Pouch-tracking lessons learned and circulation characteristics of ex-Gaston, pre-Karl, and pre-Matthew as derived from the GV dropsondes

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Two Years of Pouch-Tracking

	2009	2010
Period	7/20-10/11	6/2-10/31
	84 days	152 days
Features	34	68
TDs+	9	19
	26% of total	28% of total
TSs+	8	18

Different wave scenarios (Wang & Montgomery, Miami, 2009)

- Retrospective analysis of the waves in 2009:
  - Fast propagating waves without a pouch
    - Faster than the mean flow
  - Waves with a shallow pouch
  - Waves with a deep pouch that did not develop
    - Inhibited by dry air
  - Waves with a deep pouch that developed
    - Can be enhanced by interaction with ITCZ

Unusual scenarios 2010

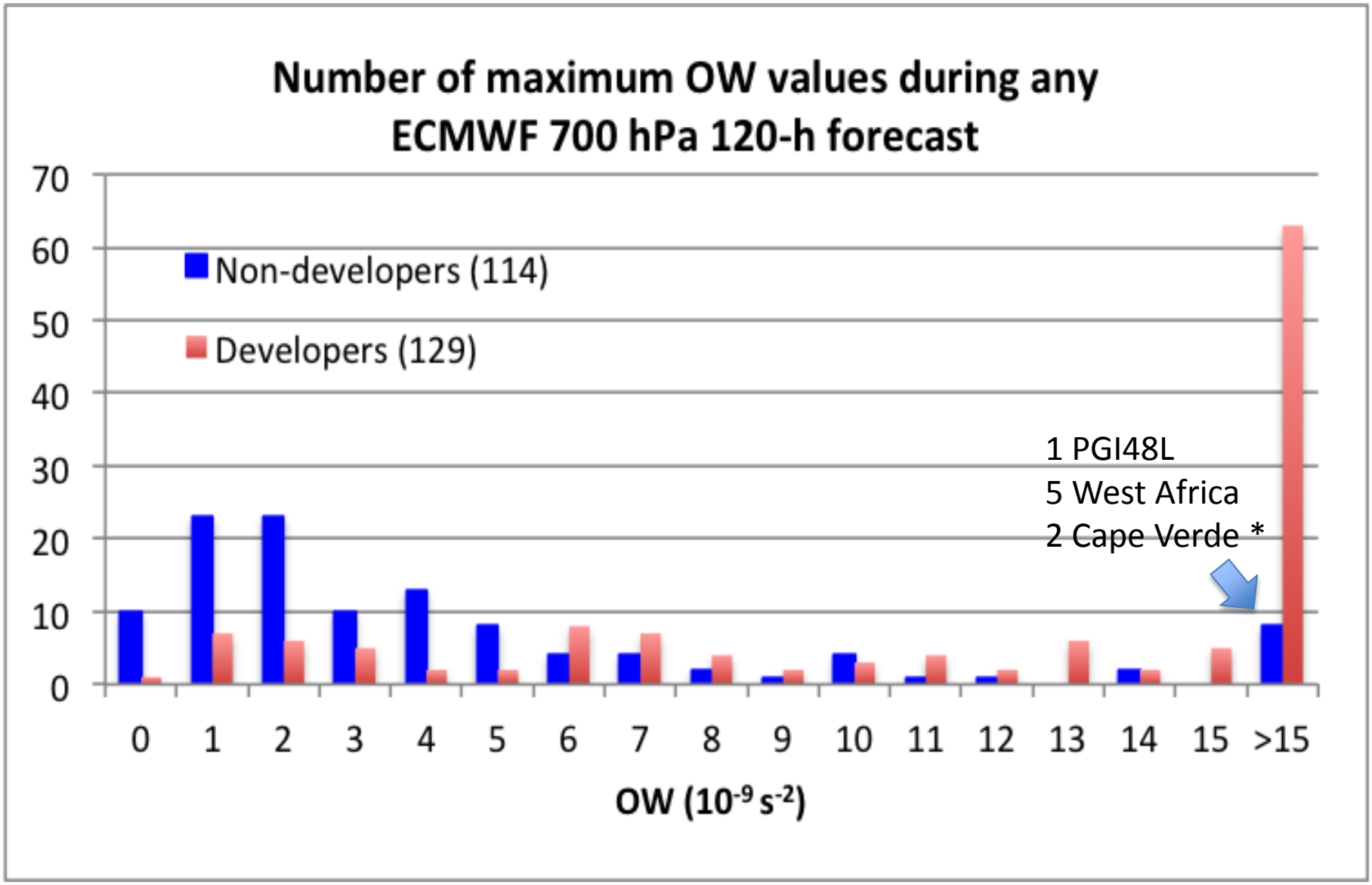
- Monsoonal influence
  - Hermine
  - PGI50L - Nicole?
  - PGI44L - Karl?
- Models forecast the development of a new pouch to the northwest of a current Central Atlantic system … Usually a false alarm
  - http://www.met.nps.edu/~mtmontgo/storms2010/PGI46L/2010091600/ukmet/PGI46L_OW_UKMET_2010091600_loop.html
  - http://www.met.nps.edu/~mtmontgo/storms2010/PGI46L/2010091600/ecmwf/PGI46L_OW_ECMWF_2010091600_loop.html

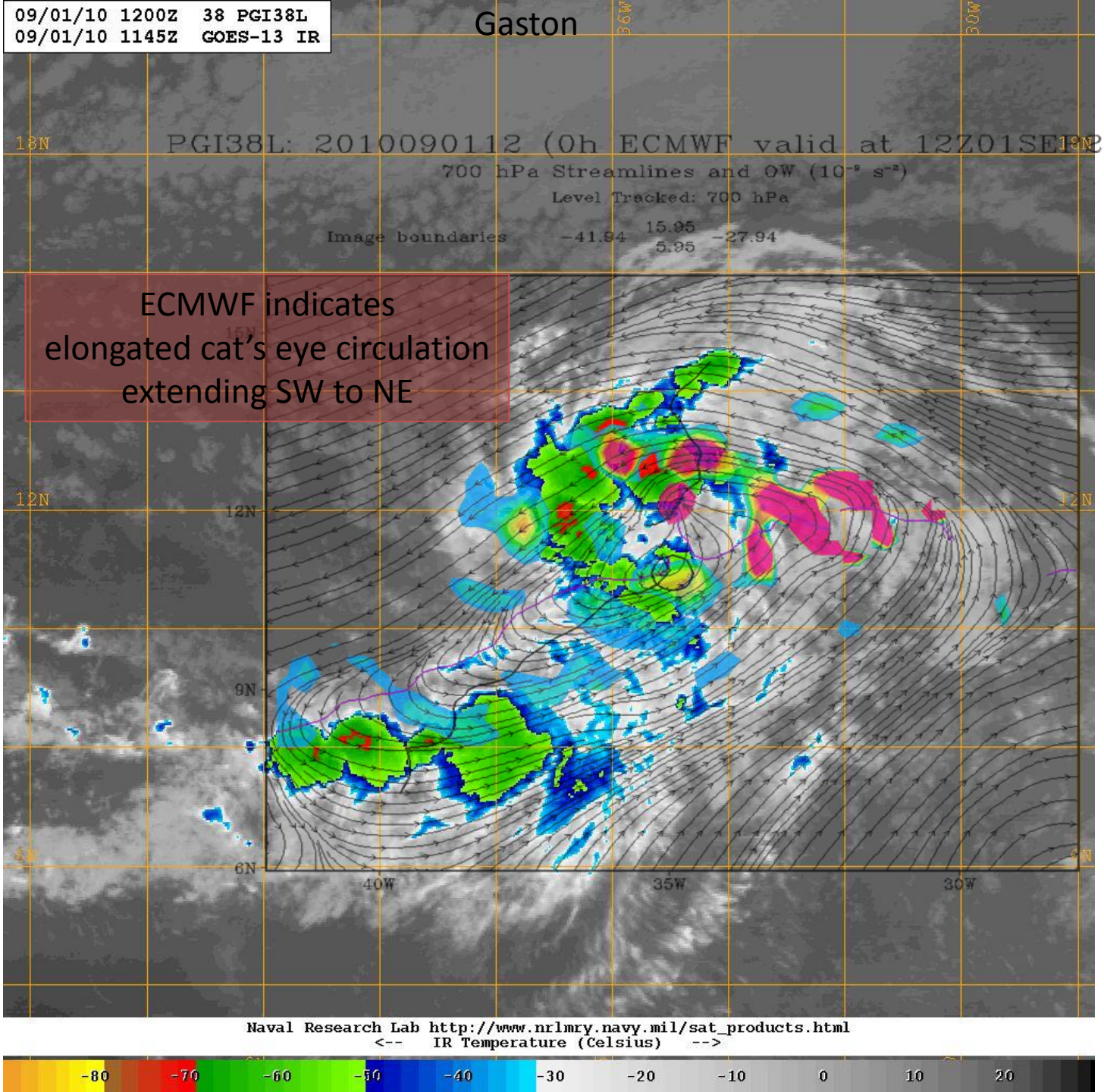
Question: Does an OW threshold of 2×10^{-9} s^{-2} in the model forecast indicate likelihood for development?

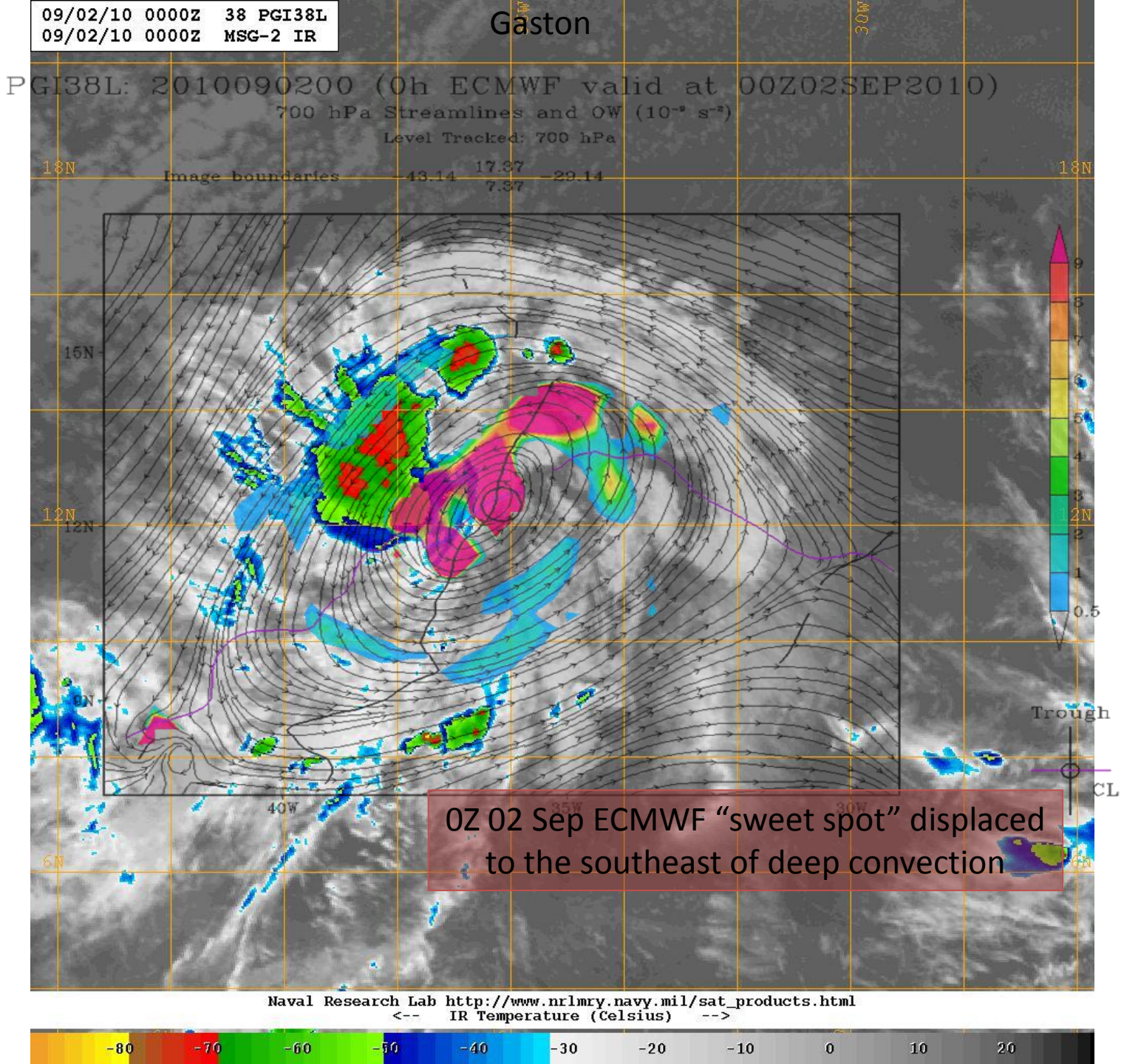
Analysis of ECMWF

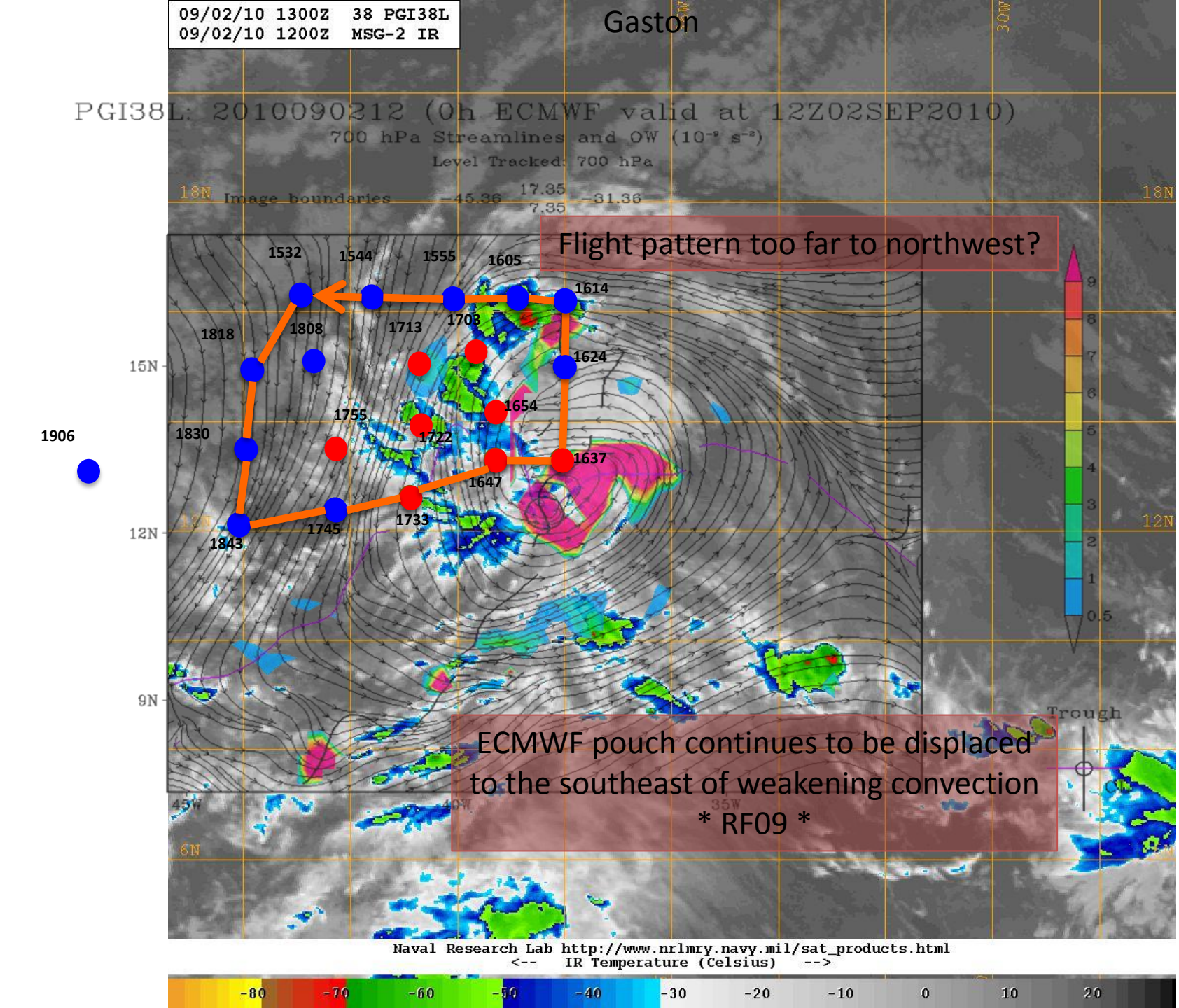
- The 2010 ECMWF forecasts of pouches with at least one 12-hourly position
- 243 forecasts (15 July – 27 October)
- Number of forecasts is skewed toward developers because they tend to last longer
- No account for the time of development
- Simple count of the maximum OW at any time during each 120-hour forecast
- Examine only the 700 hPa values for consistency, even if eventually tracked at a lower level

Question: Does an OW threshold of 2×10^{-9} s^{-2} in the model forecast indicate likelihood for development?




09/01/10 1200Z 38 PGI38L
09/01/10 1145Z GOES-13 IR
Gaston
PGI38L: 2010090112 (0h ECMWF valid at 12Z01SEP2010)
700 hPa Streamlines and OW (10⁻⁵ s⁻²)
Level Tracked: 700 hPa
Image boundaries -41.94 15.95 5.95 -27.94
ECMWF indicates
elongated cat's eye circulation
extending SW to NE
18N
12N
9N
6N
40W
35W
30W
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

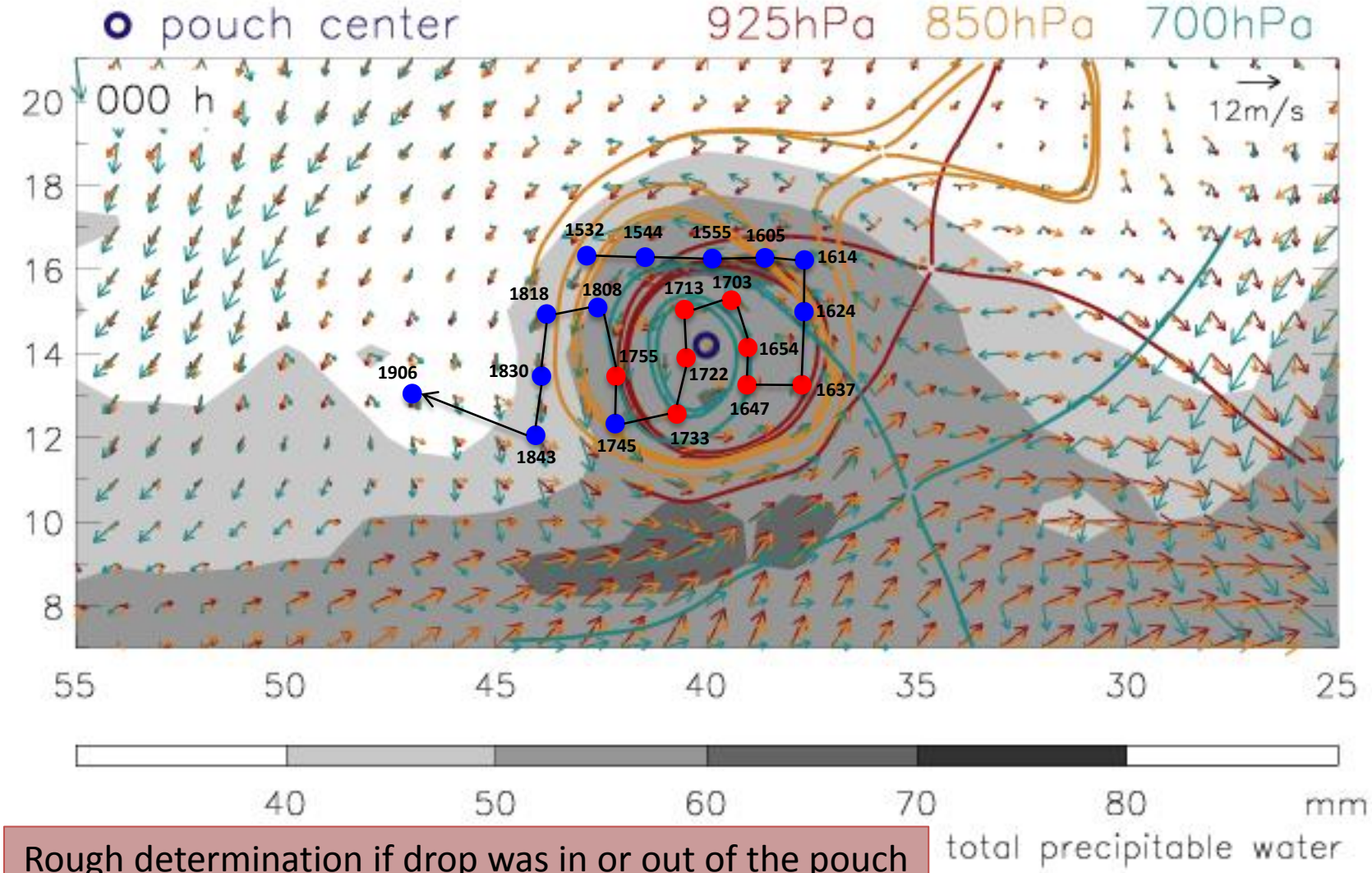

09/02/10 0000Z 38 PGI38L
09/02/10 0000Z MSG-2 IR
Gaston
PGI38L: 2010090200 (0h ECMWF valid at 00Z02SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Image boundaries
18N
15N
12N
6N
40W
35W
30W
Trough
CL
0Z 02 Sep ECMWF "sweet spot" displaced to the southeast of deep convection
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/02/10 1300Z 38 PGI38L
09/02/10 1200Z MSG-2 IR
Gaston
PGI38L: 2010090212 (0h ECMWF valid at 12Z02SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Image boundaries -45.36 17.35 7.35 -31.36
Flight pattern too far to northwest?
1532
1544
1555
1605
1614
1624
1708
1713
1808
1818
1654
1755
1722
1830
1637
1647
1733
1745
1843
1906
ECMWF pouch continues to be displaced to the southeast of weakening convection
* RF09 *
Trough
18N
15N
12N
9N
6N
45W
40W
35W
30W
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

Gaston

ECMWF Dividing Streamline Analysis 2010090300

RF09 Drops: 20100902 1532-1906 Z 4:54-8:28 hours before



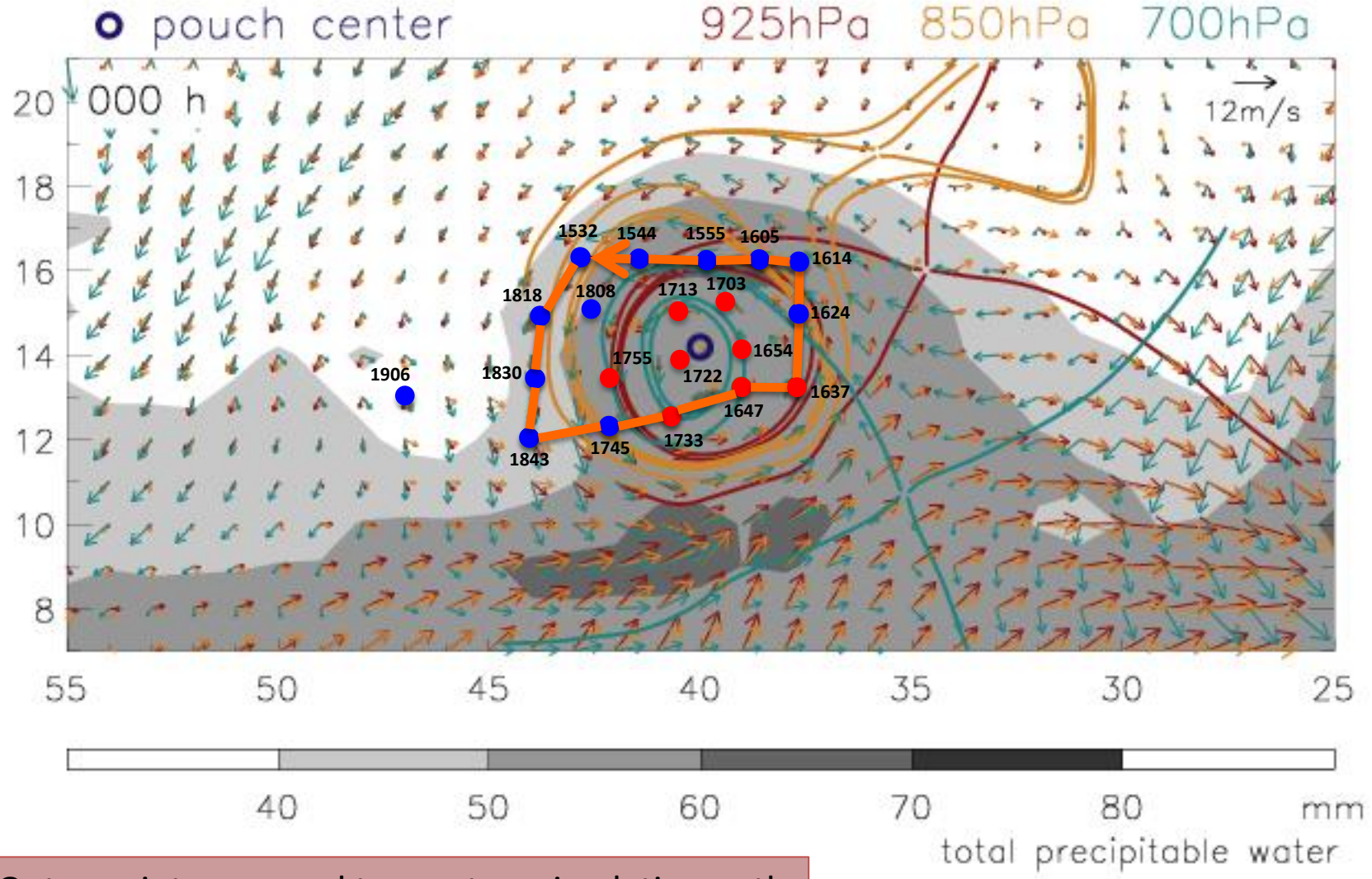
Rough determination if drop was in or out of the pouch based upon 700 hPa manifold streamline

RED – IN BLUE – OUT

Gaston

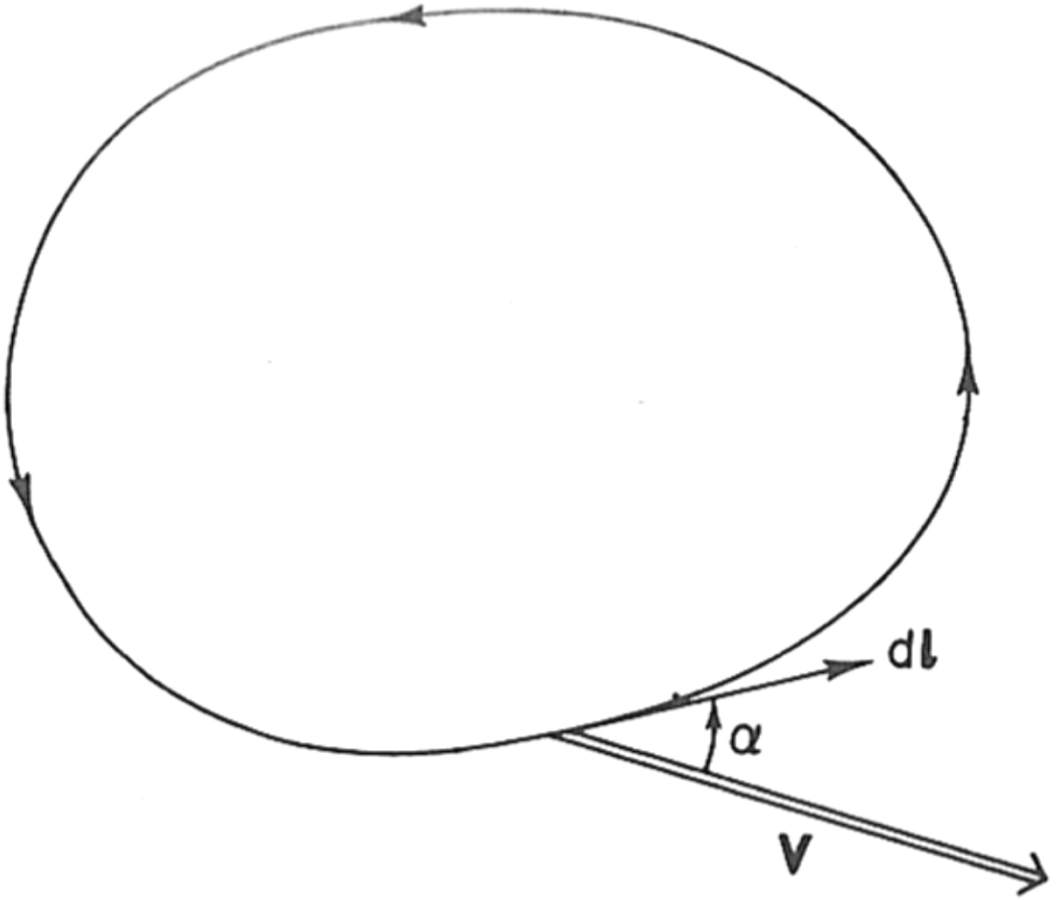
ECMWF Dividing Streamline Analysis 2010090300

RF09 Drops: 20100902 1532-1906 Z 4:54-8:28 hours before



Outer points are used to create a circulation path

Circulation



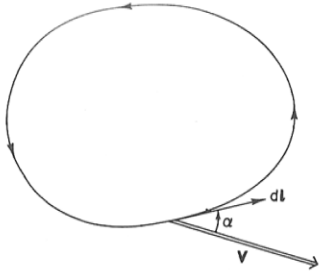
$$C = \oint V \times dl$$

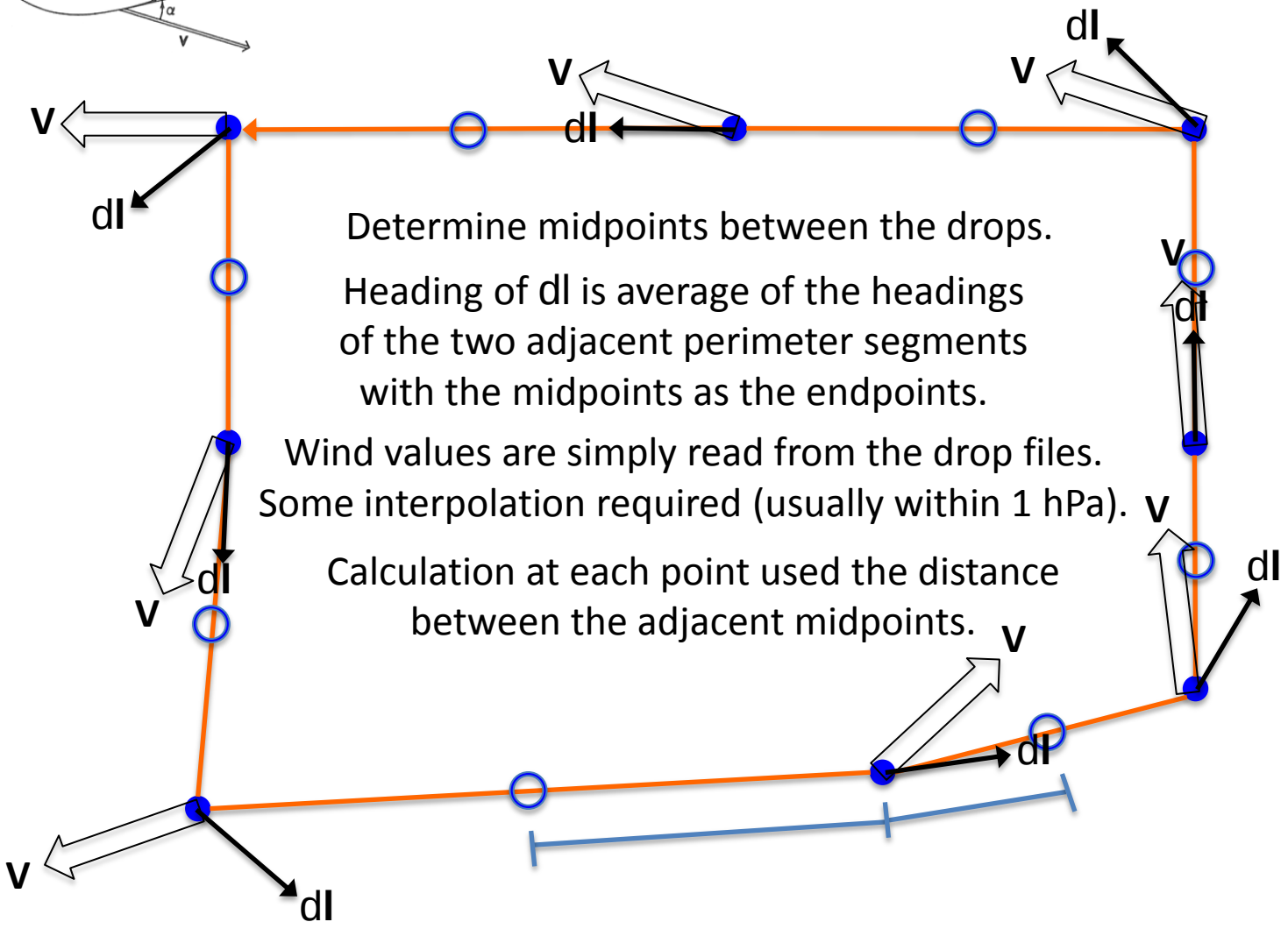
Average vorticity
C / area

Average tangential cyclonic wind
C / perimeter

Holton, An Introduction to Dynamic Meteorology (2nd)
Figure 4.1

Circulation





Determine midpoints between the drops.

Heading of dl is average of the headings of the two adjacent perimeter segments with the midpoints as the endpoints.

Wind values are simply read from the drop files. Some interpolation required (usually within 1 hPa).

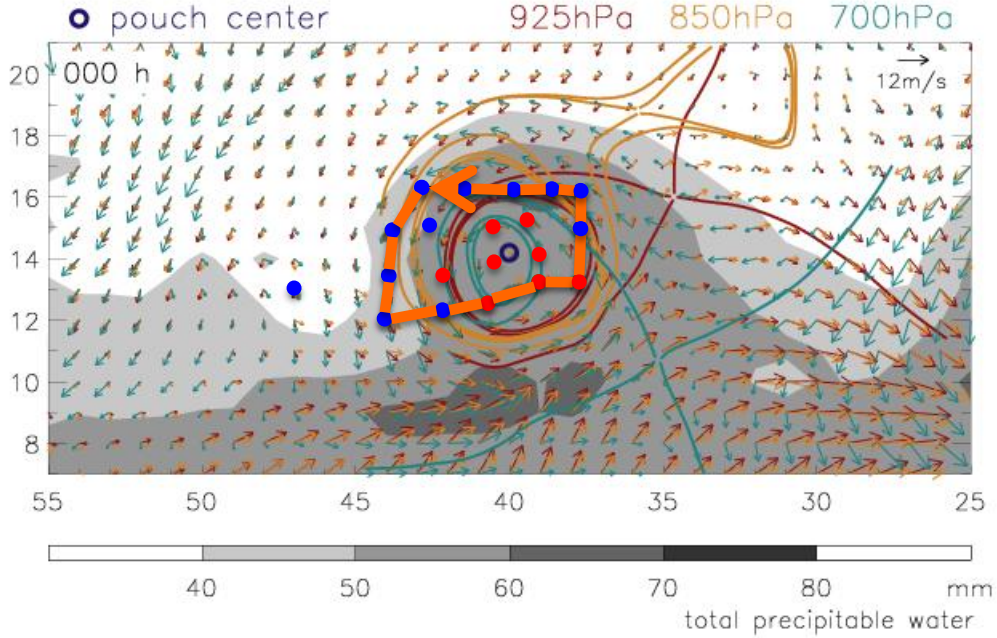
Calculation at each point used the distance between the adjacent midpoints.

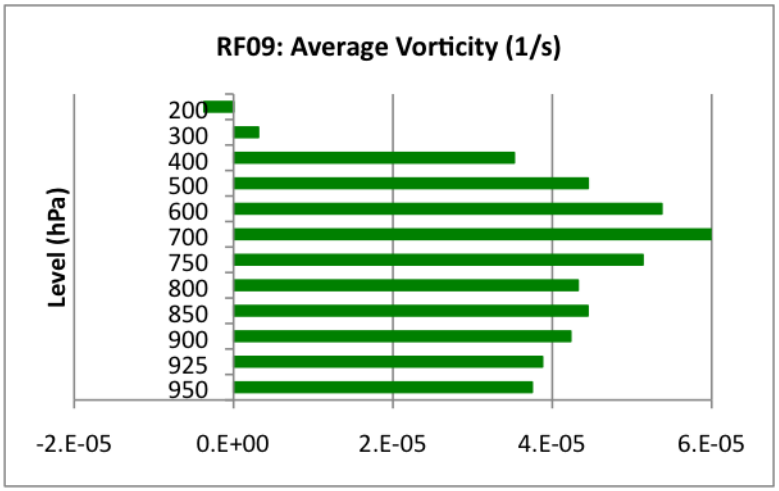
12 Levels (hPa)

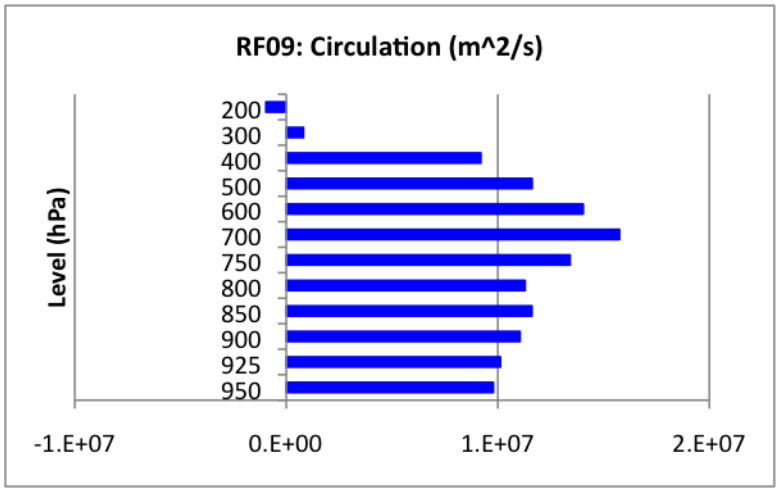
200
300
400
500
600
700
750
800
850
900
925
950

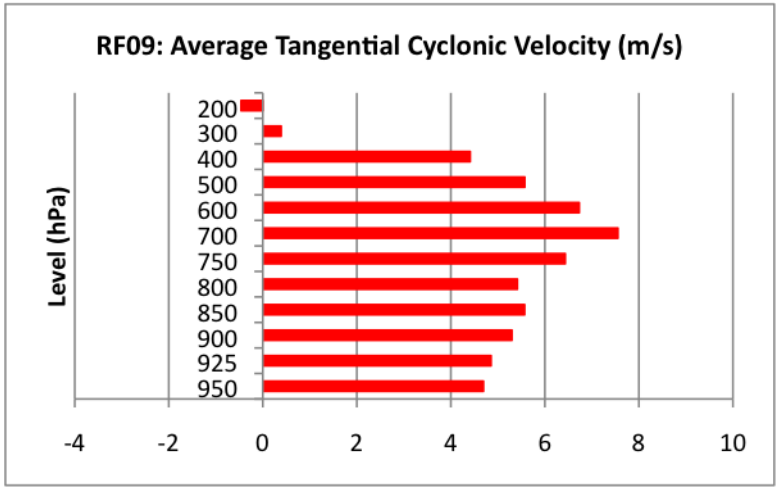
Gaston

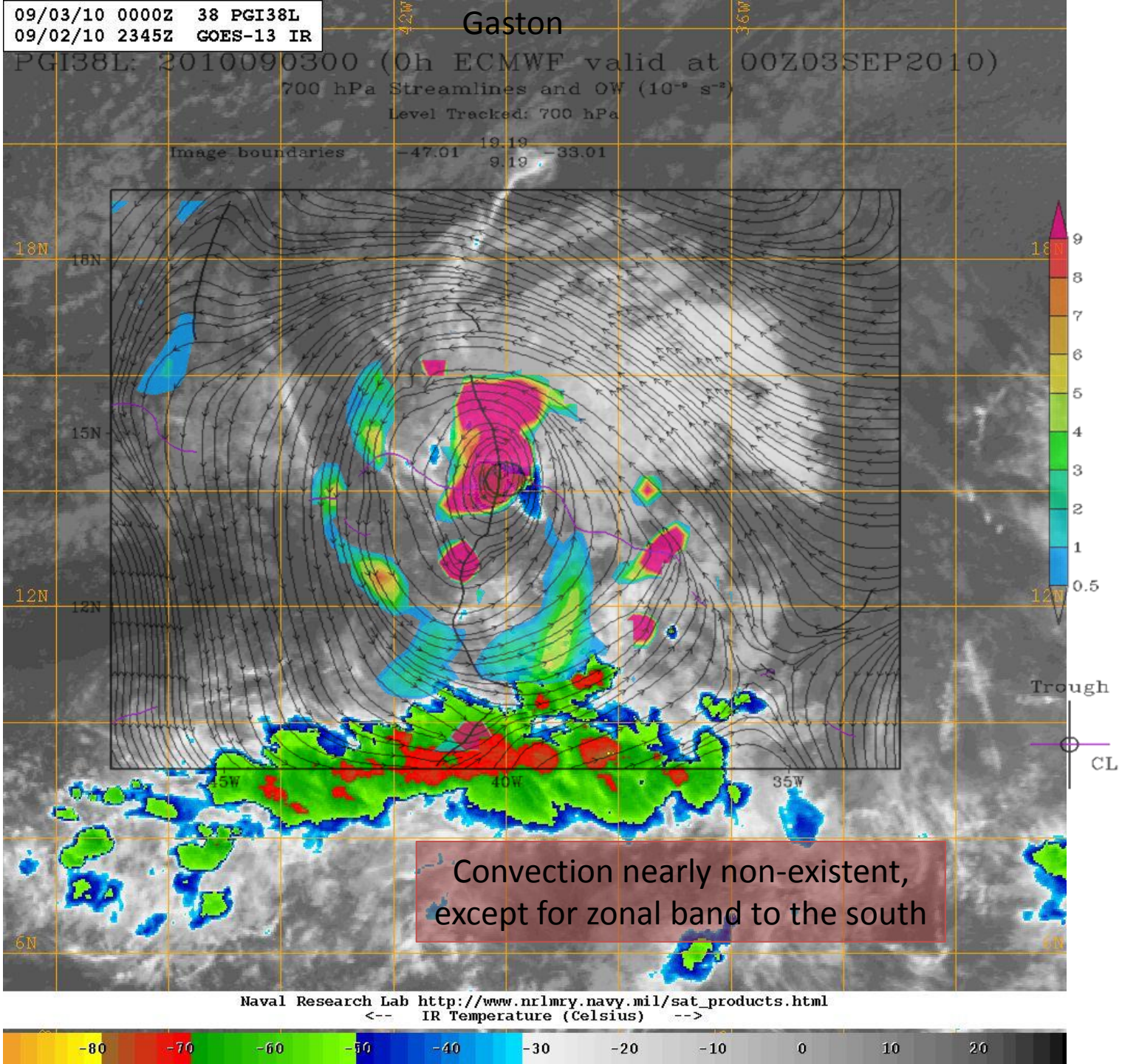
ECMWF Dividing Streamline Analysis 2010090300
RF09 Drops: 20100902 1532-1906 Z 4:54-8:28 hours before

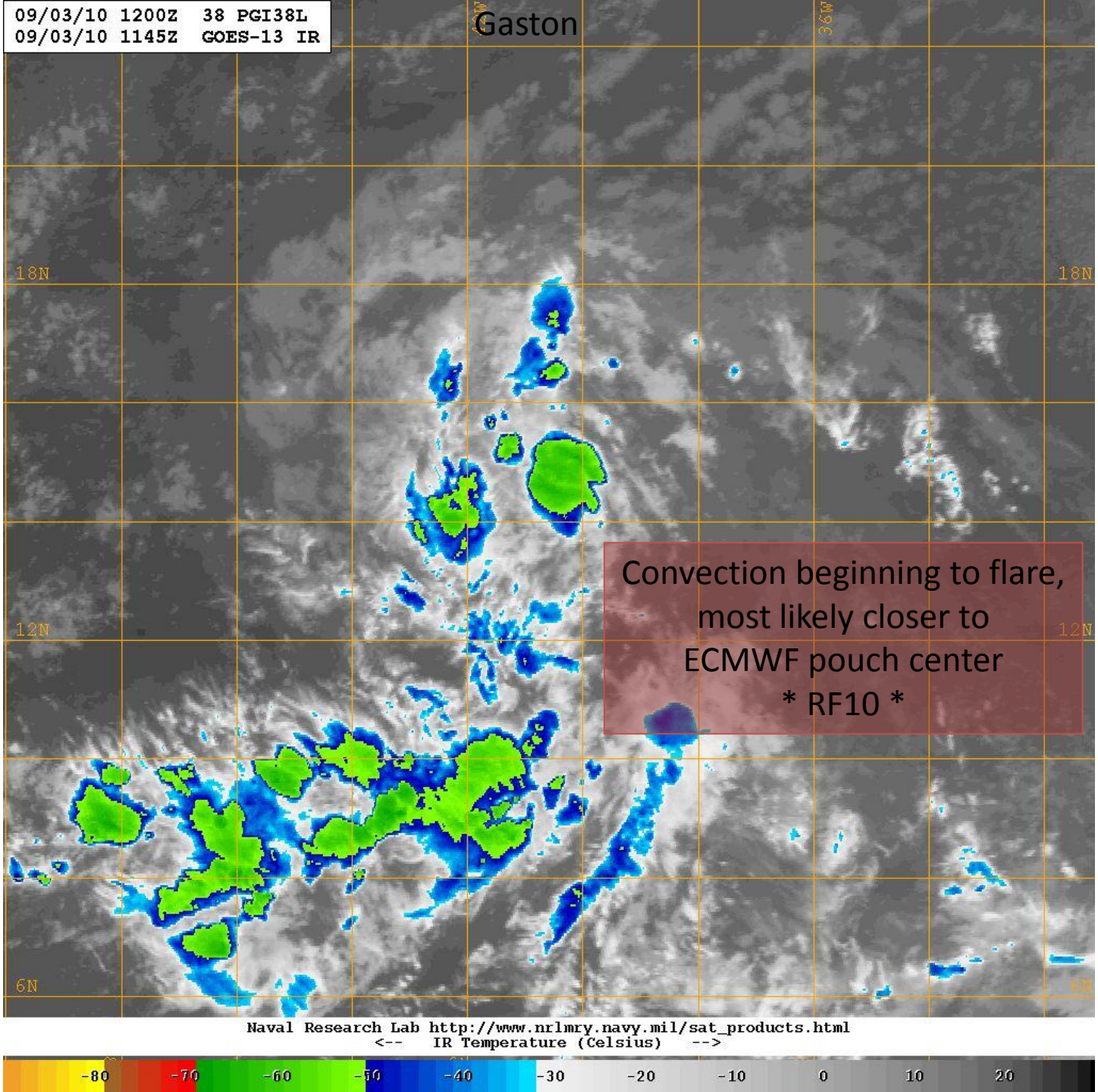






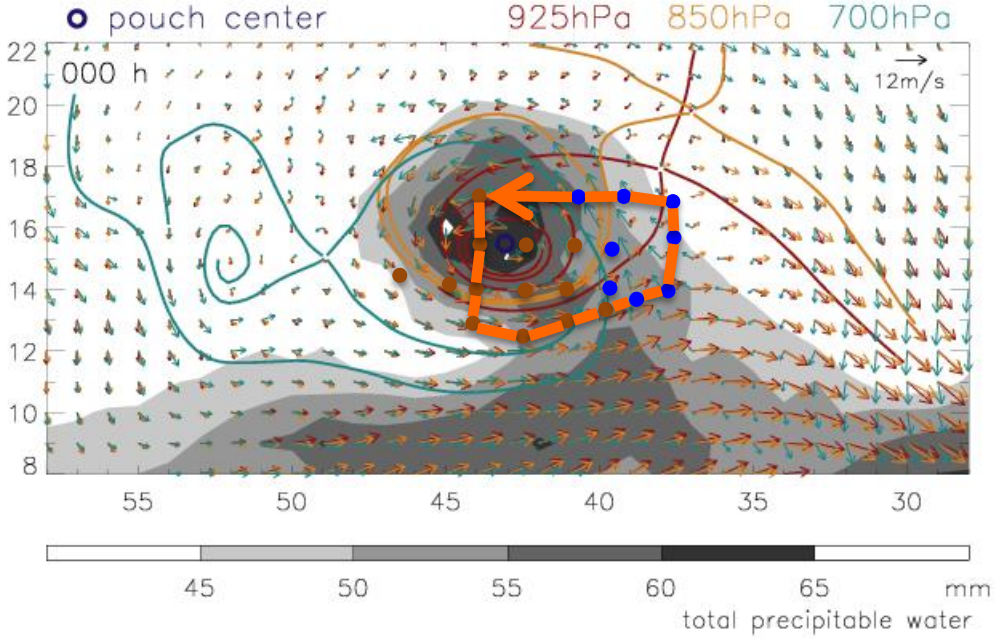


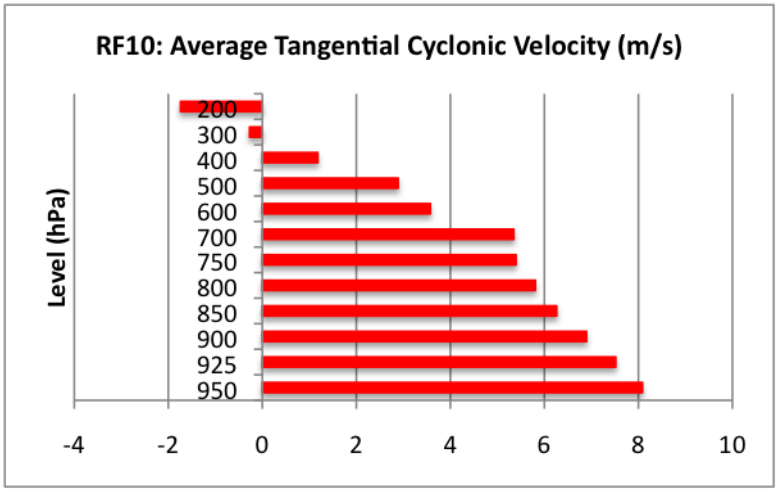

09/03/10 0000Z 38 PGI38L
09/02/10 2345Z GOES-13 IR
Gaston
PGI38L: 2010090300 (0h ECMWF valid at 00Z03SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Image boundaries -47.01 19.19 9.19 -33.01
18N
15N
12N
6N
45W
40W
35W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection nearly non-existent, except for zonal band to the south
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

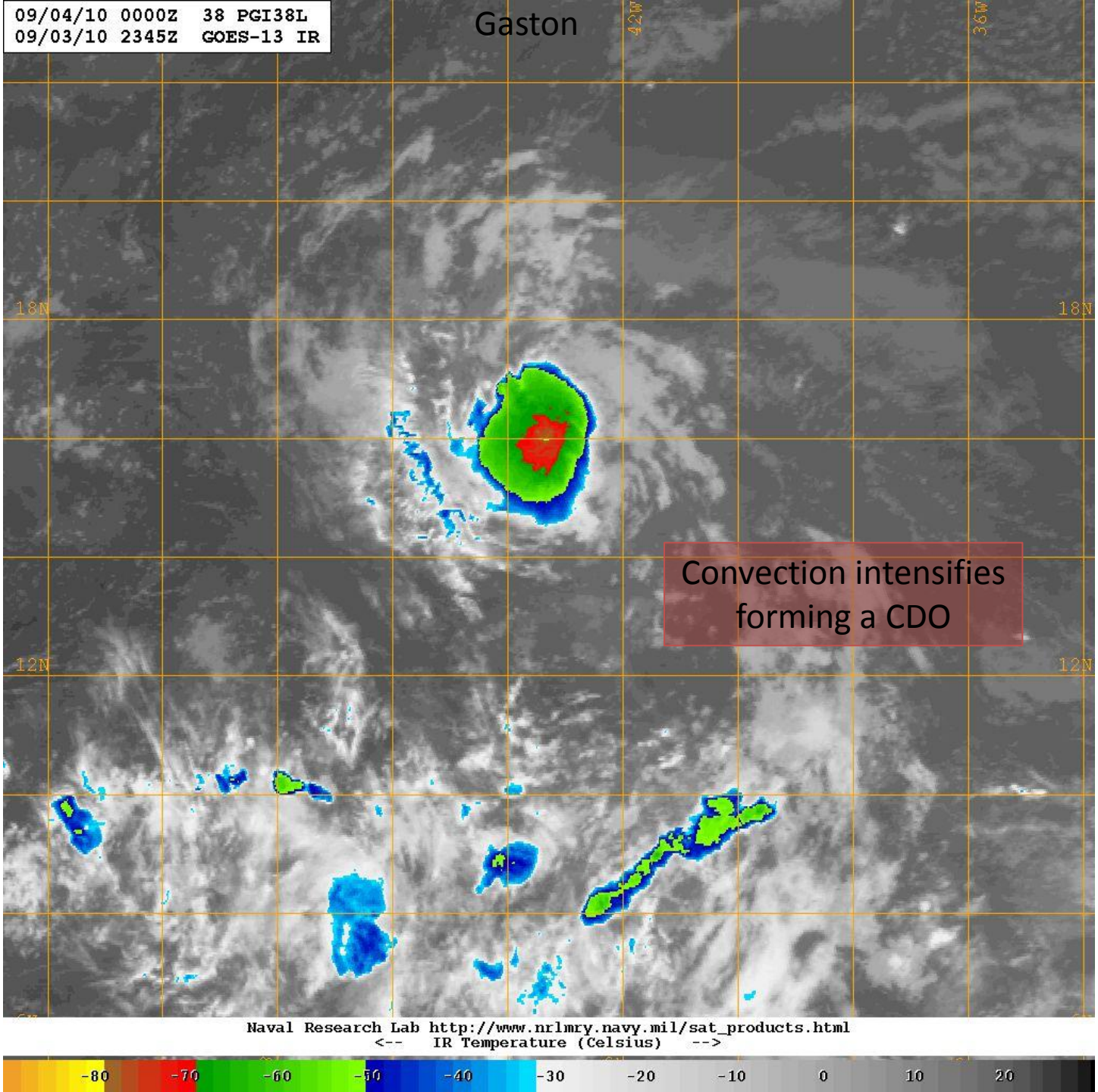

09/03/10 1200Z 38 PGI38L
09/03/10 1145Z GOES-13 IR
Gaston
36W
18N
12N
6N
Convection beginning to flare,
most likely closer to
ECMWF pouch center
* RF10 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

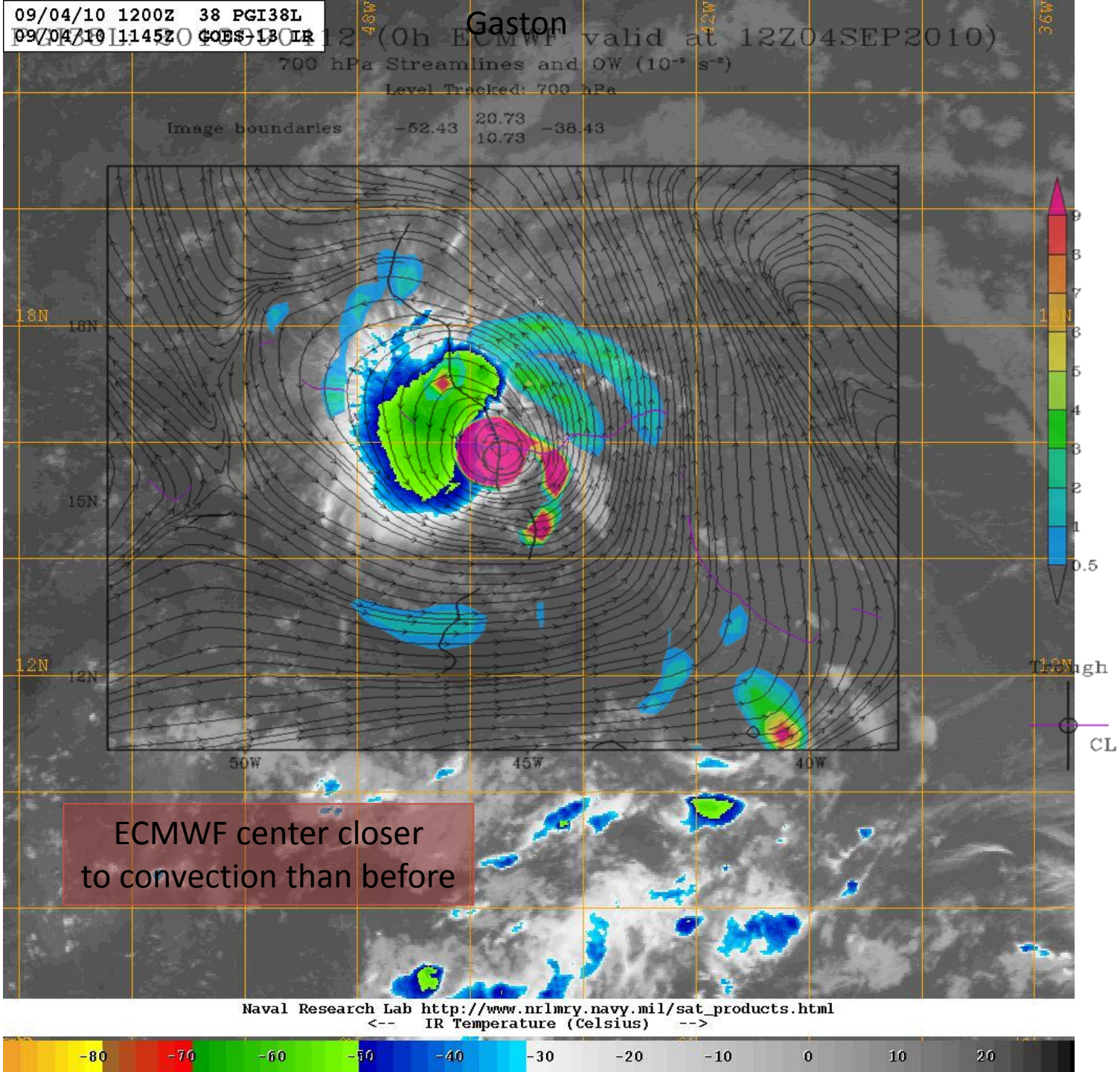
Gaston

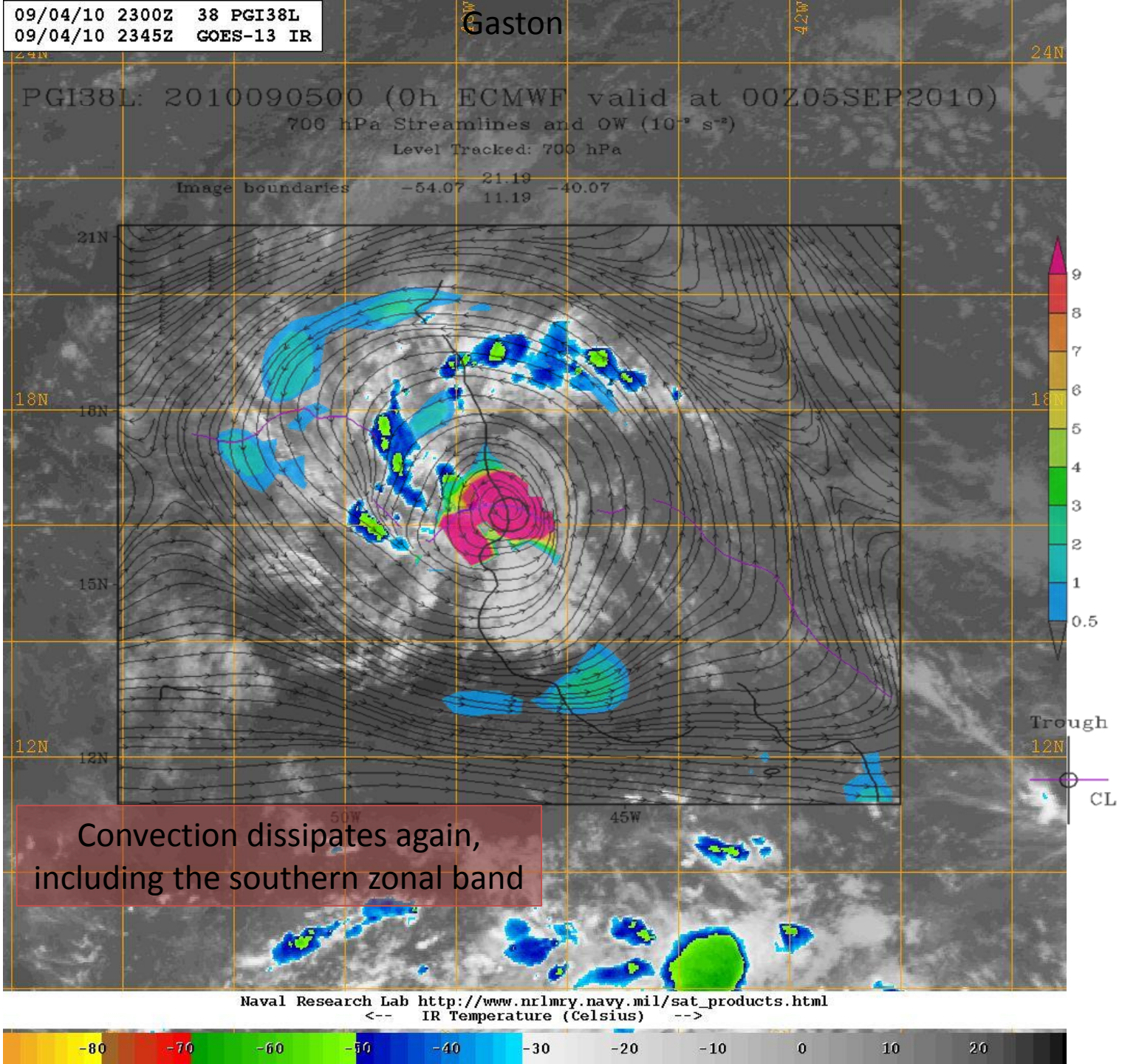
ECMWF Dividing Streamline Analysis 2010090400
RF10 Drops: 20100903 1444-1849 Z 5:11-9:16 hours before

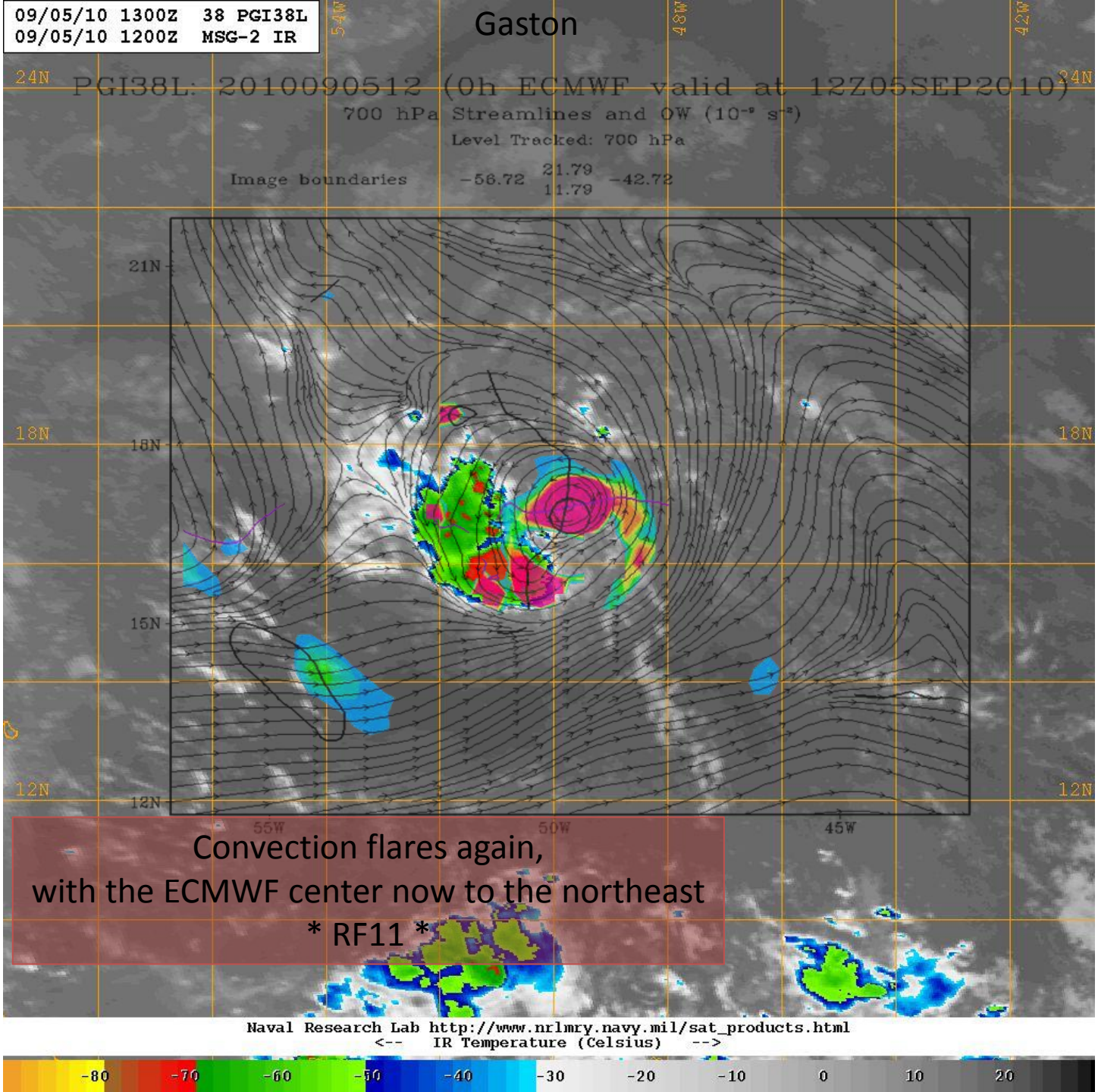


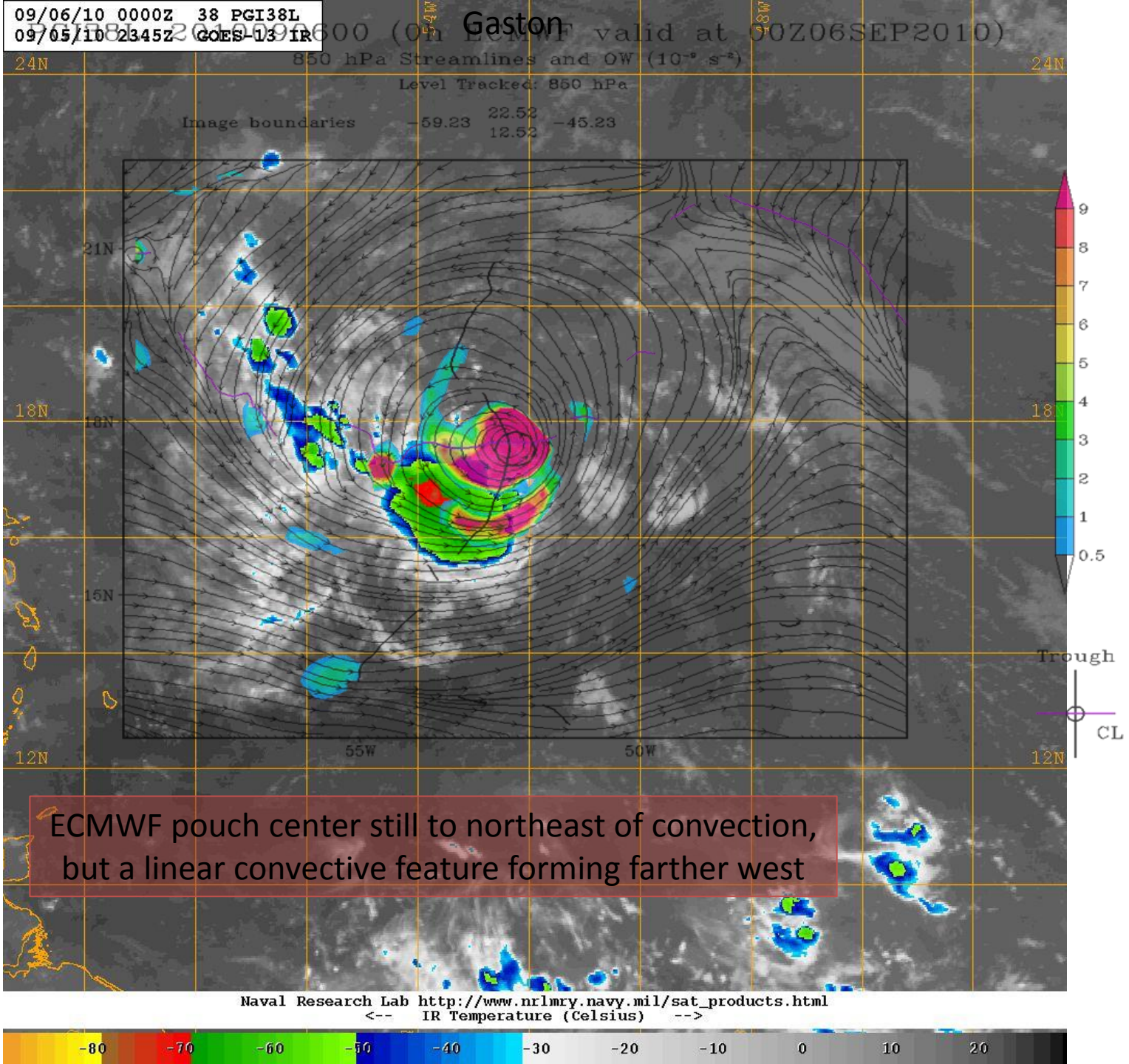


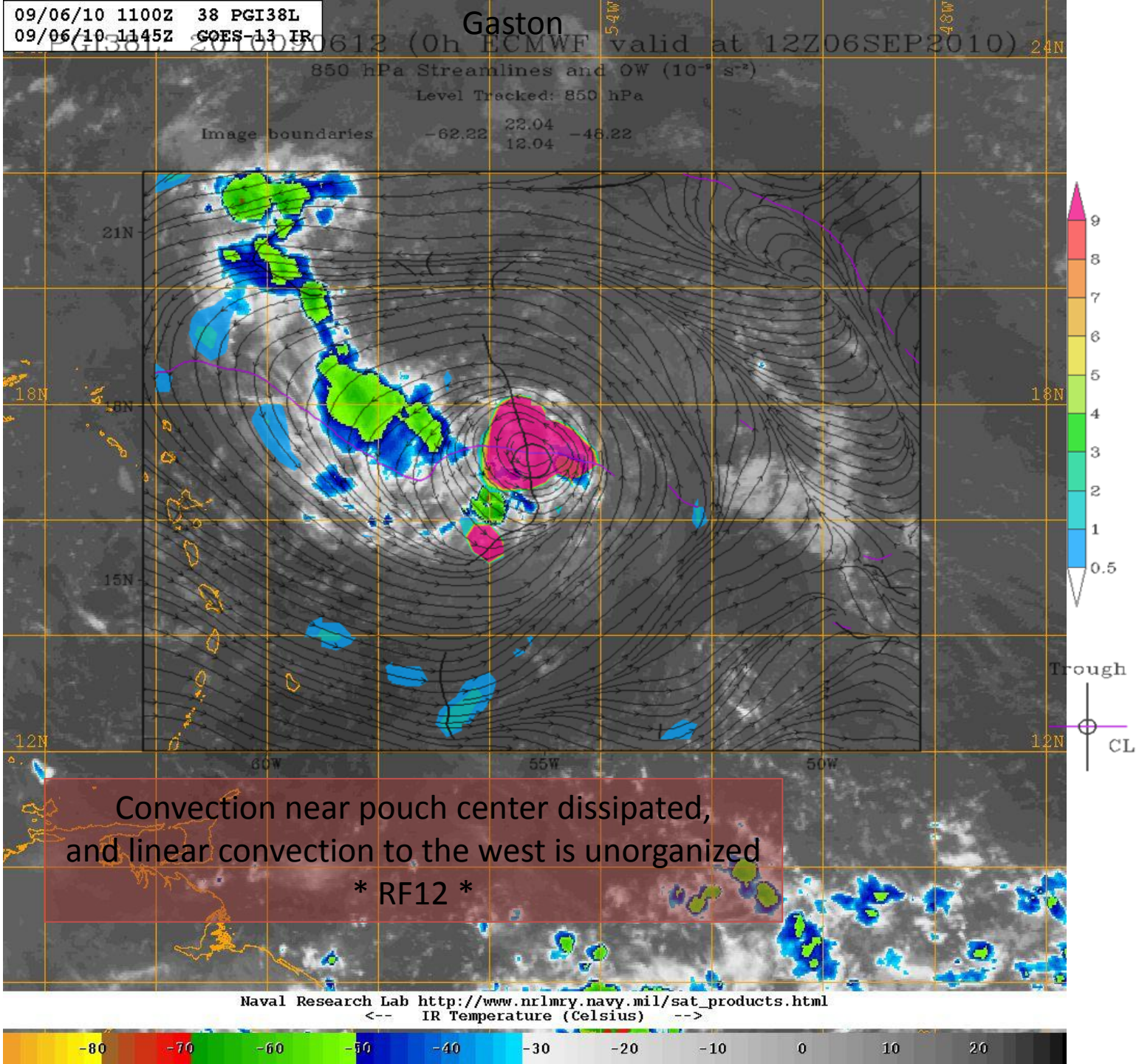

09/04/10 0000Z 38 PGI38L
09/03/10 2345Z GOES-13 IR
Gaston
42W
36W
18N
18N
Convection intensifies forming a CDO
12N
12N
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

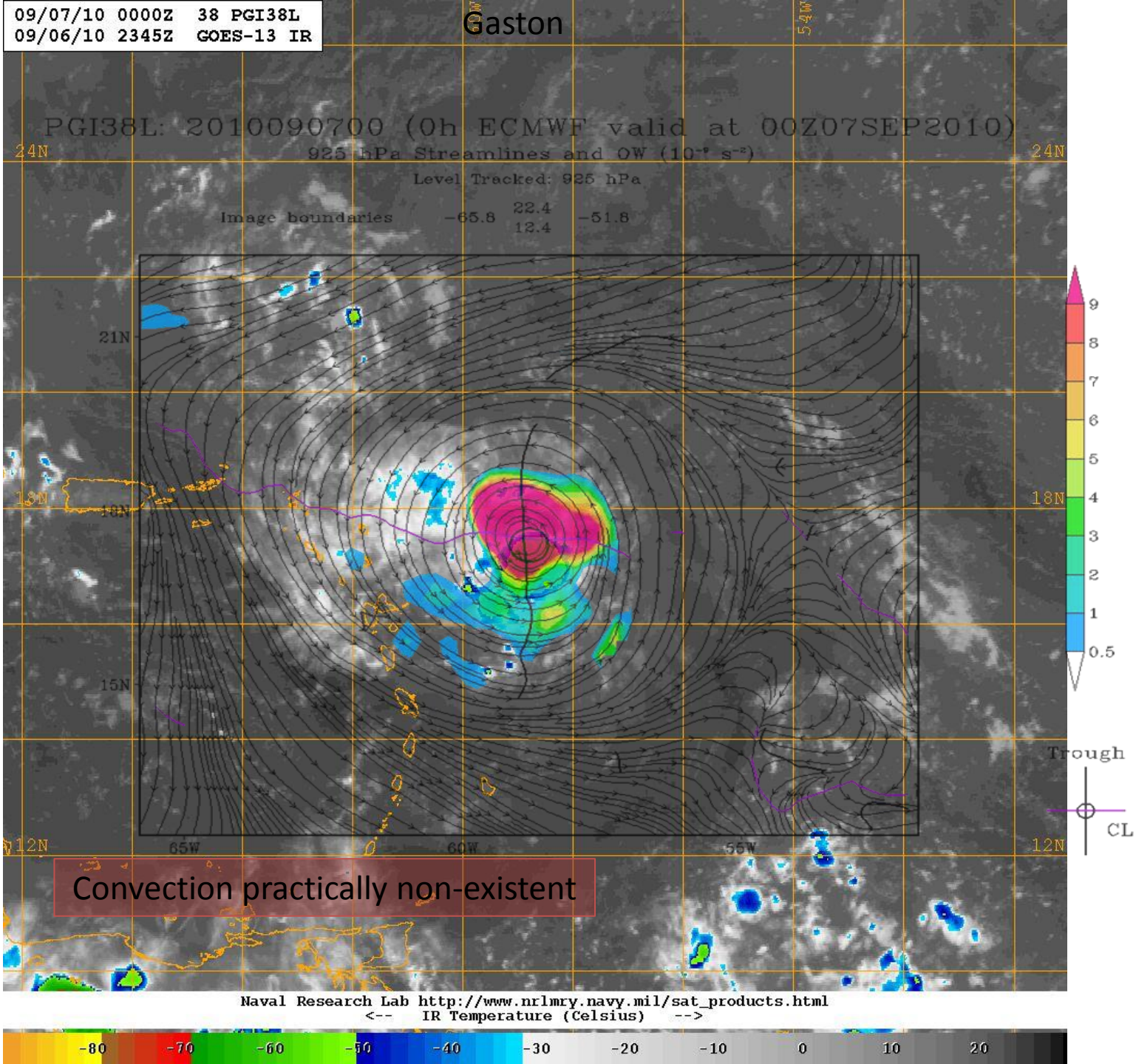

09/04/10 1200Z 38 PGI38L
09/04/10 1145Z GOES-13 IR
Gaston
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Image boundaries
-52.43
20.73
10.73
-38.43
18N
15N
12N
50W
45W
40W
9
8
7
6
5
4
3
2
1
0.5
CL
ECMWF center closer
to convection than before
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

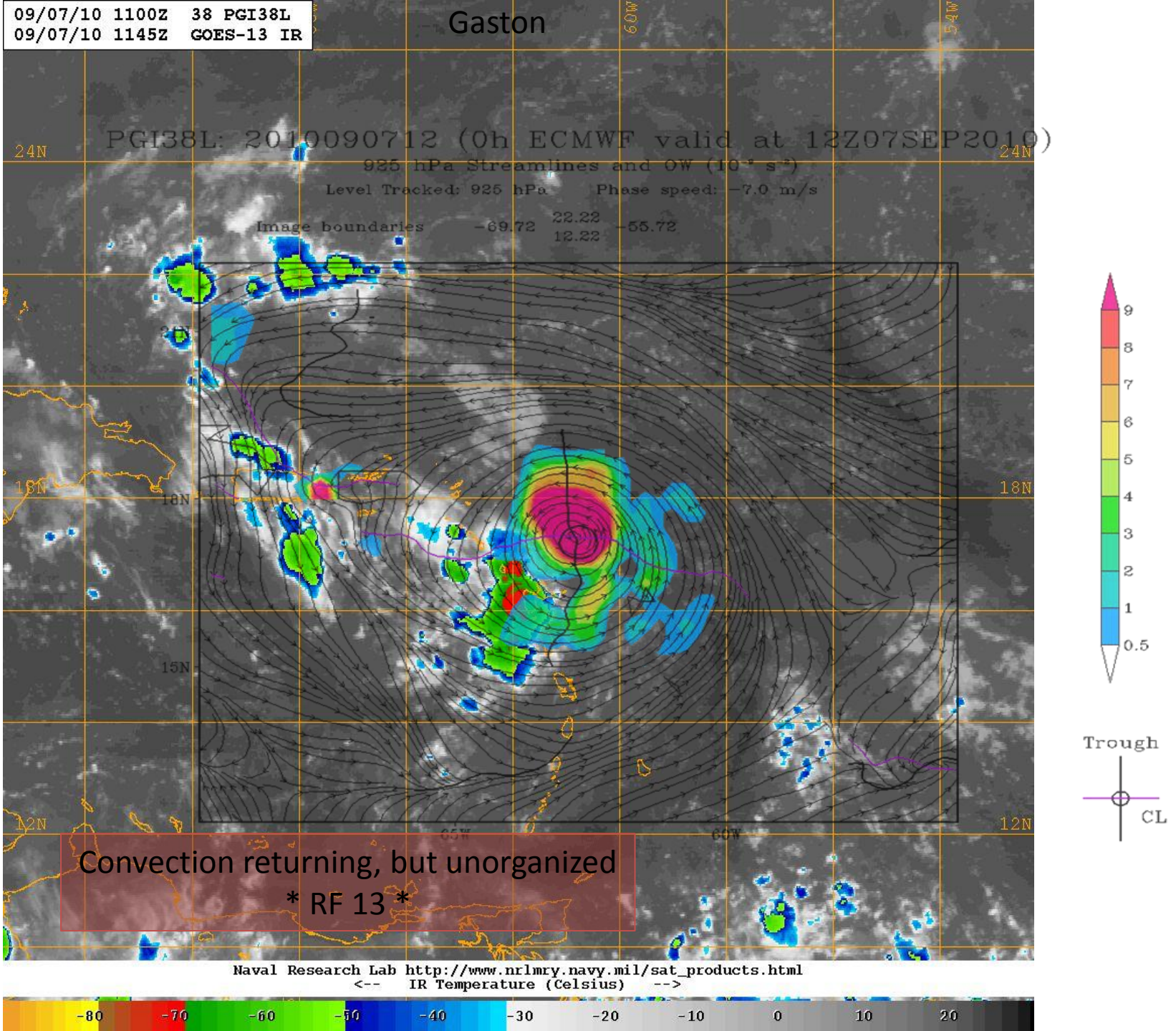

09/04/10 2300Z 38 PGI38L
09/04/10 2345Z GOES-13 IR
Gaston
PGI38L: 2010090500 (0h ECMWF valid at 00Z05SEP2010)
700 hPa Streamlines and OW (10⁻⁵ s⁻²)
Level Tracked: 700 hPa
Image boundaries -54.07 21.19 11.19 -40.07
24N
21N
18N
15N
12N
50W
45W
42W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection dissipates again, including the southern zonal band
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

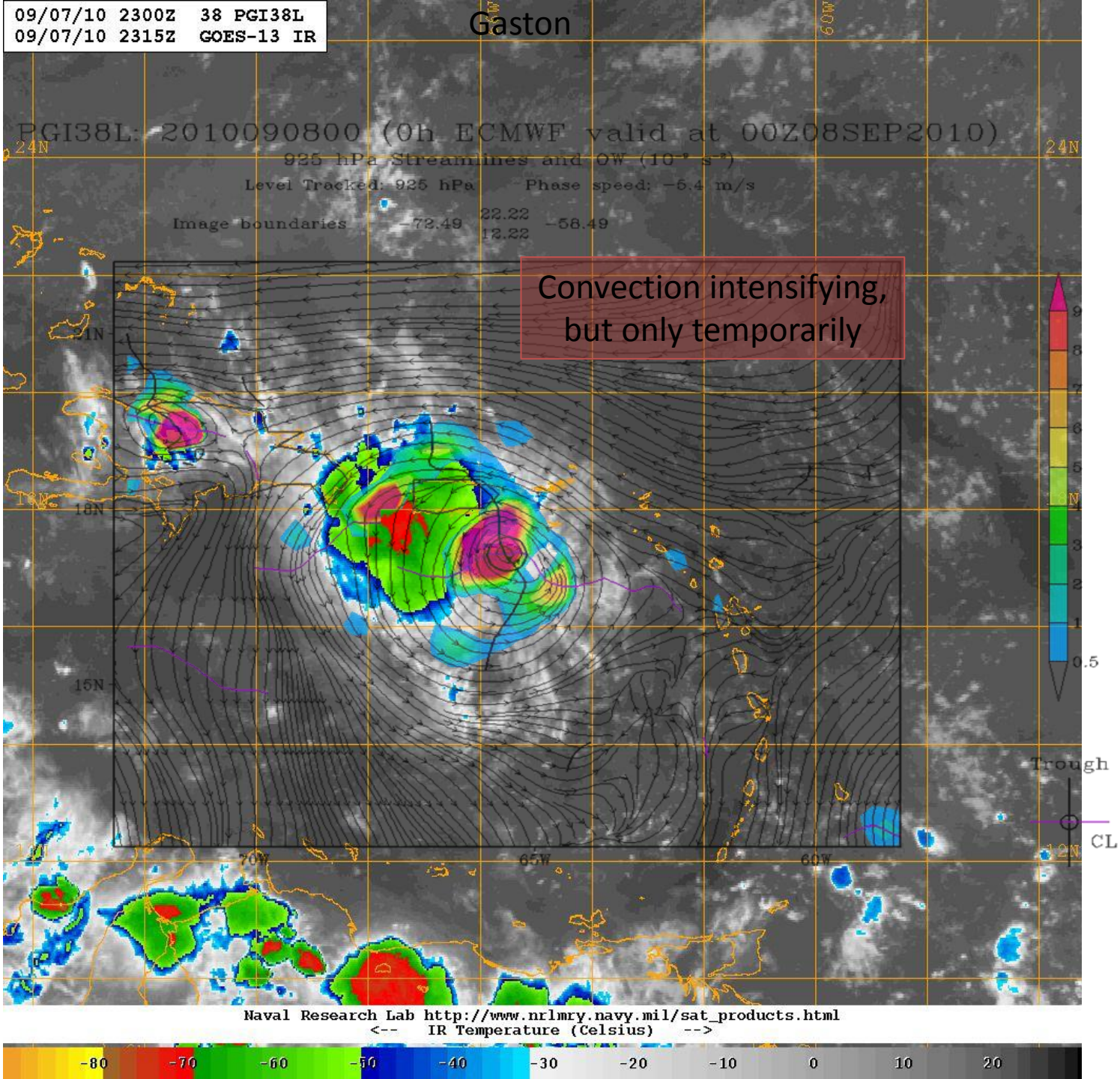

09/05/10 1300Z 38 PGI38L
09/05/10 1200Z MSG-2 IR
Gaston
PGI38L: 2010090512 (0h ECMWF valid at 12Z05SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Image boundaries -56.72 21.79 11.79 -42.72
24N
21N
18N
15N
12N
55W
50W
45W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection flares again,
with the ECMWF center now to the northeast
* RF11 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/06/10 0000Z 38 PGI38L
09/05/10 2345Z GOES-13 IR
Gaston
850 hPa Streamlines and OW (10⁻⁶ s⁻²)
Level Tracked: 850 hPa
Image boundaries -59.23 22.52 12.52 -45.23
24N
21N
18N
15N
12N
55W
50W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
ECMWF pouch center still to northeast of convection, but a linear convective feature forming farther west
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/06/10 1100Z 38 PGI38L
09/06/10 1145Z GOES-13 IR
Gaston
PGI38L 20100906 0612 (0h ECMWF valid at 12Z06SEP2010)
850 hPa Streamlines and OW (10⁻⁶ s⁻²)
Level Tracked: 850 hPa
Image boundaries -62.22 22.04 12.04 -46.22
24N
21N
18N
15N
12N
60W
55W
50W
54W
48W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection near pouch center dissipated,
and linear convection to the west is unorganized
* RF12 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

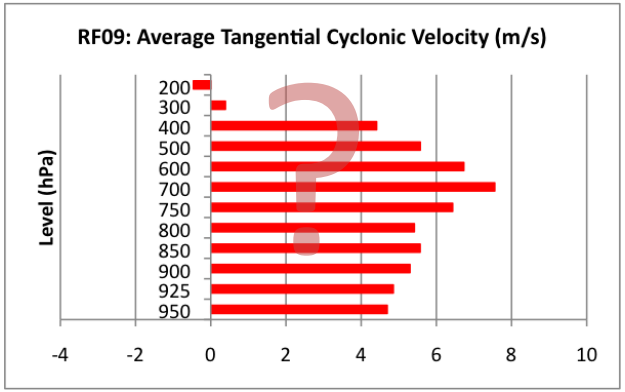

09/07/10 0000Z 38 PGI38L
09/06/10 2345Z GOES-13 IR
Gaston
PGI38L: 2010090700 (0h ECMWF valid at 00Z07SEP2010)
925 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 925 hPa
Image boundaries -65.8 22.4 12.4 -51.8
24N
21N
18N
15N
12N
65W
60W
55W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection practically non-existent
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/07/10 1100Z 38 PGI38L
09/07/10 1145Z GOES-13 IR
Gaston
PGI38L: 2010090712 (0h ECMWF valid at 12Z07SEP2010)
925 hPa Streamlines and OW (10⁻⁵ s⁻²)
Level Tracked: 925 hPa Phase speed: -7.0 m/s
Image boundaries -69.72 22.22 12.22 -55.72
24N
18N
15N
12N
60W
54W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection returning, but unorganized
* RF 13 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

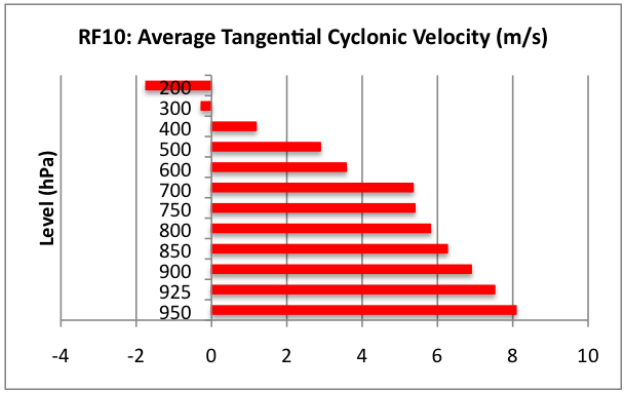

09/07/10 2300Z 38 PGI38L
09/07/10 2315Z GOES-13 IR
Gaston
PGI38L: 2010090800 (0h ECMWF valid at 00Z08SEP2010)
925 hPa Streamlines and OW (10⁻⁷ s⁻²)
Level Tracked: 925 hPa Phase speed: -6.4 m/s
Image boundaries -72.49 22.22 12.22 -58.49
Convection intensifying, but only temporarily
24N
21N
18N
15N
12N
70W
65W
60W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

Ex-Gaston (Non-developer)

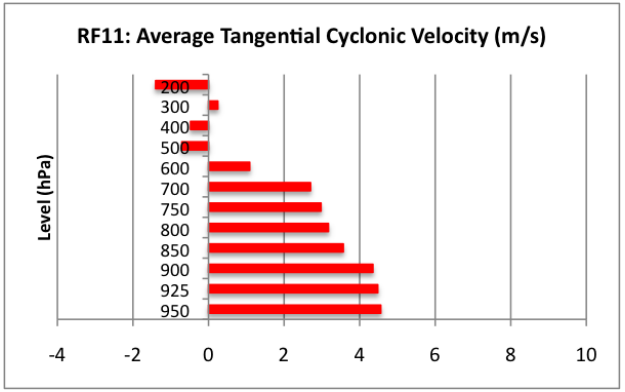
Sept 2 - Weak convection To NW



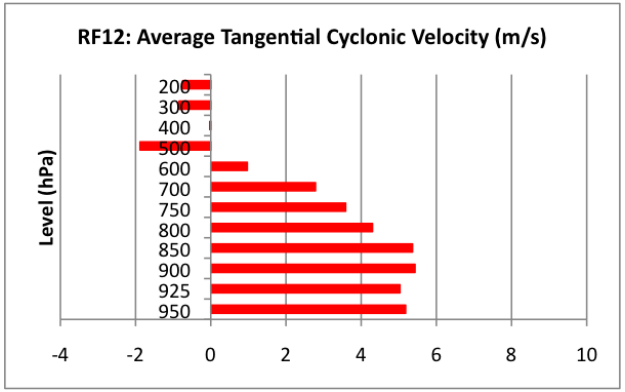
Sept 3 – Pre-CDO convection near center



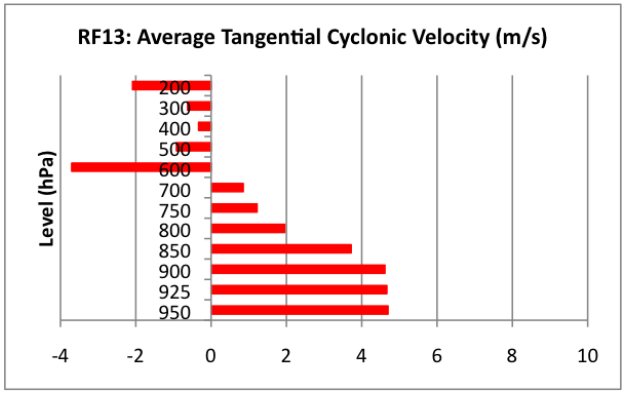
Sept 5 – Flaring convection to SW



Sept 6 – Linear convection far to NW



Sept 7 – Unorganized convection nearby



Sept 2 … Sampled only NW side of pouch?

- Average wind maximum of ~8 m/s at 700 hPa
- Cyclonic up to 300 hPa

Sept 3

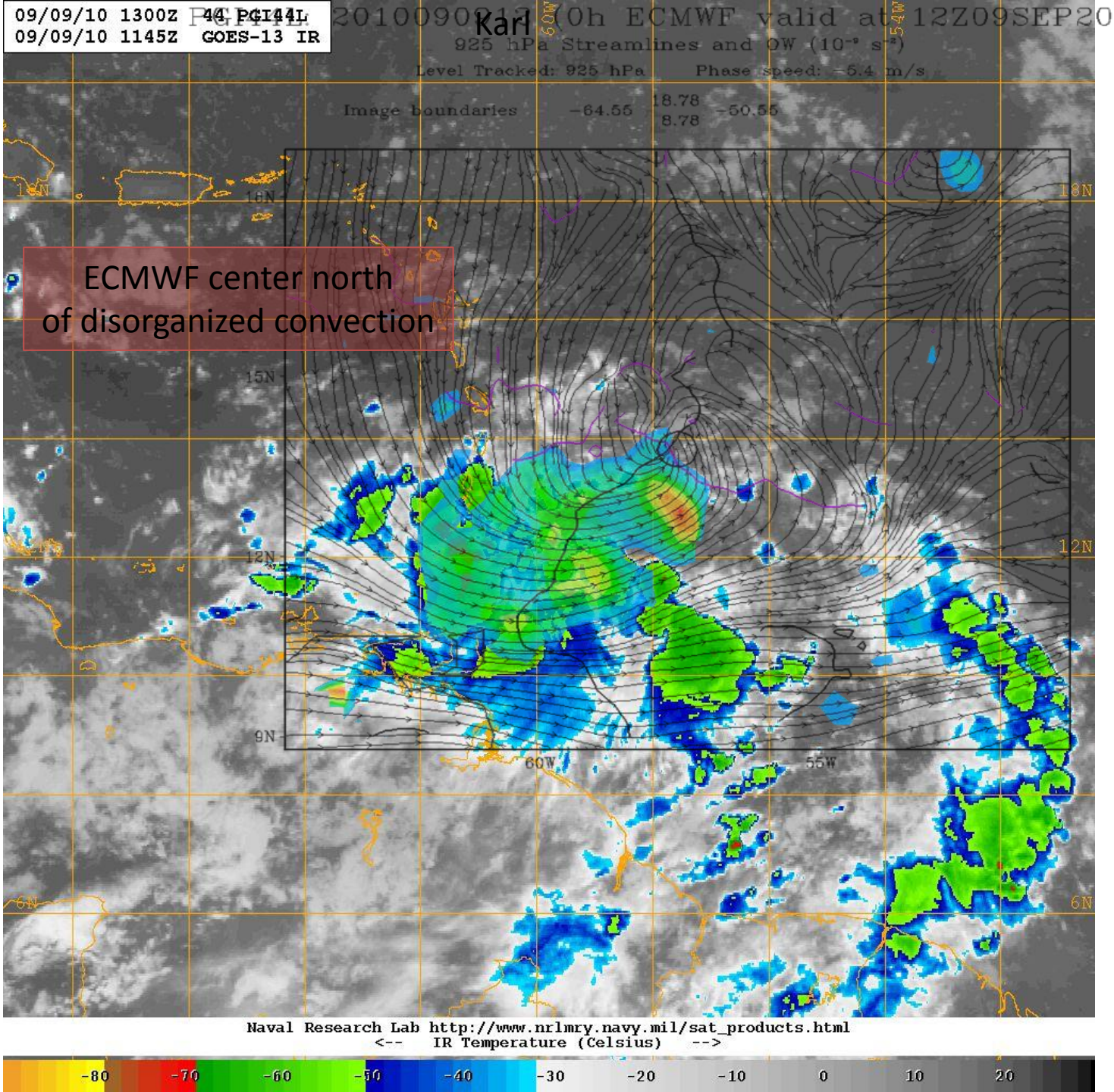
- Wind max dropped down to 950 hPa

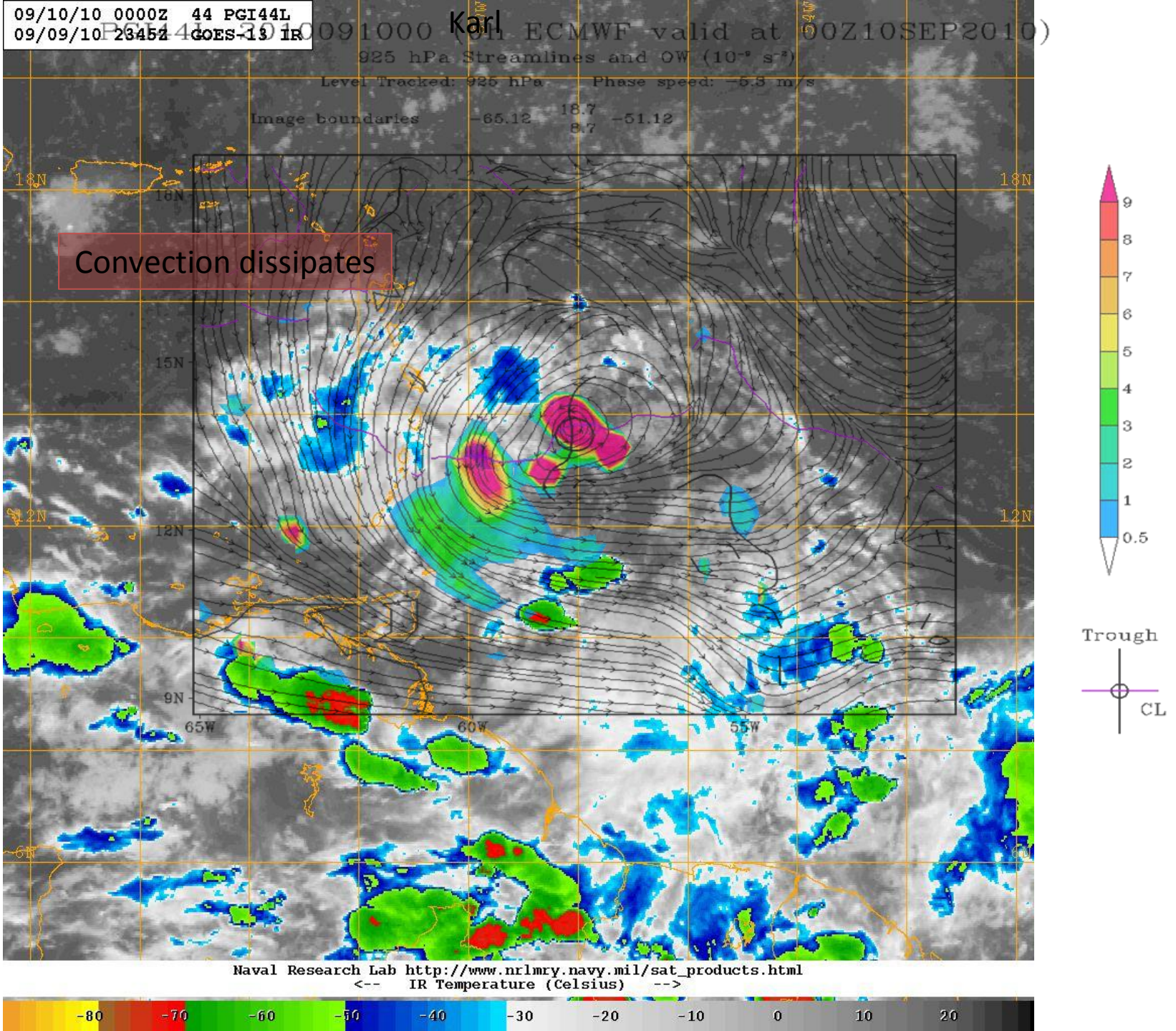
Sept 5

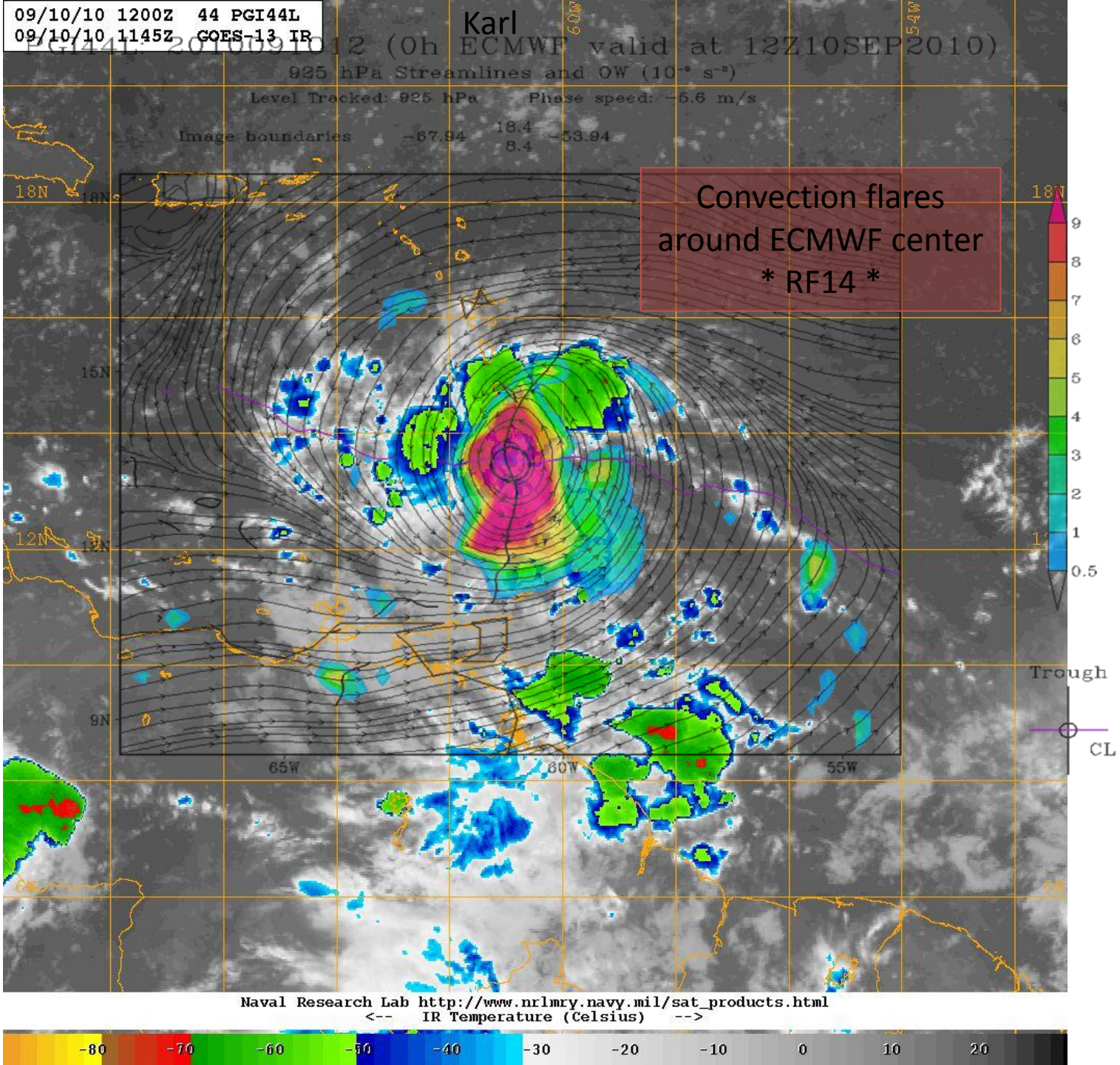
- Winds weaker
- Cyclonic only up to 600 hPa

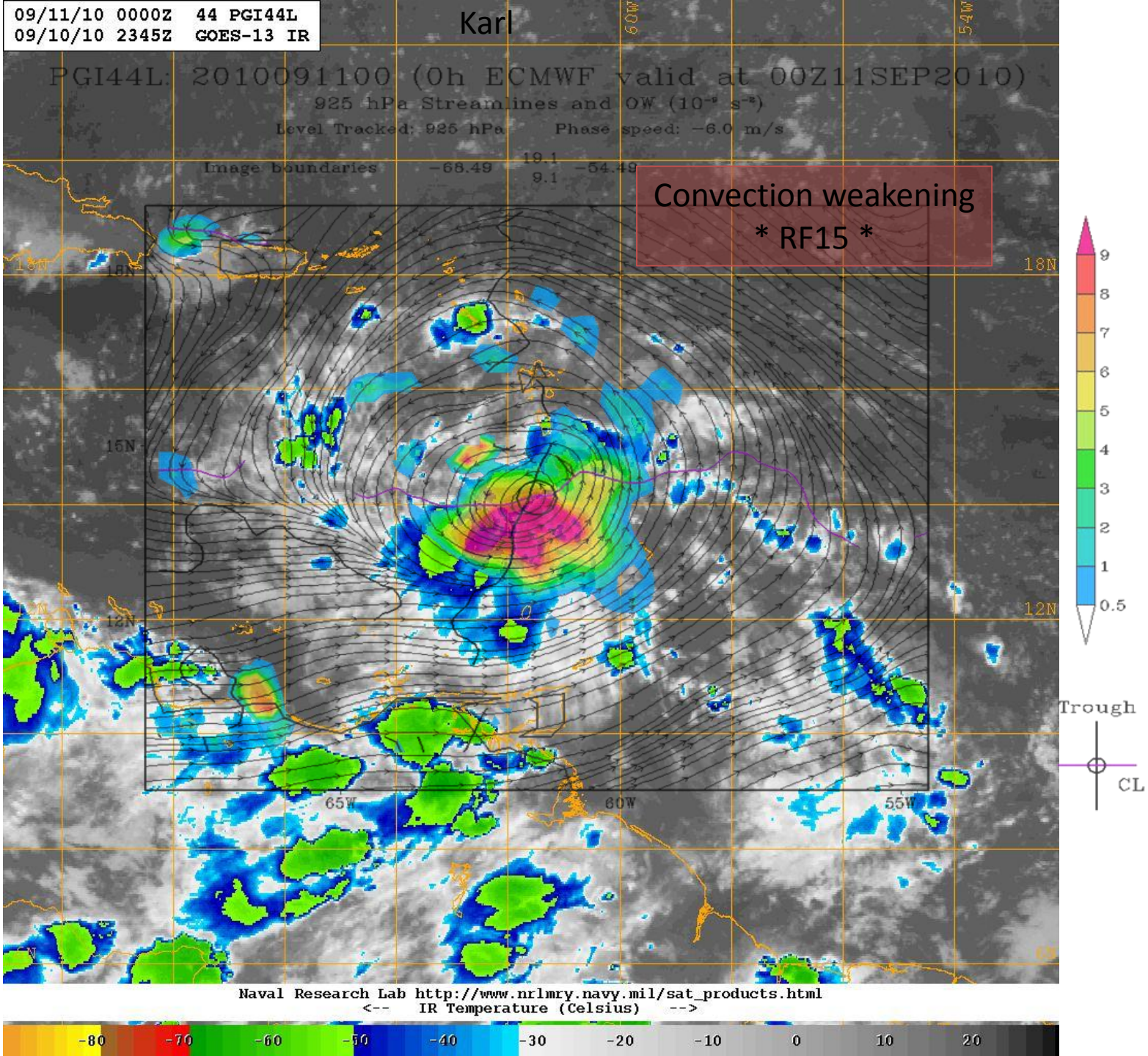
Sept 7

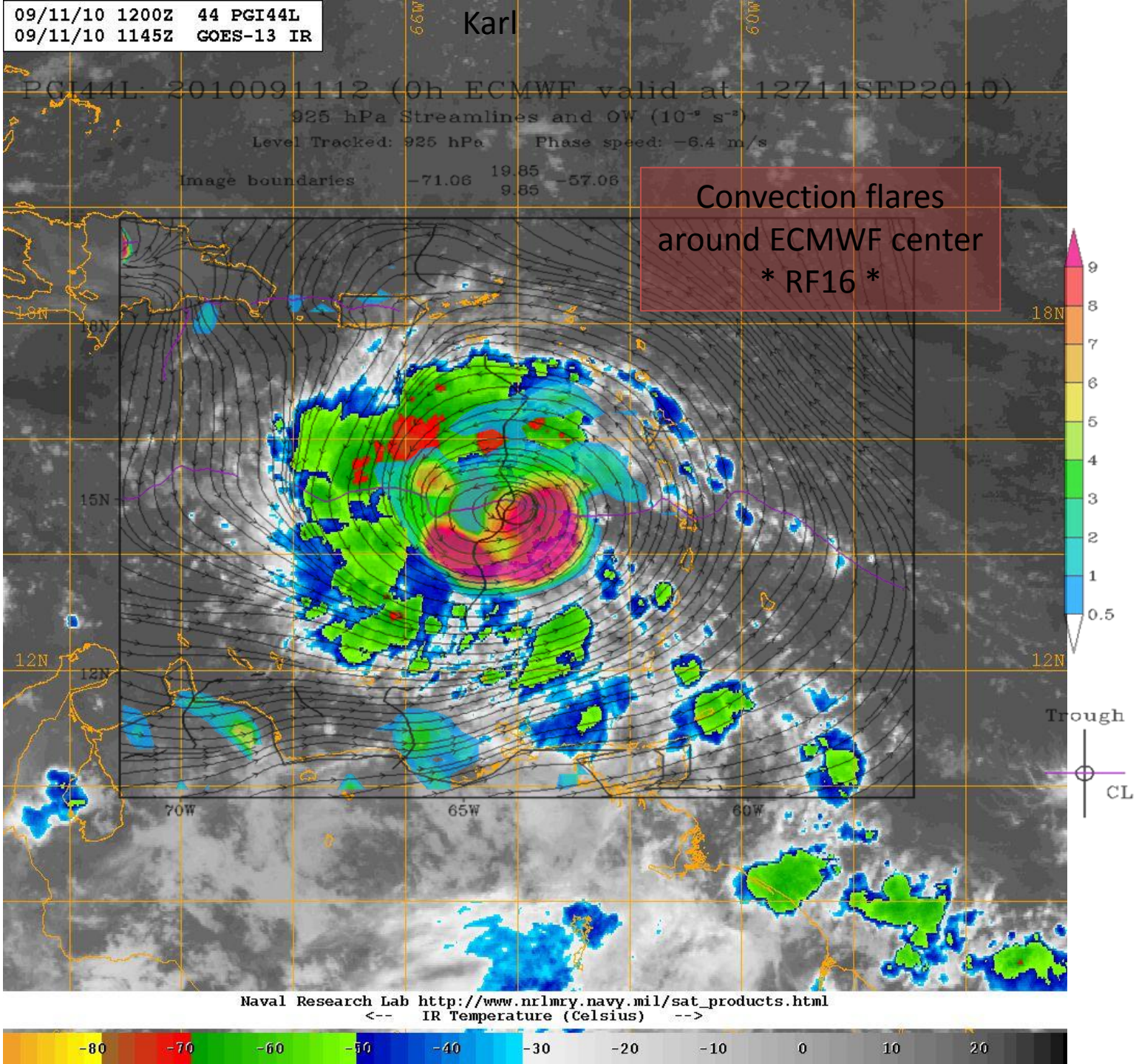
- Winds ~5 m/s only up to 900 hPa
- Cyclonic only up to 700 hPa

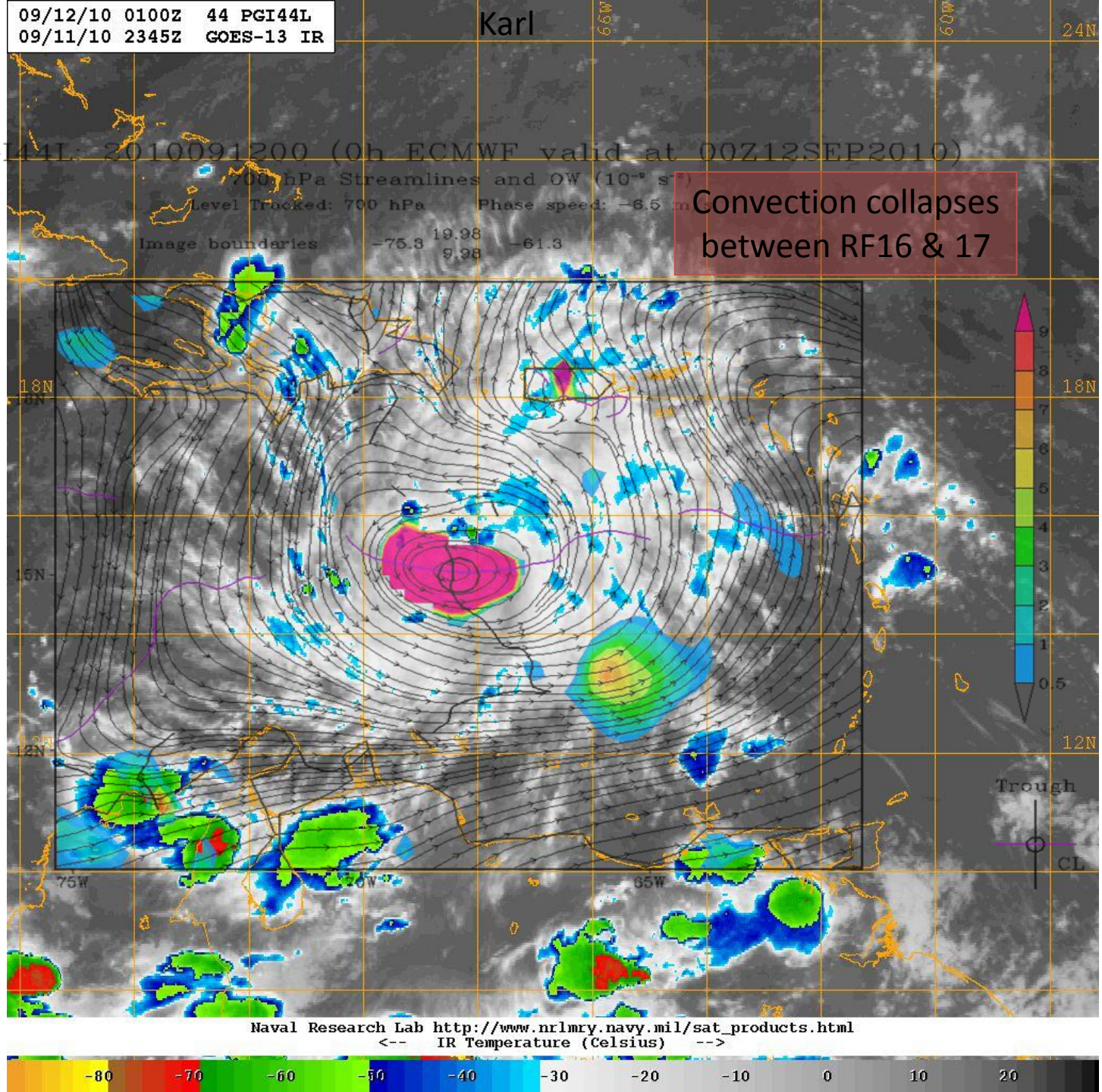

09/09/10 1300Z 44 PGI44L
09/09/10 1145Z GOES-13 IR
Karl
925 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 925 hPa
Phase speed: -5.4 m/s
Image boundaries
-64.55
18.78
8.78
-50.55
ECMWF center north
of disorganized convection
18N
15N
12N
9N
6N
60W
55W
Trough
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

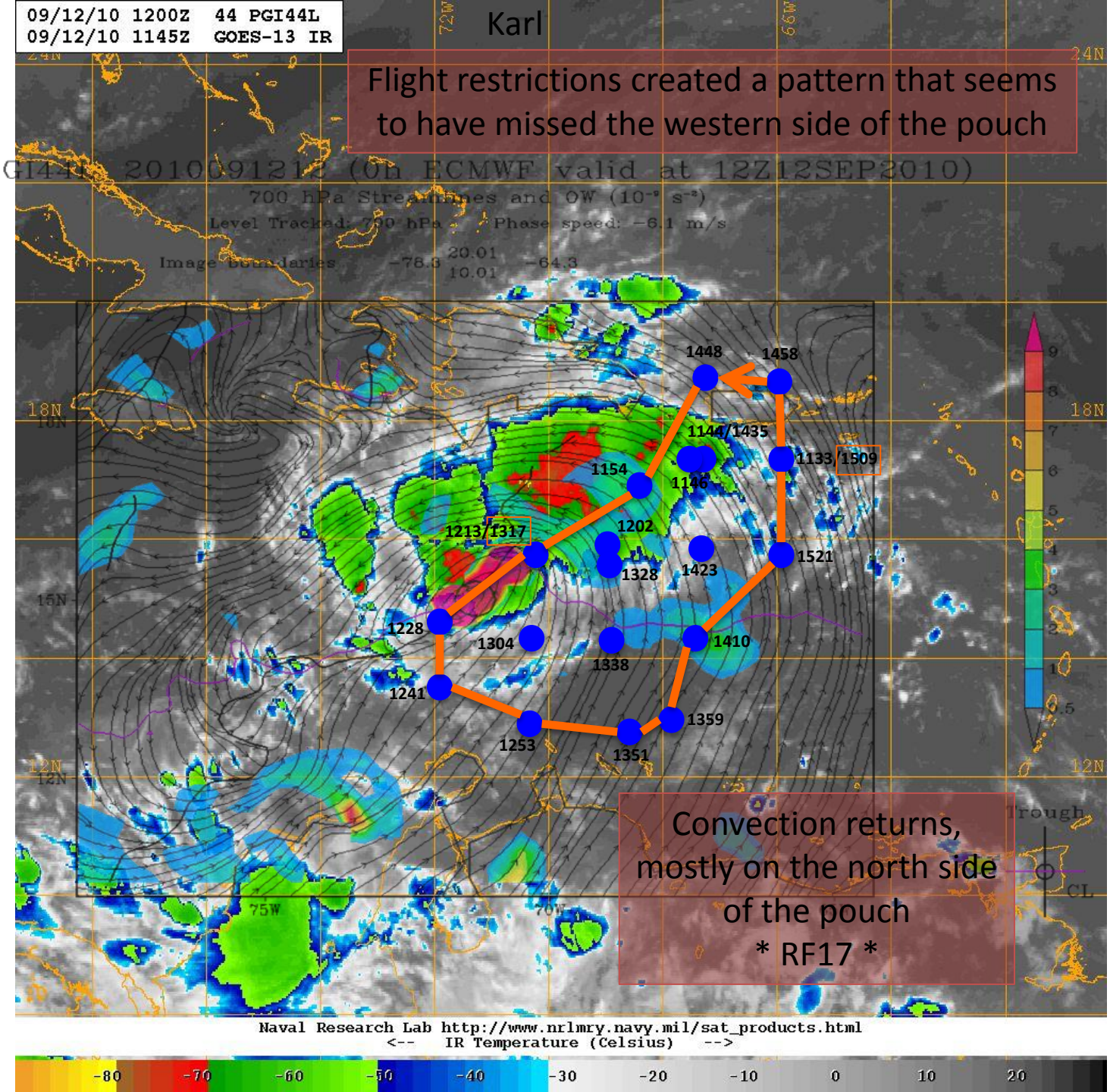

09/10/10 0000Z 44 PGI44L
09/09/10 2345Z GOES-13 IR
Karl
925 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 925 hPa
Phase speed: -5.3 m/s
Image boundaries
-65.12
18.7
8.7
-51.12
Convection dissipates
18N
15N
12N
9N
6N
65W
60W
55W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

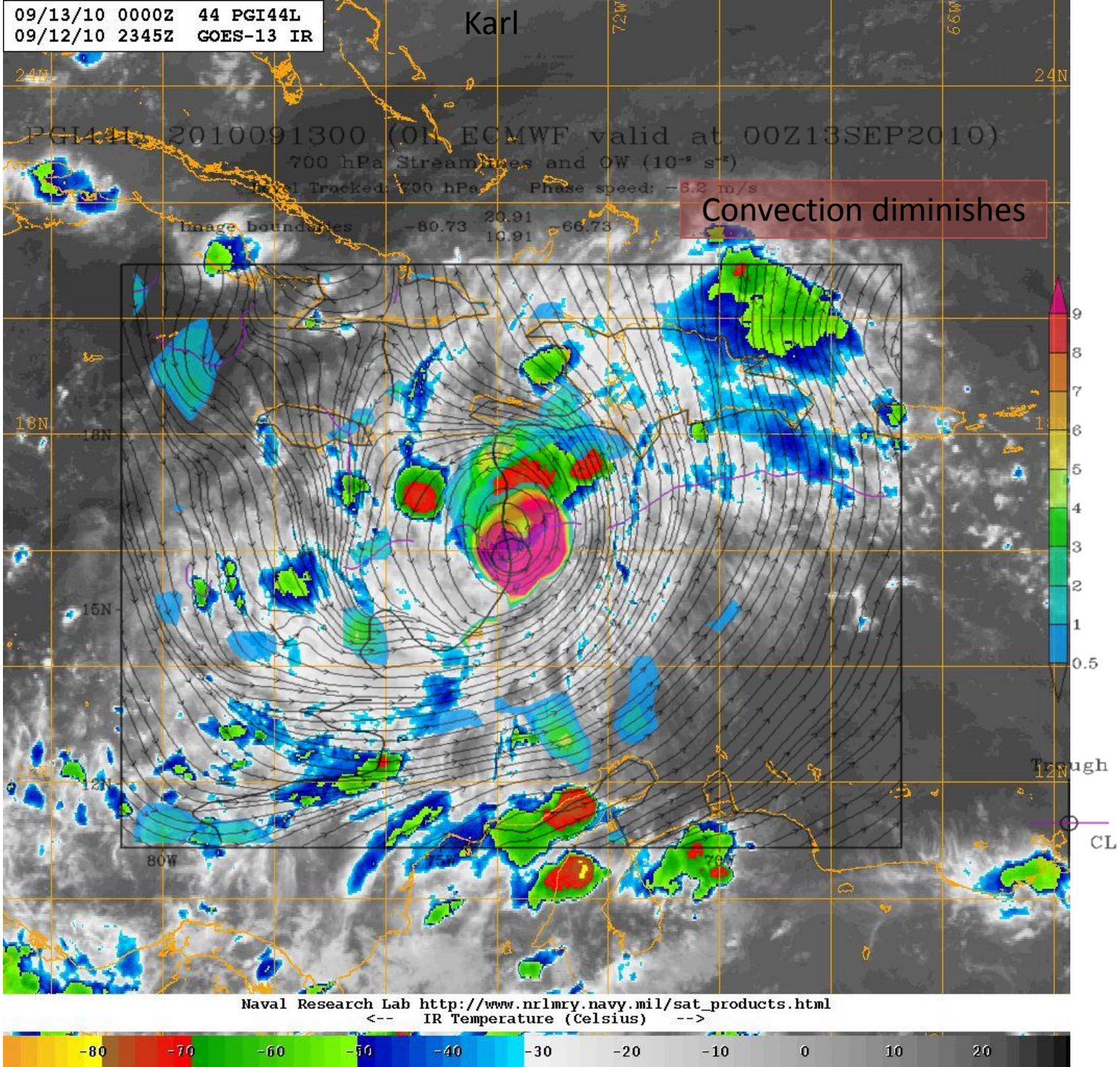

09/10/10 1200Z 44 PGI44L
09/10/10 1145Z GOES-13 IR
Karl
925 hPa Streamlines and OW (10⁻⁶ s⁻²)
Level Tracked: 925 hPa
Phase speed: -5.6 m/s
Image boundaries
-67.94
18.4
8.4
-53.94
Convection flares
around ECMWF center
* RF14 *
18N
15N
12N
9N
65W
60W
55W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

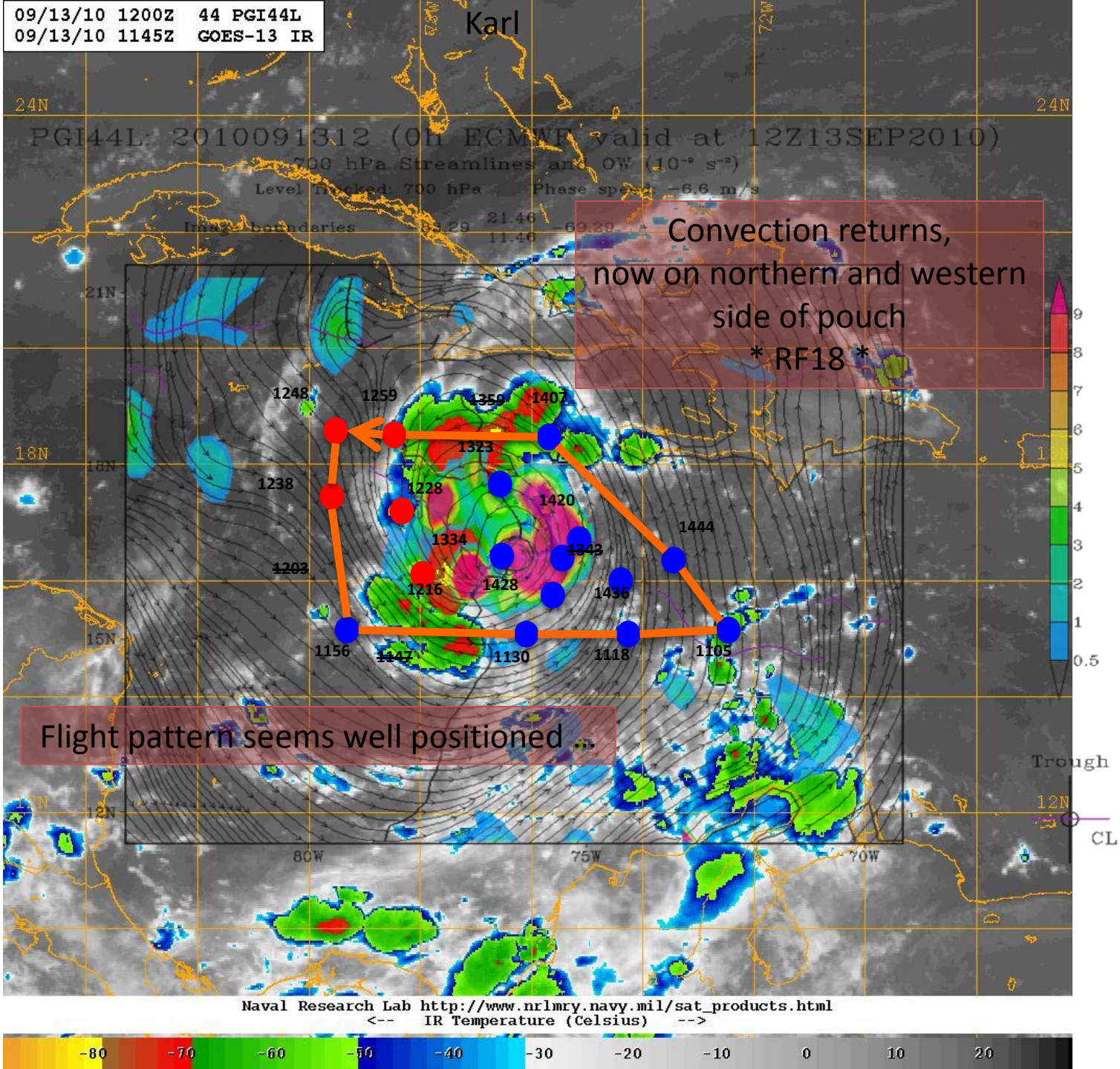

09/11/10 0000Z 44 PGI44L
09/10/10 2345Z GOES-13 IR
Karl
PGI44L: 2010091100 (0h ECMWF valid at 00Z11SEP2010)
925 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 925 hPa Phase speed: -6.0 m/s
Image boundaries -68.49 19.1 9.1 -54.49
Convection weakening
* RF15 *
18N
15N
12N
65W
60W
55W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/11/10 1200Z 44 PGI44L
09/11/10 1145Z GOES-13 IR
Karl
PGI44L: 2010091112 (0h ECMWF valid at 12Z11SEP2010)
925 hPa Streamlines and OW (10⁻⁶ s⁻²)
Level Tracked: 925 hPa Phase speed: -6.4 m/s
Image boundaries -71.06 19.85 9.85 -57.06
Convection flares around ECMWF center * RF16 *
18N
15N
12N
70W
65W
60W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

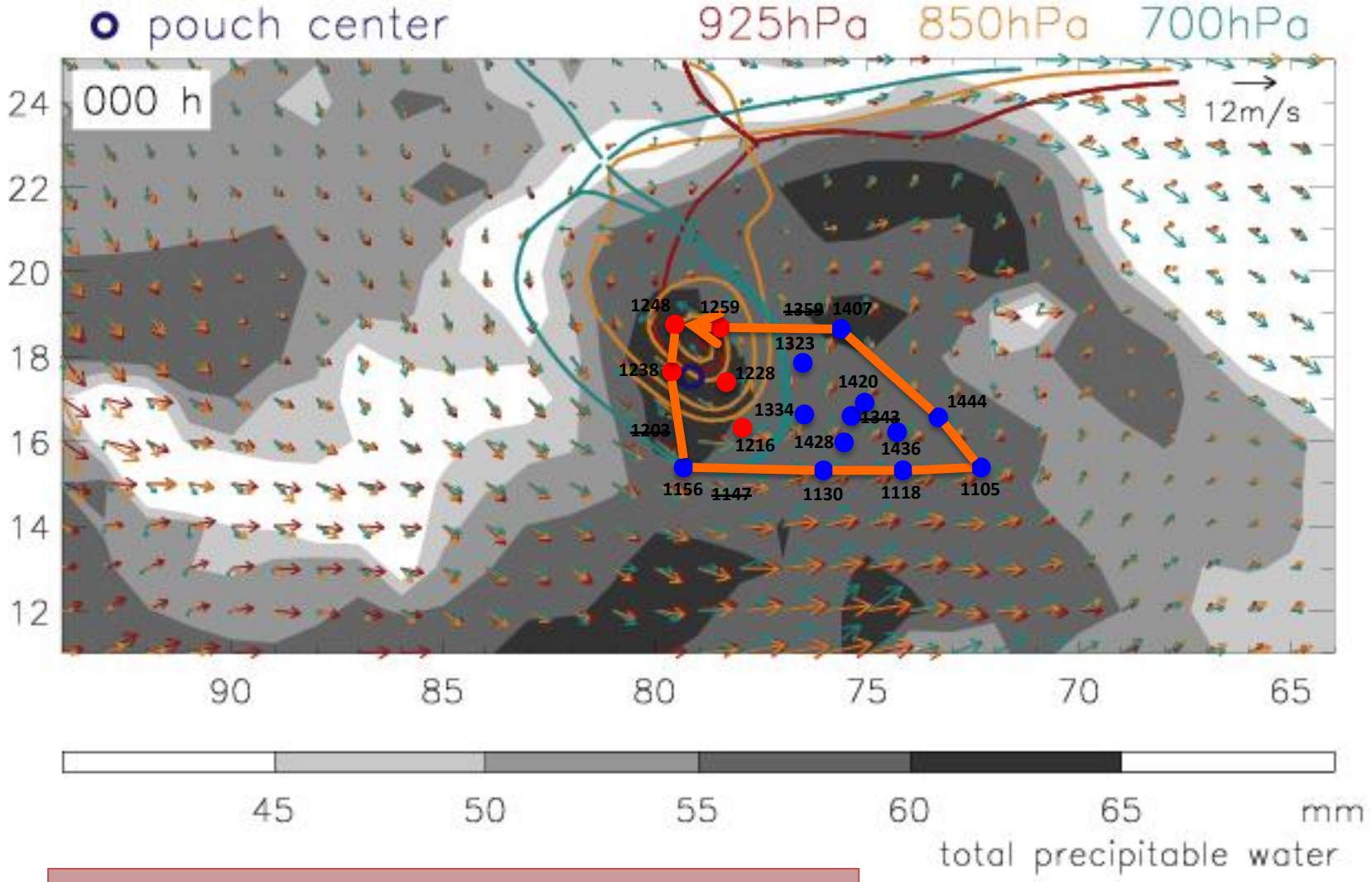

09/12/10 0100Z 44 PGI44L
09/11/10 2345Z GOES-13 IR
Karl
PGI44L.2010091200 (0h ECMWF valid at 00Z12SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Phase speed: -6.5
Image boundaries -75.3 19.98 9.98 -61.3
Convection collapses between RF16 & 17
24N
18N
15N
12N
75W
70W
65W
Trough
CL
9
8
7
6
5
4
3
2
1
0.5
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/12/10 1200Z 44 PGI44L
09/12/10 1145Z GOES-13 IR
Karl
Flight restrictions created a pattern that seems to have missed the western side of the pouch
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Phase speed: -6.1 m/s
1448
1458
1144/1435
1133/1509
1154
1146
1213/1317
1202
1328
1423
1521
1228
1304
1338
1410
1241
1253
1351
1359
Convection returns, mostly on the north side of the pouch
* RF17 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

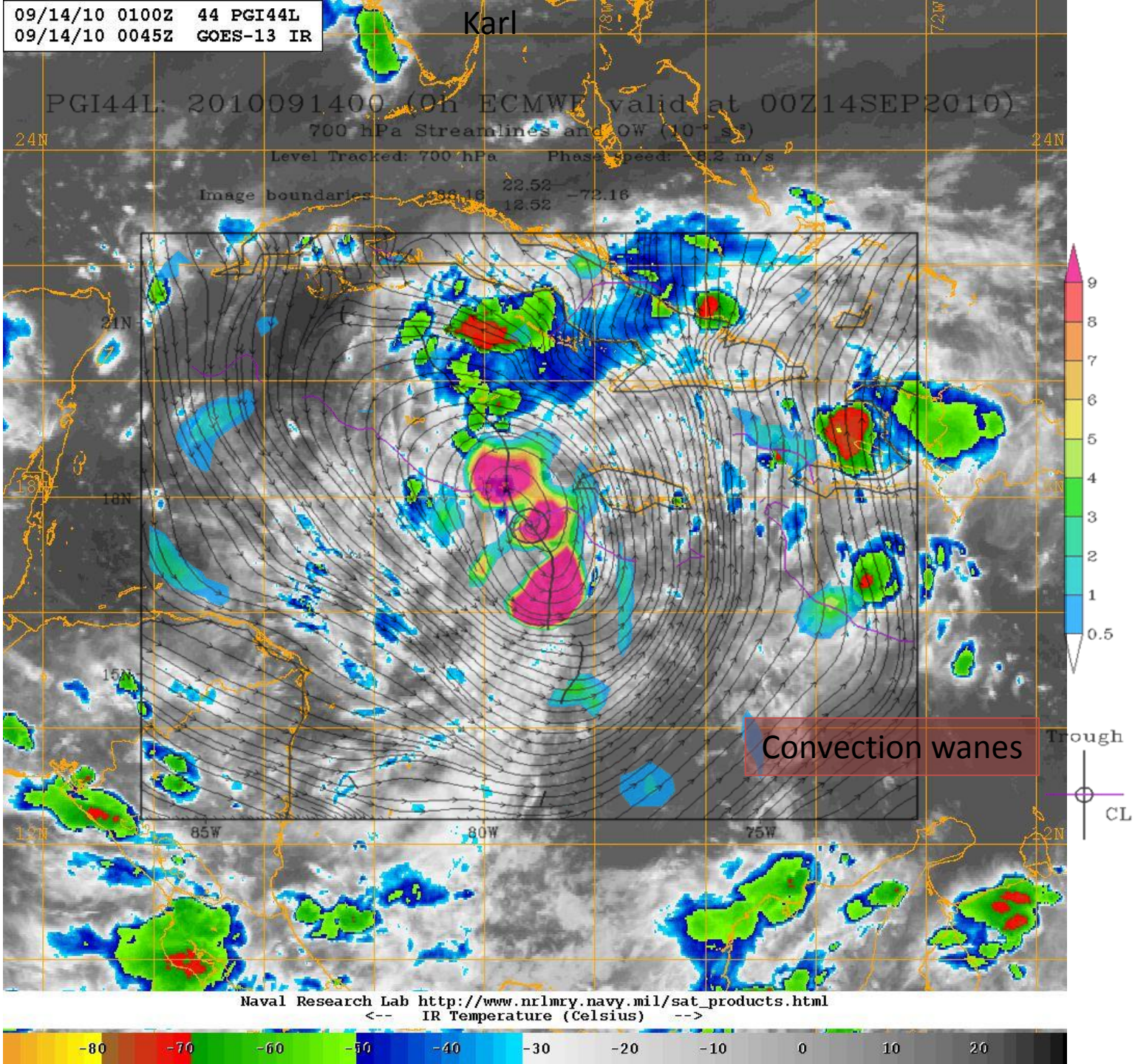

09/13/10 0000Z 44 PGI44L
09/12/10 2345Z GOES-13 IR
Karl
Convection diminishes
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

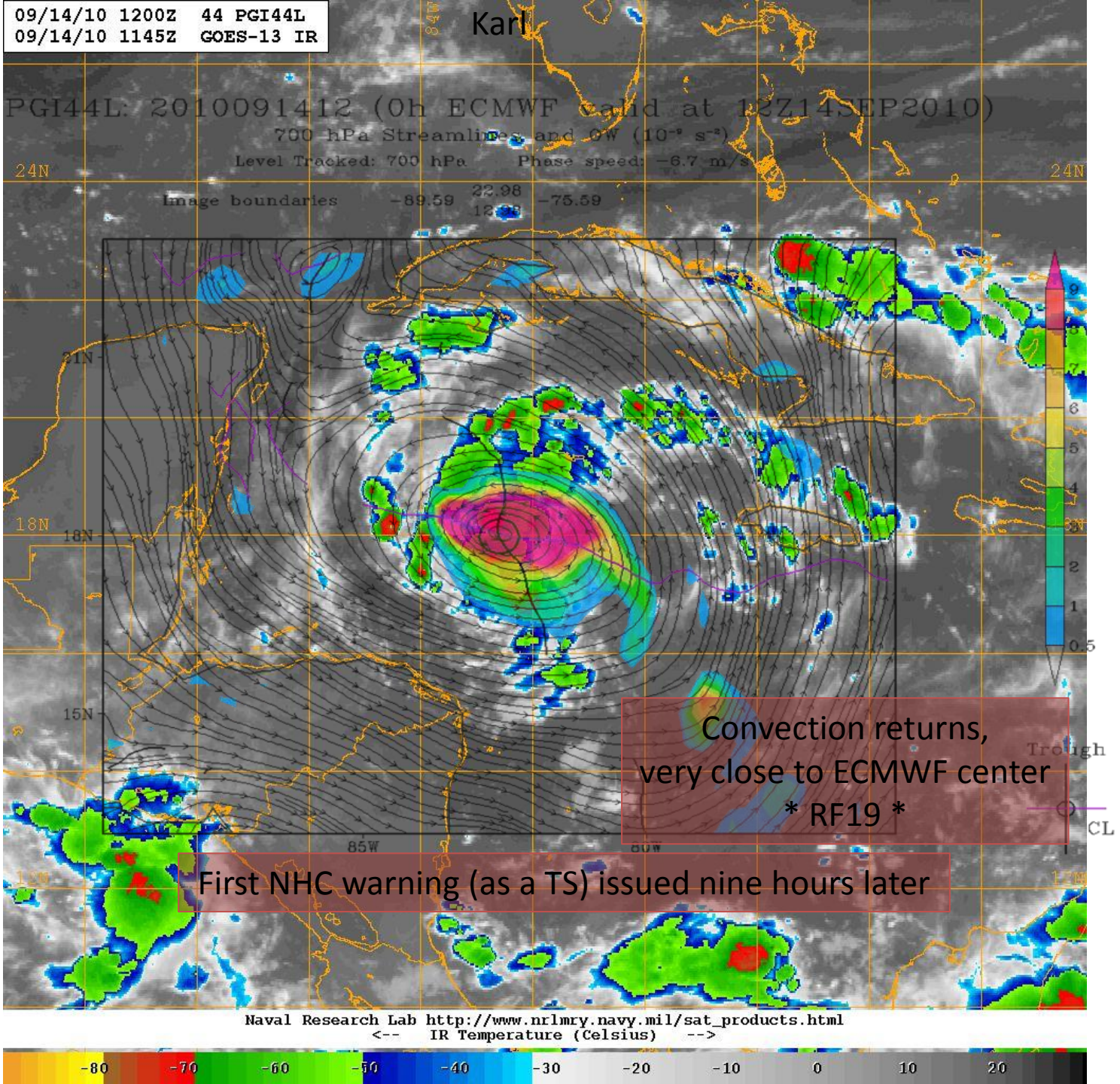

09/13/10 1200Z 44 PGI44L
09/13/10 1145Z GOES-13 IR
Karl
PGI44L: 2010091312 (0h ECMWF valid at 12Z13SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Phase speed: -6.6 m/s
Convection returns,
now on northern and western
side of pouch
* RF18 *
Flight pattern seems well positioned ...
1248
1259
1359
1407
1323
1238
1228
1420
1444
1334
1343
1203
1216
1428
1436
1156
1147
1130
1118
1105
24N
21N
18N
15N
12N
80W
75W
70W
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

ECMWF Dividing Streamline Analysis 2010091400
RF18 Drops: 20100913 1105-1444 Z 9:16-12:55 hours prior



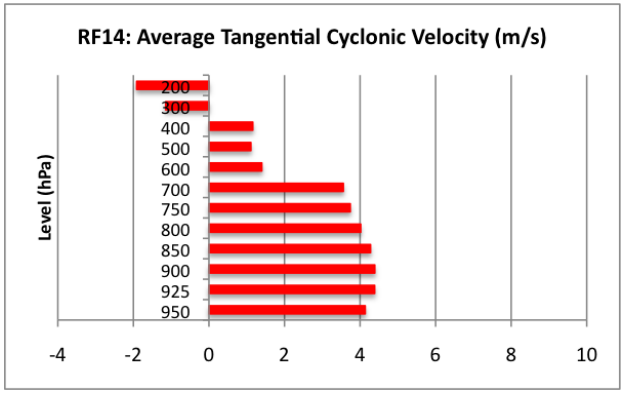
Airspace restrictions may have not us to sample the northern portion


09/14/10 0100Z 44 PGI44L
09/14/10 0045Z GOES-13 IR
Karl
PGI44L: 2010091400 (On ECMWF valid at 00Z14SEP2010)
700 hPa Streamlines and OW (10⁻⁷ s⁻²)
Level Tracked: 700 hPa
Image boundaries
22.52
12.52
-72.16
24N
21N
18N
15N
12N
85W
80W
75W
78W
72W
9
8
7
6
5
4
3
2
1
0.5
Convection wanes
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

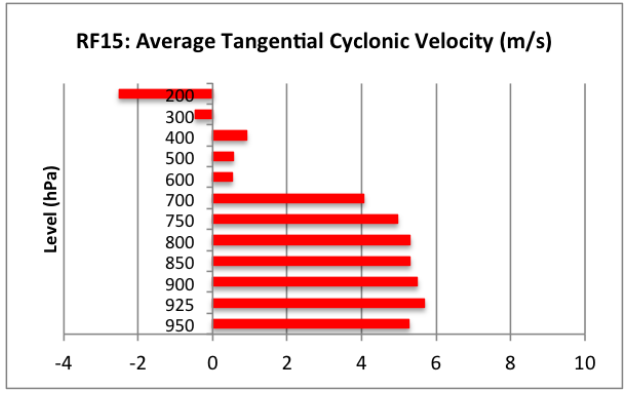

09/14/10 1200Z 44 PGI44L
09/14/10 1145Z GOES-13 IR
Karl
PGI44L: 2010091412 (0h ECMWF valid at 12Z14SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Phase speed: -6.7 m/s
Image boundaries
-89.59
22.98
-75.59
24N
21N
18N
15N
85W
Trough
CL
Convection returns,
very close to ECMWF center
* RF19 *
First NHC warning (as a TS) issued nine hours later
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

Karl

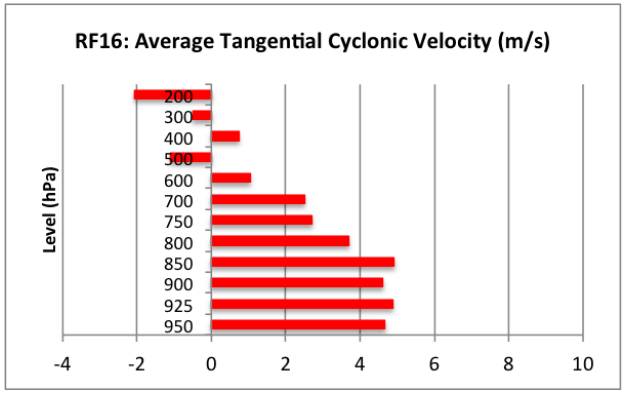
Sept 10 – Convection around center



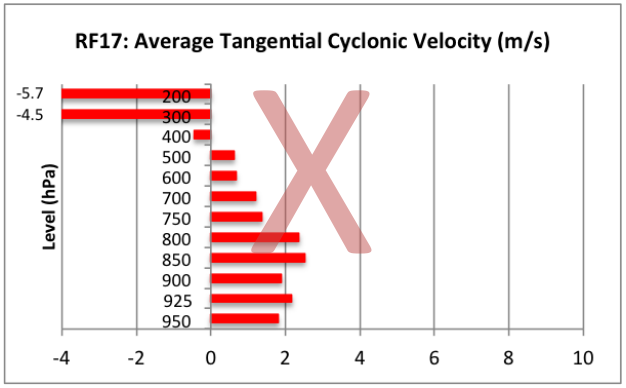
Sept 10 – Convection weakening



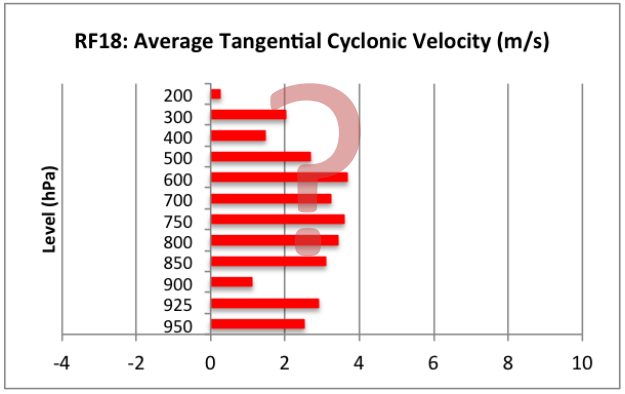
Sept 11 – Convection near center



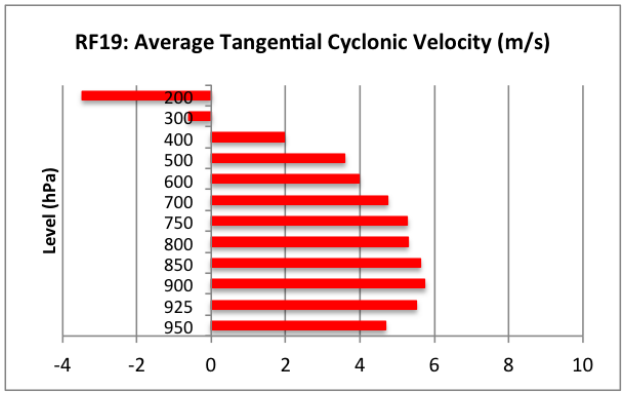
Sept 12 – Convection to north



Sept 13 – Convection to north & west



Sept 14 – Convection close to center



Sept 10 - 1st flight

- Cyclonic up to 400 hPa
- Strongest wind below 600 hPa

Sept 10 – 2nd flight … Similar to 1st flight, but

- Weak mid-levels became weaker
- Strong low-levels became stronger

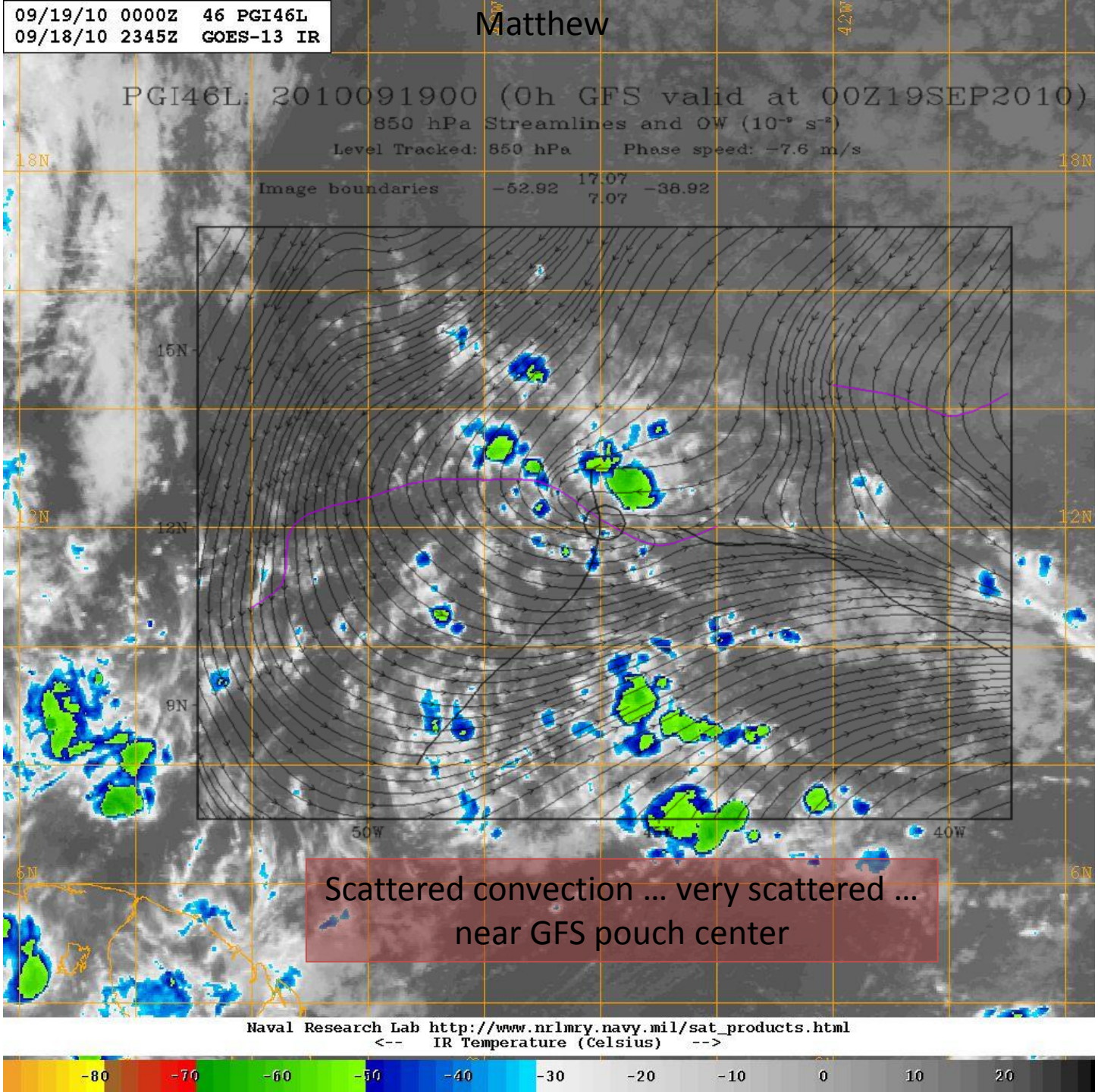
Sept 11

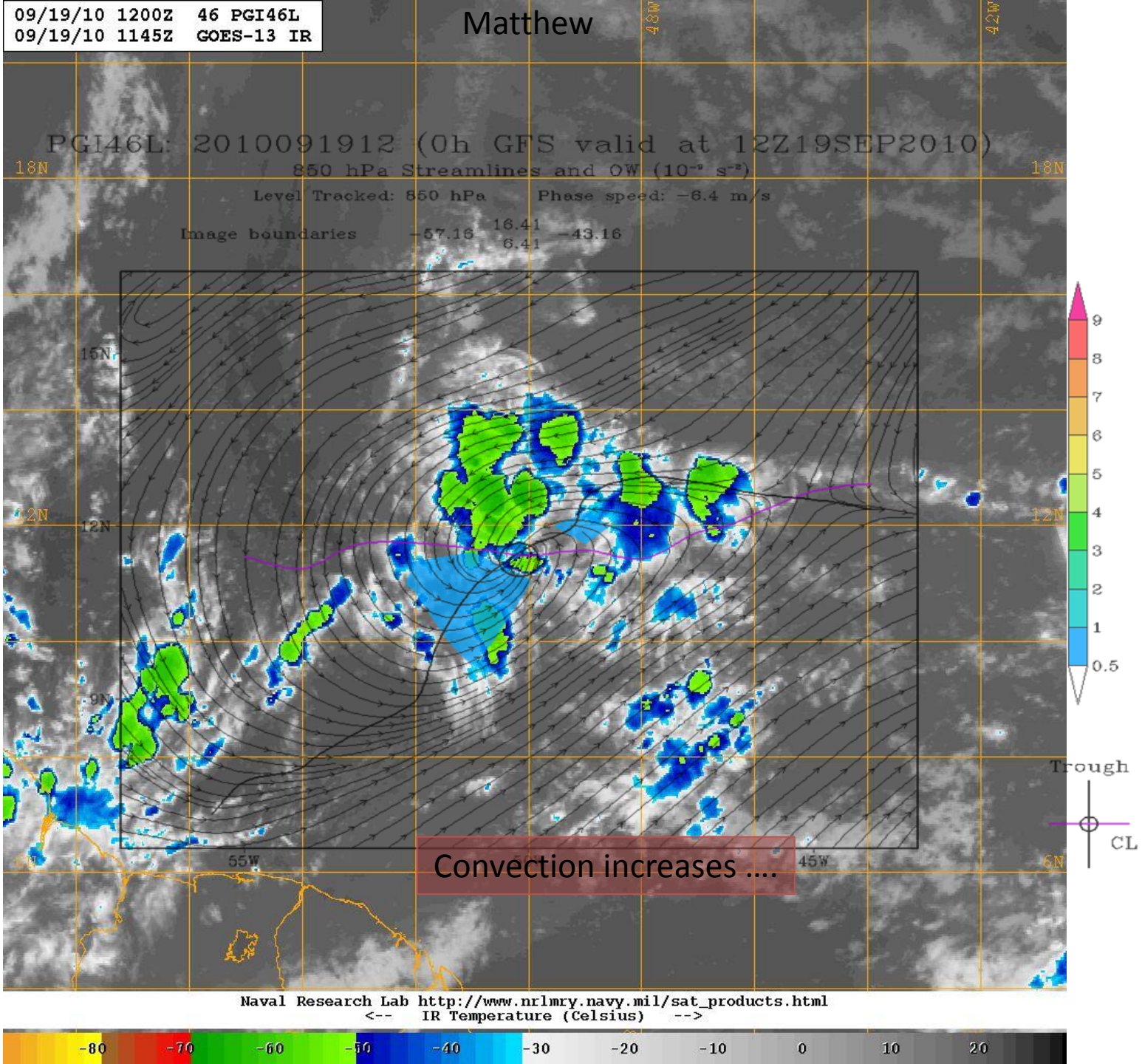
- Strongly cyclonic only up to 600 hPa

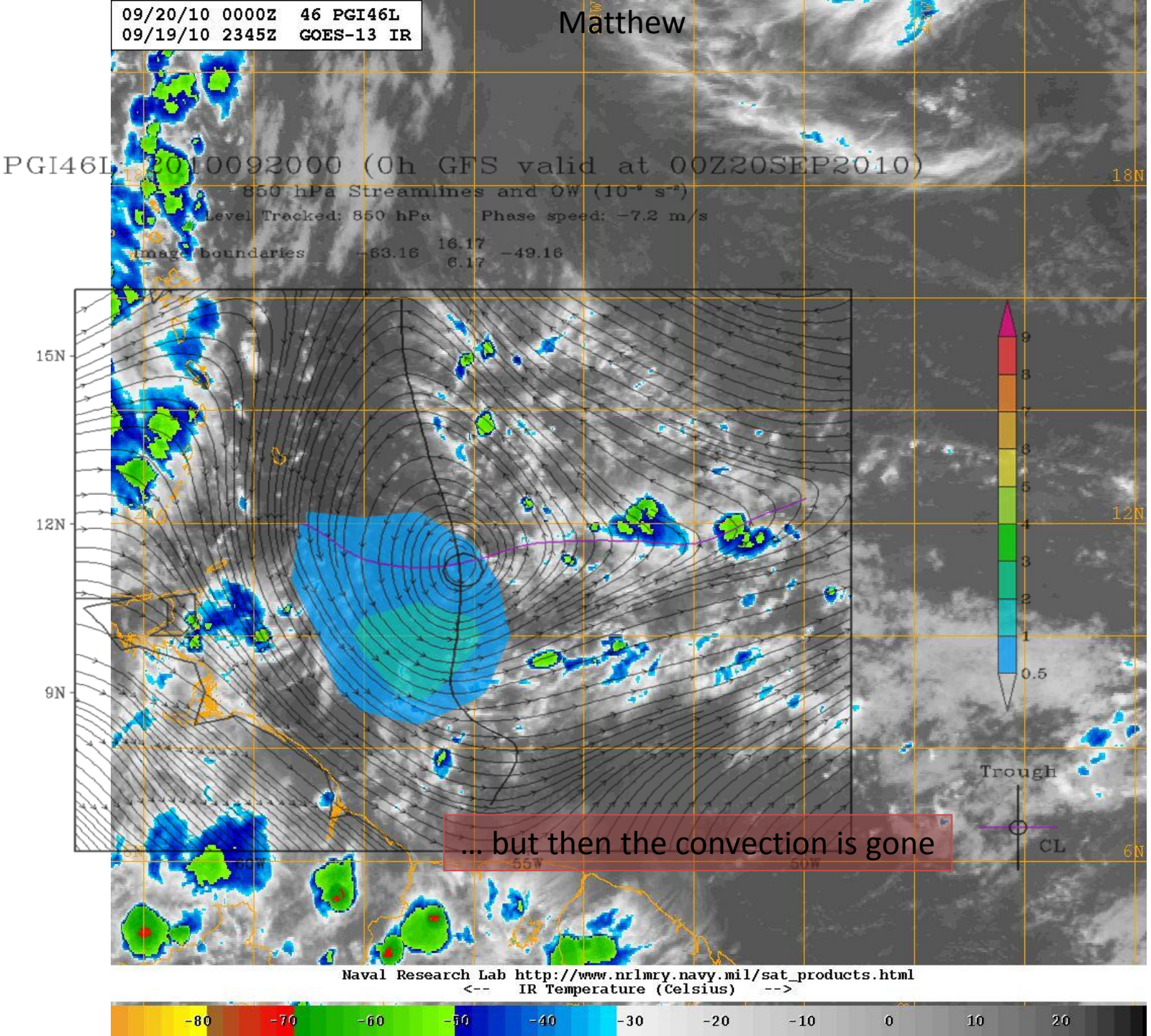
Sept 12-13: Missed portions?

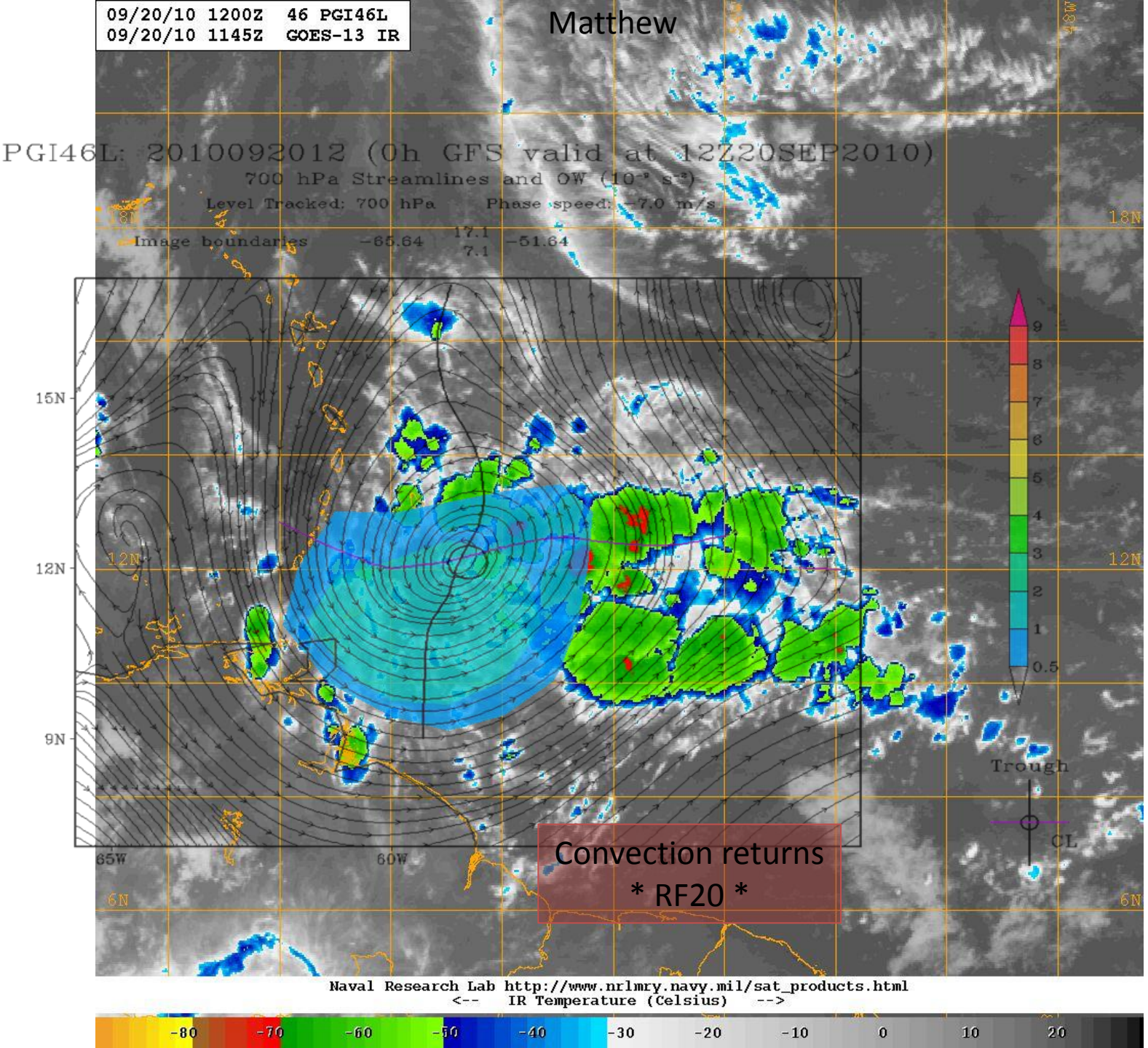
Sept 14 … Intensifies

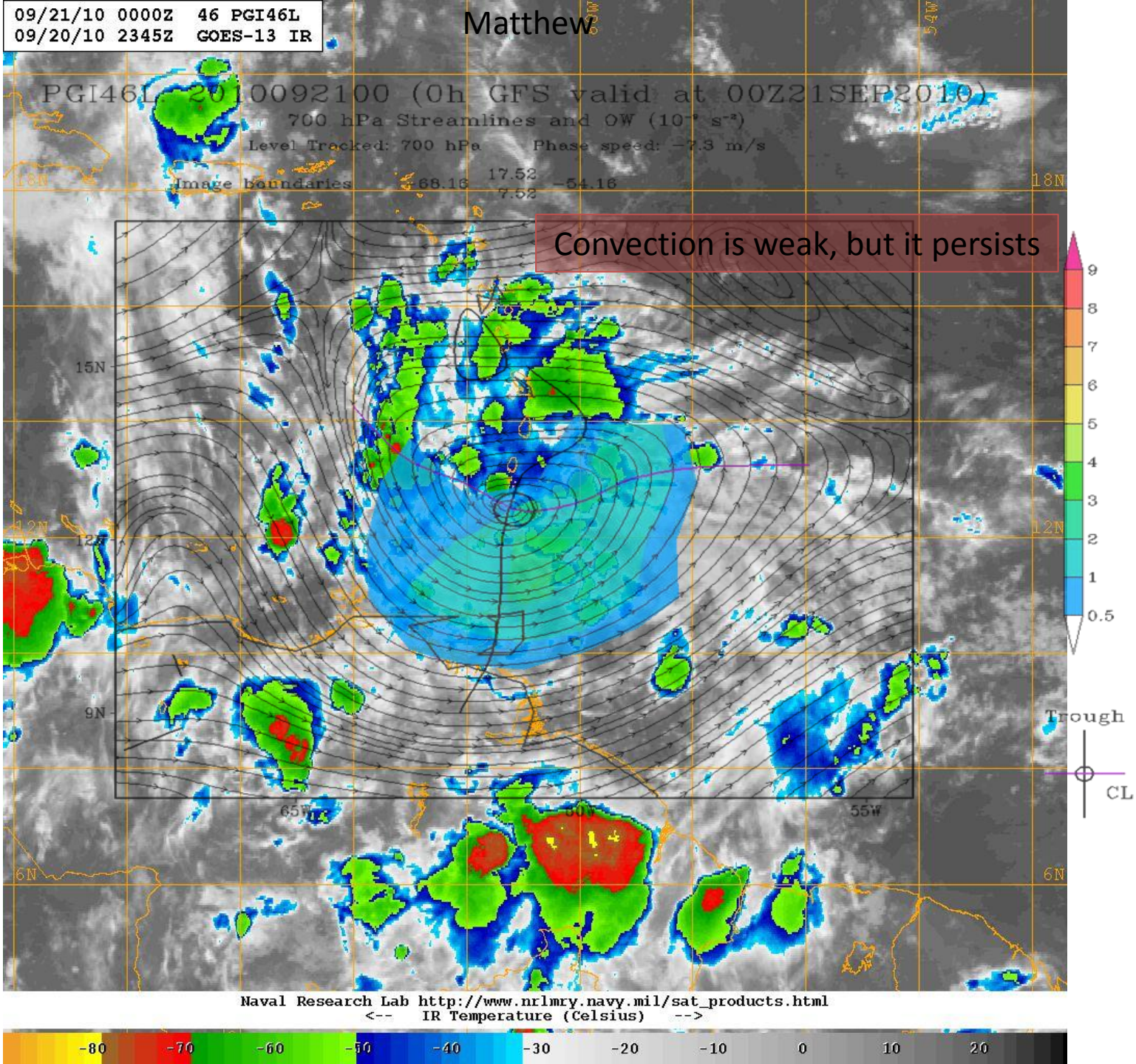
- Cyclonic up to 400 hPa
- Wind max at 900 hPa ~5.5 m/s

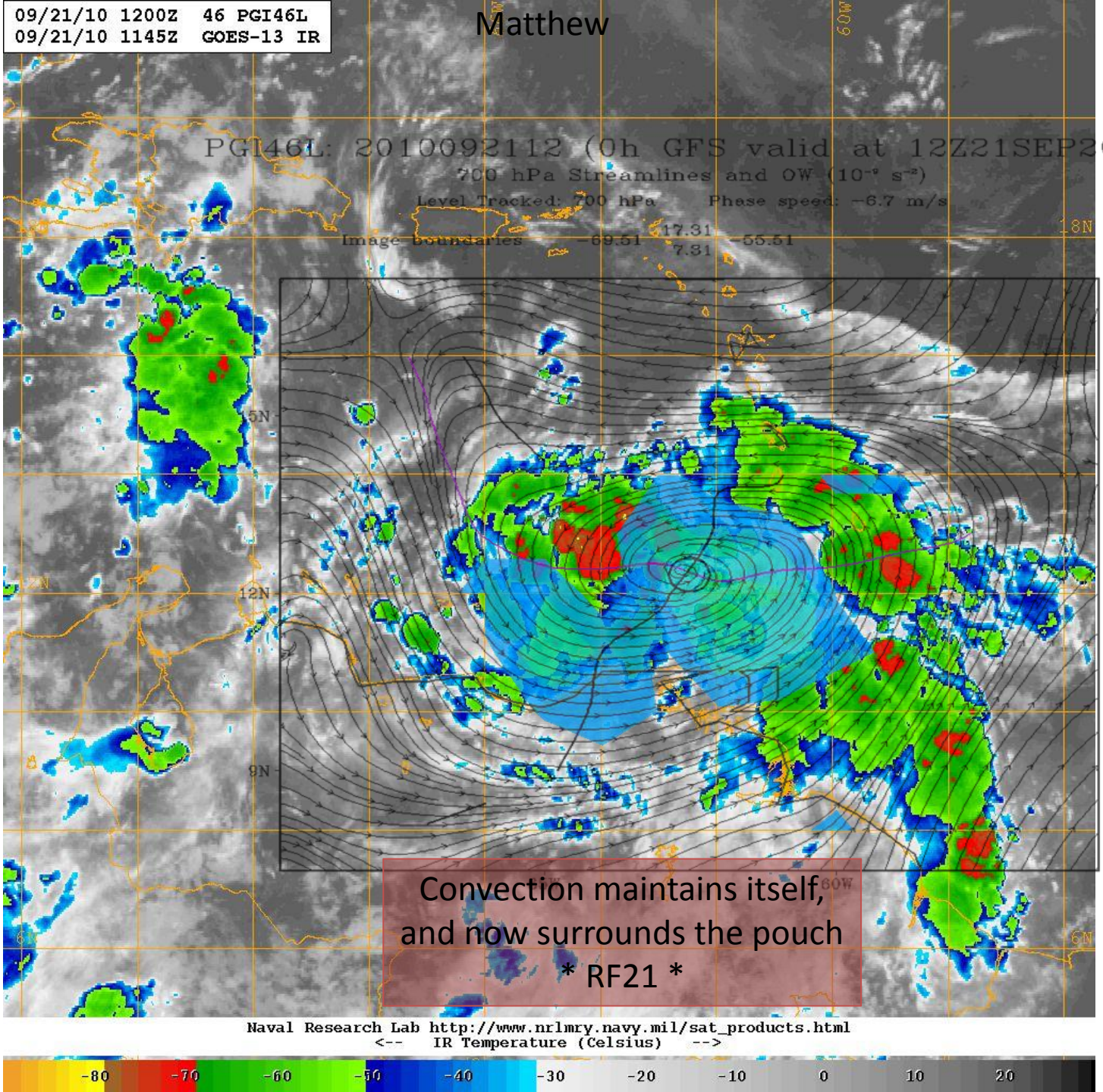

09/19/10 0000Z 46 PGI46L
09/18/10 2345Z GOES-13 IR
Matthew
PGI46L: 2010091900 (0h GFS valid at 00Z19SEP2010)
850 hPa Streamlines and OW (10⁻⁵ s⁻²)
Level Tracked: 850 hPa Phase speed: -7.6 m/s
Image boundaries -52.92 17.07 7.07 -38.92
18N
15N
12N
9N
6N
50W
40W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Scattered convection … very scattered … near GFS pouch center
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

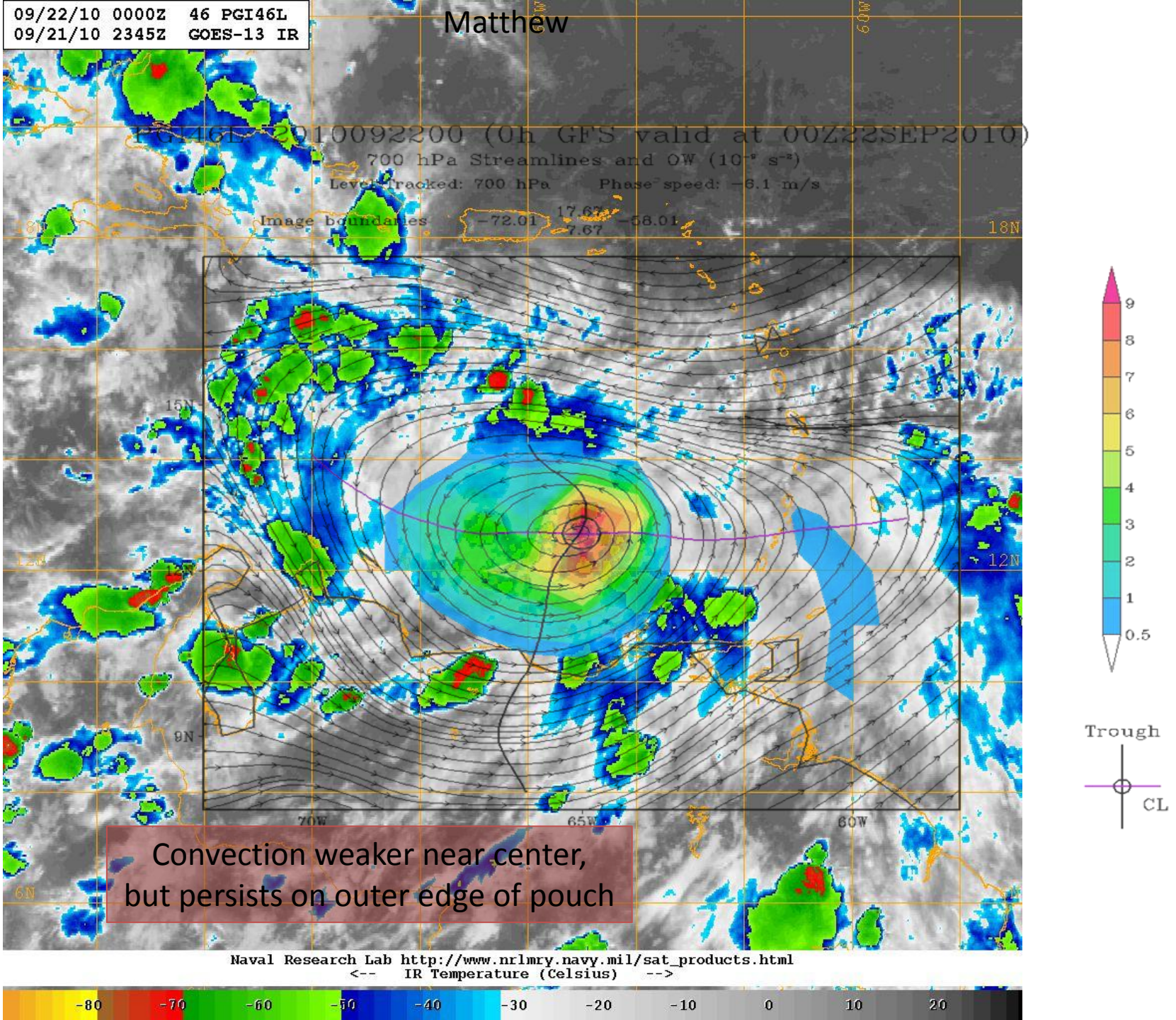

09/19/10 1200Z 46 PGI46L
09/19/10 1145Z GOES-13 IR
Matthew
PGI46L: 2010091912 (0h GFS valid at 12Z19SEP2010)
850 hPa Streamlines and OW (10⁻⁶ s⁻²)
Level Tracked: 850 hPa Phase speed: -6.4 m/s
Image boundaries -57.16 16.41 6.41 -43.16
18N
15N
12N
9N
6N
55W
45W
48W
42W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection increases ….
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

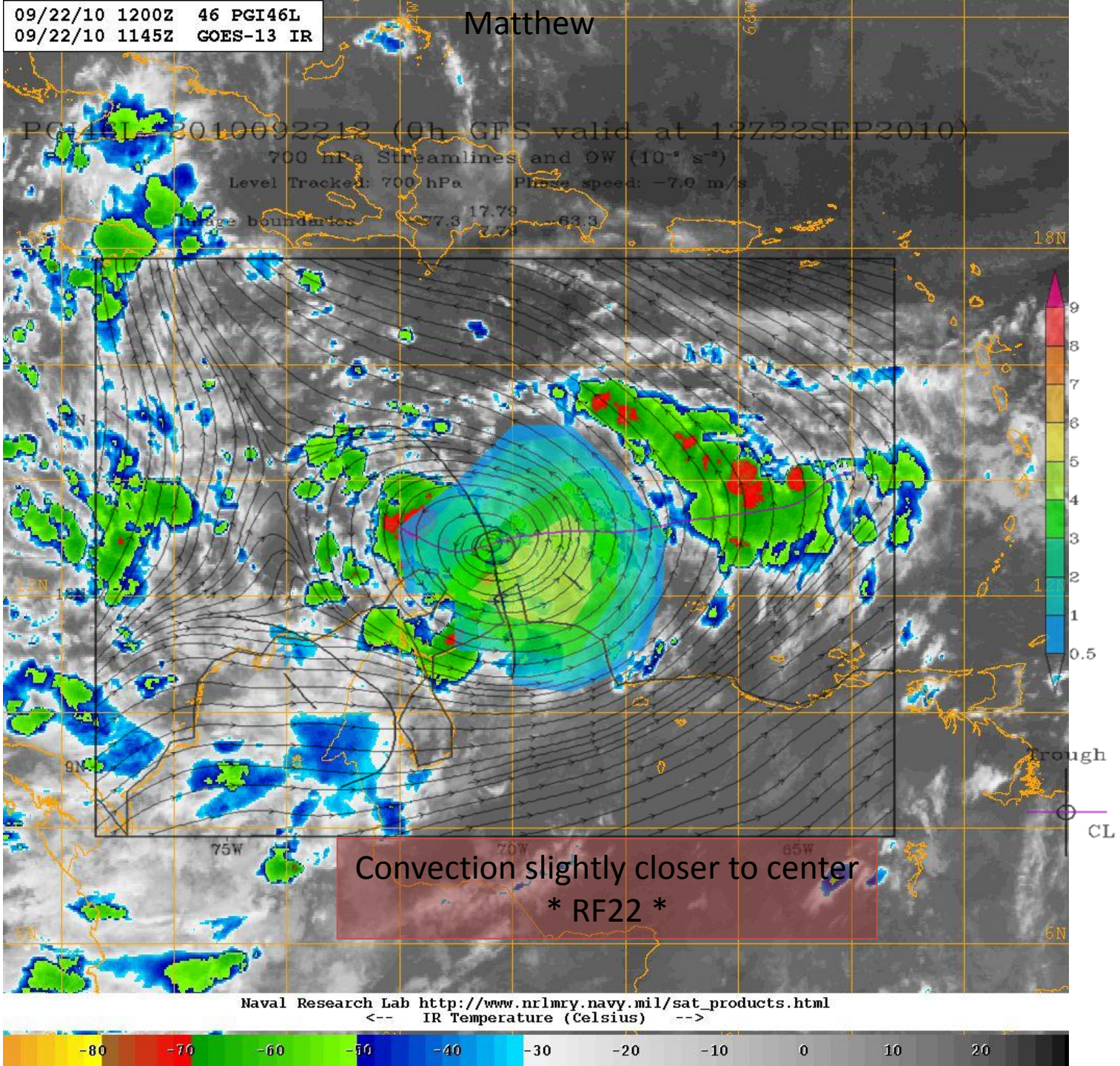

09/20/10 0000Z 46 PGI46L
09/19/10 2345Z GOES-13 IR
Matthew
PGI46L 2010092000 (0h GFS valid at 00Z20SEP2010)
850 hPa Streamlines and OW (10⁻⁶ s⁻²)
Level Tracked: 850 hPa
Phase speed: -7.2 m/s
Image boundaries
-63.16
16.17
6.17
-49.16
18N
15N
12N
9N
6N
55W
50W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
… but then the convection is gone
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

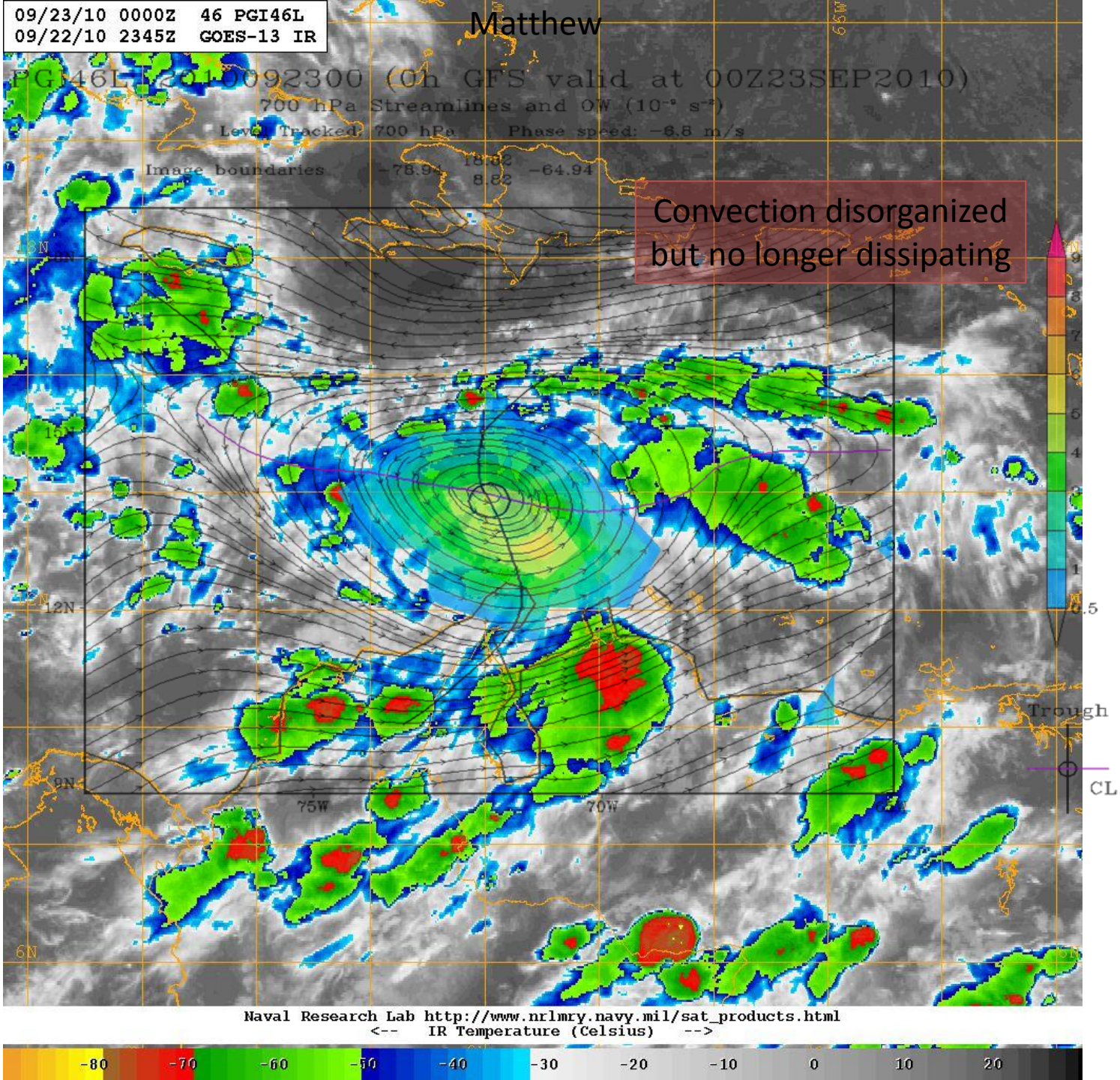

09/20/10 1200Z 46 PGI46L
09/20/10 1145Z GOES-13 IR
Matthew
PGI46L: 2010092012 (0h GFS valid at 12Z20SEP2010)
700 hPa Streamlines and OW (10⁻⁵ s⁻²)
Level Tracked: 700 hPa Phase speed: -7.0 m/s
Image boundaries -65.64 17.1 7.1 -51.64
18N
15N
12N
9N
6N
65W
60W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection returns
* RF20 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

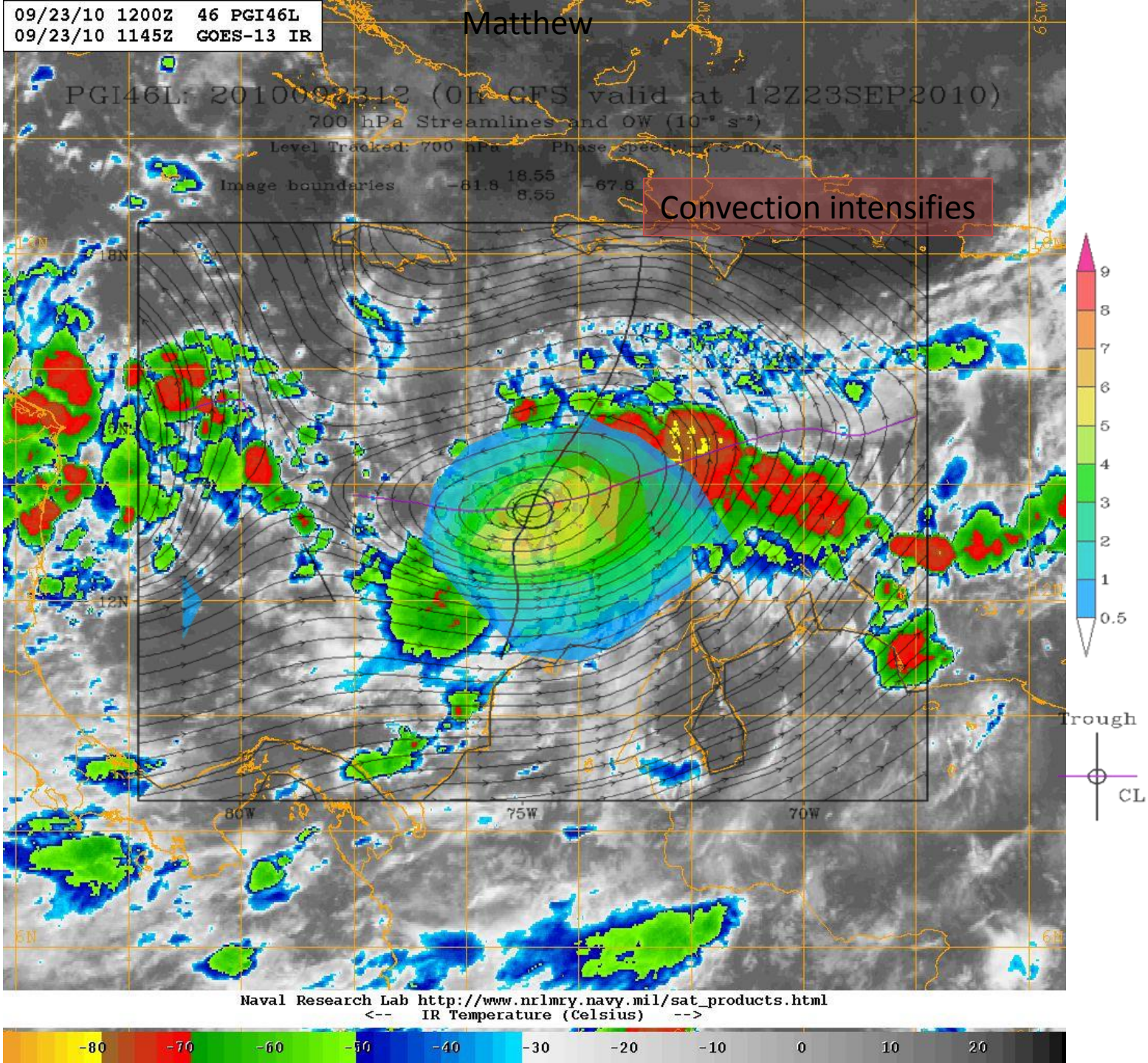

09/21/10 0000Z 46 PGI46L
09/20/10 2345Z GOES-13 IR
Matthew
PGI46L 2010092100 (0h GFS valid at 00Z21SEP2010)
700 hPa Streamlines and OW (10⁻⁷ s⁻²)
Level Tracked: 700 hPa Phase speed: -7.3 m/s
Image boundaries 68.16 17.52 -54.16 7.52
Convection is weak, but it persists
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
15N
12N
9N
6N
18N
65W
60W
55W
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/21/10 1200Z 46 PGI46L
09/21/10 1145Z GOES-13 IR
Matthew
PGI46L: 2010092112 (0h GFS valid at 12Z21SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa Phase speed: -6.7 m/s
Image boundaries -69.51 17.31 -55.51 7.31
18N
15N
12N
9N
6N
60W
Convection maintains itself,
and now surrounds the pouch
* RF21 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

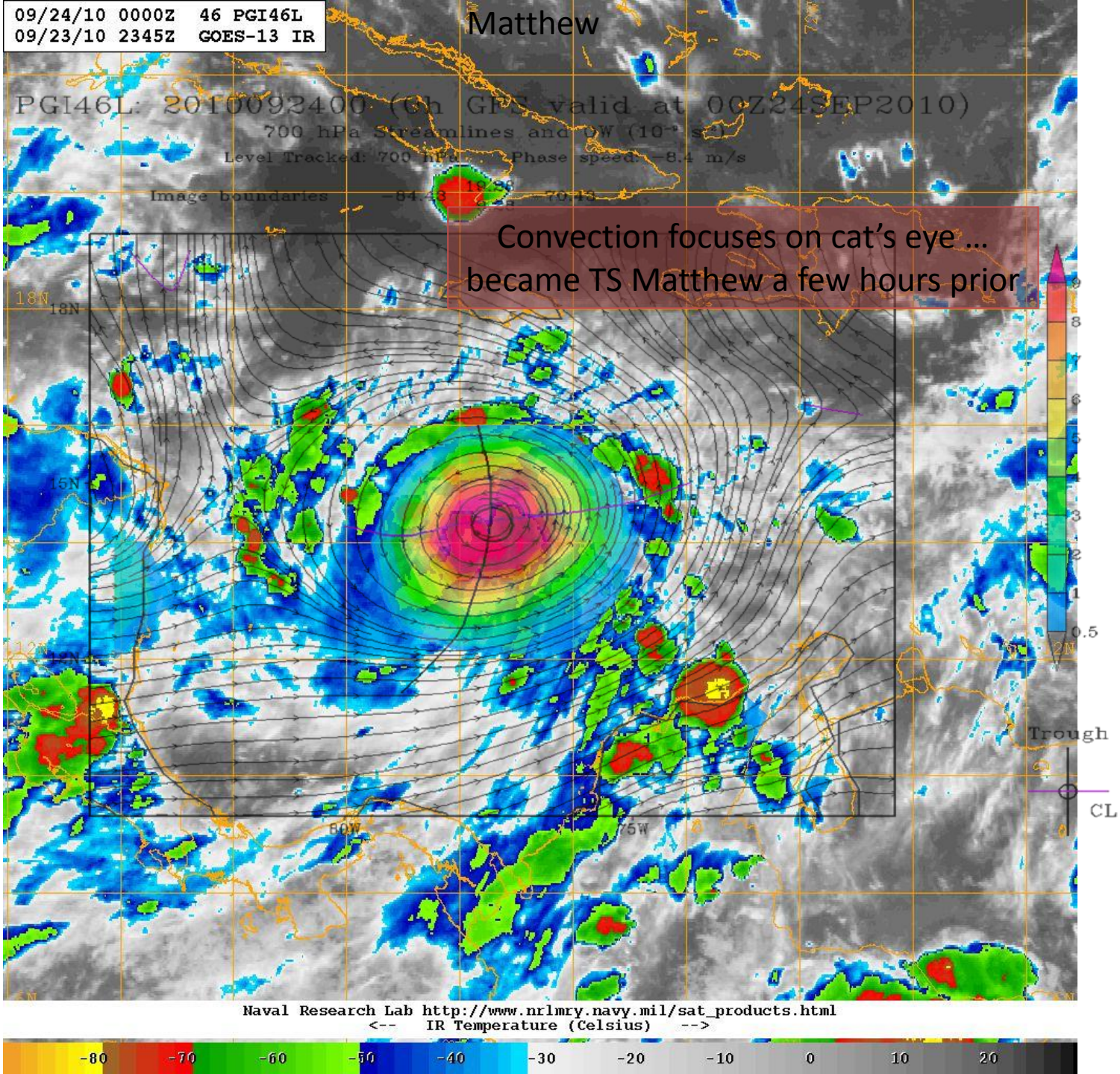

09/22/10 0000Z 46 PGI46L
09/21/10 2345Z GOES-13 IR
Matthew
700 hPa Streamlines and OW (10^{-5} s^{-2})
Level tracked: 700 hPa
Phase speed: -6.1 m/s
Image boundaries
-72.01
7.67
-58.01
18N
15N
12N
9N
6N
70W
65W
60W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection weaker near center,
but persists on outer edge of pouch
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20

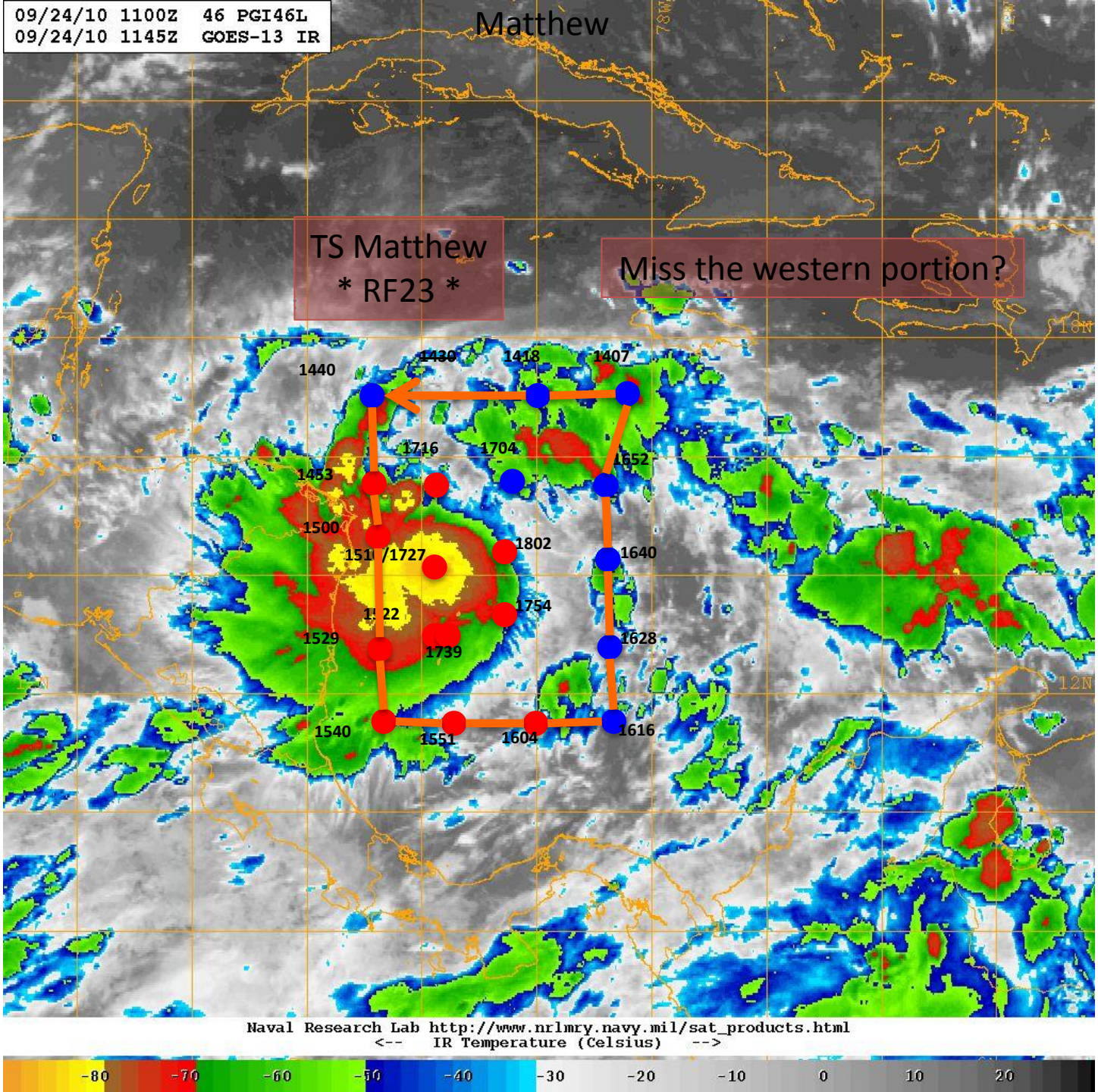

09/22/10 1200Z 46 PGI46L
09/22/10 1145Z GOES-13 IR
Matthew
700 hPa Streamlines and OW (10⁻⁵ s⁻²)
Level Tracked: 700 hPa
18N
12N
9N
6N
75W
70W
65W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Convection slightly closer to center
* RF22 *
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20


09/23/10 0000Z 46 PGI46L
09/22/10 2345Z GOES-13 IR
Matthew
700 hPa Streamlines and OW (10⁻⁵ s⁻²)
Level Tracked: 700 hPa
Phase speed: -6.8 m/s
Image boundaries
Convection disorganized
but no longer dissipating
Trough
CL
12N
9N
6N
75W
70W
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

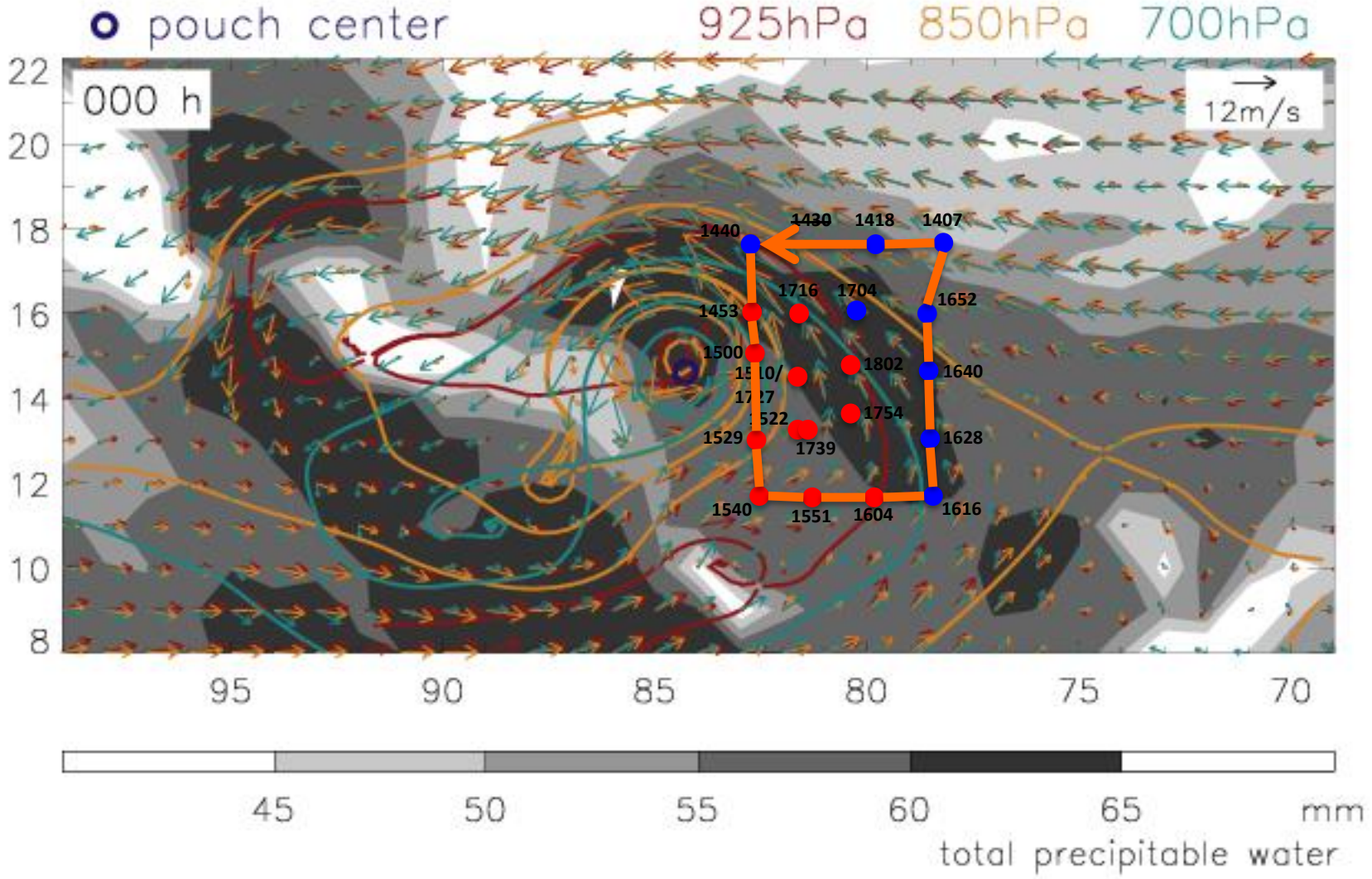


09/23/10 1200Z 46 PGI46L
09/23/10 1145Z GOES-13 IR
Matthew
PGI46L: 2010092312 (0h CFS valid at 12Z23SEP2010)
700 hPa Streamlines and OW (10⁻⁹ s⁻²)
Level Tracked: 700 hPa
Image boundaries -81.8 18.55 8.55 -67.8
Convection intensifies
18N
12N
80W
75W
70W
9
8
7
6
5
4
3
2
1
0.5
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20


09/24/10 0000Z 46 PGI46L
09/23/10 2345Z GOES-13 IR
Matthew
Convection focuses on cat's eye …
became TS Matthew a few hours prior
Trough
CL
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

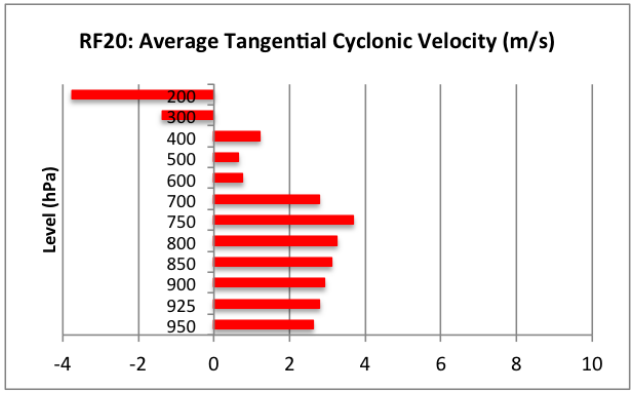

09/24/10 1100Z 46 PGI46L
09/24/10 1145Z GOES-13 IR
Matthew
TS Matthew
* RF23 *
Miss the western portion?
1440
1430
1418
1407
1716
1704
1652
1453
1500
1802
1640
1727
1754
1529
1628
1739
1540
1551
1604
1616
Naval Research Lab http://www.nrlmry.navy.mil/sat_products.html
<-- IR Temperature (Celsius) -->
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20

ECMWF Dividing Streamline Analysis 2010092500
RF23 Drops: 20100924 1407-1802 Z 5:58-9:53 hours prior

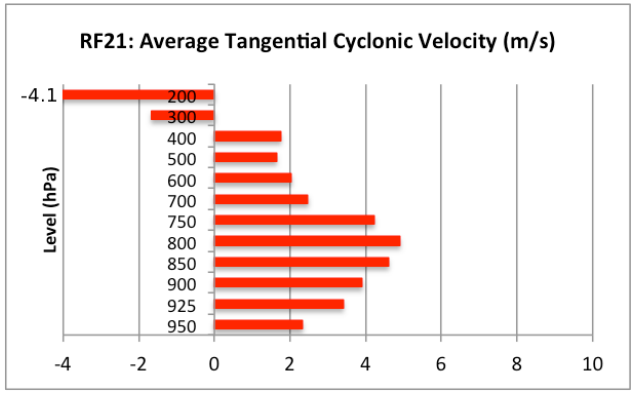


Matthew

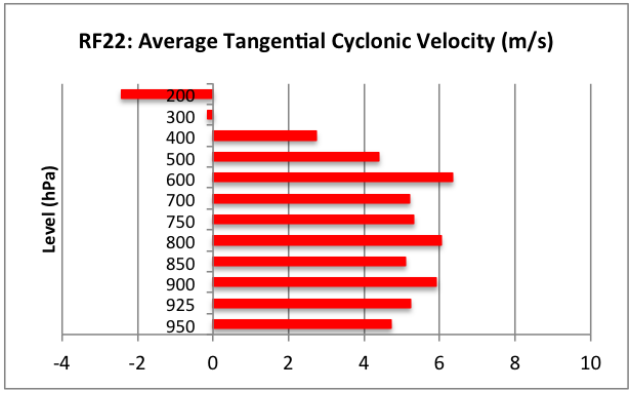
Sept 20 – Convection to east



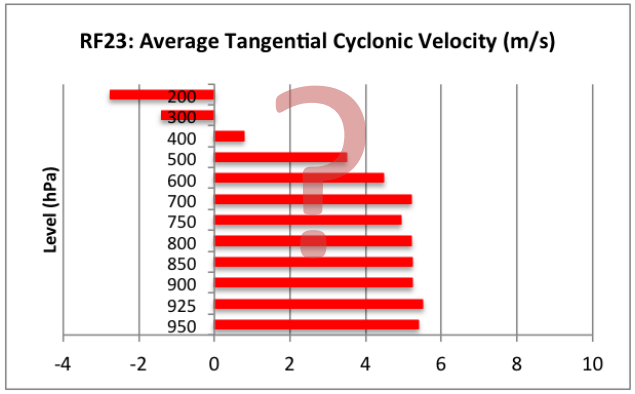
Sept 21 – Convection surrounds pouch



Sept 22 – Convection closer to center



Sept 24 – Tropical storm



Sept 20-22

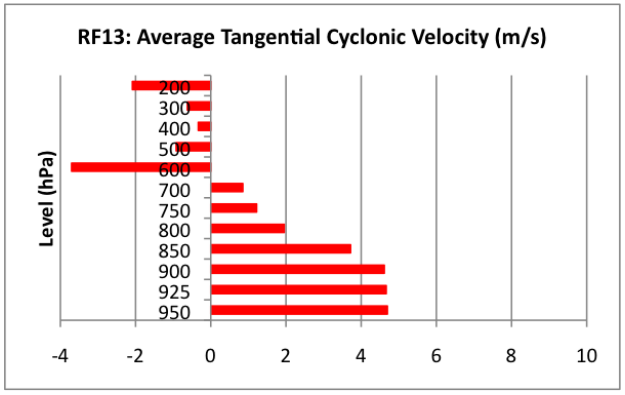
- Consistently cyclonic up to 400 hPa
- Wind max initially at 750 hPa, drops slightly to 800 hPa, but is strong throughout 600-900 hPa layer by Sept 22

Sept 24 … Now a TS

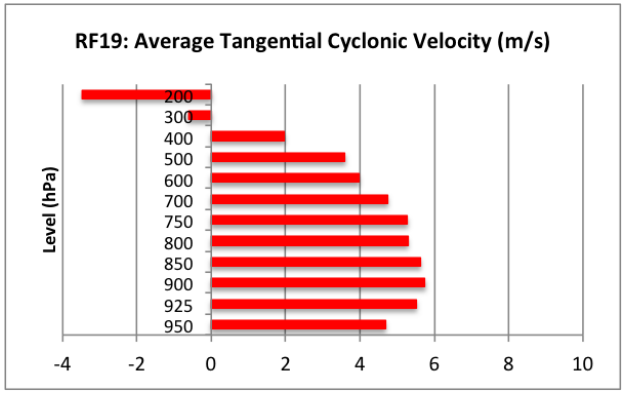
- Winds are not that different from two days prior, with some values even less (because we missed the western side?)

Comparison of Last Flights

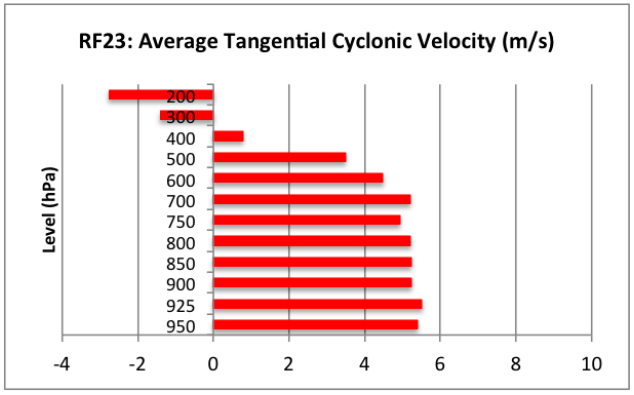
Gaston
Sept 7



Karl
Sept 14



Matthew
Sept 24

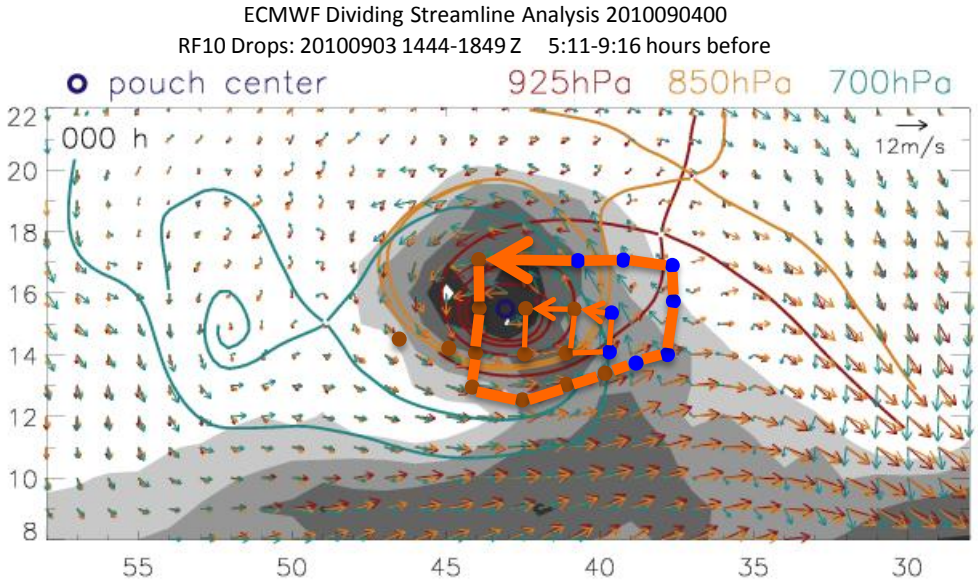


- Gaston's maximum winds not much less than other two storms, but they are confined to a shallow layer

- While Gaston is cyclonic up to only 700 hPa, Karl and Matthew are cyclonic up to 400 hPa

Future Kinematics Work

- Complete calculations for:
  - Non-developers PGI27, PGI30, PGI48(?)
  - Developers PGI36/Fiona and PGI50/Nicole
- Calculate convergence/divergence with similar techniques
- Make same calculations for smaller regions to focus on the meso-a scale



Other projects

- Test ECMWF by rerunning the model without the dropsondes (Peter Bauer, Head of Satellite Section/Research Department, ECMWF)

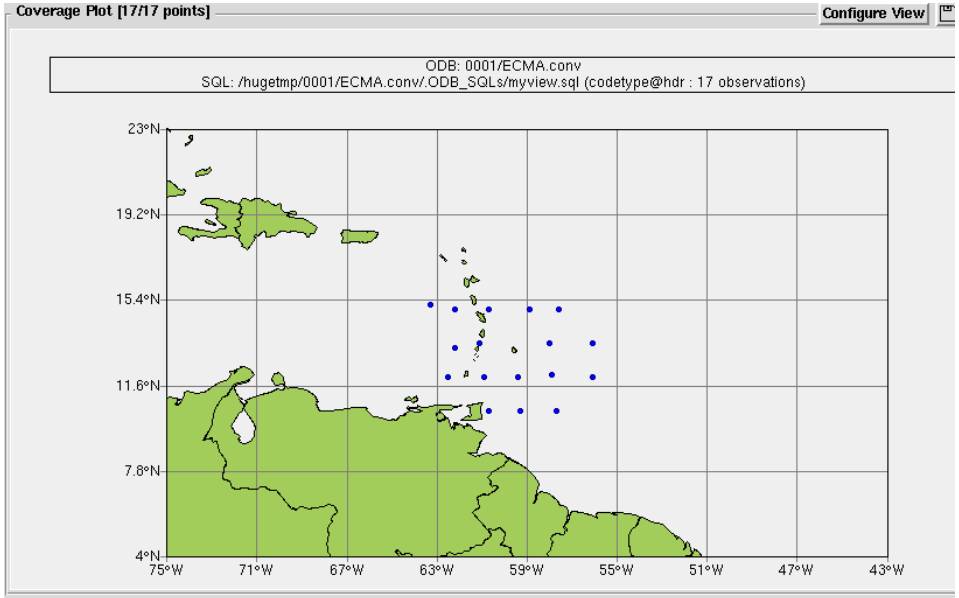


Table [17/17 rows]

Pool	Index	date@hdr	time@hdr	lat@hdr	lon@hdr	insttype@hdr	sensor@hdr	codetype@hdr	statid@hdr
1	1	10-Sep-10	09:29:00	15.2	-63.3	NULL	0	135	'15200633'
2	1	10-Sep-10	09:38:00	15	-62.2	NULL	0	135	'15000622'
3	1	10-Sep-10	09:51:00	15	-60.7	NULL	0	135	'15000607'
4	1	10-Sep-10	10:05:00	15	-58.9	NULL	0	135	'15000589'
5	1	10-Sep-10	10:15:00	15	-57.6	NULL	0	135	'15000576'
6	1	10-Sep-10	10:39:00	13.5	-56.1	NULL	0	135	'13500561'
7	1	10-Sep-10	10:51:00	12	-56.1	NULL	0	135	'12000561'
8	1	10-Sep-10	11:14:00	10.5	-57.7	NULL	0	135	'10500577'
9	1	10-Sep-10	11:26:00	10.5	-59.3	NULL	0	135	'10500593'
10	1	10-Sep-10	11:37:00	10.5	-60.7	NULL	0	135	'10500607'
11	1	10-Sep-10	11:55:00	12	-62.5	NULL	0	135	'12000625'
12	1	10-Sep-10	12:23:00	13.3	-62.2	NULL	0	135	'13300622'
13	1	10-Sep-10	12:33:00	13.5	-61.1	NULL	0	135	'13500611'
14	1	10-Sep-10	12:58:00	13.5	-58	NULL	0	135	'13500580'
15	1	10-Sep-10	13:10:00	12.1	-57.9	NULL	0	135	'12100579'
16	1	10-Sep-10	13:22:00	12	-59.4	NULL	0	135	'12000594'
17	1	10-Sep-10	13:32:00	12	-60.9	NULL	0	135	'12000609'

Other projects

- Accepting ideas for improvements and additions to the Montgomery pouch product suite and website (Saurabh Barve, NPS)

NAVAL POSTGRADUATE SCHOOL

Department of Meteorology

Montgomery Research Group

NPS Admissions Academics Research Technology Library Administration About NPS Department of Meteorology

HOME RESEARCH PUBLICATIONS PERSONNEL MISCELLANEOUS INVEST TRACKING NSF PREDICT (2010)

Current Wave-Pouches (Last run was: 00 UTC 31 October 2010)

2010 Archives

Images are of the 5-day forecast verification time for the last run: ~ 00 UTC 5 November 2010

External Links

EOL/PREDICT Field Catalog

Navy/NRL PREDICT 2010 Page

CIMSS PREDICT Support Page

JPL Tropical Cyclone System

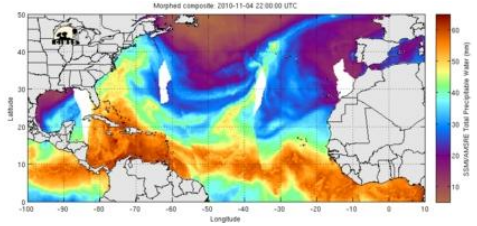
Global Model Ensemble Products (Majumdar/RSMAS)

WRF Ensemble Forecasts (Torn/UAlbany)

ENkF WRF Ensemble Forecasts (Zhang/Penn State)

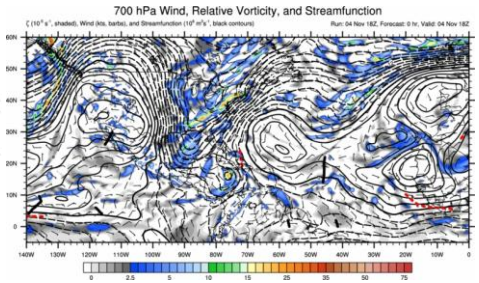
PREDICT Forecast Maps (Griffin/UAlbany)

PREDICT Facebook Page



Total Precipitable Water image courtesy of CIMSS/University of Wisconsin

IR satellite image courtesy of Naval Research Lab/Monterey



700-hPa Analysis courtesy of Matt Janiga (SUNY/Albany)

Surface Analysis courtesy of Tropical Prediction Center/NWS/NOAA

Plan for my Summer Vacation 2011

Track pouches!
July - October

No big changes from last year

- Four models: ECMWF, GFS, UKMET, NOGAPS

NOT OBJECTIVE:

- Initiation of a pouch
- Determination of the phase speed
  - Weak RH & v Hovmoller signal for weak pouches
  - Sometimes Hovmoller “appears” to change speed during the 5-day forecast
- Track plotting