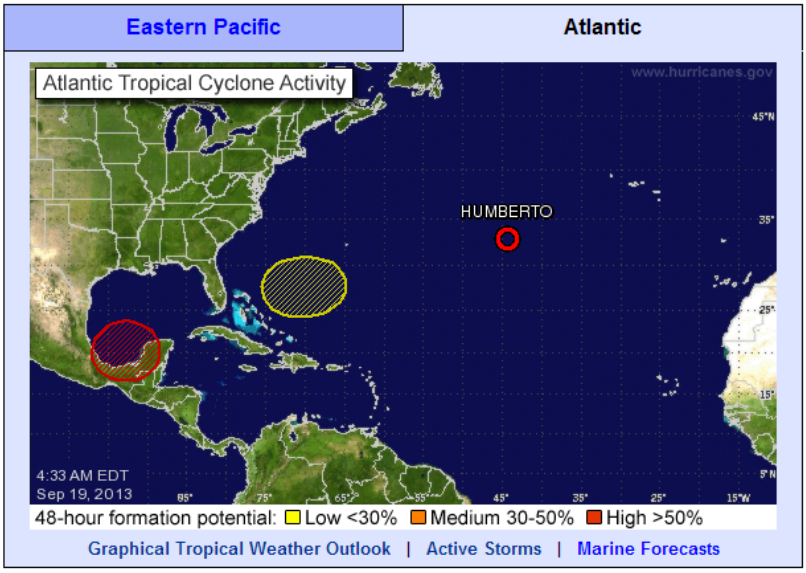
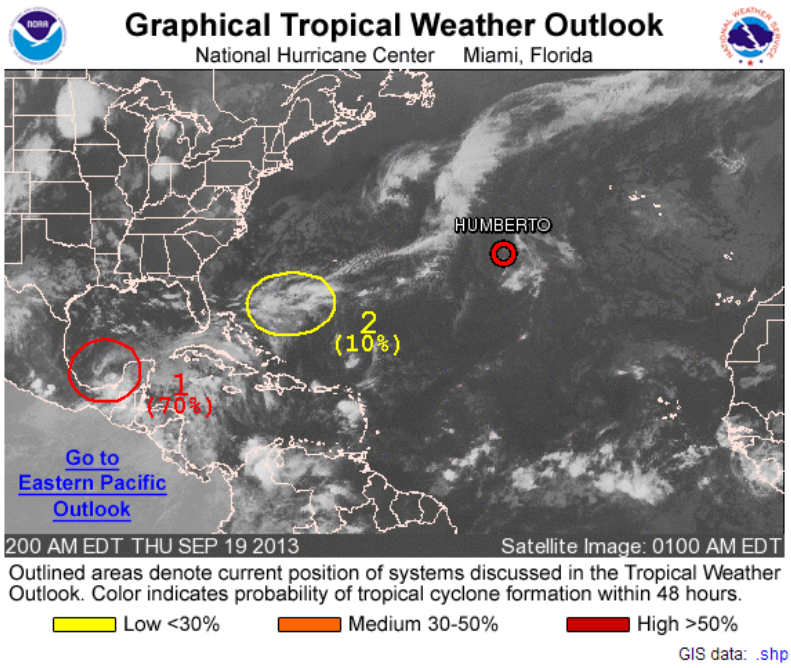
Hurricane and Severe Storm Sentinel (HS3) Mission

HS3 2013.09.19-20 Flight Report: GLOBAL HAWK AV-6 mission to Gulf of Mexico/Invest 95L

Mission Scientists:
Shift 1 (0800-1700 UT): Scott Braun/Pete Black /Pete Colarco
Shift 2 (1600-0100 UT): Deanna Hence/Bob Houze
Shift 3 (0000-0900 UT): Paul Newman/Mike Montgomery/Chris Thorncroft
Shift 4 (0800-1200 UT): Scott Braun/ Pete Black/Pete Colarco

Mission goal: The goal of this flight is to sample environment in Gulf of Mexico around Invest 95L region





The NHC discussion at 0600 UTC is shown below:

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ZCZC MIATWOAT ALL
TTAA00 KNHC DDHHMM

TROPICAL WEATHER OUTLOOK
NWS NATIONAL HURRICANE CENTER MIAMI FL
200 AM EDT THU SEP 19 2013

FOR THE NORTH ATLANTIC...CARIBBEAN SEA AND THE GULF OF MEXICO...

THE NATIONAL HURRICANE CENTER IS ISSUING ADVISORIES ON RECENTLY
DOWNGRADED TROPICAL DEPRESSION HUMBERTO...LOCATED OVER THE EASTERN
ATLANTIC WELL TO THE WEST-SOUTHWEST OF THE AZORES.

1. A LOW PRESSURE SYSTEM LOCATED OVER THE SOUTHWESTERN GULF OF MEXICO
IS PRODUCING DISORGANIZED SHOWER AND THUNDERSTORM ACTIVITY.
CONDITIONS STILL APPEAR CONDUCIVE FOR THE FORMATION OF A TROPICAL
DEPRESSION DURING THE NEXT DAY OR TWO...AND AN AIR FORCE RESERVE
HURRICANE HUNTER PLANE IS SCHEDULED TO INVESTIGATE THE LOW THIS
AFTERNOON...IF NECESSARY.  THIS SYSTEM HAS A HIGH CHANCE...70
PERCENT...OF BECOMING A TROPICAL CYCLONE DURING THE NEXT 48 HOURS
WHILE IT MOVES WEST-NORTHWESTWARD AT ABOUT 5 MPH...AND A HIGH
CHANCE...80 PERCENT...OF BECOMING A TROPICAL CYCLONE DURING THE
NEXT 5 DAYS.  THIS DISTURBANCE WILL LIKELY SPREAD HEAVY RAIN OVER
PORTIONS OF EASTERN AND SOUTHERN MEXICO AND COULD CAUSE LIFE-
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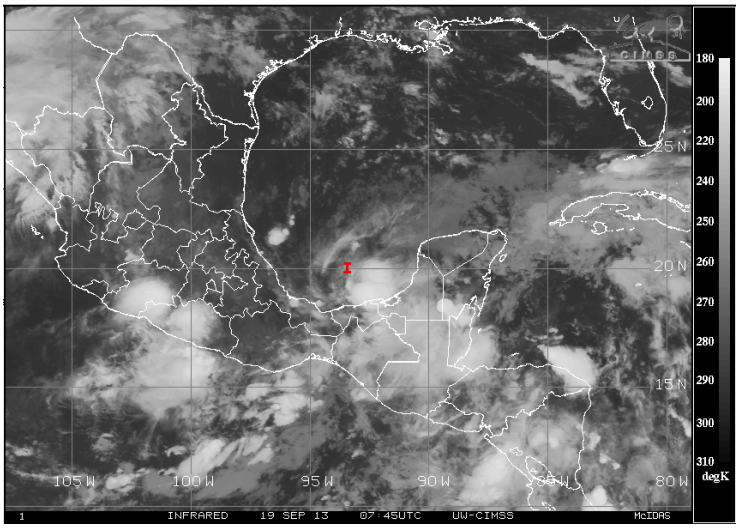
THREATENING FLOODS AND MUDSLIDES OVER AREAS ALREADY IMPACTED BY TORRENTIAL RAIN DURING THE PAST SEVERAL DAYS.

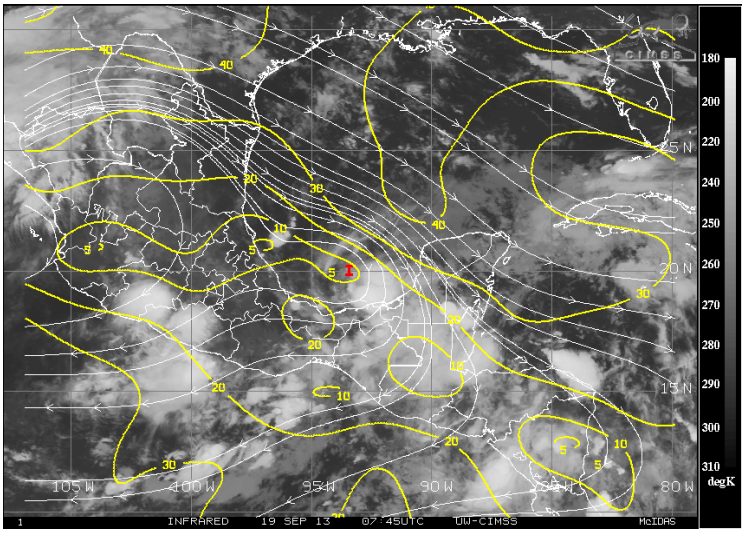
2. CLOUDINESS AND SHOWERS JUST TO THE NORTHEAST OF THE BAHAMAS ARE ASSOCIATED WITH A FRONTAL BOUNDARY AND A SURFACE TROUGH...AND AN AREA OF LOW PRESSURE IS FORECAST TO FORM IN THIS AREA DURING THE NEXT COUPLE OF DAYS. UPPER-LEVEL WINDS DO NOT APPEAR CONDUCIVE FOR SIGNIFICANT TROPICAL DEVELOPMENT...BUT THE LOW COULD STILL ACQUIRE SOME SUBTROPICAL CHARACTERISTICS WHILE IT MOVES GENERALLY NORTHEASTWARD OVER THE WESTERN ATLANTIC THROUGH EARLY NEXT WEEK. THIS SYSTEM HAS A LOW CHANCE...10 PERCENT...OF BECOMING A SUBTROPICAL CYCLONE DURING THE NEXT 48 HOURS AND A LOW CHANCE...20 PERCENT...OF BECOMING A SUBTROPICAL CYCLONE DURING THE NEXT 5 DAYS.

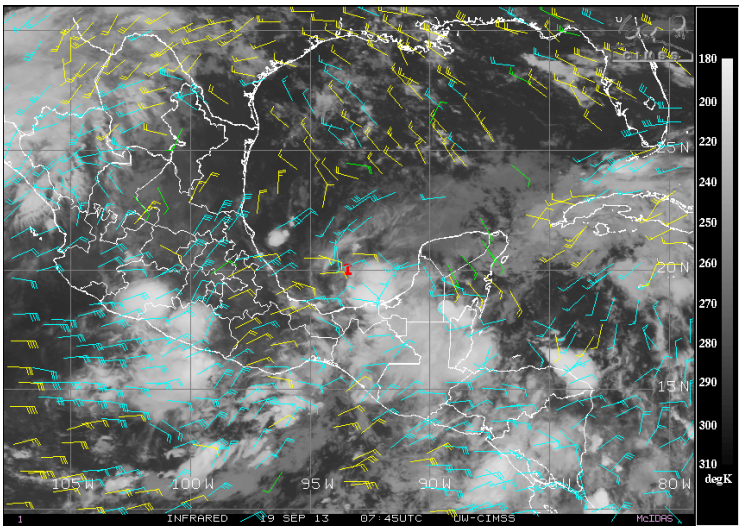
FIVE-DAY FORMATION PROBABILITIES ARE EXPERIMENTAL IN 2013. COMMENTS ON THE EXPERIMENTAL FORECASTS CAN BE PROVIDED AT...

HTTP://WWW.NWS.NOAA.GOV/SURVEY/NWS-SURVEY.PHP?CODE=ETWO

FORECASTER BERG







0934 Latest GOES imagery from CIMSS showing our Invest 95L. Light upper levels winds and system is in a relatively low shear environment in south of gulf, higher shear to north if it tracks that way could tear apart.

0949 Engines started

1015 Recycling power to bring up MCTS

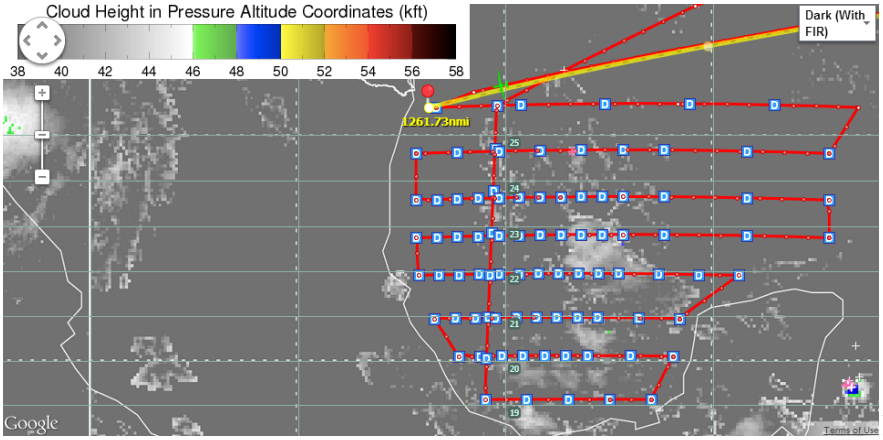
1129 Aircraft is ready to go! But the tower does not have the flight plan, got lost somewhere along the way, so we're delayed while it is refiled.

1203 We finally have clearance!

1210 Takeoff.

1441 Turning west over Florida.

1534 Trouble shooting some KU issues, otherwise about the hand-off from GHOC-E to GHOC



1717 flight track and satellite image

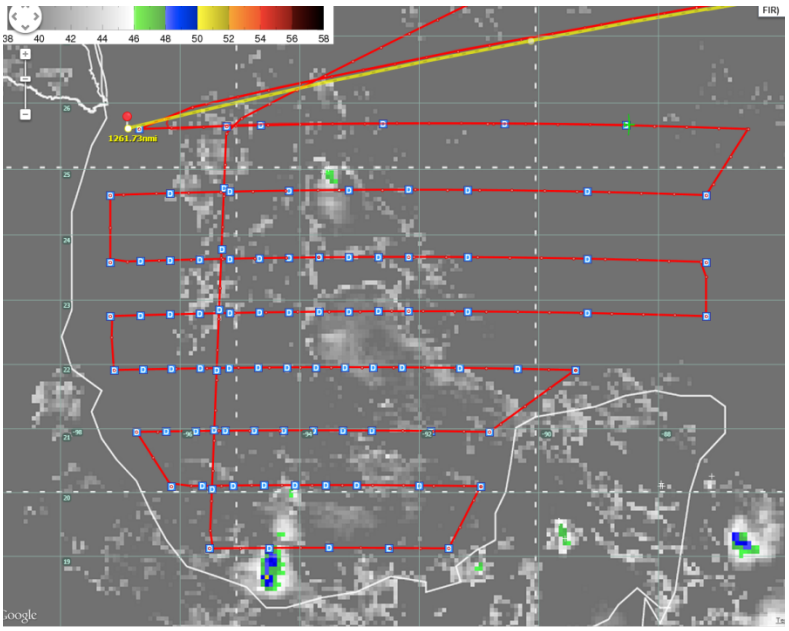
D01 1729

D02 1742

D03 1802

D04 1822

D05 1842

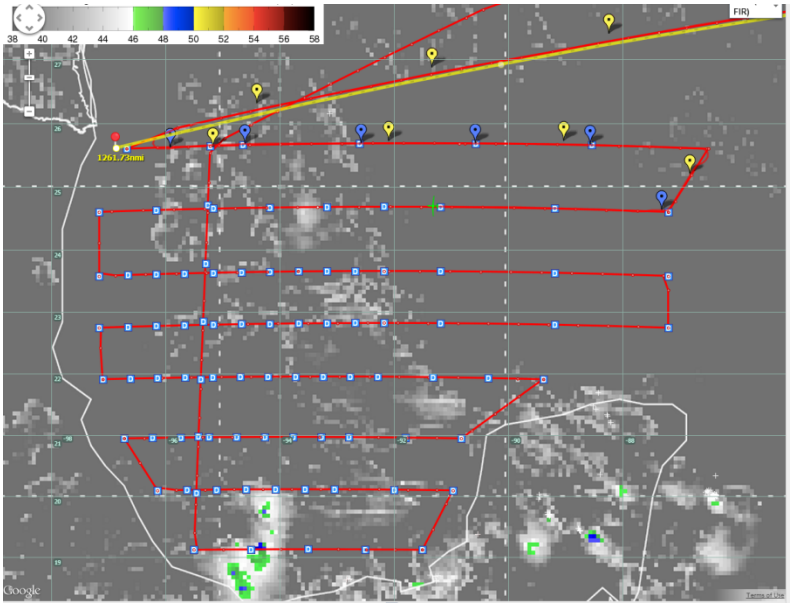


1842 (above

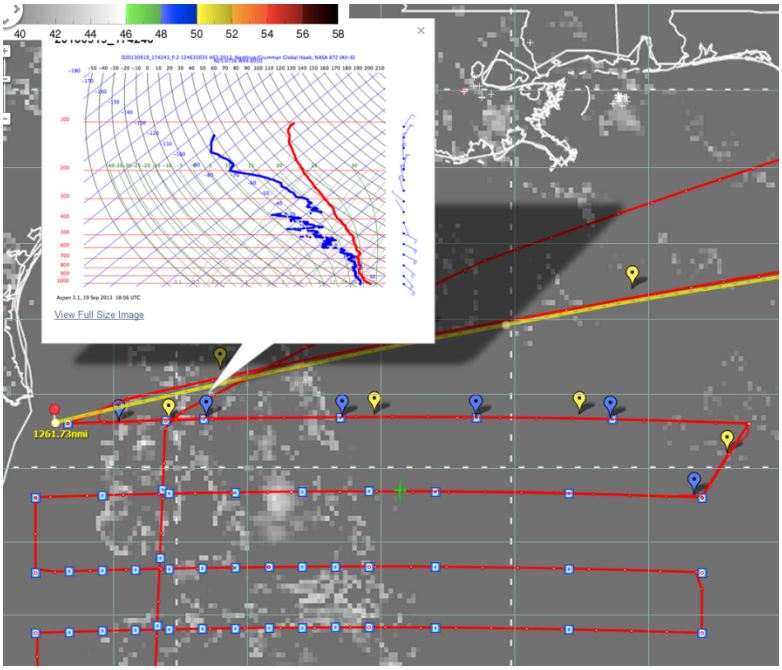
D06 1916, data questionable at first, but then designated to be ok.

D07 1936

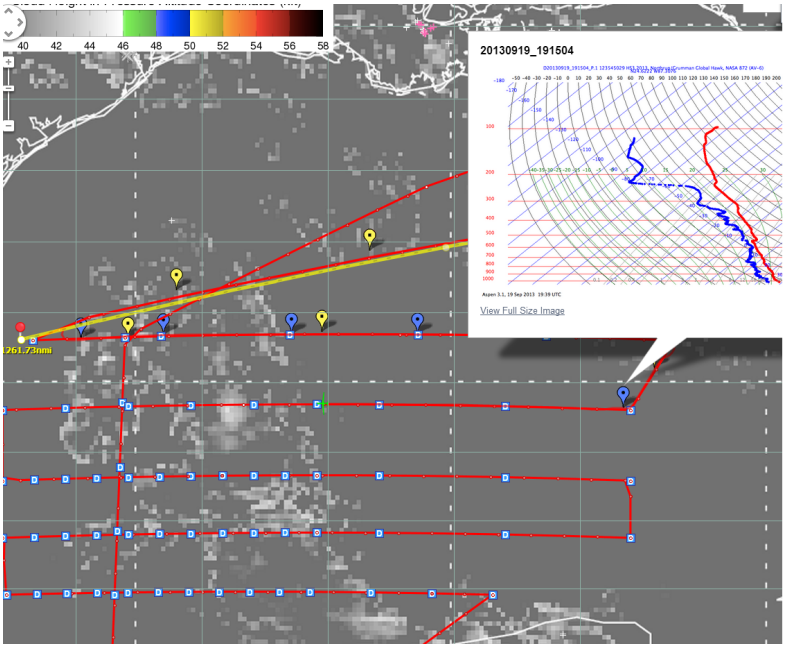
D08 1951



1953 (above)



Sounding NW quadrant (above)



Sounding NE quadrant (above)

D09 2000

D10 2009

D11 2019

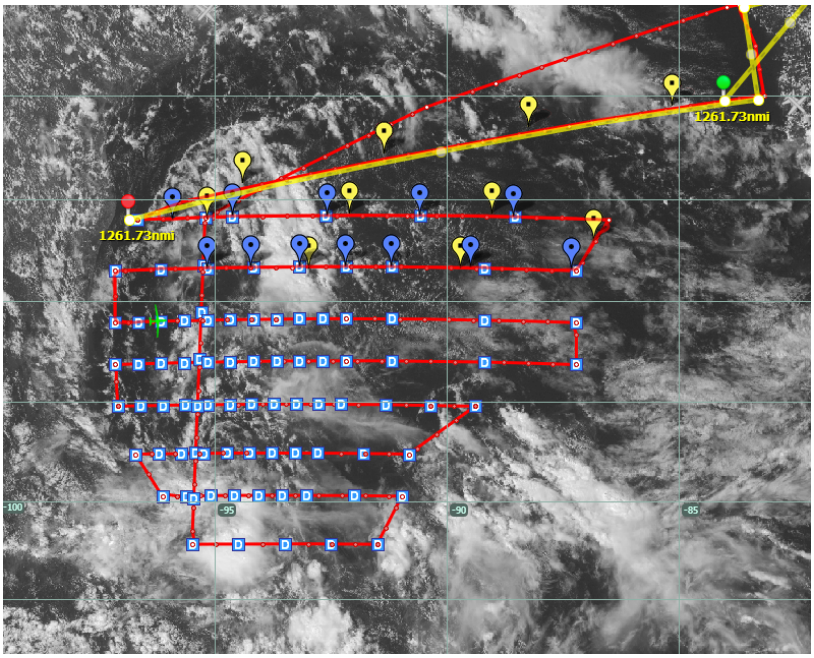
D12 2029

D13 2039

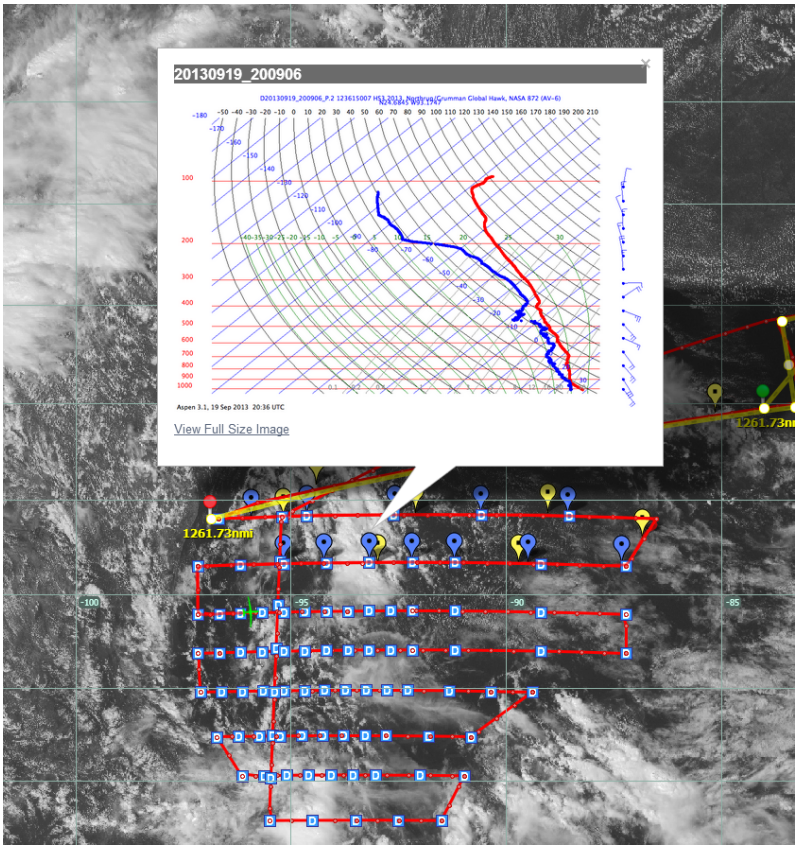
D14 2048

D15 2059

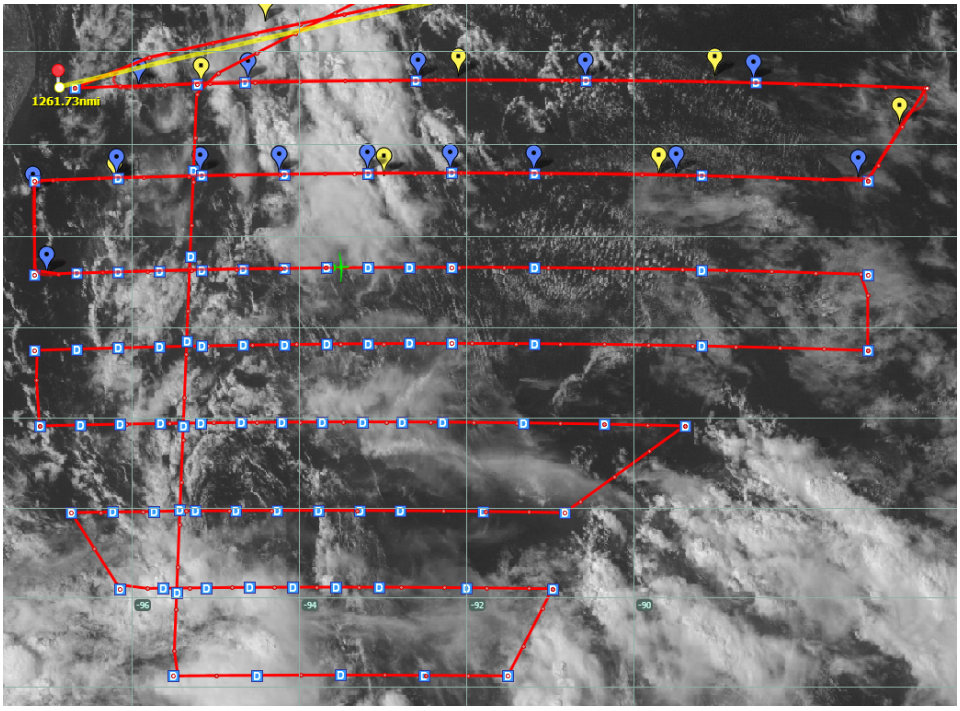
D16 2102



2106 (above)

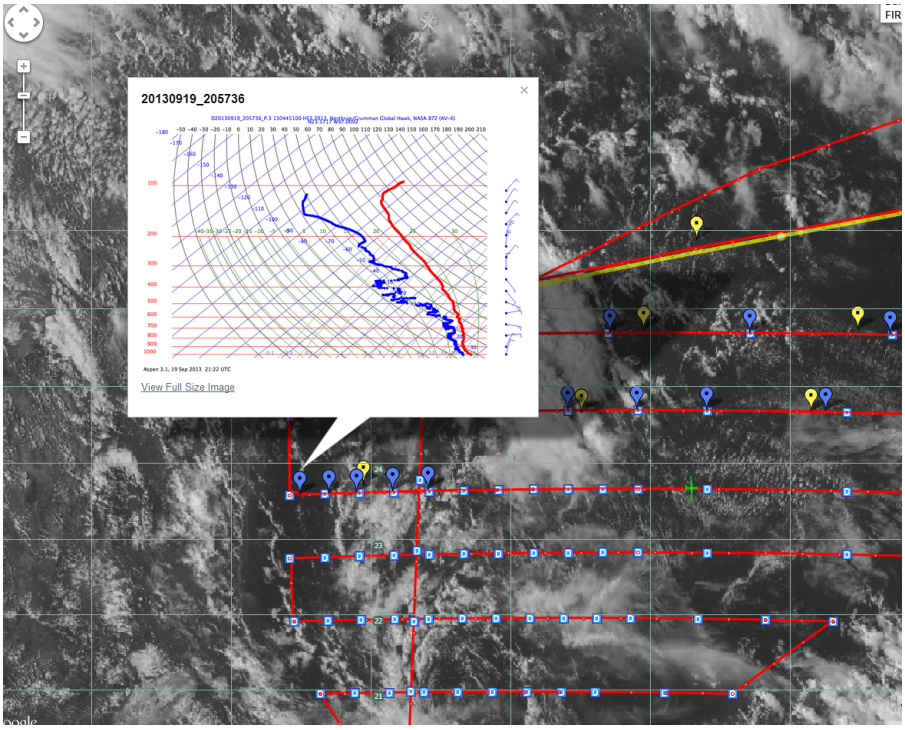


2111 (above)

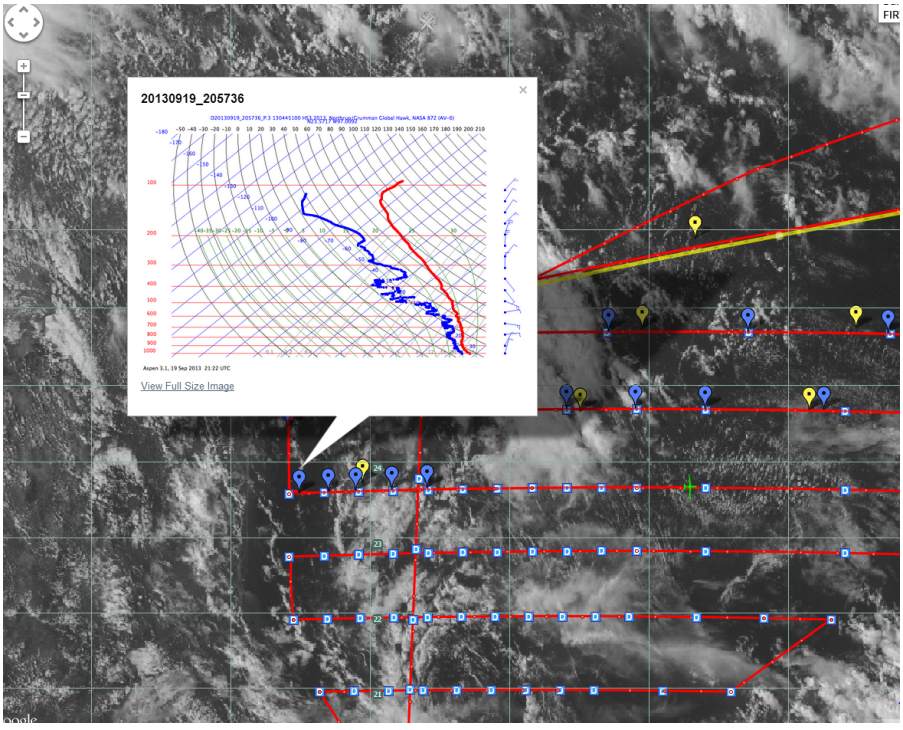


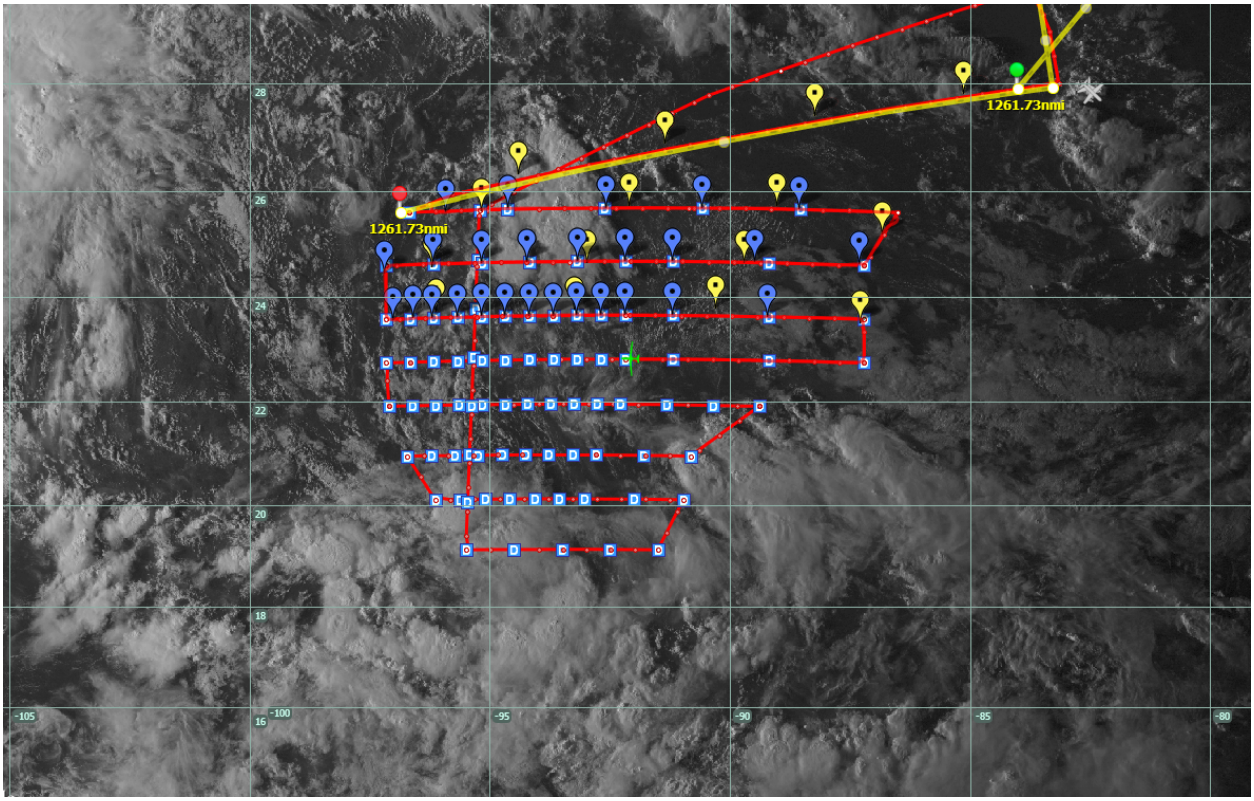
2135 (above)

Sonde @ D16 - Good release, good data21:02:21
Sonde @ D17 - Good release, good data21:06:37
Sonde @ D18 - Good release, good data21:12:11
Sonde @ D19 - Good release, good data21:17:30
Sonde @ D20 - Good release, good data21:22:55
Sonde @ D21 - Good release, good data21:28:23
Sonde @ D22 - Good release, good data21:33:36


20130919_205736
View Full Size Image

(above)


20130919_205736
View Full Size Image



2332 (above)

Sonde @ D23 - Good release, good data21:38:43
Sonde @ D24 - Good release, good data21:43:49
Sonde @ D25 - Good release, good data21:48:59
Sonde @ D26 - Good release, good data21:59:33
Sonde @ D27 - Good release, good data22:18:39
Sonde @ D28 - Good release, good data 2239
Sonde @ D29 - also good, good. 2247
Sonde @ D30 - Good release, good data. 2305
Sonde @ D31, good release, good data 2323
Sonde @ D32, good release, good data 2333

9.05pm EDT Chris Thorncroft joining Paul Neumann as Mission Scientist

Sonde @ D33, good releas, good data 2337

Sonde @ D34. good release, good data 2342

Sonde @ D35. Good release, good data 2346

Sonde @ D36, good release, good data 2351

Sonde @ D37, good release, good data 2356

Sonde @ D38, good release, good data 0000

Sonde @ D39. Good release, good data 0005

Sonde @ D40, good release, good data 0009

Sonde @ D41, good release, good data 0014

Sonde @ D42, good release, good data 0020

Sonde @ D43, good release, good data 0028

Sonde @ D44, good release, good data 0032

Sonde @ D45, good release, good data 0037

D46. D47 and D48 were skipped due to ATC

Sonde @ D49, good release, good data 0057

Tracking back to drop in planned locations

Sonde @ D48 , good release , good data 0107

Sonde @ D47, good release, good data 0112

Sonde @ D50, good release, good data 0131

21.30EDT Need to revise drop plan to shave off 50 minutes off flight time due to tracking back. Pilots currently estimate landing time to be 07:50am

First step is to remove drops D55 and D56, fly between D54 and D57

Pilot says this saves 22 minutes

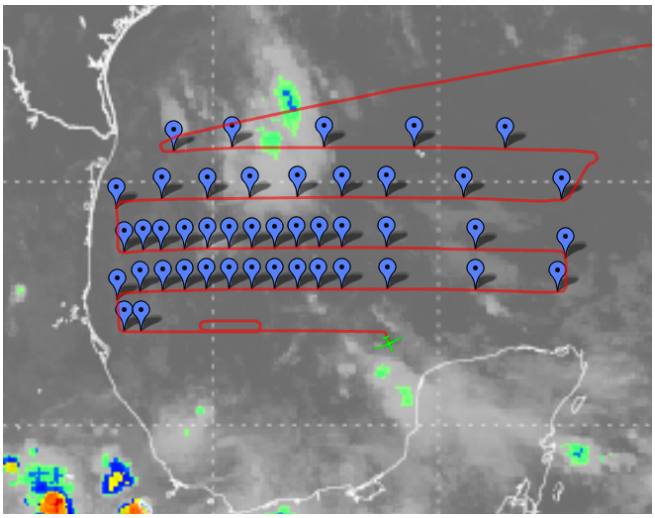
Sonde @ D51, good release, good data 0136

Sonde @ D52, good release, good data 0141

Sonde @ D53, good release, good data 0146

Sonde @ D54, good release, good data 0156

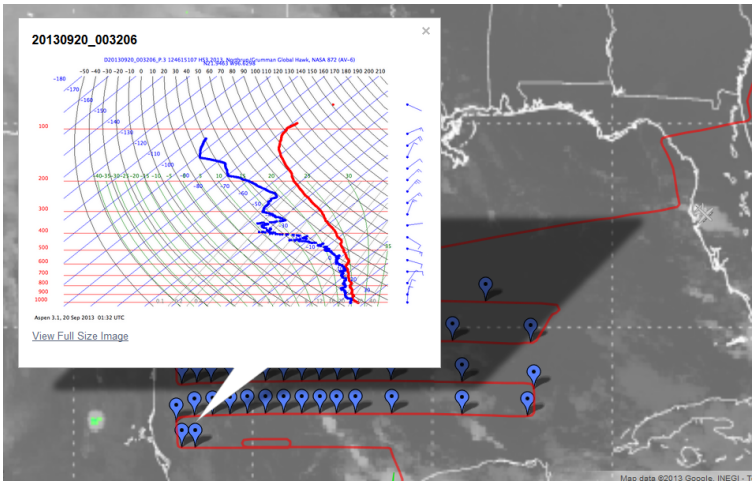
22:03EDT – plane doing a turn heading for the convection off the Yucatan coast



Sonde @ D57 good release, good data 0206

Sonde @ D58, delayed due to ATC

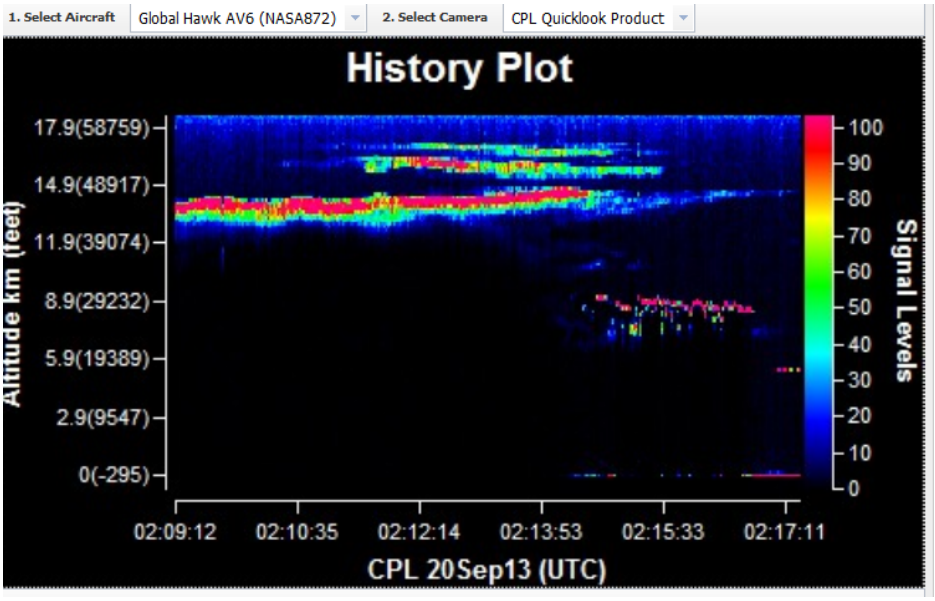
Moist cloud layer on the western side of the system, up to about 600hPa



22:14EDT Concern about losing the whole leg due to ATC! (In the end, only one drop missed.)

22:21EDT @ D58 will be dropped late

CPL plot shows Cirrus - up to 17km!



Sonde @ D58 Good release, good data 0222

Plan to cancel D76 drop and fly south from D75 and drop D77 on reaching that leg (west of original position). This will shave some more time off the flight. Pilot expects this to save another 20 mins.

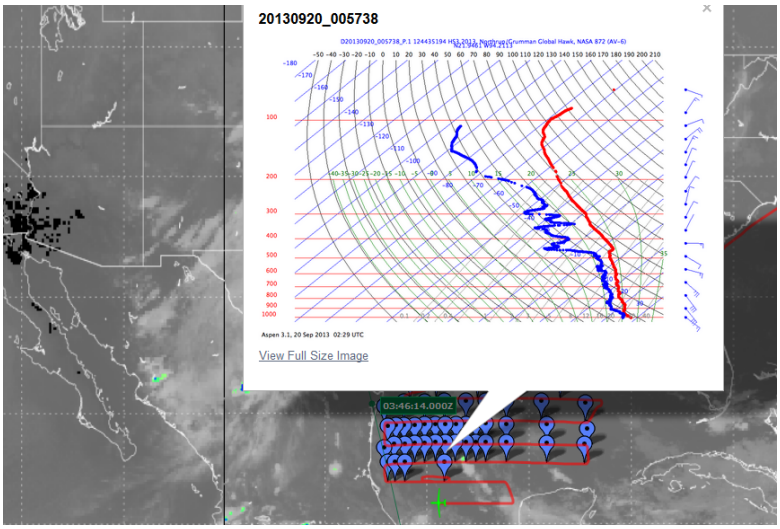
Sonde @ D59 Good release, good data, 0226

Sonde @ D60 Good release, good data, 0231

Sonde @ D61 good release, good data, 0235

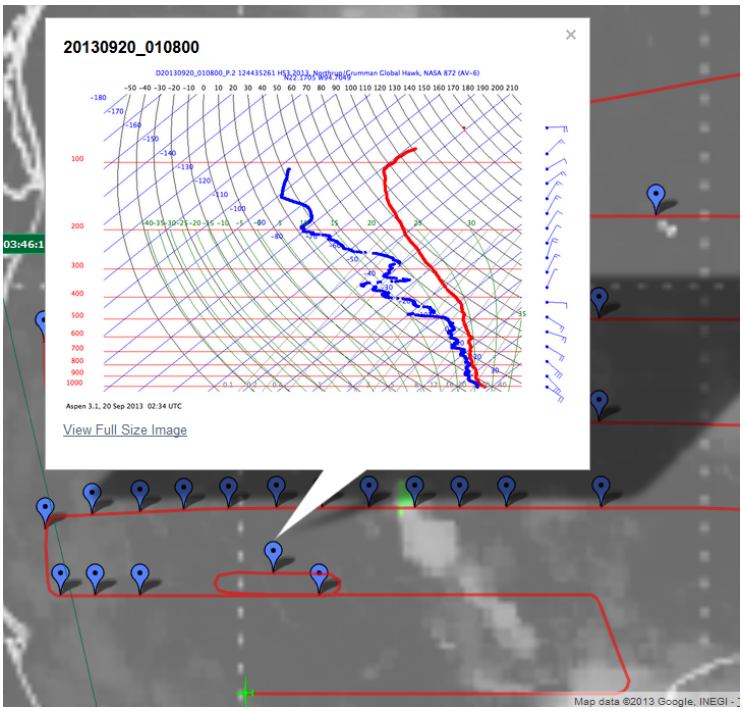
Sonde @ D62 good release, good data, 0240

Sonde below has 15 knots at sfc , 30 knots at 900hP and 850hPa



Sonde @ D63 good release, good data, 0244

Sonde below has 20knots at the sfc!, moist upto 500mb

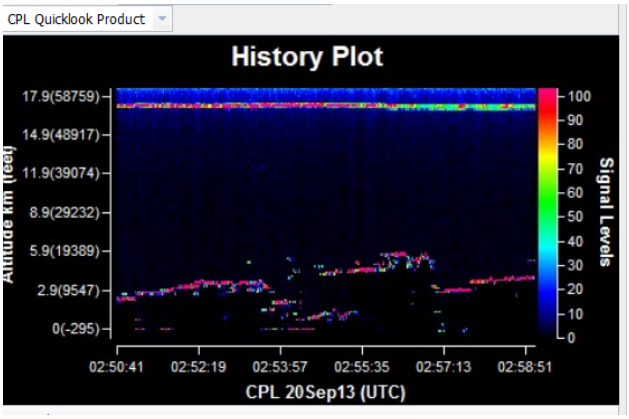


Sonde @ D64 good release, good data, 0249

Sonde @ D65 good release, good data, 0254

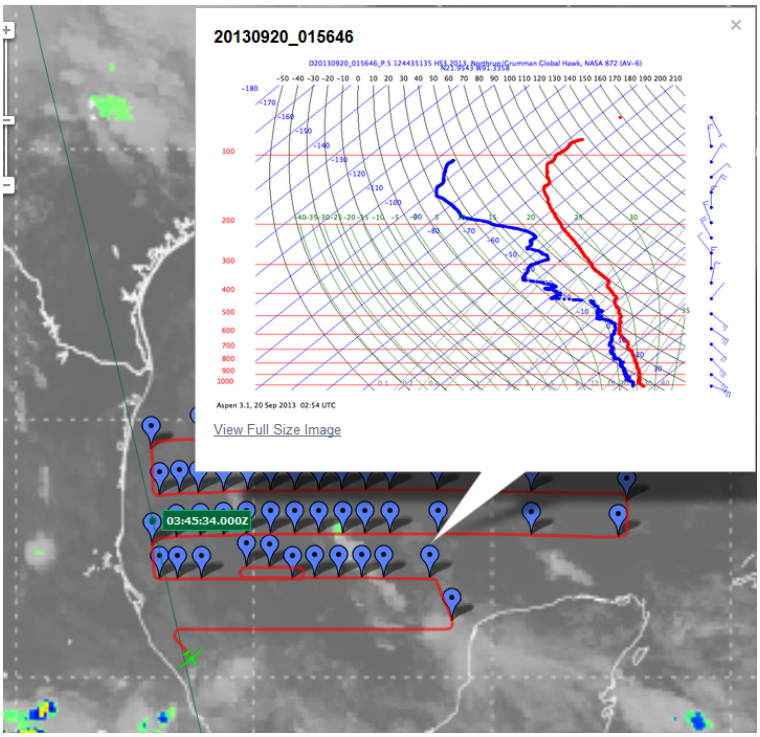
Sonde @ D66 good release, good data, 0259

More very high cirrus:



Sonde @ D67, good release, good data, 0305

25knot SE flow at 900mb in sounding below:



Sonde @ D68, good release, good data, 0314

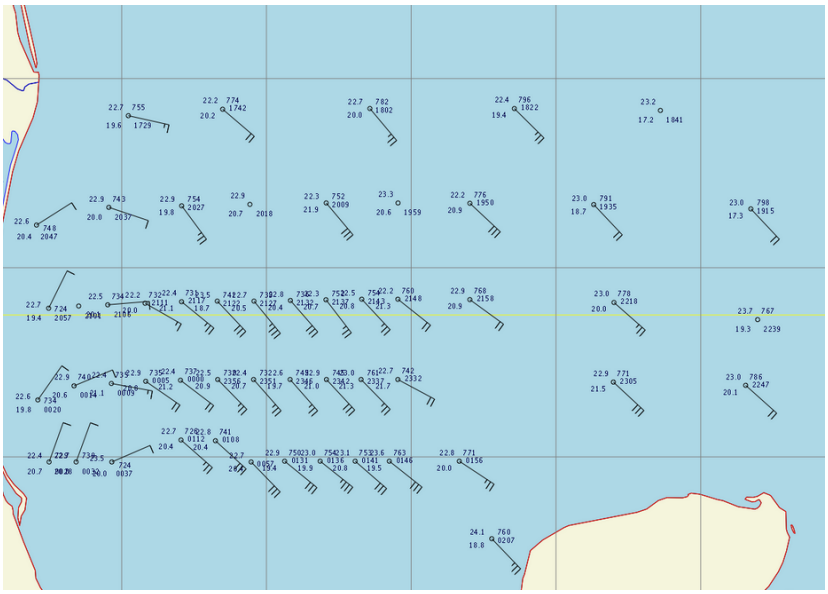
Sonde @ D69, good release, good data, 0319

Sonde @ D70, good release, good data, 0324

Sonde @ D71, good release, good data, 0330

Sonde @ D72, good release, good data, 03335

925mb winds:



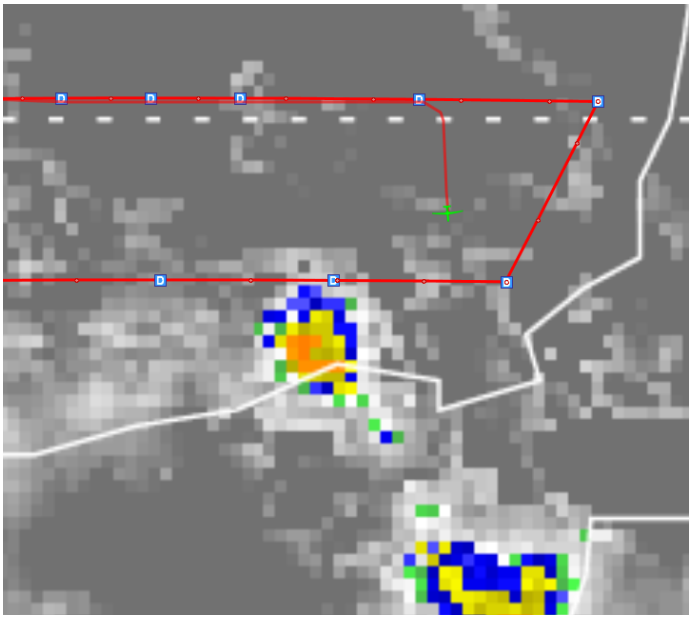
Based on 925mb winds , longitude of low level center is around 94.7W based on 22N drops

Sonde @ D73, good release, good data, 0340

Sonde @ D74, good release, good data, 0346

Sonde @ D75, good release, good data, 0357

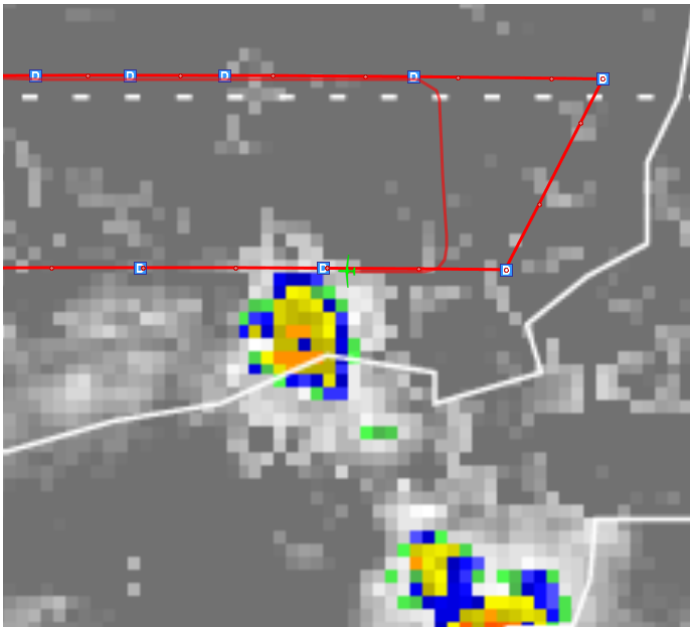
00005EDT Monitoring some developing convection south of the lower track:; image taken as 0345Z:



Sonde @ D76 skipped as planned

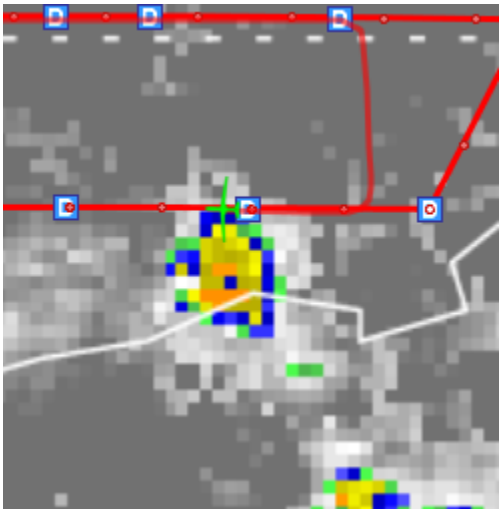
Sonde @ D77, good release, good data, 0409

0015EDT: image is 0402UTC (cloud top heights)



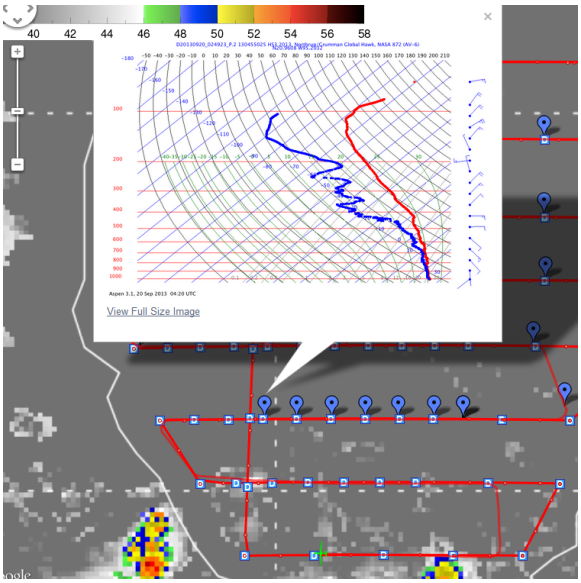
Sonde @ D78, delayed by 1 minute to match up with passage past convection

Sonde @ D78 good release, good data, 0415



Sonde @ D79 good release, good data, 0424

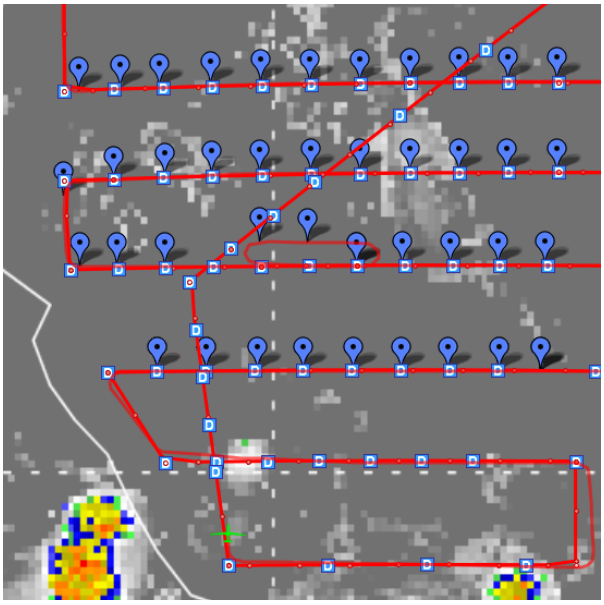
Note weak surface winds for this sonde close to center of circulation



Sonde @ D80 good release, good data 0434

Sonde @ D81 good release, good data

0044EDT starting our poleward track with adjusted track through center of circulation



Sonde @ D81 good release, good data

Sonde @ D82 good release, good data

Sonde @ D83 good release, good data

0501 Sonde @ D84 good release, good data

0506 Sonde @ D85 good release, good data

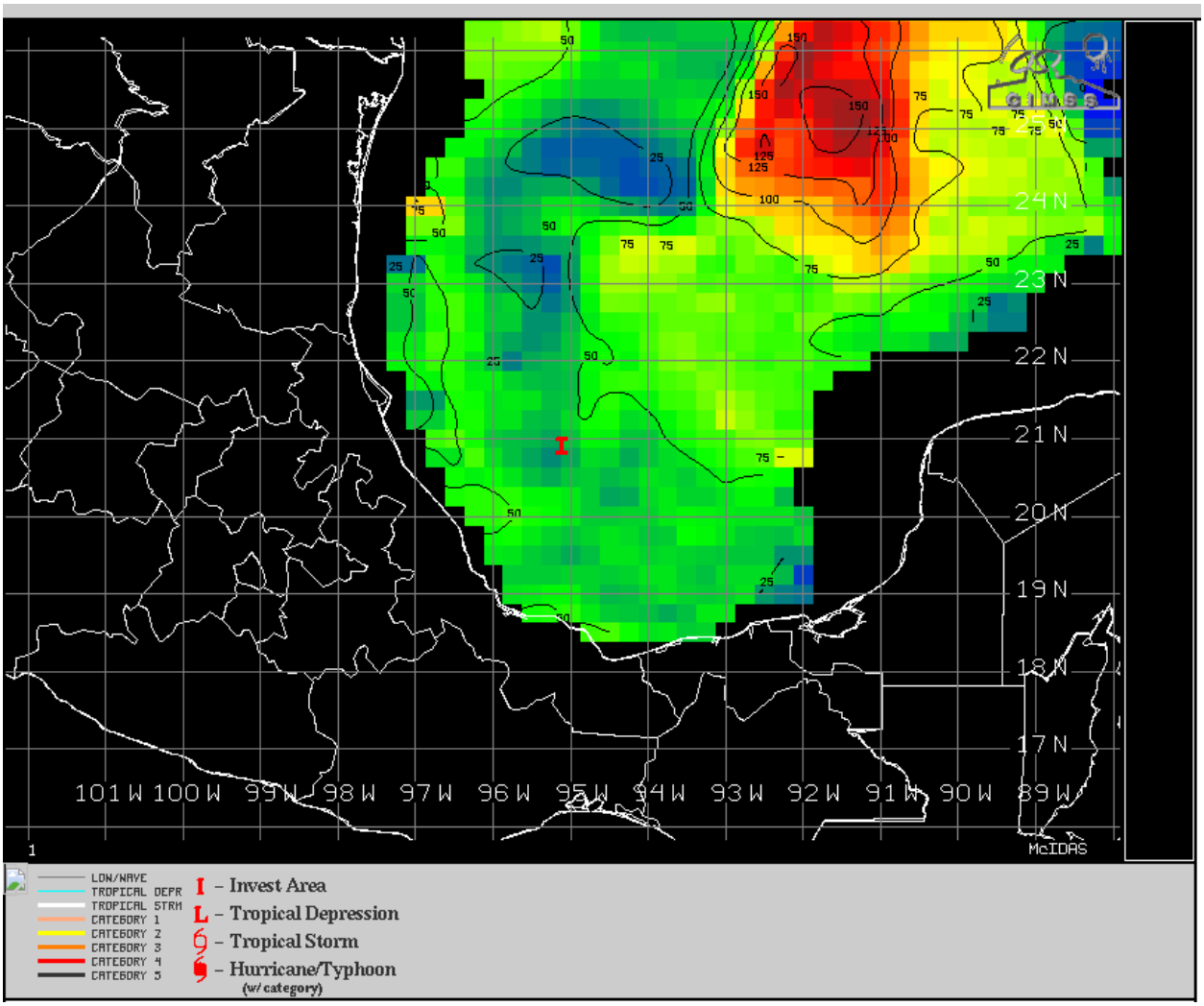
0511 Sonde @ D86 good release, good data

0516 Sonde @ D87 good release, good data

0521 Sonde @ D88 good release, good data

0526 Sonde @ D89 good release, good data

0529 On our way back home.

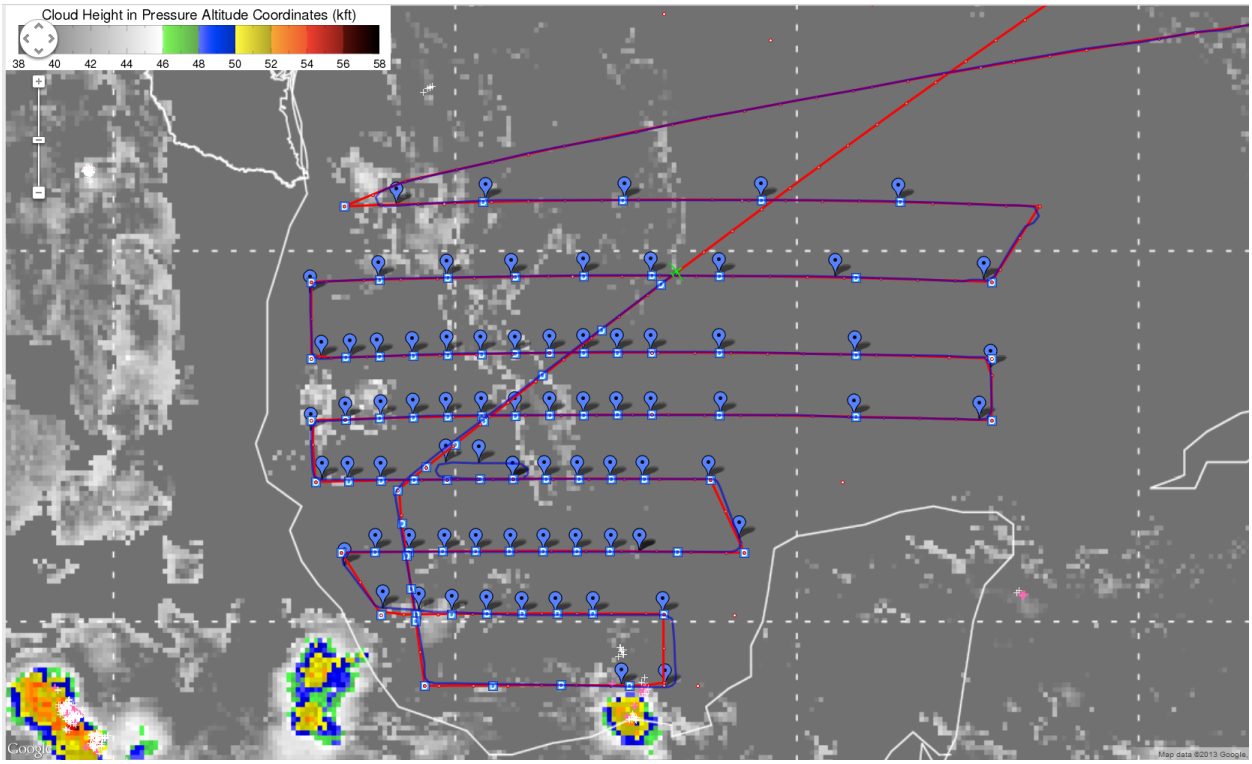


OHC plot for today from the CIMSS web site. Note that OHC is less than 50 KJ cm^{-2}.

0539 Sonde @ D90 good release, good data

0550 Sonde @ D91 good release, good data

0601 Sonde @ D92 good release, good data. Record number of sondes (88) released today.



0607 Last sonde out the tube. Screen shot of CIMSS cloud top altitude at 0532. Virtually no high cloud in the entire Gulf, except for the small system coming off the land in the Bay of Campeche. Profiles are generally moist adiabatic up to about 600 hPa in the majority of the sondes. Visually very little CIN, and some CAPE.

0611 Doesn't look particularly promising for an AV-1 flight on Fri-Sat, but this is the minimum of the diurnal cycle. Very little convection has fired in the Gulf over the course of this evening's flight.

0620 The 0600 NHC tropical Wx discussion downgraded the possibility of this developing into a tropical storm from 50% to 30%. See below:

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TROPICAL WEATHER OUTLOOK
NWS NATIONAL HURRICANE CENTER MIAMI FL
200 AM EDT FRI SEP 20 2013

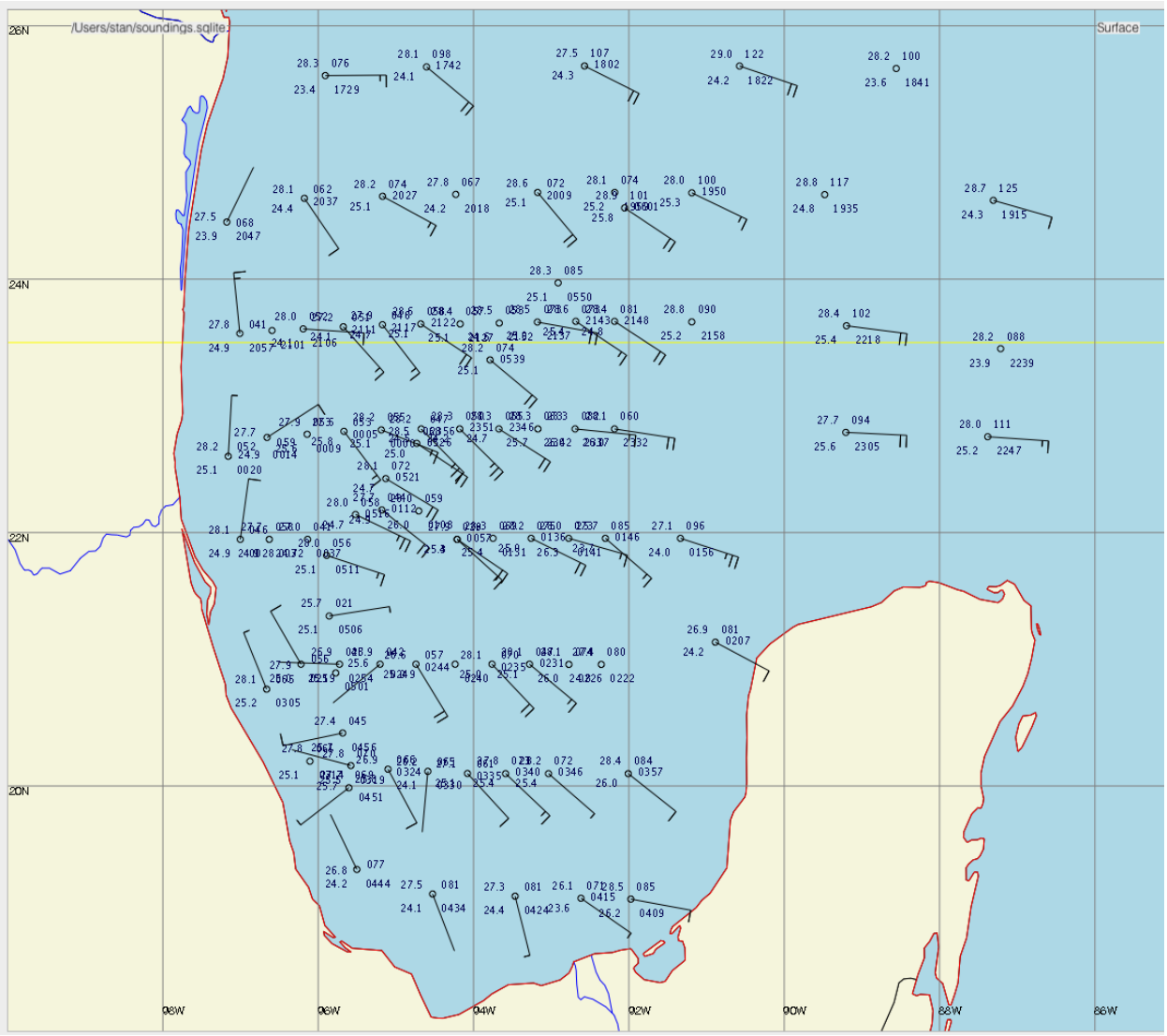
FOR THE NORTH ATLANTIC...CARIBBEAN SEA AND THE GULF OF MEXICO...

1. AN AREA OF LOW PRESSURE LOCATED OVER THE SOUTHWESTERN GULF OF
MEXICO
ABOUT 100 MILES EAST OF TUXPAN MEXICO IS PRODUCING ONLY LIMITED
SHOWER AND THUNDERSTORM ACTIVITY. ENVIRONMENTAL CONDITIONS ARE ONLY
MARGINALLY CONDUCIVE...AND SIGNIFICANT DEVELOPMENT OF THIS SYSTEM
IS BECOMING LESS LIKELY. THIS SYSTEM HAS A MEDIUM CHANCE...30
PERCENT...OF BECOMING A TROPICAL CYCLONE DURING THE NEXT 48 HOURS
```

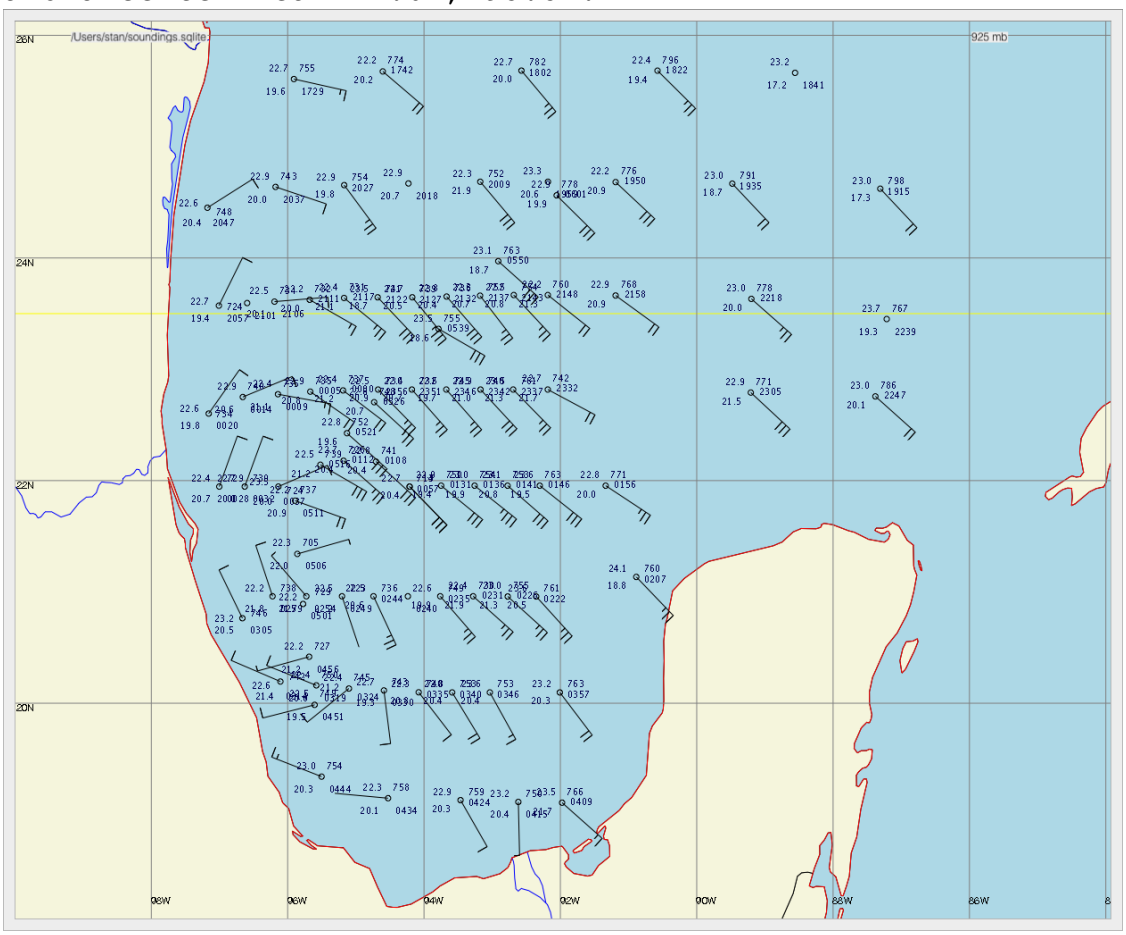
WHILE IT MOVES TOWARD THE WEST-NORTHWEST OR NORTHWEST AT 5 TO 10 MPH...AND A MEDIUM CHANCE...30 PERCENT...OF BECOMING A TROPICAL CYCLONE DURING THE NEXT 5 DAYS. THIS DISTURBANCE WILL CONTINUE TO PRODUCE LOCALLY HEAVY RAINS OVER PORTIONS OF EASTERN AND SOUTHERN MEXICO DURING THE NEXT COUPLE OF DAYS.

0622 Ready for a boring remainder of the flight.

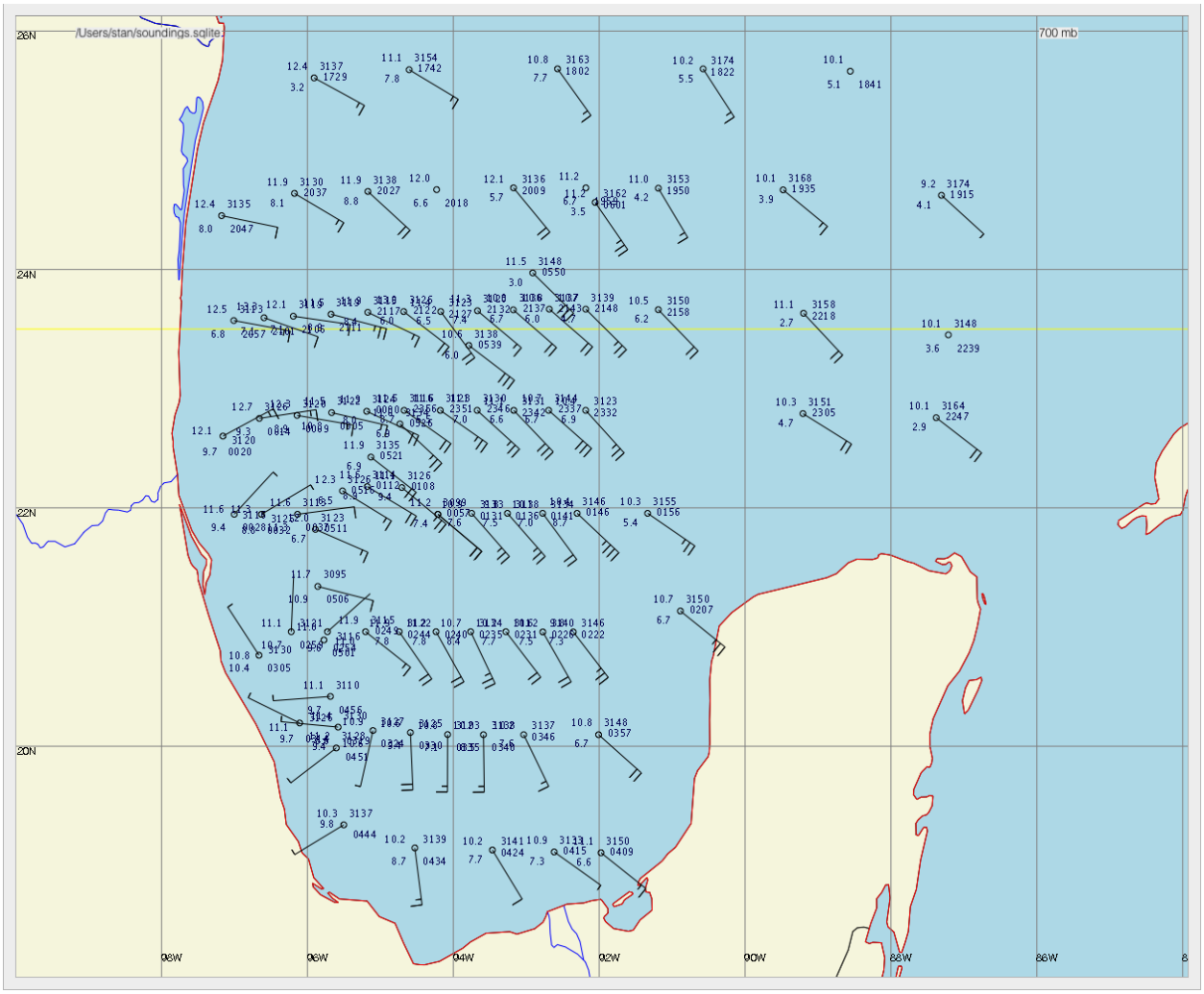
0757 Sondes are all in. Surface map shows the circulation center somewhere around 21.7N, 95.5W. Strong flow from SE in the eastern side of the pattern (as was apparent from the forecasts).



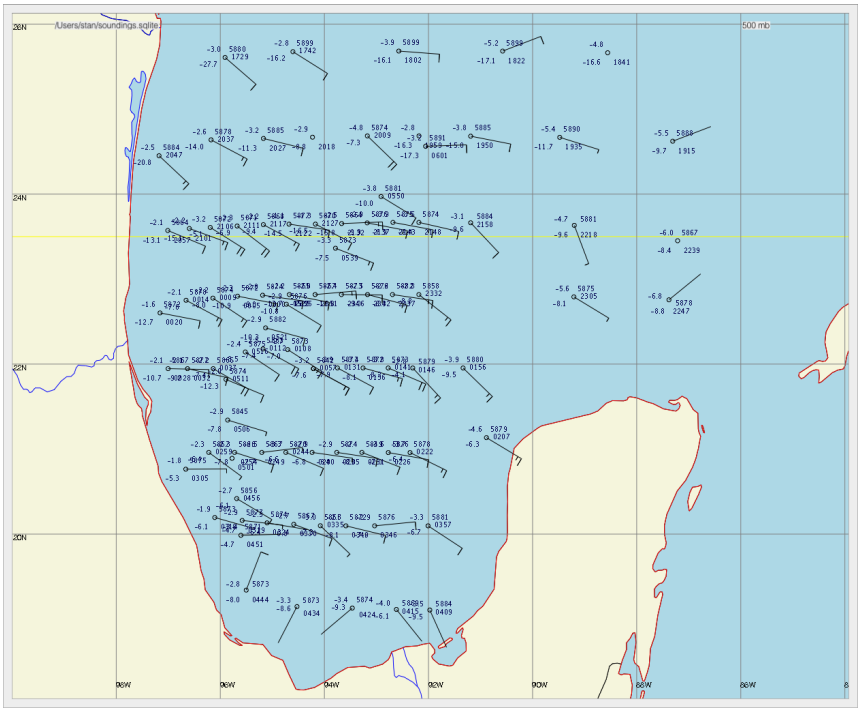
The synoptic map at 925 mb shows a clearer cyclonic circulation with strong southeasterlies along the eastern side of the storm and a center near 21.0N, 95.5W.



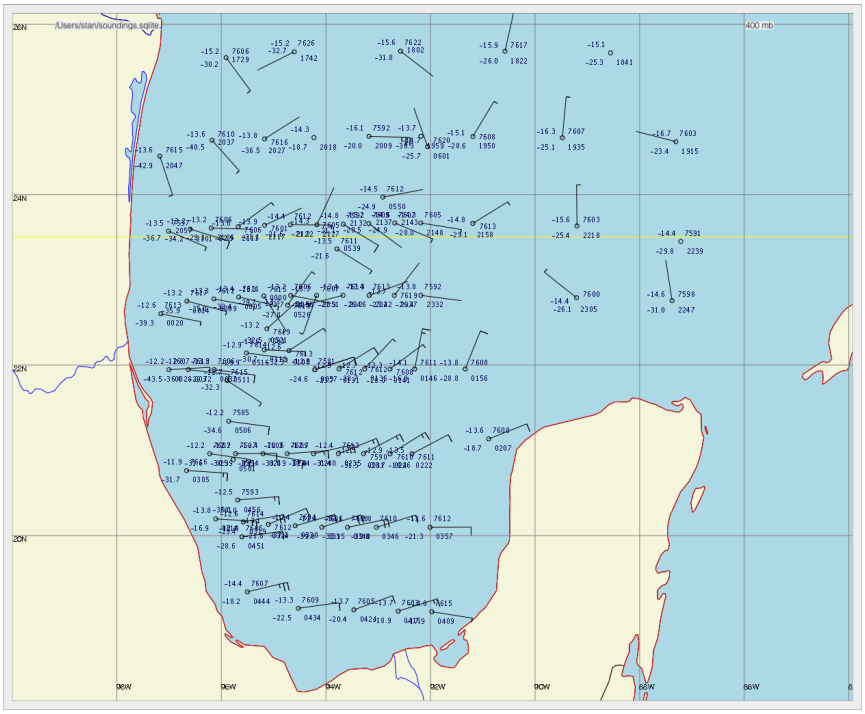
The synoptic chart below shows the 700 mb flow, with strong southeasterlies on the eastern side, turning to the west on the northern side. The center appears to be slightly southward of that at 925 mb.



At 500 mb, the flow is primarily out of the east, effectively capping the vortex below 500 mb.



Weak flow at 400 mb, with easterlies south of 22N, variable winds to the north.

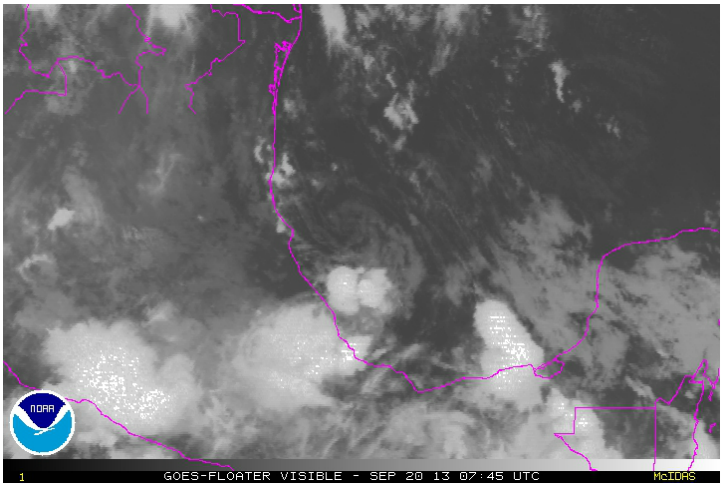


300 mb flow is primarily out of the north.

Similar flow at 250 mb, but with more variable winds south of 21N.

200 mb flow primarily from the north at 22N and northward, but sharp wind shift to westerlies near 21N and then weaker and more variable winds farther southward.

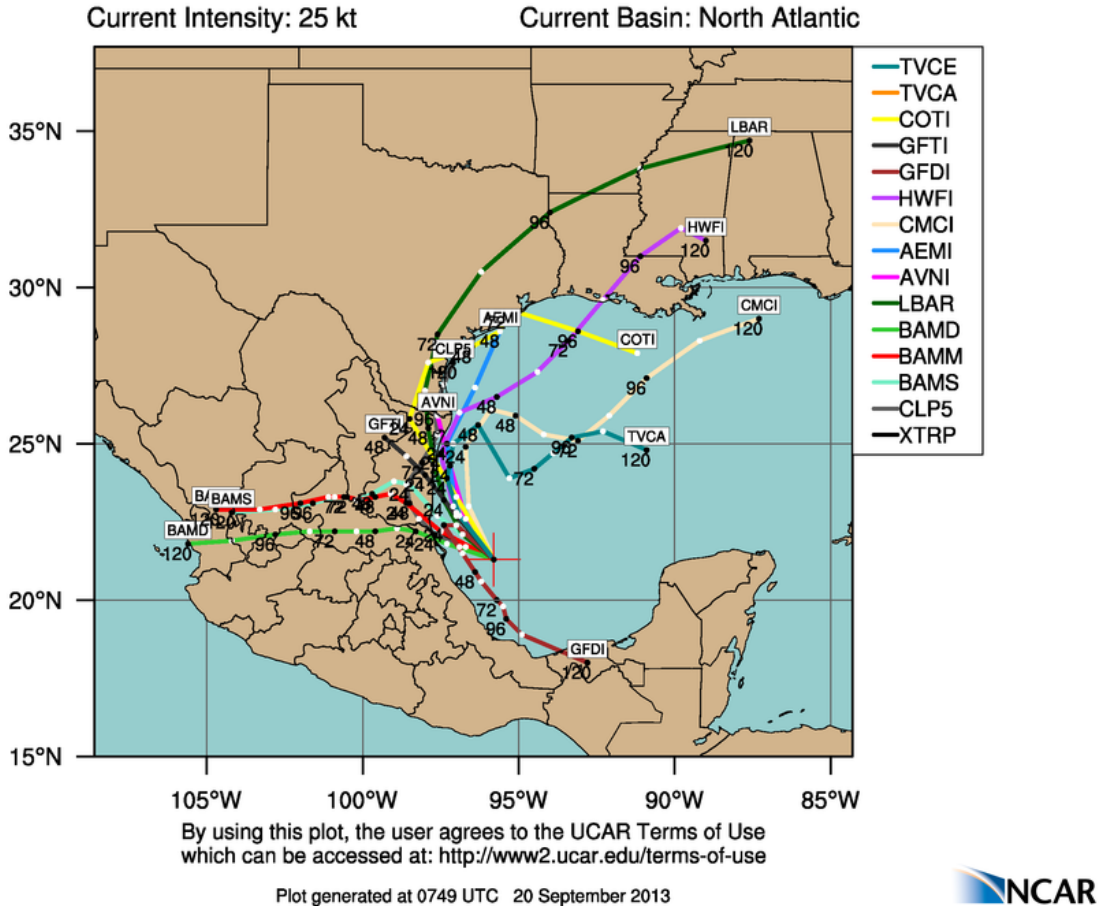
The IR image for 0745 UTC (after we left the pattern) shows some convection building up to the south of the center, but a fair distance from the center.



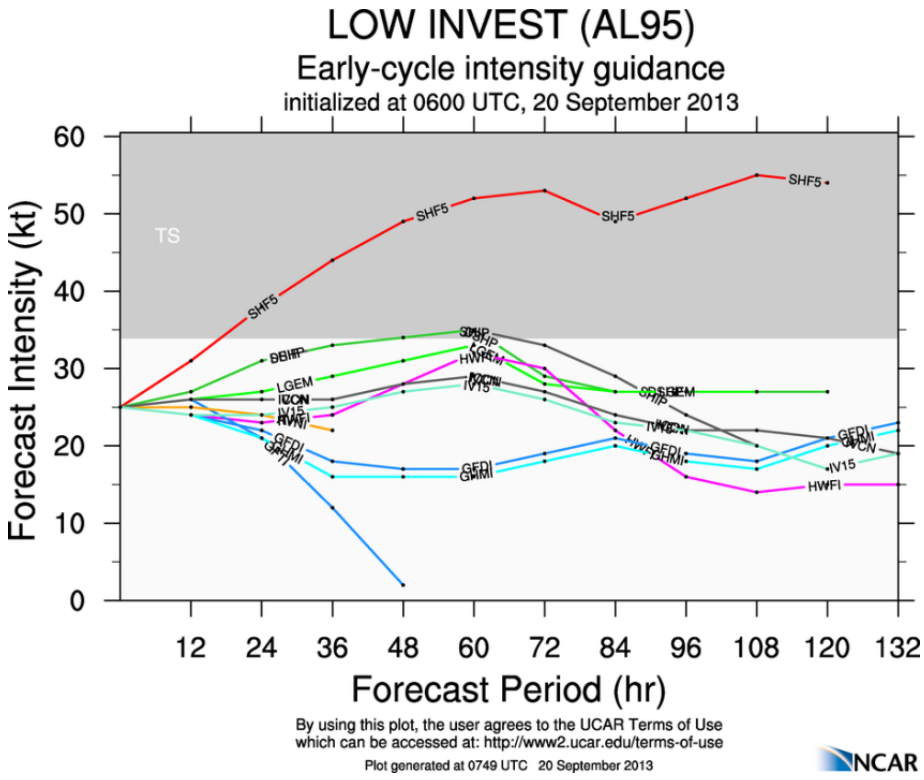
Early track guidance from 0600 UTC suggests that the storm will hug the coast for the next 2-3 days, with a couple of models still suggesting the potential for it to move back into the Gulf.

LOW INVEST (AL95)

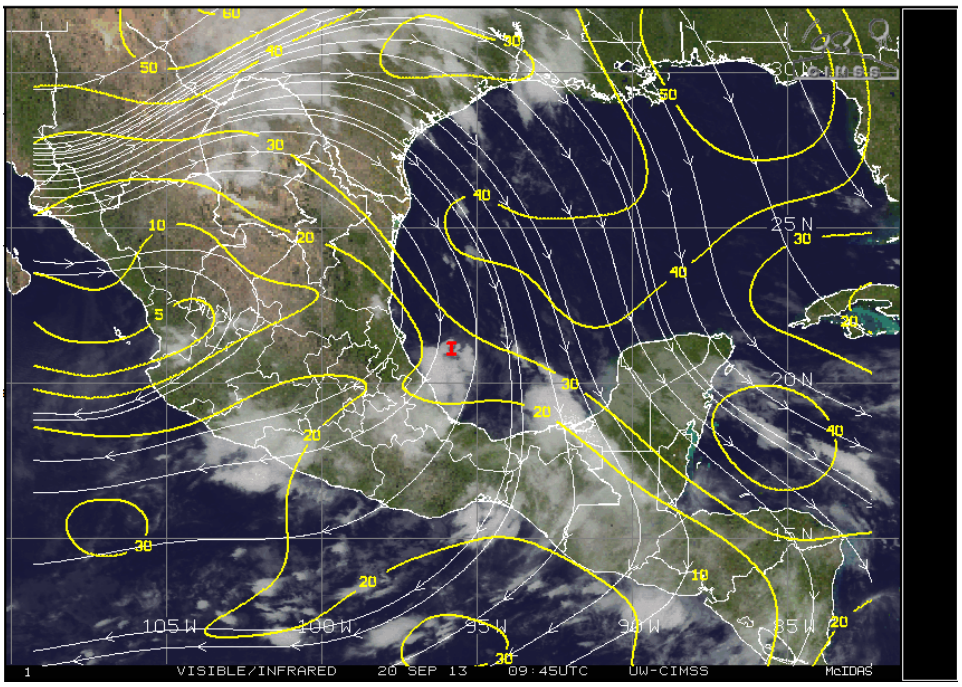
Early-cycle track guidance initialized at 0600 UTC, 20 September 2013



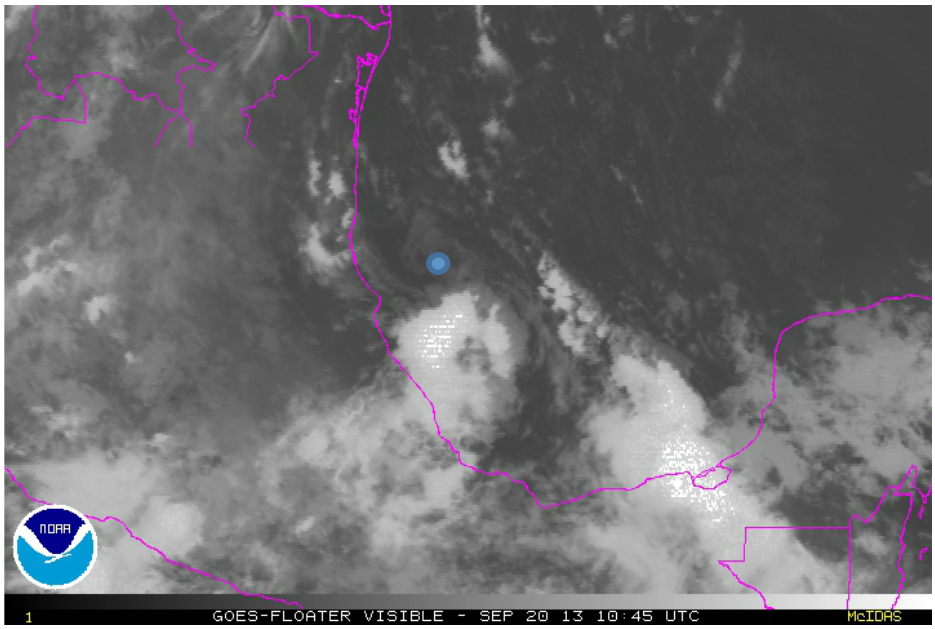
Intensity forecasts mostly keep the system below tropical storm strength through 5 and a half days.



1053 UTC Landing



CIMSS shear product suggests 20-30 kt shear over I95L. The storm would potentially be moving northward into higher shear if the shear pattern remains the same. Current convection is located south of the low-level center (see dot below) suggesting that it is displaced well downshear of the center. Convection is peaking this morning, but may die out later. The NHC gives the system only a 30% chance of development.

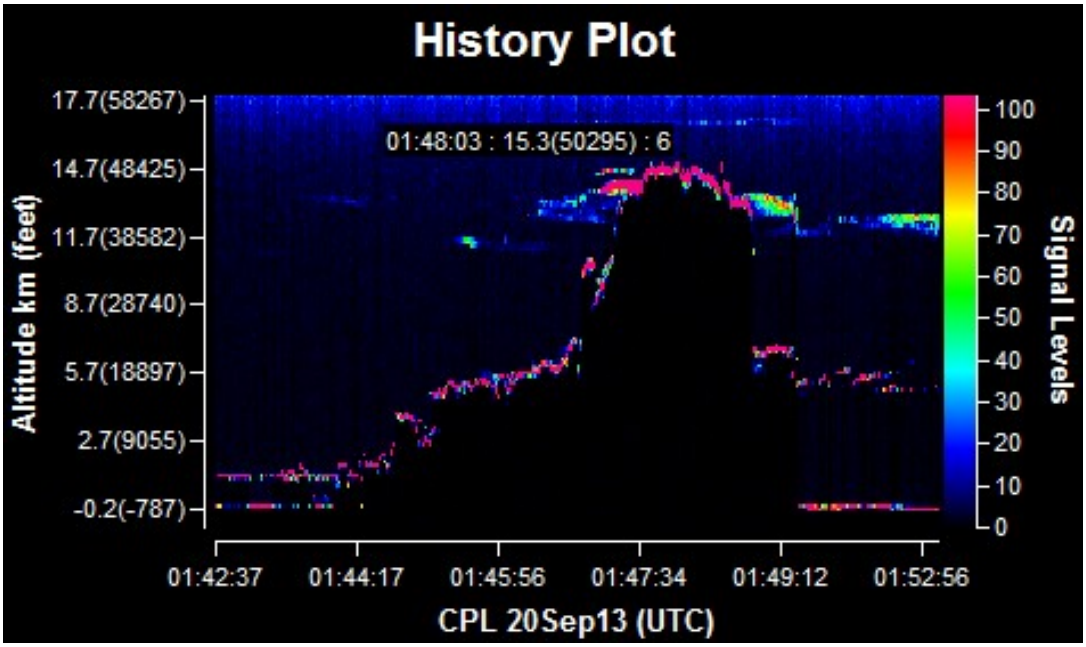


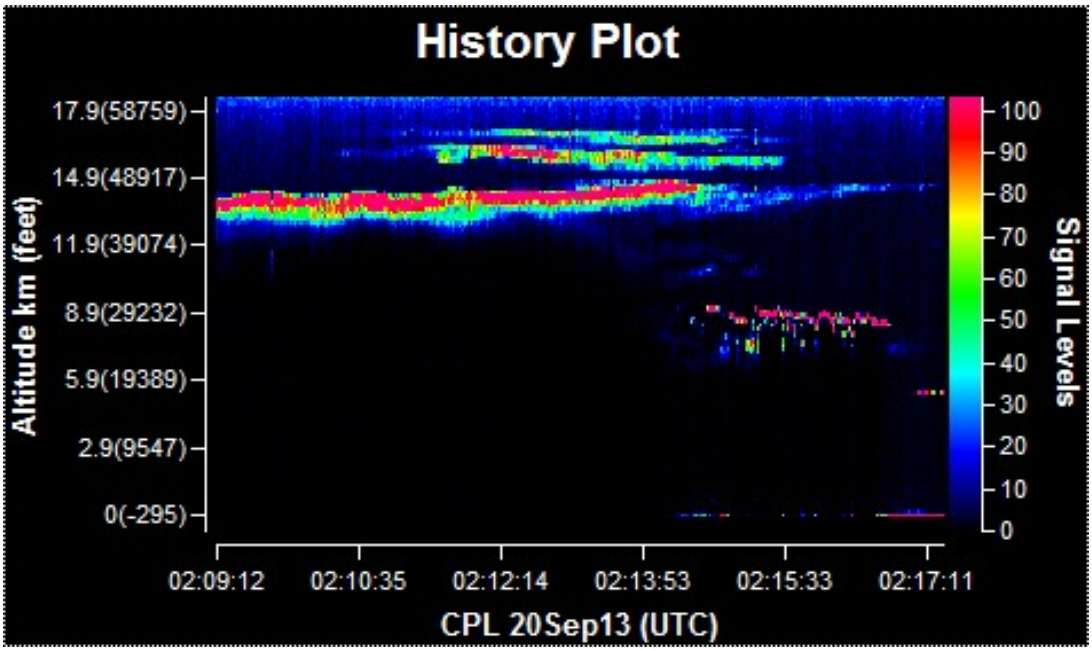
Deep clouds developing south of the low-level vortex, but already weakening by the time of the weather briefing. A decision was made to cancel the follow-on AV-1 flight for lack of a good target.

Instrument reports

CPL

CPL performed nominally during the 19-20Sep13 Science flight. Laser energies, laser 532 signal strength, and temperatures were all very good. We did sense some very high cirrus during sections plus a few overshooting tops. Attached are two real time images: one showing an overshooting top and one showing multiple high cirrus layers.





S-HIS

The S-HIS operated nominally throughout the flight. The Stirling cooler was slow to get to normal operating current after startup, but detector temperature remained stable around 77 K for the duration of the mission.

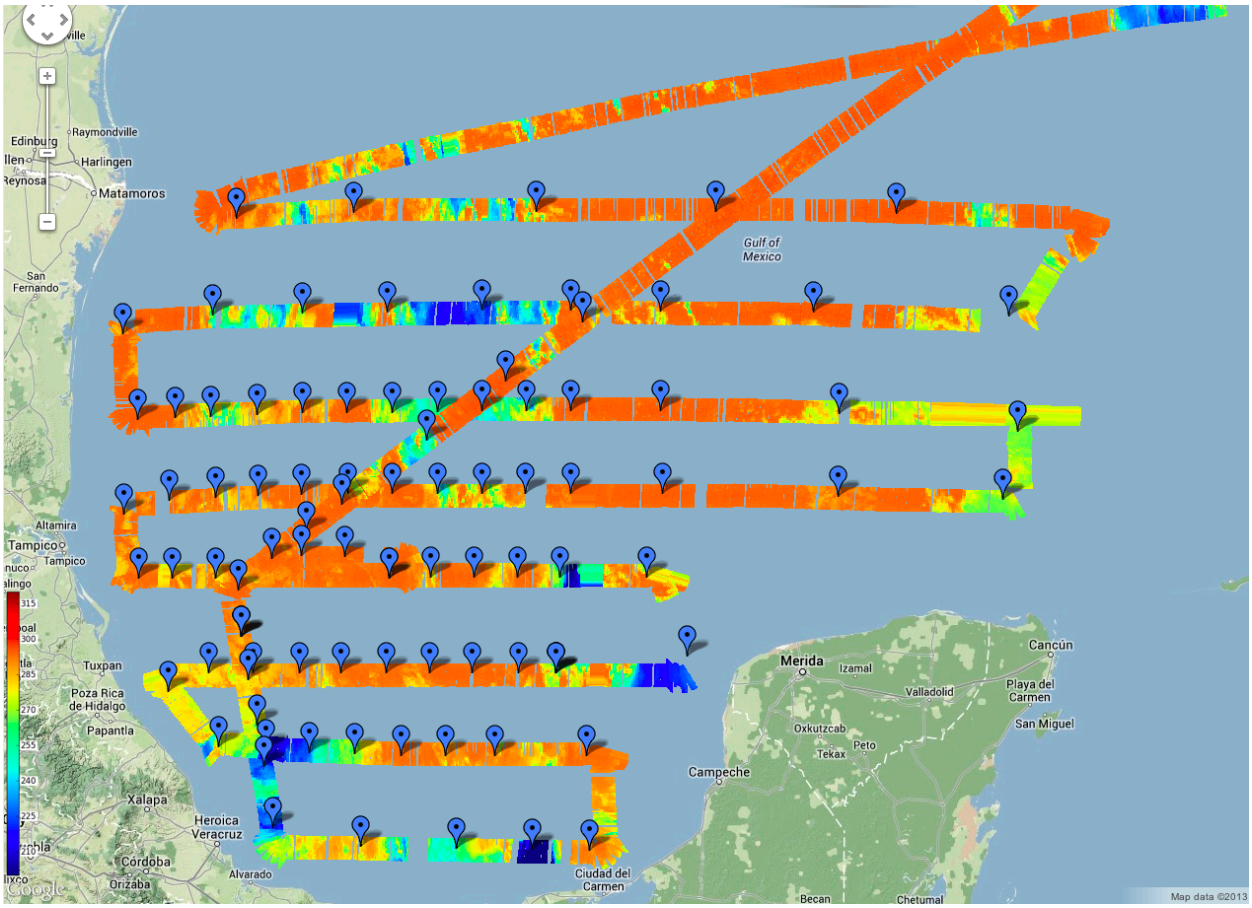


Figure 1. Scanning-HIS real-time longwave window brightness temperature observations and dropsonde locations (blue markers).

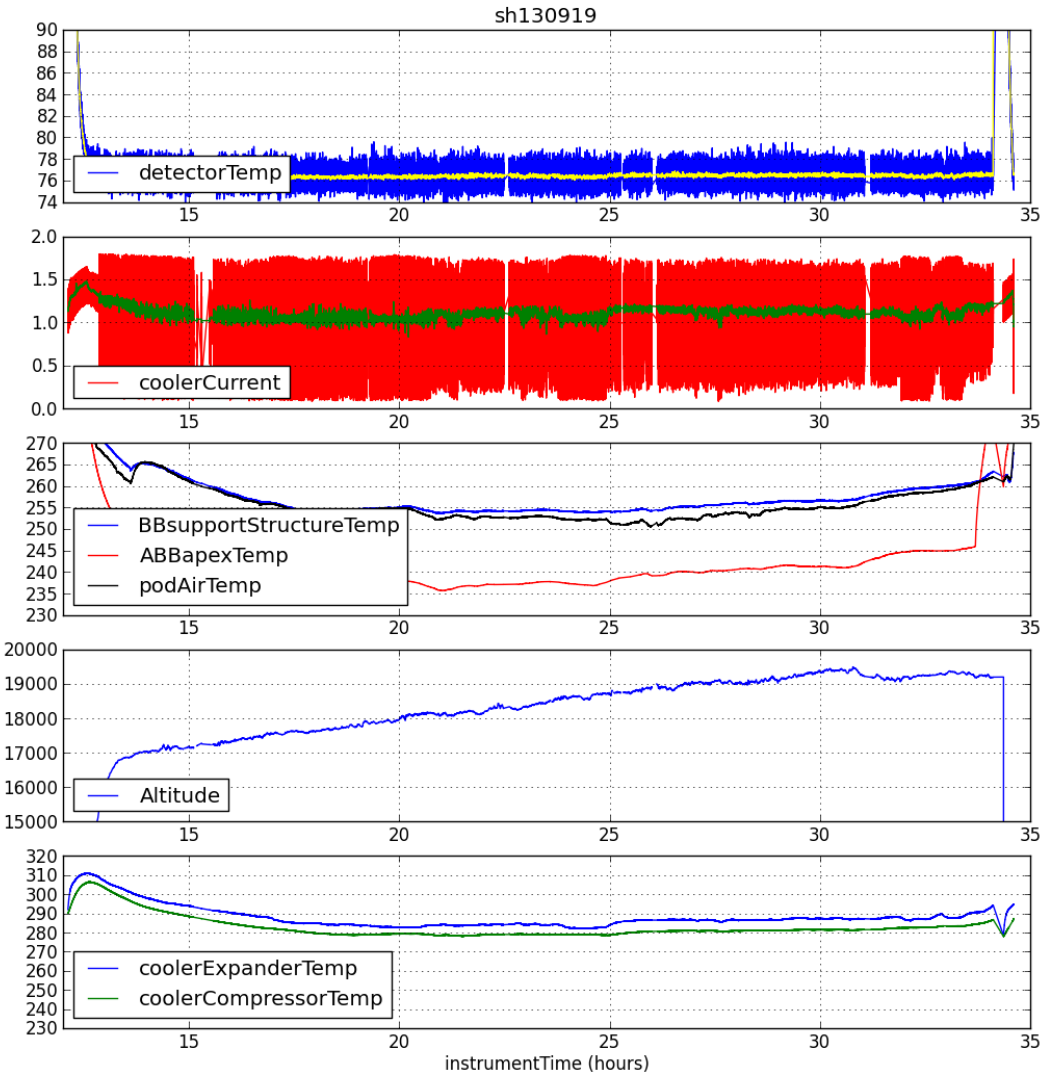


Figure 2. Time series of various Scanning-HIS engineering parameters. The detector temperature was stable at around 77 K throughout the flight. Detector current was elevated at startup but returned to its nominal 1 Amp value for the remainder of the science flight.

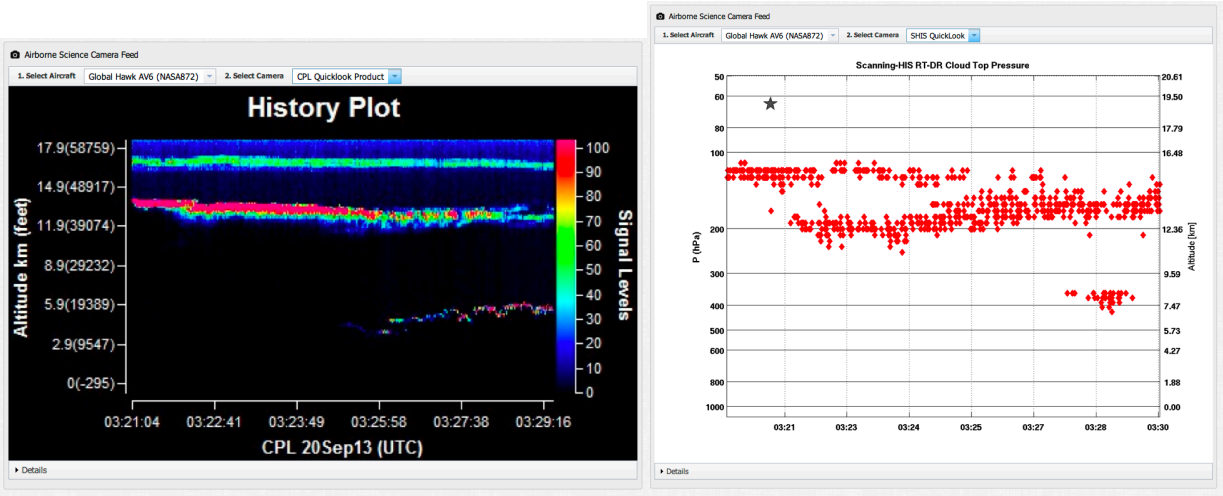


Figure 3. In the southern-most legs of the flight plan, the CPL often saw very high thin cirrus at ~16.5 km. Here is a sample comparison of the real-time CPL signal and the real-time SHIS cloud top retrievals, where the SHIS retirevals do not pick up the highest cloud layer but show good correspondence with CPL for two lower cloud layers at ~13 and 6-8 km.

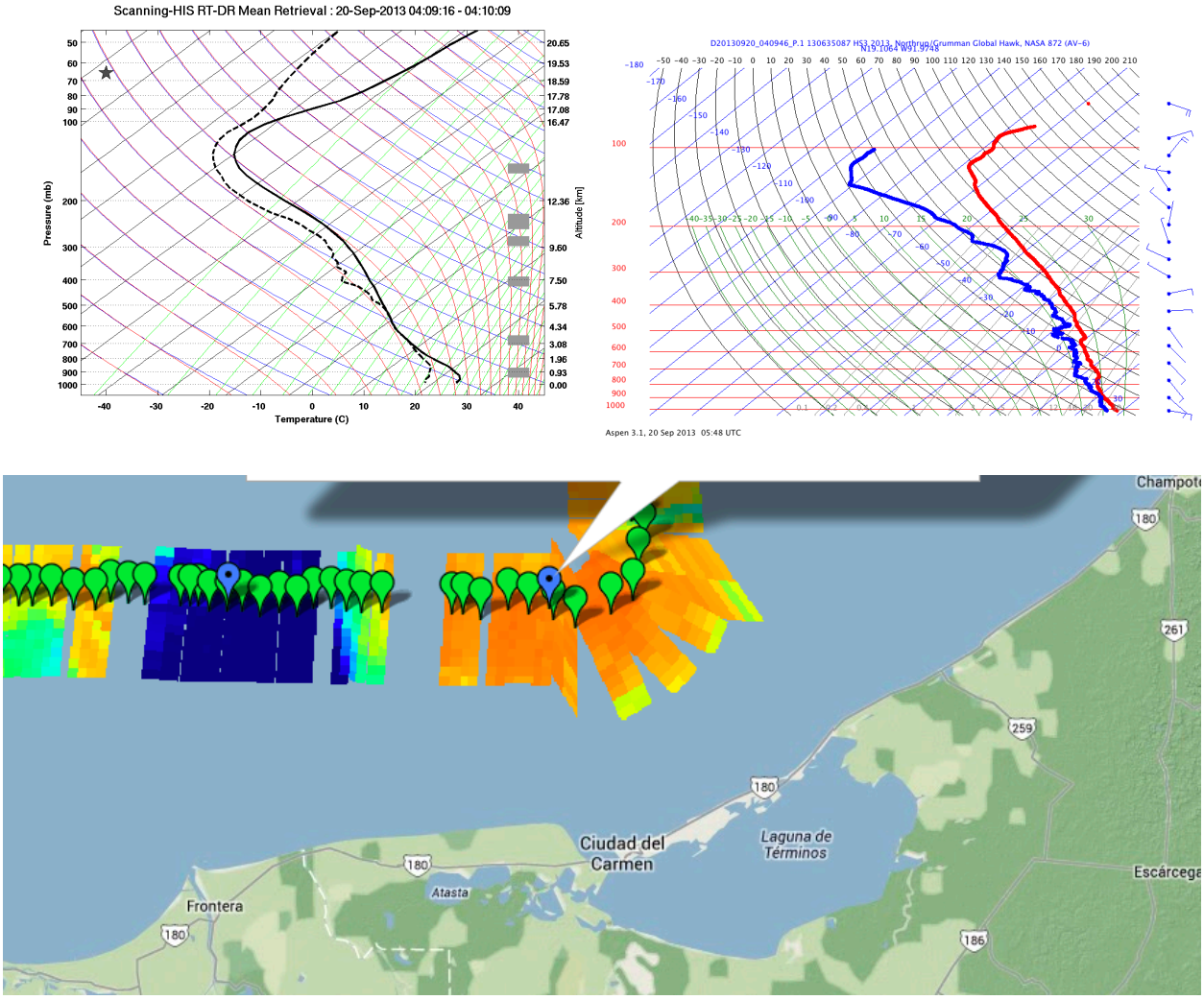


Figure 4. Comparison between S-HIS temperature and moisture structure (left) with the dropsonde profiles (right). This comparison is in the extreme SE corner of the flight pattern. Note that the water vapor around 700 mb is saturated in S-HIS profile but not in the AVAPS profile.

AVAPS

AVAPS successfully launched 88 sondes during the flight of 20130919. Preliminary indications suggest good data quality. Several flight plan modifications were conducted during the course of the flight to restructure the drop pattern near the center of circulation. All sondes were processed in near real-time by the NOAA HRD team, posted in MTS, and also broadcasted to the GTS. Wind speed and direction were not reported for 4 fast falls (D05, D09, D11,

D28). There were a couple cases with anomalously high winds directly above the surface before splash. These data were flagged during processing and not reported. This issue will need to be scrutinized post-mission more carefully. Data from the lower 2/3 of the D84 profile are missing from the D-file and the data loss is currently under investigation and may simply be a result of a partially FTP'ed file from the aircraft during the flight. Due to staffing constraints with dropsonde operations, we coordinated with the payload manager to leave AVAPS unstaffed during the return transit and landing. Instructions were provided to the payload manager to turn 5-2 OFF (AVAPS data system) and leave 6-2 ON (launcher) after dropsonde operations were complete. The payload manager then followed the normal AVAPS power down sequence for landing.

Sondes Dropped

Qty	Date	Flight
6	8-01-13	Range Flight
15	8-20-13	RF01
54	8-24-13	RF02
72	8-29-13	RF03
80	9-04-13	RF04
57	9-07-13	RF05
67	9-16-13	RF06
88	9-19-13	RF07

439 Total Deployed as of 9-120-2013

As of 9-17-2013
Total Sondes available: 111 (550-439)=111