Space Based L-Band Scatterometer and Radiometer Studies of Coincident Ocean Surface Winds and Rain Using SMAP

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THIS INVESTIGATION:

Observe the response of both the SMAP L-band Radar (V-pol,H-pol and Cross-Polarization) and Radiometer Brightness temperature (V-pol and H-pol) with high resolution (time and space) ocean surface:

1) Surface Rainrate from land-based NEXRAD radars

2) Wind speed (and direction) from NCEP high resolution products, referenced to 10 meter height

Data Sets:

Radar: SMAP L1B LORES (Alaska SAR Facility)

Radiometer: SMAP L1B TB (NSIDC – Boulder, CO)

Rain: NWS NEXRAD Reflectivity (in dBZ) with approximately 1 km resolution, with coverage up to 300 km from each station. Data collected at 6 min intervals

Wind: **URMA** *UnRestricted Mesoscale Analysis* (previously RTMA = Real Time Mesoscale Analysis) NOAA NCEP Product, One hour spacing, with 2.5 to 5 km spatial resolution.

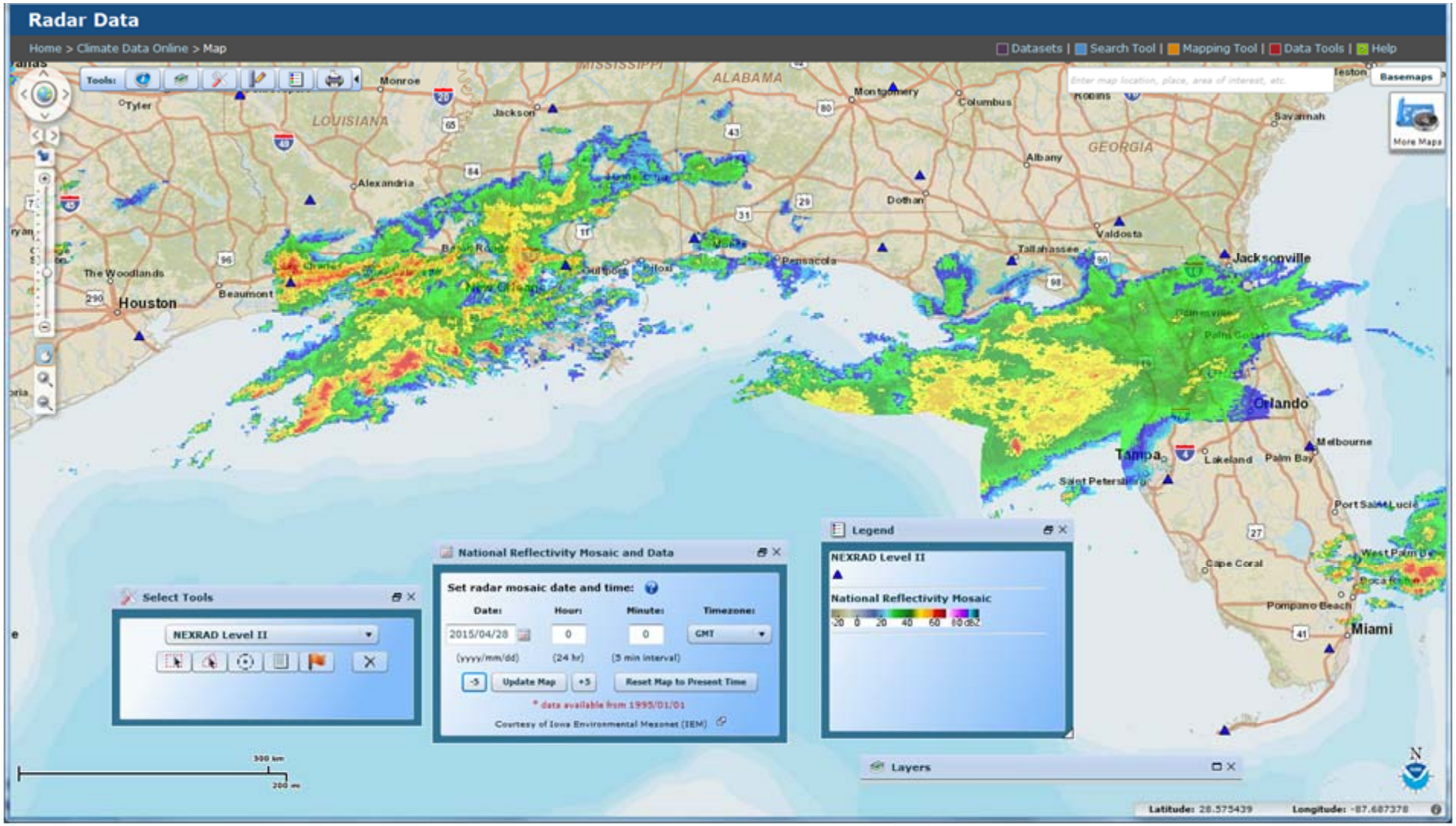
Three Events of Interest

1. April 27, 2015, in Gulf of Mexico, south of New Orleans.

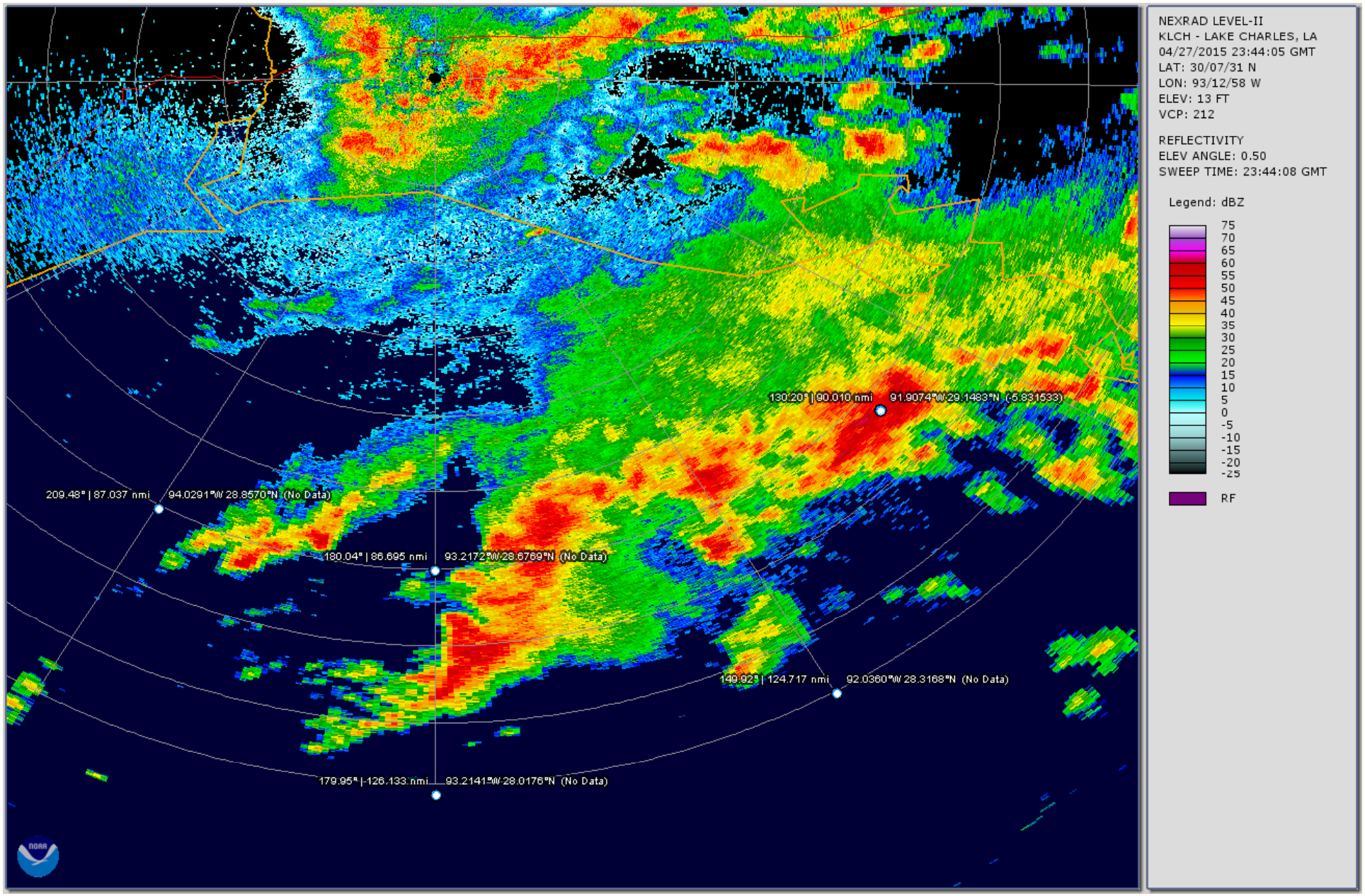
2. April 28, 2015, east of Tampa, Fl.

3. May 15, 2015, southeast of Guam, observing Hurricane Dolphin

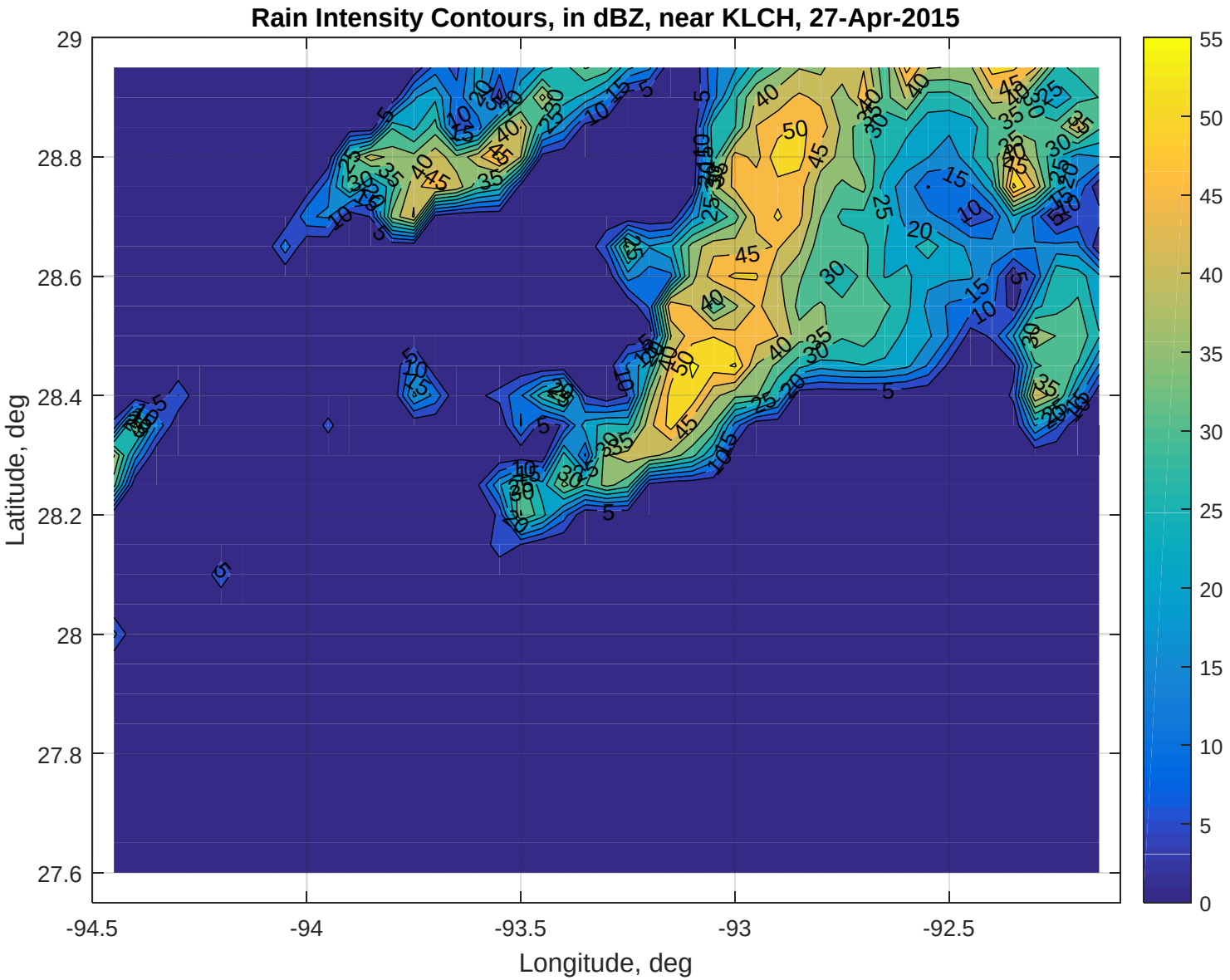
April 27, 2015 @ t=23:35 ; NEXRAD Station KLCH



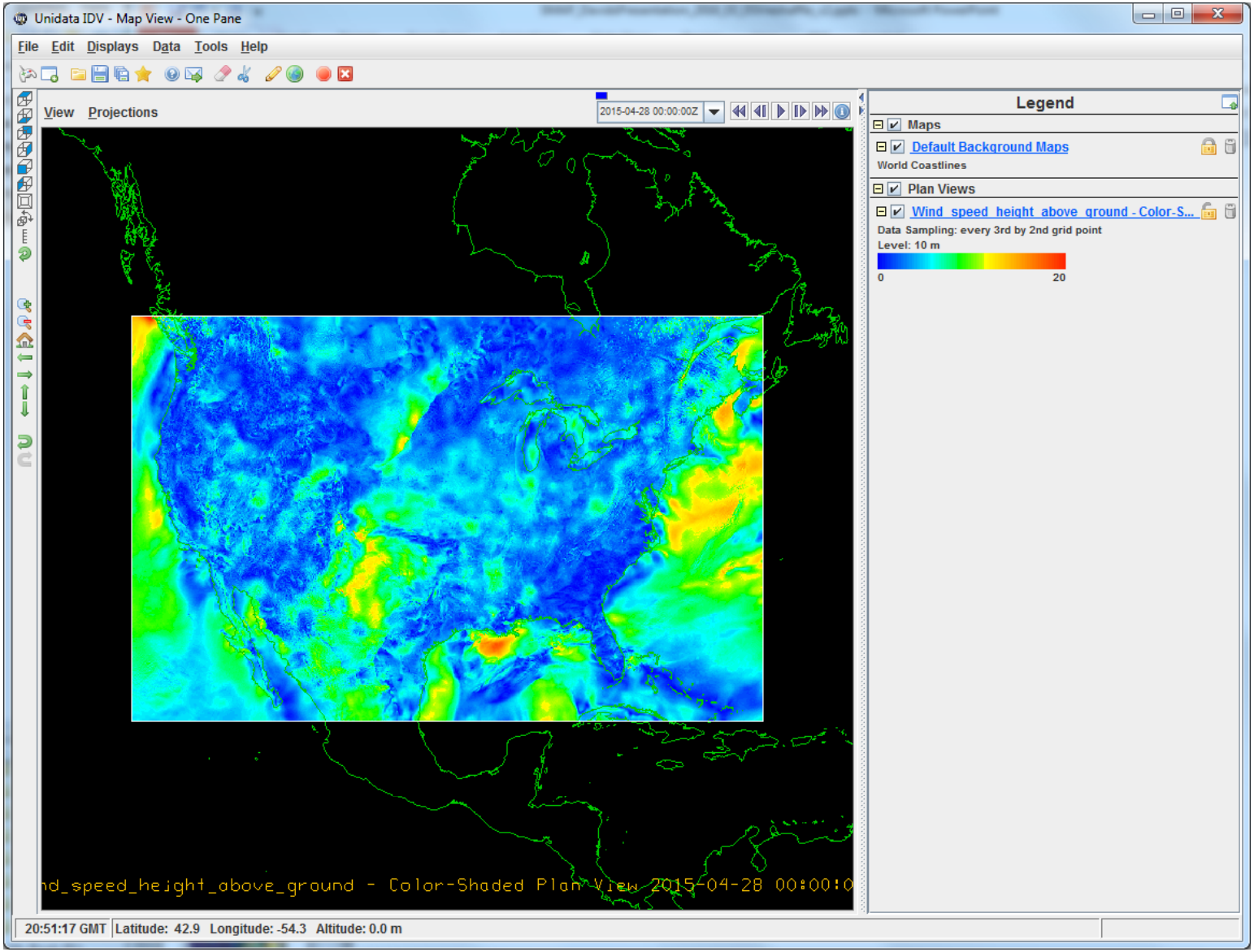
Retrieved data file with 6 minutes of SMAP overpass

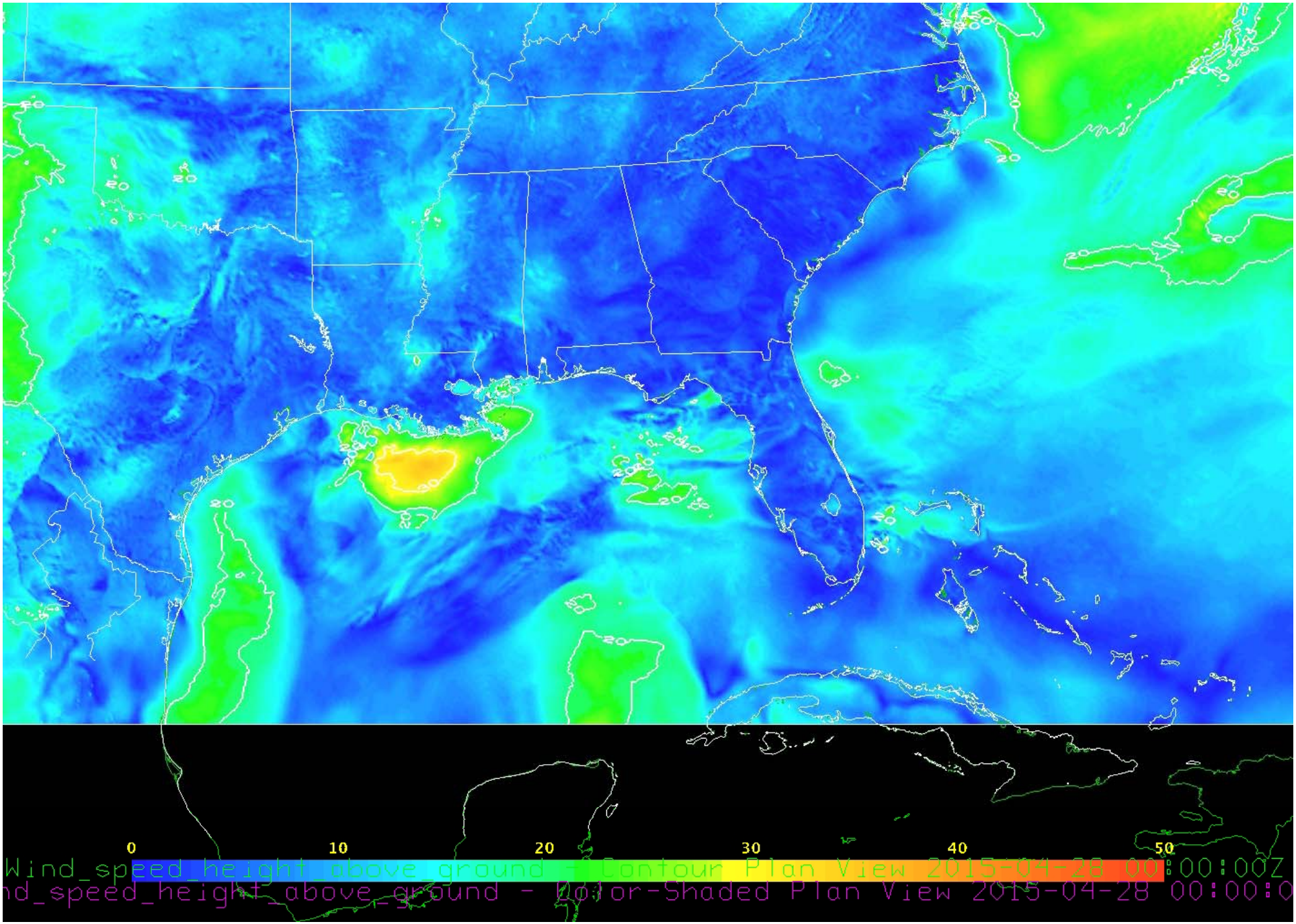


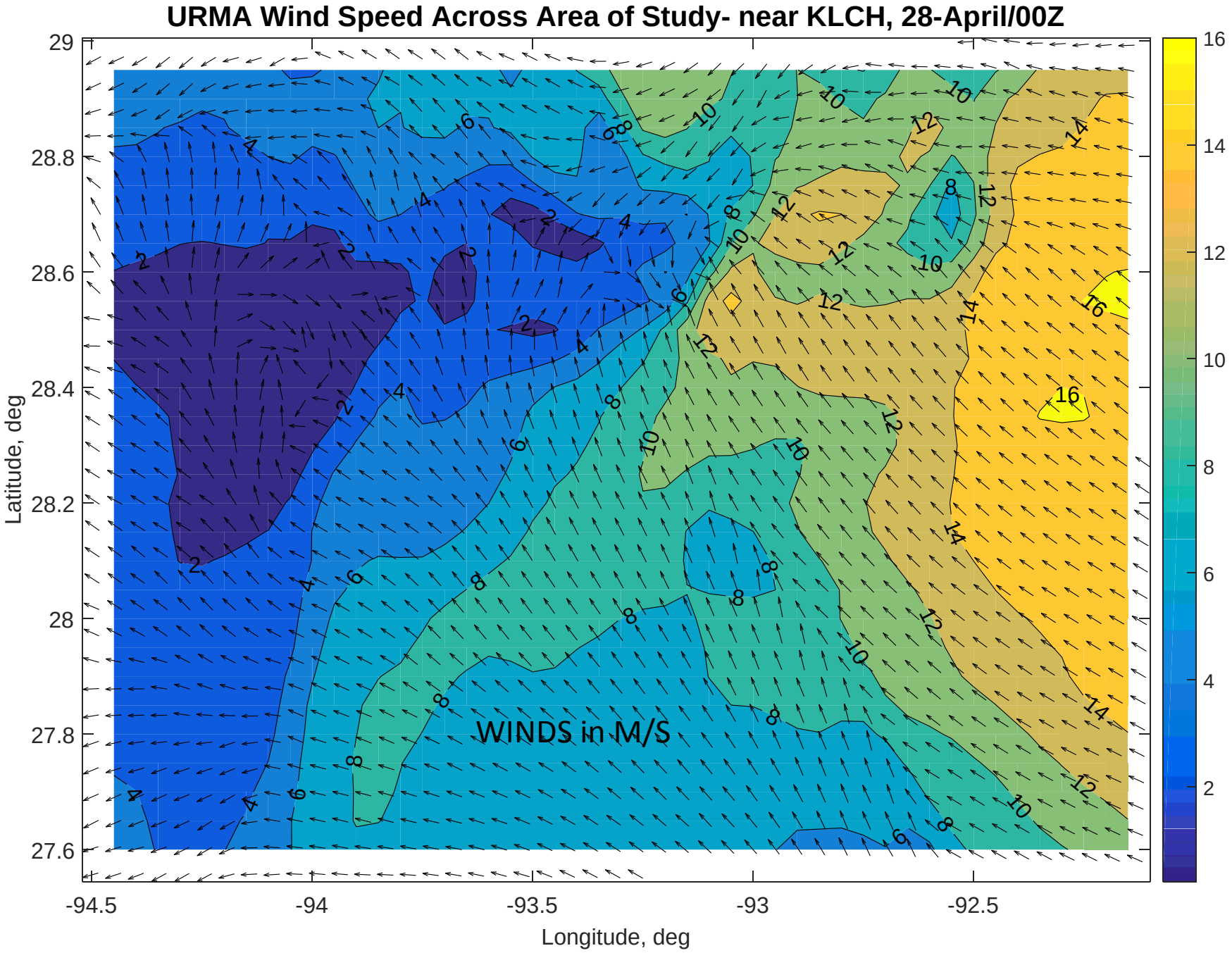
Extracting the gridded rain reflectvity

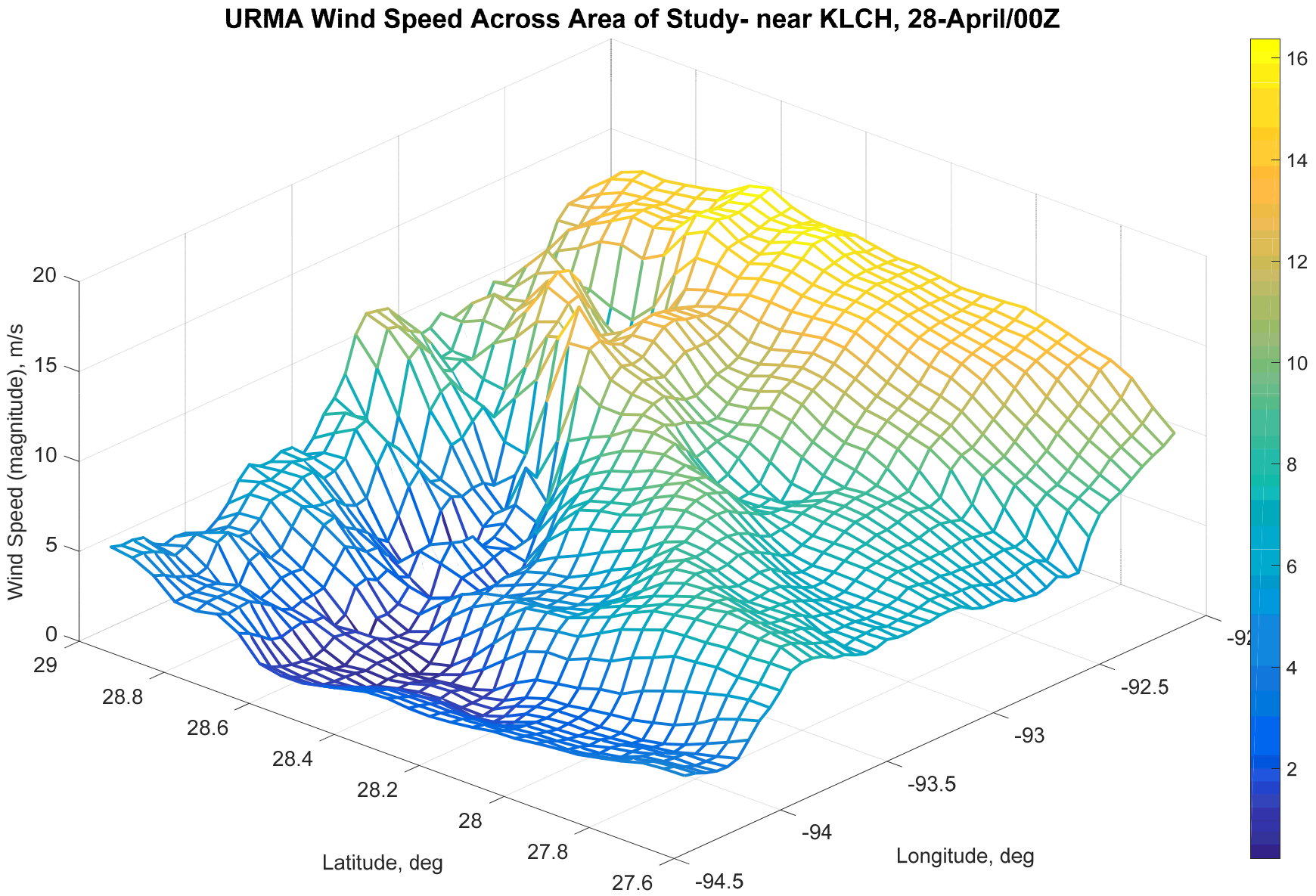


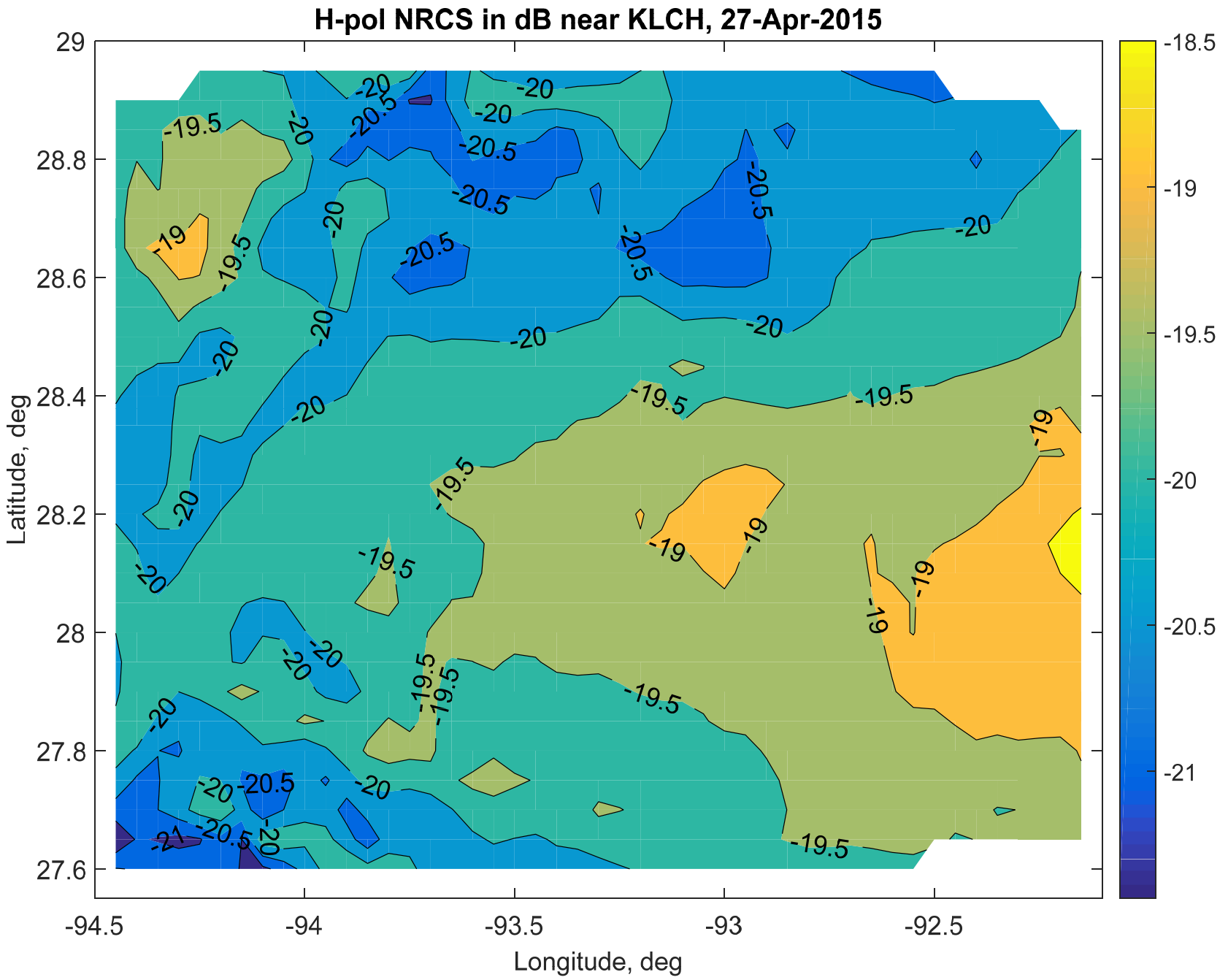
URMA Hourly Winds at 2.5 km Horizontal Resolution across the full Continental U.S. (CONUS)

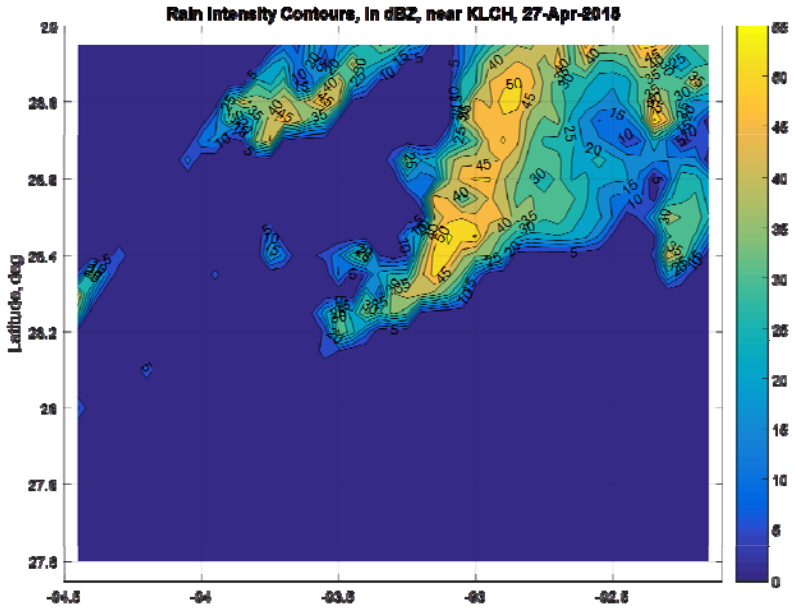


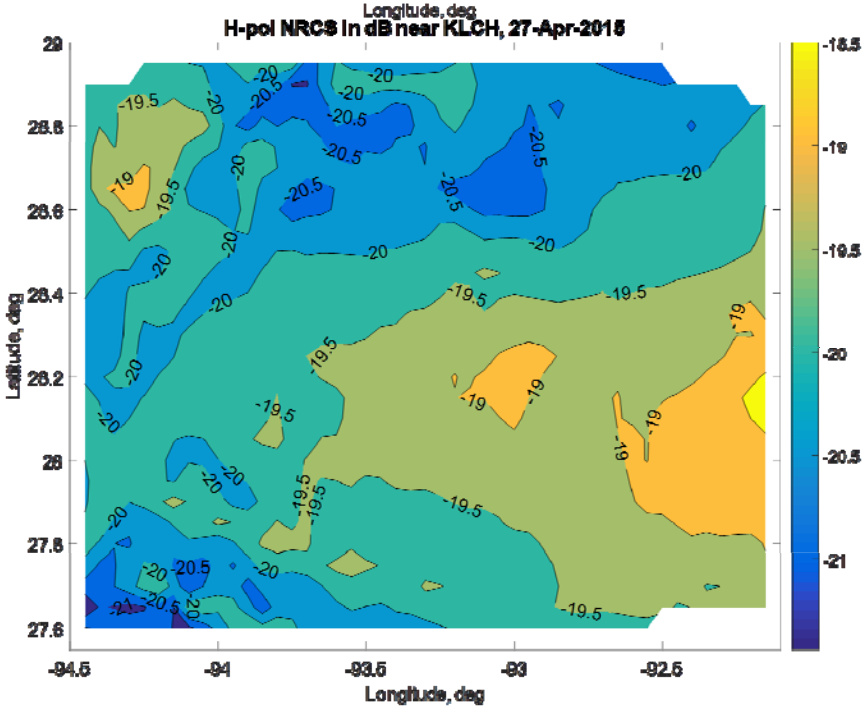

0
10
20
30
40
50
Wind_speed_height_above_ground - Contour Plan View 2015-04-28 00:00:00Z
nd_speed_height_above_ground - Color-Shaded Plan View 2015-04-28 00:00:0

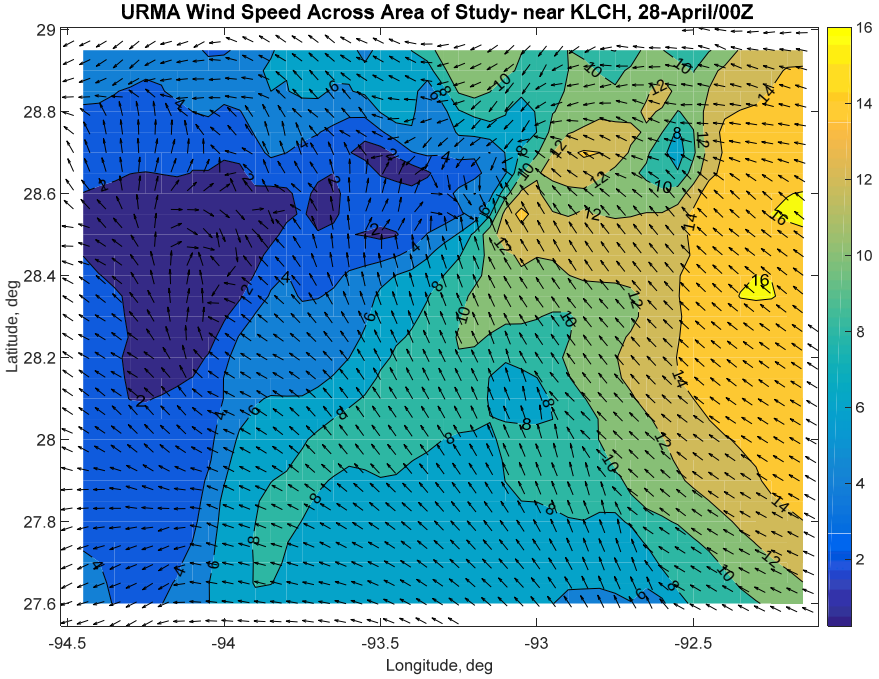

URMA Wind Speed Across Area of Study- near KLCH, 28-April/00Z
Latitude, deg
Longitude, deg
WINDS in M/S
29
28.8
28.6
28.4
28.2
28
27.8
27.6
-94.5
-94
-93.5
-93
-92.5
16
14
12
10
8
6
4
2

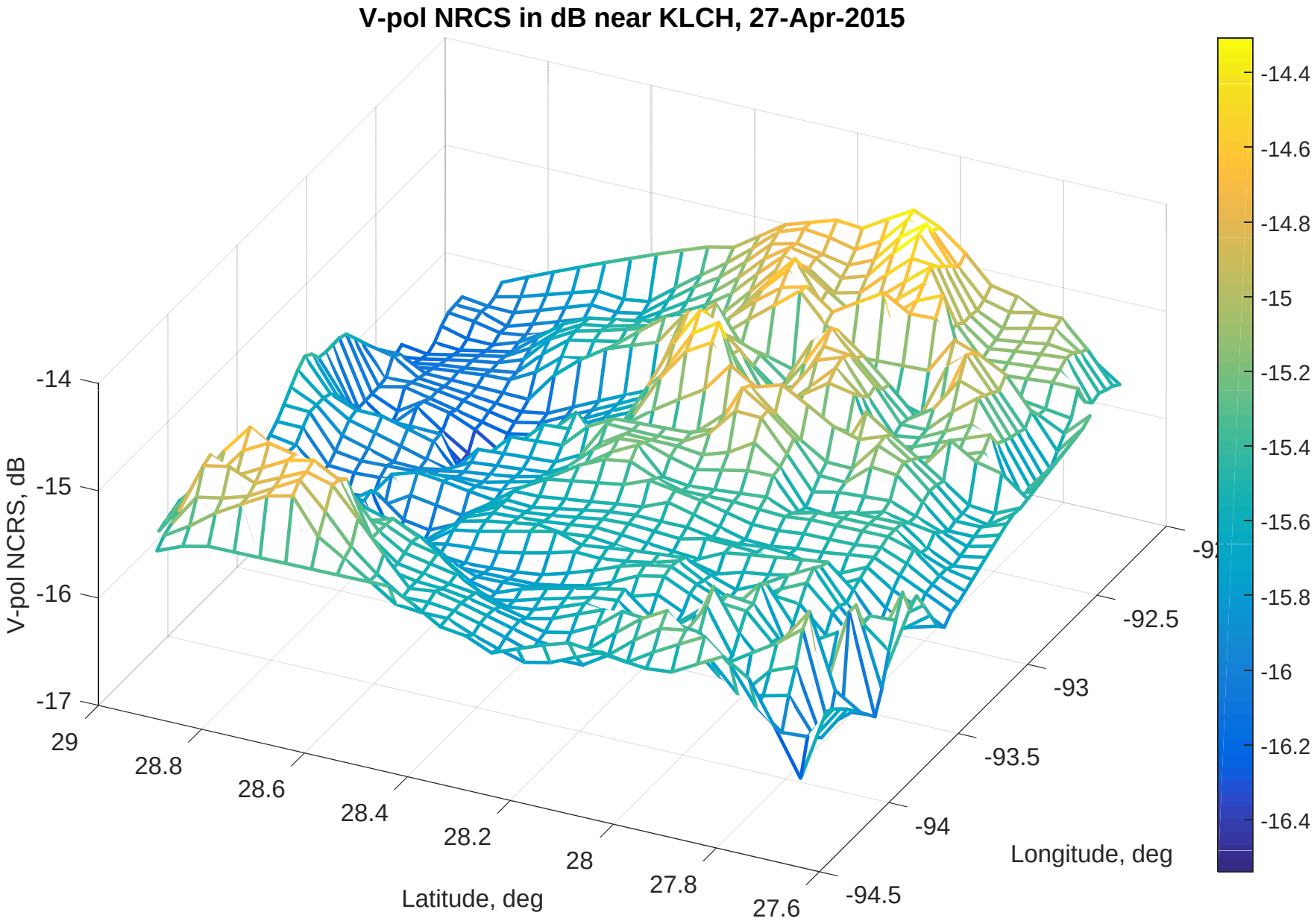

URMA Wind Speed Across Area of Study- near KLCH, 28-April/00Z
Wind Speed (magnitude), m/s
20
15
10
5
0
29
28.8
28.6
28.4
28.2
28
27.8
27.6
Latitude, deg
-94.5
-94
-93.5
-93
-92.5
Longitude, deg
16
14
12
10
8
6
4
2

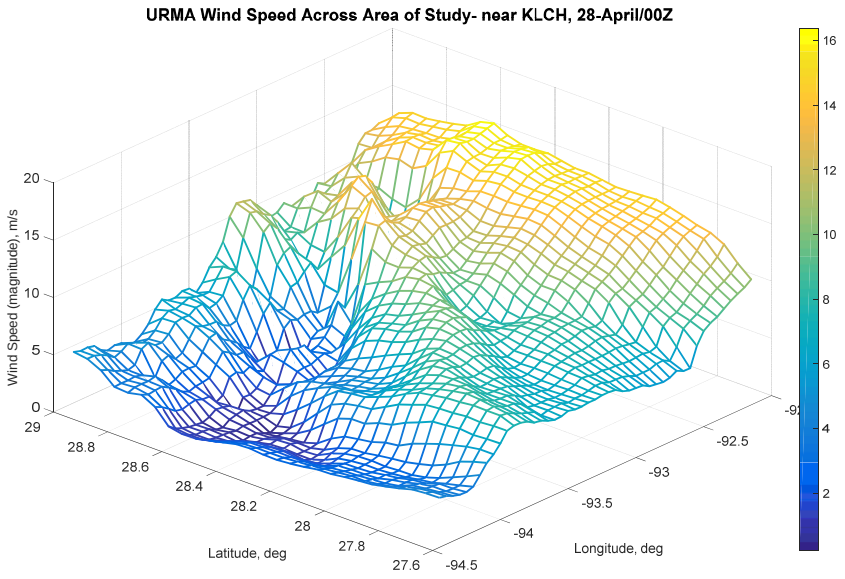

H-pol NRCS in dB near KLCH, 27-Apr-2015
Latitude, deg
Longitude, deg
29
28.8
28.6
28.4
28.2
28
27.8
27.6
-94.5
-94
-93.5
-93
-92.5
-18.5
-19
-19.5
-20
-20.5
-21

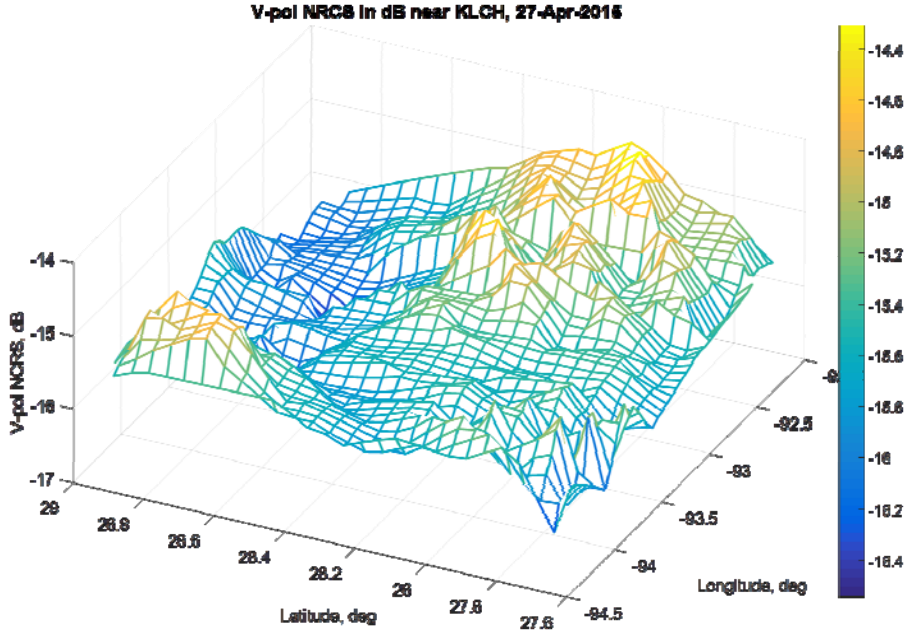

Rain Intensity Contours, in dBZ, near KLCH, 27-Apr-2015
Latitude, deg
Longitude, deg

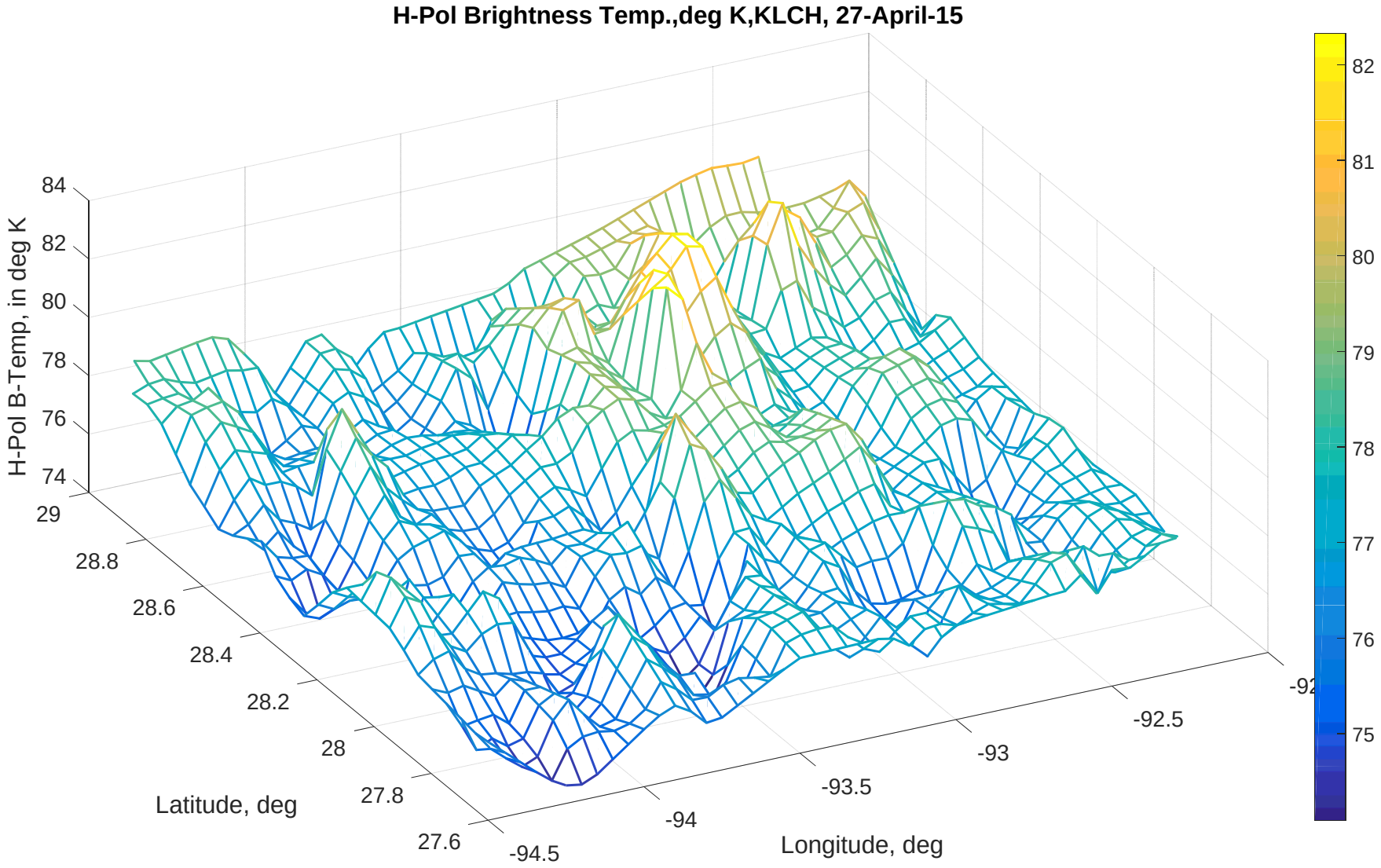

H-pol NRCS in dB near KLCH, 27-Apr-2015
Latitude, deg
Longitude, deg


URMA Wind Speed Across Area of Study- near KLCH, 28-April/00Z
Latitude, deg
Longitude, deg

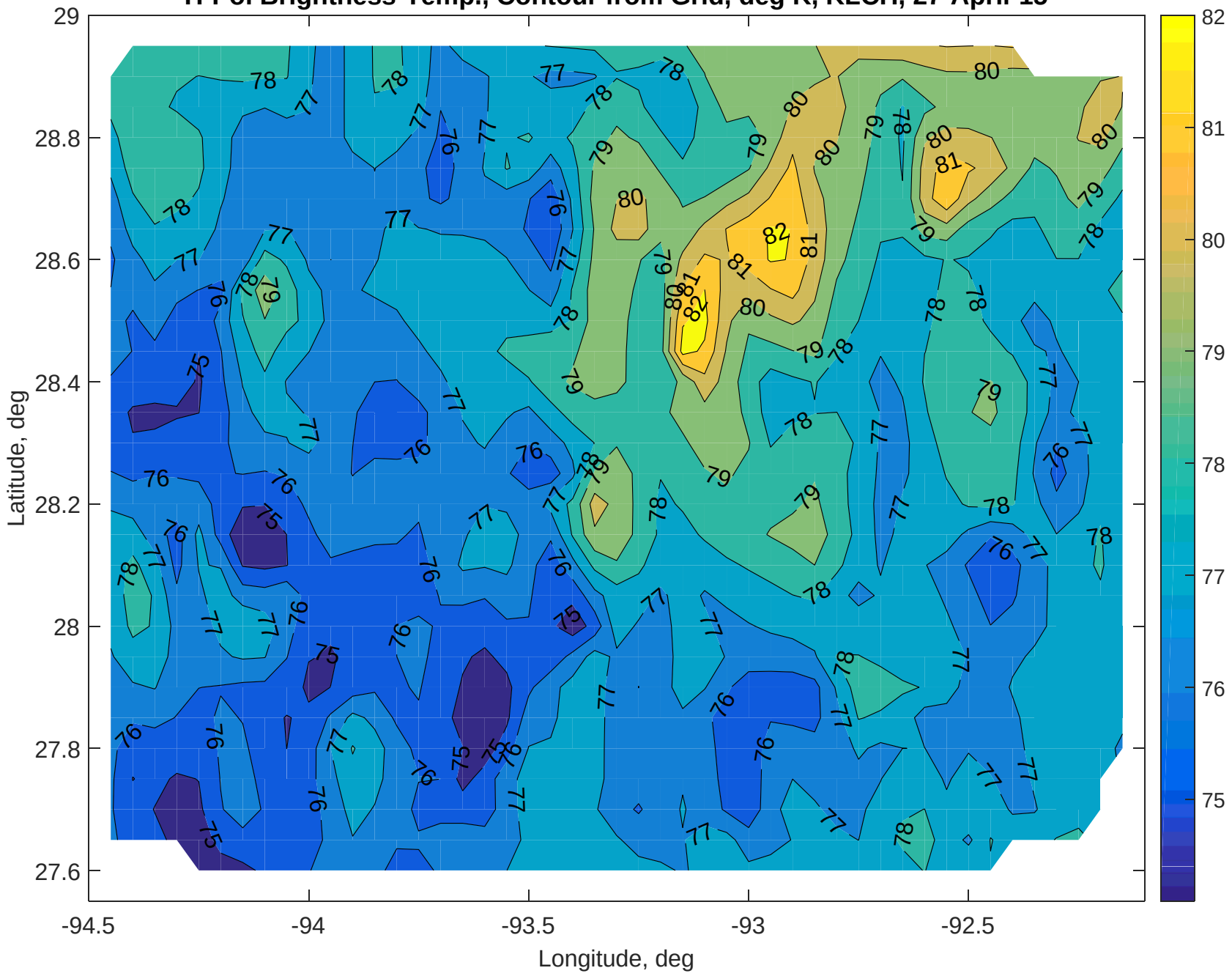

V-pol NRCS in dB near KLCH, 27-Apr-2015
V-pol NCRS, dB
-14
-15
-16
-17
Latitude, deg
29
28.8
28.6
28.4
28.2
28
27.8
27.6
Longitude, deg
-92.5
-93
-93.5
-94
-94.5
-14.4
-14.6
-14.8
-15
-15.2
-15.4
-15.6
-15.8
-16
-16.2
-16.4

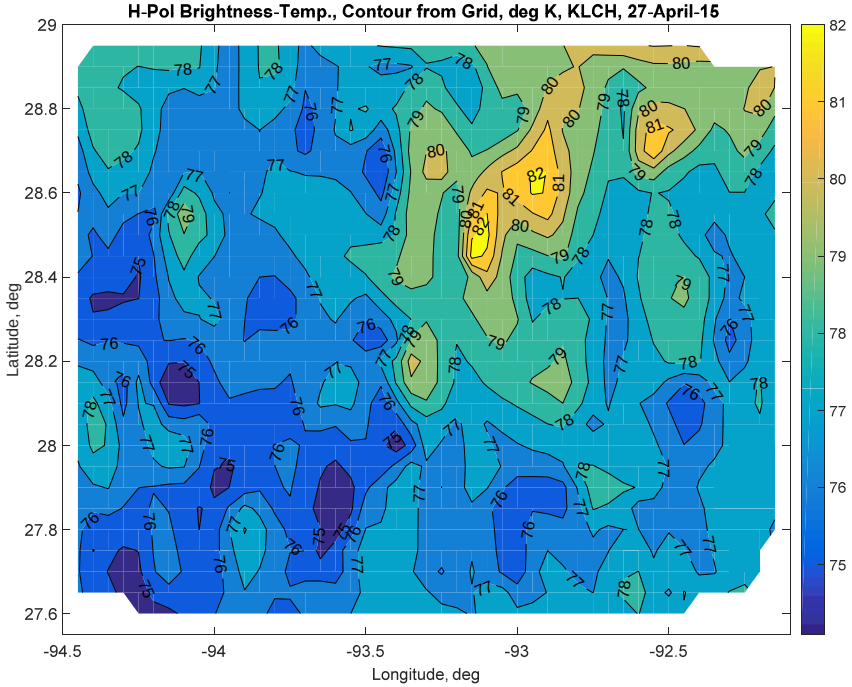

URMA Wind Speed Across Area of Study- near KLCH, 28-April/00Z
Wind Speed (magnitude), m/s
20
15
10
5
0
29
28.8
28.6
28.4
28.2
28
27.8
27.6
Latitude, deg
-94.5
-94
-93.5
-93
-92.5
Longitude, deg
16
14
12
10
8
6
4
2

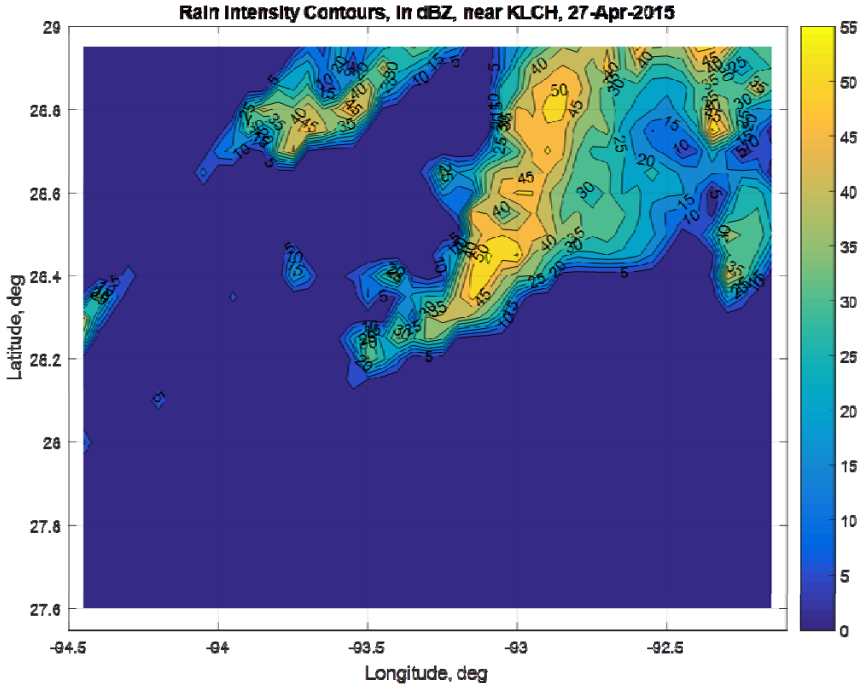

V-pol NRCS in dB near KLCH, 27-Apr-2015
V-pol NCRS, dB
-14
-15
-16
-17
29
28.8
28.6
28.4
28.2
28
27.8
27.6
Latitude, deg
-94.5
-94
-93.5
-93
-92.5
Longitude, deg
-14.4
-14.6
-14.8
-15
-15.2
-15.4
-15.6
-15.8
-16
-16.2
-16.4

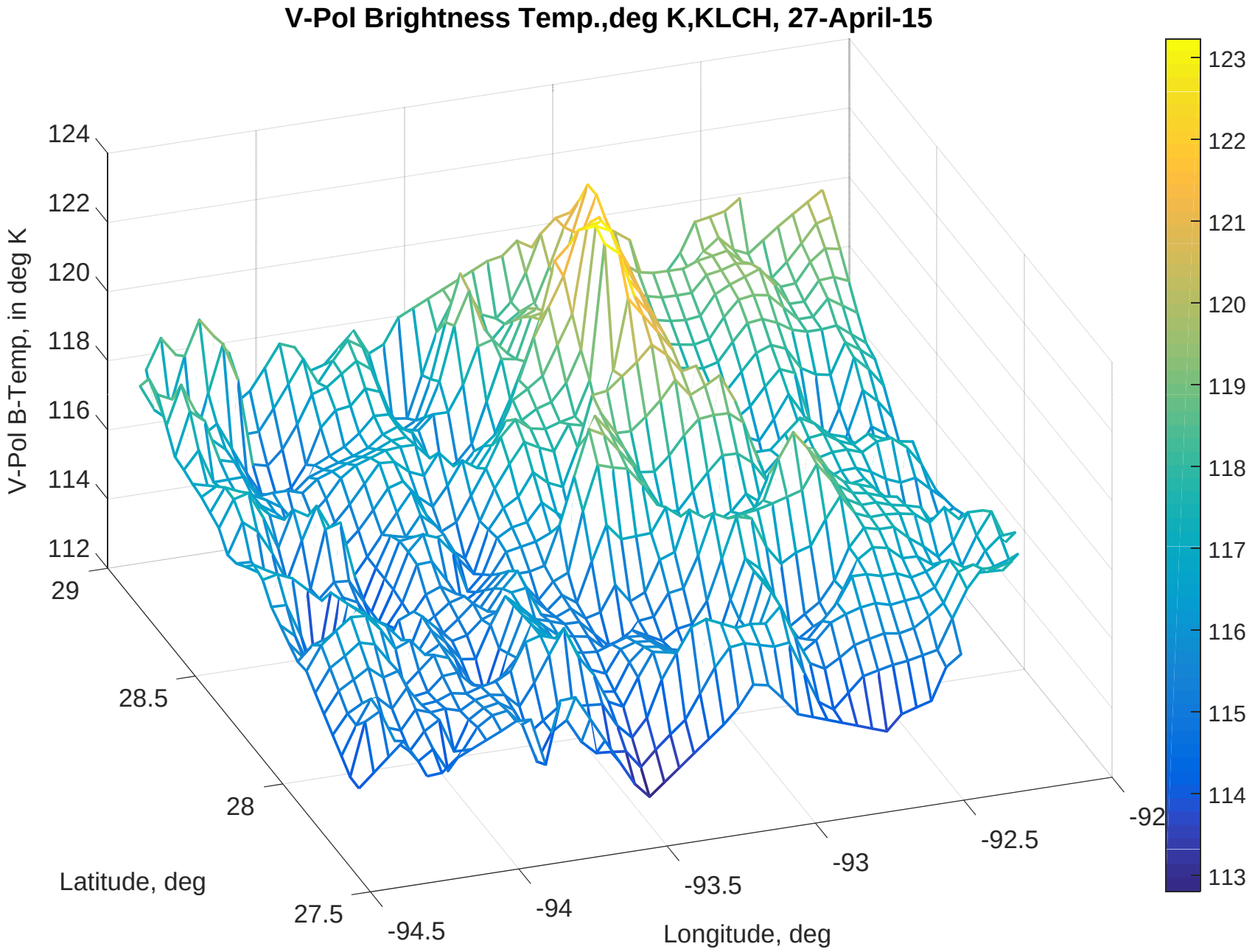


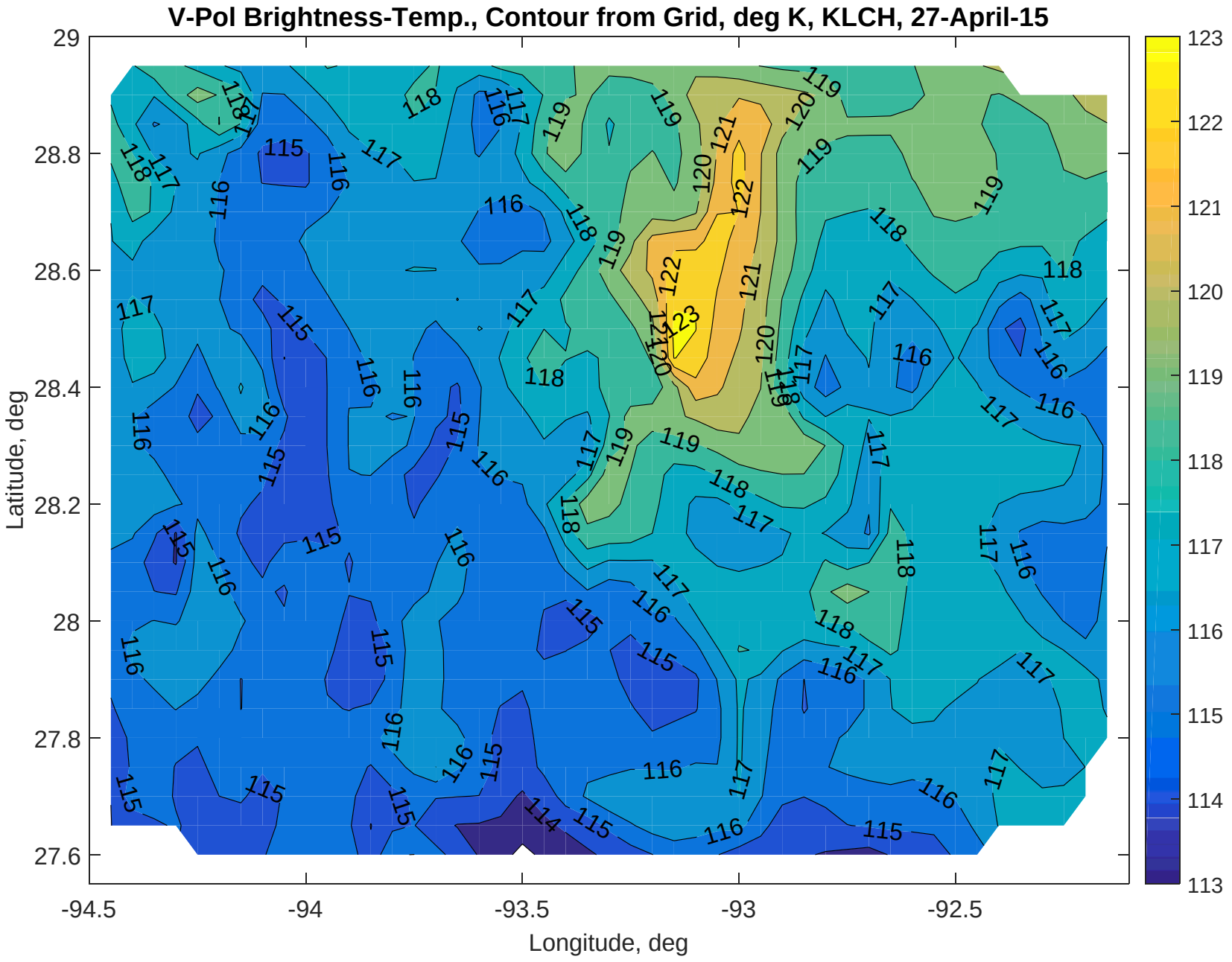
NOTE: The highest Tbh occurs where the rain intensity is largest


H-Pol Brightness-Temp., Contour from Grid, deg K, KLCH, 27-April-15
Latitude, deg
Longitude, deg
29
28.8
28.6
28.4
28.2
28
27.8
27.6
-94.5
-94
-93.5
-93
-92.5
82
81
80
79
78
77
76
75


H-Pol Brightness-Temp., Contour from Grid, deg K, KLCH, 27-April-15
Latitude, deg
Longitude, deg
29
28.8
28.6
28.4
28.2
28
27.8
27.6
-94.5
-94
-93.5
-93
-92.5
82
81
80
79
78
77
76
75

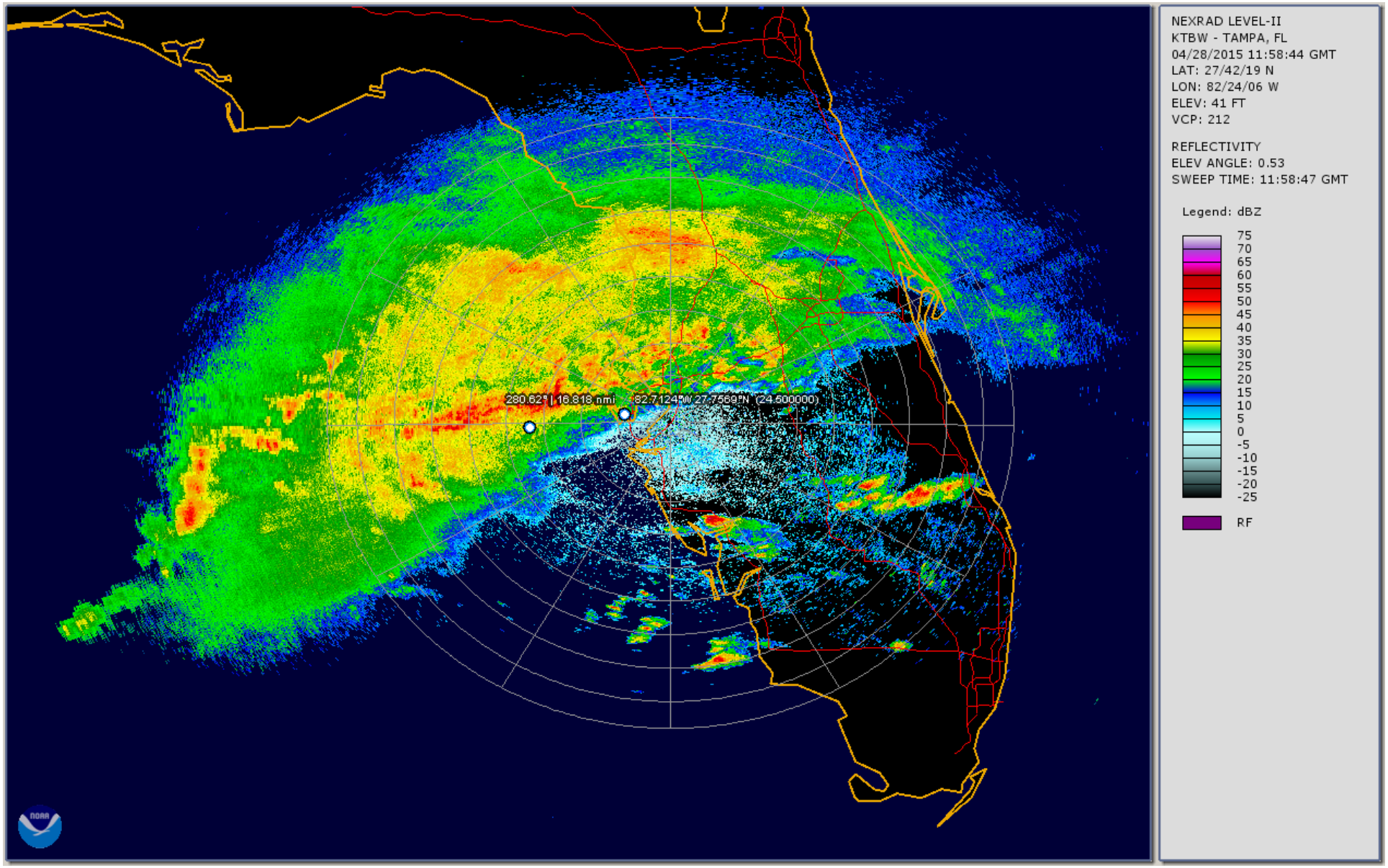

Rain Intensity Contours, in dBZ, near KLCH, 27-Apr-2015
Latitude, deg
Longitude, deg
29
28.8
28.6
28.4
28.2
28
27.8
27.6
-94.5
-94
-93.5
-93
-92.5
55
50
45
40
35
30
25
20
15
10
5
0

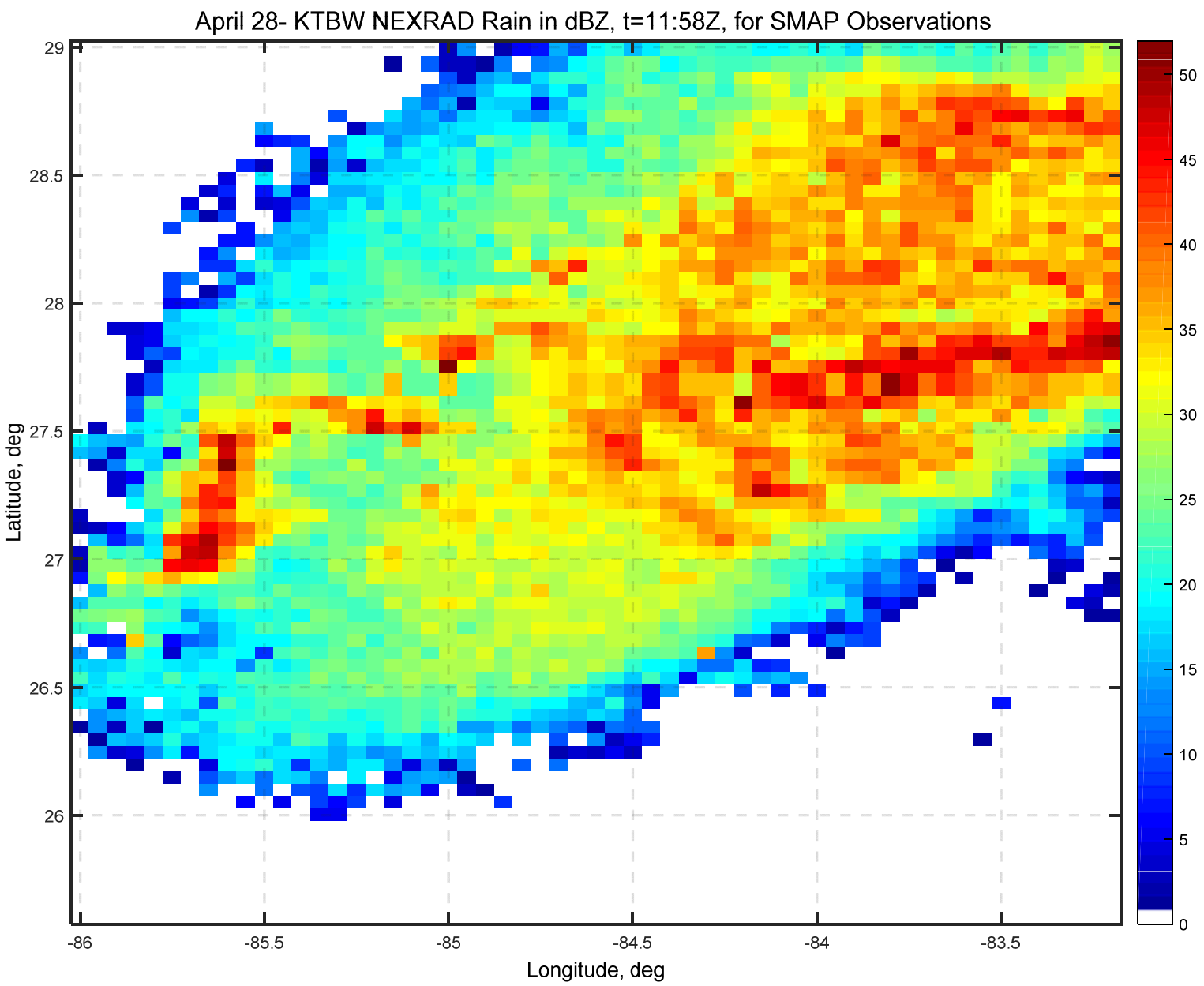

V-Pol Brightness Temp.,deg K,KLCH, 27-April-15
V-Pol B-Temp, in deg K
124
122
120
118
116
114
112
29
28.5
28
27.5
Latitude, deg
-94.5
-94
-93.5
-93
-92.5
-92
Longitude, deg
123
122
121
120
119
118
117
116
115
114
113

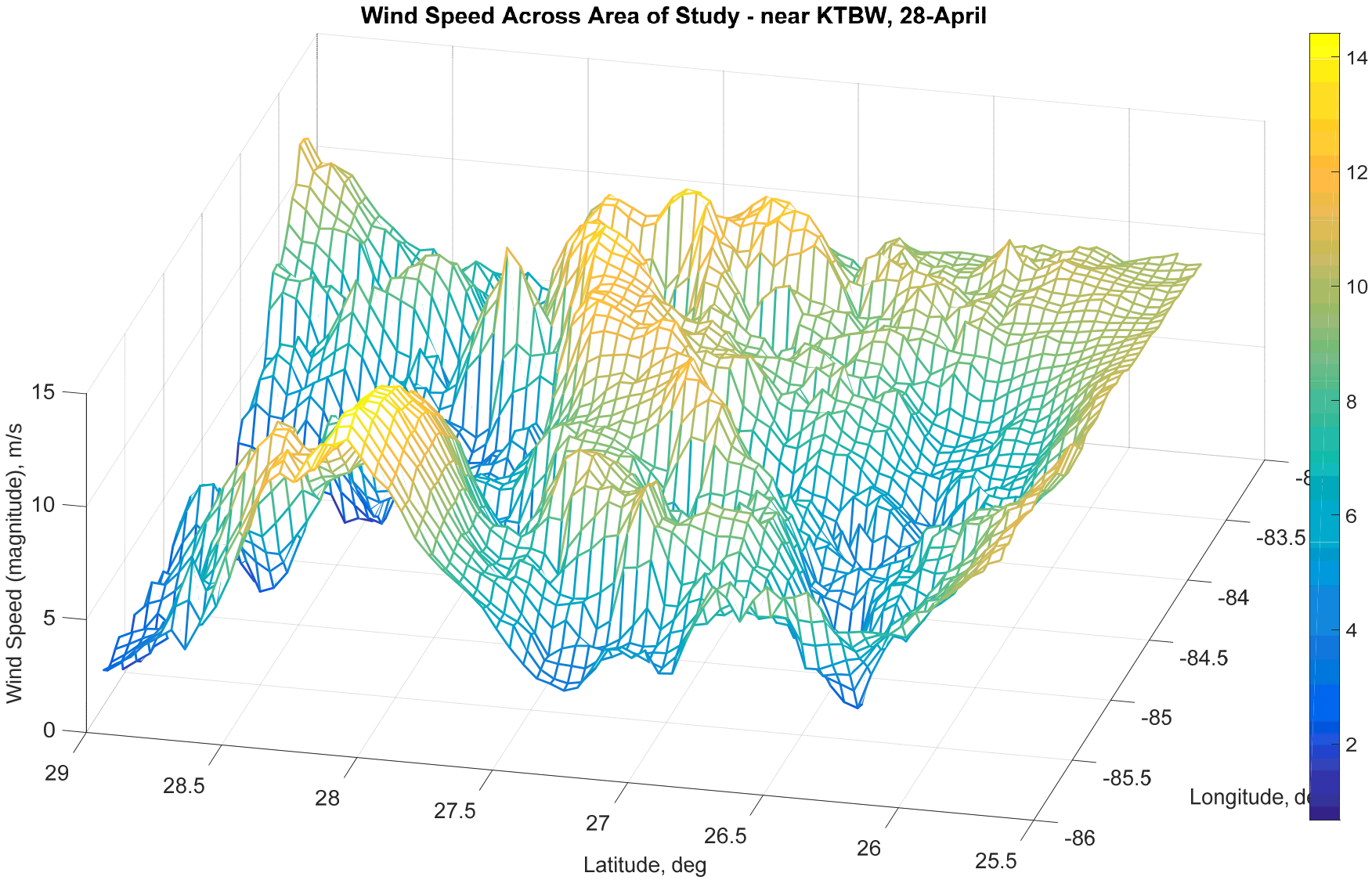

V-Pol Brightness-Temp., Contour from Grid, deg K, KLCH, 27-April-15
Latitude, deg
Longitude, deg
29
28.8
28.6
28.4
28.2
28
27.8
27.6
-94.5
-94
-93.5
-93
-92.5
123
122
121
120
119
118
117
116
115
114
113

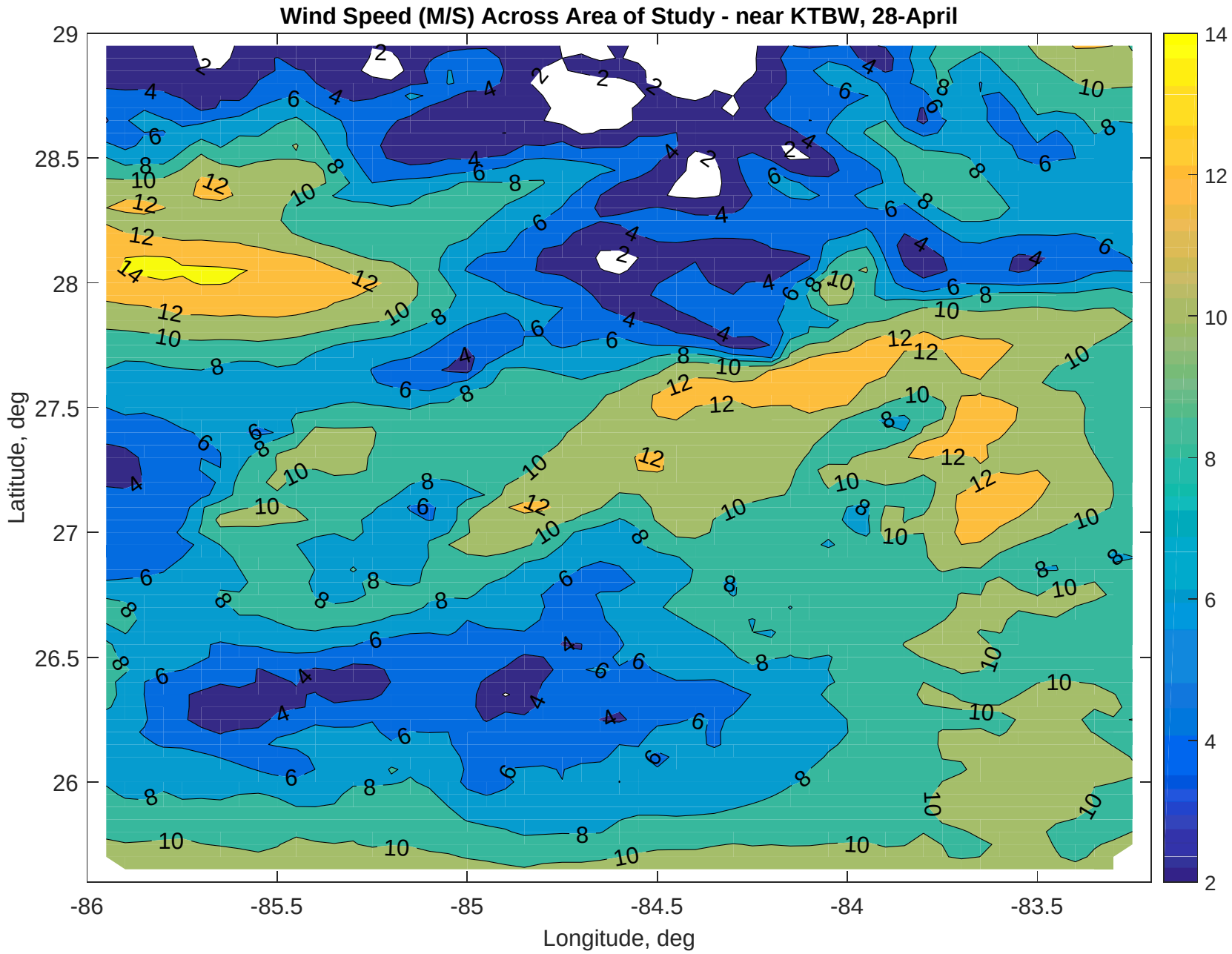
Rain event during SMAP Orbit 1271, 28-April-15

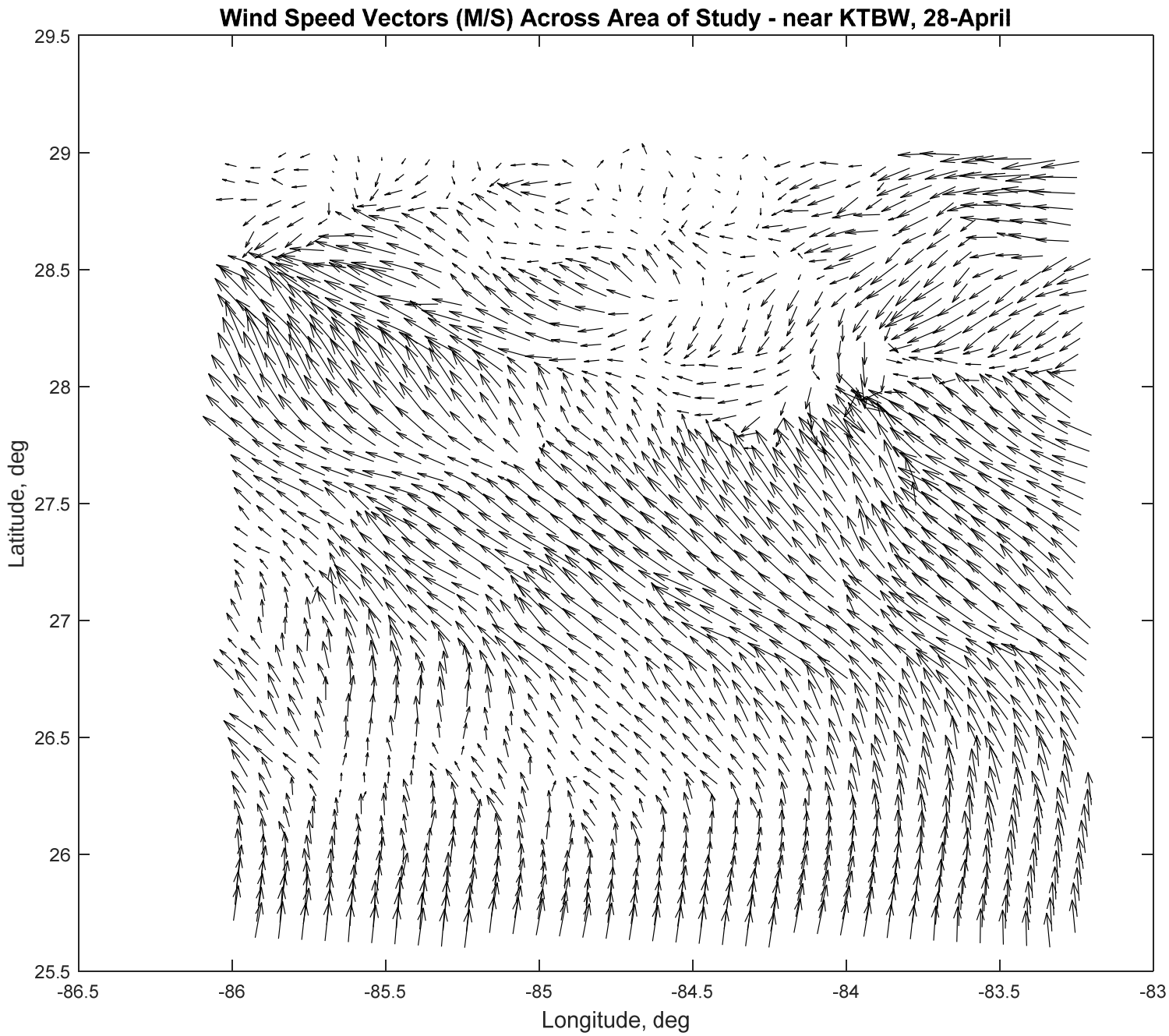
NEXRAD Radar at Tampa, FL, KTBW

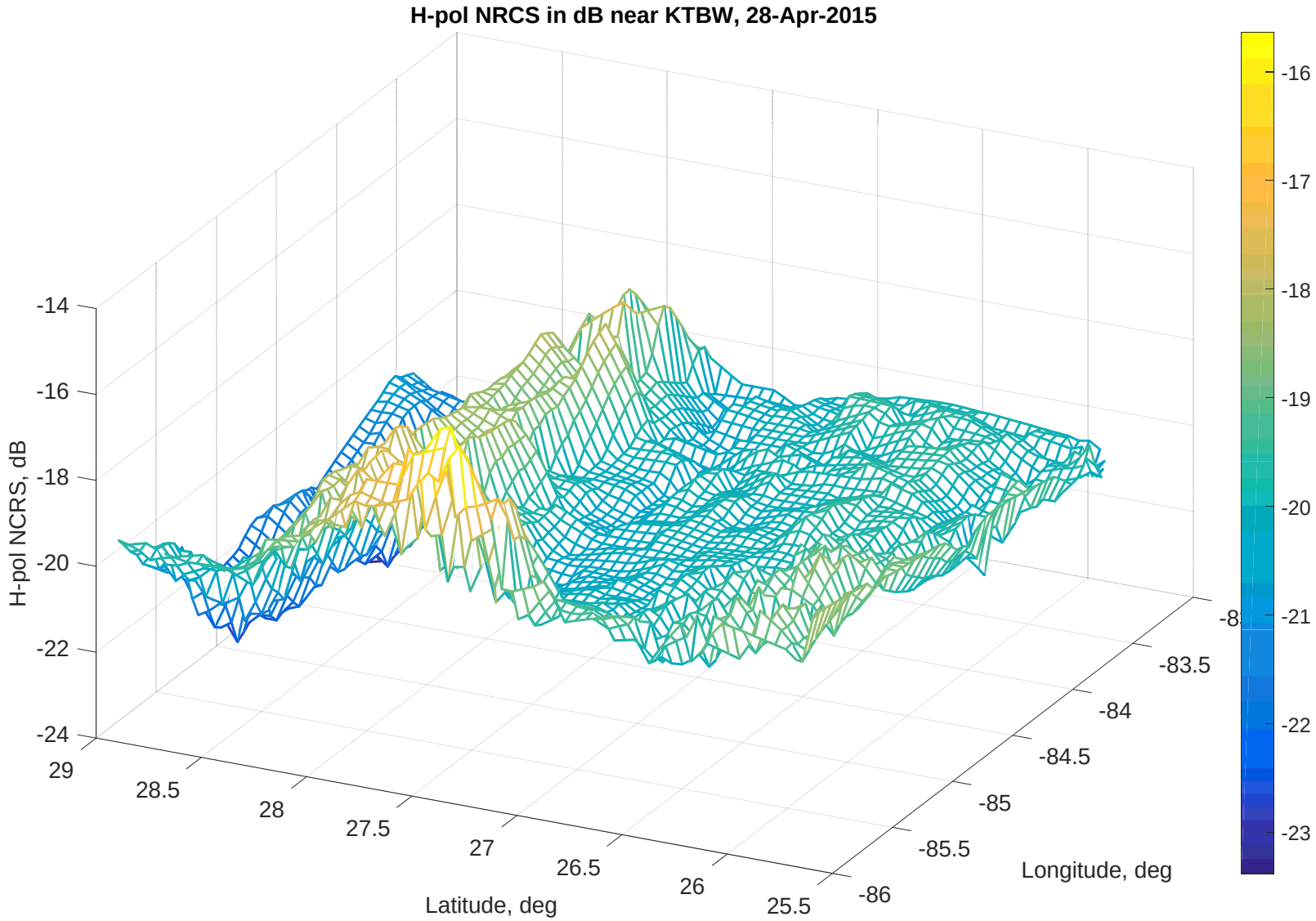

NEXRAD LEVEL-II
KTBW - TAMPA, FL
04/28/2015 11:58:44 GMT
LAT: 27/42/19 N
LON: 82/24/06 W
ELEV: 41 FT
VCP: 212
REFLECTIVITY
ELEV ANGLE: 0.53
SWEEP TIME: 11:58:47 GMT
Legend: dBZ
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
RF
280.62° | 16.818 nmi
82.7124°W 27.7569°N (24.600000)


April 28- KTBW NEXRAD Rain in dBZ, t=11:58Z, for SMAP Observations
Latitude, deg
Longitude, deg
29
28.5
28
27.5
27
26.5
26
-86
-85.5
-85
-84.5
-84
-83.5
50
45
40
35
30
25
20
15
10
5
0

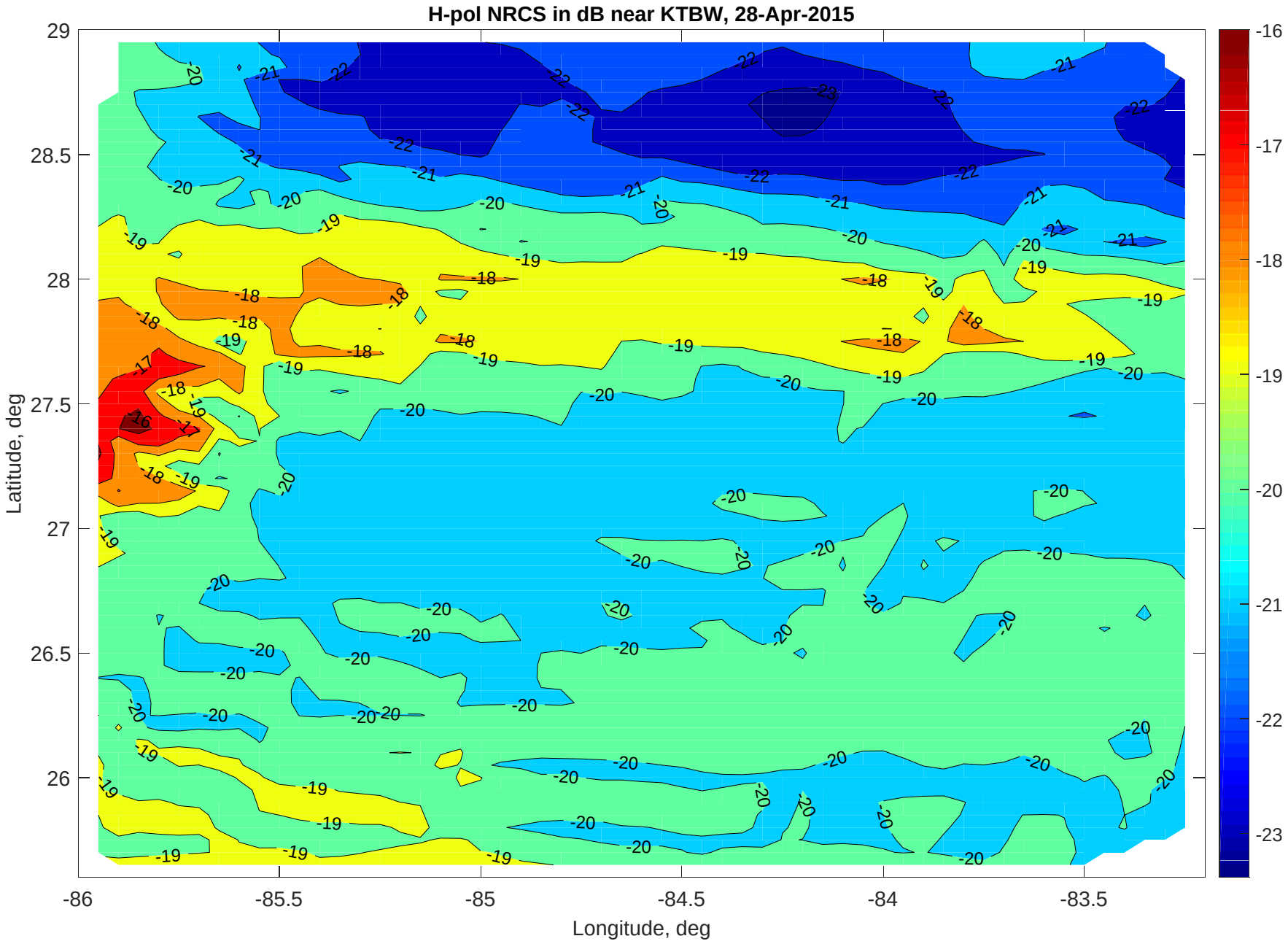

Wind Speed Across Area of Study - near KTBW, 28-April
Wind Speed (magnitude), m/s
15
10
5
0
29
28.5
28
27.5
27
26.5
26
25.5
Latitude, deg
-83.5
-84
-84.5
-85
-85.5
-86
Longitude, d
14
12
10
8
6
4
2

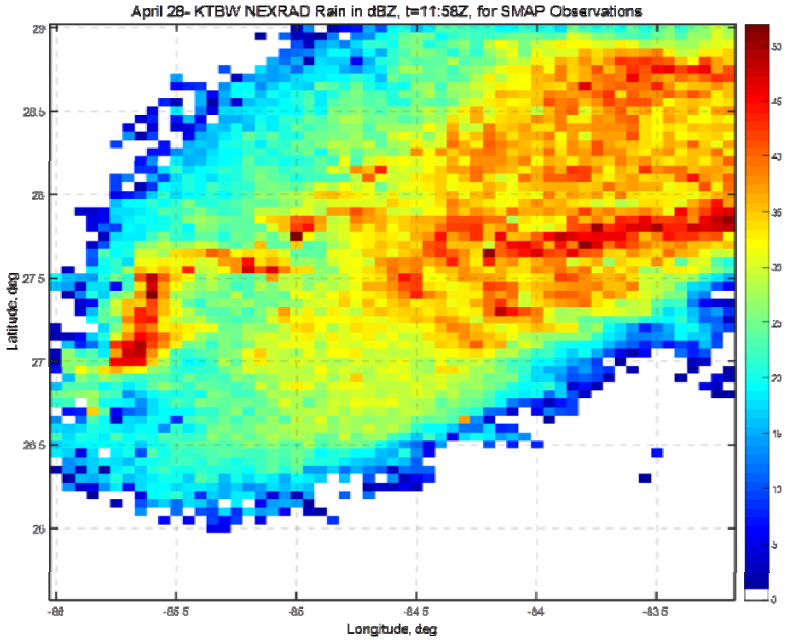

Wind Speed (M/S) Across Area of Study - near KTBW, 28-April
Latitude, deg
Longitude, deg
29
28.5
28
27.5
27
26.5
26
-86
-85.5
-85
-84.5
-84
-83.5
14
12
10
8
6
4
2

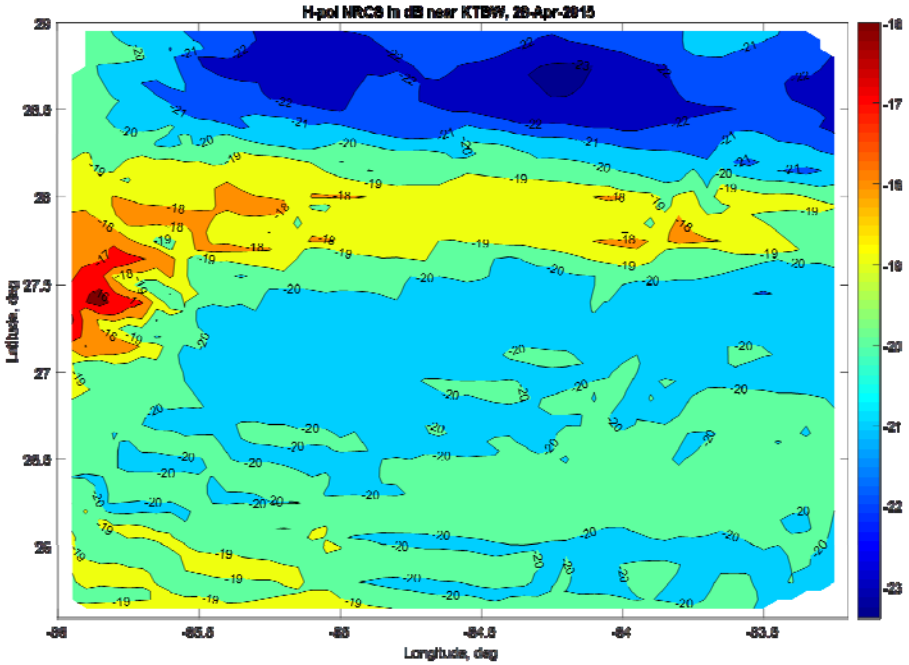

Wind Speed Vectors (M/S) Across Area of Study - near KTBW, 28-April
29.5
29
28.5
28
27.5
27
26.5
26
25.5
Latitude, deg
-86.5
-86
-85.5
-85
-84.5
-84
-83.5
-83
Longitude, deg

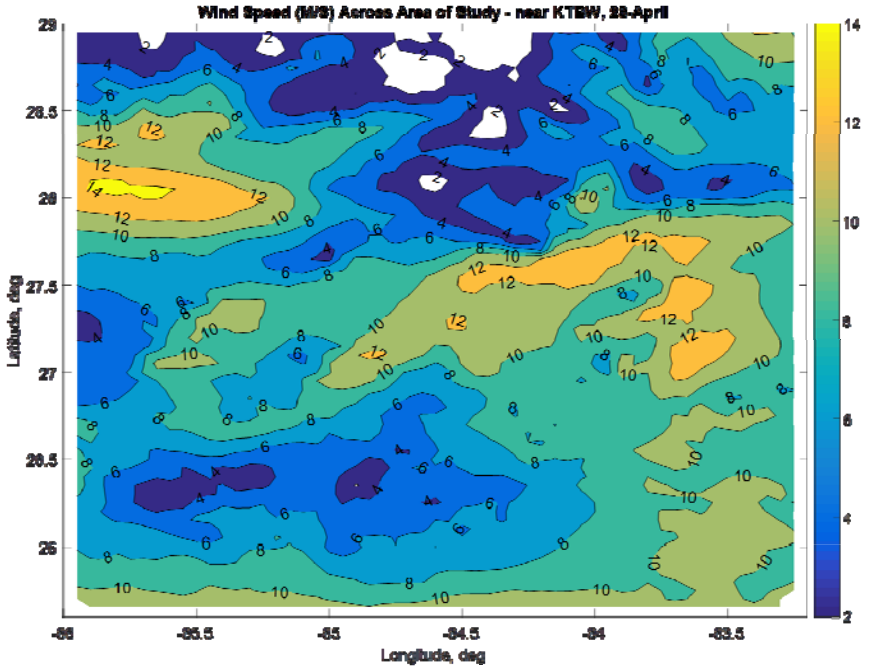


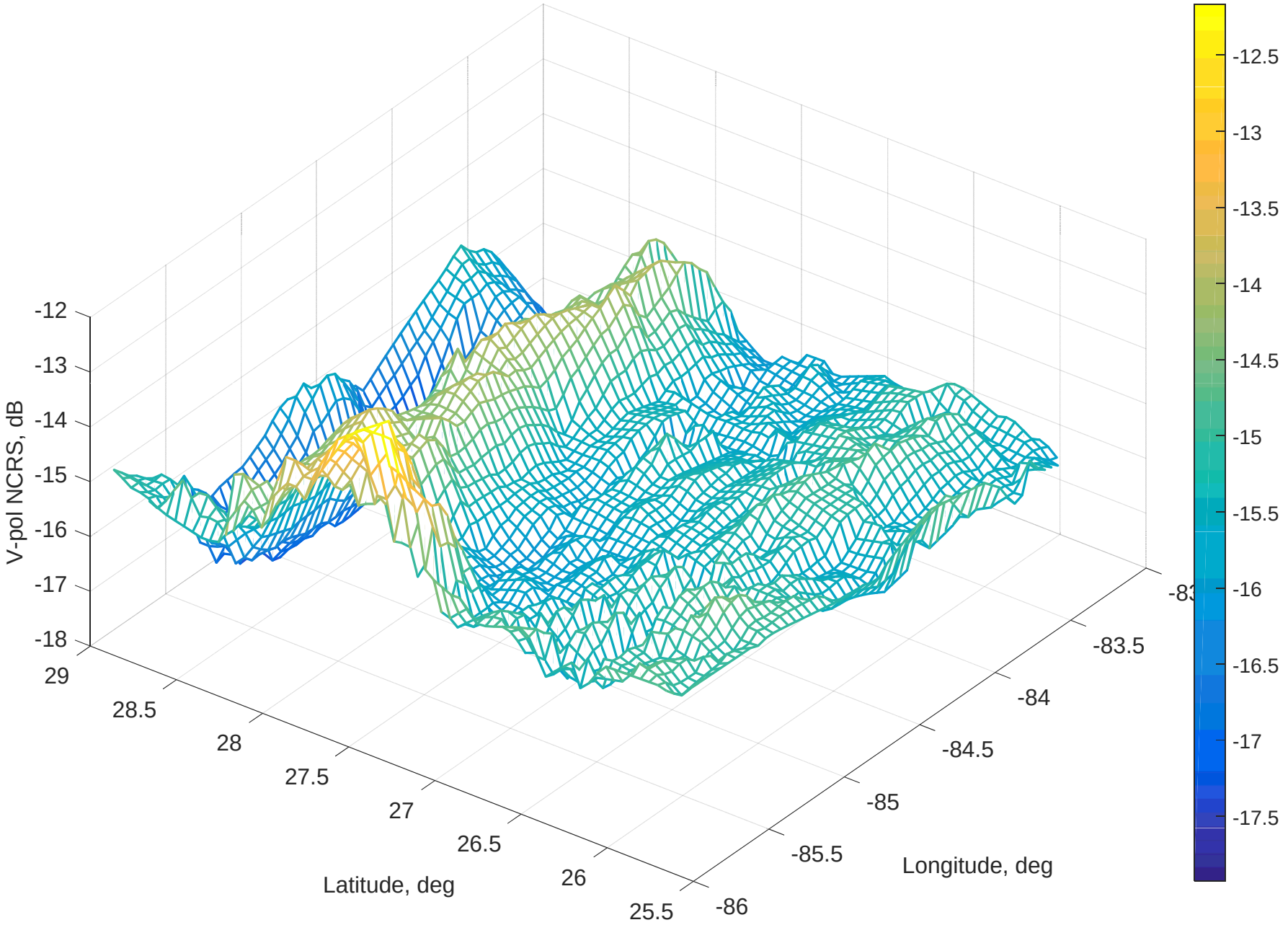
In area where the wind speeds were low, the rain increases the NRCS; but in western section high wind and rain also caused higher NRCS

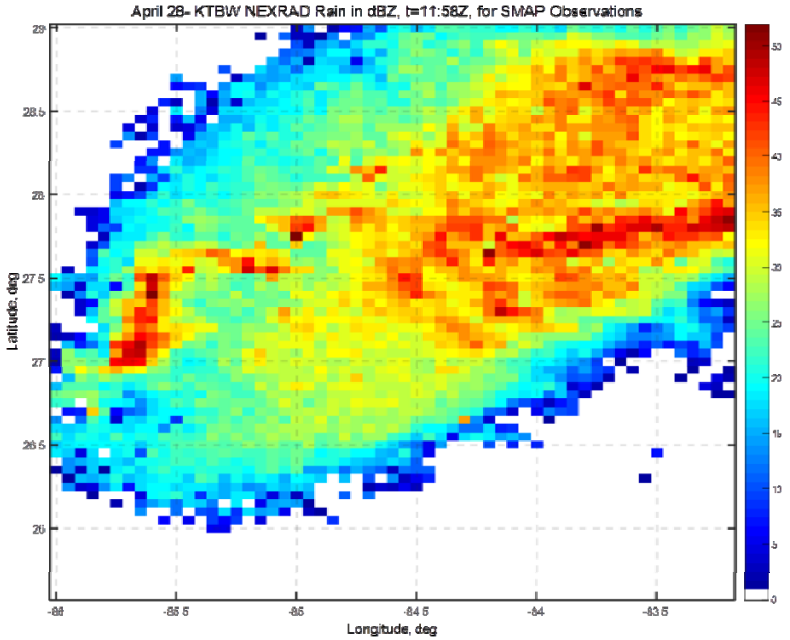

H-pol NRCS in dB near KTBW, 28-Apr-2015
Latitude, deg
Longitude, deg
29
28.5
28
27.5
27
26.5
26
-86
-85.5
-85
-84.5
-84
-83.5
-16
-17
-18
-19
-20
-21
-22
-23

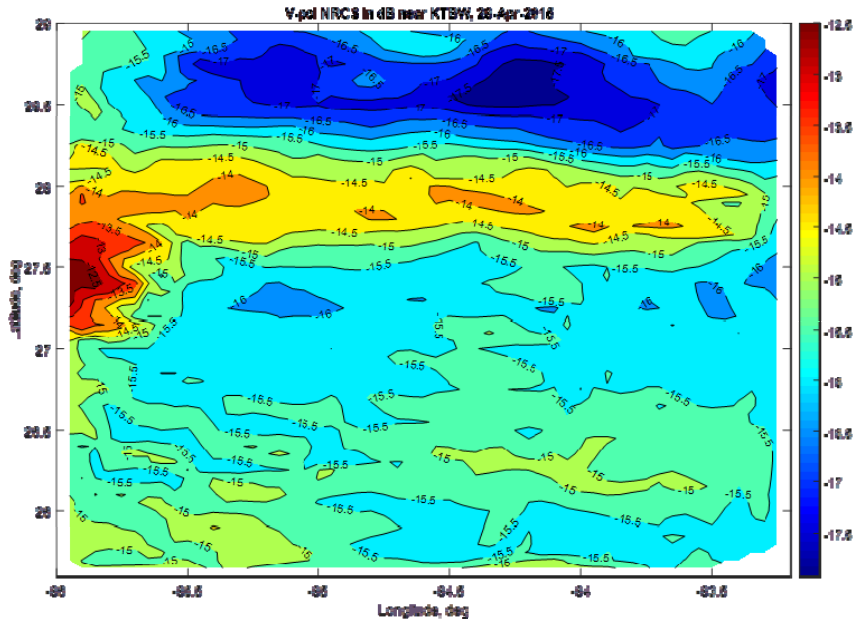

April 28- KTBW NEXRAD Rain in dBZ, t=11:58Z, for SMAP Observations
Latitude, deg
Longitude, deg

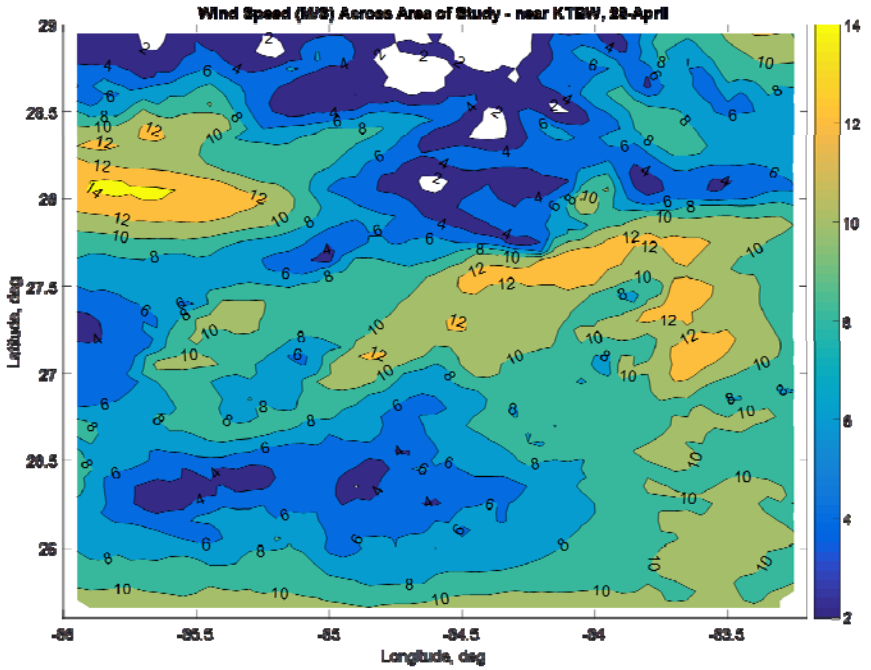

H-pol NRCS in dB near KTBW, 28-Apr-2015
Latitude, deg
Longitude, deg

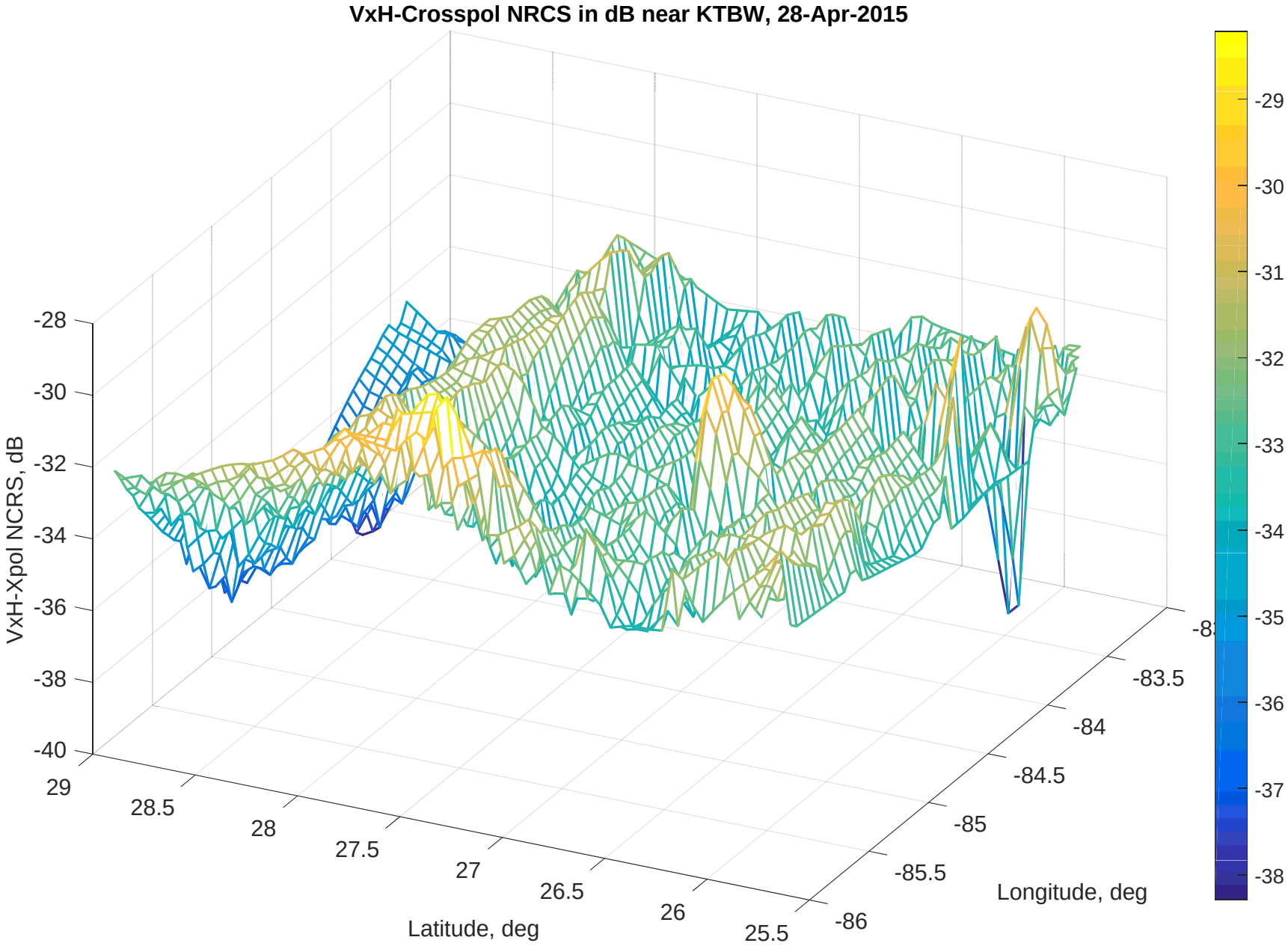

Wind Speed (M/S) Across Area of Study - near KTBW, 28-April
Latitude, deg
Longitude, deg

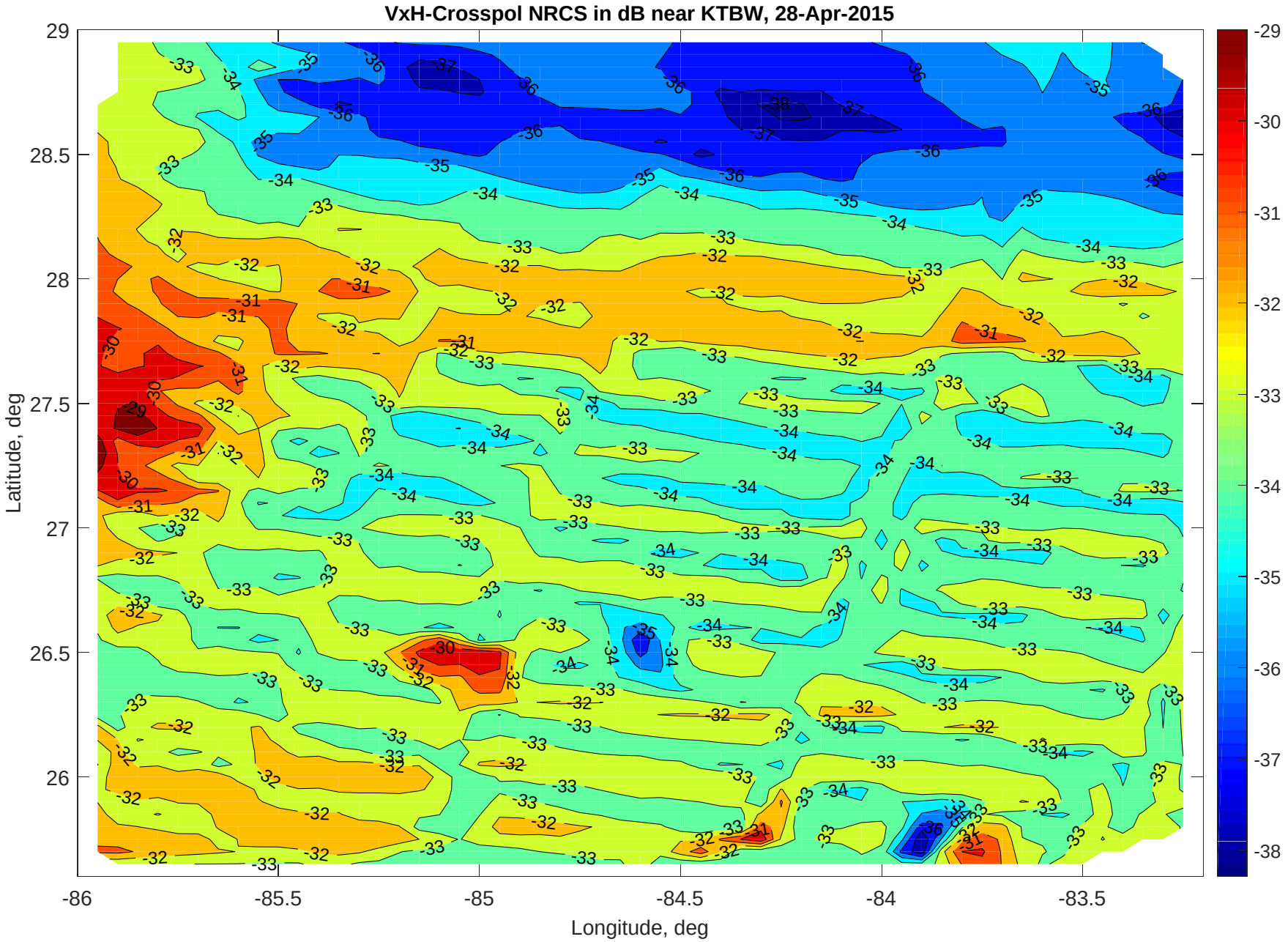

V-pol NRCS in dB near KTBW, 28-Apr-2015
V-pol NCRS, dB
-12
-13
-14
-15
-16
-17
-18
Latitude, deg
29
28.5
28
27.5
27
26.5
26
25.5
Longitude, deg
-86
-85.5
-85
-84.5
-84
-83.5
-83
-12.5
-13
-13.5
-14
-14.5
-15
-15.5
-16
-16.5
-17
-17.5

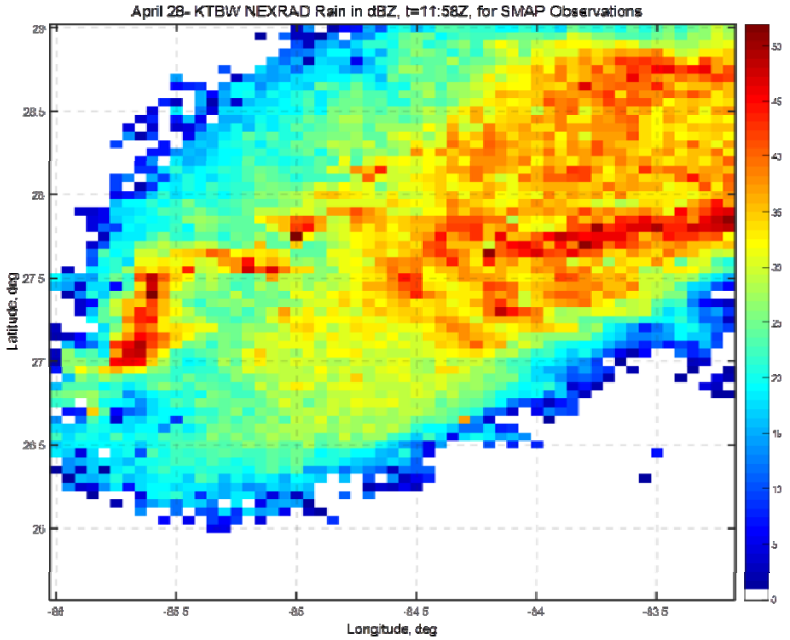

April 28- KTBW NEXRAD Rain in dBZ, t=11:58Z, for SMAP Observations
Latitude, deg
Longitude, deg

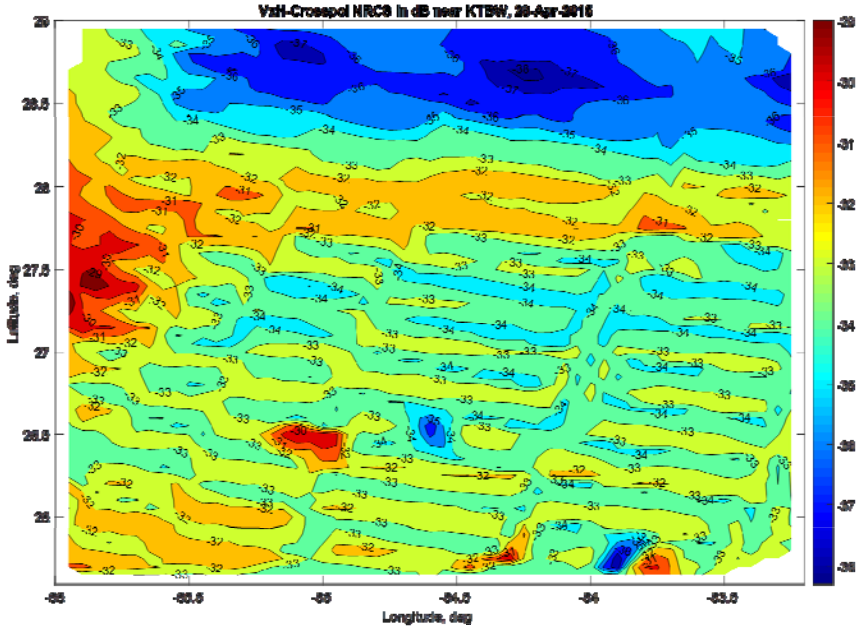

V-pol NRCS in dB near KTBW, 28-Apr-2016
Longitude, deg

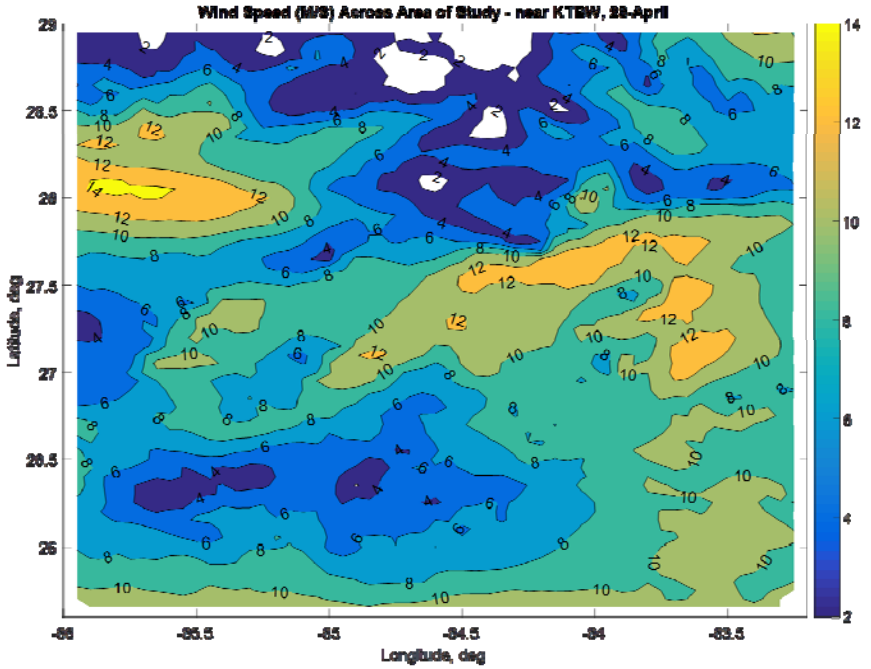

Wind Speed (M/S) Across Area of Study - near KTBW, 28-April
Latitude, deg
Longitude, deg

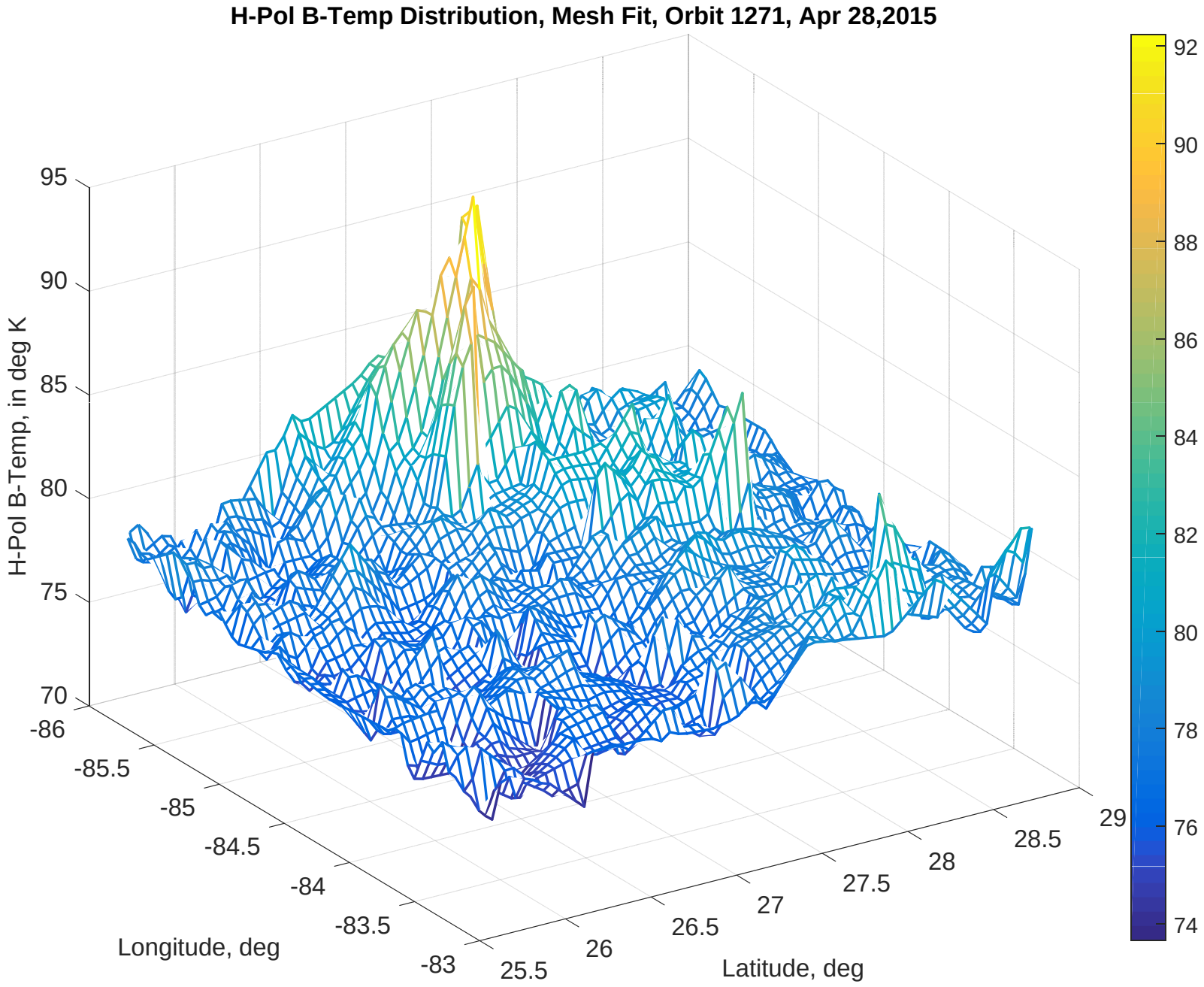

VxH-Crosspol NRCS in dB near KTBW, 28-Apr-2015
VxH-Xpol NCRS, dB
-28
-30
-32
-34
-36
-38
-40
29
28.5
28
27.5
27
26.5
26
25.5
Latitude, deg
-86
-85.5
-85
-84.5
-84
-83.5
Longitude, deg
-29
-30
-31
-32
-33
-34
-35
-36
-37
-38

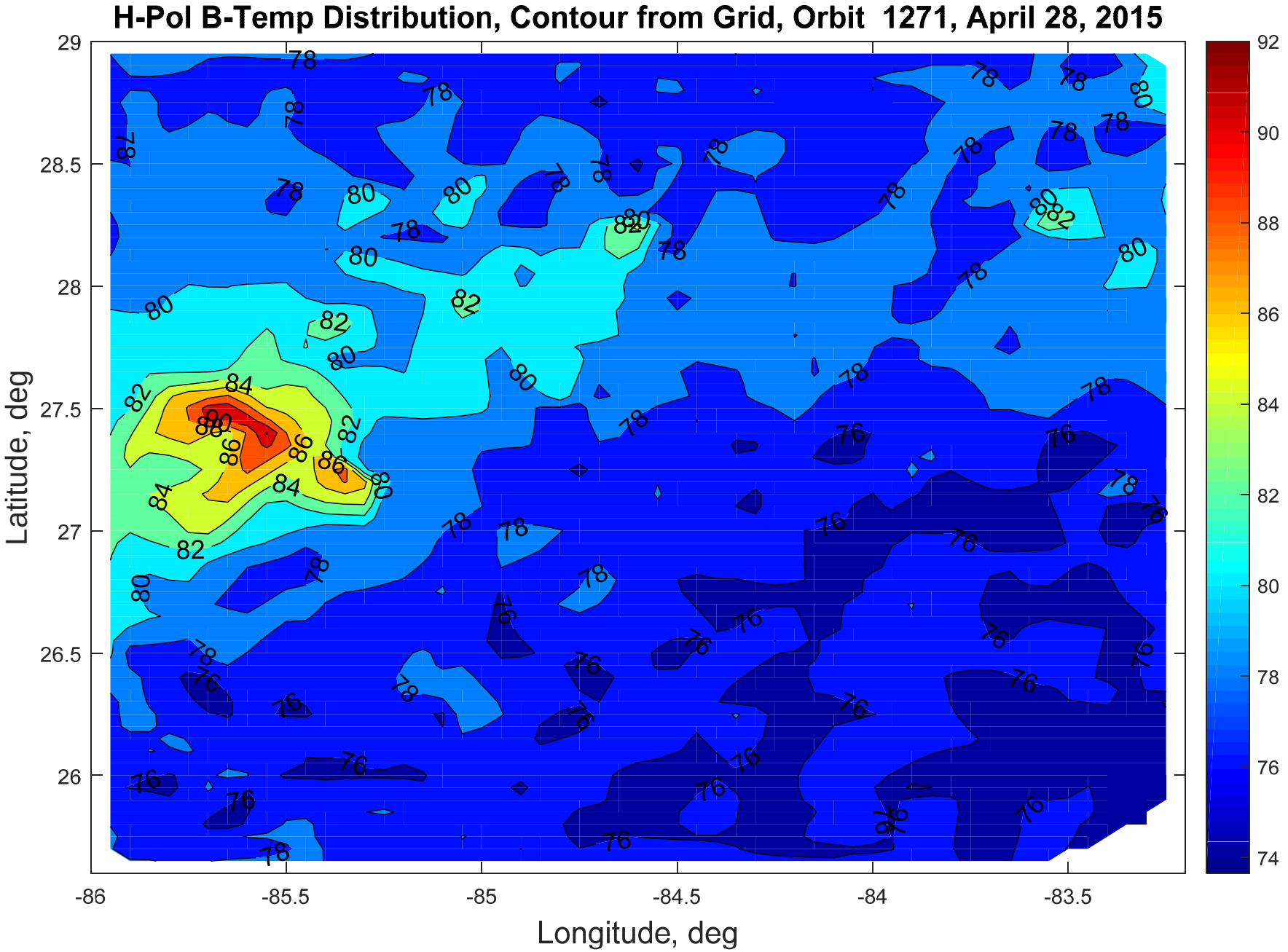

VxH-Crosspol NRCS in dB near KTBW, 28-Apr-2015
Latitude, deg
Longitude, deg
29
28.5
28
27.5
27
26.5
26
-86
-85.5
-85
-84.5
-84
-83.5
-29
-30
-31
-32
-33
-34
-35
-36
-37
-38

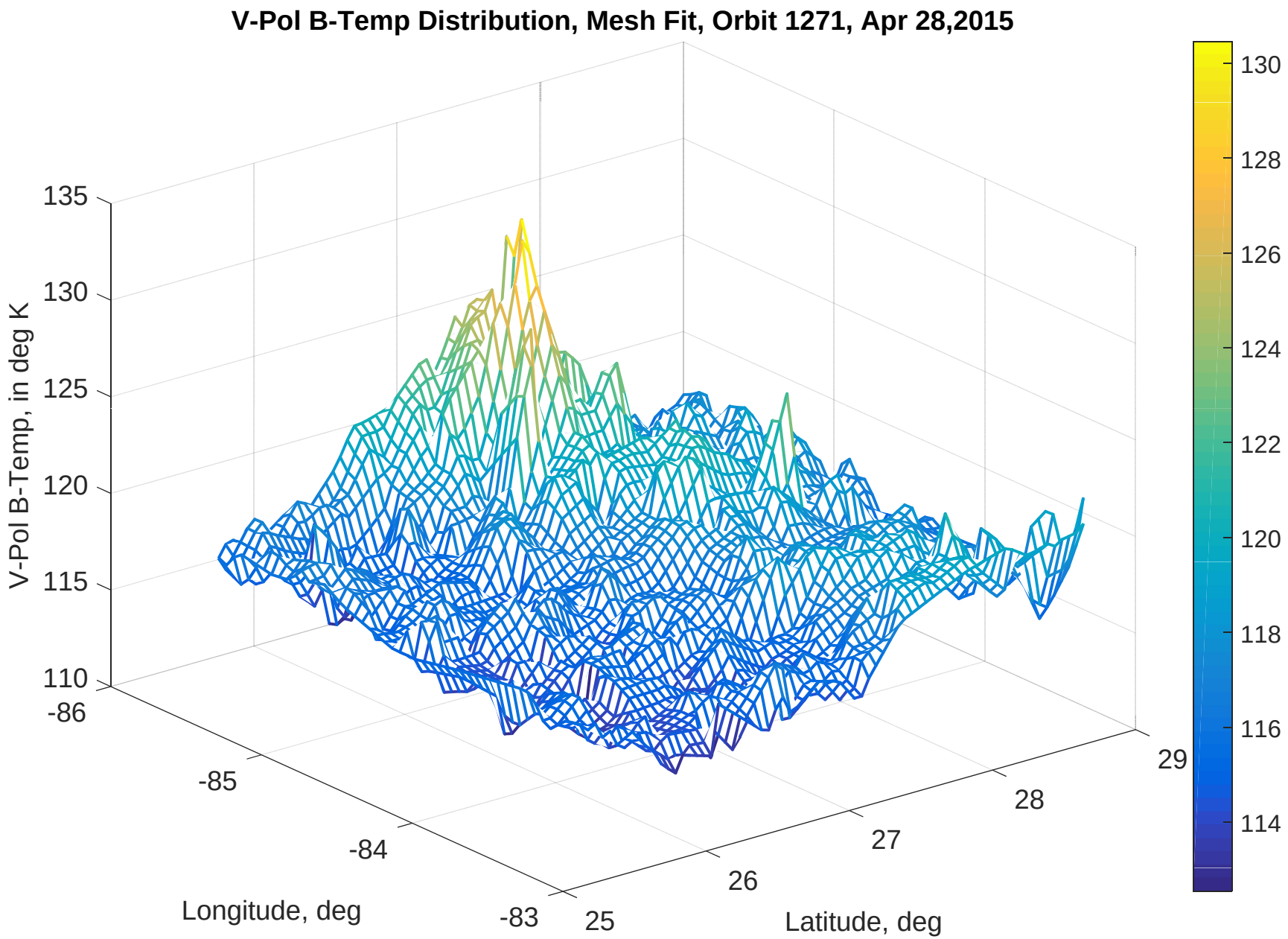

April 28- KTBW NEXRAD Rain in dBZ, t=11:58Z, for SMAP Observations
Latitude, deg
Longitude, deg

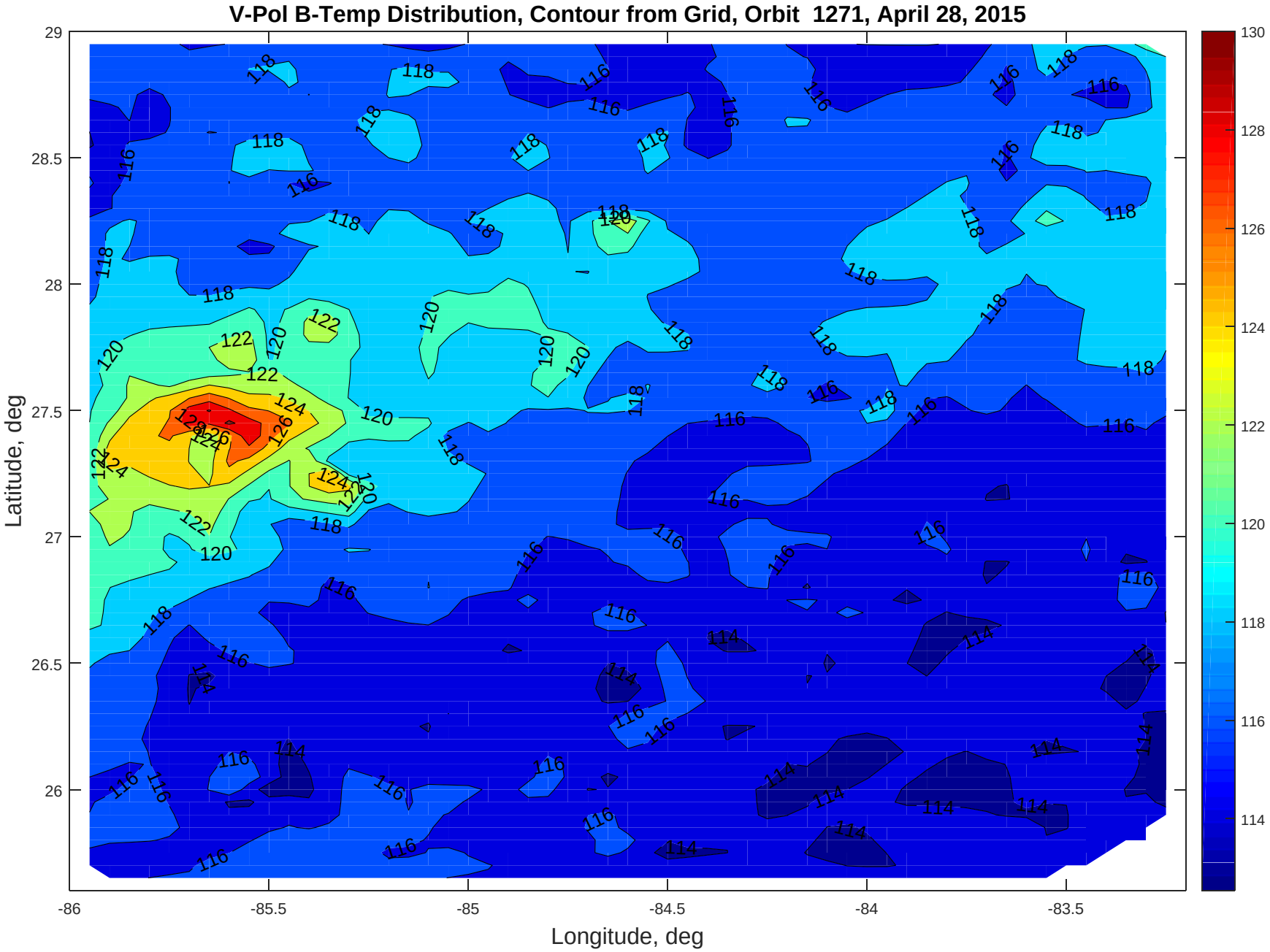

VzH-Crosspol NRCS in dB near KTBW, 28-Apr-2015
Latitude, deg
Longitude, deg


Wind Speed (M/S) Across Area of Study - near KTBW, 28-April
Latitude, deg
Longitude, deg


H-Pol B-Temp Distribution, Mesh Fit, Orbit 1271, Apr 28,2015
H-Pol B-Temp, in deg K
95
90
85
80
75
70
-86
-85.5
-85
-84.5
-84
-83.5
-83
Longitude, deg
25.5
26
26.5
27
27.5
28
28.5
29
Latitude, deg
92
90
88
86
84
82
80
78
76
74

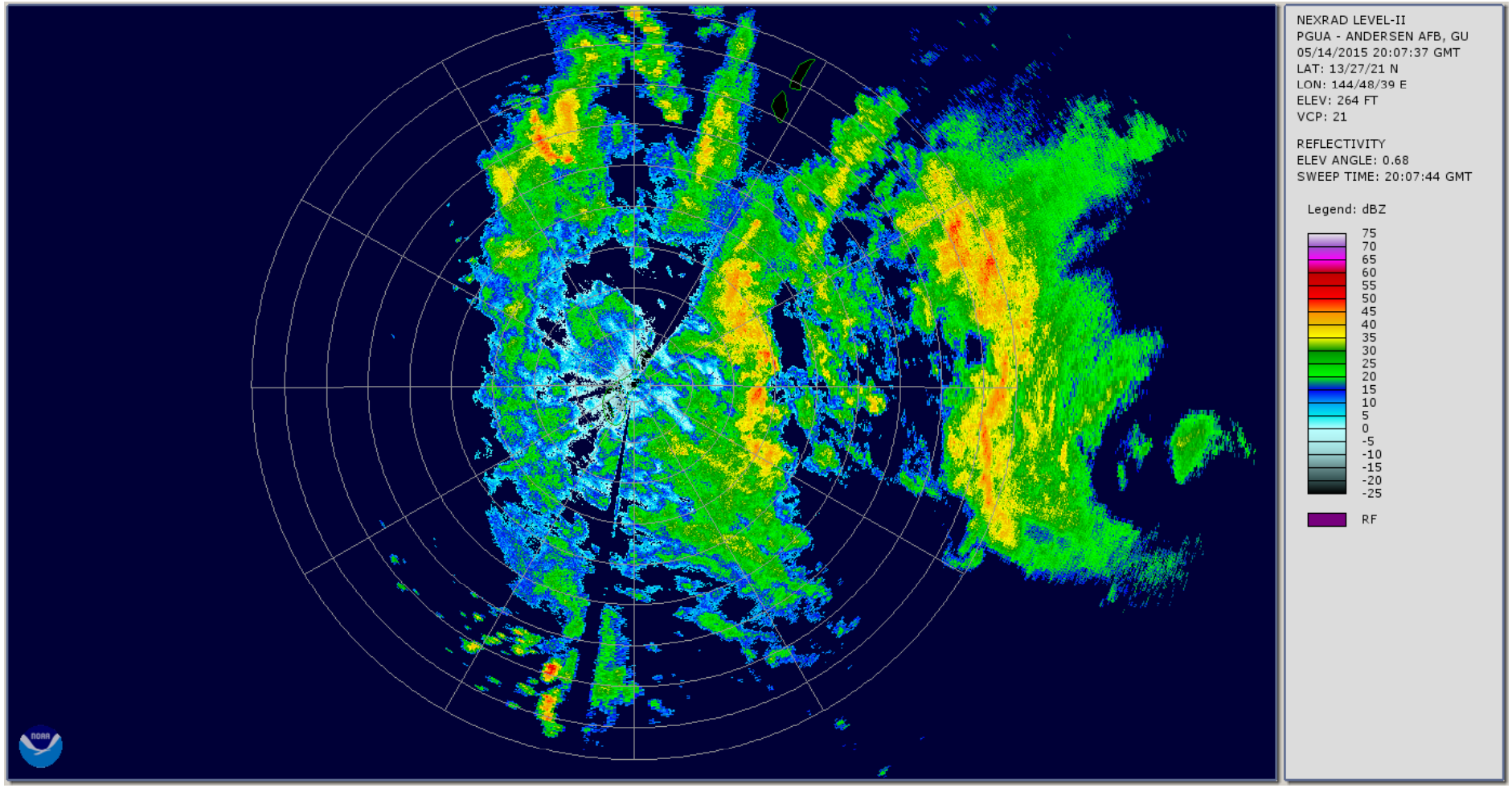

H-Pol B-Temp Distribution, Contour from Grid, Orbit 1271, April 28, 2015
Latitude, deg
Longitude, deg
29
28.5
28
27.5
27
26.5
26
-86
-85.5
-85
-84.5
-84
-83.5
92
90
88
86
84
82
80
78
76
74


V-Pol B-Temp Distribution, Mesh Fit, Orbit 1271, Apr 28,2015
V-Pol B-Temp, in deg K
135
130
125
120
115
110
-86
-85
-84
-83
Longitude, deg
25
26
27
28
29
Latitude, deg
130
128
126
124
122
120
118
116
114

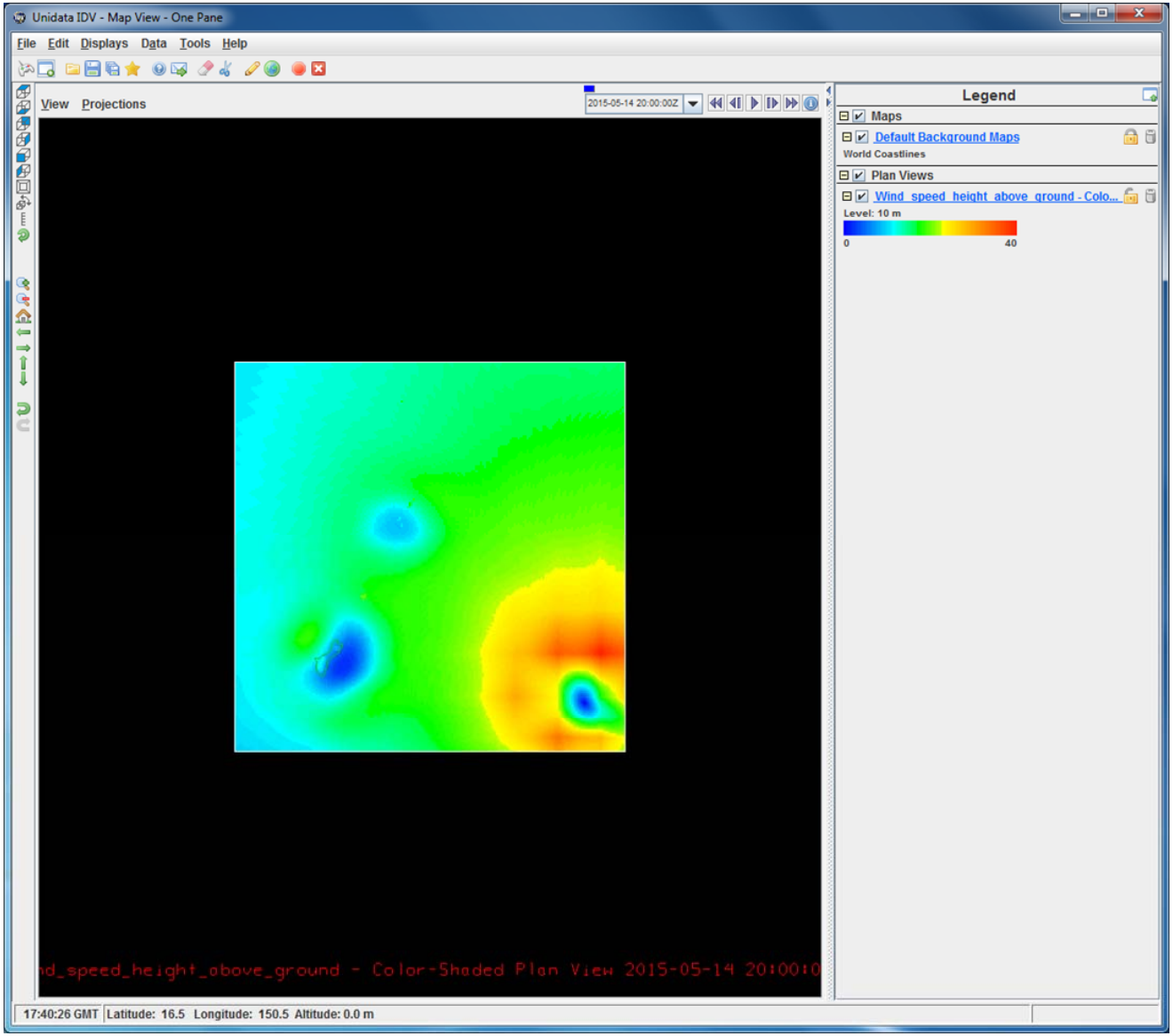

V-Pol B-Temp Distribution, Contour from Grid, Orbit 1271, April 28, 2015
Latitude, deg
Longitude, deg
29
28.5
28
27.5
27
26.5
26
-86
-85.5
-85
-84.5
-84
-83.5
130
128
126
124
122
120
118
116
114

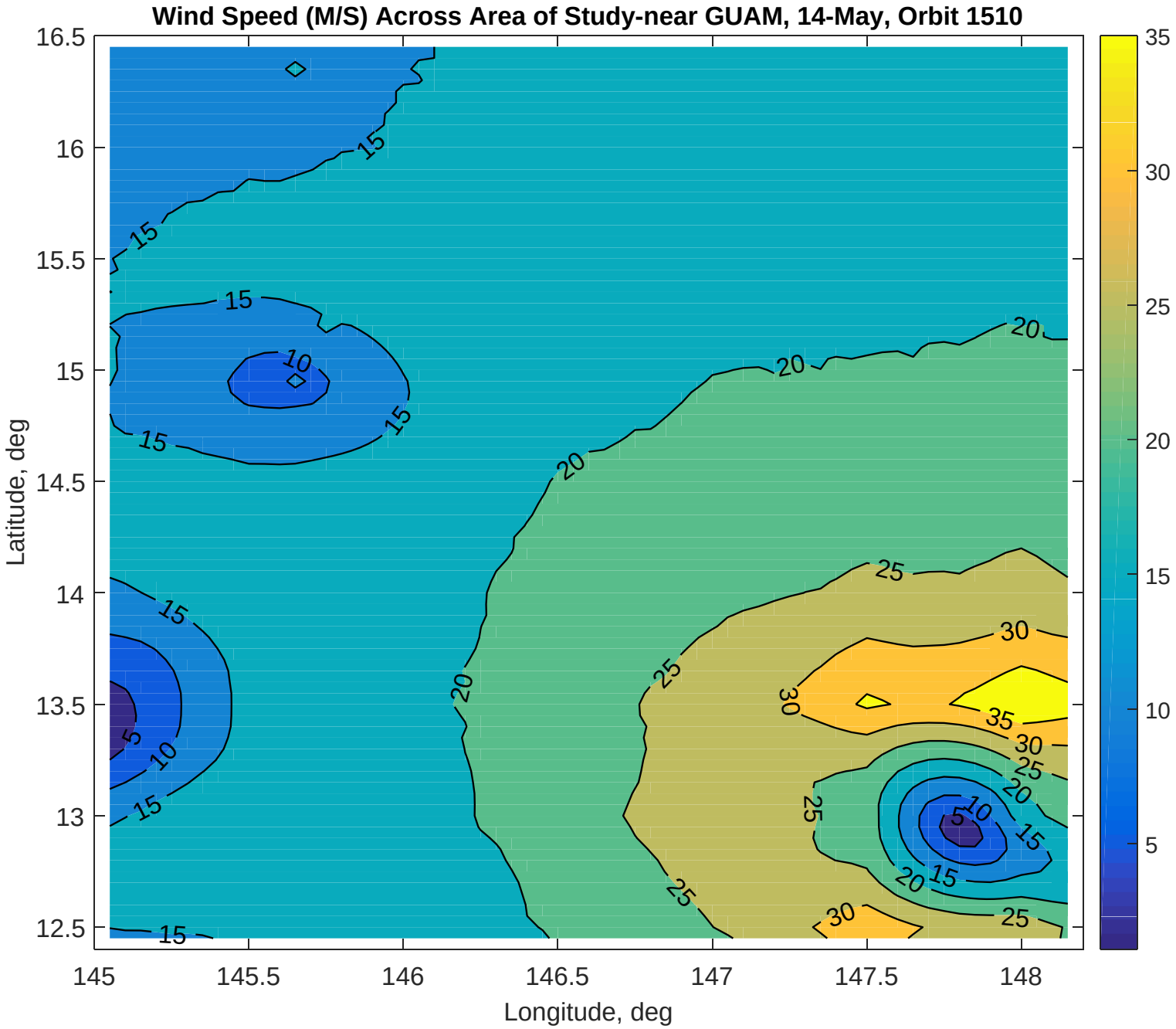
Base 801623 (E00281) 1-91

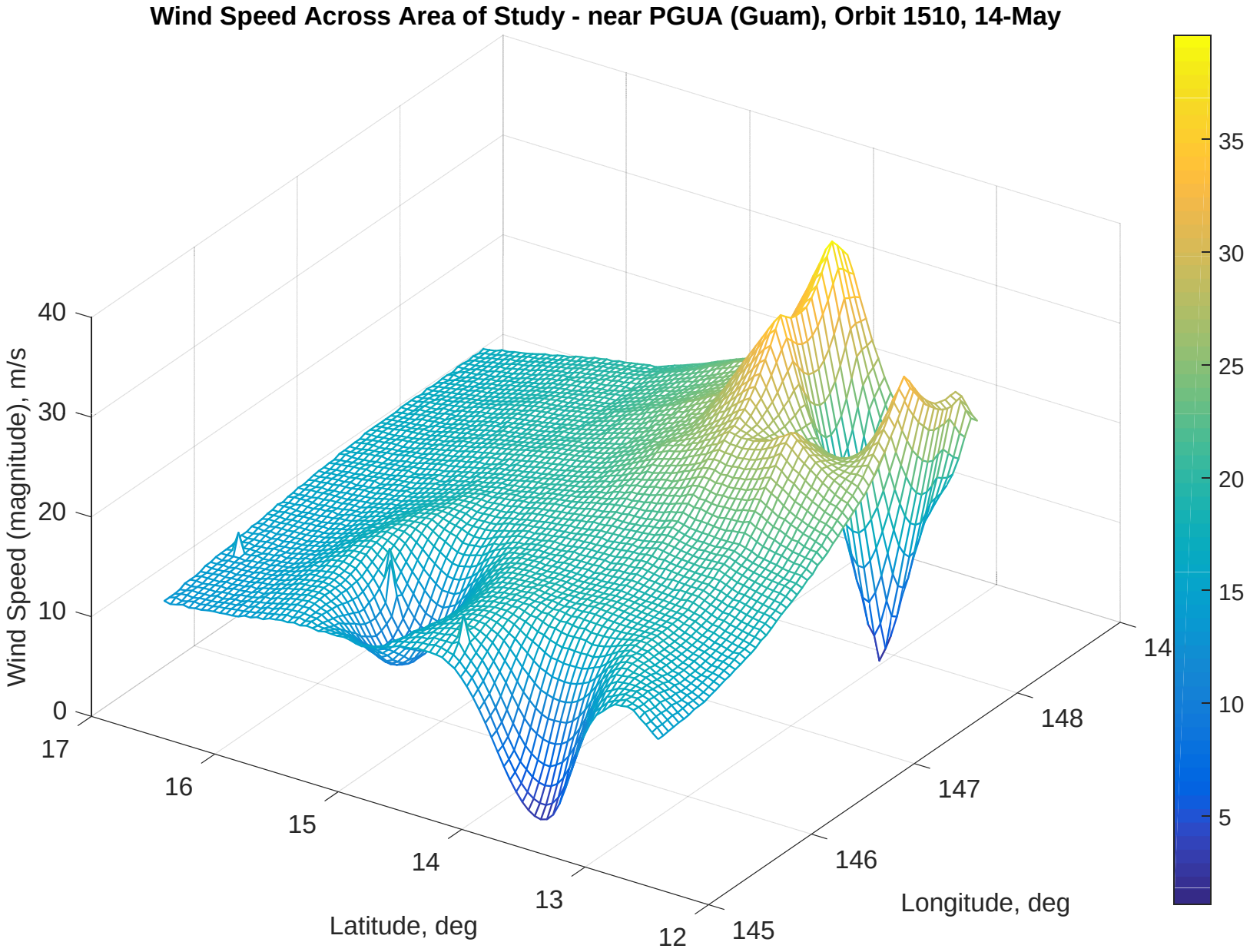
GUAM NEXRAD Radar within 6 minutes of overpass

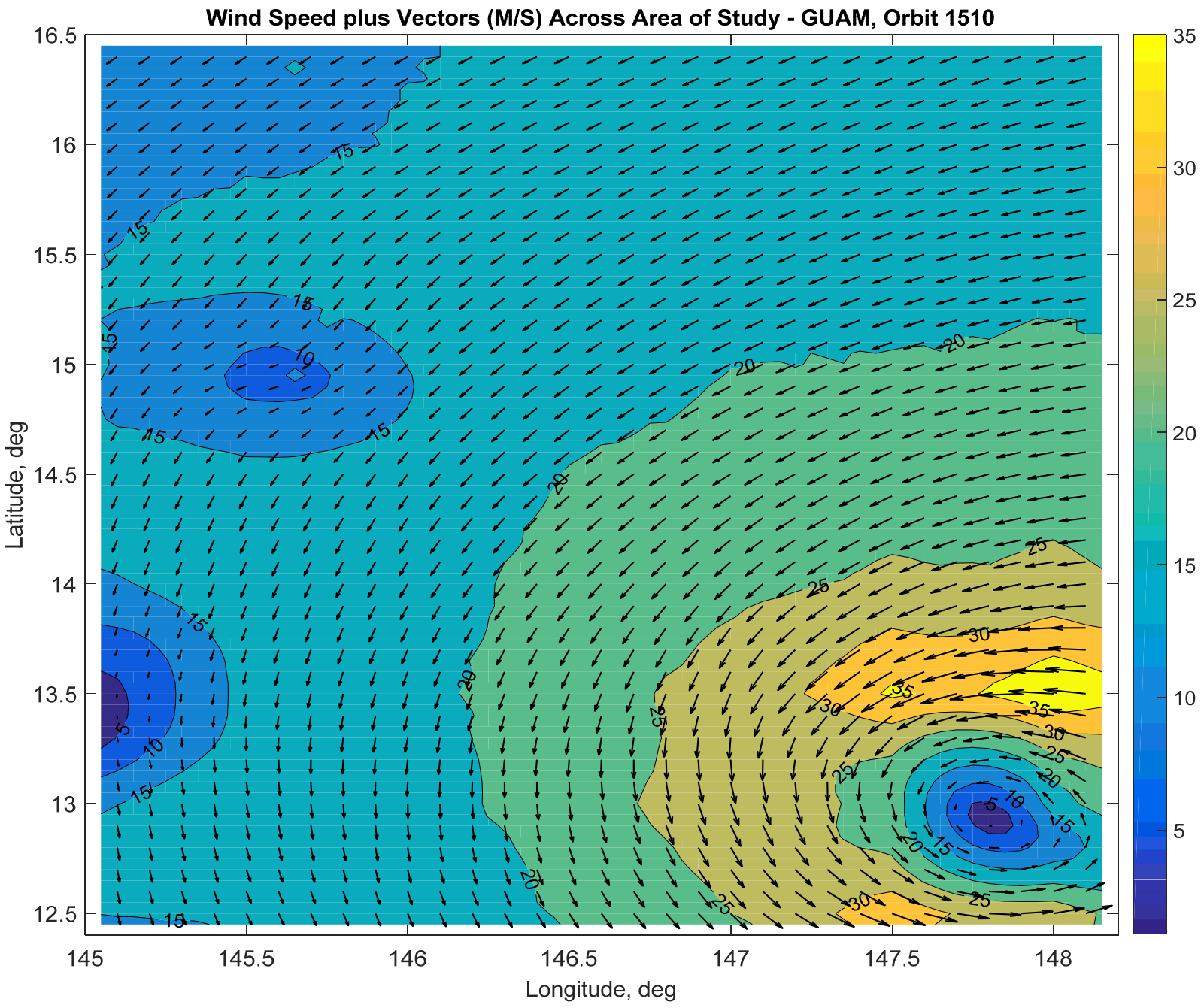


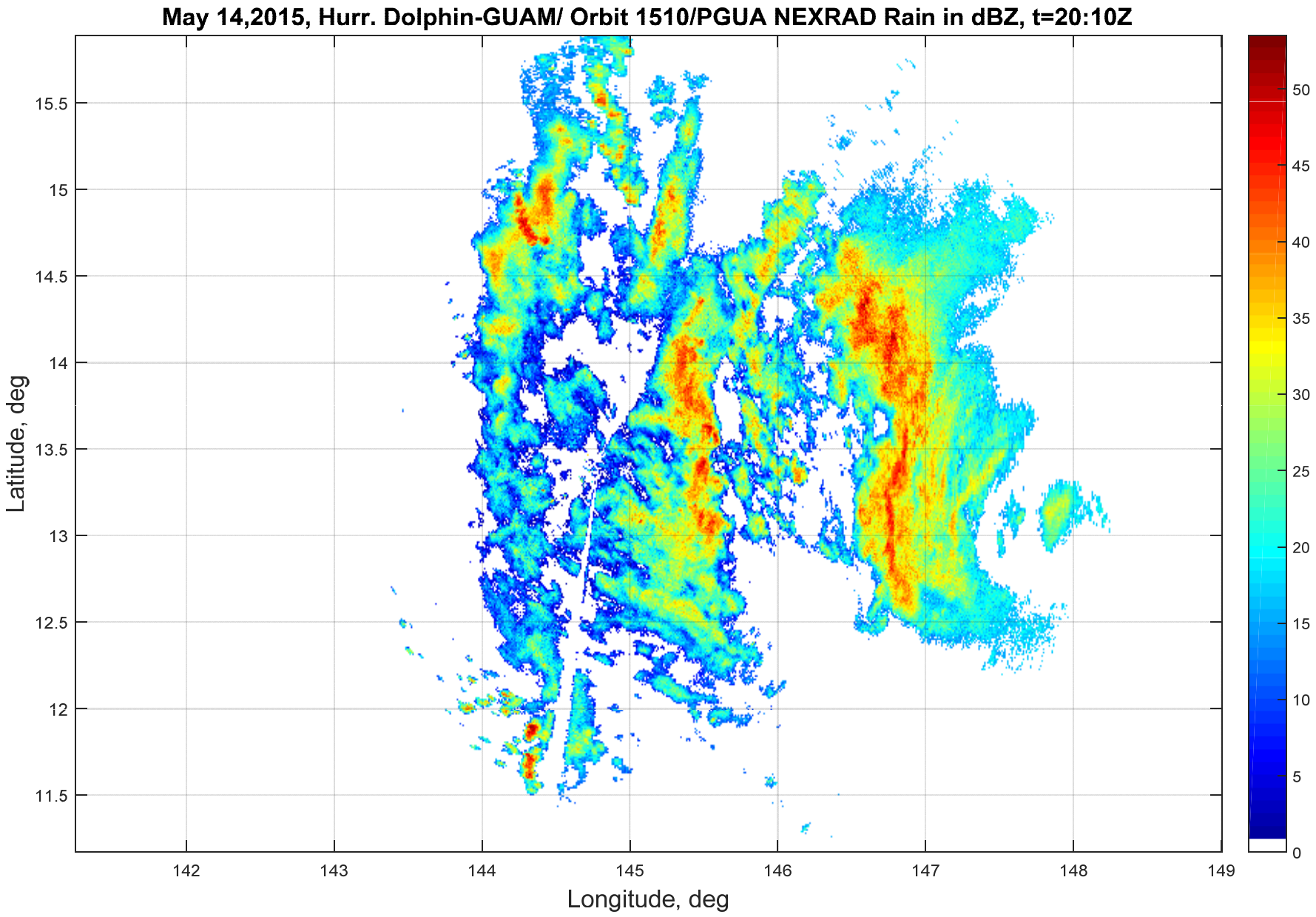
Hurricane Dolphin approaching Guam (to the west) on May 14, 2015, t=20:00Z
URMA Winds within 10 minutes of Orbit 1510

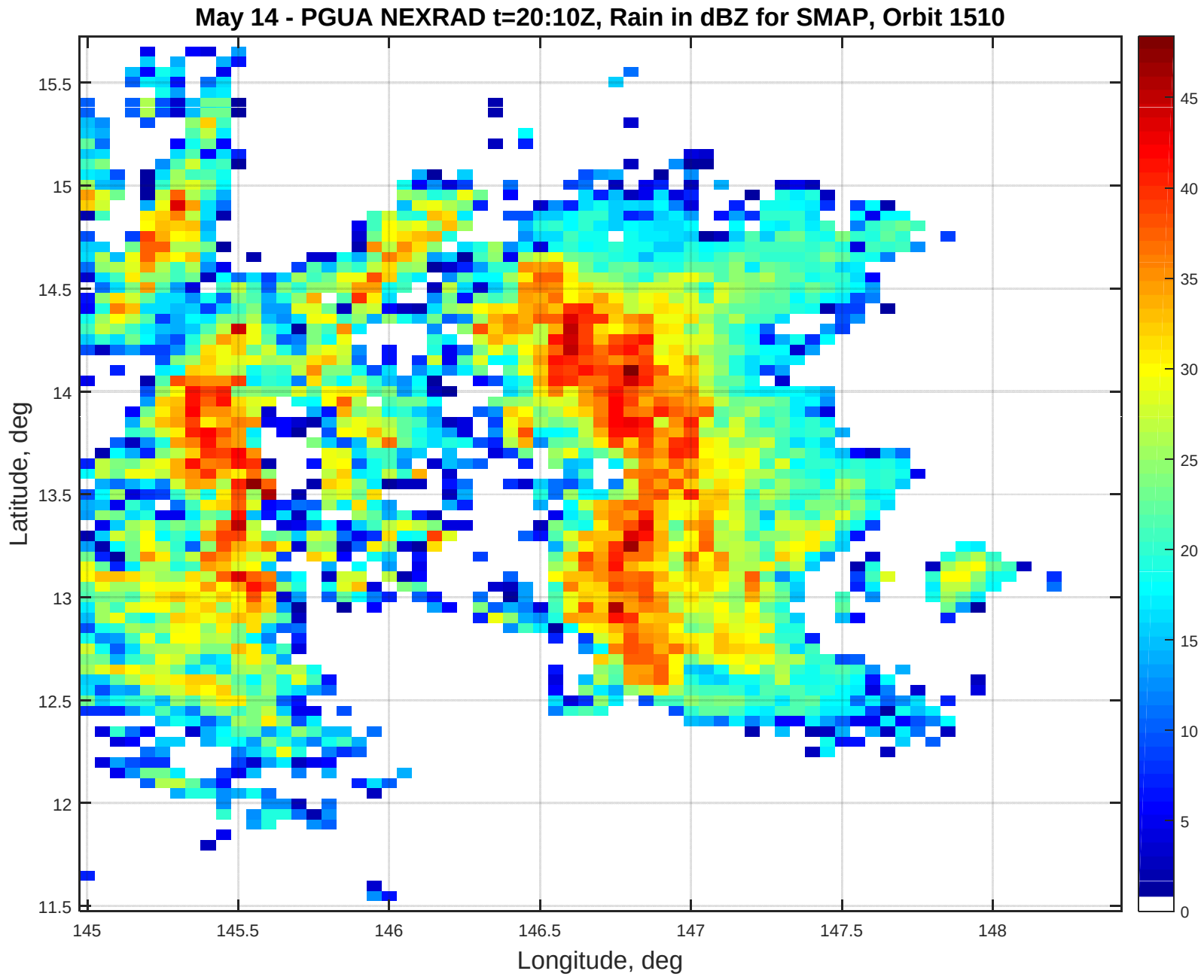


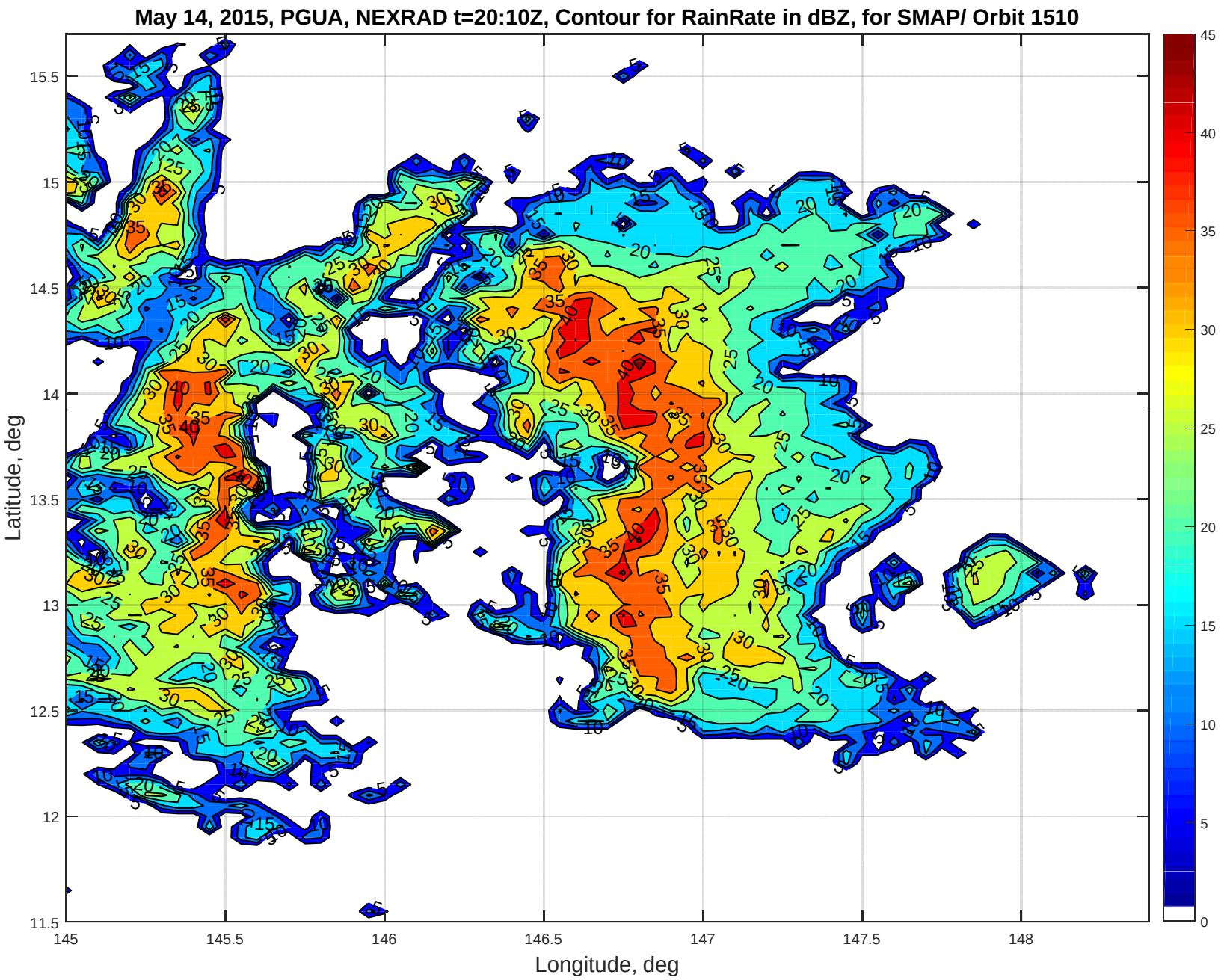

Wind Speed (M/S) Across Area of Study-near GUAM, 14-May, Orbit 1510
Latitude, deg
Longitude, deg
16.5
16
15.5
15
14.5
14
13.5
13
12.5
145
145.5
146
146.5
147
147.5
148
35
30
25
20
15
10
5

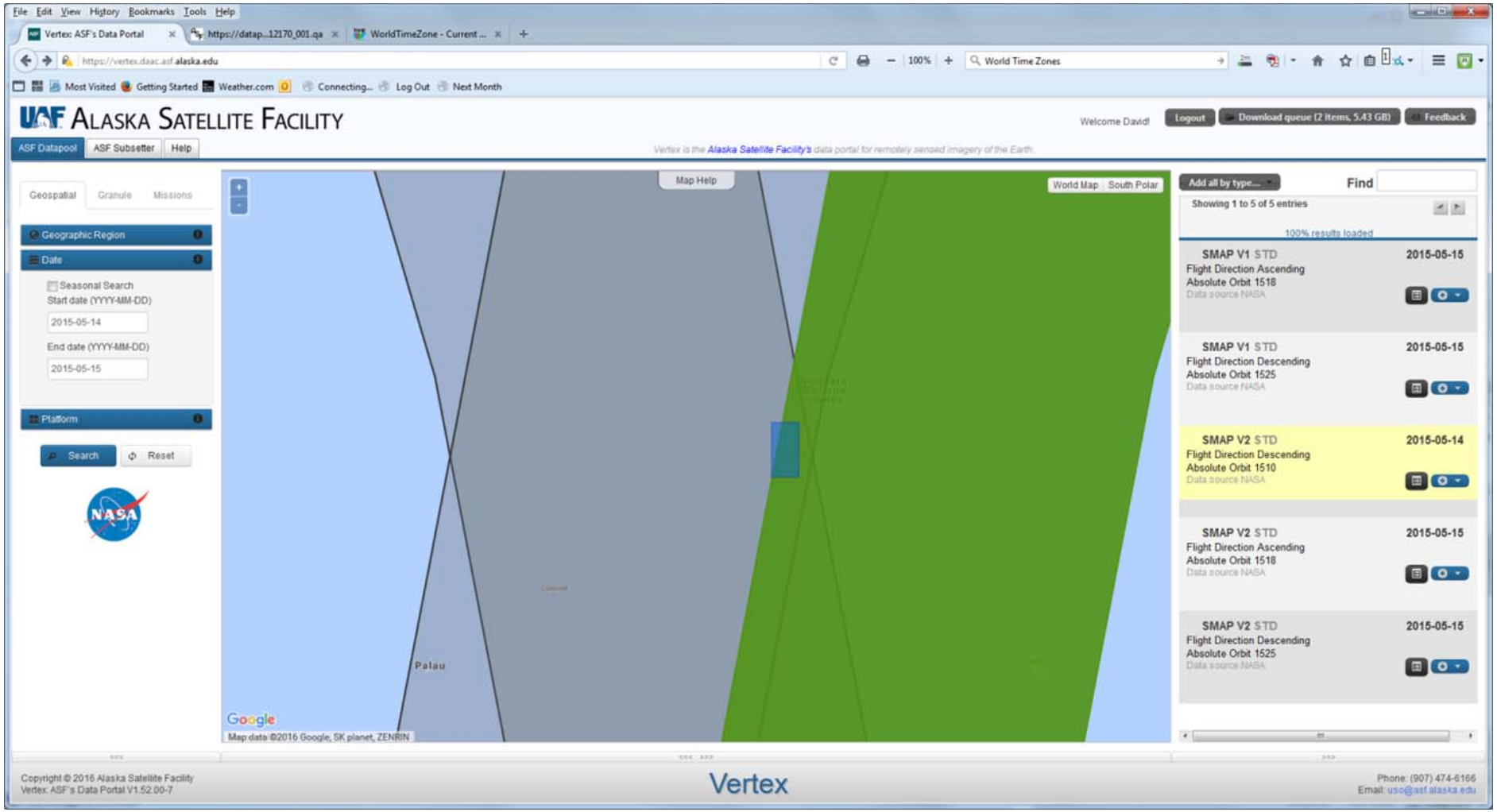

Wind Speed Across Area of Study - near PGUA (Guam), Orbit 1510, 14-May
Wind Speed (magnitude), m/s
40
30
20
10
0
17
16
15
14
13
12
Latitude, deg
145
146
147
148
14
Longitude, deg
35
30
25
20
15
10
5


Wind Speed plus Vectors (M/S) Across Area of Study - GUAM, Orbit 1510
Latitude, deg
Longitude, deg
16.5
16
15.5
15
14.5
14
13.5
13
12.5
145
145.5
146
146.5
147
147.5
148
35
30
25
20
15
10
5


May 14,2015, Hurr. Dolphin-GUAM/ Orbit 1510/PGUA NEXRAD Rain in dBZ, t=20:10Z
Latitude, deg
15.5
15
14.5
14
13.5
13
12.5
12
11.5
Longitude, deg
142
143
144
145
146
147
148
149
50
45
40
35
30
25
20
15
10
5
0


May 14 - PGUA NEXRAD t=20:10Z, Rain in dBZ for SMAP, Orbit 1510
Latitude, deg
Longitude, deg
15.5
15
14.5
14
13.5
13
12.5
12
11.5
145
145.5
146
146.5
147
147.5
148
45
40
35
30
25
20
15
10
5
0


May 14, 2015, PGUA, NEXRAD t=20:10Z, Contour for RainRate in dBZ, for SMAP/ Orbit 1510
Latitude, deg
Longitude, deg
15.5
15
14.5
14
13.5
13
12.5
12
11.5
145
145.5
146
146.5
147
147.5
148
45
40
35
30
25
20
15
10
5
0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Seasonal Search
Start date (YYYY-MM-DD)
2015-05-14
End date (YYYY-MM-DD)
2015-05-15
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Reset
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South Polar
Palau
Google
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Find
Showing 1 to 5 of 5 entries
100% results loaded
SMAP V1 STD
2015-05-15
Flight Direction Ascending
Absolute Orbit 1518
Data source NASA
SMAP V1 STD
2015-05-15
Flight Direction Descending
Absolute Orbit 1525
Data source NASA
SMAP V2 STD
2015-05-14
Flight Direction Descending
Absolute Orbit 1510
Data source NASA
SMAP V2 STD
2015-05-15
Flight Direction Ascending
Absolute Orbit 1518
Data source NASA
SMAP V2 STD
2015-05-15
Flight Direction Descending
Absolute Orbit 1525
Data source NASA
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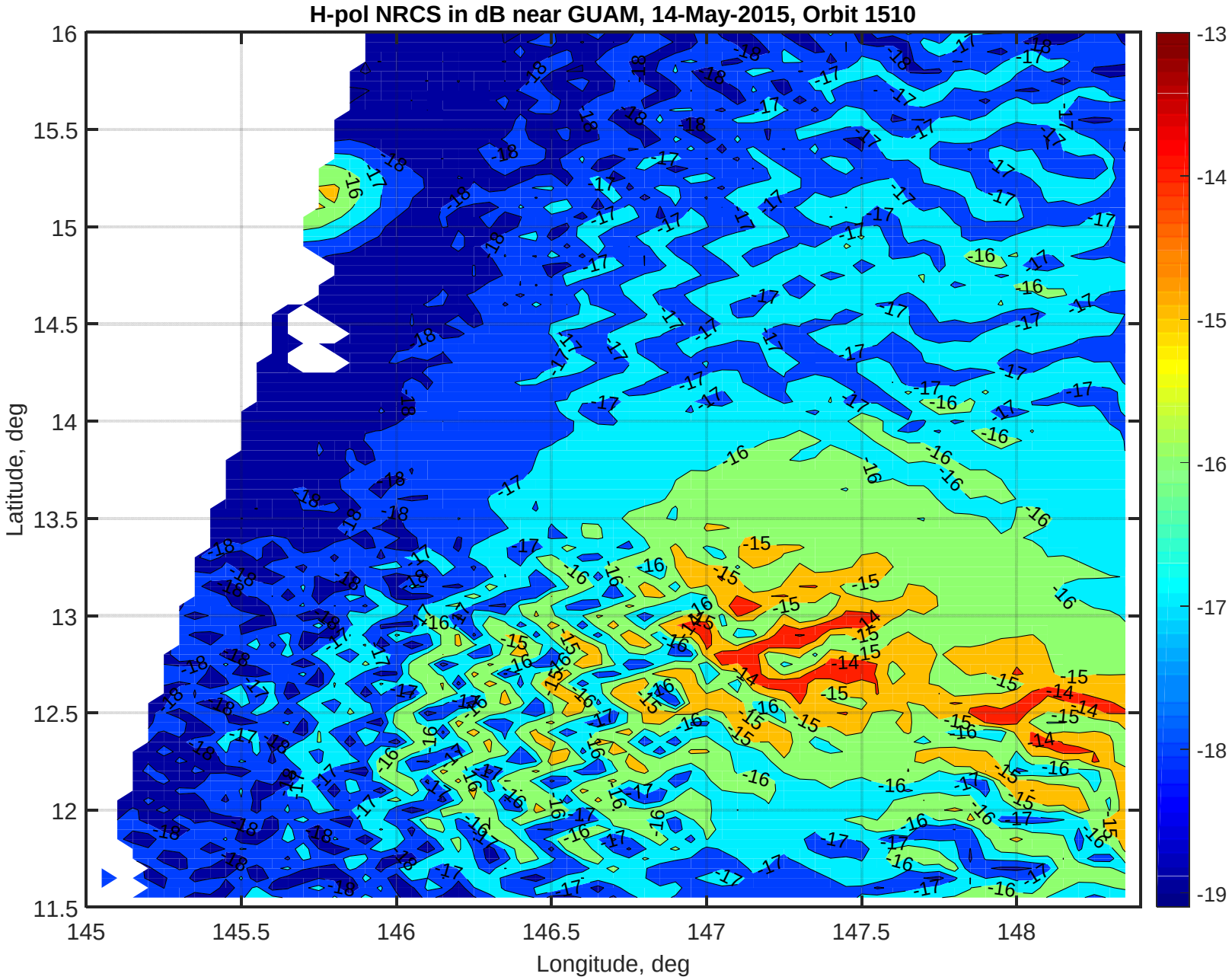
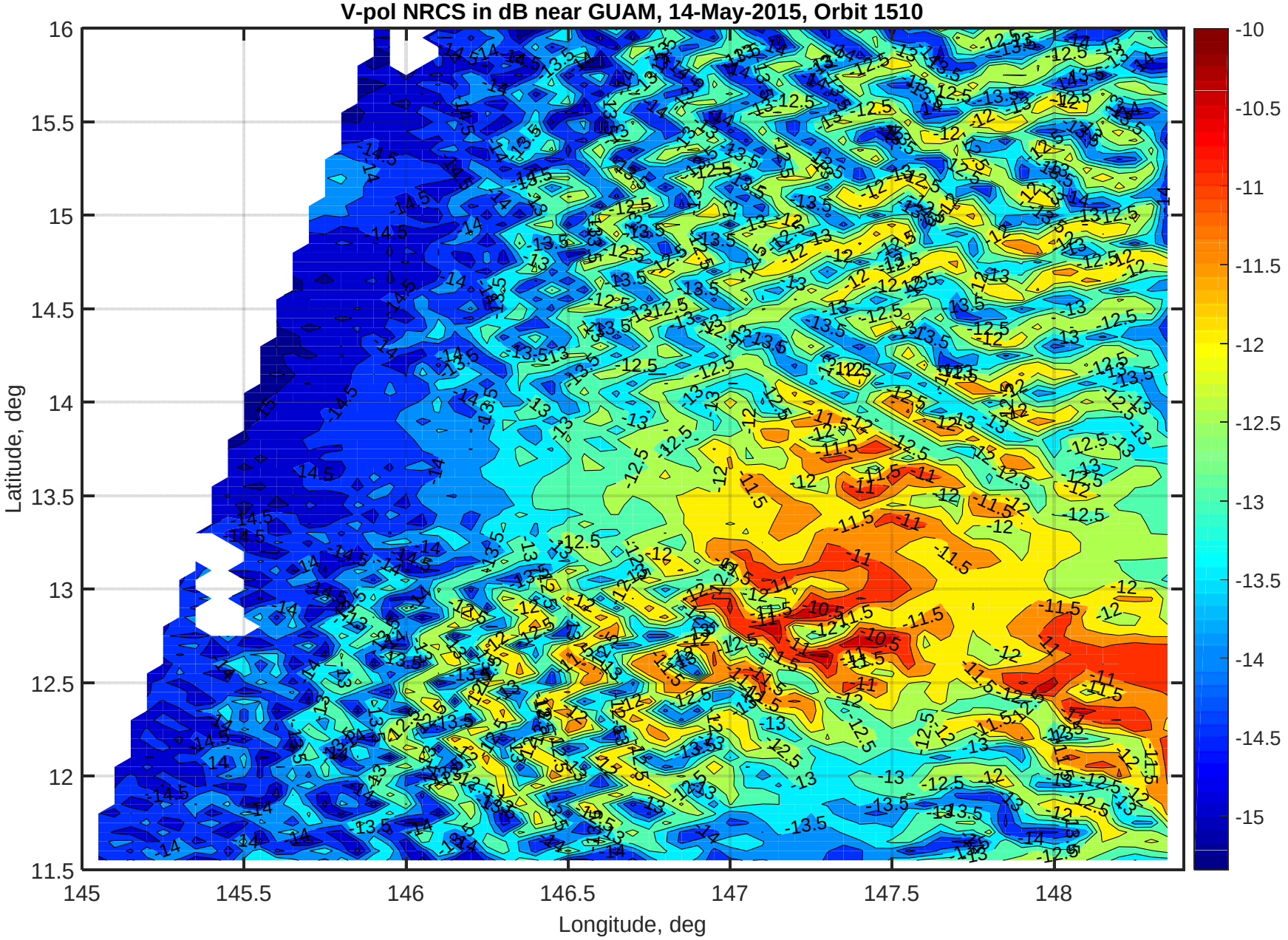
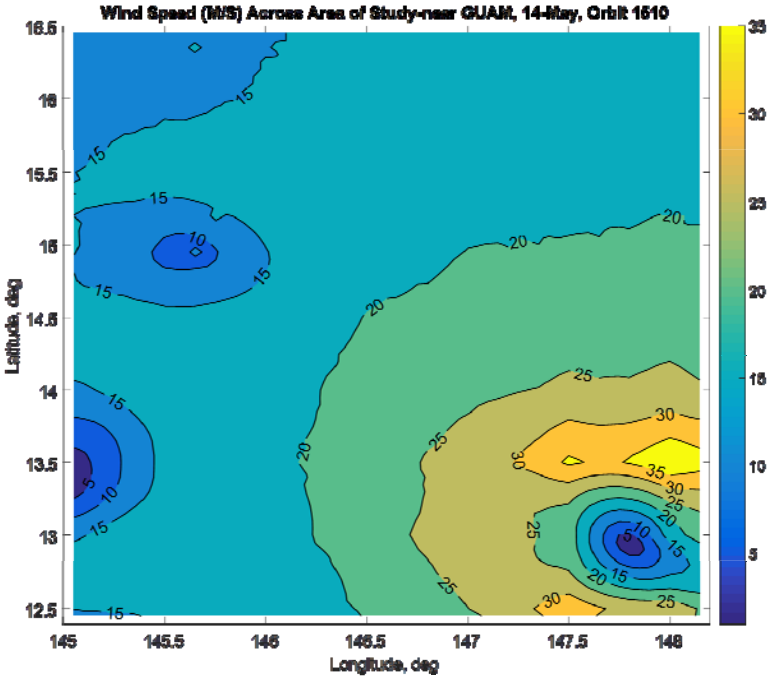
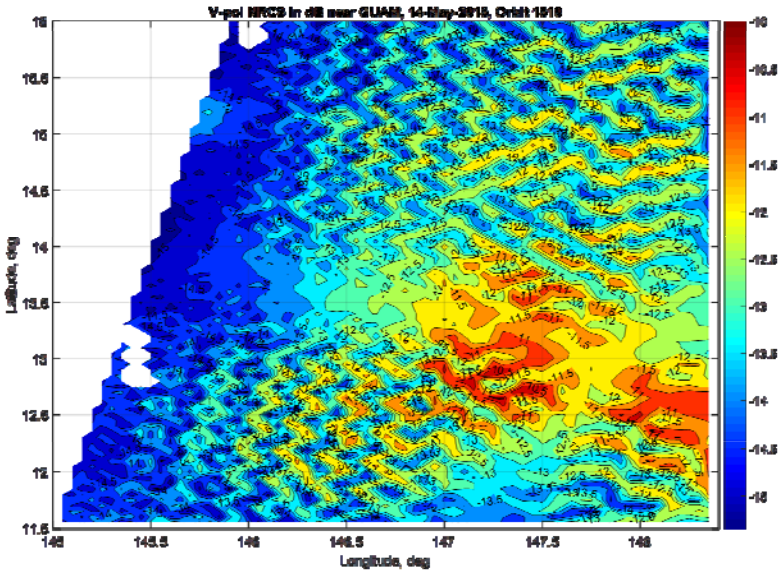
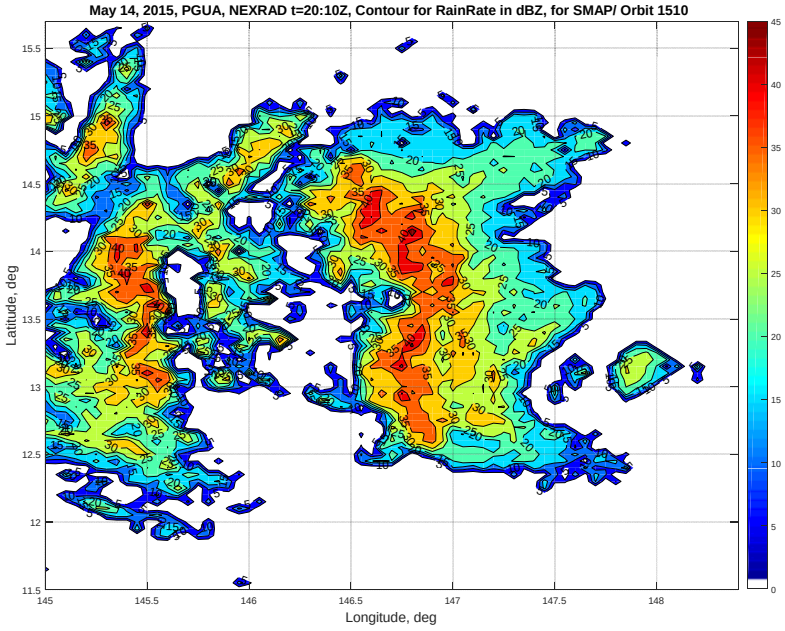
Phone: (907) 474-6166
Email: uso@asf.alaska.edu

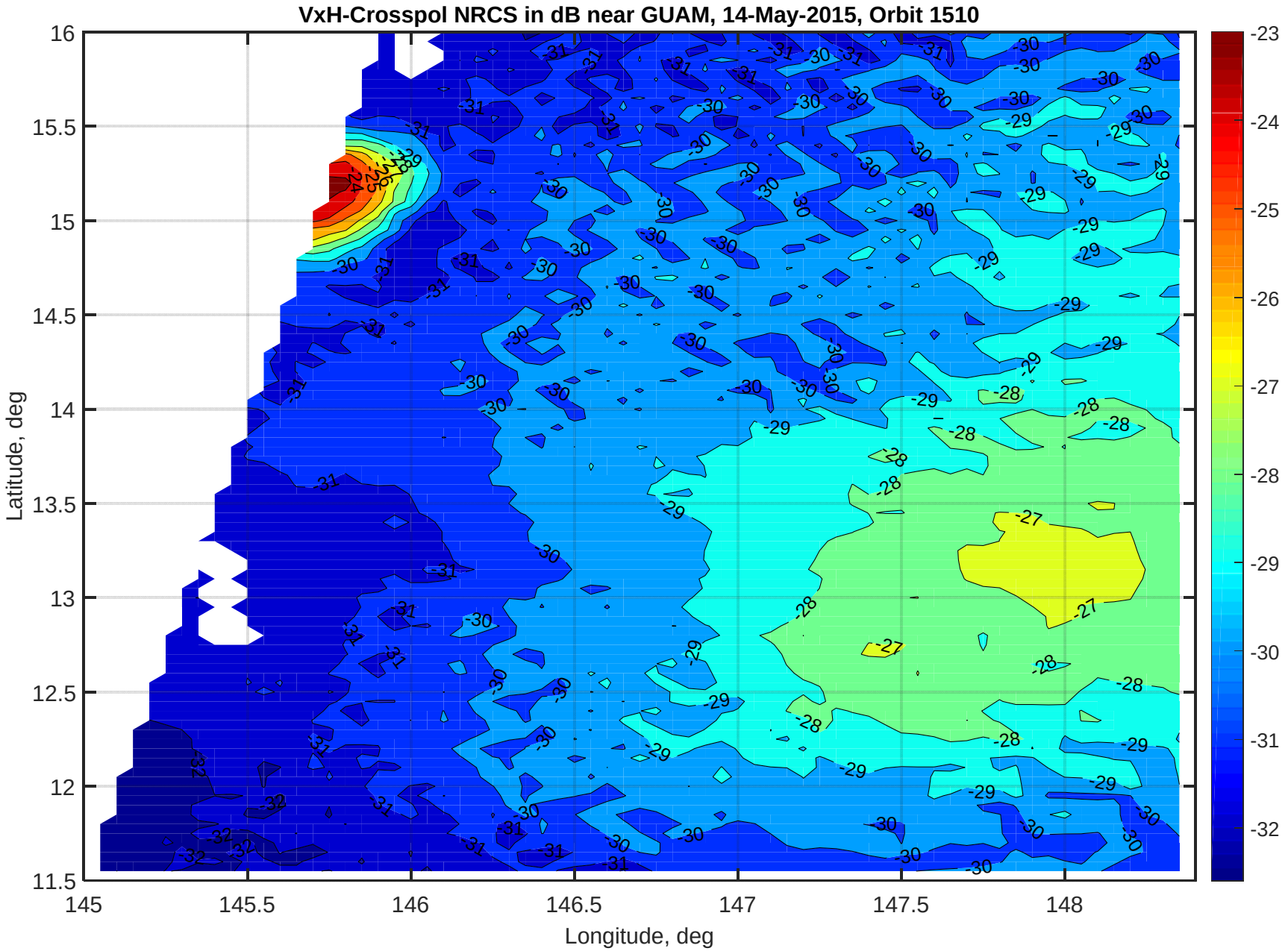

H-pol NRCS in dB near GUAM, 14-May-2015, Orbit 1510
Latitude, deg
Longitude, deg
16
15.5
15
14.5
14
13.5
13
12.5
12
11.5
145
145.5
146
146.5
147
147.5
148
-13
-14
-15
-16
-17
-18
-19

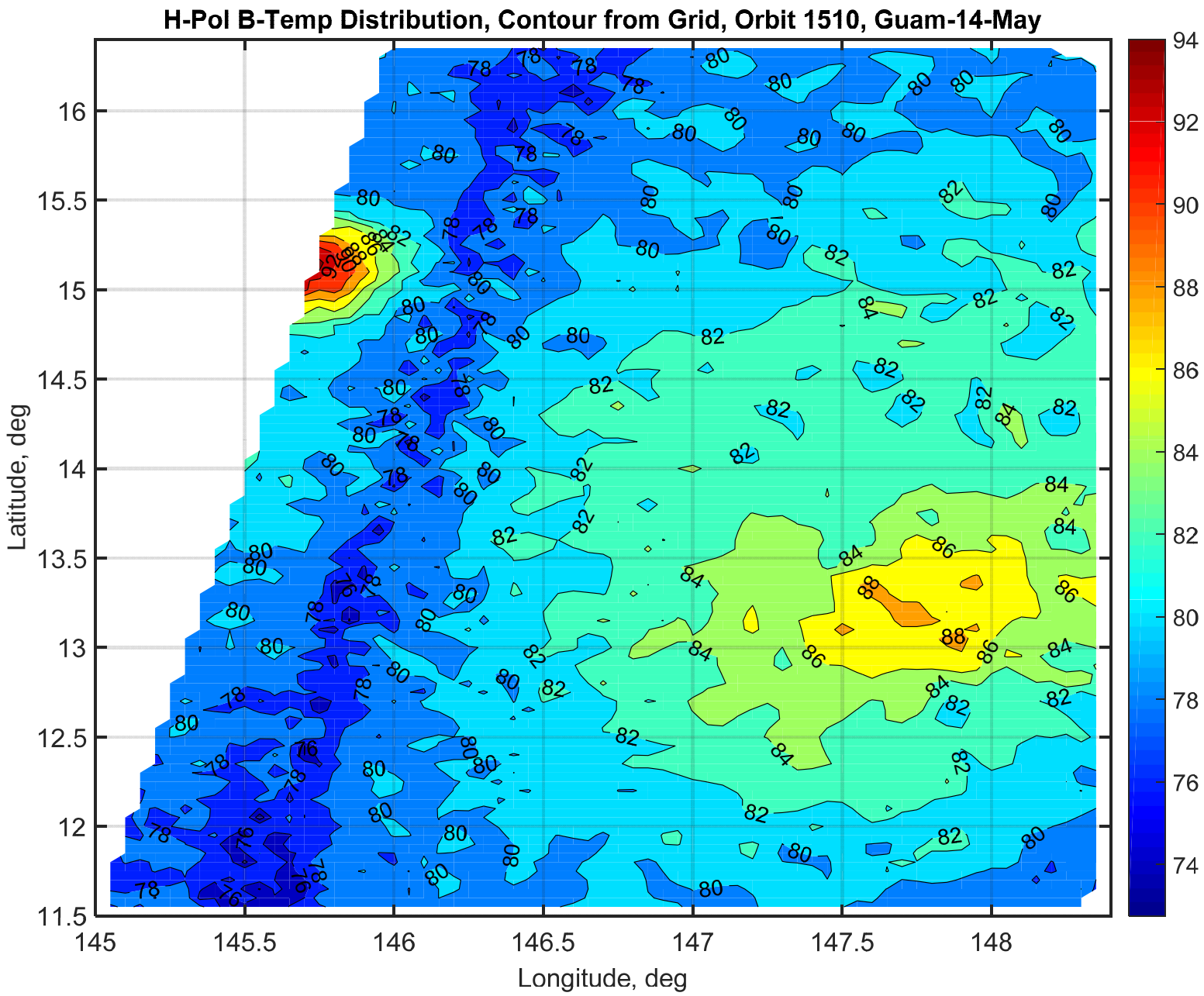

V-pol NRCS in dB near GUAM, 14-May-2015, Orbit 1510
Latitude, deg
Longitude, deg
16
15.5
15
14.5
14
13.5
13
12.5
12
11.5
145
145.5
146
146.5
147
147.5
148
-10
-10.5
-11
-11.5
-12
-12.5
-13
-13.5
-14
-14.5
-15

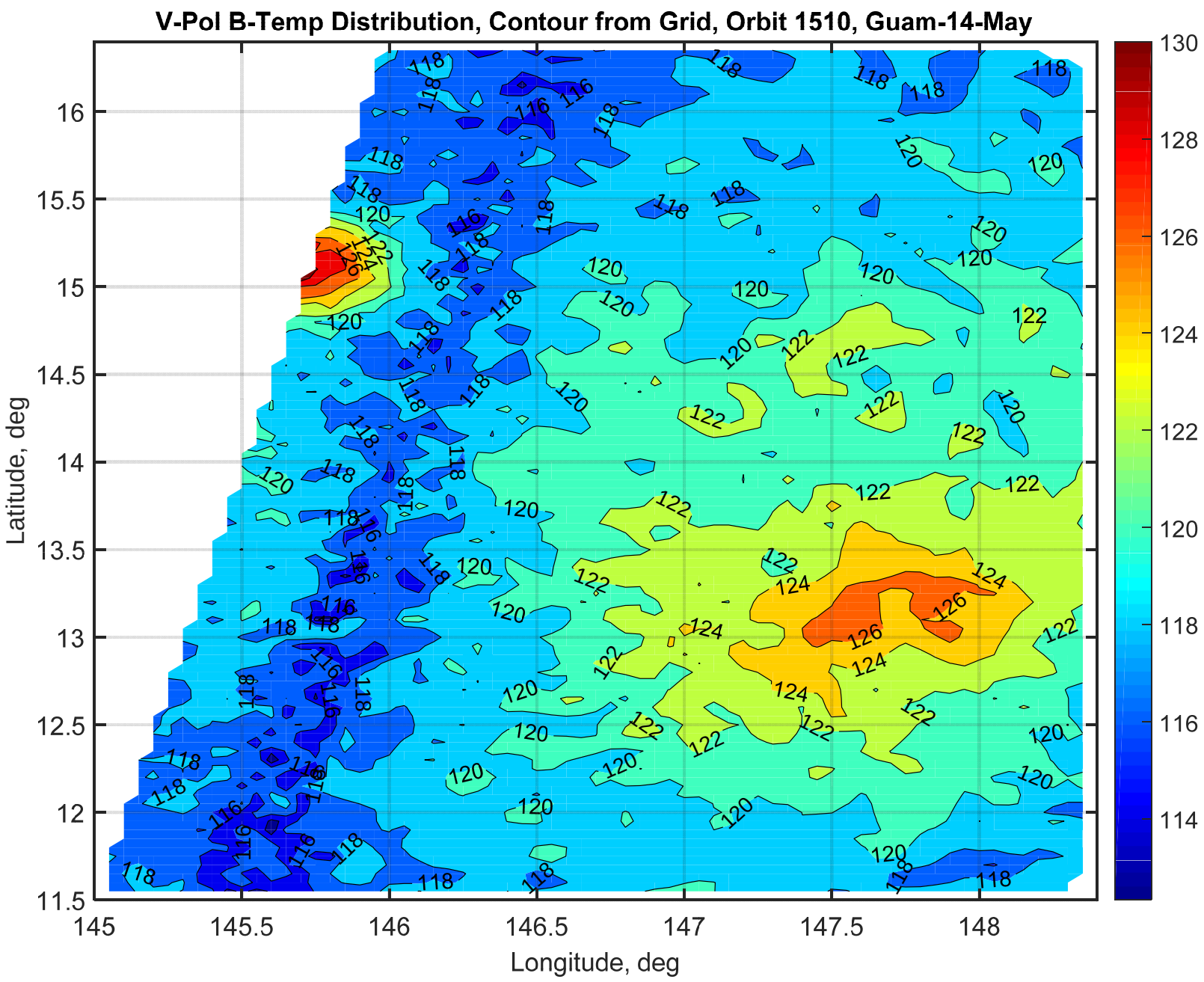

Wind Speed (M/S) Across Area of Study-near GUAM, 14-May, Orbit 1510
Latitude, deg
Longitude, deg


V-pol NRCS in dB near GUAM, 14-May-2015, Orbit 1510
Latitude, deg
Longitude, deg


May 14, 2015, PGUA, NEXRAD t=20:10Z, Contour for RainRate in dBZ, for SMAP/ Orbit 1510
Latitude, deg
Longitude, deg


VxH-Crosspol NRCS in dB near GUAM, 14-May-2015, Orbit 1510
Latitude, deg
Longitude, deg
16
15.5
15
14.5
14
13.5
13
12.5
12
11.5
145
145.5
146
146.5
147
147.5
148
-23
-24
-25
-26
-27
-28
-29
-30
-31
-32


H-Pol B-Temp Distribution, Contour from Grid, Orbit 1510, Guam-14-May
Latitude, deg
Longitude, deg
16
15.5
15
14.5
14
13.5
13
12.5
12
11.5
145
145.5
146
146.5
147
147.5
148
94
92
90
88
86
84
82
80
78
76
74


V-Pol B-Temp Distribution, Contour from Grid, Orbit 1510, Guam-14-May
Latitude, deg
Longitude, deg
16
15.5
15
14.5
14
13.5
13
12.5
12
11.5
145
145.5
146
146.5
147
147.5
148
130
128
126
124
122
120
118
116
114

Observations from this orbit over Hurricane Dolphin show;

1. The strongest winds in the bands around the eye of the storm are resolved by both the radar and the radiometer

2. The spatial features of the radar (H & V-pol) show highly irregular patterns on the surface

3. For winds > 15 m/s there are no distinct rain features in the radiometer data

In general these results are in agreement with results from Tang, et al, in Remote Sensing of the Environment (2013)

This report is only the beginning of thisinvestigation