EMC Production Suite Review 2005
Ocean Prediction Center

Joe Sienkiewicz – Chief (Acting) Ocean Applications Branch
Science and Operations Officer

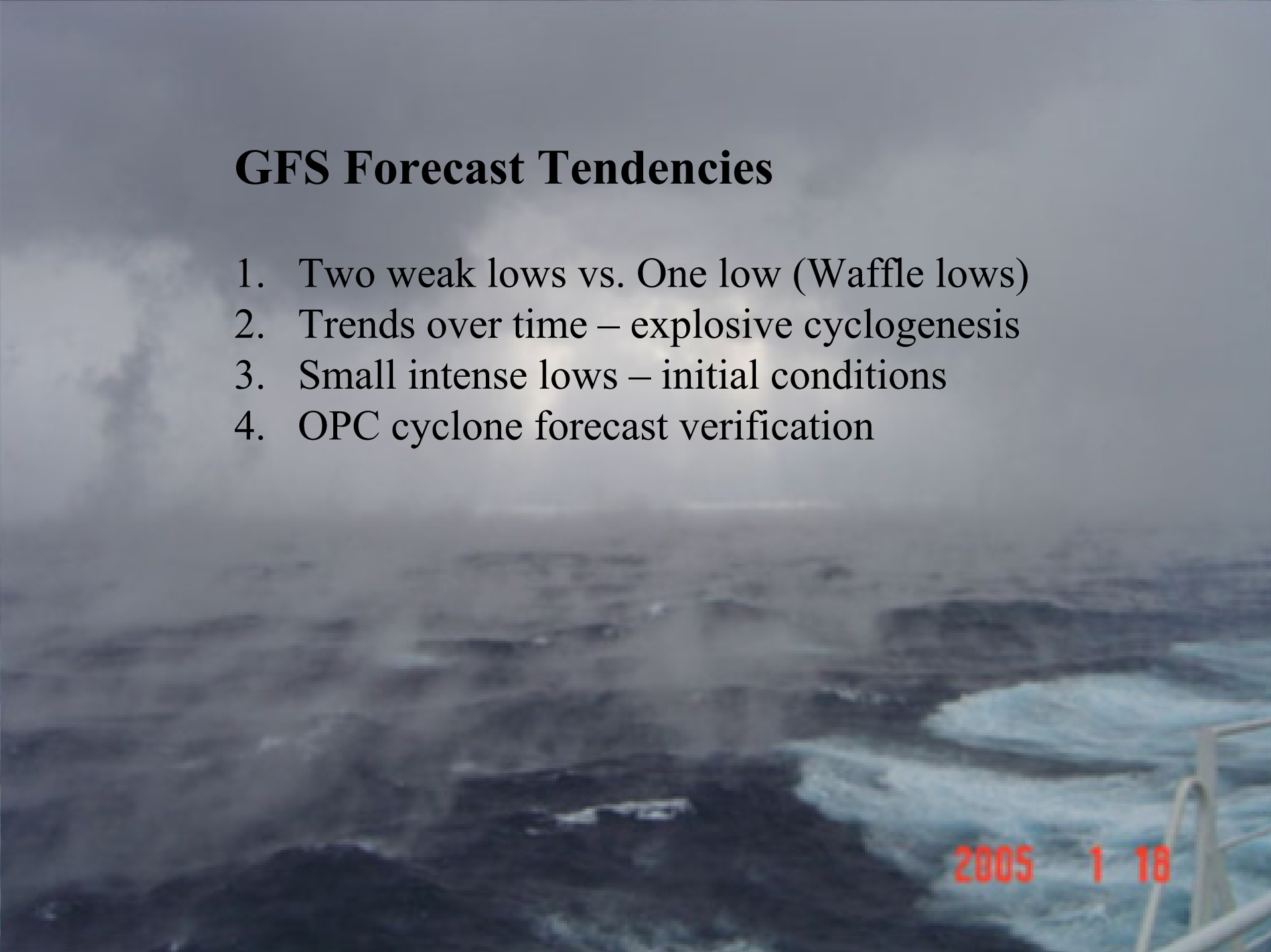
Outline

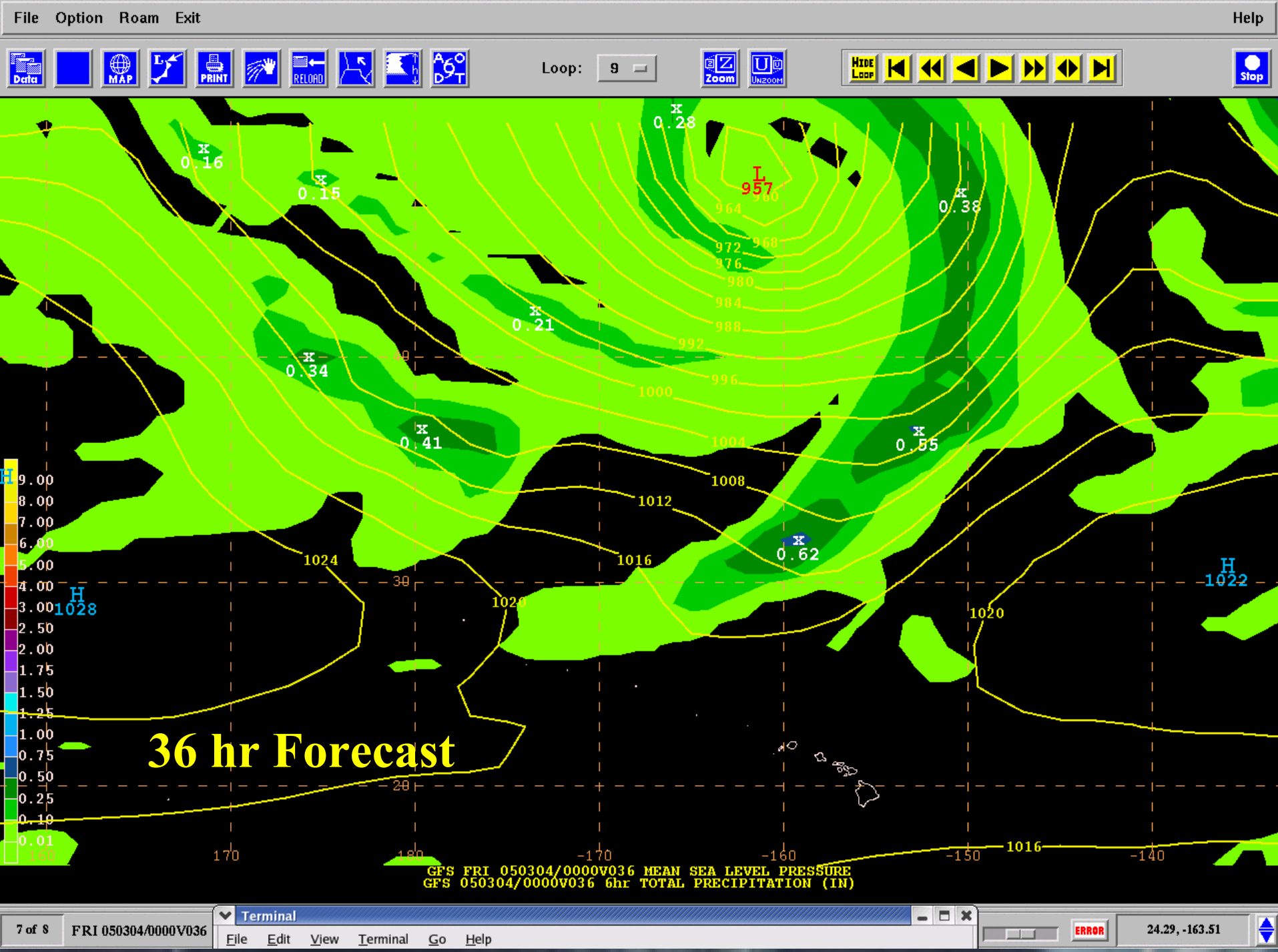
1. **GFS Forecast Tendencies**
2. **Cyclone forecast verification**
3. **Winds**
4. **RTOFS_ATL (HYCOM)**

2005 1 18

GFS Forecast Tendencies

1. Two weak lows vs. One low (Waffle lows)
2. Trends over time – explosive cyclogenesis
3. Small intense lows – initial conditions
4. OPC cyclone forecast verification

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GFS FRI 050304/0000V036 MEAN SEA LEVEL PRESSURE
GFS 050304/0000V036 6hr TOTAL PRECIPITATION (IN)
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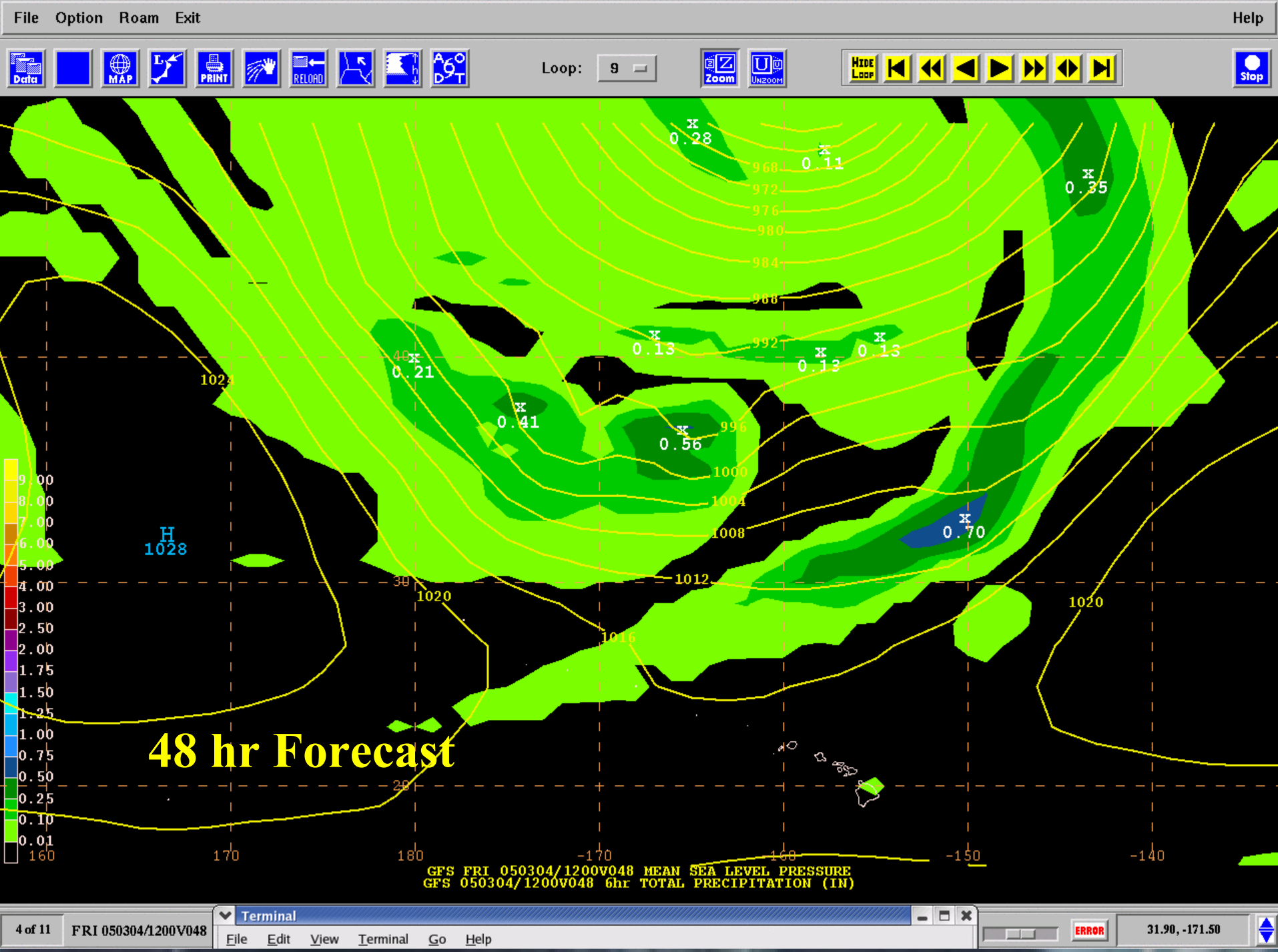
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GFS 050304/1200V048 6hr TOTAL PRECIPITATION (IN)
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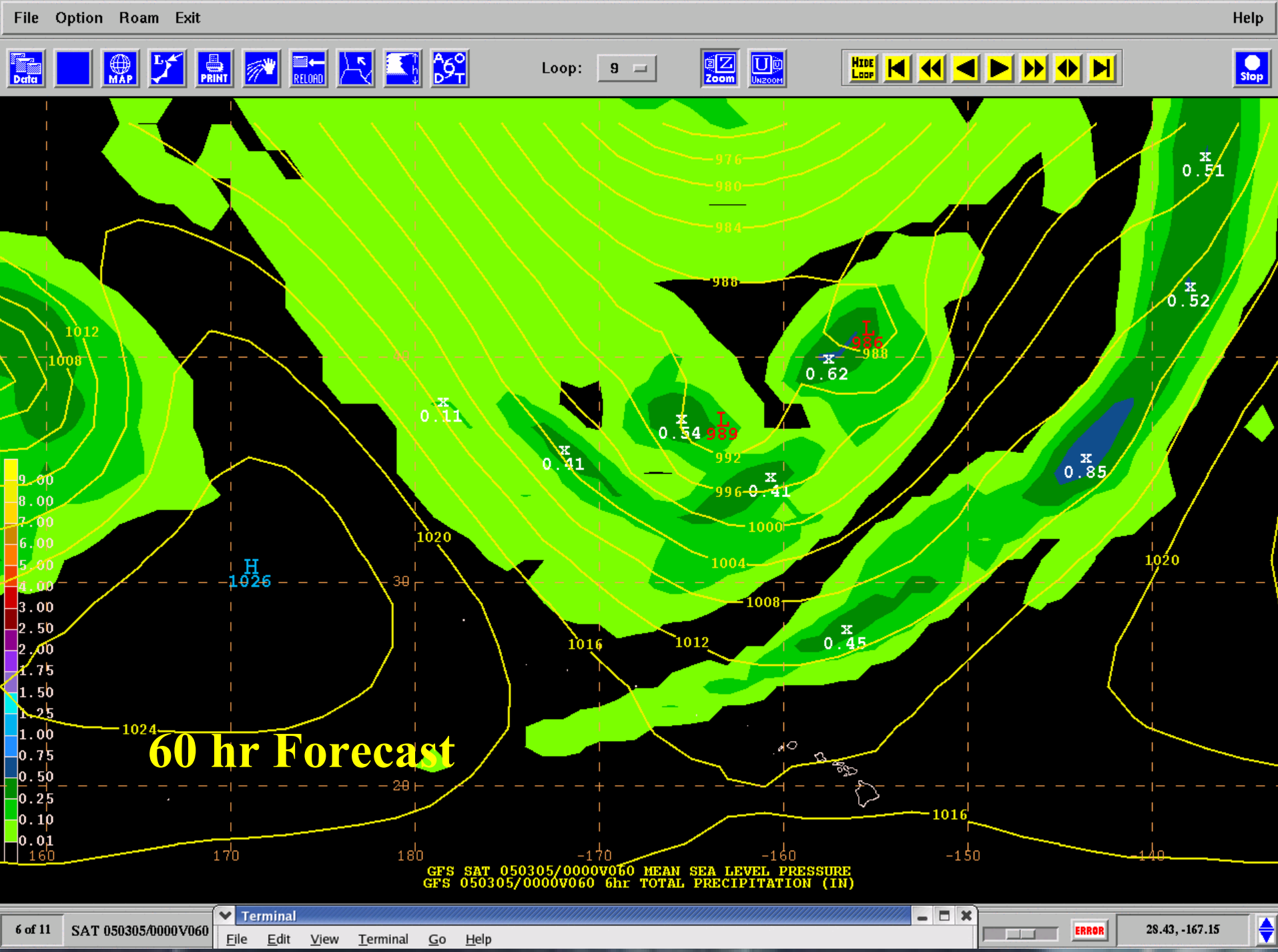
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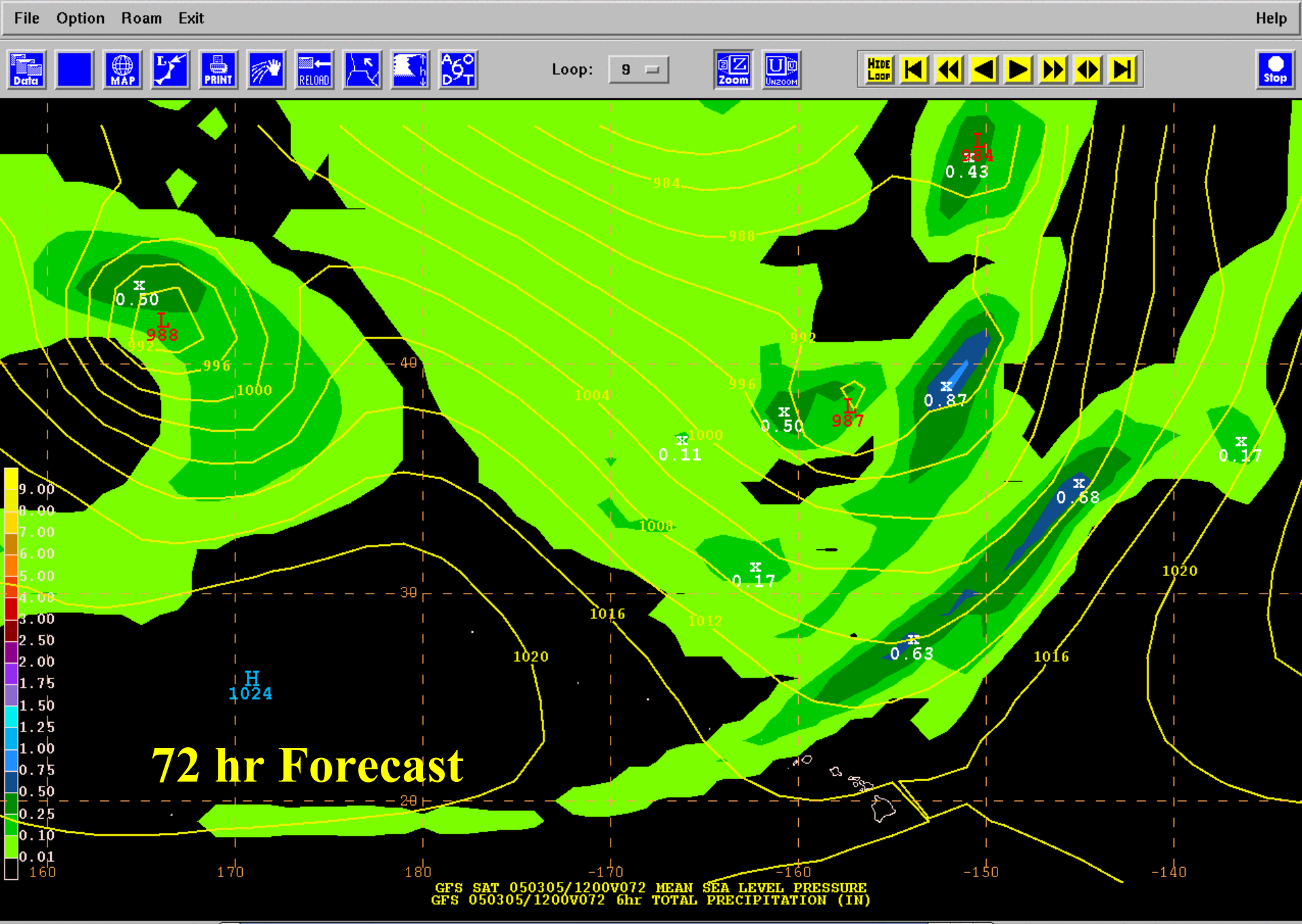
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GFS 050305/1200V072 6hr TOTAL PRECIPITATION (IN)
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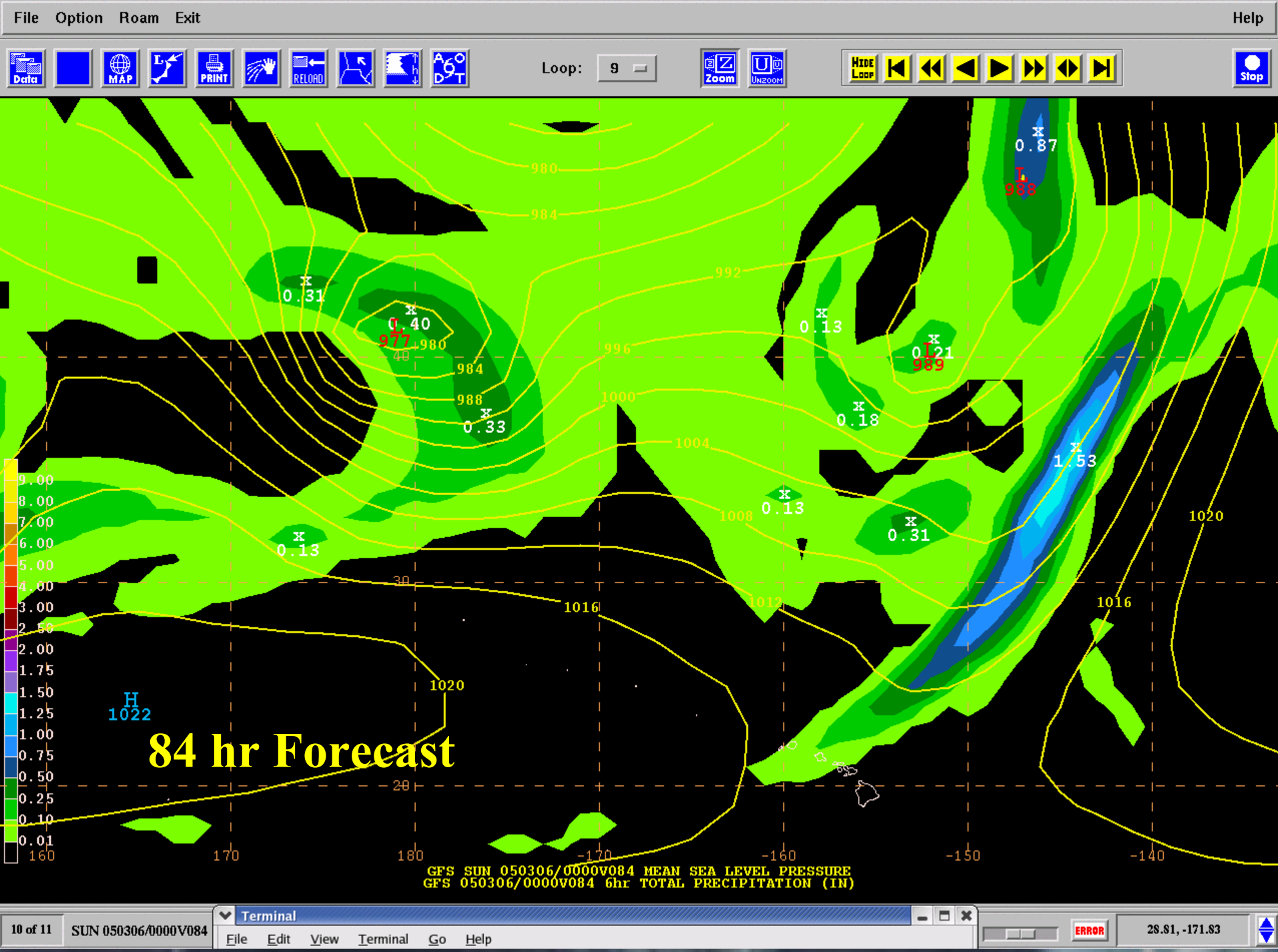
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GFS 050306/0000V084 6hr TOTAL PRECIPITATION (IN)
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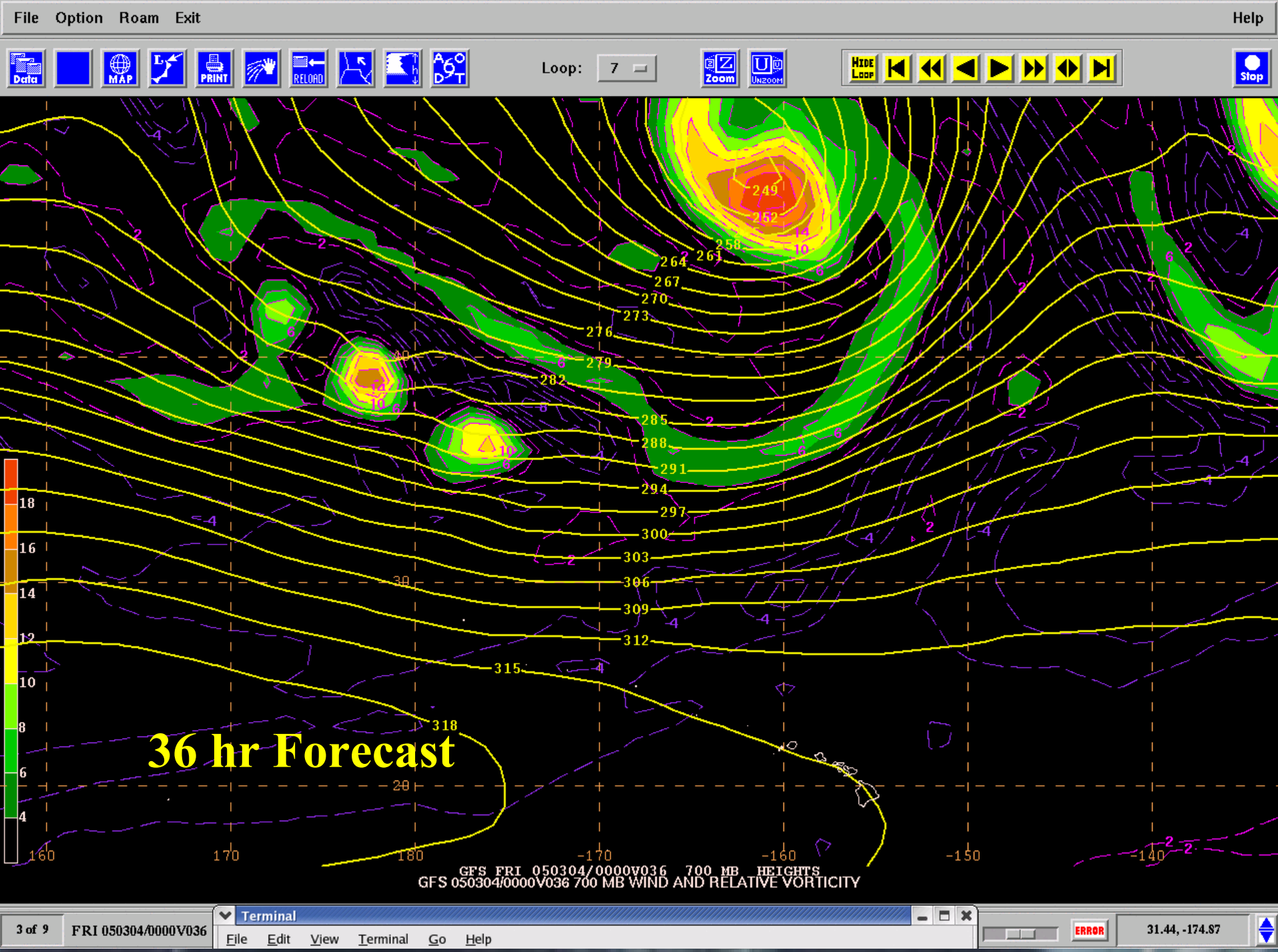
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GFS 050304/0000V036 700 MB WIND AND RELATIVE VORTICITY
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FRI 050304/0000V036
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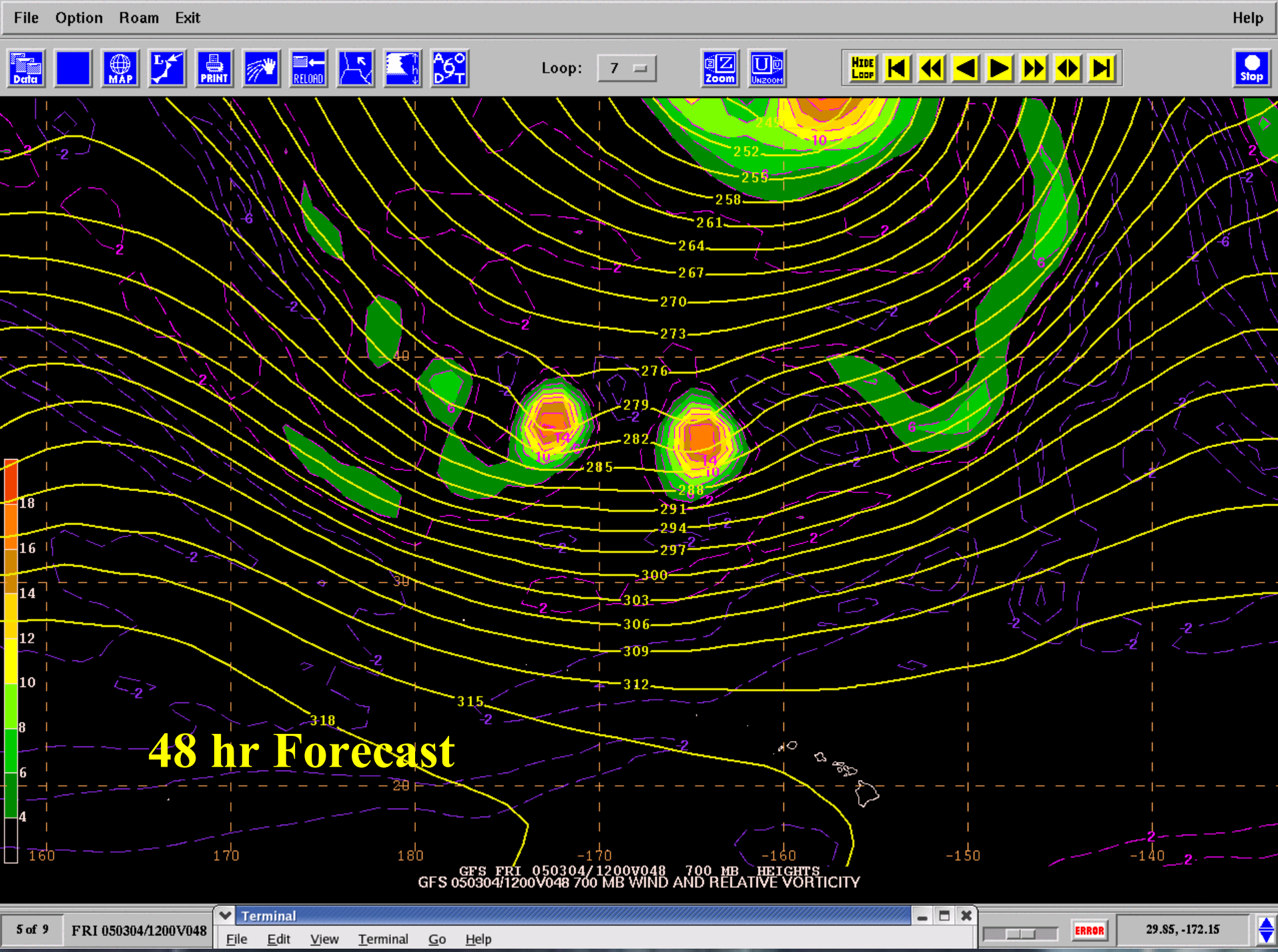
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GFS 050304/1200V048 700 MB WIND AND RELATIVE VORTICITY
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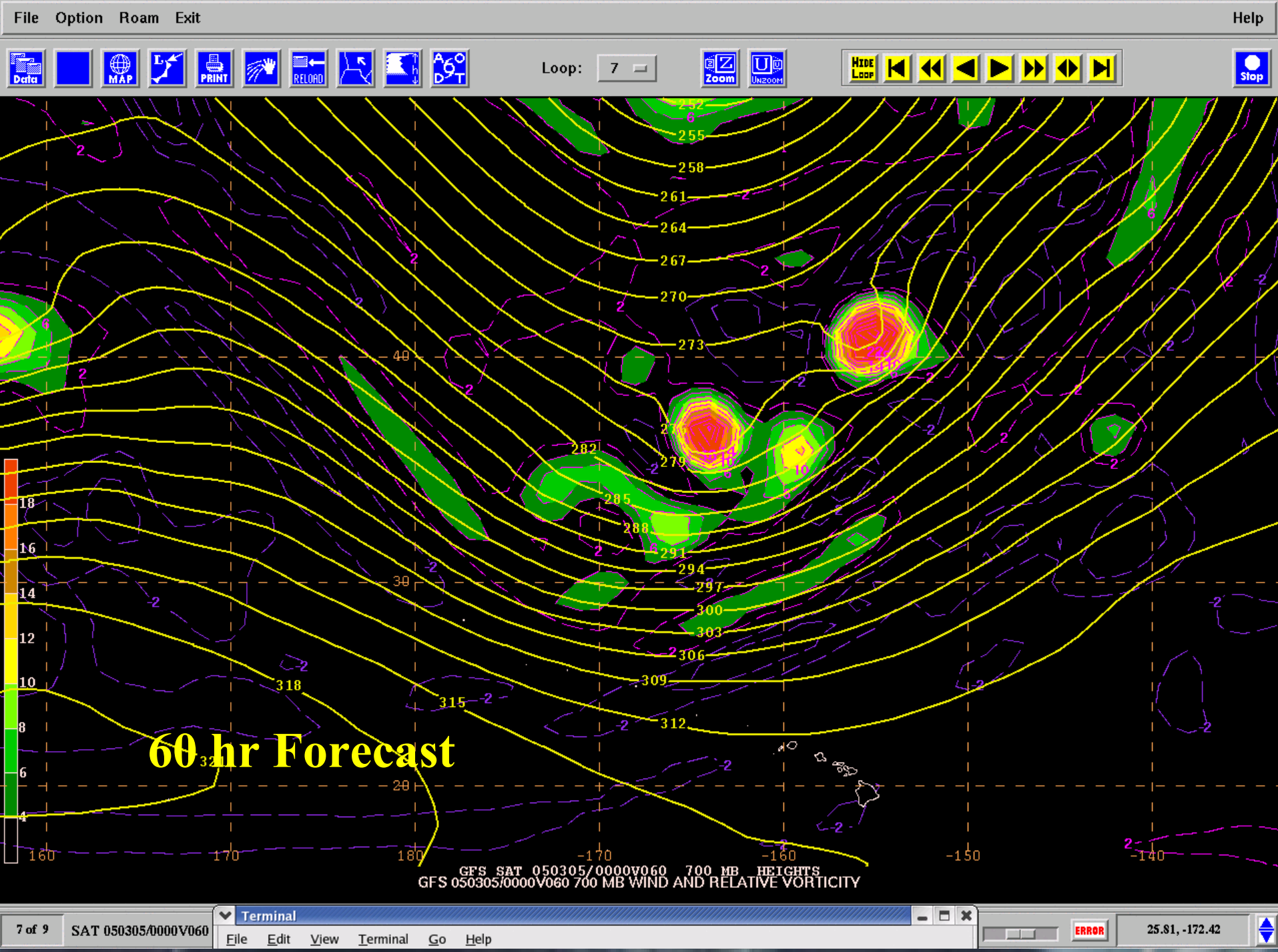
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GFS 050305/0000V060 700 MB WIND AND RELATIVE VORTICITY
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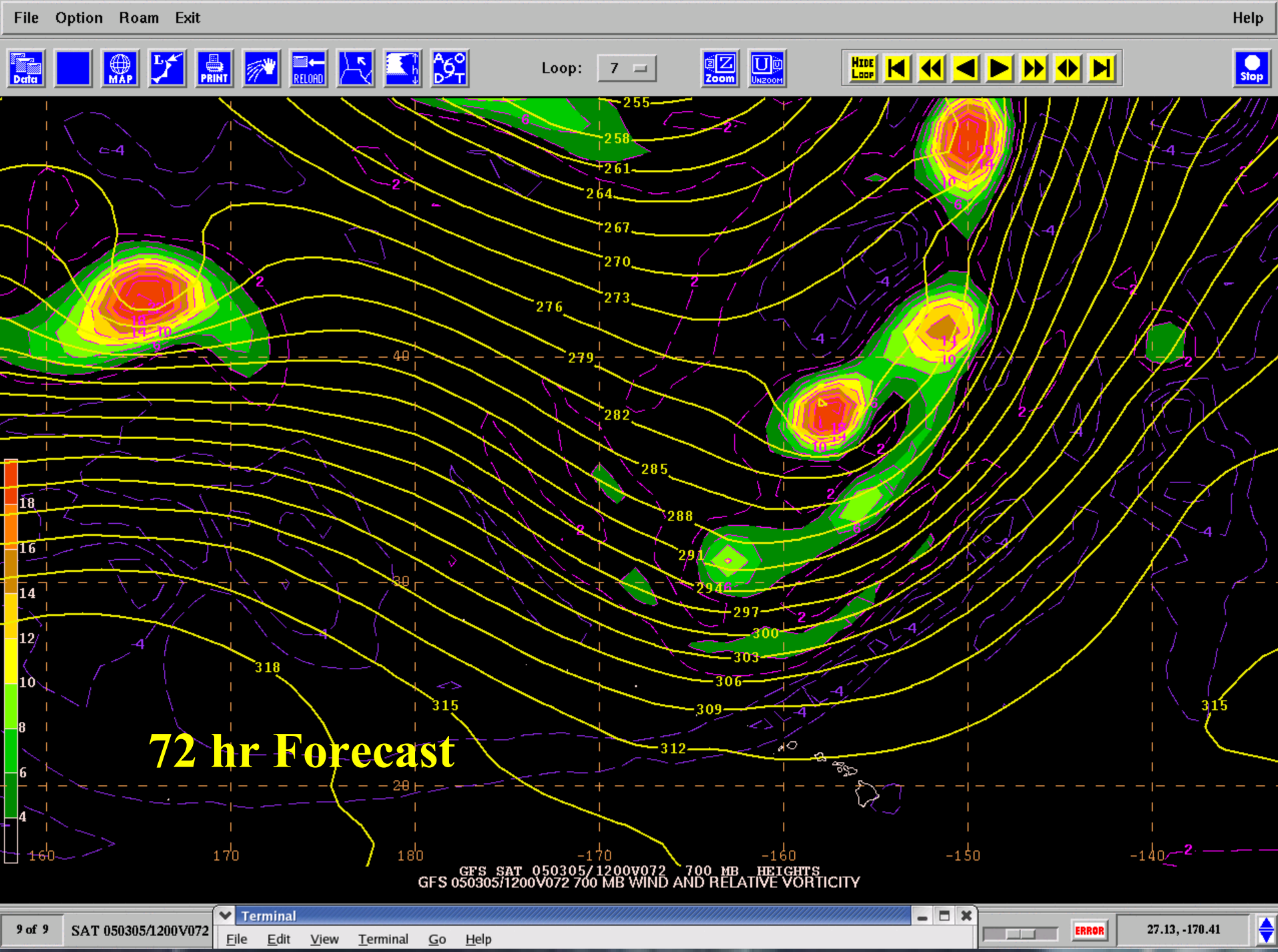
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GFS 050305/1200V072 700 MB WIND AND RELATIVE VORTICITY
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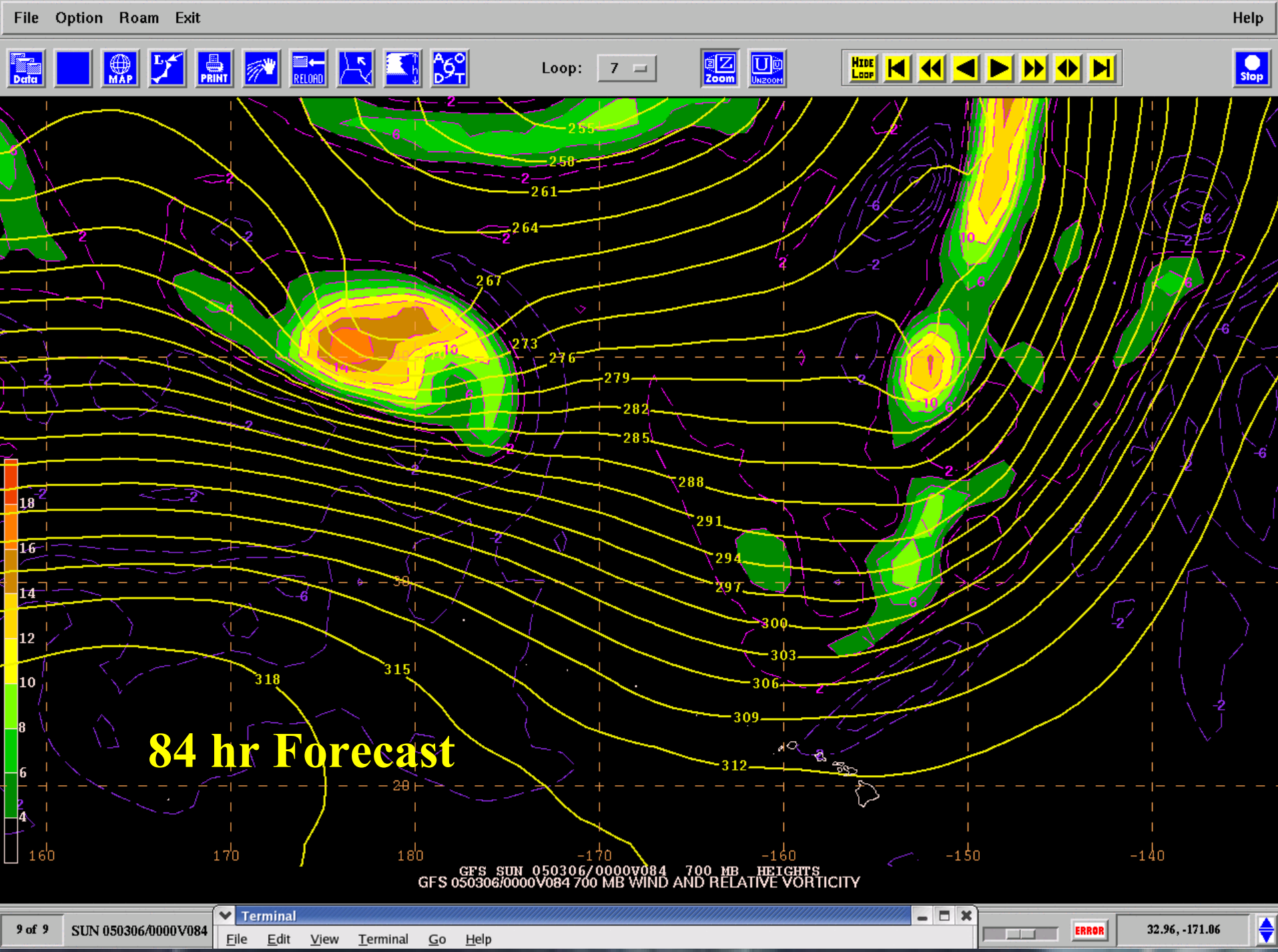
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GFS 050306/0000V084 700 MB WIND AND RELATIVE VORTICITY
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SUN 050306/0000V084
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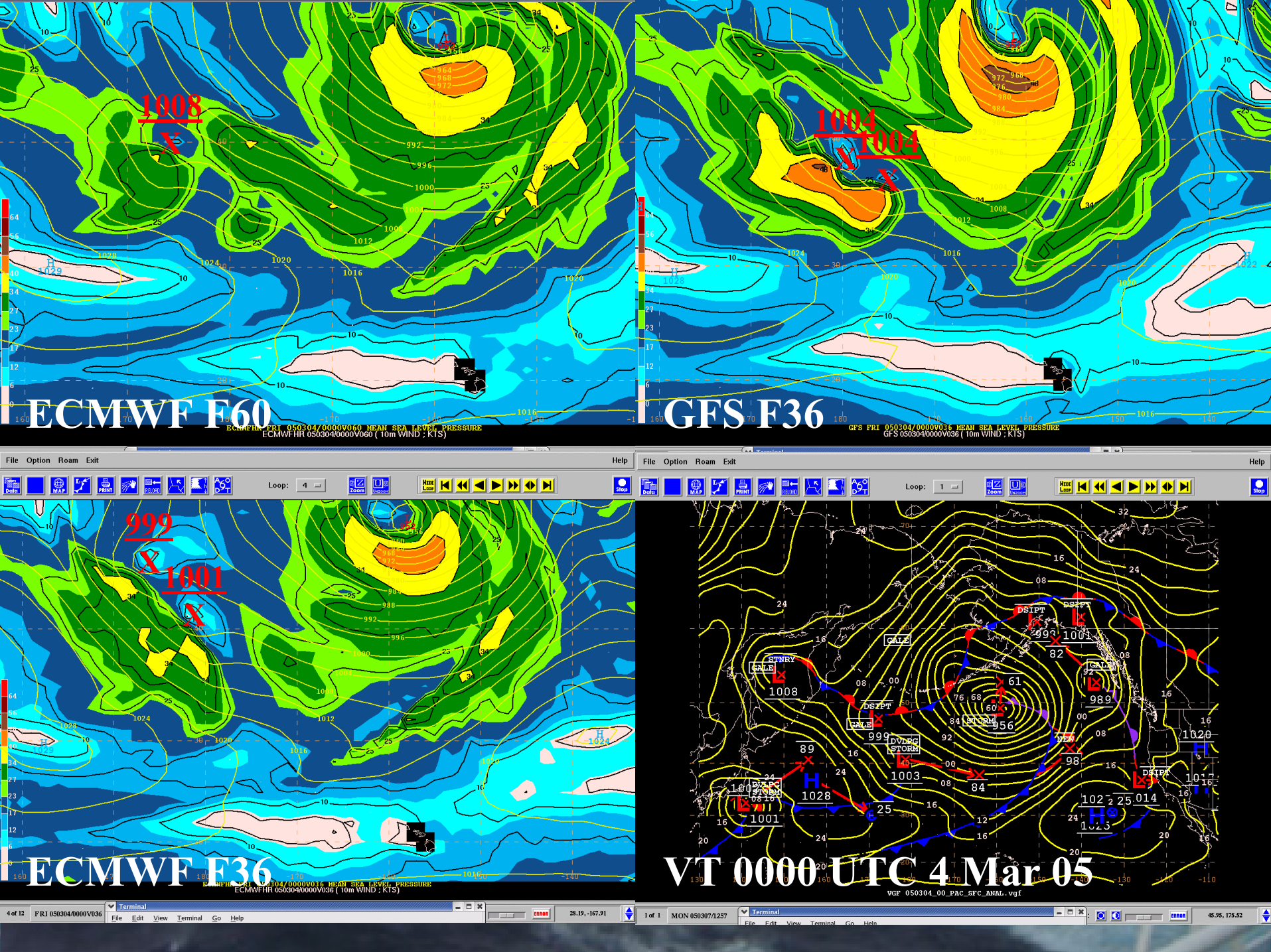
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1004
1004
GFS FRI 050304/0000V036 MEAN SEA LEVEL PRESSURE
GFS 050304/0000V036 (10m WIND ; KTS)
ECMWF F36
992
1001
ECMWF HR 050304/0000V036 MEAN SEA LEVEL PRESSURE
ECMWF HR 050304/0000V036 (10m WIND ; KTS)
VT 0000 UTC 4 Mar 05
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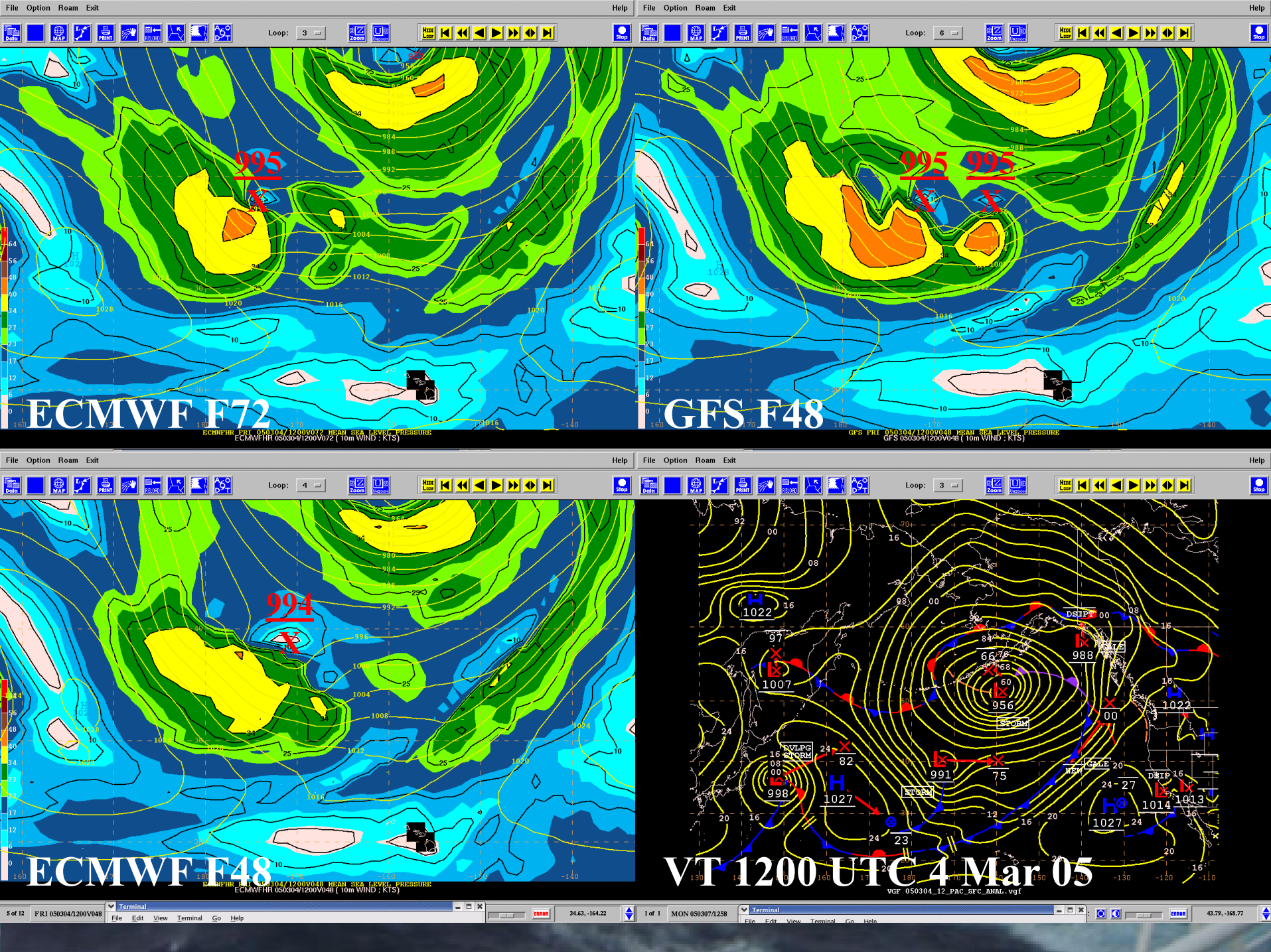
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ECMWFHR 050304/1200V048 (10m WIND ; KTS)
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STORM
DVLPG STORM
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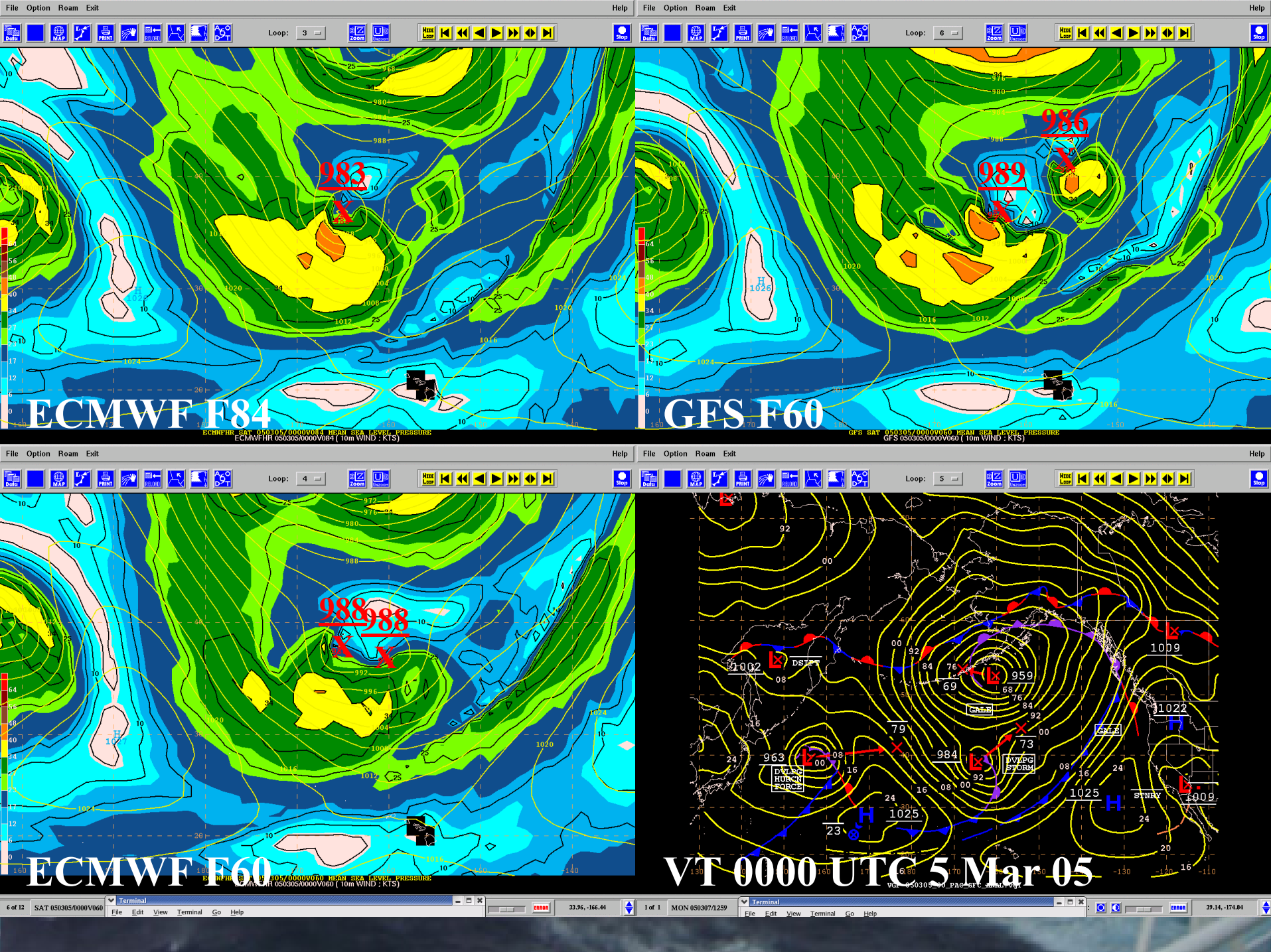
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VT 0000 UTC 5 Mar 05
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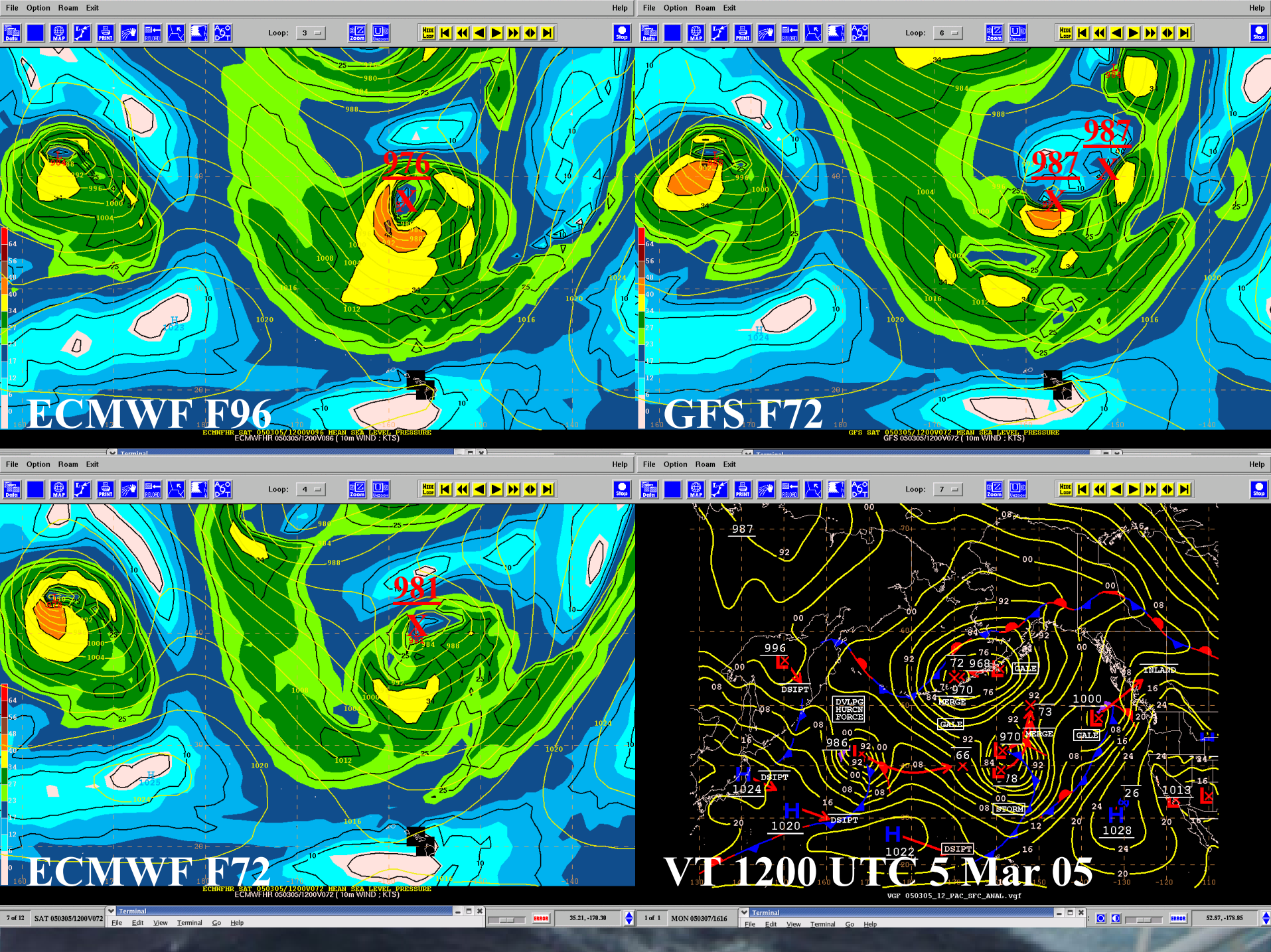
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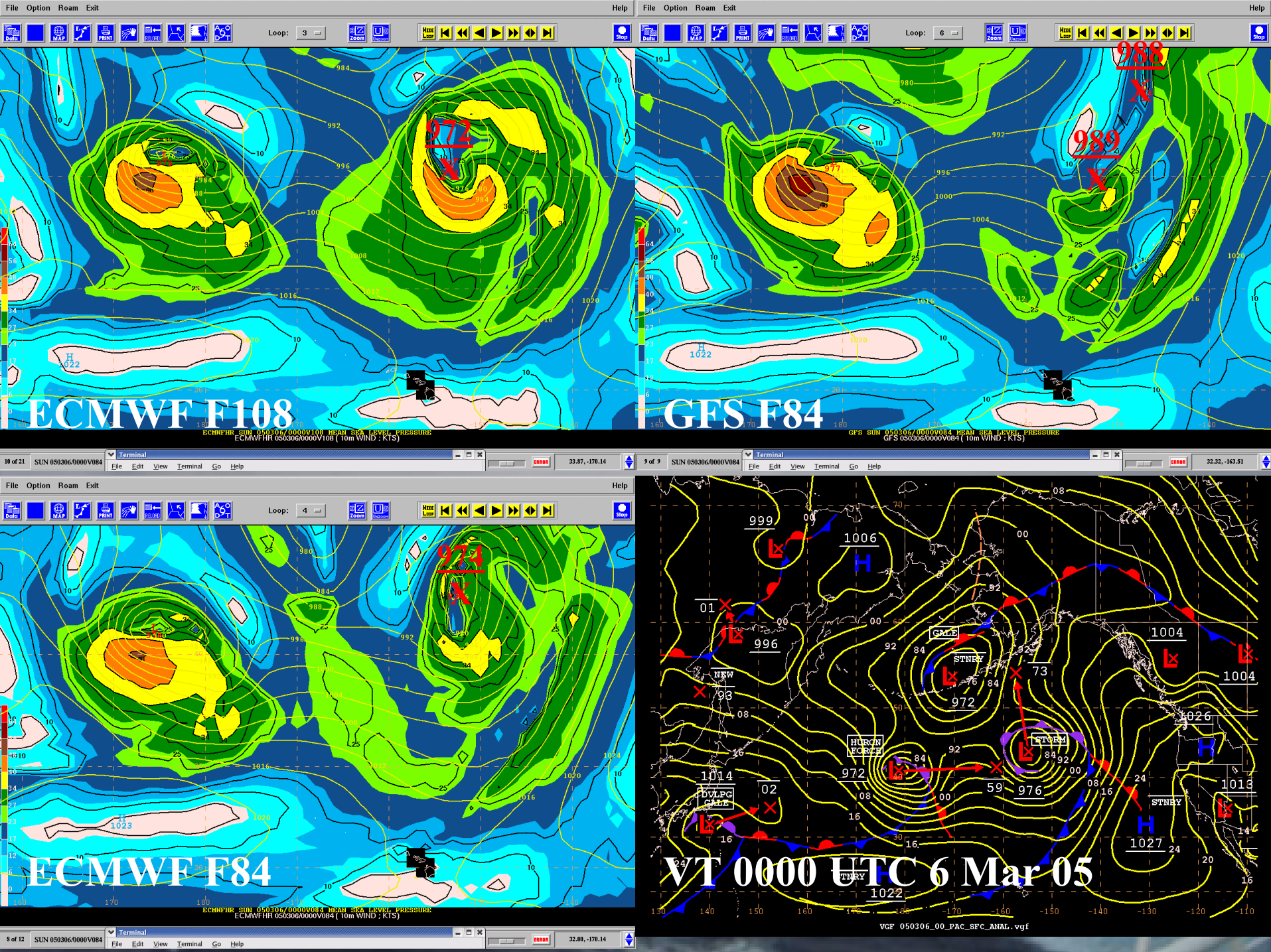
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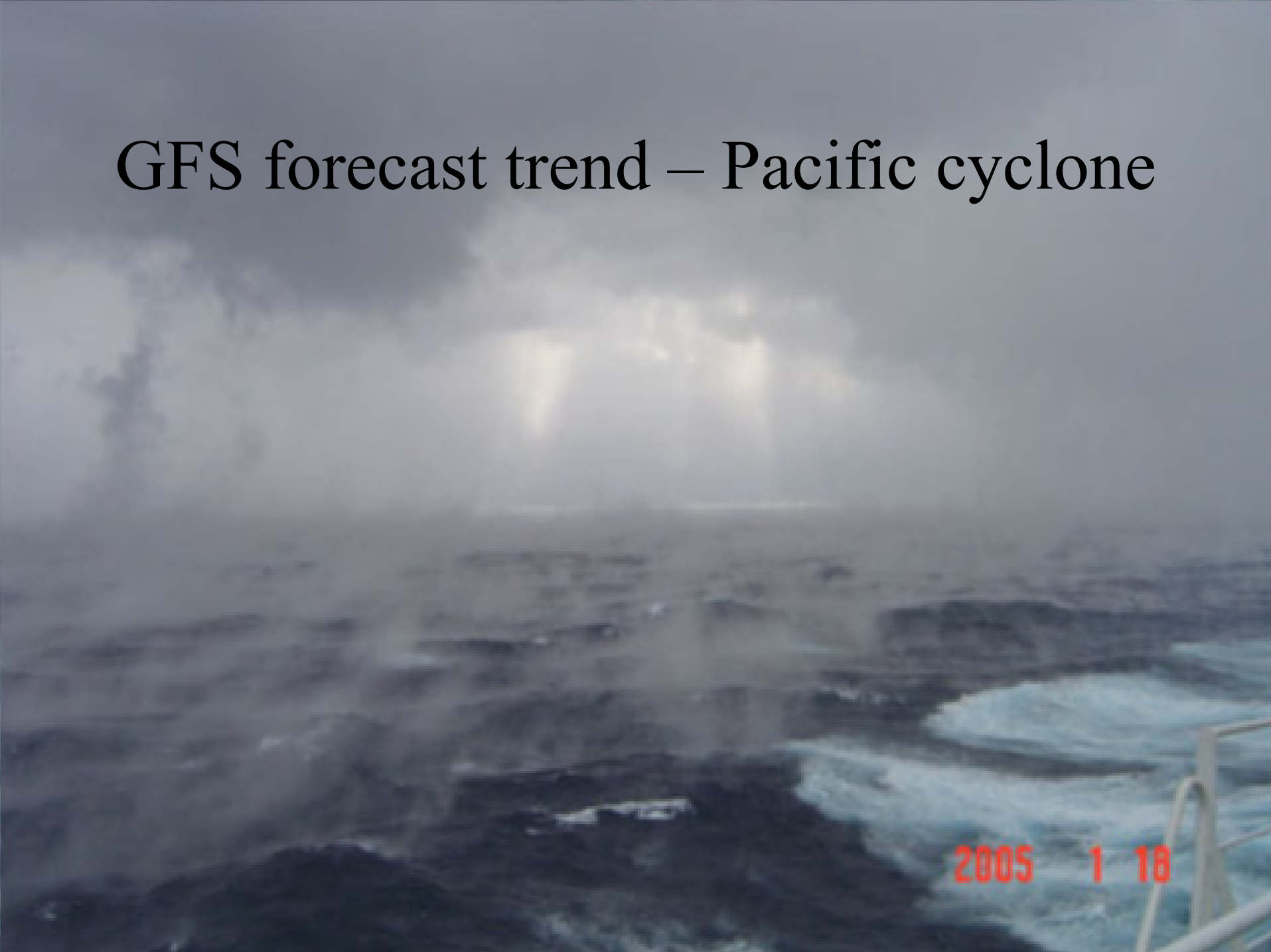
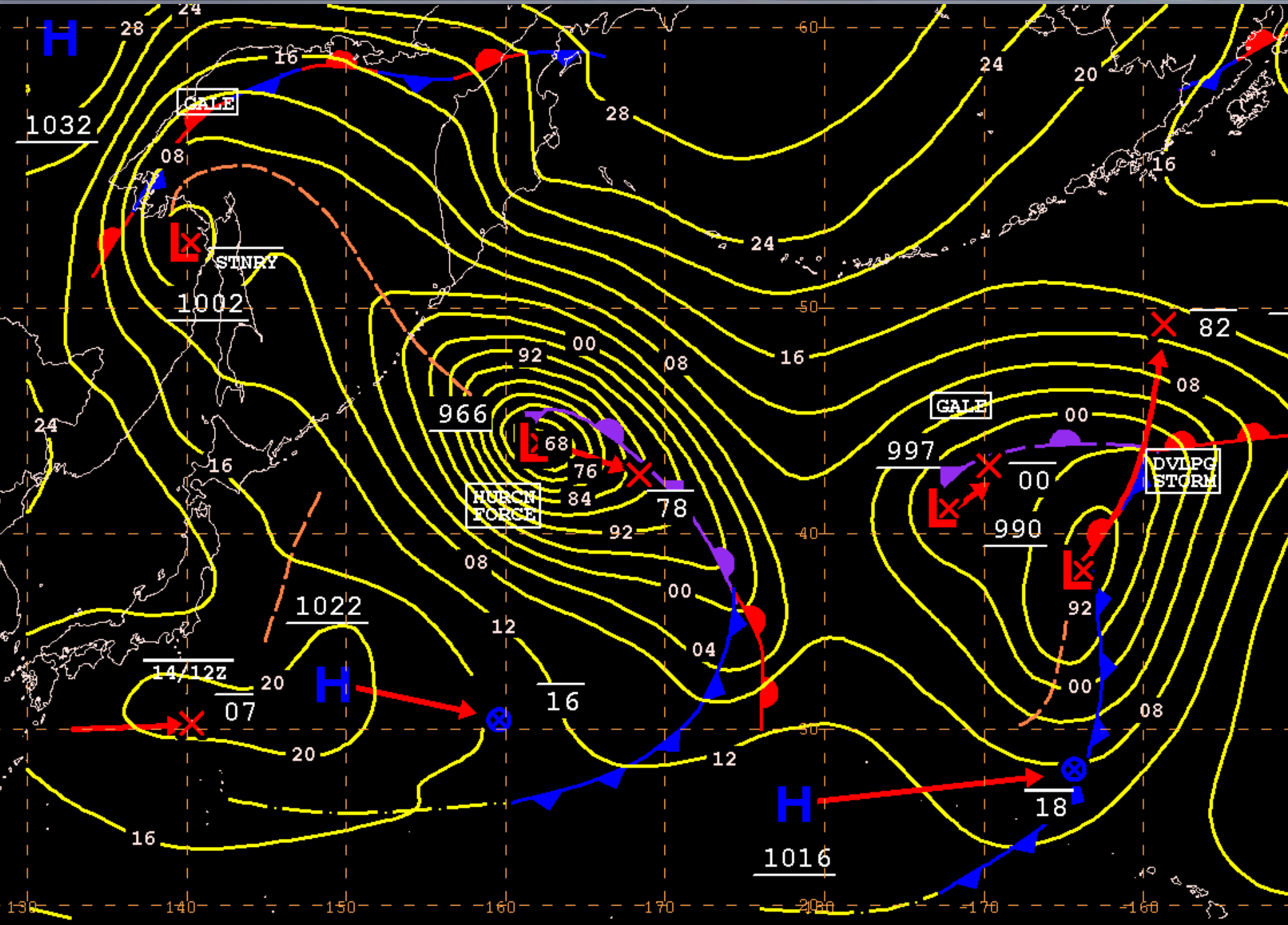
GFS forecast trend – Pacific cyclone

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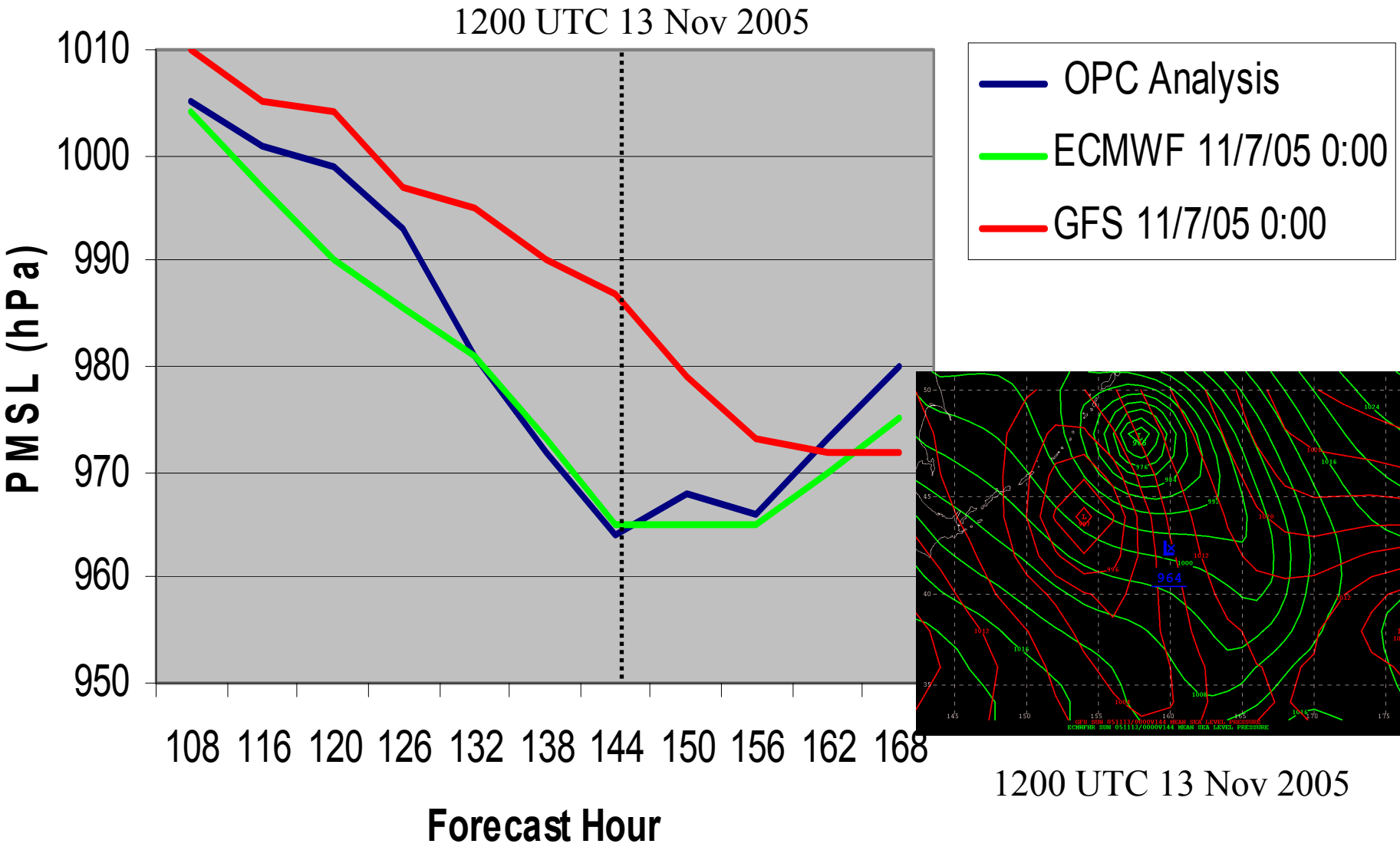
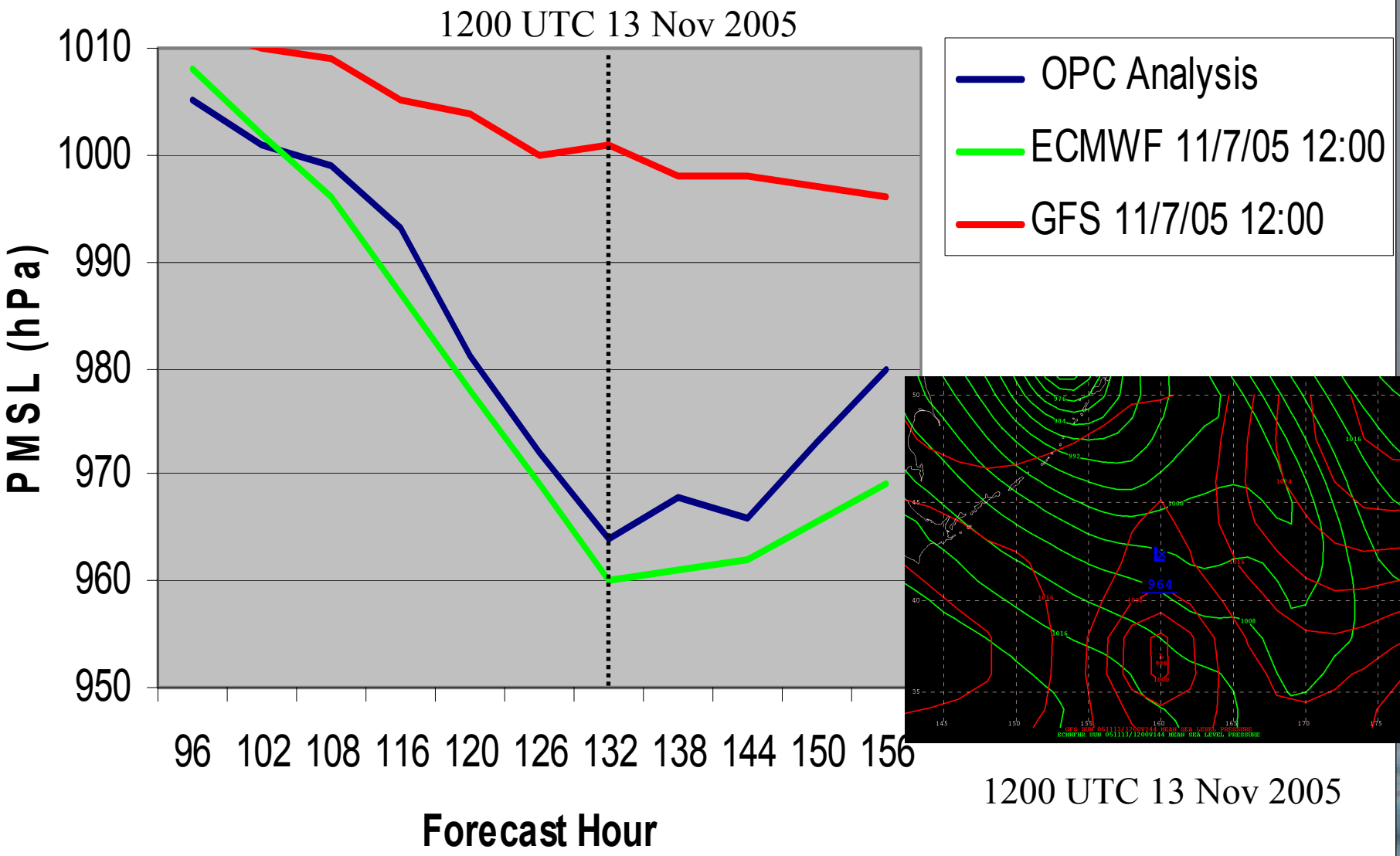
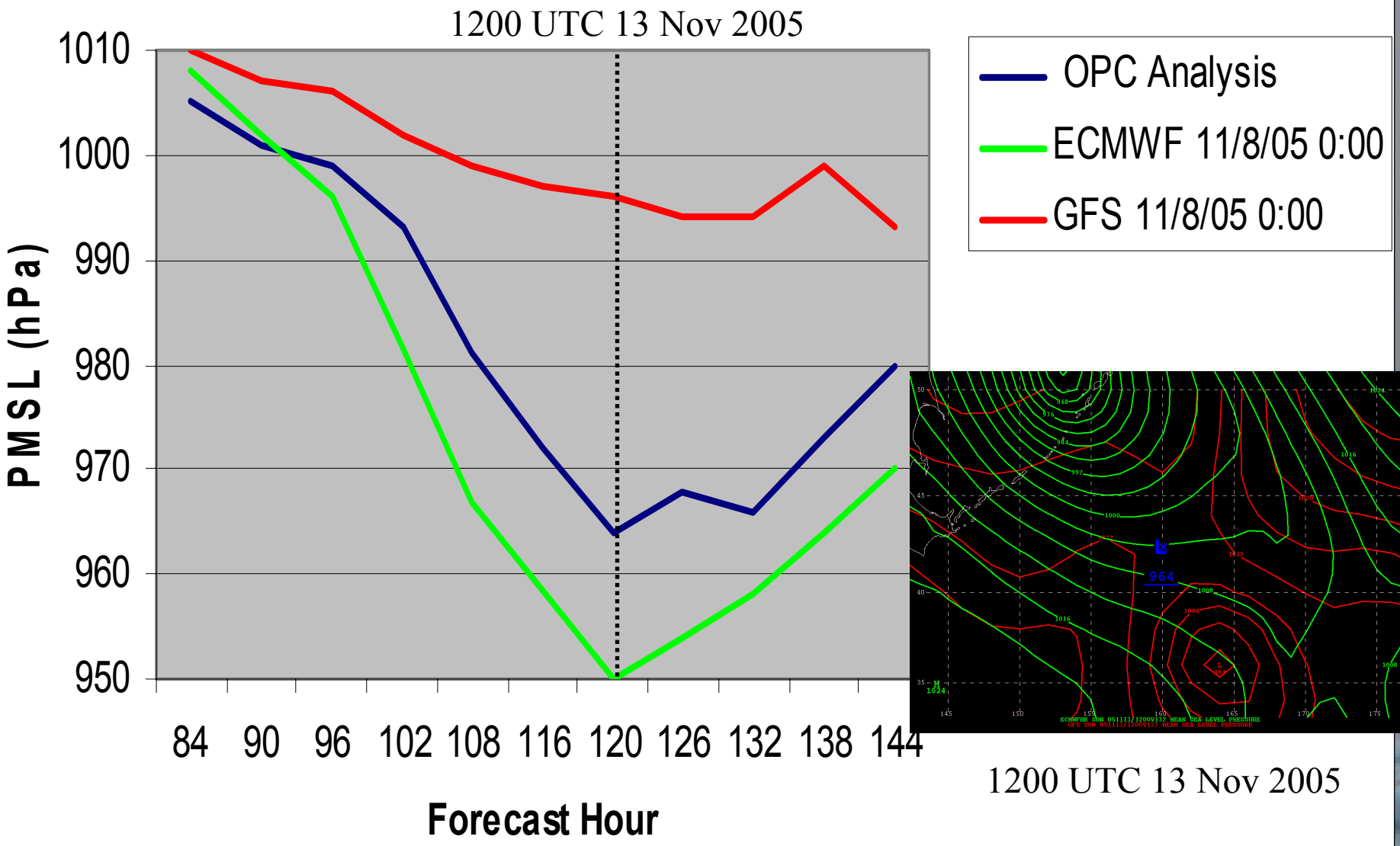
Pacific Cyclone Nov 2005



Pacific Cyclone Nov 2005



Pacific Cyclone Nov 2005



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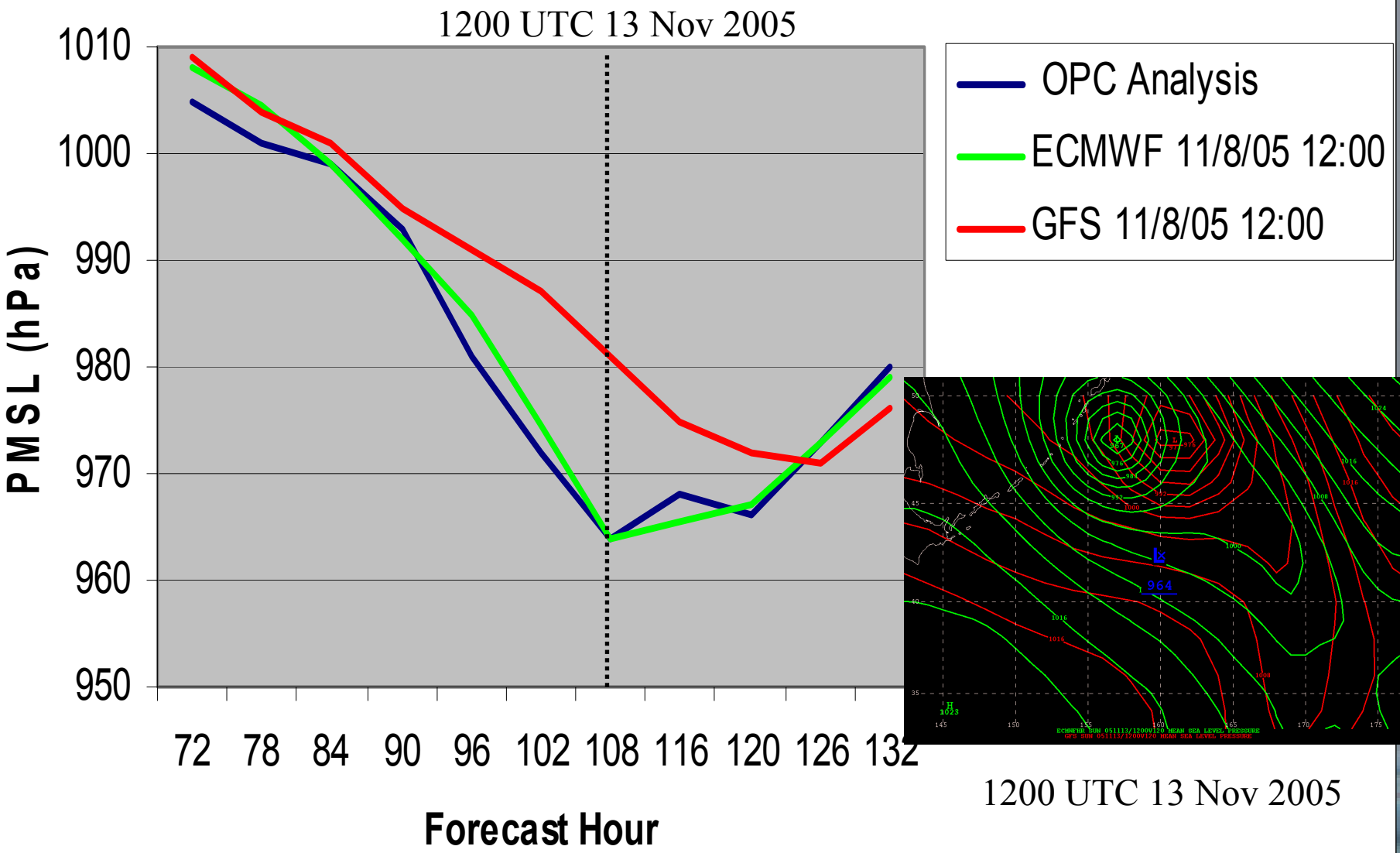
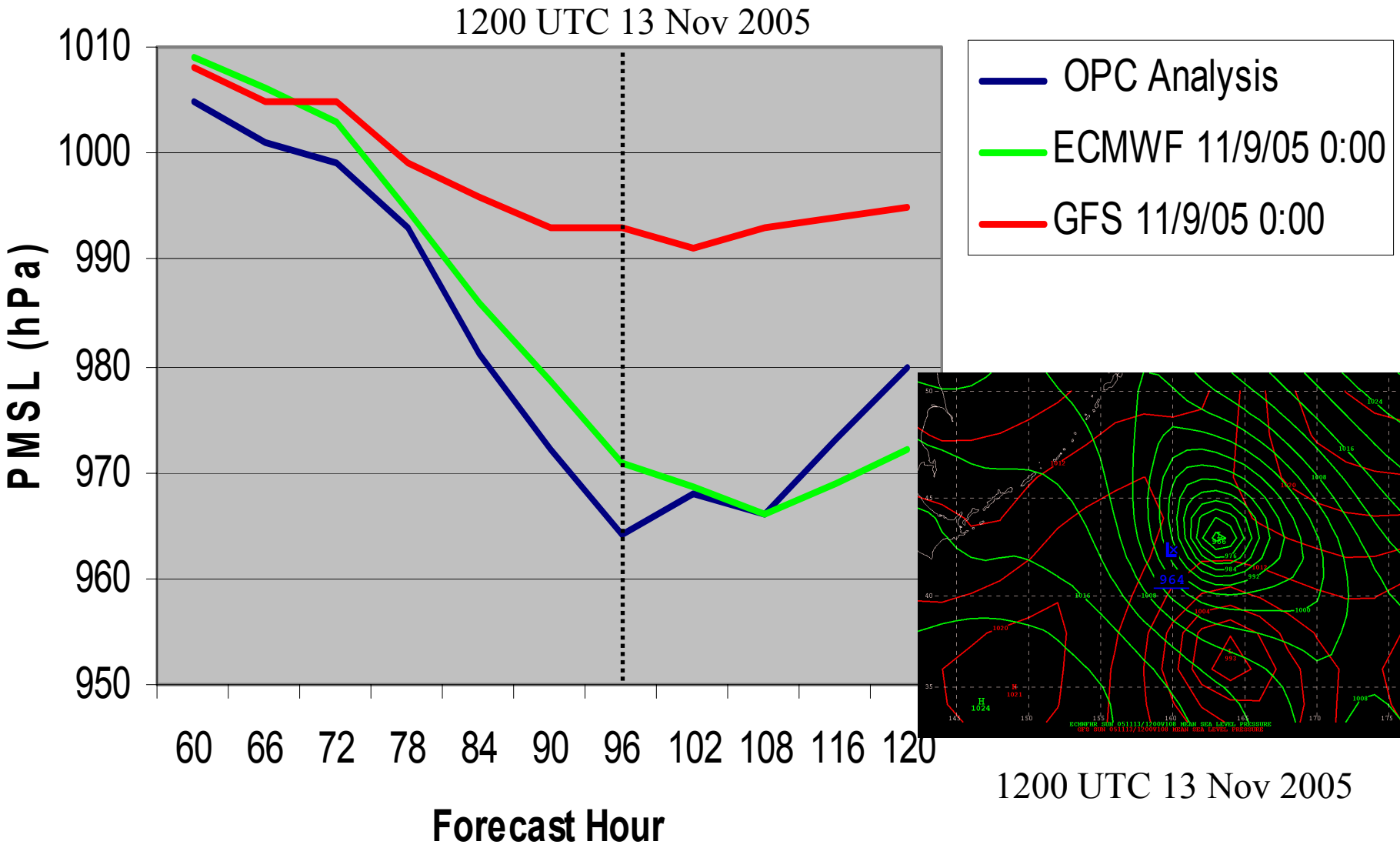
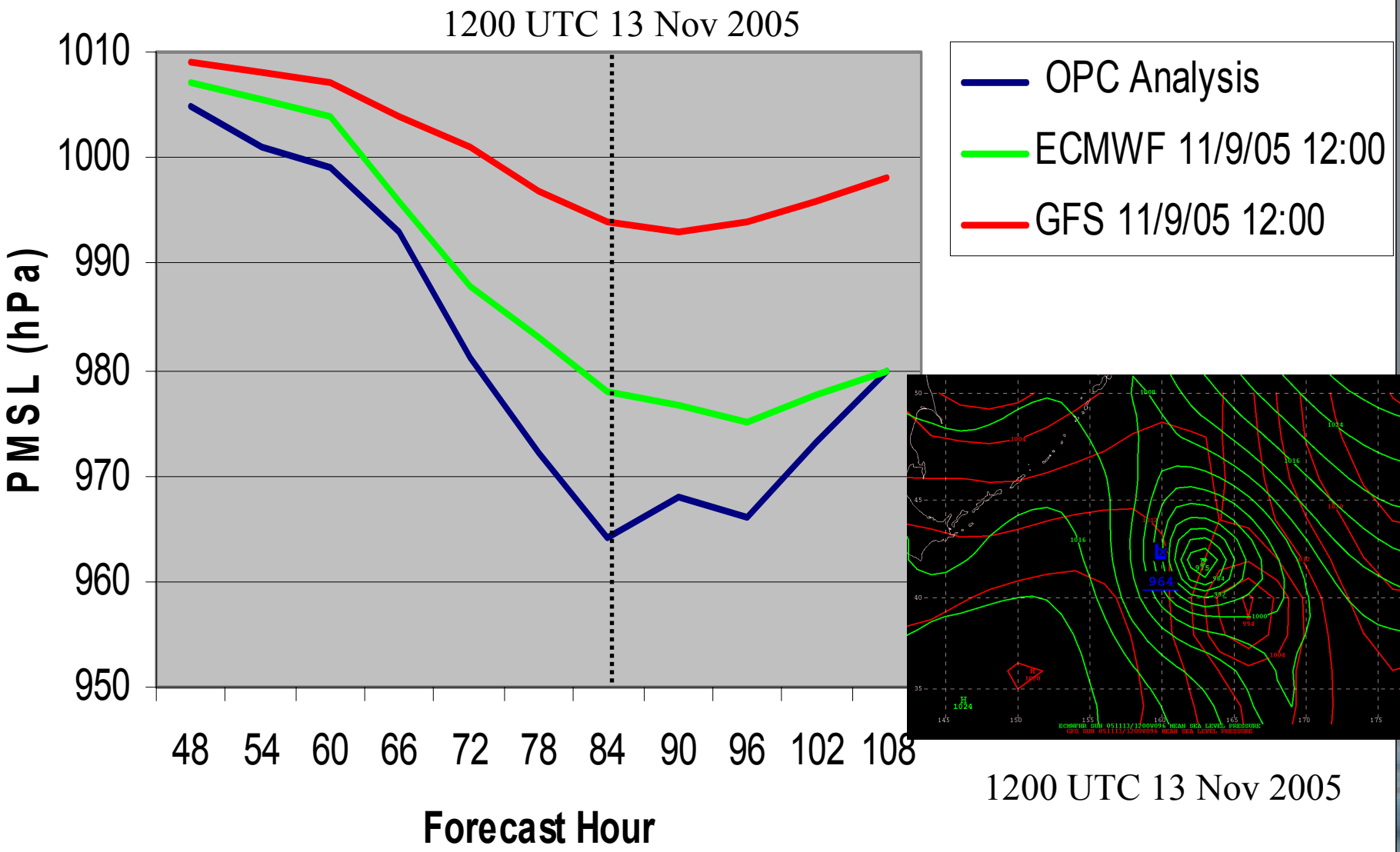


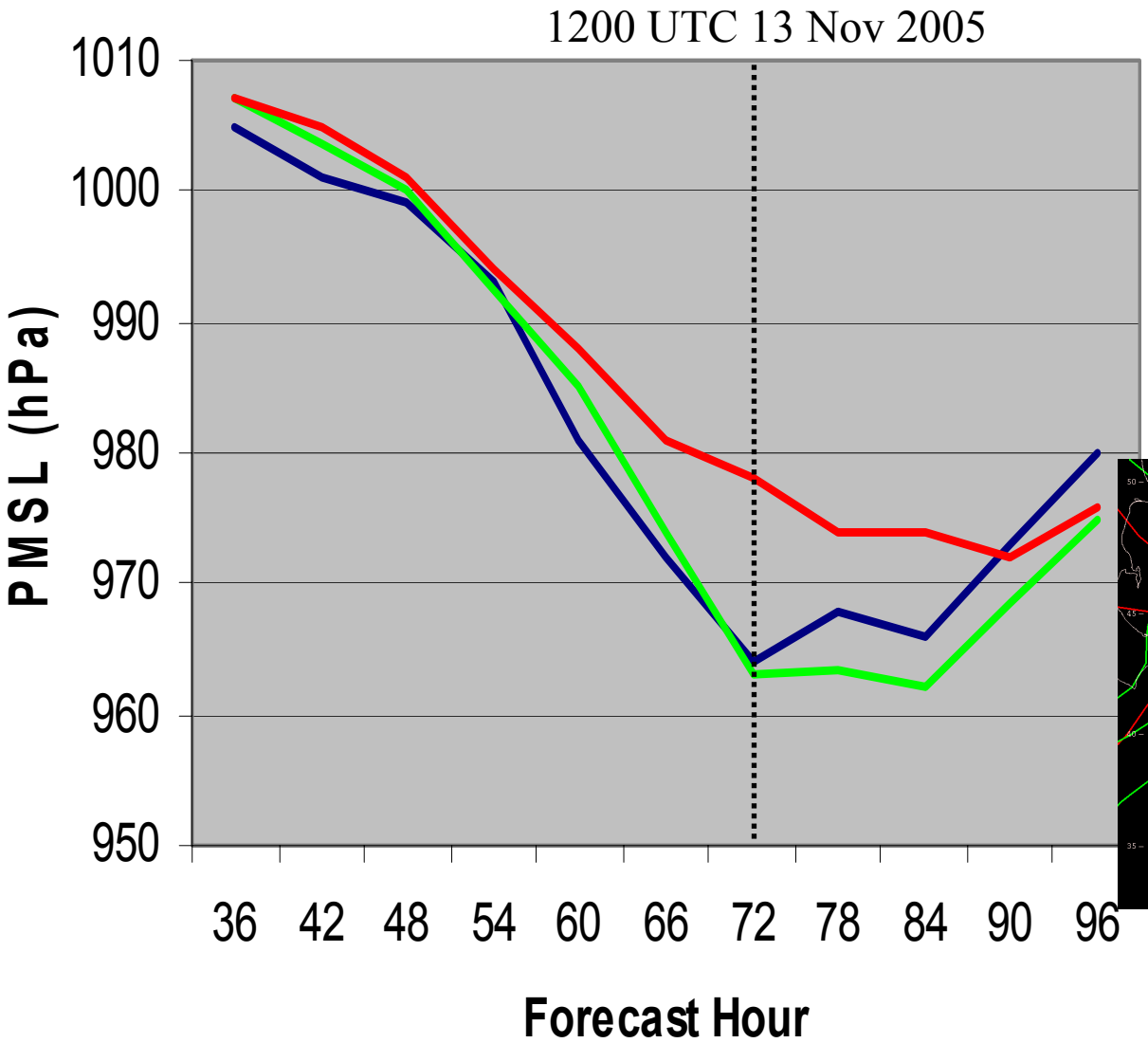
Pacific Cyclone Nov 2005

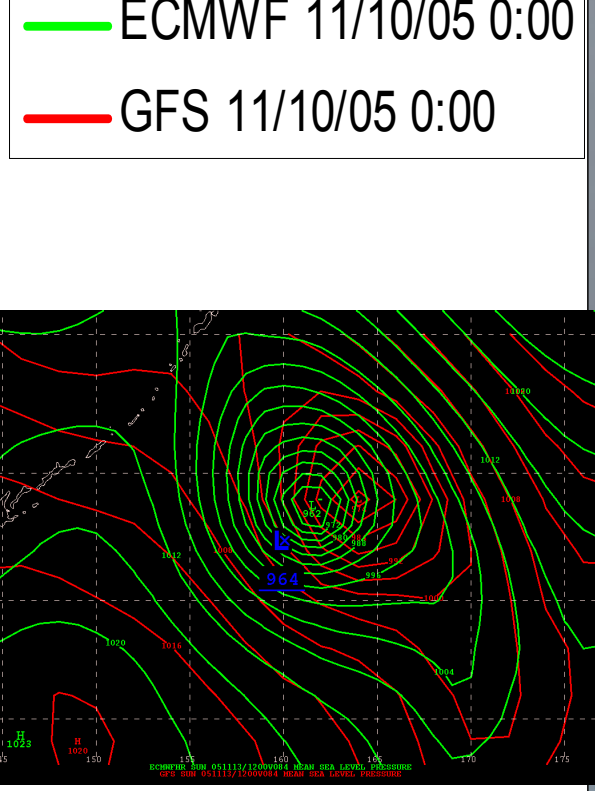


Pacific Cyclone Nov 2005



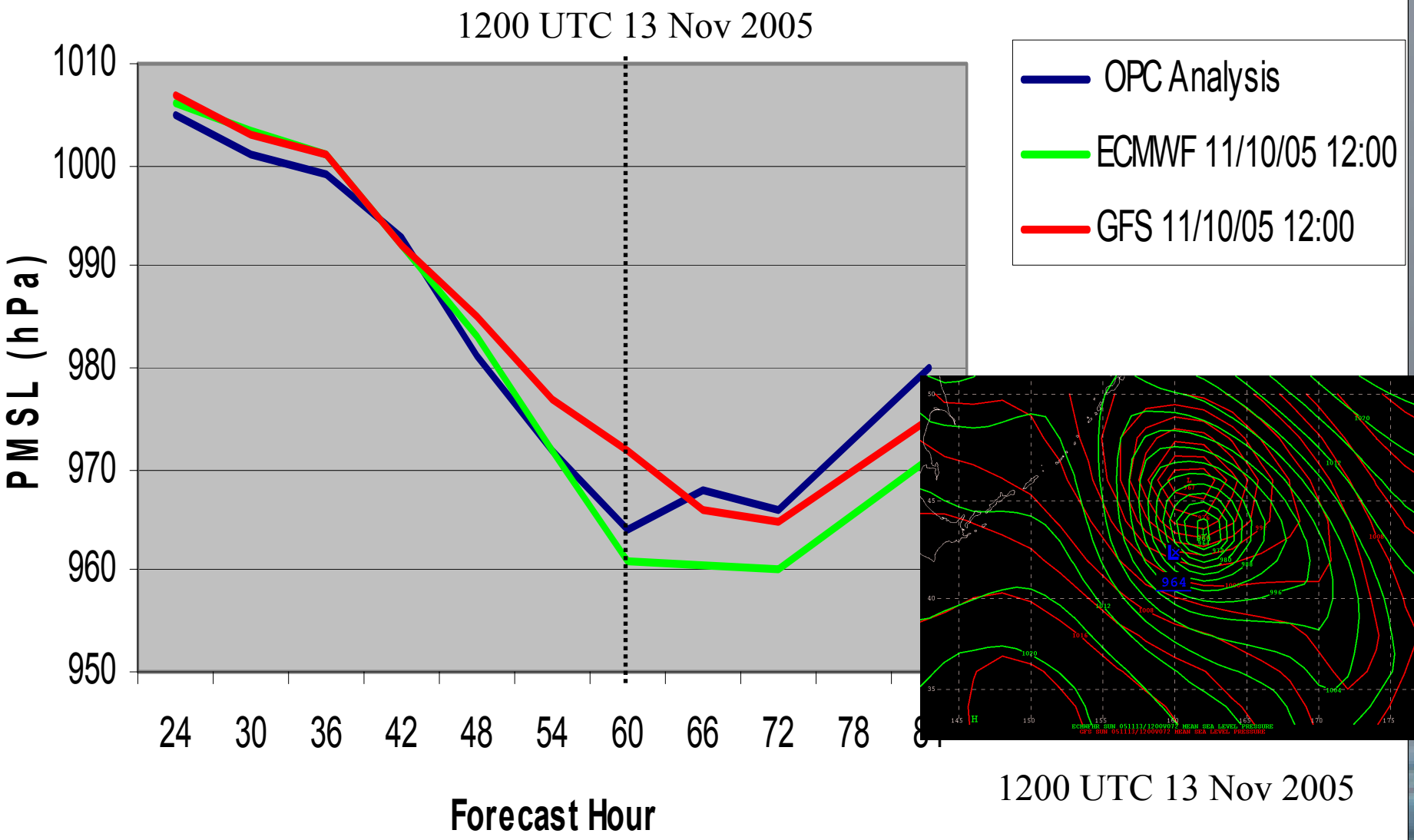
Pacific Cyclone Nov 2005



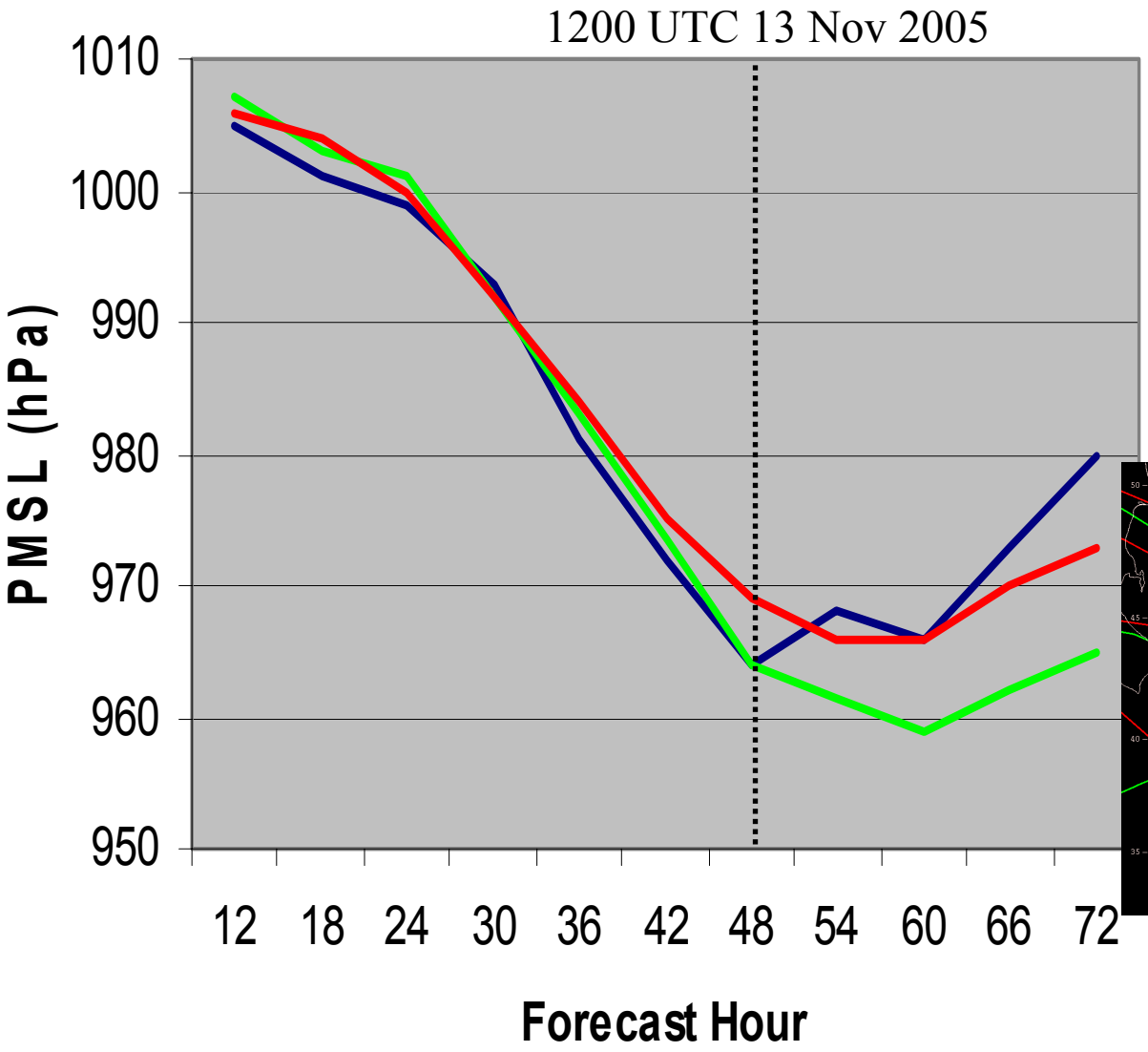


1200 UTC 13 Nov 2005

Pacific Cyclone Nov 2005



Pacific Cyclone Nov 2005



OPC Analysis

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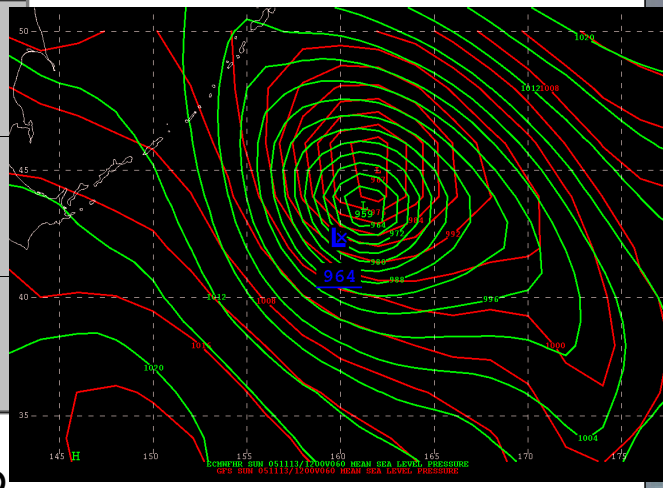
GFS 11/11/05 0:00



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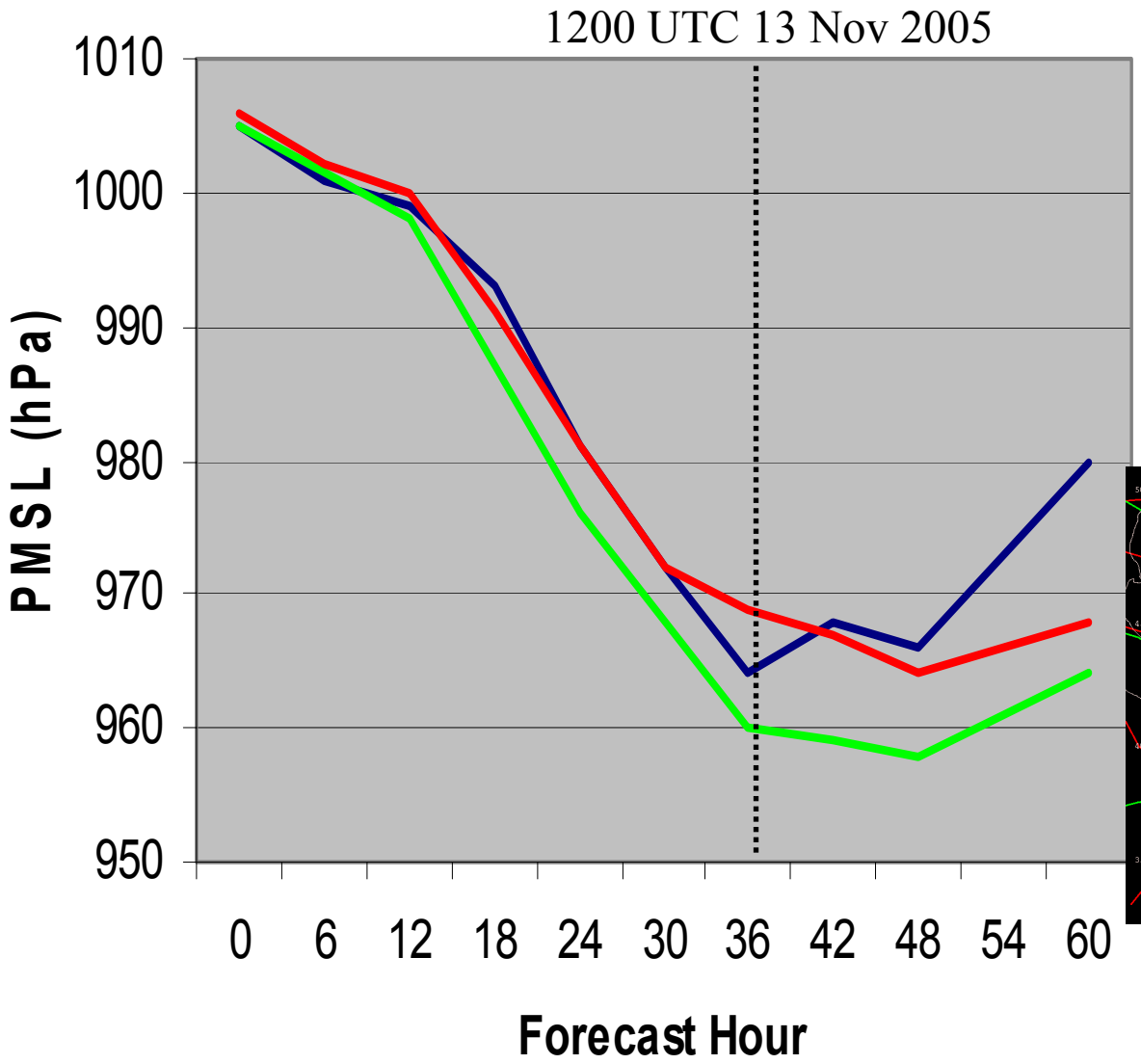
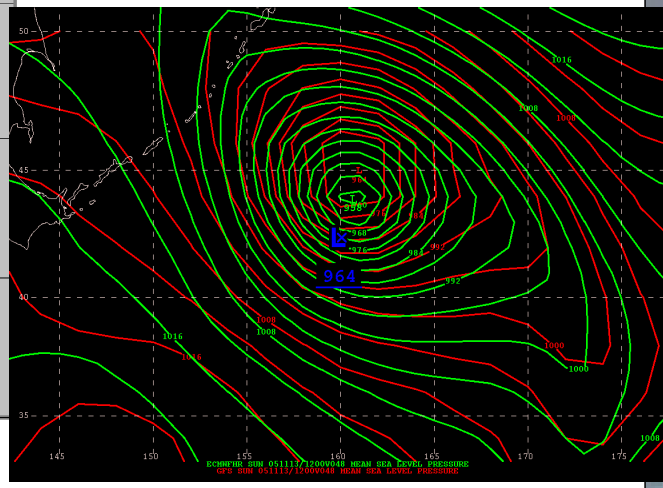
Pacific Cyclone Nov 2005





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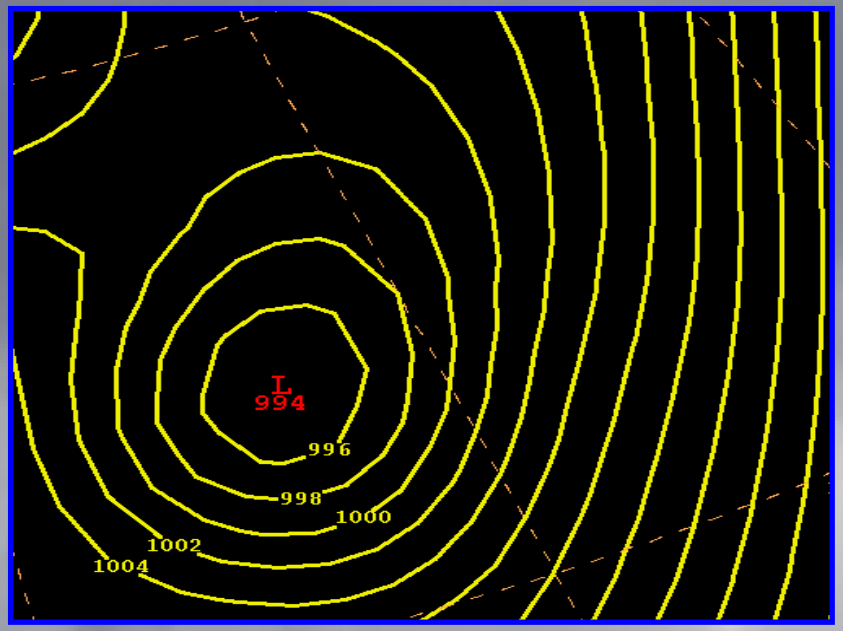
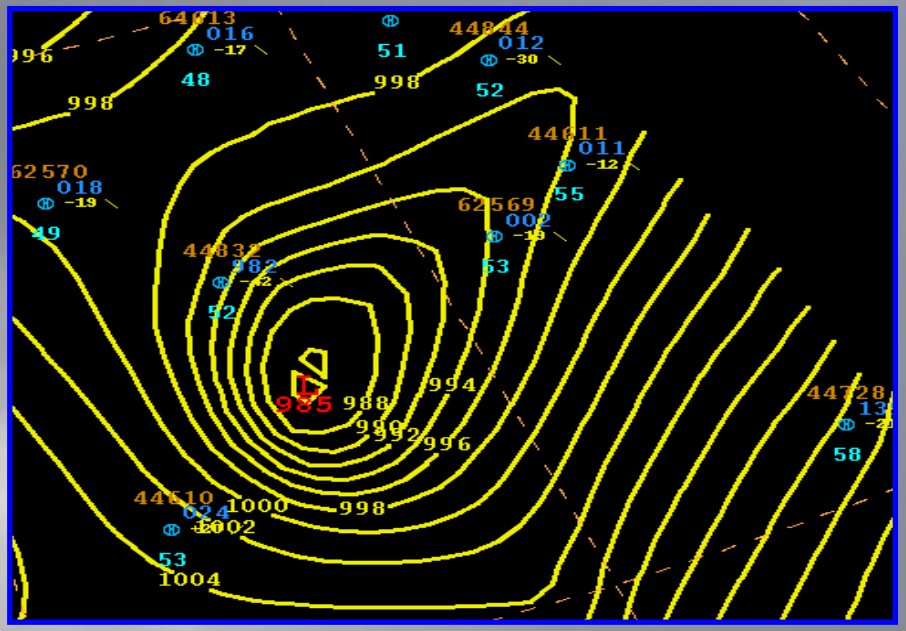
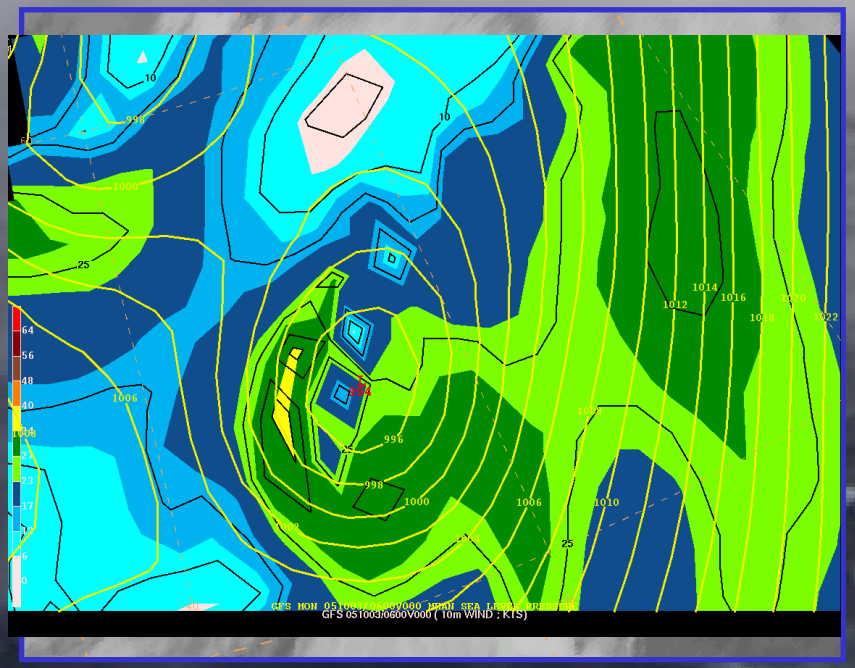
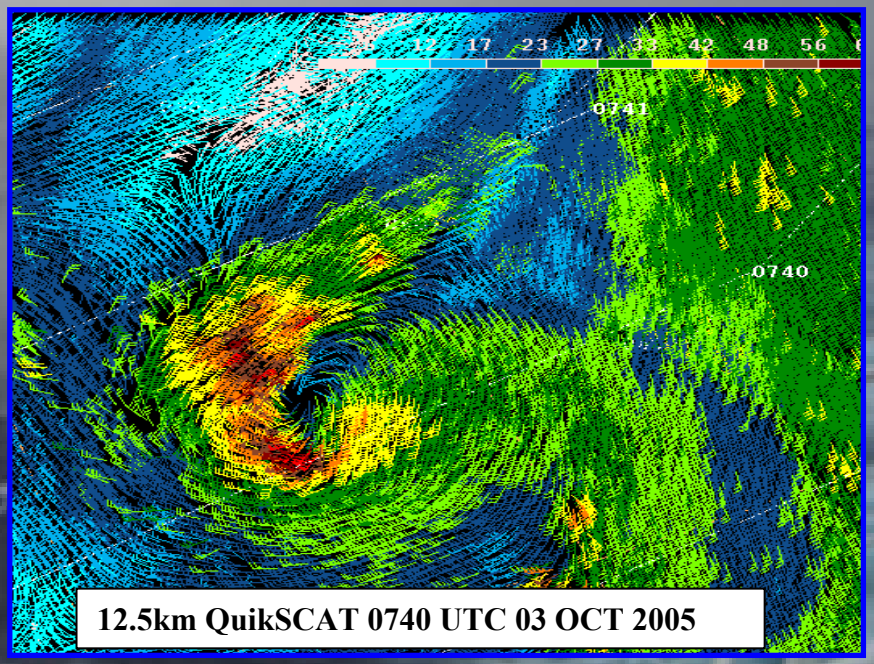




GFS PMSL Analysis 0600 UTC 03 OCT 2005

UWPBL4.1 PMSL Analysis 0740 UTC 03 OCT 2005





12.5km QuikSCAT 0740 UTC 03 OCT 2005

QuikSCAT

GFS

ECMWF

10 Jan 2005

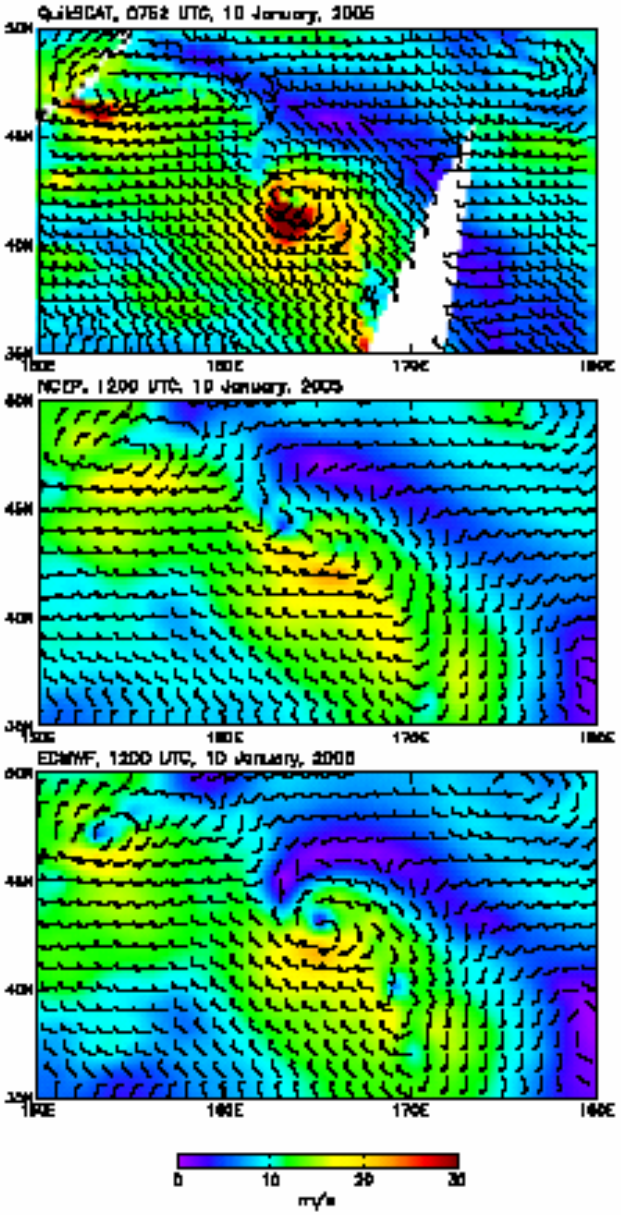
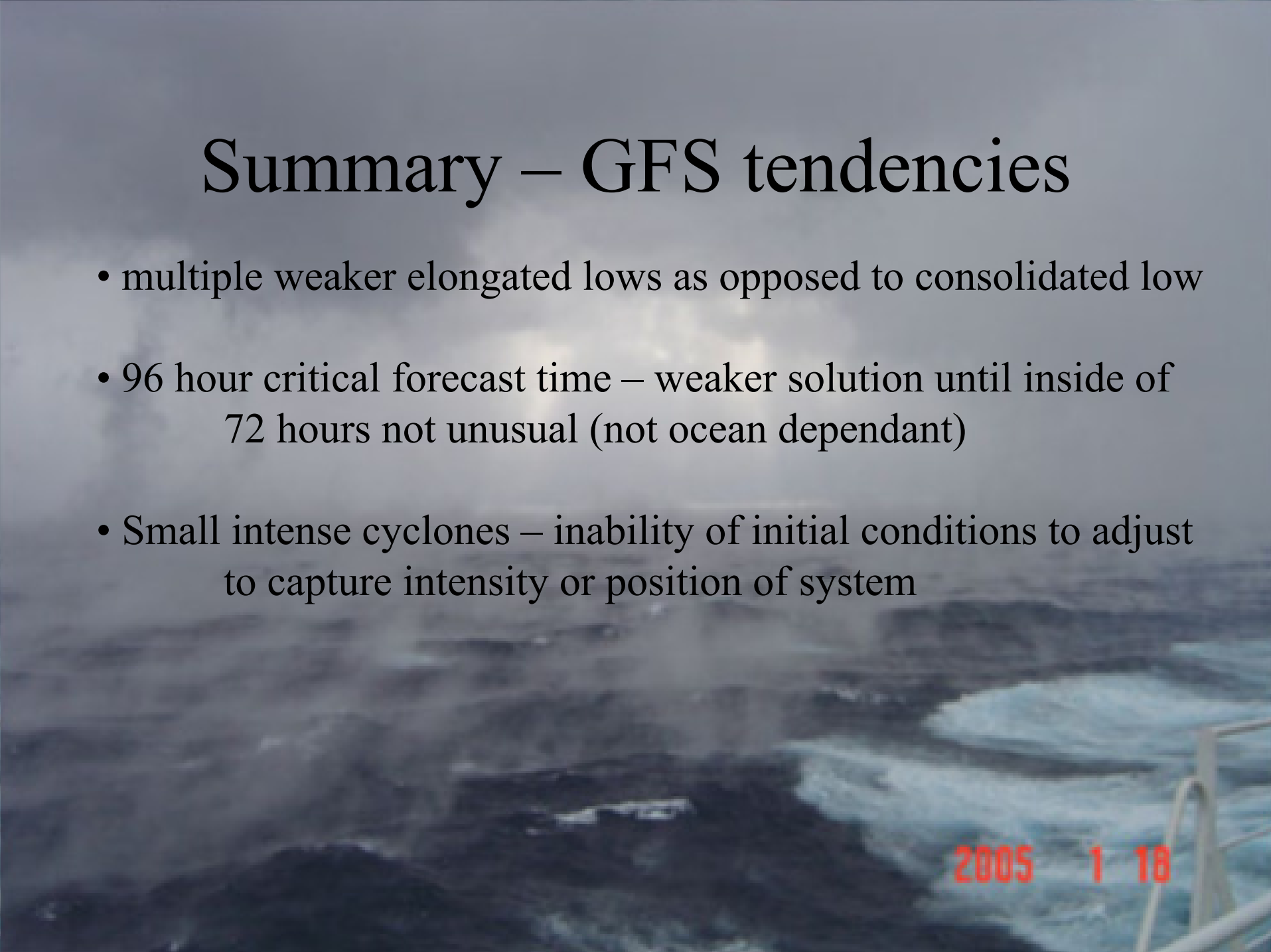


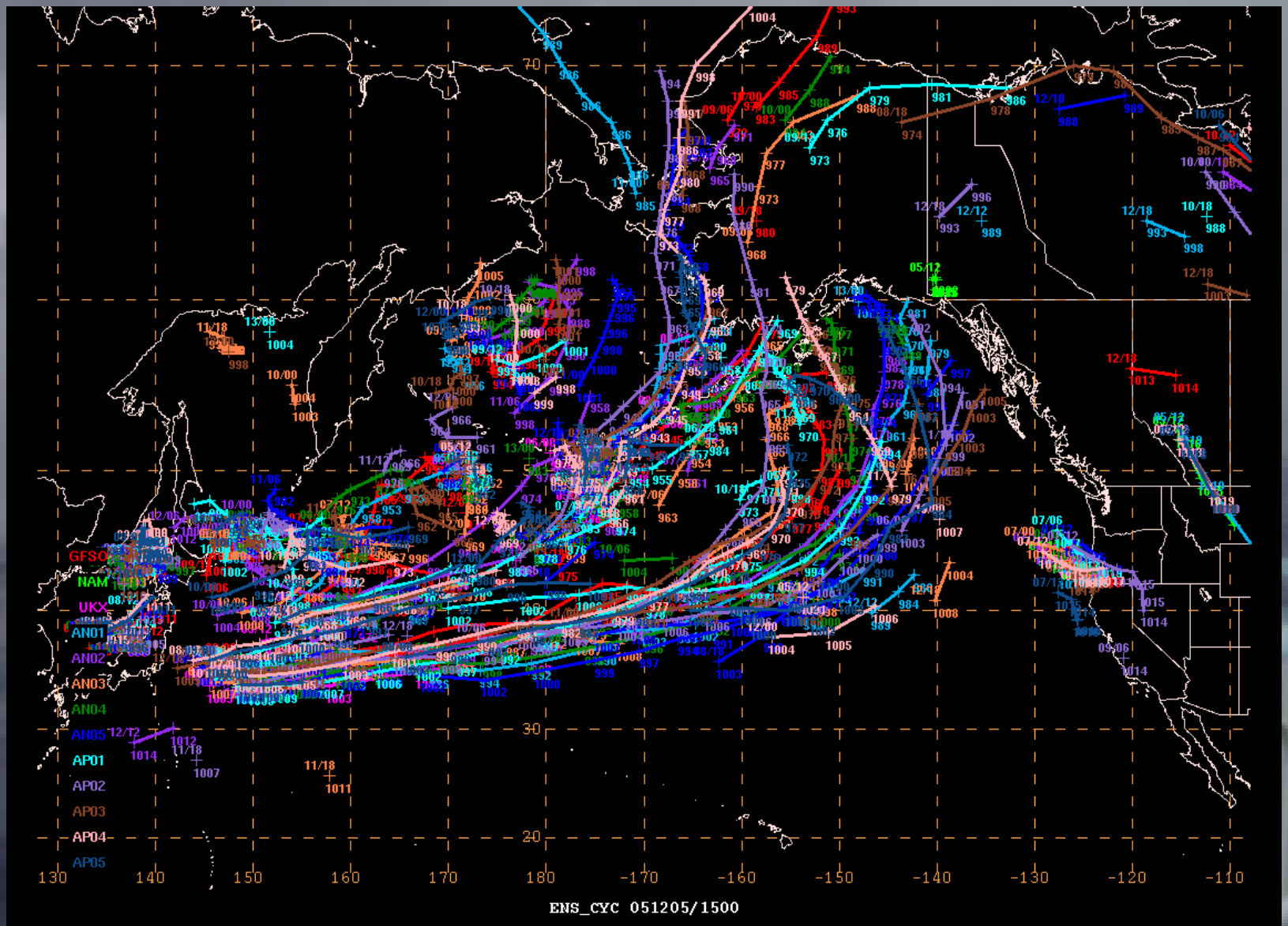
FIG. 3. The wind fields in the western North Pacific on 10 January 2005 constructed for the times indicated on each panel from QuikSCAT observations of 10-m winds (top), and from analyses of 10-m winds by the NCEP (middle) and ECMWF (bottom) global numerical weather prediction models. Following meteorological convention, the wind barbs are in knots. The color scale corresponds to the wind speed in m s^{-1}.

Summary – GFS tendencies

- multiple weaker elongated lows as opposed to consolidated low
- 96 hour critical forecast time – weaker solution until inside of 72 hours not unusual (not ocean dependant)
- Small intense cyclones – inability of initial conditions to adjust to capture intensity or position of system

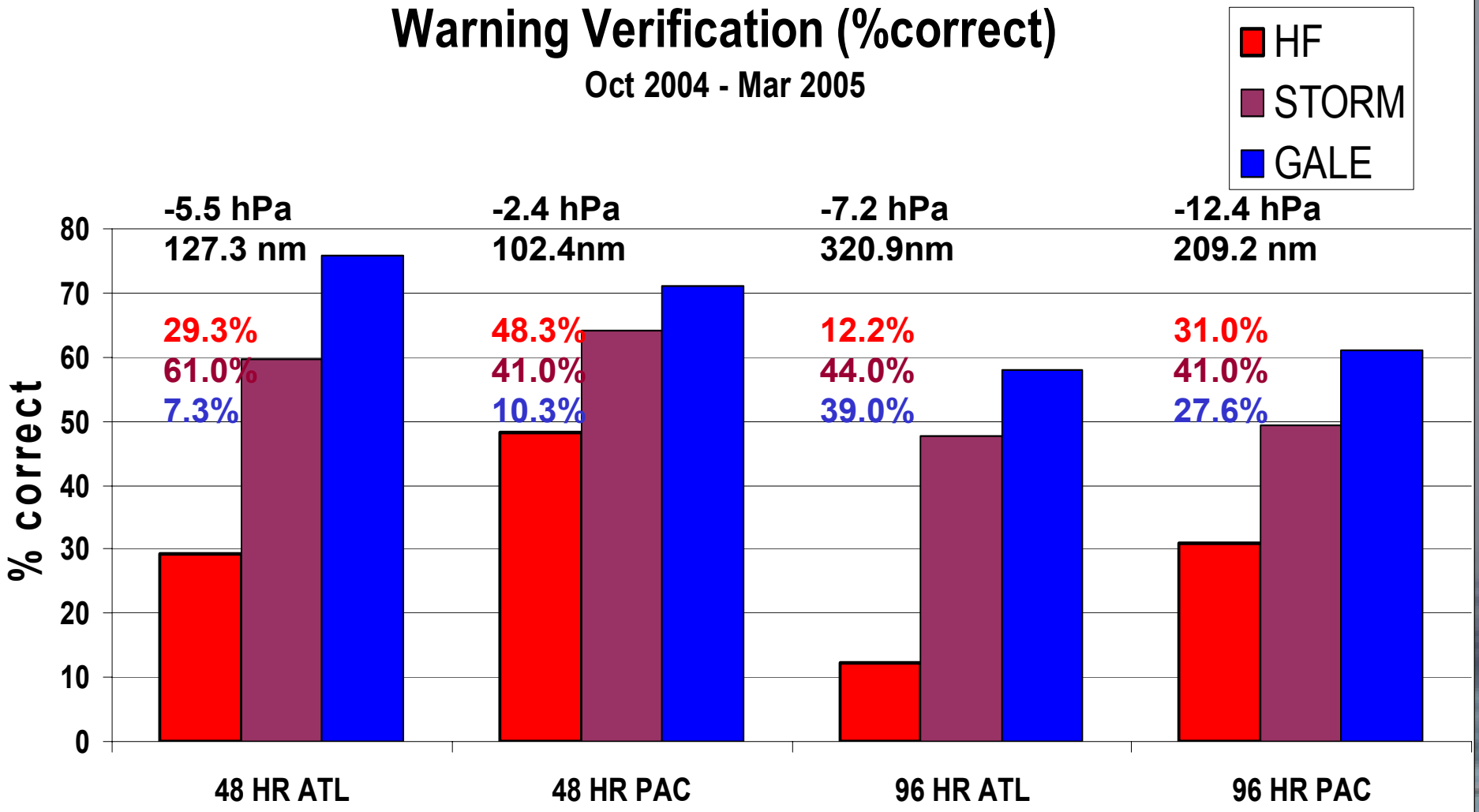


Cyclone Track Guidance



OPC Cyclone Verification (Atlantic)

	Forecast period (h)		
	48	72	96
2003 TPC Atlantic track error (n mi)	123 (256)	161 (197)	191 (125)
1993-2002 TPC track error (n mi)	150 (2229)	224(1818)	----
2004-05 OPC Atlantic track error (n mi) All cyclones	123 (329)		247 (300)
2004-05 OPC Atlantic track error (n mi) ≤980	111 (107)		256 (102)
2004-05 OPC Atlantic track error (n mi) ≤965	88 (26)		205 (24)
2004-05 OPC Atlantic track error (n mi) Hurricane Force	127 (30)		321 (30)


Warning Verification (%correct)
Oct 2004 - Mar 2005
HF
STORM
GALE
% correct
80
70
60
50
40
30
20
10
0
-5.5 hPa
127.3 nm
29.3%
61.0%
7.3%
-2.4 hPa
102.4nm
48.3%
41.0%
10.3%
-7.2 hPa
320.9nm
12.2%
44.0%
39.0%
-12.4 hPa
209.2 nm
31.0%
41.0%
27.6%
48 HR ATL
48 HR PAC
96 HR ATL
96 HR PAC

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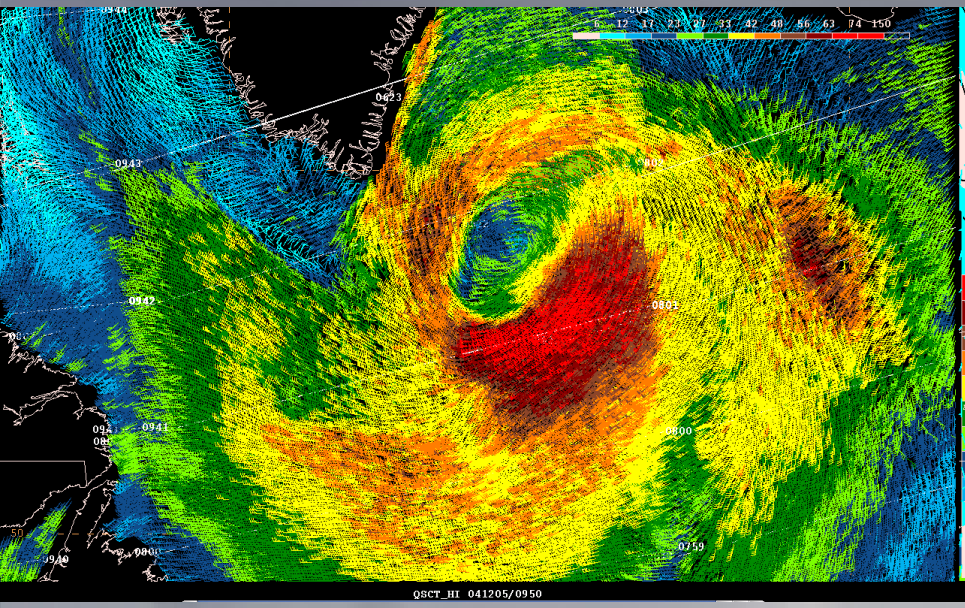
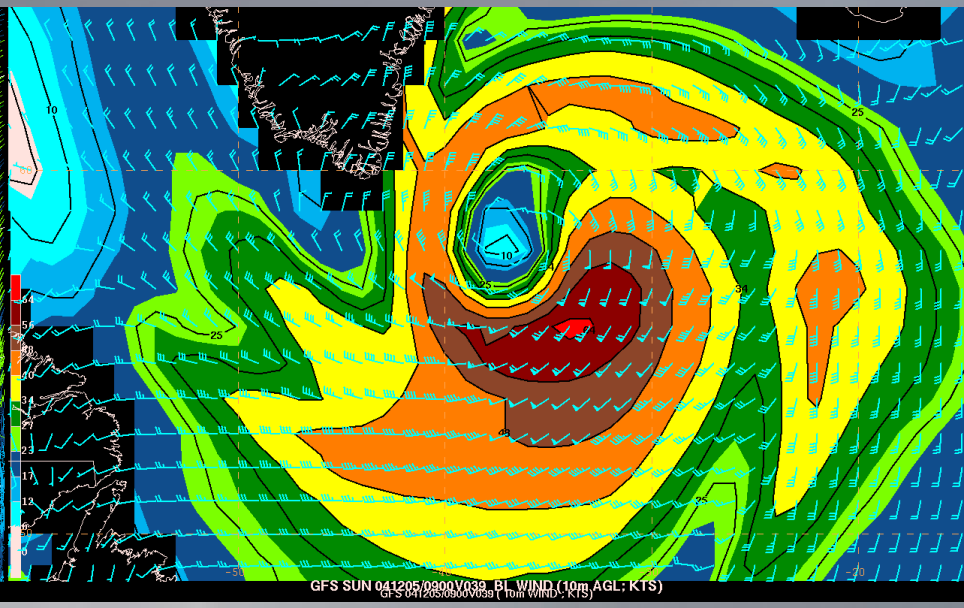
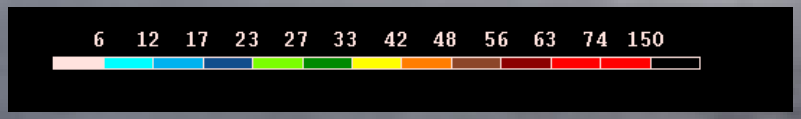
WINDS



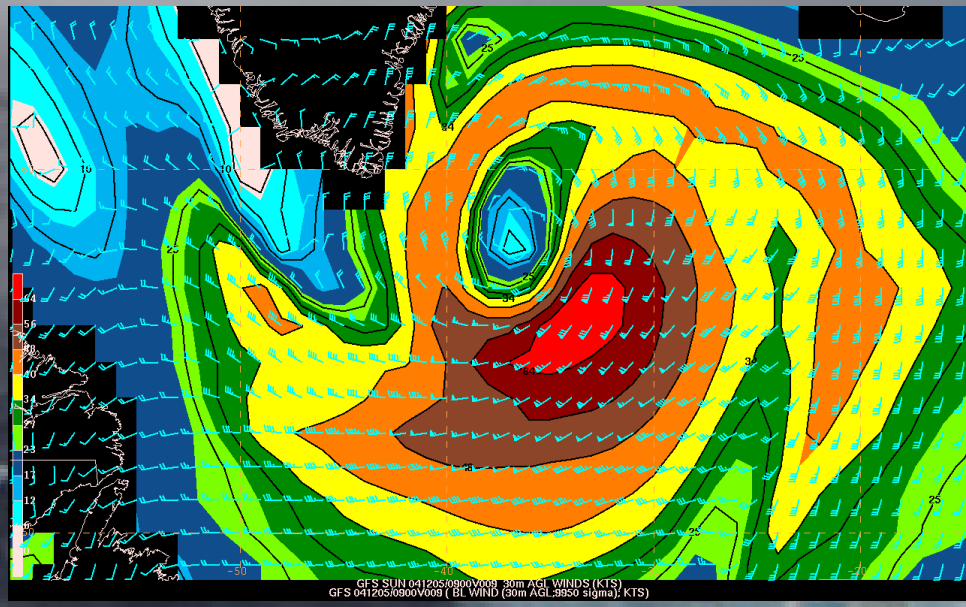
QuikSCAT 12.5 km winds



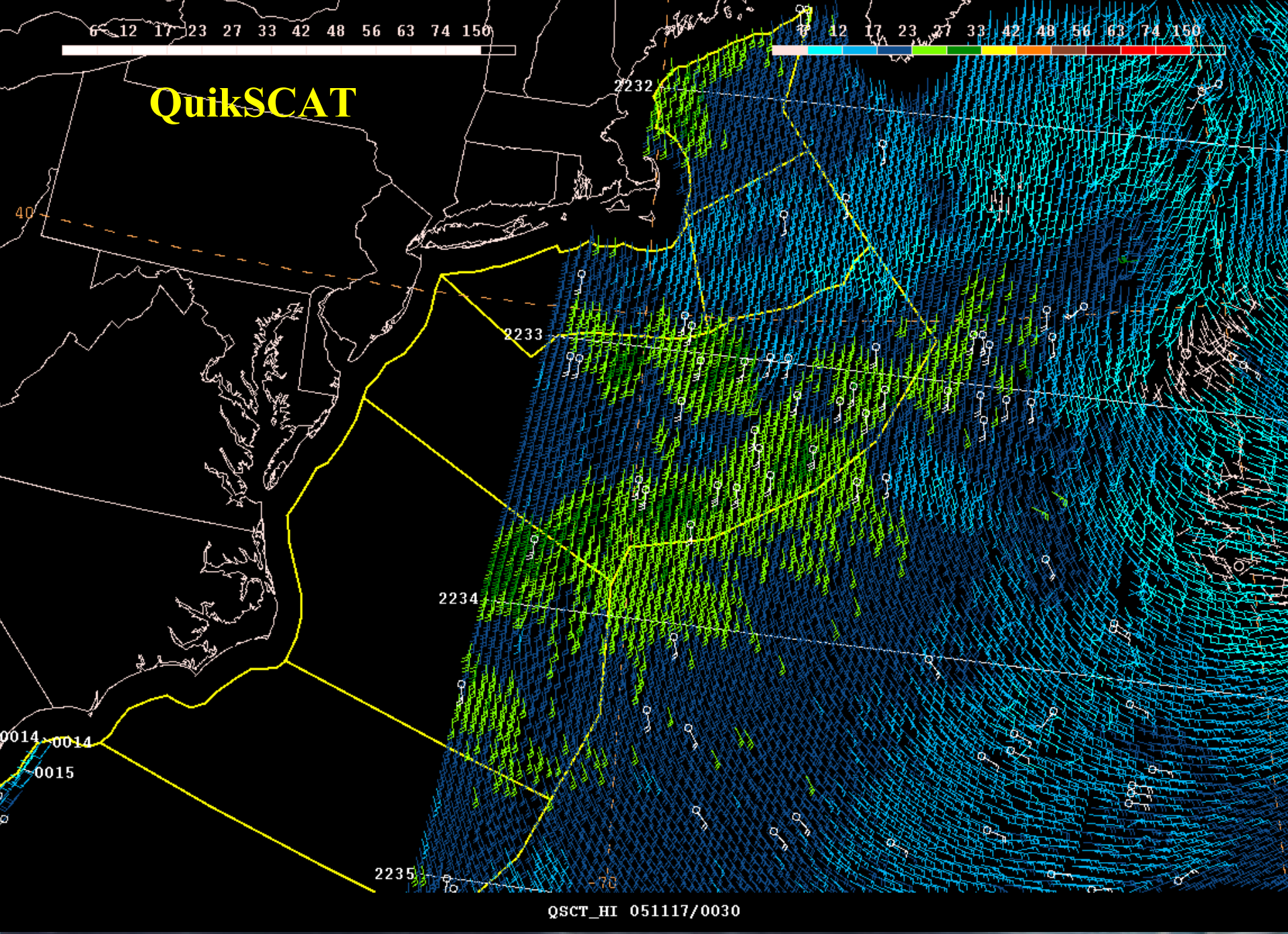
GFS 39 hr fcst – 10m winds

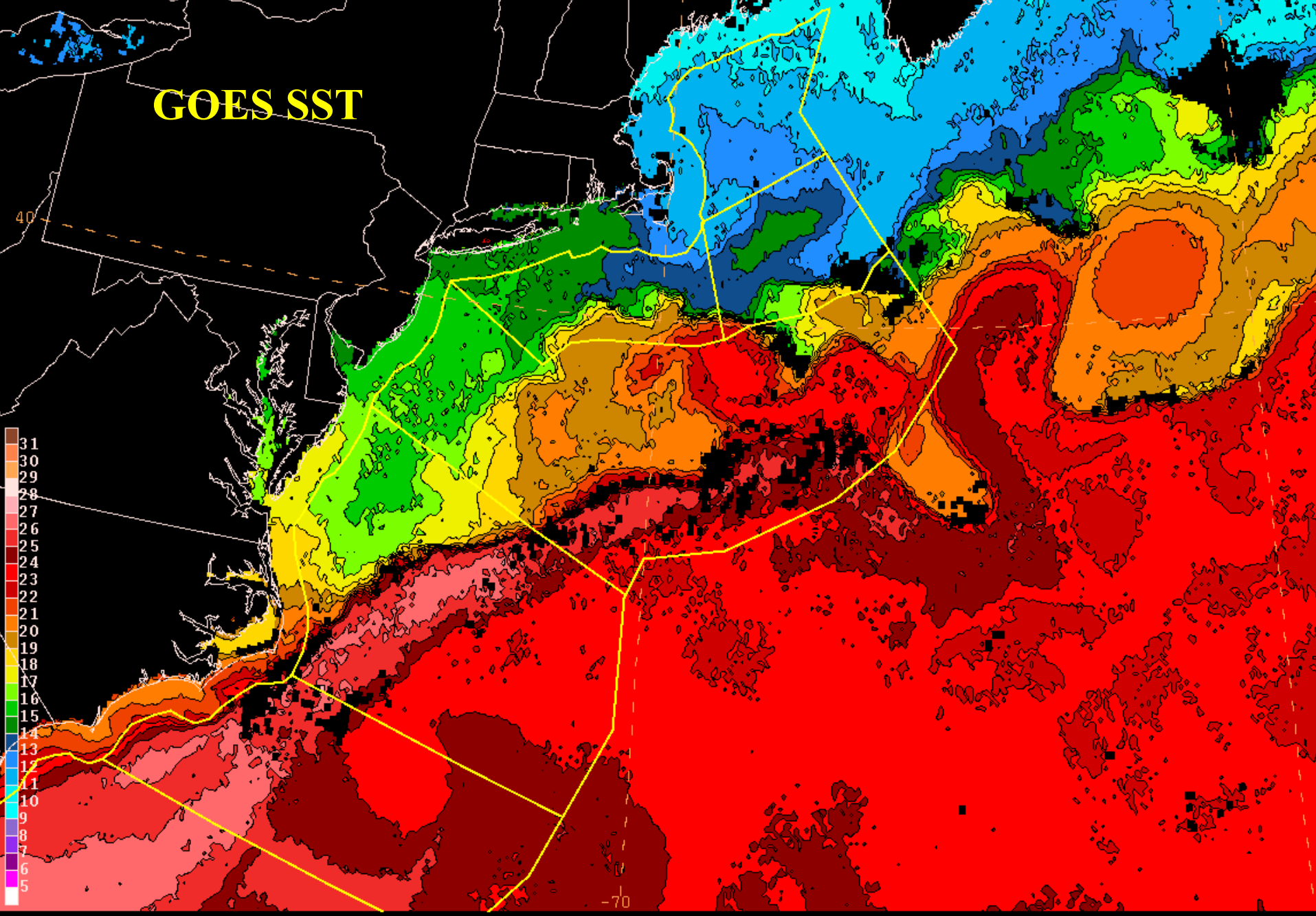


Wind speed - knots

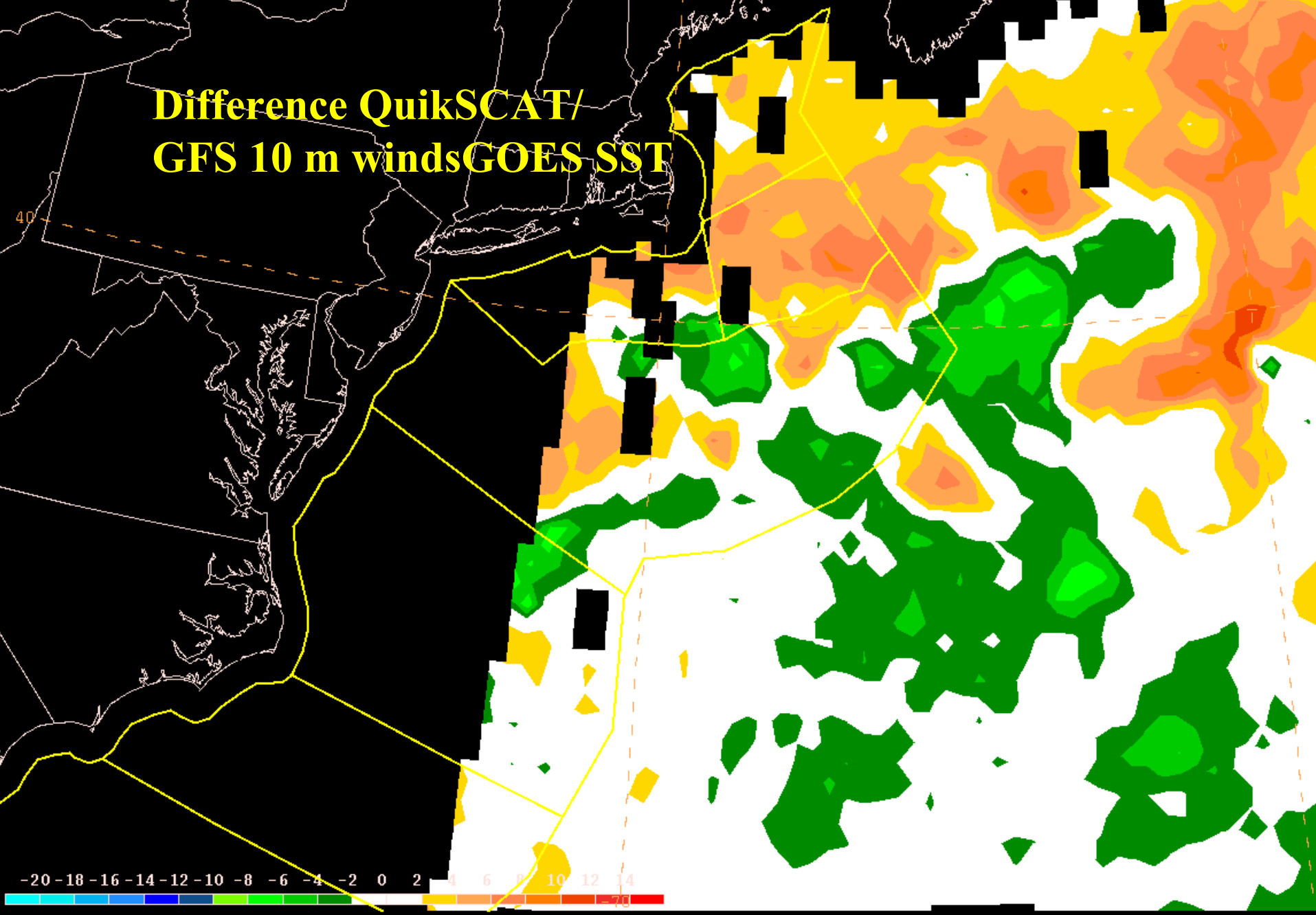


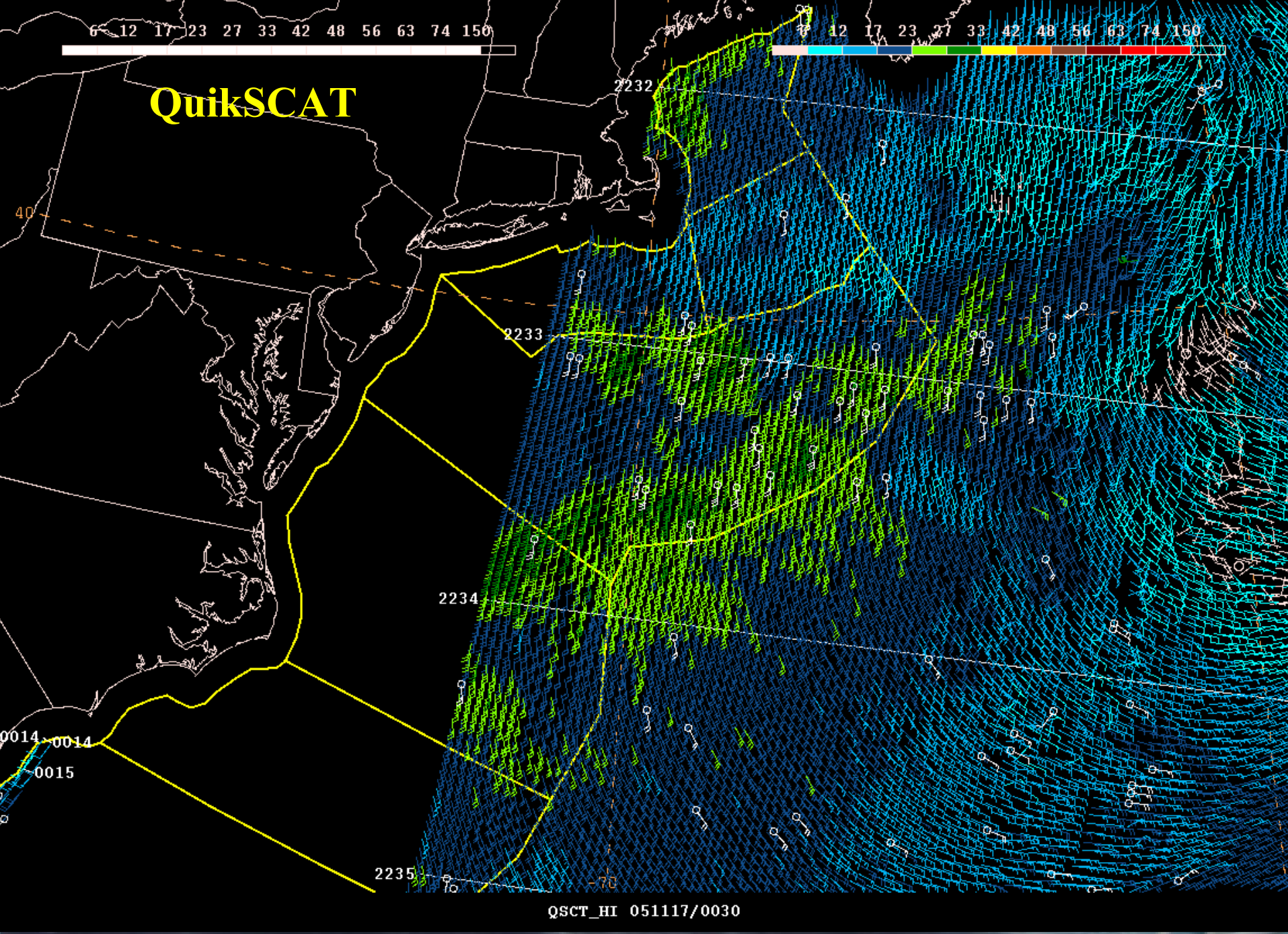
GFS 39 hr fcst – 30m winds

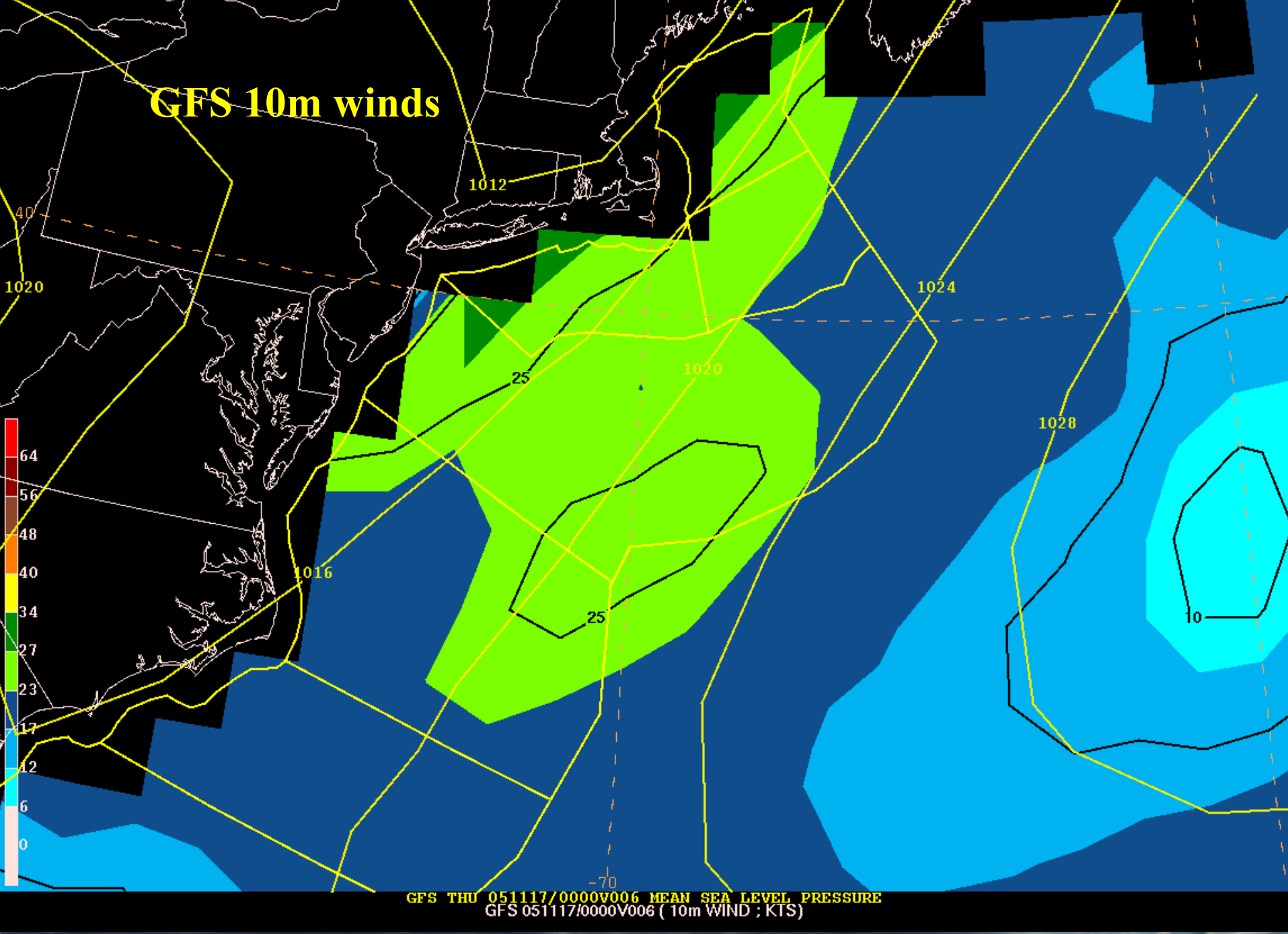

QuikSCAT
6 12 17 23 27 33 42 48 56 63 74 150
6 12 17 23 27 33 42 48 56 63 74 150
2232
2233
2234
2235
40
-70
0014
0014
0015
QSCT_HI 051117/0030

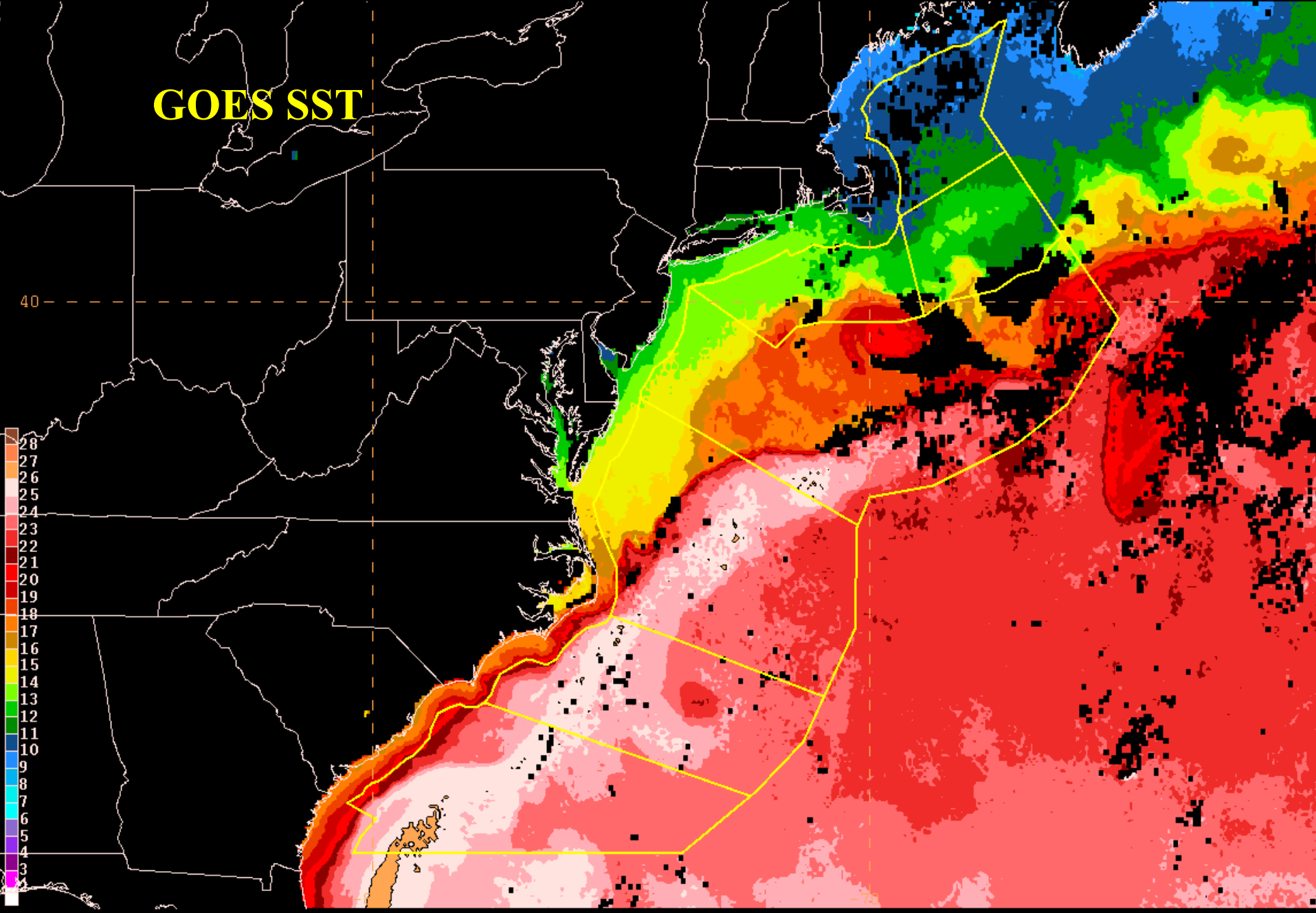

GOES SST
40
-70
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
GOESSST:3DAILY_WATL 051117/1300V000 GOES 6km SST (deg C)

Difference QuikSCAT/ GFS 10 m windsGOES SST

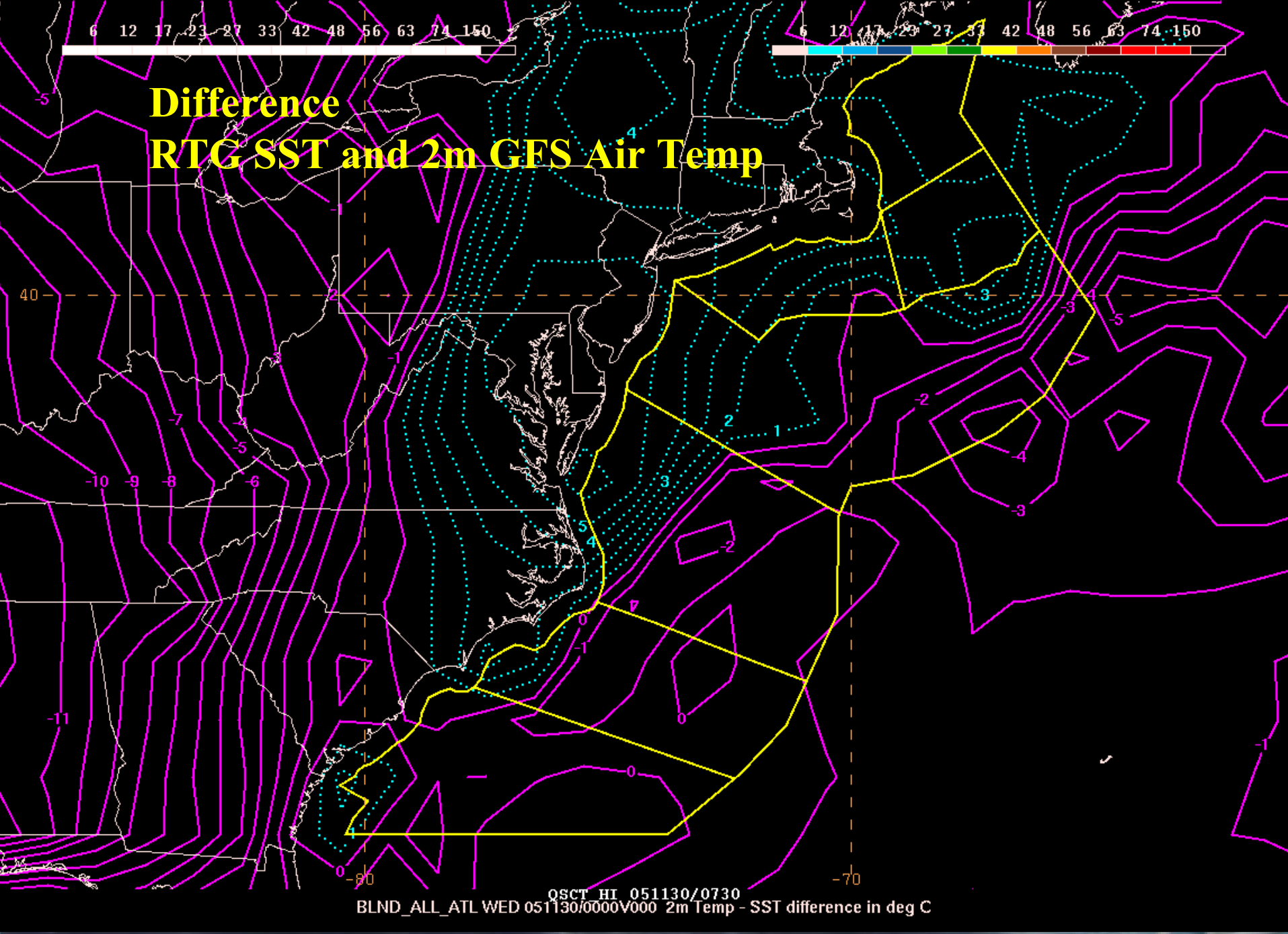


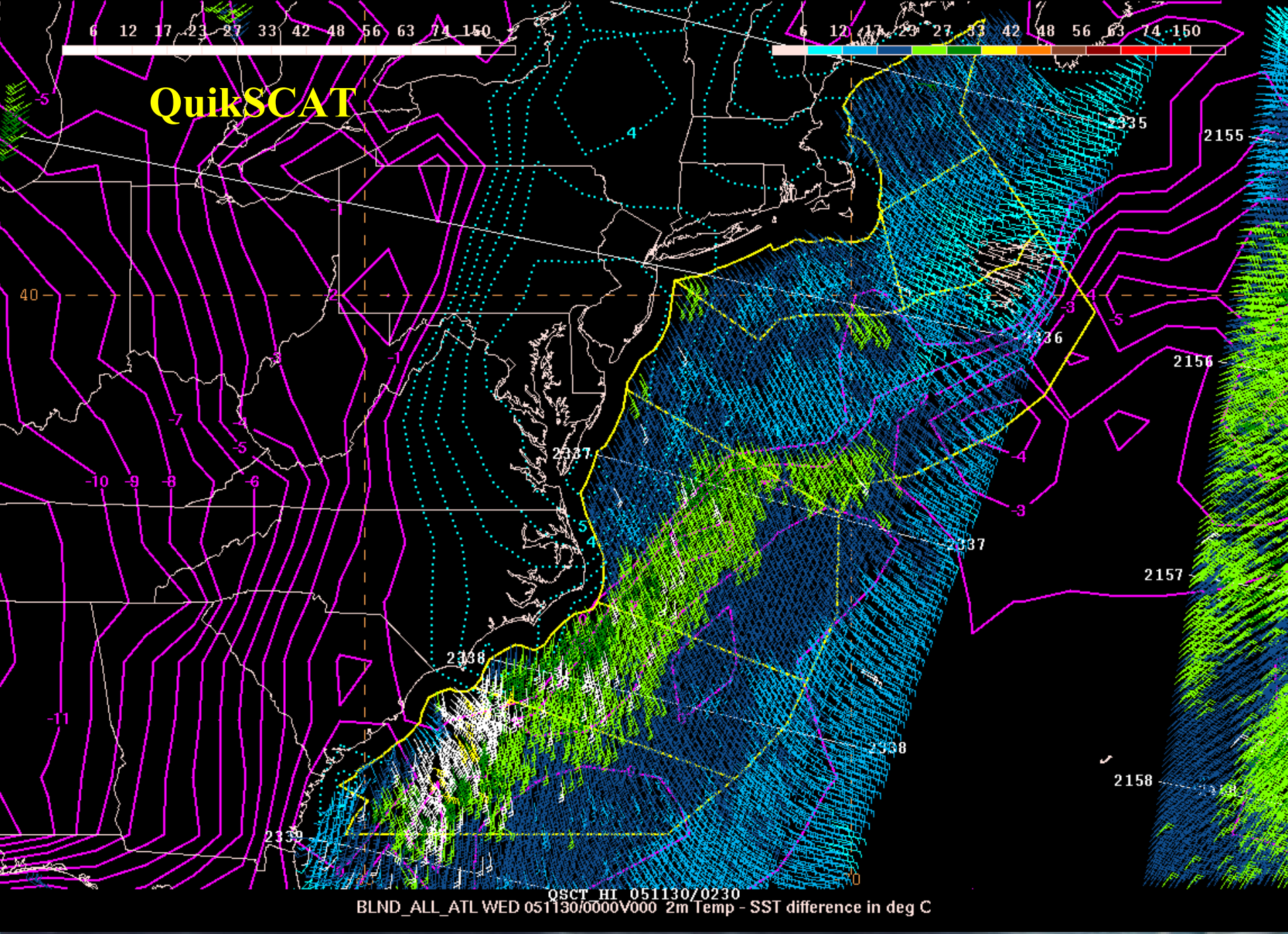

QuikSCAT
6 12 17 23 27 33 42 48 56 63 74 150
6 12 17 23 27 33 42 48 56 63 74 150
2232
2233
2234
2235
40
-70
0014
0014
0015
QSCT_HI 051117/0030

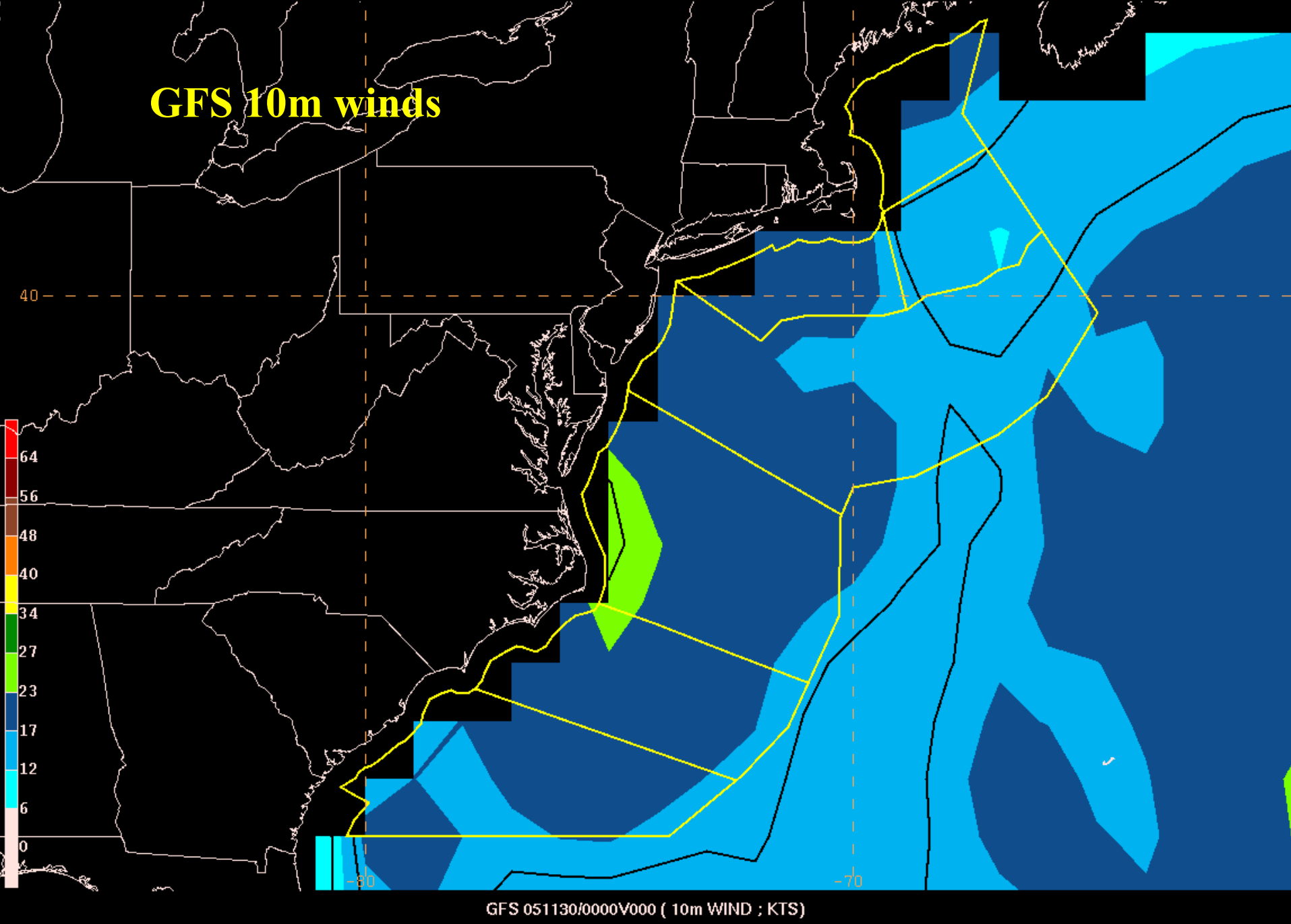

GFS 10m winds
1012
40
1020
1024
1020
25
1028
64
56
48
40
34
27
23
17
12
6
0
1016
25
10
-70
GFS THU 051117/0000V006 MEAN SEA LEVEL PRESSURE
GFS 051117/0000V006 (10m WIND ; KTS)

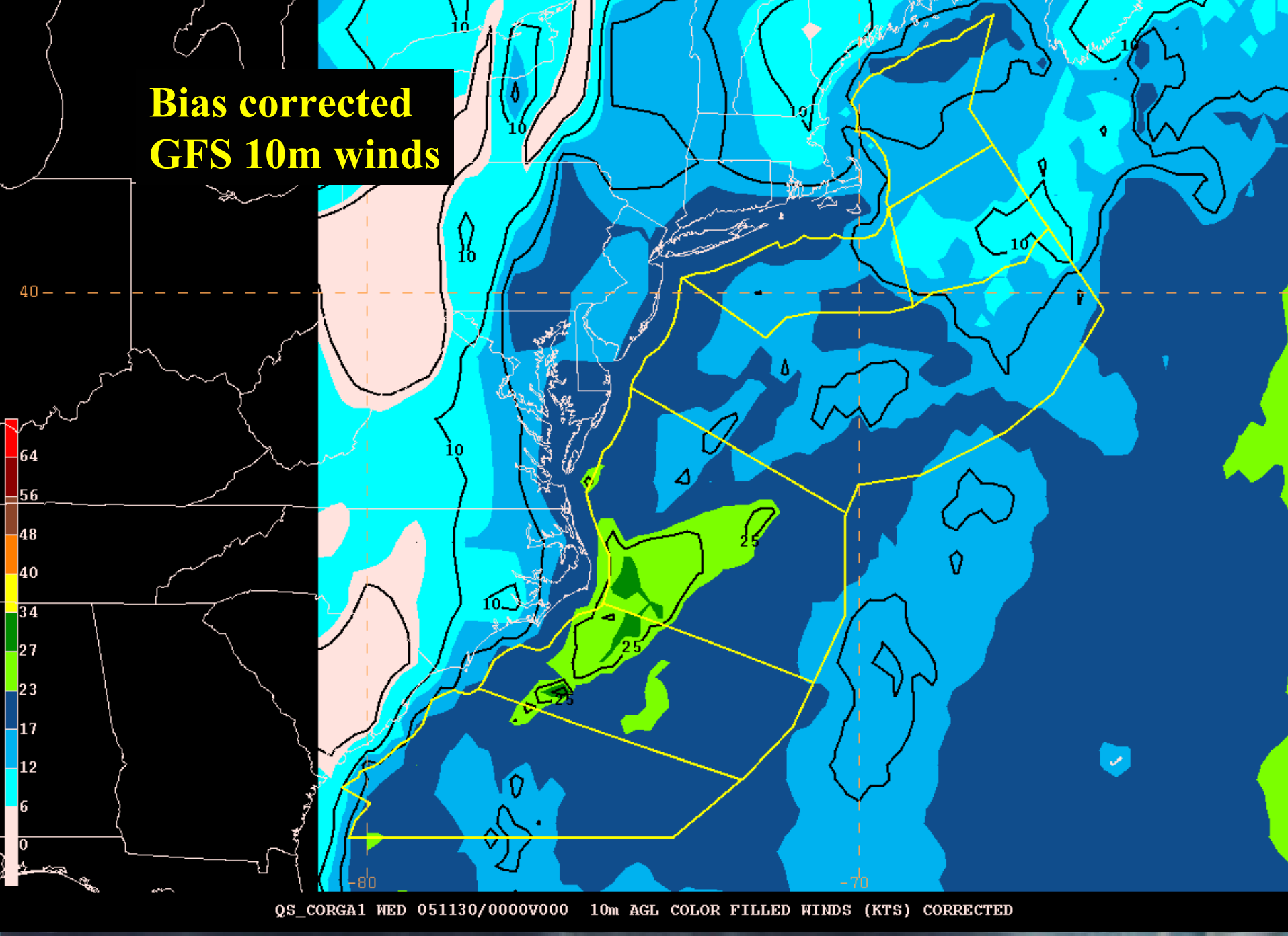

GOES SST
40
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
GOESSST:3DAILY_WATL 051201/1200V000 GOES 6km SST (deg C)

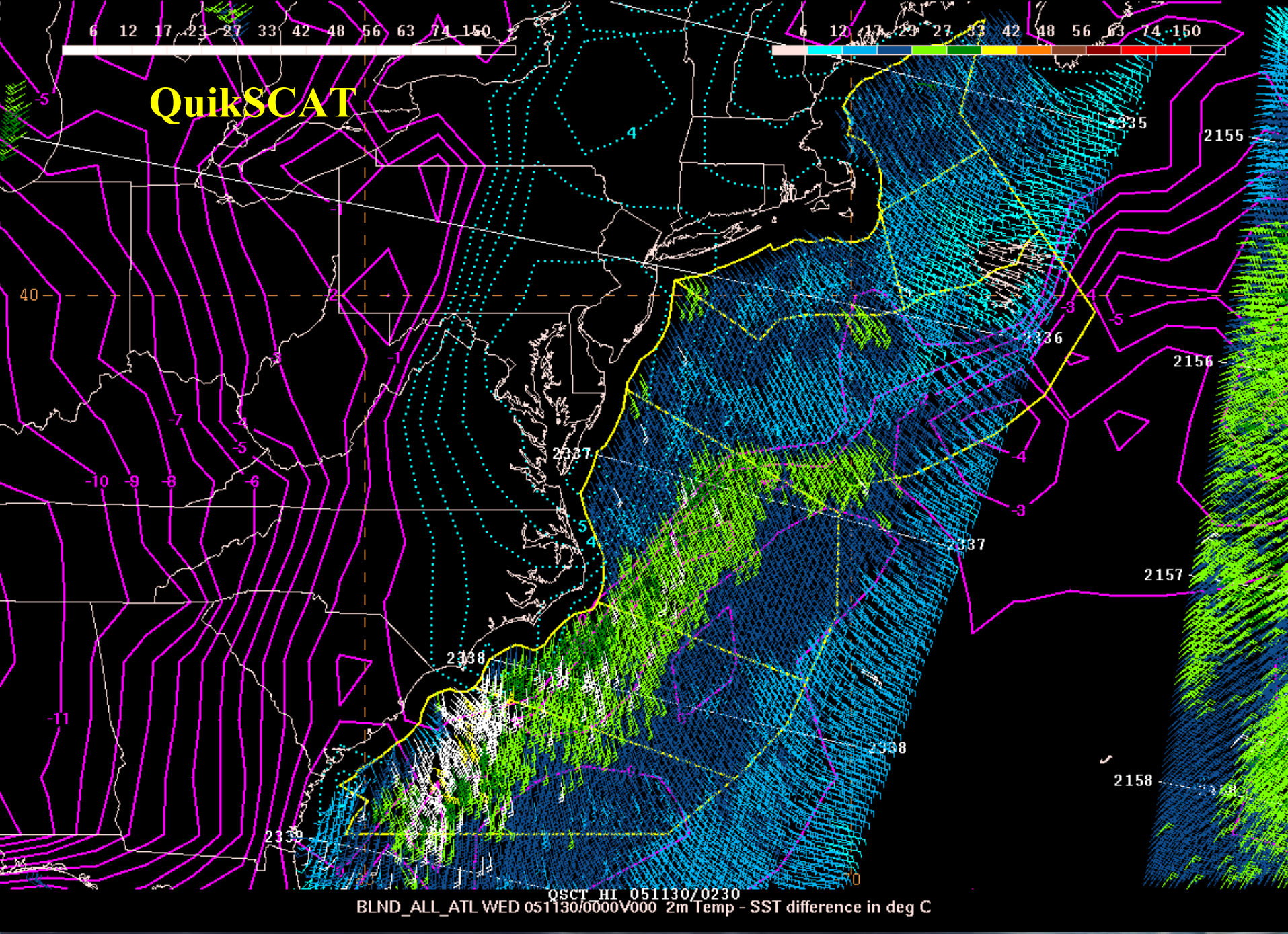
Difference
RTG SST and 2m GFS Air Temp




QuikSCAT
6 12 17 23 27 33 42 48 56 63 74 150
6 12 17 23 27 33 42 48 56 63 74 150
2335
2155
2336
2156
2337
2157
2338
2158
2339
QSCT_HI 051130/0230
BLND_ALL_ATL WED 051130/0000V000 2m Temp - SST difference in deg C


GFS 10m winds
40
64
56
48
40
34
27
23
17
12
6
0
-80
-70
GFS 051130/0000V000 (10m WIND ; KTS)


Bias corrected
GFS 10m winds
64
56
48
40
34
27
23
17
12
6
0
40
-80
-70
10
25
QS_CORGA1 WED 051130/0000V000 10m AGL COLOR FILLED WINDS (KTS) CORRECTED


QuikSCAT
6 12 17 23 27 33 42 48 56 63 74 150
6 12 17 23 27 33 42 48 56 63 74 150
2335
2155
2336
2156
2337
2157
2338
2158
2339
QSCT_HI 051130/0230
BLND_ALL_ATL WED 051130/0000V000 2m Temp - SST difference in deg C

Forecast challenges

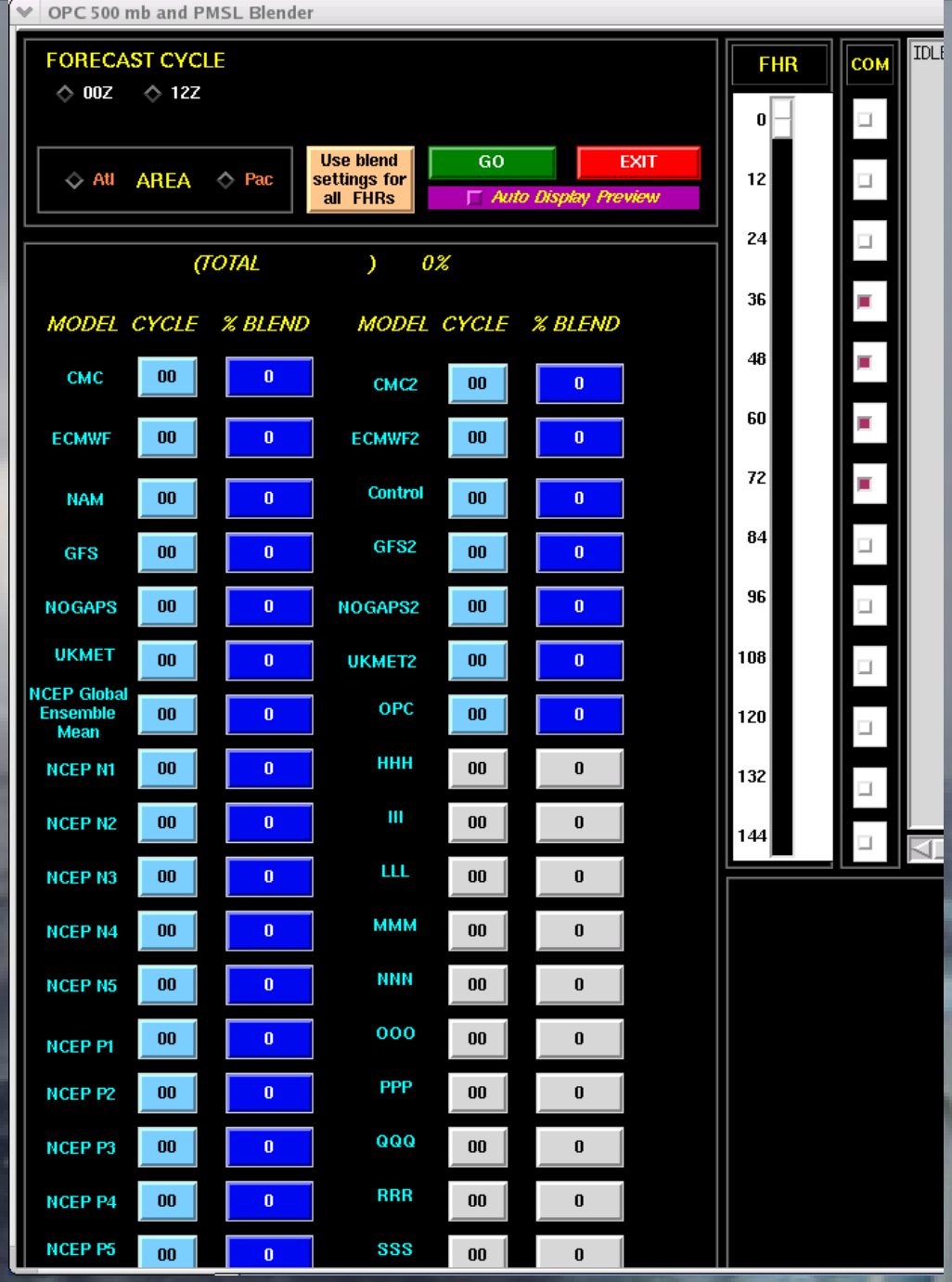
- Can’t use all available guidance (overwhelmed)
- Not same fields from all guidance
- Interested in warning categories
  - Wind guidance tends to be too weak
- Waves
- Stability effects

Forecast Techniques

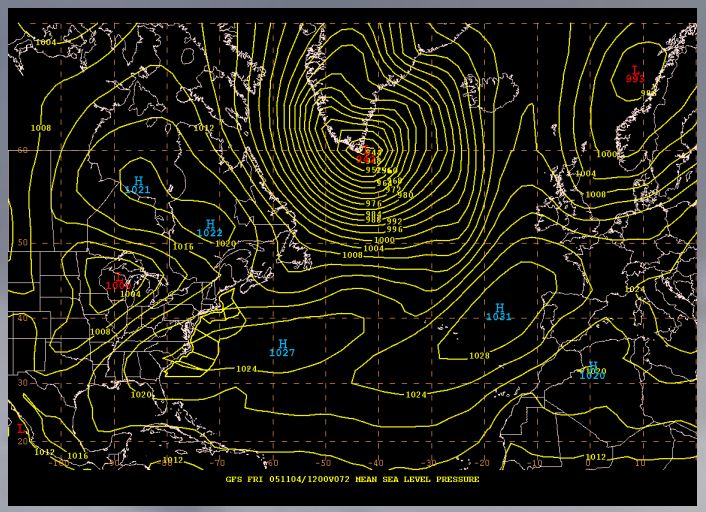
Graphical User Interface

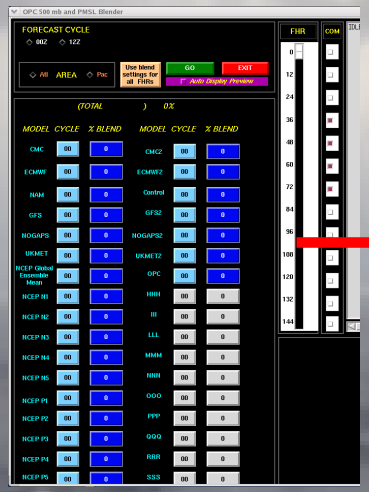
Weighted mean of forecaster desired models as basis for Forecast

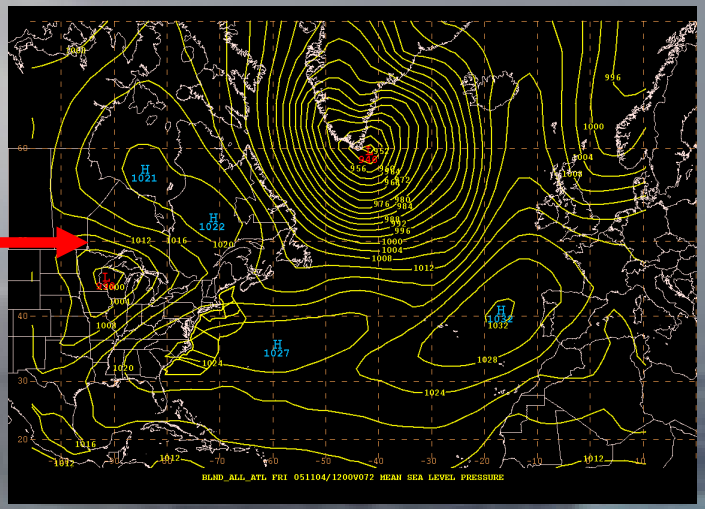
(Blender)

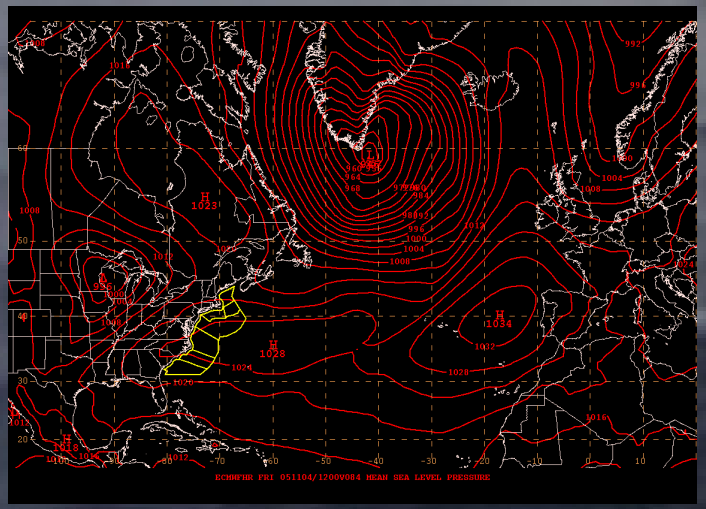


50% GFS – f072









Blender

Blended - f072 SLP

50% ECMWF – f084

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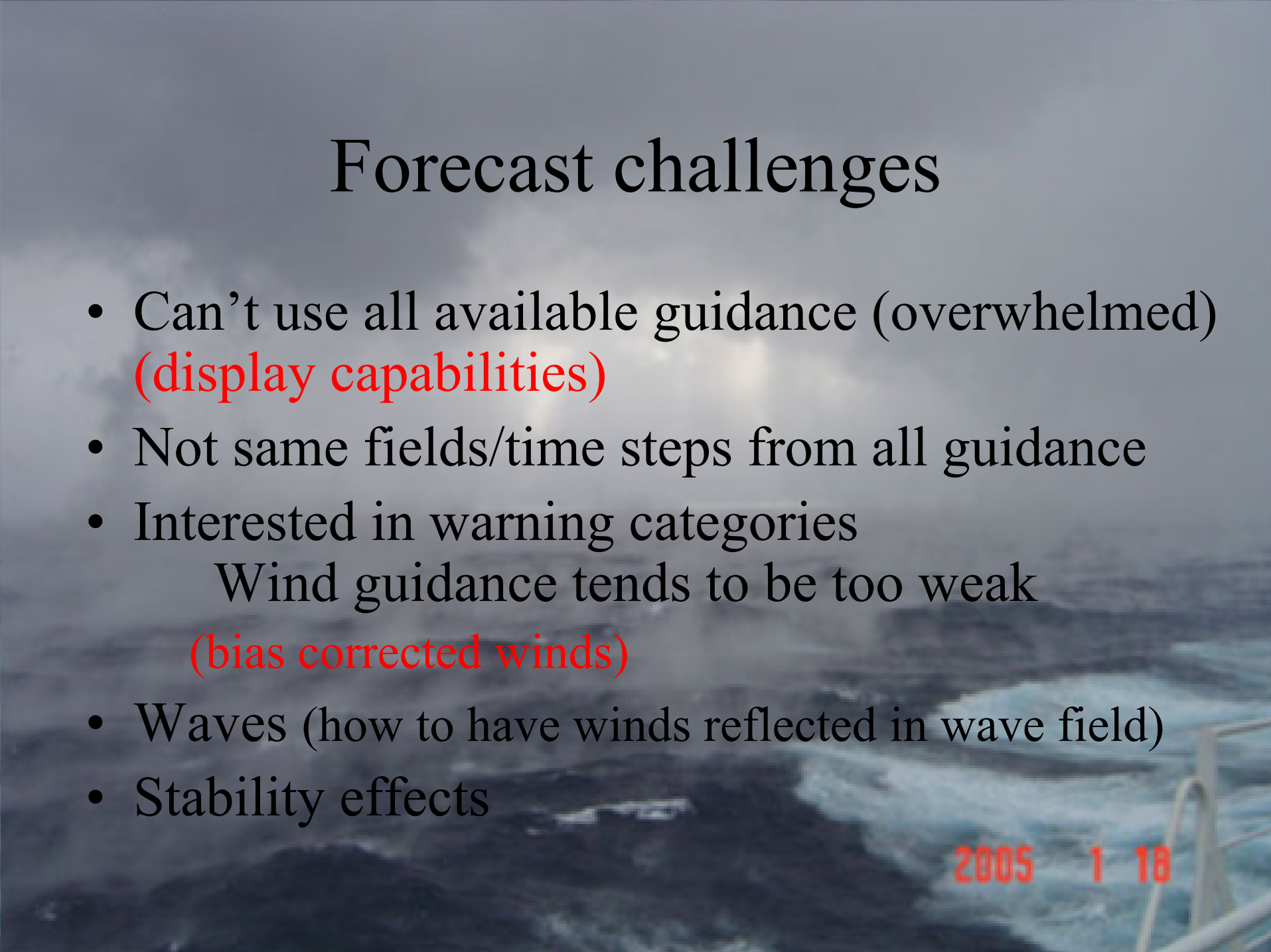
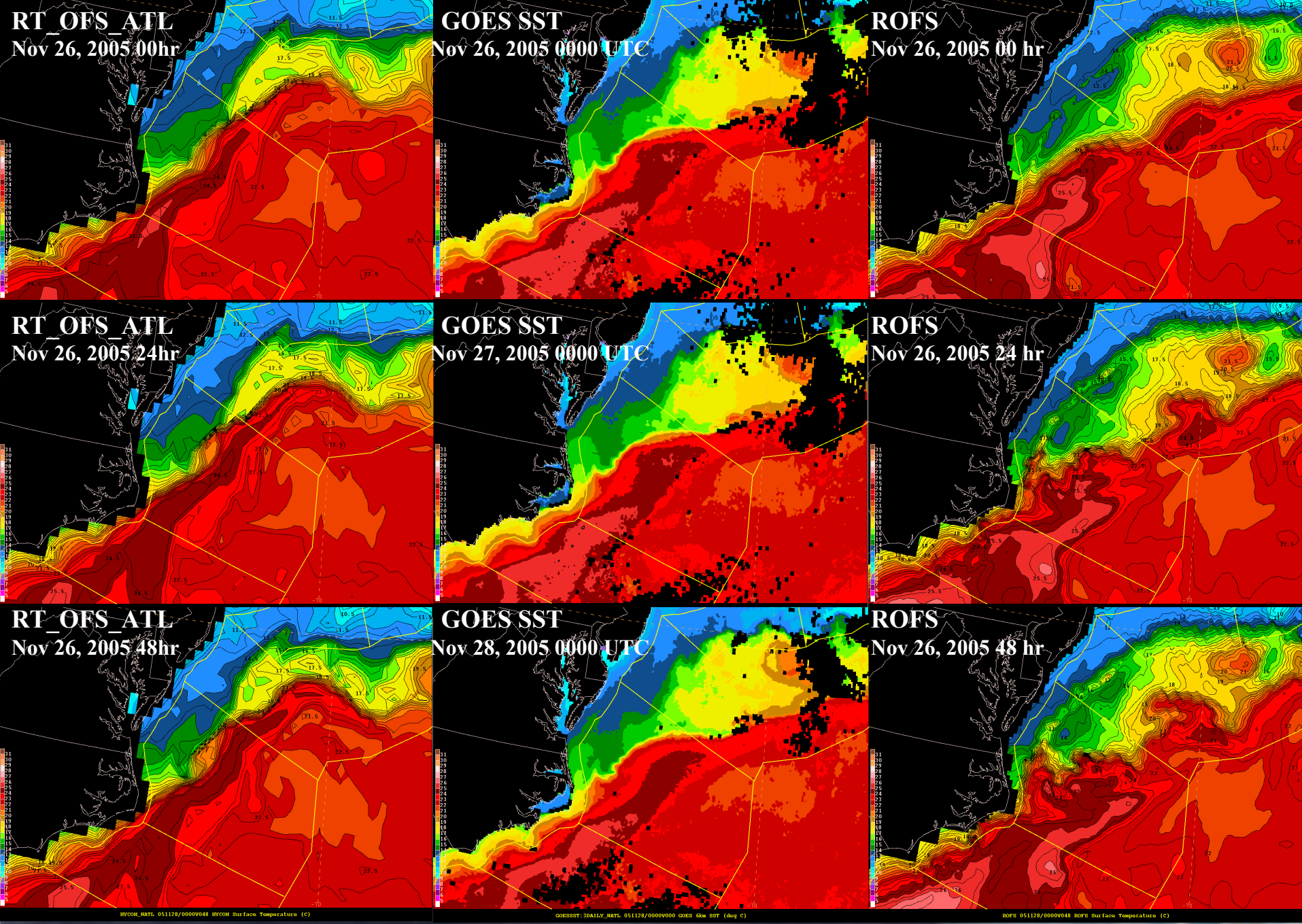
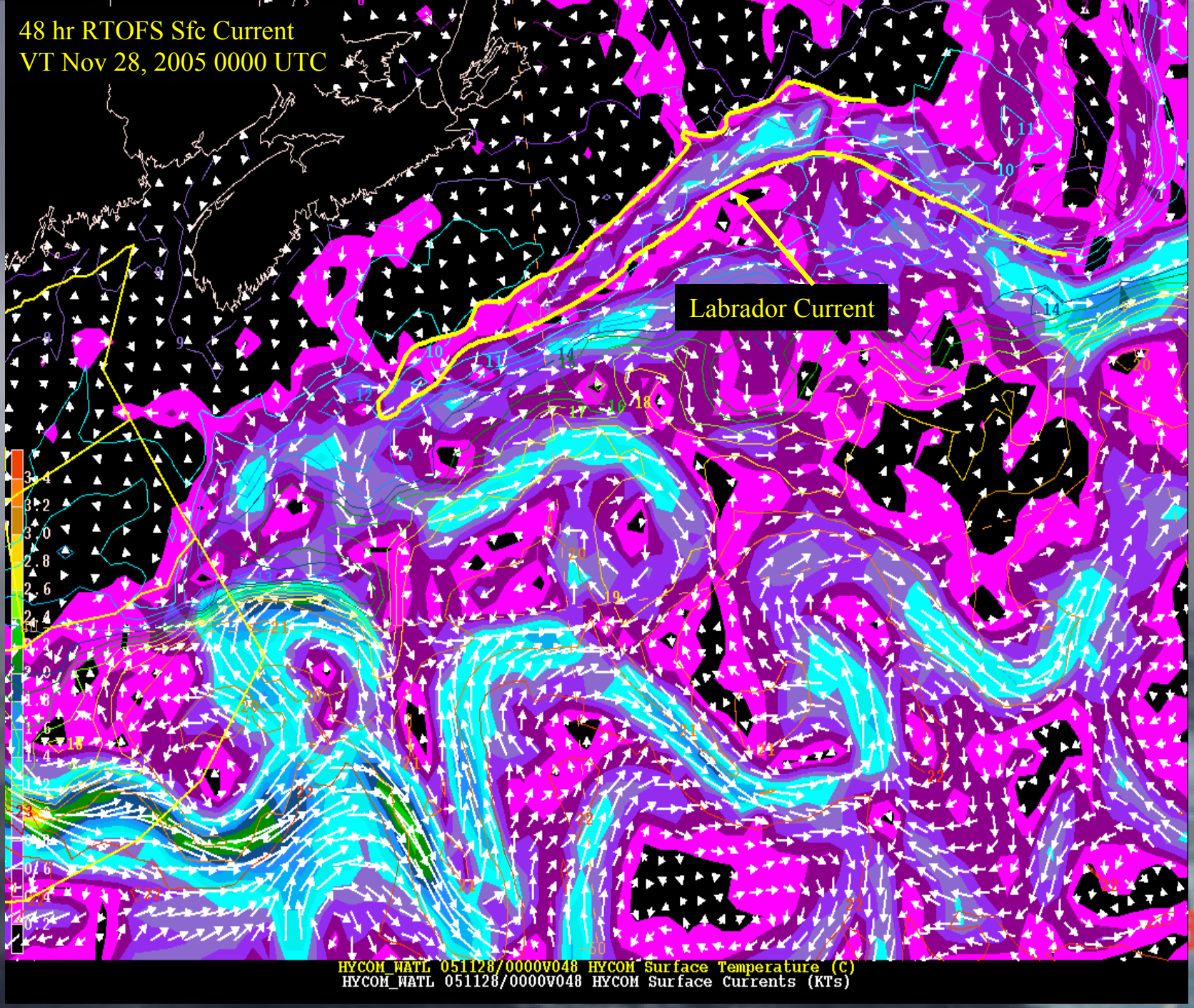
Forecast challenges

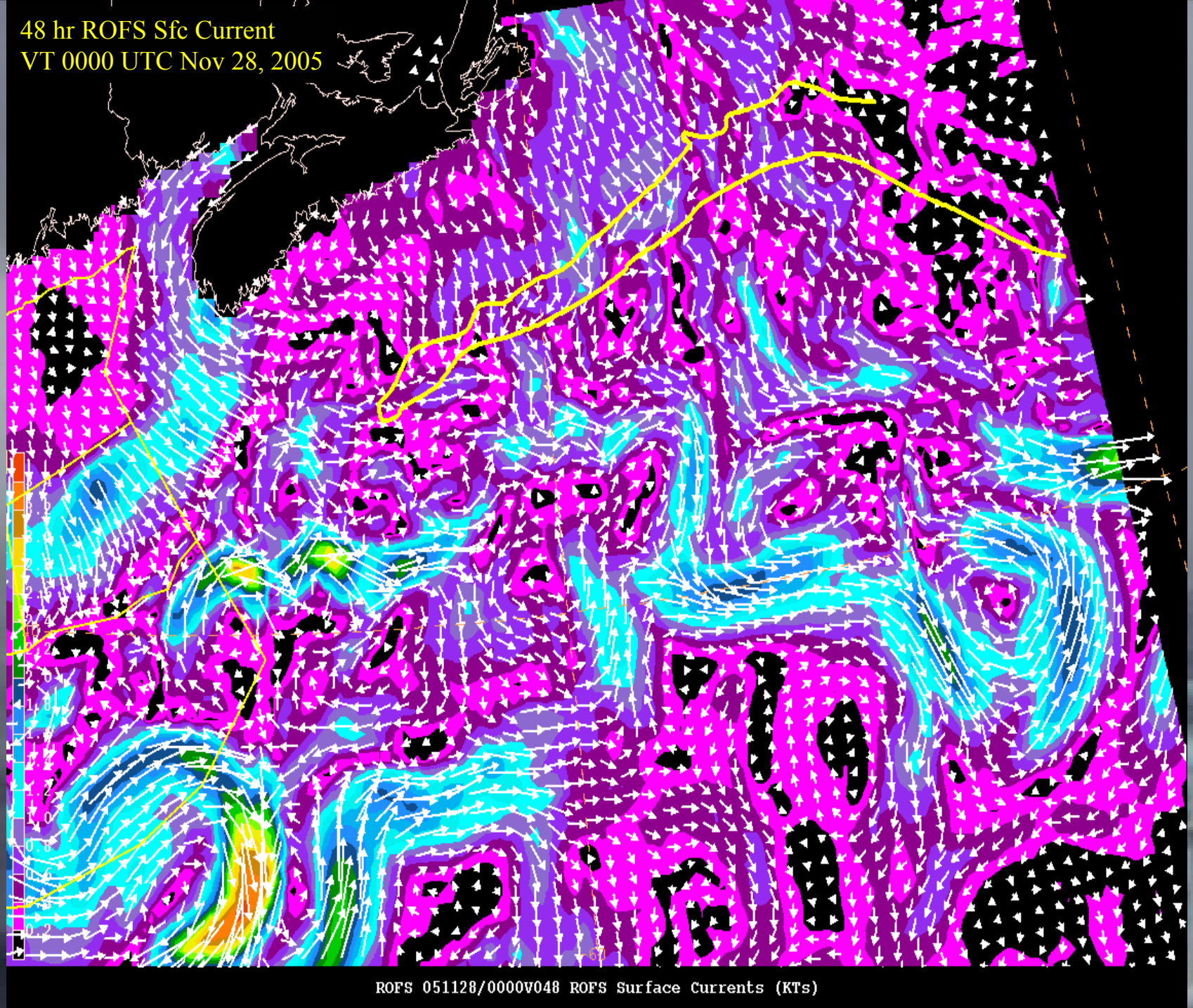
- Can’t use all available guidance (overwhelmed) (display capabilities)
- Not same fields/time steps from all guidance
- Interested in warning categories
  Wind guidance tends to be too weak
  (bias corrected winds)
- Waves (how to have winds reflected in wave field)
- Stability effects



Real Time Ocean Forecast System
RT_OFS Atlantic

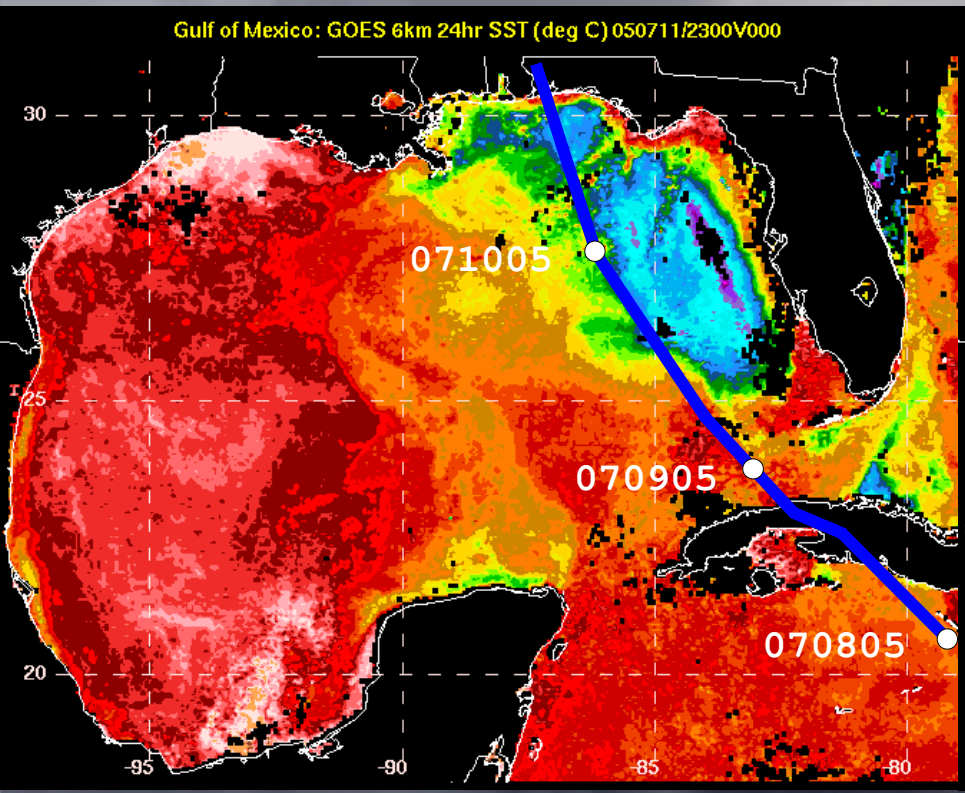

RT_OFS_ATL
Nov 26, 2005 00hr
GOES SST
Nov 26, 2005 0000 UTC
ROFS
Nov 26, 2005 00 hr
RT_OFS_ATL
Nov 26, 2005 24hr
GOES SST
Nov 27, 2005 0000 UTC
ROFS
Nov 26, 2005 24 hr
RT_OFS_ATL
Nov 26, 2005 48hr
GOES SST
Nov 28, 2005 0000 UTC
ROFS
Nov 26, 2005 48 hr
HYCOM_NATL 051128/00000048 HYCOM Surface Temperature (C)
GOESSST:3DAILY_NATL 051128/00000000 GOES 6km SST (deg C)
ROFS 051128/00000048 ROFS Surface Temperature (C)

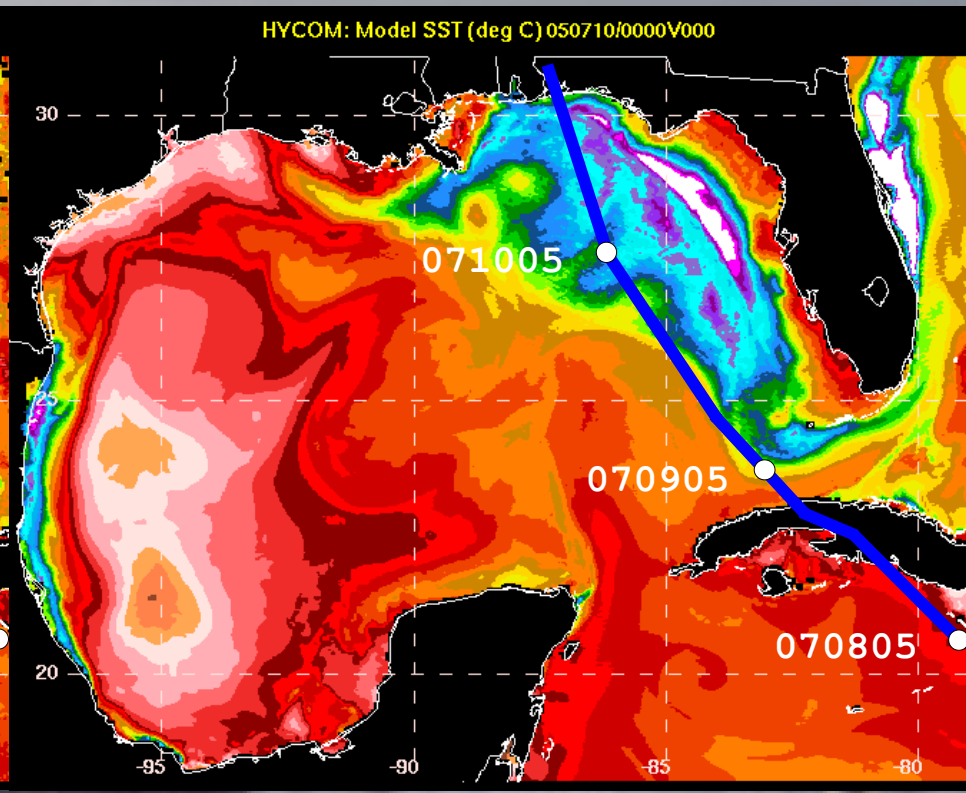

48 hr RTOFS Sfc Current
VT Nov 28, 2005 0000 UTC
Labrador Current
HYCOM_WATL 051128/0000V048 HYCOM Surface Temperature (C)
HYCOM_WATL 051128/0000V048 HYCOM Surface Currents (KTs)


48 hr ROFS Sfc Current
VT 0000 UTC Nov 28, 2005
ROFS 051128/0000V048 ROFS Surface Currents (KTs)

Case: Hurricane Dennis

July 11, 2005 - Goes SST (6 km) and HYCOM SST Analysis (F000)

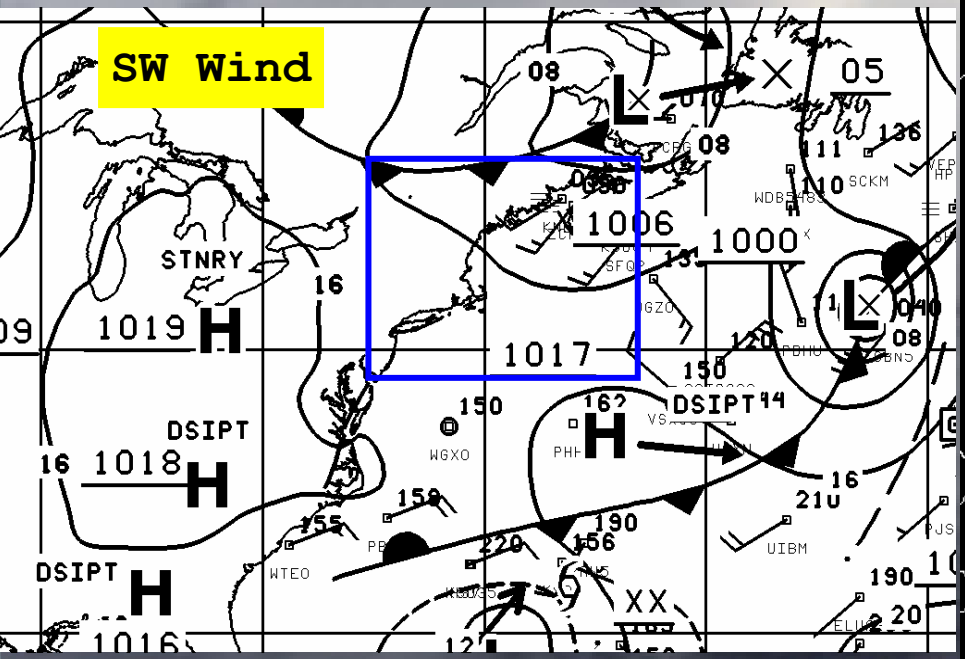


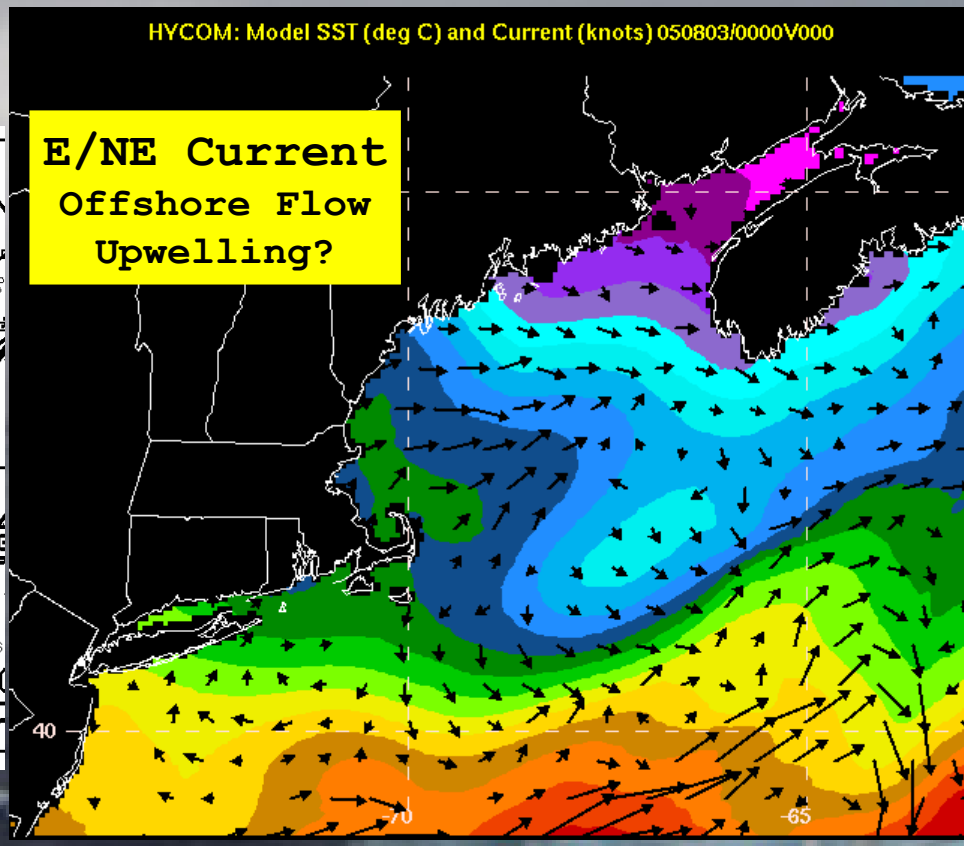


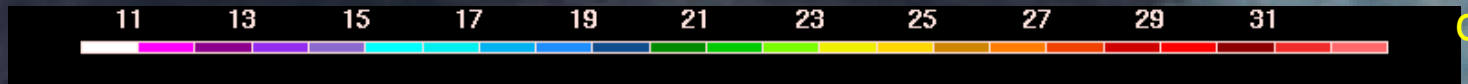
degrees C

Case: Gulf of Maine

August 3, 2005 – OPC Surface Analysis and HYCOM SST and Current Analysis (F000)

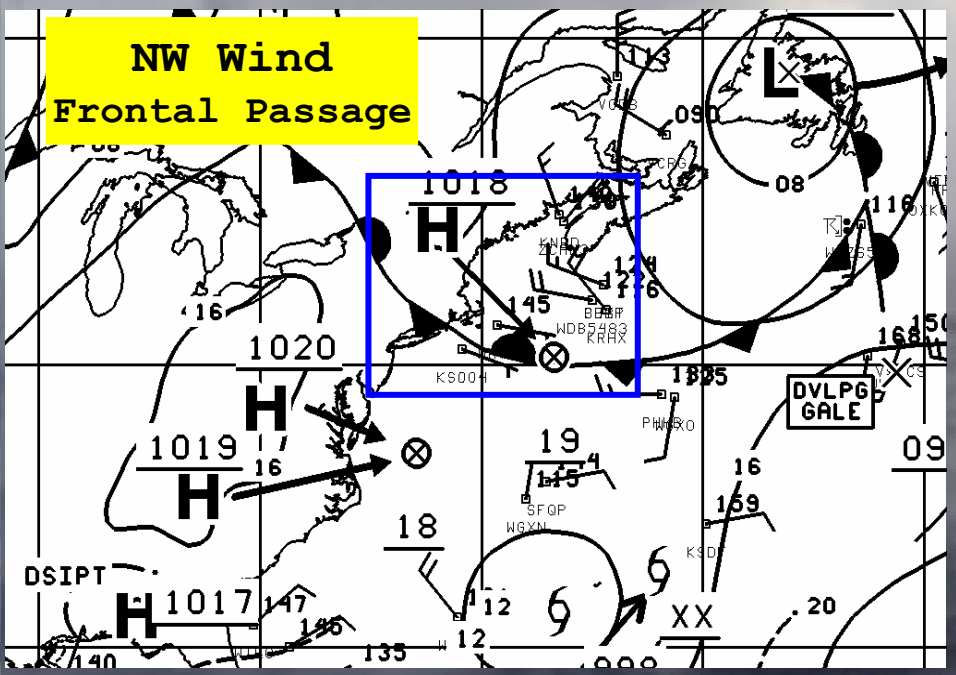


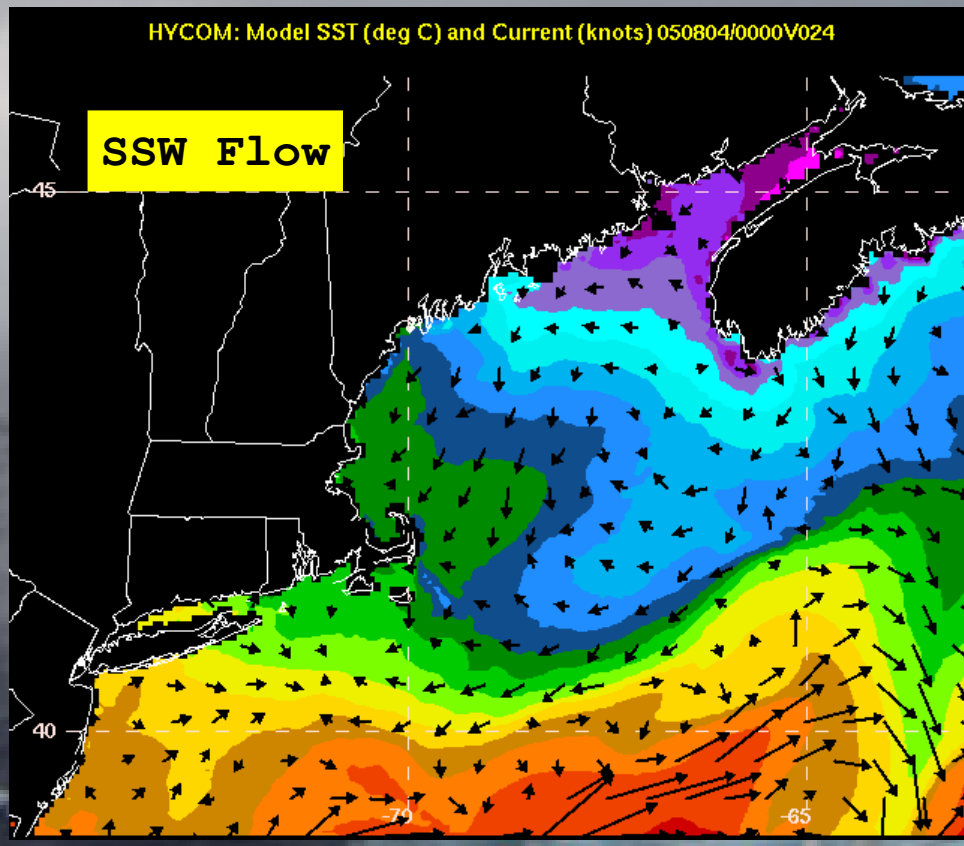




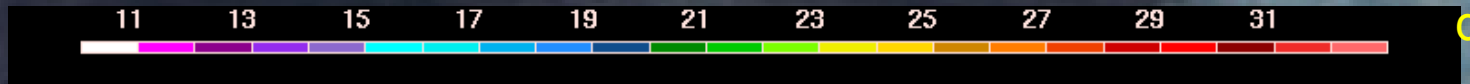
Case: Gulf of Maine

August 4, 2005 – OPC Surface Analysis and HYCOM SST and Current Forecast (F024)





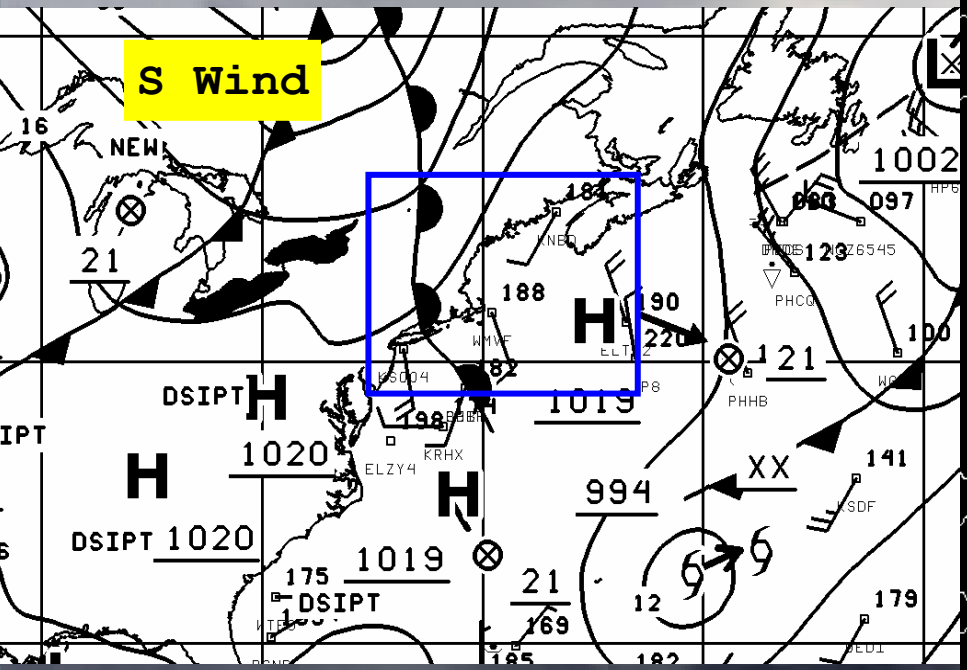
2005 1 18

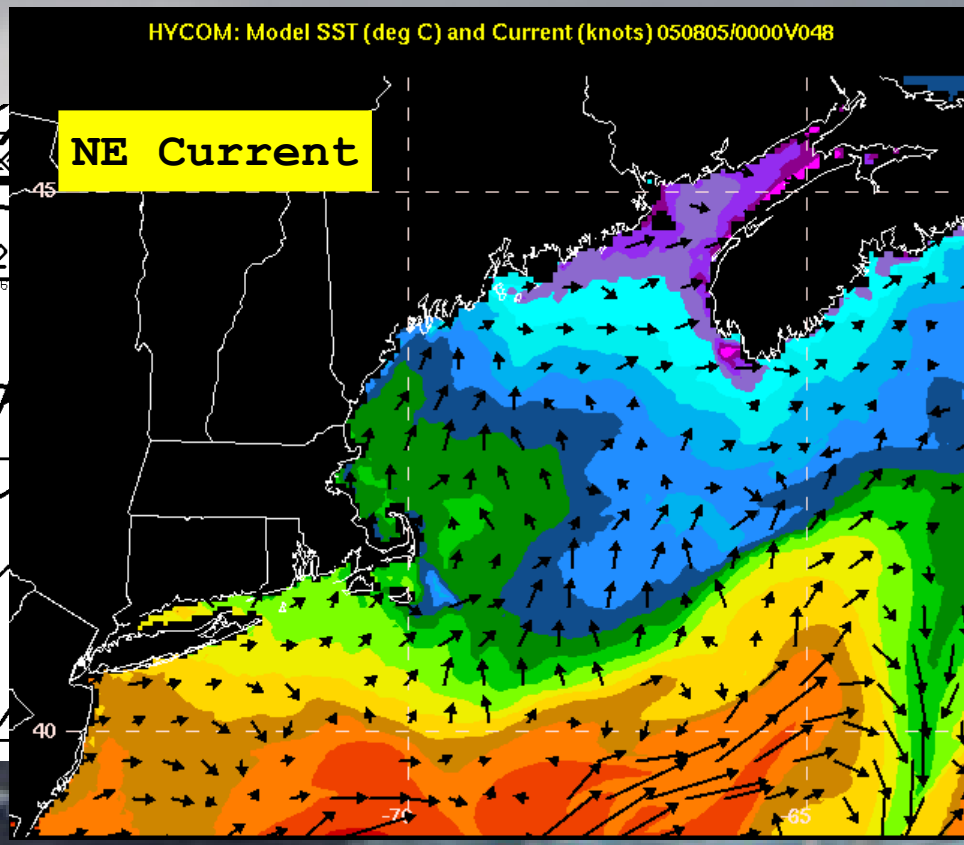


degrees C

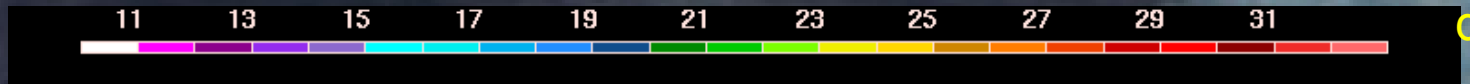
Case: Gulf of Maine

August 5, 2005 – OPC Surface Analysis and HYCOM SST and Current Forecast (F048)





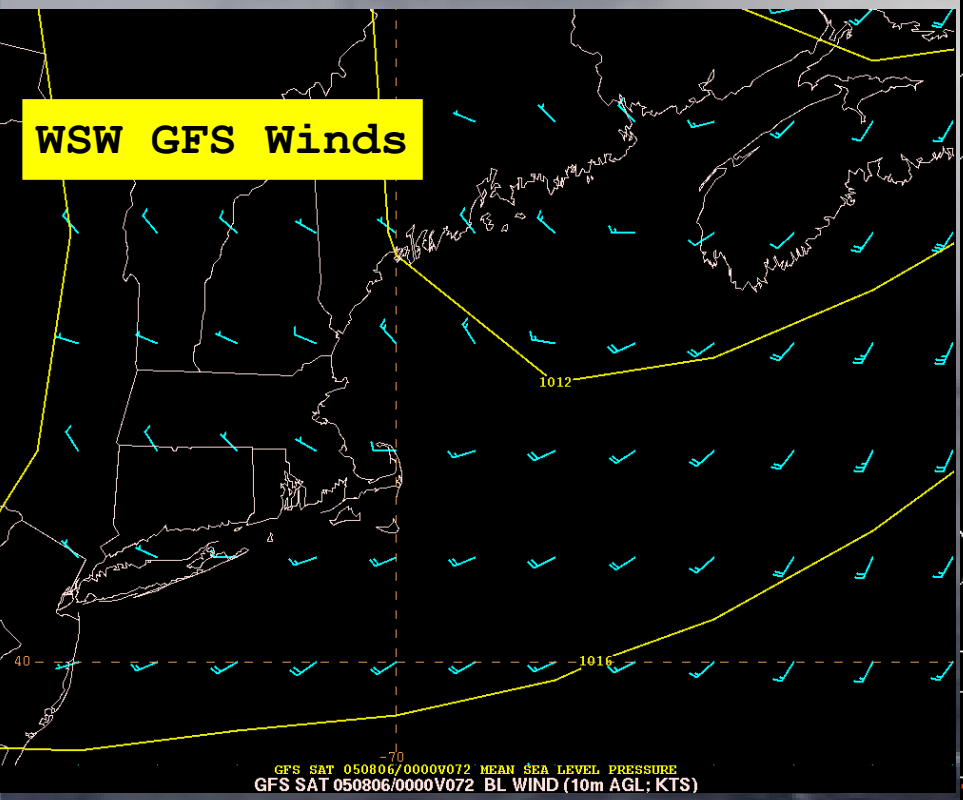
2005 1 18

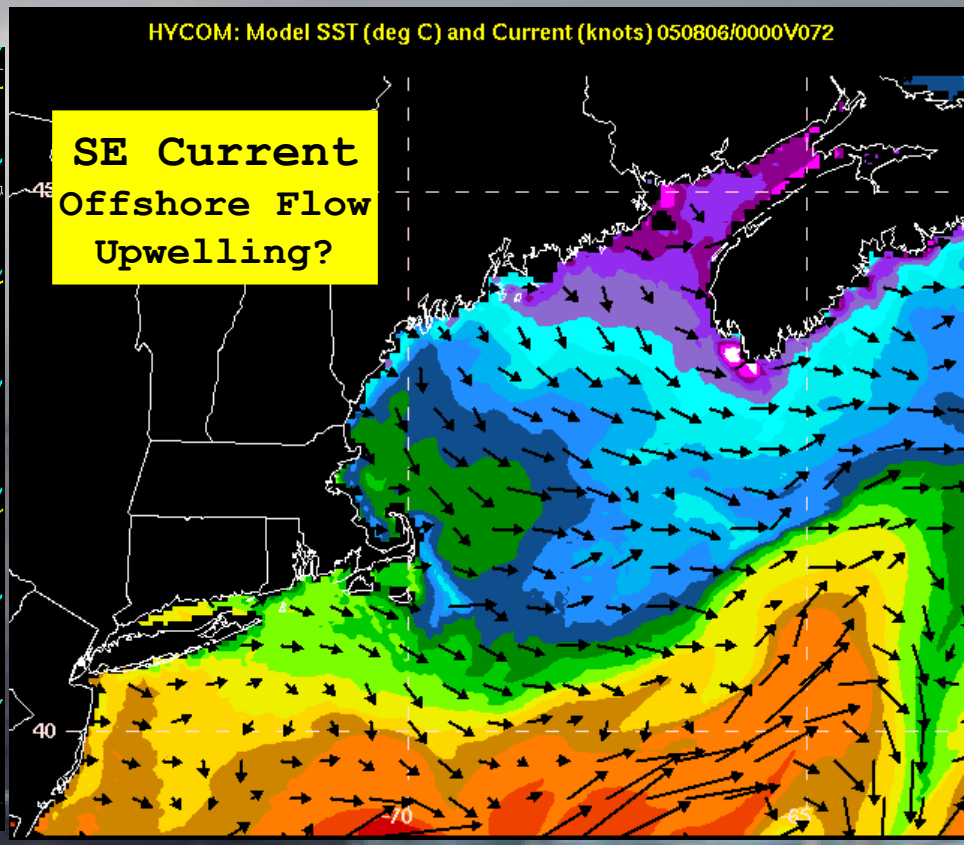


degrees C

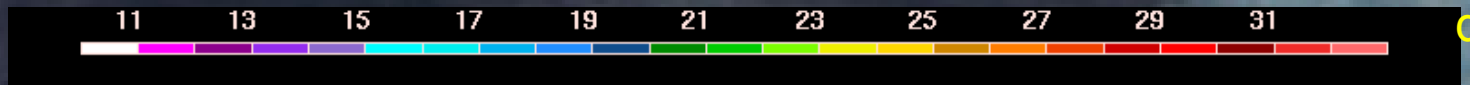
Case: Gulf of Maine

August 6, 2005 – OPC Surface Analysis and HYCOM SST and Current Forecast (F072)





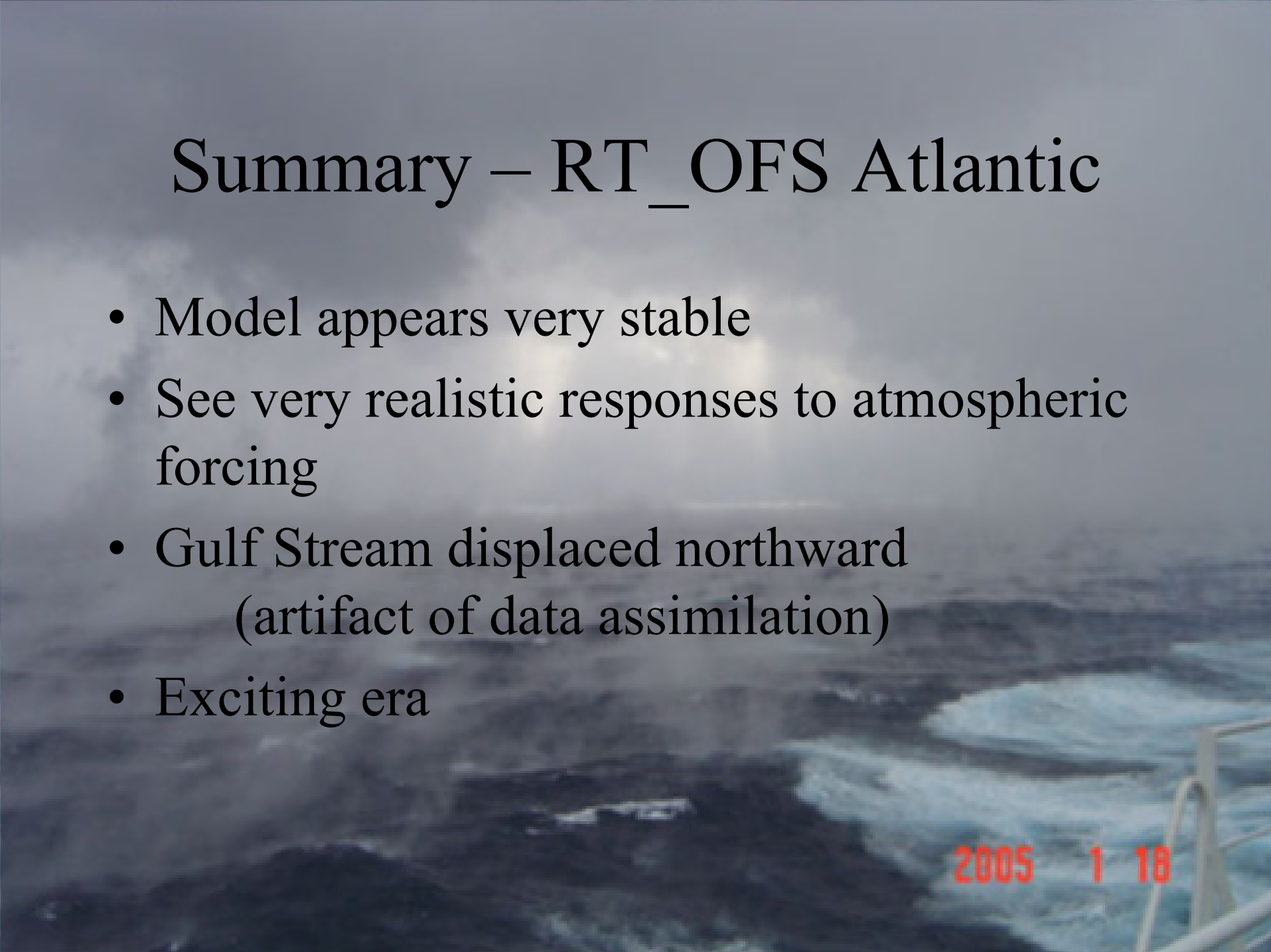
2005 1 18



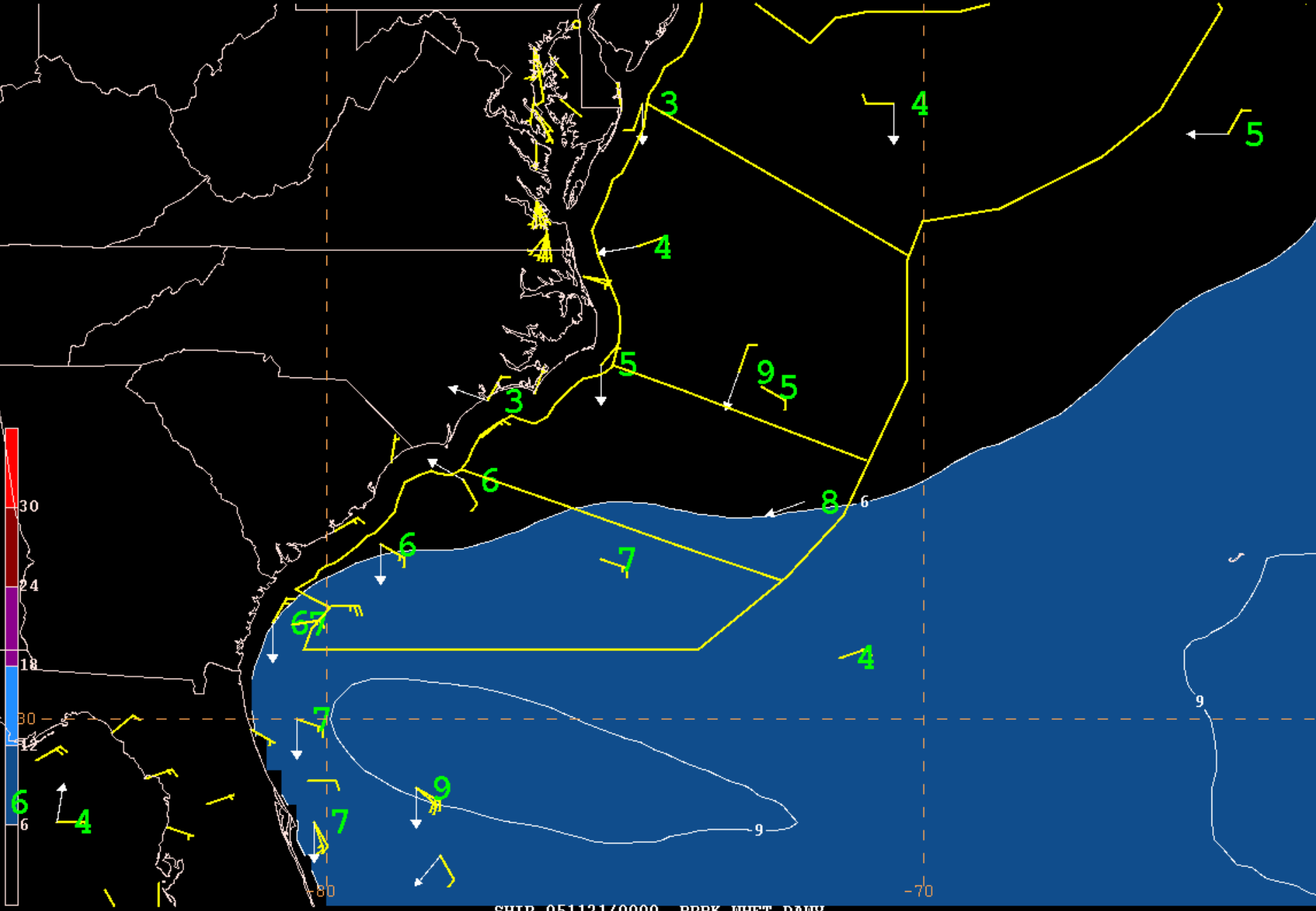
degrees C

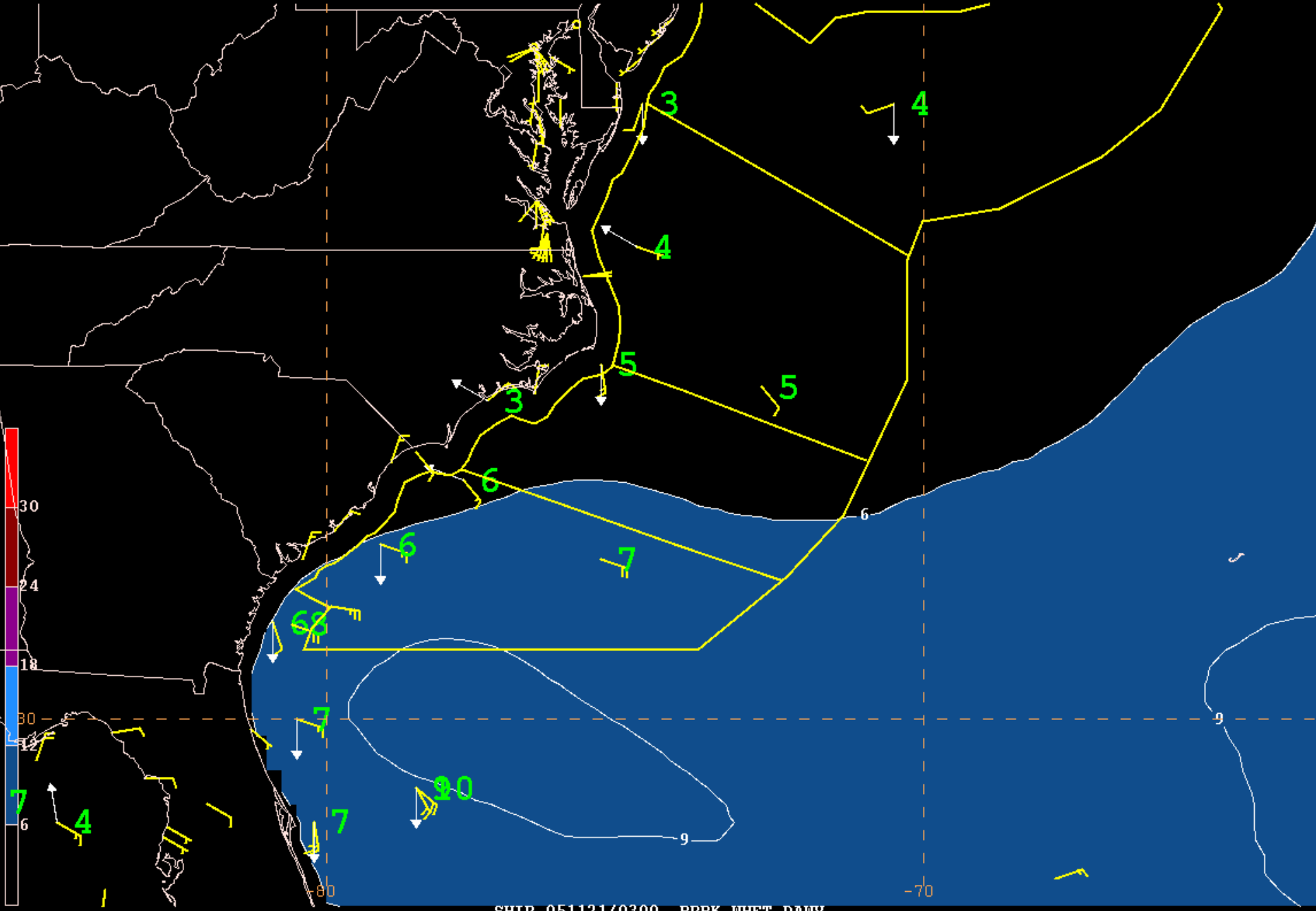
Summary – RT_OFS Atlantic

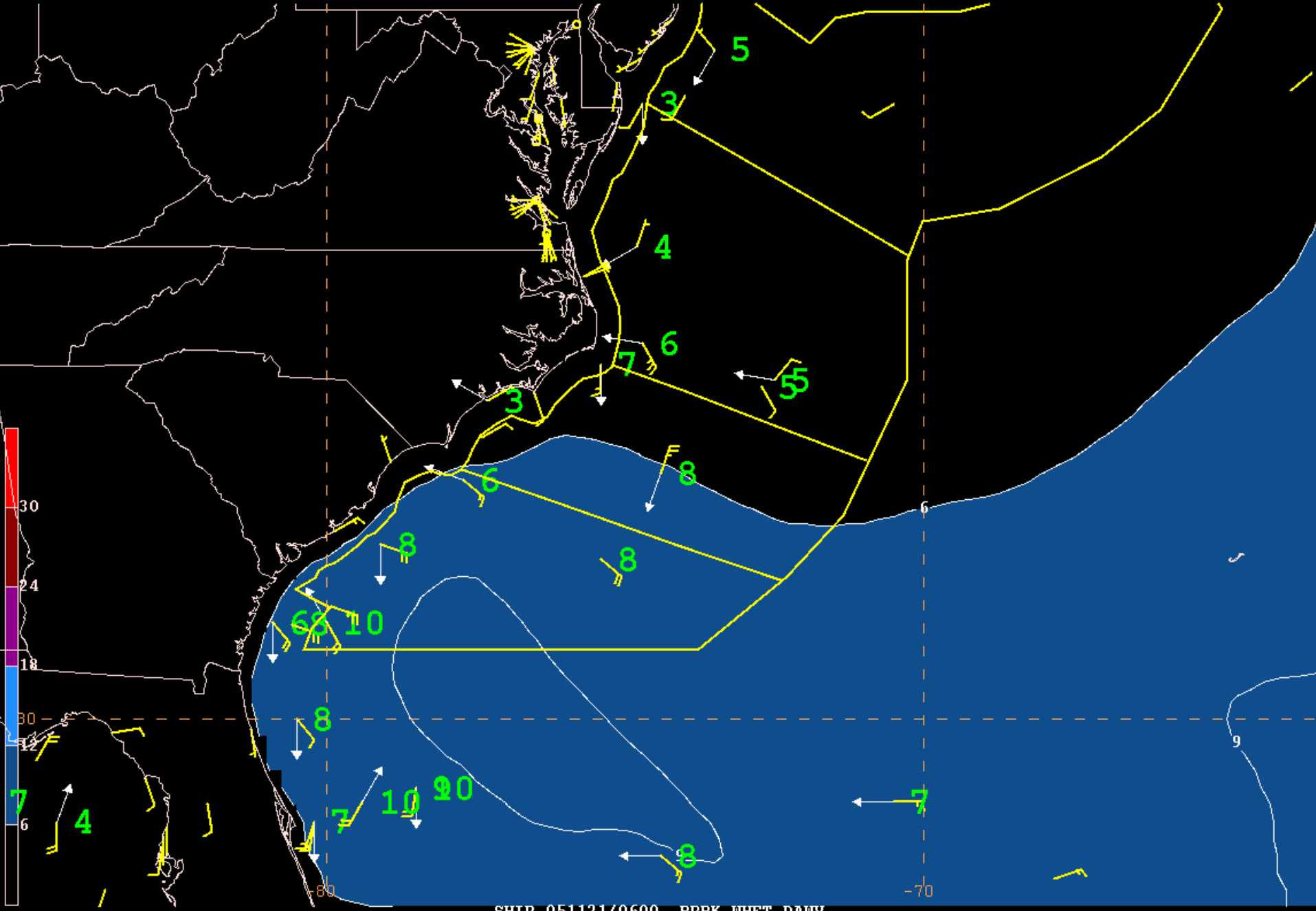
- Model appears very stable
- See very realistic responses to atmospheric forcing
- Gulf Stream displaced northward
  (artifact of data assimilation)
- Exciting era

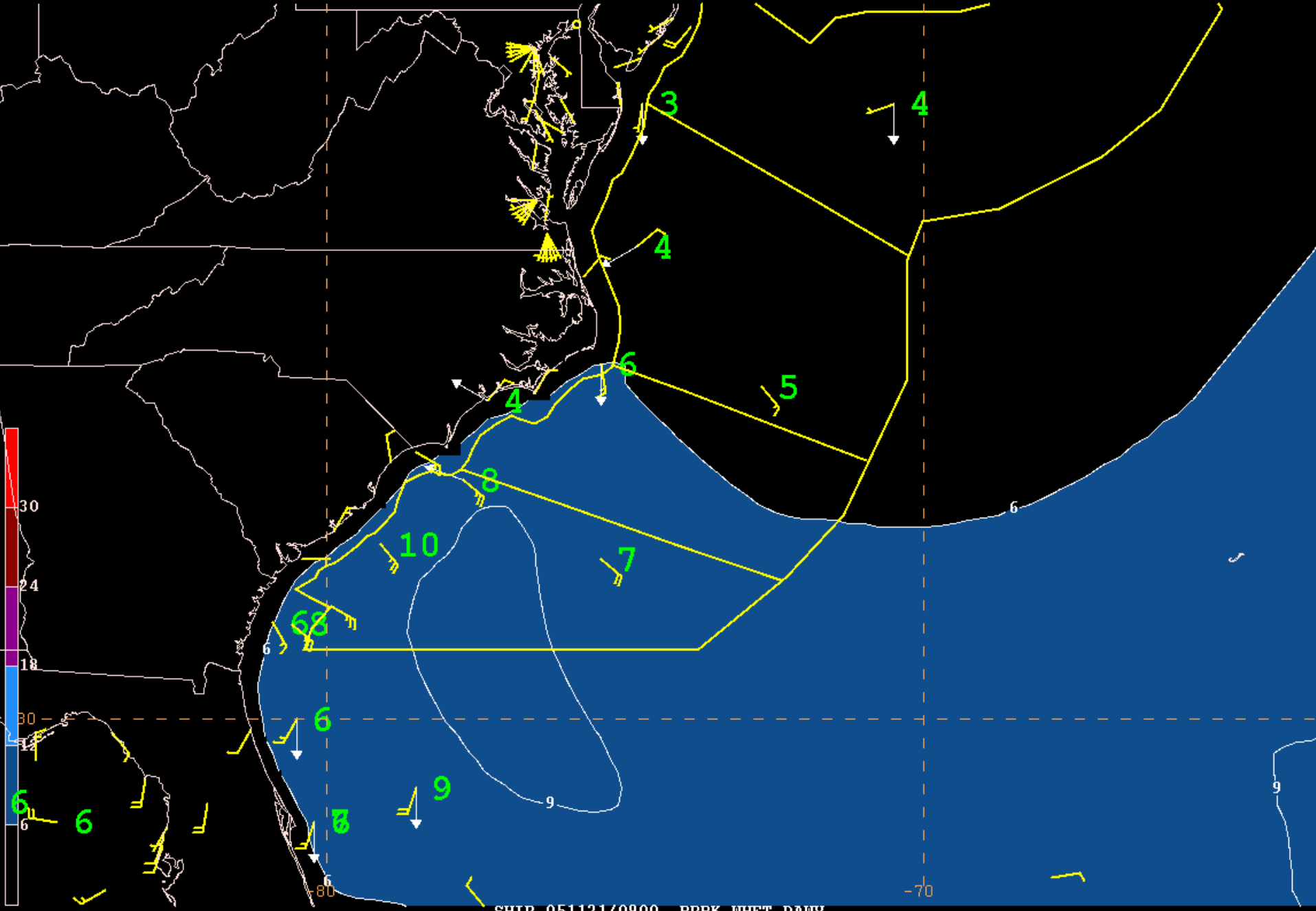


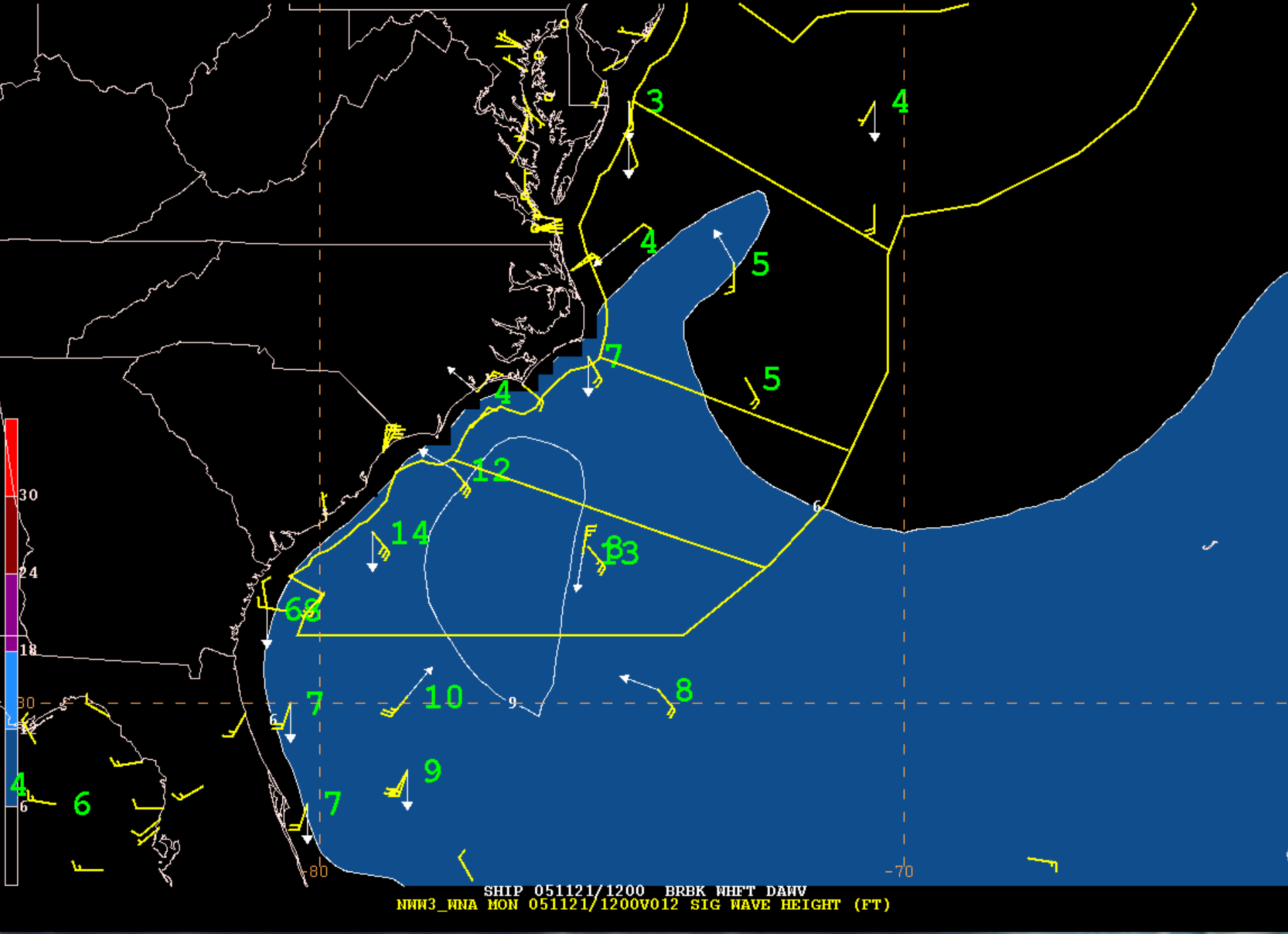
WAVES

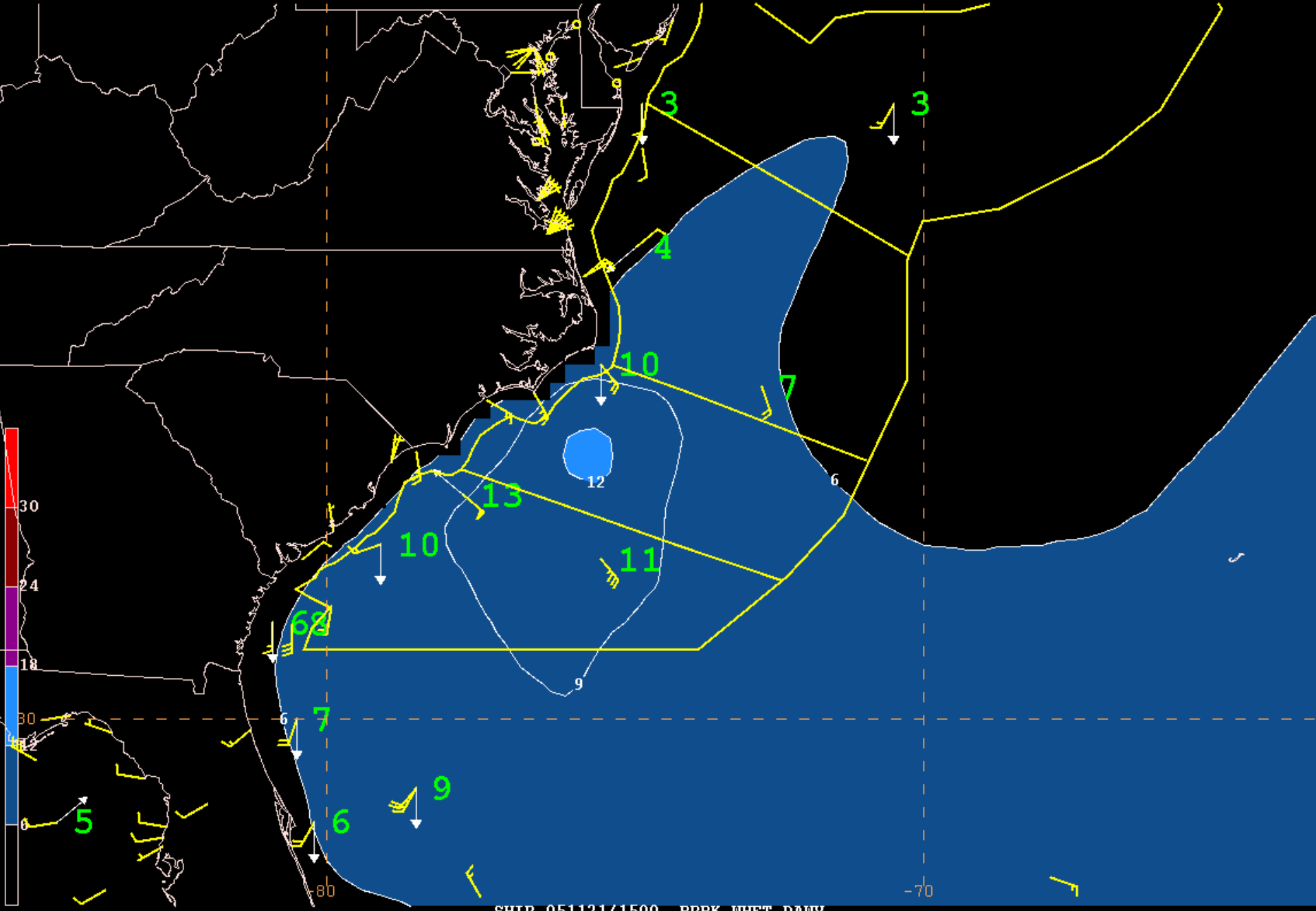

30
24
18
12
6
-80
-70
SHIP 051121/0000 BRBK WHFT DAWV
NWW3_WNA MON 051121/0000V000 SIG WAVE HEIGHT (FT)

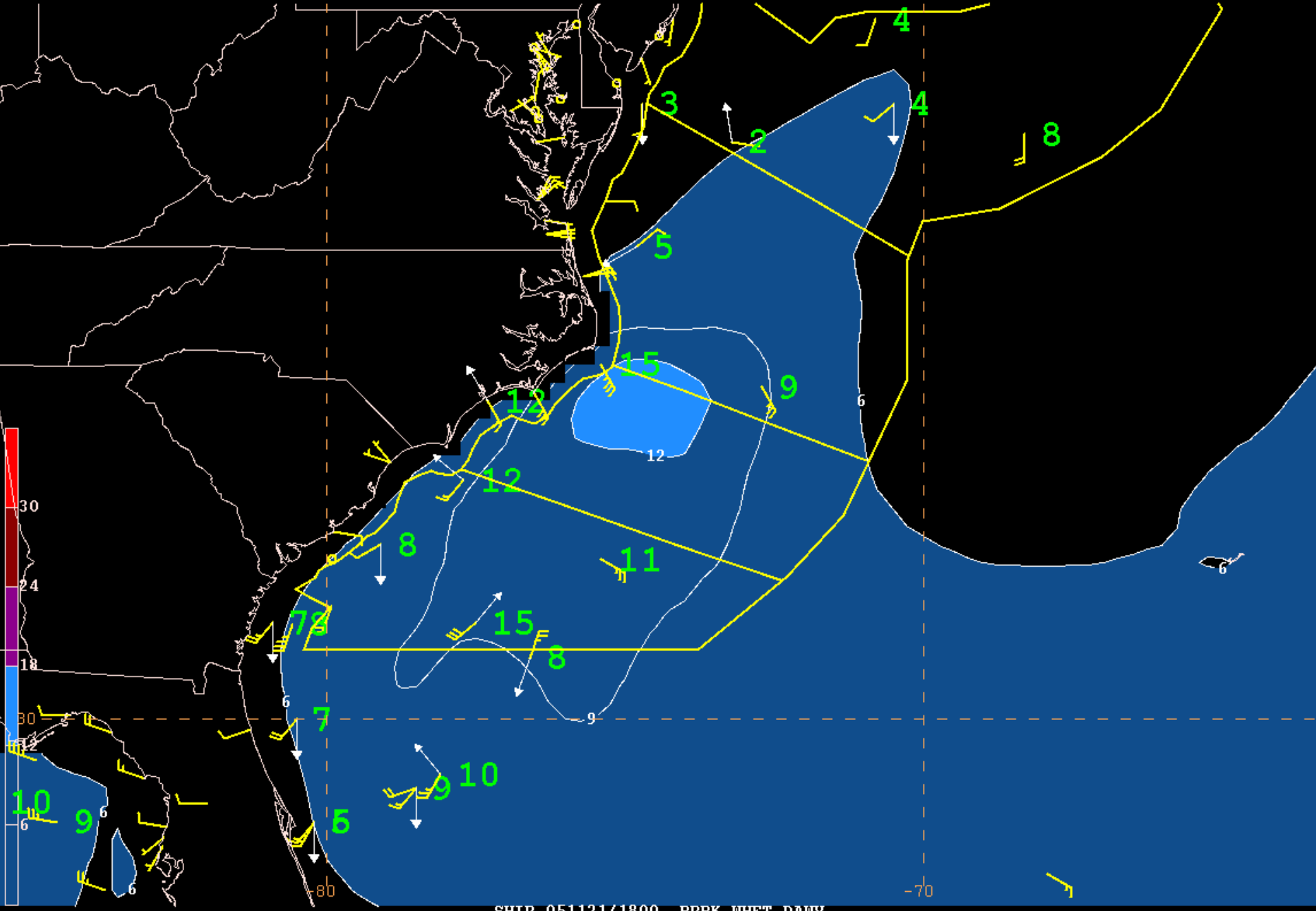

30
24
18
12
6
3
4
5
6
7
8
9
10
-80
-70
SHIP 051121/0300 BRBK WHFT DAWV
NWW3_WNA MON 051121/0300V003 SIG WAVE HEIGHT (FT)

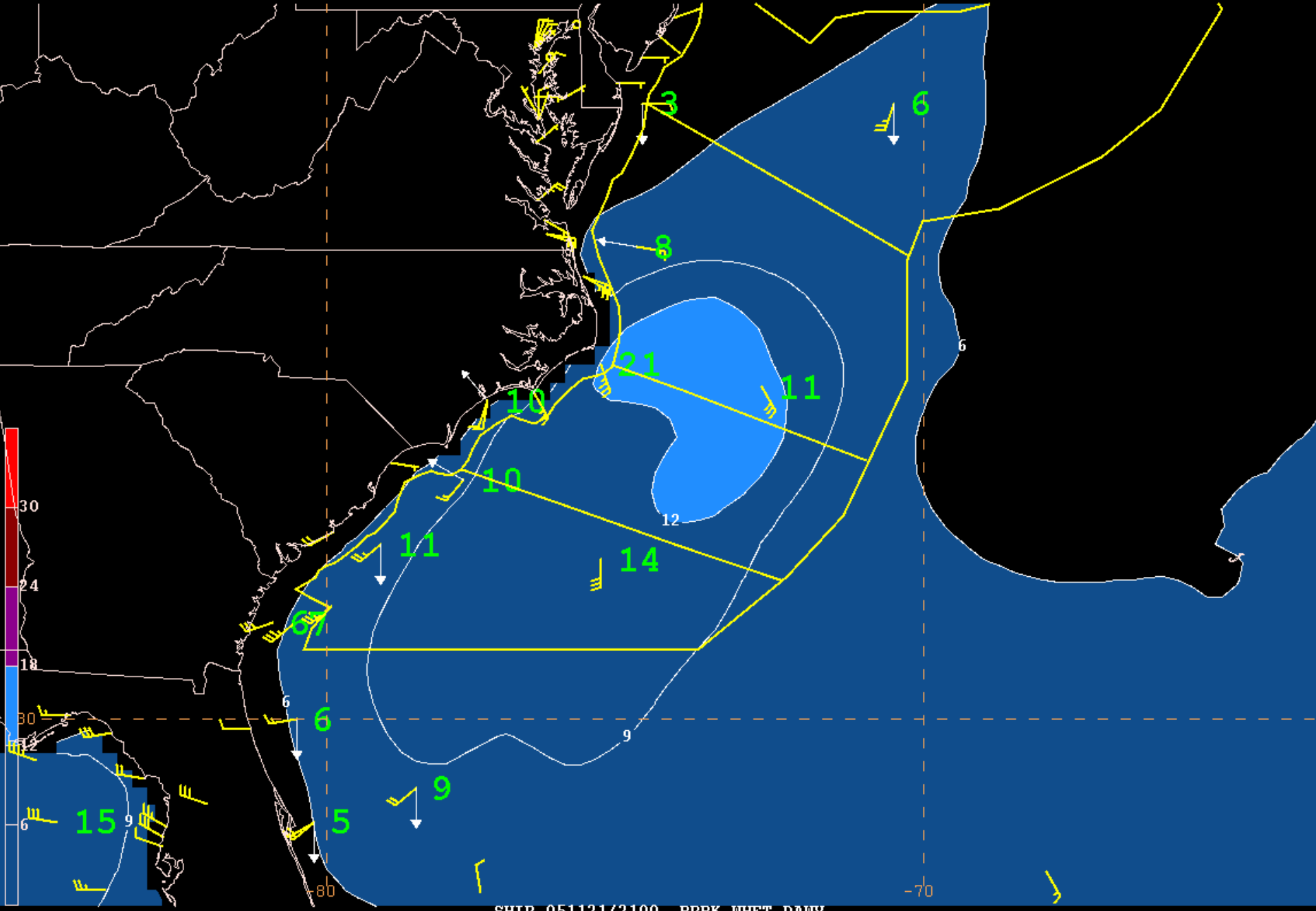

SHIP 051121/0600 BRBK WHFT DAWV
NWW3_WNA MON 051121/0600V006 SIG WAVE HEIGHT (FT)

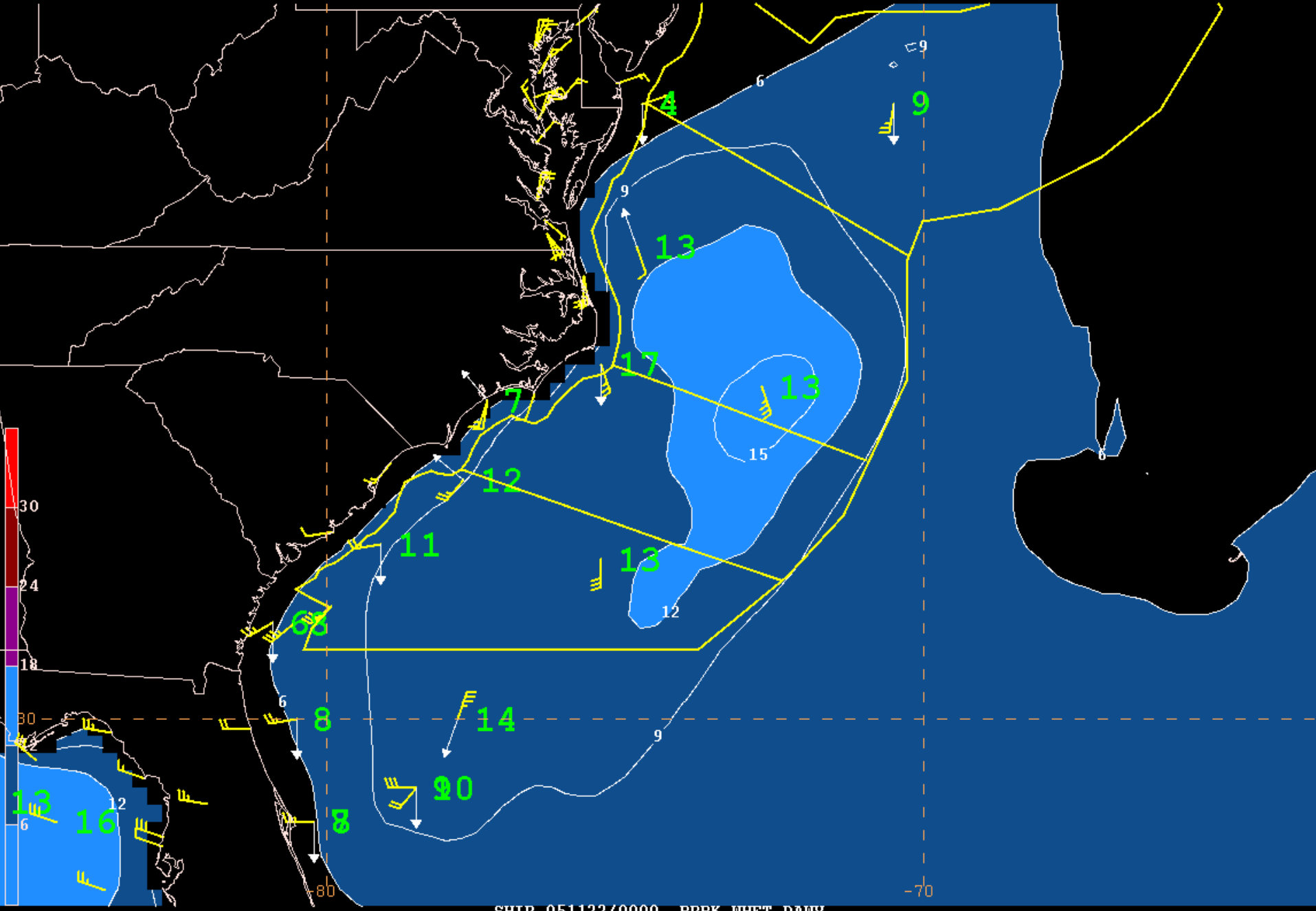

SHIP 051121/0900 BRBK WHFT DAWV
NWW3_WNA MON 051121/0900V009 SIG WAVE HEIGHT (FT)

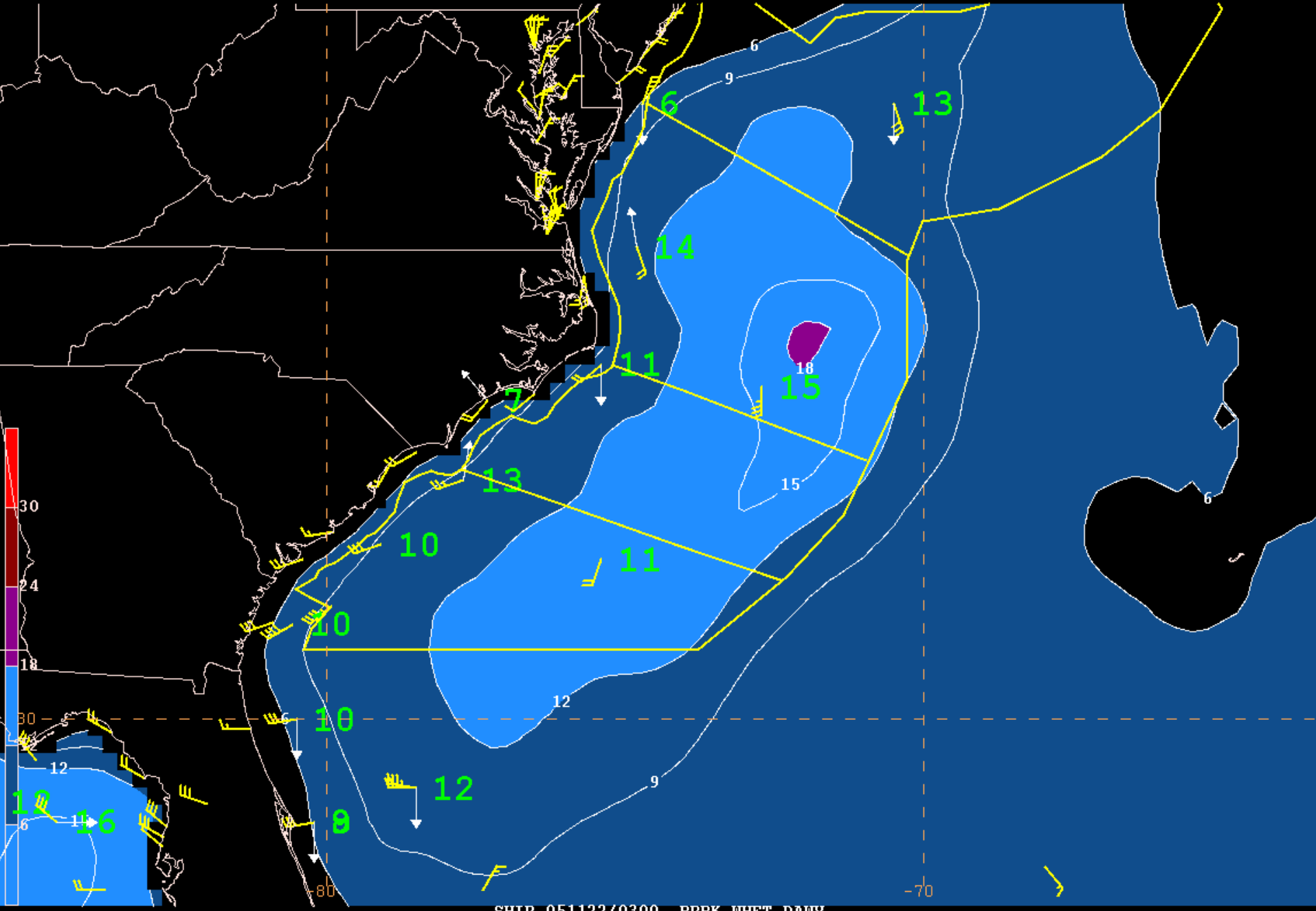

SHIP 051121/1200 BRBK WHFT DAWV
NWW3_WNA MON 051121/1200V012 SIG WAVE HEIGHT (FT)
30
24
18
12
6
-80
-70

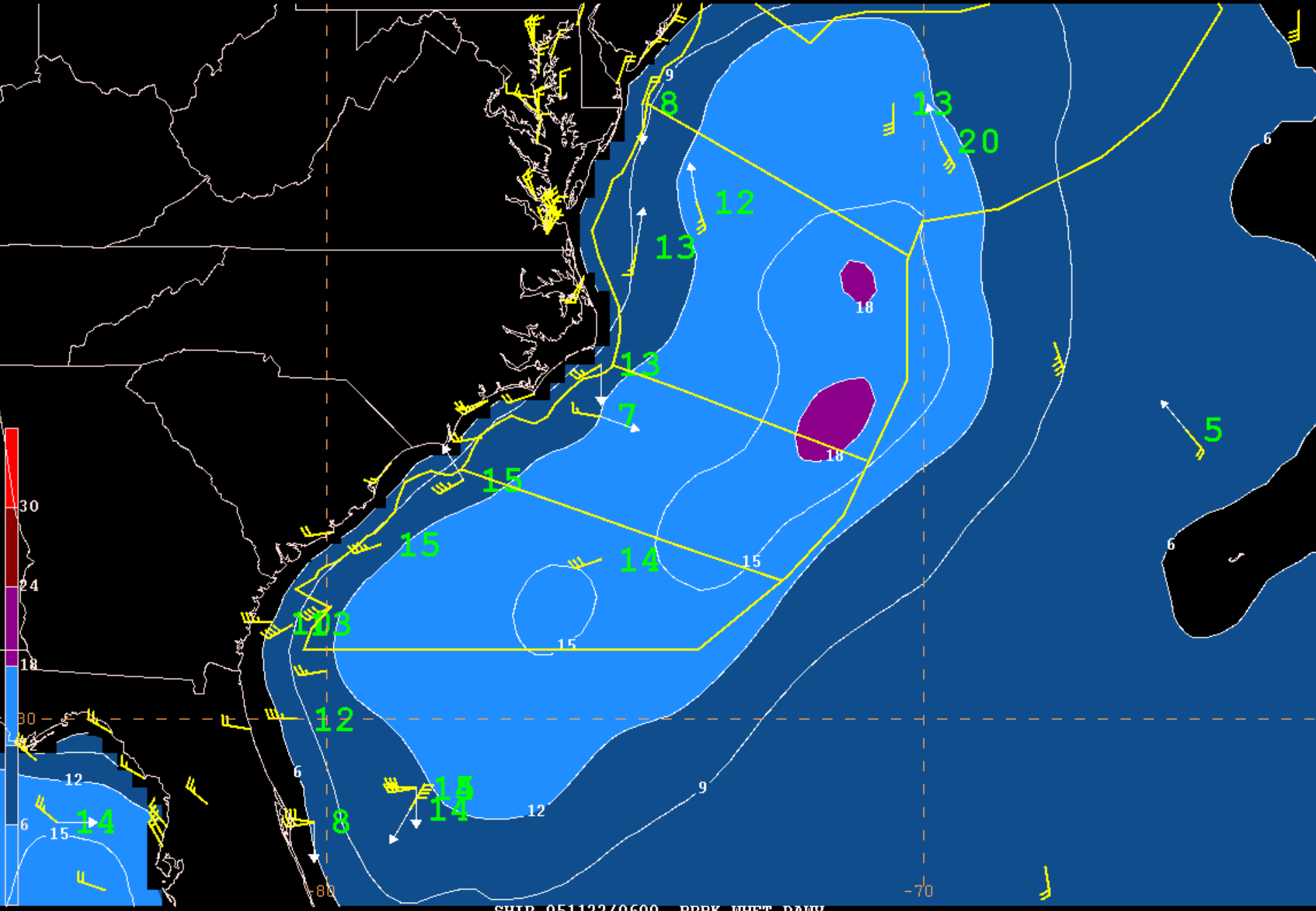

3
3
4
10
7
12
6
13
10
11
6
9
7
9
6
5
30
24
18
12
6
-80
-70
SHIP 051121/1500 BRBK WHFT DAWV
NWW3_WNA MON 051121/1500V015 SIG WAVE HEIGHT (FT)

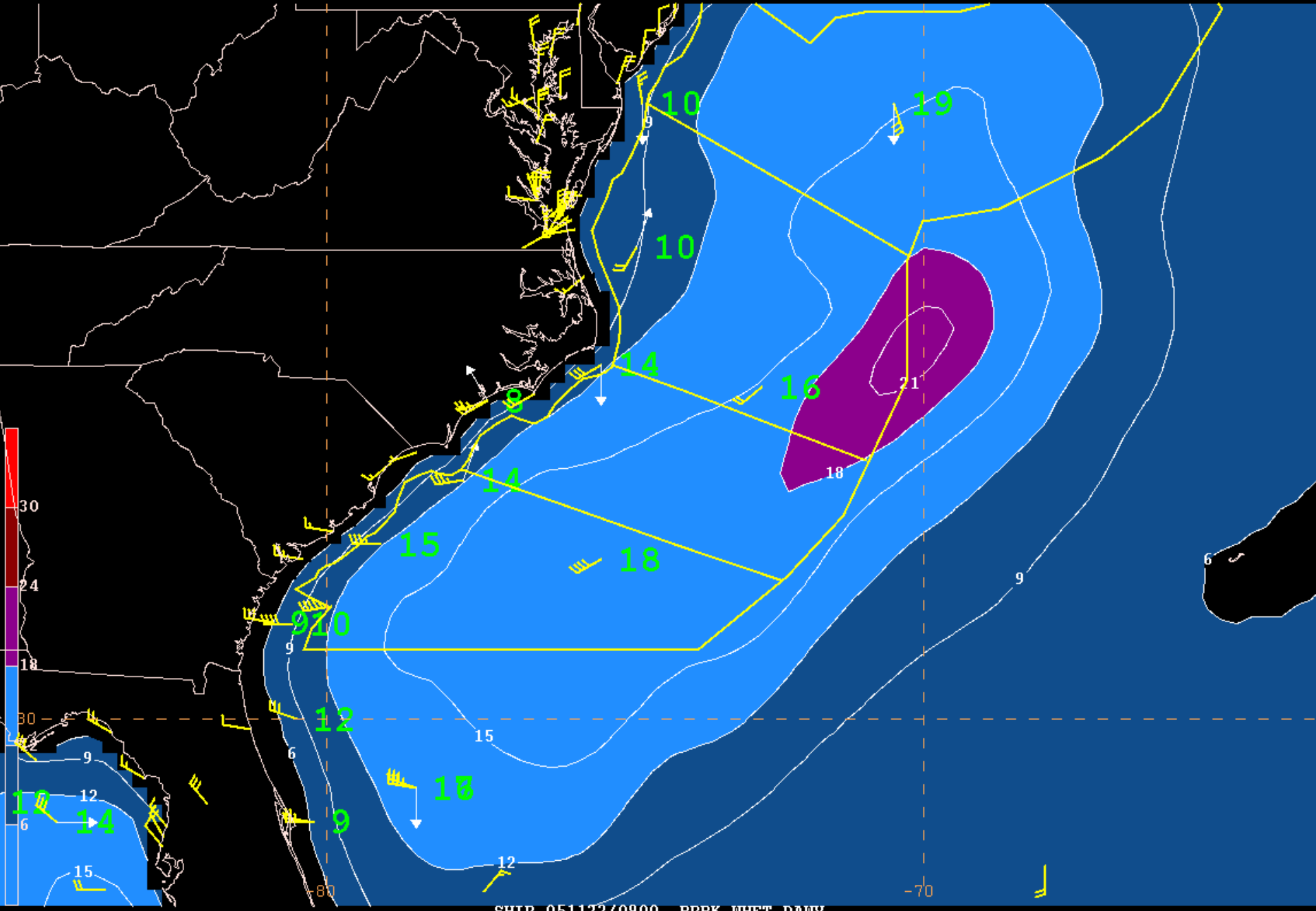

SHIP 051121/1800 BRBK WHFT DAWV
NWW3_WNA MON 051121/1800V018 SIG WAVE HEIGHT (FT)

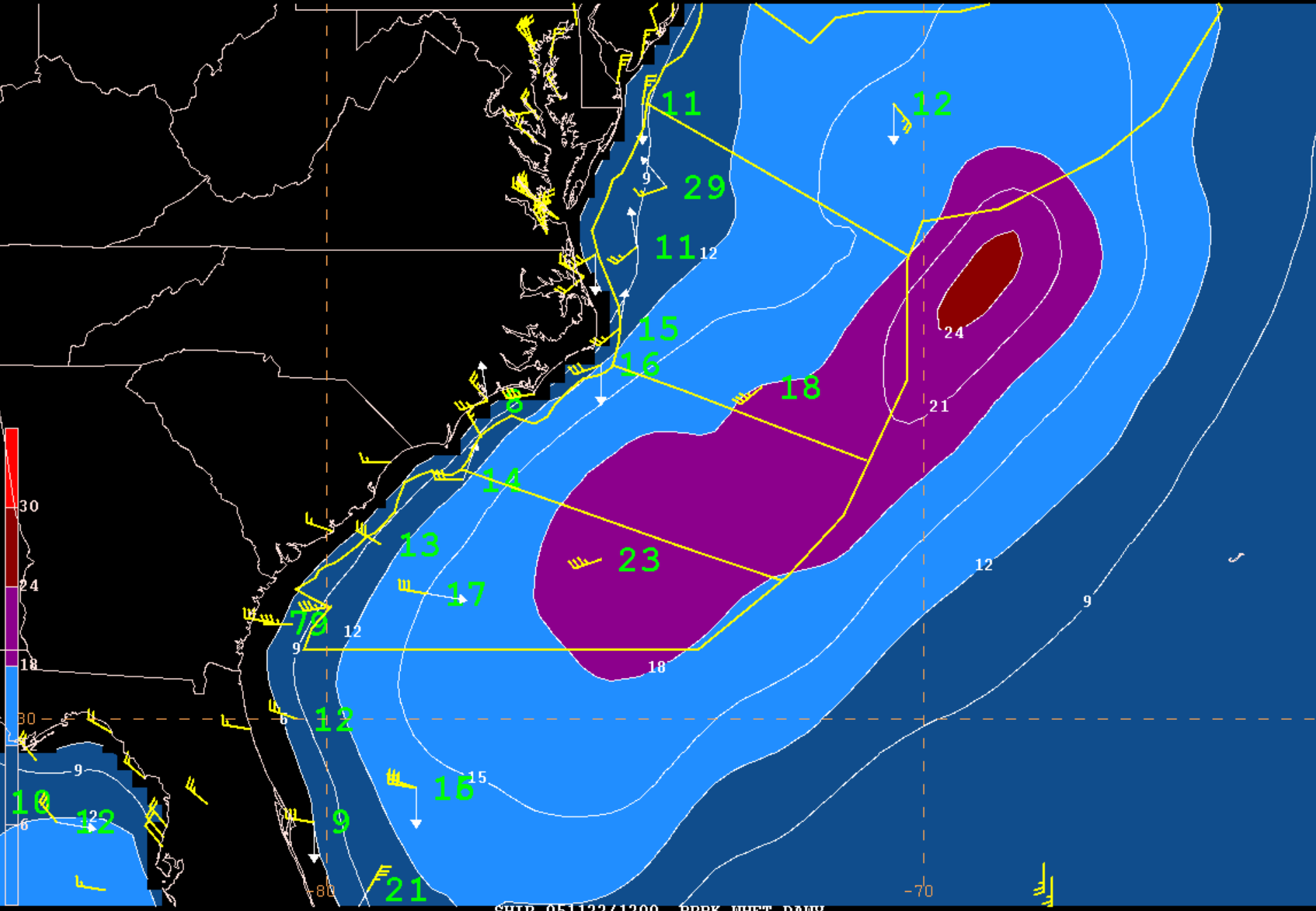

SHIP 051121/2100 BRBK WHFT DAWV
NWW3_WNA MON 051121/2100V021 SIG WAVE HEIGHT (FT)

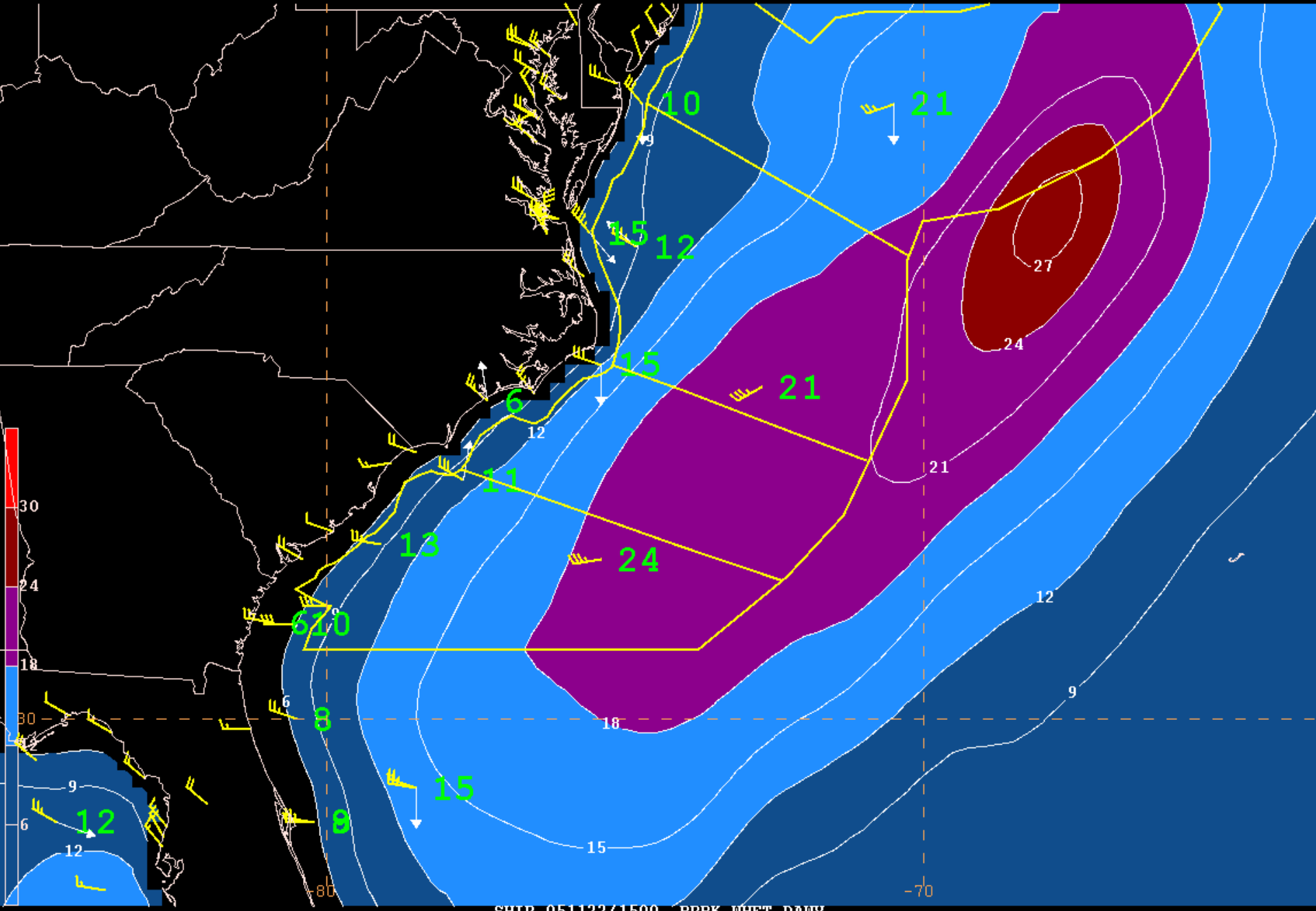

SHIP 051122/0000 BRBK WHFT DAWV
NWW3_WNA TUE 051122/0000V024 SIG WAVE HEIGHT (FT)

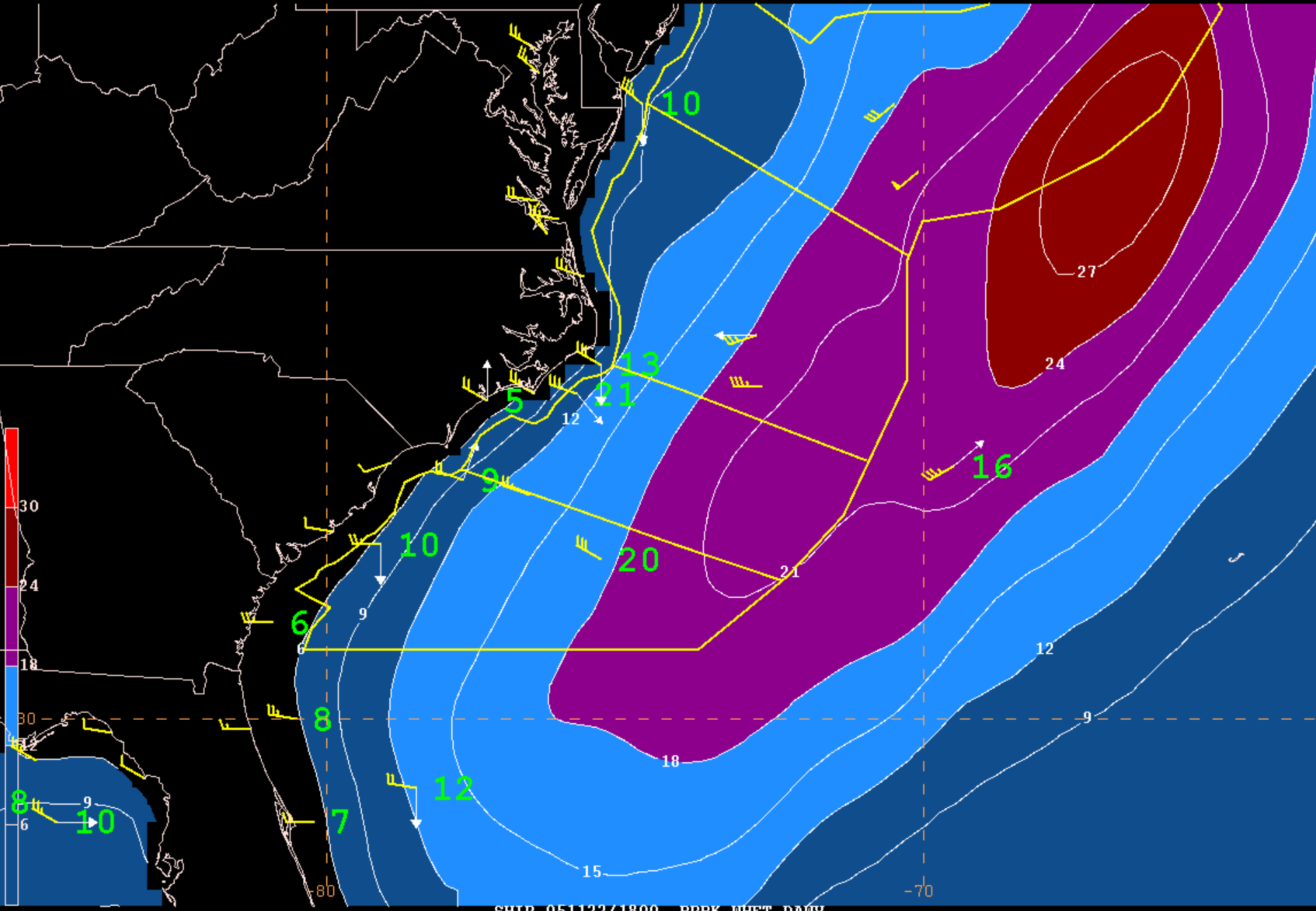

SHIP 051122/0300 BRBK WHFT DAWV
NWW3_WNA TUE 051122/0300V027 SIG WAVE HEIGHT (FT)


SHIP 051122/0600 BRBK WHFT DAWV
NWW3_WNA TUE 051122/0600V030 SIG WAVE HEIGHT (FT)


SHIP 051122/0900 BRBK WHFT DAWV
NWW3_WNA TUE 051122/0900V033 SIG WAVE HEIGHT (FT)


SHIP 051122/1200 BRBK WHFT DAWV
NWW3_WNA TUE 051122/1200V036 SIG WAVE HEIGHT (FT)


SHIP 051122/1500 BRBK WHFT DAWV
NWW3_WNA TUE 051122/1500V039 SIG WAVE HEIGHT (FT)


SHIP 051122/1800 BRBK WHFT DAWV
NWW3_WNA TUE 051122/1800V042 SIG WAVE HEIGHT (FT)