

Large-scale View of Mid-latitude Plasma Convection



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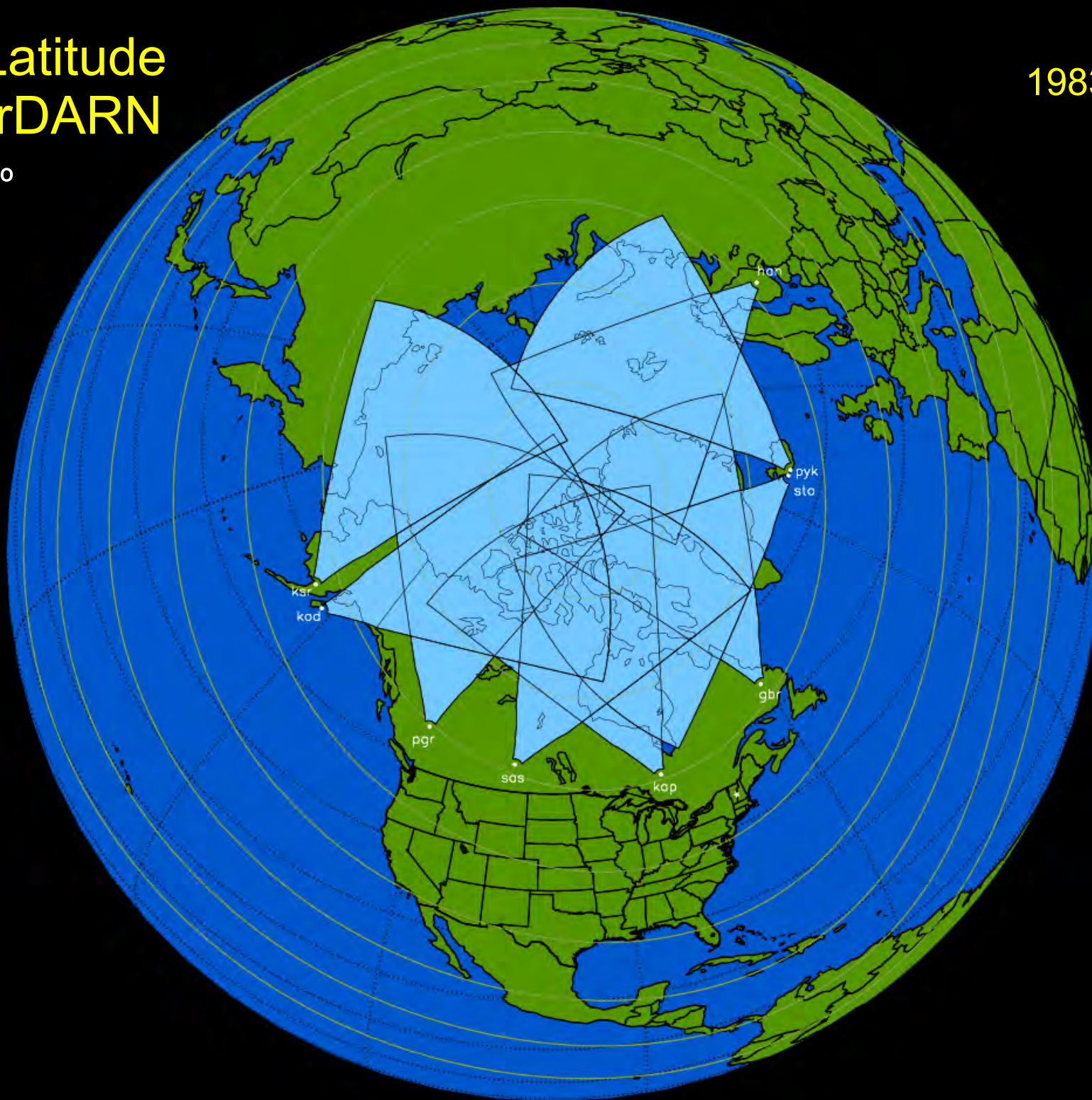
Elsayed Talaat
JHU/APL, Laurel Maryland

2012 CEDAR Workshop
Santa Fe, NM

High-Latitude SuperDARN

1983-2004

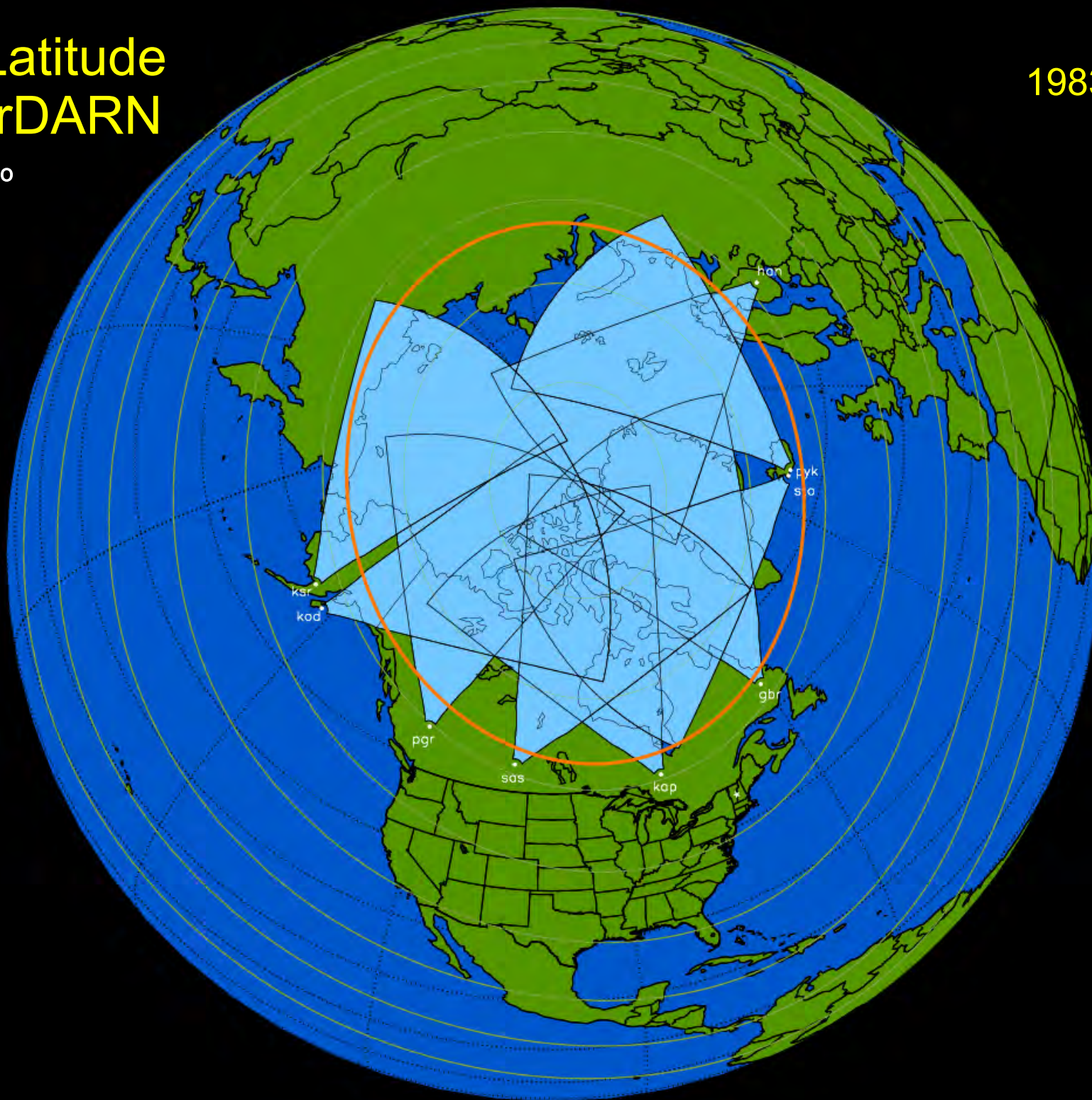
>62°



High-Latitude SuperDARN

1983-2004

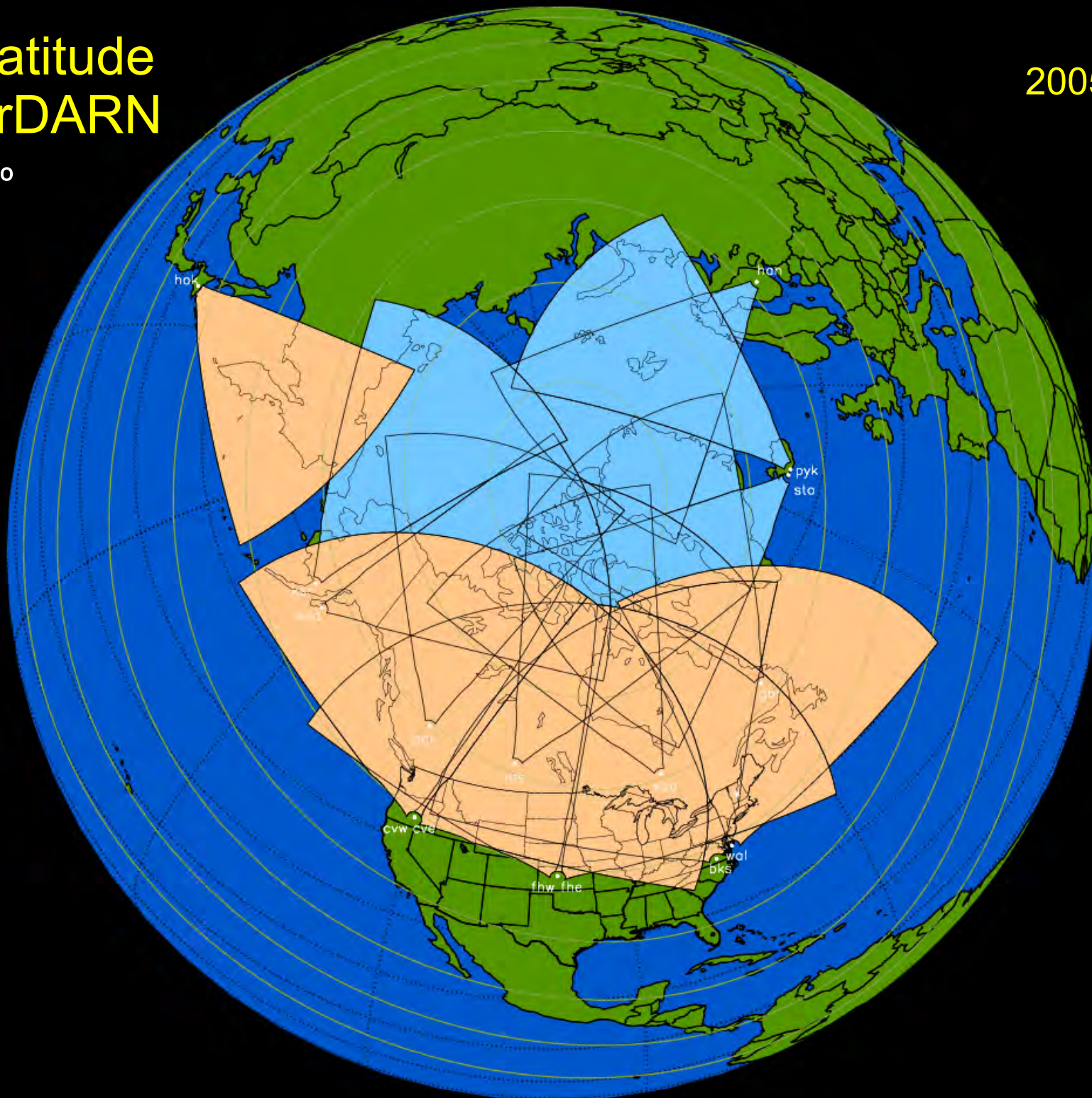
>62°



Mid-Latitude SuperDARN

2005-2010

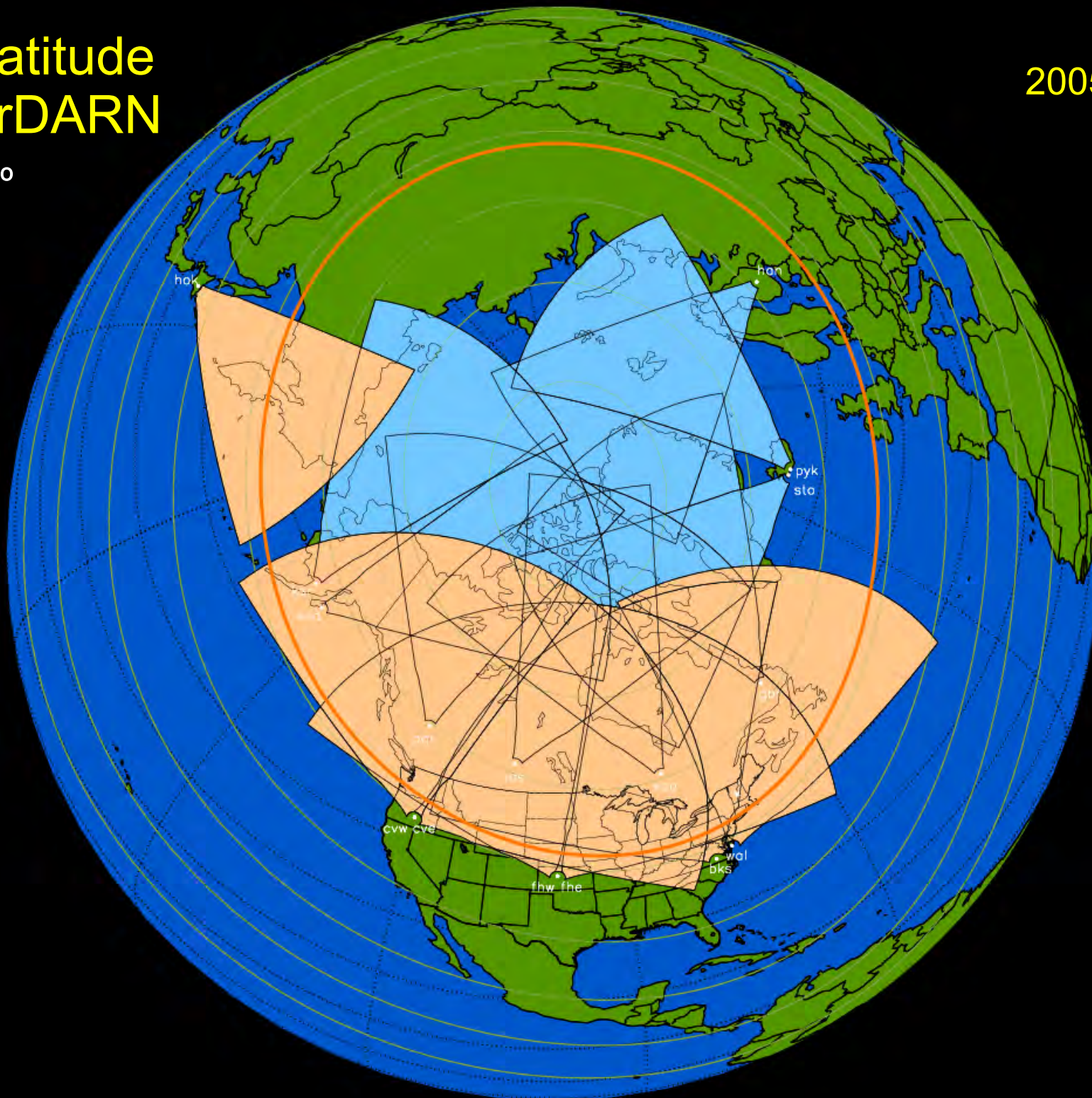
>50°



Mid-Latitude SuperDARN

2005-2010

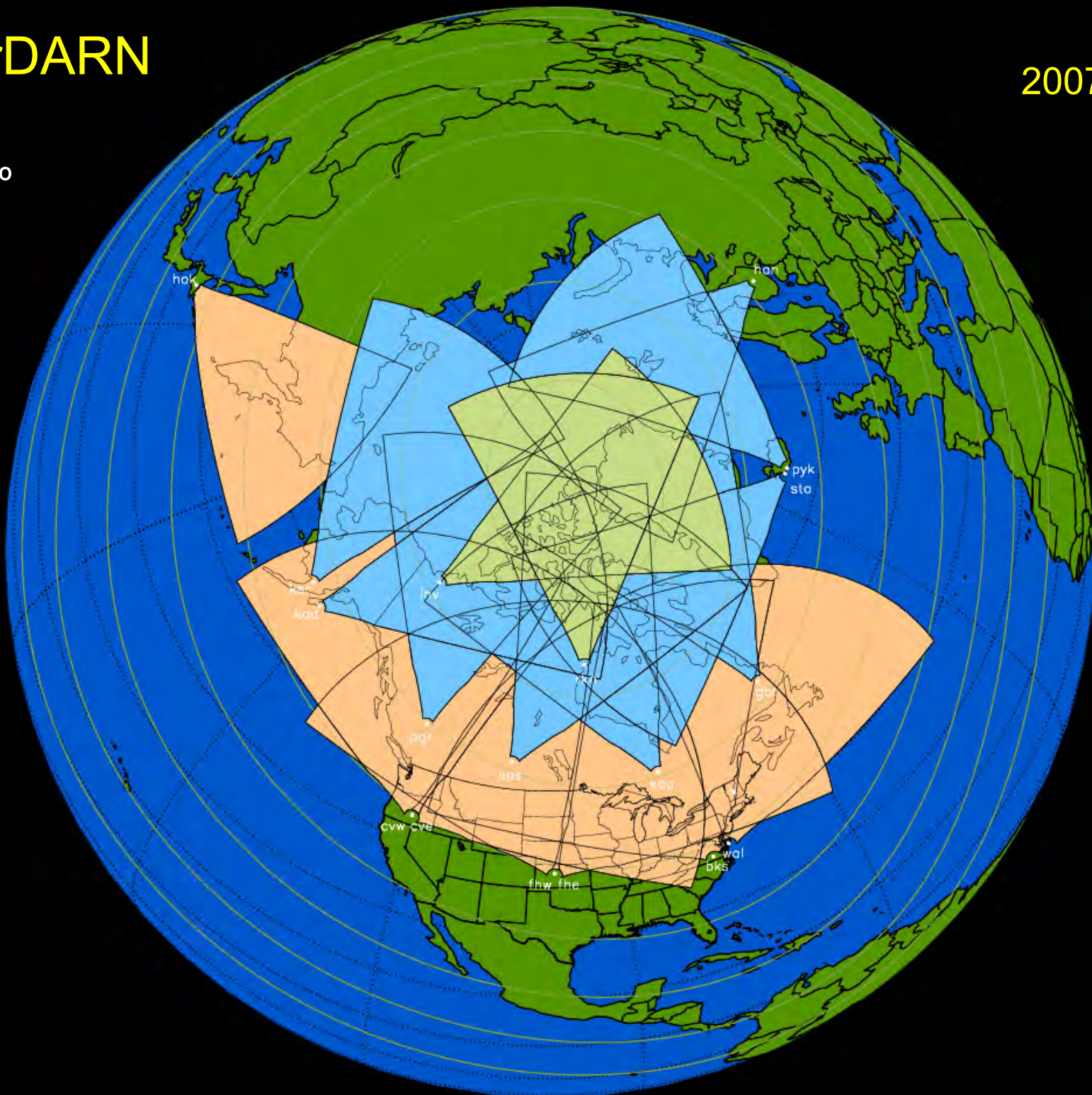
>50°



PolarDARN

2007-2008

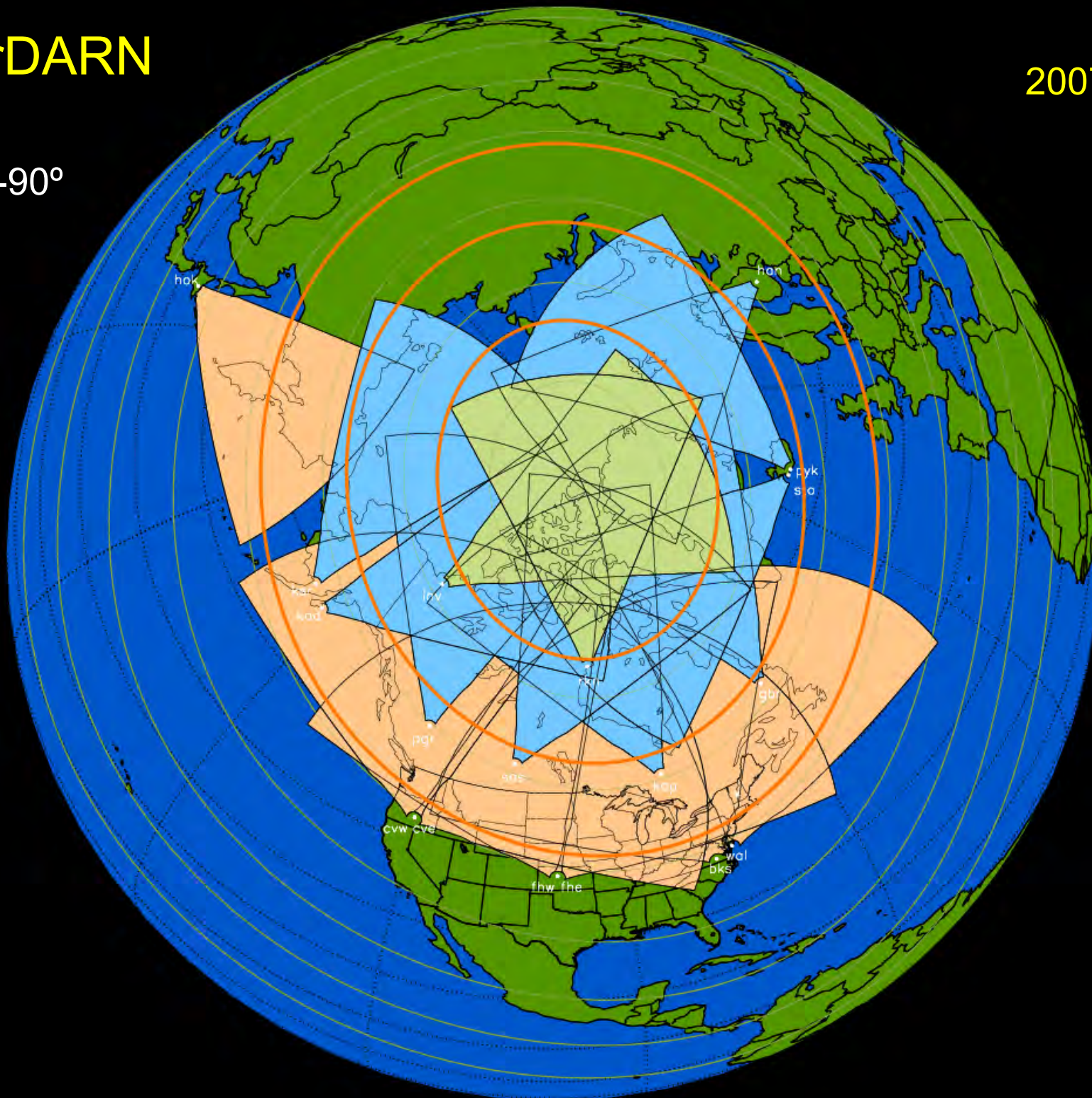
>72°



PolarDARN

2007-2008

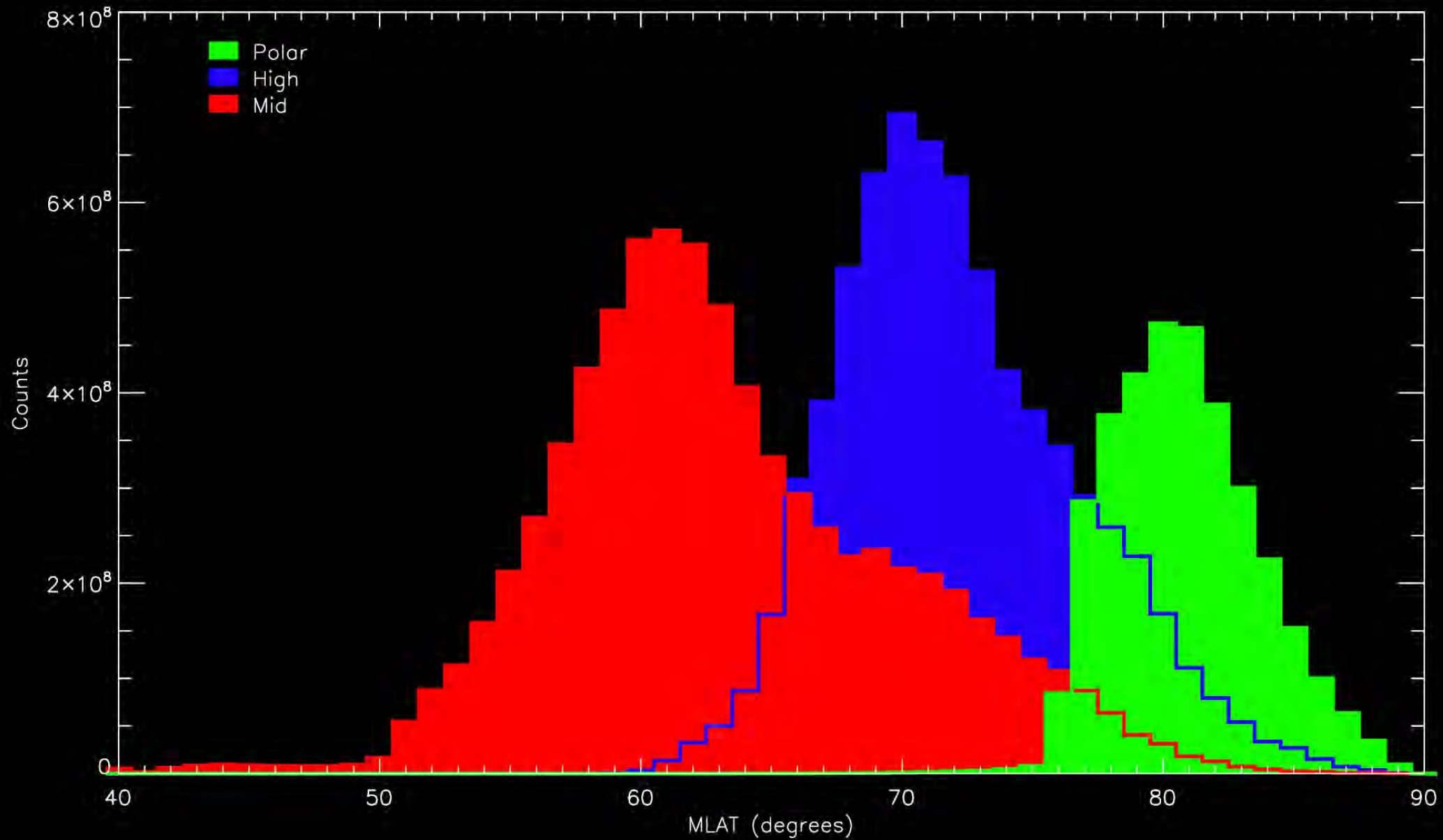
50°-90°



SuperDARN Backscatter

2011

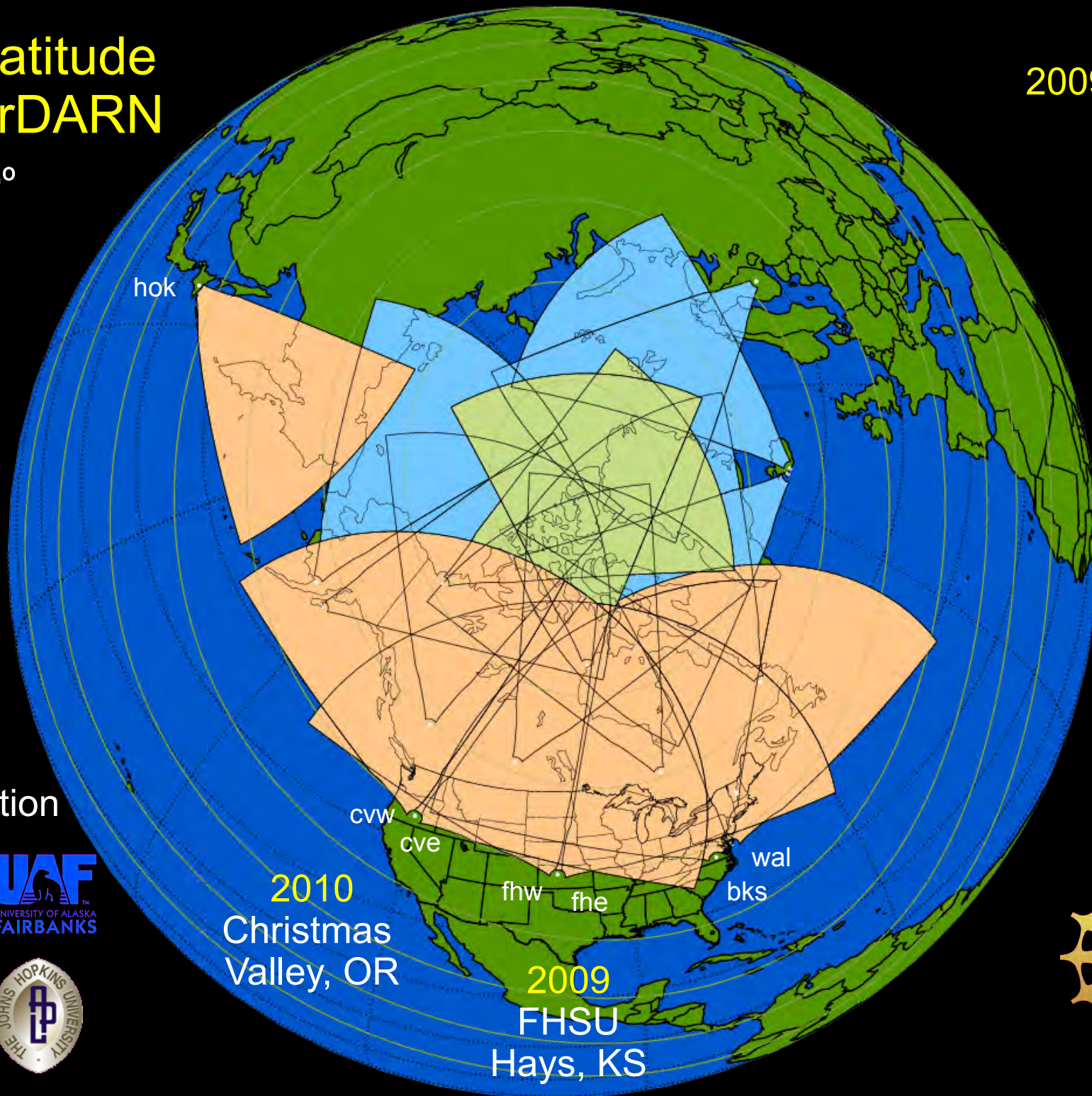
MLAT



Mid-Latitude SuperDARN

2009-2012

>50°



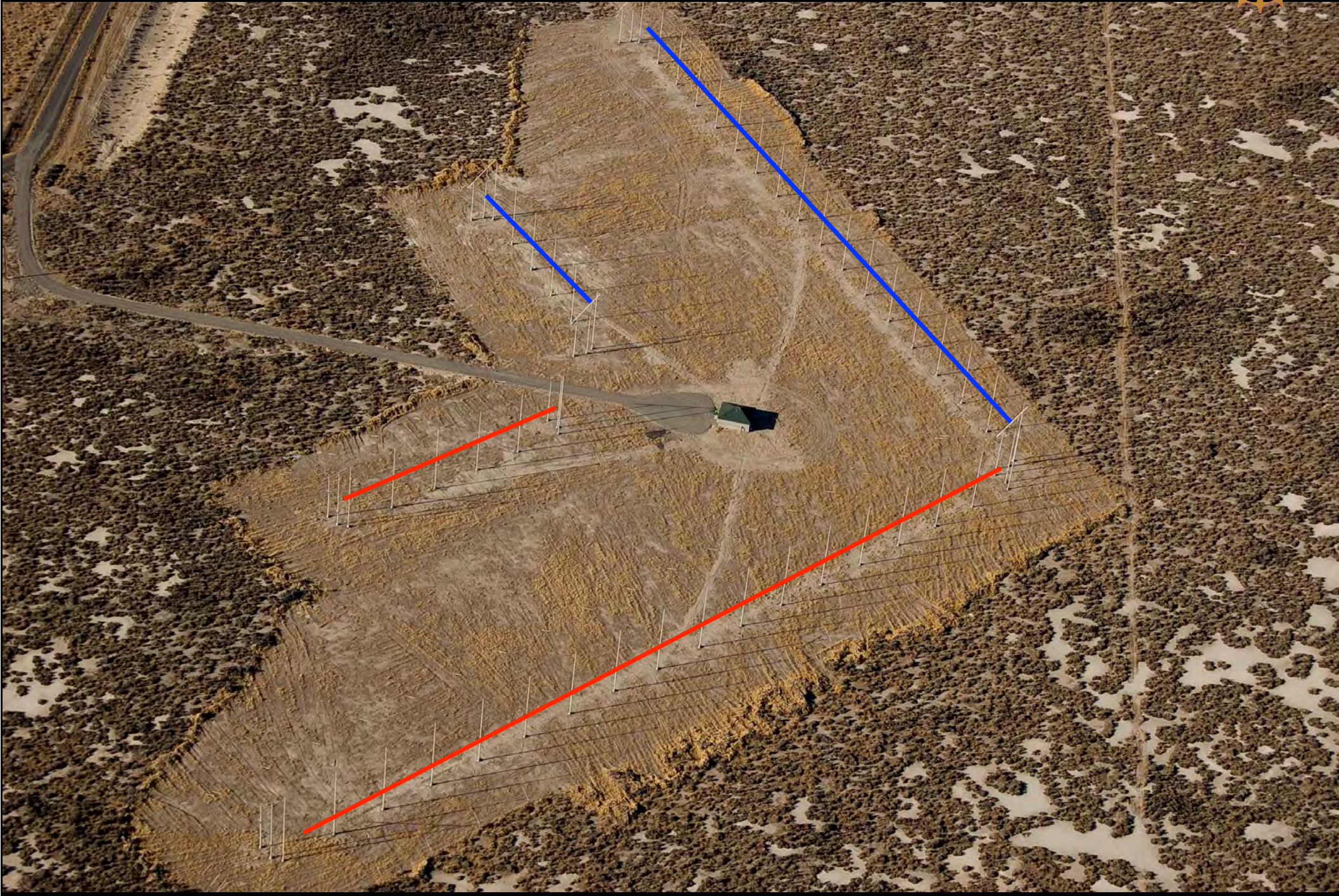
MSI
Collaboration



2010
Christmas
Valley, OR

2009
FHSU
Hays, KS





Oregon MSI Radars

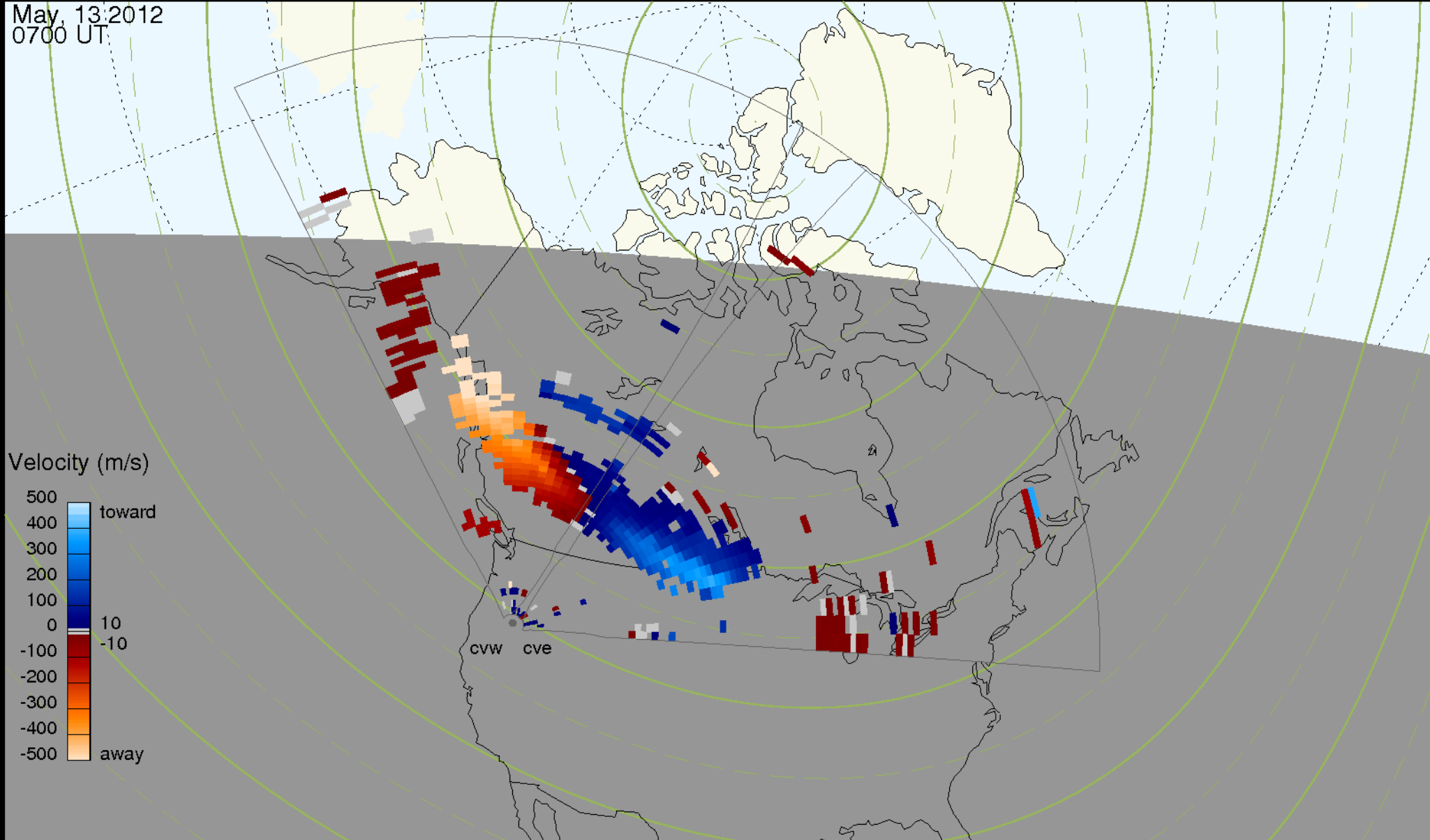
Christmas Valley, OR



SAPS - Sub Auroral Polarization Stream

Foster and Burke, EOS, 2002

May, 13, 2012
0700 UT

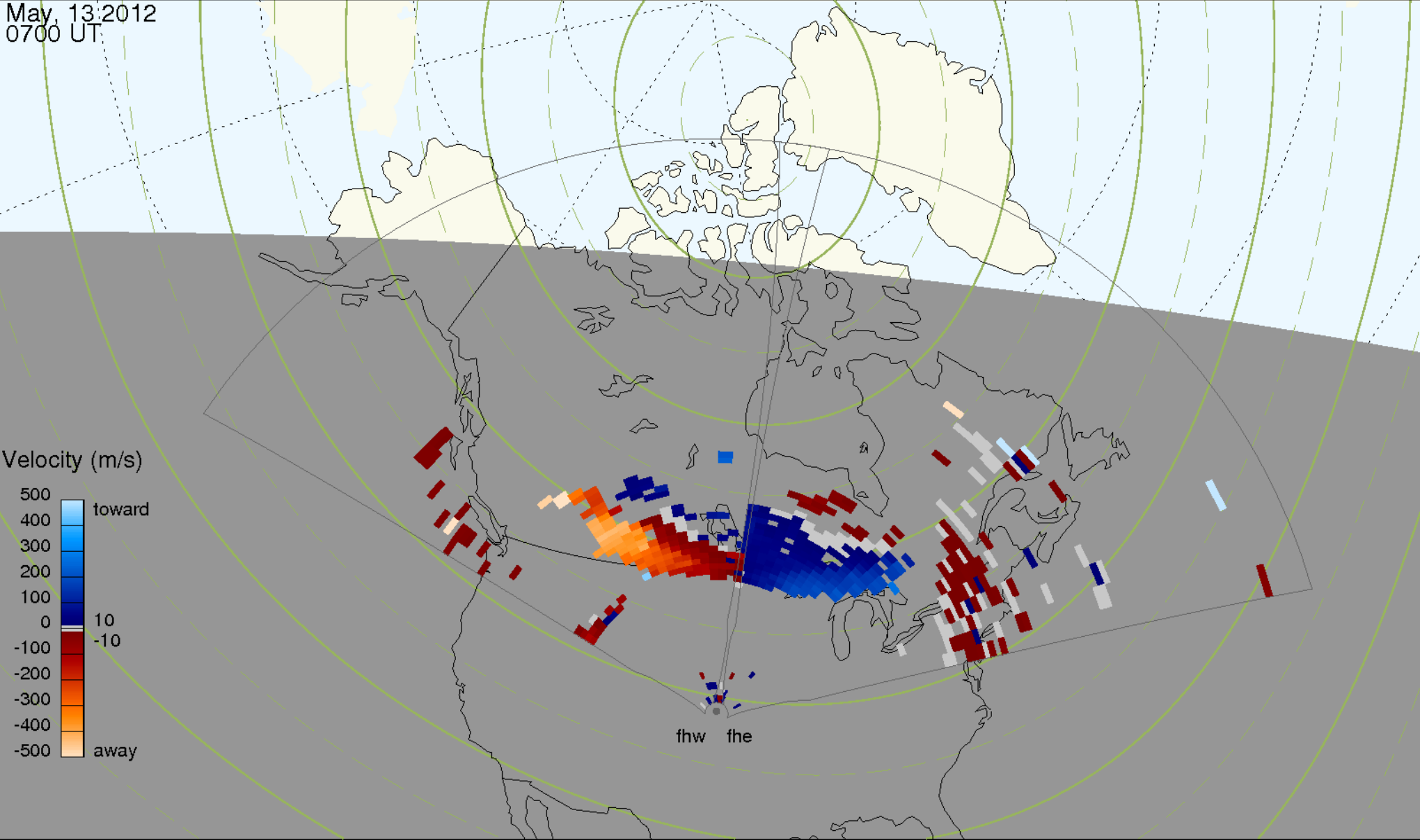


Kansas MSI Radars

Hays, KS



May, 13, 2012
0700 UT

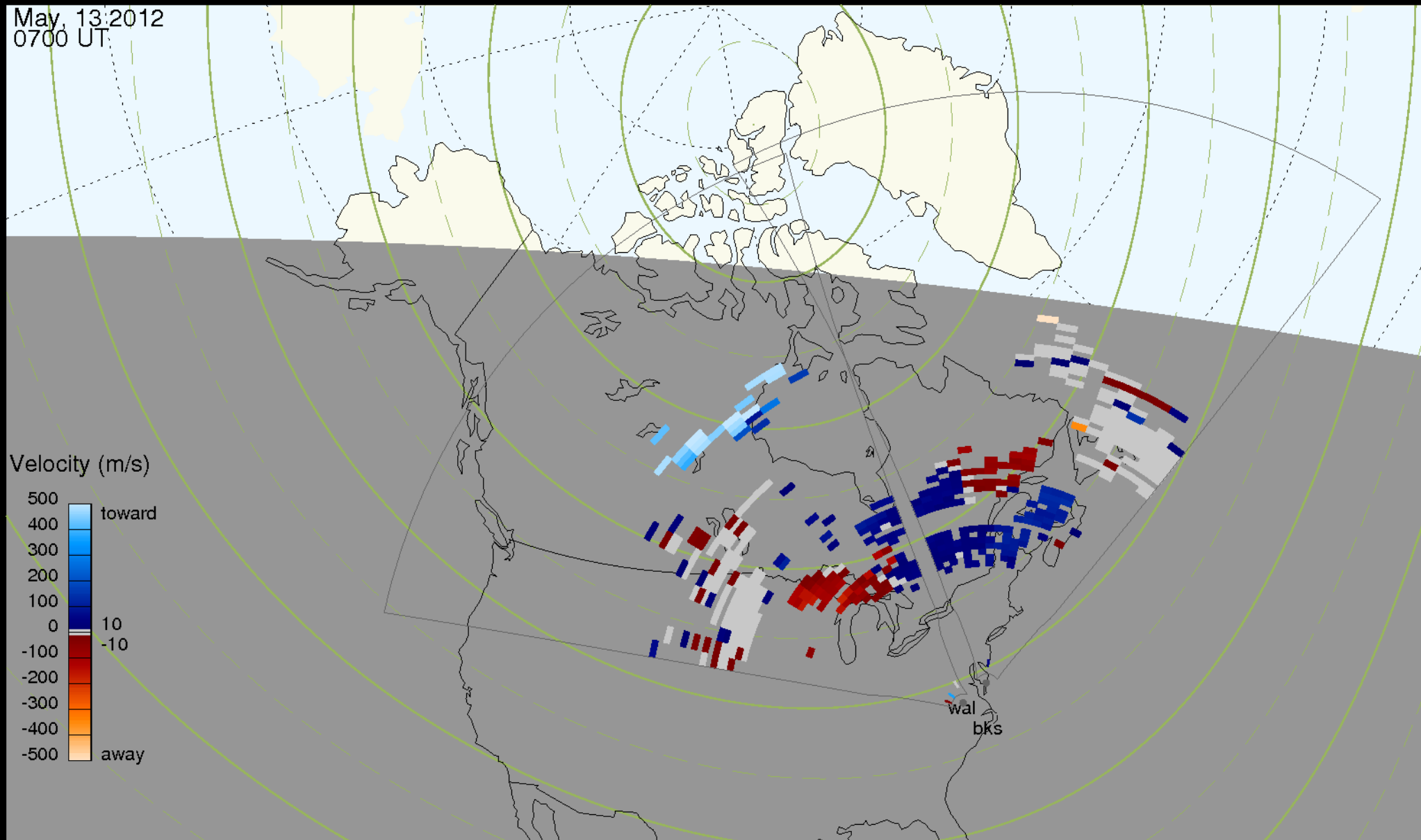


Virginia SuperDARN Radars

Wallops Island, VA
Blackstone, VA



May, 13, 2012
0700 UT

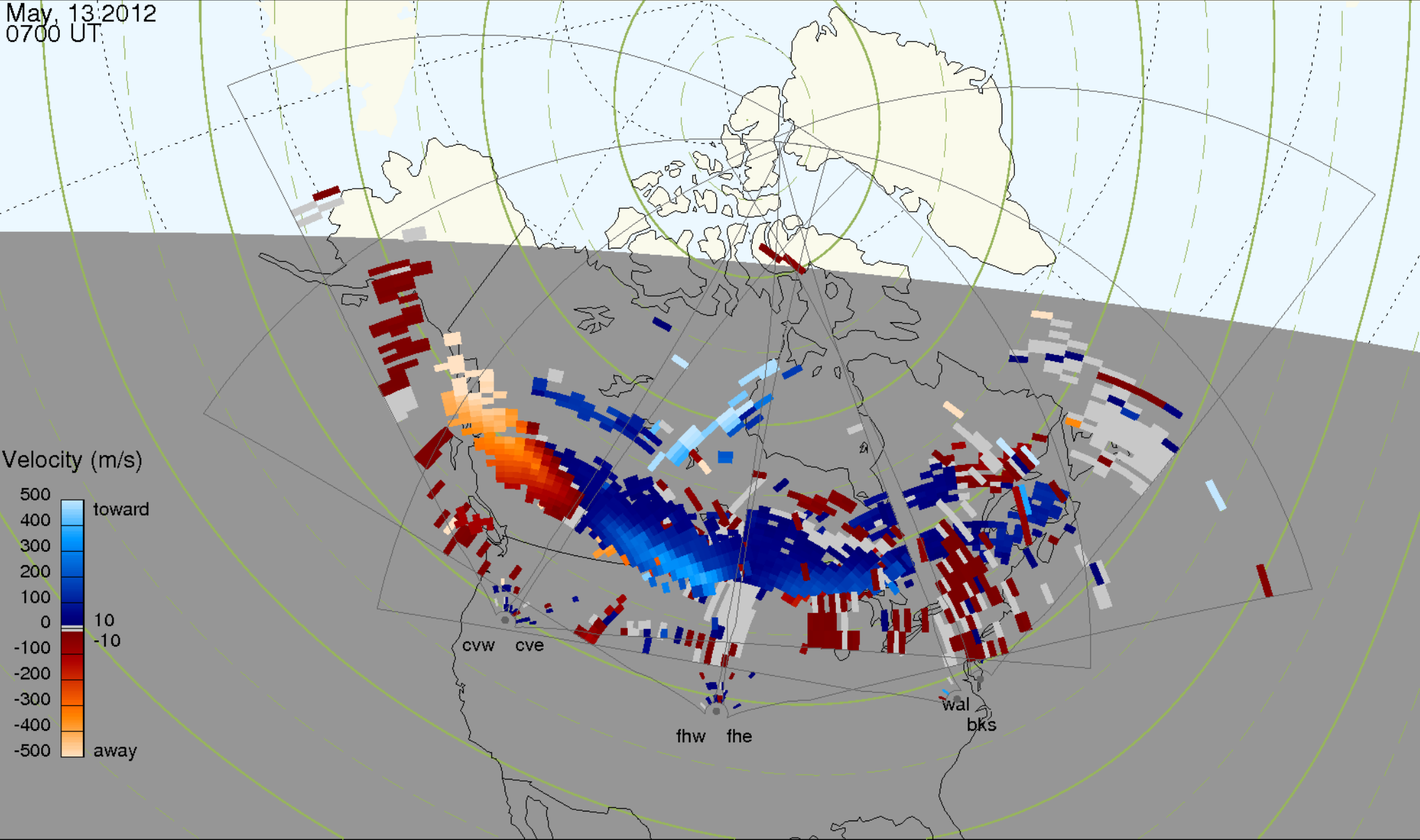


SuperDARN Mid-Latitude Radars



SAPS - Sub Auroral Polarization Stream

May, 13, 2012
0700 UT

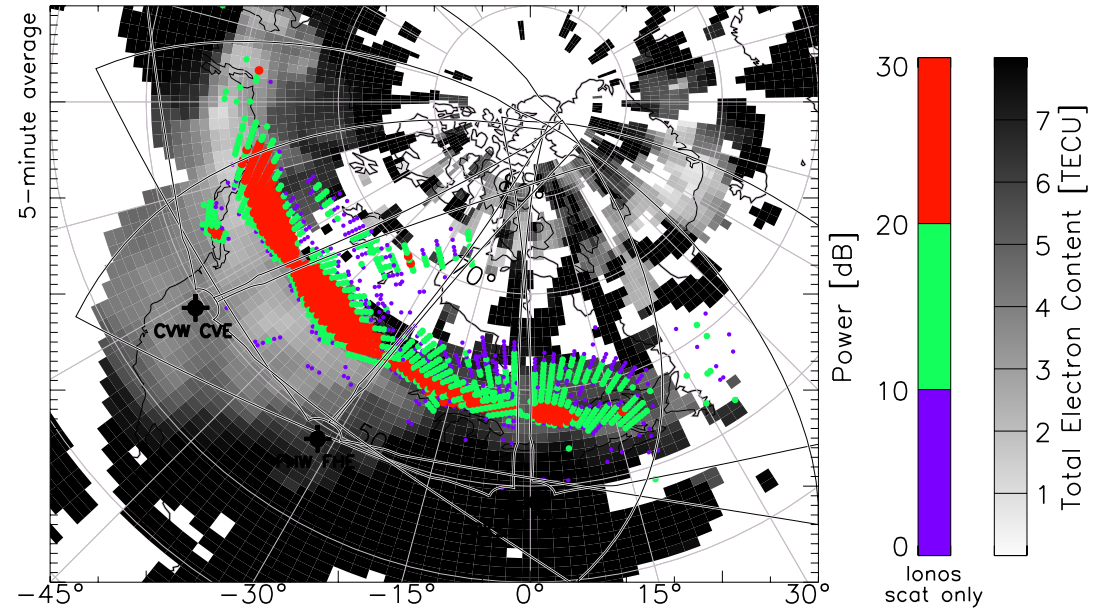
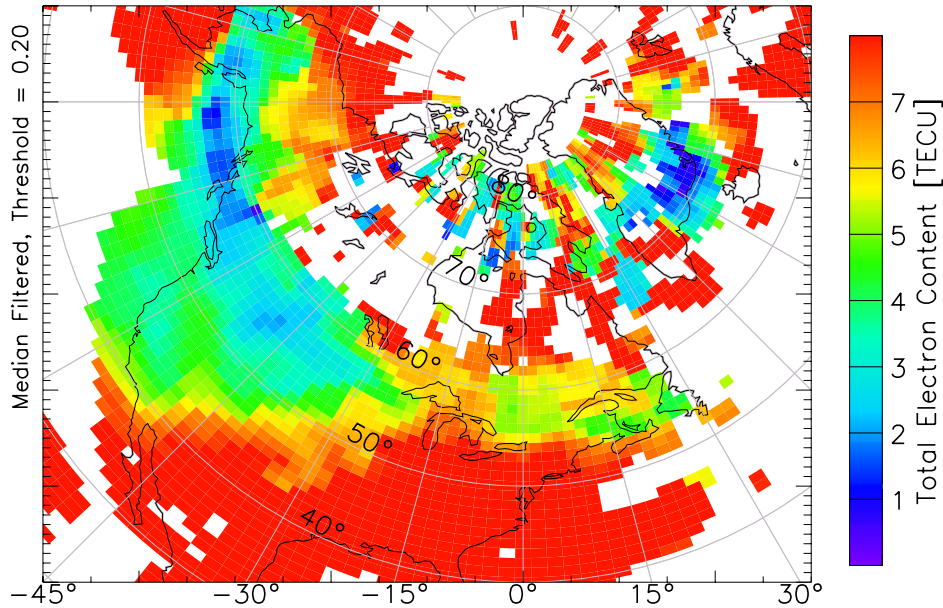


SuperDARN Mid-Latitude Radars

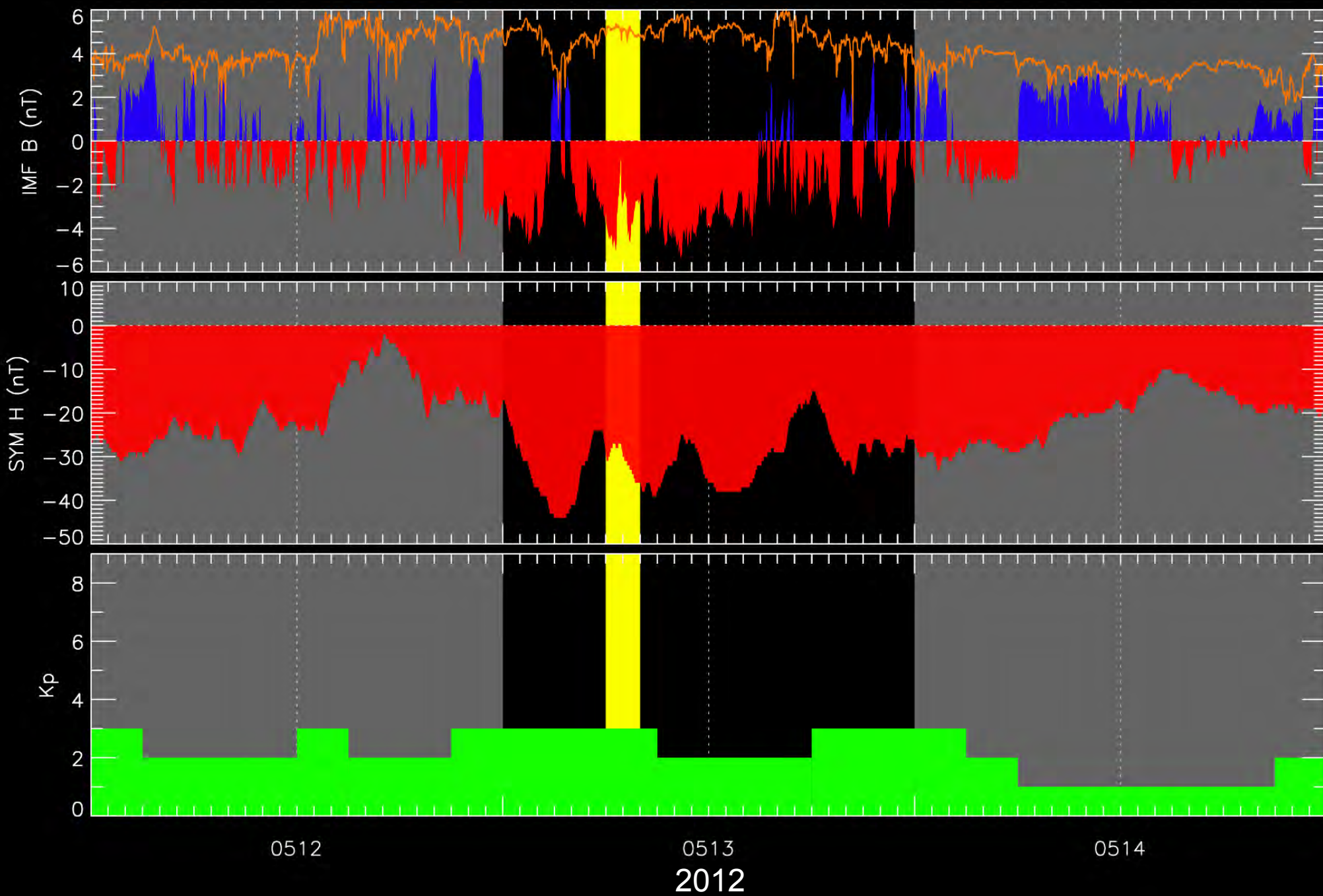
SAPS - Sub Auroral Polarization Stream



GPS/TEC



Solar Wind and Geophysical Conditions



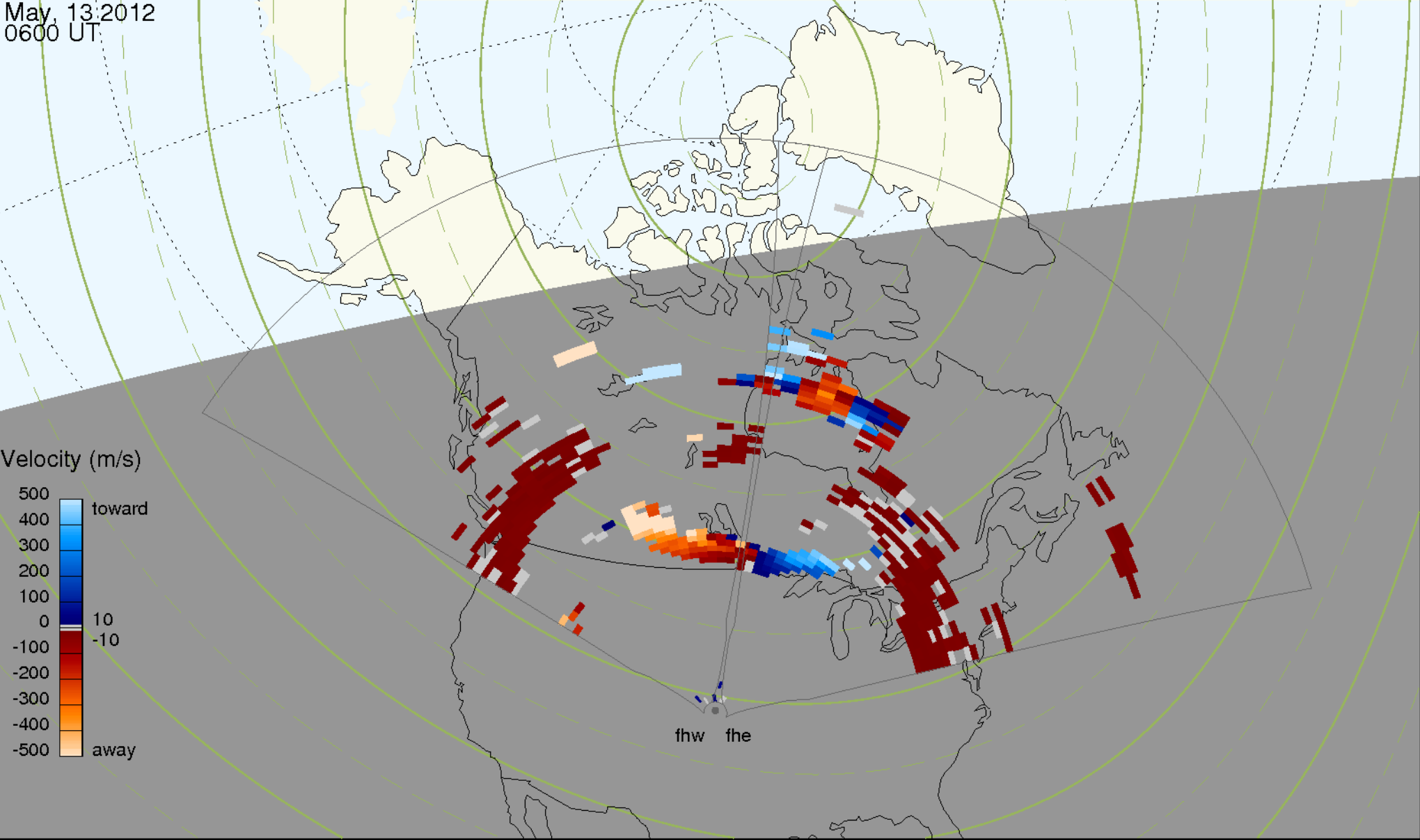
Oregon MSI Radars

Christmas Valley, OR



SAPS - Sub Auroral Polarization Stream

May, 13, 2012
0600 UT

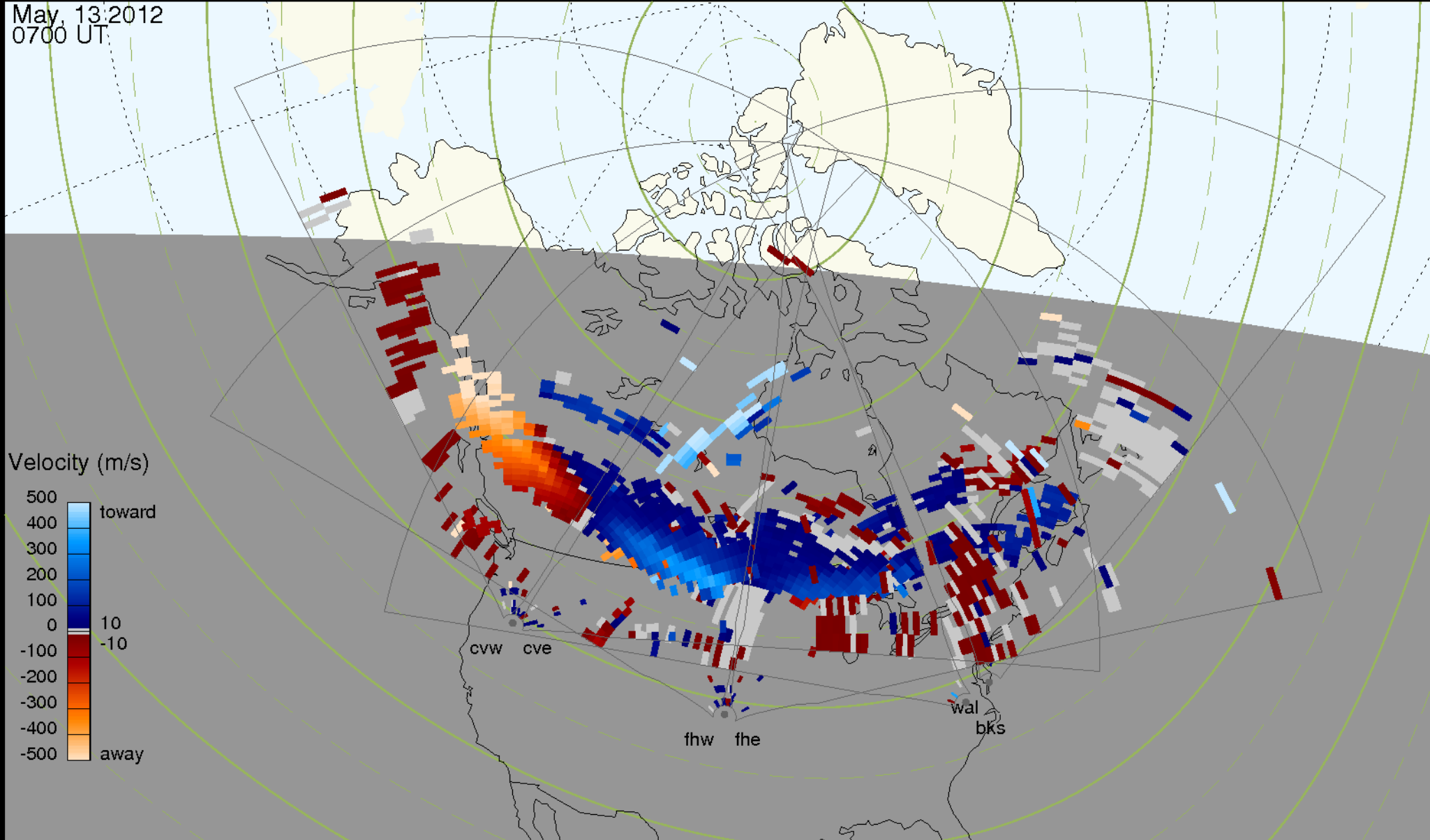


SuperDARN Mid-Latitude Radars

SAPS - Sub Auroral Polarization Stream



May, 13, 2012
0700 UT

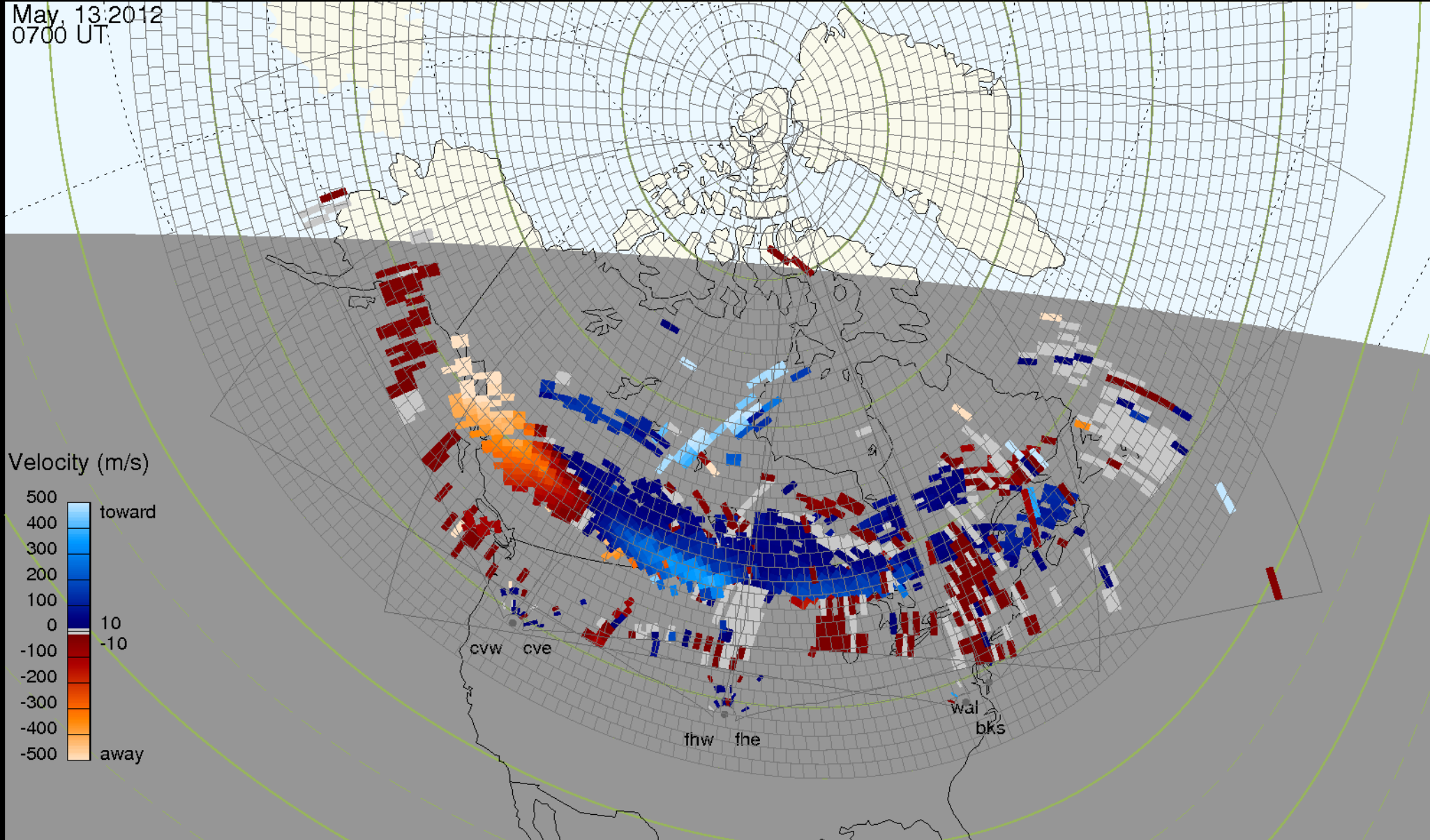


SuperDARN Mid-Latitude Radars

SAPS - Sub Auroral Polarization Stream



May, 13, 2012
0700 UT



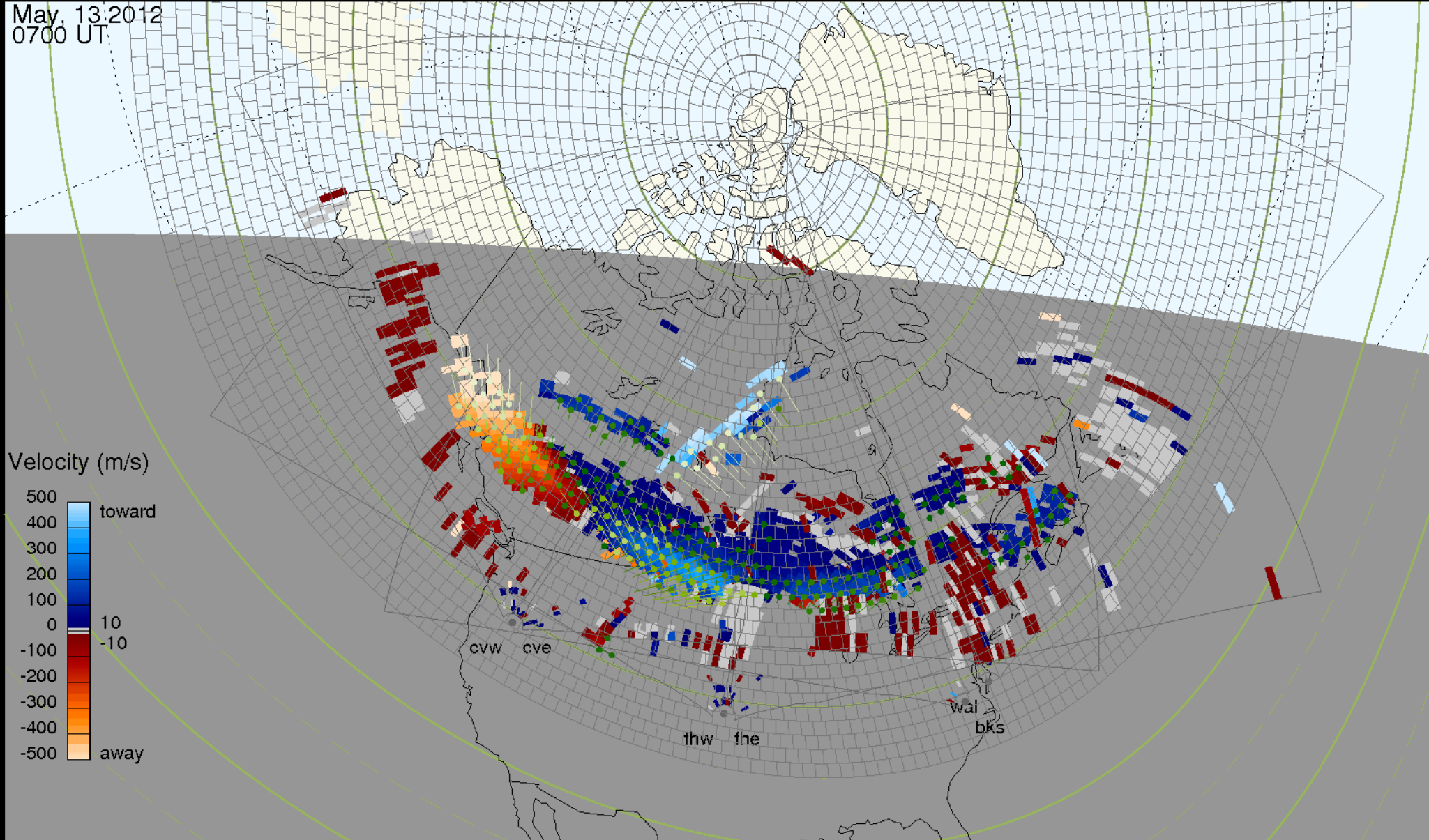
SuperDARN Mid-Latitude Radars

SAPS - Sub Auroral Polarization Stream

line-of-sight



May, 13, 2012
0700 UT



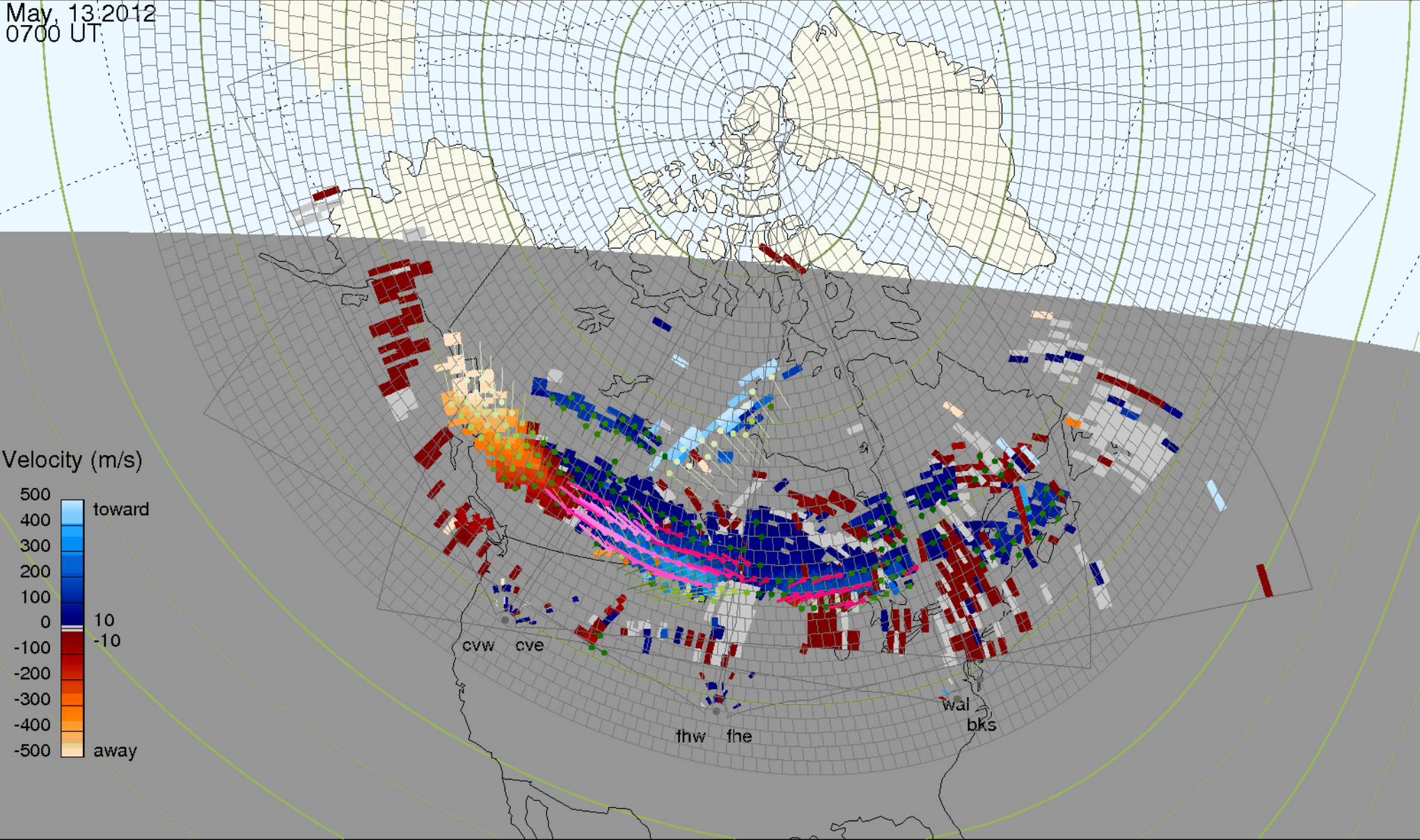
SuperDARN Mid-Latitude Radars

SAPS - Sub Auroral Polarization Stream

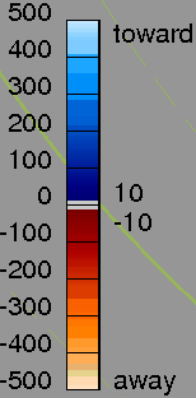
2D velocity



May, 13, 2012
0700 UT



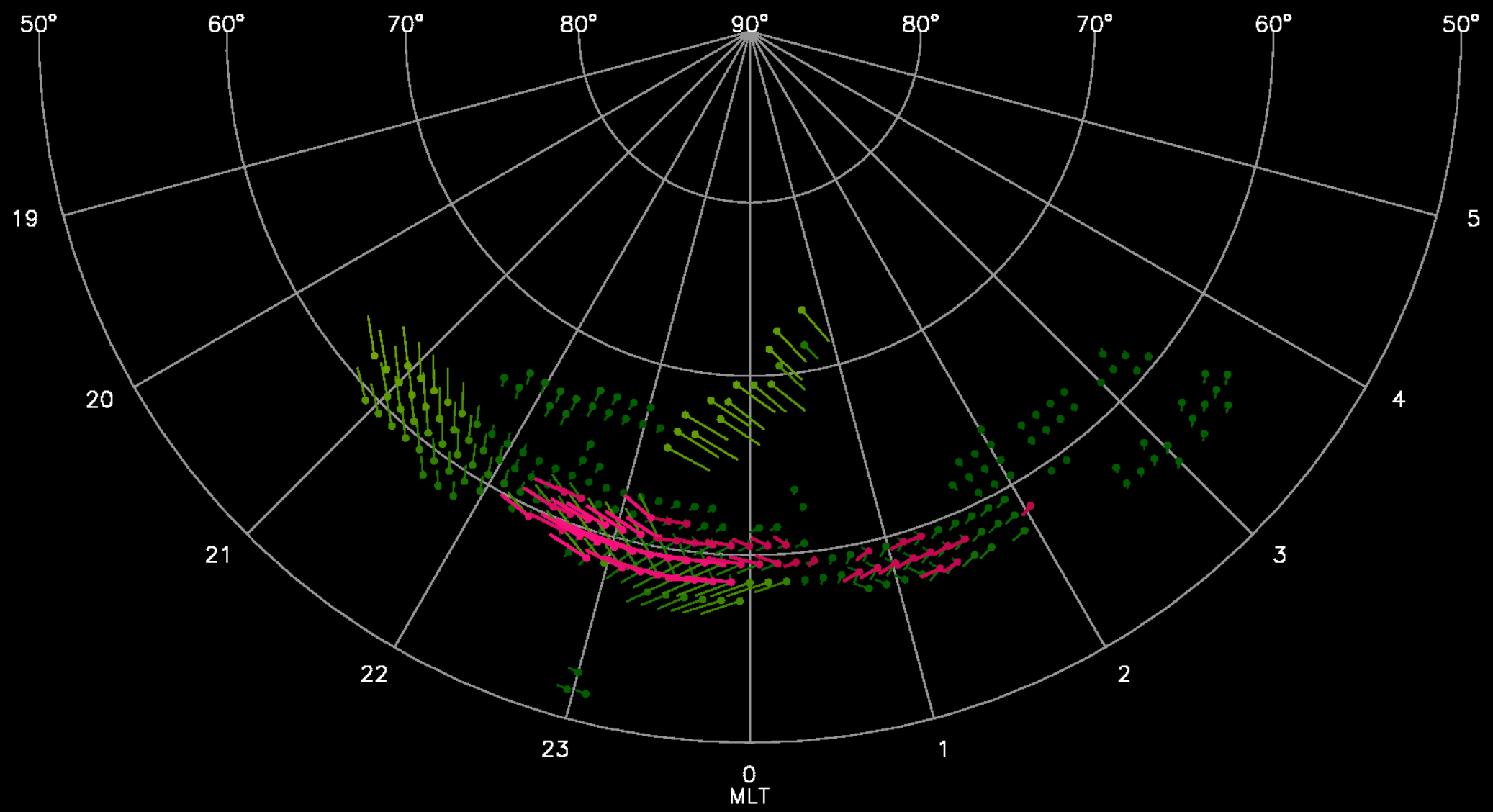
Velocity (m/s)



2D SAPS Velocity

MLAT, MLT

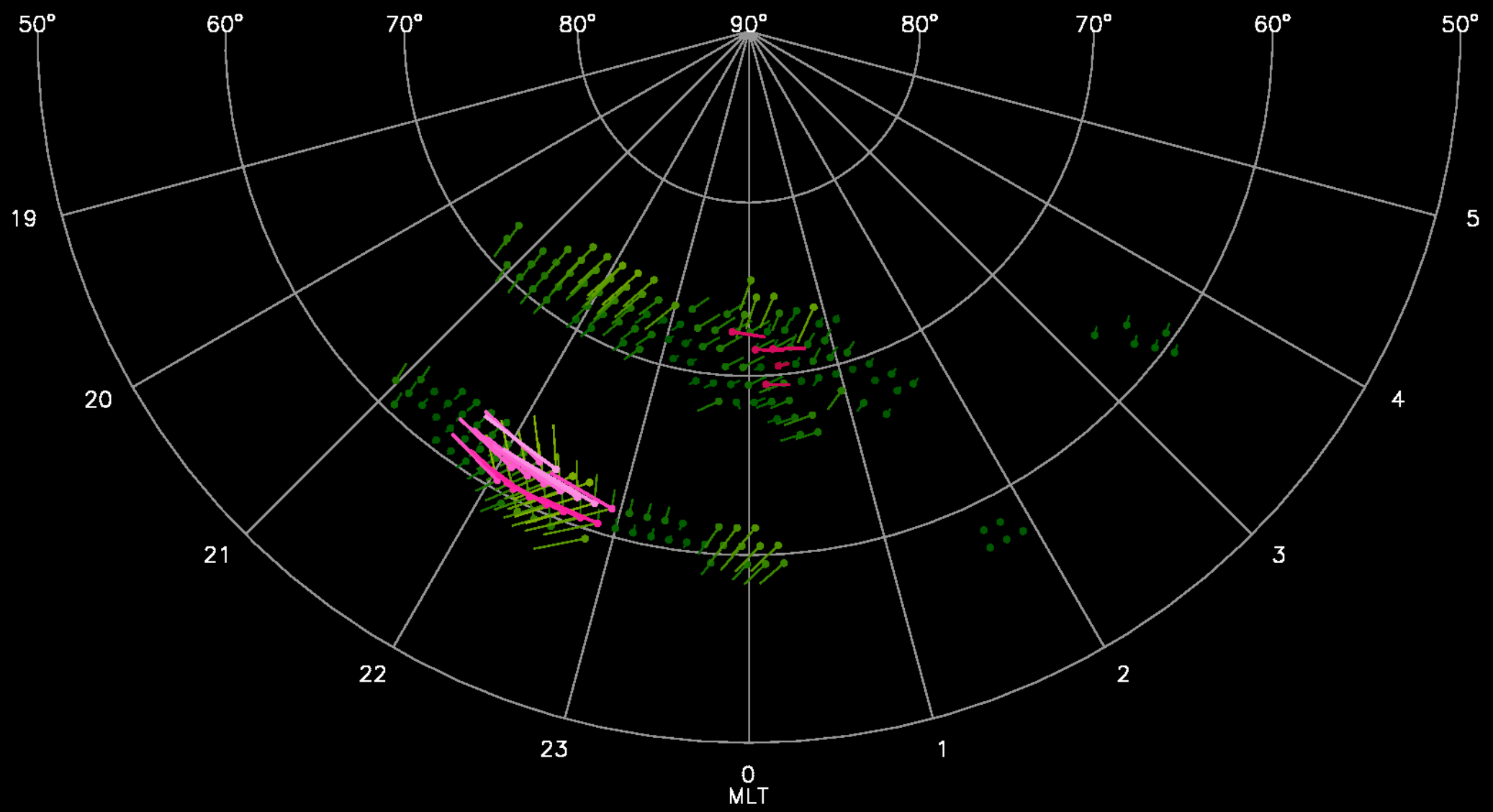
20120513
0700 UT



2D SAPS Velocity

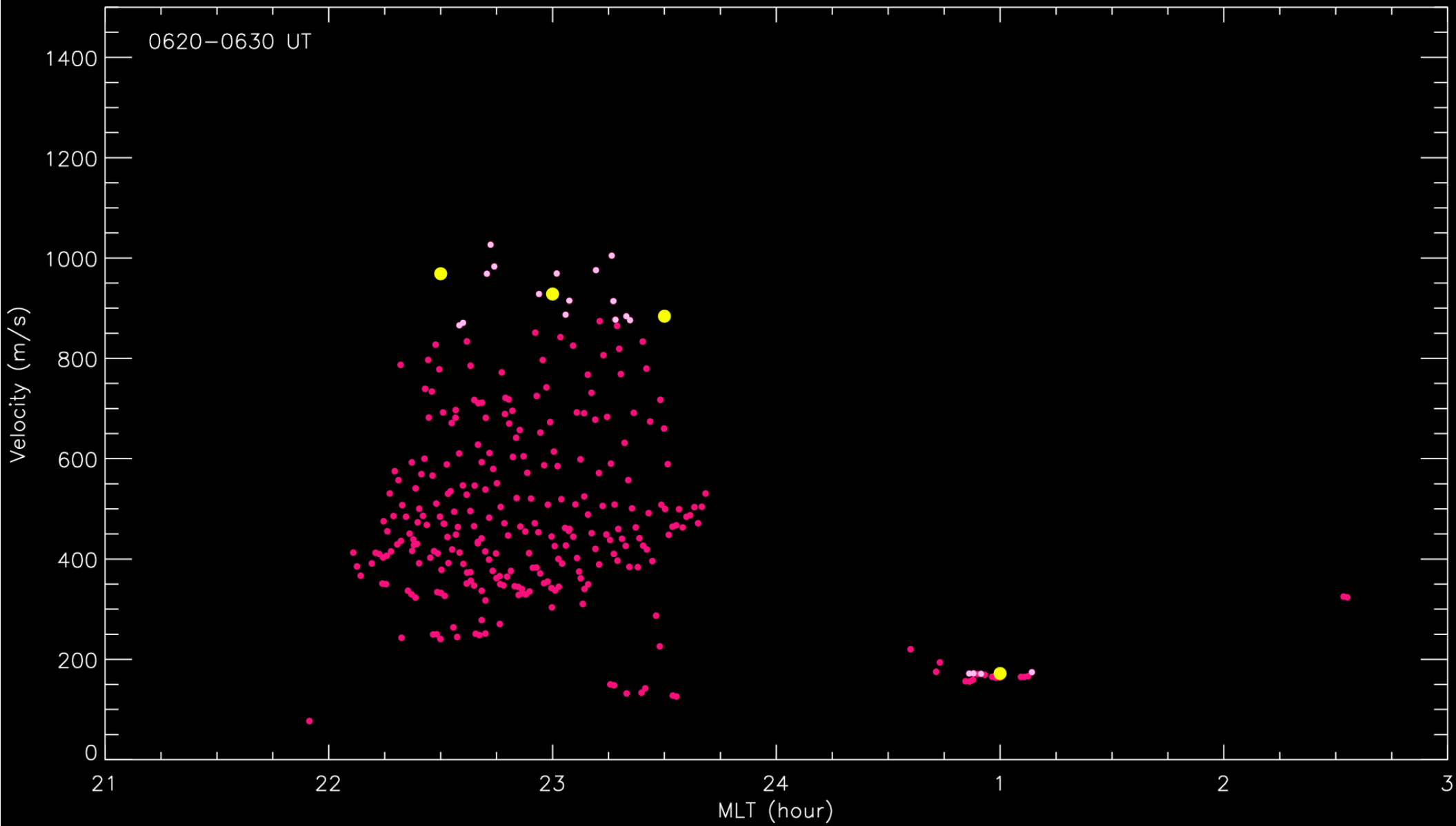
MLAT, MLT

20120513
0600 UT



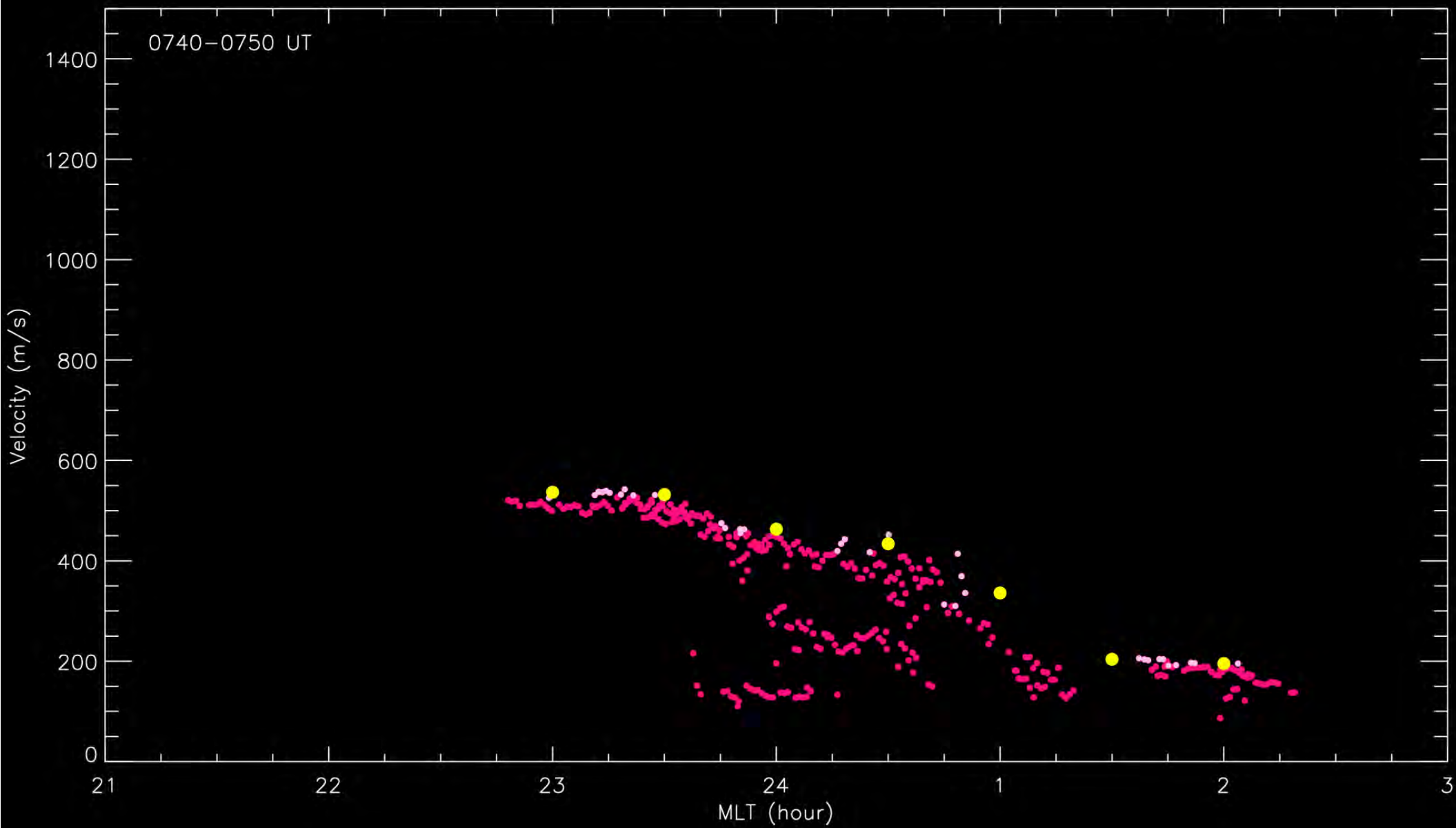
2D SAPS Velocity

velocity variation



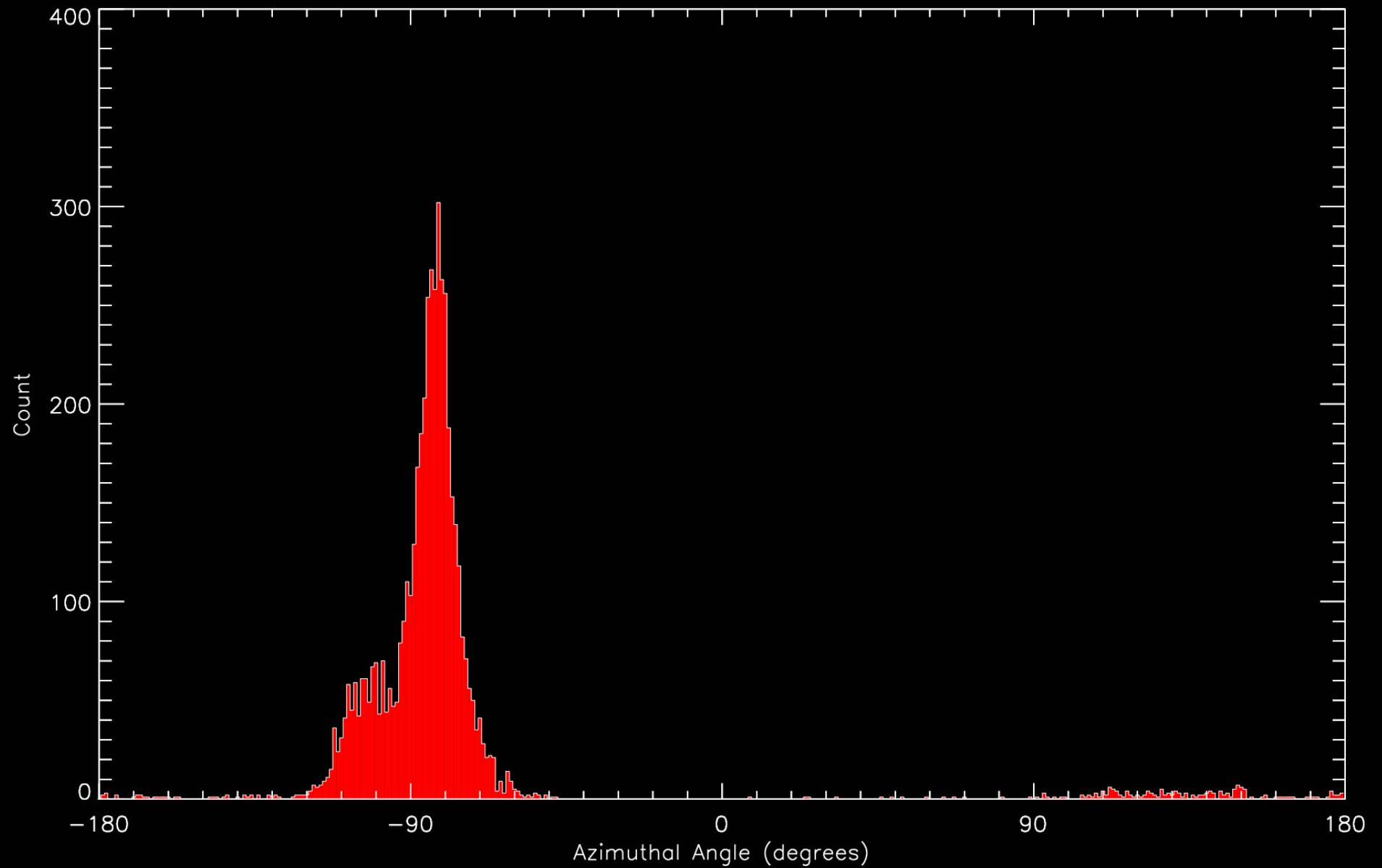
2D SAPS Velocity

velocity variation



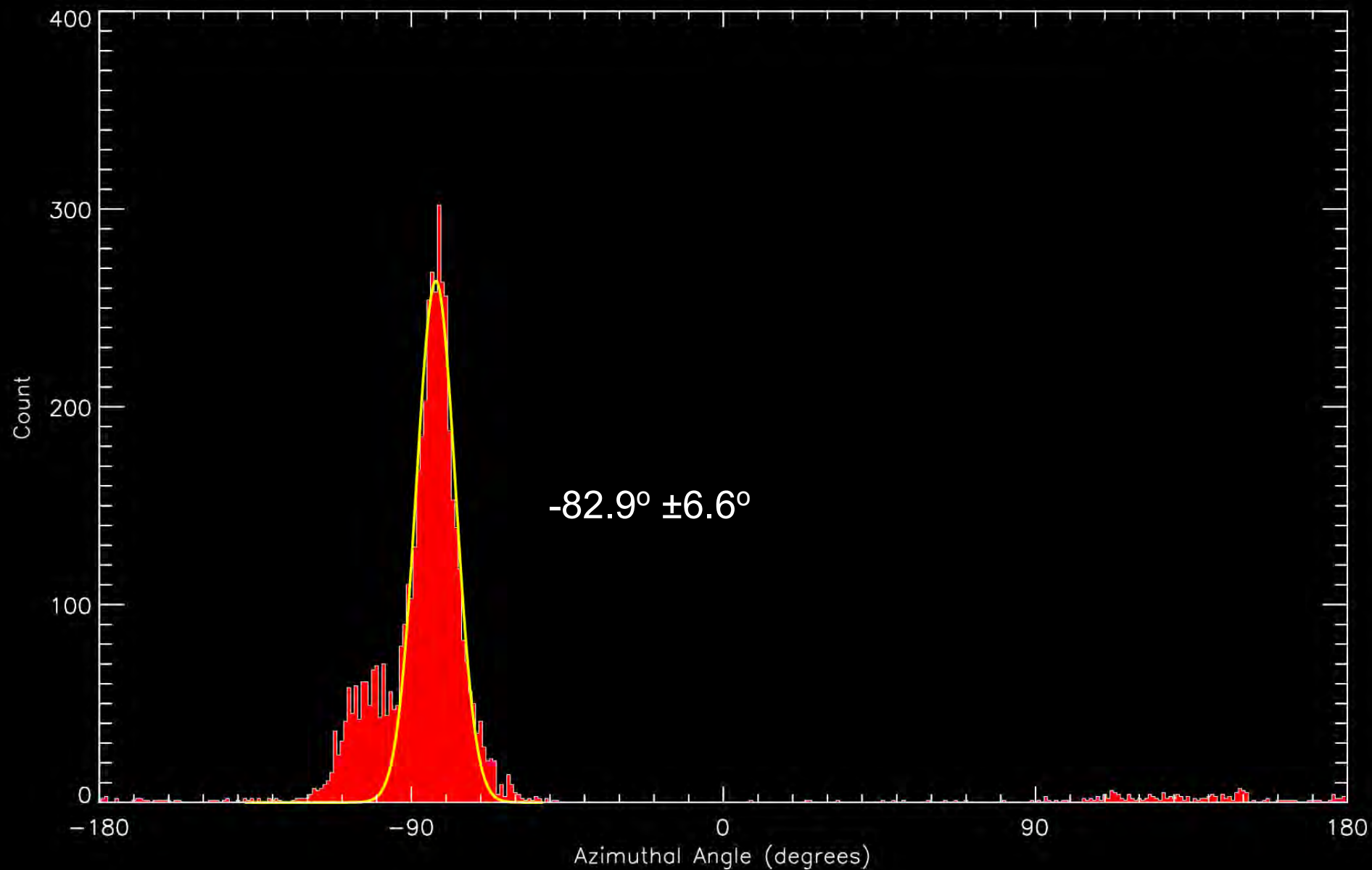
2D SAPS Velocity

Azimuthal Variation



2D SAPS Velocity

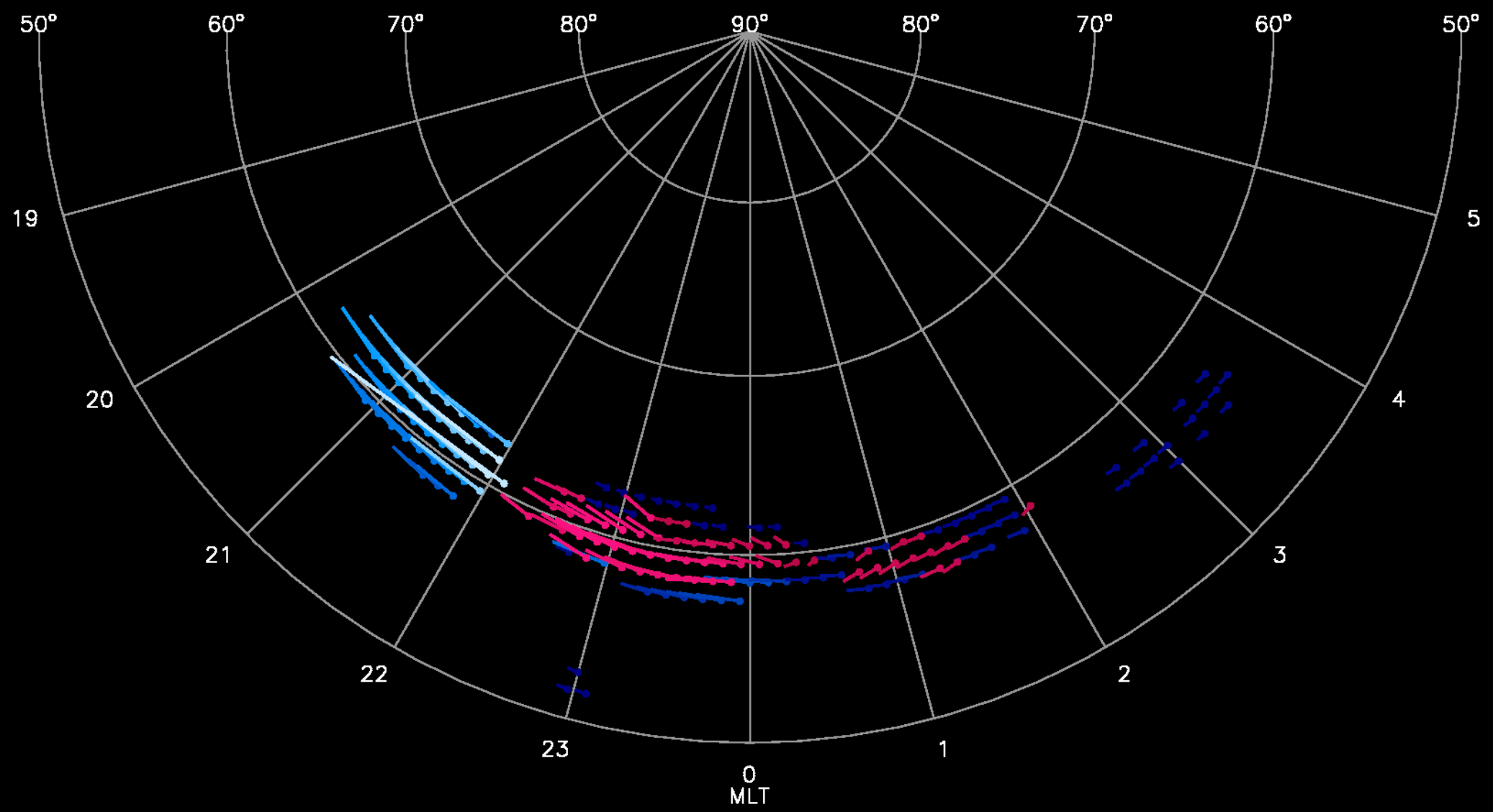
Azimuthal Variation



2D SAPS Velocity

MLAT, MLT

20120513
0700 UT



2D SAPS Velocity

MLAT, MLT

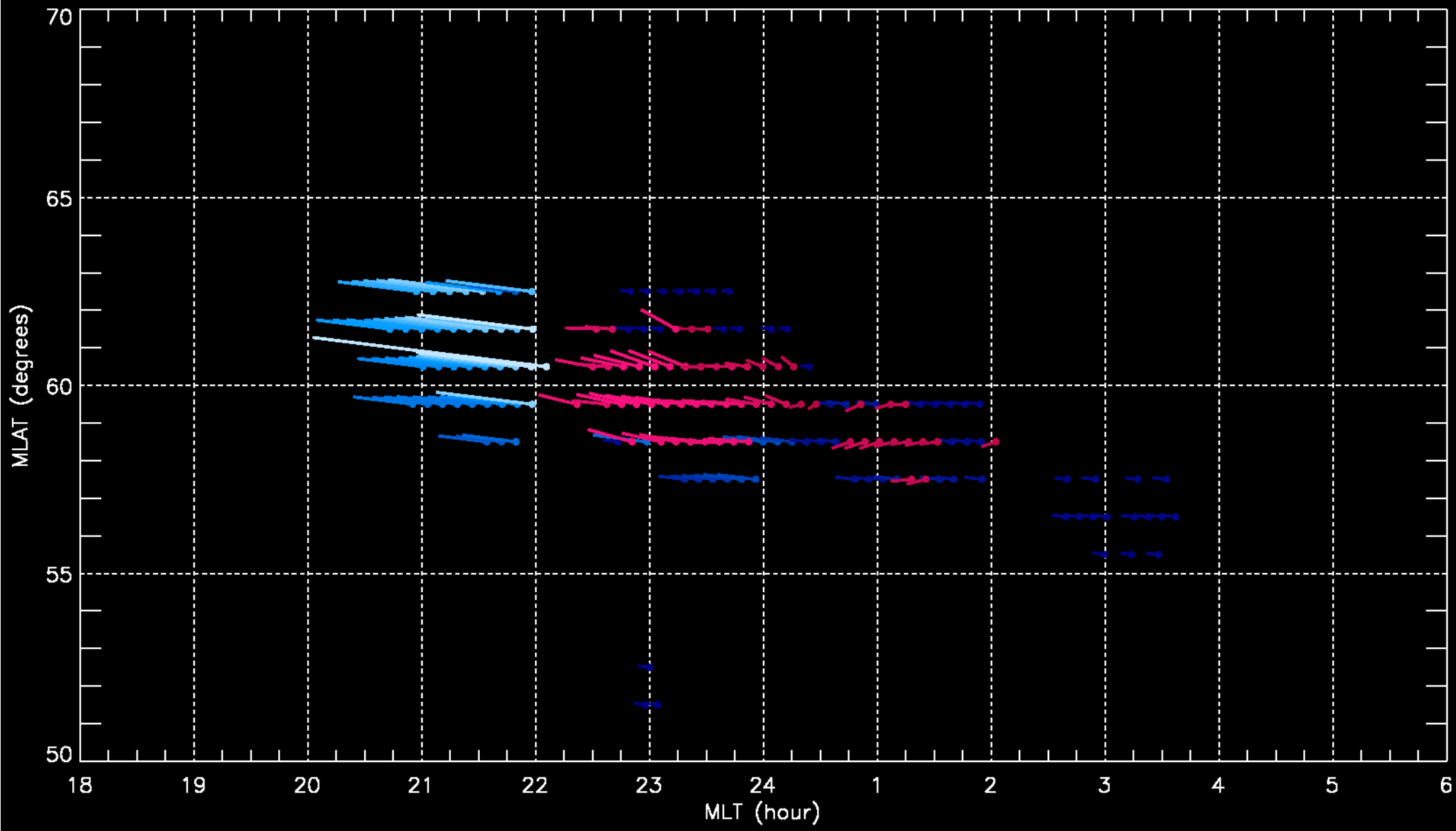
20120513

0700 UT

MRC

1 km/s

PRJ



2D SAPS Velocity

MLAT, MLT

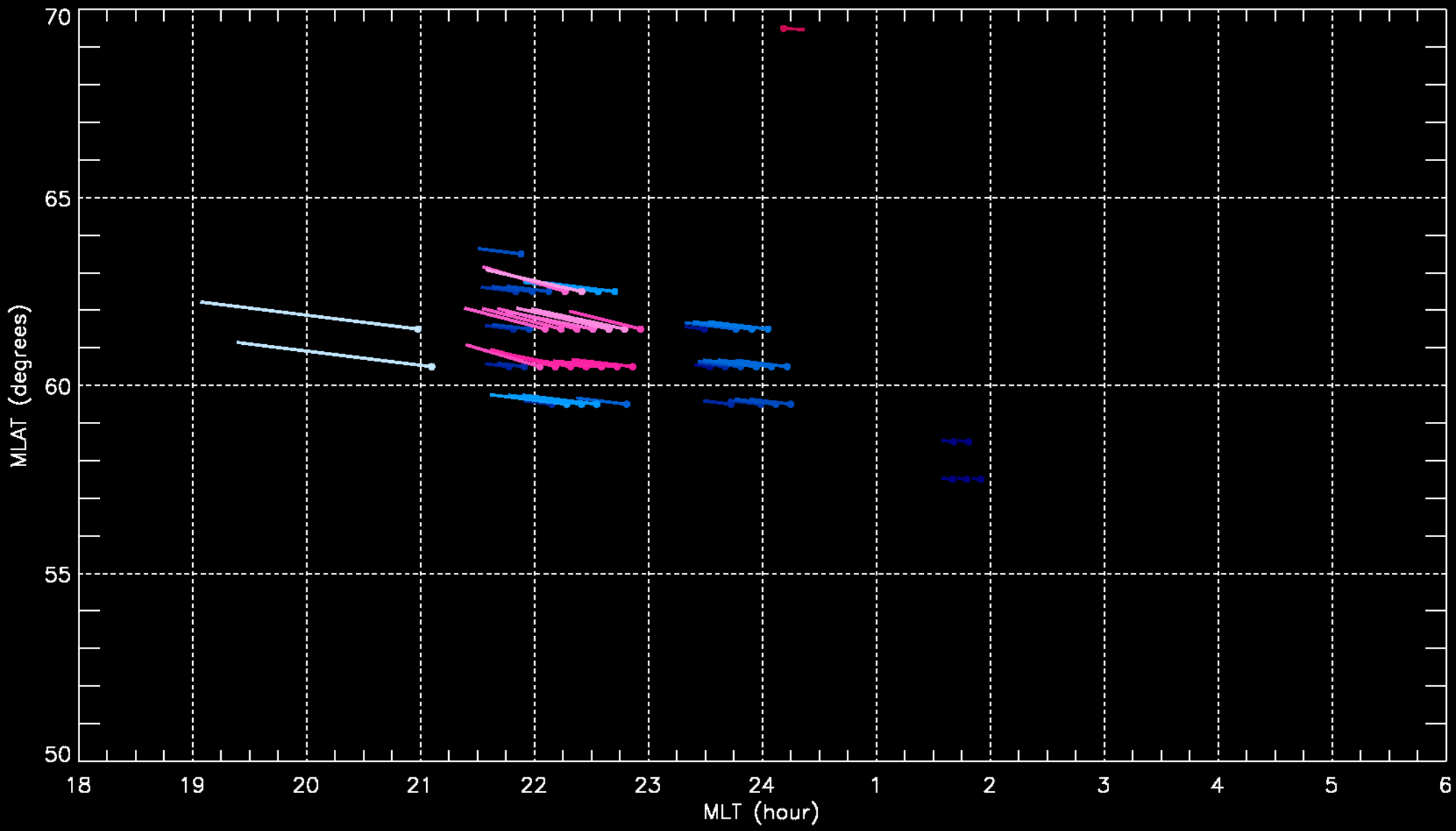
20120513

0600 UT

MRG

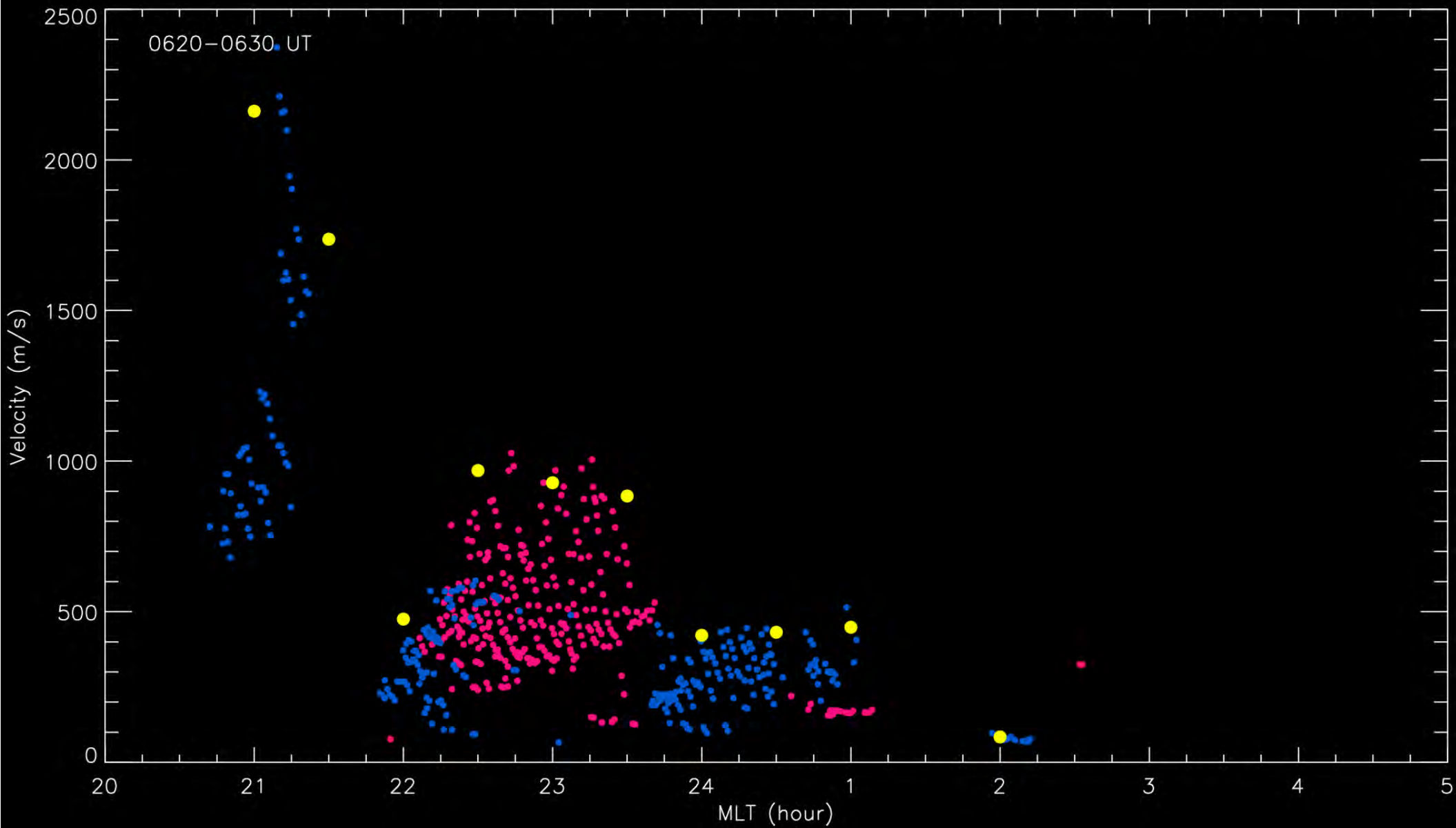
1 km/s

PRJ



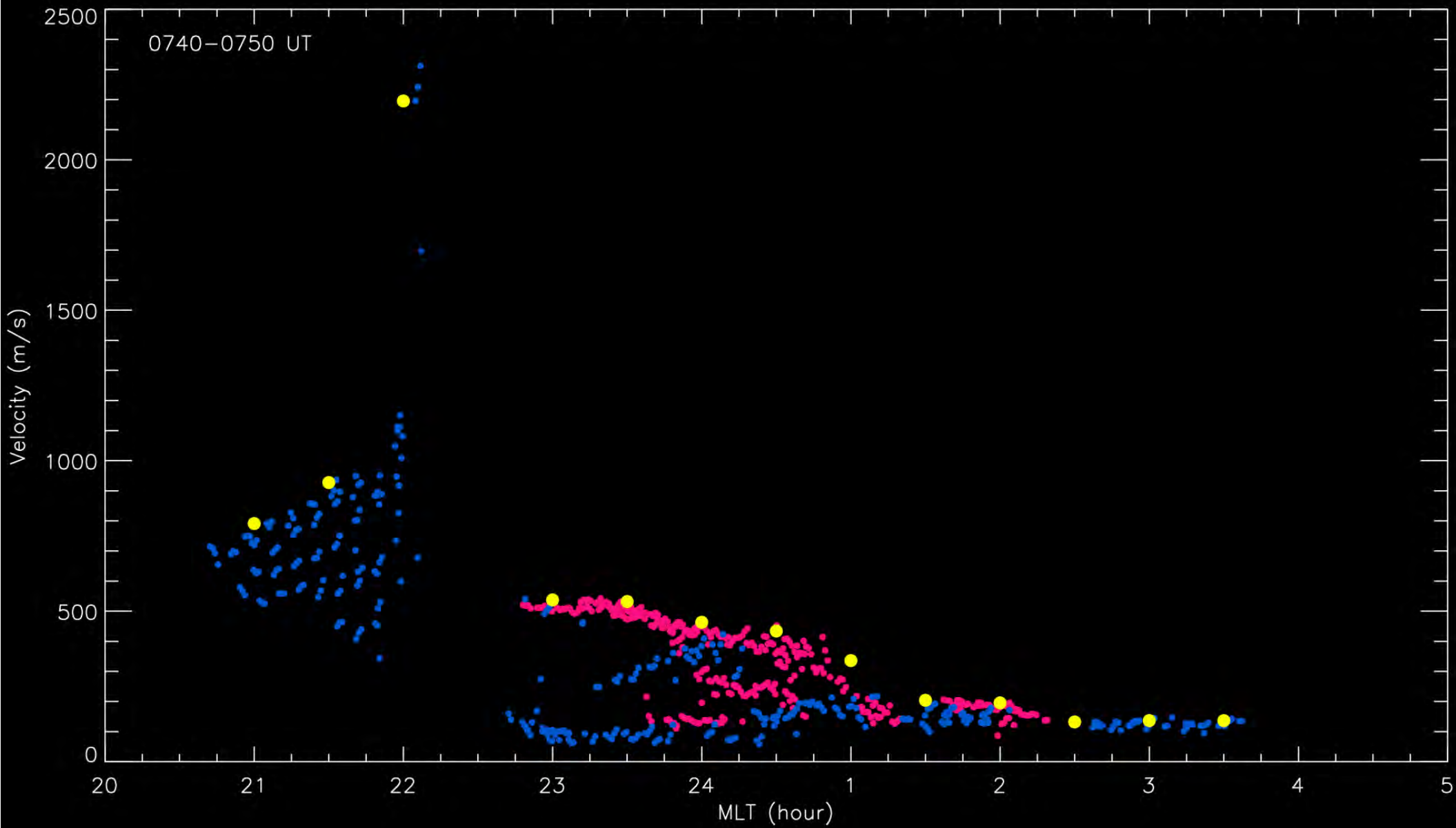
2D SAPS Velocity

velocity variation



2D SAPS Velocity

velocity variation



Event Summary

May 13, 2012 0600-0800 UT

Sub Auroral Polarization Stream

Foster and Burke, EOS, 2002

2D velocity

1-min resolution

~5 hours MLT

(>7 hours MLT LOS)

Peak flows

Clausen et al., JGR, 2012

near 60°

(62° @ 21 MLT 57° @ 3MLT)

Foster and Vo, JGR, 2002

Erickson et al., JGR, 2011

~3° wide

westward flow ($-83^\circ \pm 7^\circ$)

>1 km/s (2D)

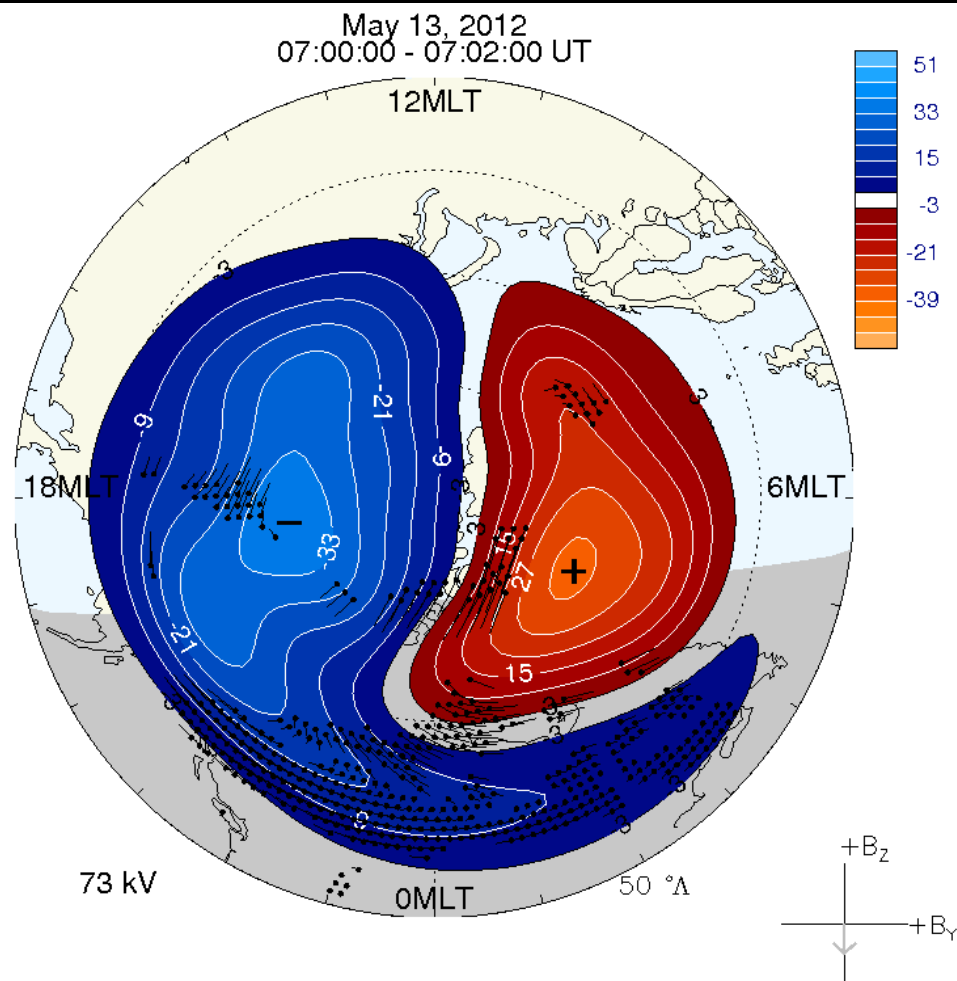
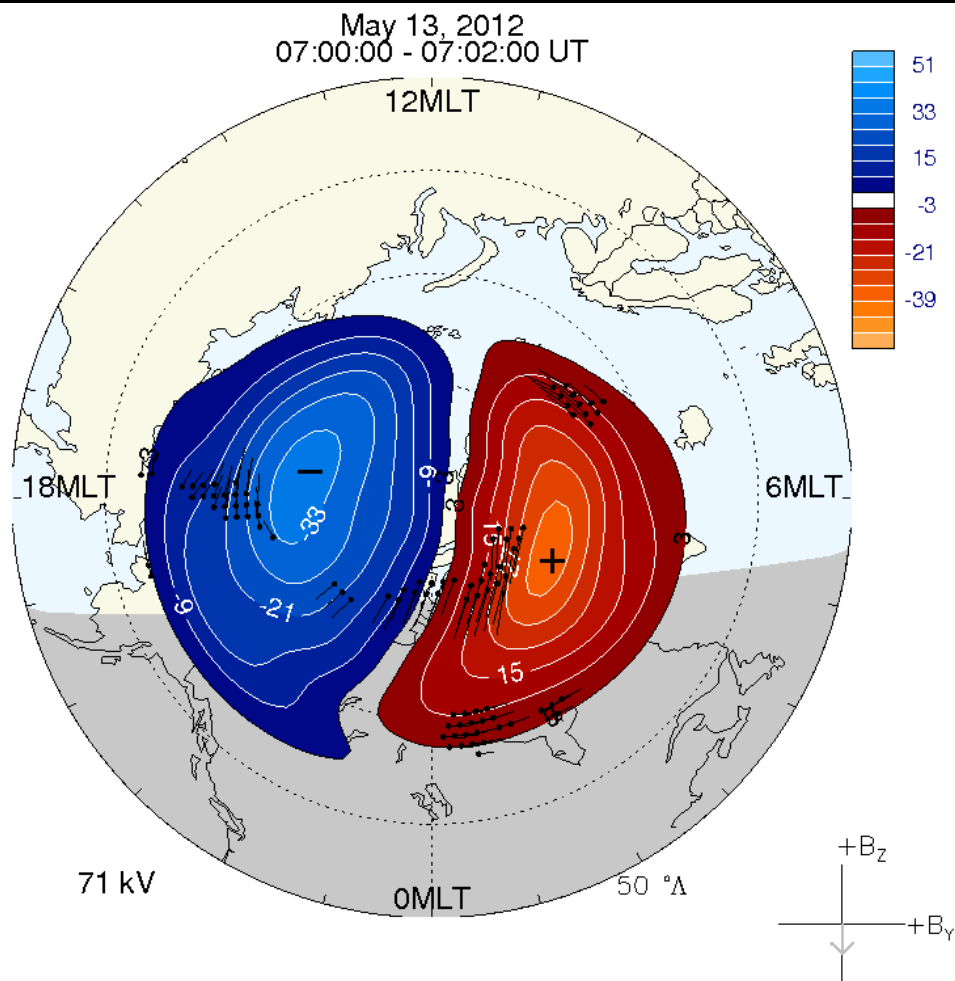
>2 km/s (inferred)

velocity variation with MLT: linear or exponential?

Large-Scale Convection

high-latitude

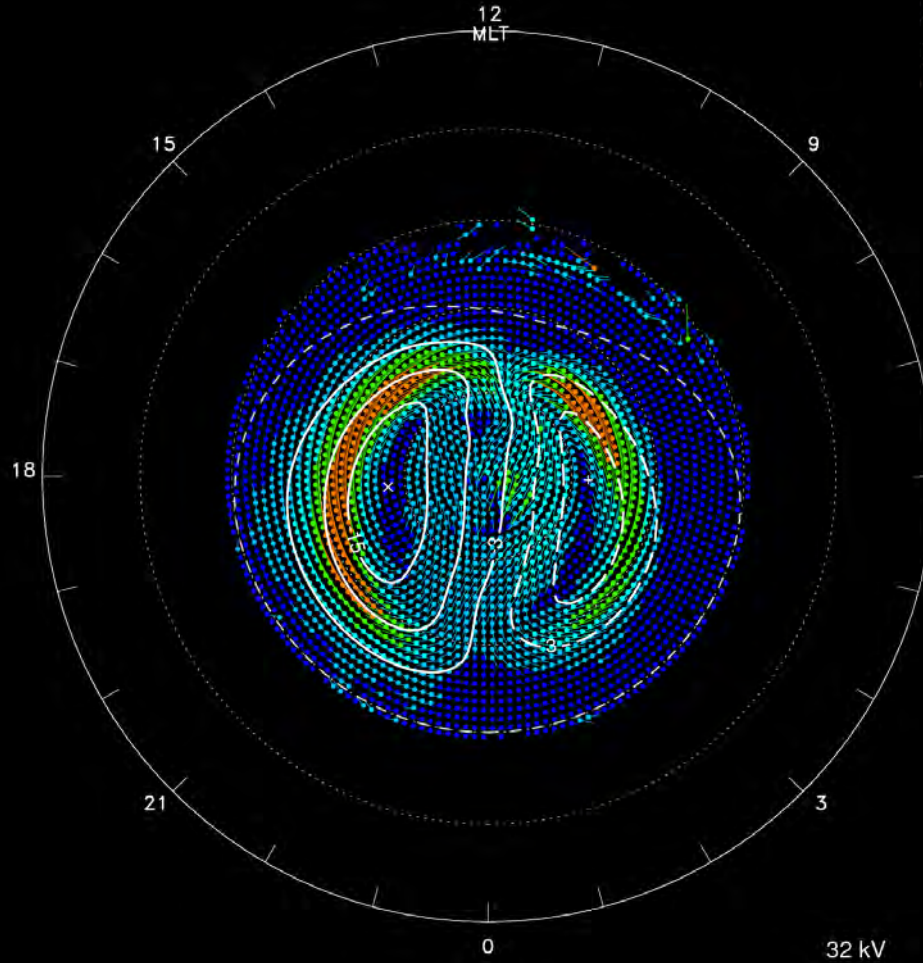
all radars



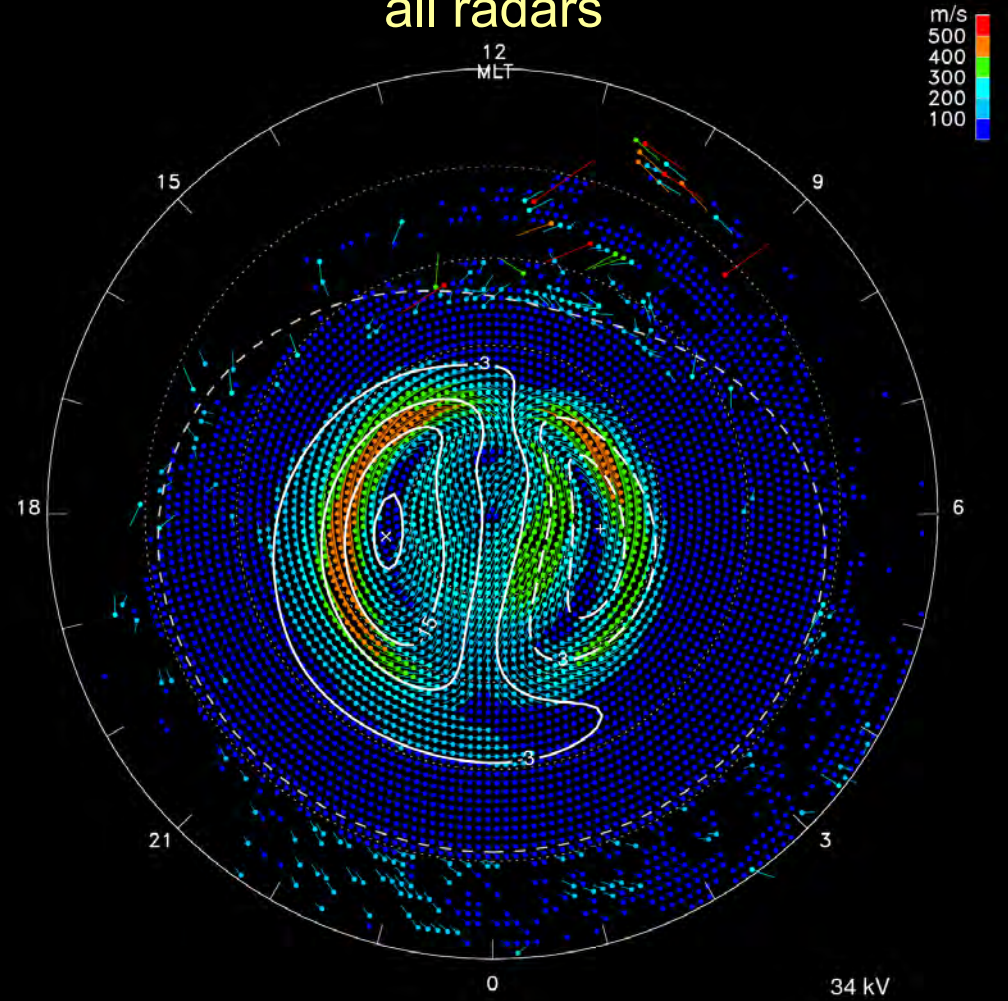
Average Convection

2009-2011

high-latitude



all radars

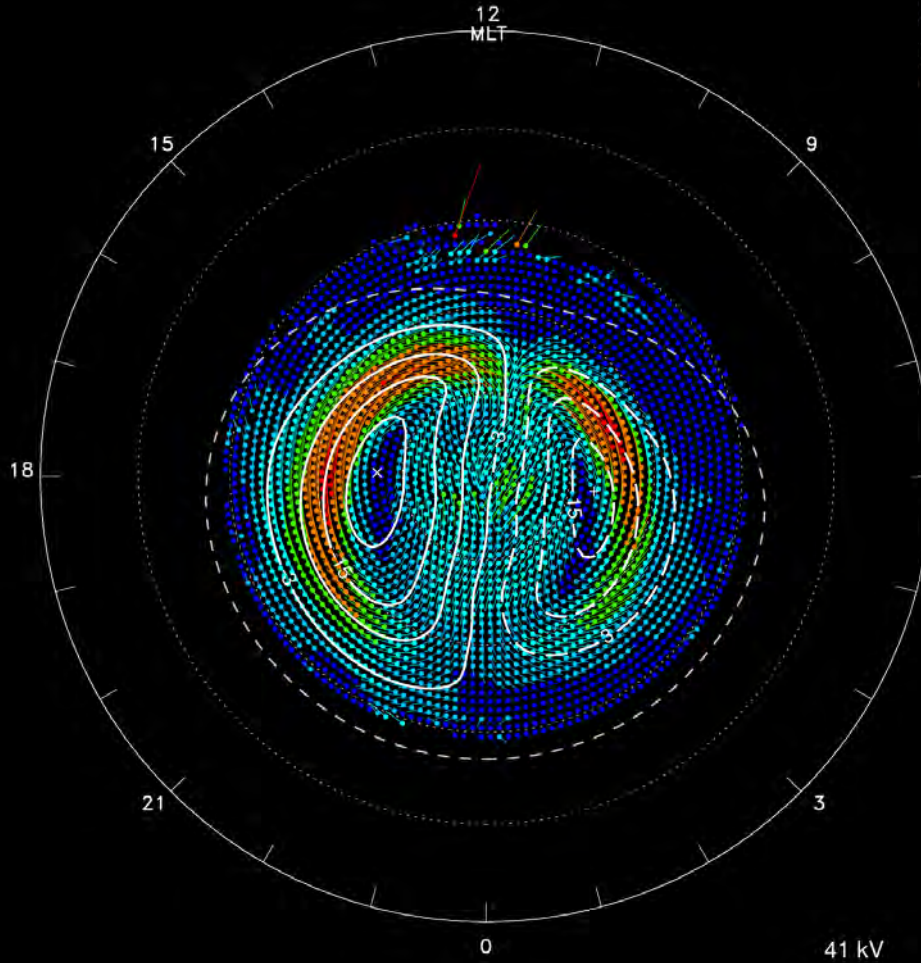


Kp1

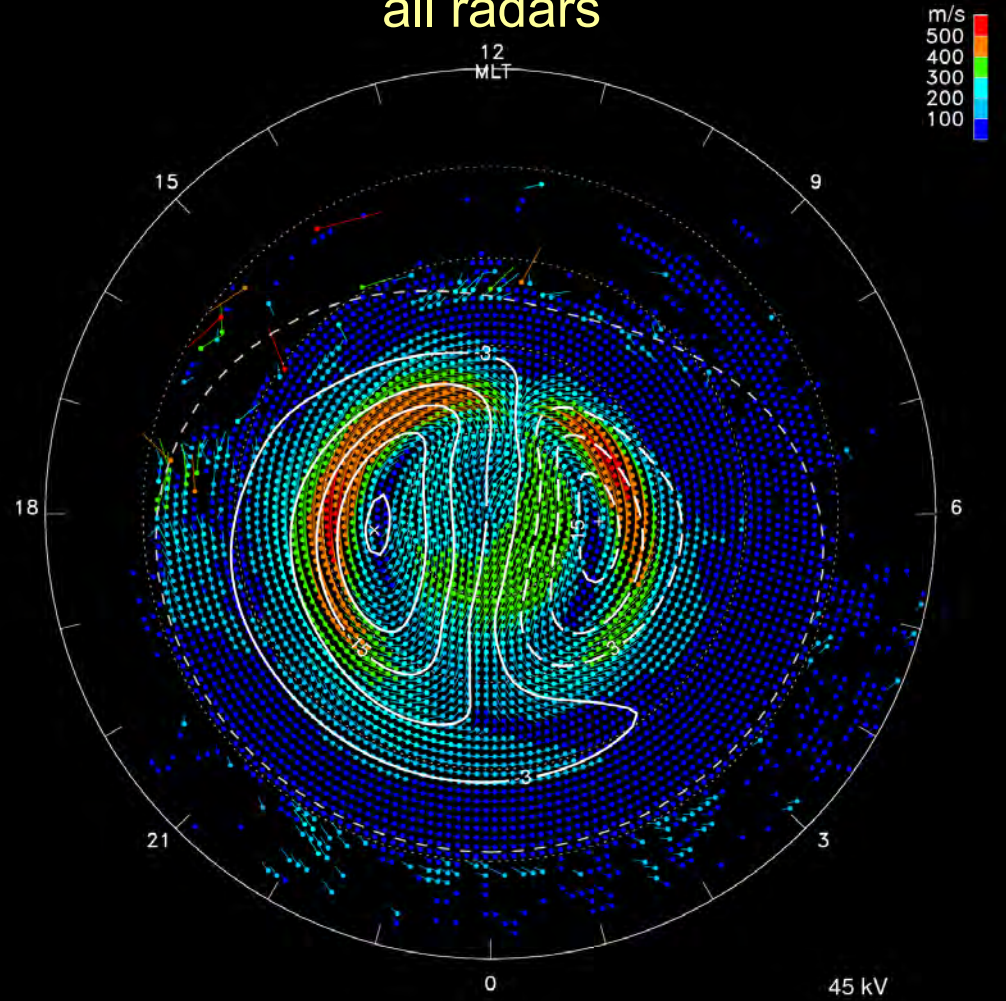
Average Convection

2009-2011

high-latitude



all radars

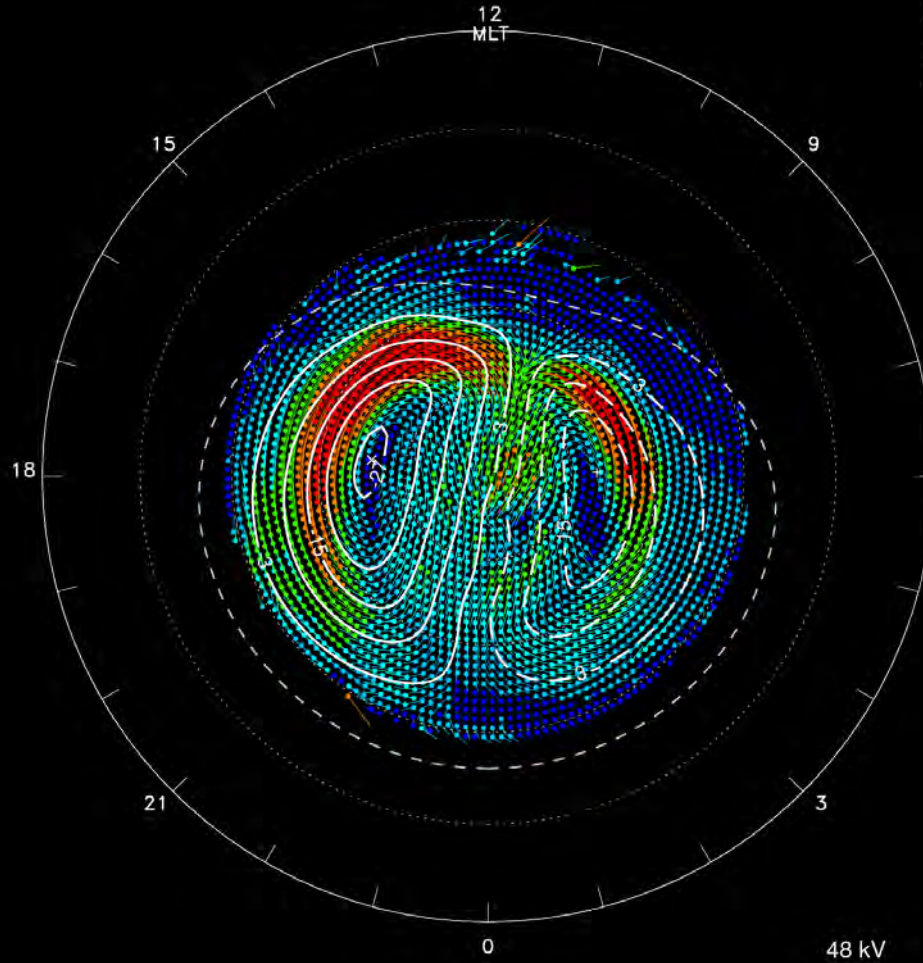


Kp2

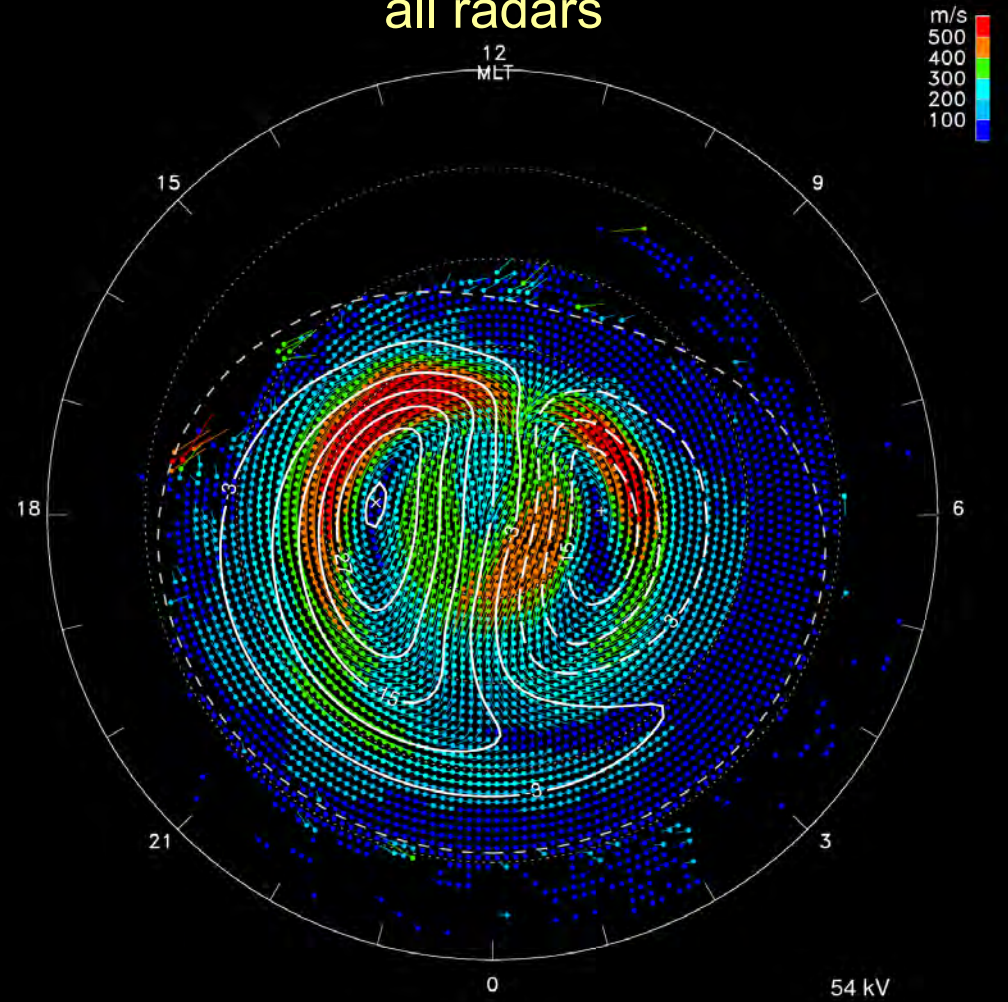
Average Convection

2009-2011

high-latitude



all radars

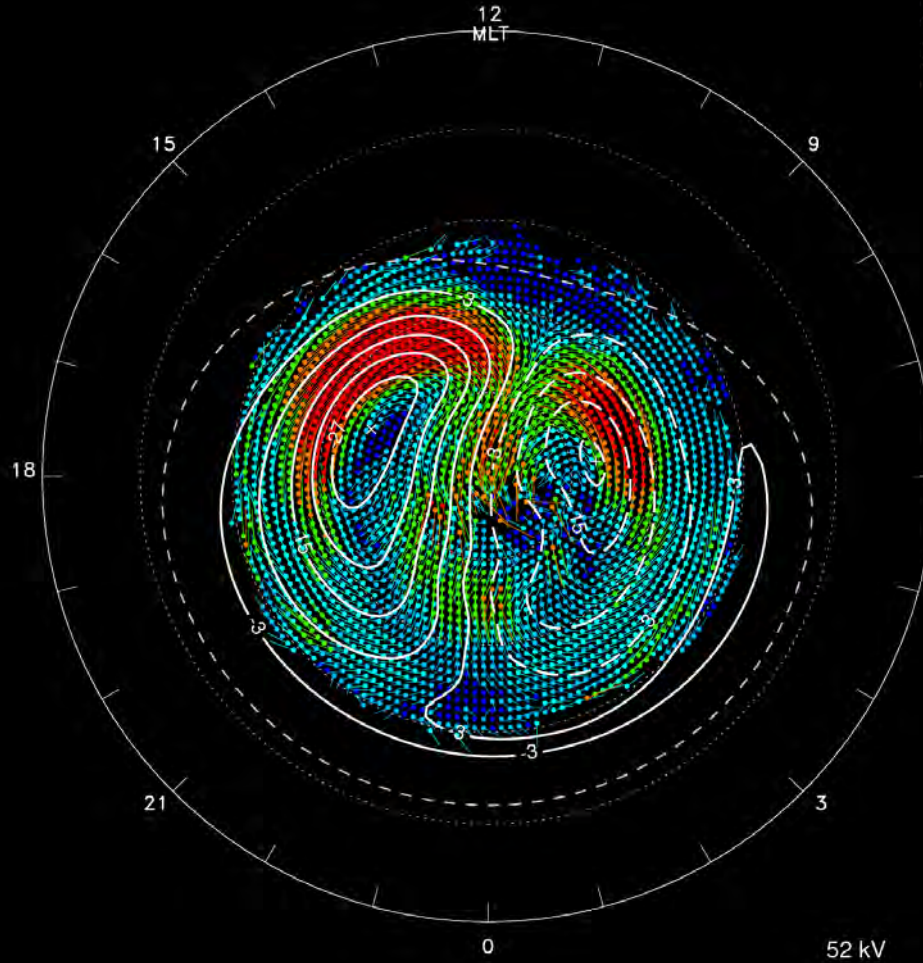


Kp3

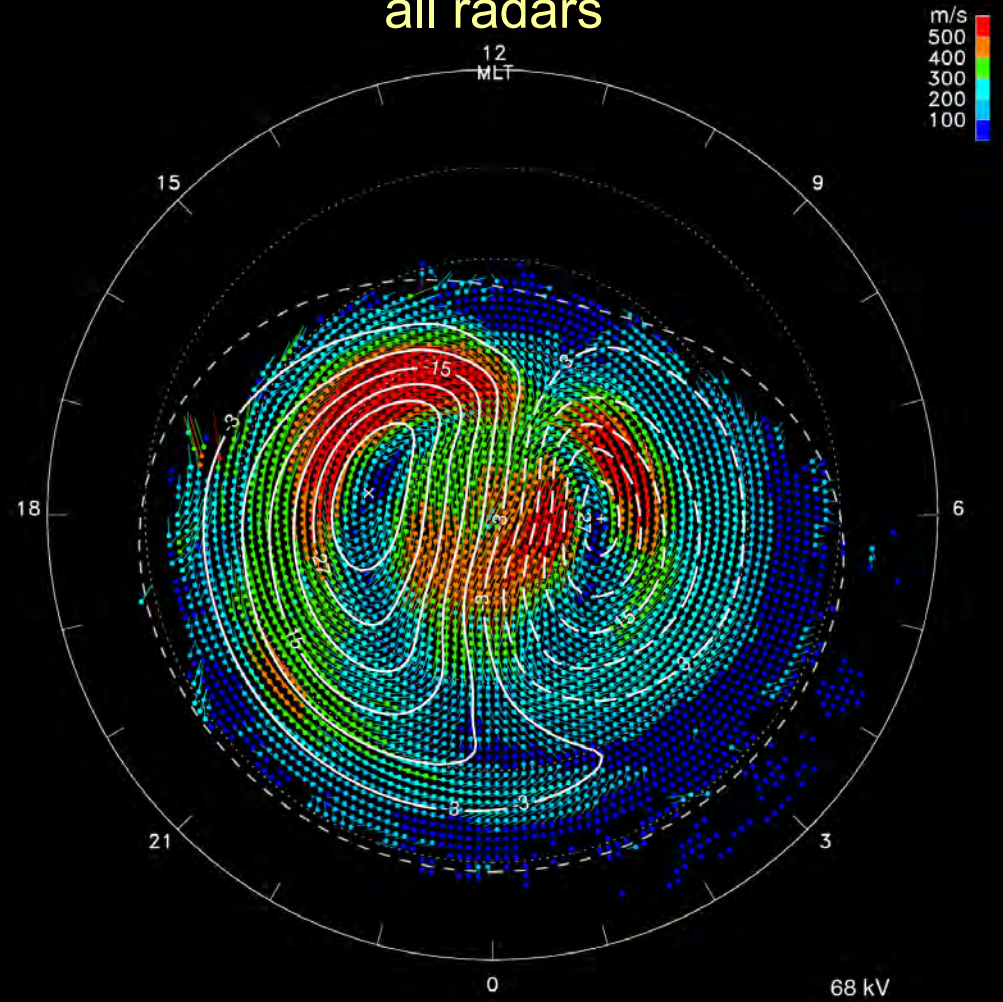
Average Convection

2009-2011

high-latitude



all radars

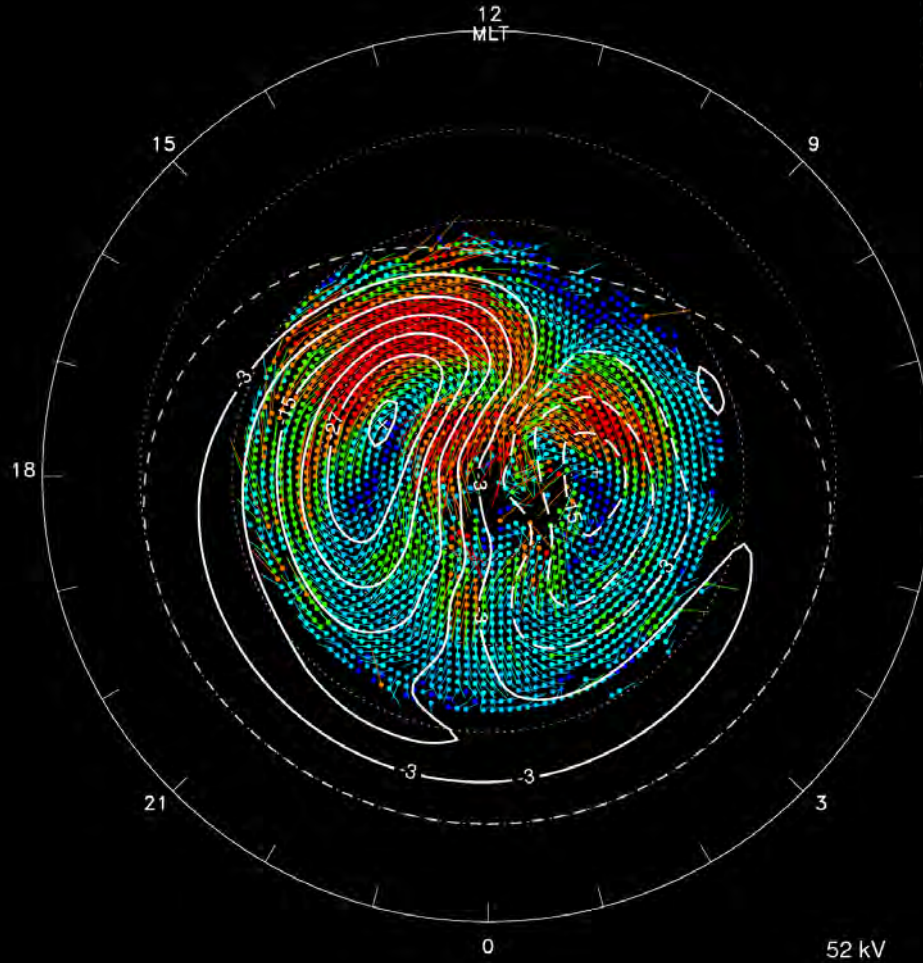


Kp4

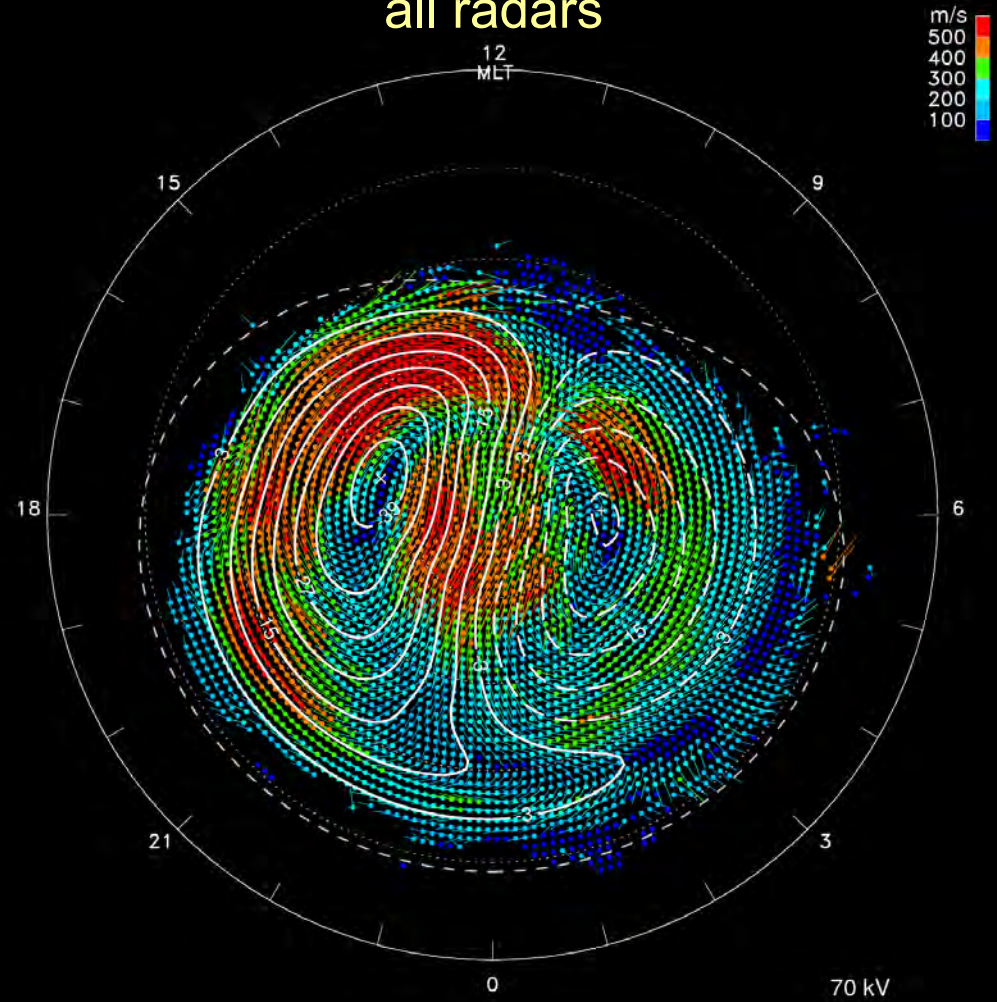
Average Convection

2009-2011

high-latitude



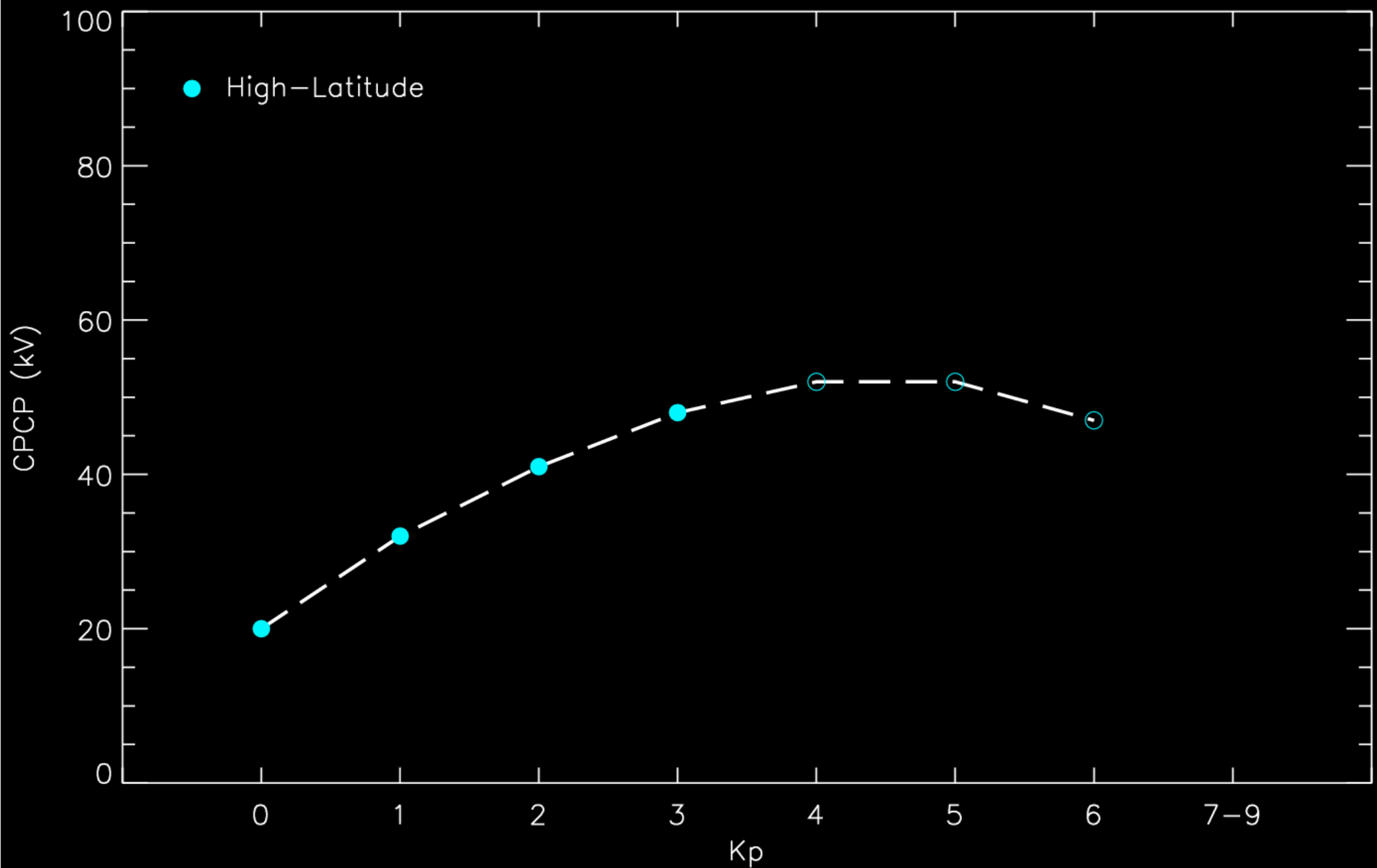
all radars



Kp5

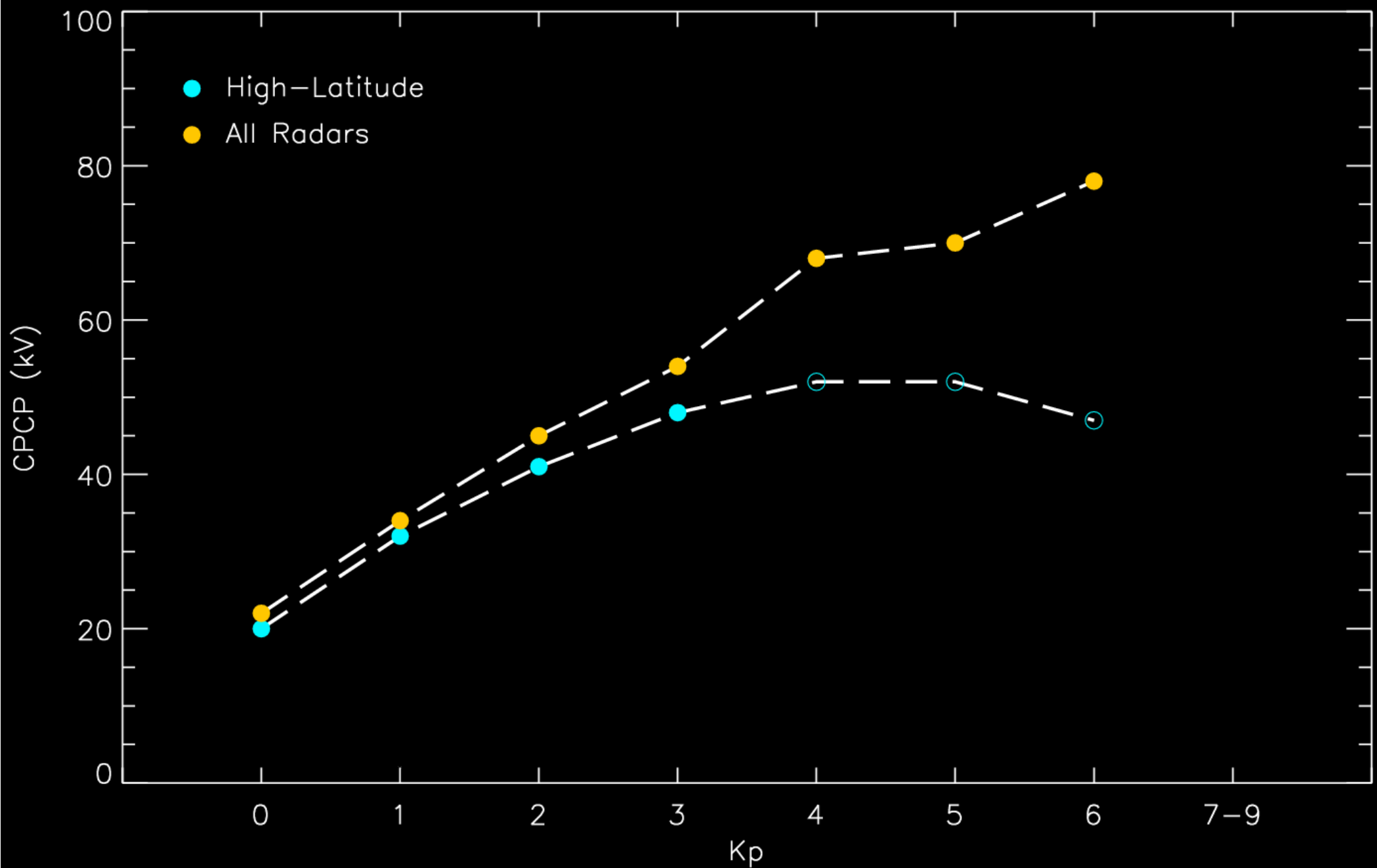
Average Convection

2009-2011



Average Convection

2009-2011



Summary

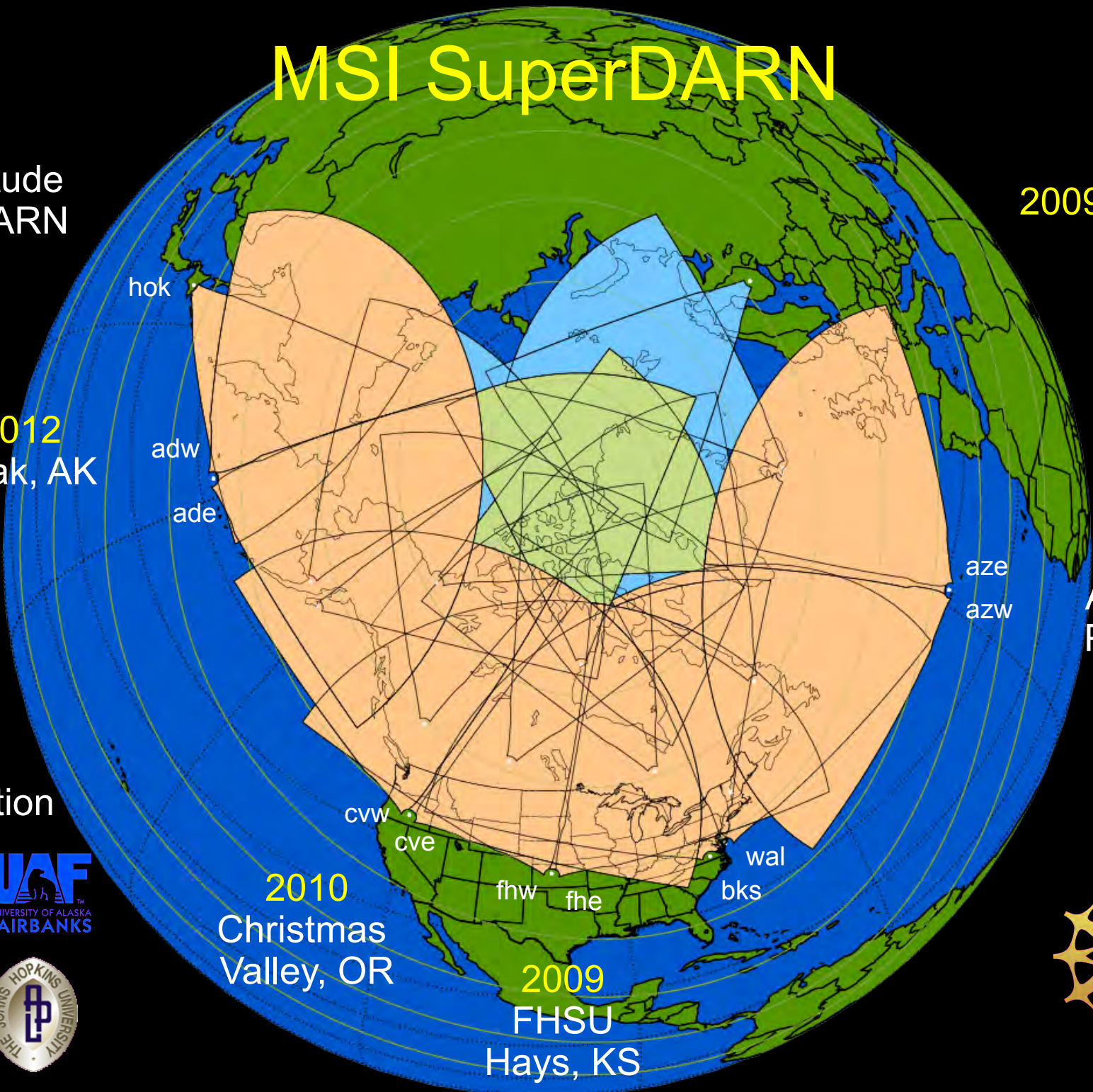
- Mid-Latitude SuperDARN extended observations
 - 50° and below
 - ~7 hours of MLT (soon to be >12)
- Regularly observe SAPS for $K_p \geq 2$
 - Continuously measure 2D flows
 - ~5 hours of MLT
- Distorted nightside convection $K_p \geq 1$
 - Westward flow at low latitudes
 - increased transpolar potential (increasing with K_p)
- Plasmasphere scatter
 - Plasmasphere Boundary Layer (PBL) proxy

MSI SuperDARN

Mid-Latitude
SuperDARN

>50°

2009-2012



2012
Adak, AK

2012
Azores,
Portugal

MSI
Collaboration



2010
Christmas
Valley, OR

2009
FHSU
Hays, KS

