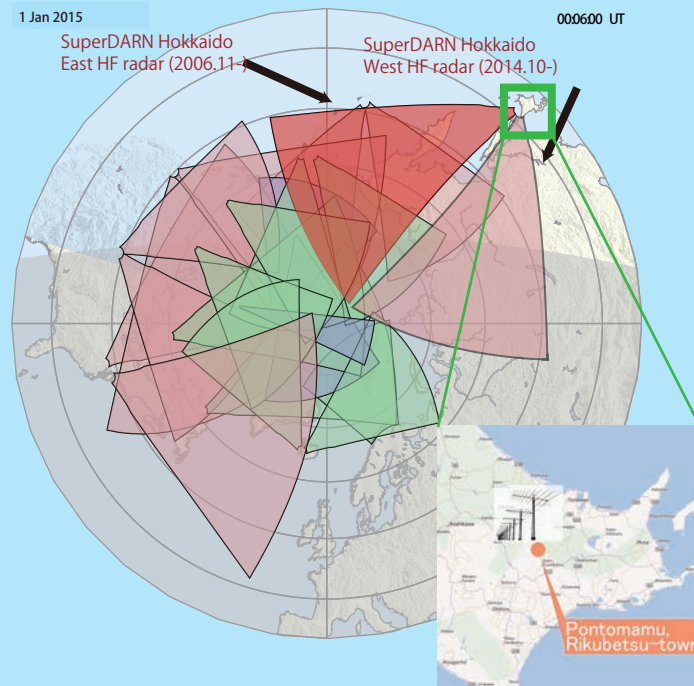


# What is SuperDARN?

SuperDARN (Super Dual Auroral Radar Network) is an international collaboration project by twelve countries in the world. SuperDARN consists of 22 radars in the northern hemisphere and 11 radars in the southern hemisphere, covering the northern and southern high- and mid-latitude regions.

SuperDARN observes ionospheric plasma convection in the high- and mid-latitude regions with temporal resolution of 1–2 min. Recently, as shown in the right figure, SuperDARN is useful not only for magnetospheric / ionospheric research but also for thermospheric and mesospheric research.

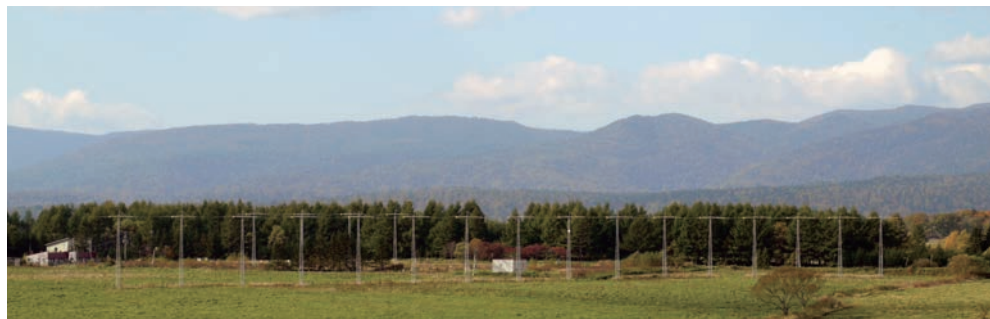
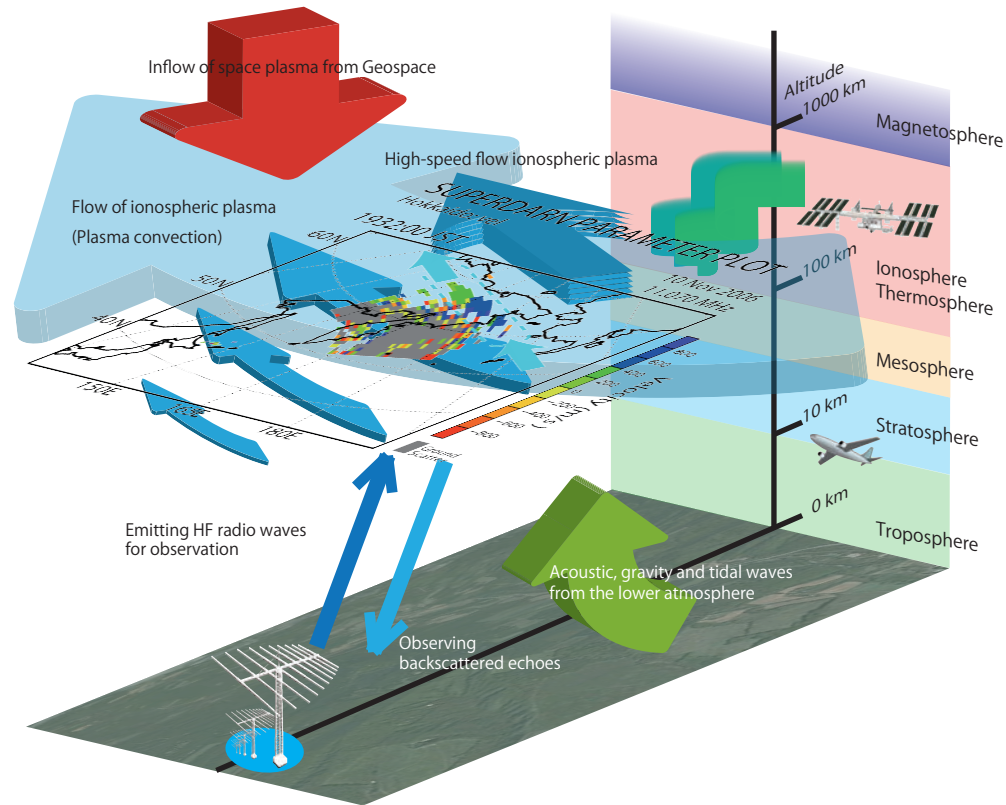


## Hokkaido radar as the lowest latitude SuperDARN

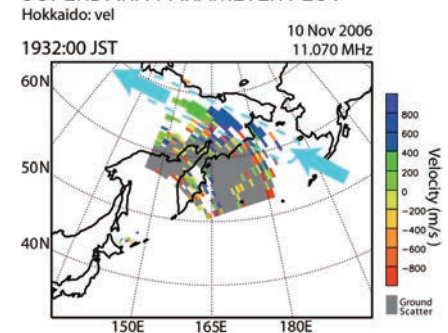
Most SuperDARN radars had their fields of views in the regions higher than 60 geomagnetic latitude until about 10 years ago. Mid-latitude SuperDARN radars began operation in 2005, and new discoveries are being made with these radars newly constructed by countries such as Japan, USA and UK. The Hokkaido radar is constructed by the Institute for Space–Earth Environmental Research, Nagoya University, Japan, and is located at the lowest latitude. The Hokkaido radar has great advantages for the coordinated observations with many other scientific instruments developed by several Japanese institutes.

# Exploring the boundaries of the universe and the earth

The Earth's upper atmosphere contains the thermosphere formed by solar irradiance, and ionosphere consisting of ionized atoms and molecules. These atmospheric layers contain a variety of phenomena. By observing the boundary between the universe and the earth, we are continuously investigating the influences of ionospheric disturbance on human activities (car navigation, communication and so on) and the effects of long-term solar activity on terrestrial environment.



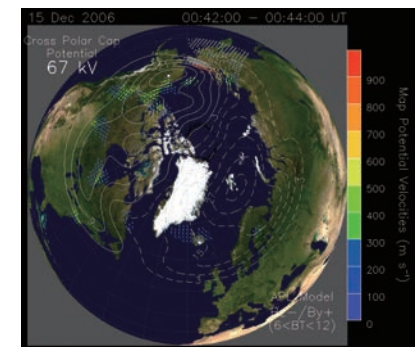
## SUPERDARN PARAMETER PLOT



## Monitoring the occurrence of high-speed plasma flow

Ionospheric high-speed plasma flow (about 1–2 km/s) over the Far East Russia is monitored by the Hokkaido HF radar.

The radar is able to investigate details of structure and variability of distant ionosphere by emitting HF radio waves toward north-northeast and receiving backscattered echoes.



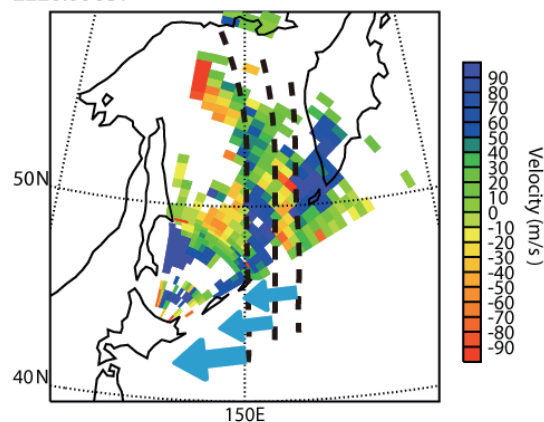
## International collaboration for improved understanding of plasma convection

Plasma convection pattern is obtained from SuperDARN radar network. Ground network experiments provide global-scale information on near real time basis.

## SUPERDARN PARAMETER PLOT

Hokkaido: vel

2220:00 JST 12 Jan 2008



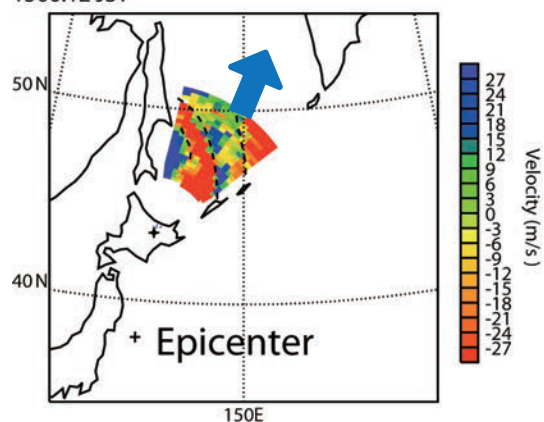
### Disturbance of ionospheric plasma is captured

Wavy structure of ionospheric plasma disturbances propagating with speed of several hundred m/s has been captured by the radar. These structures are considered to be generated by ionospheric instabilities.

## SUPERDARN PARAMETER PLOT

Hokkaido: vel

1500:12 JST 11 Mar 2011



### Ground oscillation signal transmitted up to the ionosphere have been observed

Ionospheric perturbation was observed after the 2011 Tohoku Earthquake. Acoustic waves generated by seismic waves are transmitted to the upper atmosphere and ionosphere. The ionospheric disturbances travels with speed of several hundred m/s – several km/s, reflecting horizontal propagation of ground seismic waves.

## Specifications of the Hokkaido HF Radar

Frequency band	9~16 MHz
Maximum power	10 kW
Pulse specifications	Multi pulses
Duty ratio	about 2.5 %
Pulse length	100~300 micro seconds
1 pulse pattern length	0.1 seconds
Time resolution	1 second ~ 2 mins
Range resolution	15 km to about 100 km
Antenna specification	Log periodic antenna
Number of antenna	16 (main array) 4 (Interferometer array)
Antenna height	about 15 m
Antenna spacing	15.24 m
Beam directions	0~60 degree(16 directions)
Beam width (horizontal)	about 5 degree
Beam width (vertical)	about 40 degree
Maximum range	3500 km or more

## Location

### Hokkaido East

(geographic coordinates)  
+43.53 N, +143.61 E  
(geomagnetic coordinates)  
36.76, -144.78

### Hokkaido West

(geographic coordinates)  
+43.54 N, +143.61 E  
(geomagnetic coordinates)  
36.77, -144.78



## SuperDARN Hokkaido HF Radar

Pontomamu, Rikubetsu-town Ashoro-gun, Hokkaido 089-4346 Japan  
<http://cicr.isee.nagoya-u.ac.jp/hokkaido/>

## Institute for Space-Earth Environmental Research, Nagoya University

Furo-cho, Chikusa-ku, Nagoya 464-8601 Japan  
TEL: 81-52-747-6306 FAX: 81-52-747-6313  
<http://cicr.isee.nagoya-u.ac.jp/>

## Rikubetsu Observatory

Uenbetsu Rikubetsu-town Ashoro-gun, Hokkaido 089-4301 Japan  
TEL & FAX: 81-156-27-8103

Oct, 2015

# SuperDARN

## Hokkaido Pair of radars (HOP)



Institute for Space-Earth Environmental Research  
Nagoya University