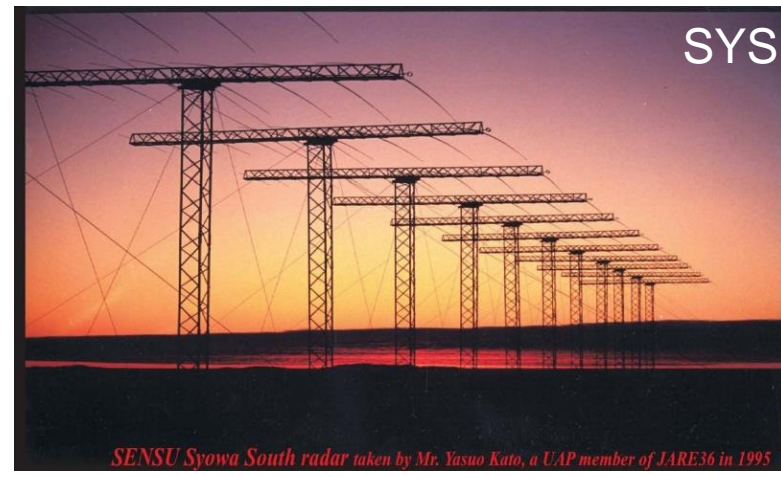


(中緯度)SuperDARNの現状と今後の計画

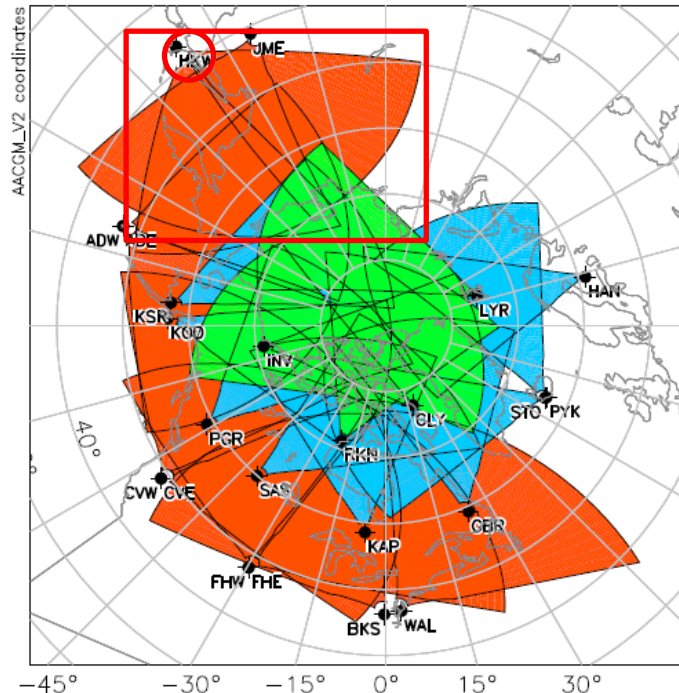
西谷 望 (名大ISEE), 堀 智昭 (名大ISEE),
行松 彰 (極地研), SuperDARN PIs



Super Dual Auroral Radar Network (SuperDARN)

Standard temporal resolution: 1-2 min

Northern Hemisphere

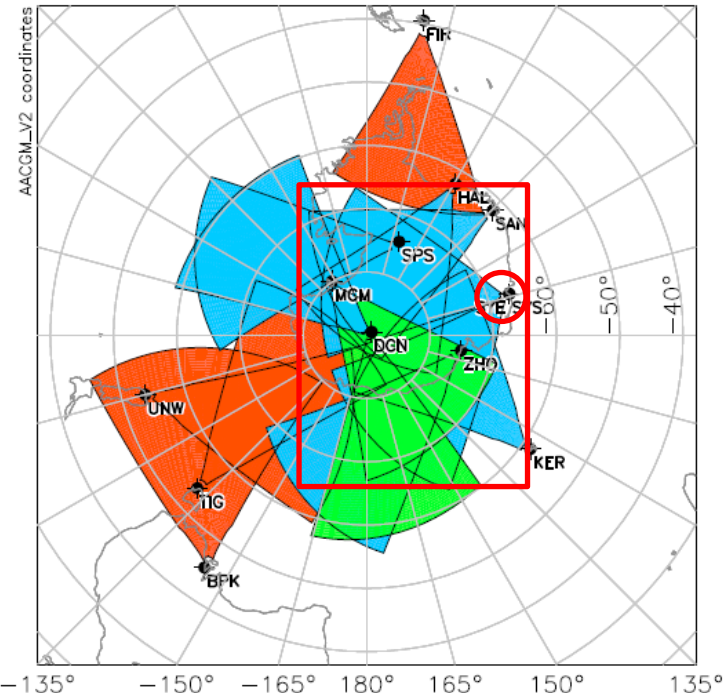


High-latitude

Mid-latitude

Polar cap

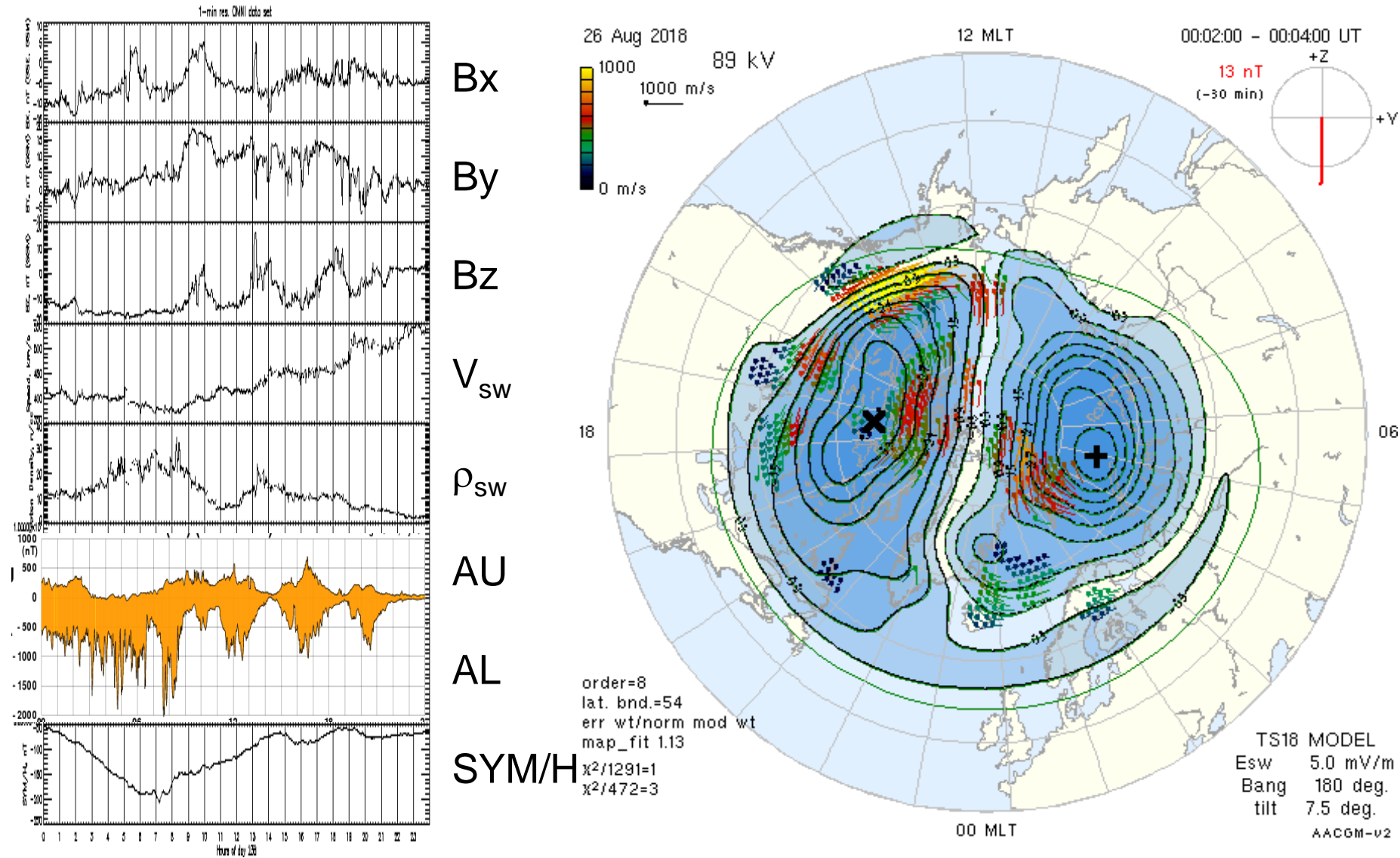
Southern Hemisphere



Number of operating HF radars: 38 (24 in the northern and 14 in the southern hemispheres) as of Feb 01, 2022, operated under the cooperation of about 10 countries

The radars use basically the same hardware architecture, same operation software, same schedule, same data format and same data analysis software, provide important information for the space weather / geospace dynamics studies.

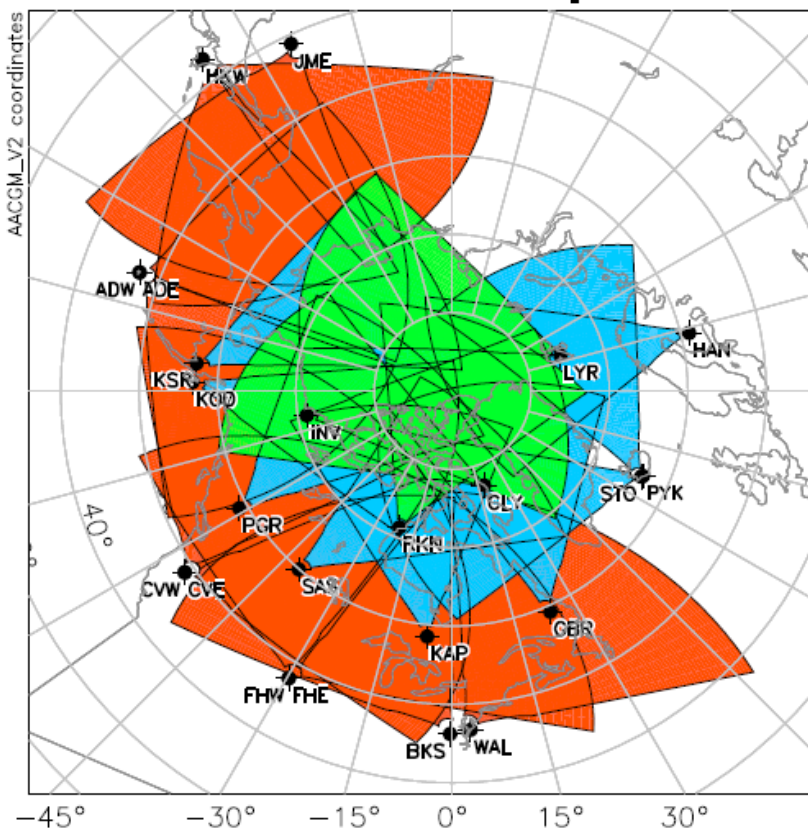
26 Aug 2018, SuperDARN convection map



Importance of studying the distribution of ionospheric convection on a global scale, not only in the polar region but also in the subauroral region.

Super Dual Auroral Radar Network (SuperDARN)

Northern Hemisphere



High-latitude

Mid-latitude

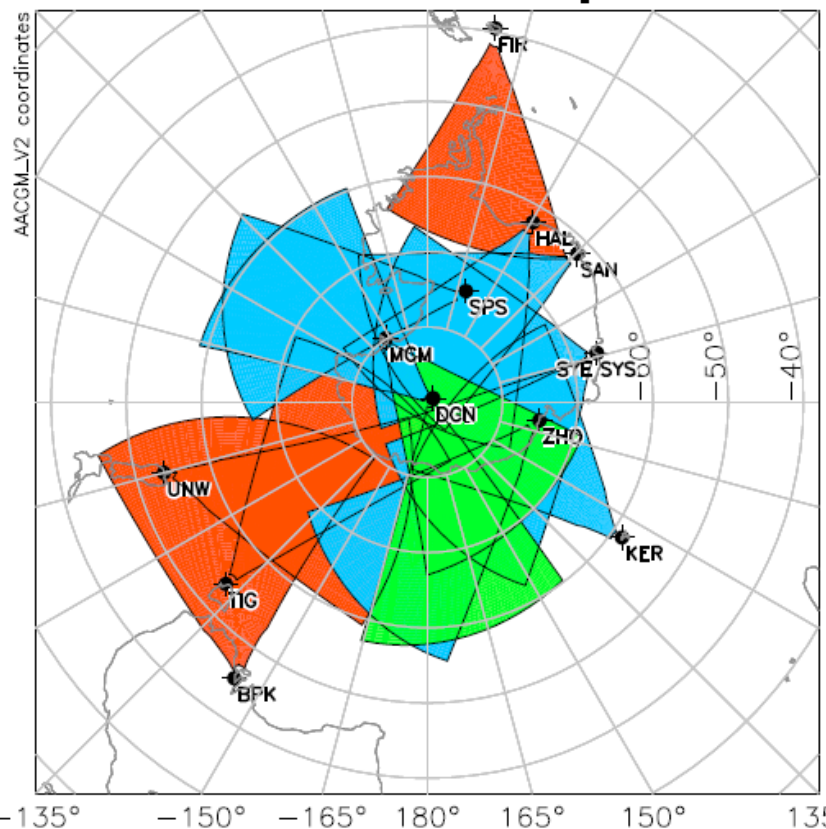
Polar cap

(2005-)

(1995-)

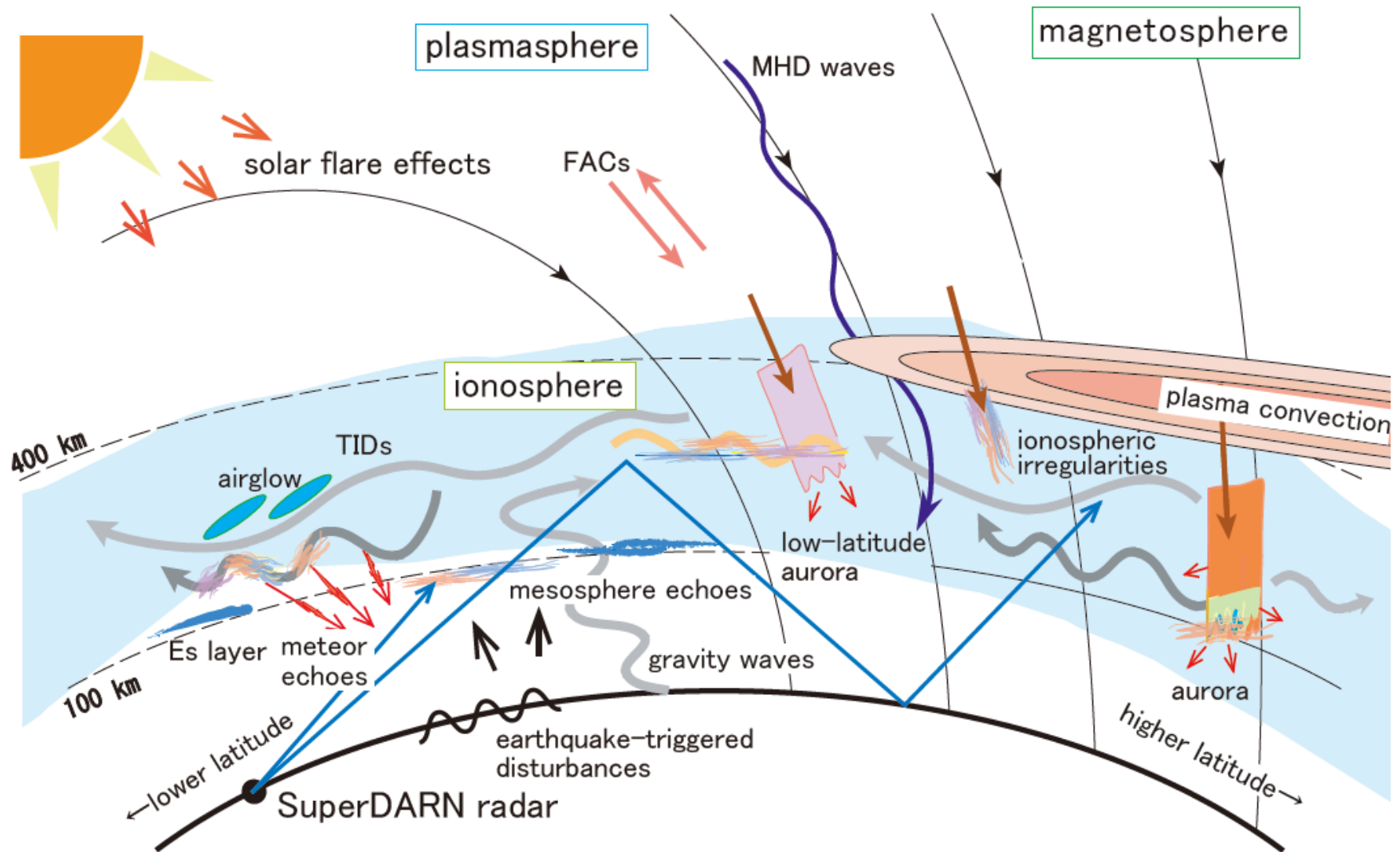
(2005-)

Southern Hemisphere



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

Scientific objectives of SuperDARN



Nishitani et al. (PEPS, mid-latitude SuperDARN review, 2019)

SuperD

(<https://github.com/ericniebler/superd>)

- [illegible]


2021/11/02

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SuperDARN

SuperDARN

The Super Dual Auroral Radar Network (SuperDARN) is a global network of scientific radars monitoring conditions in the near-Earth space environment. The radars are synchronized to scan together, allowing researchers to monitor space weather conditions in the Earth's magnetosphere. The data collected by SuperDARN worldwide, the analysis of this data, and the resulting information, contributes to the scientific understanding of space weather that has the potential to provide tangible benefits, implications, and impact across many sectors; including radio and satellite communication, pipelines and power grids. [SuperDARN Canada](#), which has its headquarters at the University of Saskatchewan, is the Canadian contribution to the international SuperDARN program.

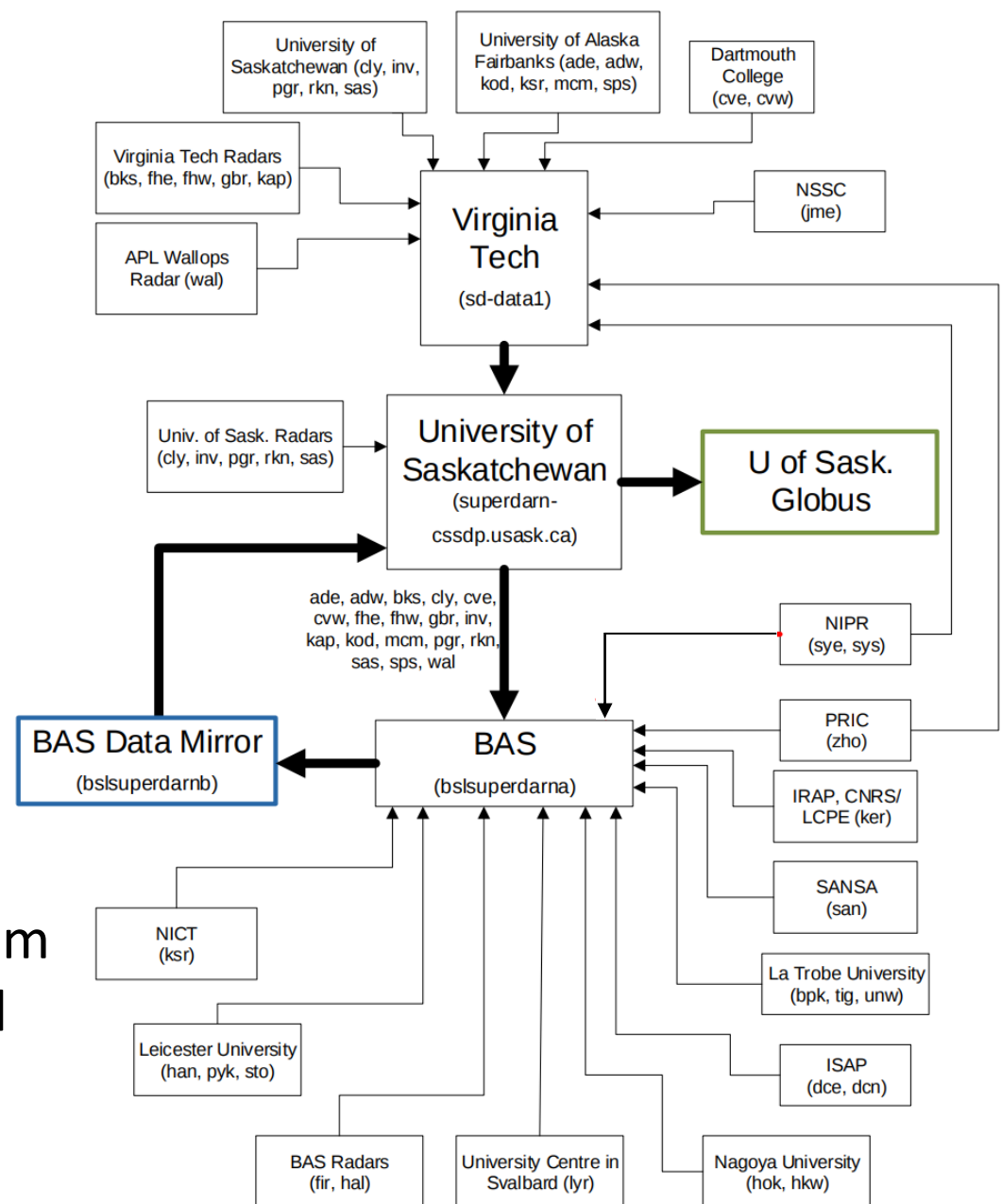
Approved Date ⇅	Title ↓	Author(s)
26-Jul-2021	SuperDARN 2018 RAWACF	<i>Super Dual Auroral Radar Network</i>
26-Jul-2021	SuperDARN 2017 RAWACF	<i>Super Dual Auroral Radar Network</i>
20-Jul-2021	SuperDARN 2016 RAWACF	<i>Super Dual Auroral Radar Network</i>
28-Jul-2021	SuperDARN 2015 RAWACF	<i>Super Dual Auroral Radar Network</i>

DOI's!

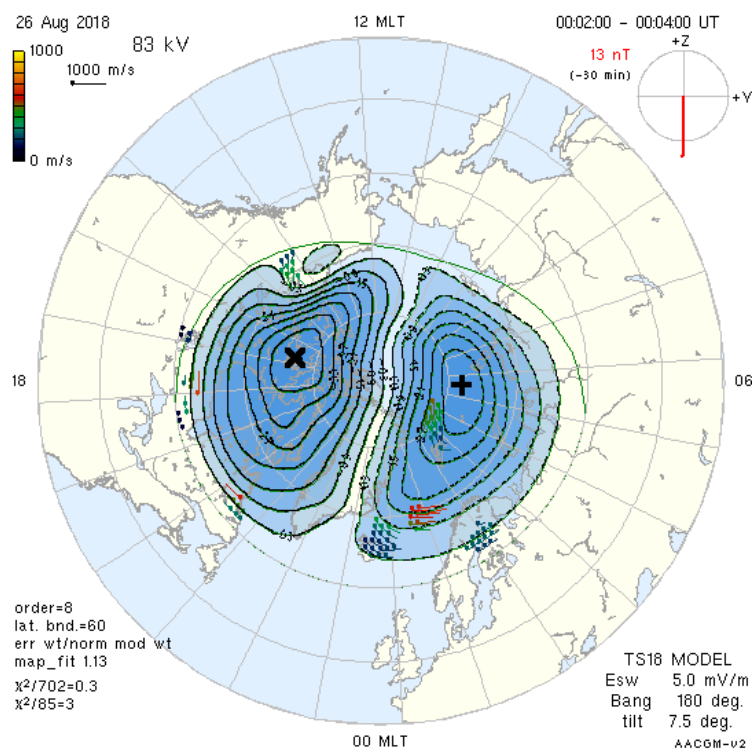
SuperDARN data transfer block diagram (tentative, from SuperDARN Data Distribution Working Group github)

rawacf format data are distributed between the SuperDARN institutes.

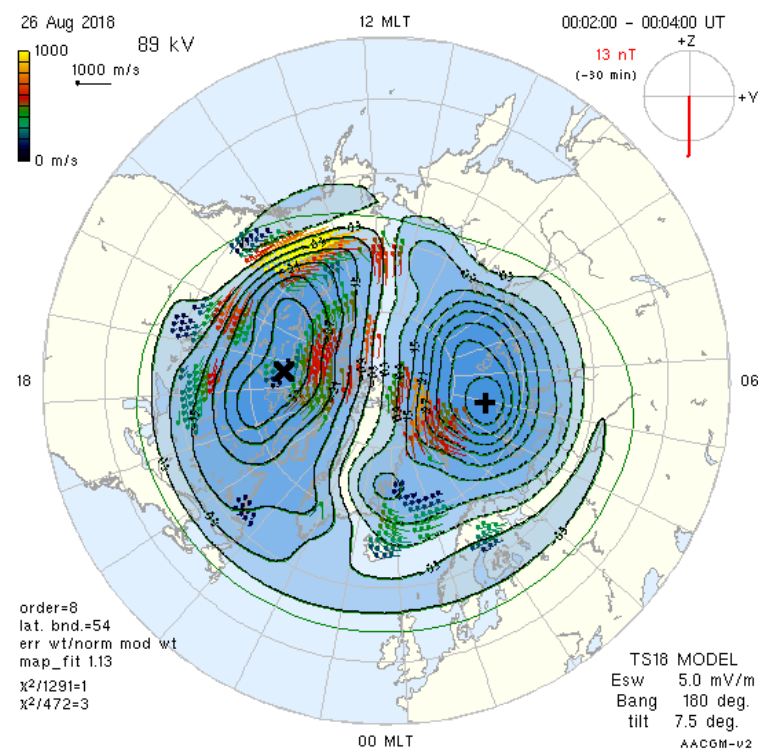
fitacf format data are created by each institute (some of them distribute them to the general scientific community – e.g., Virginia Tech, ERGSC etc.).



2018.8.26



fitacf2

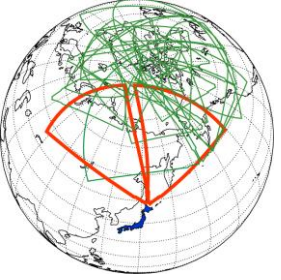


fitacf3

Other radars status (as of May 2021)

- ADE, ADW, HAN, PYK, STO – decommissioned, but new radars planned
- UNW – decommissioned
- LYR, KER, SYS – stopped but repair in progress
- Borealis radars – imaging capability implemented

Hokkaido East (HOK) / Hokkaido West (HKW) status



Recent updates of the SuperDARN HOP radars



- Radar system check (2021.10.18-20)
- Repair of Antennas (2021.11.1) (HOP West F5)
- BASBOX problem at HOK (2021.8.3-17) – recovered by using the power supply unit of another BASBOX. The other one was repaired at Univ. of Leicester and sent back to Rikubetsu in September.
- Main computer problem at HOK (2021.11.30-12.1, 12.3-6, 7,8,27). The spare one's mother board (very old) died. Now the original one is operating but sometimes it stops working suddenly. Recently the spare one's mother board was replaced with another board (slightly different), sent to the radar site and is now waiting for the onsite testing.
- HKW simulator main computer / data computer suddenly died. We are going to purchase motherboards.
- Mid-latitude SuperDARN review paper (Nishitani et al., PEPS 2019) – now the number of citation is 85 (ref. google scholar)
- The plan of introducing a mirror server at Nagoya Univ. was not realized because only https protocol was acceptable at CIDAS data center network.
- The plan of implementing an imaging capability at the HOK radar is in progress.

Future perspectives of SuperDARN

SuperDARN history: high-, mid- and low/equatorial latitudes

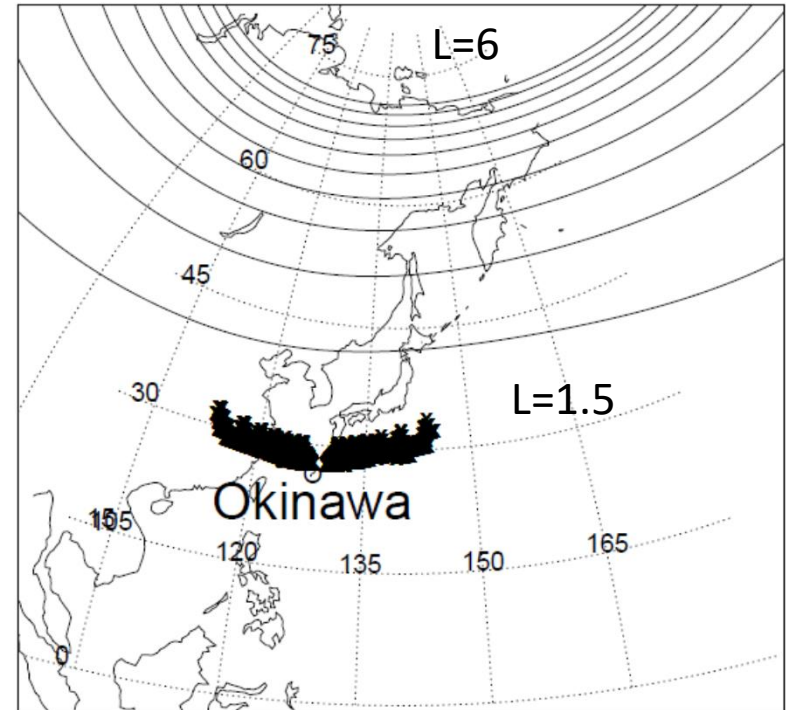
Region	Auroral lat.	Mid-lat.	Polar lat.	Low / eq. lat.
1980s	First HF radar at Goose Bay (1983) Greenwald et al. (1985) – design			
1990s	Official beginning of SuperDARN (1995) Greenwald et al. (1995) – Overview of SuperDARN			
2000s	Chisham et al. (2007) – review of (mainly high-lat.) SuperDARN	First mid-latitude SuperDARN at Wallops (2005)	First PolarDARN at Rankin Inlet (2007)	
2010s		Nishitani et al. (2019) – review of mid-latitude SuperDARN		
2020s - 2021/11/02		SGEPSS conference (online)		First equatorial SuperDARN in early 2020s?

Equatorial / low latitude HF radar

- **Overview:** Build a SuperDARN type radar at low / equatorial latitude region, perform high temp. res. 2-D observation of ionosphere and upper atmosphere. Establish observation network of the above region in collaboration with other observation and numerical simulation groups. Aim to clarify the global dynamics of the ionosphere and upper atmosphere.
- **Budget amount:** >~120 M JPY
- **Participating institutes:** ISEE / Nagoya U., NICT, NIPR, UEC etc.
- **Timeline:** Completed 5-10 years later, will operate for more than 10 years

Scientific objectives

- Plasma bubbles, LSWS (Large Scale Wave Structure), TIDs
- Ionospheric convection during large geomagnetic storms
- Equatorial low latitude ionospheric convection disturbances
 - disturbance dynamo, penetration electric field, overshielding, tide, ...
- Etc.



(x points: possible ionospheric echo points meeting aspect angle condition, 9MHz, up to 2.5 hop)

Summary

- SuperDARN radar network is a powerful tool for studying the ionospheric dynamics with high time resolution ($\leq 1-2$ min).
- (rawacf-format) data were labelled DOI.
- Some radars are stopped or decommissioned, but most of the SuperDARN radars are operating normally.
- Mid-latitude SuperDARN review paper received PEPS most cited paper award 2021 (google scholar citations: 85 as of 22 Feb 2022).

Browser tabs: Yahoo! JAPAN, 出席済み出席者, GitHub - SuperD..., Yahoo! JAPAN, Review of the acc, review of the acc, Yahoo! JAPAN, VT SuperDAR...

Address bar: vt.superdarn.org/tiki-index.php

Search: Go

Navigation: Most Visited, Google, Yahoo! JAPAN, このページを編集する, SuperDARN Worksho..., SuperDARN Worksho..., Midlatitude SuperDAR..., ERG-SuperDARN Conj..., テレワーク実施計画・管...

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- Contact/Visit Us
- VT Pub List
- Tutorials
- Student Opportunities

▼ **Radars**

- Maps/Tables/Links
- Operating Schedule
- Radar Coverage Tool
- Conjugate FOV Tool
- Radar Finder
- Ray-Tracing Tool

▼ **Software**

▼ **SuperDARN Data**

- Real Time Data (USask)
- Daily Data Calendar
- CRID Inventory
- Data Access**
- Map Potential Data
- Data Inventory

THE SUPERDARN 'FLAGS' MAP UPDATED TO SHOW NEW RADAR SITES IN AUSTRALIA, JAPAN, AND SVALBARD (NORWAY)

SuperDARN is made possible through the cooperation and funding of ten countries... a true international effort!

Welcome to SuperDARN!

SuperDARN stands for Super Dual Auroral Radar Network. The network consists of more than 30 low-power HF radars that look into Earth's upper atmosphere beginning at mid-latitudes and extending into the polar regions. The radars operate continuously and observe the motion of charged particles (plasma) in the ionosphere and other effects that provide scientists with information on Earth's space environment. The knowledge gained from this work provides insight into space weather hazards including radiation exposure for high-altitude travelers and disruptions to communication networks, navigation systems (GPS), and electrical power grids.

The SuperDARN Research Group at Virginia Tech (VT) collaborates with an international community of scientists and engineers to operate radars and share data. The VT Group operates five radars. For a summary of the radars and their affiliations, visit the [Radar Maps/Tables/Links](#) web page.

U.S. SuperDARN Collaboration

The U.S. component of SuperDARN is funded by the National Science Foundation under the Space Weather Research (SWR)

Discussion topics

- ISEE international joint research program / visiting scientist position
- (Planned) ISEE international technical exchange program
- SuperDARN imaging capability
- New SuperDARN radars
- Etc.