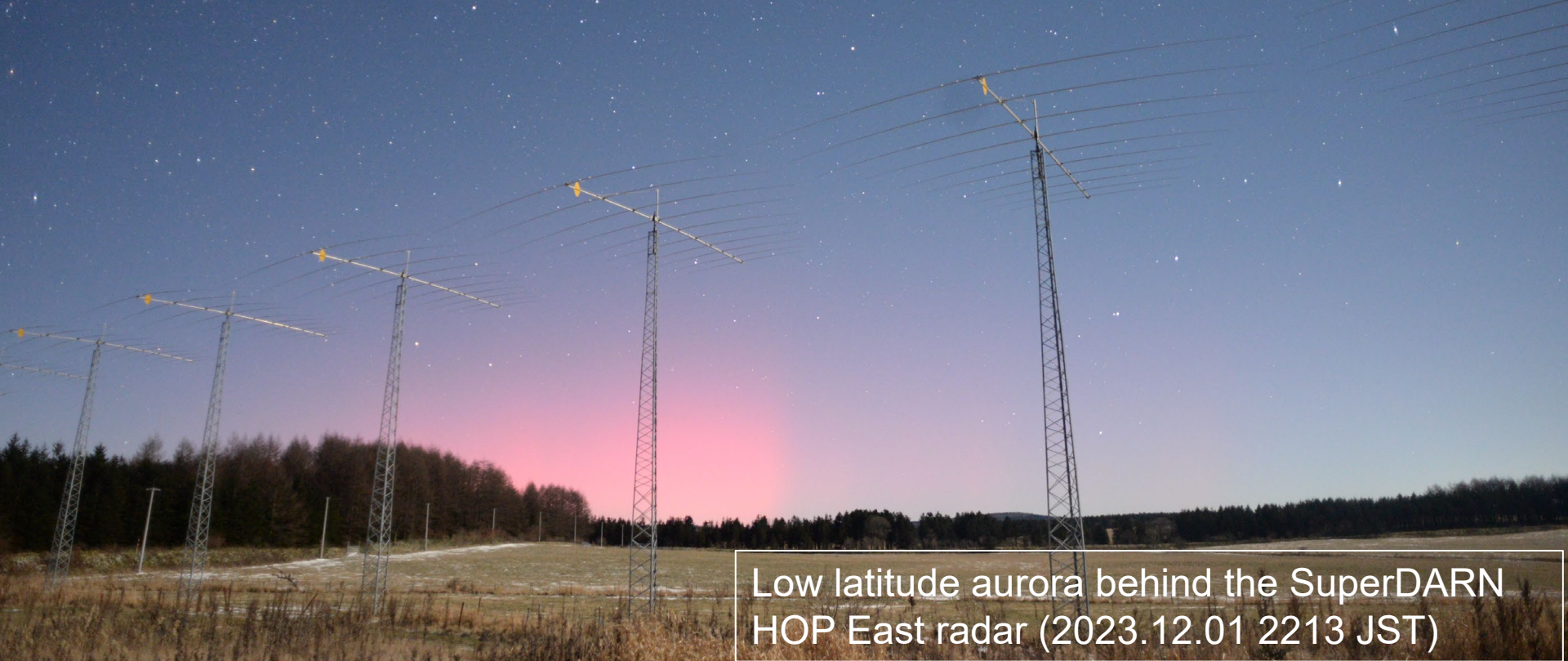


Low latitude aurora behind the SuperDARN  
HOP East radar (2023.11.06 0236 JST)

西谷 望、堀 智昭 (名大ISEE)、  
SuperDARN PIs

# SuperDARN HOPLレーダーにより観測された 低緯度オーロラに伴う電離圏対流

SuperDARN HOP radars observations of convective  
flows associated with low-latitude auroras

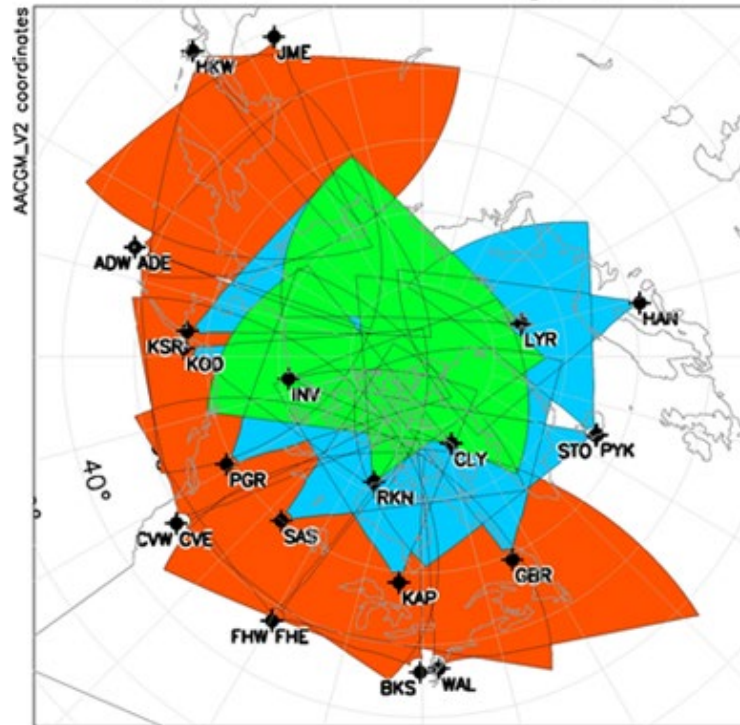


Low latitude aurora behind the SuperDARN  
HOP East radar (2023.12.01 2213 JST)

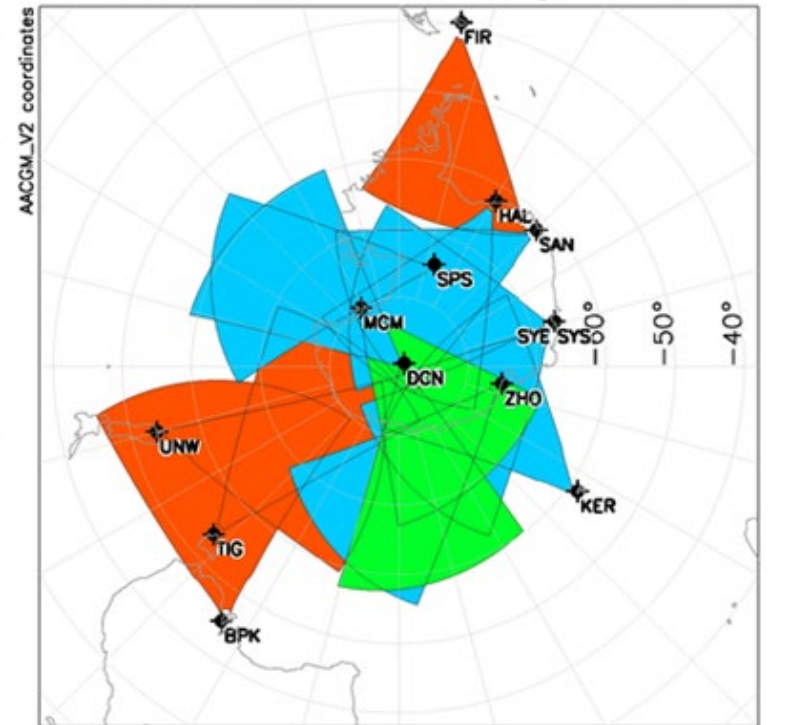
西谷 望、堀 智昭 (名大ISEE)、  
SuperDARN PIs

# Super Dual Auroral Radar Network (SuperDARN)

## Northern Hemisphere



## Southern Hemisphere



High-latitude

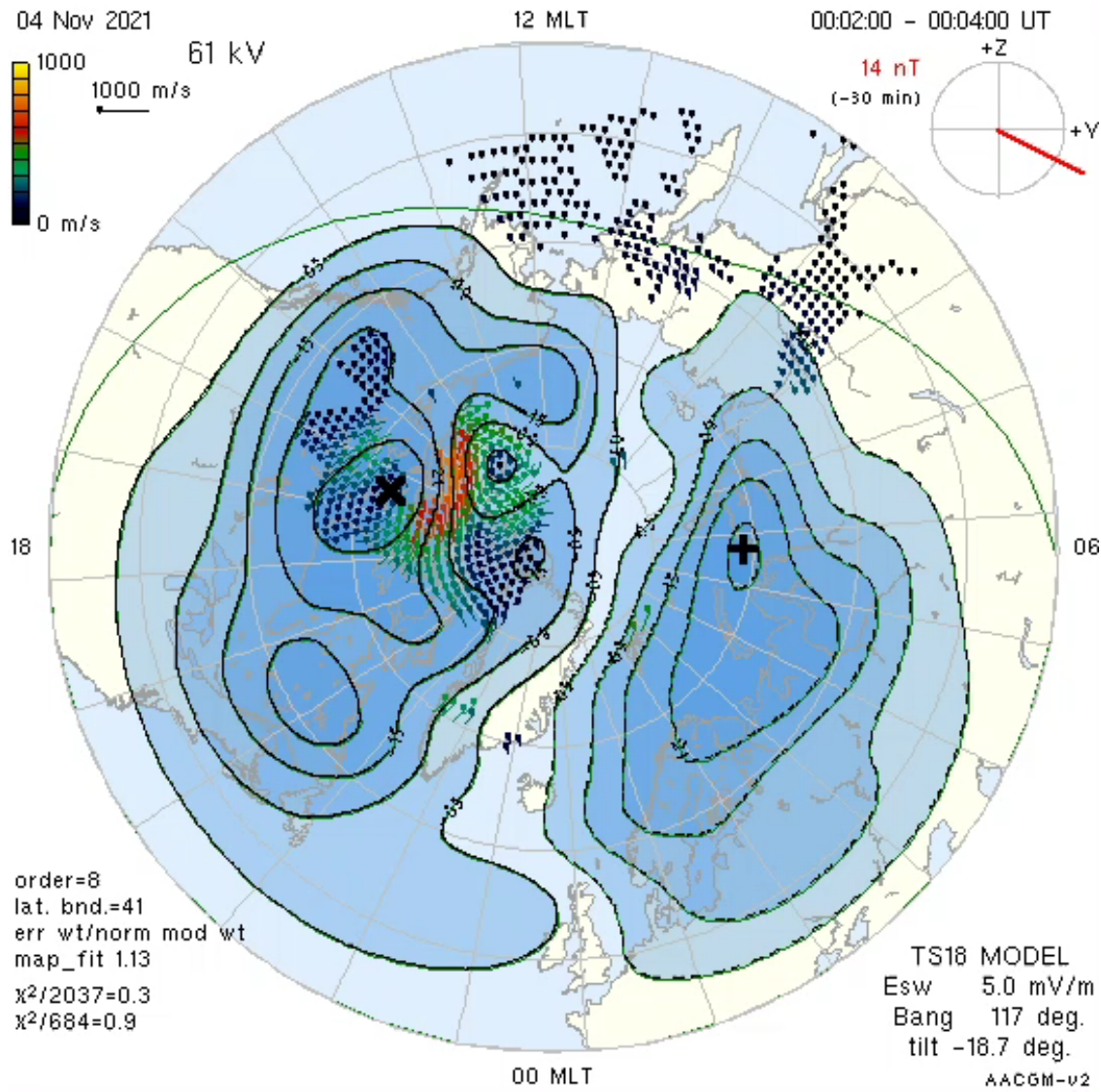
Mid-latitude

Polar cap

Number of operating HF radars: 38 (24 in the northern and 14 in the southern hemispheres) as of Jul 01, 2022

Standard temporal resolution: 1-2 min

# Global convection map movie on 04 Nov 2021

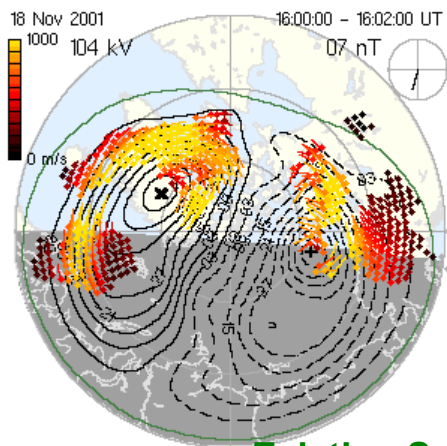
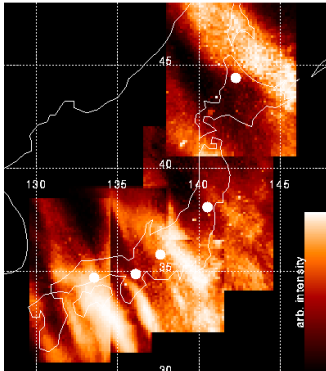


提供:  
名古屋大M2  
大森君

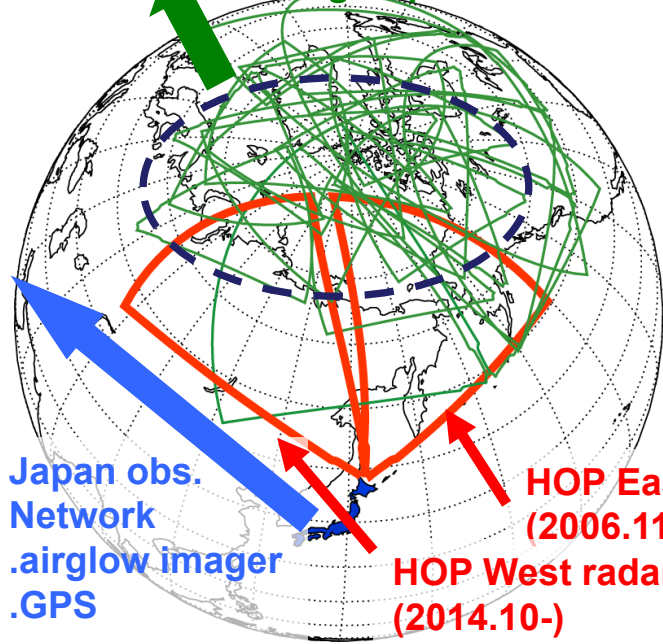
# SuperDARN Hokkaido Pair of (HOP) radars (2006.11-)

## Airglow imagers

OI 630-nm emission  
22/05/1998 23:10 JST



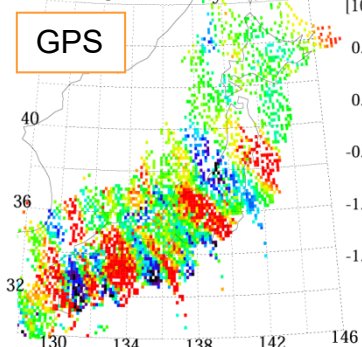
Existing SuperDARN network



## GPS

23:10 JST May 22, 1998

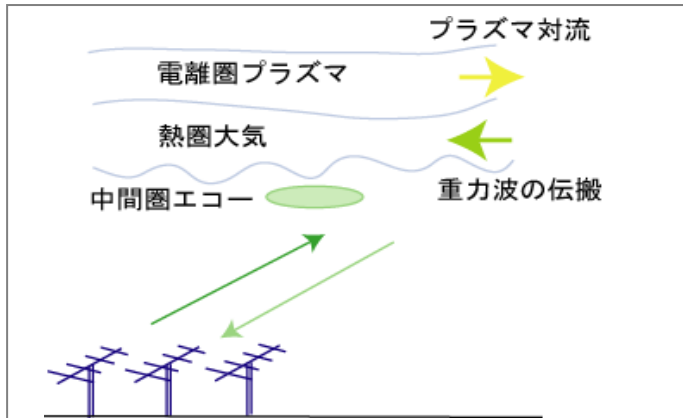
TEC [ $10^{16}/m^2$ ]



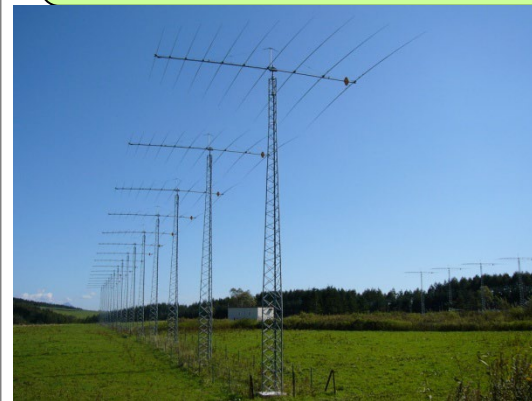
Japan obs.  
Network  
.airglow imager  
.GPS

HOP East radar  
(2006.11-)

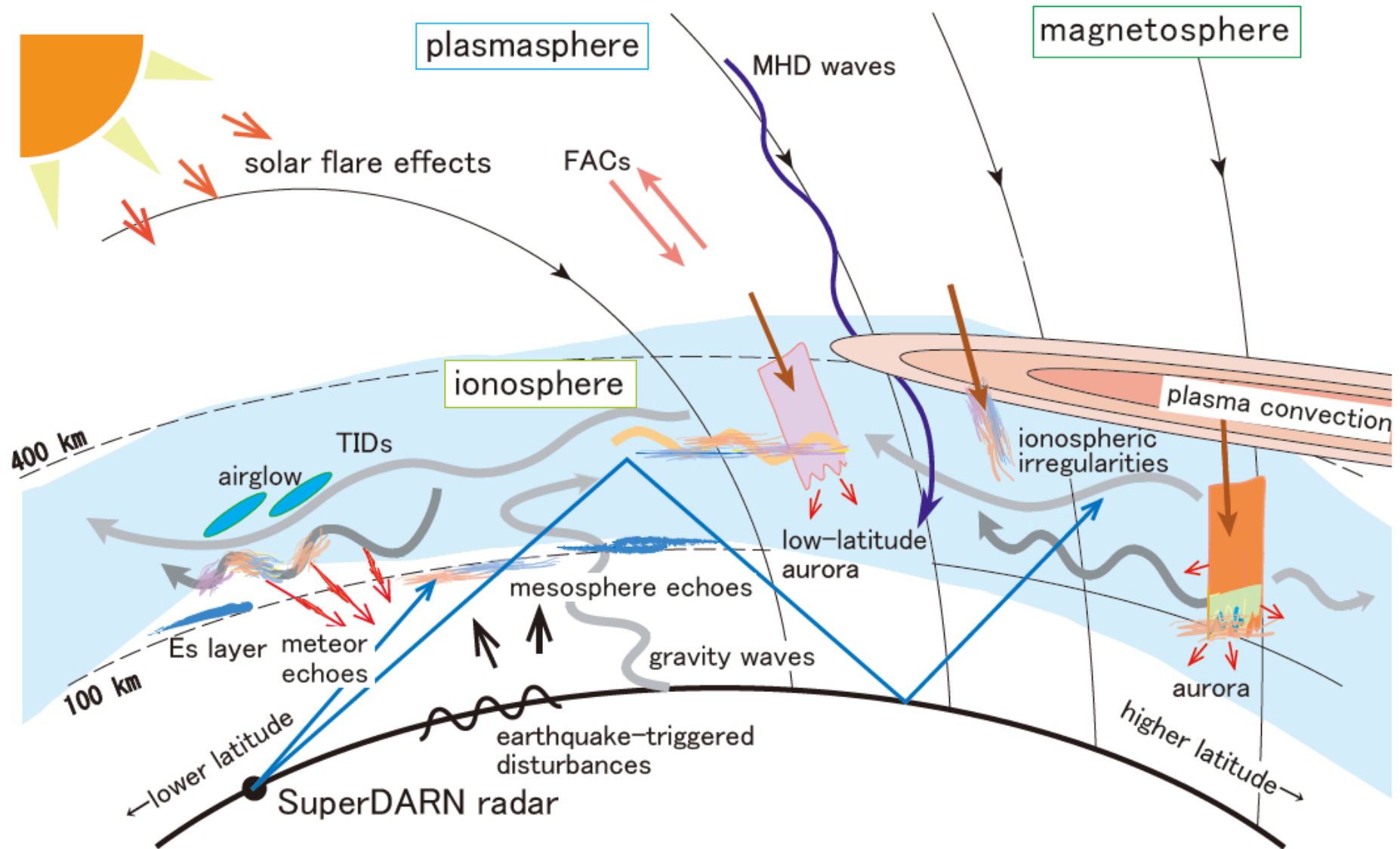
HOP West radar  
(2014.10-)



Study of ionosphere, thermosphere and upper mesosphere



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



Schematic objectives of the SuperDARN radars  
 Nishitani, Ruohoniemi, Lester et al., Mid-latitude SuperDARN review paper (PEPS, 2019, PEPS most cited award 2021)

# Fujii et al. (1994) – convection / FAC associated with auroral bulges

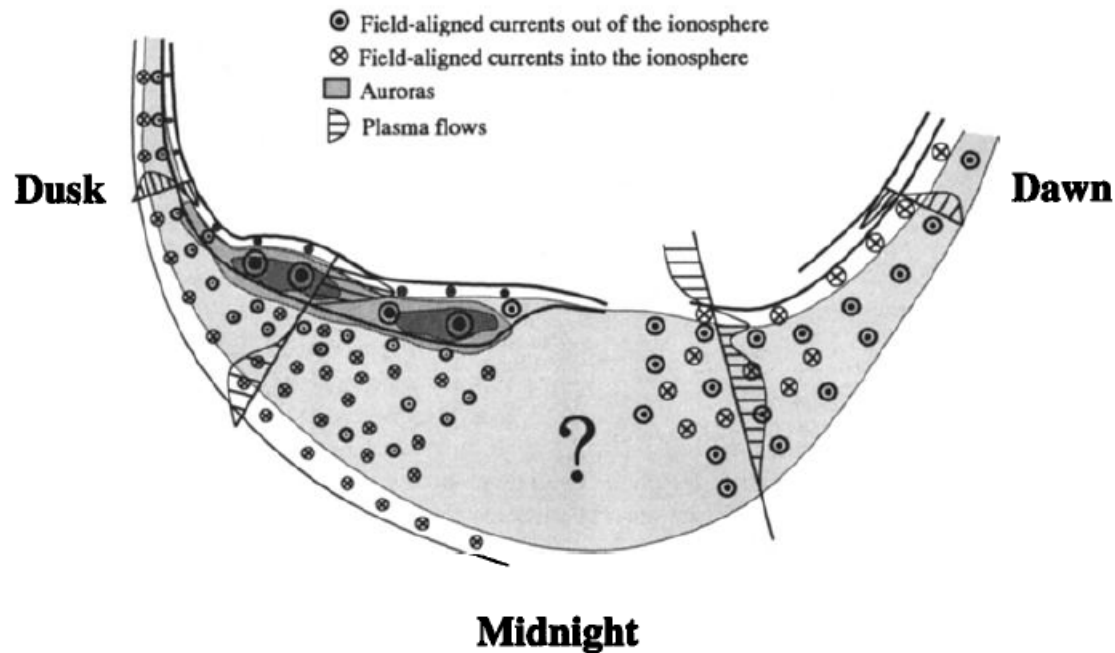


Fig. 11. The distributions of FACs, electric fields (plasma flows), and auroras associated with the generic aurora during a bulge-type substorm. At the poleward boundary of the bulge a pair of upward and downward FACs is observed associated with a narrow eastward and/or antisunward plasma flow.

How about low-latitude aurora?



# Rees and Roble (1975) – SAR arc as a result of ring current / plasmasphere overlapping

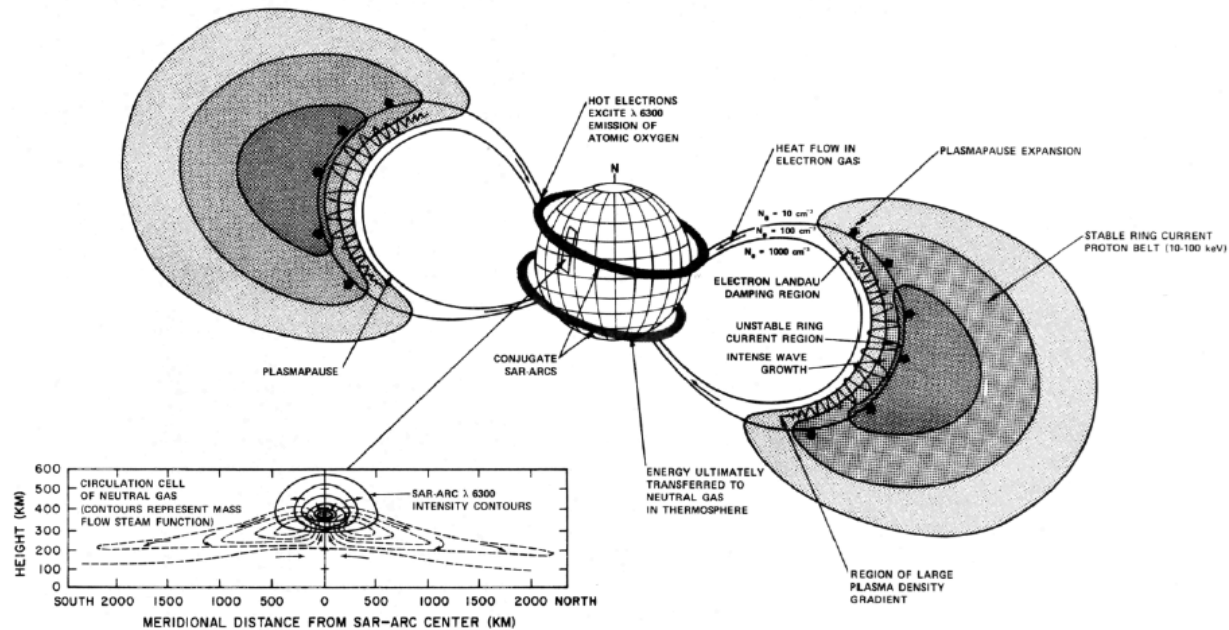


Fig. 43. Schematic diagram of the processes acting within an SAR arc.

Role of the electric field is not described.  
The current cases do not seem to be “Stable” arcs.

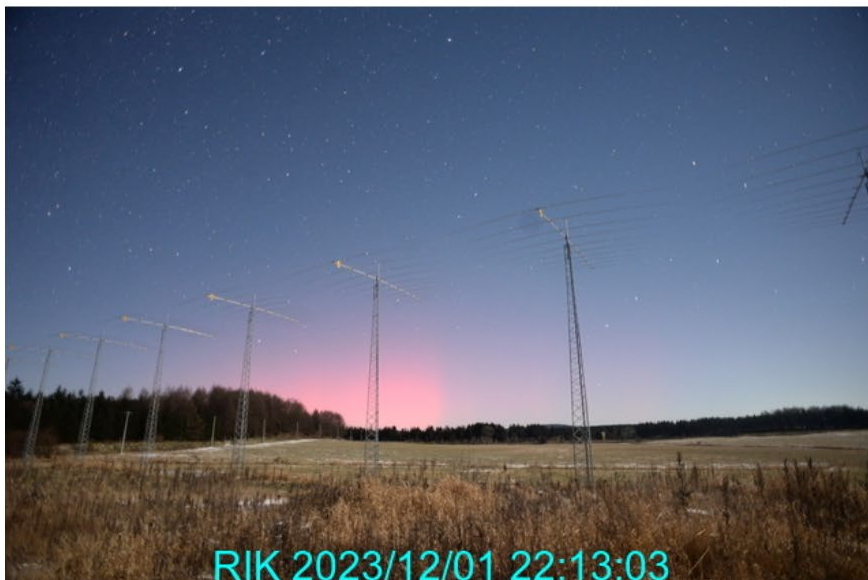
ホーム » お知らせ

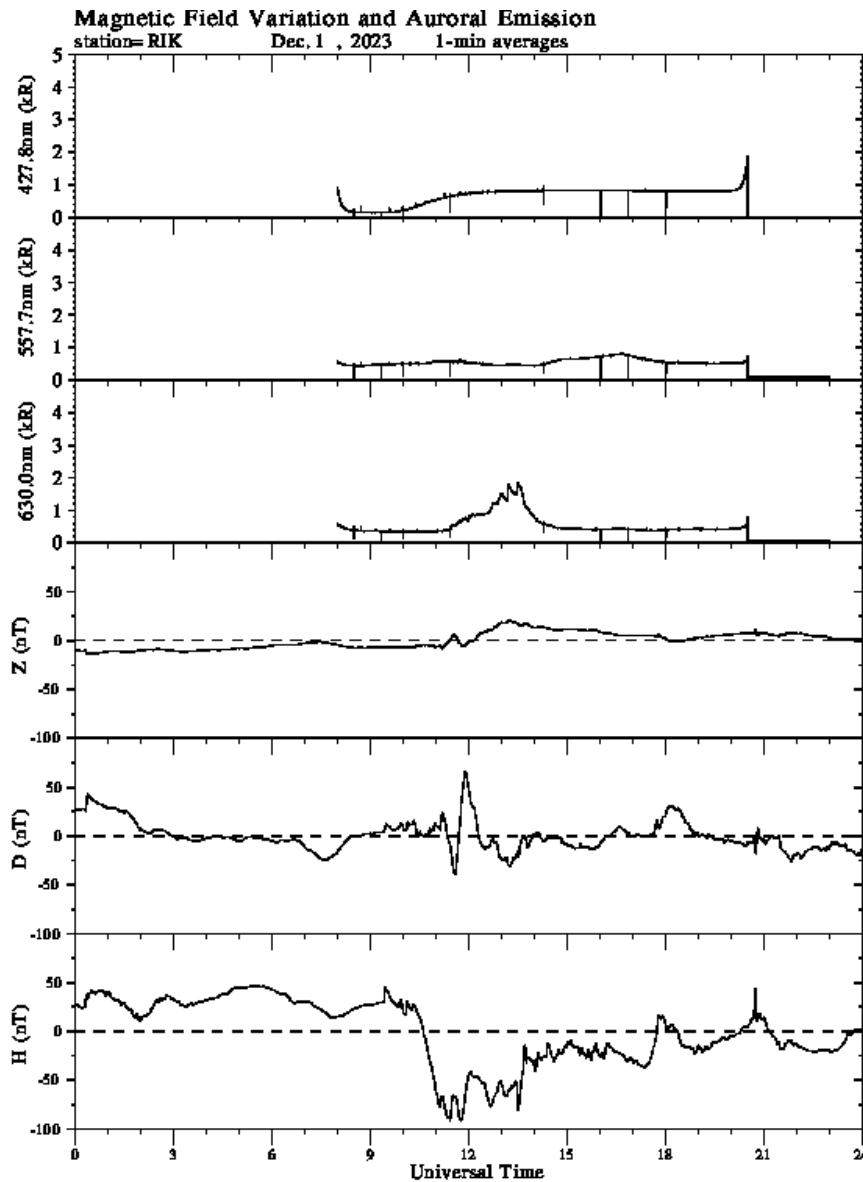
## 北海道の陸別・母子里観測所で磁気嵐に伴う低緯度オーロラを観測しました。

2023-12-04

2023年12月1日の晩に、当研究所の北海道陸別・母子里観測所で、肉眼で見える明るさの低緯度オーロラを観測しました。詳しくはこちらをご参照ください。

[https://stadb2.isee.nagoya-u.ac.jp/member/shiokawa/aurora\\_231201.html](https://stadb2.isee.nagoya-u.ac.jp/member/shiokawa/aurora_231201.html)





Photometer and  
 magnetometer  
 data@Rikubetsu  
 (courtesy of K.  
 Shiokawa)

Dec 01, 2023  
 00-24 UT

# Aurora Observed by the camera (Nikon D610) at the radar site



2024/02/07

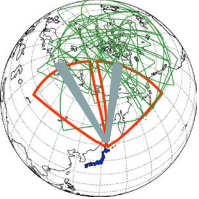
SuperDARN研究集会@九大

2213-2228 JST, 2023/12/01

# Low-latitude aurora observed at Rikubetsu Astronomical Observatory (Courtesy of T. Murata)



陸別町銀河の森天文台で2023年12月1日に撮影したタイムラプス動画のロングバージョンです。この動画は、20:21~23:03の約2時間半の観測画像871枚を使用しています。約170倍速の動画になります。<https://www.youtube.com/watch?v=p2B3IWT6A0c>



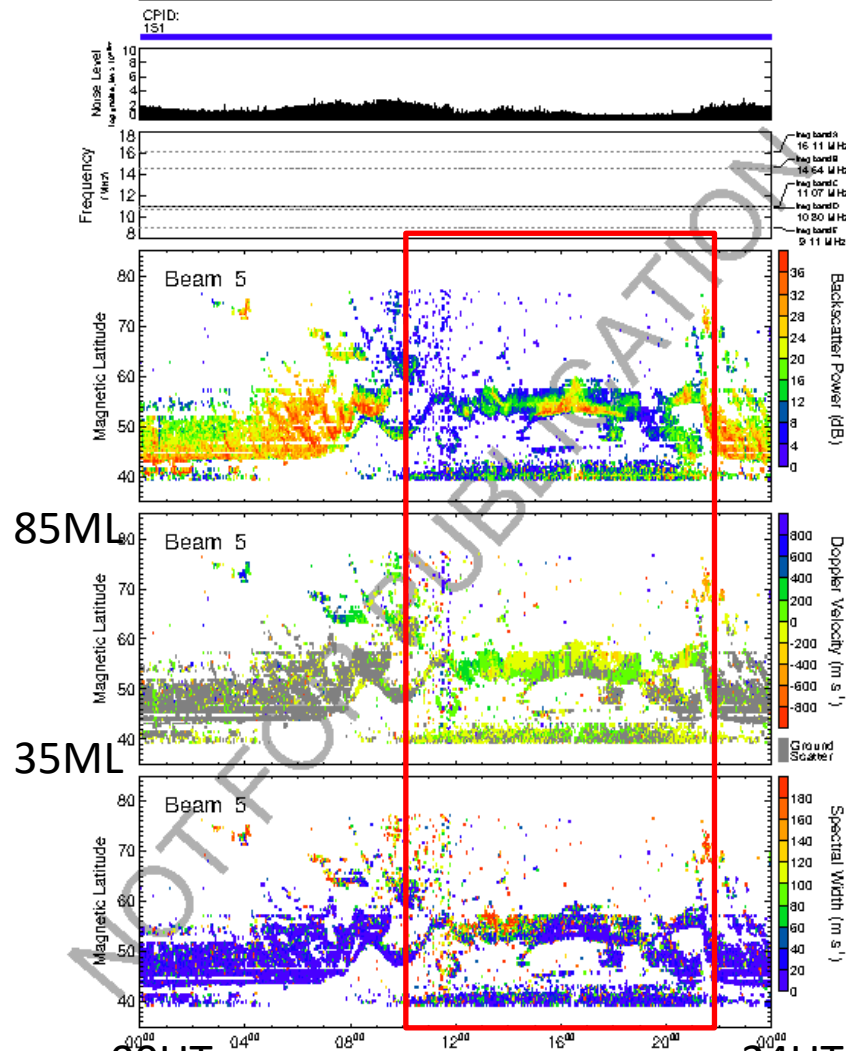
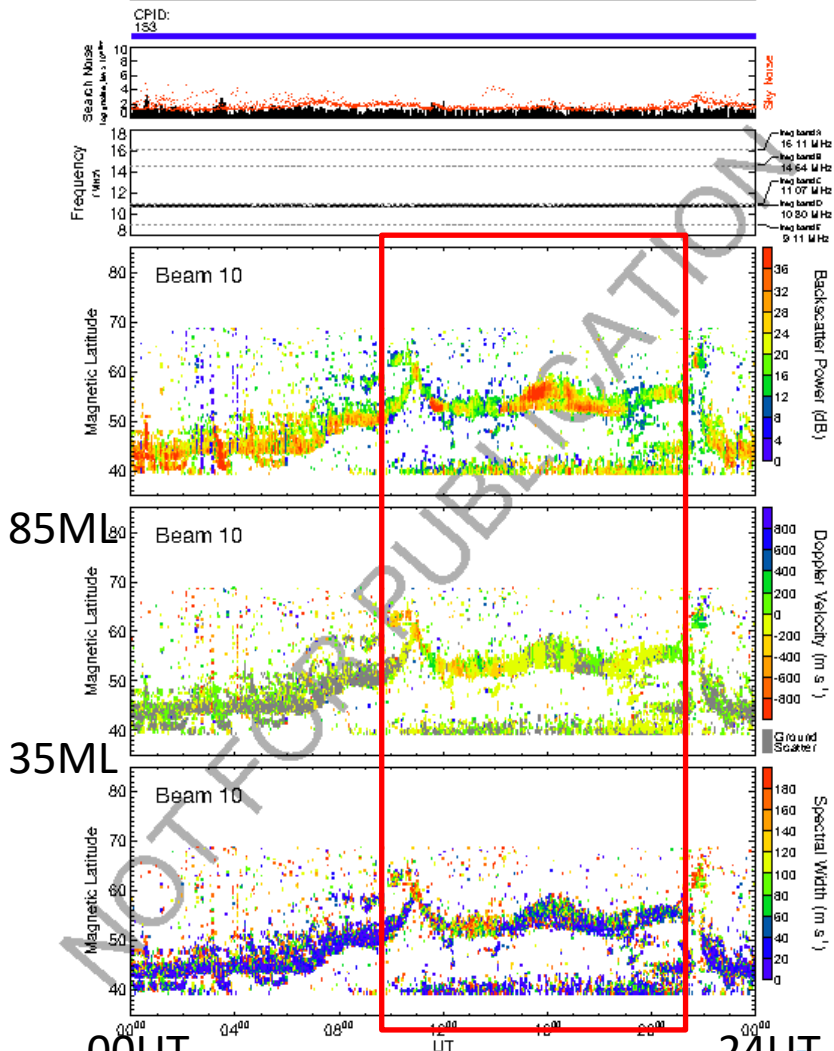
# Dec 01, 2023

LT=UT+9 hrs

## Hokkaido West / East quicklook plots

HOKKAIDO WEST RADAR SUMMARY PLOT 1 Dec 2023

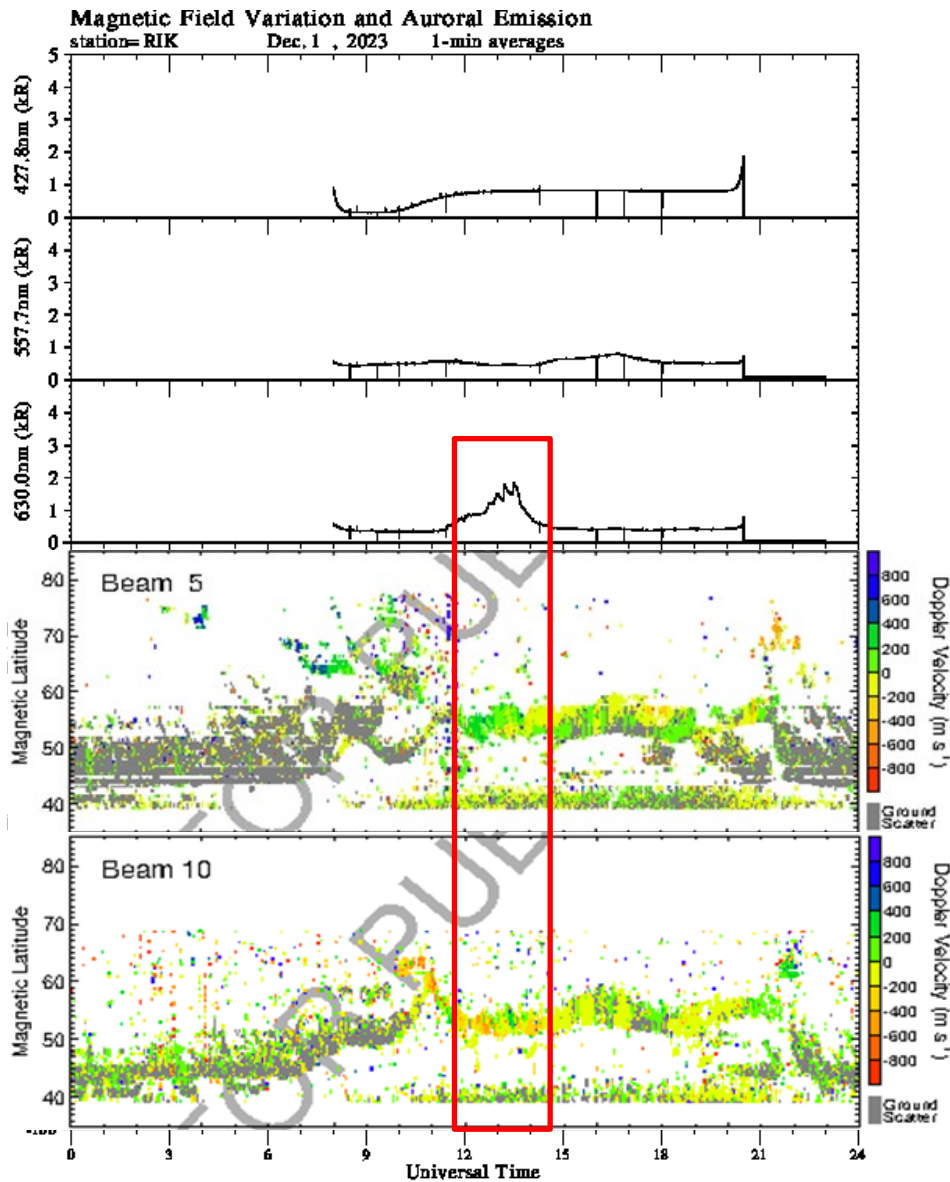
HOKKAIDO RADAR SUMMARY PLOT 1 Dec 2023



00UT  
2024/02/07

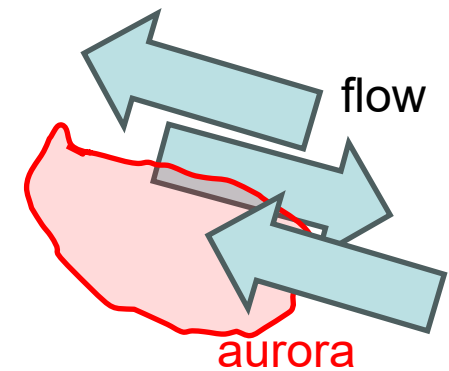
24UT  
SuperDARN 研究集会@九大

00UT  
24UT  
ISE



Photometer and magnetometer data@Rikubetsu (courtesy of K. Shiokawa)

Dec 01, 2023  
 00-24 UT



21-00 MLT





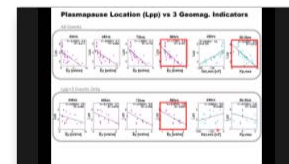
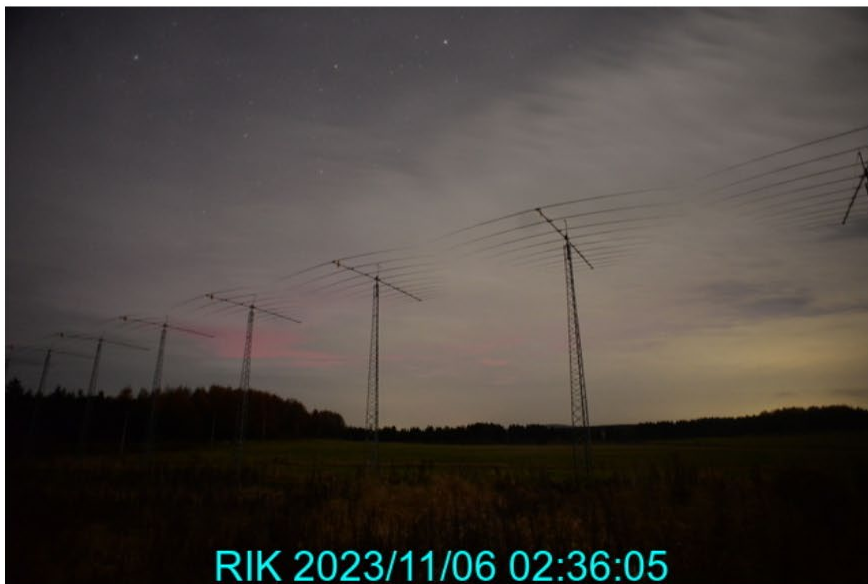
ホーム » お知らせ

## 北海道の陸別観測所で磁気嵐に伴う低緯度オーロラを観測しました。

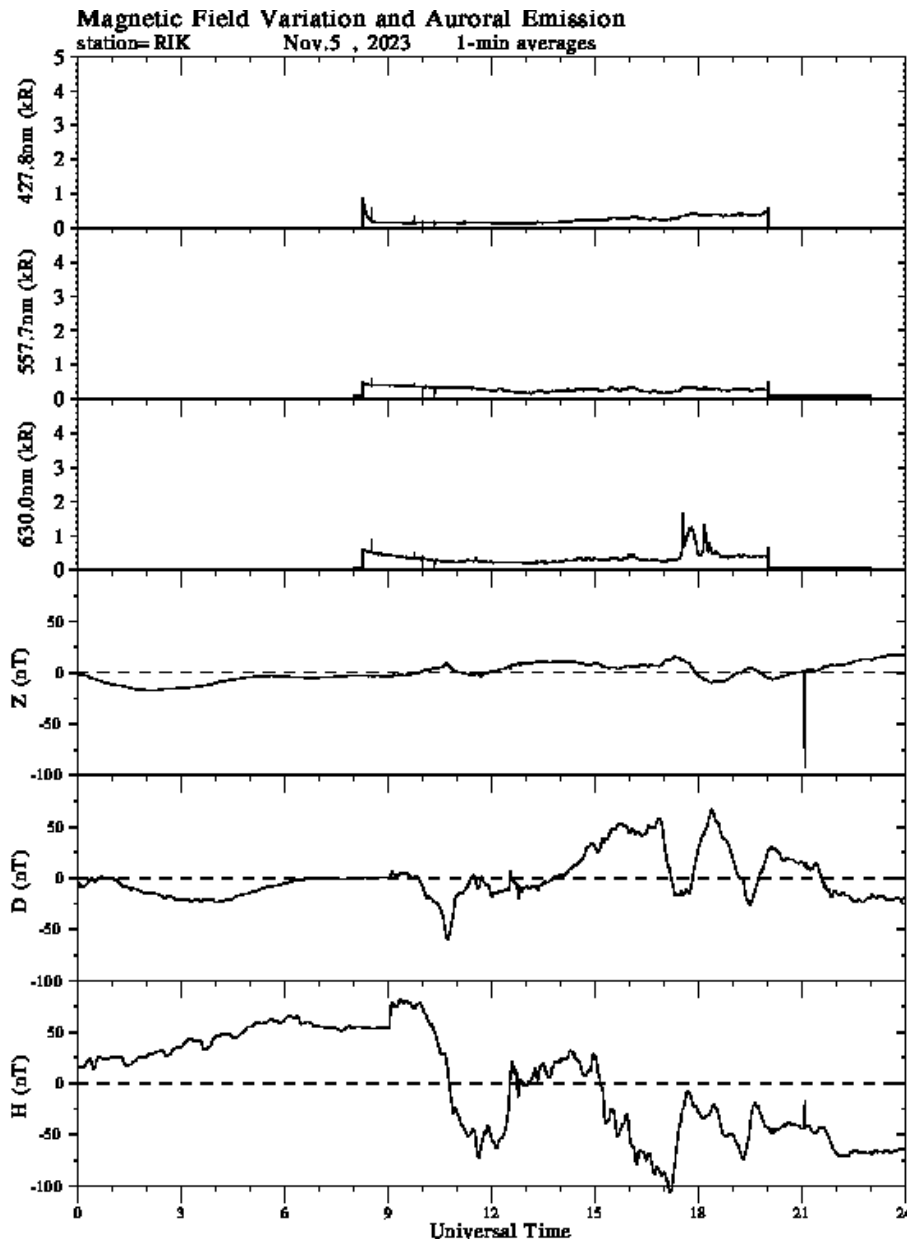
2023-11-07

2023年11月5日の晩に、当研究所の北海道陸別観測所で、低緯度オーロラを観測しました。詳しくはこちらをご参照ください。

[https://stdb2.isee.nagoya-u.ac.jp/member/shiokawa/aurora\\_231105.html](https://stdb2.isee.nagoya-u.ac.jp/member/shiokawa/aurora_231105.html)



[ページトップ](#)



Photometer and magnetometer data@Rikubetsu (courtesy of K. Shiokawa)

Nov 5, 2023  
 00-24 UT

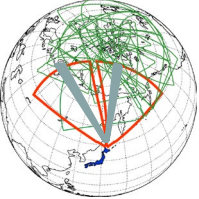
# Aurora Observed by the camera (Nikon D610) at the radar site



2024/02/07

SuperDARN研究集会@九大

0236 – 0251 JST, 2023/11/06



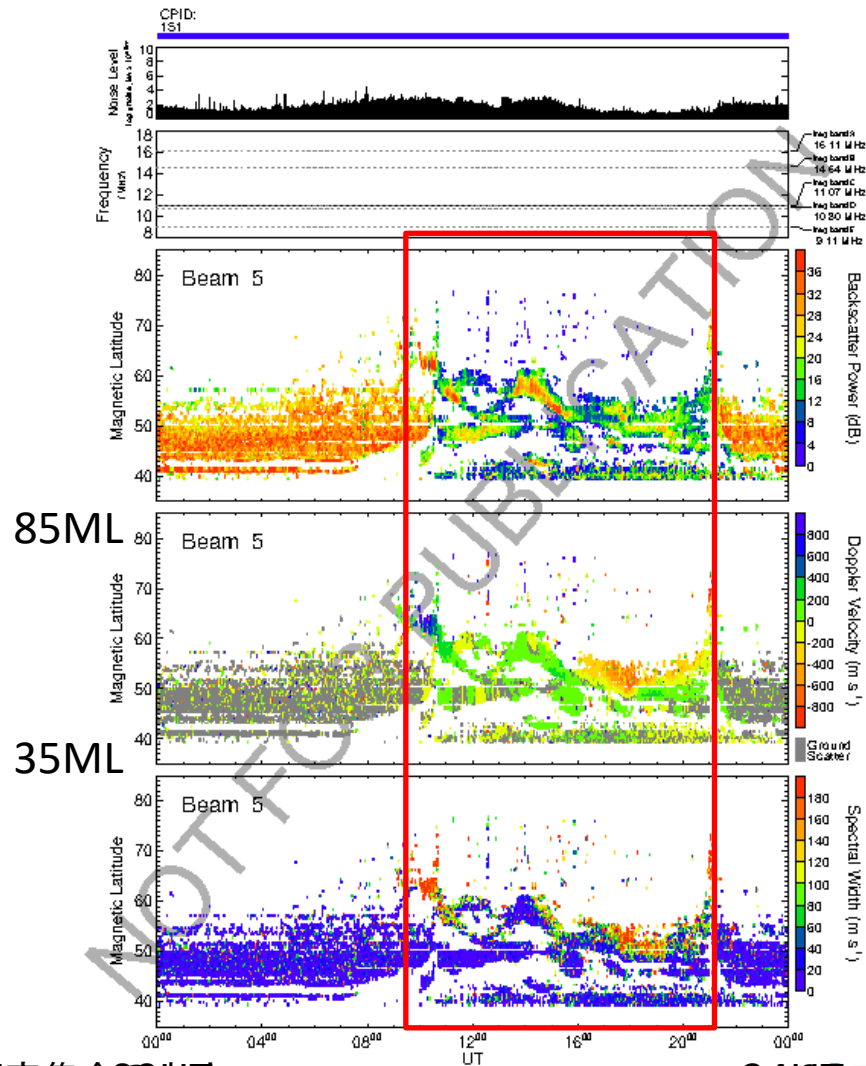
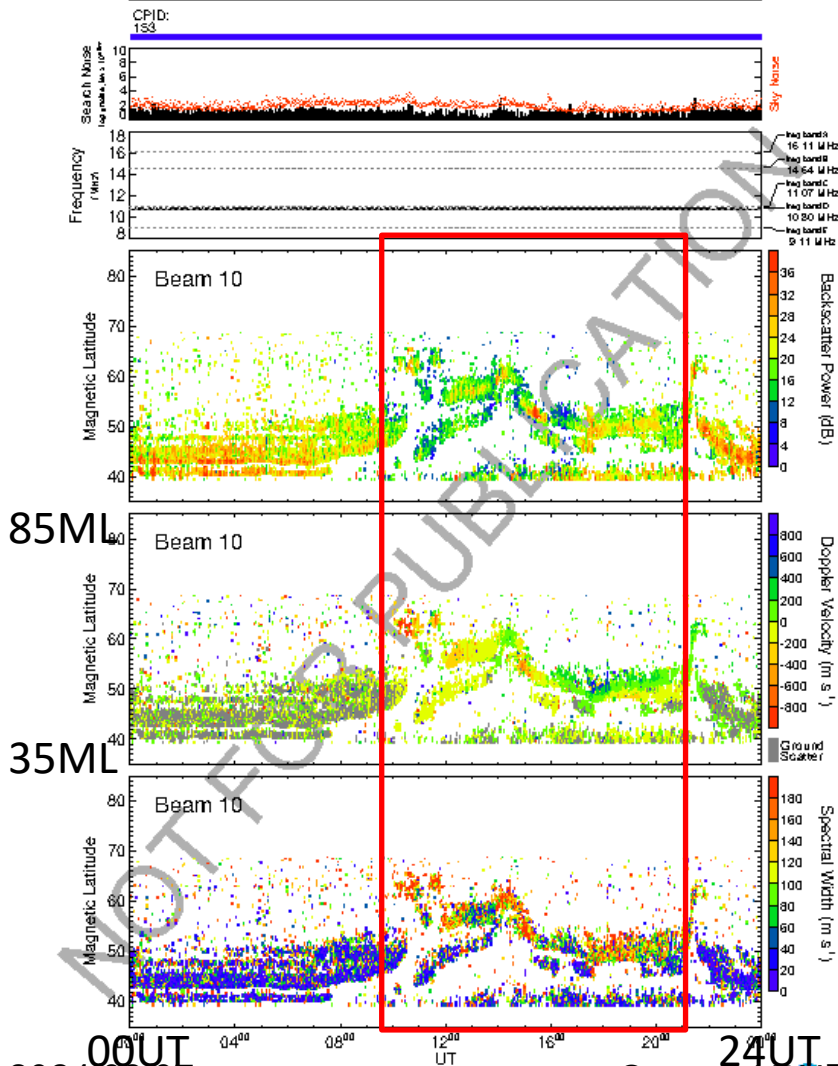
Nov 05, 2023

LT=UT+9 hrs

# Hokkaido West / East quicklook plots

HOKKAIDO WEST RADAR SUMMARY PLOT 5 Nov 2023

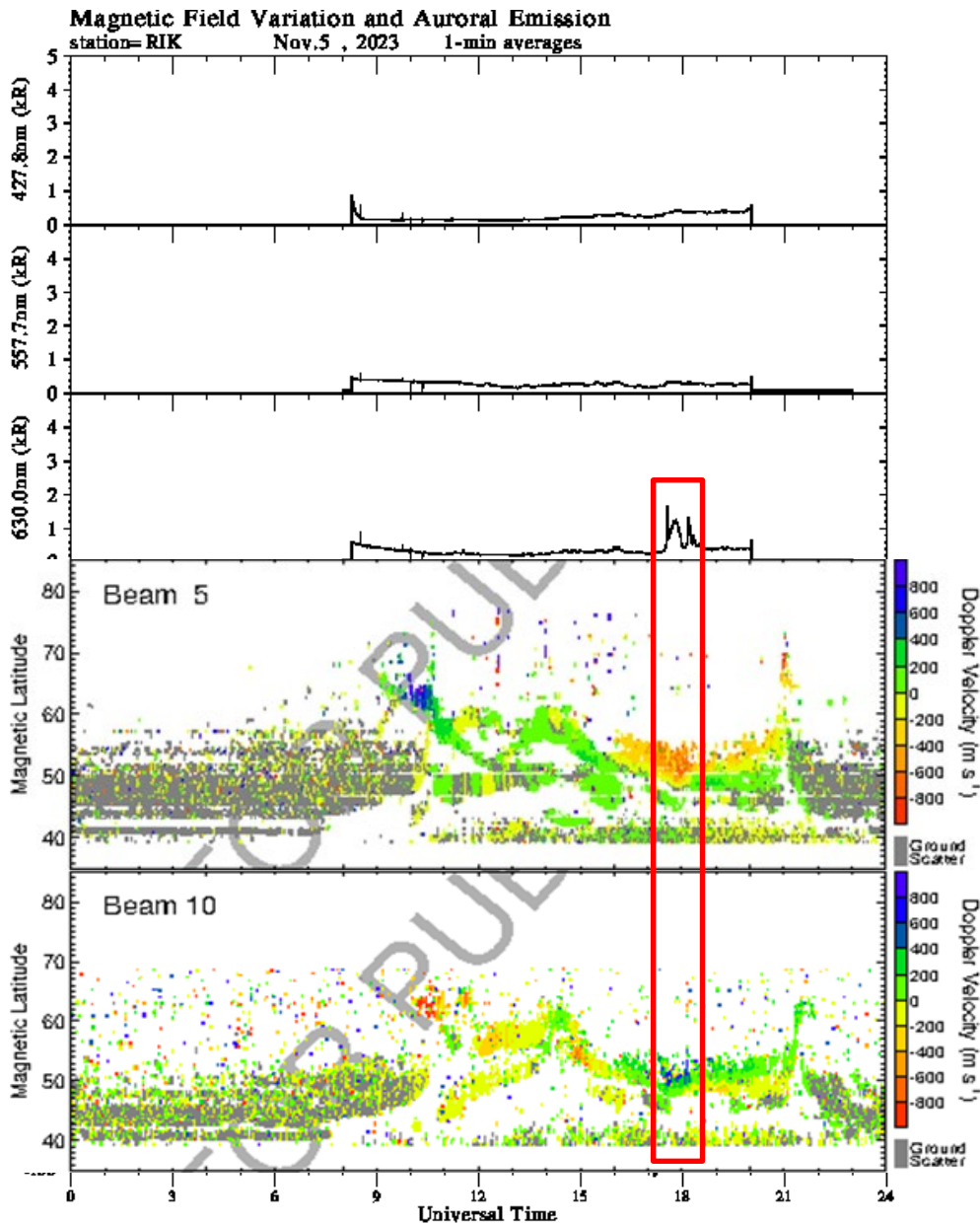
HOKKAIDO RADAR SUMMARY PLOT 5 Nov 2023



2024/02/07

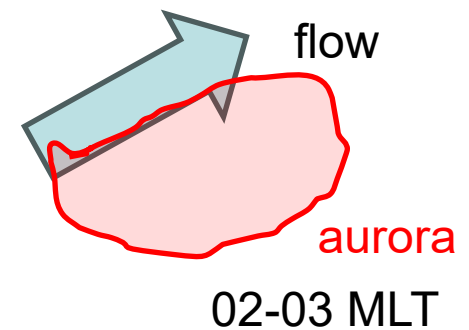
SuperDARN 研究集会 @ 筑大

24/10/2023

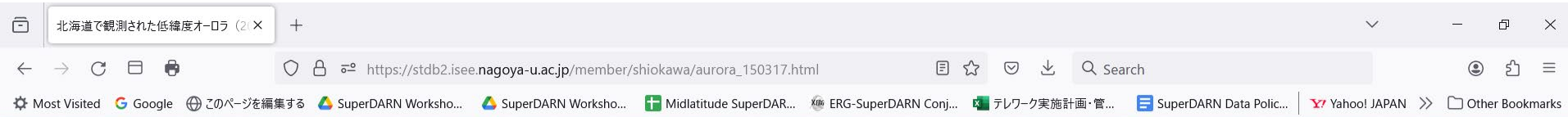


Photometer and magnetometer data@Rikubetsu (courtesy of K. Shiokawa)

Nov 5, 2023  
 00-24 UT



# https://stadb2.isee.nagoya-u.ac.jp/member/shiokawa/aurora\_150317.html



## 北海道で観測された低緯度オーロラ (2015年3月18日)



提供: 名古屋大学太陽地球環境研究所・西谷望 北海道足寄郡陸別町 北海道陸別HFレーダーサイト 2015年3月18日1:10:00JSTから25秒露出

北海道足寄郡陸別町の北海道陸別HFレーダーサイトにおいて、2015年3月18日1:10:00JSTから北の空を25秒露出。空がぼんやり赤く光っているのが低緯度オーロラ。その下に緑から白っぽく見える構造は、街明かりに照らされた雲と思われる。提供: 名古屋大学太陽地球環境研究所・西谷望准教授

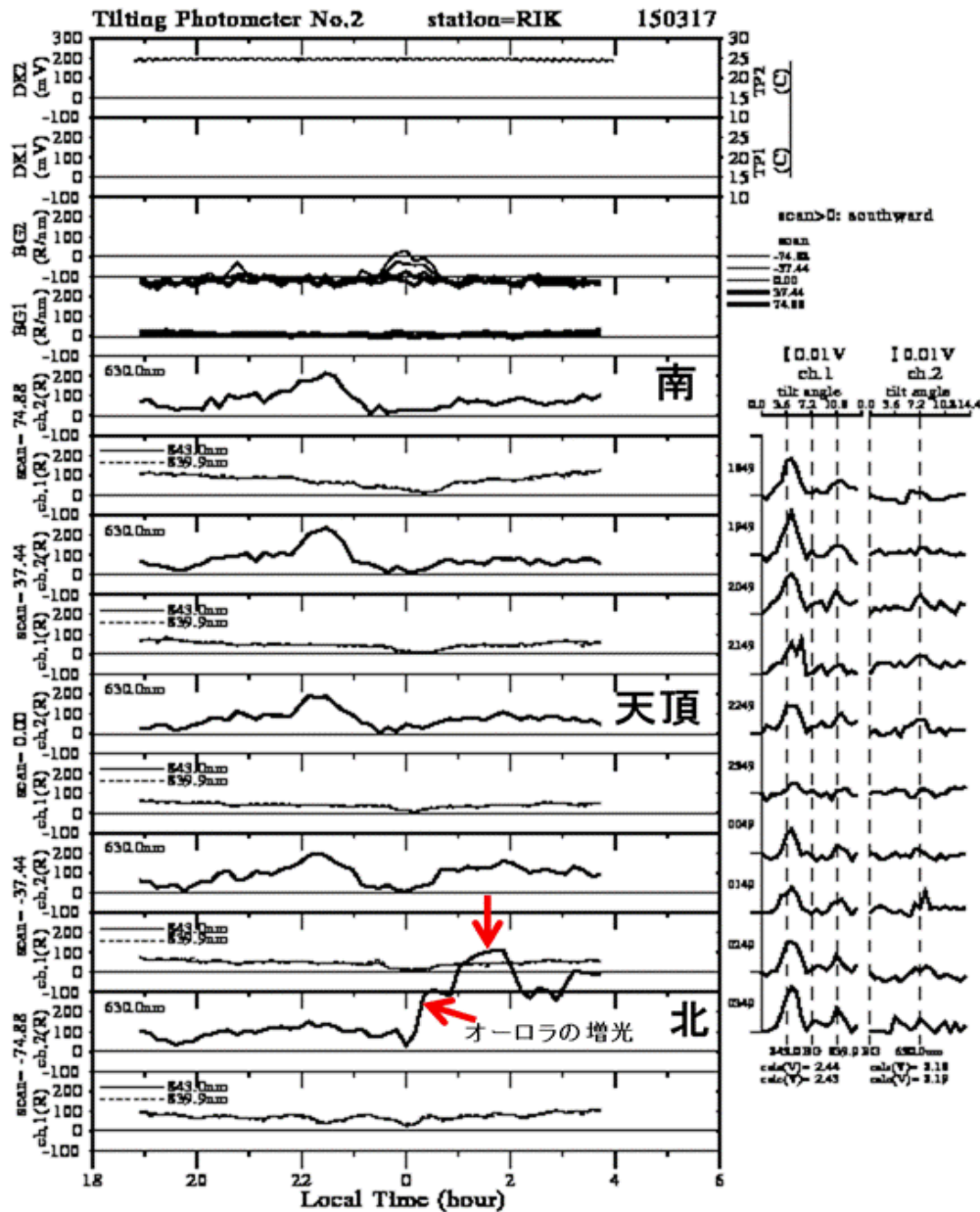
[23:00-04:30JSTの連続写真はこちら](#)

[北海道陸別HFレーダーのホームページへ](#)

# Aurora photographed at Rikubetsu radar site (1400-2030 UT, 5 min int., 25 s exposure)



Camera: Nikon D700 ISO-3200, F/2.8

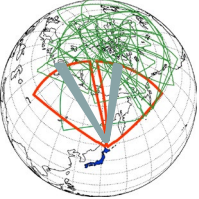


提供:名古屋大学太陽地球環境研究所

Photometer and magnetometer data@Rikubetsu (courtesy of K. Shiokawa)

March 17, 2015  
18-06 UT





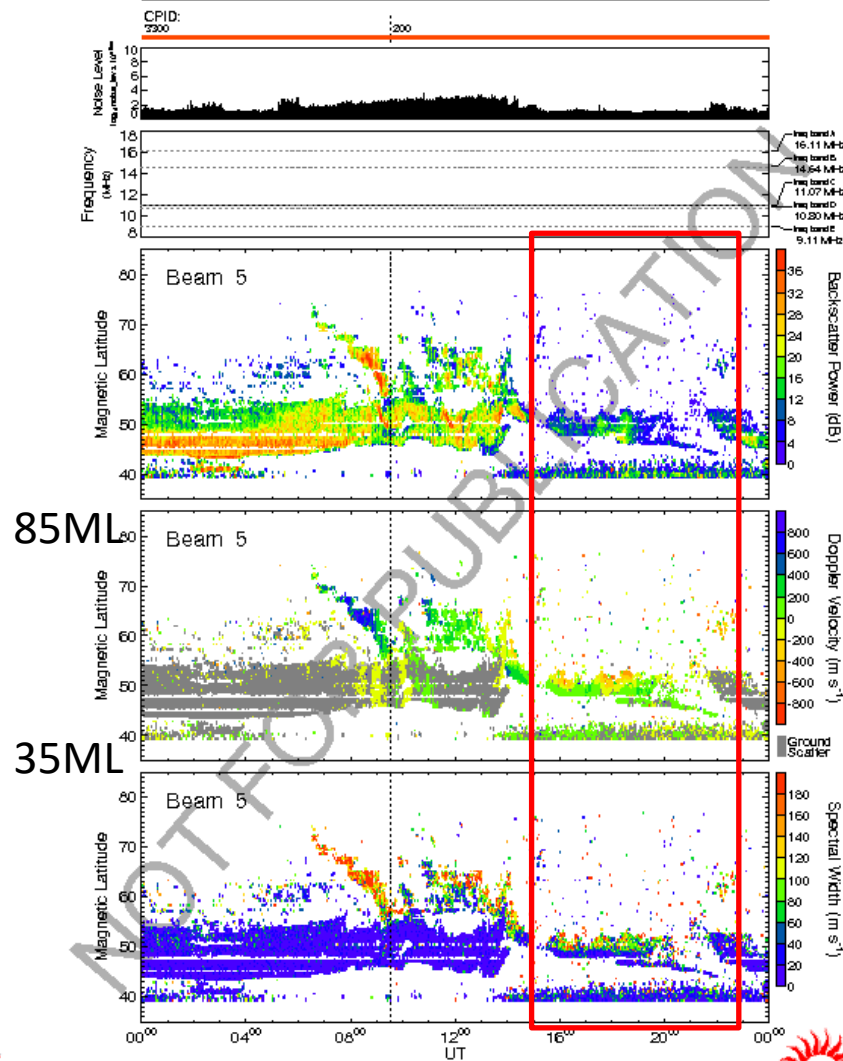
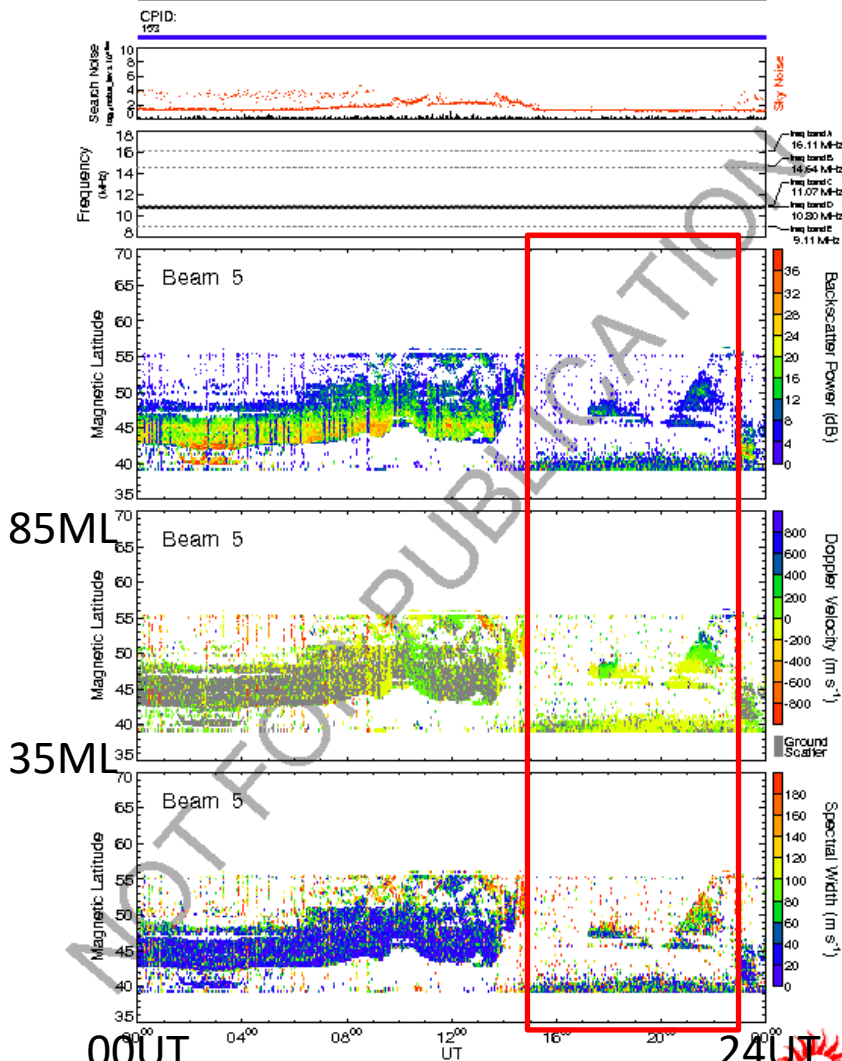
March 17, 2015

LT=UT+9 hrs

# Hokkaido West / East quicklook plots

HOKKAIDO WEST RADAR SUMMARY PLOT 17 Mar 2015

HOKKAIDO RADAR SUMMARY PLOT 17 Mar 2015



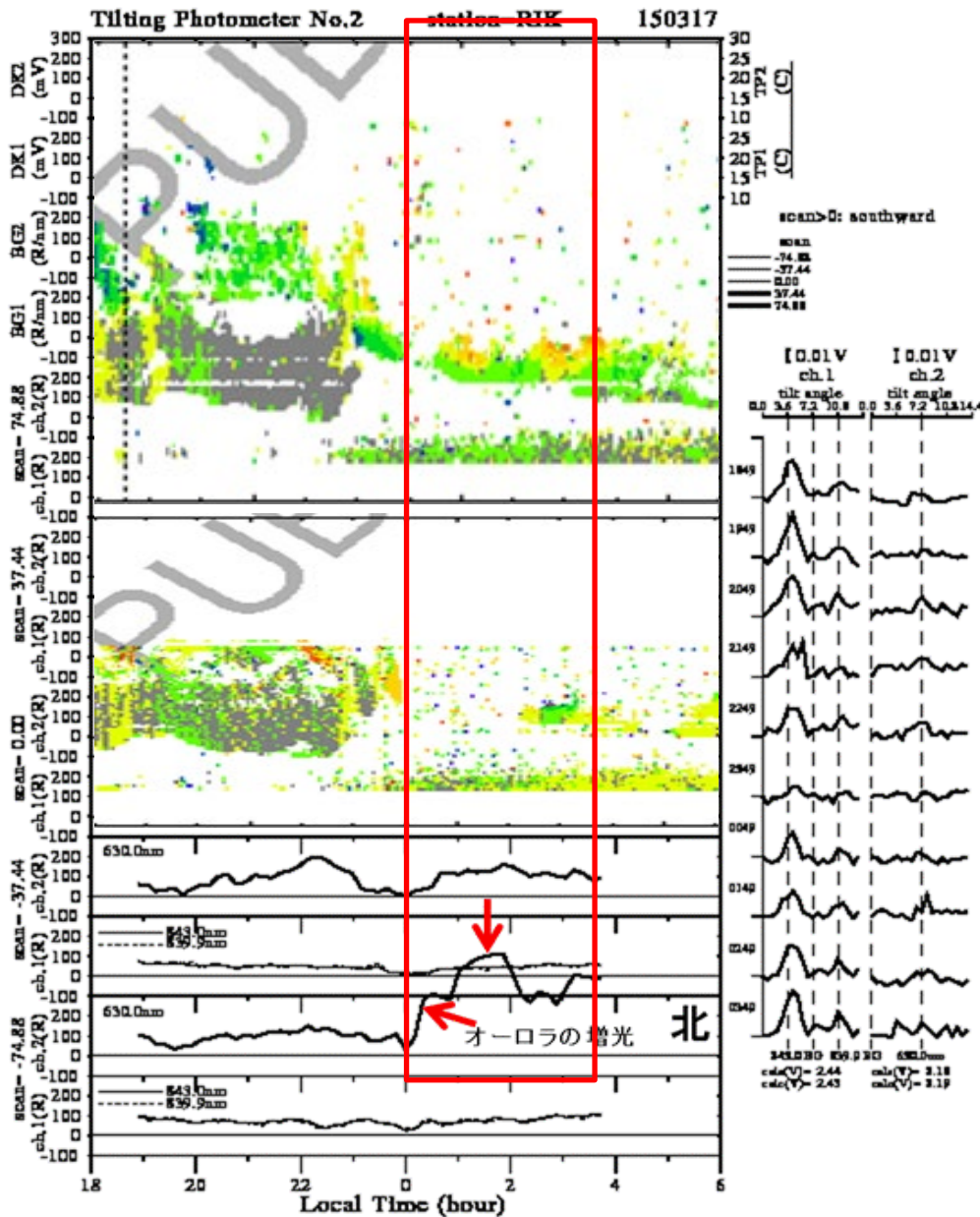
00UT  
2024/07/07

24UT  
SuperDARN 研究集会 @ 地球  
STEL

24UT  
STEL

# Photometer and magnetometer data@Rikubetsu (courtesy of K. Shiokawa)

March 17, 2015  
18-06 JST  
(09-21 UT)



提供: 名古屋大学太陽地球環境研究所

九大

26

# Summary of events

Date	Local time	Flow characteristics	Phase relation
01 Dec 2023	21-24 LT	Enhancement of sheared flows	Somehow related
05 Nov 2023	2.5-3.5 LT	Enhancement of Eastward (DAPS?) flows	In phase
17 Mar 2015	01-05 LT	Enhancement of sheared flows	Some phase difference although the characteristic period is the same

# Summary

- During the low-latitude aurora events, we detected DAPS eastward flows / a shear of flows strongly correlated with the low-latitude auroral emission on 05 Nov 2023, 01 Dec 2023, and 17 March 2015.
- Although detailed comparison is ongoing, there seems to be some relationship between the auroral emission and the convective flow variations.
- Comparison with other instruments such as satellite data (including image information), other ground-based data and numerical simulation results is promising.



# Discussion topics

- Presentation file upload
- Arase-SD campaign
- JPGU
- SuperDARN Workshop in Beijing (May 20-24)
- SD-j-core (later Feb or March)
- Next Japanese SuperDARN Workshop
- SYE/SYS, HOK/HKW aging issue (machine, human)