Nonprecipitating Phenomena Seen by the S-PolKa Radar In AMIE

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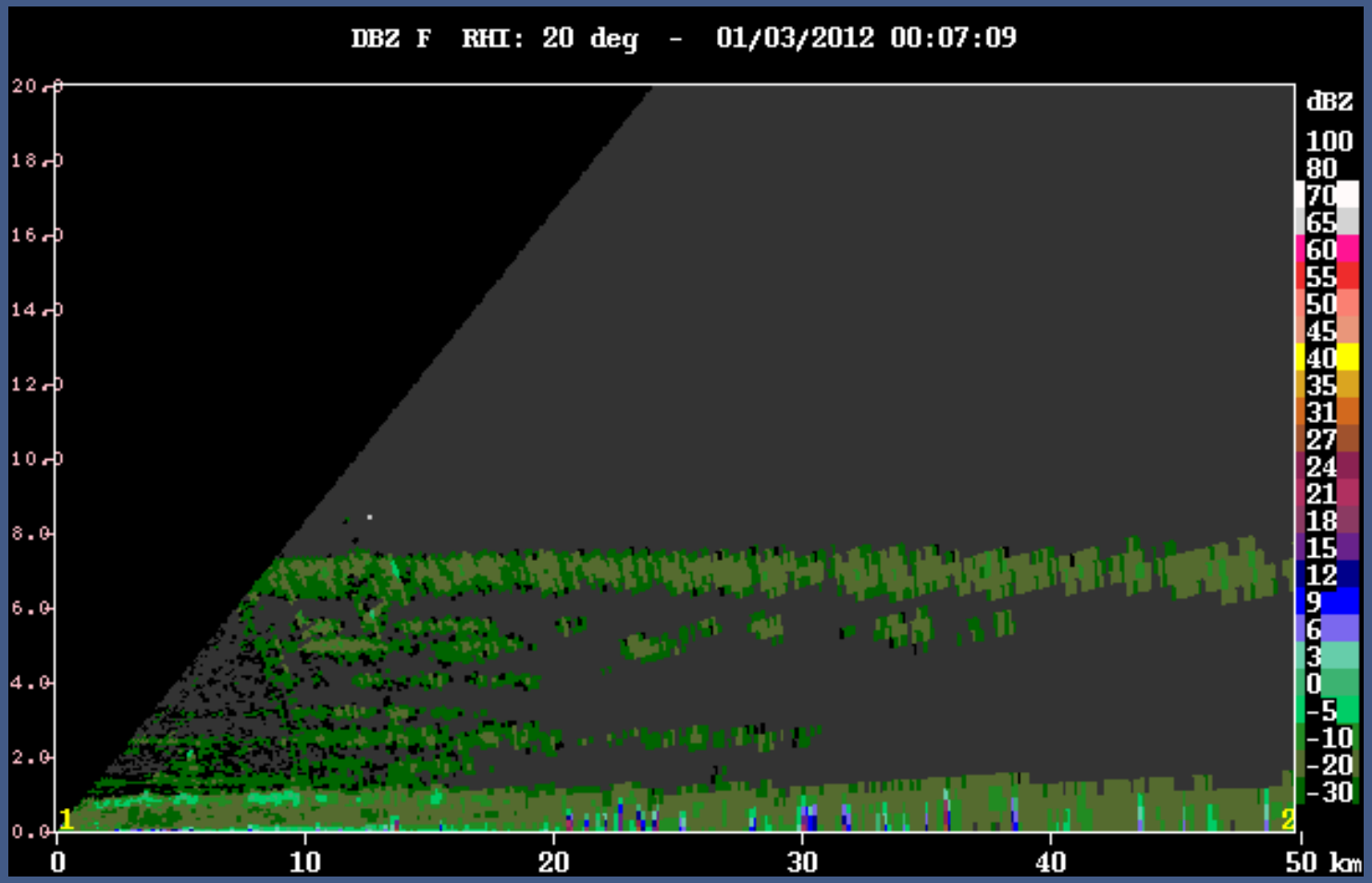
Summary

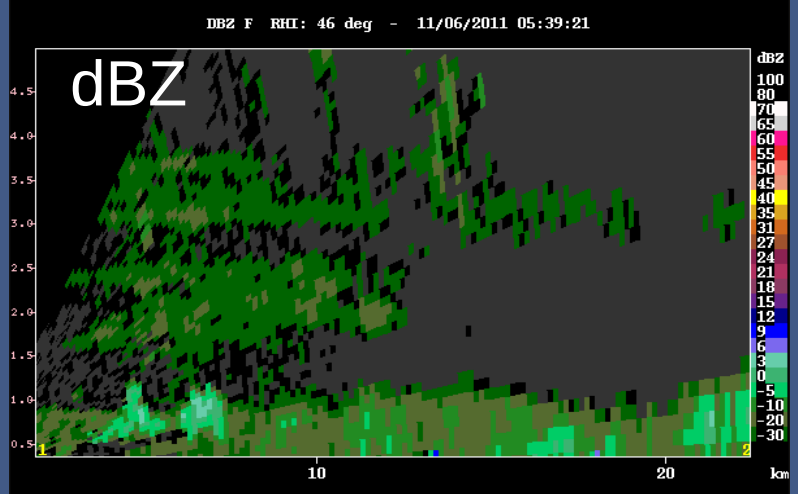
Non-precipitation features seen by S-PolKa in AMIE

- **Humidity**
- **Cumulus organization**
- **Cirrostratus & altocumulus layers**
- **Anvils of deep convection**

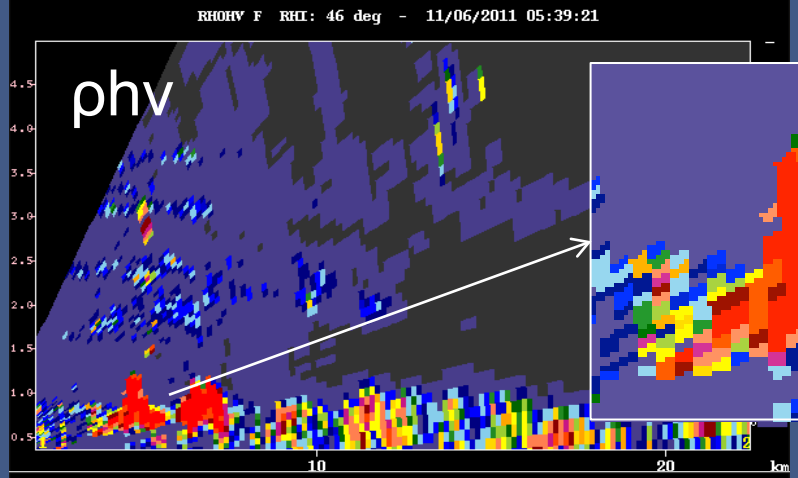
Humidity gradient layers and nonprecipitating clouds

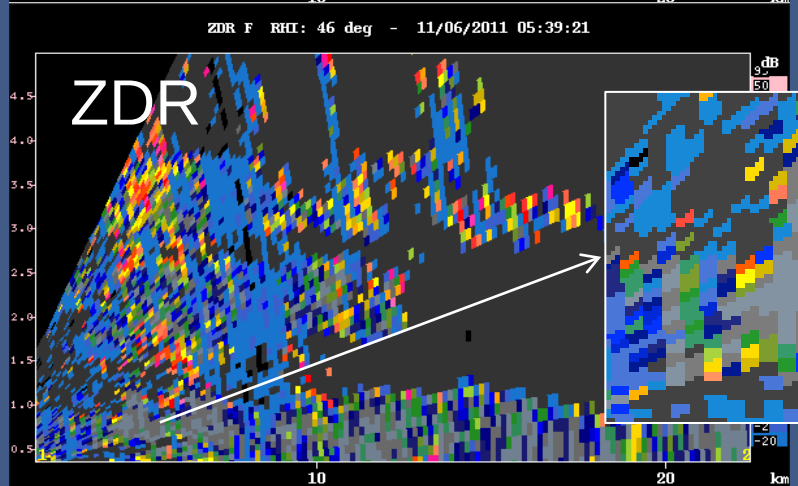


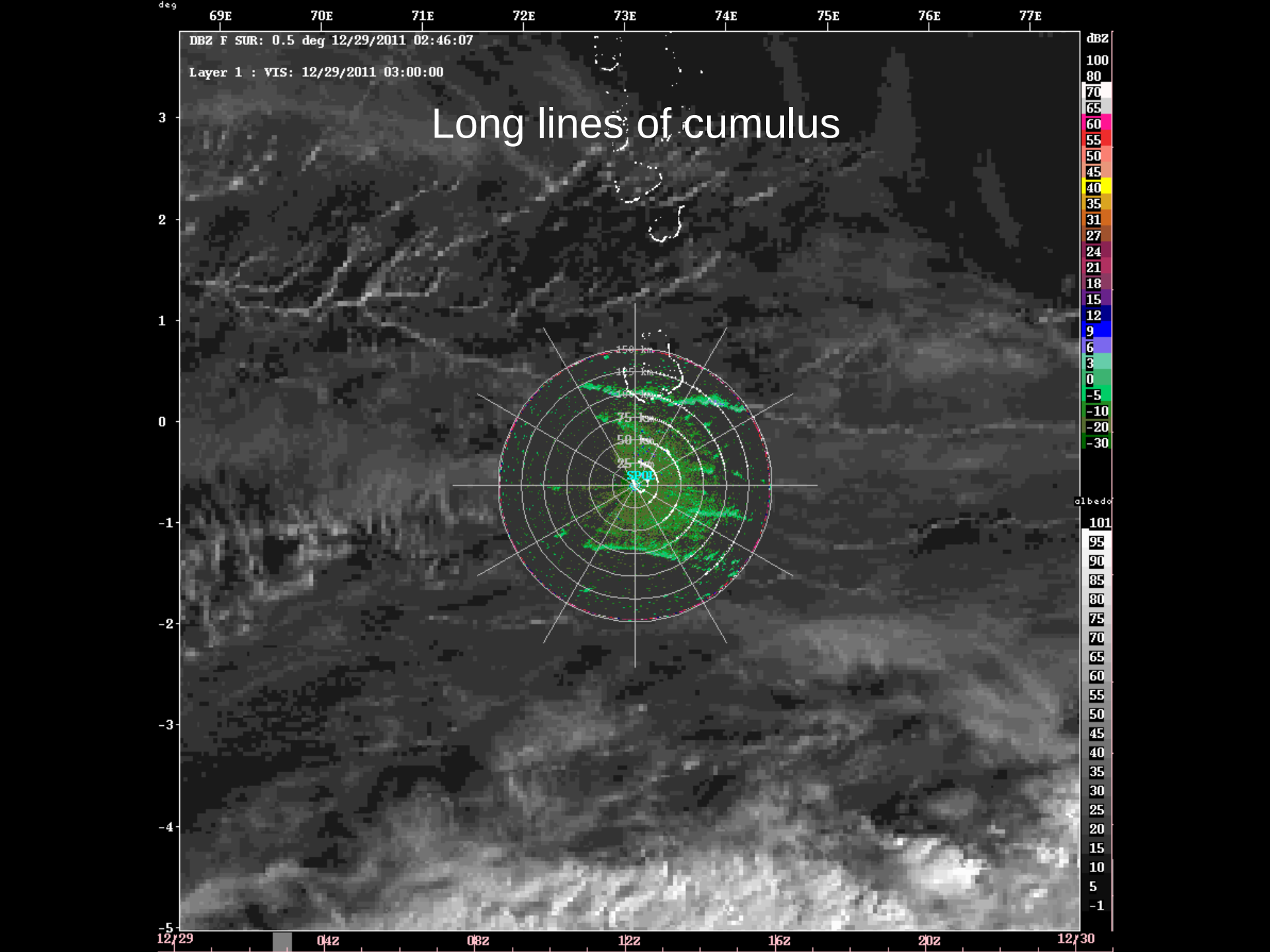
Bragg scattering shows nonprecipitating cumulus in the moist layer

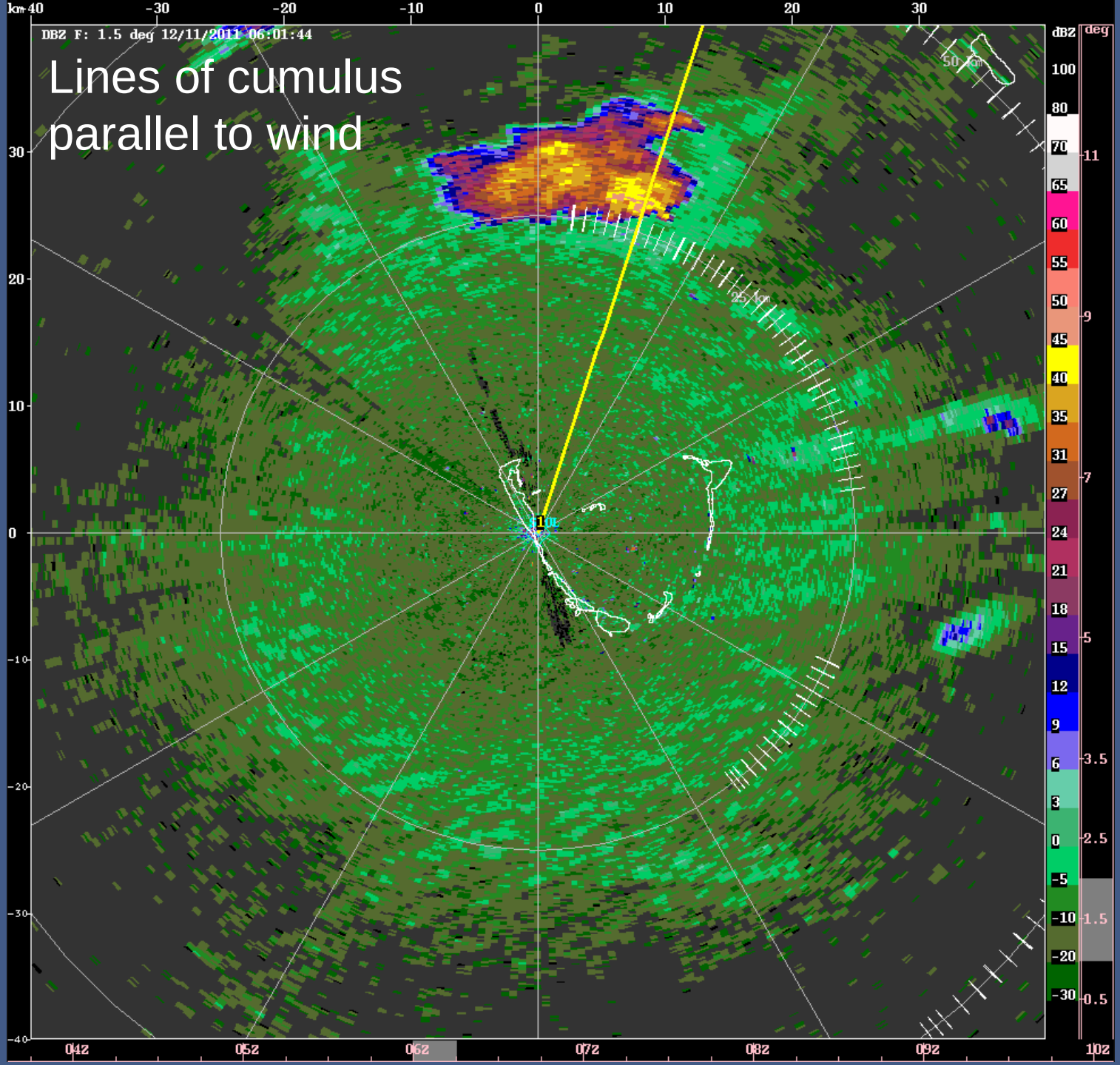


"Mantle Echoes"
Knight and
Miller (1998)



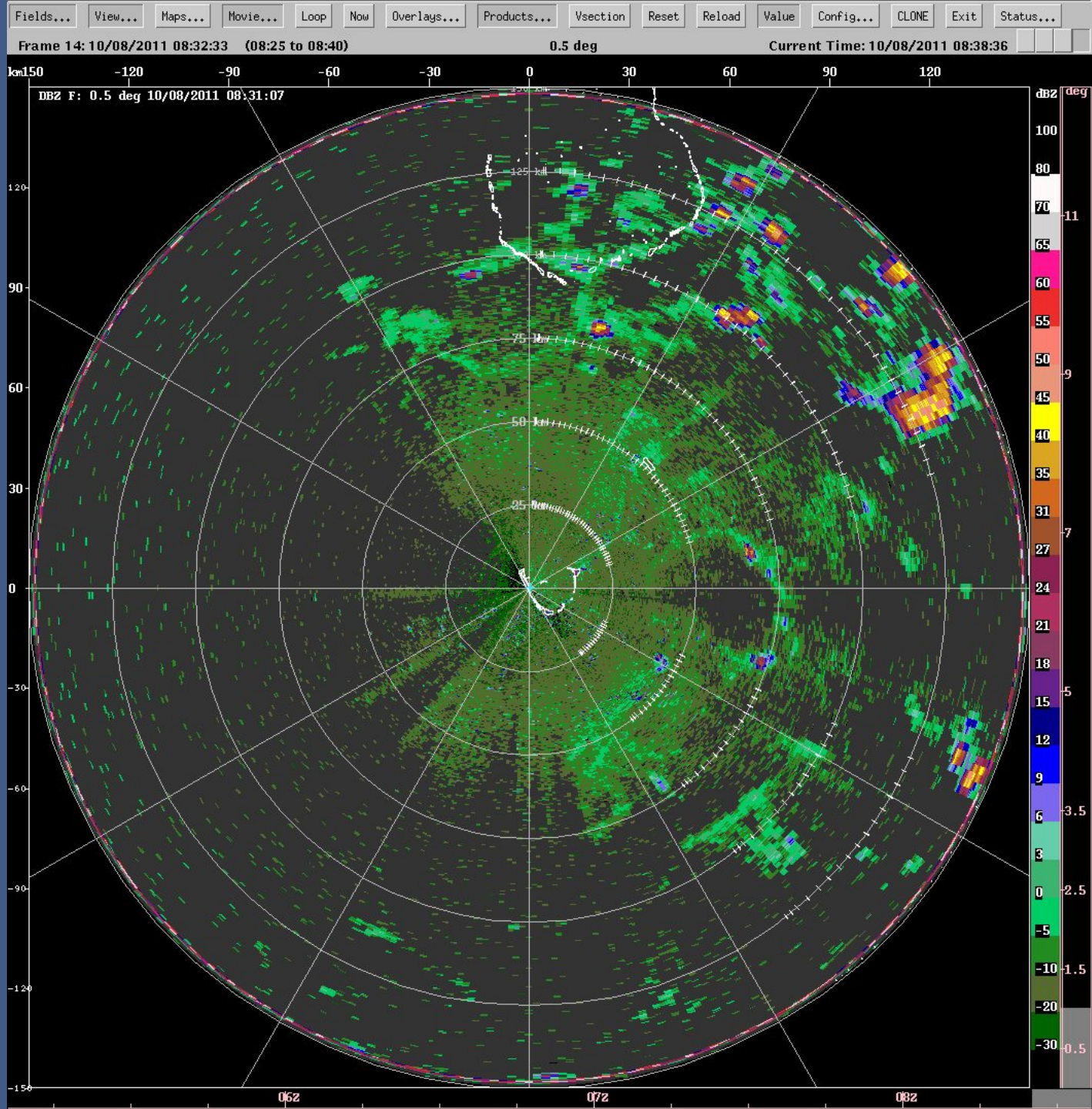



DBZ F SUR: 0.5 deg 12/29/2011 02:46:07
Layer 1 : VIS: 12/29/2011 03:00:00
Long lines of cumulus
deg
69E
70E
71E
72E
73E
74E
75E
76E
77E
3
2
1
0
-1
-2
-3
-4
-5
dBZ
100
80
70
65
60
55
50
45
40
35
31
27
24
21
18
15
12
9
6
3
0
-5
-10
-20
-30
150 km
125 km
100 km
75 km
50 km
25 km
SPOL
albedo
101
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
-1
12/29
042
082
122
162
202
12/30

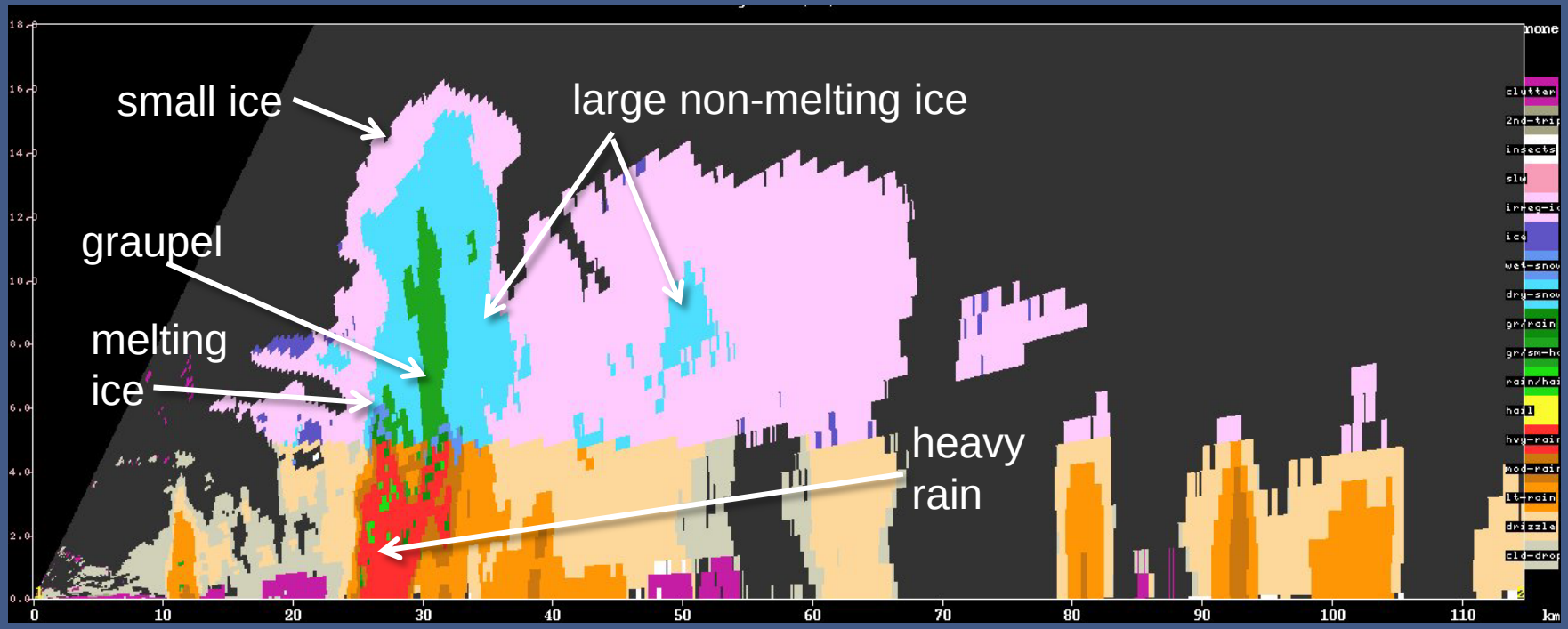

DBZ F: 1.5 deg 12/11/2011 06:01:44
Lines of cumulus parallel to wind
km
dBZ
deg
042
052
062
072
082
092
102

Slightly active moist layer

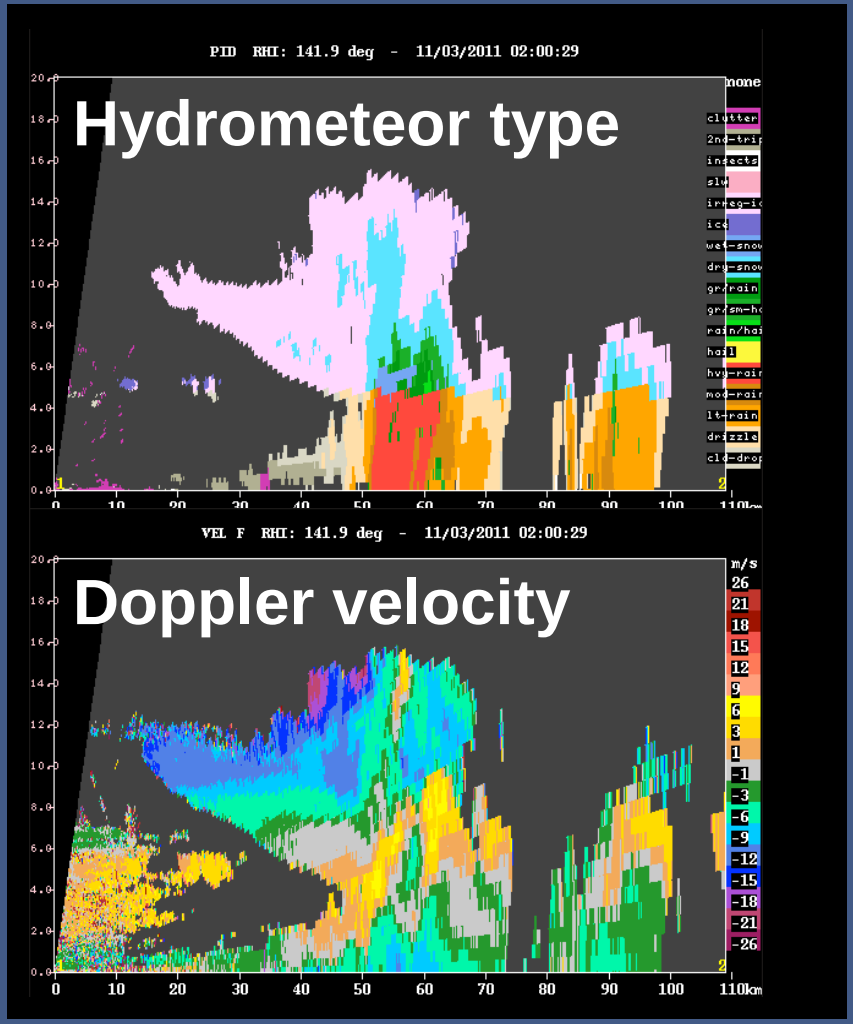
Clouds building at cold pool boundaries



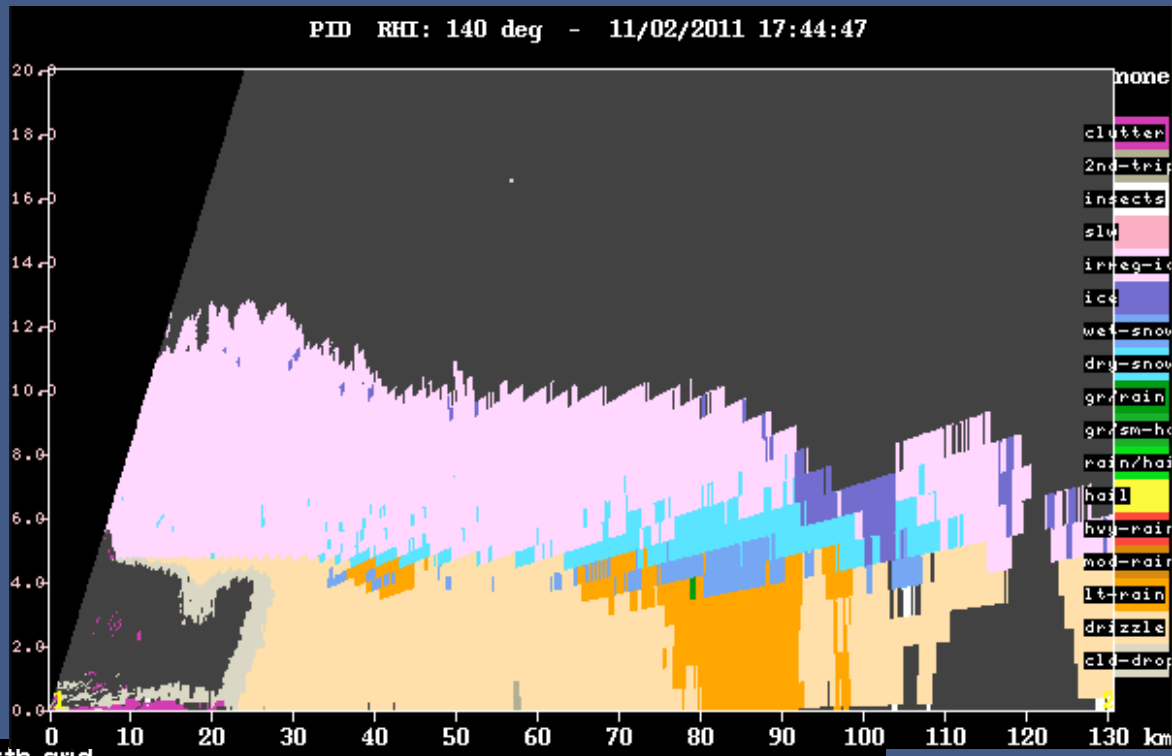
Hydrometeor identification

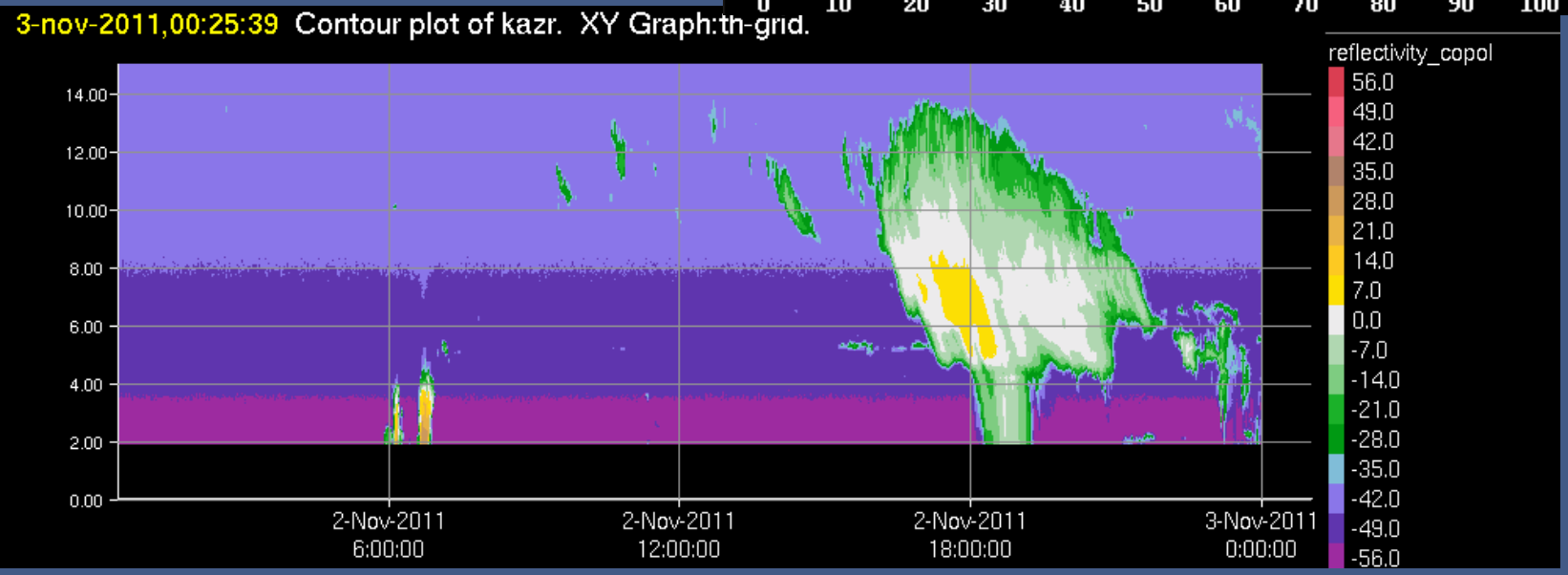


An anvil example

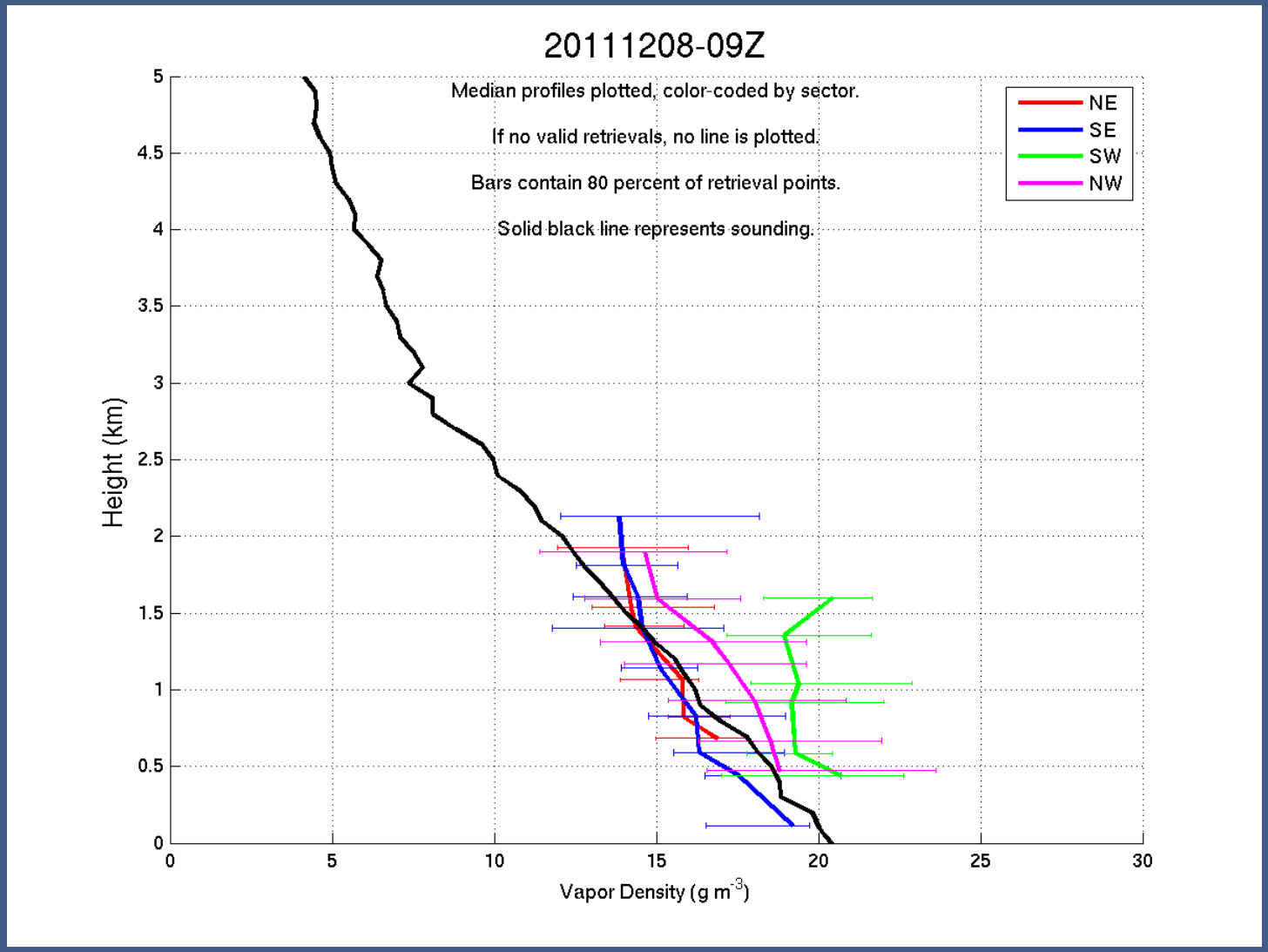


A stratiform region anvil seen by both S-PolKa and KAZR





Dual-wavelength humidity profiles

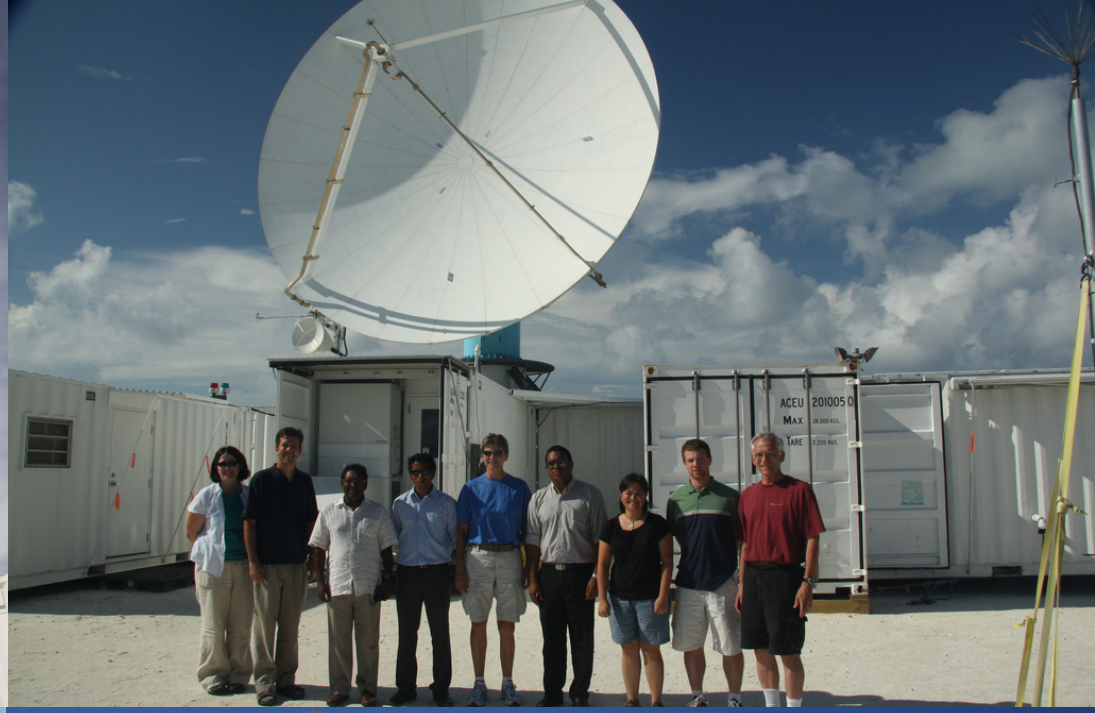


End

This research was sponsored by DOE ARM grant #DE-SC0001164/ER-64752

Extras

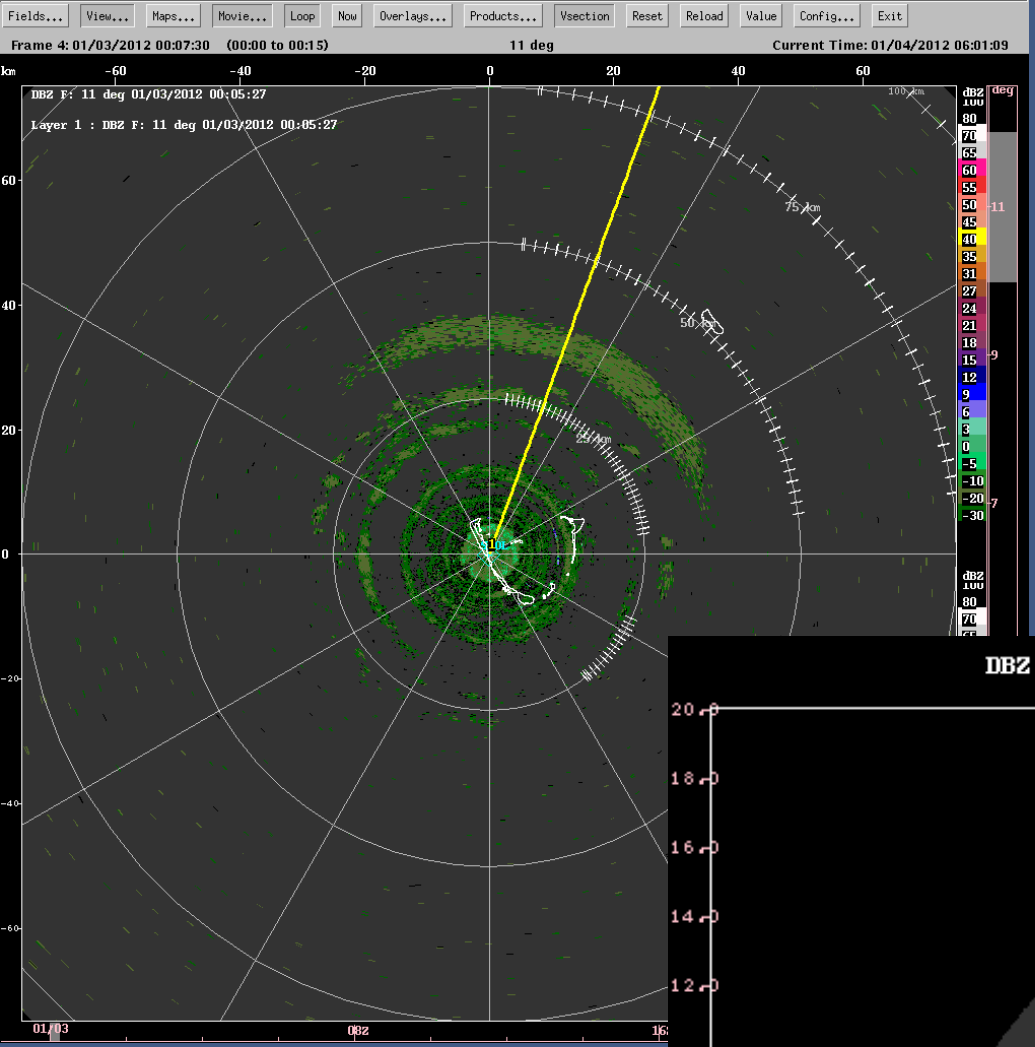
NCAR S-PolKa Radar
S
Ka

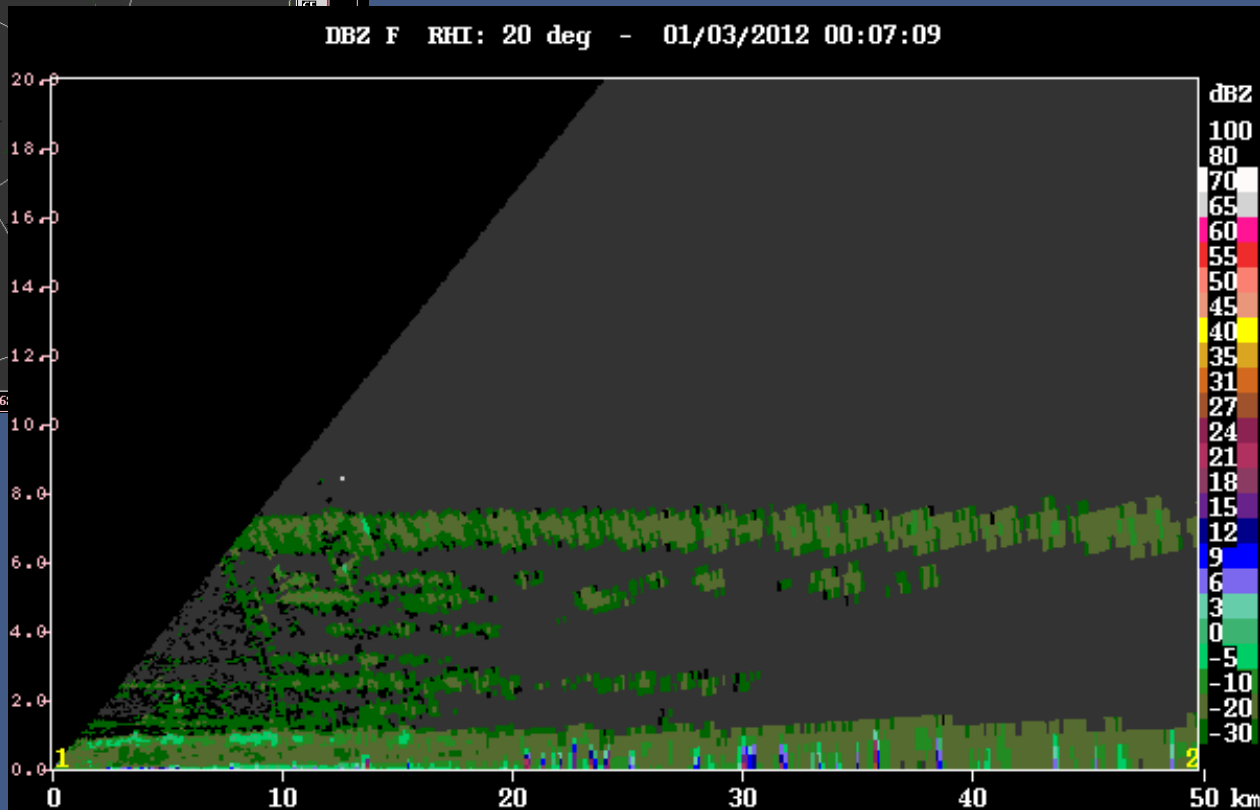


Habitat for Humanity

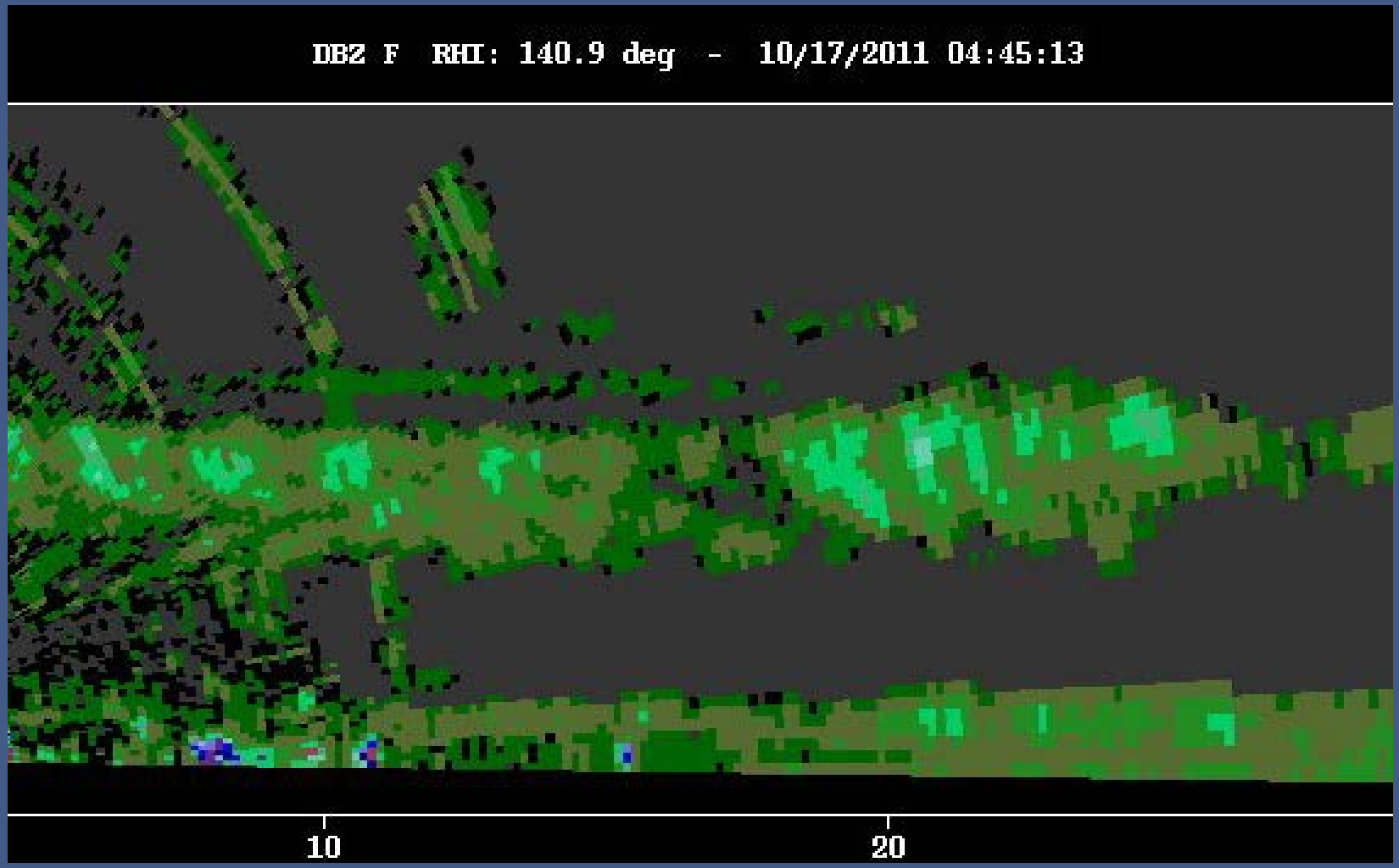
Examples of Humidity Features and Nonprecipitating Clouds Seen by S-PolKa

Humidity gradient rings and nonprecipitating clouds

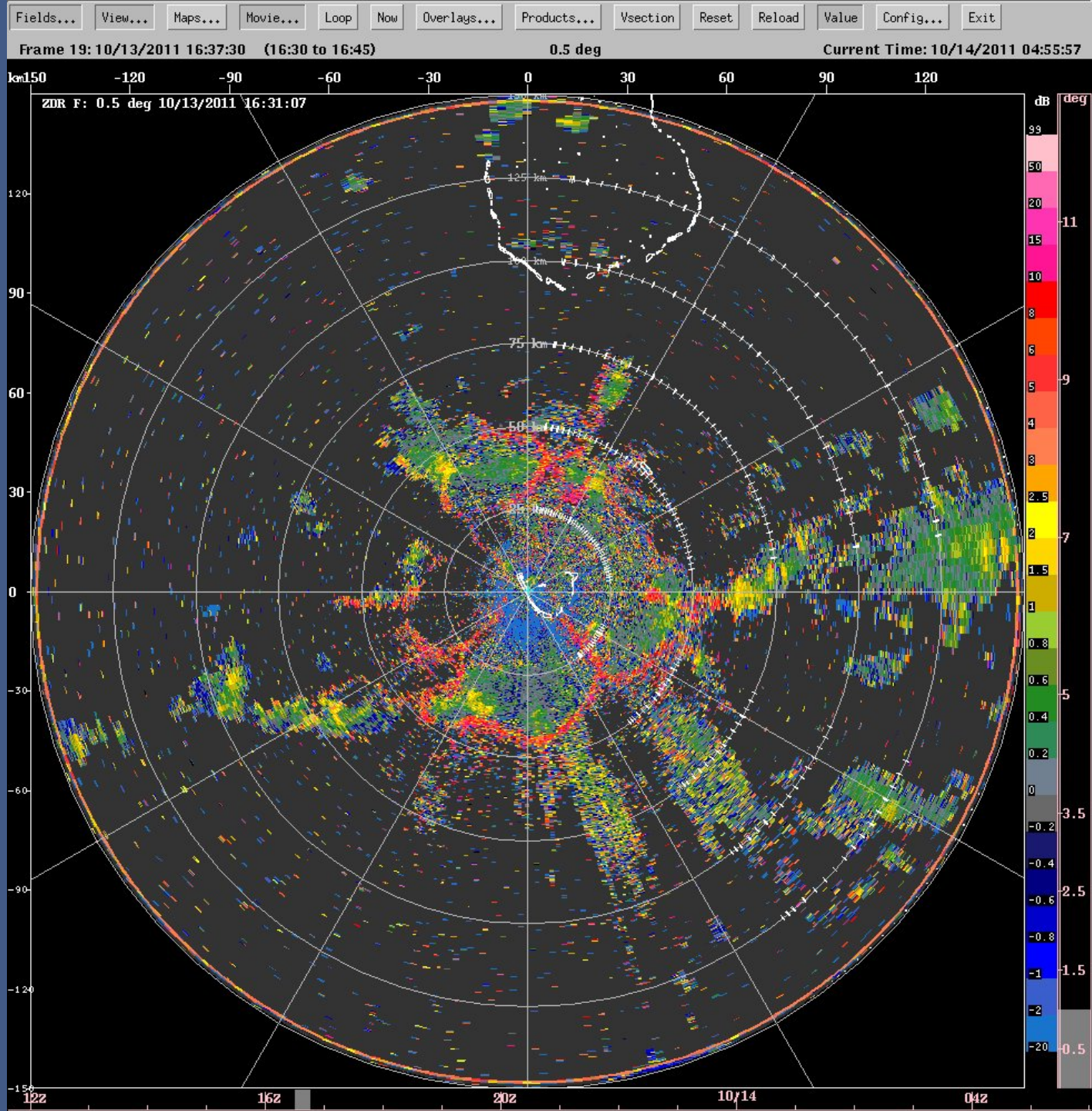




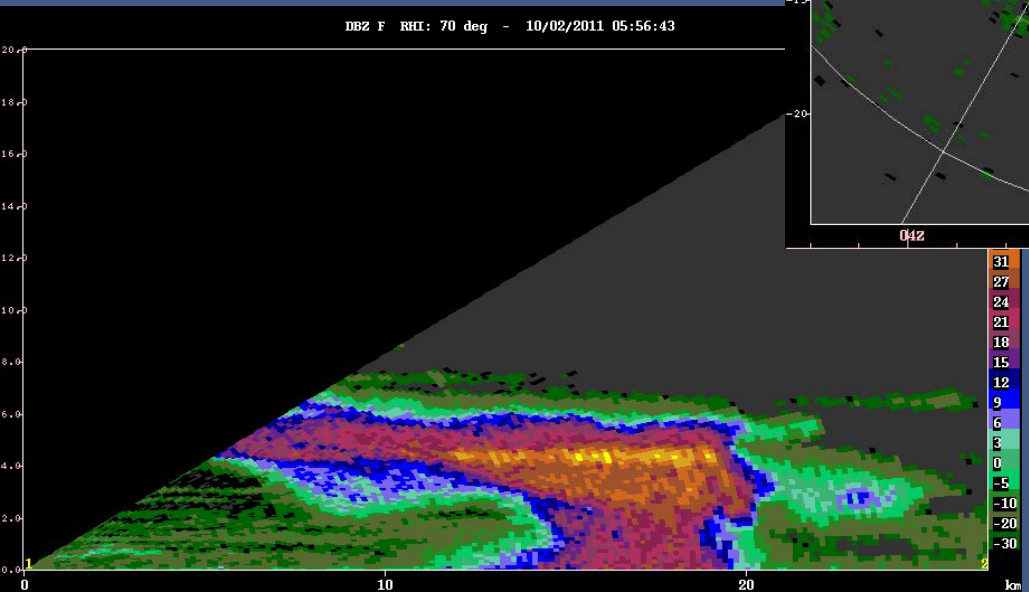
Nonprecipitating clouds and virga



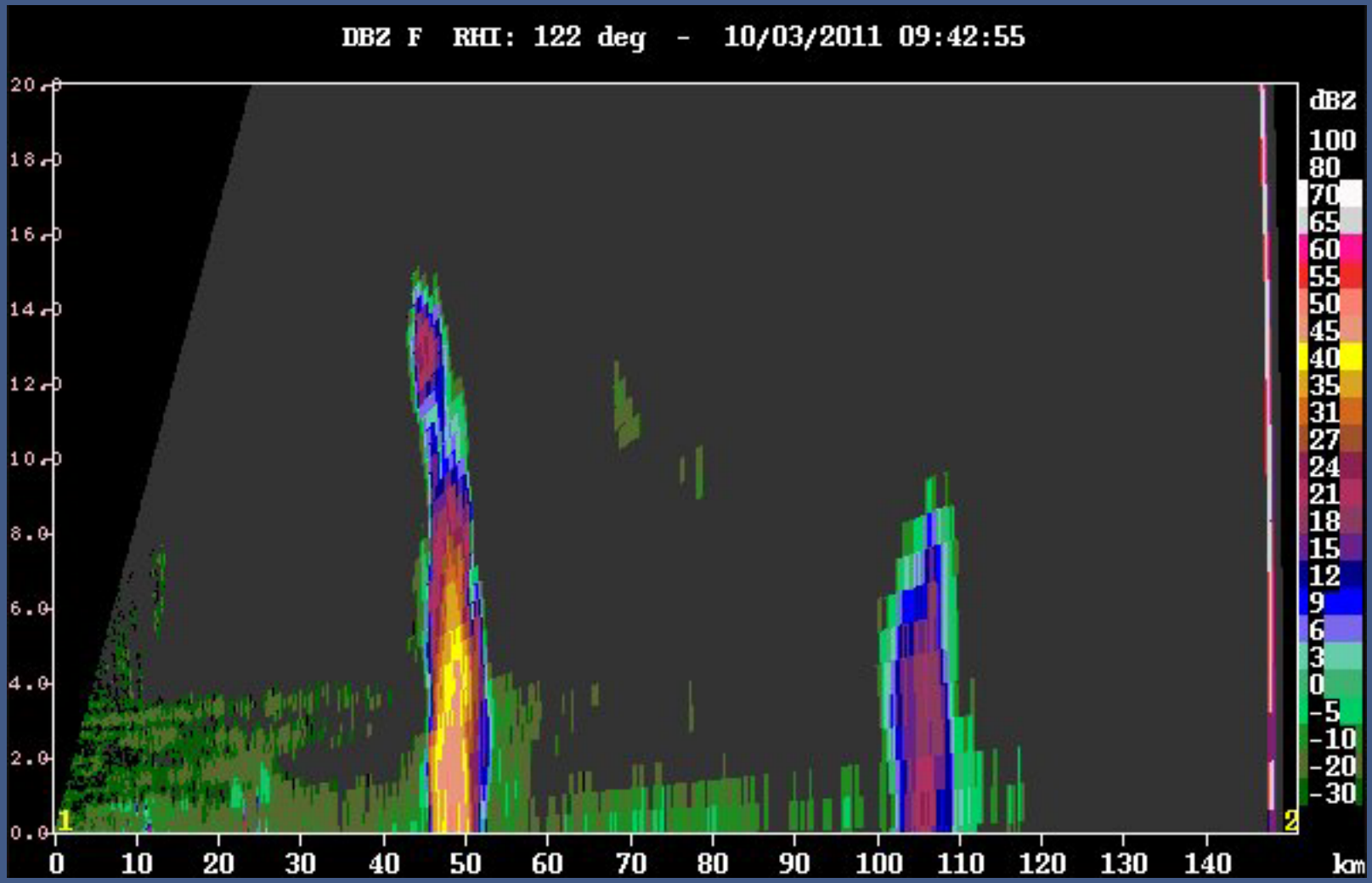
Cold pool examples seen in differential reflectivity (ZDR)



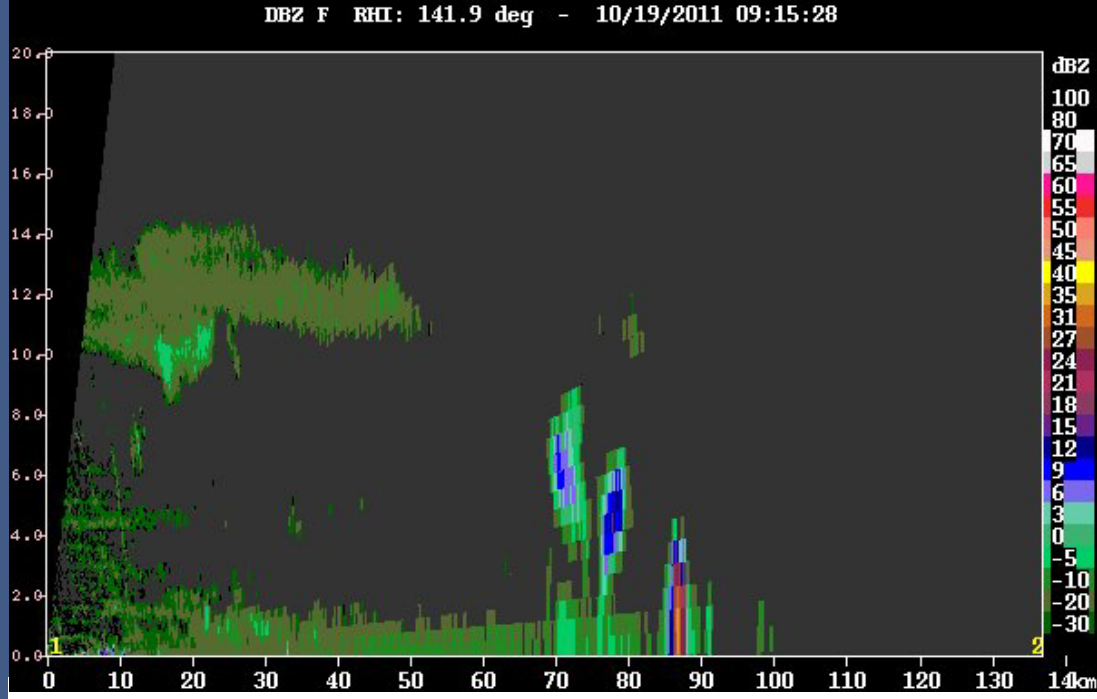
Humidity rings and anvil cloud

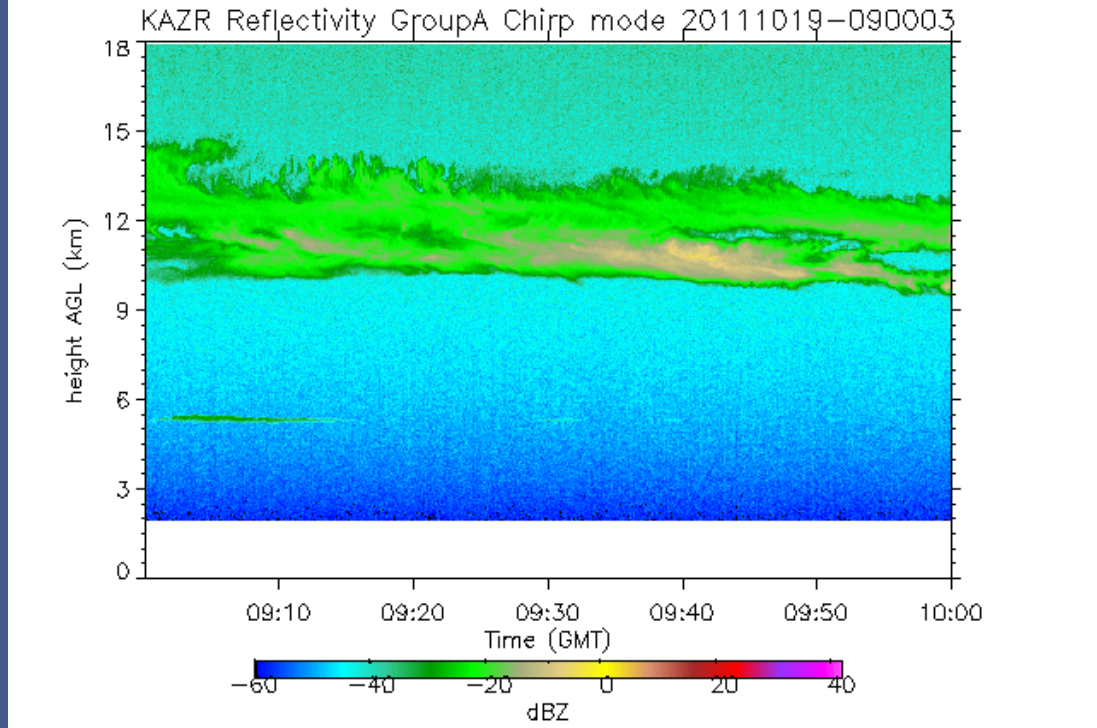


The “worm echo”



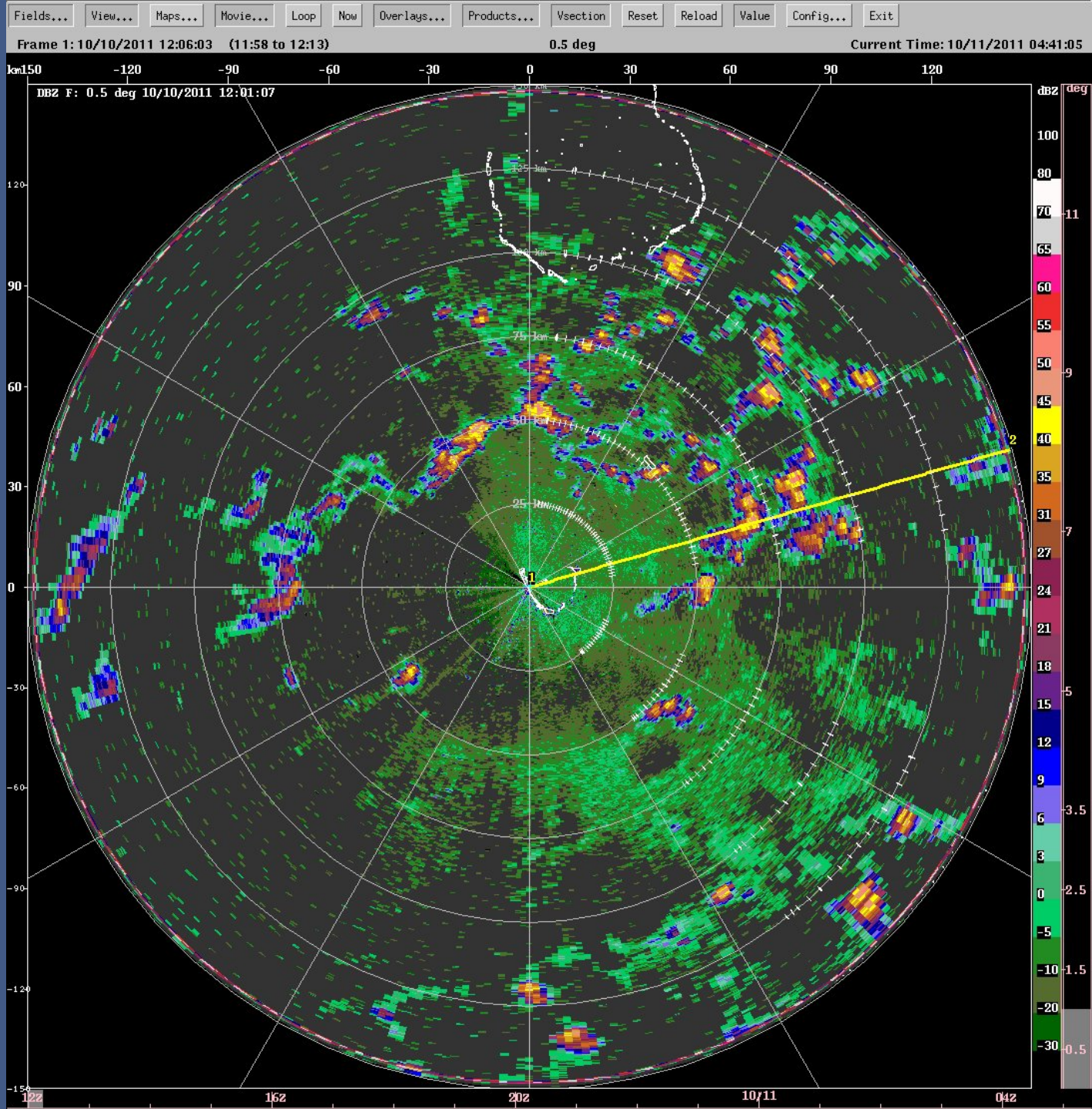
Upper-level cloud over KAZR





Slightly active moist layer

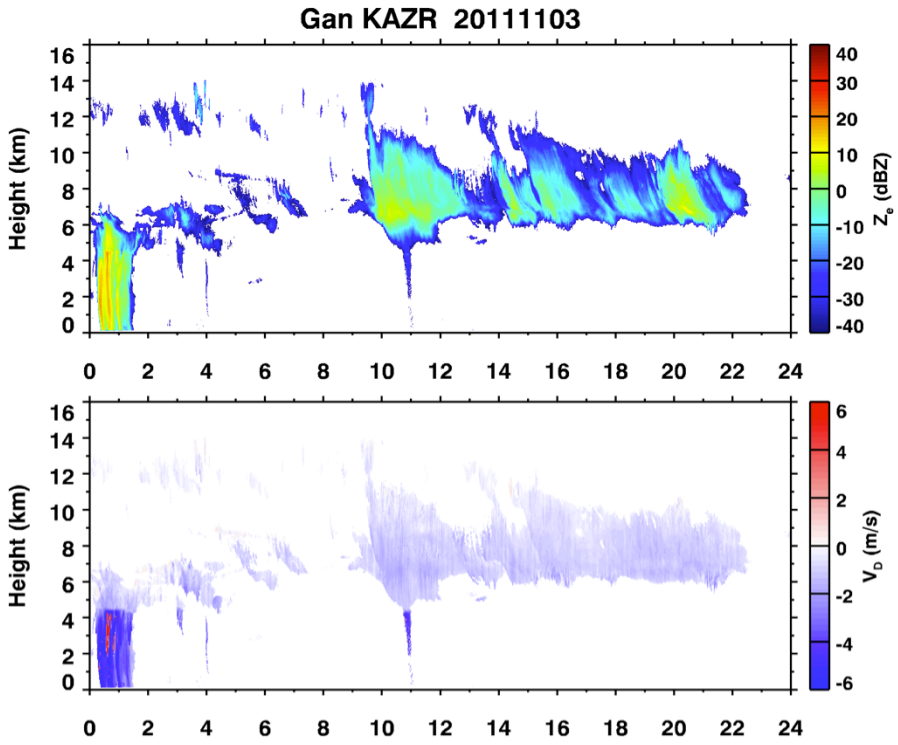
Clouds building at cold pool boundaries



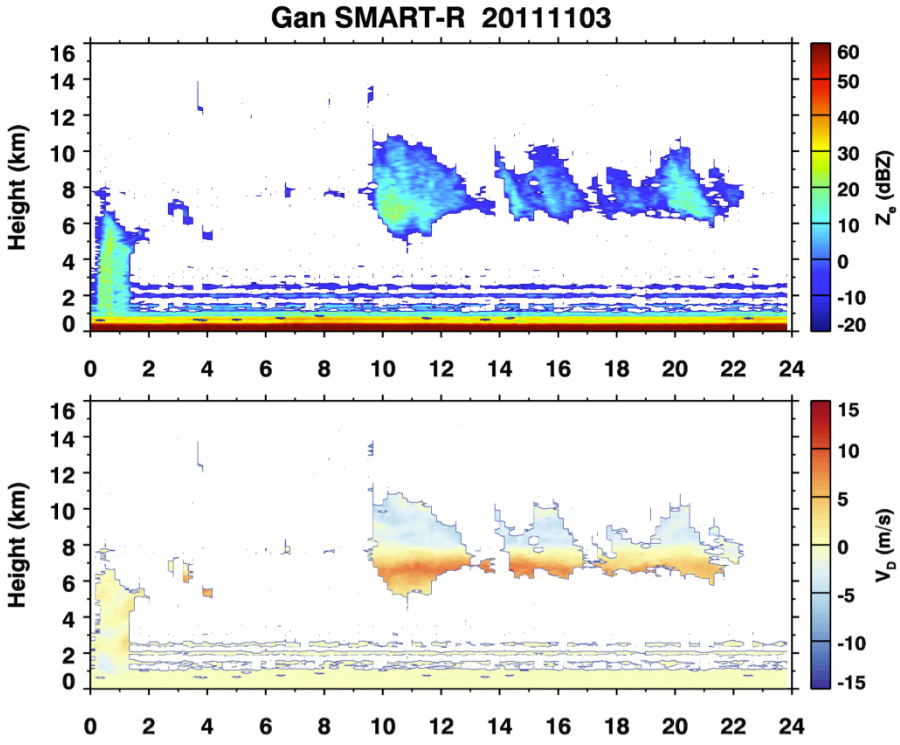
More Extras

Gan KAZR and SMART-R

KAZR



SMART-R

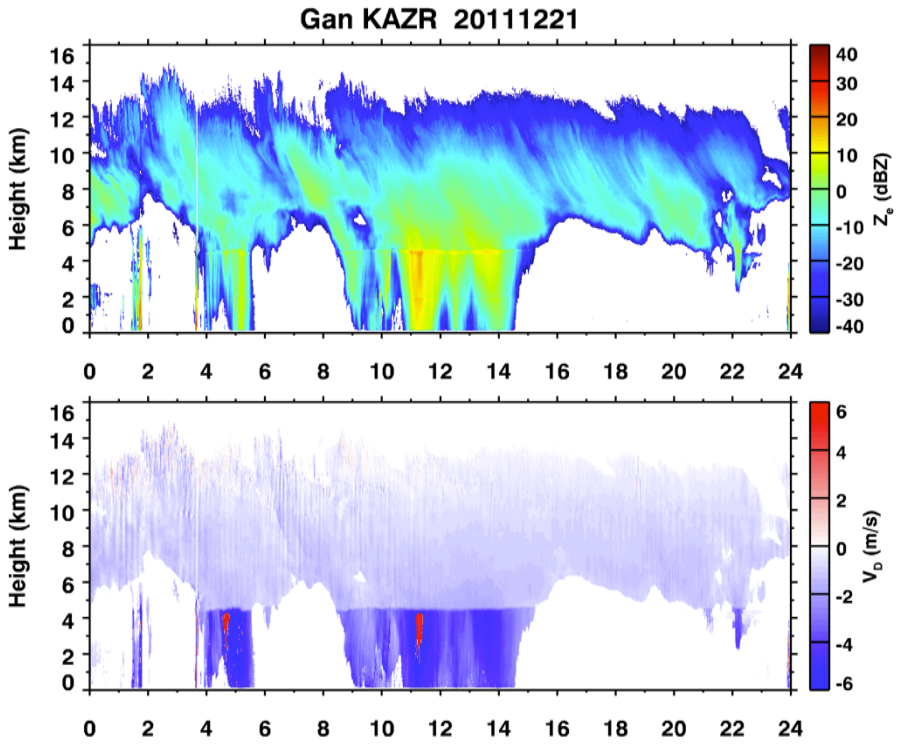


- **Generally agree well above 3-km height**
- **SMART-R low level (1-3km) AP**
- **Below 1-km SMART-R ground clutter?**

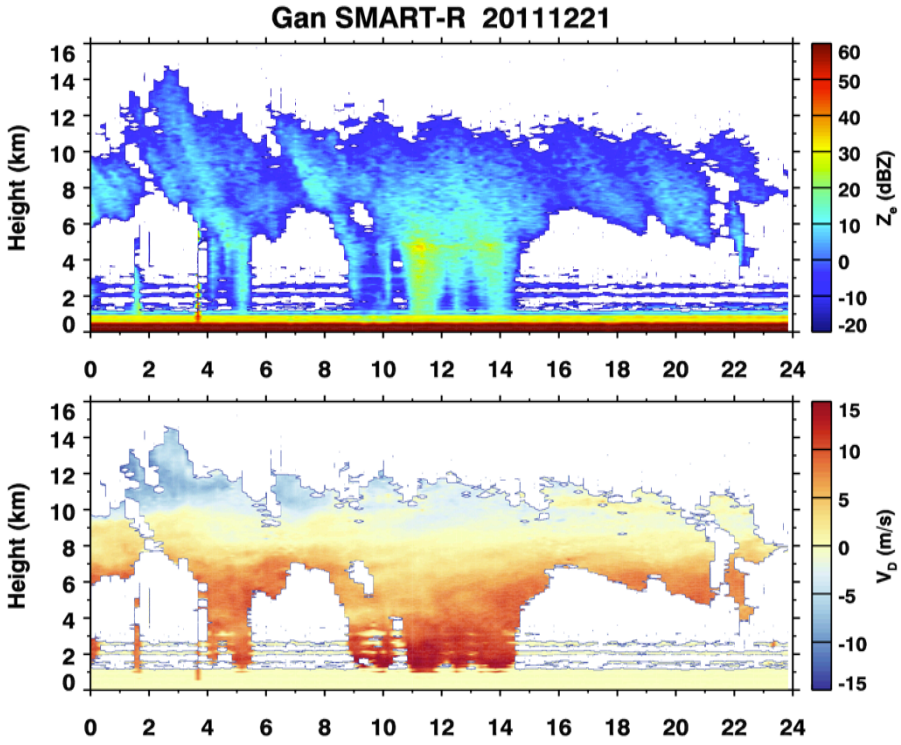
Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle *Since 1965*

Gan KAZR and SMART-R

KAZR

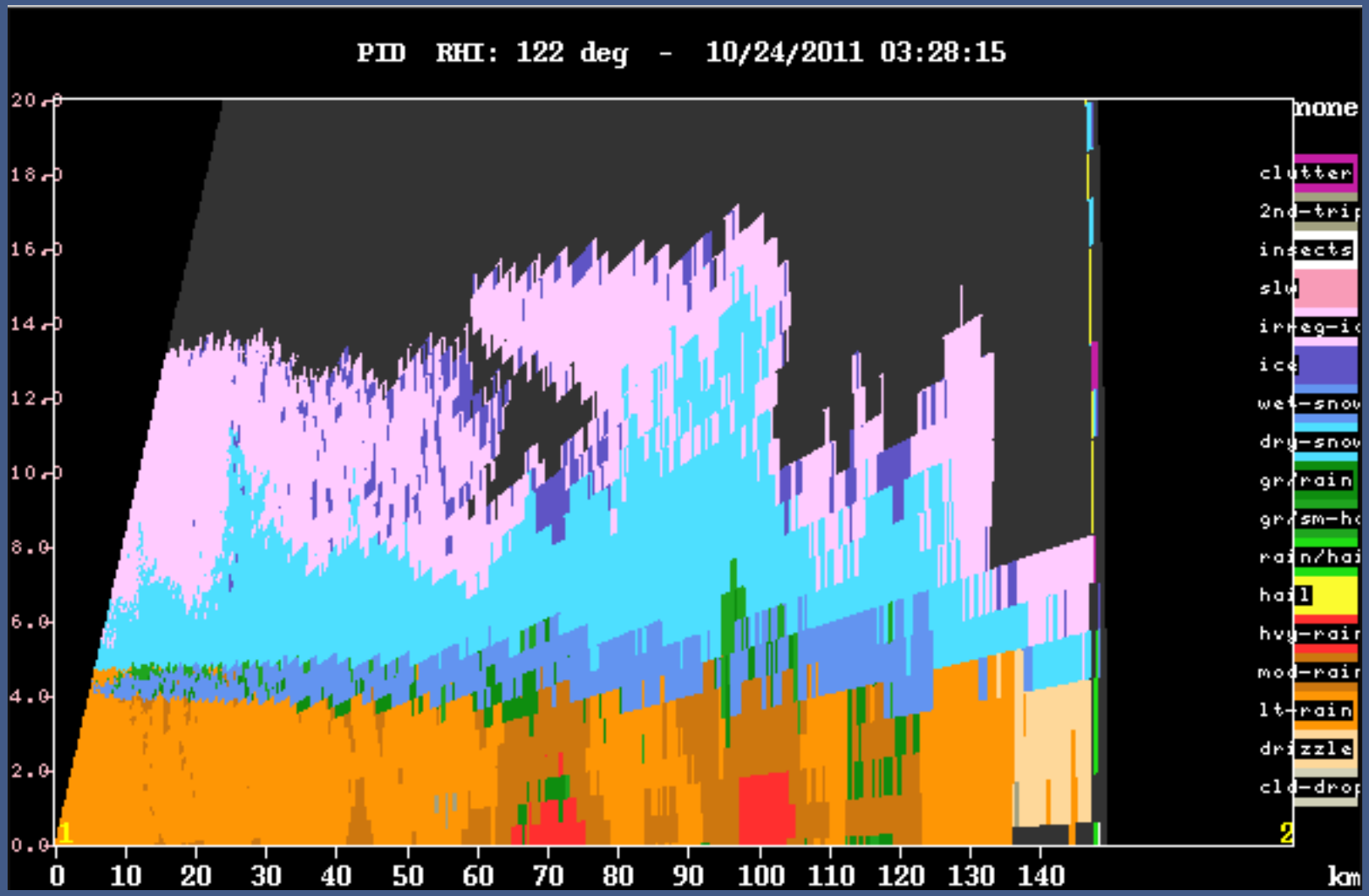


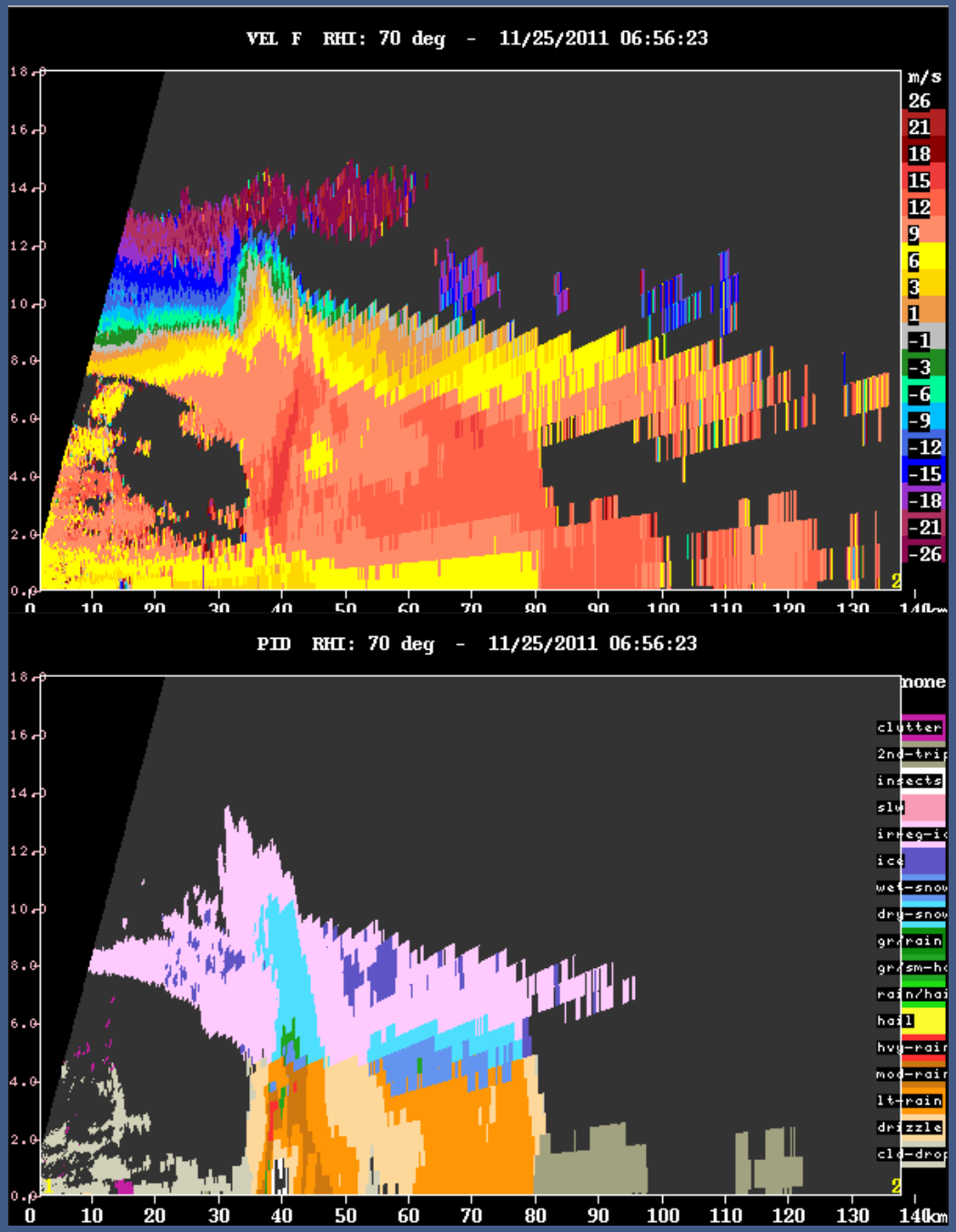
SMART-R

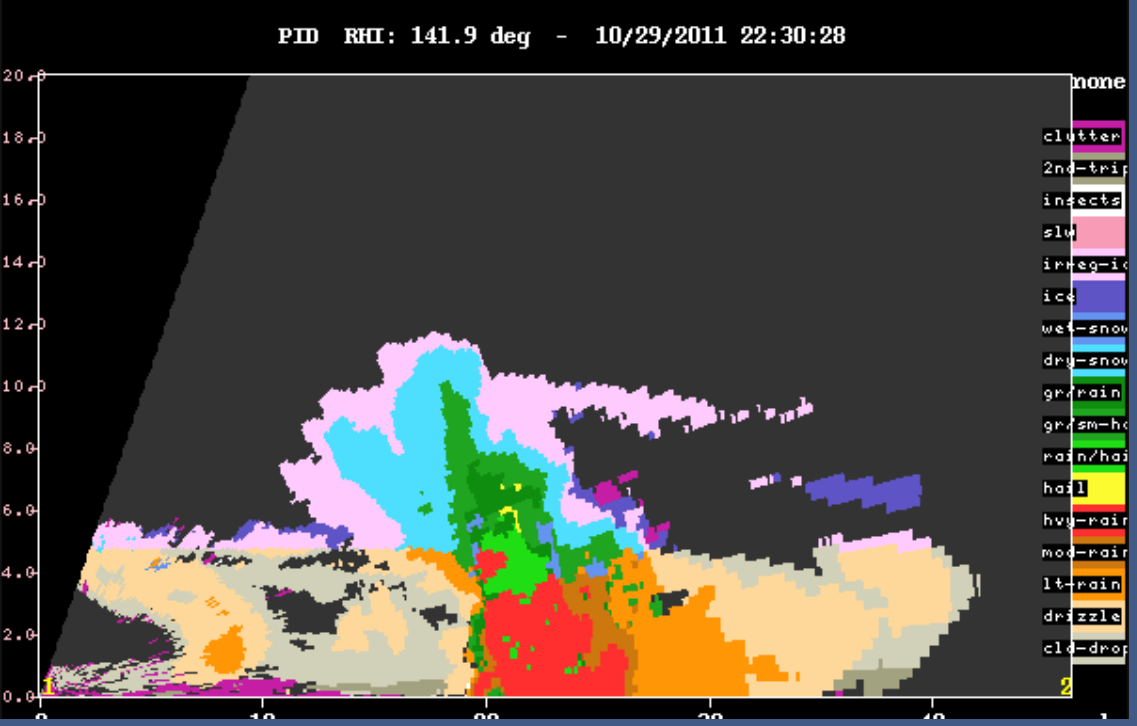


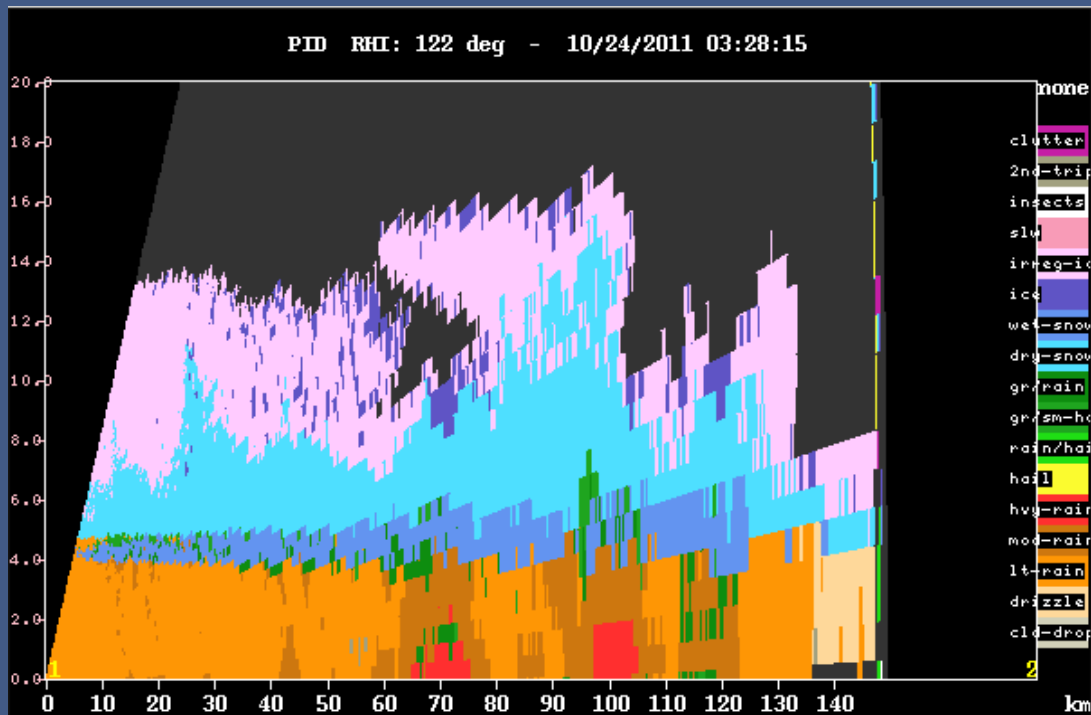
- **Note: color scale is different between two radars**
- **Z_{top} difference is about 1~2 km**
- **SMART-R Z_e is about 8 dB too high**

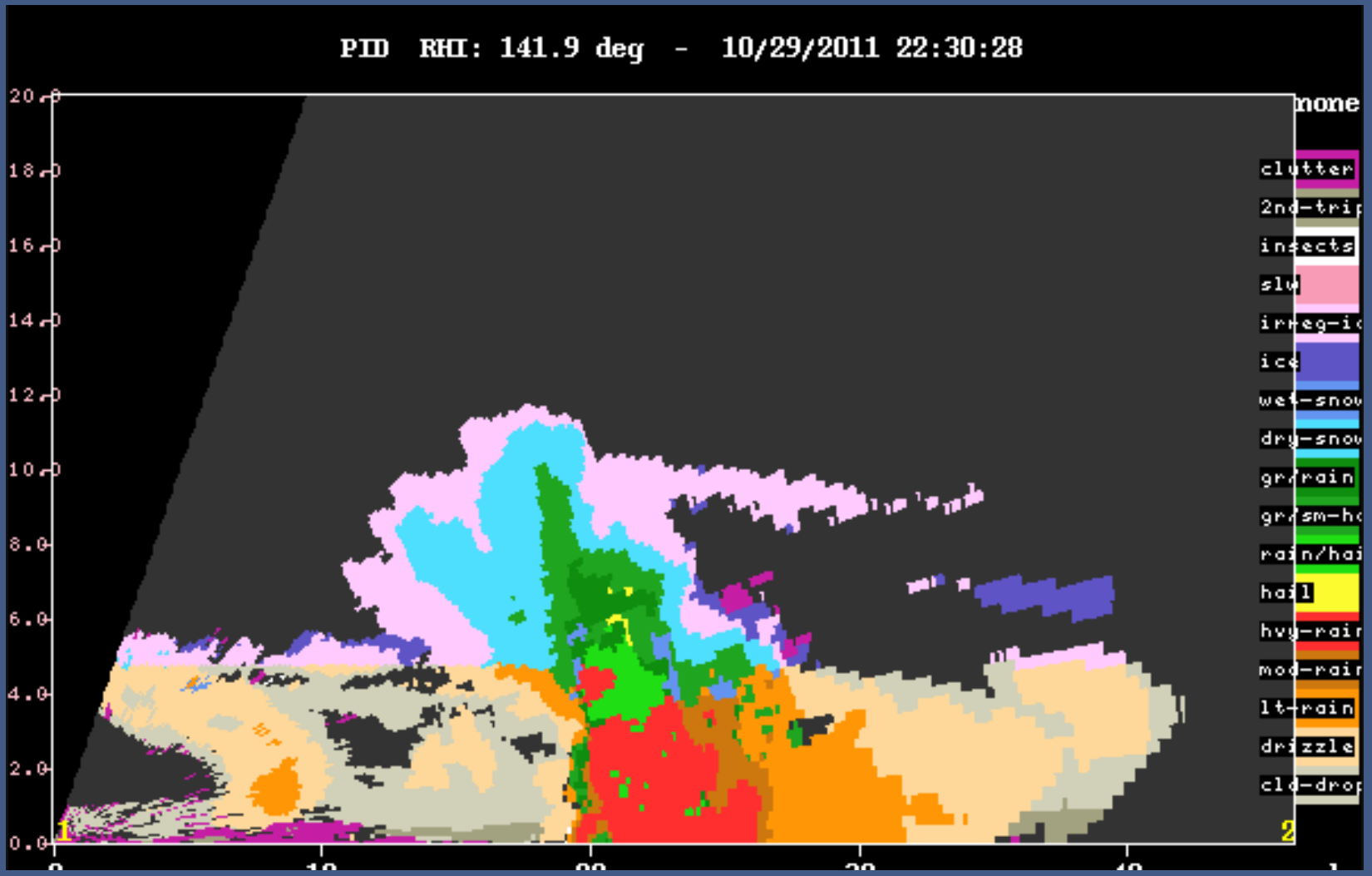
Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle *Since 1965*

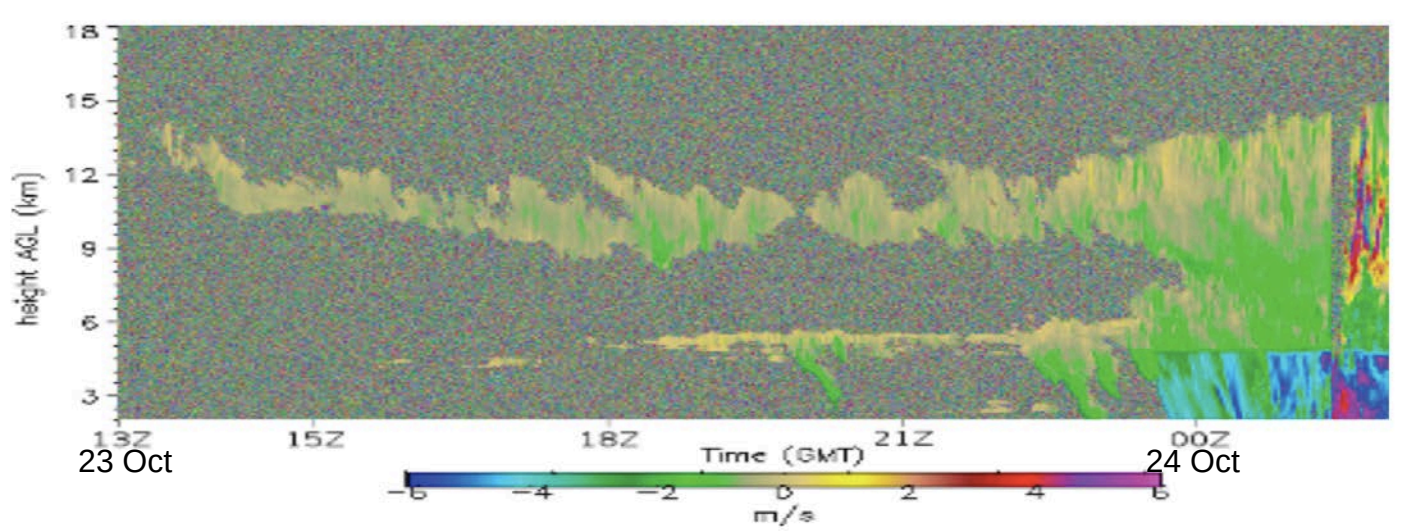

PID RHI: 122 deg - 10/24/2011 03:28:15
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140
km
none
clutter
2nd-trip
insects
slug
irreg-ice
ice
wet-snow
dry-snow
gr/rain
gr/sm-hail
rain/hail
hail
hvy-rain
mod-rain
lt-rain
drizzle
cld-drop
1
2


VEL F RHI: 70 deg - 11/25/2011 06:56:23
m/s
26
21
18
15
12
9
6
3
1
-1
-3
-6
-9
-12
-15
-18
-21
-26
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140km
PID RHI: 70 deg - 11/25/2011 06:56:23
none
clutter
2nd-trip
insects
slw
irreg-ice
ice
wet-snow
dry-snow
gr/rain
gr/sm-hail
rain/hail
hail
hvy-rain
mod-rain
lt-rain
drizzle
cld-drop


PID RHI: 141.9 deg - 10/29/2011 22:30:28
none
clutter
2nd-trip
insects
slw
irreg-ic
ice
wet-snow
dry-snow
gr/rain
gr/sm-ha
rain/hai
hail
hvy-rain
mod-rain
lt-rain
drizzle
cld-drop
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1
2

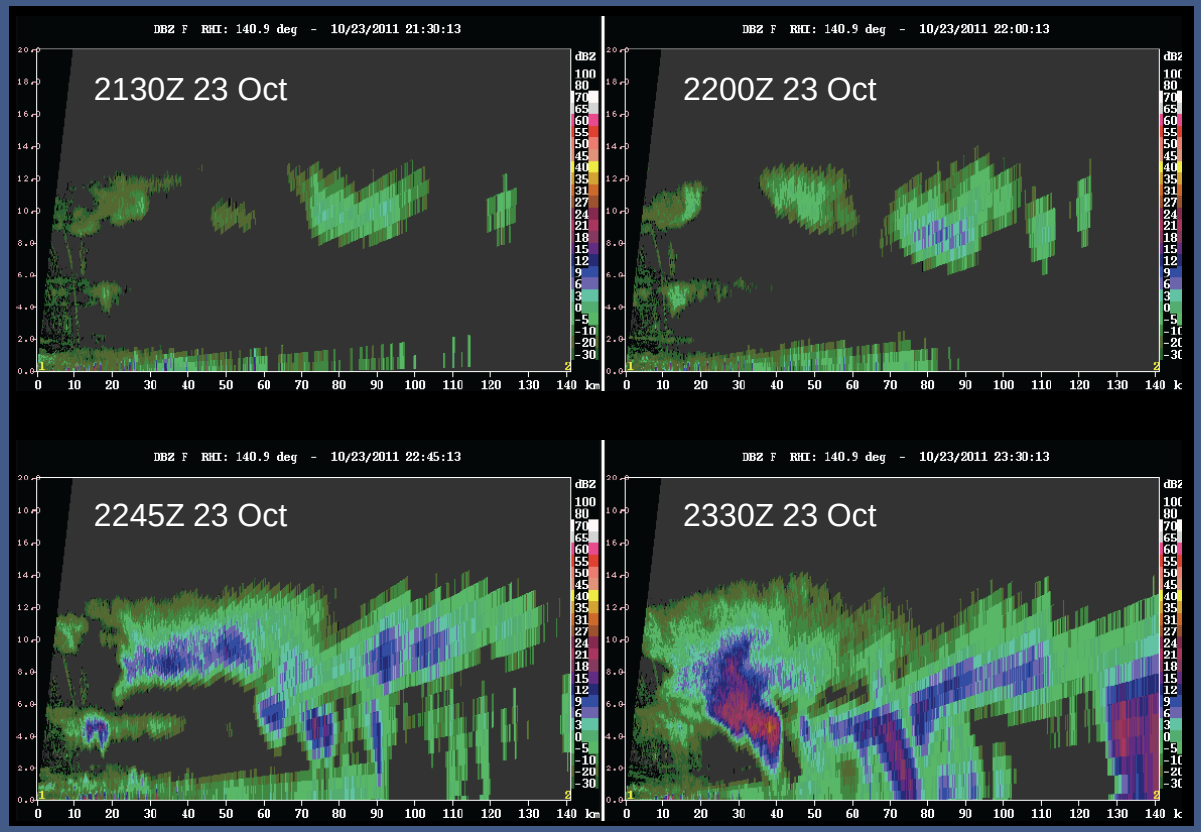

PID RHI: 122 deg - 10/24/2011 03:28:15
none
clutter
2nd-trip
insects
slw
irreg-ic
ice
wet-snow
dry-snow
gr/rain
gr/sm-ha
rain/hai
hail
hvy-rain
mod-rain
lt-rain
drizzle
cld-drop
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
km
1
2


PID RHI: 141.9 deg - 10/29/2011 22:30:28
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
none
clutter
2nd-trip
insects
slw
irreg-ice
ice
wet-snow
dry-snow
gr/rain
gr/sm-hail
rain/hail
hail
hvy-rain
mod-rain
lt-rain
drizzle
cld-drop
1
2


height AGL (km)
18
15
12
9
6
3
13Z
15Z
18Z
21Z
00Z
Time (GMT)
−6
−4
−2
0
2
4
6
m/s

23 Oct

24 Oct


DBZ F RHI: 140.9 deg - 10/23/2011 21:30:13
2130Z 23 Oct
DBZ F RHI: 140.9 deg - 10/23/2011 22:00:13
2200Z 23 Oct
DBZ F RHI: 140.9 deg - 10/23/2011 22:45:13
2245Z 23 Oct
DBZ F RHI: 140.9 deg - 10/23/2011 23:30:13
2330Z 23 Oct

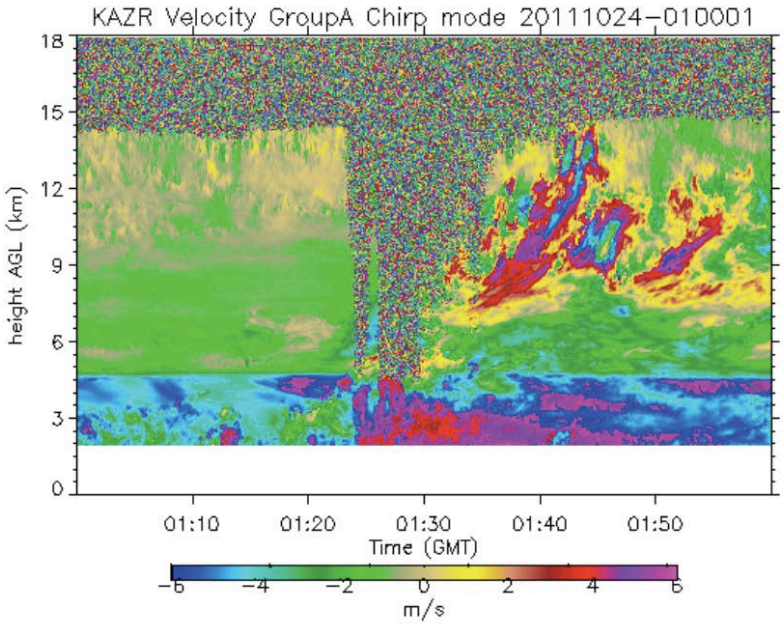


Figure 6. DOE KAZR vertically pointing Ka-band radar image for 0100-0200 UTC 24 October 2011.

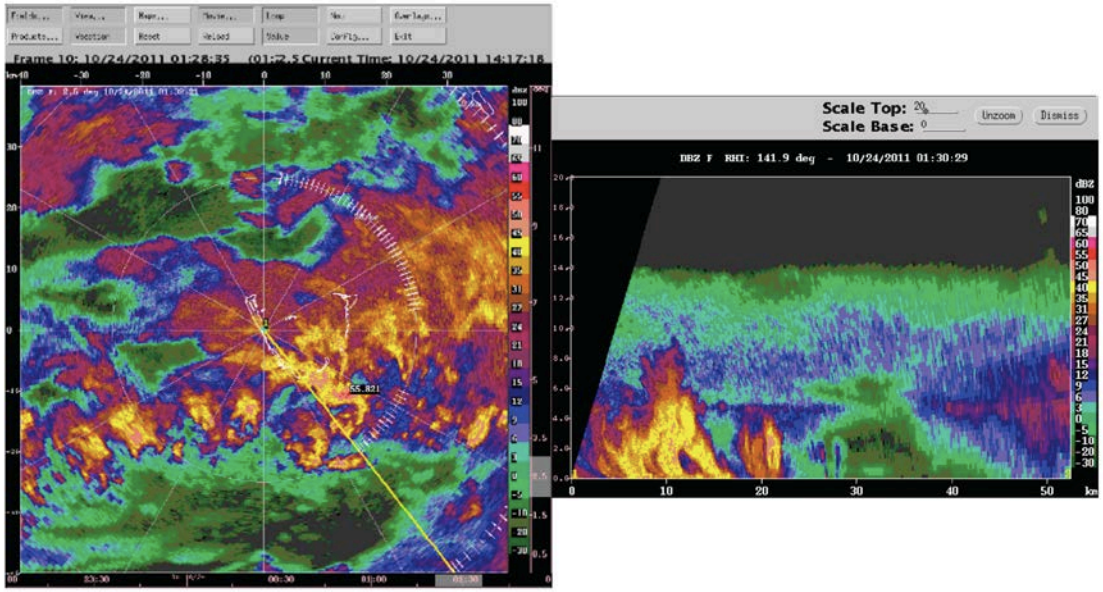


Figure 10. S-PolKa S-band reflectivity at 2.5 deg elevation at 0132 UTC 24 October 2011 (left), and an RHI at 140.9 deg at 0130 UTC (right).

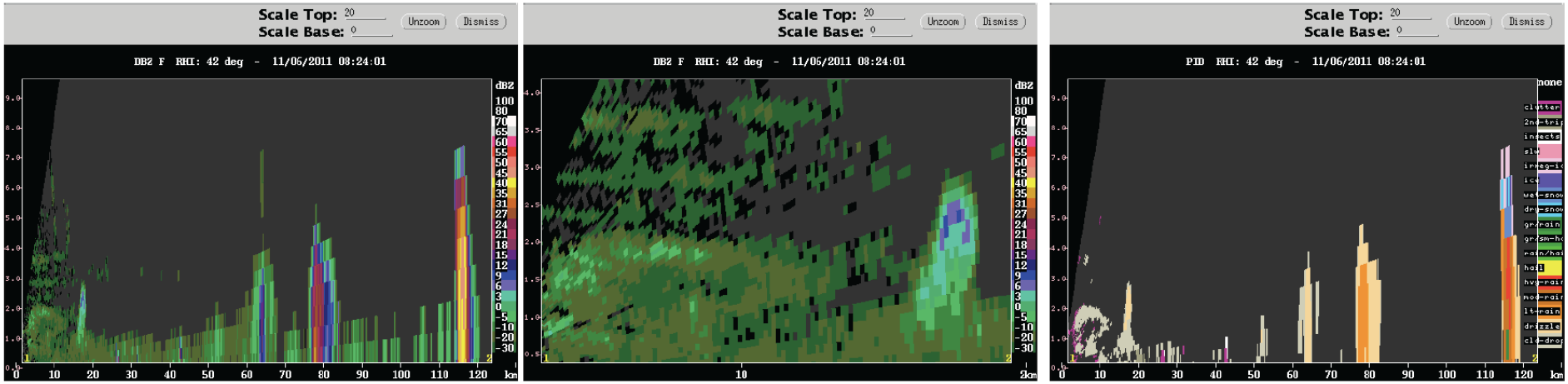
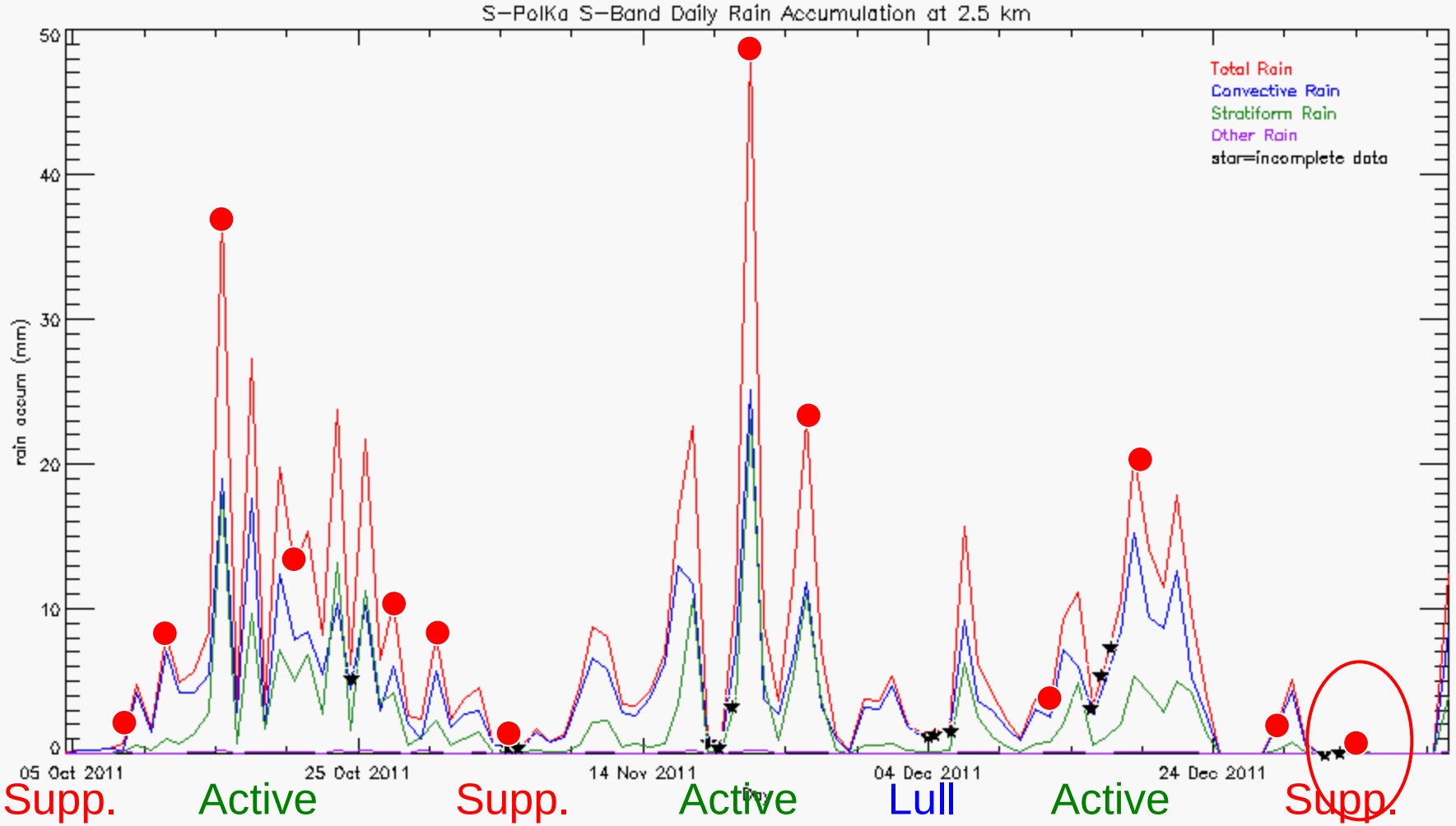
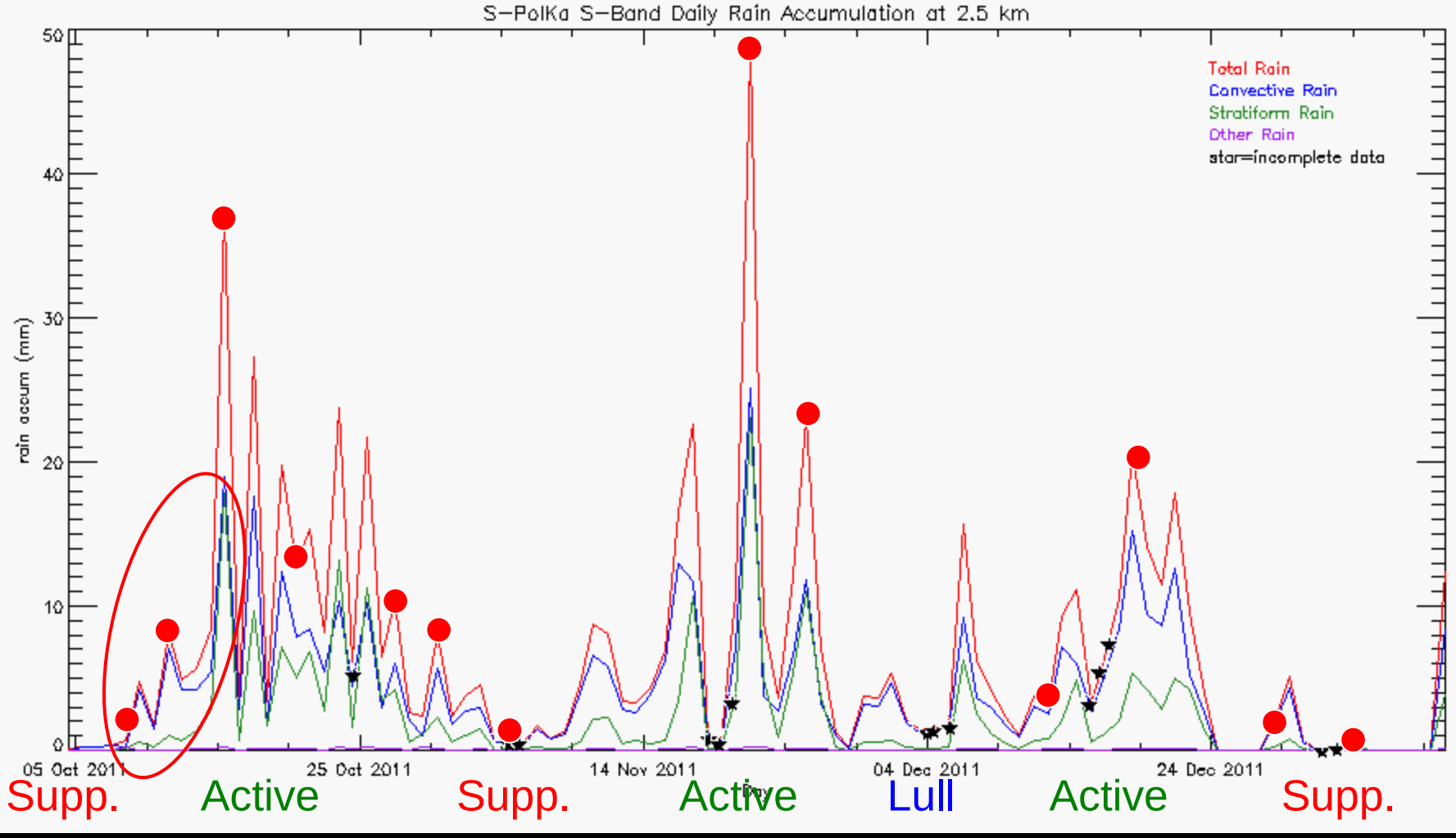
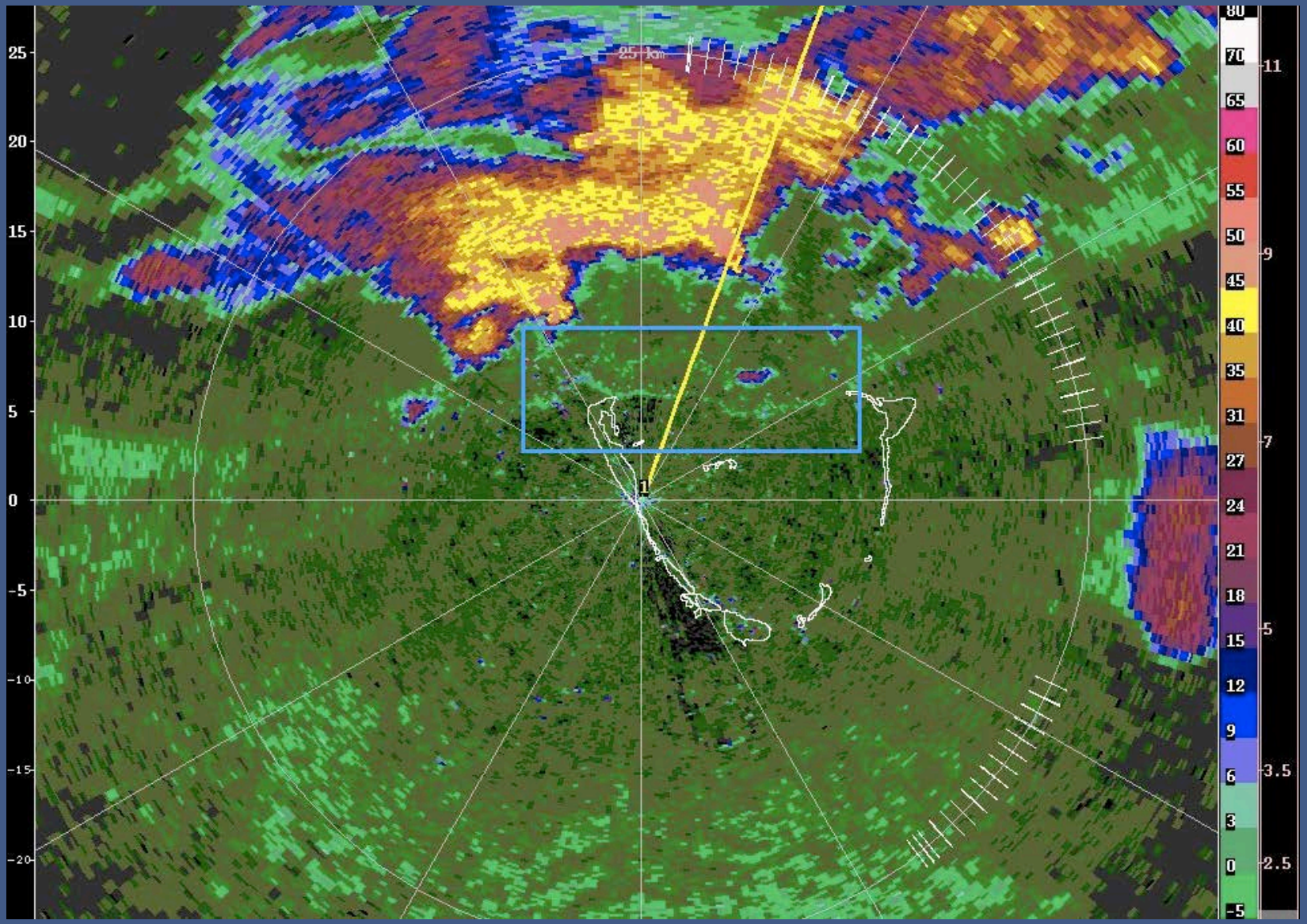


Figure 7. S-PolKa S-band data taken at about 0830 UTC on 6 November 2011. Upper: PPI of reflectivity. Lower: RHIs of reflectivity (unzoomed), reflectivity (zoomed), and polarimetrically determined particle type.

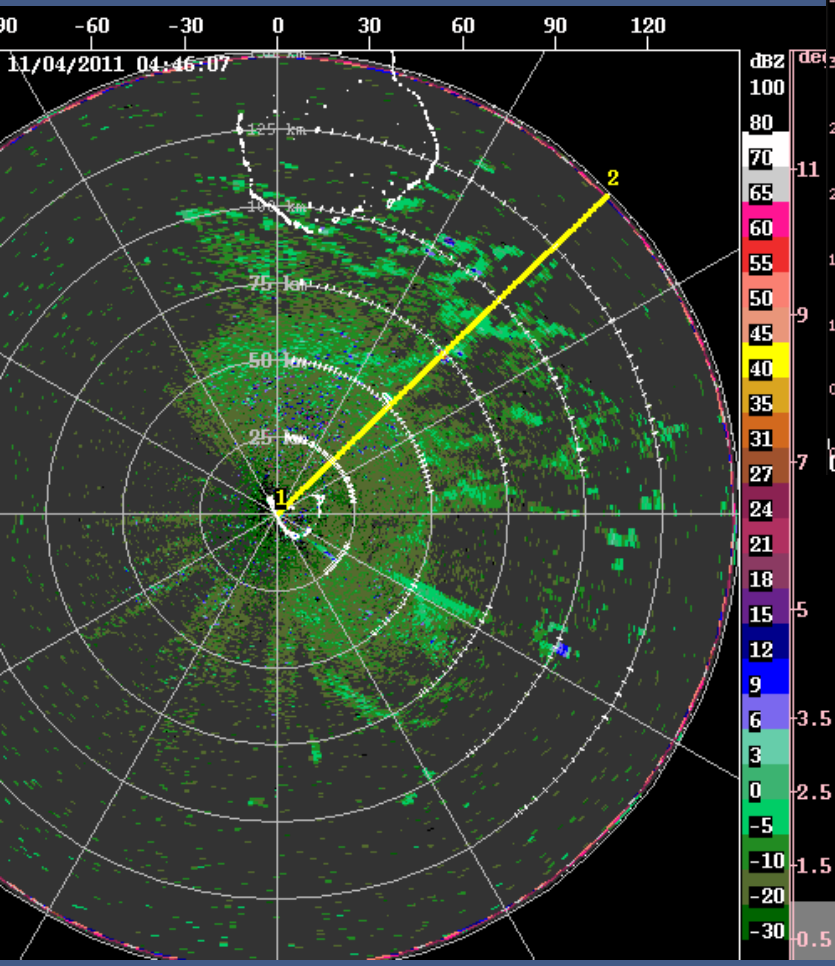
Rain over area scanned by S-PolKa

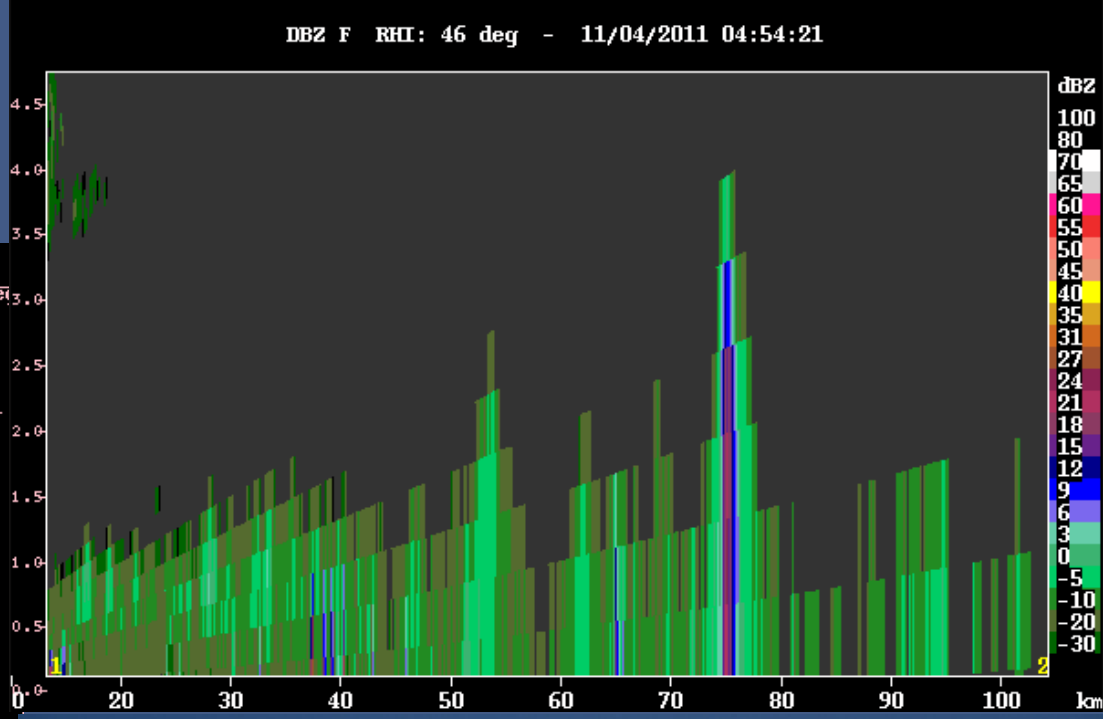


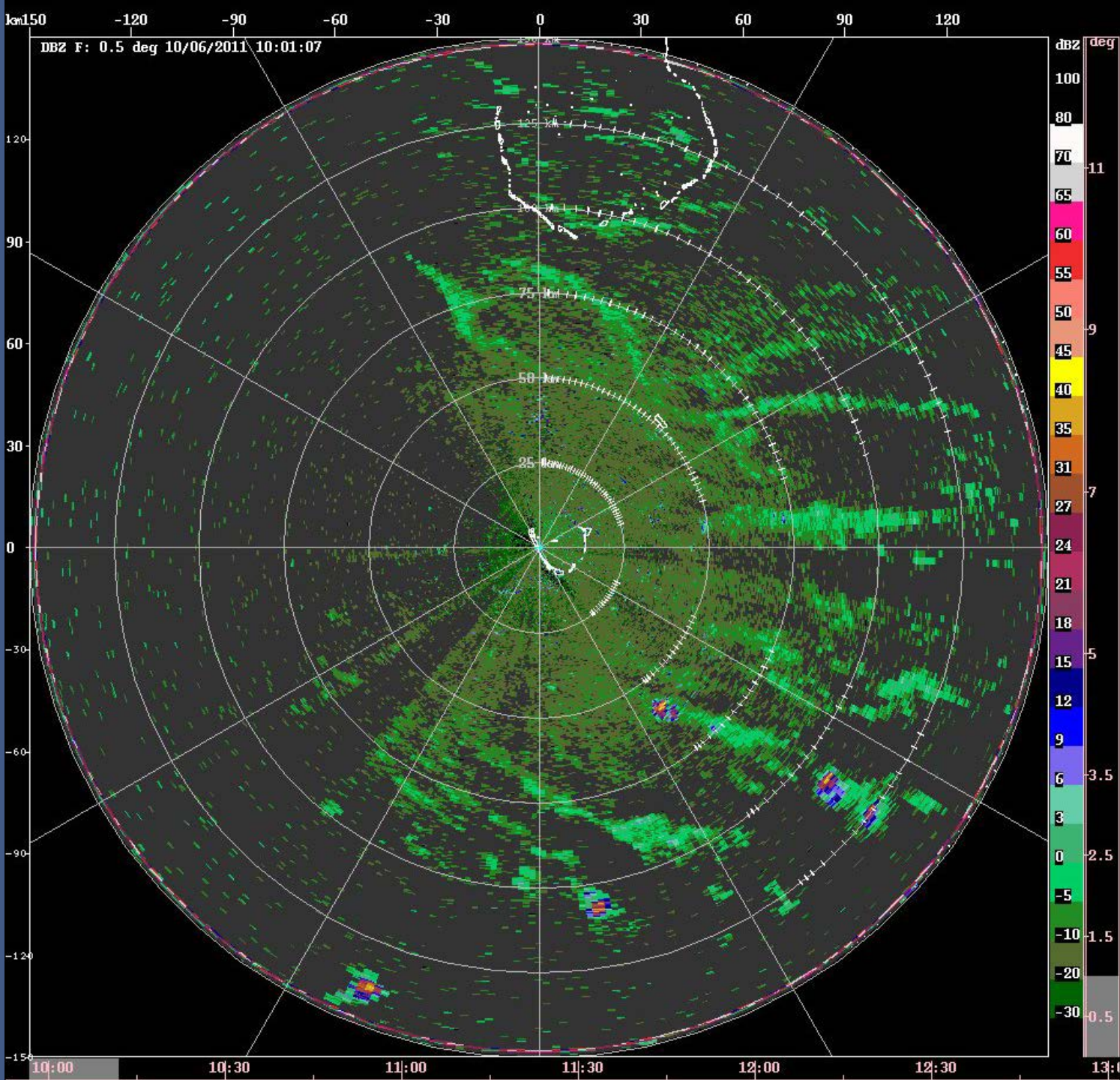

S-PolKa S-Band Daily Rain Accumulation at 2.5 km
Total Rain
Convective Rain
Stratiform Rain
Other Rain
star=incomplete data
rain accum (mm)
0
10
20
30
40
50
05 Oct 2011
25 Oct 2011
14 Nov 2011
04 Dec 2011
24 Dec 2011
Supp.
Active
Supp.
Active
Lull
Active
Supp.


25 km
25
20
15
10
5
0
-5
-10
-15
-20
80
70
65
60
55
50
45
40
35
31
27
24
21
18
15
12
9
6
3
0
-5
11
9
7
5
3.5
2.5

Suppressed condition clouds





Suppressed phases:

Lines of non-precipitating clouds