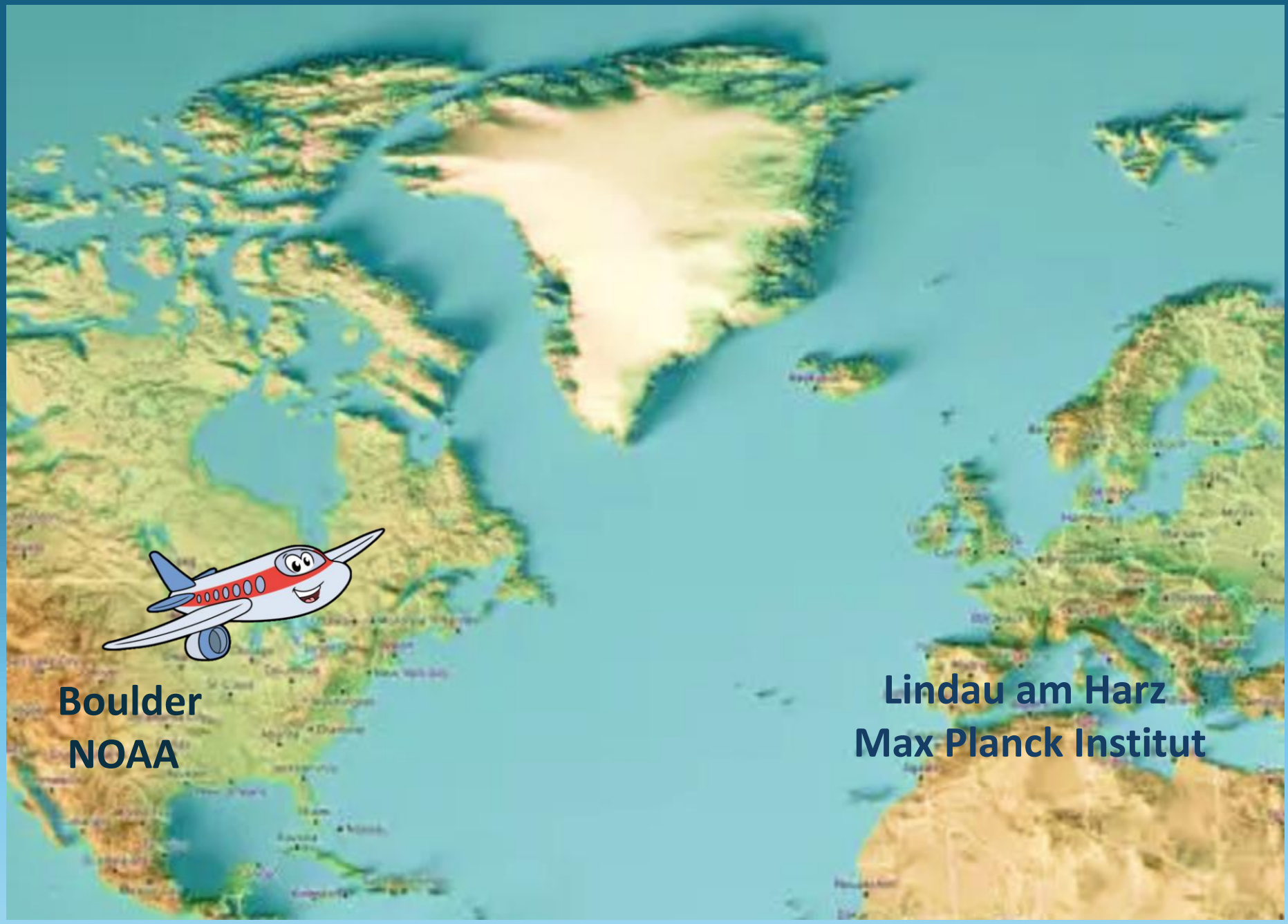
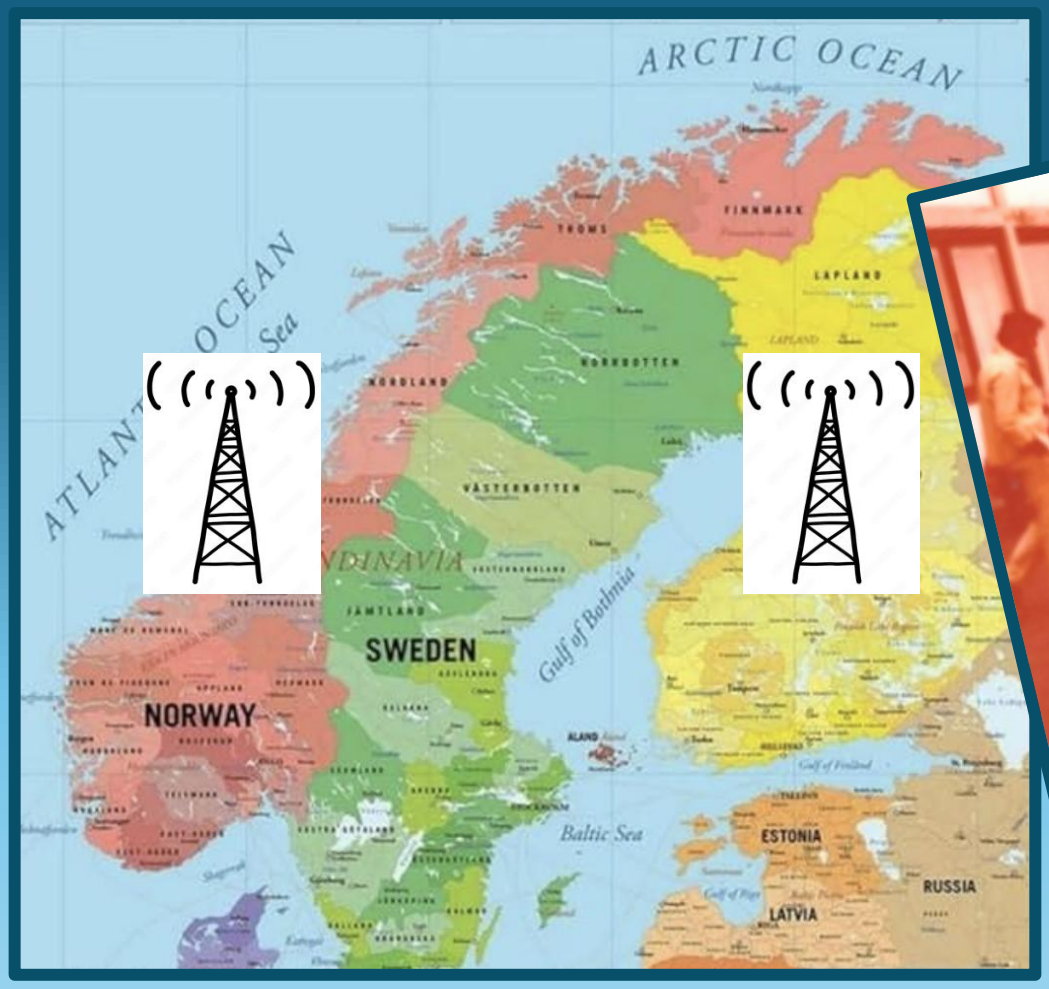
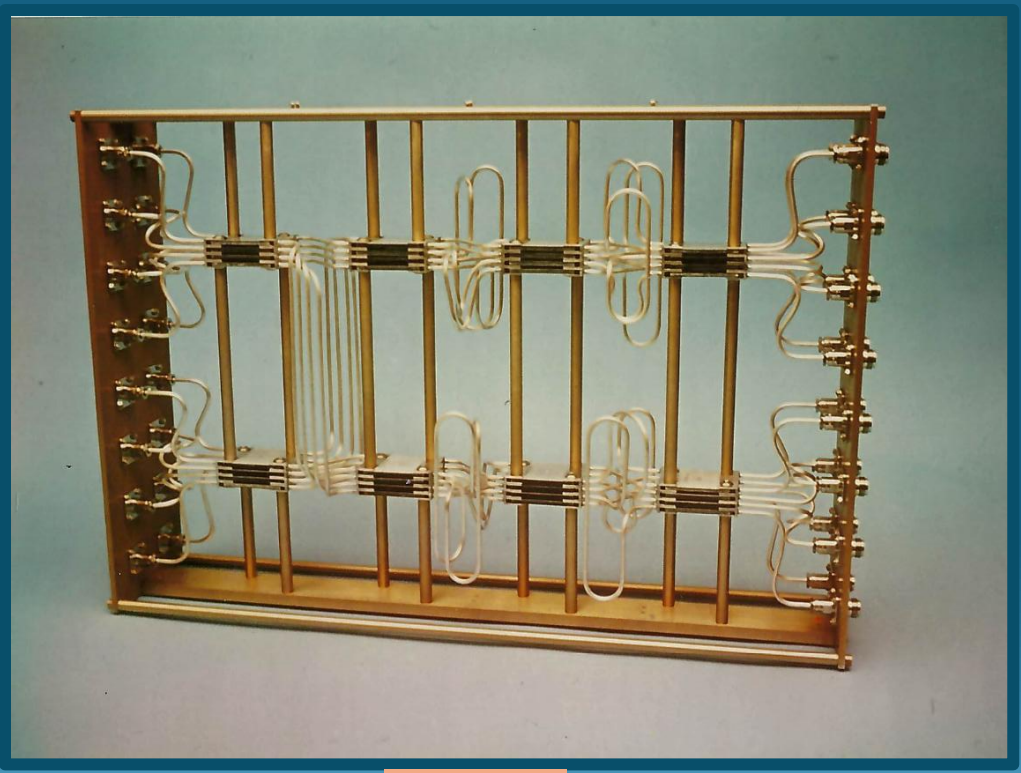
The History of SuperDARN


Boulder
NOAA
Lindau am Harz
Max Planck Institut

S.T.A.R.E. IS BORN!

Scandinavian Twin Auroral Radar Experiment





circa 1976

Characteristics of the STARE Radars

	Malvik, Norway	Hankasalmi, Finland
Operating Freq.	140 Mhz	143.8 Mhz
Output Power	50 kW	50 kW
TX Pulse Length	100 microsec	100 microsec
Lag to First Sample	3.4 msec	3.4 msec
Number of Range Gates	50	50
Double Pulse Separation	30 microsec	30 microsec
Integration Time	20-60 secs	20-60 s ecs

3.2 Analysis of data

STARE data has been analysed by WALKER *et al.* (1979) and fits these predictions very

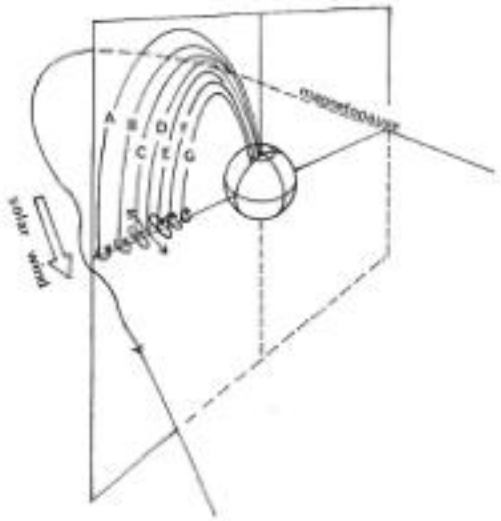


Fig. 5. Schematic diagram of SCH mechanism. The solar wind causes a surface wave on the magnetopause. The field lines A, B, C, D, E, F, G move as shown. The toroidal frequency of D matches the wave frequency leading to a large toroidal component. The polarization changes across the resonance.

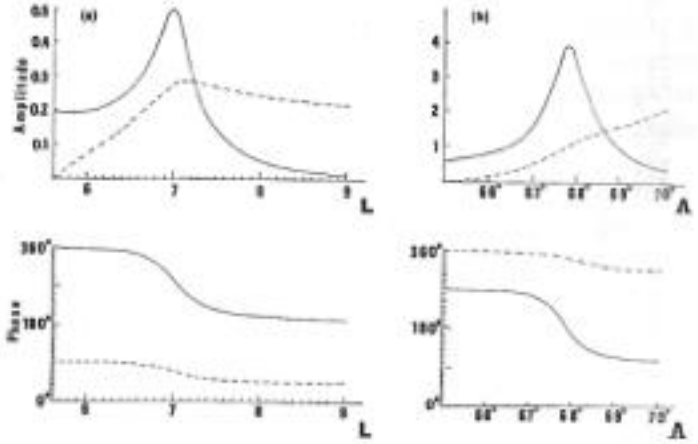


Fig. 6. Amplitude and phase of the electric fields in the meridian (full line) and perpendicular to the meridian (dashed line): (a) In the equatorial plane expressed as a function of L. (b) At ground level expressed as a function of Λ, the geomagnetic latitude. $k_1/k_0=0.12$, $q=0$, $m=5$, $L_R=5.6$, $L_B=6.2$ (from WALKER (1980), where notation is described).

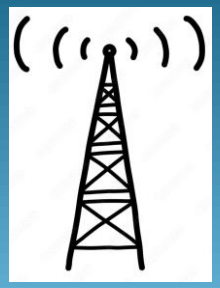
… on to JHU/APL, 1979

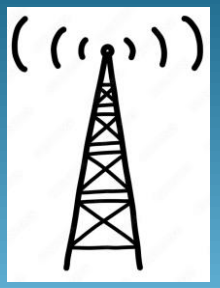
Activities

- Continued working on STARE data.
- Began investigating HF radars to study ionosphere.
  - Enables measurements of E and F regions.
  - Allows entire ionosphere to be studied.
  - A network of HF radars could facilitate monitoring large regions of the ionosphere.
- Submitted proposal to NSF to conduct initial measurements testing HF radars in Alaska.
- Initial results indicated development of HF radars would be beneficial to research of the ionosphere.

D.A.R.N.

Dual Auroral Radar Network





Halley Station, Antarctica

Goose Bay, Labrador

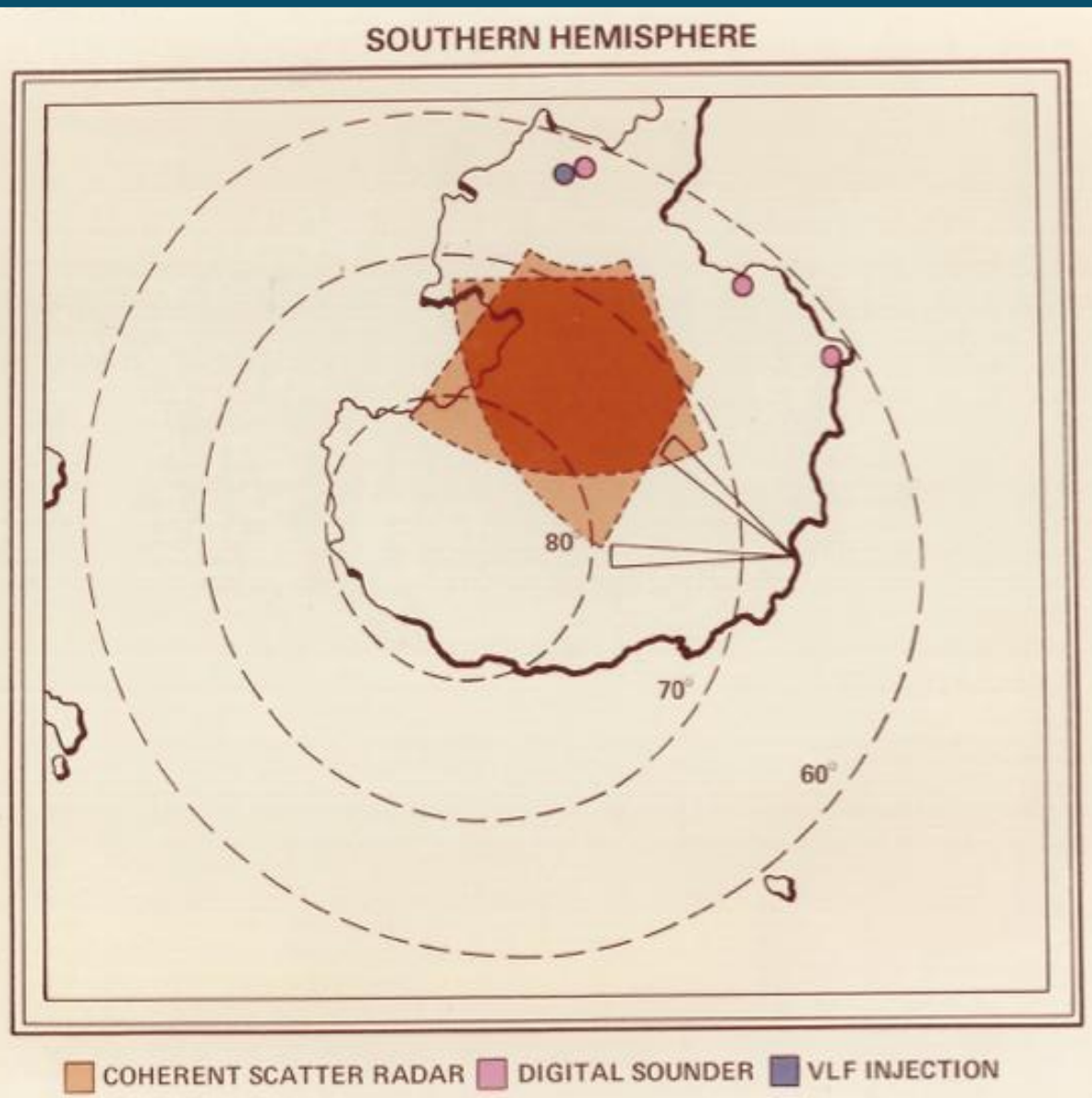
That DARN Experiment!

Goose Bay, Labrador

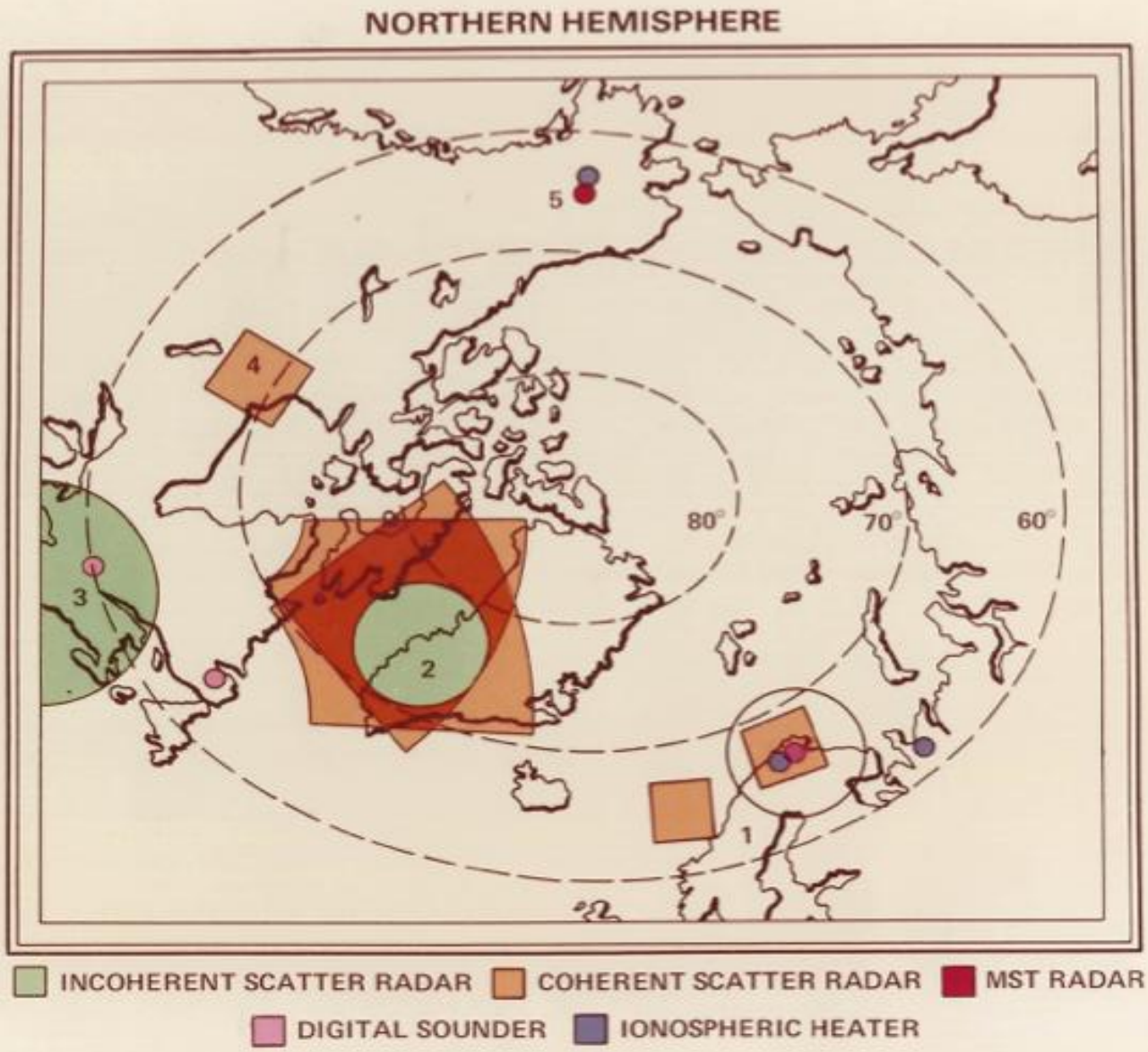
1983

Halley Research Station

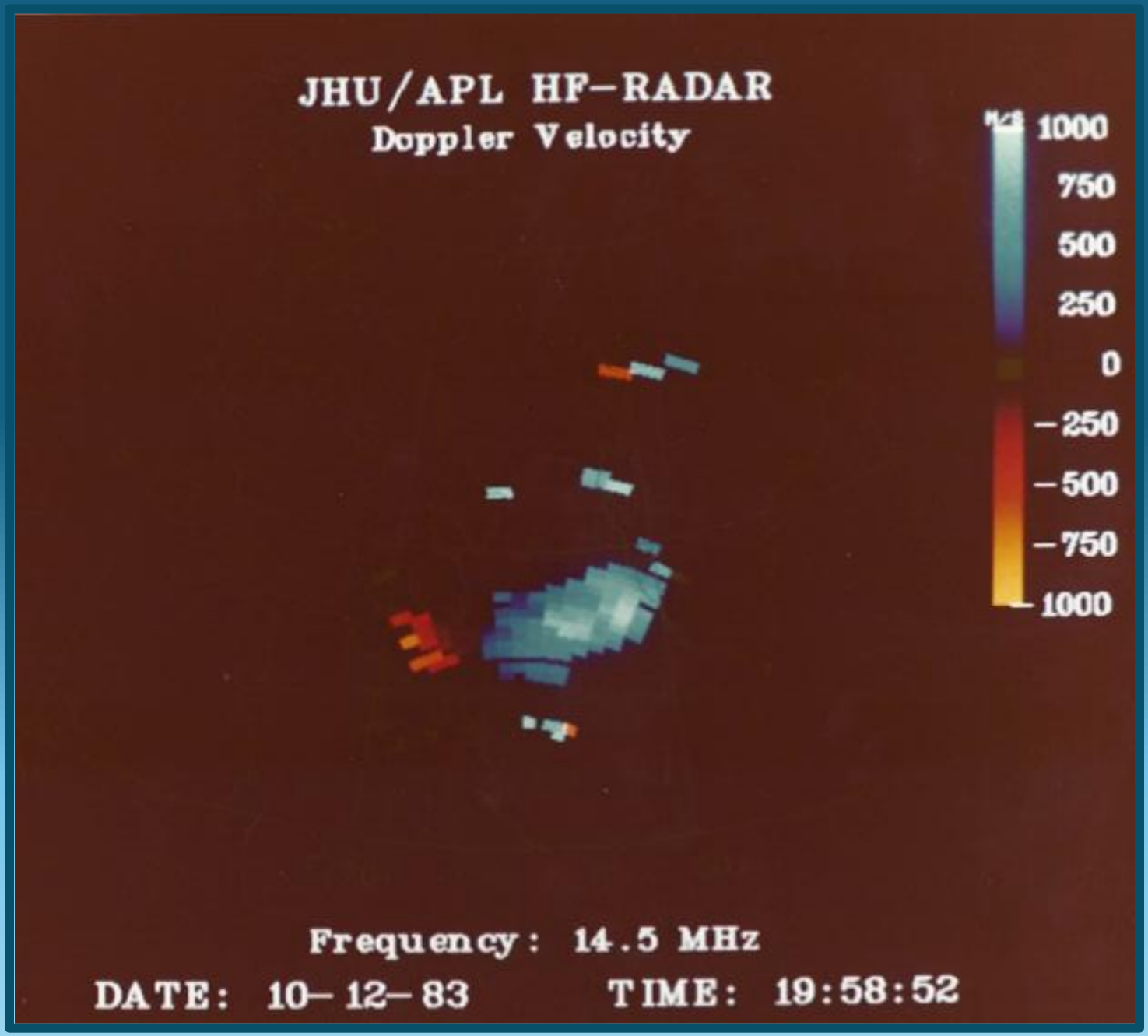
1988

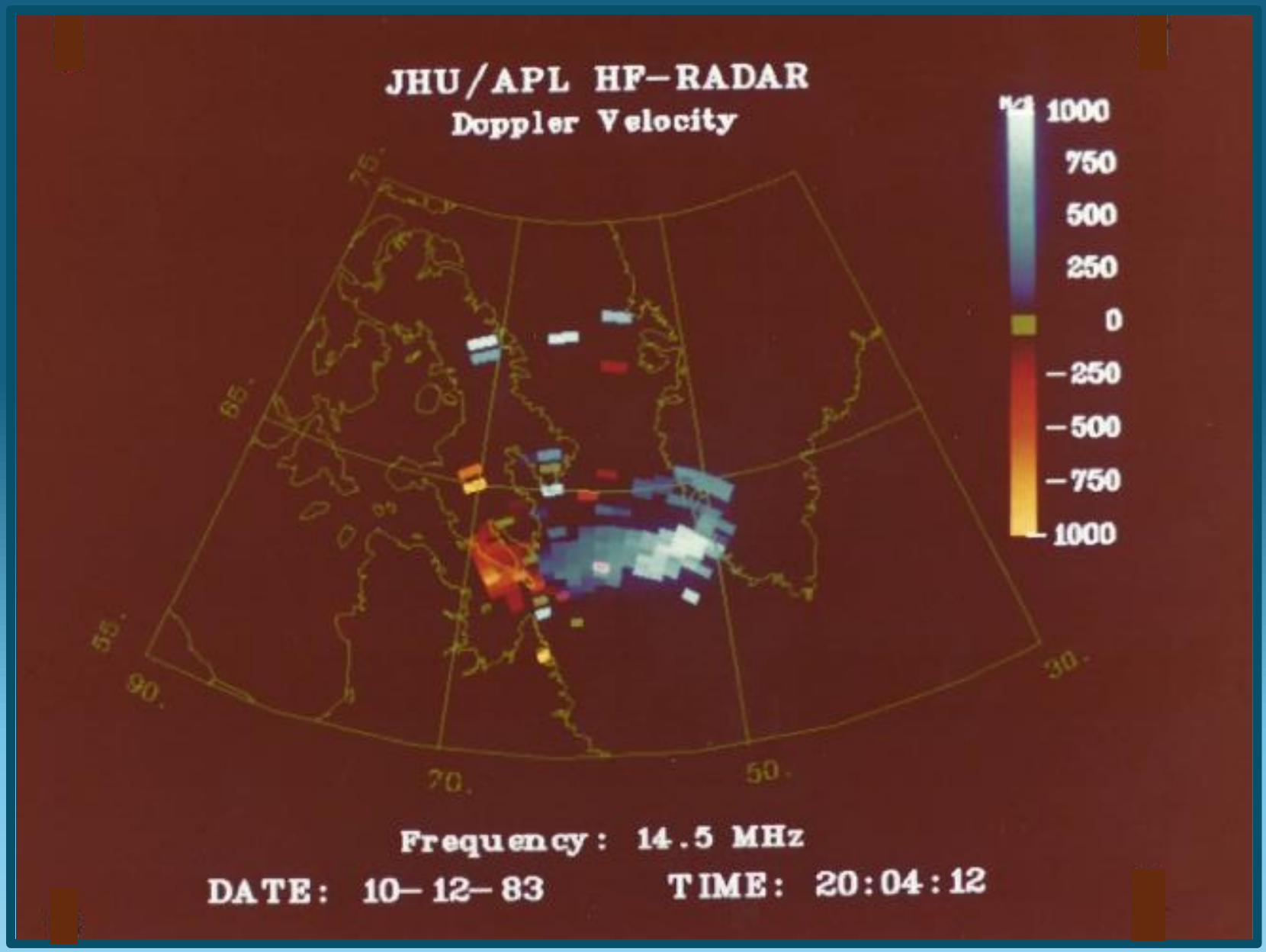

SOUTHERN HEMISPHERE
80°
70°
60°
COHERENT SCATTER RADAR
DIGITAL SOUNDER
VLF INJECTION

NEW HIGH LATITUDE RADIOSCIENCE INSTRUMENTATION



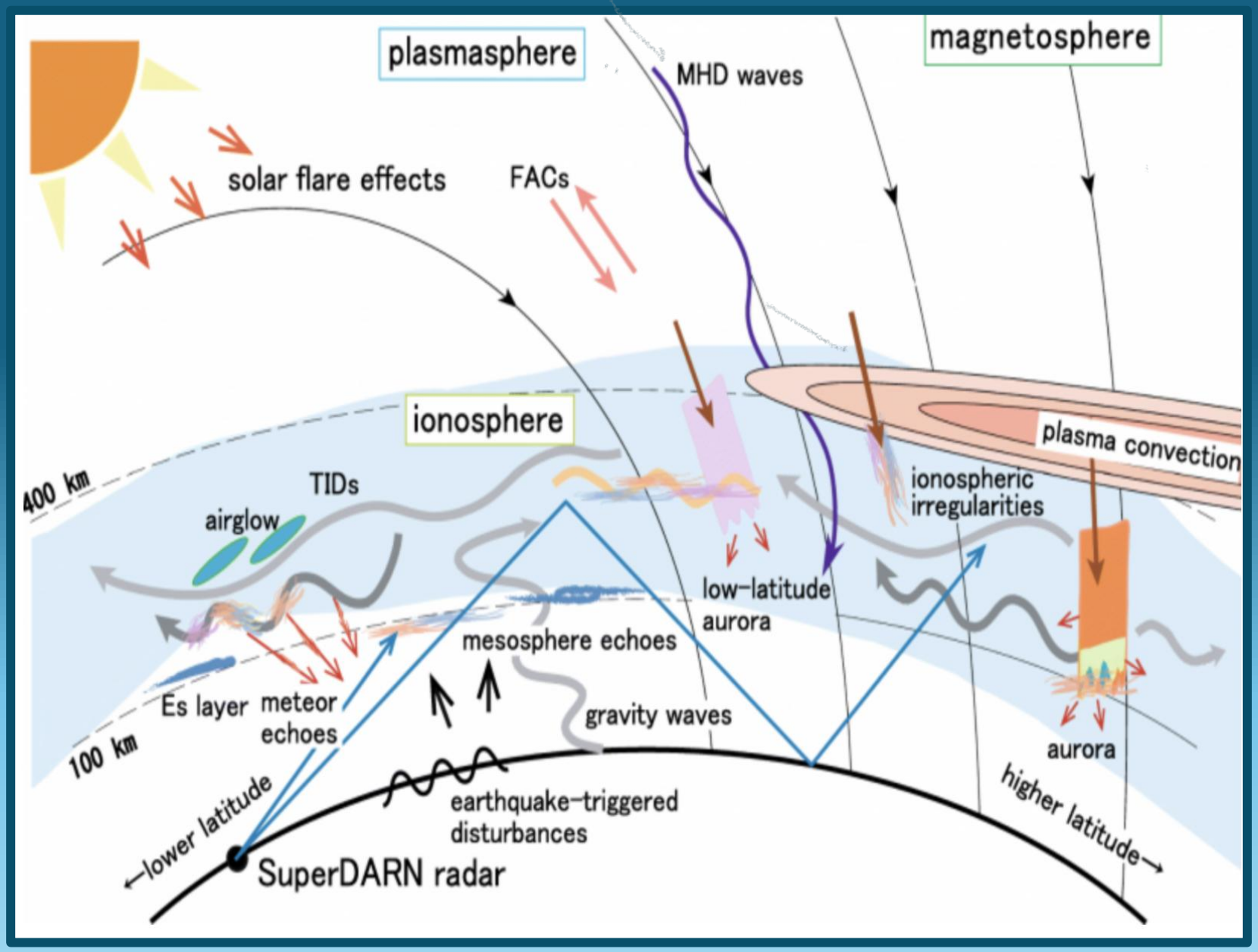

POLAR ANGLO-AMERICAN CONJUGATE EXPERIMENT
PACE
JHU/APL NSF NERC/BAS
BRITISH ANTARCTIC TERRITORY
HALLEY
BRITISH ANTARCTIC SURVEY
RRS BRANSFIELD
British Antarctic Territory
10p
24p
29p
50p
IGY
1957-58
74 CANADA
BRITISH ANTARCTIC TERRITORY
POSTAL OFFICER
15 JAN 1988
GOOSE BAY


JHU/APL HF-RADAR
Doppler Velocity
1000
750
500
250
0
-250
-500
-750
1000
Frequency: 14.5 MHz
DATE: 10-12-83
TIME: 19:58:52

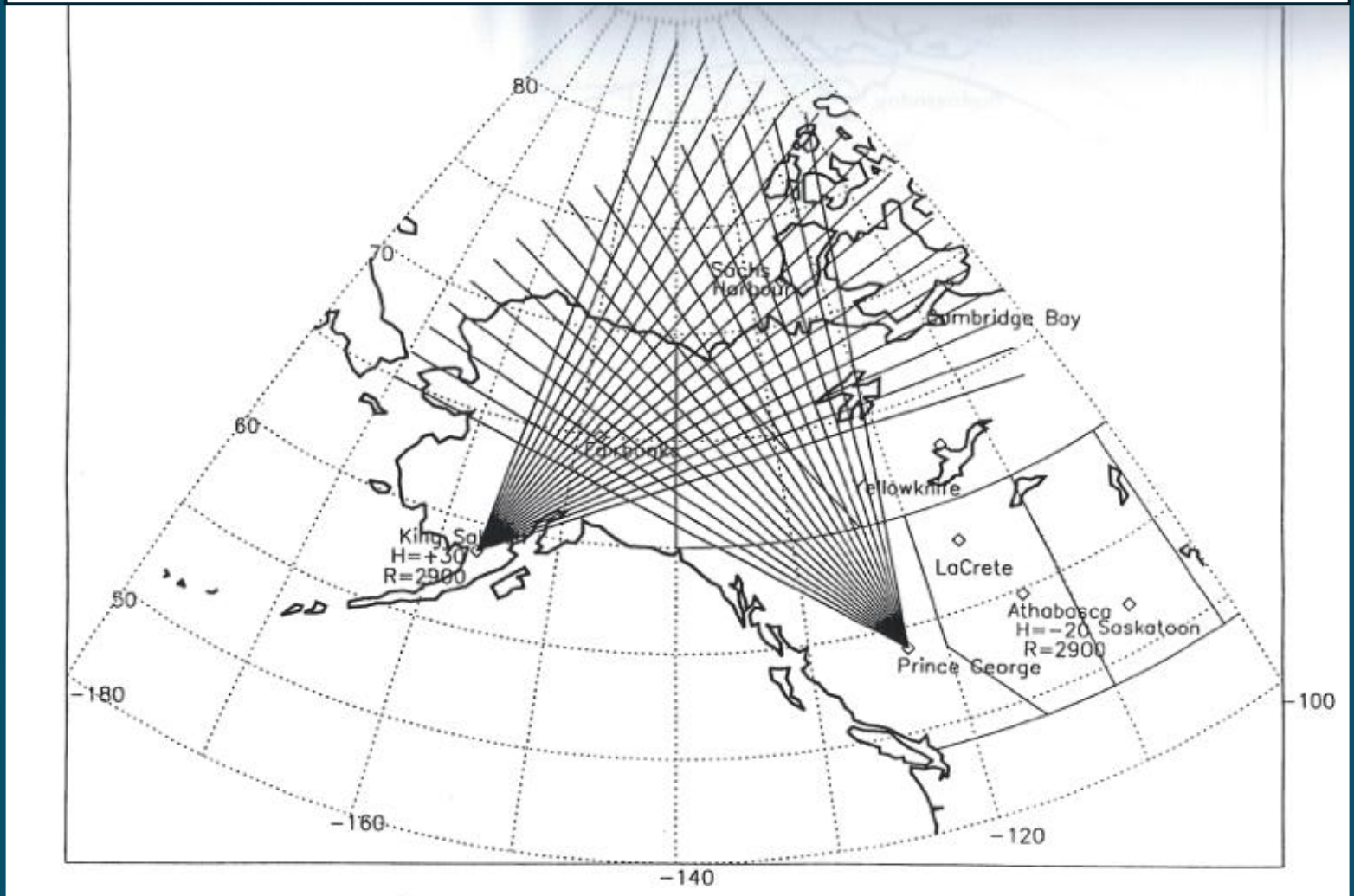

JHU/APL HF-RADAR
Doppler Velocity
m/s
1000
750
500
250
0
-250
-500
-750
-1000
75.
65.
55.
90.
70.
50.
30.
Frequency: 14.5 MHz
DATE: 10-12-83
TIME: 20:04:12

SuperDARN

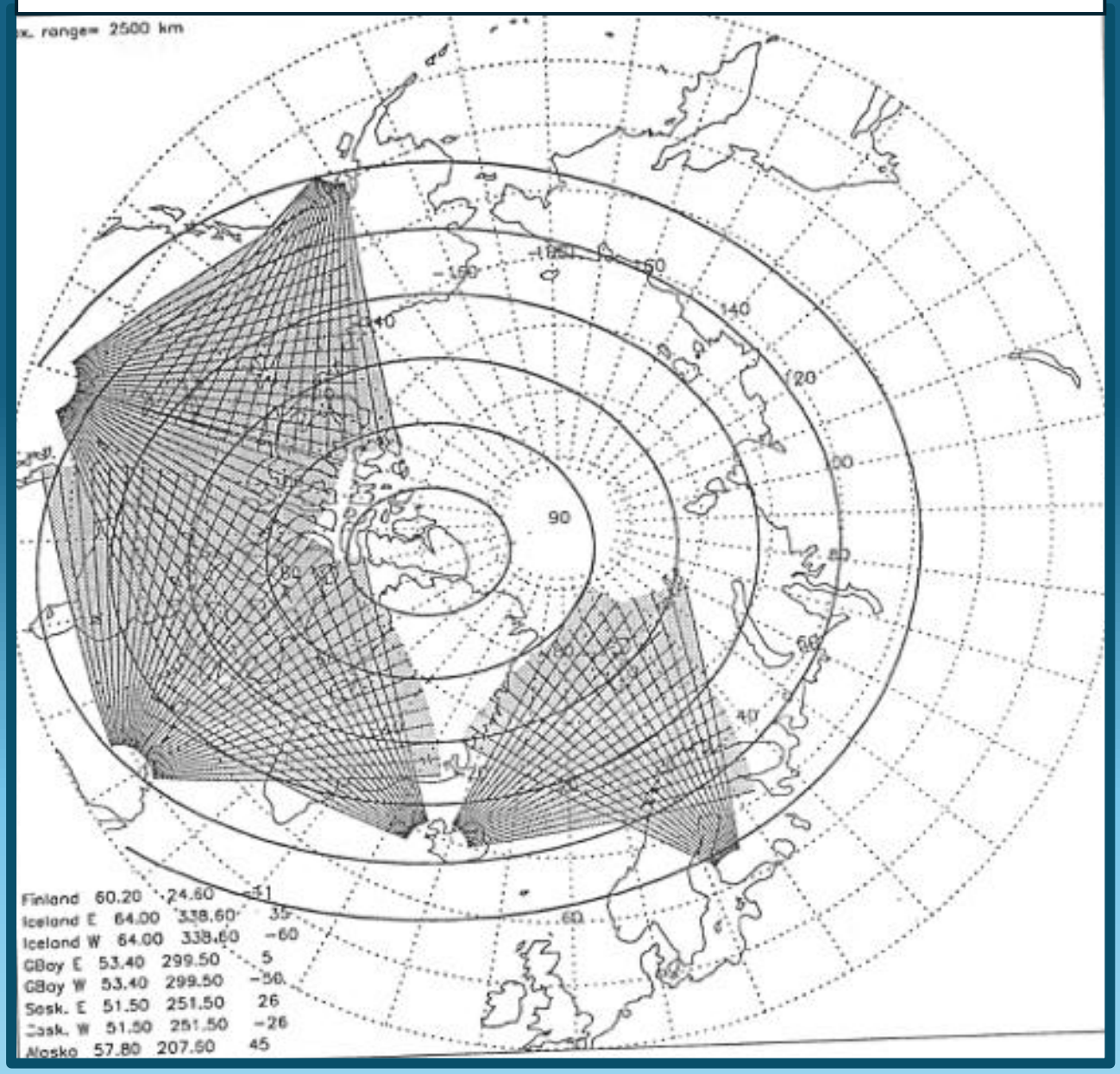
Natural Phenomena Observable with SuperDARN Radars



Possible SuperDARN Overlay

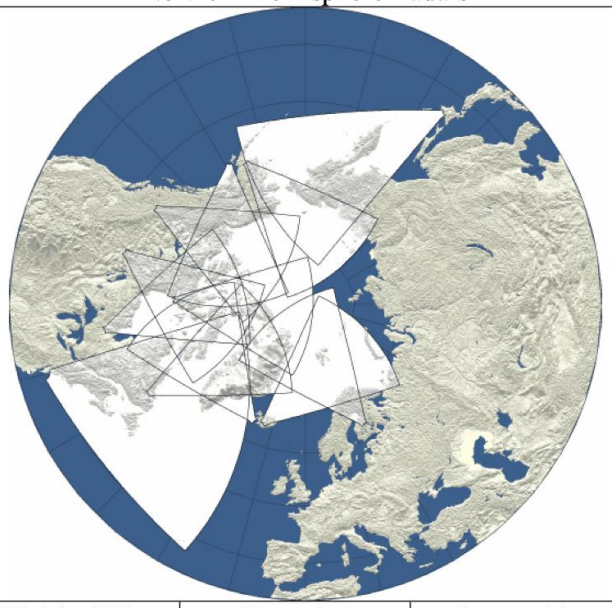


Common SuperDARN Viewing Areas in Northern Hemisphere

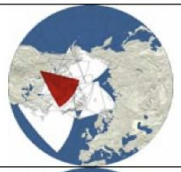
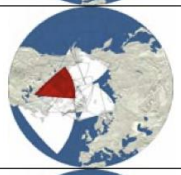
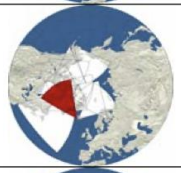
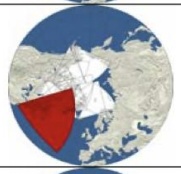


SuperDARN Locations

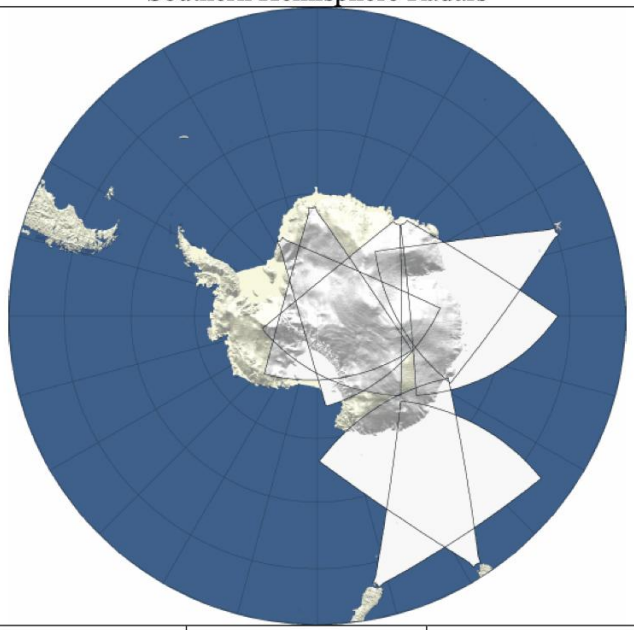
Northern Hemisphere Radars



Location	Field-of-View	Operating Institution	Geographic Coordinates	Geomagnetic Coordinates
Rankin Inlet, Nunavut, Canada		University of Saskatchewan	62.82° N 93.11° W	72.96° N 28.17° W
King Salmon, Alaska, USA		Communications Research Laboratory	58.68° N 156.65° W	57.43° N 100.51° E
Kodiak, Alaska, USA		University of Alaska Fairbanks	57.60° N 152.2° W	57.17° N 96.28° W
Prince George, British Columbia, Canada		University of Saskatchewan	53.98° N 122.59° W	59.88° N 65.67° W

Northern Hemisphere Radars				
Location	Field-of-View	Operating Institution	Geographic Coordinates	Geomagnetic Coordinates
Saskatoon, Saskatchewan, Canada		University of Saskatchewan	52.16° N 106.53° W	61.34° N 45.26° W
Kapuskasing, Ontario, Canada		Johns Hopkins Applied Physics Laboratory	49.39° N 82.32° W	60.06° N 9.22° W
Goose Bay, Newfoundland, Canada		Johns Hopkins Applied Physics Laboratory	53.32° N 60.46° W	61.94° N 23.02° E
Stokkseyri, Iceland		LPCE/CNRS	63.86° N 22.02° W	65.04° N 67.33° E
Þykkvybær, Iceland		University of Leicester	63.86° N 19.20° W	64.59° N 69.65° E
Hankasalmi, Finland		University of Leicester	62.32° N 26.61° E	59.78° N 105.53° E
Wallops Island, Virginia, USA		Johns Hopkins Applied Physics Laboratory	37.93° N 75.47° W	30.63° N 75.52° E
Hokkaido, Japan		Solar-Terrestrial Environment Laboratory	43.53° N 143.61° E	38.14° N 145.67° W

Southern Hemisphere Radars



Location	Field-of-View	Operating Institution	Geographic Coordinates	Geomagnetic Coordinates
Halley Station, Antarctica		British Antarctic Survey	75.52° S 26.63° W	61.68° S 28.92° E
Sanae, Antarctica		University of KwaZulu-Natal	71.68° S 2.85° W	61.52° S 43.18° E
Syowa, Antarctica		National Institute of Polar Research	69.00° S 39.58° E	55.25° S 23.00° E
Syowa, Antarctica		National Institute of Polar Research	69.01° S 39.61° E	55.25° S 22.98° E

Southern Hemisphere Radars				
Location	Field-of-View	Operating Institution	Geographic Coordinates	Geomagnetic Coordinates
Kerguelen Island		LPCE/CNRS	49.35° S 70.26° E	58.73° S 122.14° E
Tasmania		LaTrobe University	43.38° S 147.23° E	55.31° S 133.36° W
Unwin, New Zealand		LaTrobe University	46.51° S 168.38° E	55.15° S 106.54° W

Charts courtesy of Penn State University

SuperDARN Memories

Wallops Island, 2005

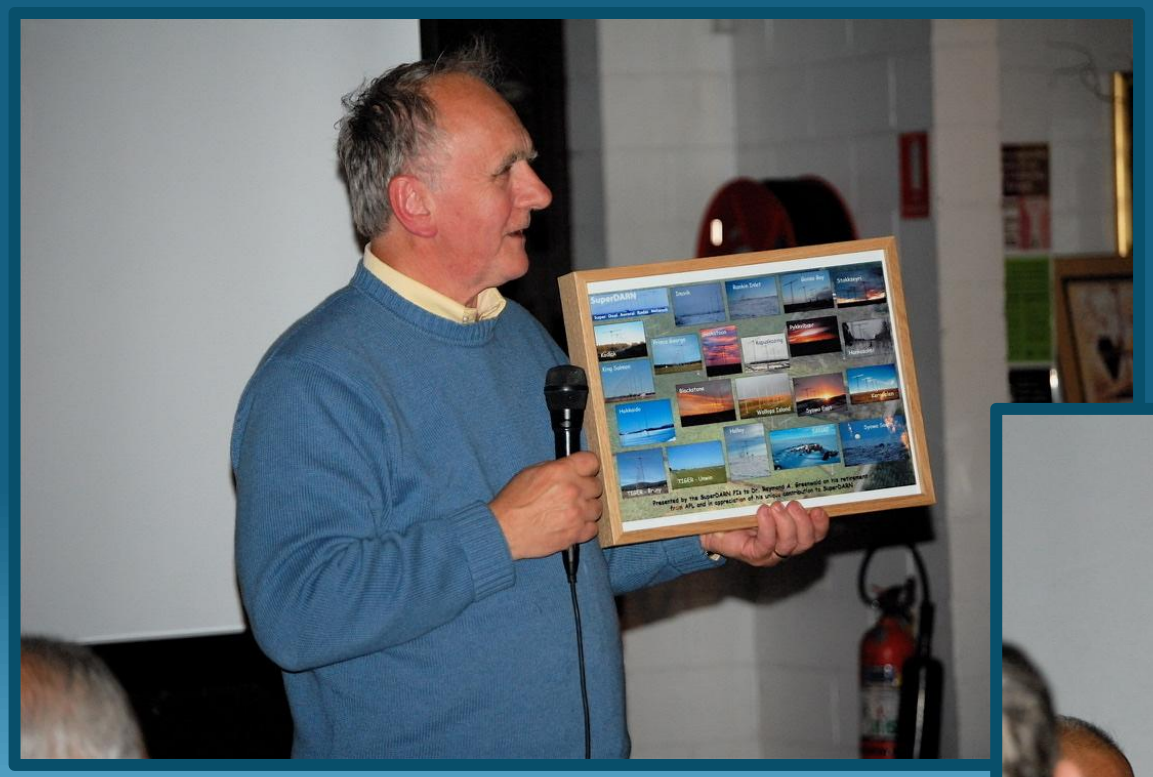
Hokkaido, July 2007

Antenna Construction, 2007

Accompanying Persons Mischief, Hokkaido 2007

McGuigan's Winery, Australia 2008

Spoon Award, Newcastle 2008



Ray Retires, Mark Steps Up 2008

Dining in Oslo, 2008

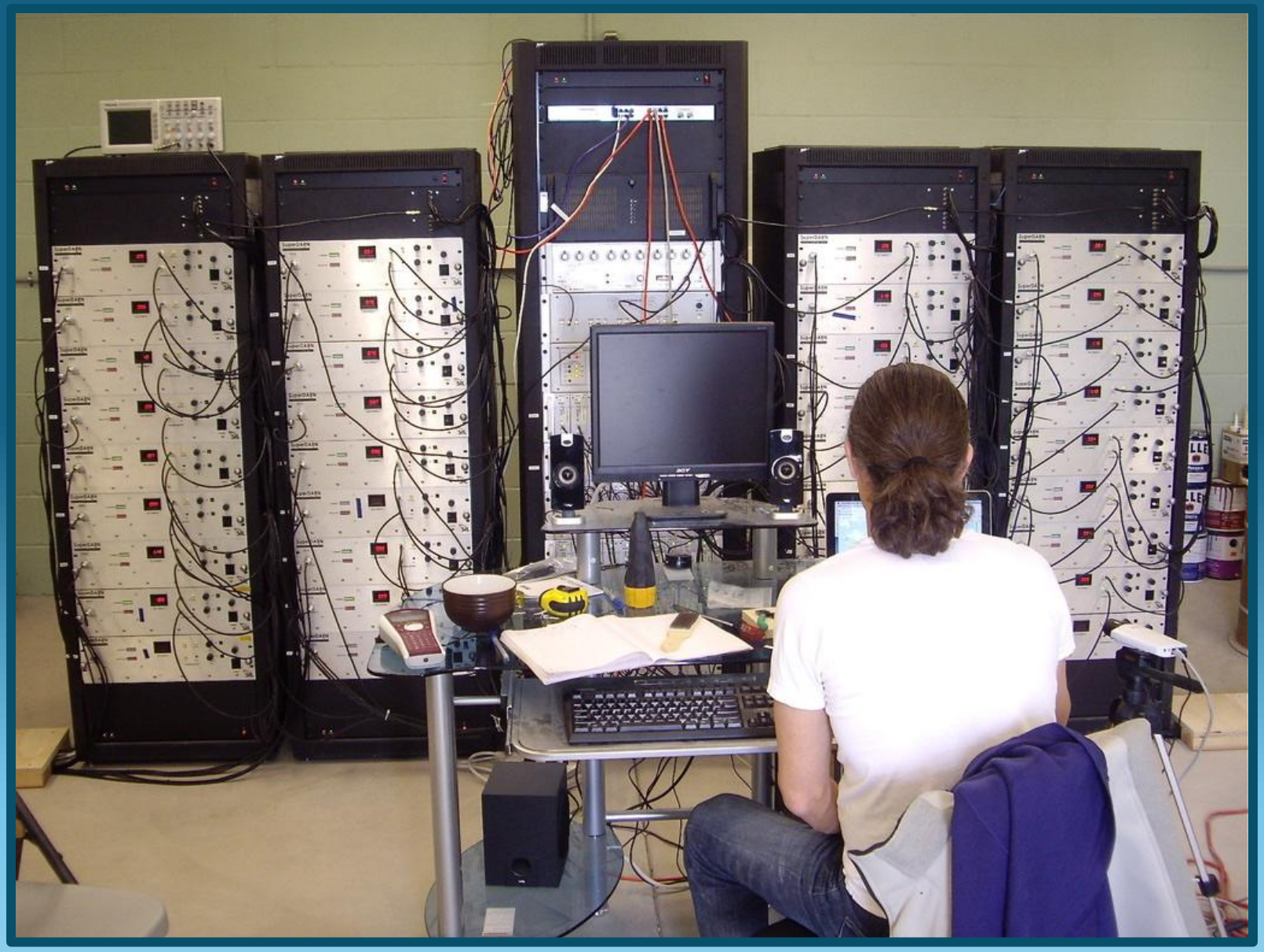
First Stake at Fort Hayes, 2009

Meeting of the Minds, 2009

The Hairpin Turns of Corsica, 2009

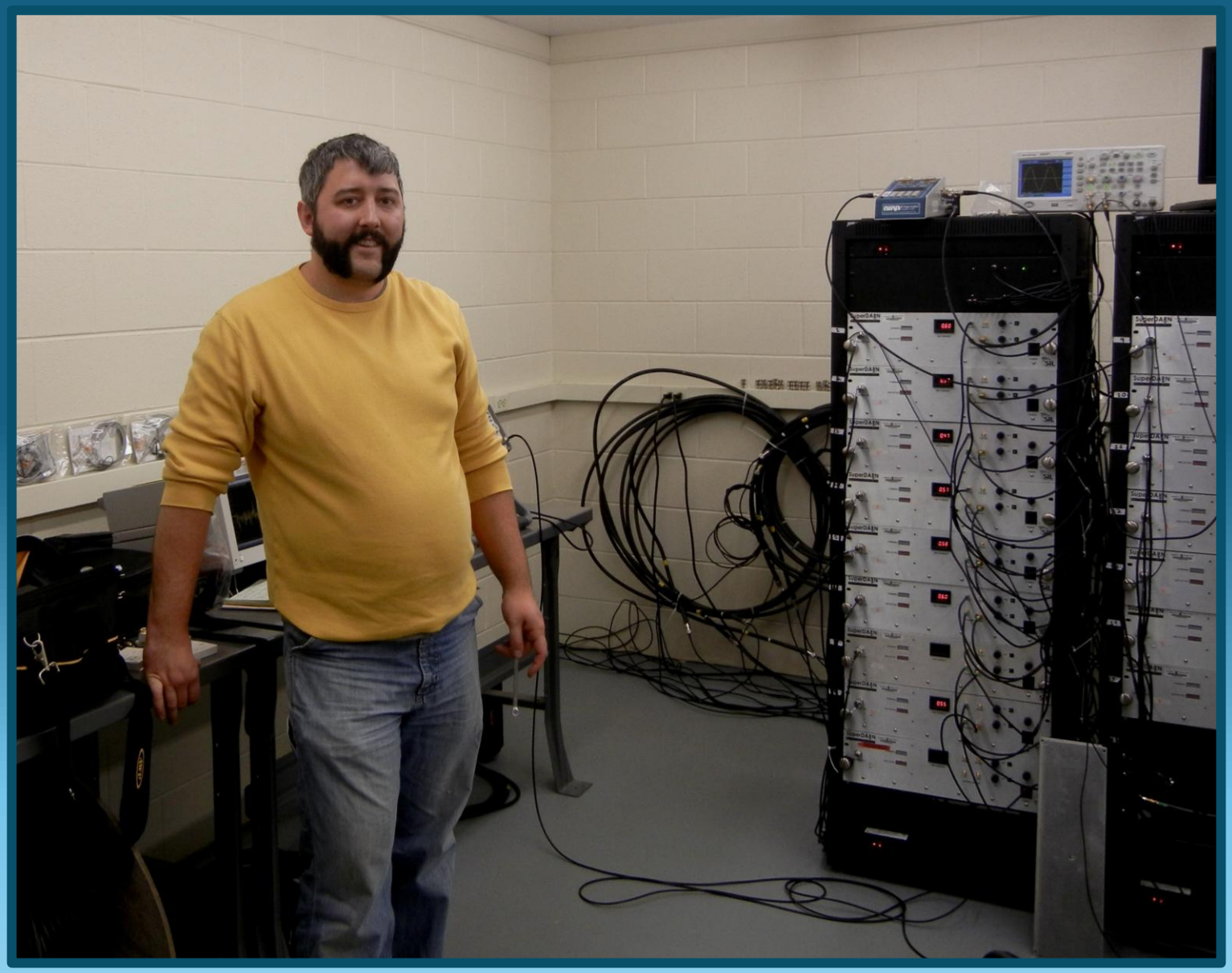
Antenna Art, Fort Hayes 2009

Firey Brai
in
Newcastle,
2010



Simon Directs the Happy Valley Radars, 2011

Enjoying
The
Dartmouth Outing Club,
2011



Kevin at Blackstone, or is it Wallops? 2012

Signing of the Agreement to Build the Azores Array
(It never happened.)

A Surprise 70th for Ray on the Huangpu River, 2012

An Icy Excursion in Svalbard, 2014

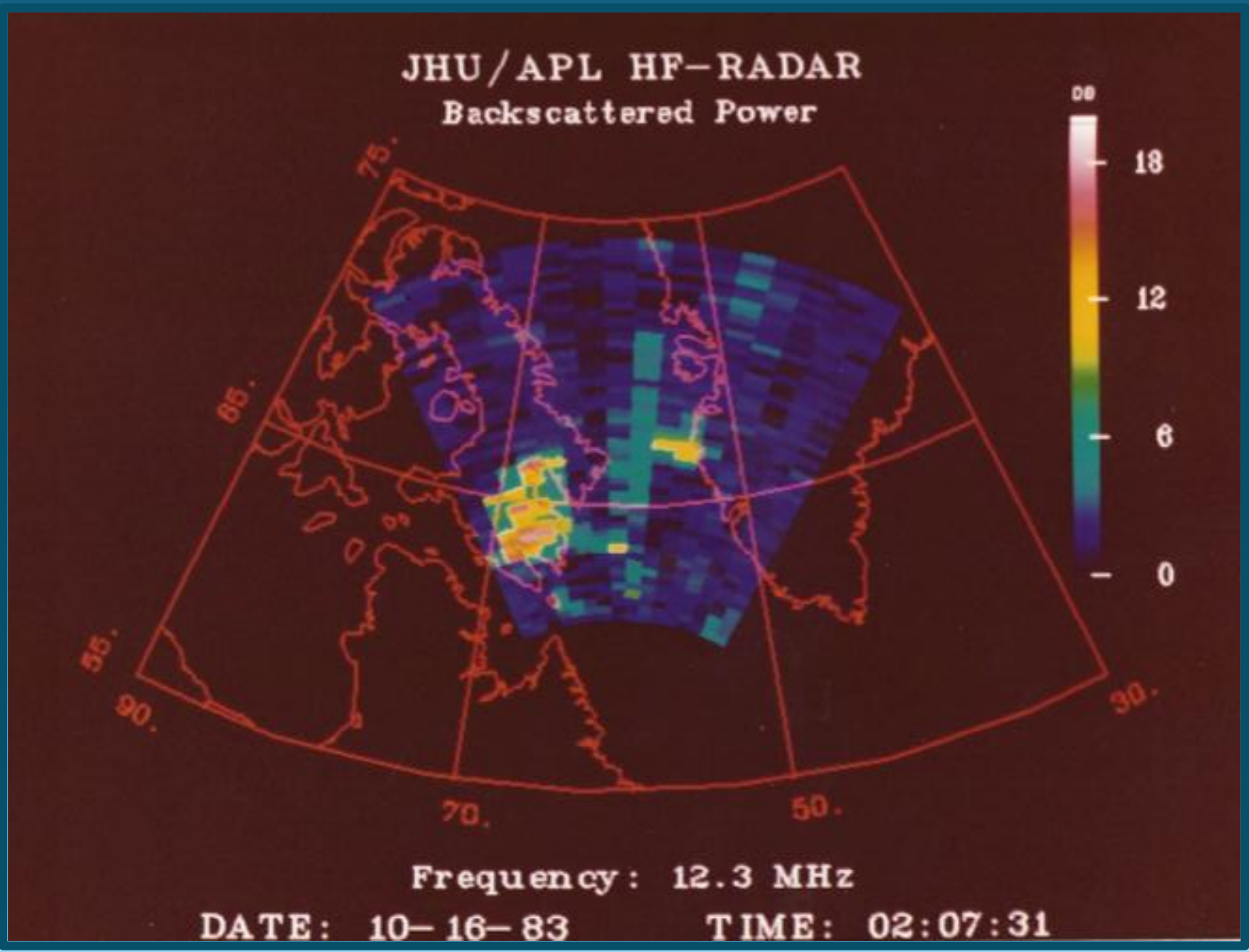
The Old Guard Boards a Train in Leicestershire, 2015

Lunchtime in San Quirico d'Orcia, 2017

Making Music in the Fuji-Q Highlands, 2019

En Route to the Mountain Kingdom on Lesotho, 2023

Enduring SuperDARN Friendships


JHU/APL HF-RADAR
Backscattered Power
dB
18
12
6
0
75.
65.
55.
90.
70.
50.
30.
Frequency: 12.3 MHz
DATE: 10-16-83
TIME: 02:07:31