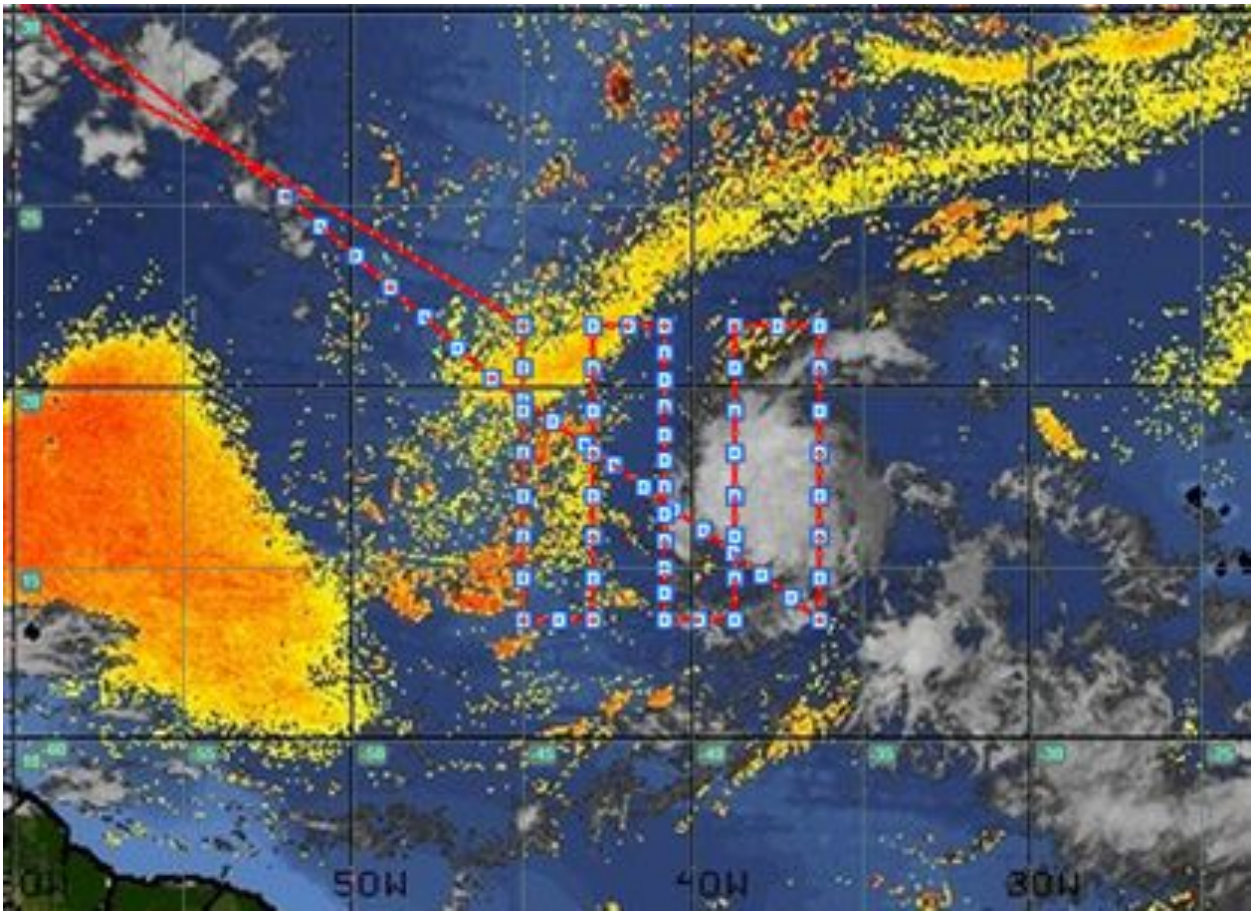
Hurricane and Severe Storm Sentinel (HS3) Mission

HS3 2014-09-11 Flight Report: GLOBALHAWK AV-6 06L Flight

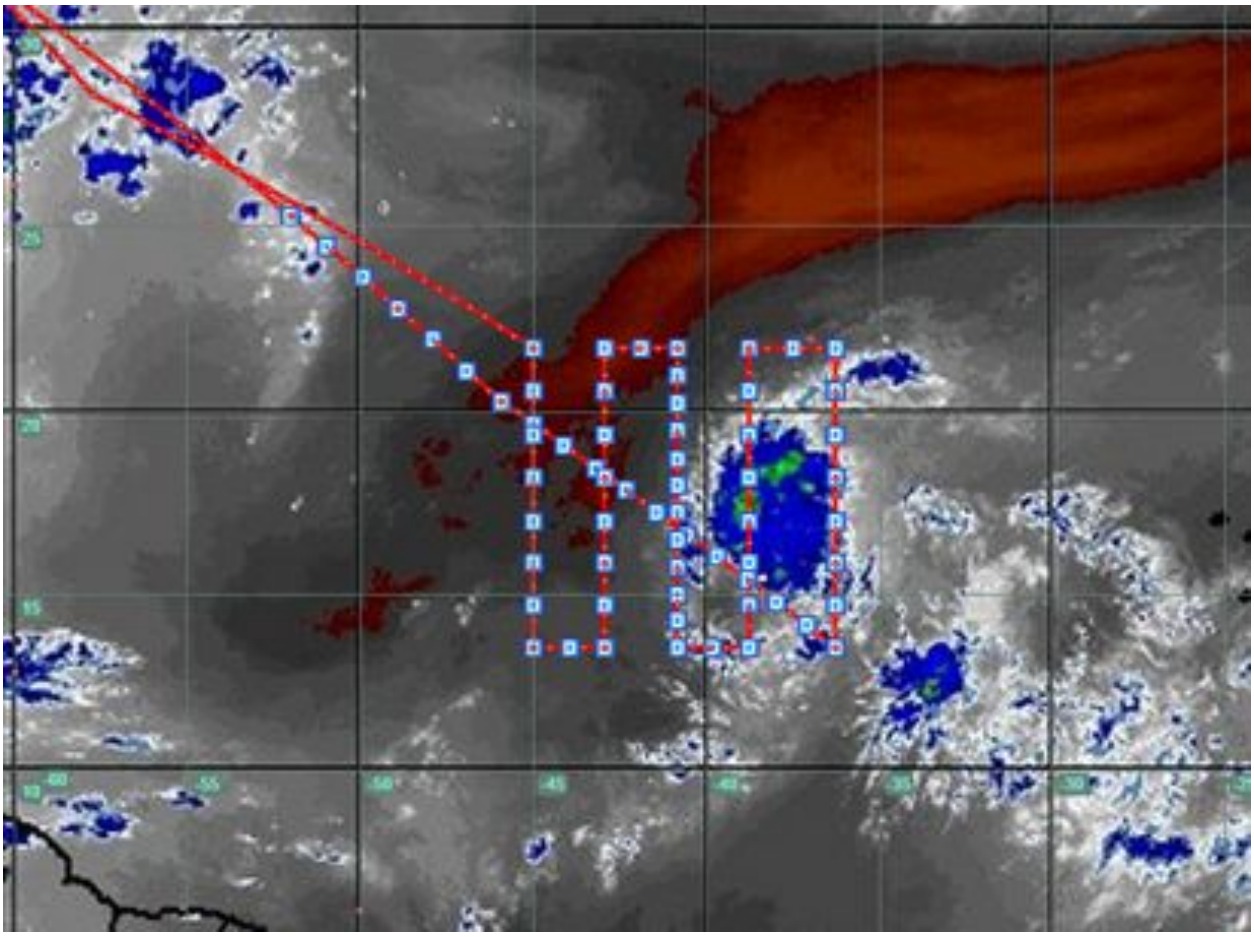
Flight Scientists:
Shift 1 (1700-2100 EDT): Paul Newman, Jon Moskaitis
Shift 2 (2000-0500 EDT): M. Black, Mike Montgomery, Jon Zawislak
Shift 3 (0400-1300 EDT): S. Braun, D. Hence, P. Black
Shift 4 (1200-2100 EDT): Paul Newman, Jon Moskaitis

Takeoff: 11/2213z
Landing: 12/2150z

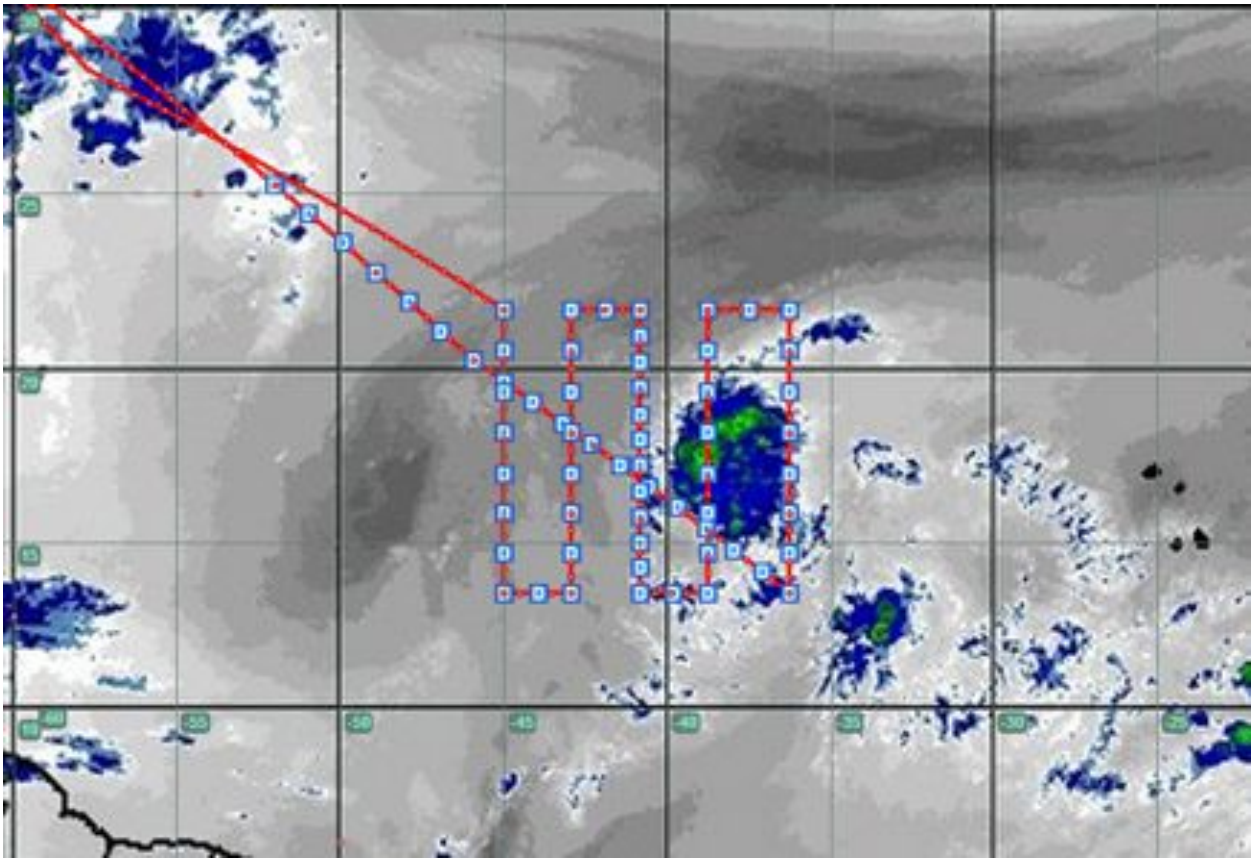
Mission goal: Science flight to investigate 06L as it intensifies into tropical storm Edouard.



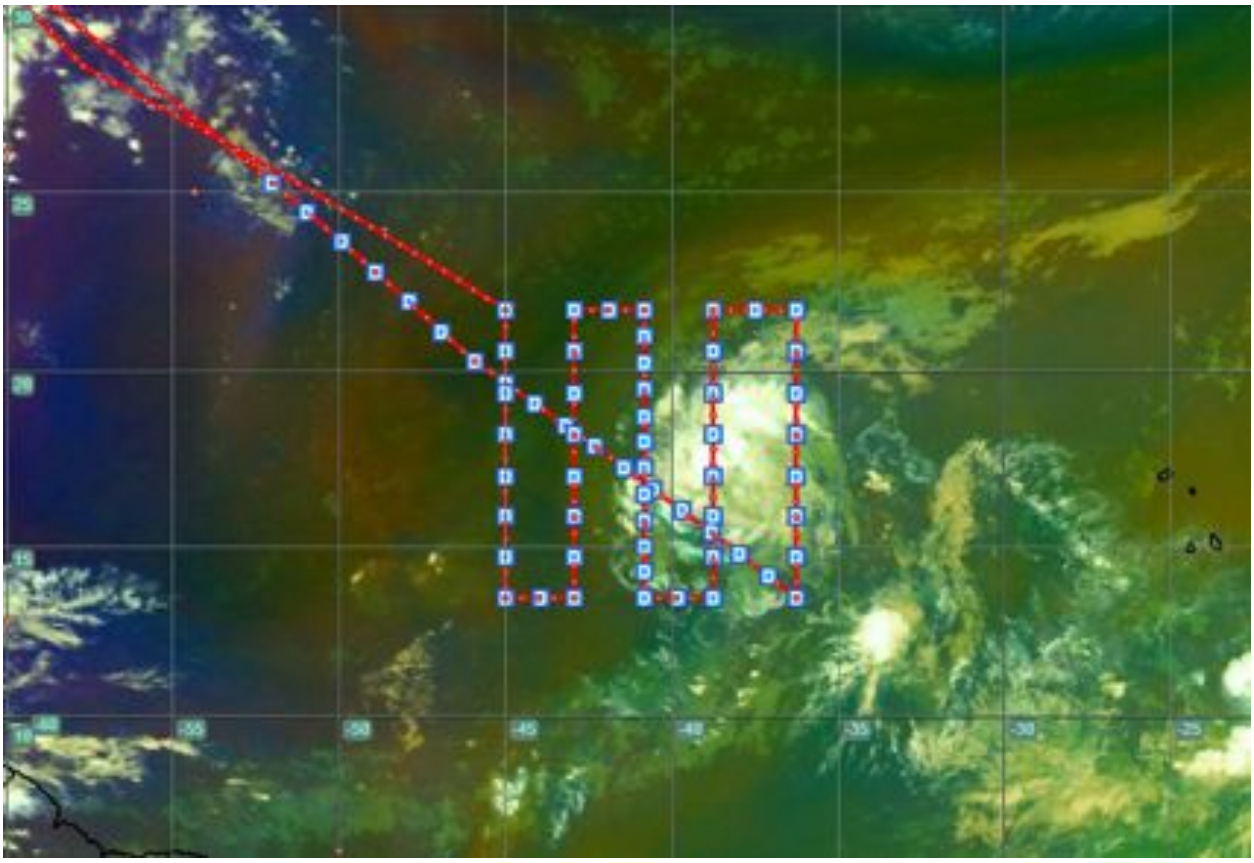
06L at 2100z: SAL air layer tracking and flight plan.



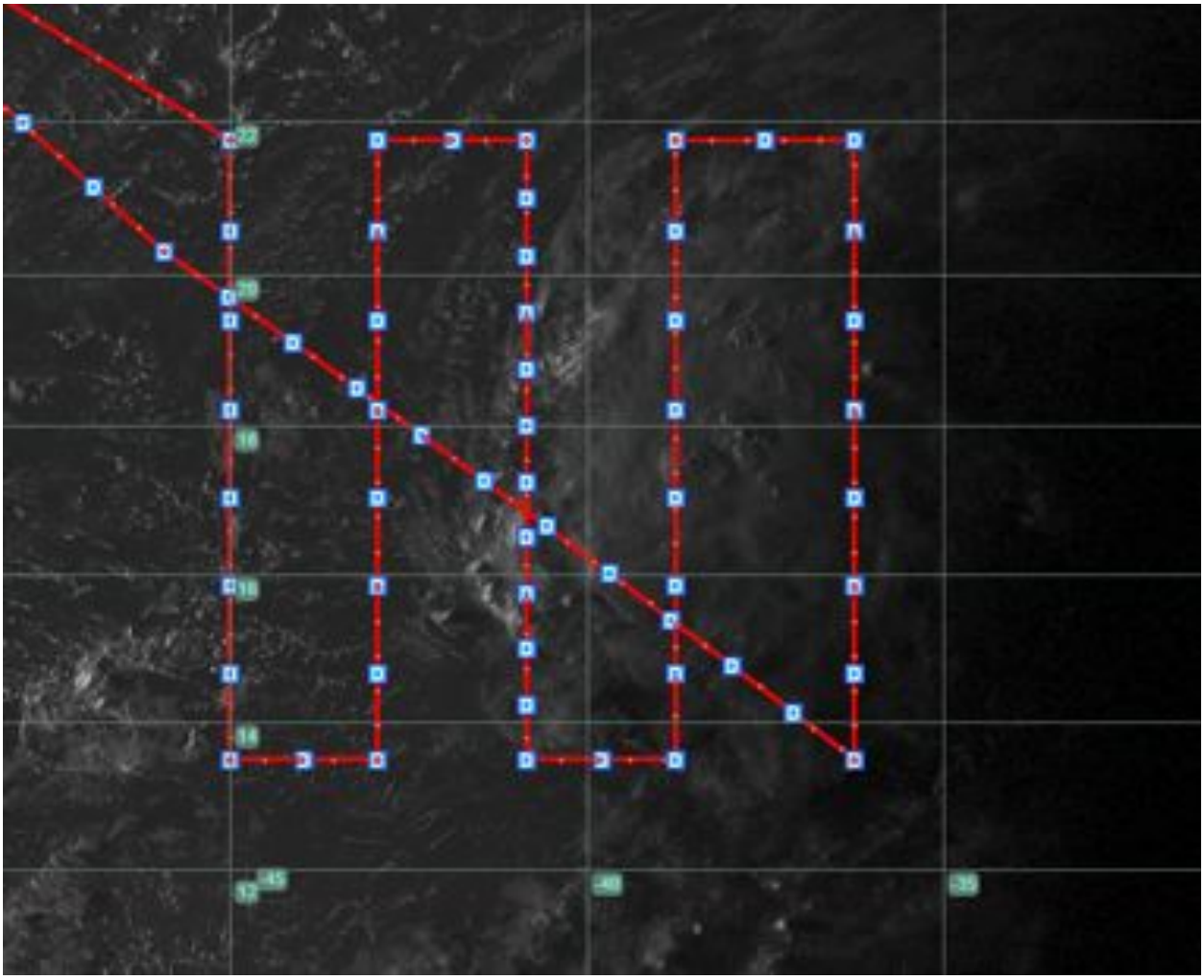
06L at 2100z: Mid-level water vapor and flight plan



06L at 2100z: Upper-level water vapor and flight plan



91L at 2100z: RGB Airmass and flight plan



06L at 2100z: Last light visible image and flight plan.

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WTNT41 KNHC 112041
TCDAT1

TROPICAL DEPRESSION SIX DISCUSSION NUMBER 2
NWS NATIONAL HURRICANE CENTER MIAMI FL AL062014
500 PM AST THU SEP 11 2014

Tropical Depression Six is slowly becoming better organized, with increasing convective banding in the northwestern semicircle. Satellite intensity estimates from TAFB and SAB are 35 kt and 30 kt respectively, and a recent CIRA AMSU estimate was 32 kt. The initial intensity remains 30 kt. The cirrus outflow is good in the northern semicircle and poor elsewhere.

The initial motion is 310/13. A low-/mid-level ridge north of the cyclone should steer it generally west-northwestward to northwestward for the next 3-4 days. After that, the track guidance forecasts the system to turn generally northward between the ridge and a large mid-/upper-level low south of Bermuda. the guidance has come into somewhat better agreement that the northward turn should occur between 49W-55W, as the Canadian model has shifted westward since its previous run. The official forecast is an update of the previous package, and it lies near the center of the guidance envelope.

The depression remains in an environment of light vertical wind shear. The large-scale models continue to forecast some increase in southerly shear after 24 hours, although less shear is forecast than seen for the previous advisory. The intensity guidance responds to this, and to increasing sea surface temperatures along the forecast track, by showing more intensification than previously, especially after 48 hours. The new intensity forecast is nudged upward from 72-120 hours in best agreement with the intensity consensus.

FORECAST POSITIONS AND MAX WINDS

INIT	11/2100Z	17.0N	38.2W	30 KT	35 MPH
12H	12/0600Z	17.9N	40.0W	35 KT	40 MPH
24H	12/1800Z	19.0N	42.2W	40 KT	45 MPH
36H	13/0600Z	20.1N	44.3W	45 KT	50 MPH
48H	13/1800Z	21.6N	46.3W	50 KT	60 MPH
72H	14/1800Z	24.5N	50.0W	60 KT	70 MPH
96H	15/1800Z	27.5N	52.5W	65 KT	75 MPH
120H	16/1800Z	30.5N	53.5W	75 KT	85 MPH

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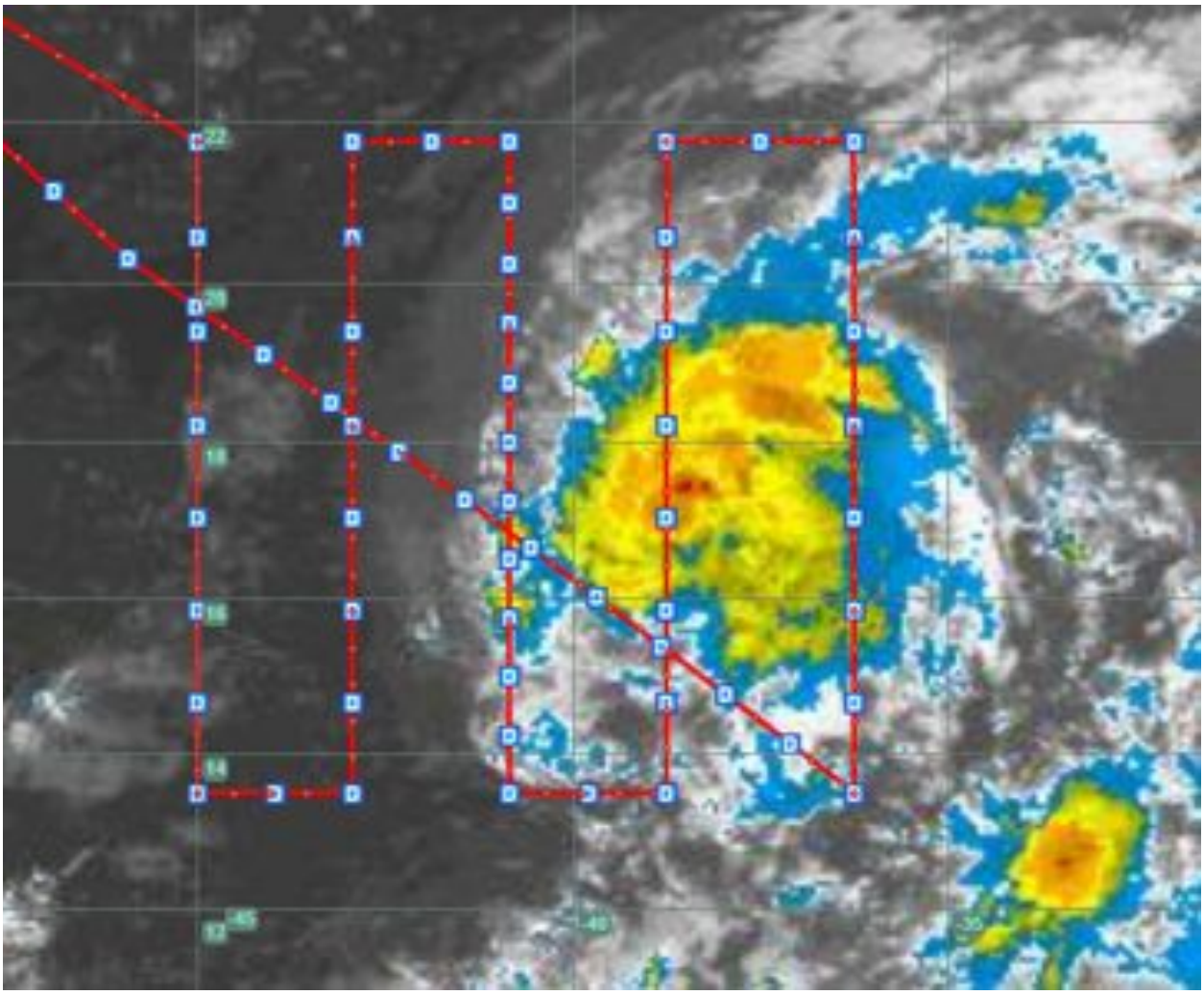
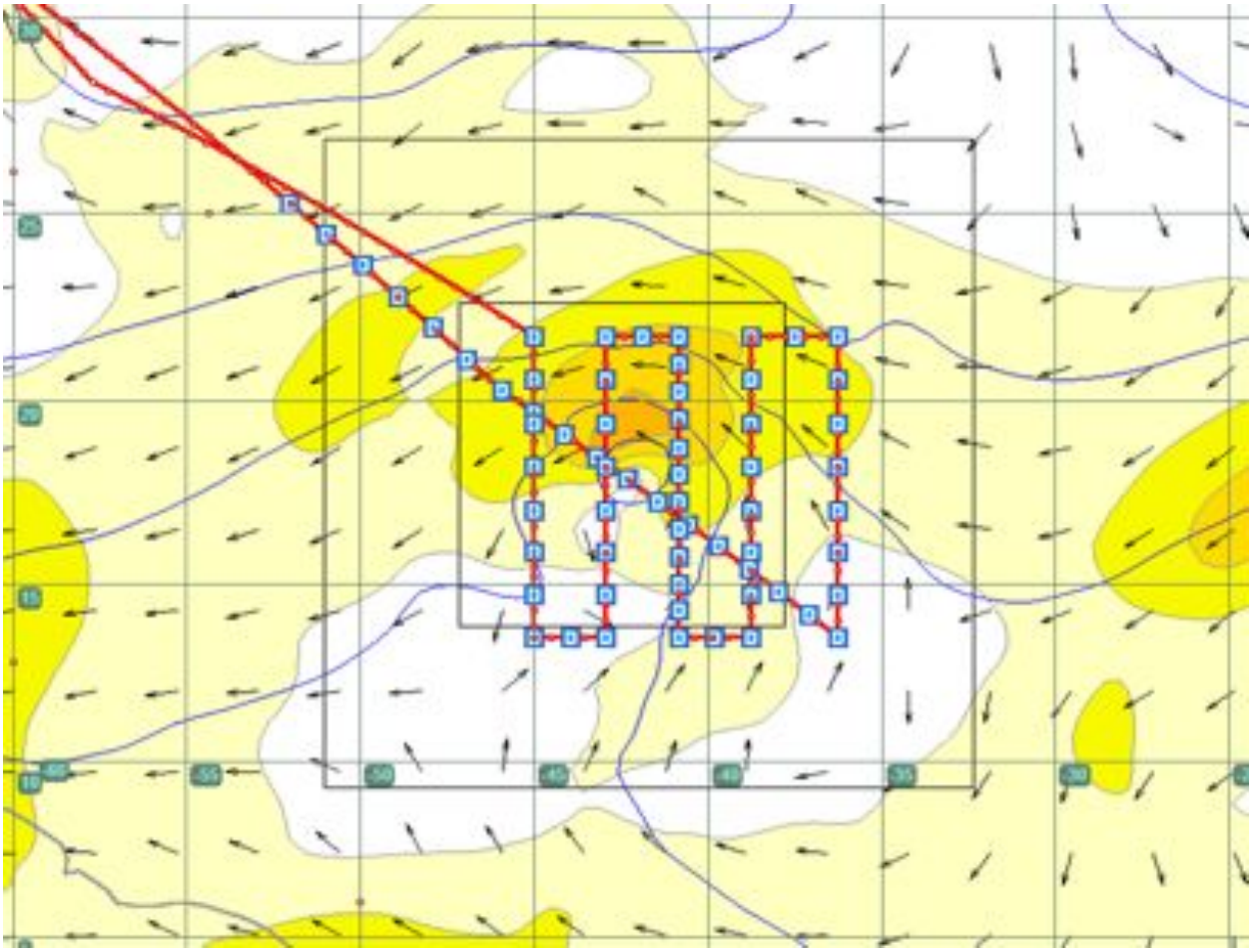
Forecaster Beven

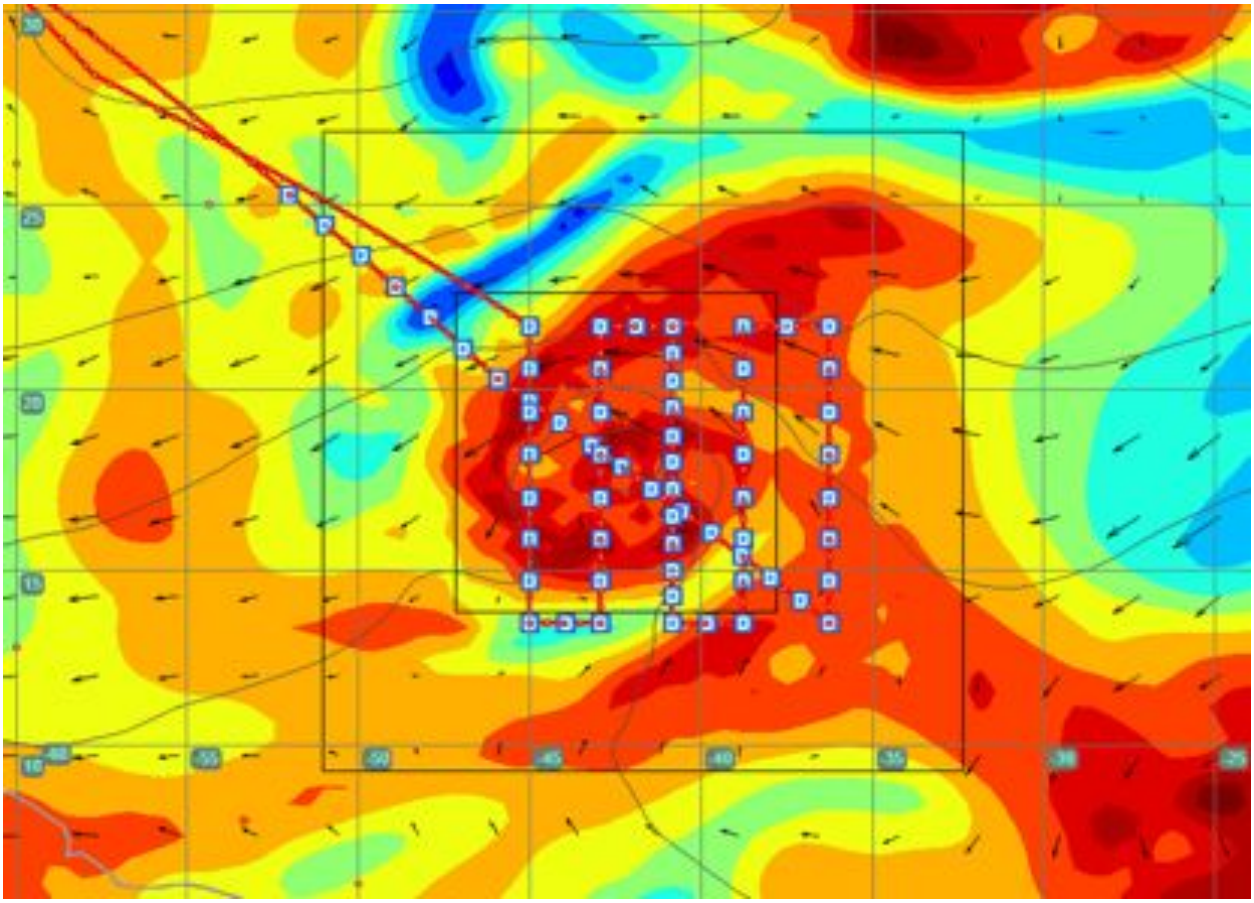
NHC discussion from 5pm eastern time on Sept. 11



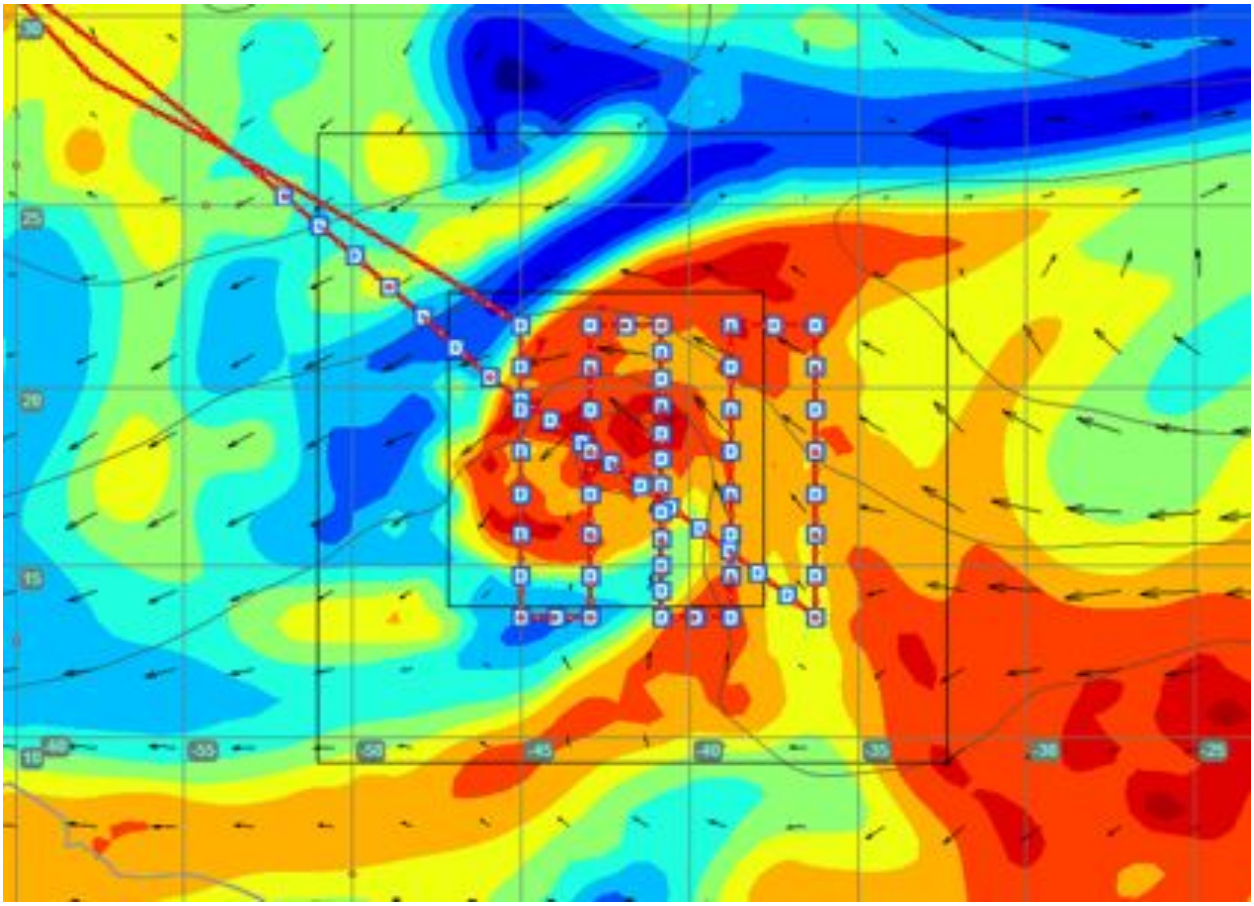
06L at 2100z: Infrared image and flight plan.



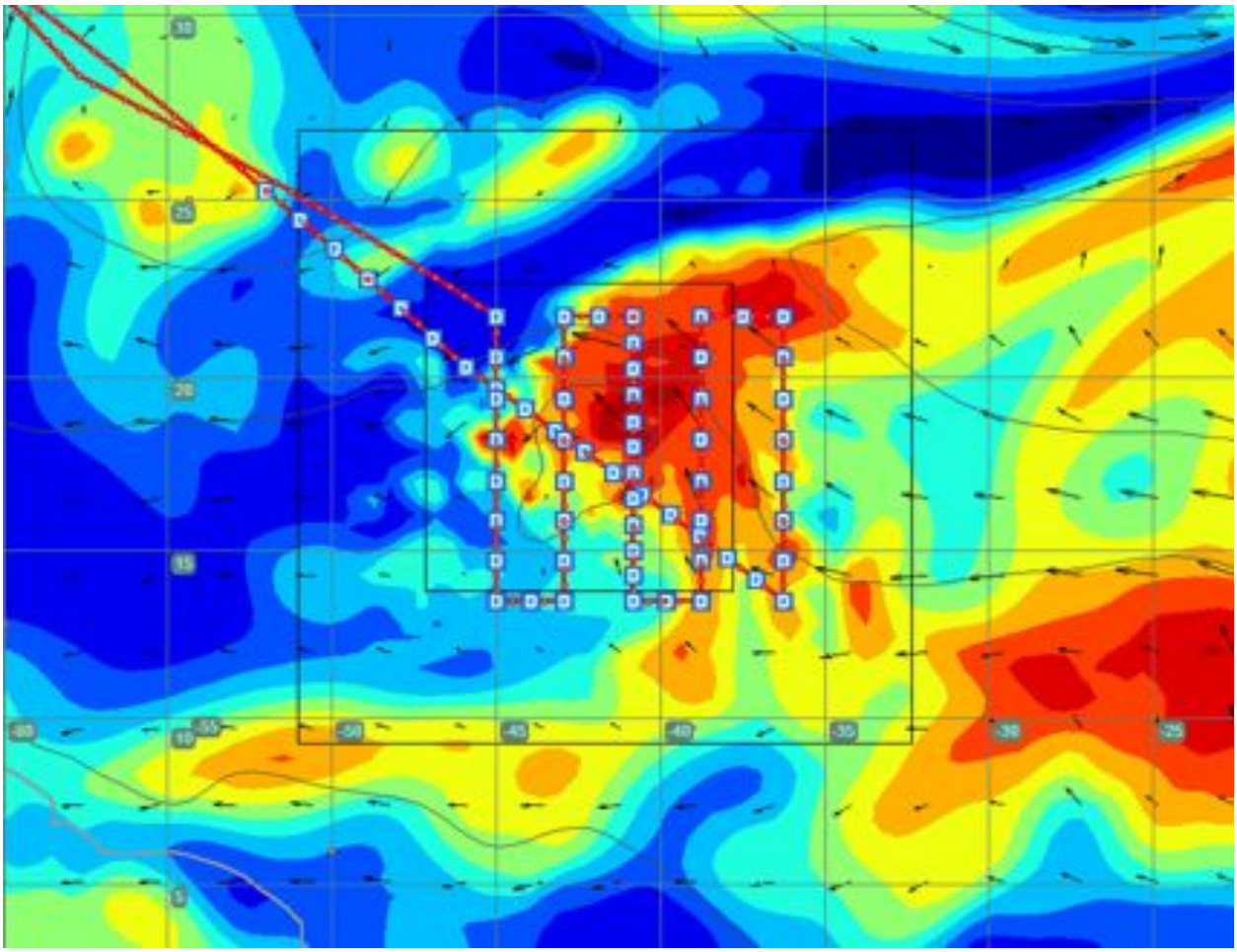
COAMPS-TC 850 mb wind speed (contours), wind direction (vectors) and geopotential height (blue contours every 20 m) forecast valid at 12/12z. 24 h forecast. 20-25 m/s winds north of center (pink dot).



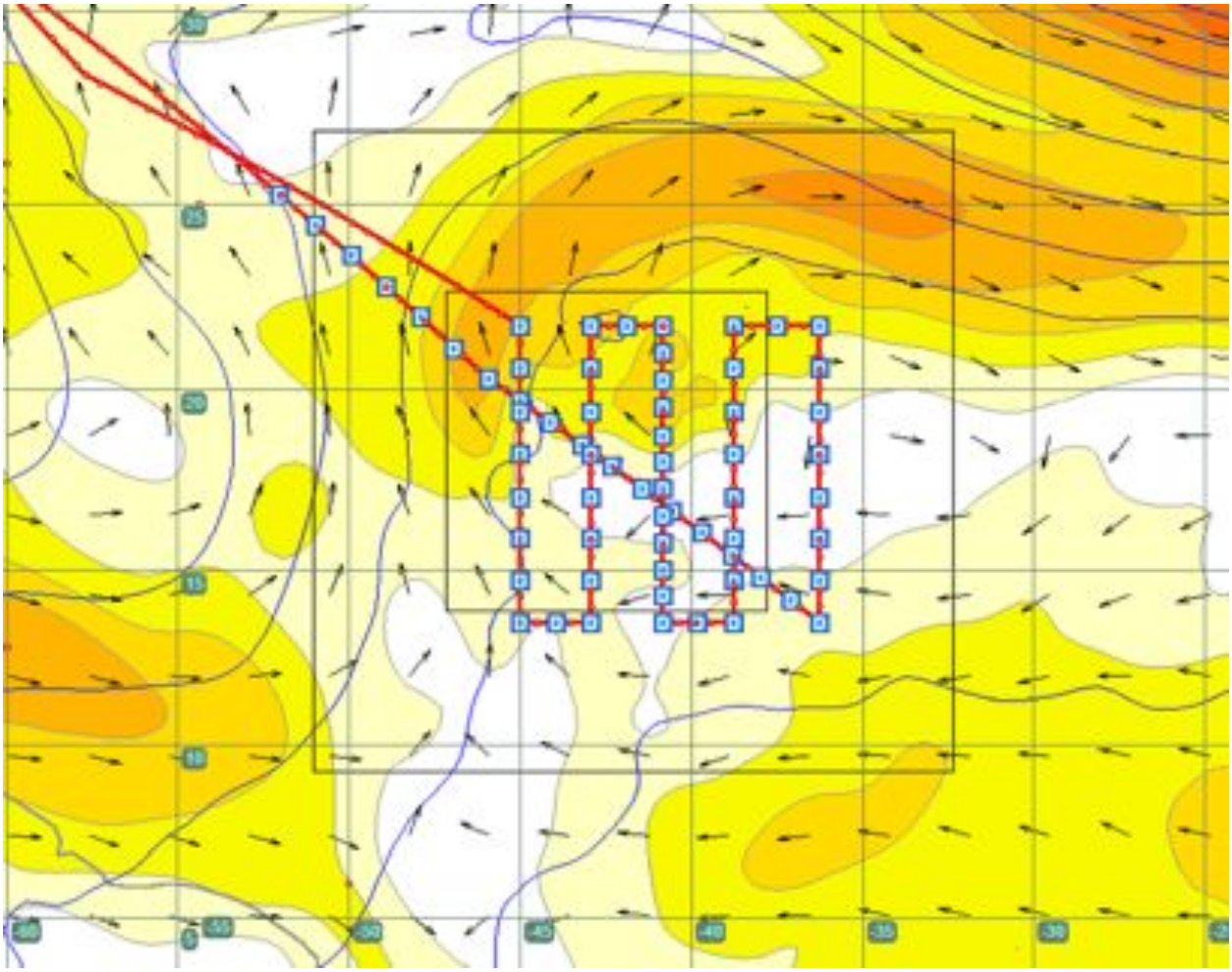
COAMPS-TC 850 mb relative humidity (colors), wind vectors and geopotential height (gray contours every 20 m) forecast valid at 12/12z. 24 h forecast. Bright red is 80% RH.



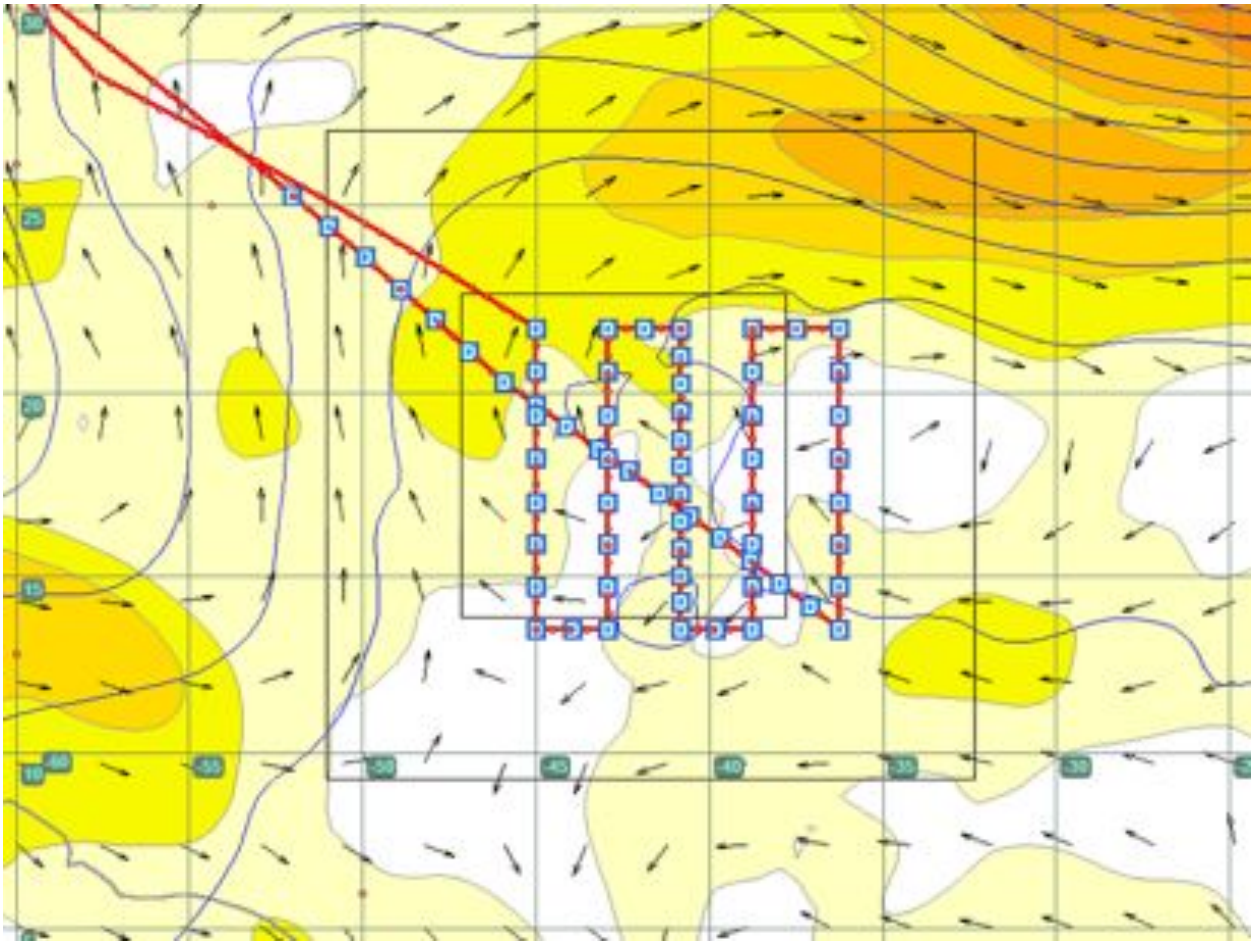
COAMPS-TC 700 mb relative humidity (colors), wind vectors and geopotential height (gray contours every 20 m) forecast valid at 12/12z. 24 h forecast. Bright red is 80% RH.



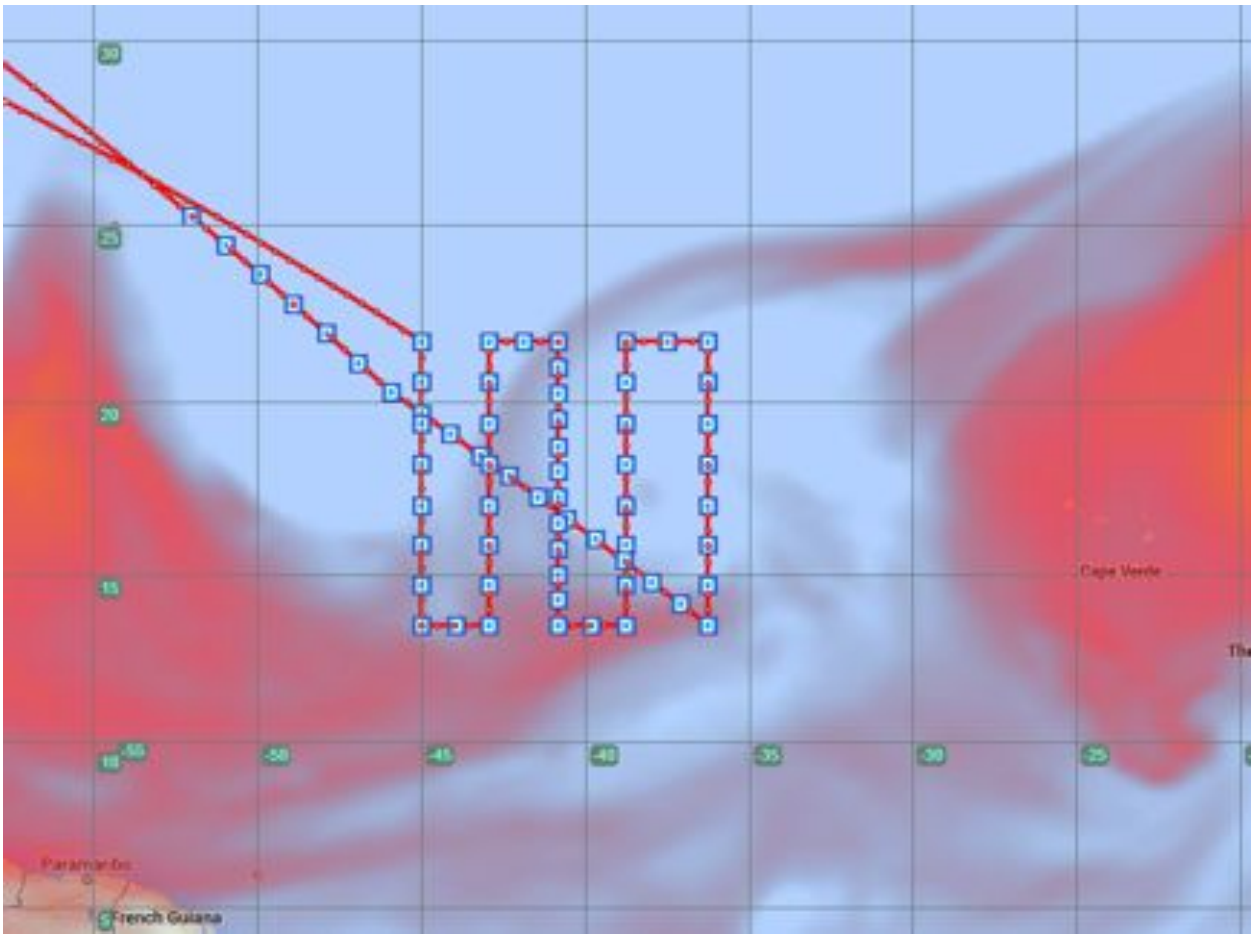
COAMPS-TC 500 mb relative humidity (colors), wind vectors and geopotential height (gray contours every 20 m) forecast valid at 12/12z. 24 h forecast. Bright red is 80% RH.



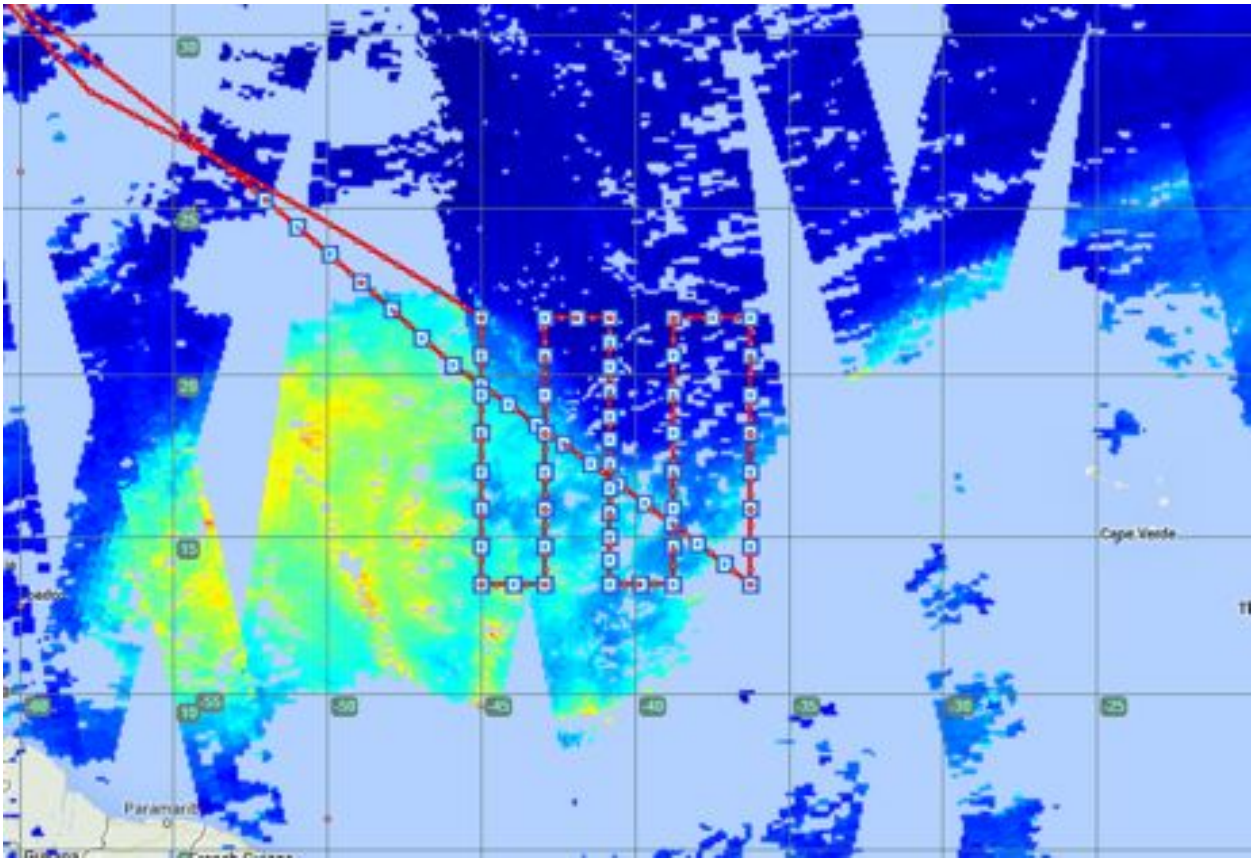
COAMPS-TC 200 mb wind speed (contours), wind direction (vectors) and geopotential height (blue contours every 20 m) forecast valid at 12/12z. 24 h forecast. Outflow heads west and north from 06L.



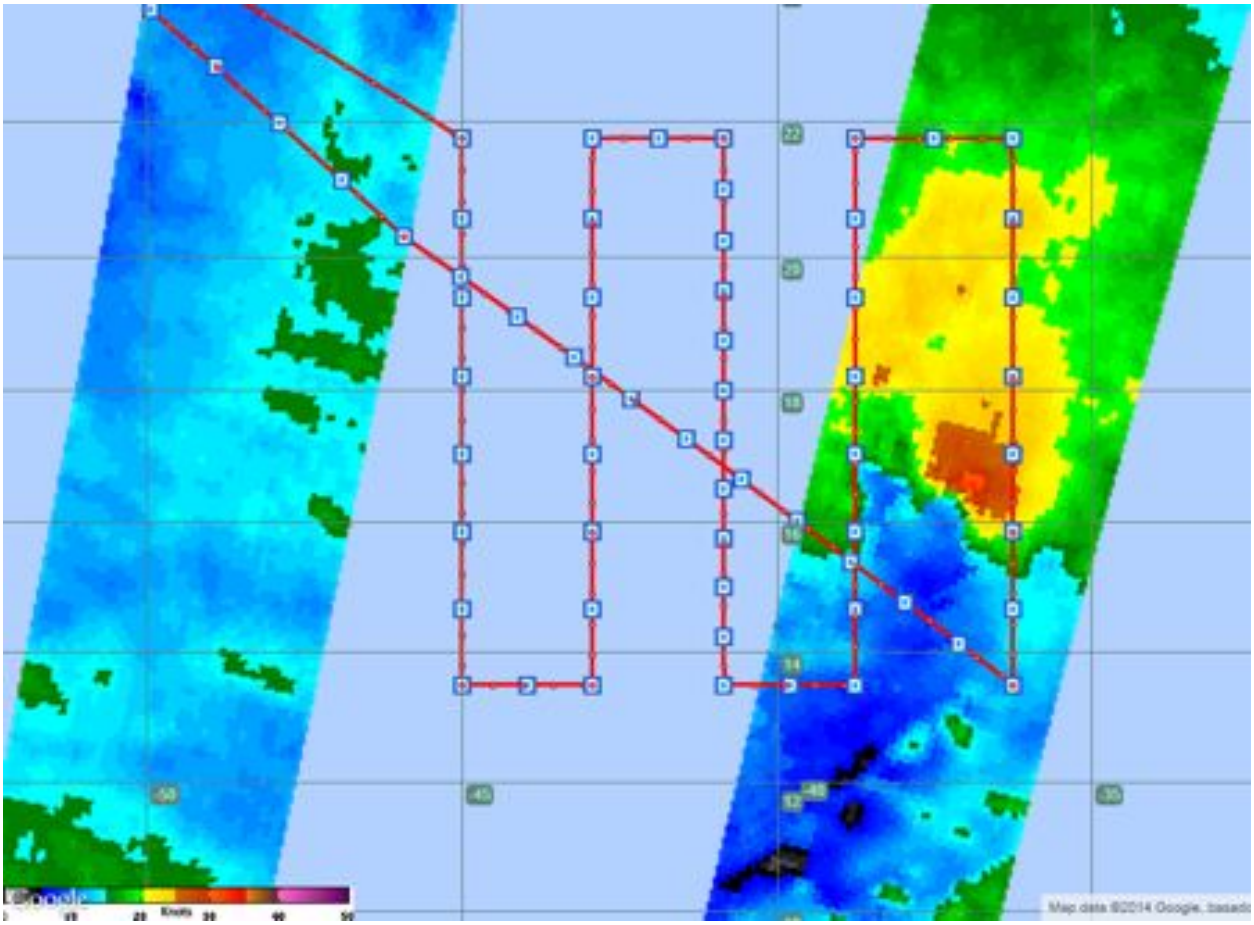
COAMPS-TC 150 mb wind speed (contours), wind direction (vectors) and geopotential height (blue contours every 20 m) forecast valid at 11/12z. 24 h forecast. Outflow heads west and north from 91L.



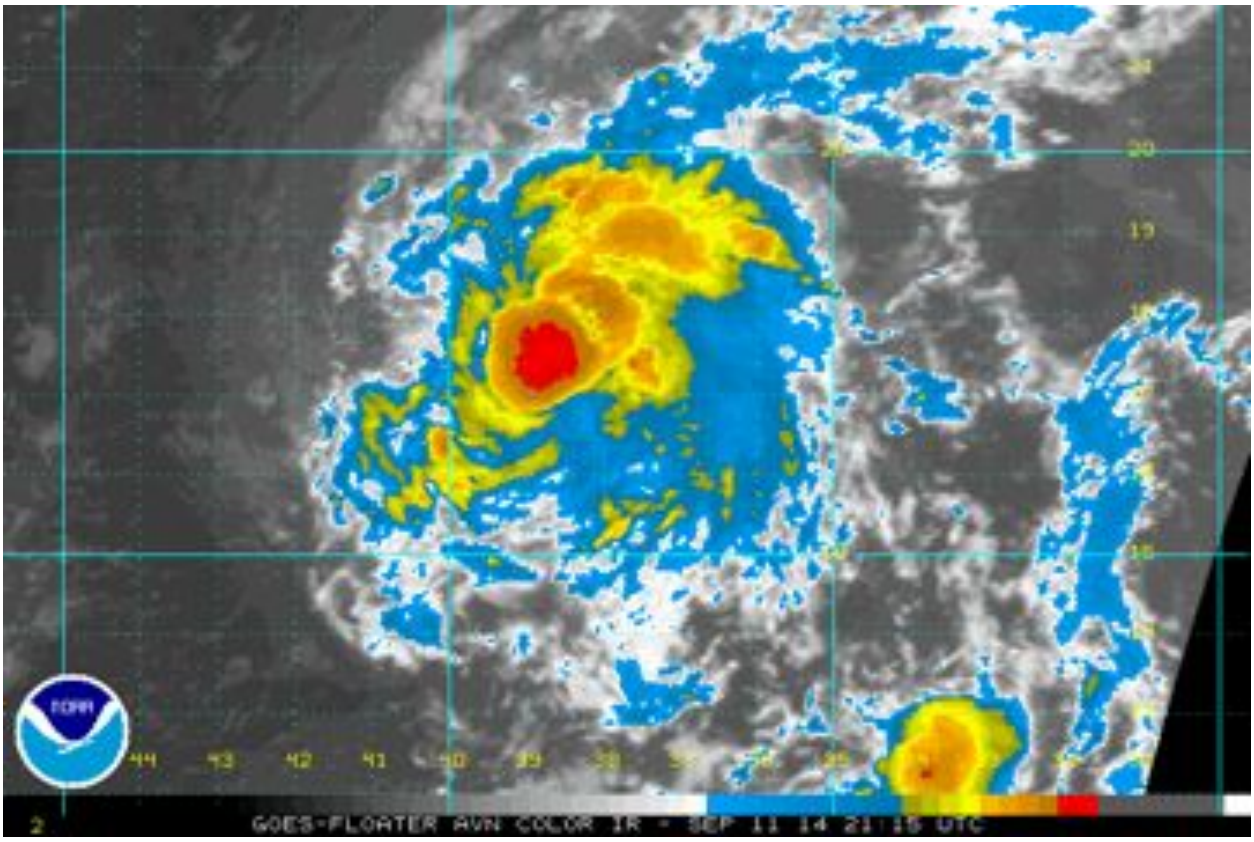
GOES5 Dust extinction AOT (550nm) valid at 11/2100z.



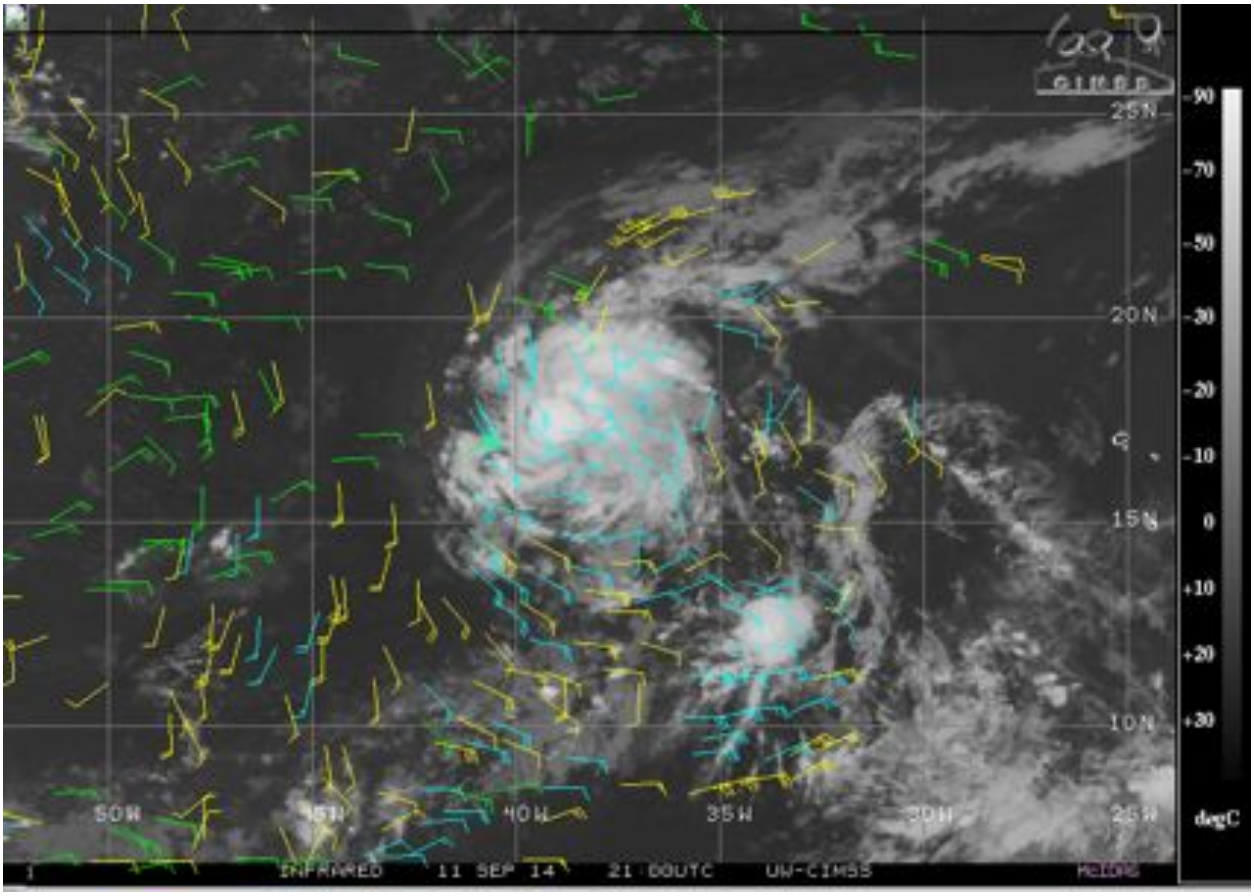
Aqua and Terra AOT.



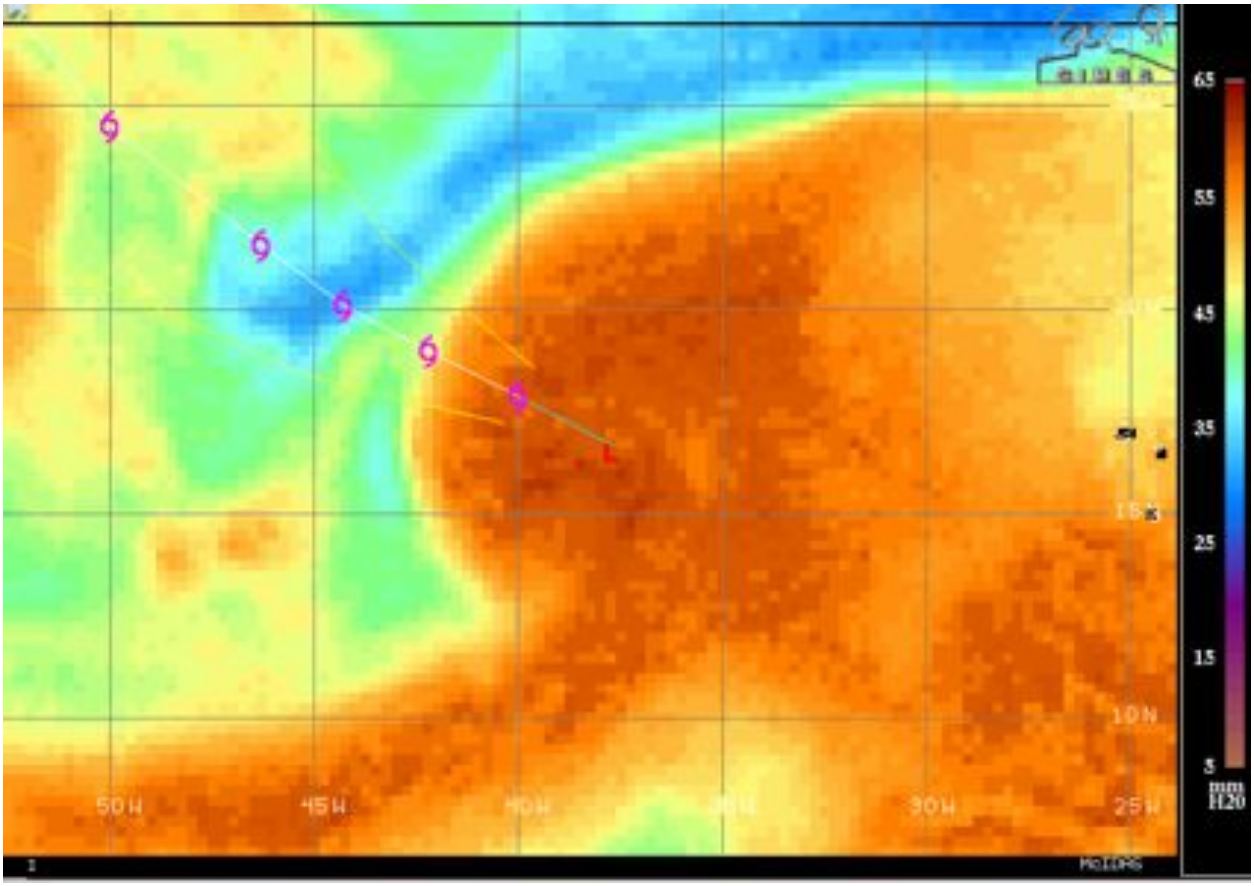
ASCAT wind speeds



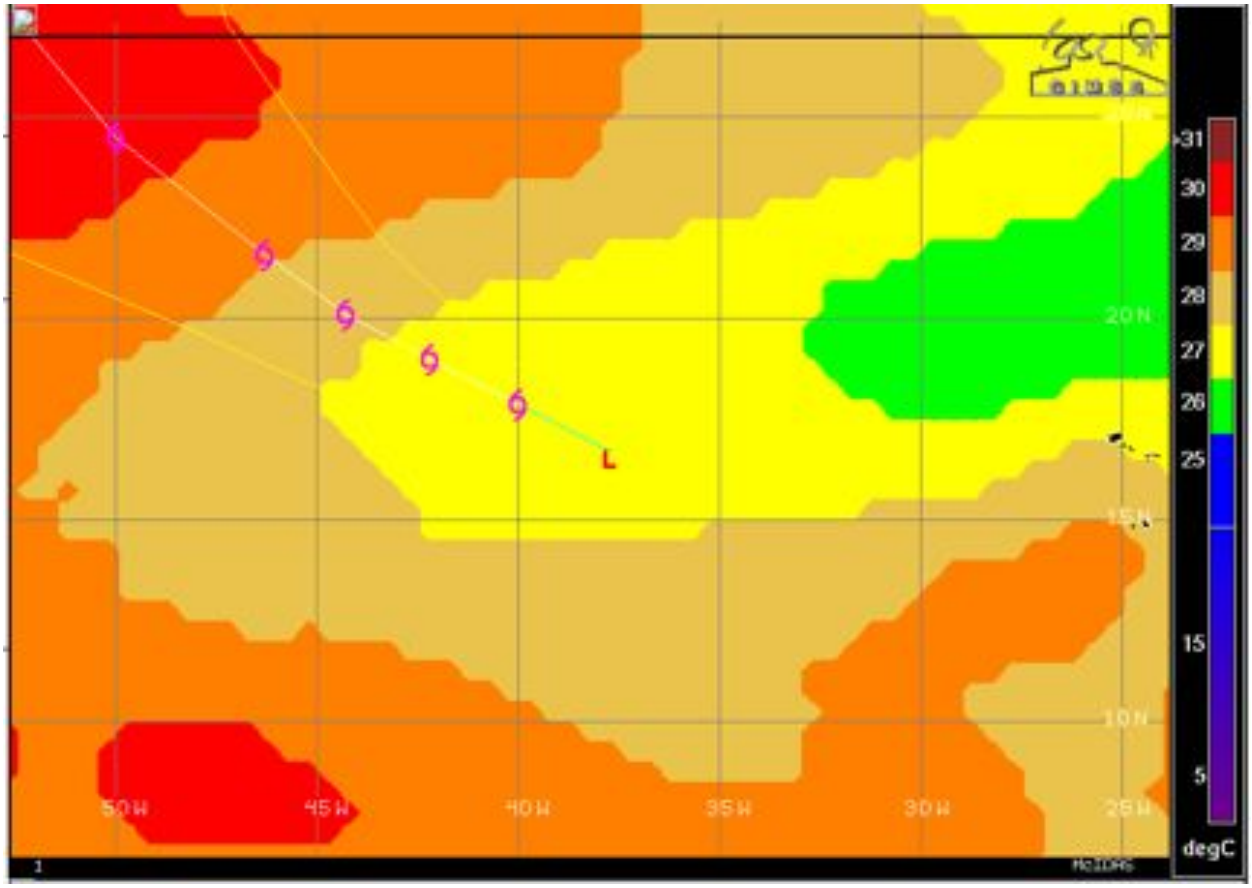
Convective burst just NW of center at 11/2115z. NHC 11/2100z analysis position is 17.0N, 38.2W



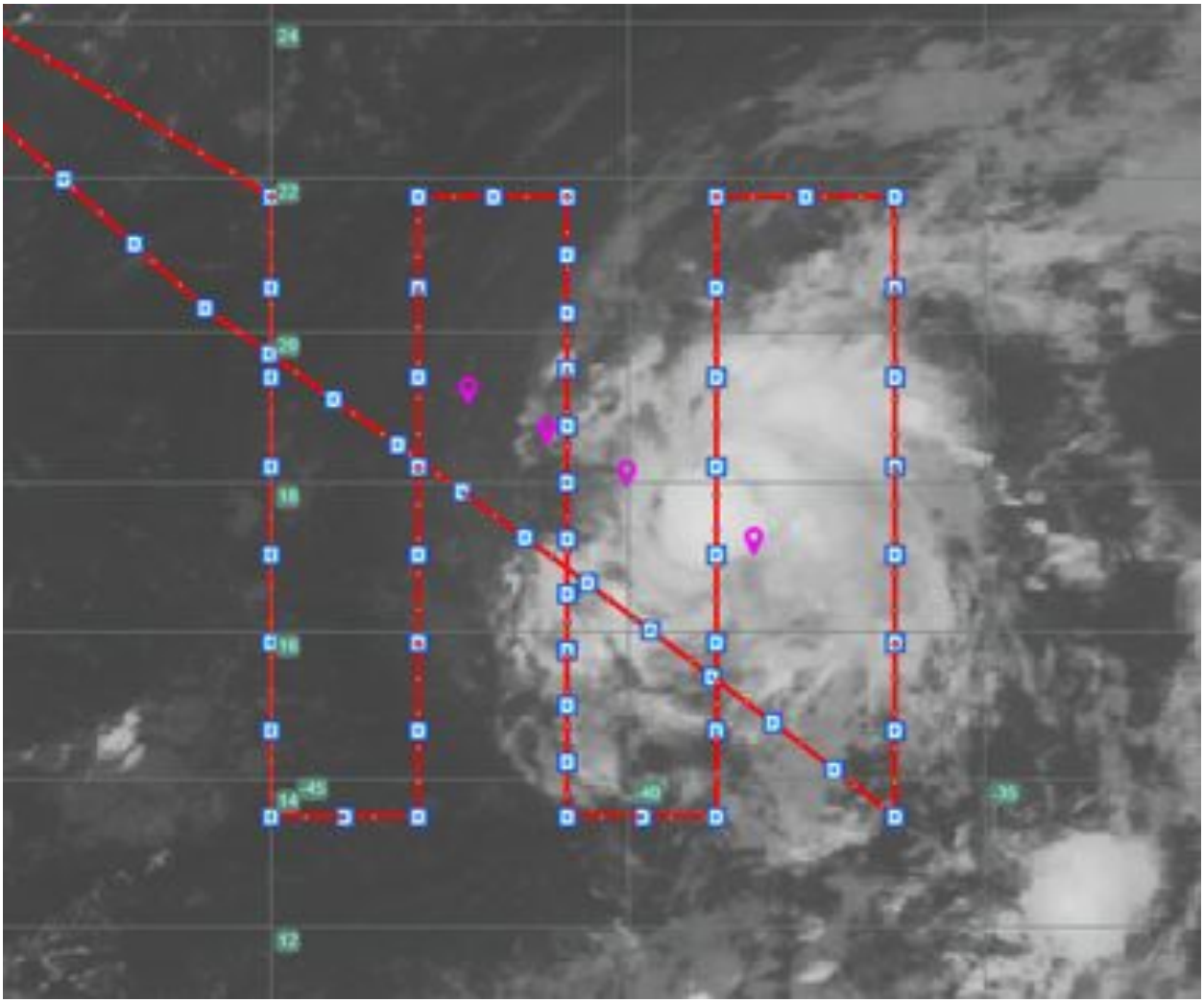
CIMSS infrared and upper-level AMVs at 2100z.



CIMSS TPW at 2100z (along with NHC forecast track).



SST at 2100z, along with NHC forecast track.



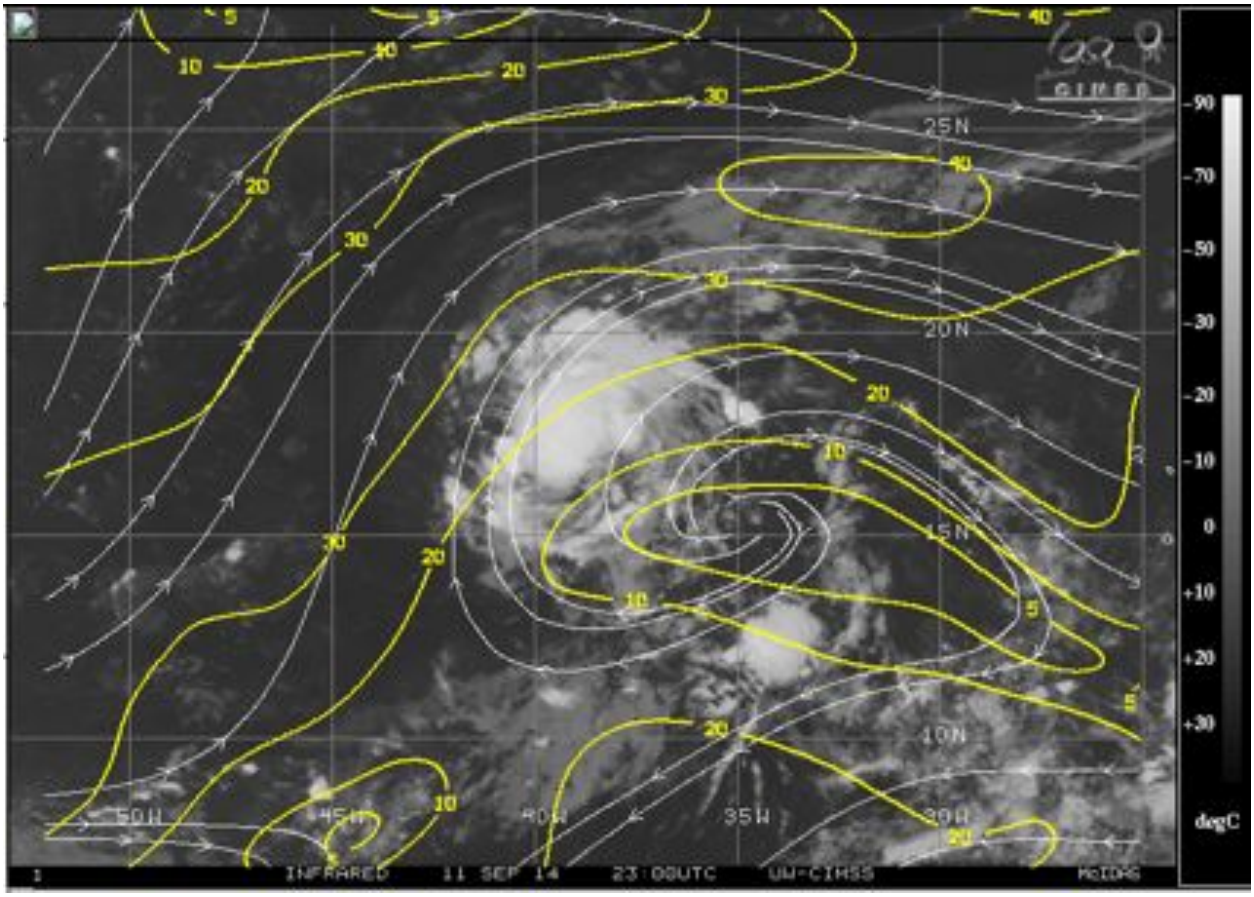
Flight plan with NHC 11/21z analysis position, 12/06z forecast position, 12/12z forecast position, and 12/18z forecast position (arranged from SE to NW).

Last Updated: 2014-09-11T22:15:01.000000

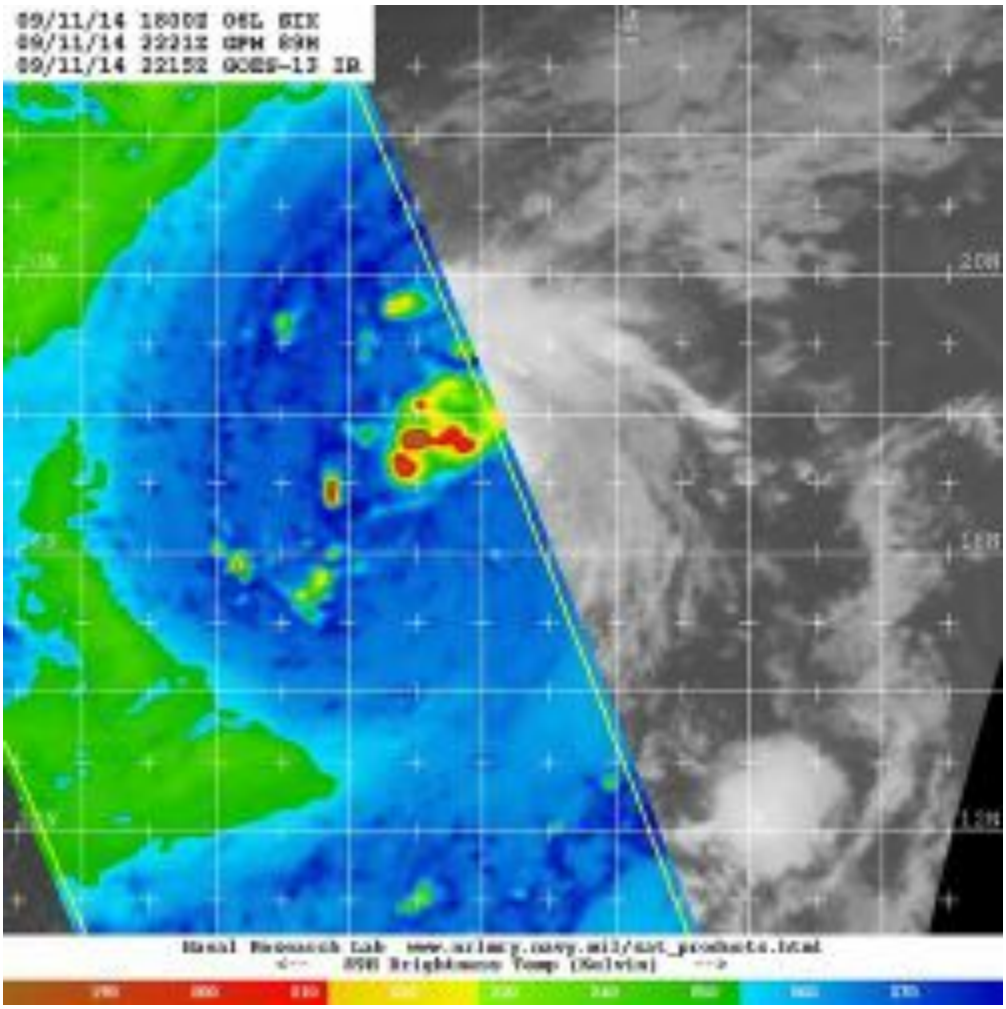
Last Updated: 2014-09-11T22:15:31.000000

A couple HDVIS images just after takeoff.

Daylight cam

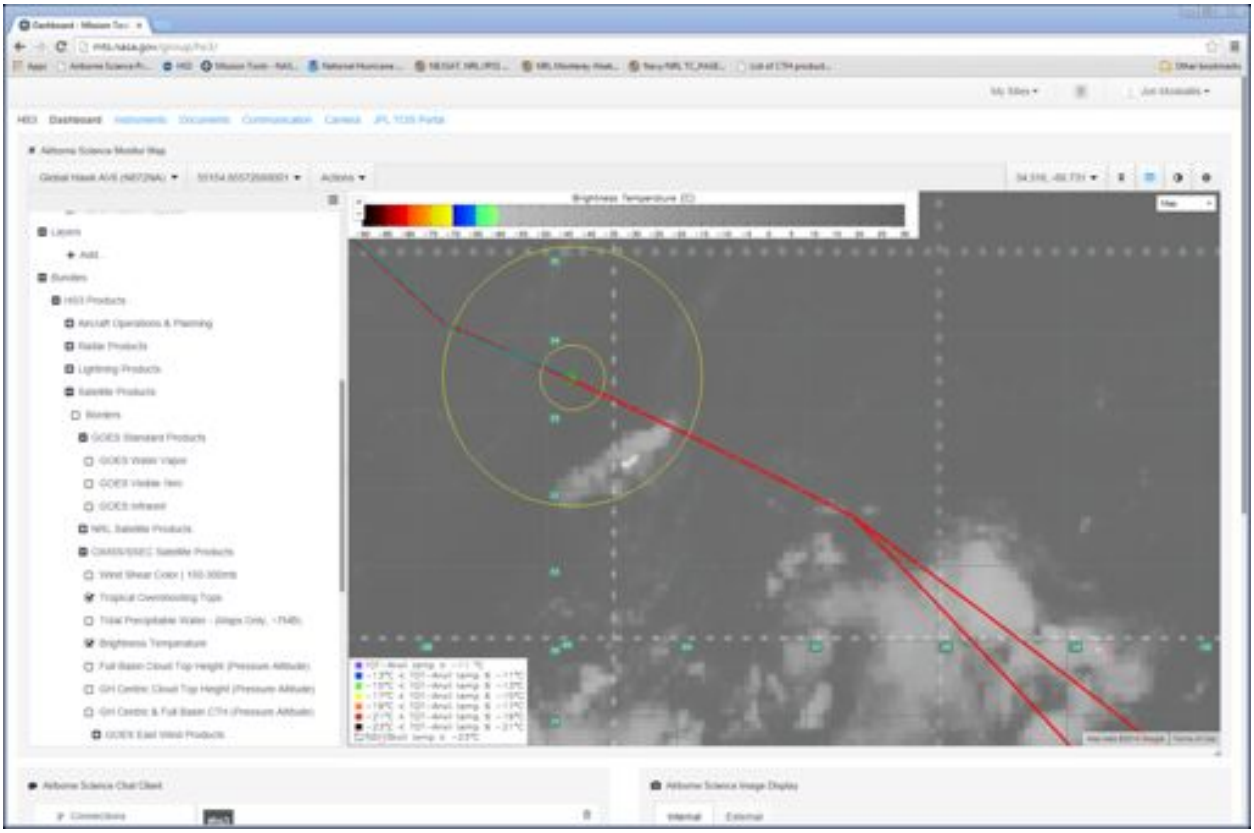


Infrared and deep layer shear at 2300z



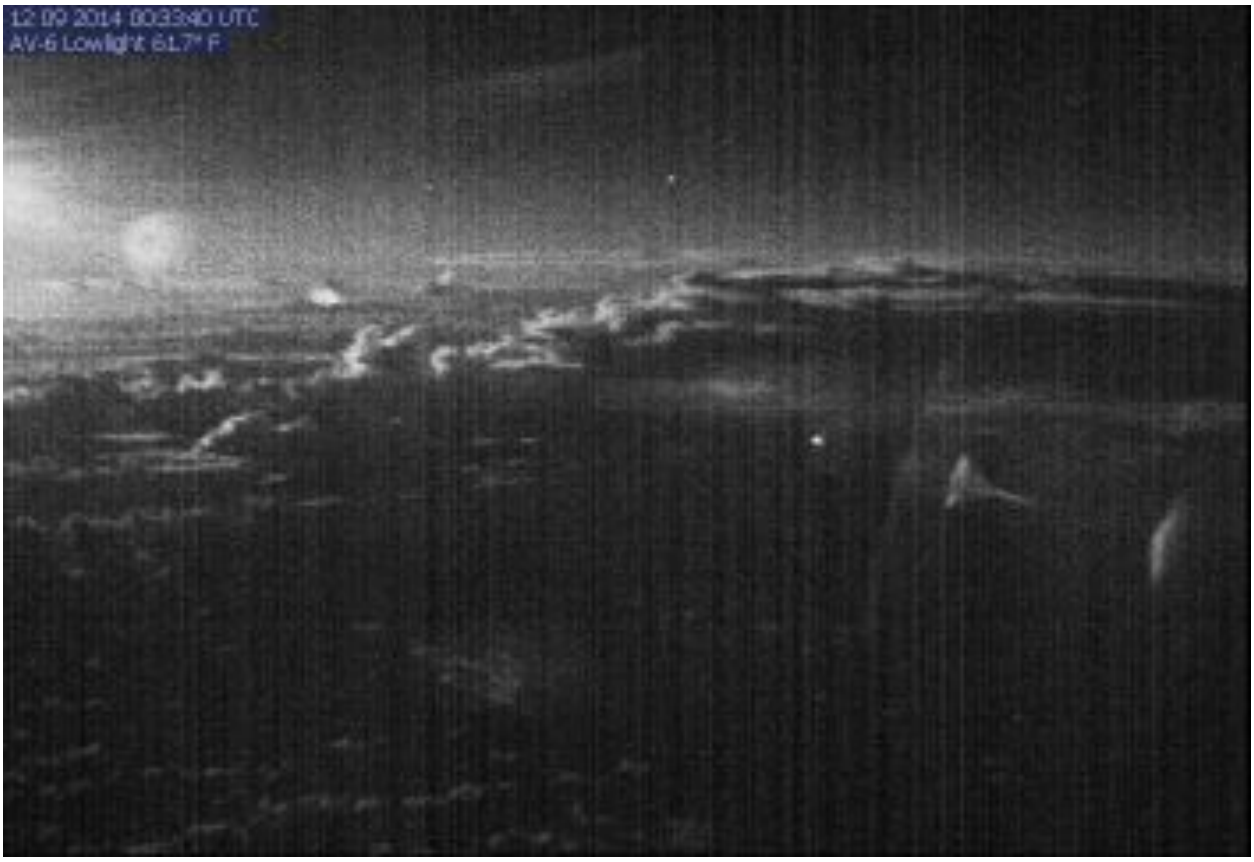
89GHz pass from GPM at 11/2221z. Deep convection NW of center, downshear-left I think.

0015Z – M. Black, Mike Montgomery,



0027z- Brightness temperature of scattered convection associated with upper level trough - ~40-45kft cloud tops – nice Low-light camera imagery but not available on MTS (broken link)- Payload manager can see imagery though

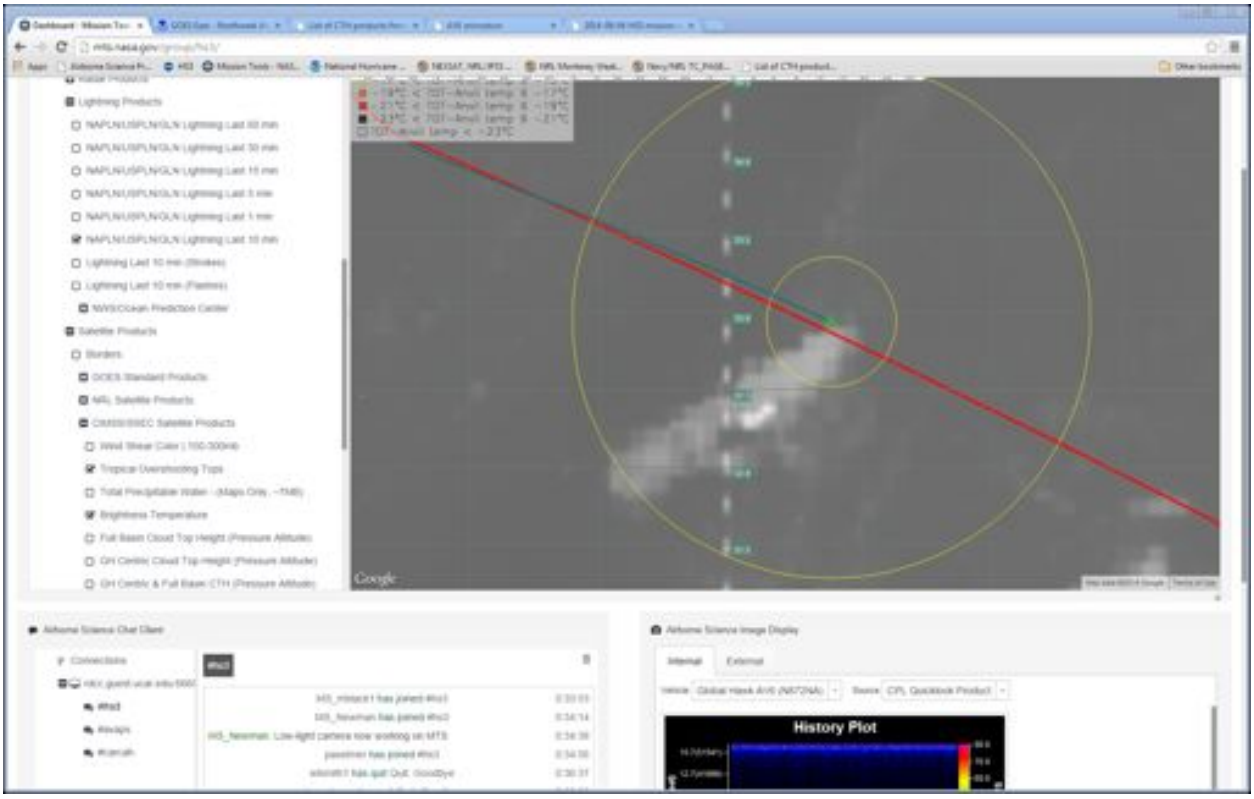
Low light camera image at 0033z – moon rise and isolated convection

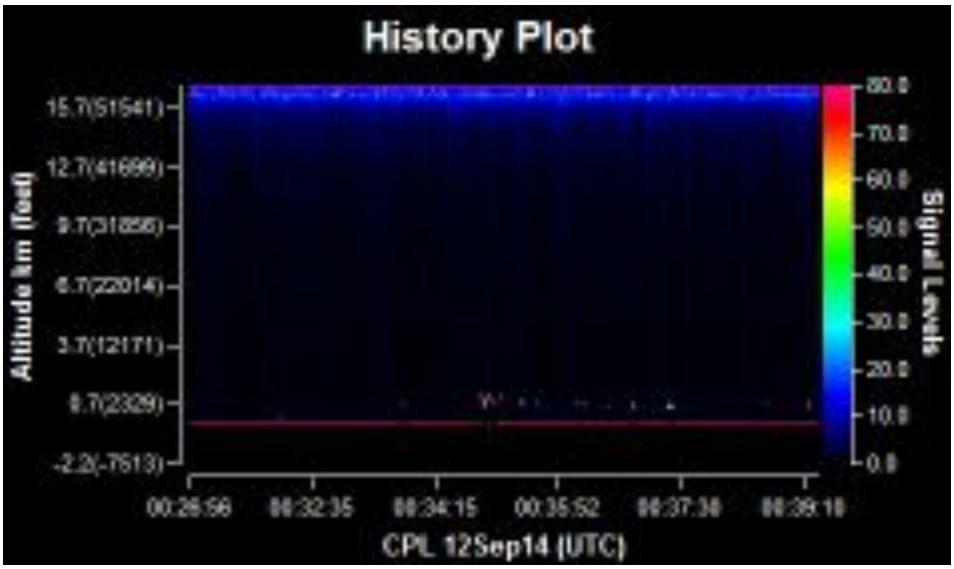



12 09 2014 003740 UTC
AV-6 Lowlight 61.7° F

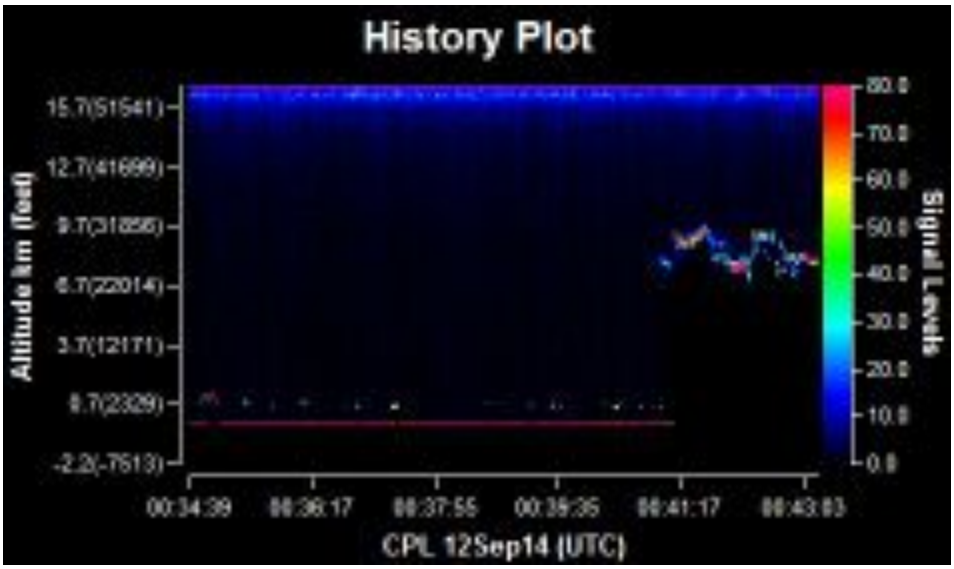

12 09 2014 003940 UTC
AV-6 Lowlight 6018' F


12 09 2014 003040 UTC
AV-6 Lowlight 60.8° F

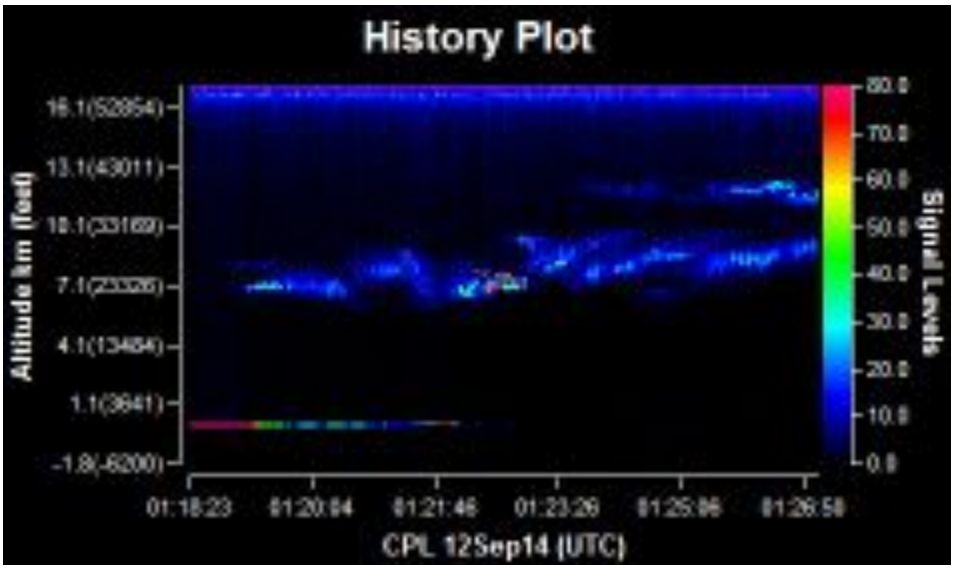

Lightning Products
Satellite Products
Borders
Tropical Overshooting Tops
Brightness Temperature
Google
Airborne Science Chat Client
Airborne Science Image Display
History Plot



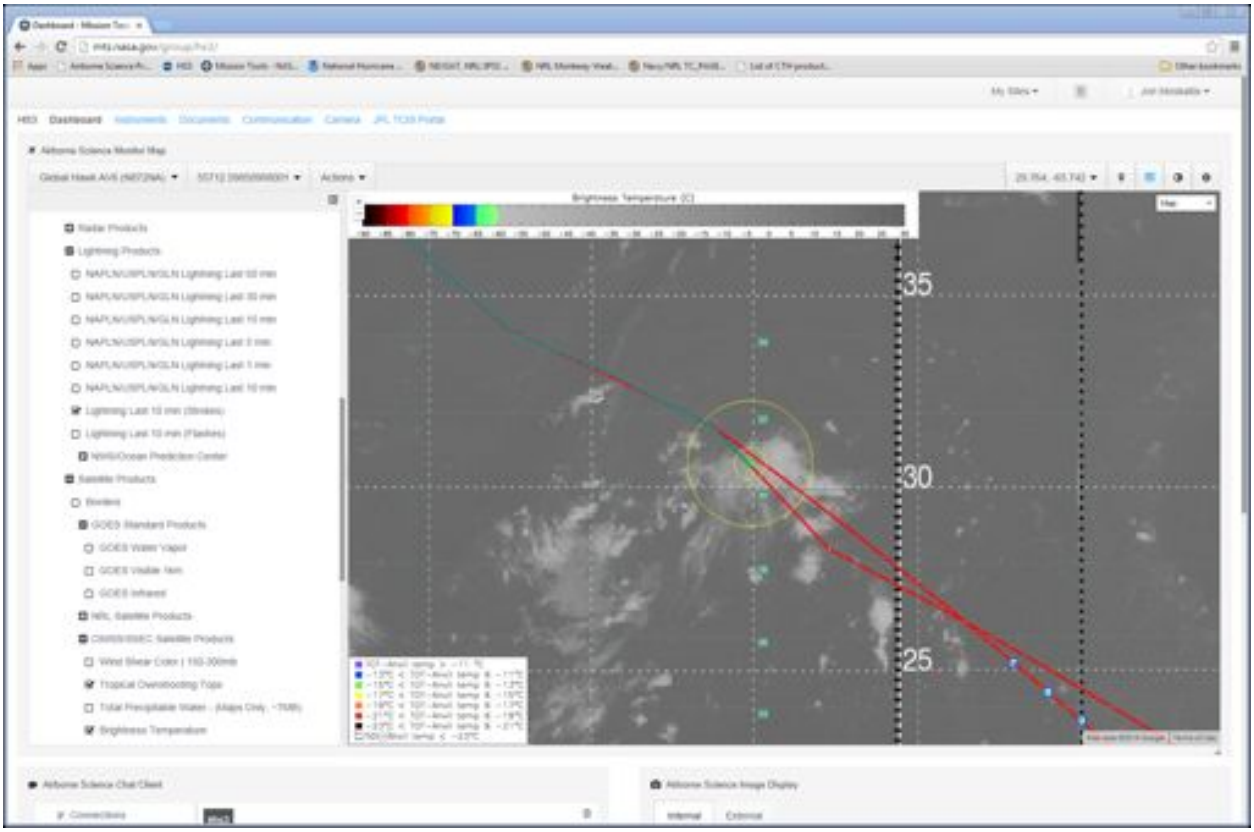
Almost all clear skies before traversing cells



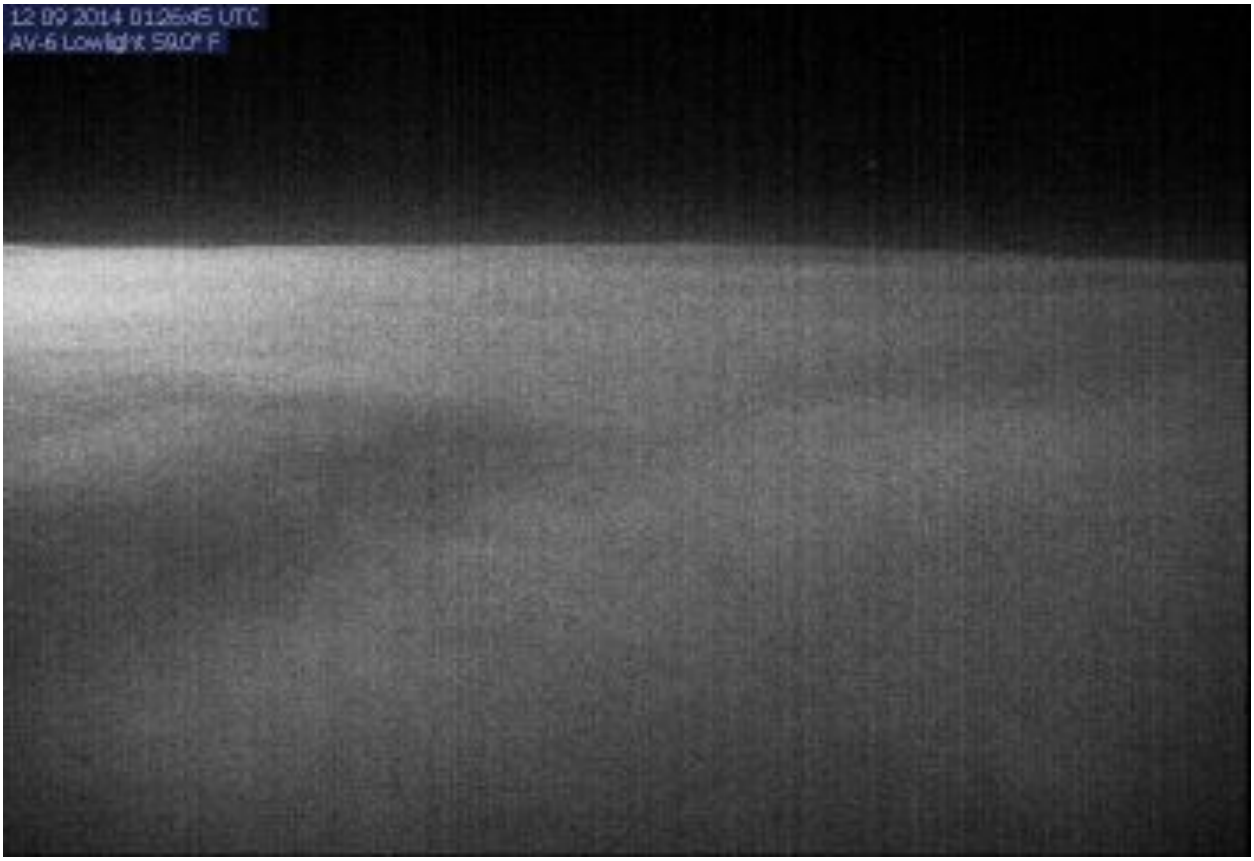
Overpass of convection- brightness temp showed about 40 kft tops- CPL shows low 30 k ft


History Plot
16.1(52854)
13.1(43011)
10.1(33169)
7.1(23326)
4.1(13484)
1.1(3641)
-1.8(-6200)
Altitude km (feet)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Signal Levels
01:18:23
01:20:04
01:21:46
01:23:26
01:25:06
01:26:50
CPL 12Sep14 (UTC)

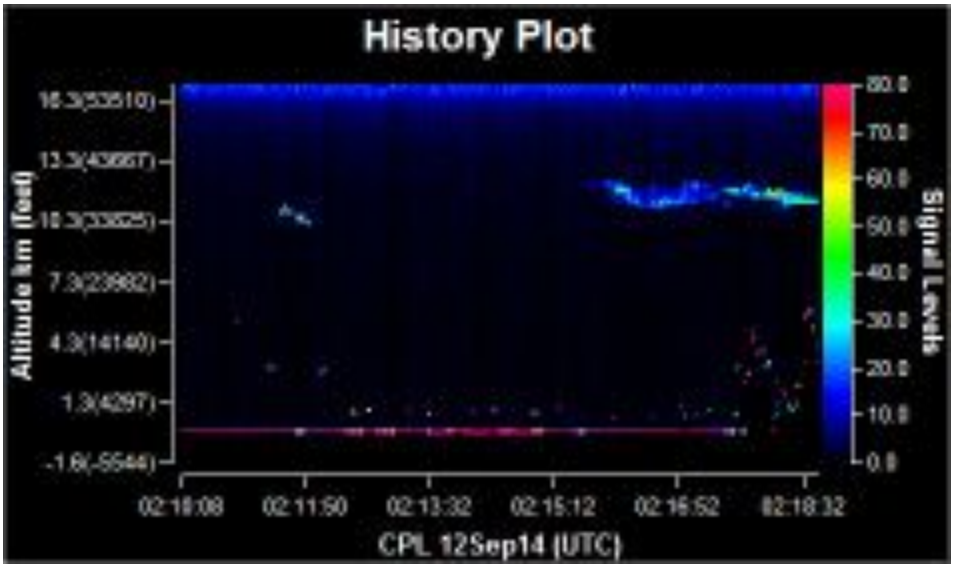
.


35
30
25

2AQAA

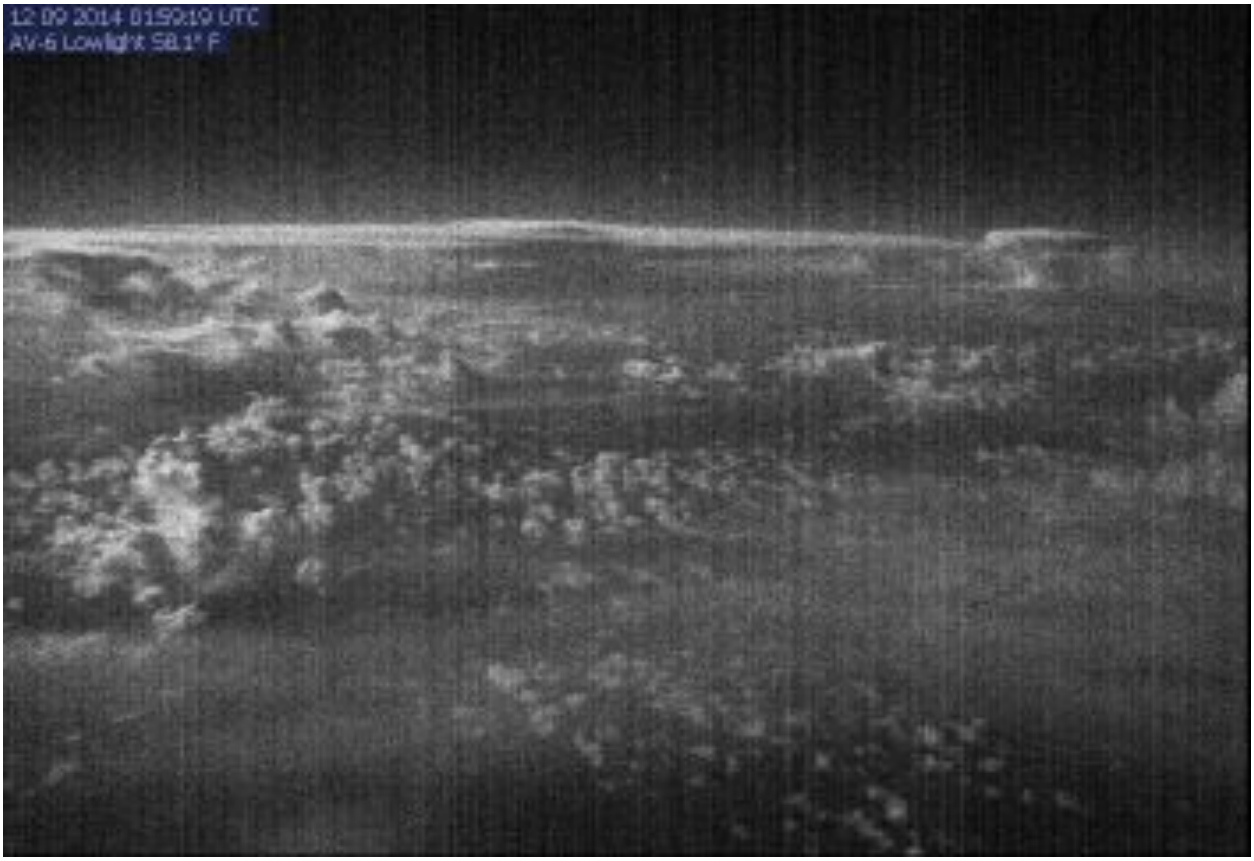


0200Z: Image below shows the low light view of the convection overflown. CTH doesn't indicate any area over aver 40kft and only about 1 flash per 10 minutes. No concern for overflight.

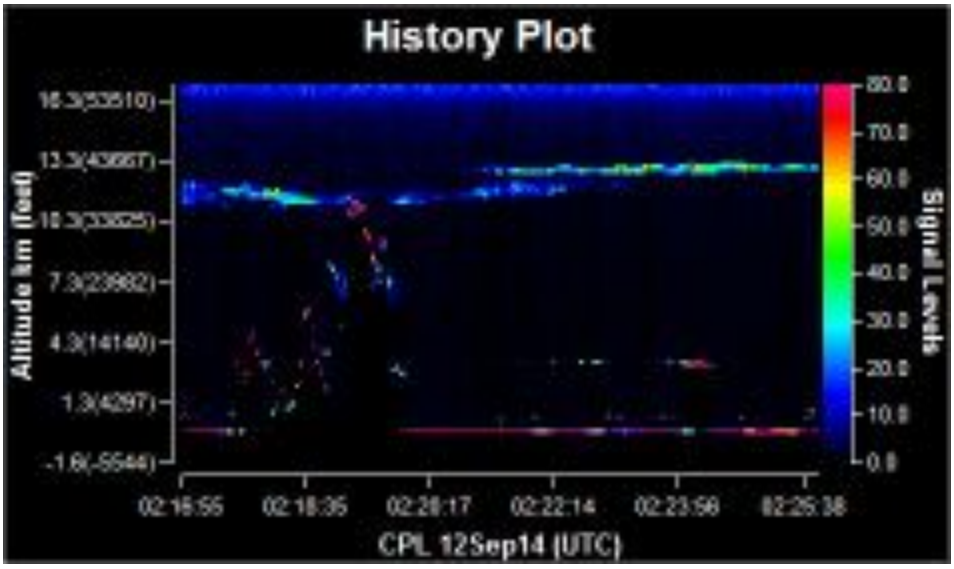


TD06 being upgraded to TS Edouard at 00Z 17.0 N, 38.9W, 35 kt, 1012 mb, storm motion 305/12kt

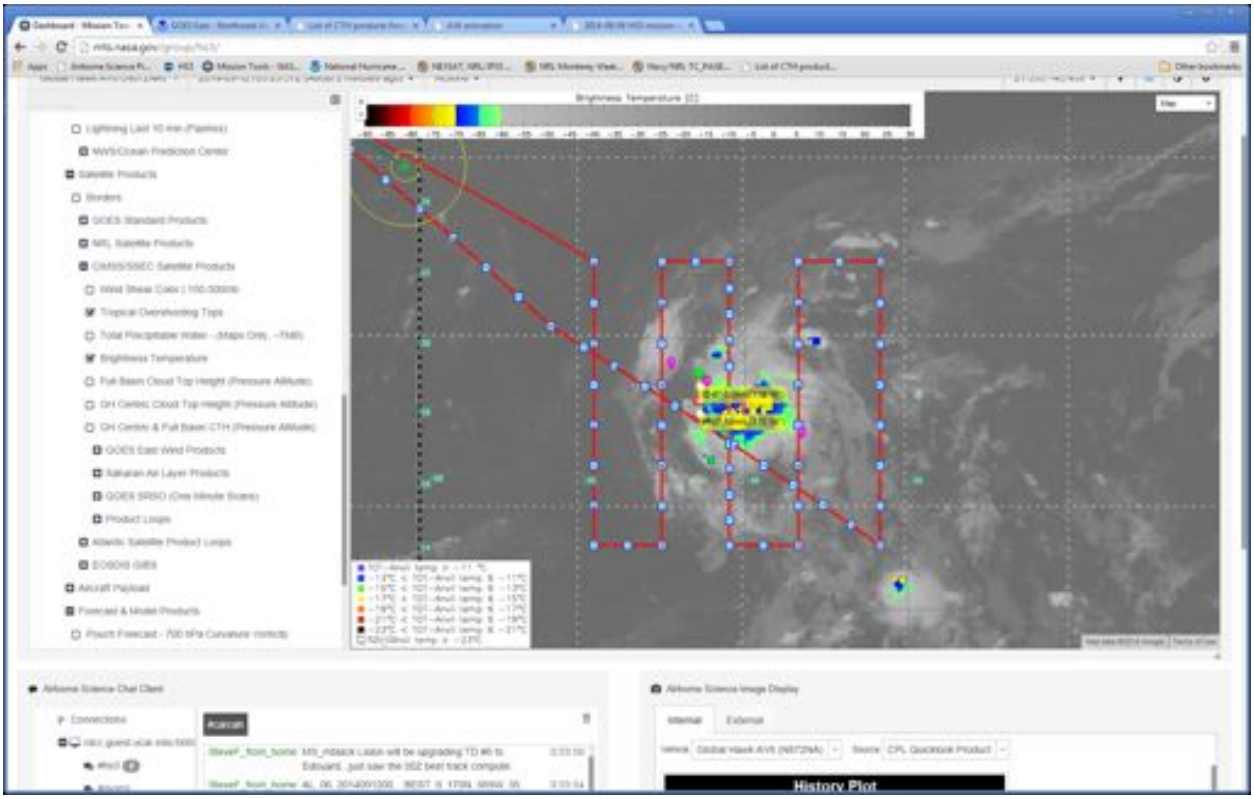
Shifting entire pattern to cross center about 09z at an estimated position of 18N, 40.5W



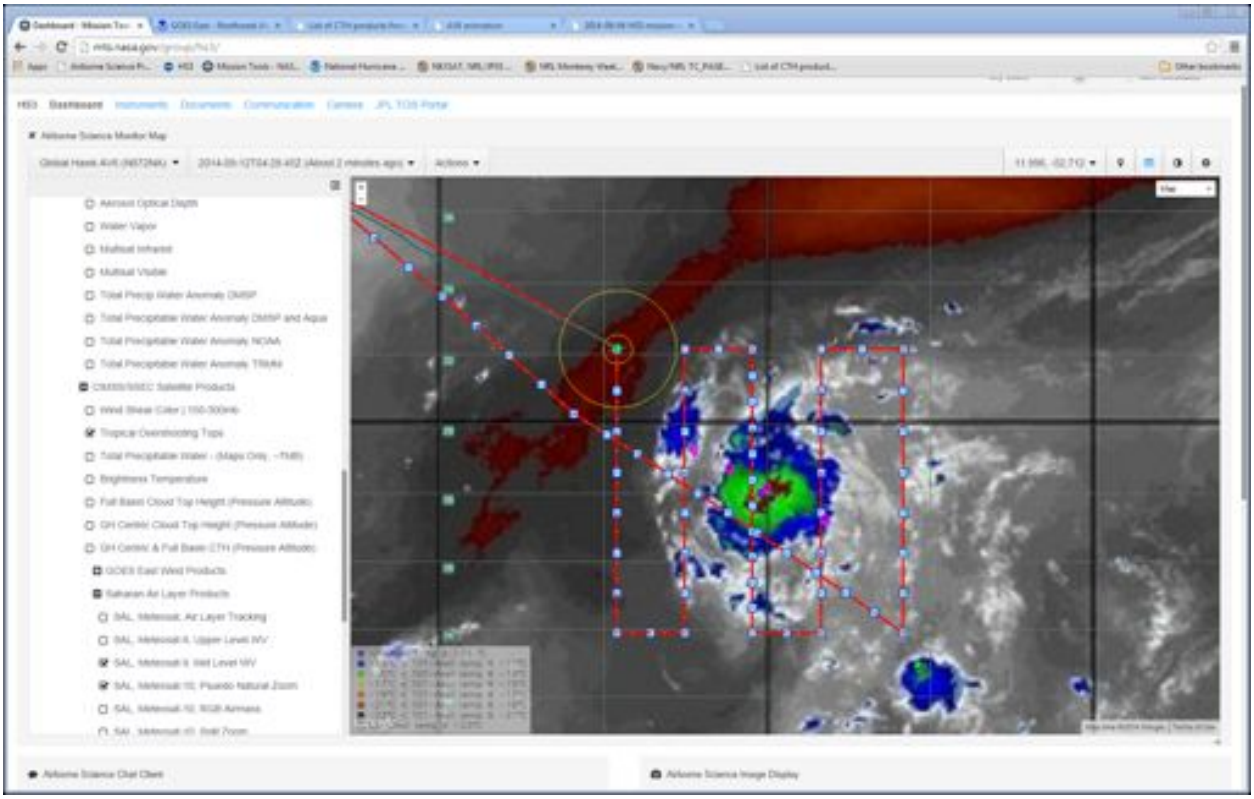
AV-6 lowlight camera en route to P29/Eduard.

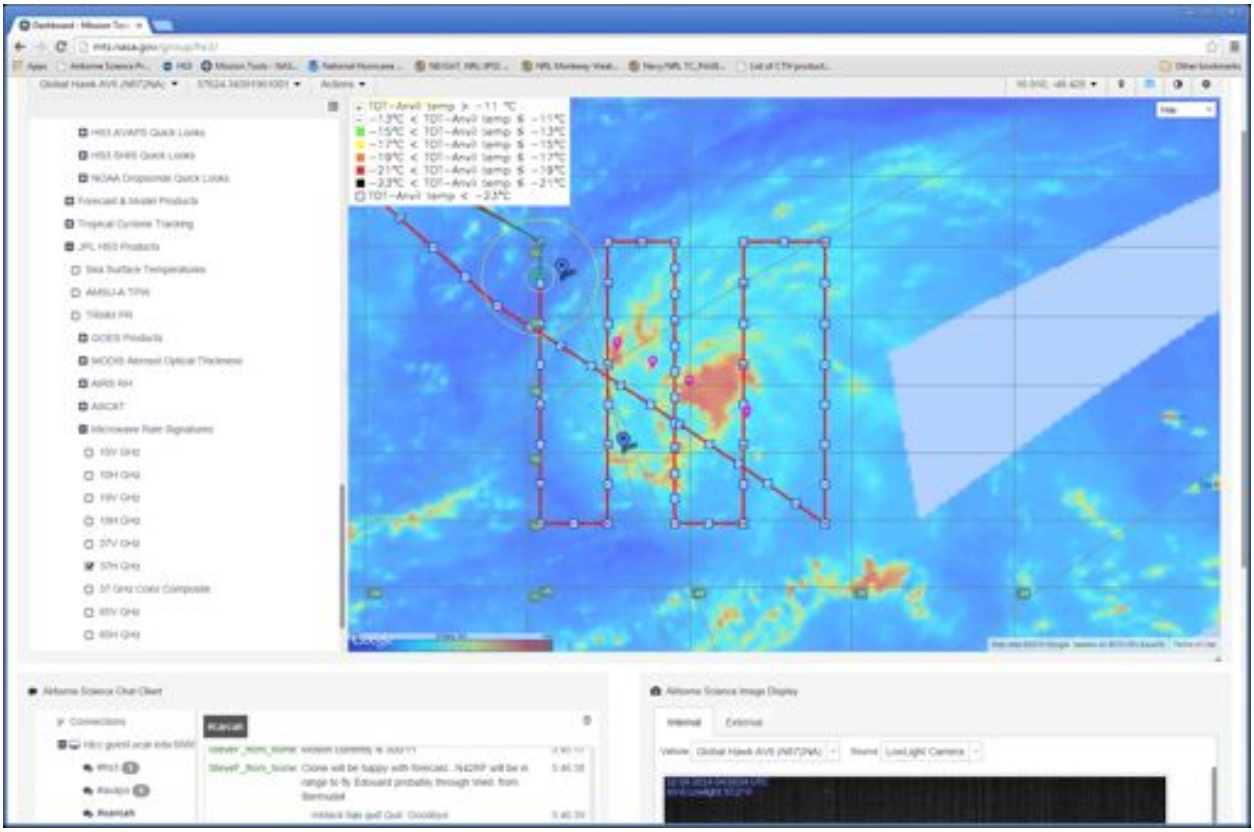


Scanning HIS en route to P29/Edouard

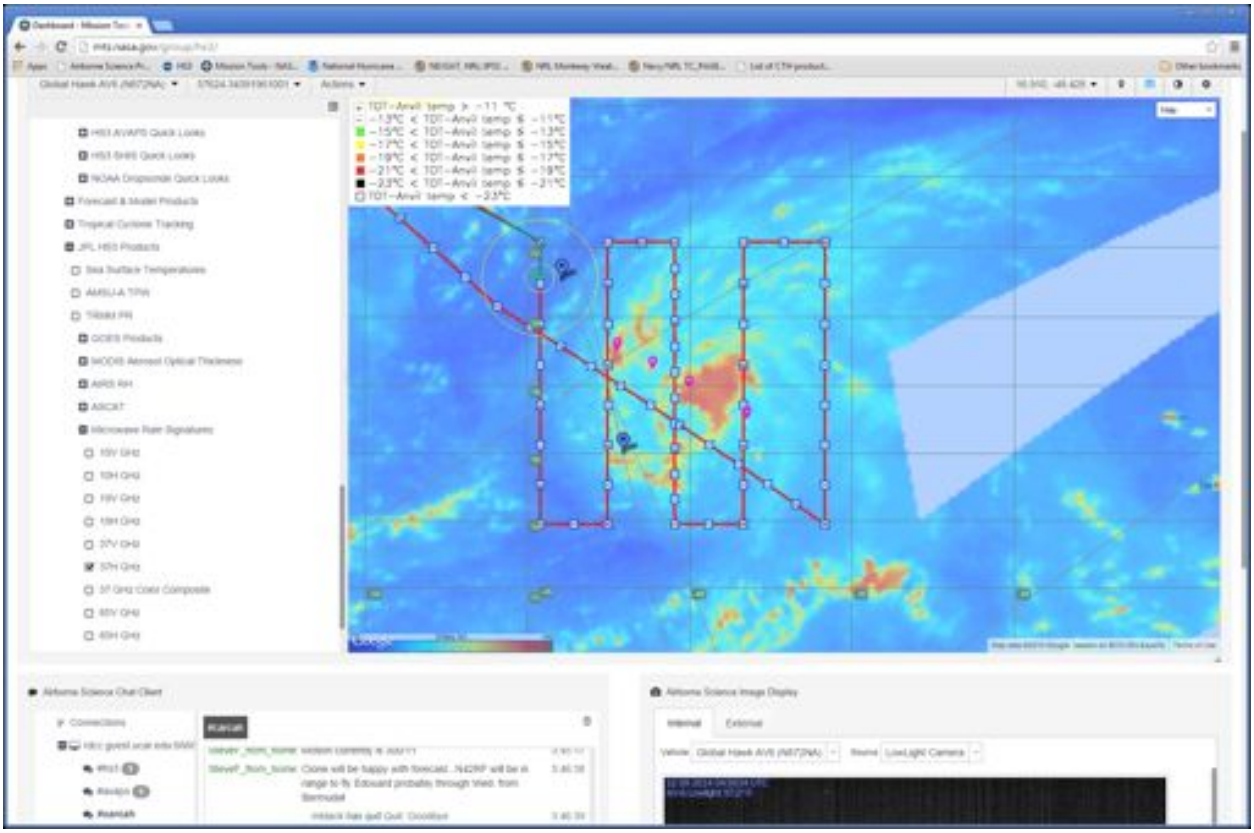


Drop 1 @ 0429Z- AVAPS- got a system fault – trouble shooting





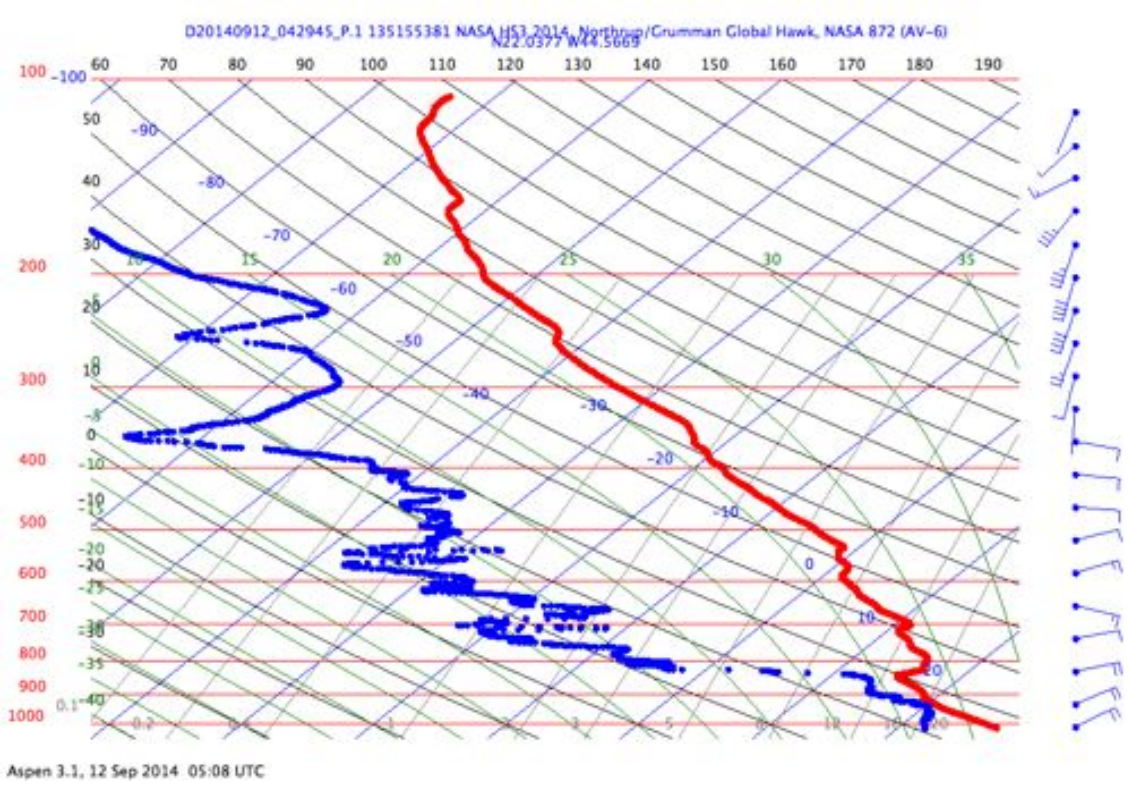
TOT product just after first drop release.



We are told that AVAPS system problem has been cleared and are now proceeding to release test dropsonde. Dropsonde away. However, AVAPS reports same problem as with Drop #1. Skipping originally-scheduled dropsonde #4.

AVAPS now thinks it is a software and not a hardware problem and thinks things will work but with some work. Michael Black said he got a D-file from first drop. It looks good. Here is what it looks like.

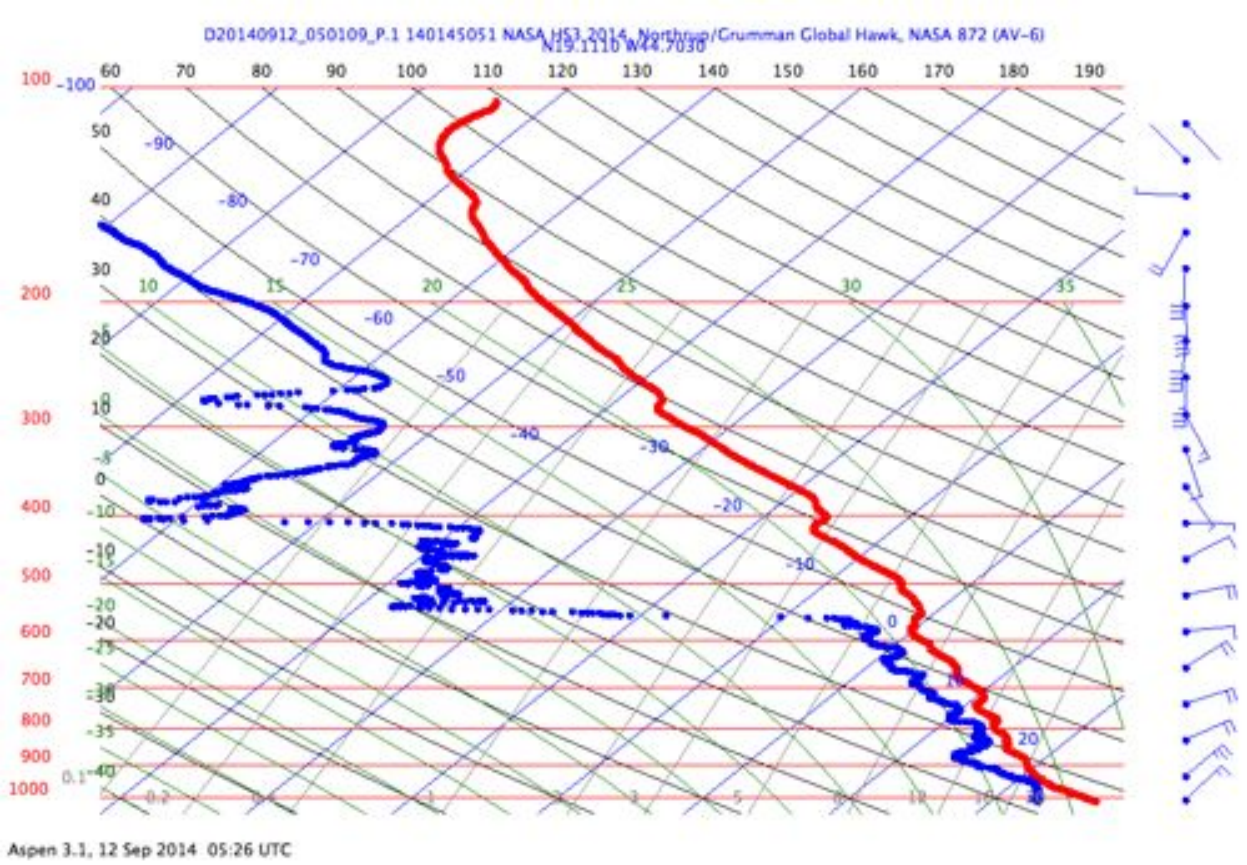
Drop #1 (0429 Z)



From the foregoing infrared image showing a very dry slot on the northwest corner of the pattern, s very dry slot is indicated. Drop #1 confirms this expectation with very large dew point depressions above approx.. 850 mb

We missed the originally scheduled Drop #2, but managed to drop this sonde near the originally scheduled Drop #3 location. Here is what it looks like.

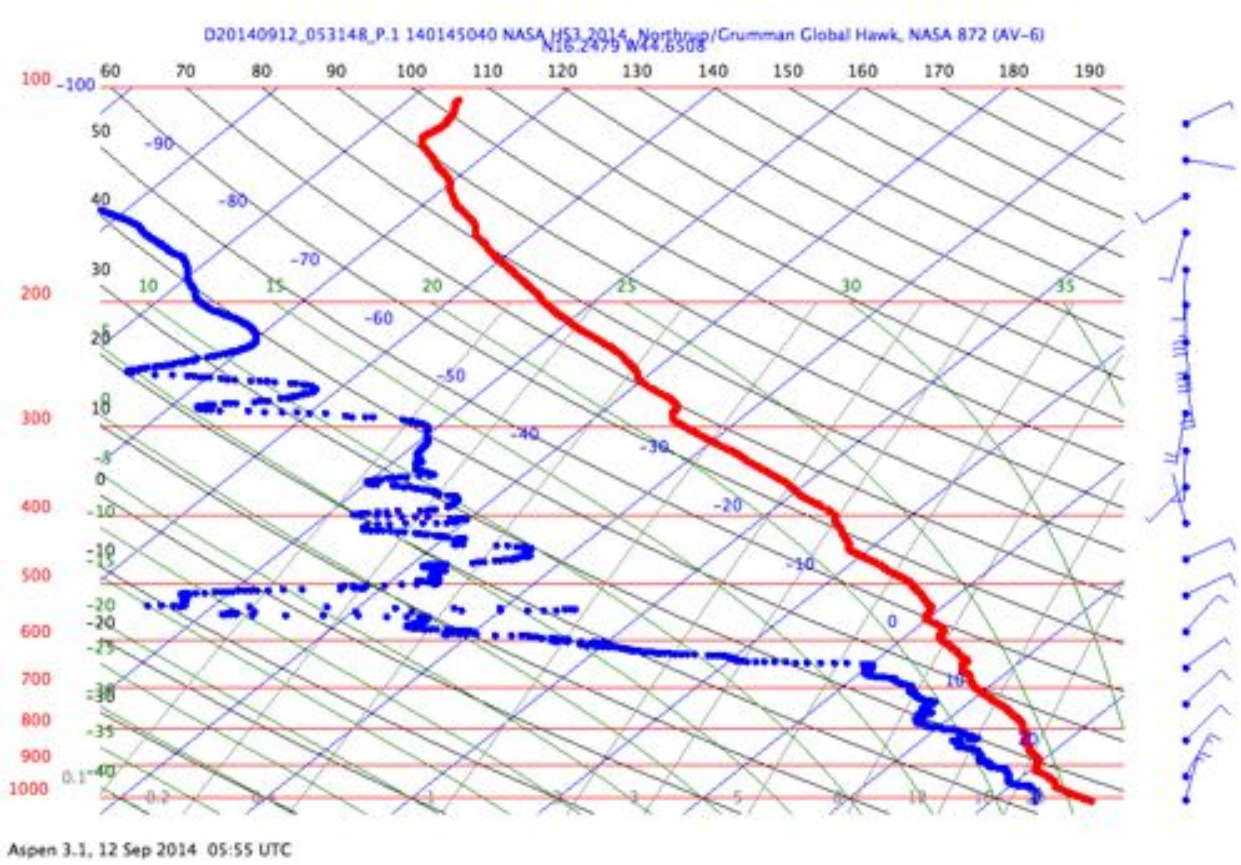
Drop #2 (0501 Z)



Sounding is Dramatically more moist between 950 mb and approx. 550 mb. Presumably we have just crossed the pouch (moist envelope) boundary. (Will examine this further below).

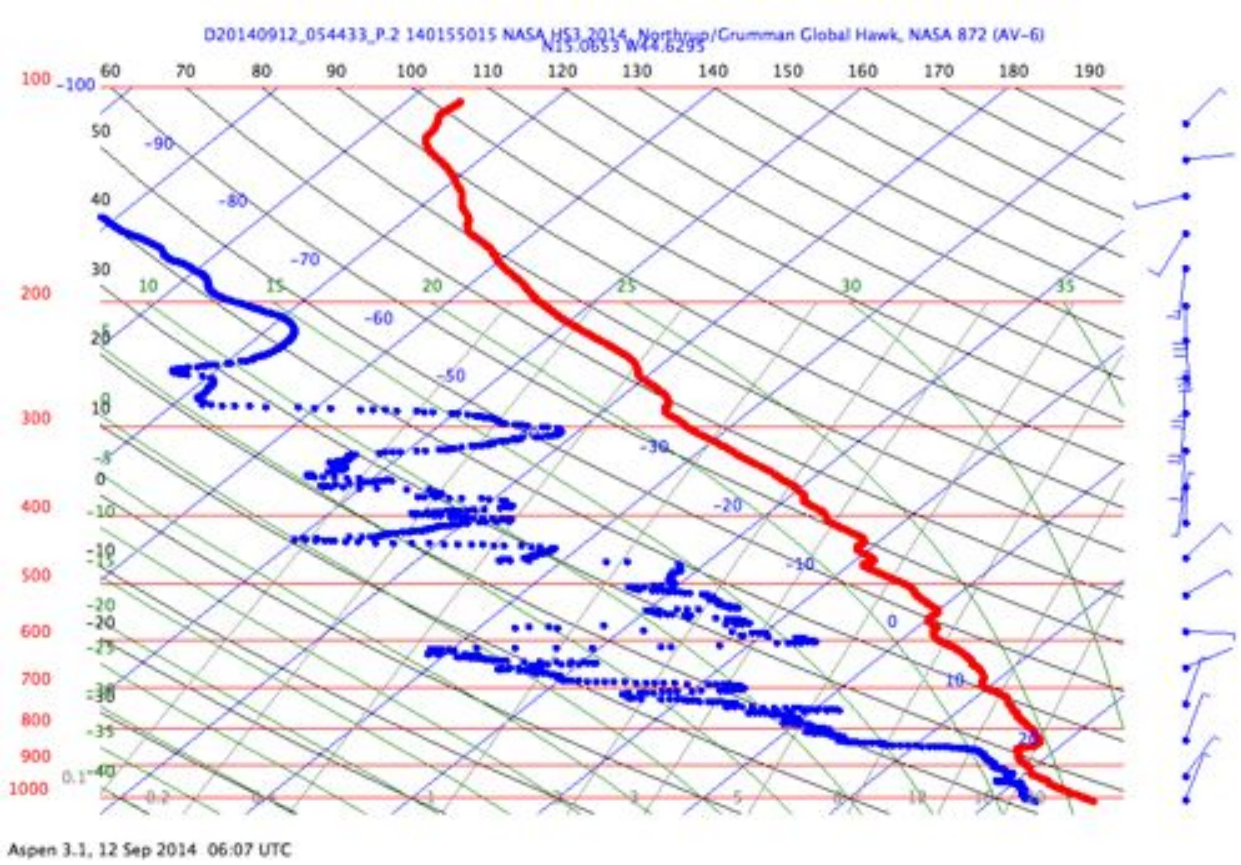
Wind speeds in lowest 50 mb for this drop are in range of 15 – 25 knots.

Drop #4 (0531 Z)



Profile for drop #3 is still moist, but a little drier in lowest 400 mb than drop #3. Wind speeds in lowest 50 mb are also weaker than drop #2.

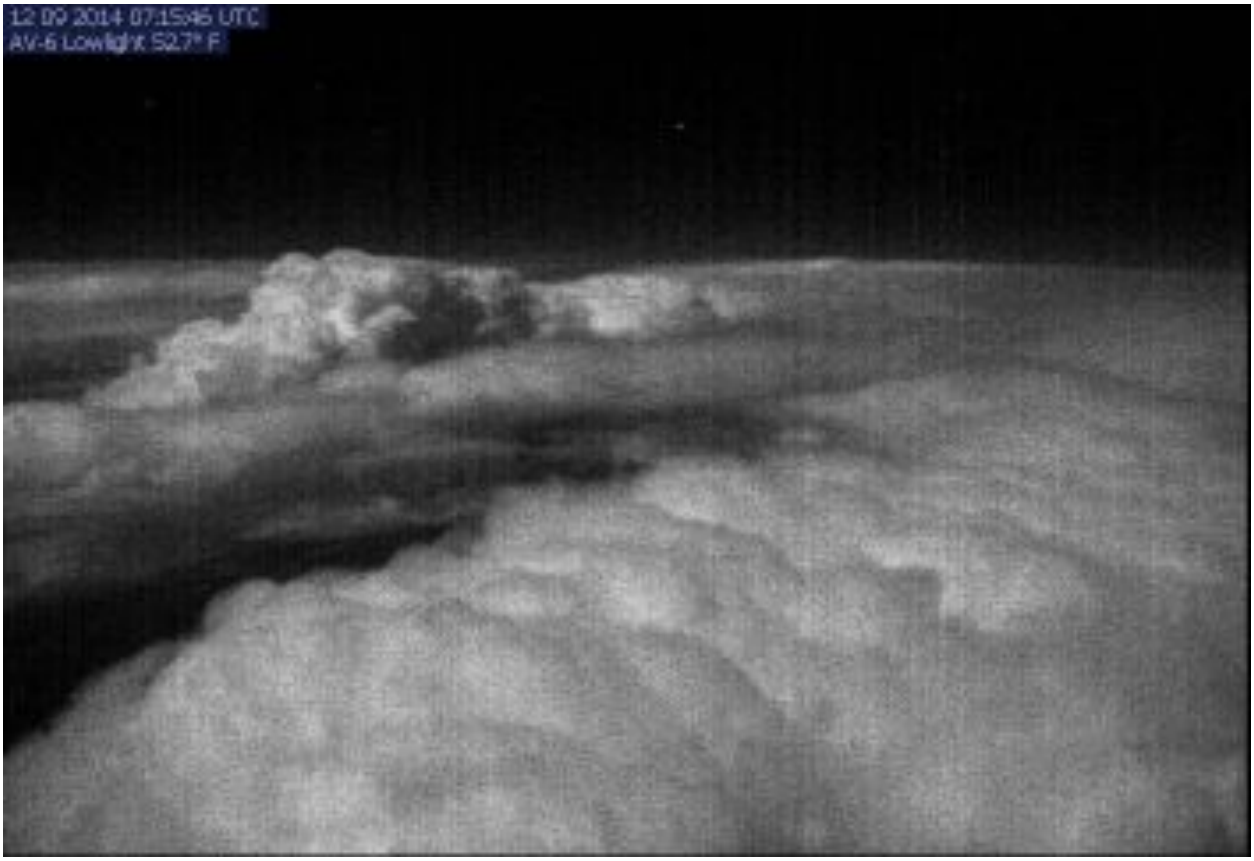
Drop #5 (0531 Z) shows drier low levels relative to drop #4.



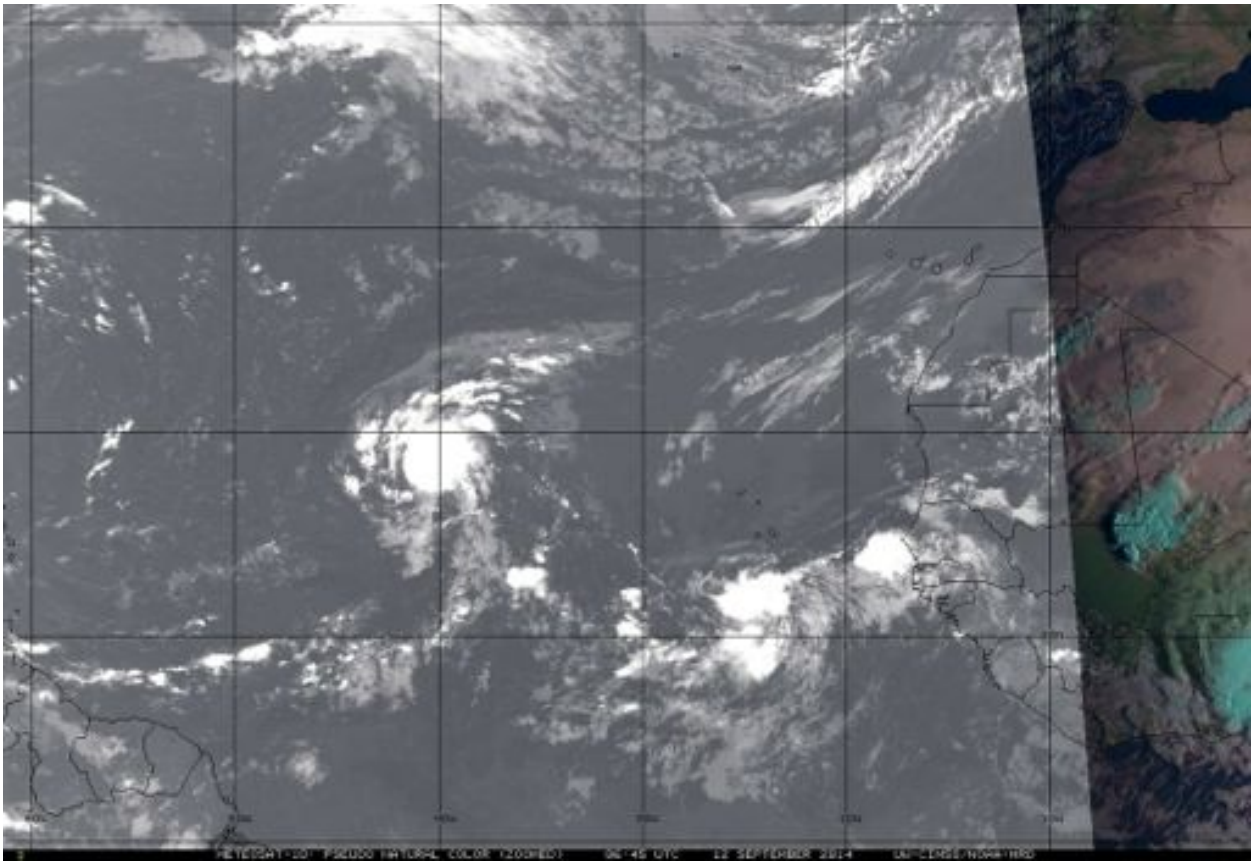
AVAPS has decided to recycle the AVAPS power system on board the AV-6. The first southernmost east-west flight segment will not have any drops.

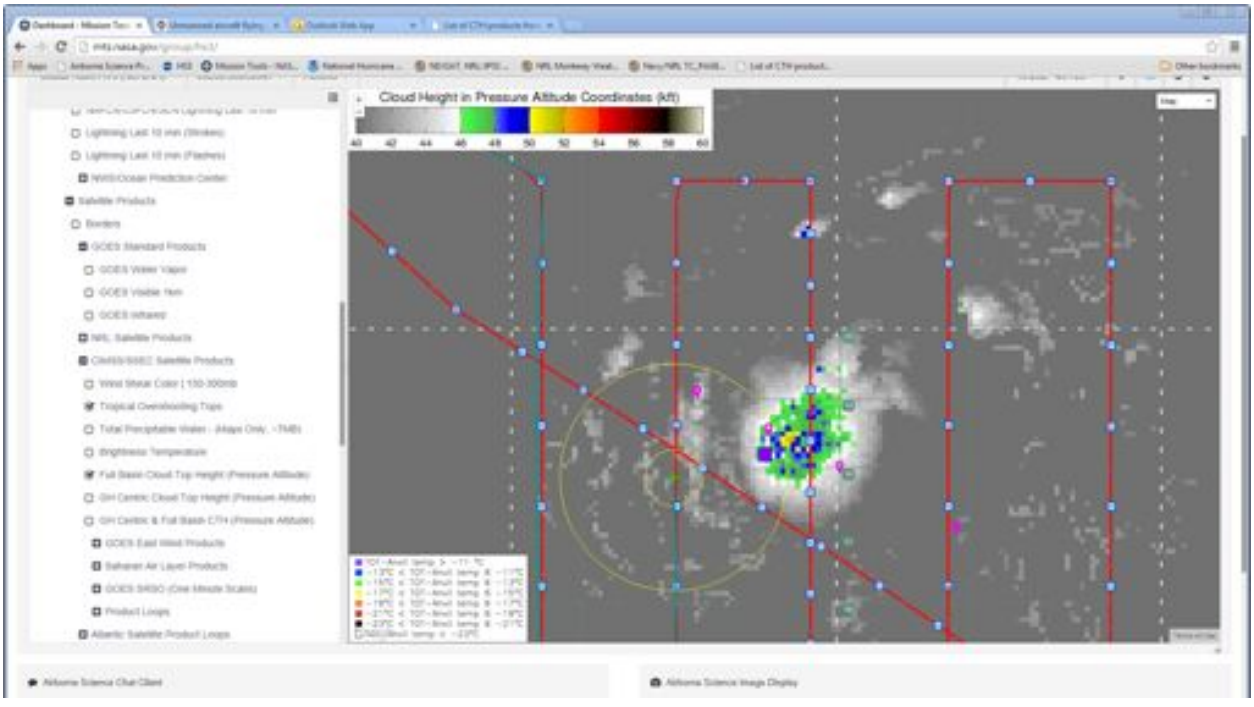
0630Z: Power cycling seems to have resolved the temperature issue with the sonde release motor. Will proceed with the current drop timing unless problem comes up again.

0700Z: Bursts have continued near the center over the past few hours, and the areal coverage of rainfall – particularly the symmetry – may be increasing as a result (see CTH below).

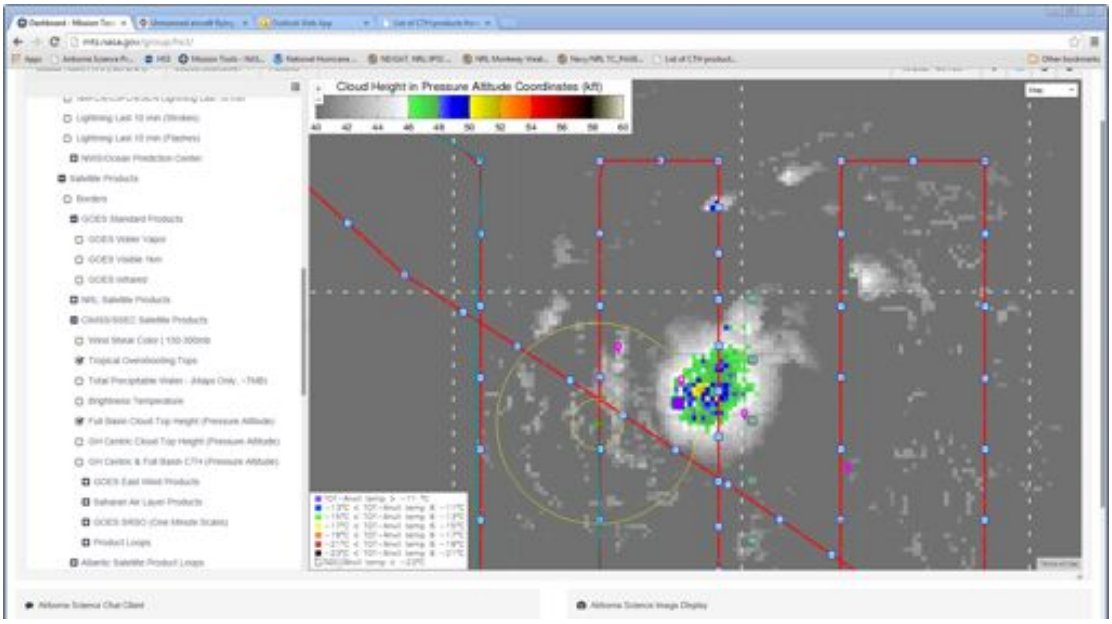


AV-6 lowlight camera as plane flies north on second north-south leg. Some bubbling convection evident slightly left of image center (left of plane track).

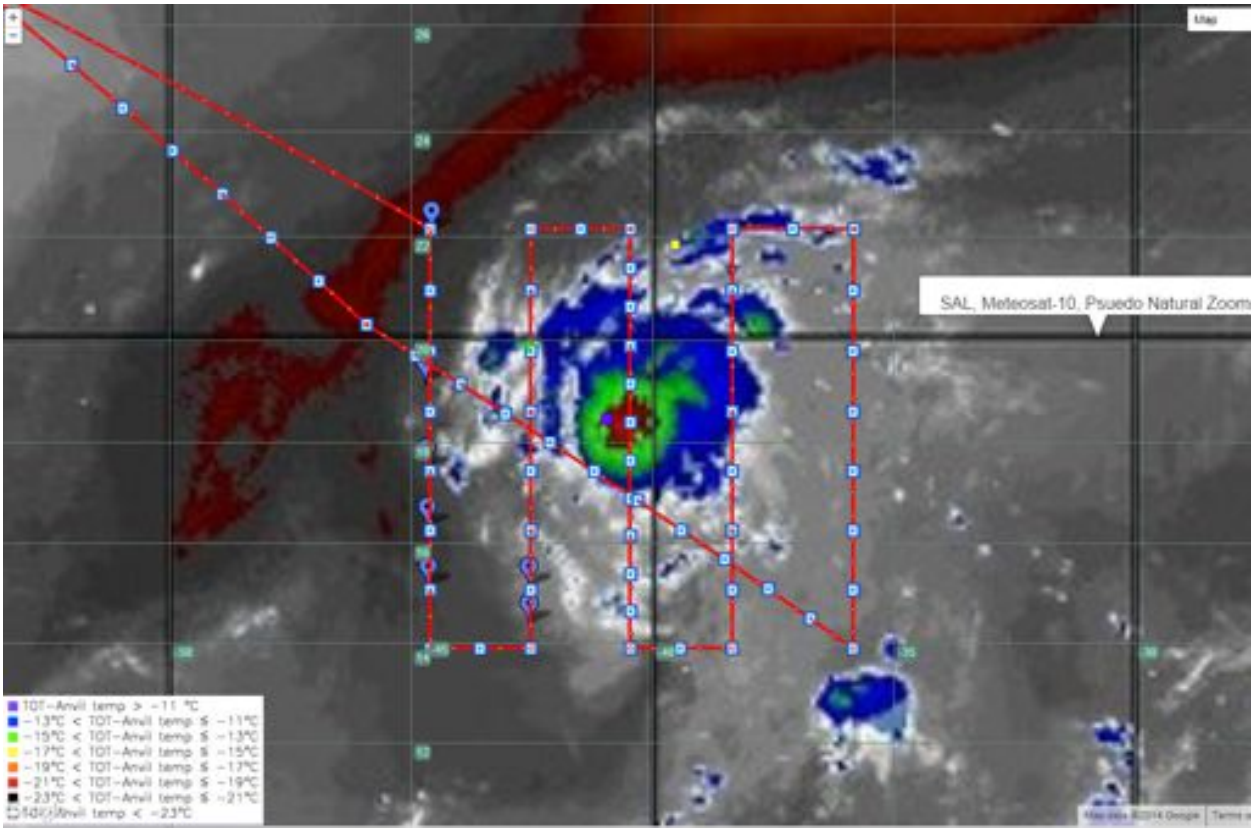



Cloud Height in Pressure Altitude Coordinates (kft)
40 42 44 46 48 50 52 54 56 58 60

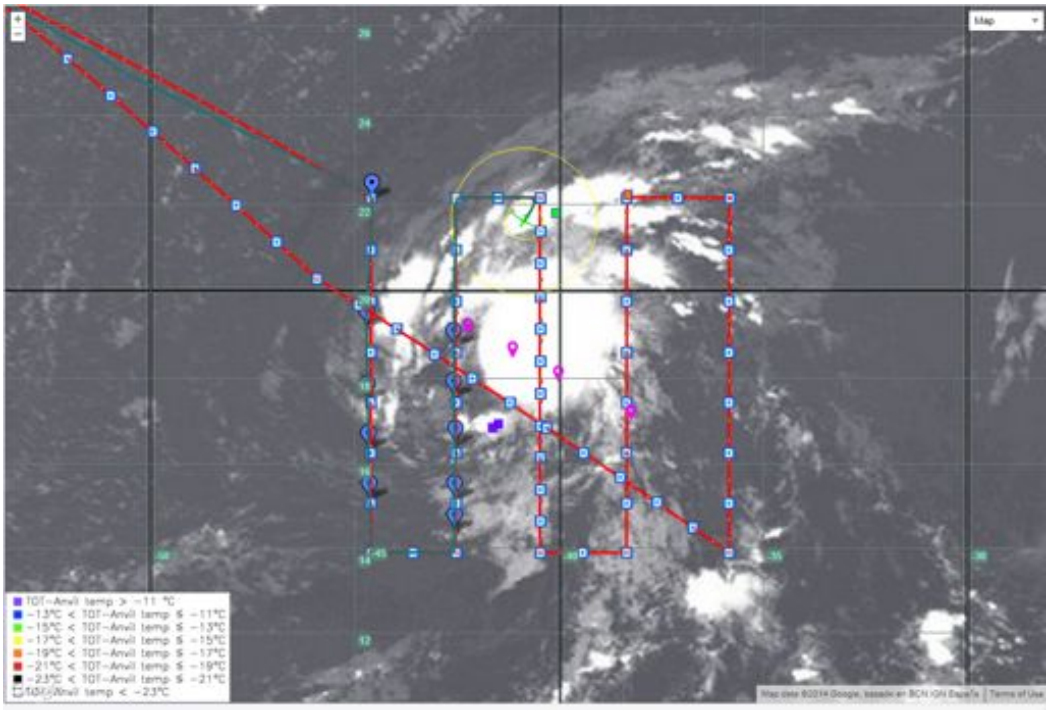
CTH screen capture



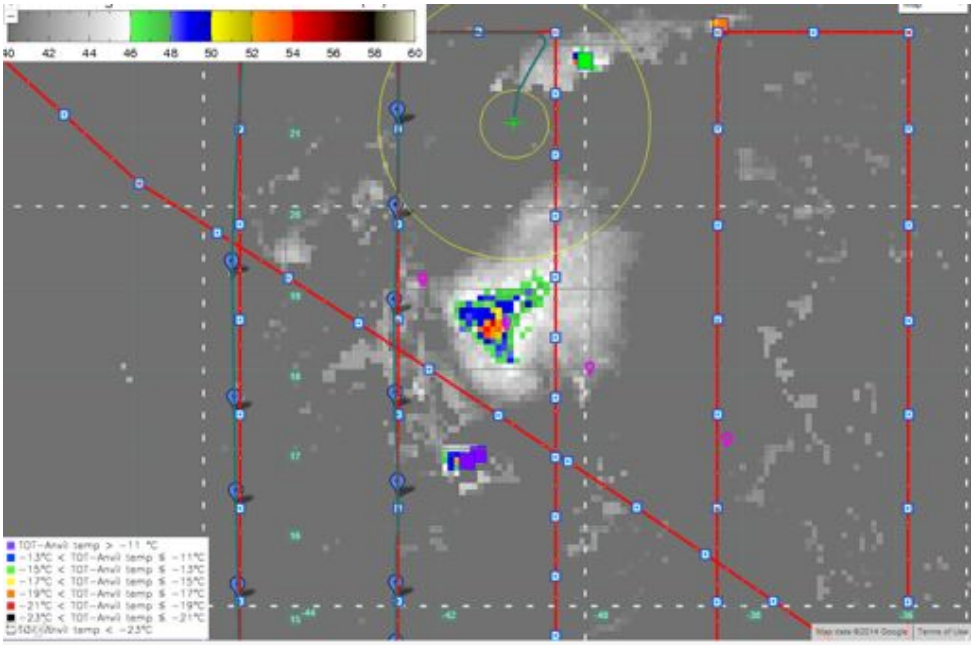
TOT superimposed on Flight track and airplane location at ~0720 Z

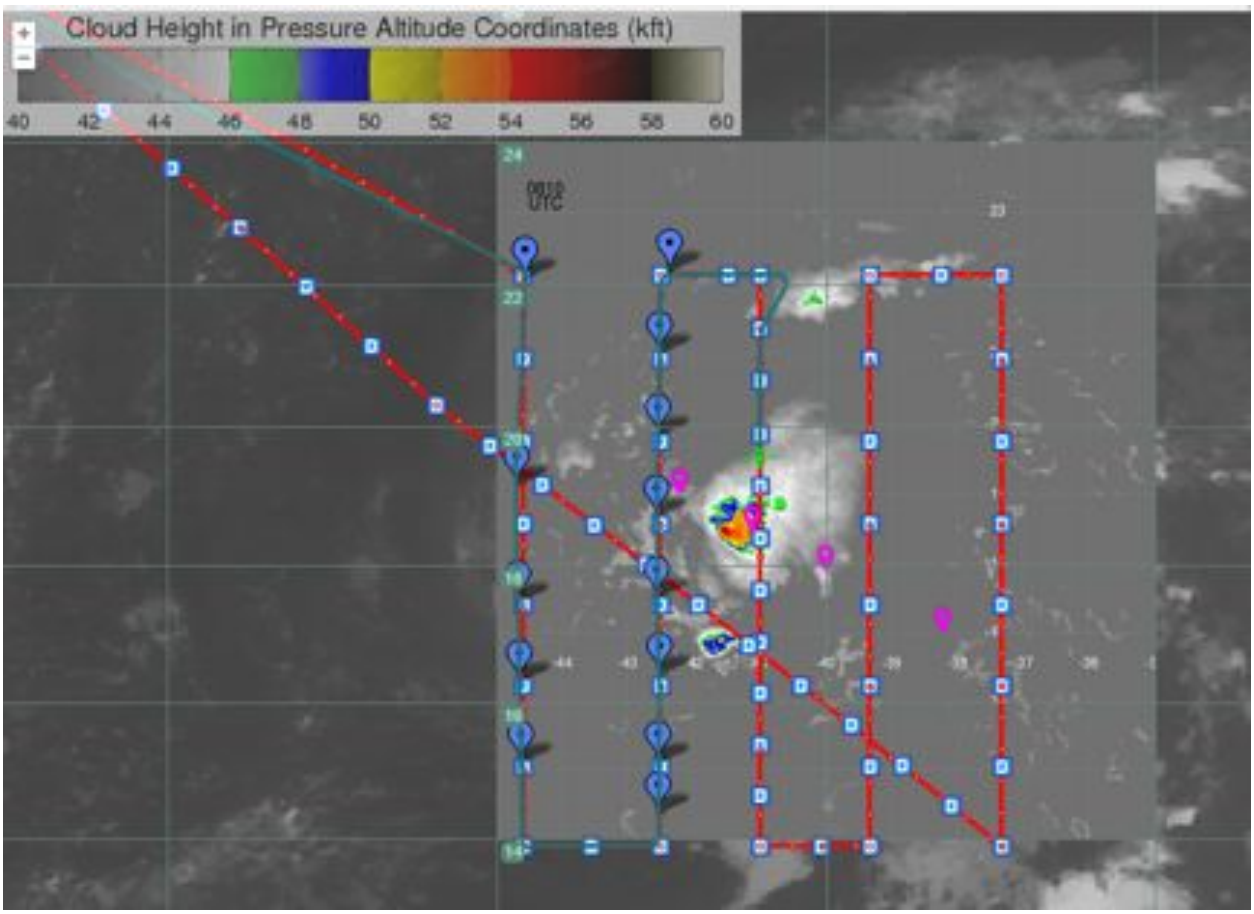

SAL, Meteosat-10, Psuedo Natural Zoom
TOT-Anvil temp > -11 °C
-13°C < TOT-Anvil temp ≤ -11°C
-15°C < TOT-Anvil temp ≤ -13°C
-17°C < TOT-Anvil temp ≤ -15°C
-19°C < TOT-Anvil temp ≤ -17°C
-21°C < TOT-Anvil temp ≤ -19°C
-23°C < TOT-Anvil temp ≤ -21°C
TOT-Anvil temp < -23°C

0814 Course correction. Shifting third leg to 41W to get closer to the estimated center.

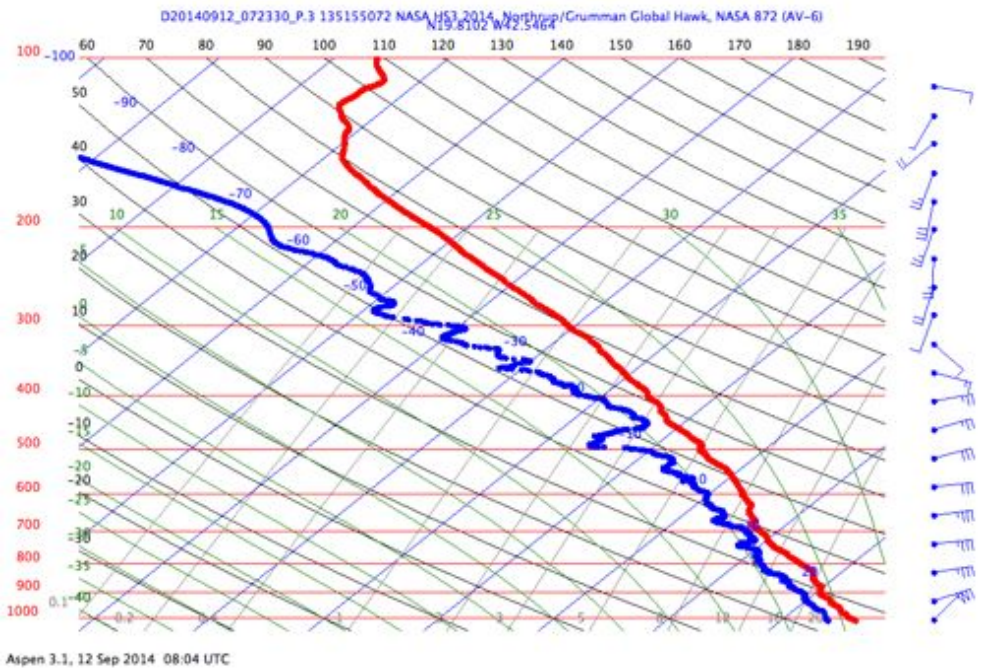


Cloud top heights (below) show intensifying convection just west of track.

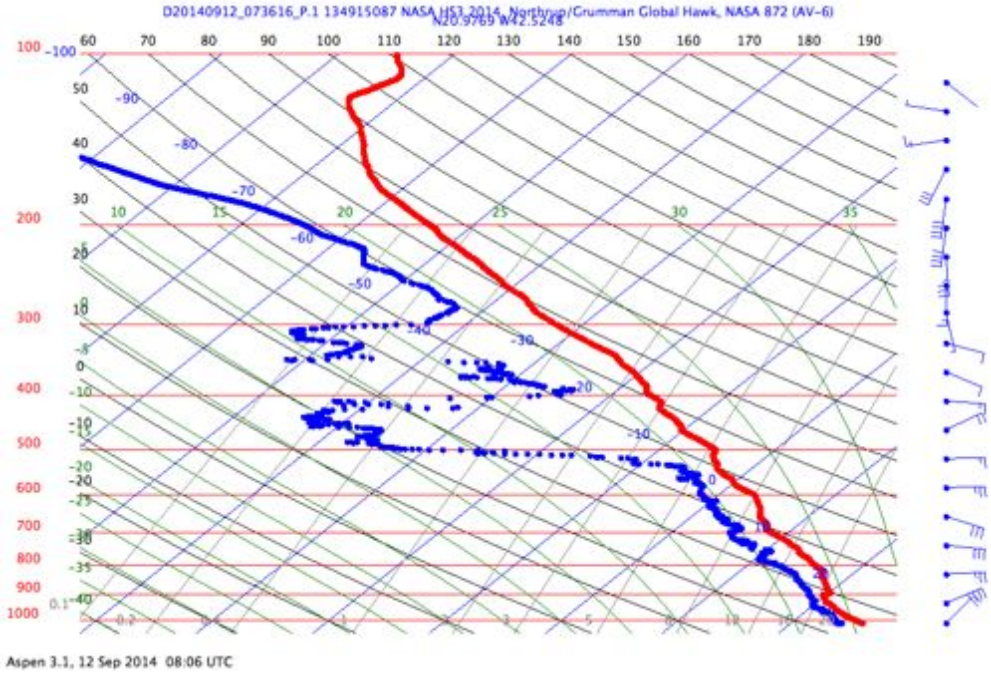




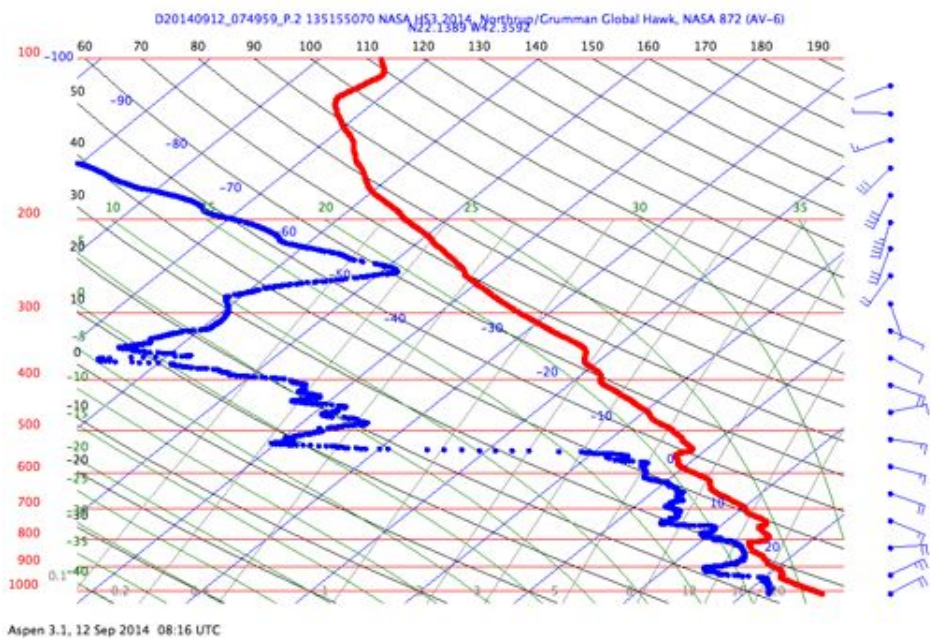
New flight pattern now in MTS with last three legs shifted about 1deg westward. Approaching intense convective cell just west of track.



Drop D15, third to last drop near end of leg two. Shows moist conditions through the troposphere.



Drop D16, next to last drop at north end of leg two. Starting to see dry air again above 500 mb.



Drop D17 at north end of leg two. Very dry air above 550 mb.

NHC mentions Global Hawk in its 5am discussion.

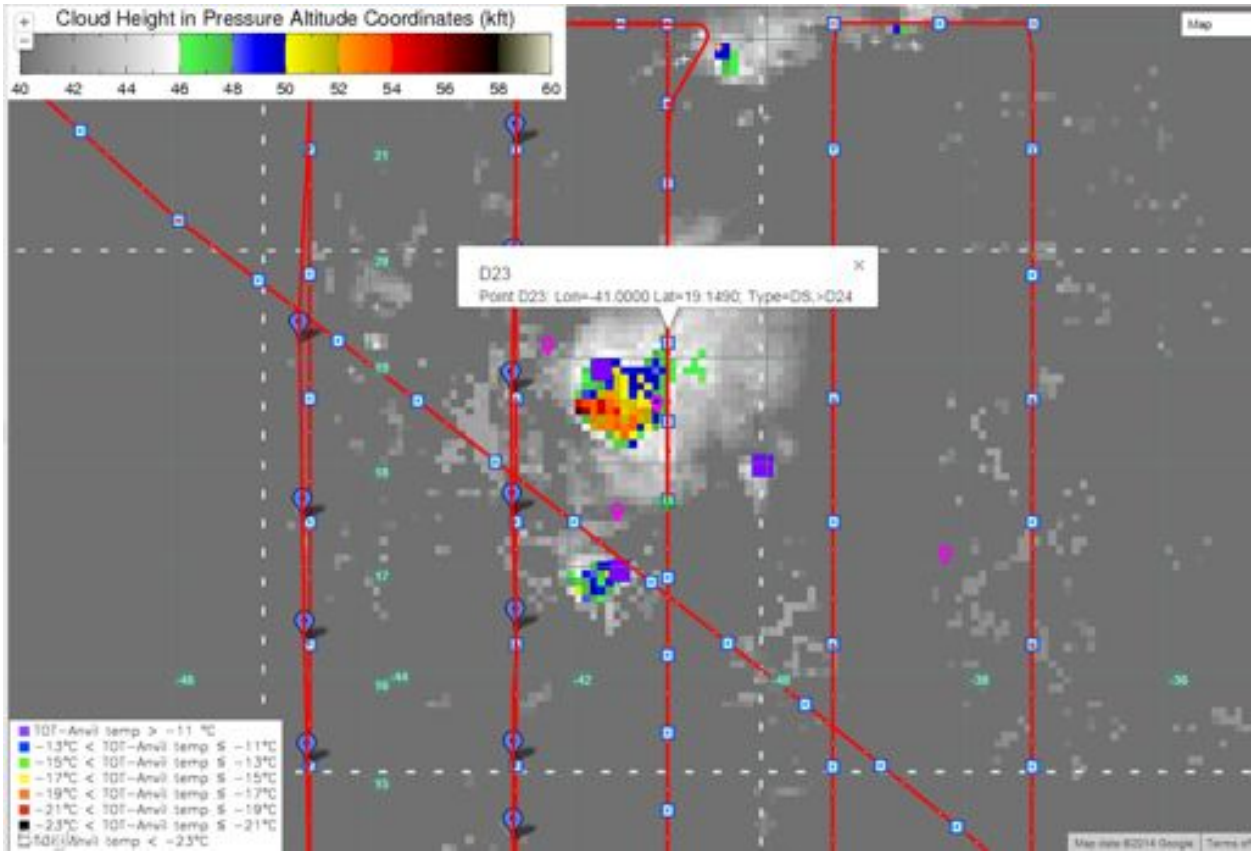
TROPICAL STORM EDOUARD DISCUSSION NUMBER 4
NWS NATIONAL HURRICANE CENTER MIAMI FL AL062014
500 AM AST FRI SEP 12 2014

Edouard is feeling the effects of moderate vertical wind shear as the center is on the southwest edge of the deep convection. The current intensity values from both SAB and TAFB suggest that the cyclone remains a low-end tropical storm and its intensity is kept at 35 kt. While Edouard will be traversing progressively warmer waters during the next three to four days, it may only gradually intensify due to the inhibiting effects of about 15 kt of deep layer shear and dry lower-tropospheric air. **Indeed, dropsondes launched by the unmanned NASA Global Hawk aircraft this evening showed very dry conditions just to the southwest of Edouard.** The official intensity forecast, based upon a blend of the LGEM and SHIPS statistical models and the HWRF dynamical model, is just slightly below the prediction from the previous advisory.

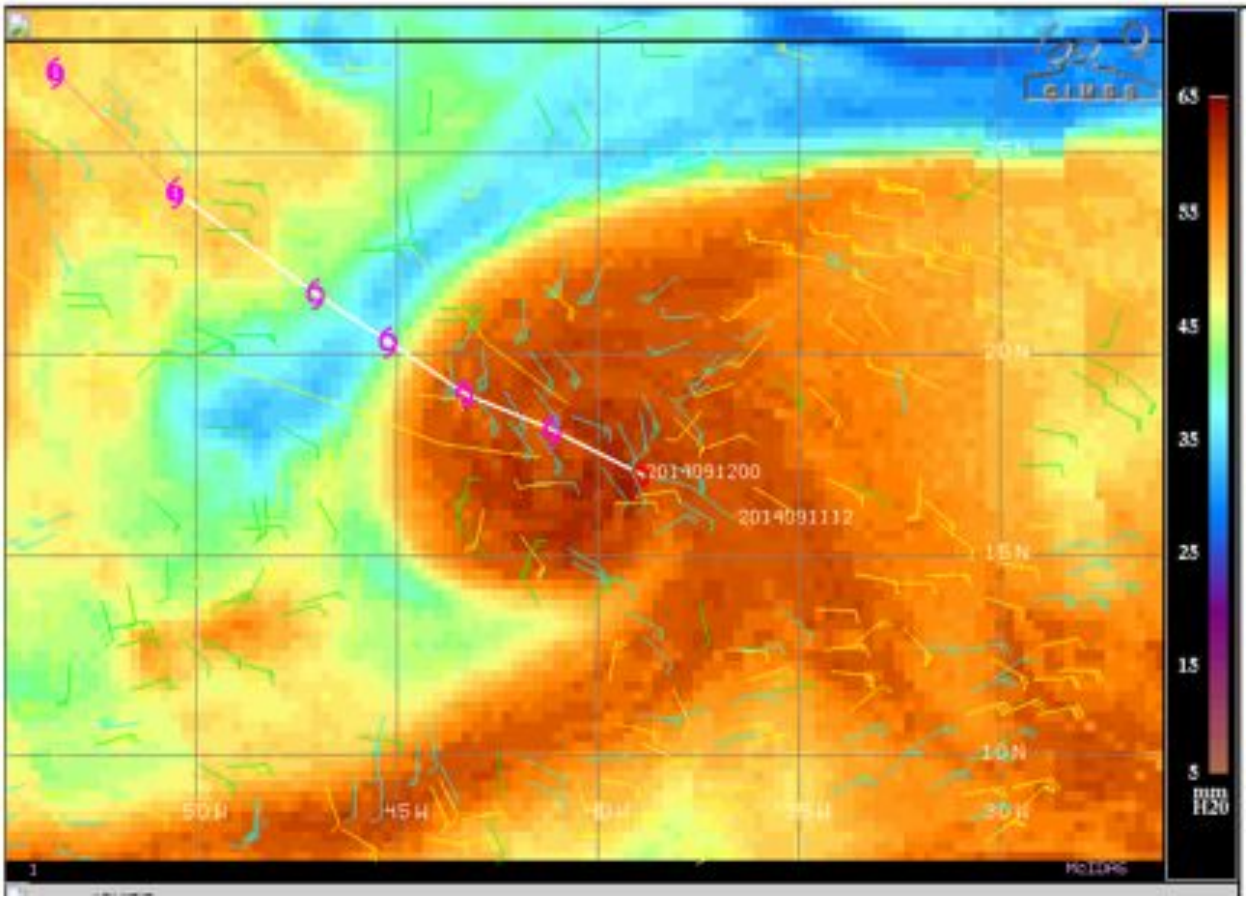
Microwave passes by the TRMM and SSMI low-earth orbiting satellites assisted substantially in determining the initial position and current motion, indicating that Edouard was a bit farther west than estimated earlier. The tropical storm is moving west-northwestward at a faster rate of about 13 kt. Edouard should gradually turn toward to the north by the end of the forecast period, as it moves around the periphery of a deep-layer ridge to its north and through a weakness in the ridge. The official track forecast is based upon the tightly clustered TVCA multi-model consensus and is slightly west of the previous track prediction because of the more westerly initial position.

FORECAST POSITIONS AND MAX WINDS

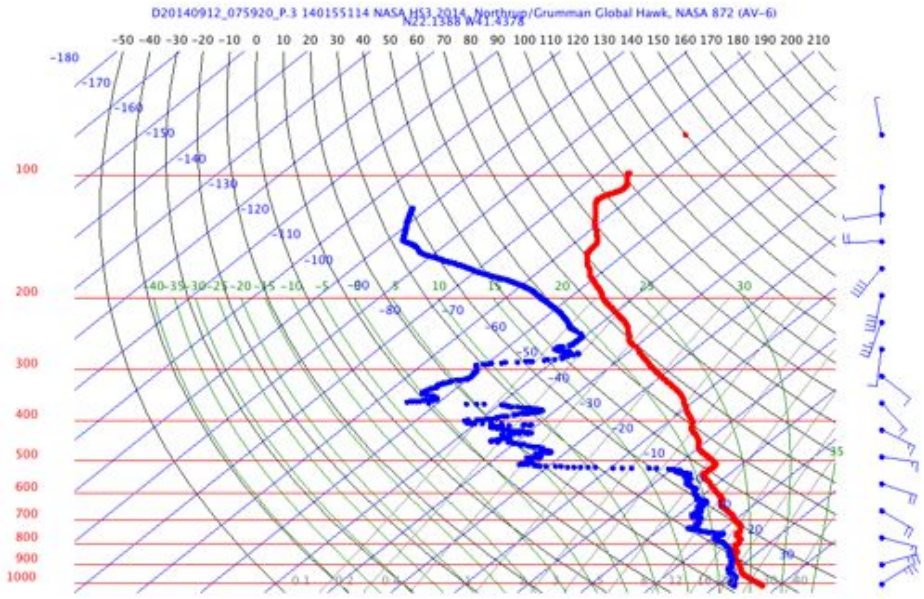
INIT	12/0900Z	17.6N	41.7W	35 KT	40 MPH
12H	12/1800Z	18.6N	43.5W	40 KT	45 MPH
24H	13/0600Z	19.7N	45.5W	40 KT	45 MPH
36H	13/1800Z	20.7N	47.5W	45 KT	50 MPH
48H	14/0600Z	22.0N	49.3W	50 KT	60 MPH
72H	15/0600Z	24.8N	53.0W	60 KT	70 MPH
96H	16/0600Z	27.5N	55.5W	70 KT	80 MPH
120H	17/0600Z	31.0N	55.5W	70 KT	80 MPH



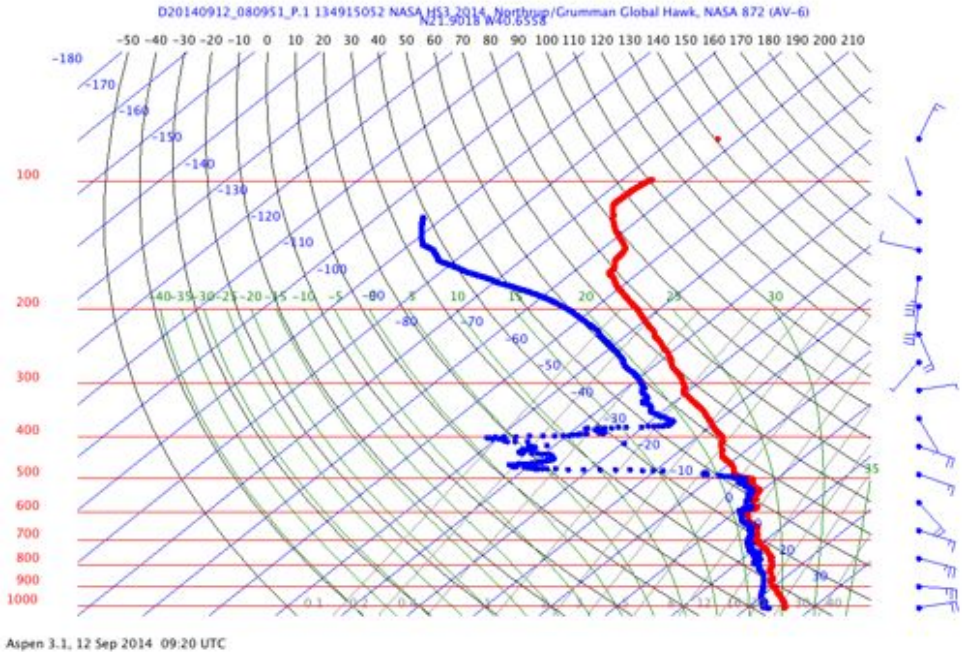
0830-0900 Three extra drops added along this third leg between points D23-24, D24-25, and D25-26. Passed by convective burst. No lightning associated with the burst, but there is some lightning associated with an outer band to the north and west.



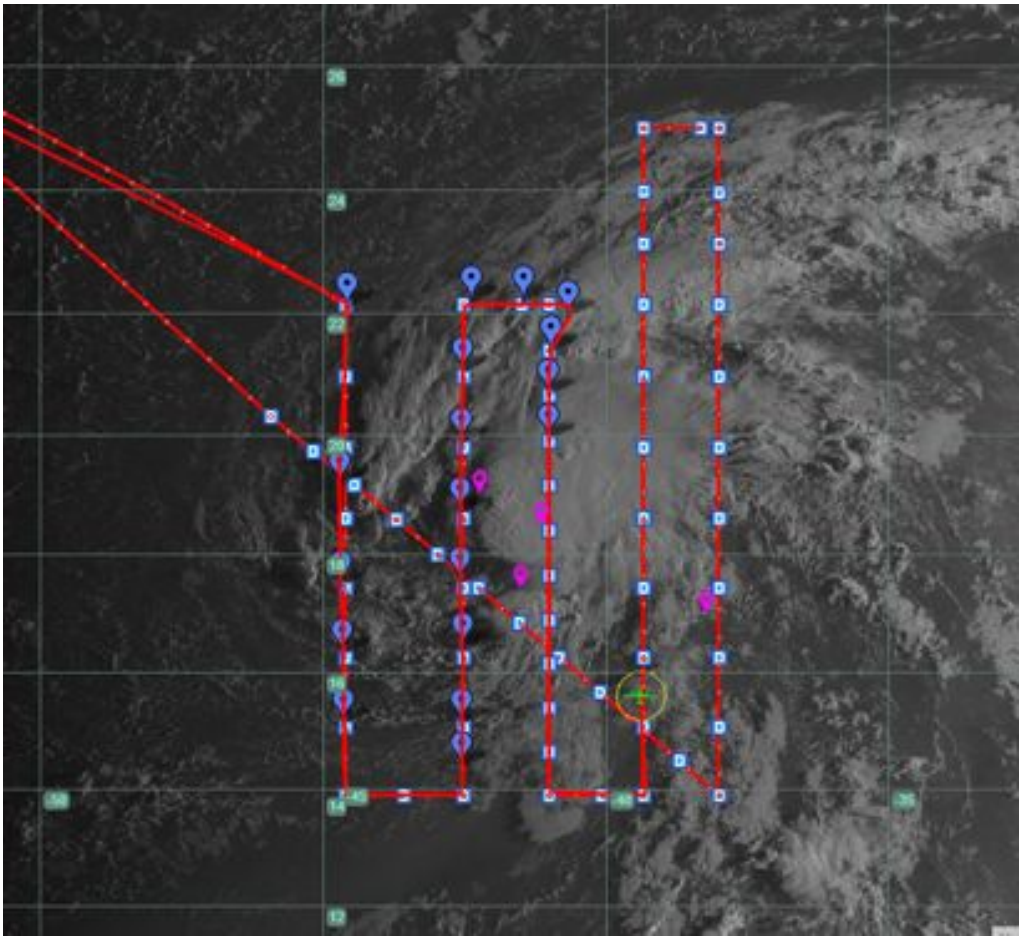
0700 Edouard shows nice outflow to the north. We will extend the last two legs northward to 25N to catch the bulk of the outflow jet.



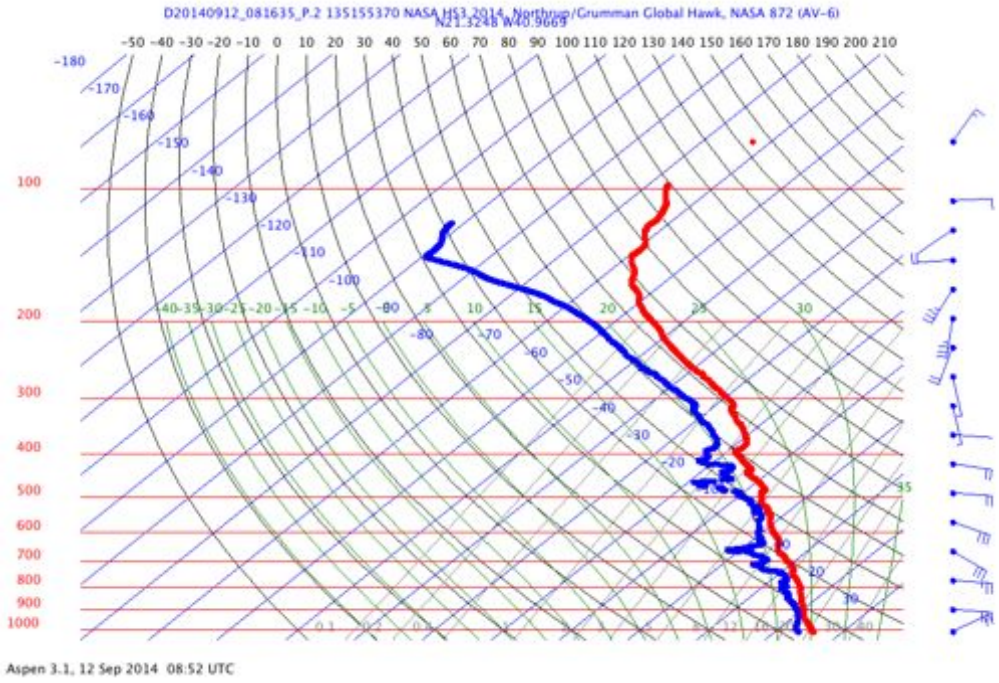
Drop on flight segment between legs 2 and 3 shows very dry conditions above 500mb.



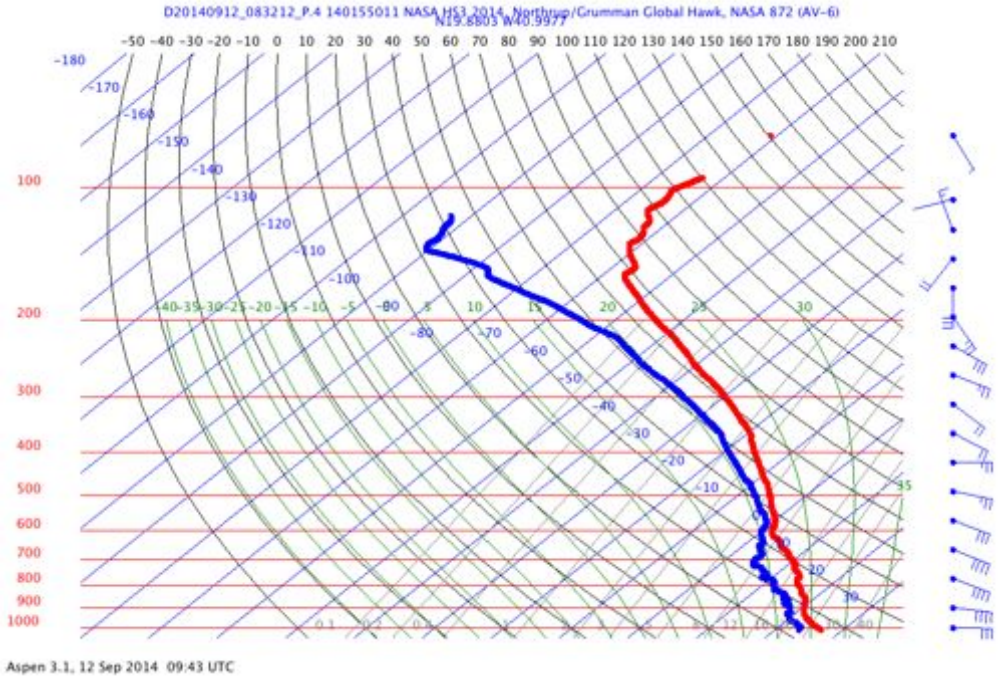
First drop on the third leg shows quick transition, much more moist than previous drop above 500 mb and nearly saturated at low levels.



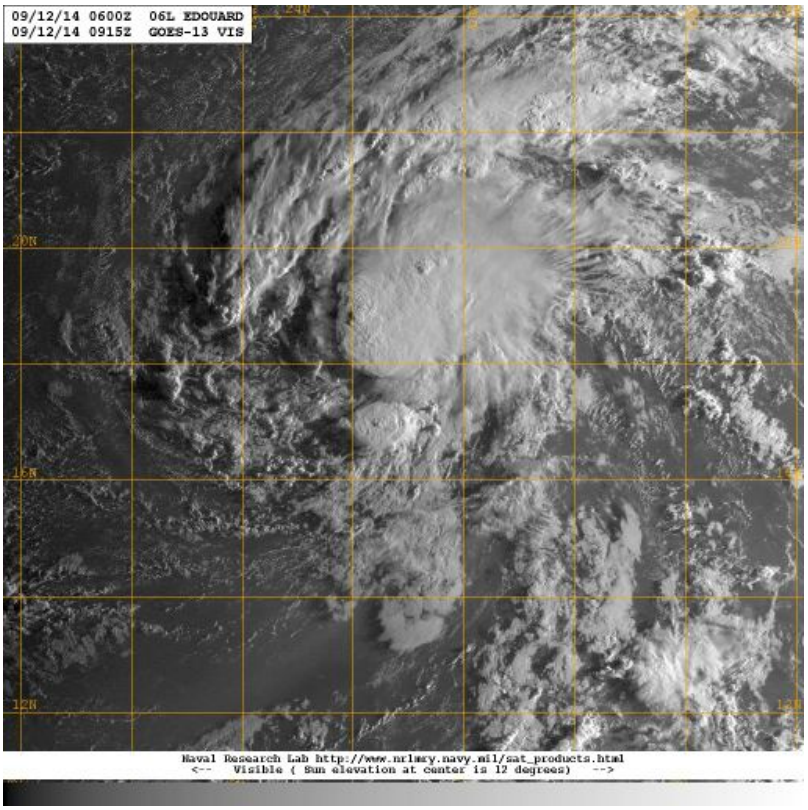
The satellite image suggests that the drops with dry air on the north end were just north of the outer convective rainband. The first drop on the third leg was very close to the convective band, probably passed through it at lower levels.



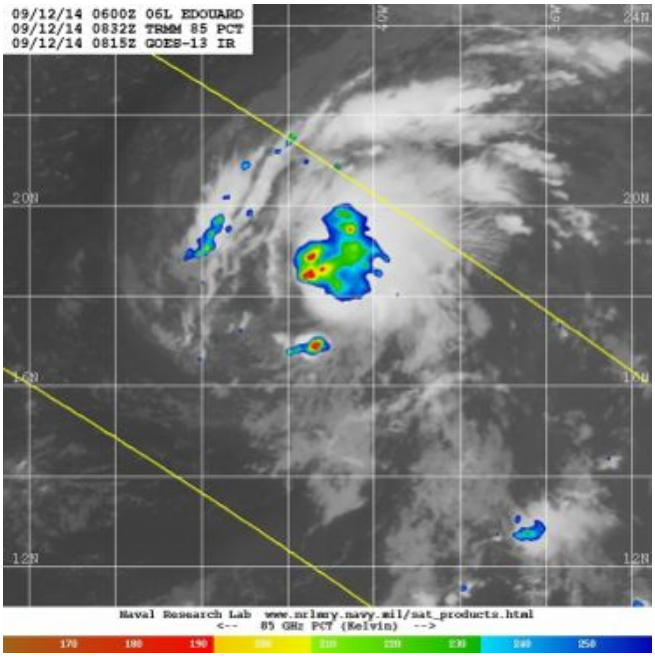
The second drop on leg 3 just a bit to the south of the last drop shows very moist conditions through the troposphere, so sharp moisture gradient in this region.



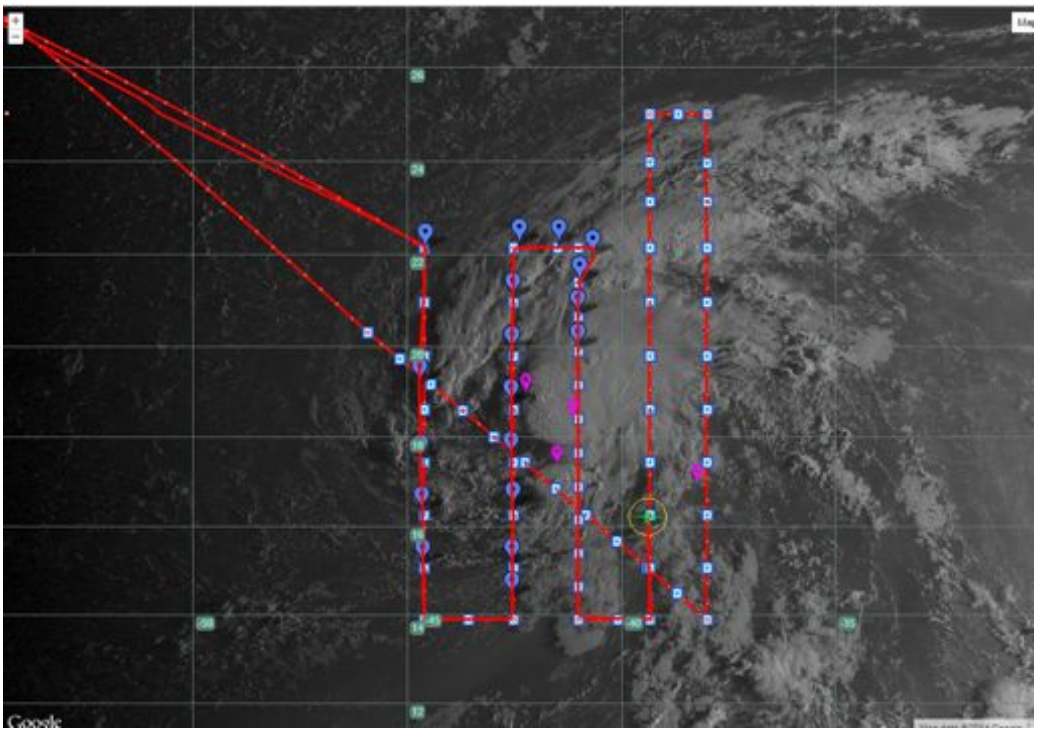
Fourth drop along the third leg. Starting to see stronger easterly winds along the north side of Edouard, about 30 kt at 1000 mb.



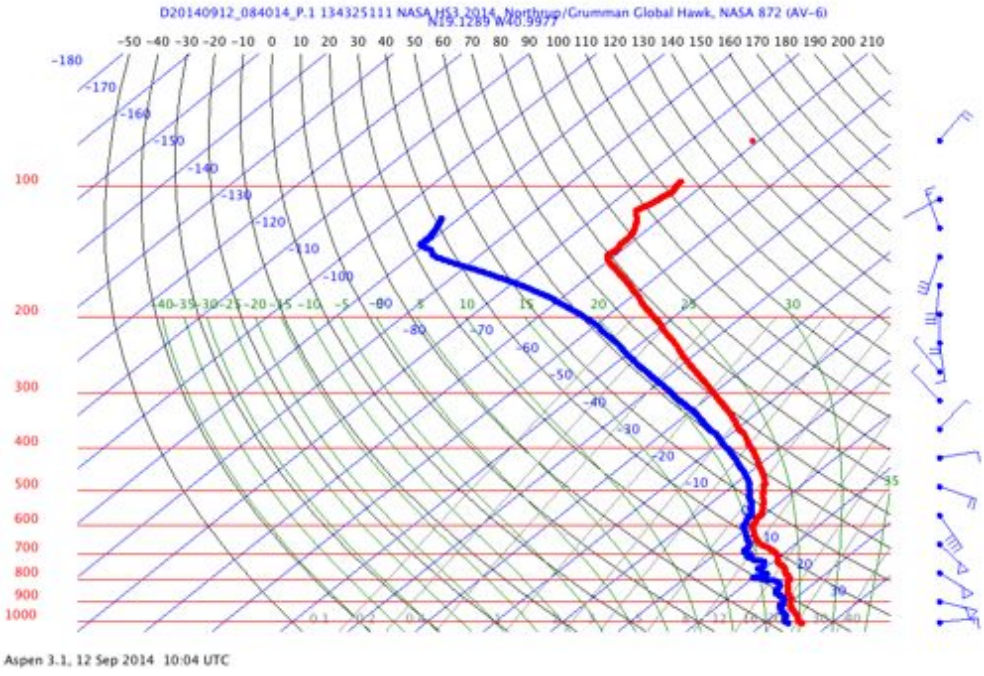
0915 visible image nicely shows the convective burst and the outer region of convection on the north and west sides of the burst.



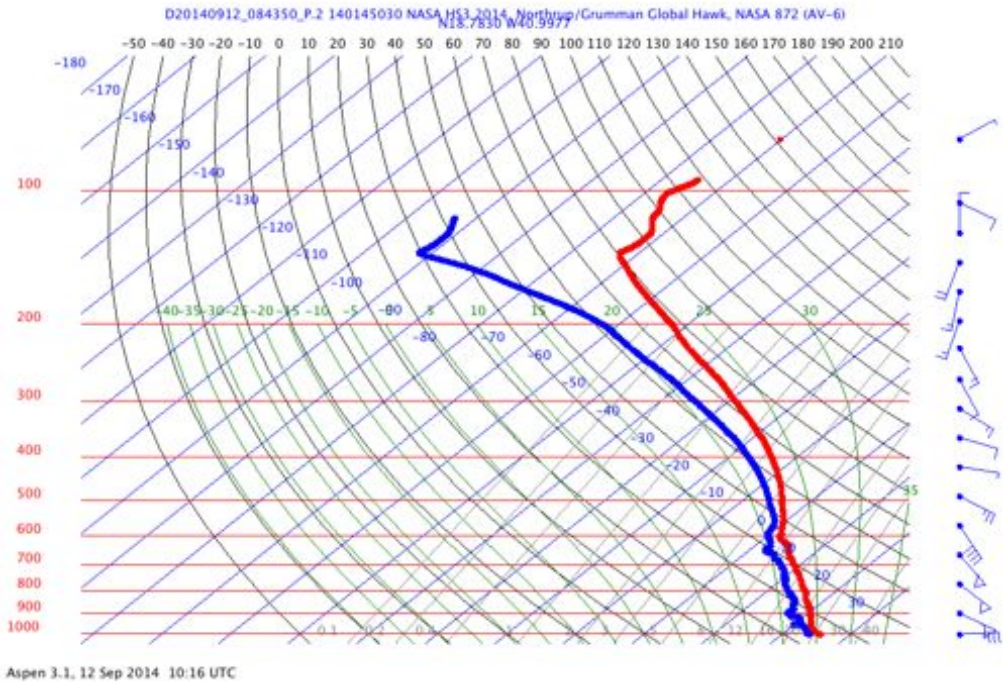
0832 TMI image showing 85 GHz PCT.



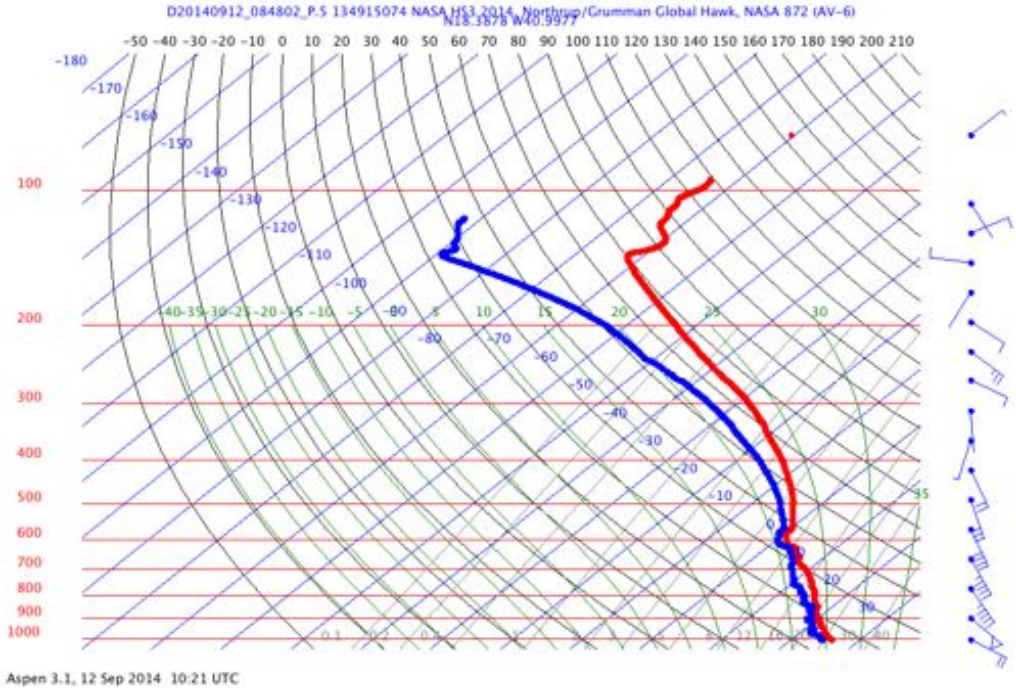
Adjusted flight pattern now in MTS. Last two legs extended northward to sample the outflow jet. The last leg has been shifted westward to get closer to the storm and cross some striated clouds on the northeastern side of Edouard.



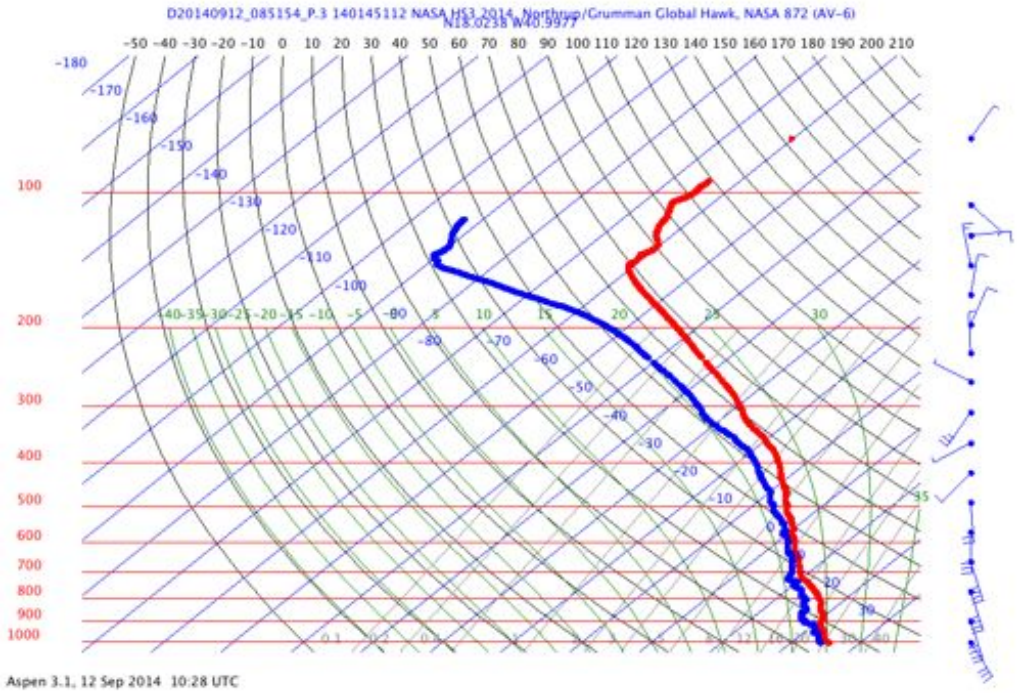
Plot above shows data from the 5th drop on the third leg. 50 kt winds from 900 to ~650 mb then dropping to 15 kt at 1000 mb.



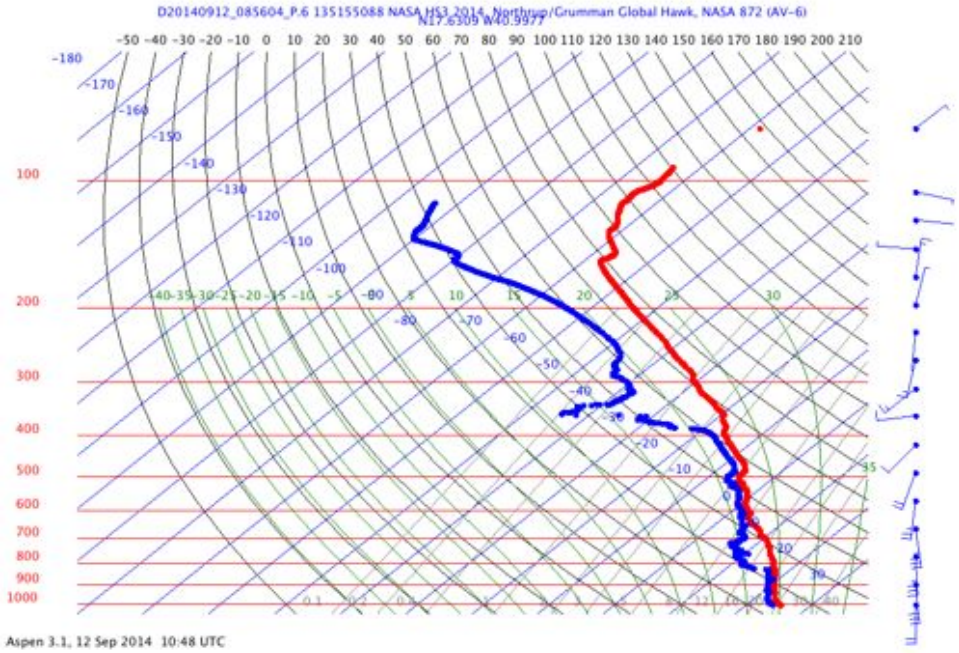
The next drop (#6 on the leg) also shows a layer of 50 kt winds at low levels, but with 30 kt near 1000 mb.



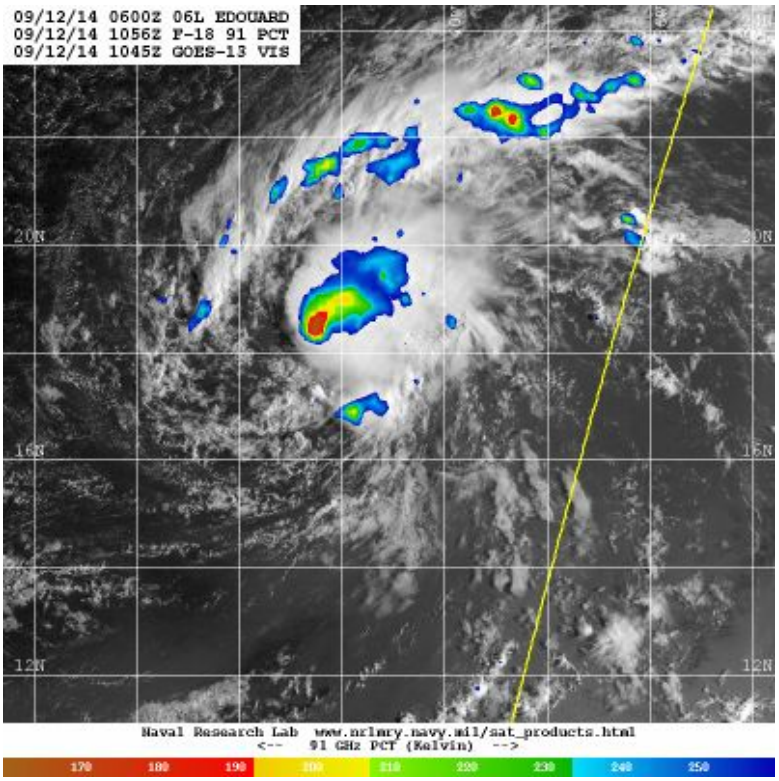
7th drop—Starting to see turning of low-level winds from the southeast.



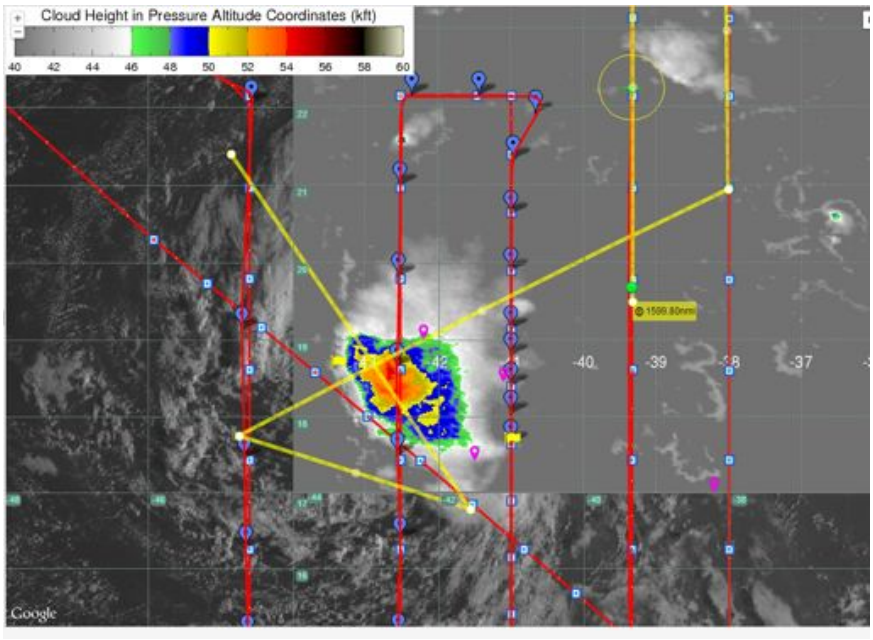
8th drop—Flow becoming more southerly, indicating a position east of the center.



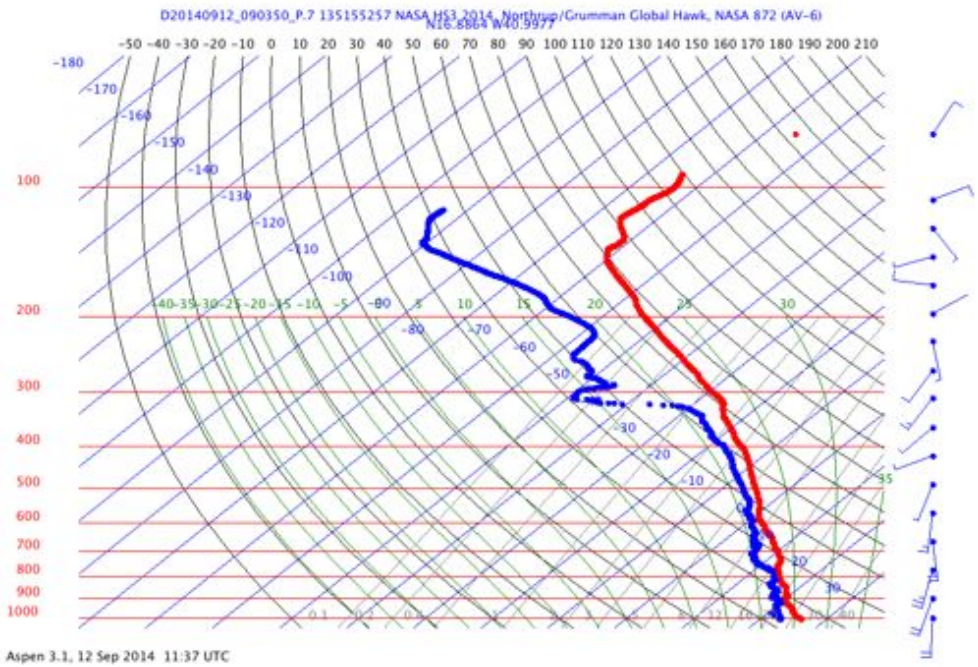
9th drop—Continued southerly flow at low levels. Starting to see some dry air again above 400 mb.



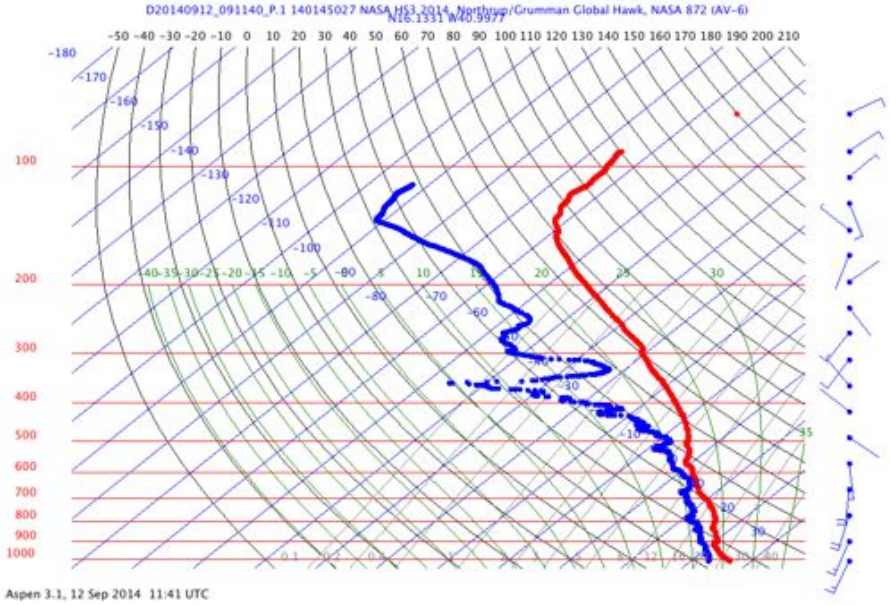
1056 SSMIS overpass of Edouard. Consistent with CTH estimates showing convective burst with a hint of curvature suggesting an improving circulation.



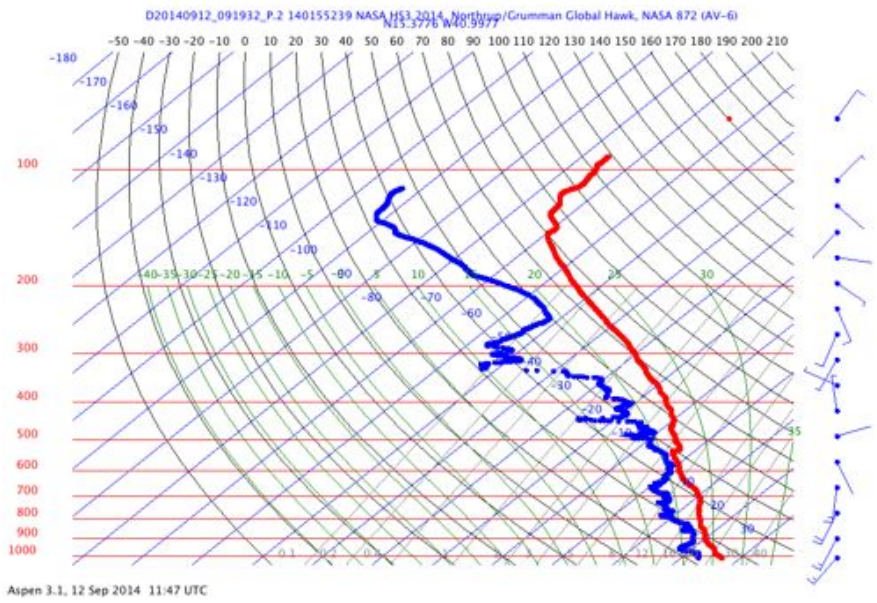
1124 The last leg is looking uninteresting at this point, so we are modifying the flight path to try to make a couple crosses over the center.



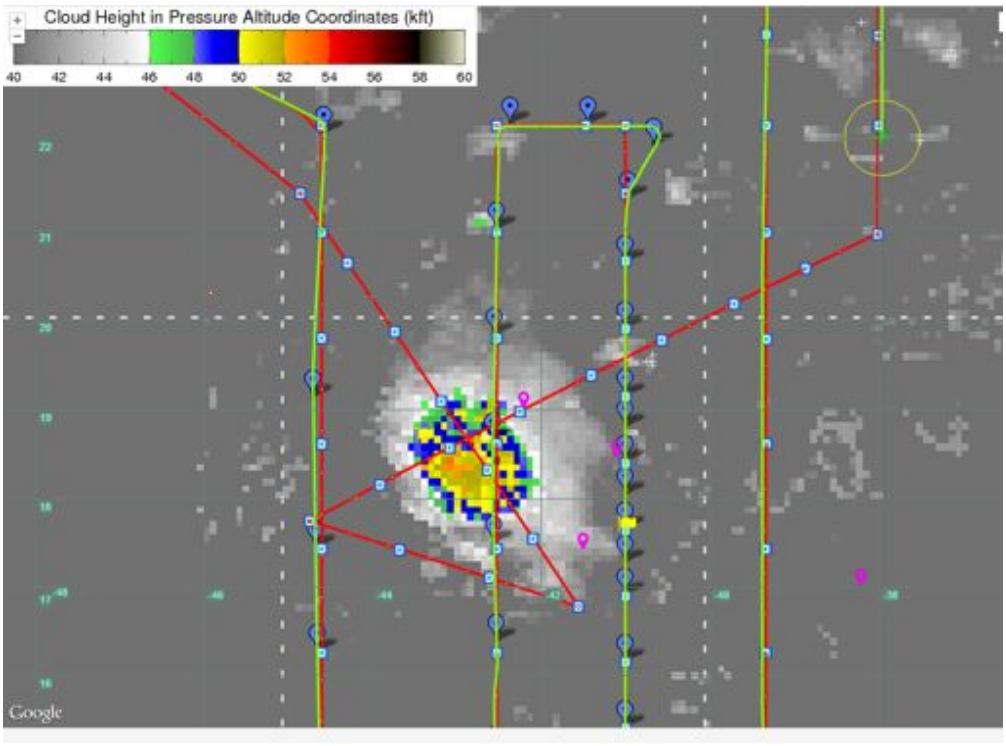
11th drop on 3rd leg, moist up to almost 300 mb, then somewhat dry. Very weak winds above 500 mb.



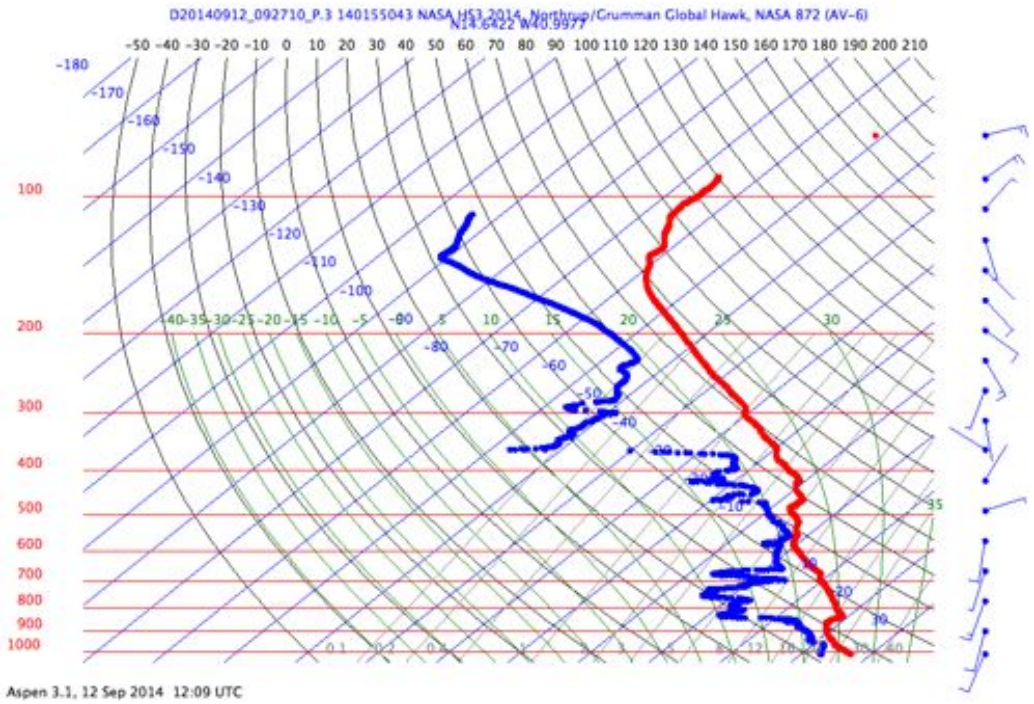
12th drop—a bit dryer above 500 mb. Still has very weak winds above that level.



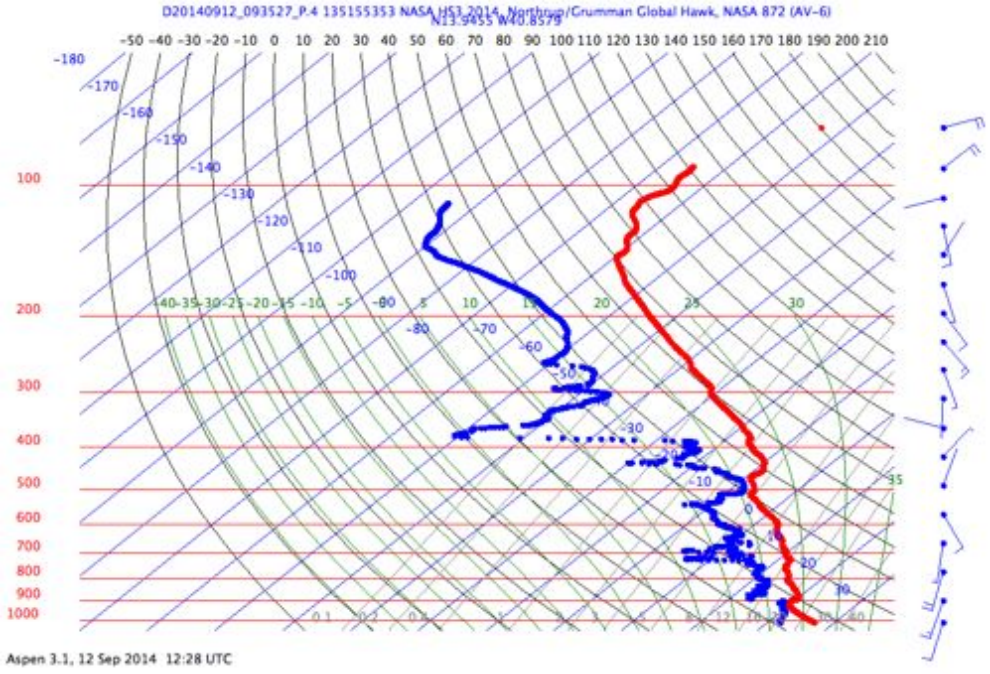
13th drop—Low level winds becoming more southwesterly. Weak winds from 600 mb on up.



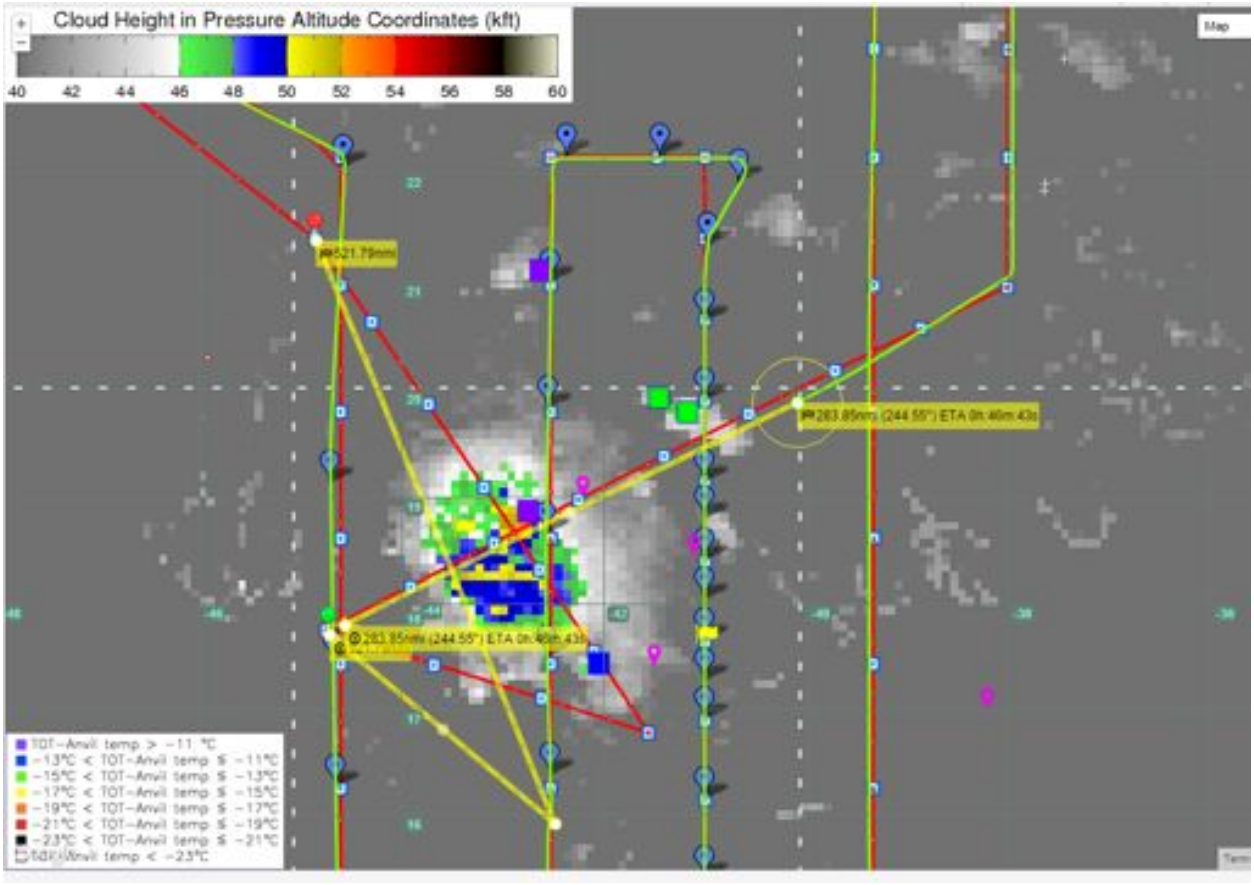
1200 Lightning showing up along the planned flight track. The first area is associated with relatively low cloud top heights (<46 kft). The second area is associated with the decaying convective burst, which interestingly did not have lightning when at peak.



Next to last drop on 3rd leg. SAL like profile at low levels, although not sure if it is actually SAL. Will have to check CPL data later.

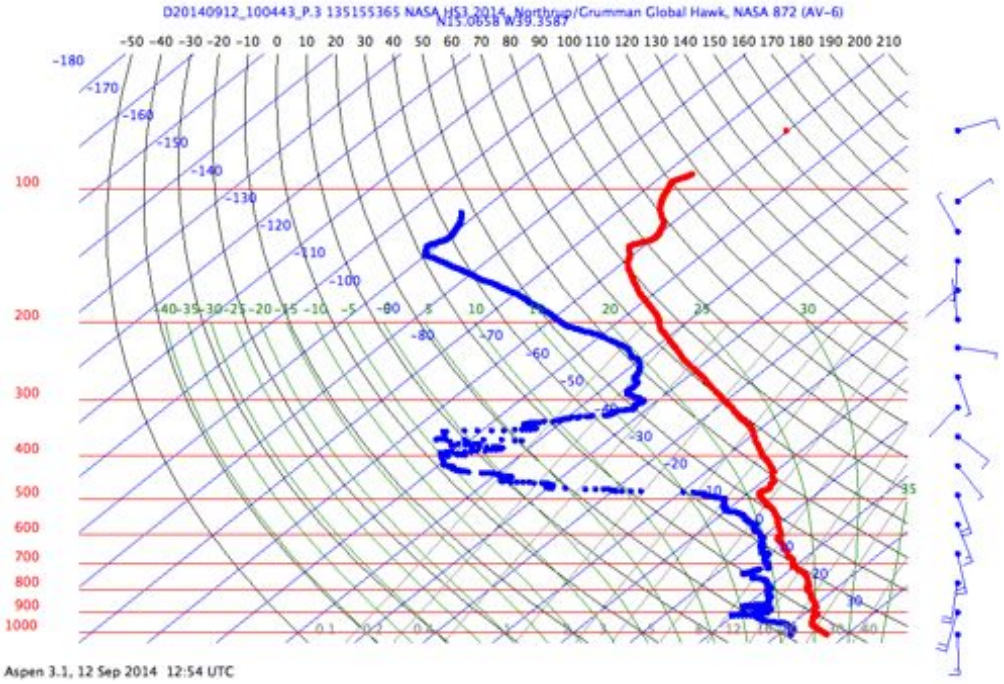


Last drop on 3rd leg. SAL like structure not apparent here.

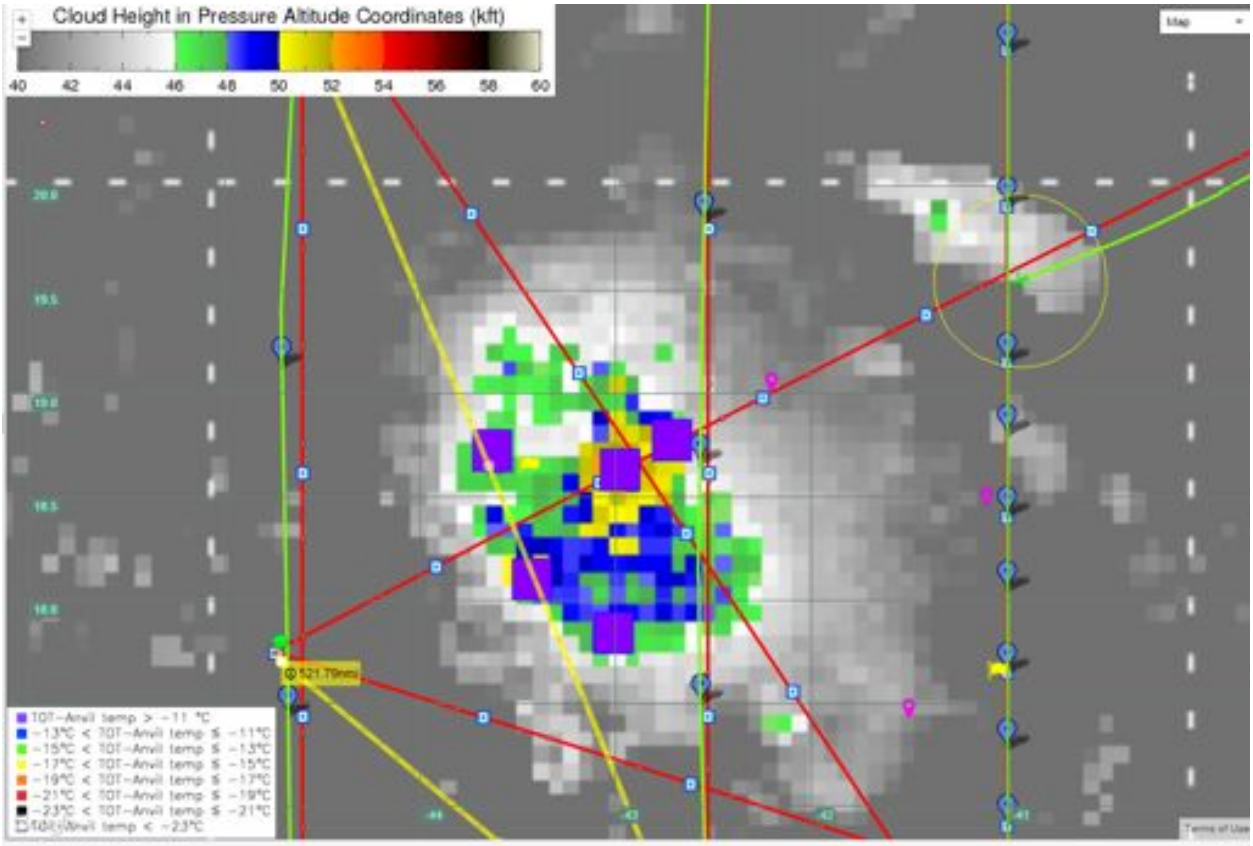


1230 Lightning has disappeared along the flight track. The convective burst is largely weakening, althought the NE corner of it bears watching.

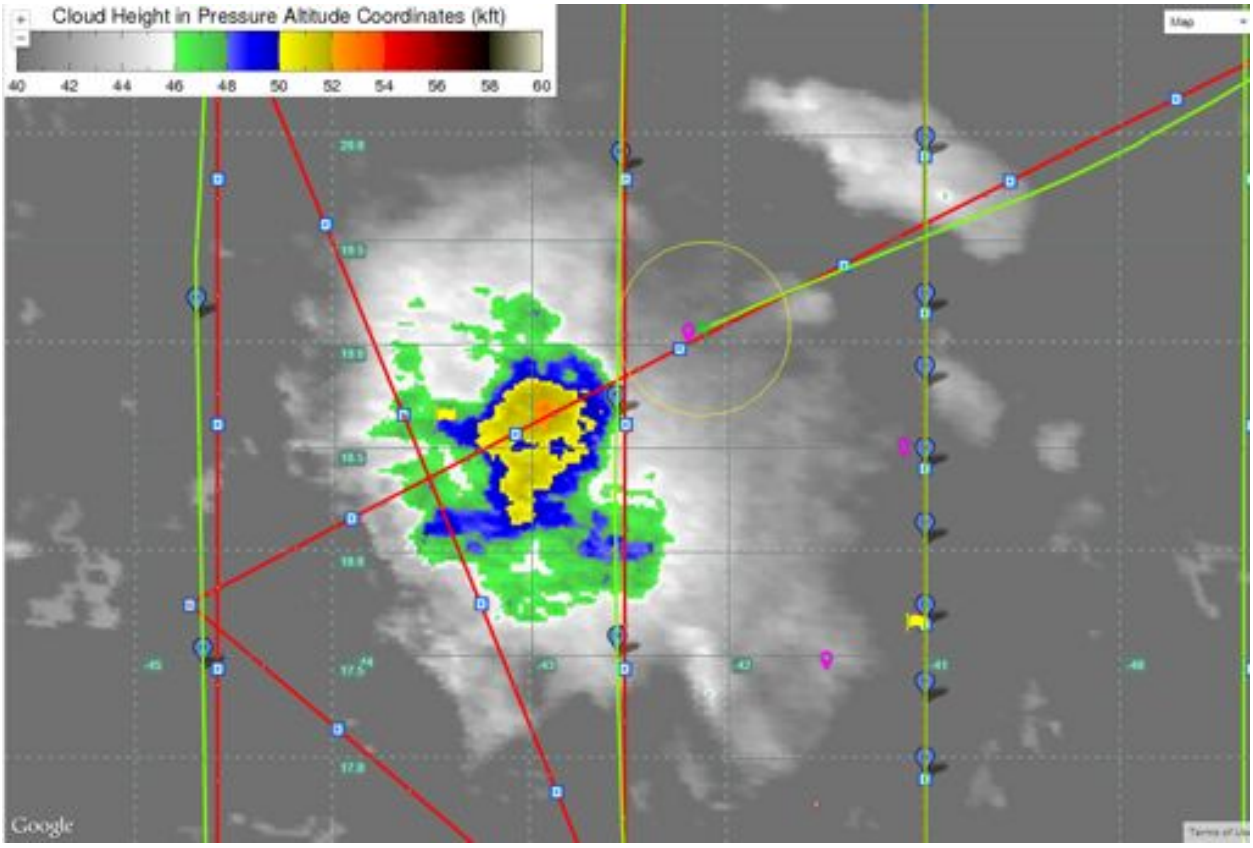
1312 Daylight camera view of the deep convection well out ahead of the GH.



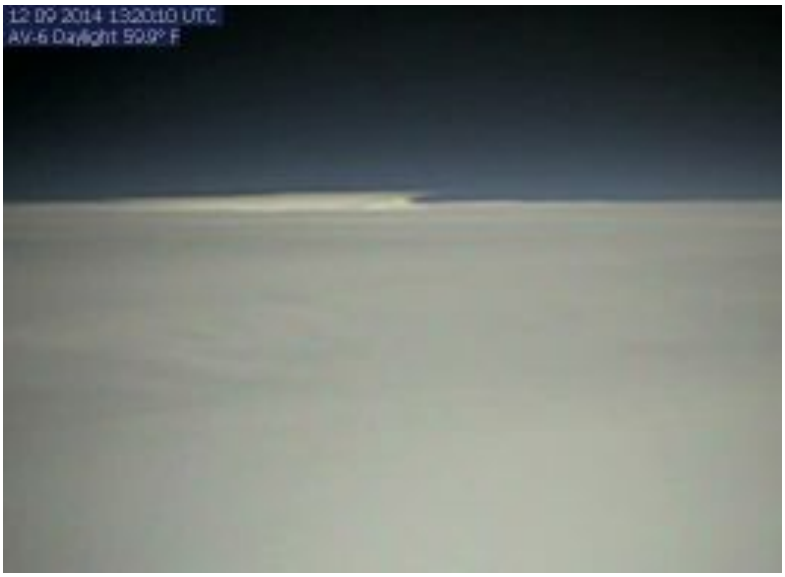
Second dropsonde on the 4th (northbound) leg. Prominent dry layer between 500-300 mb.



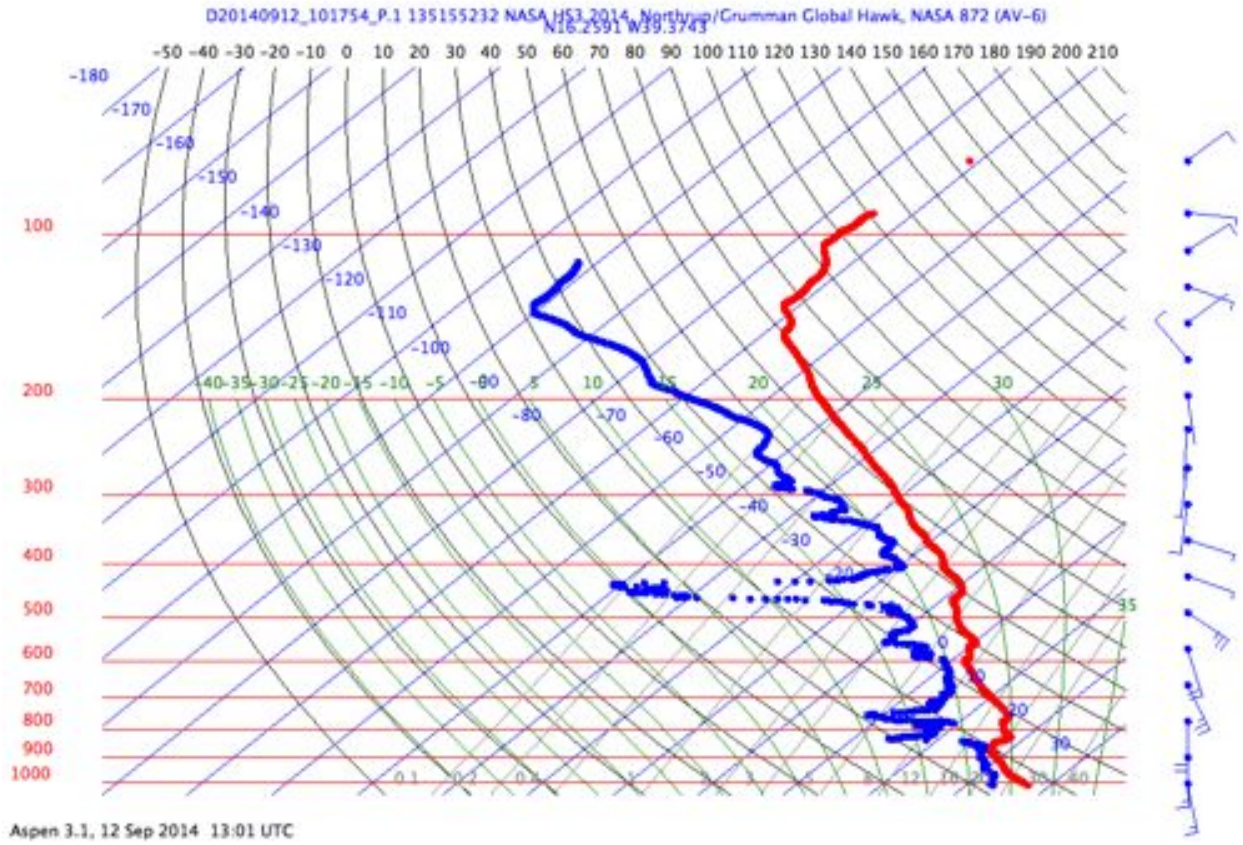
1245 As we approach the convective area, some minor overshooting tops, no lightning. Cloud tops peaking near 52 kft.



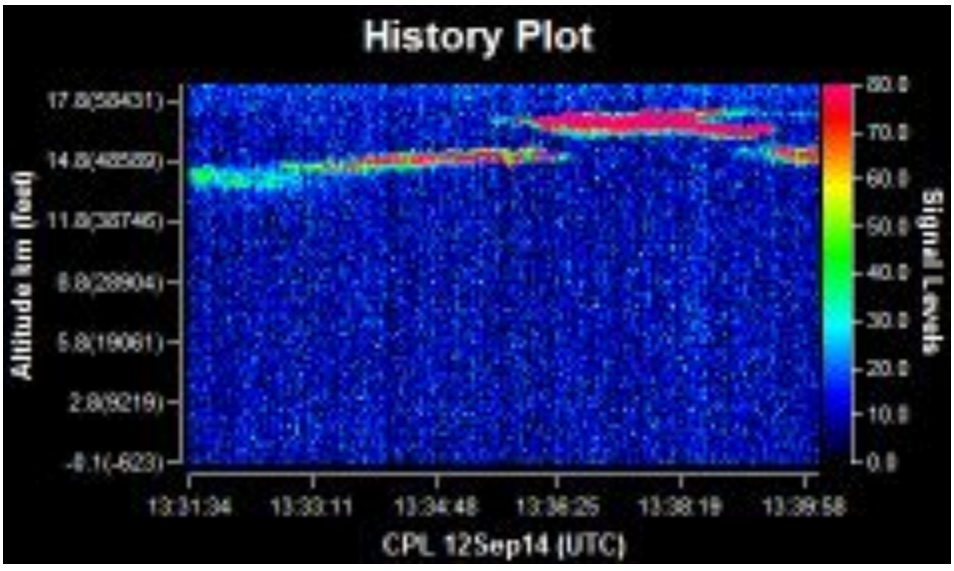
1310 Higher resolution CTH product showing new convective tower with tops ~52-53 kft. There are a couple lightning flashes (not shown) just before the tower where tops are ~48-50 kft.



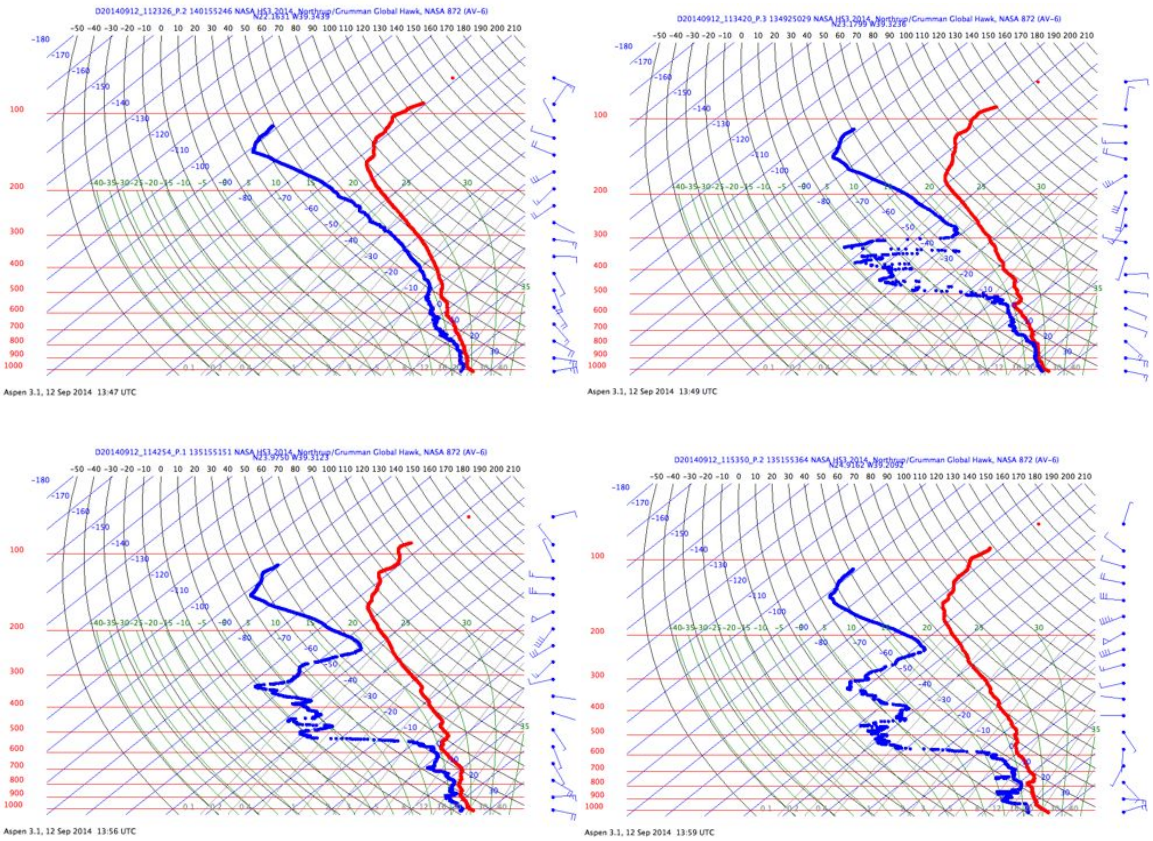
1320 Daylight view of convective tower.



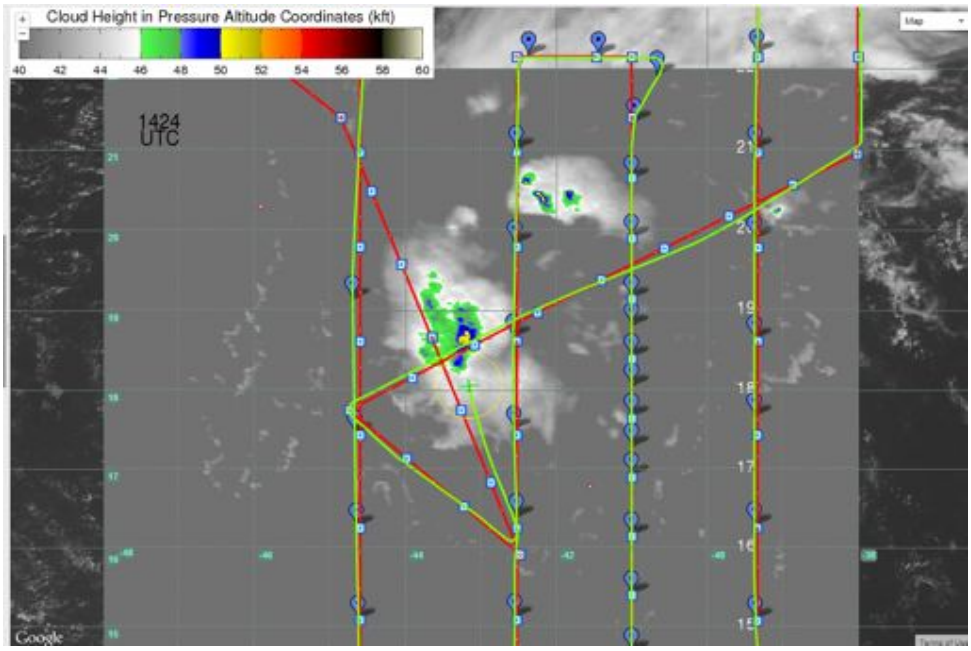
Third sonde on northbound leg has only a thin layer of dry air.



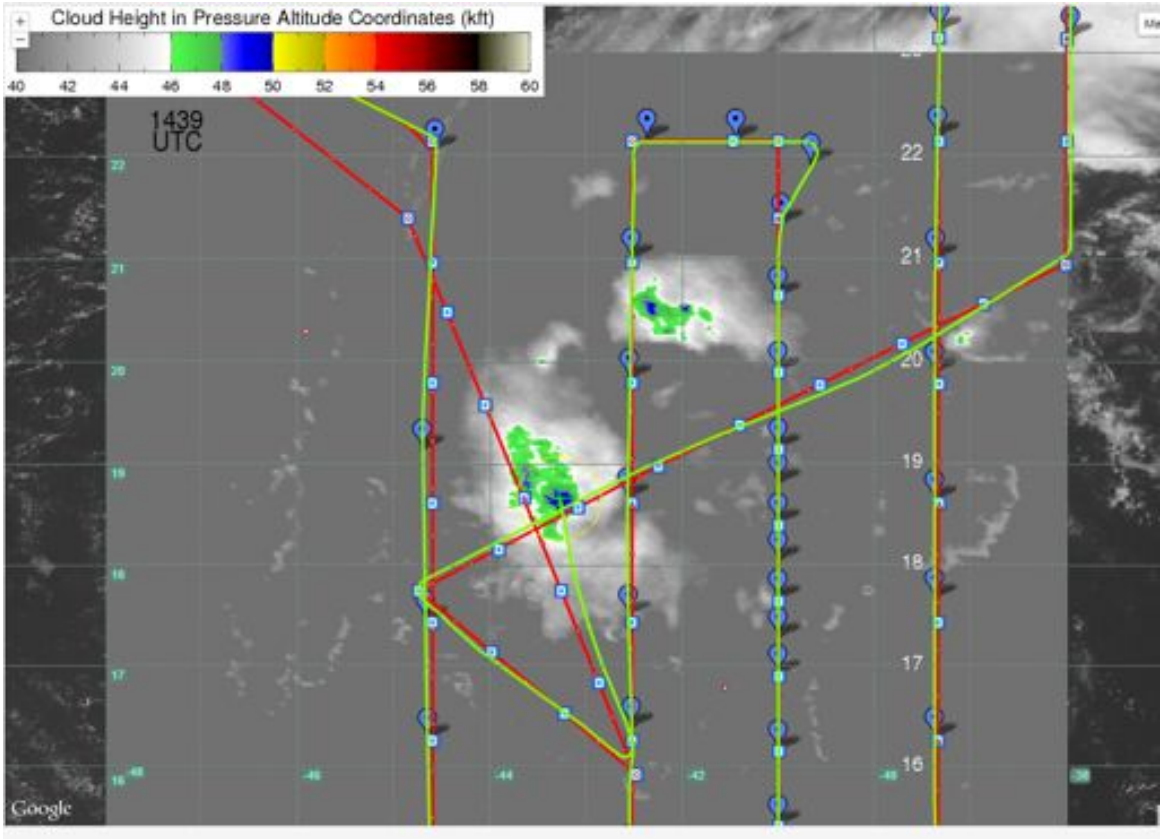
1344 CPL real-time image of cloud tops during the pass over the convective system. Peak heights at 58.2 kft.



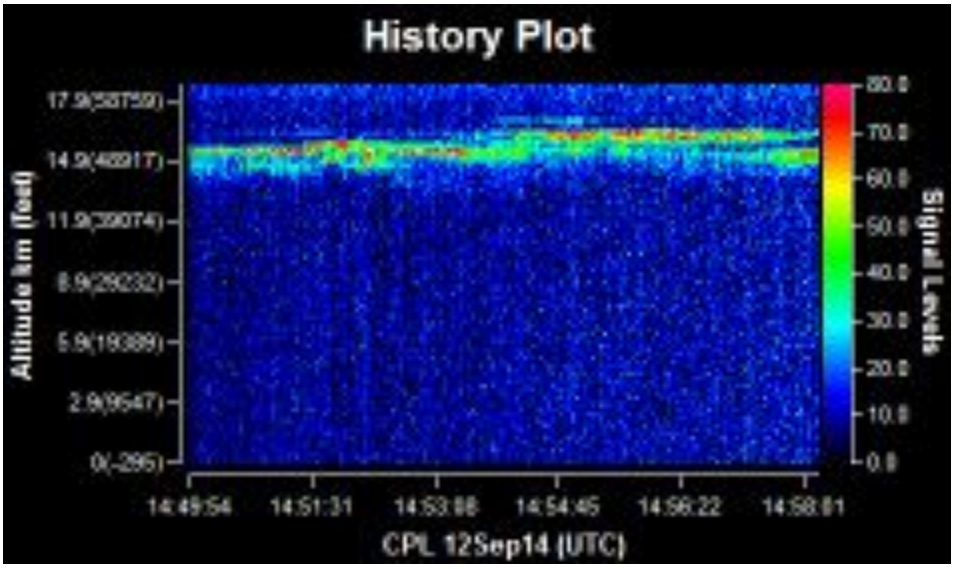
Starting from the 4th sonde south of the north end of the 4th leg to the northernmost sonde on the leg (going left to right, top to bottom)—Moist profile transitions to a very deep dry layer Outflow with winds near 30 kt near 175 mb increasing to 50 kt near 175-200 mb to the north.



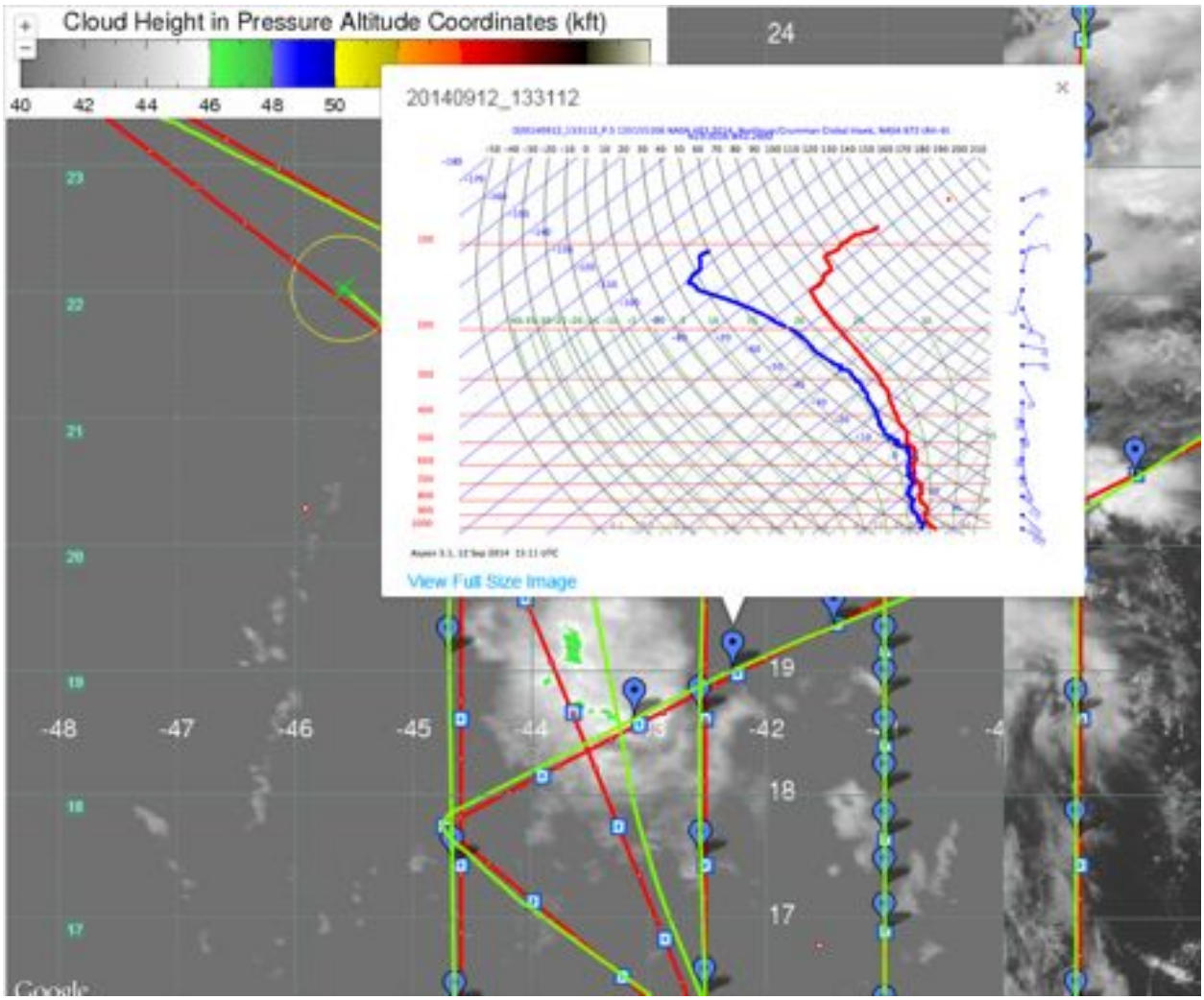
1424 Actual flight path is a bit east of planned track. Pilots had to add a way point to original plan for ATC issue. Leslie was given the new point, but didn't update the flight plan in MTS.



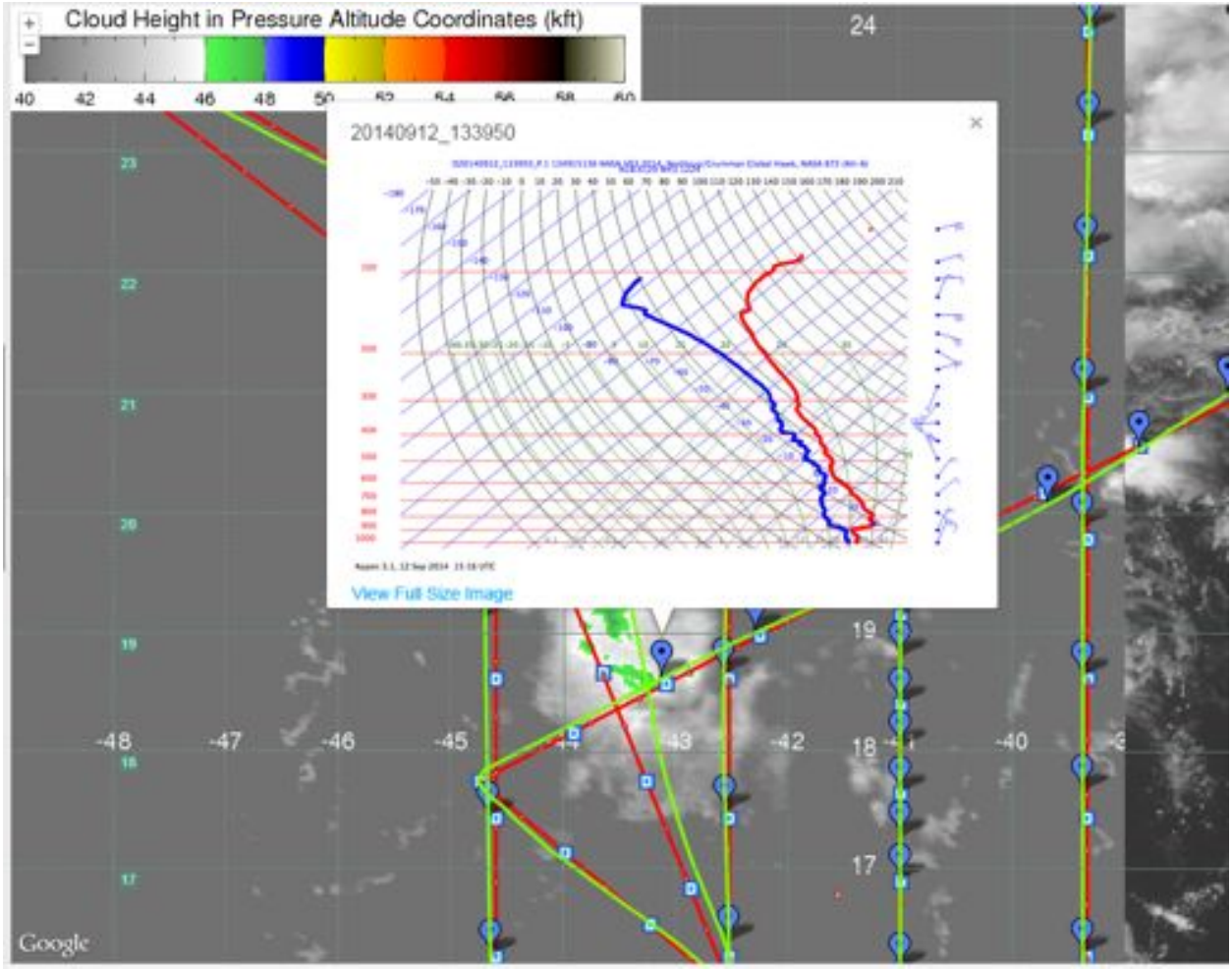
Deviation put us almost right over the convection (GOES image about 20 min old).



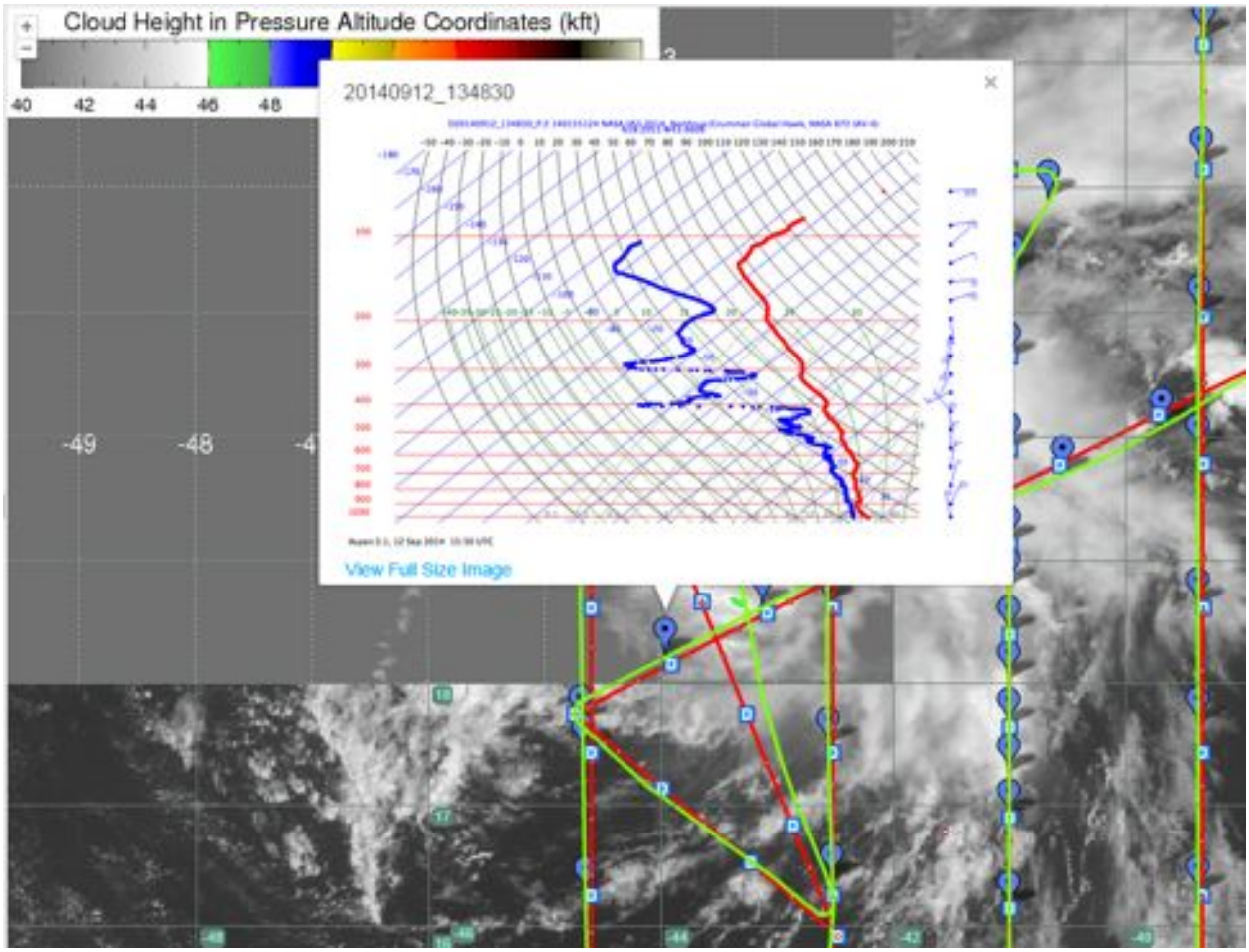
1500 CPL cloud tops for last pass over the deep convection. Cloud tops near 54 kft.



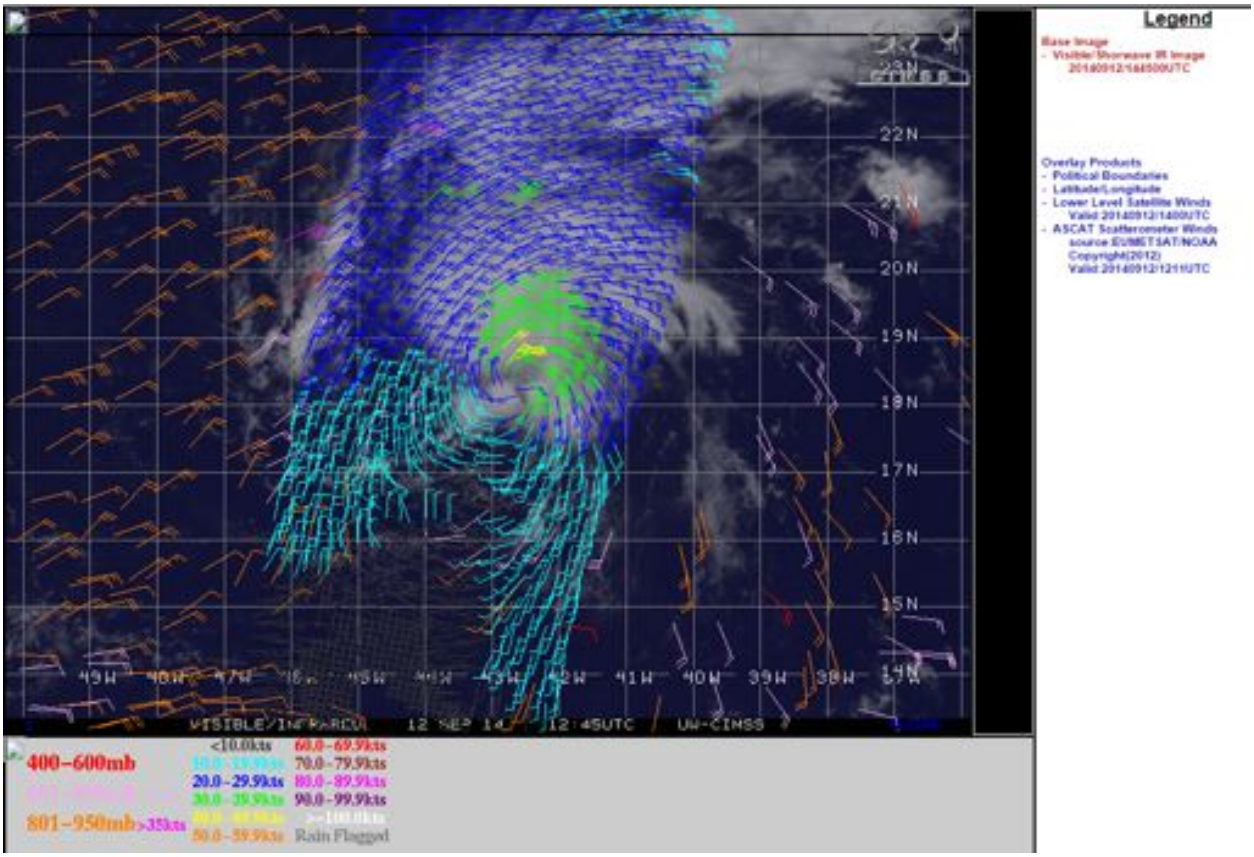
1510 The plot



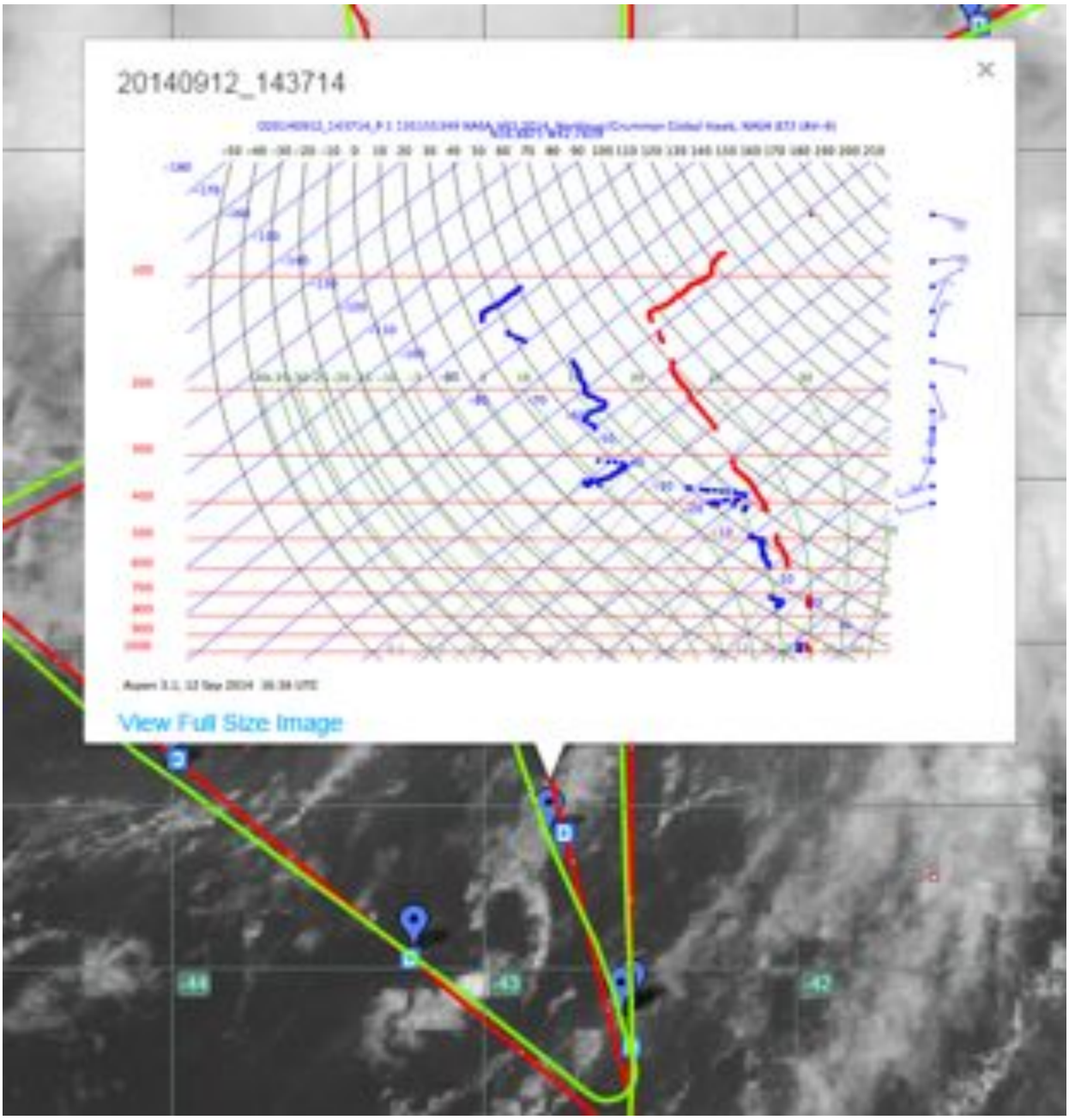
1510 This drop was near the center. Winds switched around to the northeast at low-to-mid levels except just above 800 mb where winds were out of the southeast. Very strong inversion at the top of the PBL, perhaps associated with subsidence adjacent to the convection. The surface pressure for this sonde was 999 mb with 11m/s sfc wind. D. Herndon estimates storm “central pressure” of about 997 mb (1 mb per 10 kt of sfc wind).



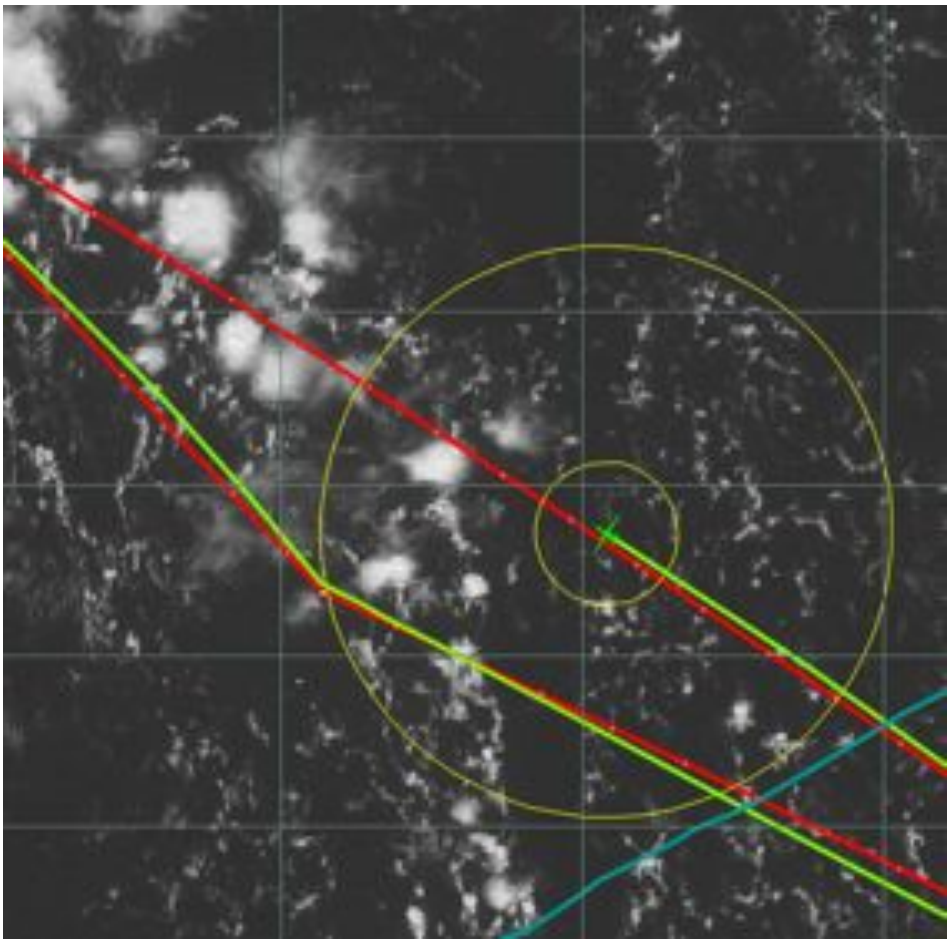
1540 This sonde shows a deep layer of northerlies suddenly switching to southerlies near 400 mb and very dry air aloft.

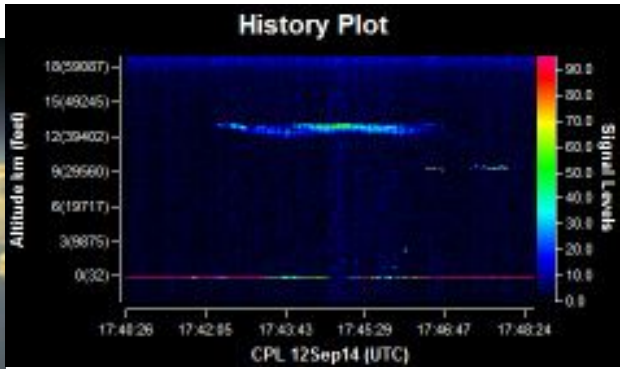


ASCAT, low-level winds and infrared image valid between 1200z and 1400z



1717: Last sonde for which there is a quick-look at the moment (along final flight leg across storm). There is some trouble transfering AVAPS data from the plane for this sonde and sondes launched afterwards, but the data is recorded aboard the plane.





1736: Approaching some convection. Tops near 40K ft.

TROPICAL STORM EDOUARD DISCUSSION NUMBER   5
NWS NATIONAL HURRICANE CENTER MIAMI FL   AL062014
1100 AM AST FRI SEP 12 2014

The cloud pattern is a little more organized, and microwave data
suggest that the center is more embedded within the deep convection.
Based on a blend of Dvorak estimates from SAB,TAFB and objective
numbers from CIMSS the winds are increased to 40 kt. This intensity
is confirmed by a recent scatterometer pass.

The cyclone has a large low-level circulation and the upper-level
outflow has improved. Most of the global models as well as SHIPS
suggest a decrease in the wind shear during the next few days.
In addition, Edouard will be moving over a pool of anomalously
warm water. This should result in gradual strengthening as indicated
in the NHC forecast, which in fact is very close to the intensity
consensus model ICON.

The cyclone is moving toward the west-northwest at 14 knots steered
by the flow around the periphery of the Atlantic subtropical ridge.
A gradual turn to the northwest and north is forecast in about 3 to
4 days when the ridge weakens. The NHC forecast is basically on top
of the multi-model consensus, which has remained in place from 06
to 12 UTC. The guidance in general is tighly clustered, increasing
the confidence in the track forecast.

The unmanned NASA Global Hawk aircraft is dropping numerous sondes
near and around Edouard and these data are being ingested by
global models to help with the initialization.

FORECAST POSITIONS AND MAX WINDS

INIT	12/1500Z	18.5N	43.0W	40 KT	45 MPH
12H	13/0000Z	19.2N	44.5W	45 KT	50 MPH
24H	13/1200Z	20.5N	46.5W	50 KT	60 MPH
36H	14/0000Z	21.8N	48.4W	50 KT	60 MPH
48H	14/1200Z	23.0N	50.2W	60 KT	70 MPH
72H	15/1200Z	26.0N	54.0W	70 KT	80 MPH
96H	16/1200Z	28.5N	56.0W	75 KT	85 MPH
120H	17/1200Z	32.0N	55.5W	75 KT	85 MPH

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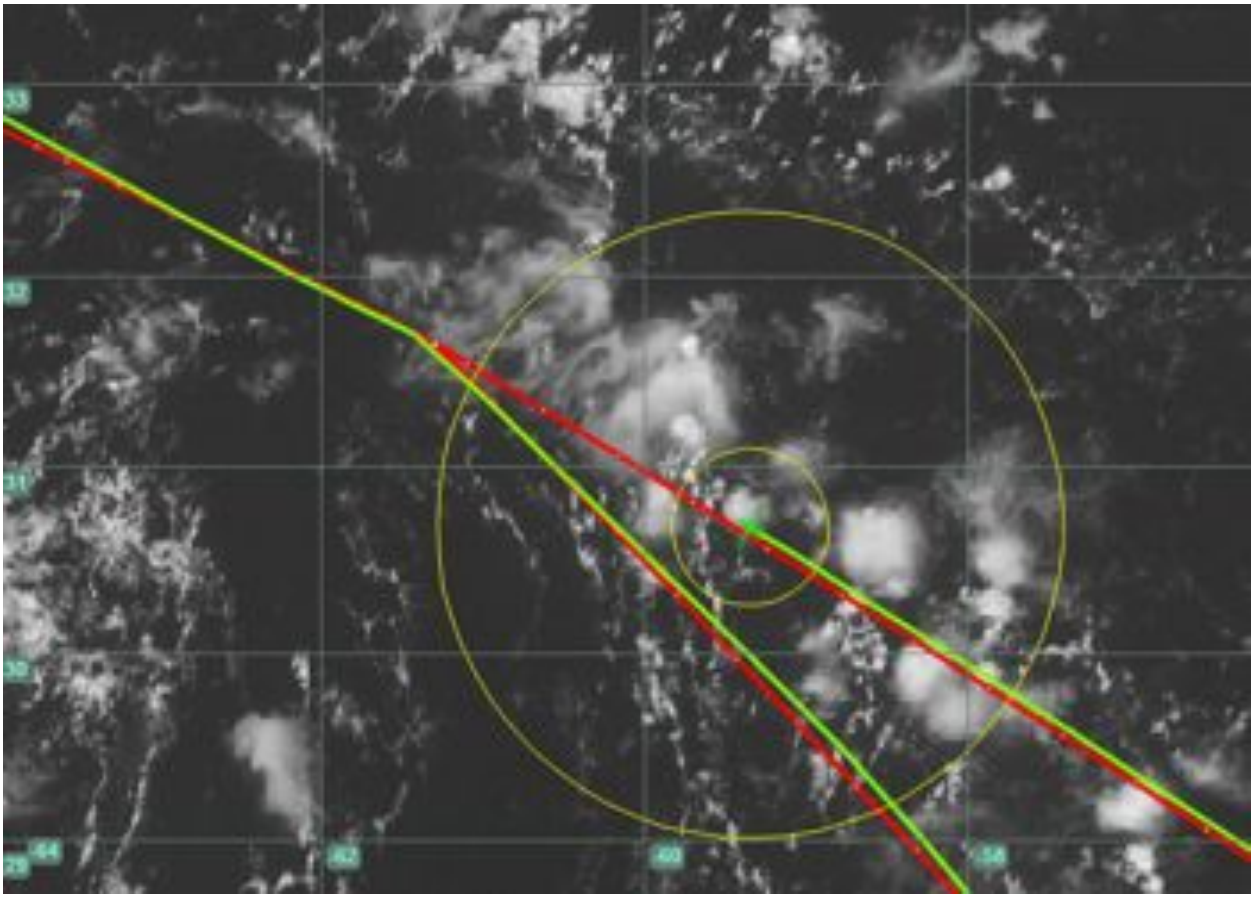
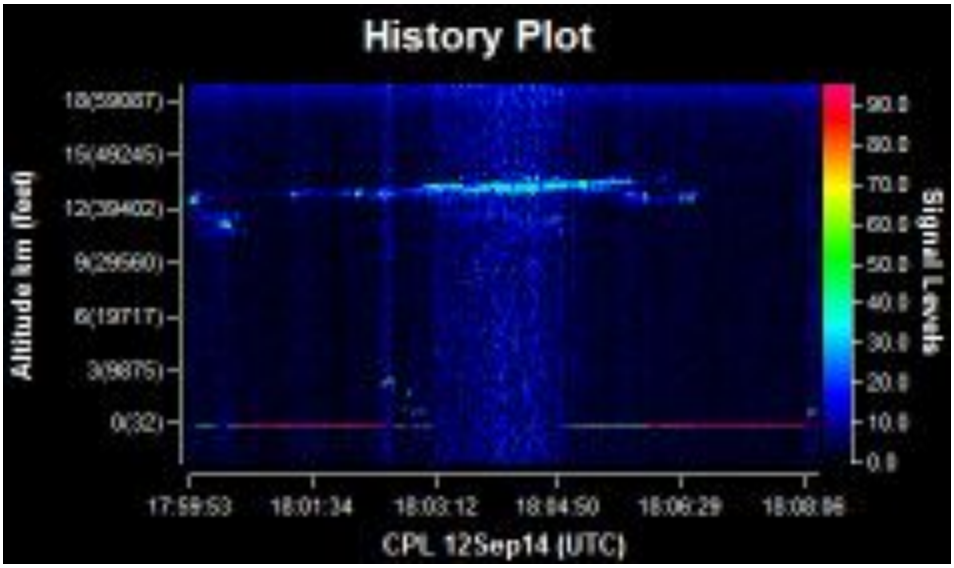
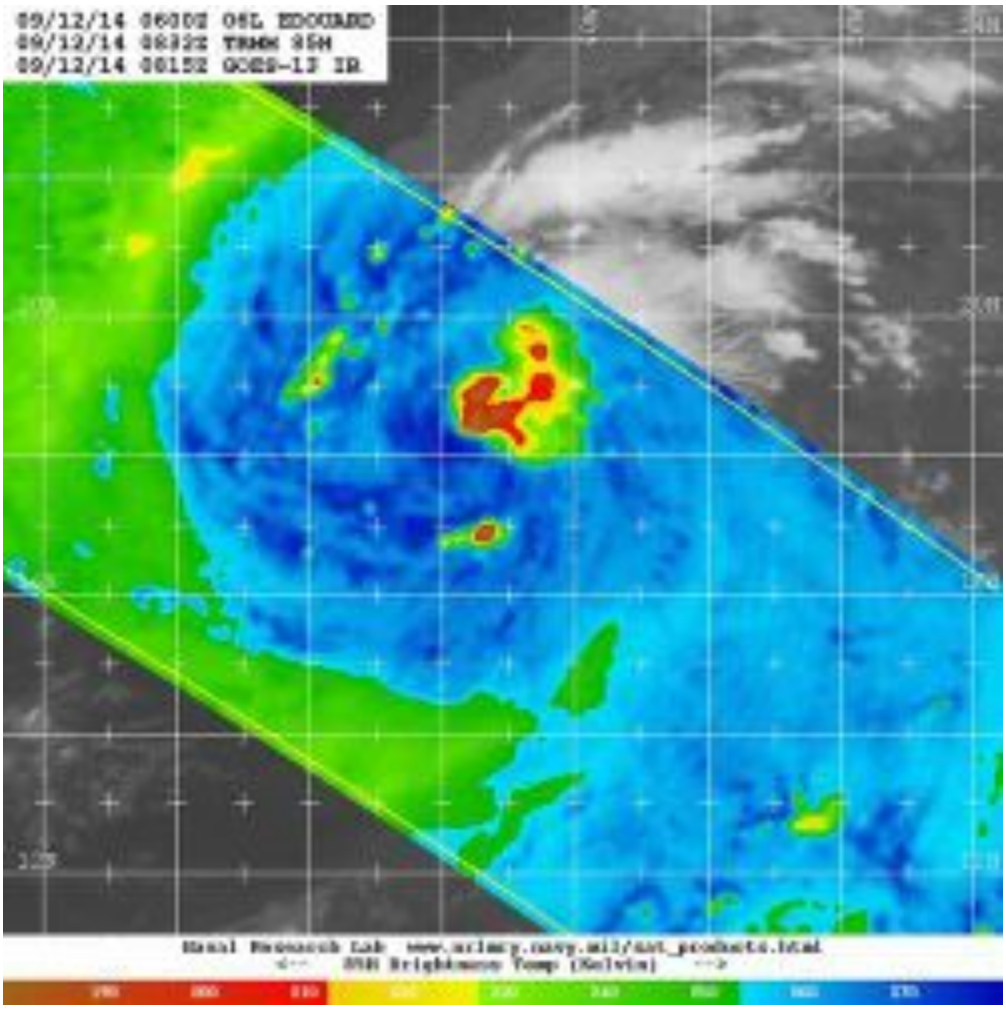
Forecaster Avila

11am NHC discussion mentioning Global Hawk

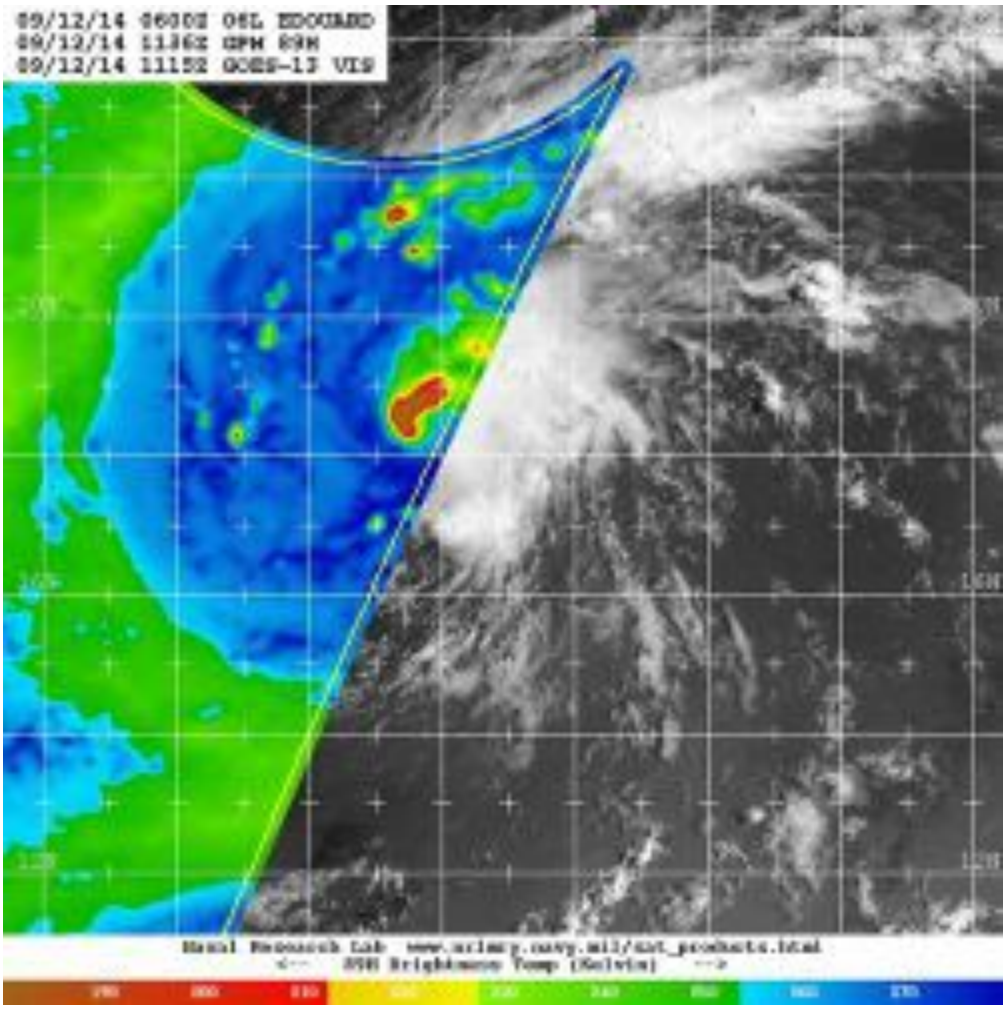




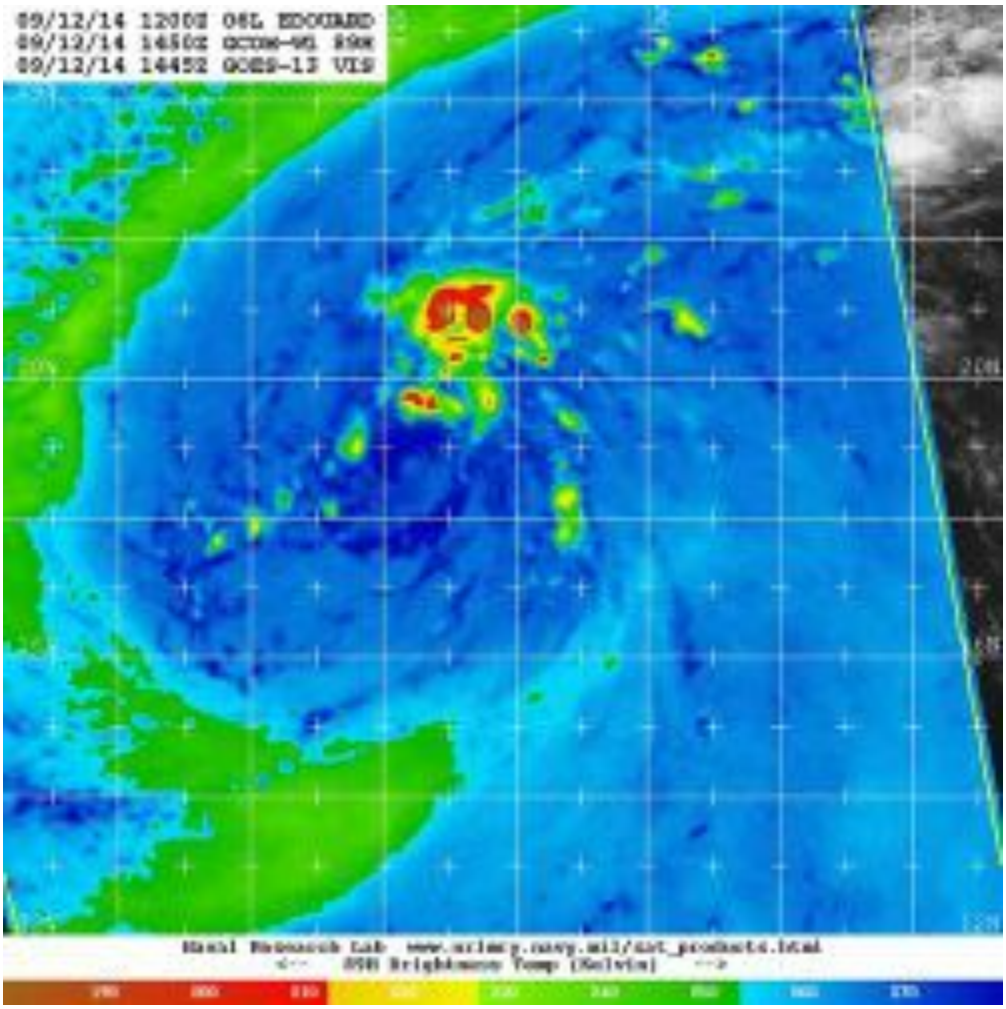
1810: Continue over some spotty convection. Tops in the low to mid 40Ks. No lightning to speak of.



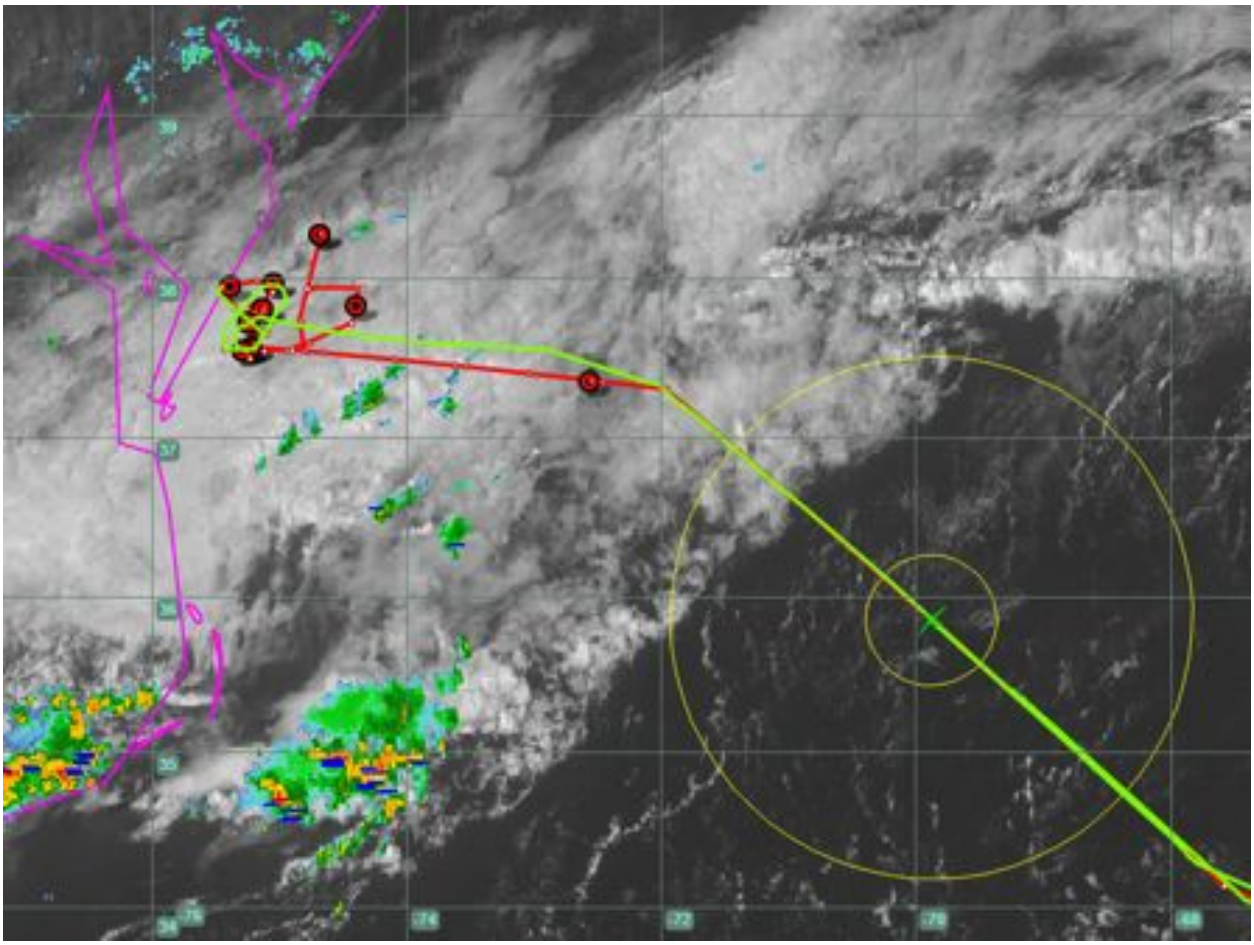
TRMM 85GHz at 0832z



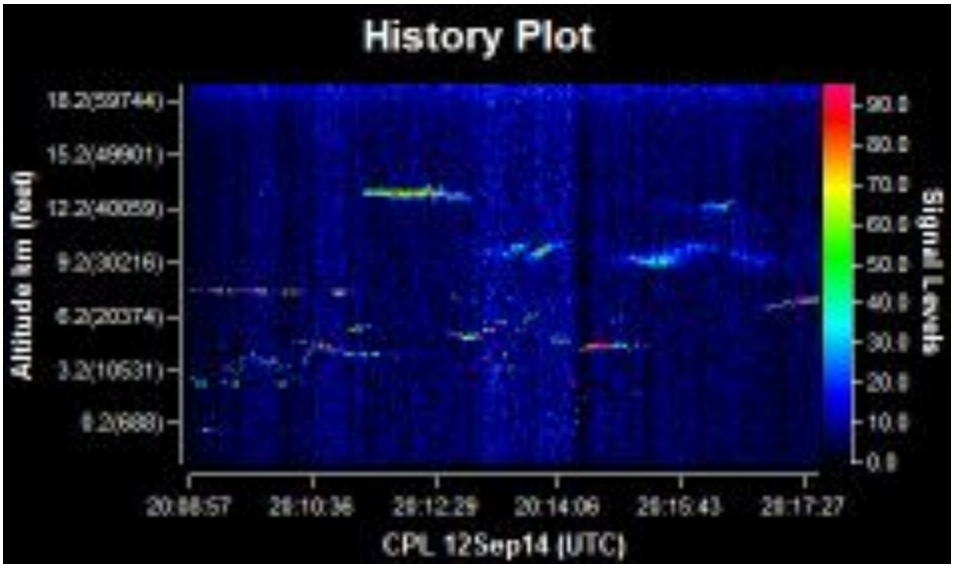
GPM 89GHz at 1136z



GCOM 89GHz at 1450z. Convection off to NE of low-level center.



1958: Coming up to Whiskey-386 soon. Might be a couple showers to avoid. CTH < 40K ft along the track.



CPL crossing spotty convection

TROPICAL STORM EDOUARD DISCUSSION NUMBER   6
NWS NATIONAL HURRICANE CENTER MIAMI FL   AL062014
500 PM AST FRI SEP 12 2014

The unmanned NASA Global Hawk aircraft dropped a sonde and measured a minimum pressure of 999 mb with 23 kt near the center of Edouard. This leads to a minimum central pressure estimate of 998 mb. Another sonde measured surface winds of 40 kt confirming earlier ASCAT data, and this value will be used as the initial intensity. After some disruption of the cloud pattern a couple of hours ago, satellite images indicate that there is some reorganization going on at this time. It appears that the shear has begun to weaken and the outflow is expanding. Most of the intensity guidance calls for gradual strengthening, and this is consistent with the decrease in shear, and the fact that Edouard will be moving over a pool of anomalously warm water during the next few days. The NHC forecast is similar to the intensity consensus ICON.

Edouard has been moving toward the northwest or 305 degrees at 11 kt during the past few hours. Global models show an expansion of the subtropical ridge to the north, and this pattern should force the cyclone to move on a general west-northwest to northwest track during the next 3 to 4 days. After that time, the ridge is forecast to weaken, and a gradual turn to the north is anticipated. There is high confidence on the northward turn over open Atlantic since the dynamical guidance is tightly packed. The NHC forecast follows closely the multi-model consensus TVCA and the average of the ECMWF and the GFS.

FORECAST POSITIONS AND MAX WINDS

INIT	12/2100Z	19.5N	44.1W	40 KT	45 MPH
12H	13/0600Z	20.5N	45.8W	45 KT	50 MPH
24H	13/1800Z	21.8N	47.8W	50 KT	60 MPH
36H	14/0600Z	23.2N	50.0W	55 KT	65 MPH
48H	14/1800Z	24.5N	52.0W	60 KT	70 MPH
72H	15/1800Z	27.5N	56.0W	75 KT	85 MPH
96H	16/1800Z	31.5N	57.0W	75 KT	85 MPH
120H	17/1800Z	37.0N	53.0W	75 KT	85 MPH

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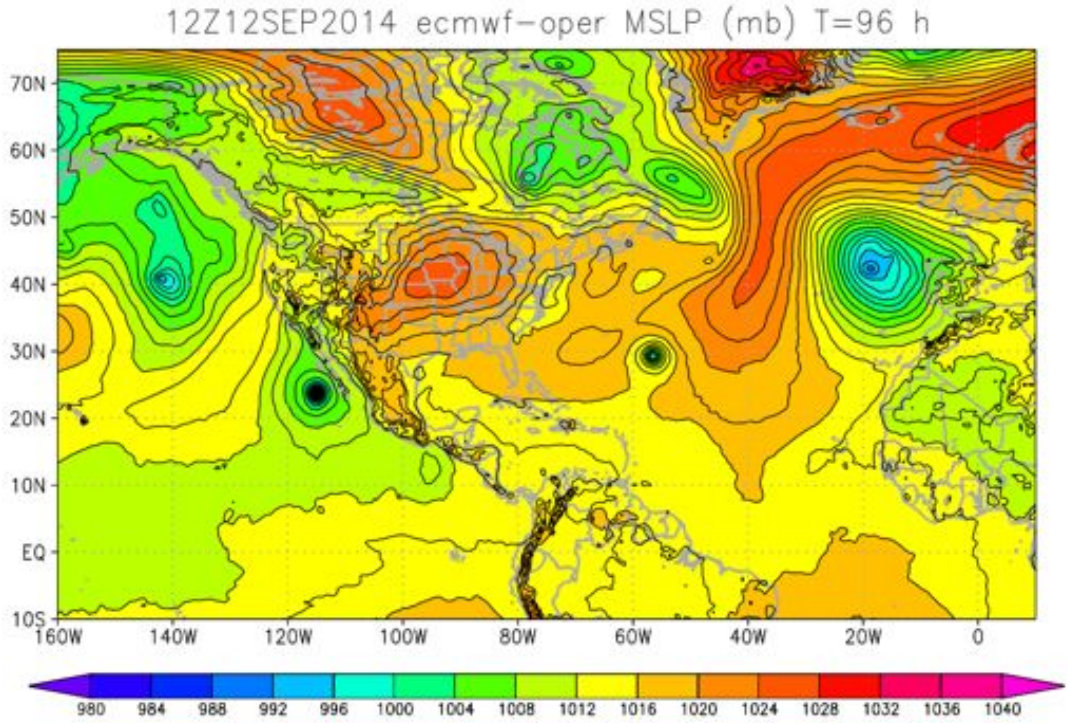
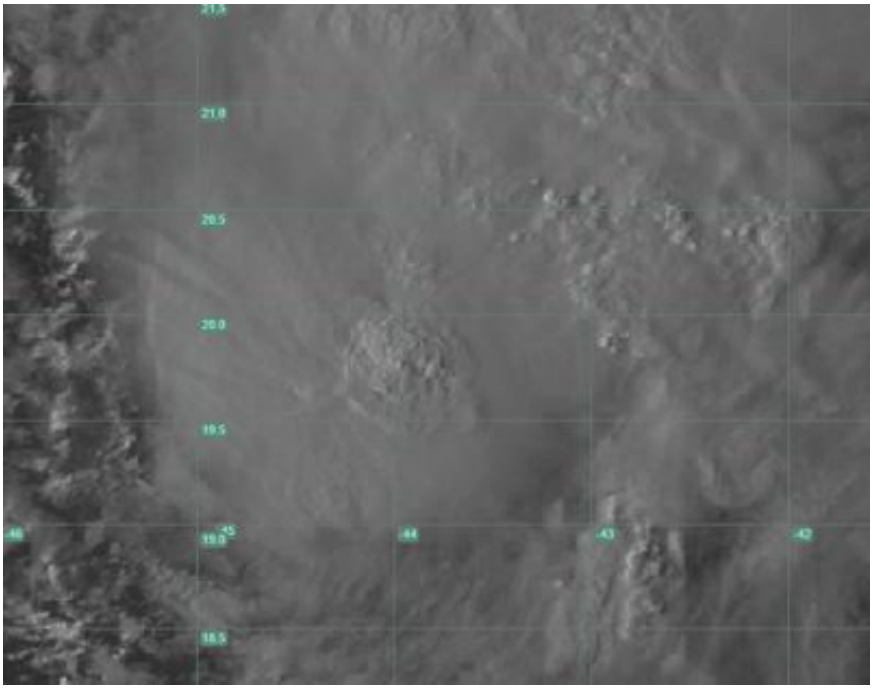
Forecaster Avila

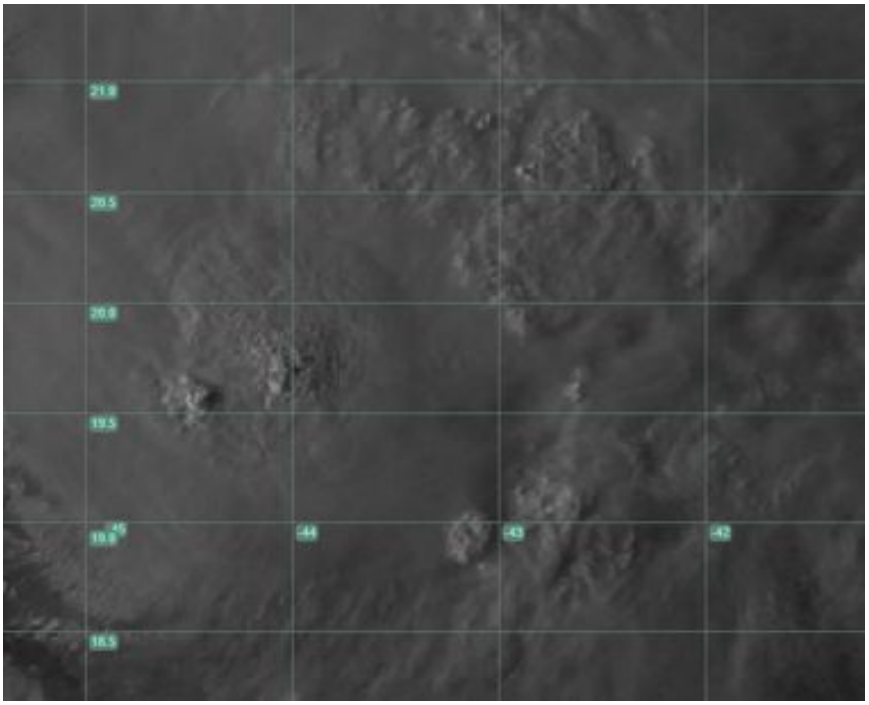
2100z: NHC discussion



The 12/12z ECMWF forecast now intensifies Edouard (earlier couple of runs weakened the TC).

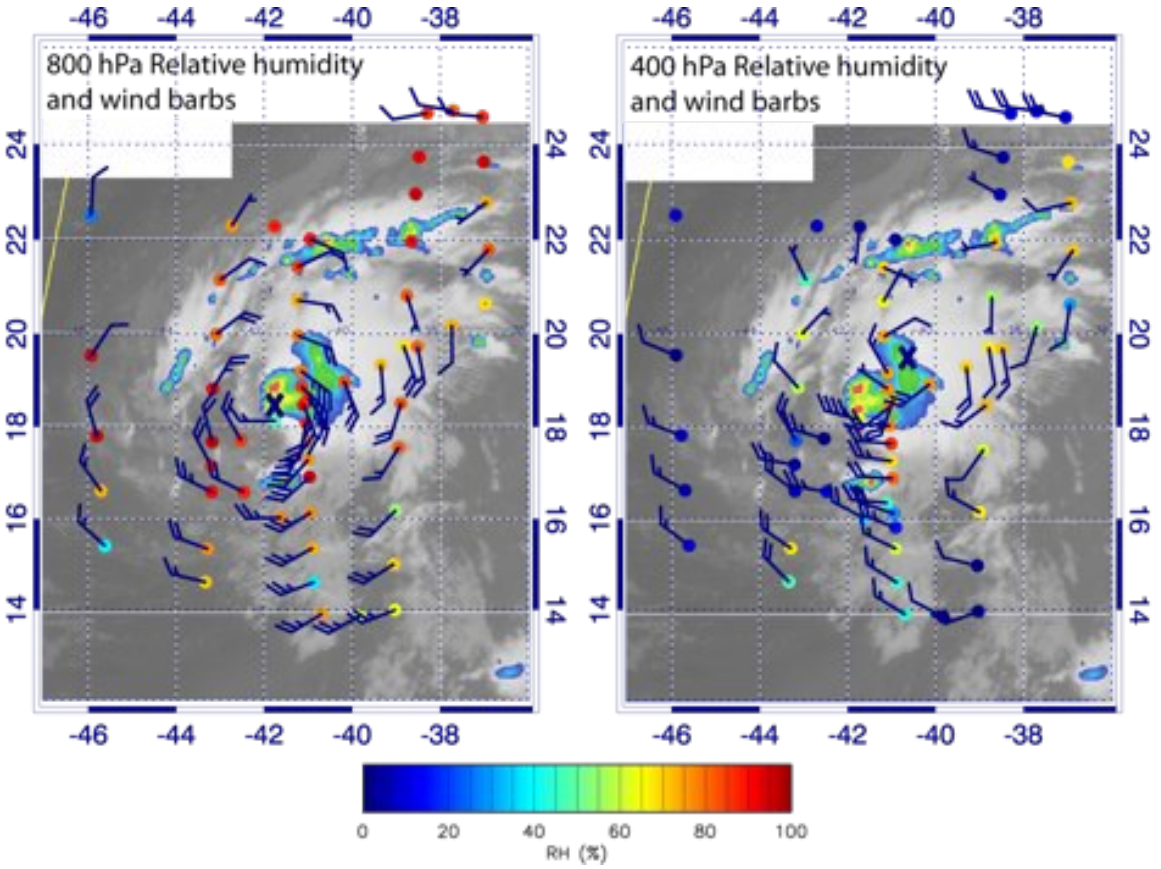


2100: Visible image of Edouard from MTS.



Last light visible image of Edouard.

Landing at 2150z



The above figures show the sonde distribtion in a storm-relative reference frame. Wind barbs show storm-relative winds. Color filled circles show relative humidity at 800 and 400 hPa. Some dry air in the low-level environment, but generally distant from the center. The exception is the drop near the center that shows a RH of ~40% just south of the convective burst. The vertical profile for this sonde was suggestive of strong low-level descent and perhaps the formation of the nascent eye. At 400 hPa, very dry air was impinging on the western-to-southwestern side of the storm indicating that shear and mid-to-upper level dryness were the main inhibiting influences.

Instrument summaries

AVAPS

AVAPS loaded 65 sondes and successfully deployed 64 sondes as commanded. One sonde was not deployed and returned safely in its proper location in the dispenser. System faults occurred on several of the first five sonde launches due to high temperatures on the shuttle motor that controls ejection of the dropsondes. Sondes were successfully ejected during the faults, but the time required to recover resulted in missing planned deployment locations 2 and 4. After the fifth launch the fault could not be

cleared and the system was powered down to allow the motor to cool. The delay resulted in missing planned locations 8 and 9, but the system performed without mechanical fault following the restart. The other significant problem that occurred was the loss of some or all of the real-time data on the final 8 sondes deployed. The problem was traced to a drift in the clock of the AVAPS data computer which resulted in an apparent time mismatch with the deployed sondes. Raw data were still recorded and the data will be recoverable in post processing. NOAA HRD personnel performed real-time processing on the available data as usual.

Following the flight the launcher mechanism was removed from the aircraft and a thermostat replaced to avoid further overheating problems. During testing after reinstallation of the system another problem was encountered with the positioning of the launcher shuttle. The tests suggest that system faults are likely on the next flight, but it may be possible to clear them by manually repositioning the shuttle. Given the priority of the potential target, operation in this mode seems warranted.

Sondes Allocated		**750**	
Remaining		**432**	**57.6%**
Released		**318**	**42.4%**
Flight	**Take off Date**	**Sonde Usage**	**Sondes Left**
RF01	8/26/2014	75	675
RF02	8/28/2014	70	605
RF03	9/3/2014	50	555
RF04	9/5/2014	59	496
RF05	9/11/2014	64	432

S-HIS Summary

A. Merrelli, SSEC, University of Wisconsin-Madison

This flight took AV6 over Tropical Storm Eduardo, in a lawnmower pattern with a total of 64 sonde drops. The flight path was adjusted to include passes directly over the center, taking the aircraft over the deepest convective clouds in the storm. TS Eduardo was not interacting with a very strong Saharan Air Layer (SAL), but there was a large gradient in the total moisture amount with the region to the west and north of the storm having much drier air. Figure 1 shows an example cross-section of the relative humidity from the S-HIS retrievals on the outbound flight segment, when the aircraft was still to the northwest of the storm center. Figure 2 shows a similar cross-section but while the aircraft was to the southeast.

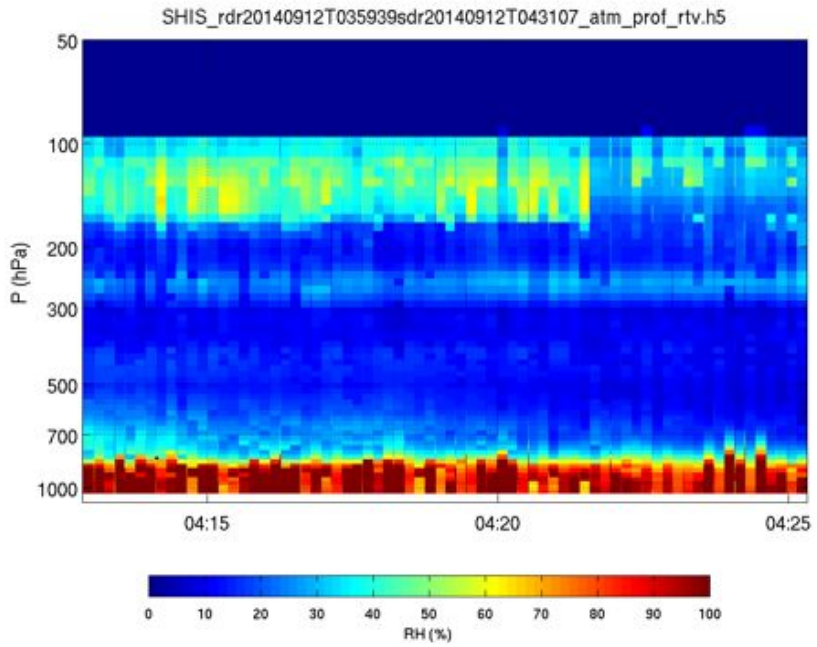


Figure 1. RH cross-section from S-HIS retrievals, from the area to the northwest of TS Eduardo, showing drier air. RH is nearly saturated up to approximately 850 hPa and very low above this level.

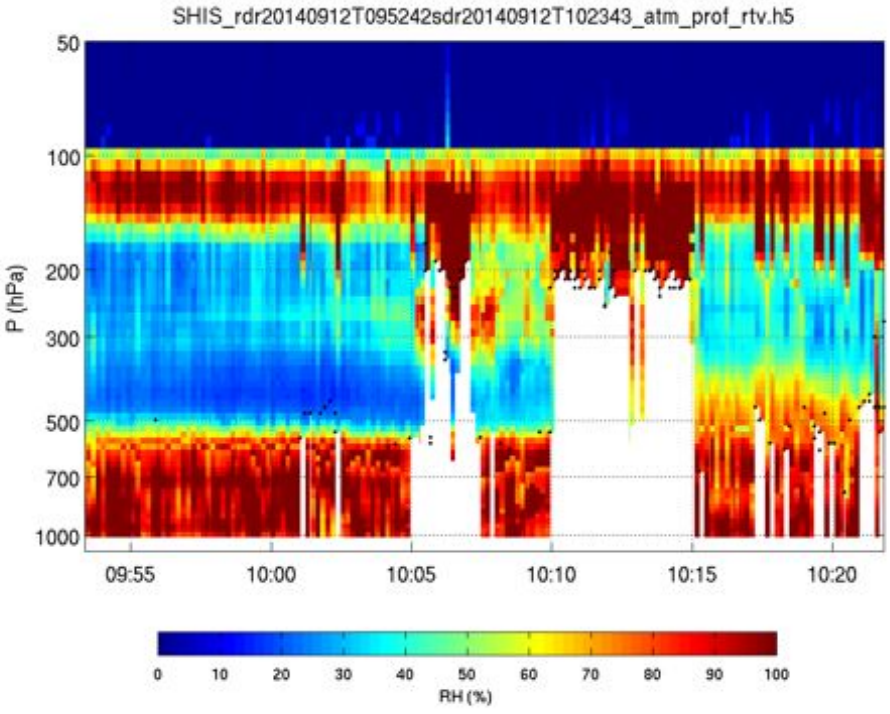


Figure 2. RH cross-section from S-HIS retrievals, from the area to the southeast of TS Eduardo, showing moister conditions. RH is nearly saturated up to approximately 600 hPa, and saturated regions appear near the upper level clouds at 200 – 300 hPa.

Another near real time product was added to the MTS system, which shows a comparison of the AVAPS dropsonde temperature and dewpoint profiles with the S-HIS retrieved T and DP profiles. All four profiles are overplotted on the same axis, along with a GFS forecasted temperature profile. This new plot is labeled “SHIS/AVAPS Comparison Skew-T” under the “Near-Line Dual Regression Products” in MTS. In these comparisons, the S-HIS retrieval is the average over all S-HIS retrievals from data collected during the sonde drop, with some simple outlier rejection. The comparisons are quite good, with the S-HIS retrieval capturing the same large scale vertical moisture structures as the drop sonde, limited of course by the cloud cover. Some selected comparison plots are shown below, to help illustrate the information in the S-HIS retrievals compared to the dropsonde.

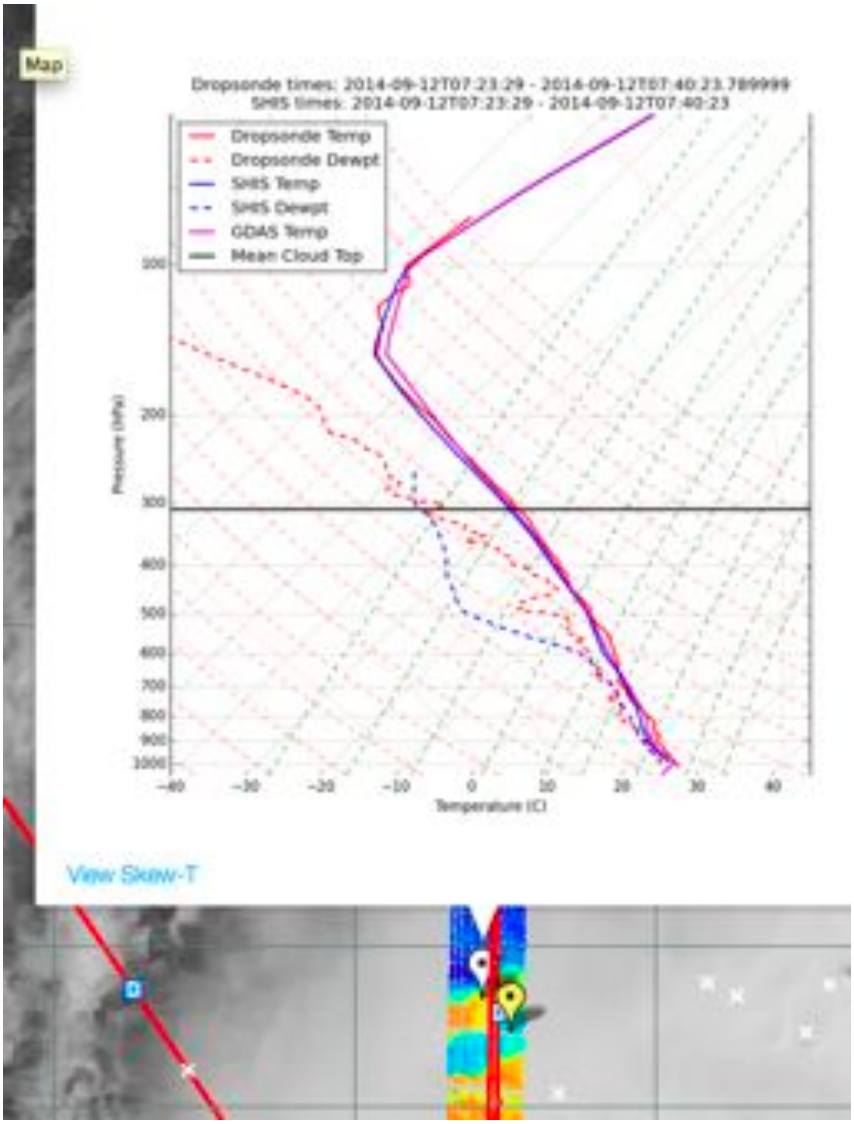


Figure 3. Example retrieval in partially cloudy region. In this case the dewpoint profile from the dropsonde and S-HIS retrieval do not match well (see discussion in text)

Figure 3 shows retrieval near high level (Cloud Top Pressure, CTP ~ 300 hPa), where the S-HIS dewpoint is not a good match to the sonde underneath the cloud. In cases like this, the comparison is somewhat ambiguous, since several factors complicate the comparison. First, horizontal variations in cloud cover will likely be associated with large variations in the humidity field. The basic averaging scheme used for the S-HIS retrieval here may simply be sampling a different air volume with different dewpoint. This effect could be exacerbated if the part of the profile below the cloud was only sampled by a small number of retrievals, especially if these few retrievals contained complicated multi-layer clouds that are difficult retrievals. The brightness temperature image for 895 cm^{-1} wavenumber (the IR window channel) shows some possibly clear areas. The warm colors – oranges and reds – correspond to warm brightness temperatures. Figure 4 shows a similar case, but this time the S-HIS retrieval more closely matches the under-cloud profile from the dropsonde. Note again that the brightness temperature image shows clear areas in the vicinity, possible larger in area than in the previous case.

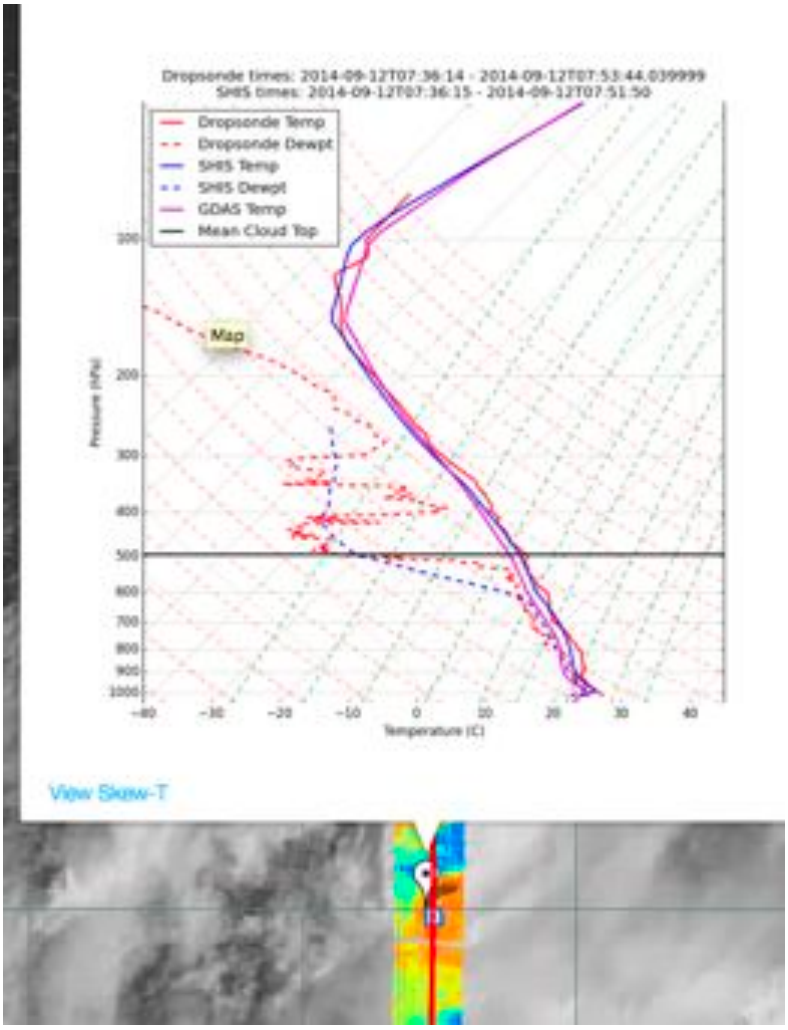


Figure 4. Another example retrieval in partially cloudy region. In this case the dewpoint profile from the dropsonde and S-HIS retrieval match well (see discussion in text)

Figure 5 shows a case where the GFS forecasted temperature profile shows a large bias. Both the retrieval and dropsonde match well for this case, and show a roughly 5 degree C difference to the GFS forecast. Figure 6 shows the comparison for one of the passes over the storm center. The high altitude clouds in this case have no gaps, so the S-HIS can only retrieve the temperature down to cloud top (CTP ~ 200 hPa), and the dry layer underneath is only detectable by the dropsonde. Using brightness temperature image for context, shows an unbroken cloud layer with very cold cloud top temperature.

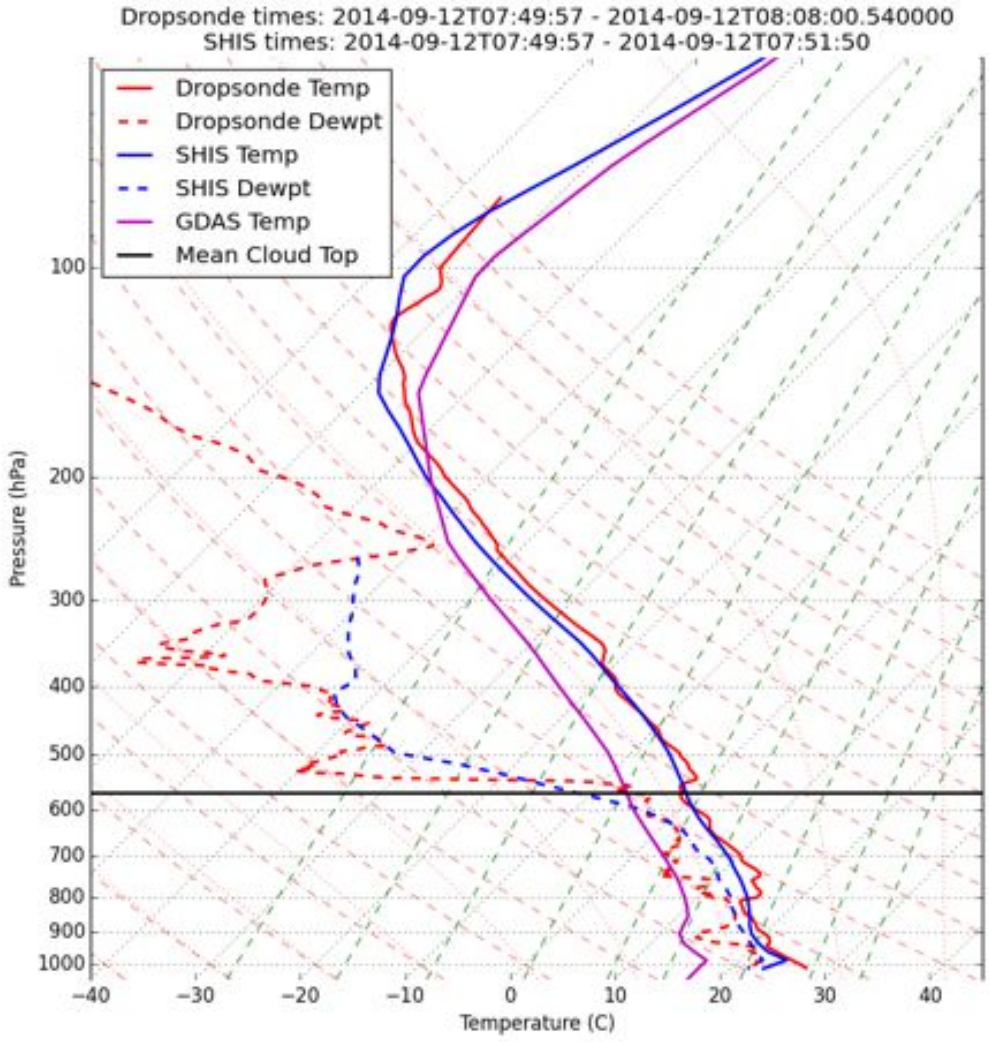


Figure 5. Case where the S-HIS retrieval and dropsonde show a large difference to the GFS forecast temperature profile.

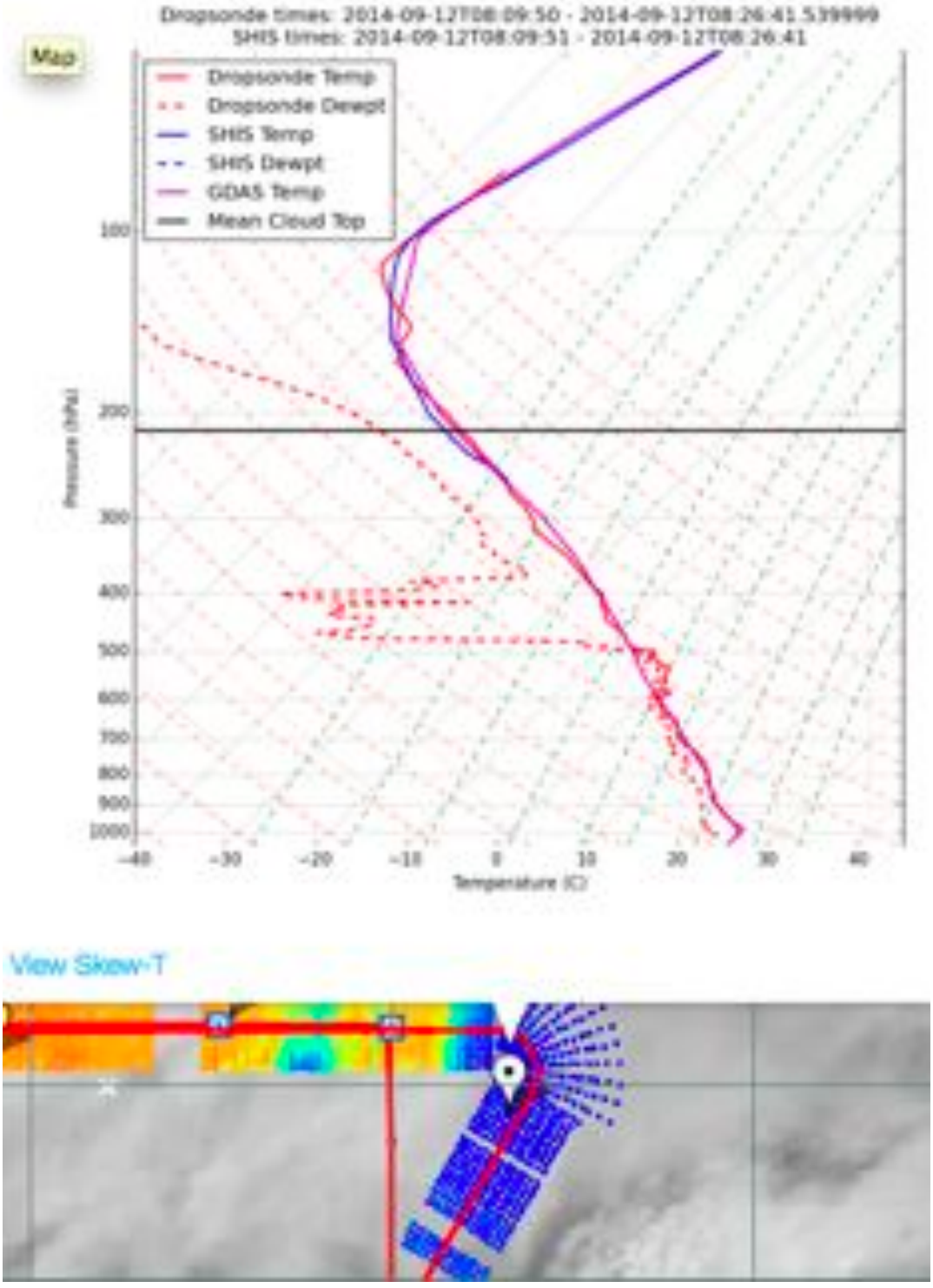


Figure 6. Example retrievals over the high level cloud layers near the storm center. In this case there are no gaps in the clouds so S-HIS has no information for the profile below the CTP at ~ 200 hPa.

Instrument Summary

The Scanning-HIS operated well throughout the flight. An instrument power cycle (15 minutes off) at 45 minutes prior to the first science waypoint was implemented. A second power cycle was performed when detector temperatures were noted to be decreasing to nominal temperatures more slowly than expected after the scheduled power cycle.

Timeline (All times are UTC and are only approximate):

- 2114 GH engine start
- 2206 Ku ON and transmitting
- 2209 S-HIS Power on
- 2213 Takeoff
- 2245 S-HIS detectors cooled
- 0342 S-HIS power cycle; ~45 minutes prior to science waypoint 1 (15 minutes off)
- 0359 S-HIS power cycle complete, IL41 on
- 0446 S-HIS power cycle
- 0452 S-HIS power cycle complete, IL41 on
- 0532 S-HIS detectors at ~80K
- 0610 S-HIS detectors at near nominal temperature
- 2021 S-HIS descent heaters on
- 2042 Instrument power OFF before descent (IL42, IL41, DC42, DC41)
- 2101 Instrument power ON (DC41, DC42, IL41, IL42)
- 2129 Instrument power OFF (DC41, DC42, IL41, IL42)
- 2150 Landing

CPL

This is the flight that no data was recorded on the instrument disk. We were able to find the problem the next day and were ready for flight #6. We do have all of the quicklook images (the ones that are displayed on MTS) and we also have the actual profile data from the 532 channel (which are sent down on KU and captured on the GHOC computer). With some work, we can use these to produce higher quality images and cloud heights, but we have no 1064 data (or depol) from this flight. Currently, no products are available for this flight.