SHOUT Research Flight 6 – 20160924 - Karl

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Shift 2 Mission Scientists: Eric Hendricks, Dave Nolan, Peter Black, Jon Moskaitis
Shift 3 Mission Scientists: Gary Wick, Jason Dunion, Chris Velden

Log initiated by G. Wick

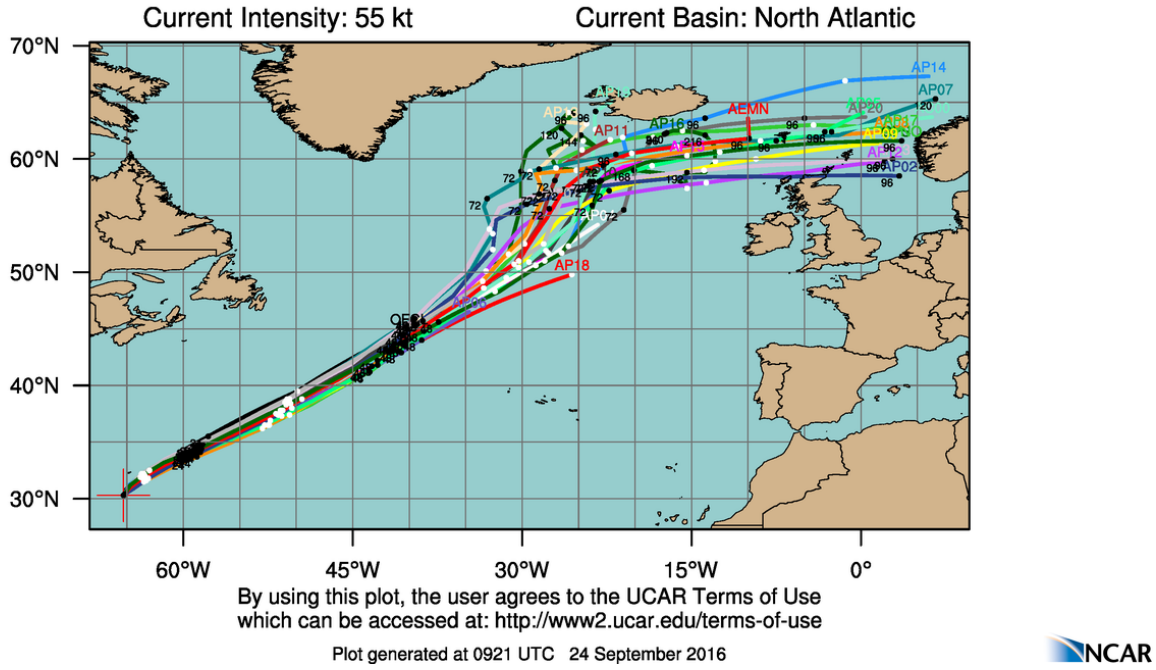
Mission to sample Tropical Storm/Hurricane Karl as it tracks rapidly off to the northeast following its turn near Bermuda. It is hoped that this flight will catch Karl at hurricane strength and even catch some of the intensification. This will be the second flight into Karl providing a nice connection between our first flight and later planned sampling by the NAWDEX team after it undergoes ET and tracks toward Europe. Coordination during this flight is expected with the NOAA G-IV which will be doing ET sampling and N-43.

Payloads are AVAPS, HAMSR, and HIWRAP. During the previous flight, AVAPS had an issue with one of their bins which prevented the release of the last 8 sondes. The problem appeared to be related to a sticking latch on one of the releases, but the problem could not be duplicated on the ground. For this flight, that bin will be considered questionable and saved for last. A full 90 sondes will be loaded, but planning should be based on the assumption of only ~80 available sondes.

The following map taken from the RAL page highlights GFS ensemble track uncertainty out at the ~72 hour period when in the period of NAWDEX sampling. The NAWDEX team has already commented on this uncertainty and voiced hope that data from our GH flight could help reduce this uncertainty in advance of their flight.

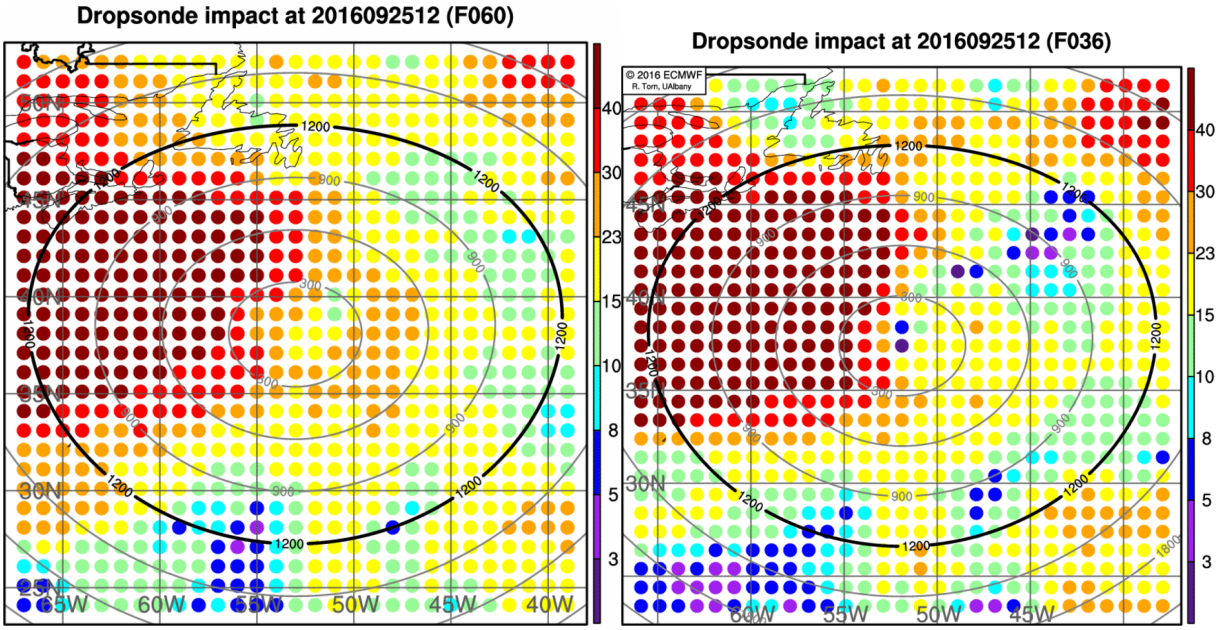
TROPICAL STORM KARL (AL12)

NCEP GFS Ensemble track guidance initialized at 0000 UTC, 24 September 2016

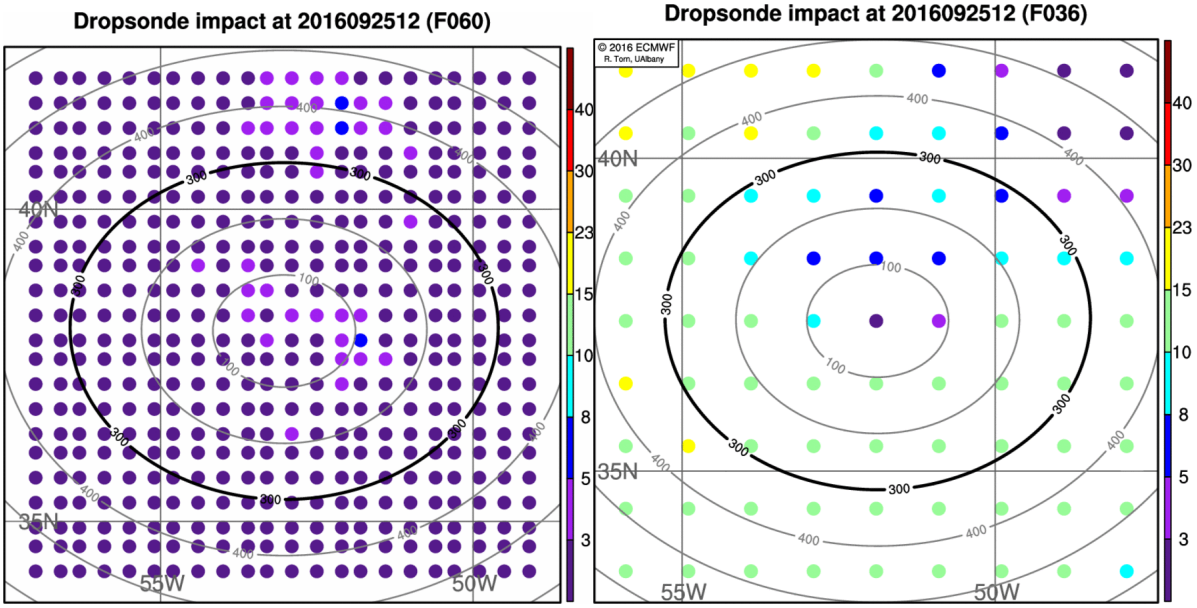


Targeting discussion from Ryan Torn

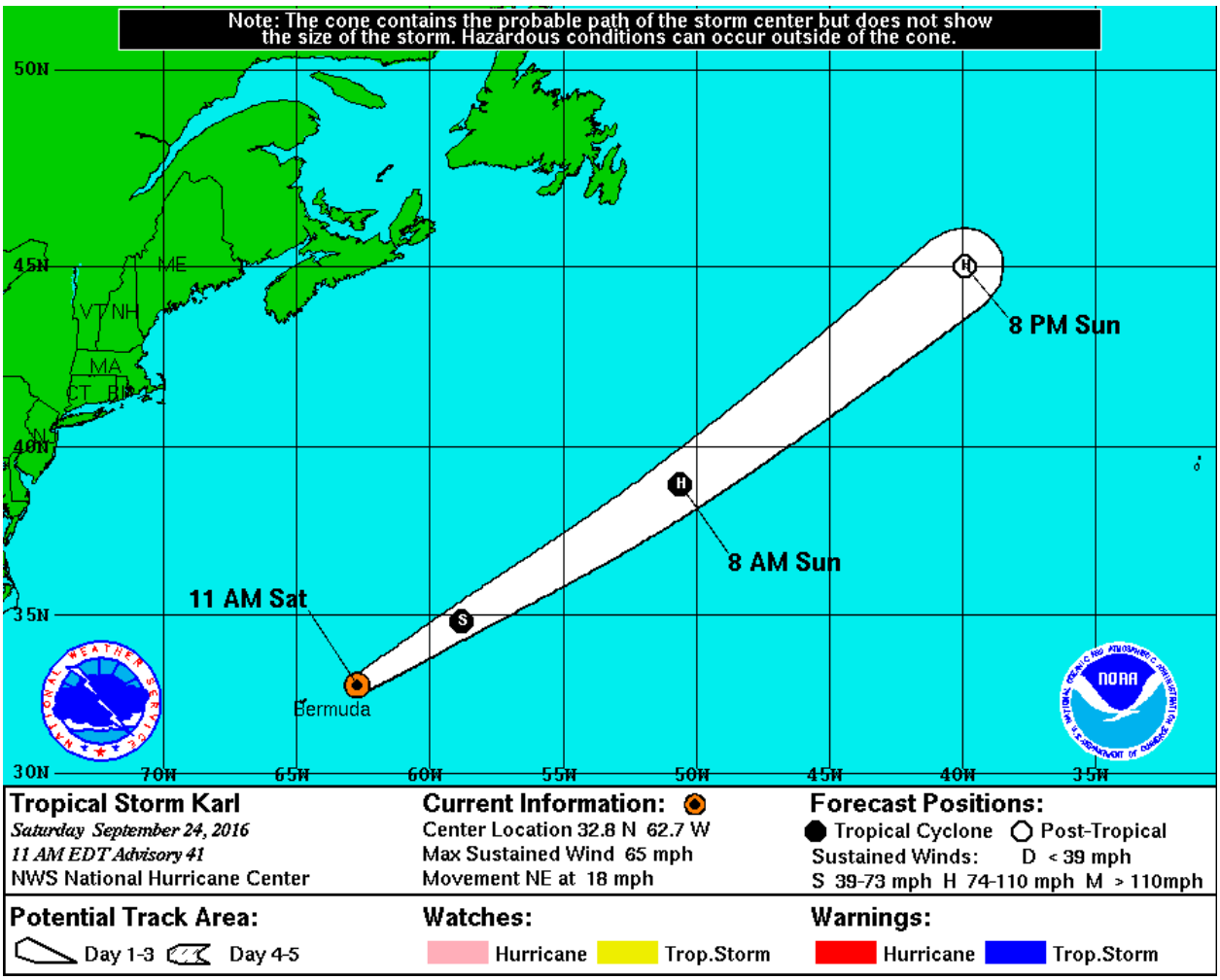
The focus of today's discussion is on TS Karl targets for 1200 UTC 25 September. Both ECMWF and HWRF data are available, though the trackers do not last much longer than 0000 UTC 26 September. For track, the HWRF (left) and ECMWF (right) targets are concentrated on the west of the TS associated with the trough that is going to accelerate the storm. This sensitive pattern for COAMPS is consistent with this.



For intensity, the HWRF (left) does not have any great target locations, while the ECMWF (right) is concentrated to the northwest and west, presumably due to baroclinic processes. COAMPS also shows sensitivity close to the storm, though it is also sensitive to the downstream state.



Forecast map from NHC 11 am discussion



TROPICAL STORM KARL DISCUSSION NUMBER 41
NWS NATIONAL HURRICANE CENTER MIAMI FL AL122016
1100 AM AST SAT SEP 24 2016

Data from the last NOAA Hurricane Hunter aircraft mission into Karl earlier this morning found peak flight-level winds of 63 kt at 8,000 ft and a peak SFMR wind of 47 kt. Based on these data, the initial intensity is held at 55 kt for this advisory, but this could be a little generous. The latest minimum central pressure based on a dropsonde from the aircraft is 994 mb. Karl is still expected to strengthen, but it seems likely that this will be at least partly due to baroclinic effects, as the global models shows Karl intensifying while the shear increases to over 50 kt by 24 hours. The new NHC intensity forecast follows this trend, and keeps Karl as a 70-kt cyclone with a very large wind field when it becomes post-tropical in 36 hours. The circulation of Karl should be absorbed by a large extratropical cyclone over the north Atlantic by 48 hours, as shown in the global model solutions.

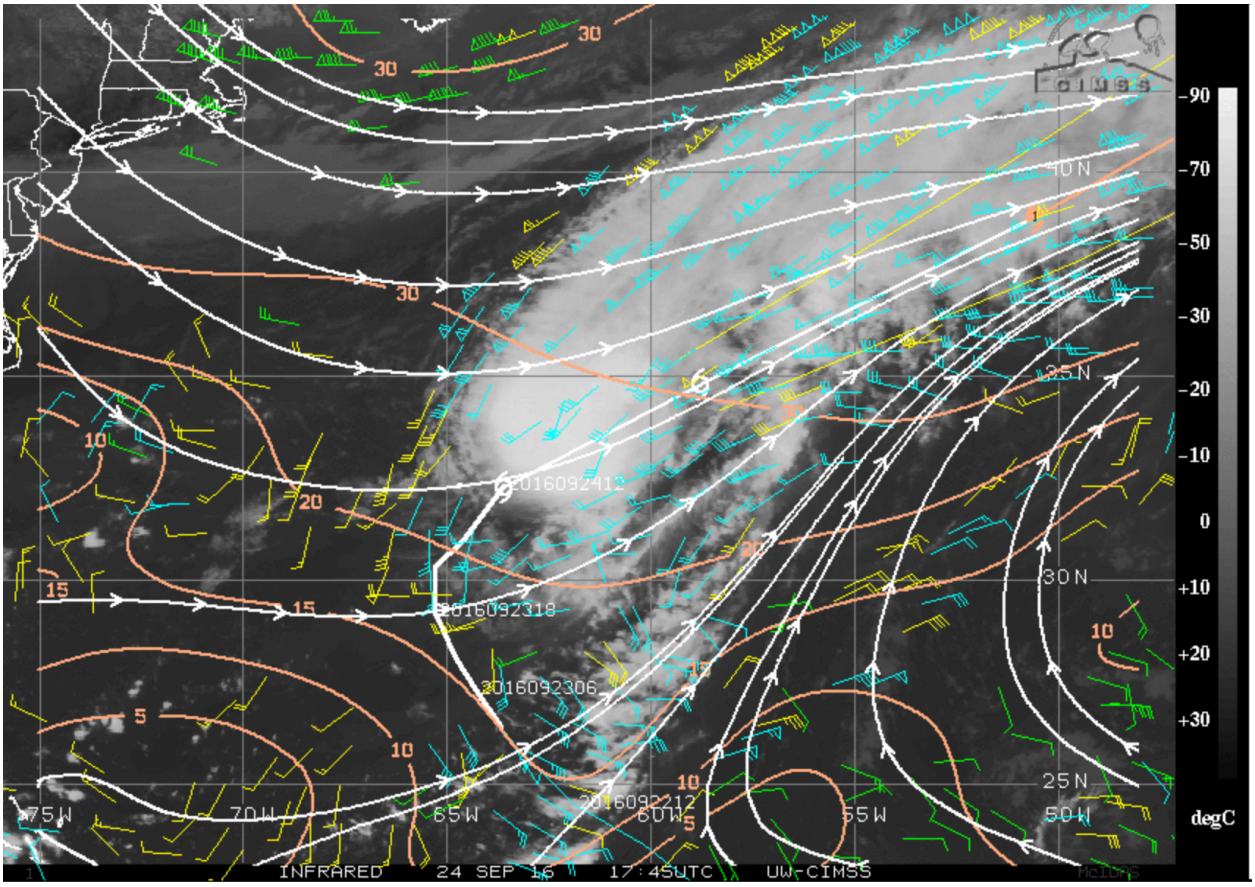
The aircraft last fixed the center on the southeastern side of the deep convection, and the initial motion estimate is now 050/16. Karl should accelerate quickly northeastward ahead of a broad deep-layer trough moving into the Atlantic until it is absorbed, with the forward speed expected

to reach 50 kt by 36 hours. The new NHC track forecast is an update of the previous one and remains near the middle of the tightly packed guidance envelope.

The track, intensity, and wind radii forecast of Karl's post-tropical phase has been coordinated with the Ocean Prediction Center.

FORECAST POSITIONS AND MAX WINDS

INIT 24/1500Z 32.8N 62.7W 55 KT 65 MPH
12H 25/0000Z 34.8N 58.8W 60 KT 70 MPH
24H 25/1200Z 38.9N 50.6W 70 KT 80 MPH
36H 26/0000Z 45.0N 39.9W 70 KT 80 MPH...POST-TROPICAL
48H 26/1200Z...ABSORBED



Karl beginning to pick up speed and move towards the NE. 1745Z image above shows movement since the 12Z NHC position. Position might be slightly to the north of the forecast track at the moment. Outflow jet is still strong over Karl. Deep layer mean streamlines show good agreement with forecast track (white line with symbols; first white TS symbol is 12Z position). Cloud top temperatures are still in the -70 to -75C range with cloud top heights around 53-55kft.

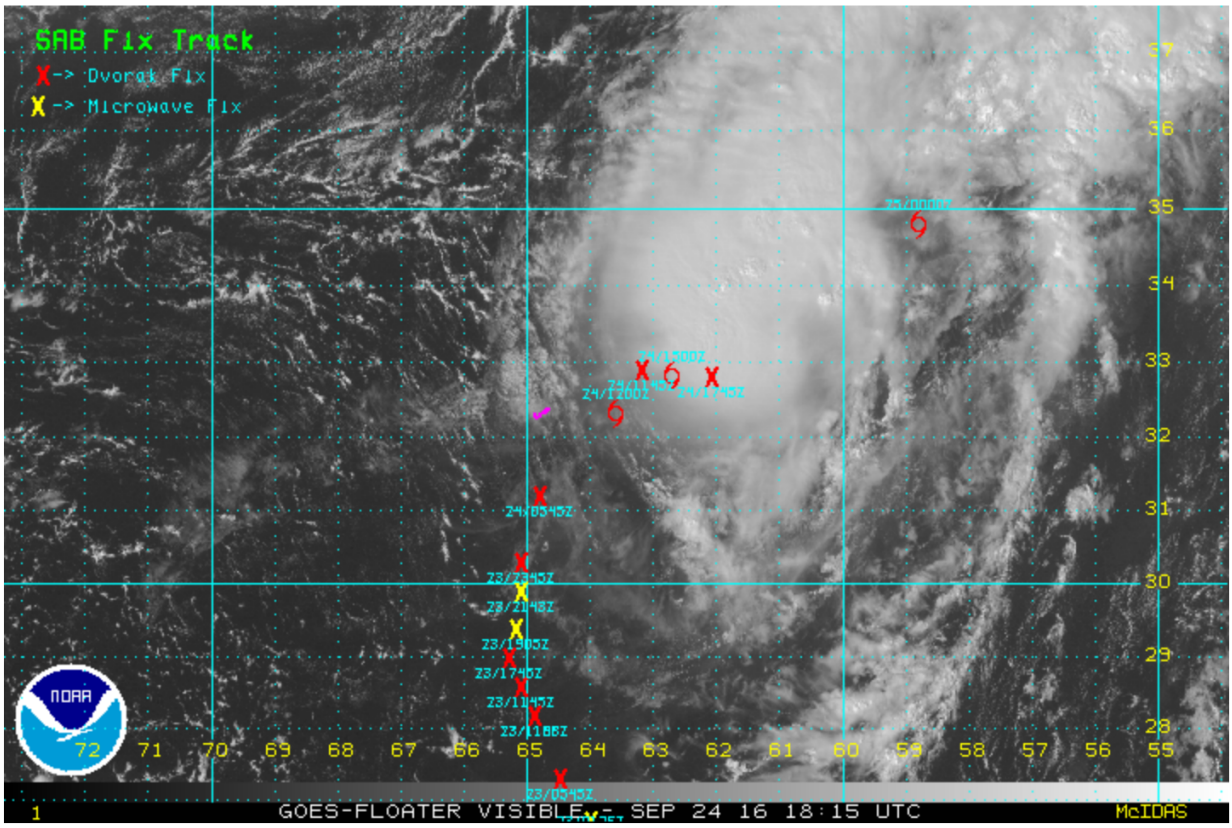
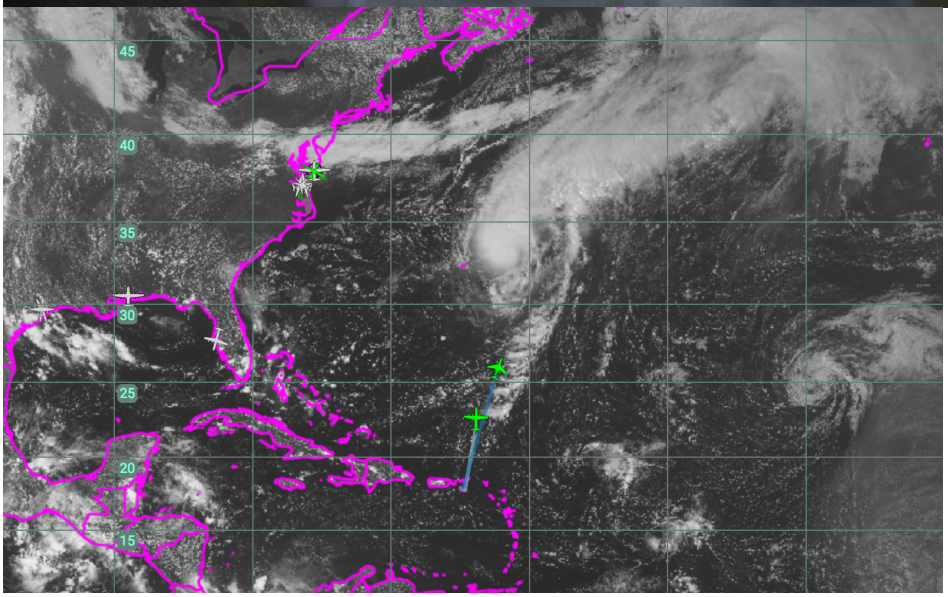
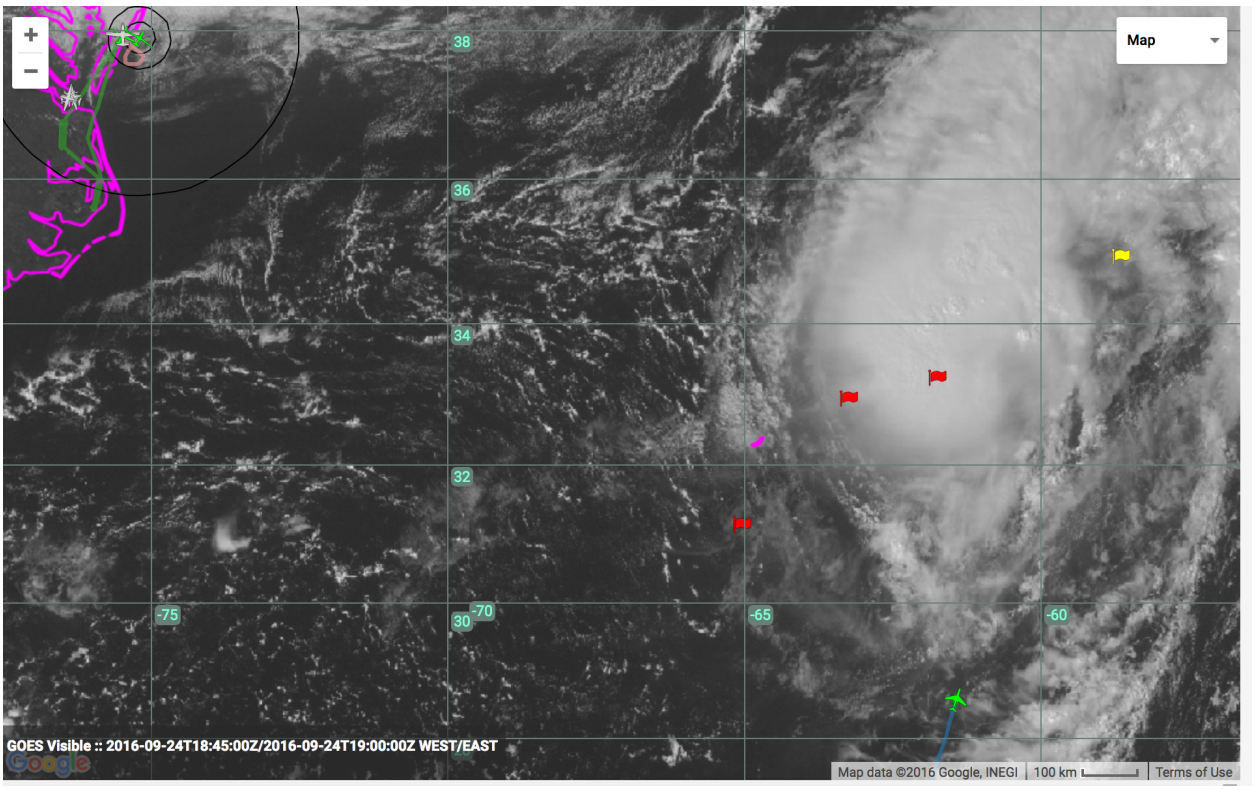


Image showing the past satellite and Dvorak fix positions from NOAA/SAB for Karl prior to aircraft takeoff.

1847Z: Airborne

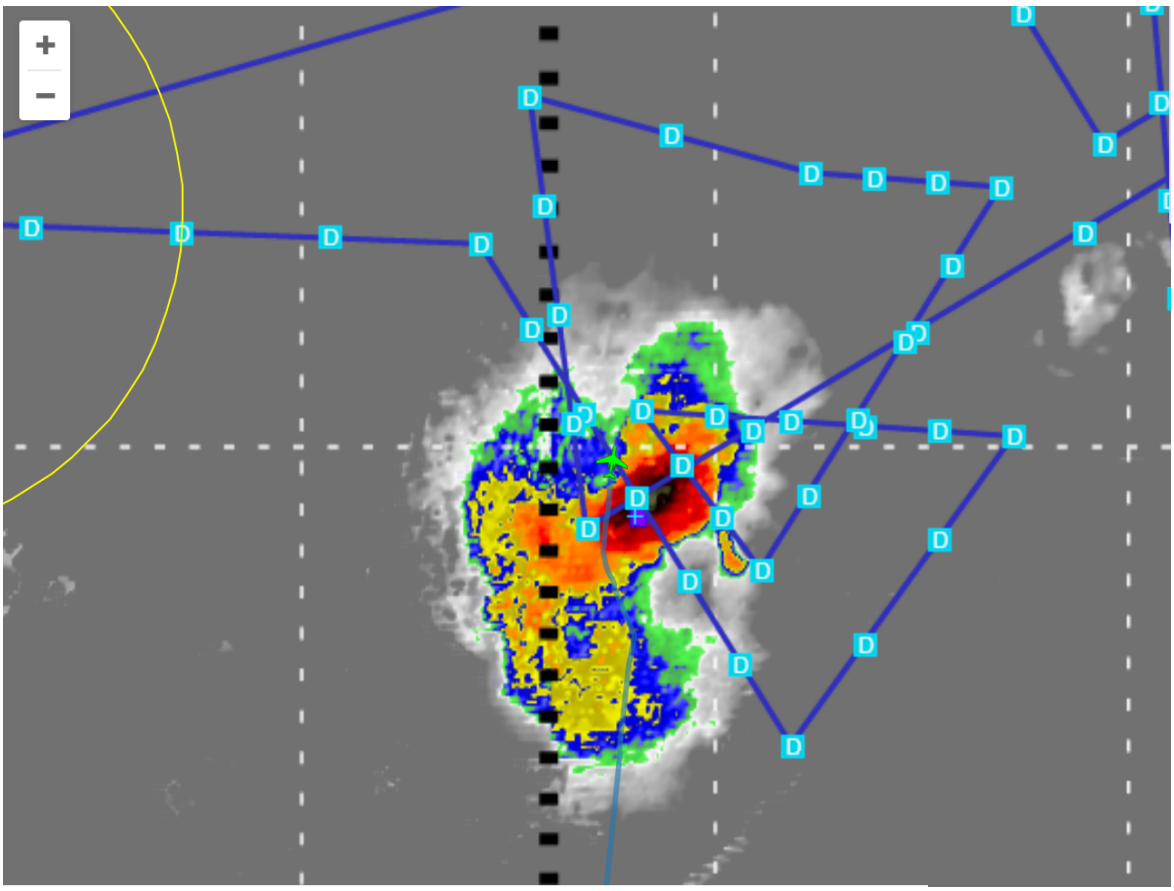


GOES Sep 24, 2016 1815Z image showing Karl, Lisa and the frontal cloud band just north of Wallops. NOAA GIV and P3 are enroute to Karl.

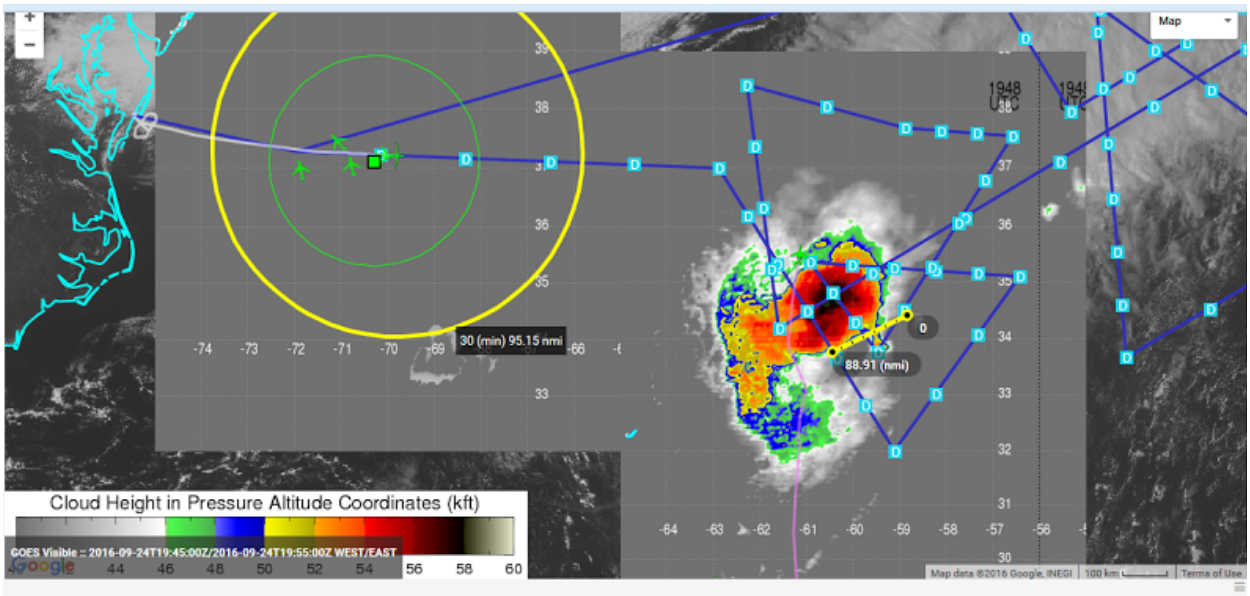


Karl with estimated positions ar 0545Z, 1145Z, 1745Z and NHC forecast at 00Z

Missed sonde 1 at point1 move it to point 2 due to ATC



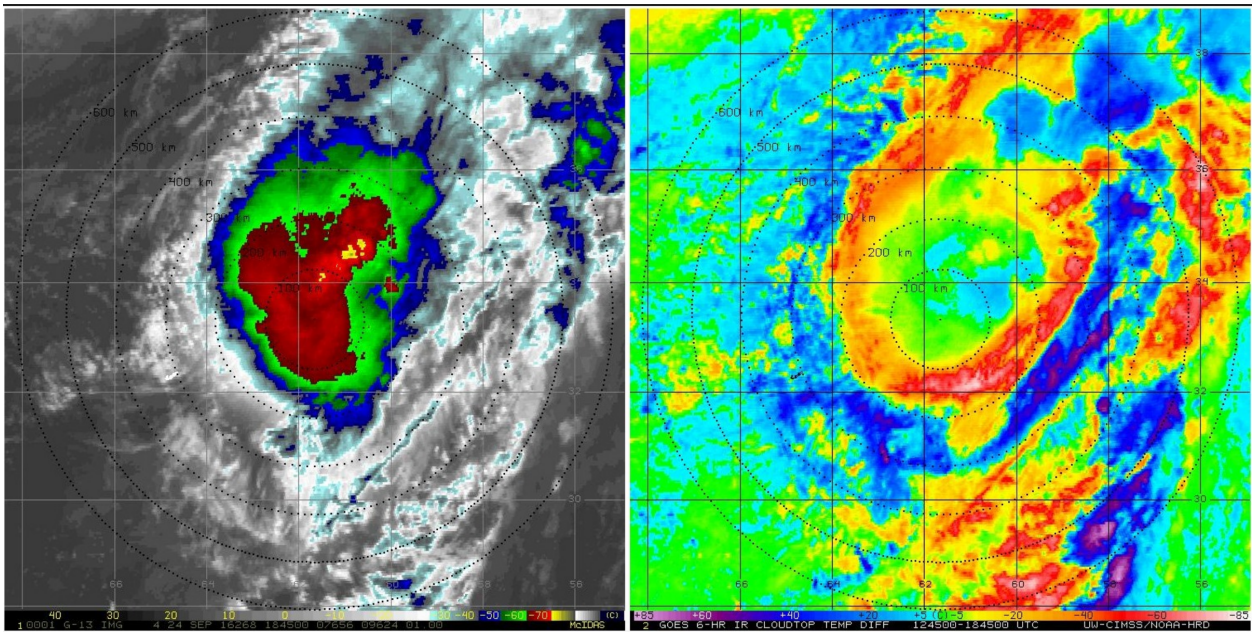
Update track #2 for Karl. First butterfly leg (NW -> SE) was moved to the SW about 90nmi. This was done to try and penetrate southwestern convective region.



First drop is on hold due to air traffic.

2016Z: Drop 1 at location 2; good drop

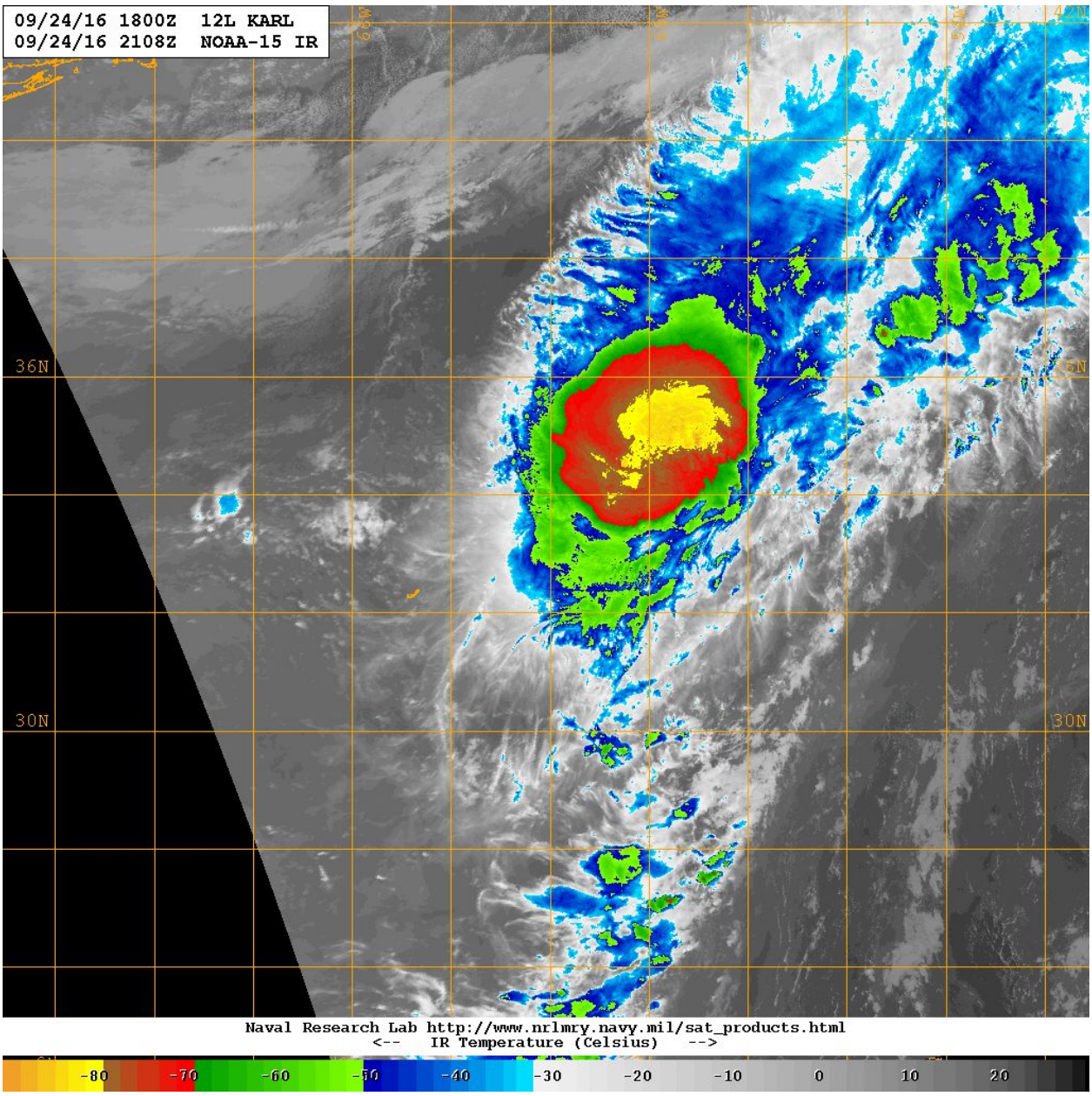
2029Z: Drop 2 at location 3; good drop



Karl showing great diurnal pulse signal (warming in blue and cooling in red shades… difference between 1245 and 1845 images).

2043Z: Drop 3 at location 4; good drop

2058Z: Drop 4 at location 5; good drop

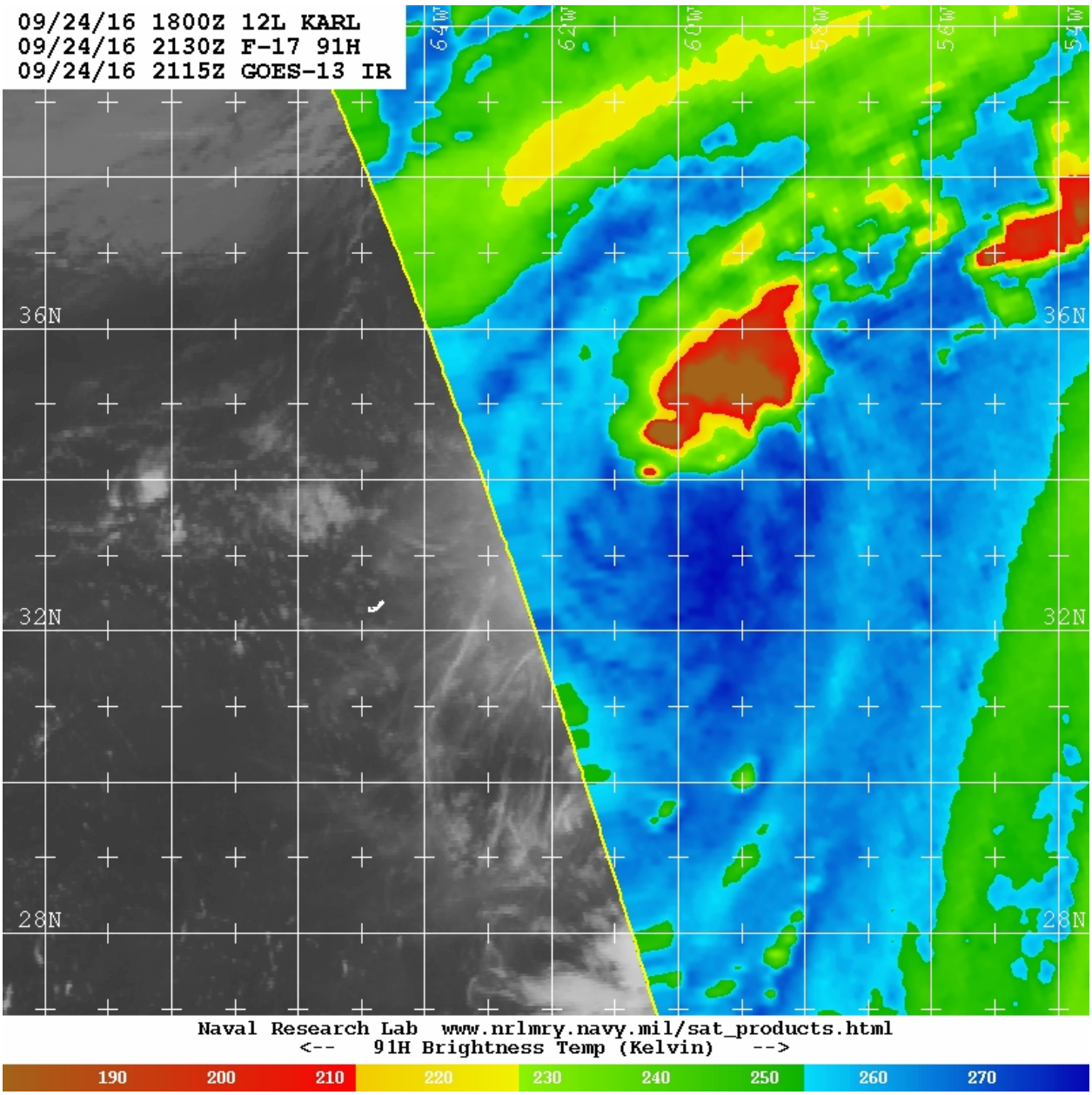


2108Z: NOAA15 IR image. Cloud top temperature down to about -86 deg C. Not bad for 35 N latitude!

2110Z: Drop 5 at location 6; good drop

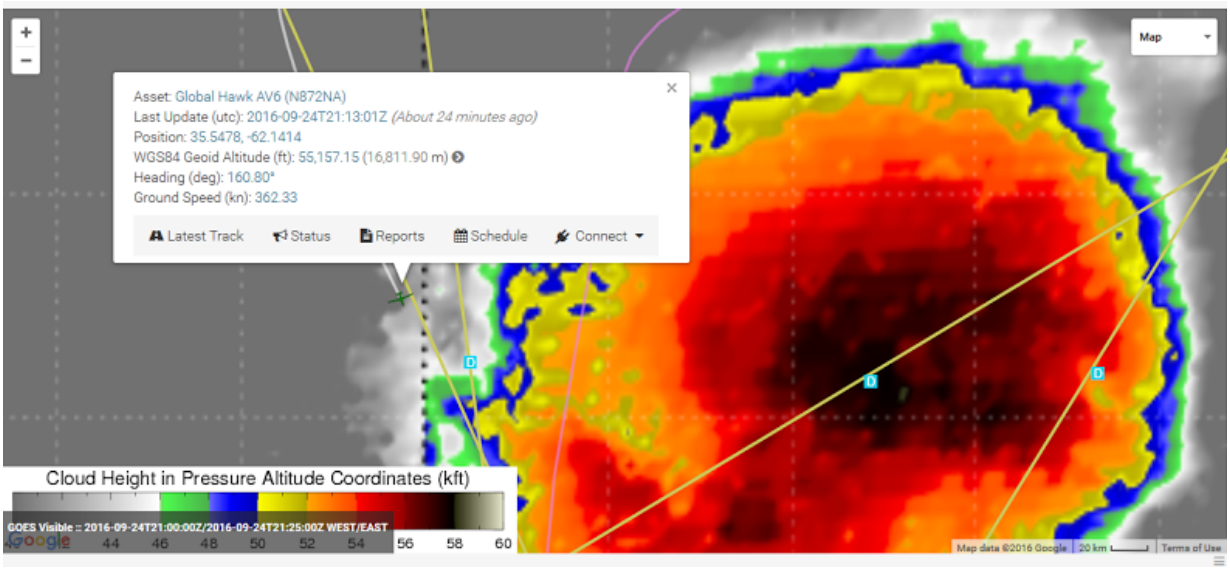
2113Z Approaching cloud tops > 50K but no TOTS or lightning. Waiting for next image to see if there is any change.

2122Z: Drop 6 at location 7; good drop



2130Z: SSMIS 91GHz image; convection displaced north of center; which is at 33.6N, 61.1W at 21z per NHC

2136Z: Drop 7 at location 8; good drop

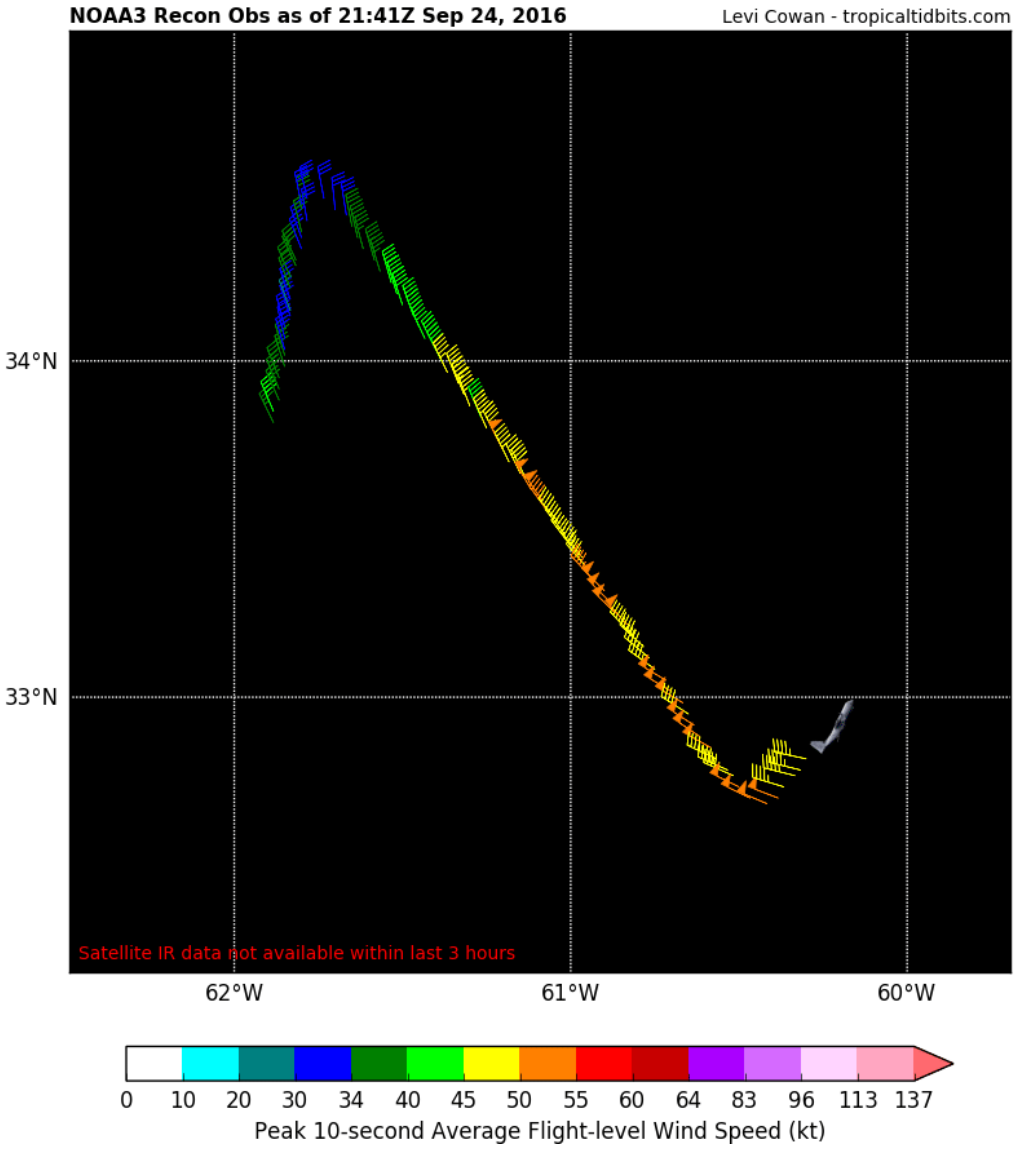


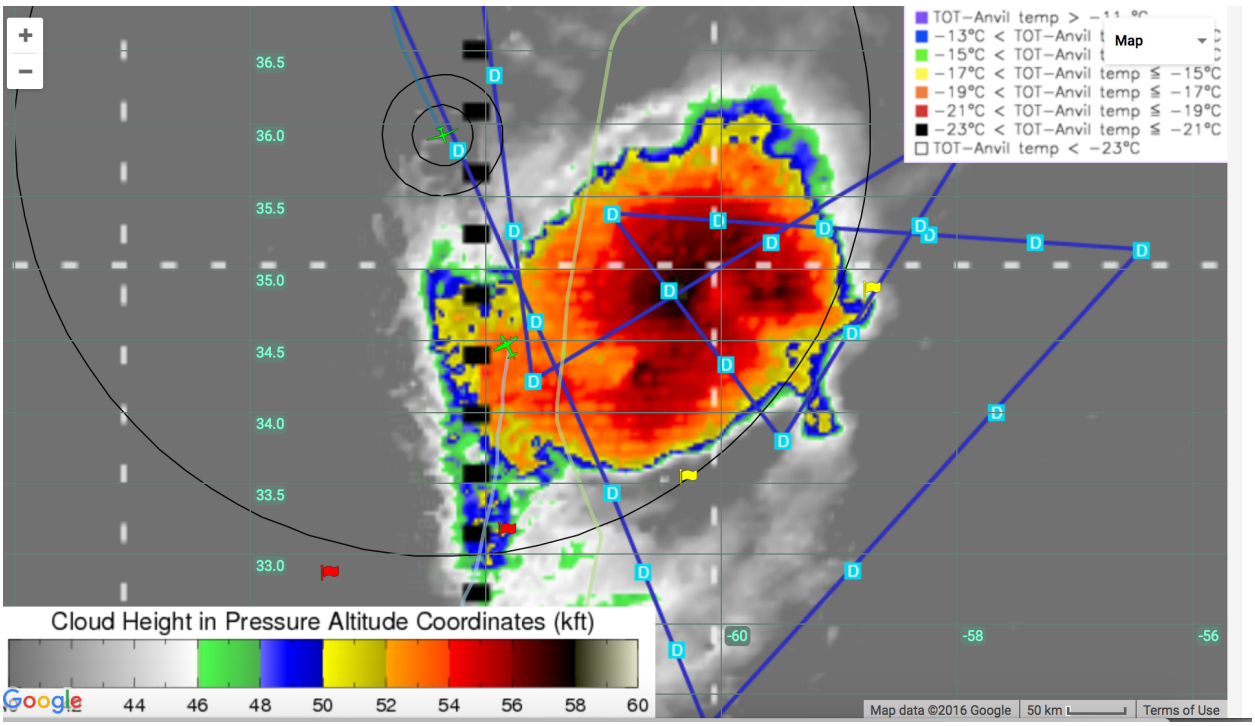
MTS is currently not showing the correct location of the Global Hawk.

2143Z: Drop 8 at location 9; good drop

2149Z: Drop 9 at location 10; good drop

Modified the initial transect through storm for estimated position at 33.6N 60.3W but moved this west since P3 felt center was west of there. However looks like initial guess was correct based on P3 obs which clearly missed the center.

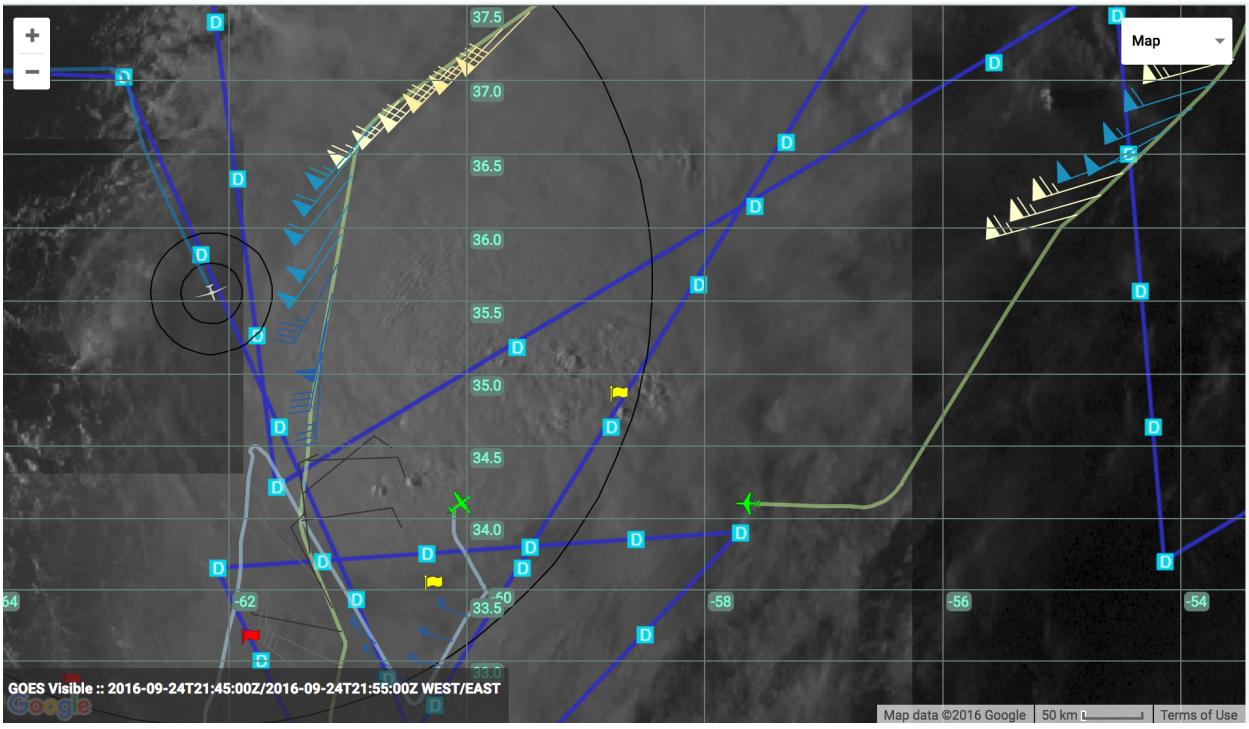

NOAA3 Recon Obs as of 21:41Z Sep 24, 2016
Levi Cowan - tropicaltidbits.com
34°N
33°N
Satellite IR data not available within last 3 hours
62°W
61°W
60°W
0 10 20 30 34 40 45 50 55 60 64 83 96 113 137
Peak 10-second Average Flight-level Wind Speed (kt)



Center is very difficult to locate even in vis imagery.

2156Z: Drop 10 at location 11; good drop

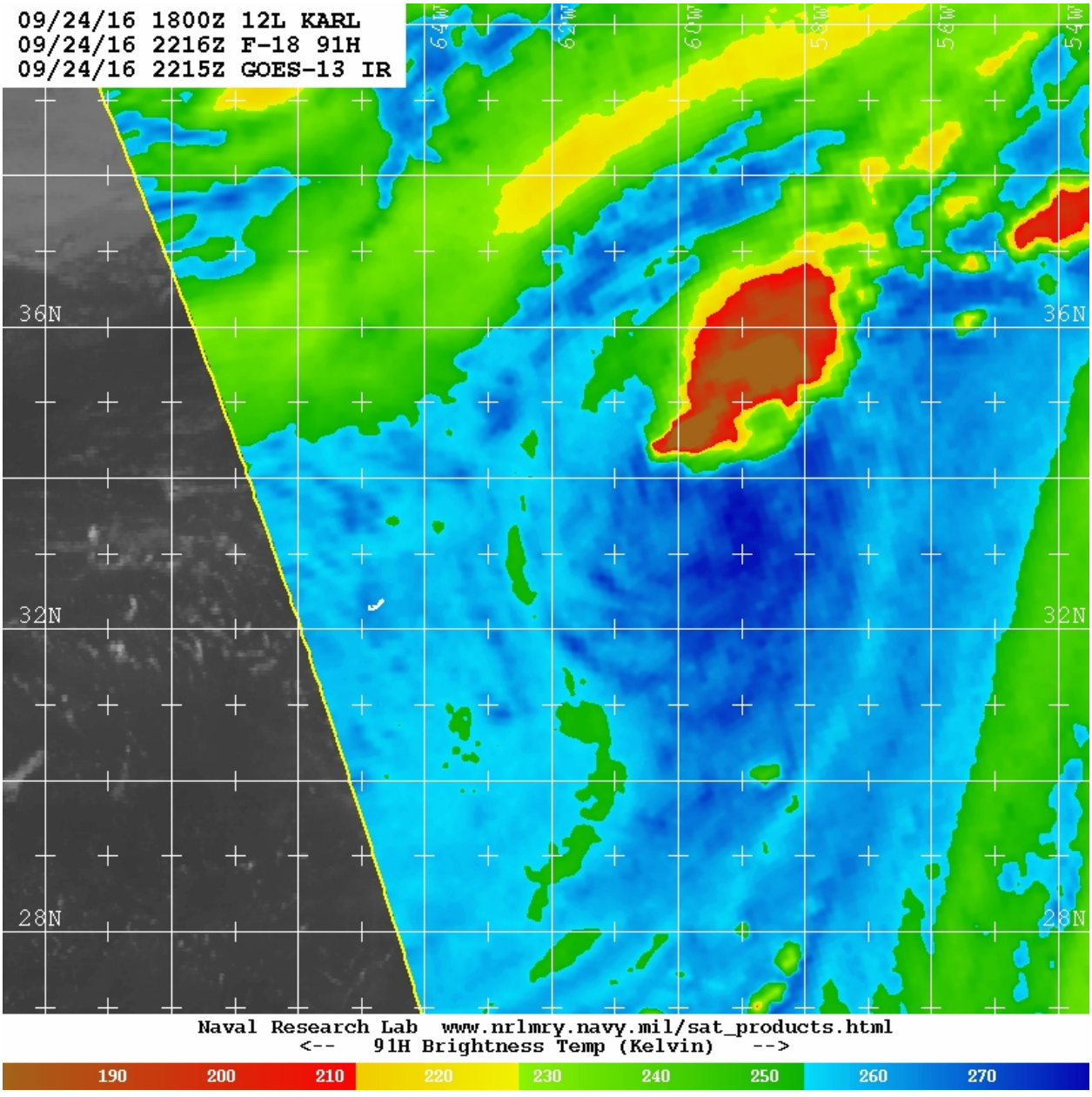
2204Z: Drop 11 at location 12; good drop



GIV HDOBS showing outflow jet northwest of Karl along with vis image indicating gravity waves in the convection on northwest side of convective burst.

22:12Z P3 indicates center is near or just north of 34N though this may be ~ 700 mb with surface center a bit south of there. Regardless will bump the east to west leg north a bit to try and hit the center.

2213Z: Drop 12 at location 13; good drop



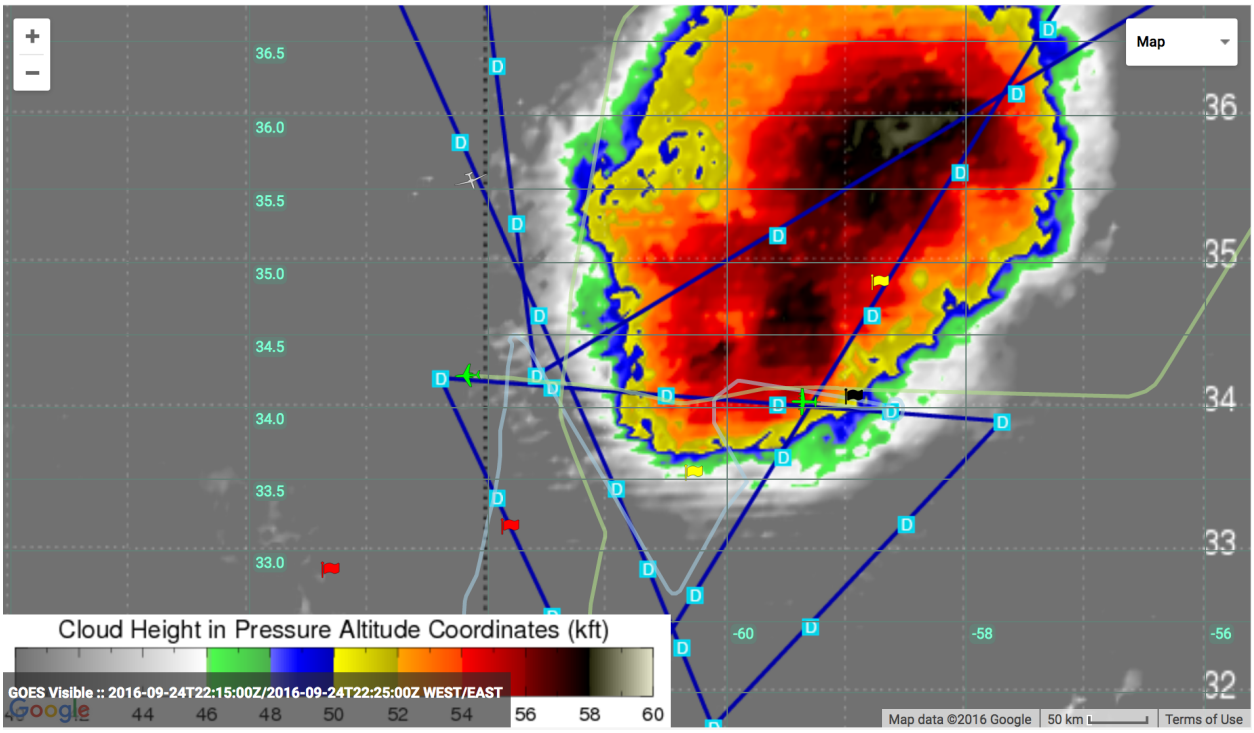
2216z: SSMIS 91GHz image. Center likely somewhat closer to convective mass w.r.t. earlier SSMIS image.

2226Z: Drop 13 at location 14; good drop

2230Z: Drop 14 at location 15; good drop

Skirting the southern edge of deeper convection. MTS not updating so black flag denotes estimated position of GH. A few OTs have shown up just north of track but no significant lightning in this somewhat active region. Last visible images showed these OTs nicely. Proceeding along the track as planned.

22:44 P3 reports lightning observed and they are nearby but unknown where or how frequent. Nothing is showing on MTS.



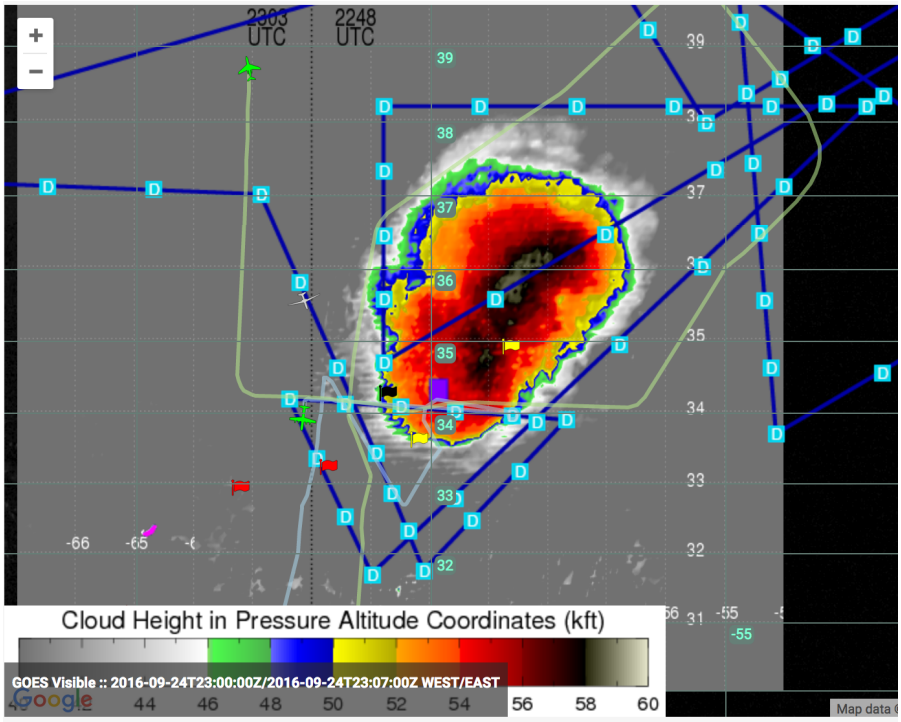
2240Z: Drop 15 at location 16; good drop

2249Z: Drop 16 at location 17; good drop

2307Z: Drop 18 at location 19; good drop

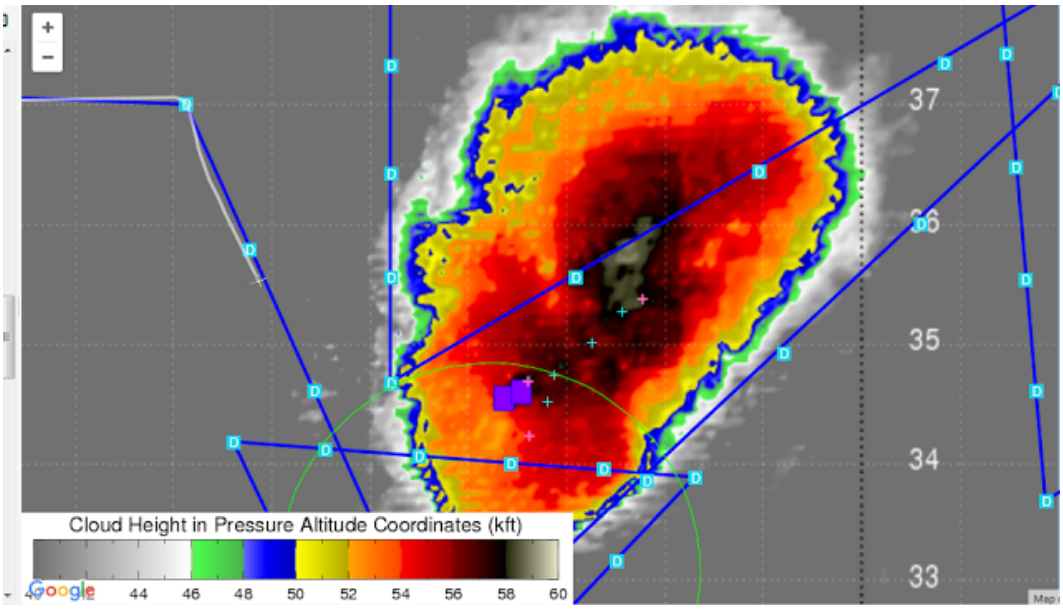
GH position is back up via radar location (right click then “show nearby”)

2312Z: Modify the large butterfly to avoid cloud tops > 55K with tops near -83C that will intersect our track in next 1-2 hours. Especially the NE track. This places the higher tops just west of track. The northern portion of the butterfly is lifted north a bit to clear this area as it moves NE.



2315Z: Drop 19 at location 20; good drop

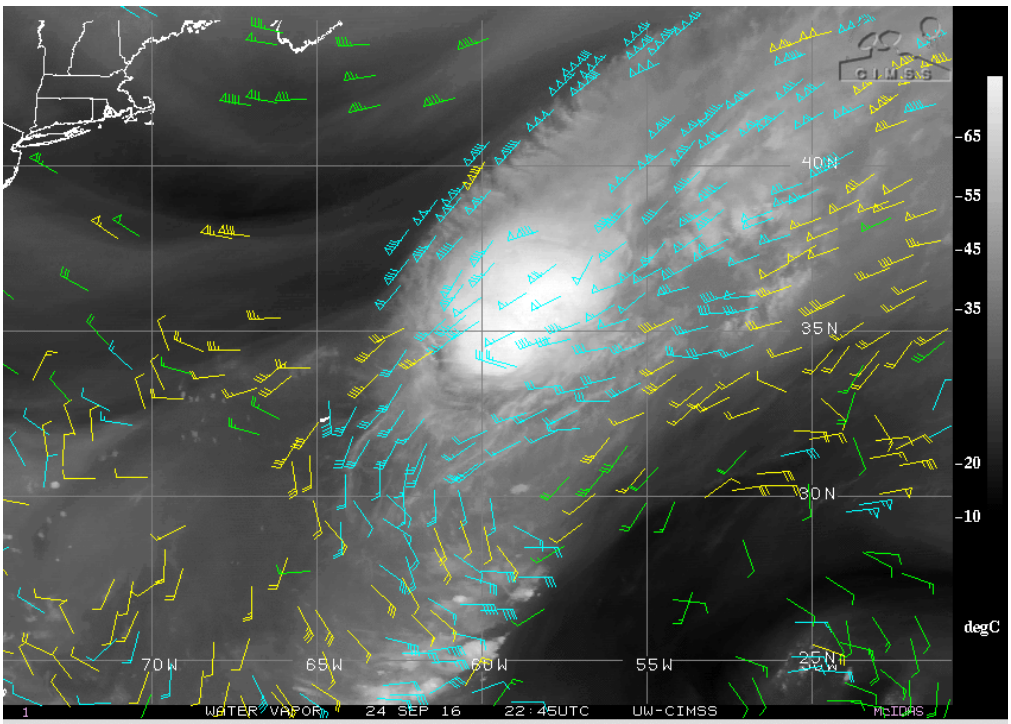
2325Z: Drop 20 at location 21; good drop



2327Z: I'm not sure I've ever seen cloud-top heights this high this far north.

2335Z: Drop 21 at location 22; good drop

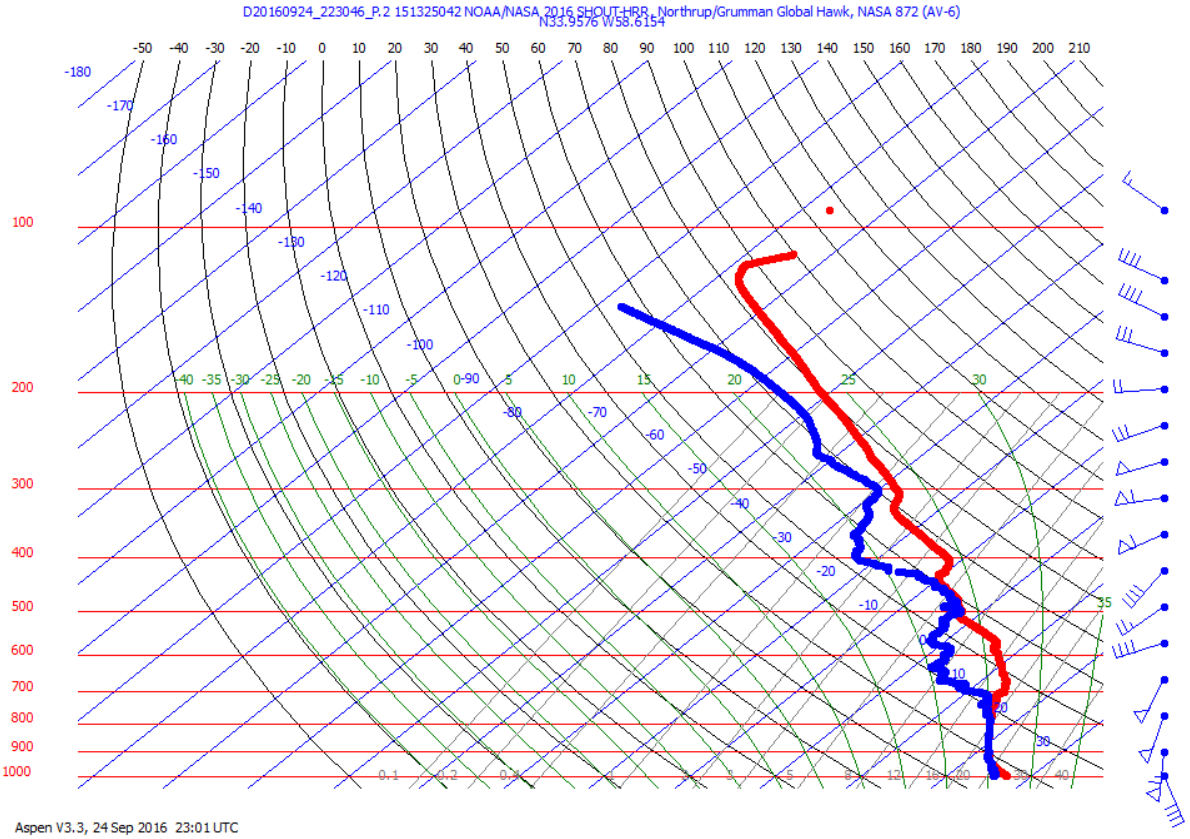
Water vapor and feature track winds show trough approaching from the west. Stronger winds now cutting across the center with about 35 knots of southwest shear.



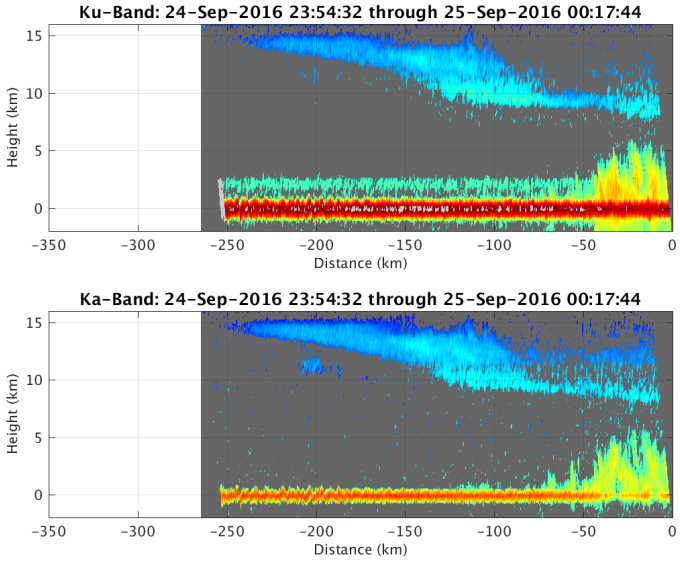
0006Z: Drop 23 at location 24; good drop

Drop at 2240Z appears to have hit very close to the surface center with moist BL and light surface winds. Vortex tilt is evident with stronger winds aloft. Temperature anomaly appears to have weakened some since yesterday. Surface pressure of 991.5 mb with 10 kts of wind puts MSLP near 990 mb.

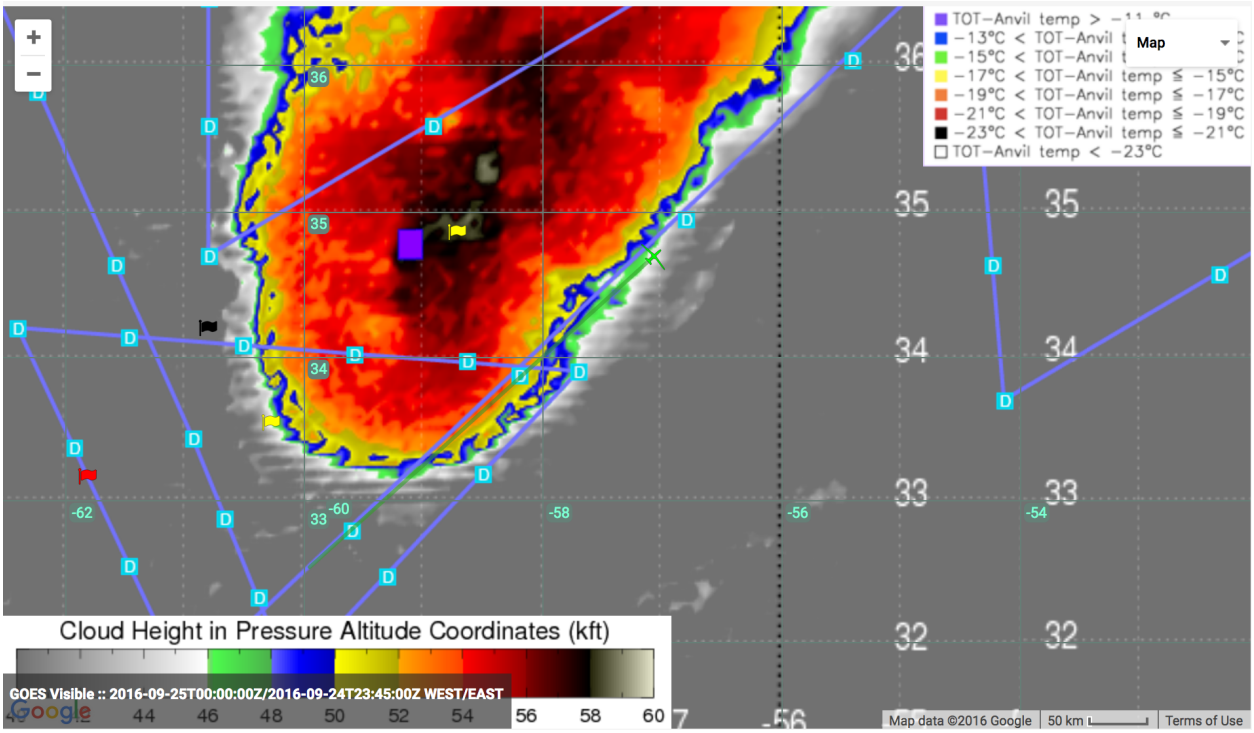
65 knot winds just above the surface on 2230Z drop

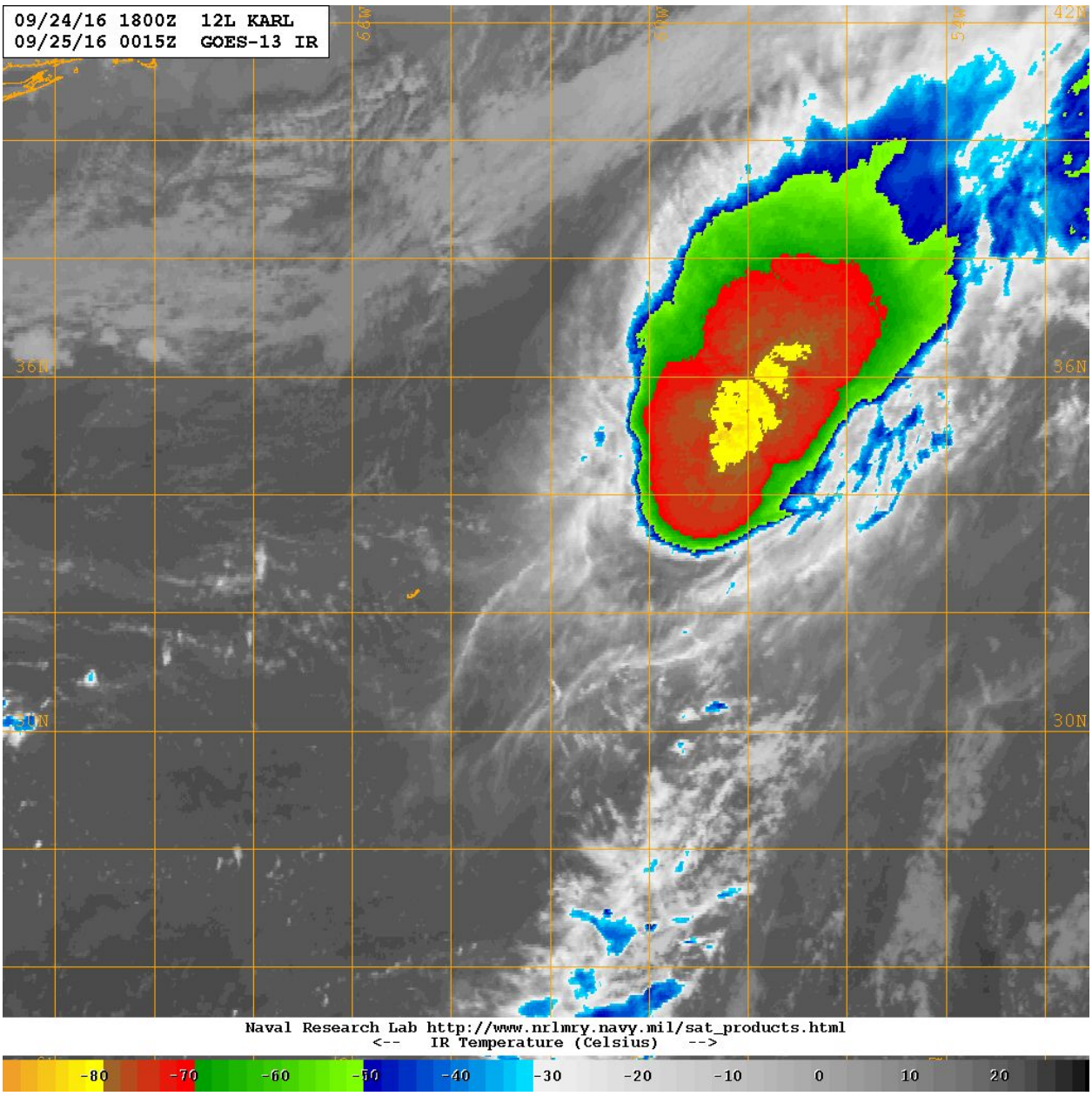


0013Z: HIWRAP is back online



Skirting southeast edge of higher clouds tops.


TOT−Anvil temp > −11.8°C
−13°C < TOT−Anvil t
−15°C < TOT−Anvil t
−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
Map
Cloud Height in Pressure Altitude Coordinates (kft)
44 46 48 50 52 54 56 58 60
GOES Visible :: 2016-09-25T00:00:00Z/2016-09-24T23:45:00Z WEST/EAST
Google
Map data ©2016 Google
50 km
Terms of Use



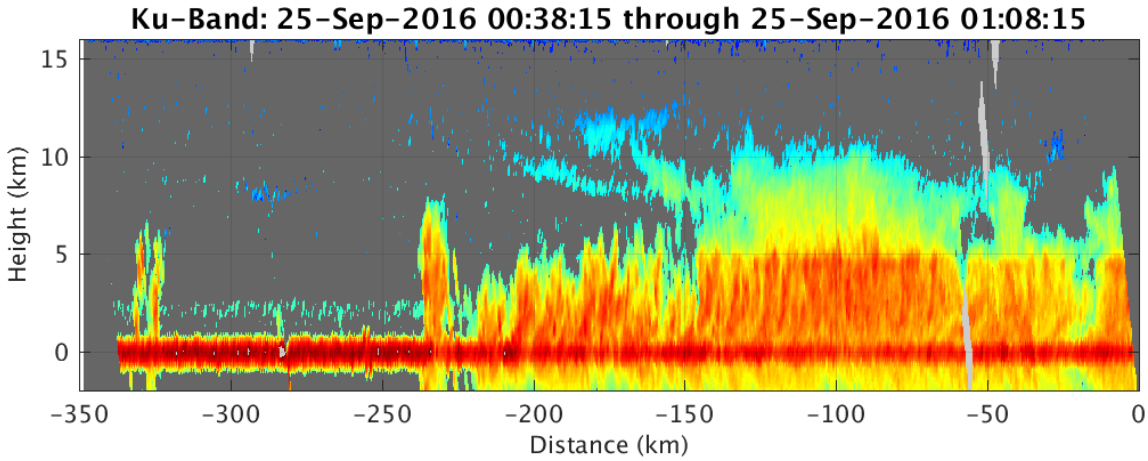
0015z: GOES 13 IR still shows cloud top temps below -80 deg C

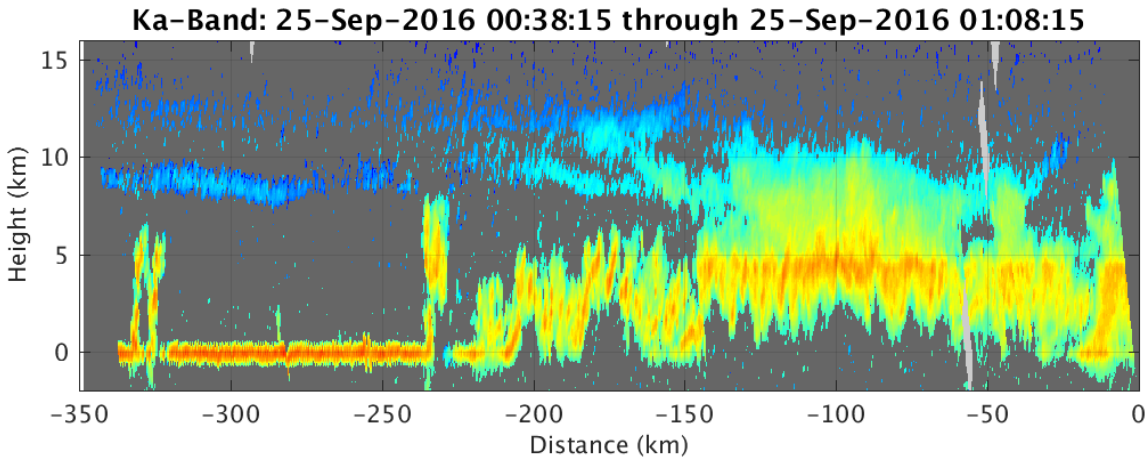
0023Z: Drop 24 at location 25; good drop

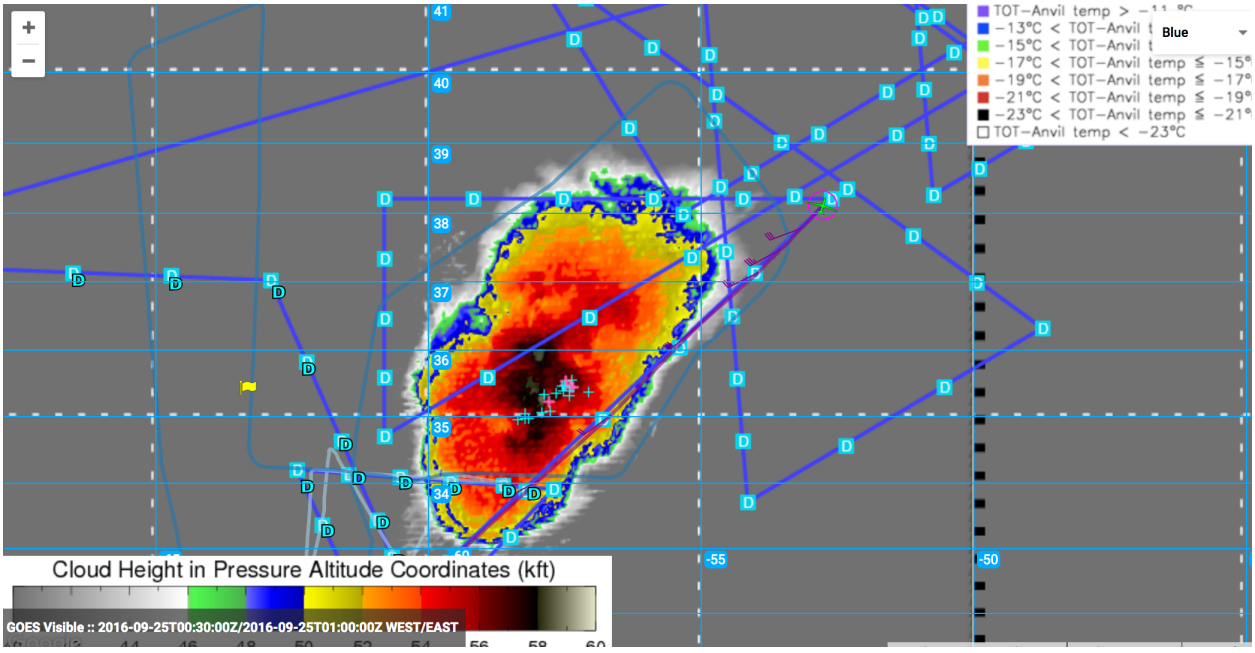
0038Z: Drop 25 at location 26; good drop

0054Z: Drop 26 at location 27; good drop

0110Z: HIWRAP shallow convection:

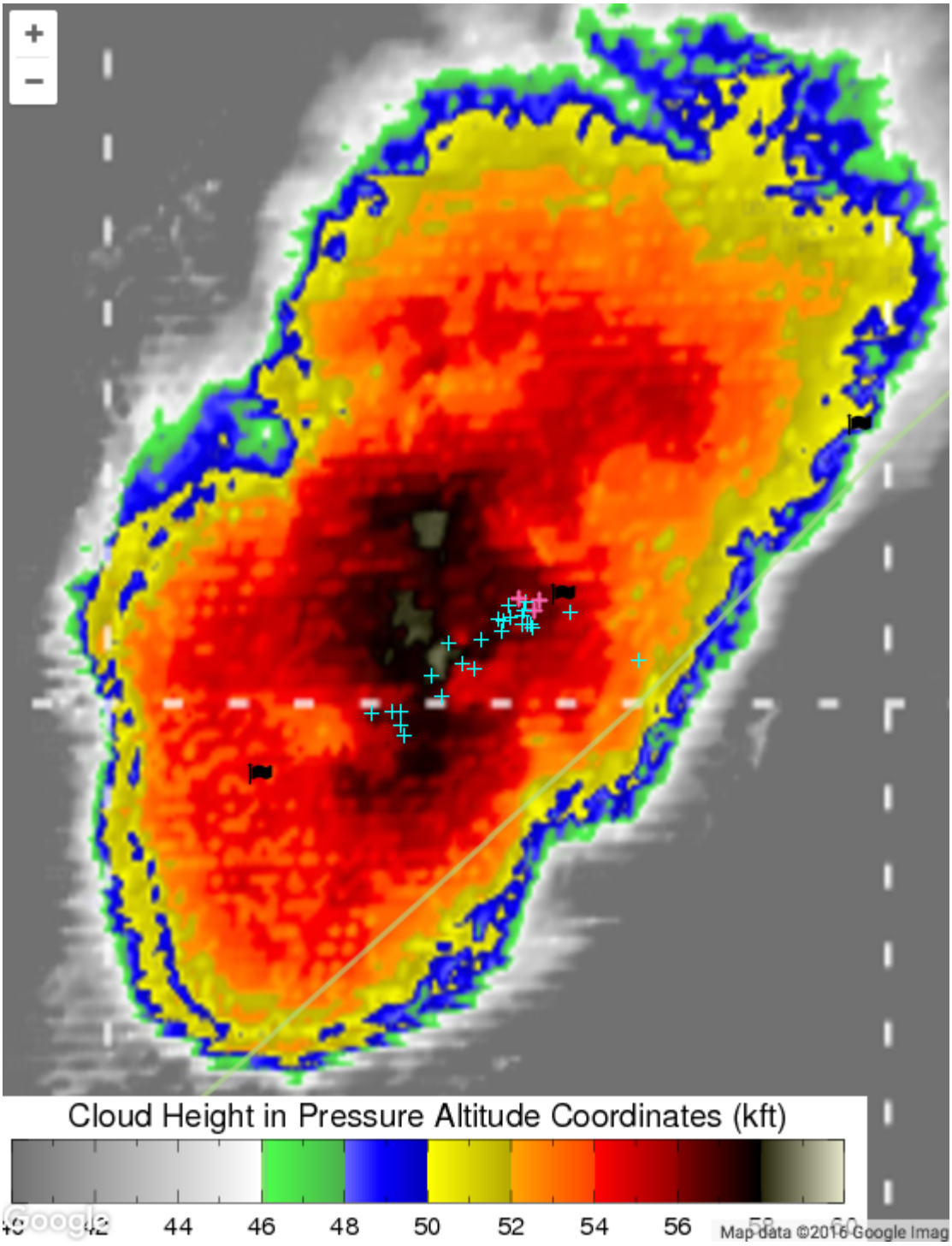






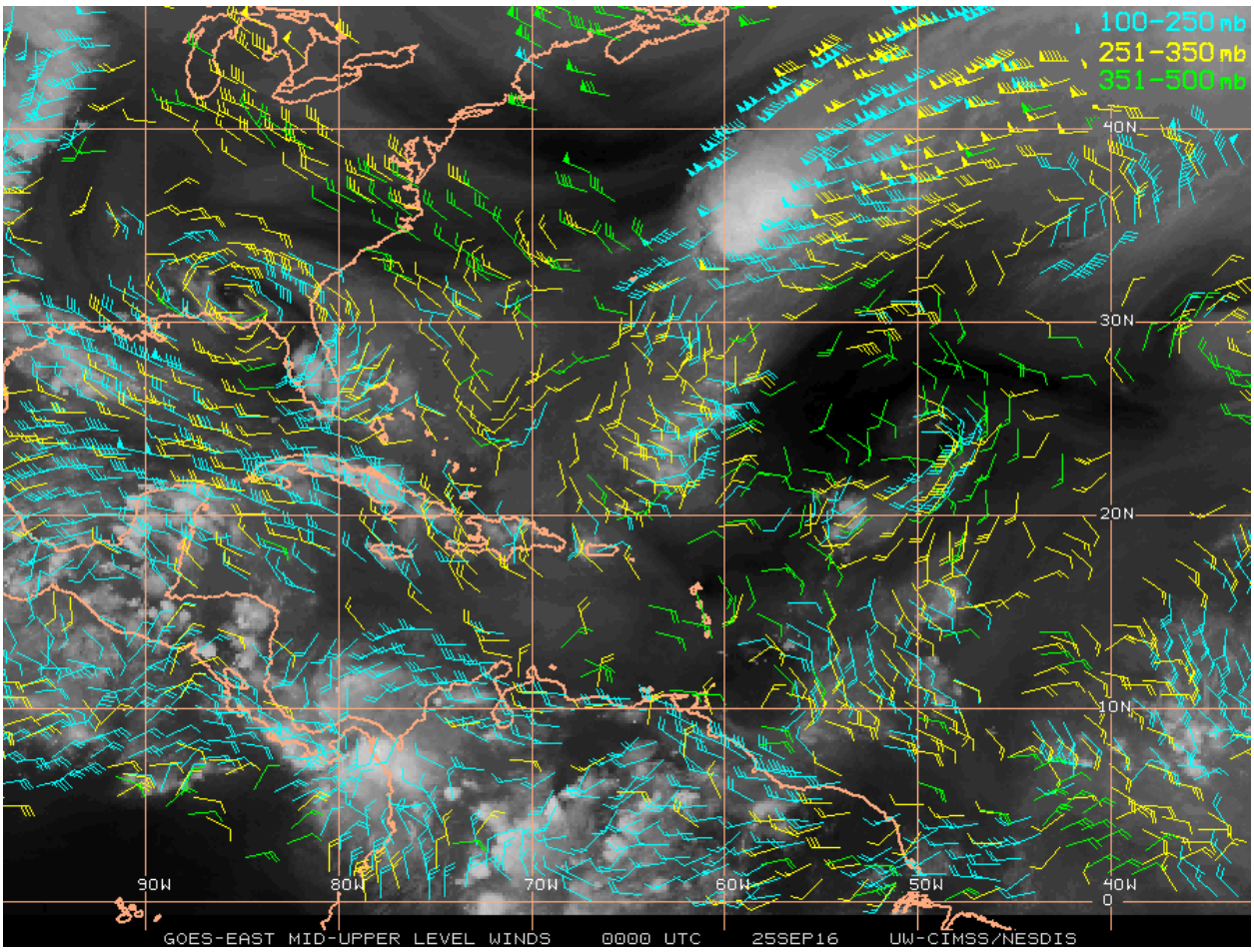
Making turn heading west, for east-west leg. Crossing the northern periphery of system and linkage of outflow with jet.

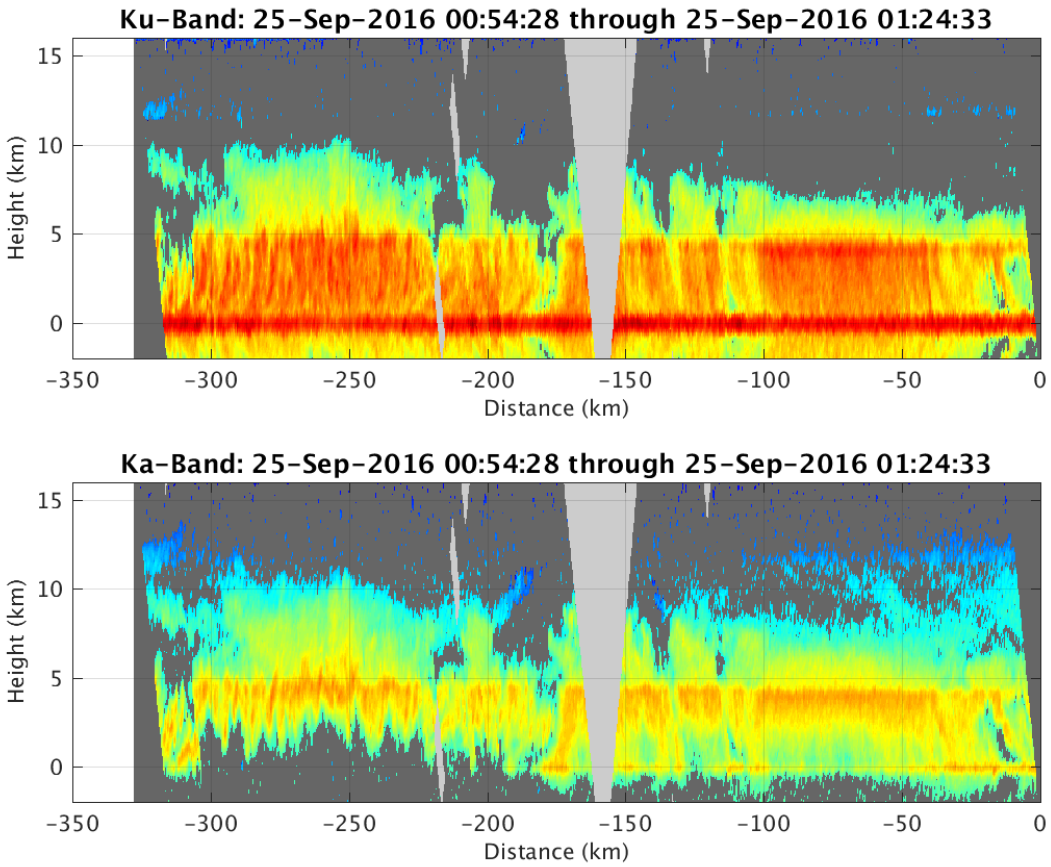
0111Z: Drop 27 25 nmi west of location 28. Good drop.



0112Z: CTH from 0045z and last 10 minutes of lightning. Black flags are NHC forecast center positions for 00z (extrapolated), 03z (extrapolated) and 06z. At the moment, center is likely just SW of SWmost lightning.

Multiple airlines taking advantage of 180 kt jet. The word is out.


100-250 mb
251-350 mb
351-500 mb
40N
30N
20N
10N
0
90W
80W
70W
60W
50W
40W
GOES-EAST MID-UPPER LEVEL WINDS 0000 UTC 25SEP16 UW-CIMSS/NESDIS



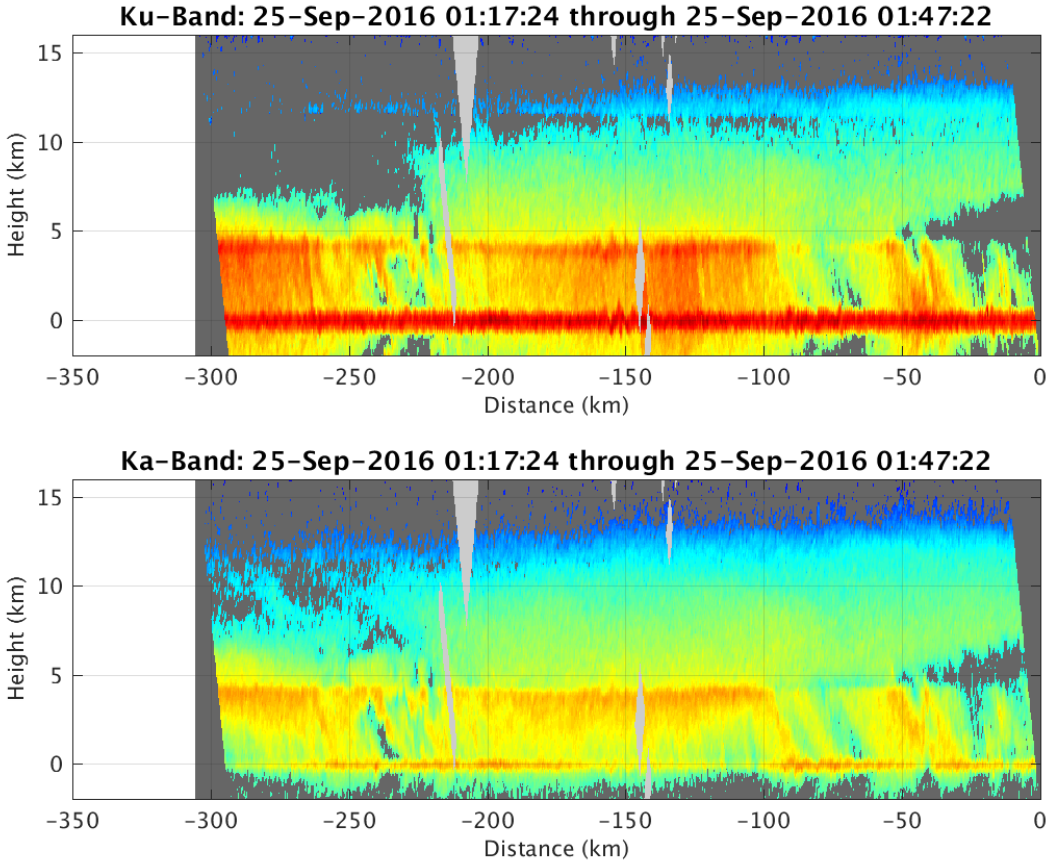
0124Z: HIWRAP showing precip NE/downstream of center

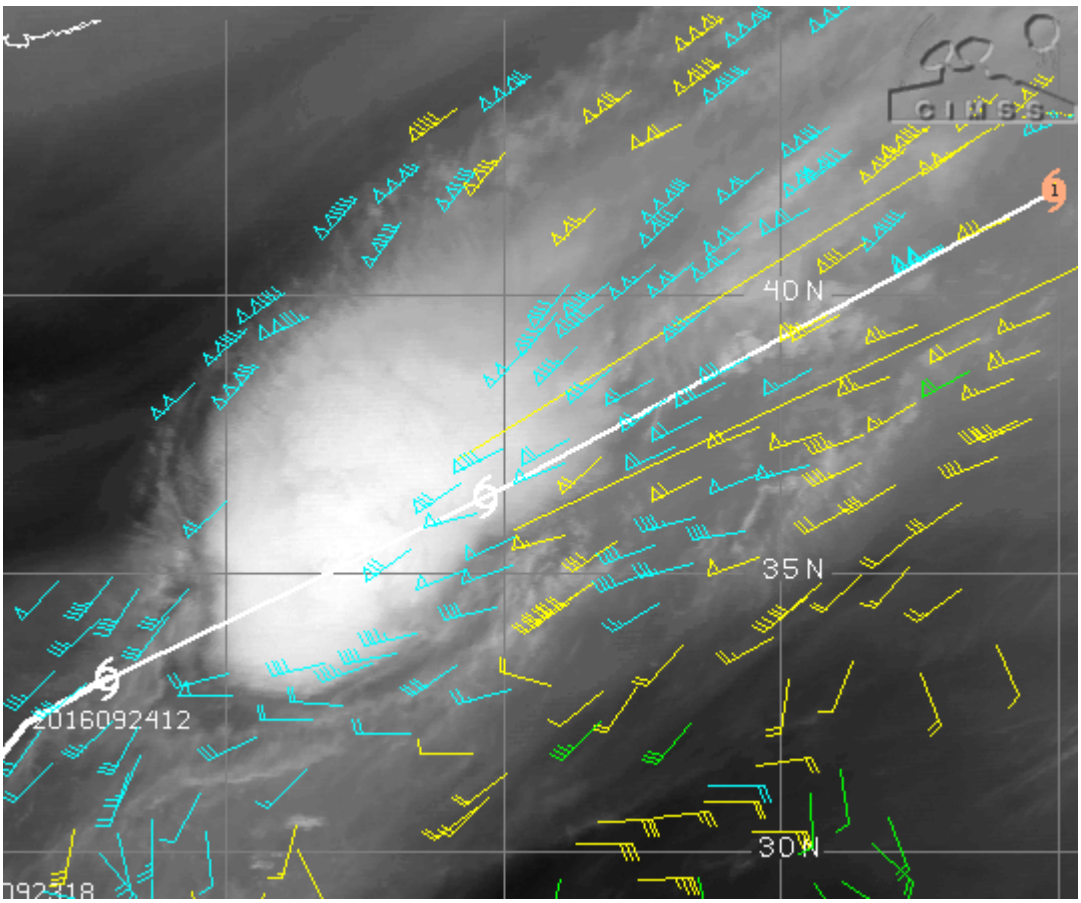
0123Z: Drop 28 at location 29; good drop.

0130Z: NHC analysis position at 00z: 34.2N, 59.3W

Pilots wanted to shift track approximately 5 nmi north of update 7 track due to high cloud tops. Had older satellite imagery at time, so done as a safeguard.

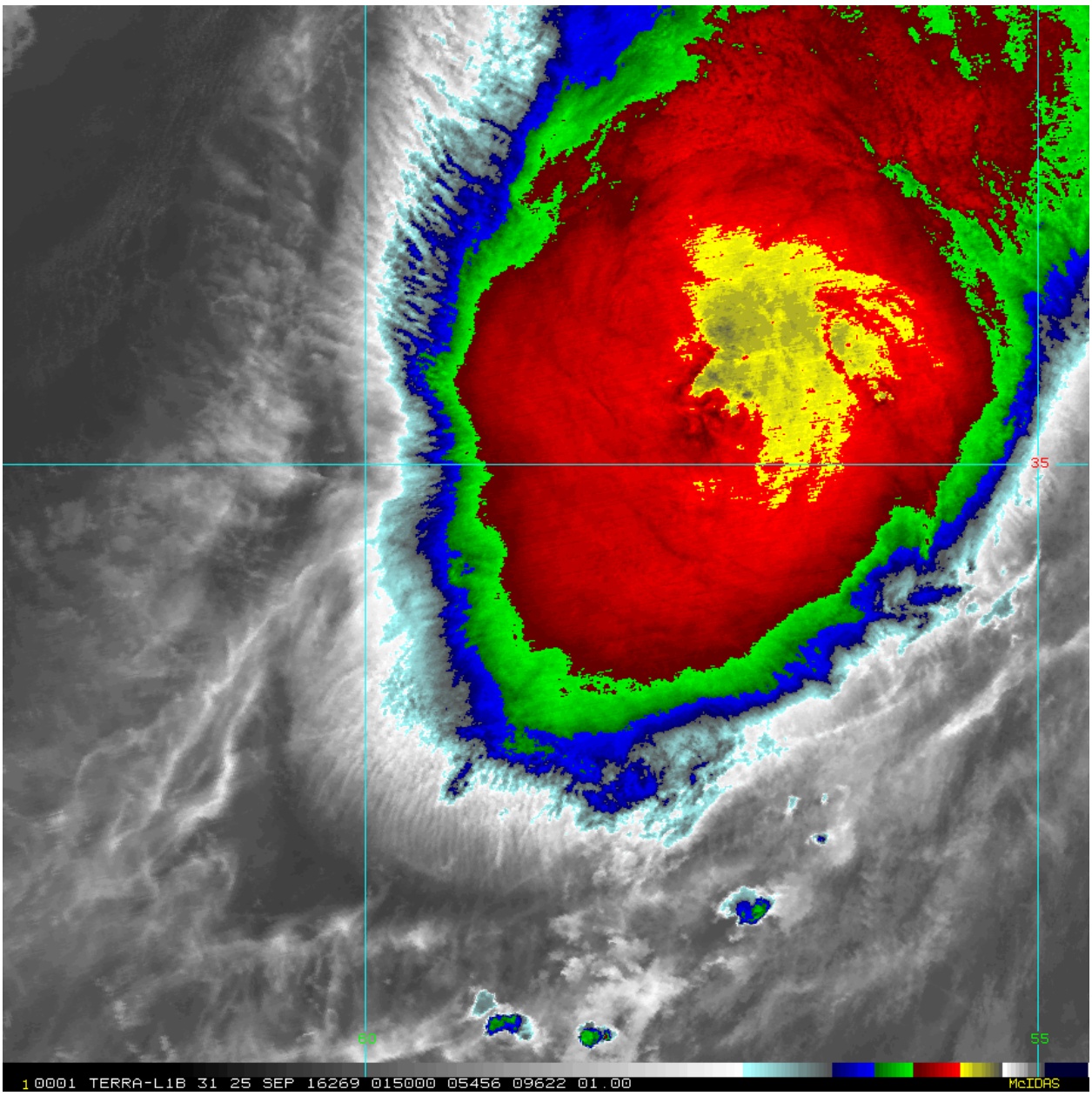
0137Z: Drop 29 5 nmi north of location 30; good drop.


Ku-Band: 25-Sep-2016 01:17:24 through 25-Sep-2016 01:47:22
Height (km)
15
10
5
0
-350
-300
-250
-200
-150
-100
-50
0
Distance (km)
Ka-Band: 25-Sep-2016 01:17:24 through 25-Sep-2016 01:47:22
Height (km)
15
10
5
0
-350
-300
-250
-200
-150
-100
-50
0
Distance (km)

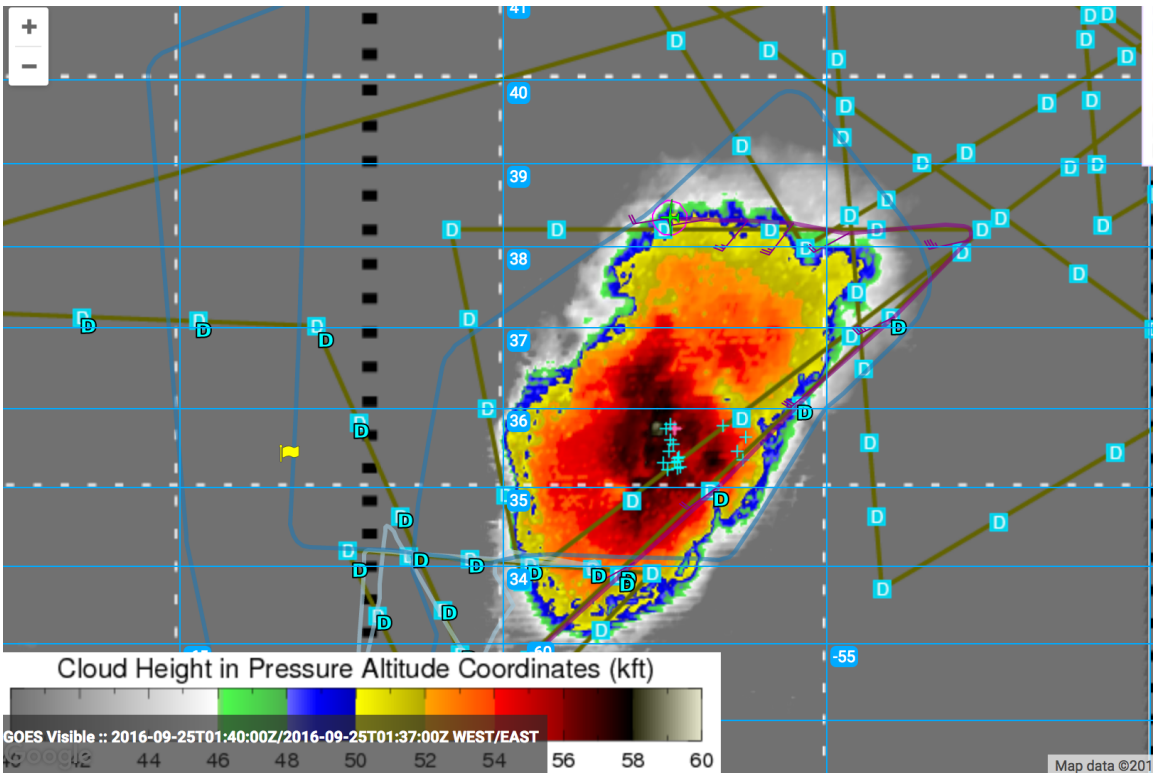


0145Z: AMVs and water vapor image. Currently we are flying north of the convective mass along about 38 N. Should see winds well in excess of 100 kt as outflow blasts NE.

0150Z: UPDATE 8 to track submitted. Move 37 Southeast to skirt around storm and set up for next leg to potentially avoid TOTs/lightning.



0150Z: MODIS IR image of Karl. Cloud top temps almost to -90 deg C in the coldest spots

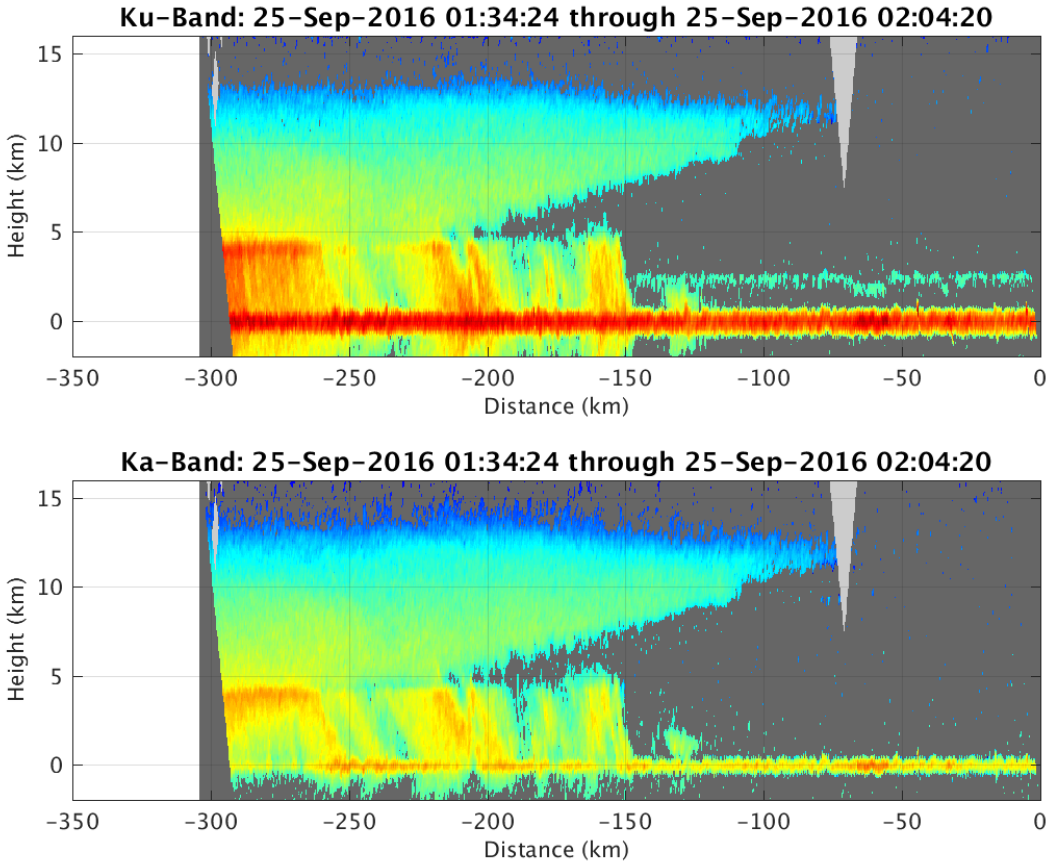


0152Z: Drop 30 launched 5 nmi north of location 31; good drop.

0157Z. GH moving back south along track as out of convective area. Drops will be at locations again.

0207Z: Drop 31 at location 32; good drop.

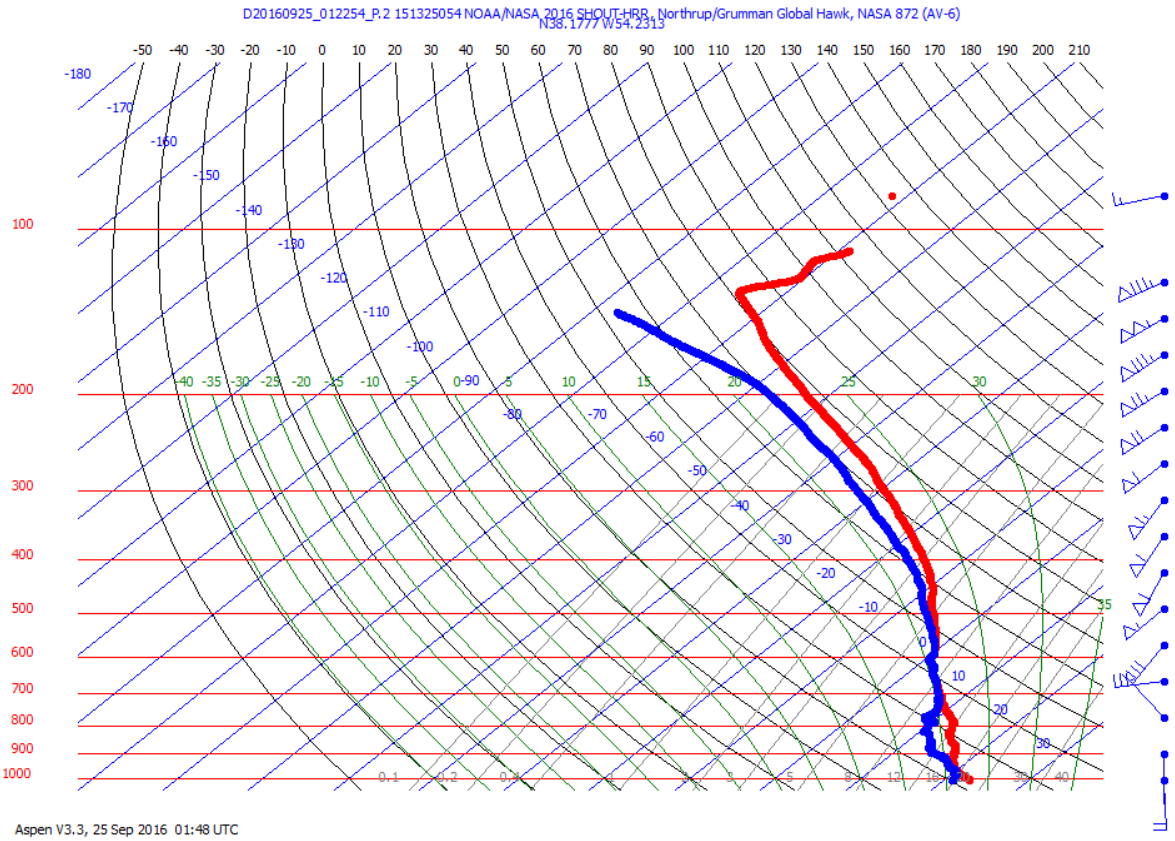
:



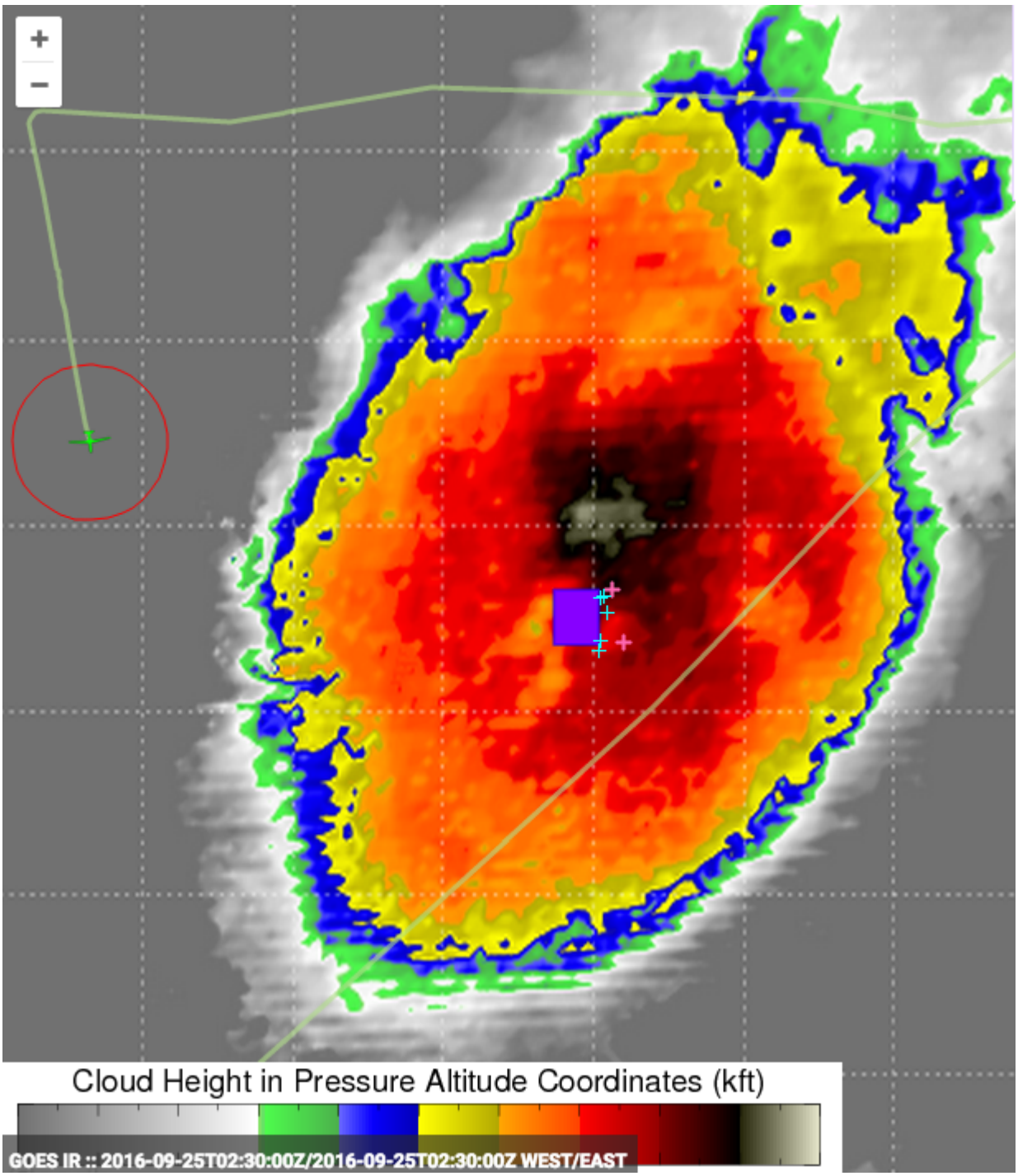
0206z: HIWRAP shows us leaving the cirrus anvil

0224Z: Drop 32 10 nmi SSE of location 33; good drop

0234Z: Drop 33 at location 34; good drop



Drop location 29 depicting 110 kt winds at 200 mb.



0241Z: CTH from 0218Z, TOTs and lightning.

0300Z UPDATE FROM NHC: 25/0300Z 35.0N 58.0W 55 KT 65 MPH
TROPICAL STORM KARL DISCUSSION NUMBER 43
NWS NATIONAL HURRICANE CENTER MIAMI FL AL122016

1100 PM AST SAT SEP 24 2016

Karl continues to produce a large area of cold-topped convection to the northeast of the center. However, data from the NOAA P-3, NOAA G-IV, and the NASA/NOAA Global Hawk aircraft indicate that the circulation is losing definition as the cyclone accelerates toward the northeast. The initial intensity of 55 kt is based on a combination of dropsonde, flight level, and SFMR winds from the three planes, and the central pressure of 992 mb is based on data from a Global Hawk dropsonde. While Karl is expected to become post tropical by 24 hours, it should intensify to a hurricane-force system as it does so, and this is shown in the intensity forecast. By 36 hours, the system should be absorbed into a larger extratropical low to its northwest.

The initial motion estimate is now 055/25. Karl should continue to accelerate on a general northeastward heading ahead of a broad deep-layer trough until the cyclone is absorbed, and the forward speed is expected to be near 50 kt by 24 hours. The new NHC track forecast is an update of the previous one and remains near the middle of the tightly packed guidance envelope.

FORECAST POSITIONS AND MAX WINDS

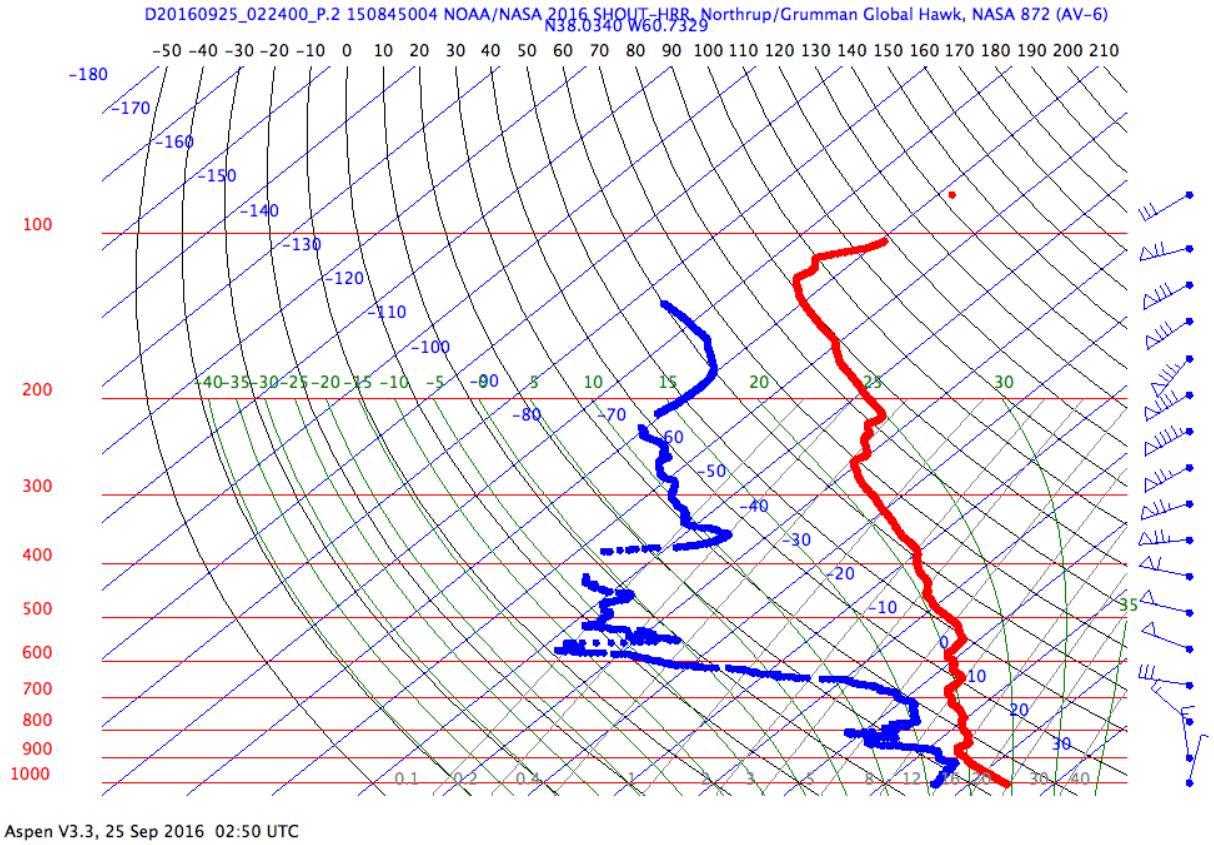
INIT 25/0300Z 35.0N 58.0W 55 KT 65 MPH
12H 25/1200Z 38.2N 51.3W 60 KT 70 MPH
24H 26/0000Z 44.6N 41.5W 70 KT 80 MPH...POST-TROPICAL
36H 26/1200Z...ABSORBED BY LARGER EXTRATROPICAL LOW

$$
Forecaster Beven

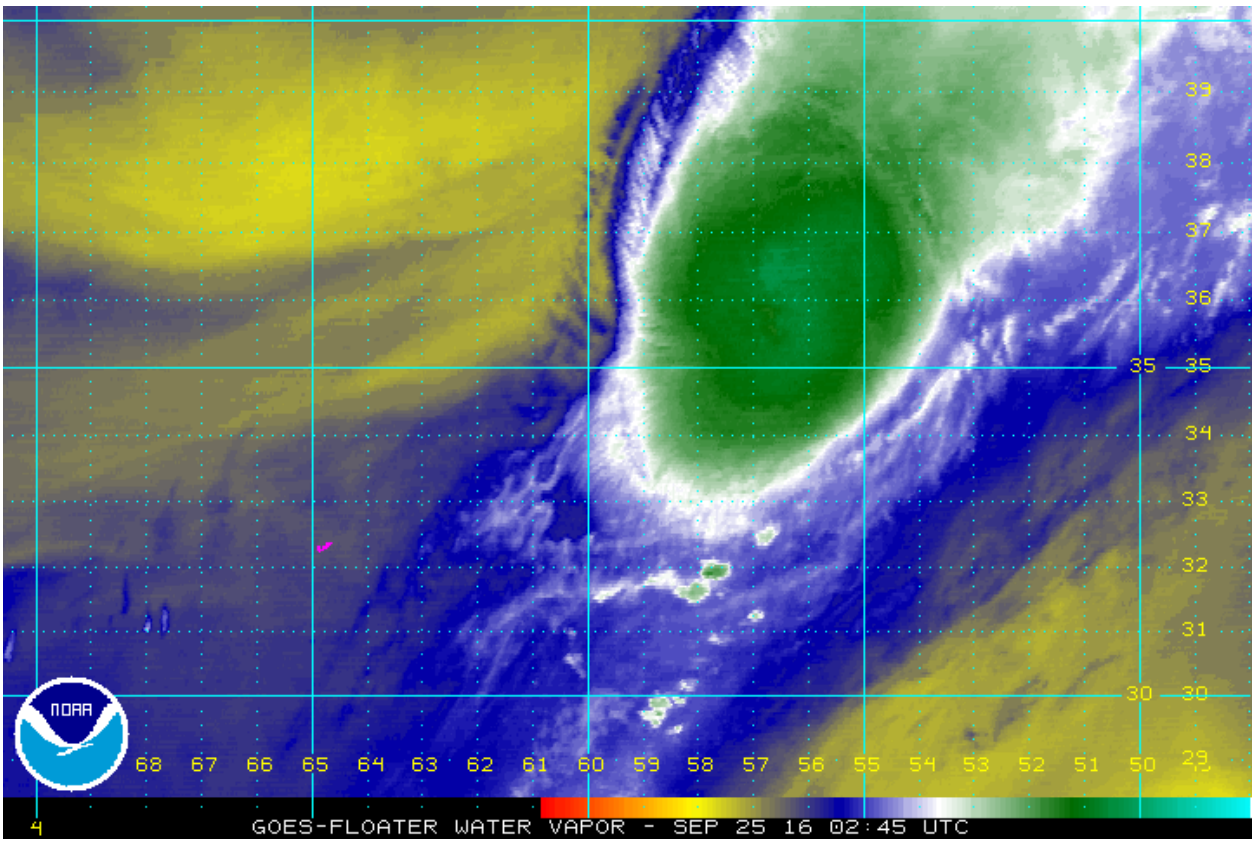
0246Z: Drop 34 at location 35; good drop.

0258Z :Drop 35 at location 36; good drop.

0312Z: Drop 36 7 nmi east of location 37; good drop.



Drop made at 0224Z, NW corner of pattern about 215 nmi NW of center. Mid-level dry air closing in on Karl.

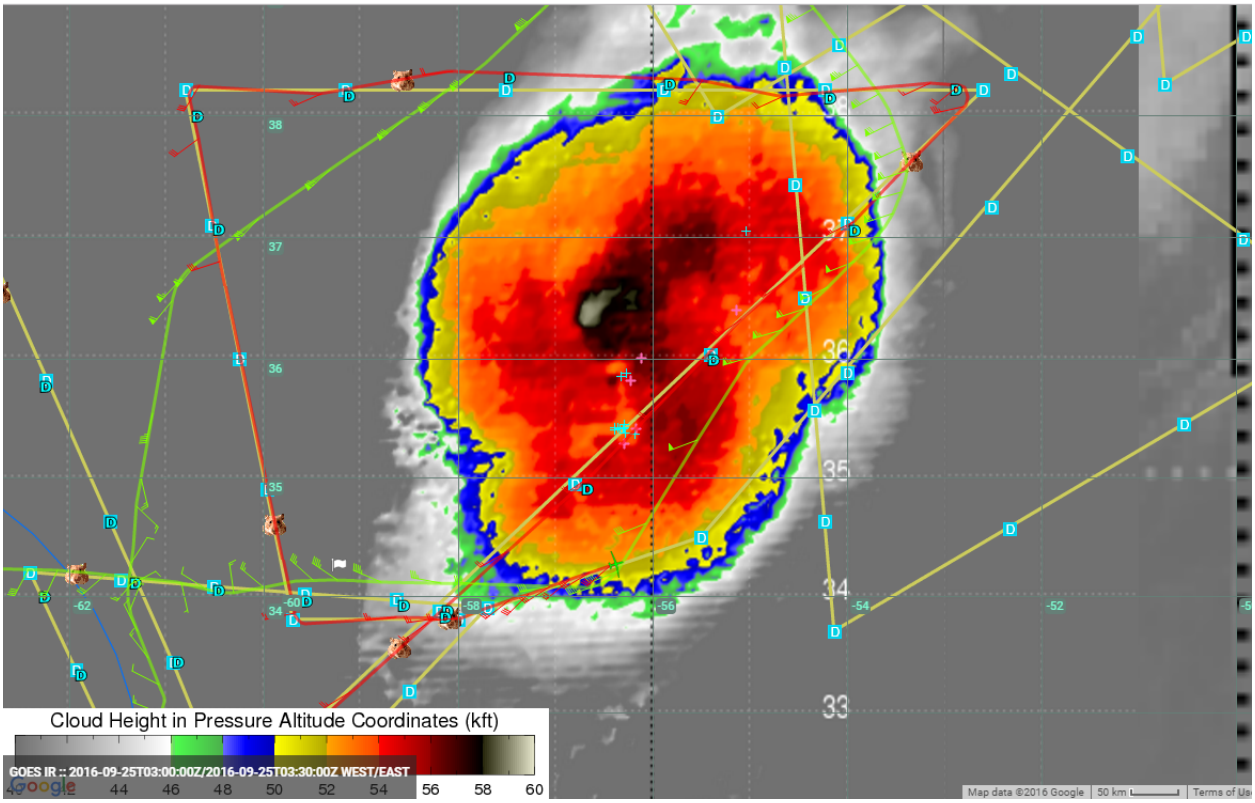


0245Z GOES -13 Water vapor. Drop above at 38N, 60.7W, on edge of dry air

0325Z: Drop 37 just east of location 38; good drop.

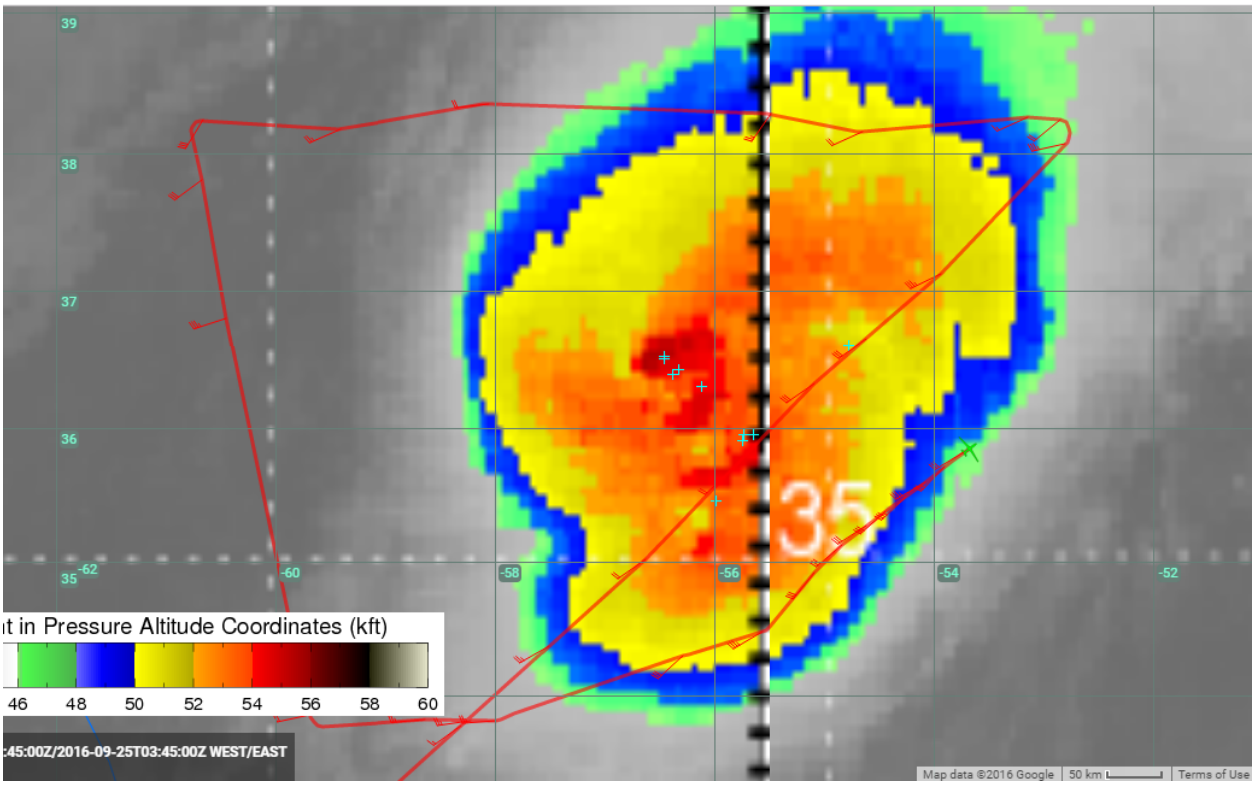
0347Z: Drop 38 at location 39; good drop.

Adjustment made: moved point 43 1 degree south to capture outflow better on next SE-NW leg.

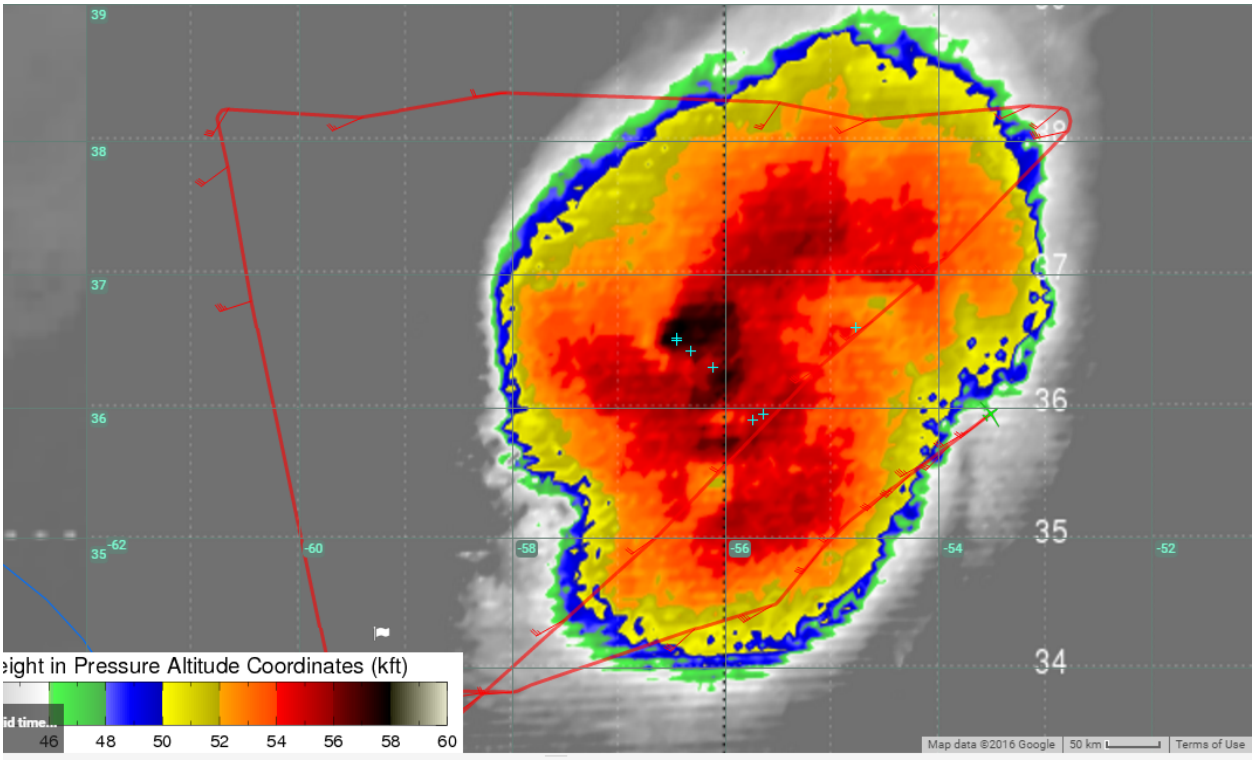


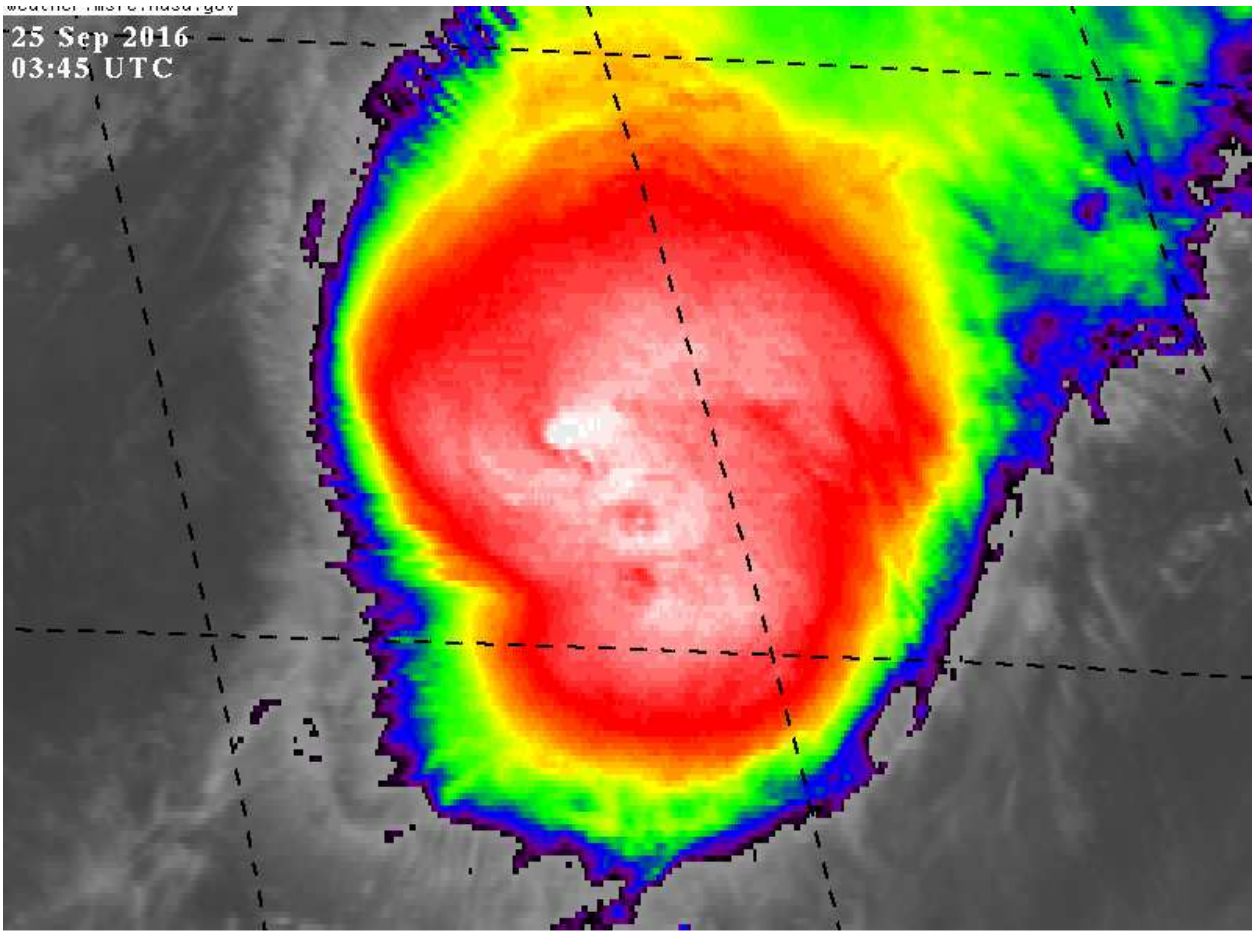
Overshooting tops to 59K ft.

0404Z: Drop 39 at location 40; good drop.

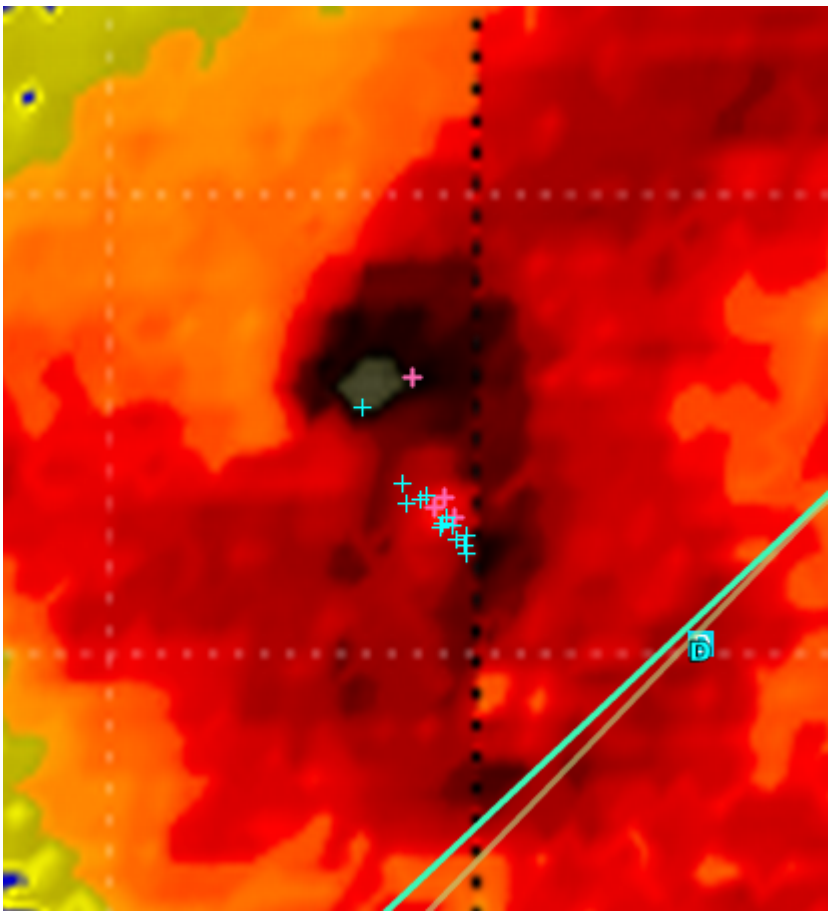


Spiral outflow from center overshooting turret 0408Z

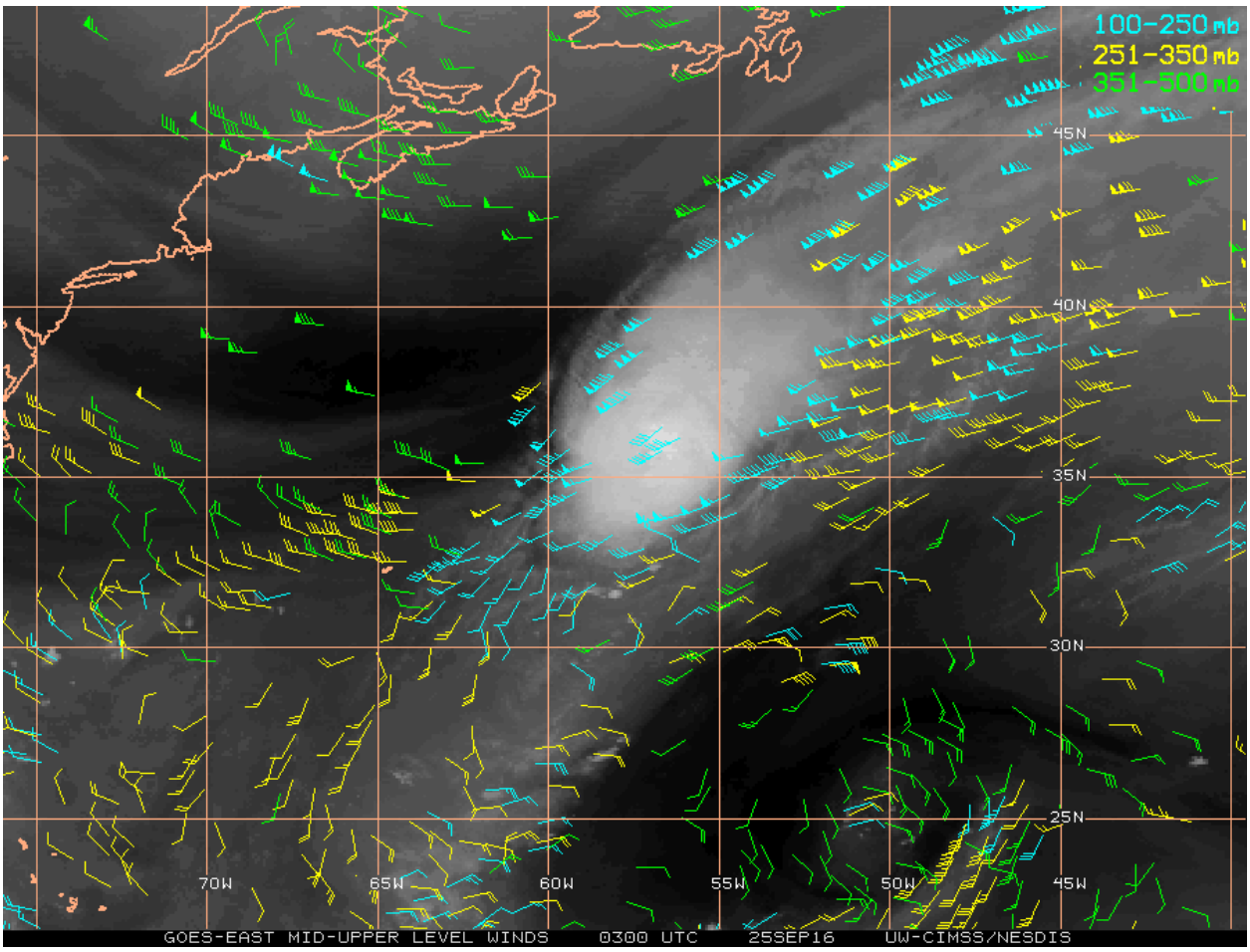




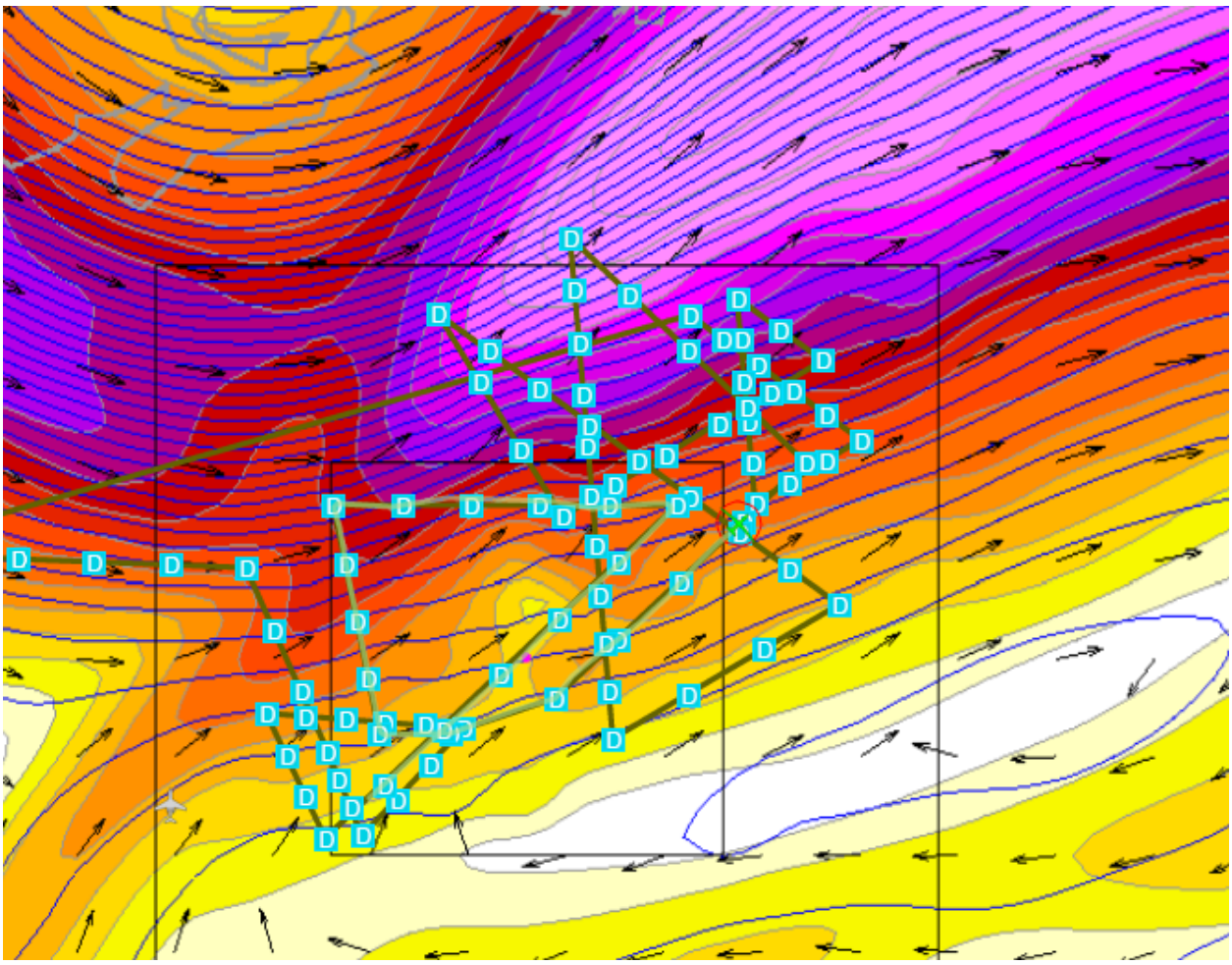
0420Z: Drop 40 at location 41; good drop. [Added at 0535Z: may be problem with this sonde. Stan_HRD notes missing most of data. AVAPs thinks may be problem with that sonde. Will investigate when GH lands]



0425: Lightning continues near highest cloud tops (58,000 ft) NE of surface center (probably)

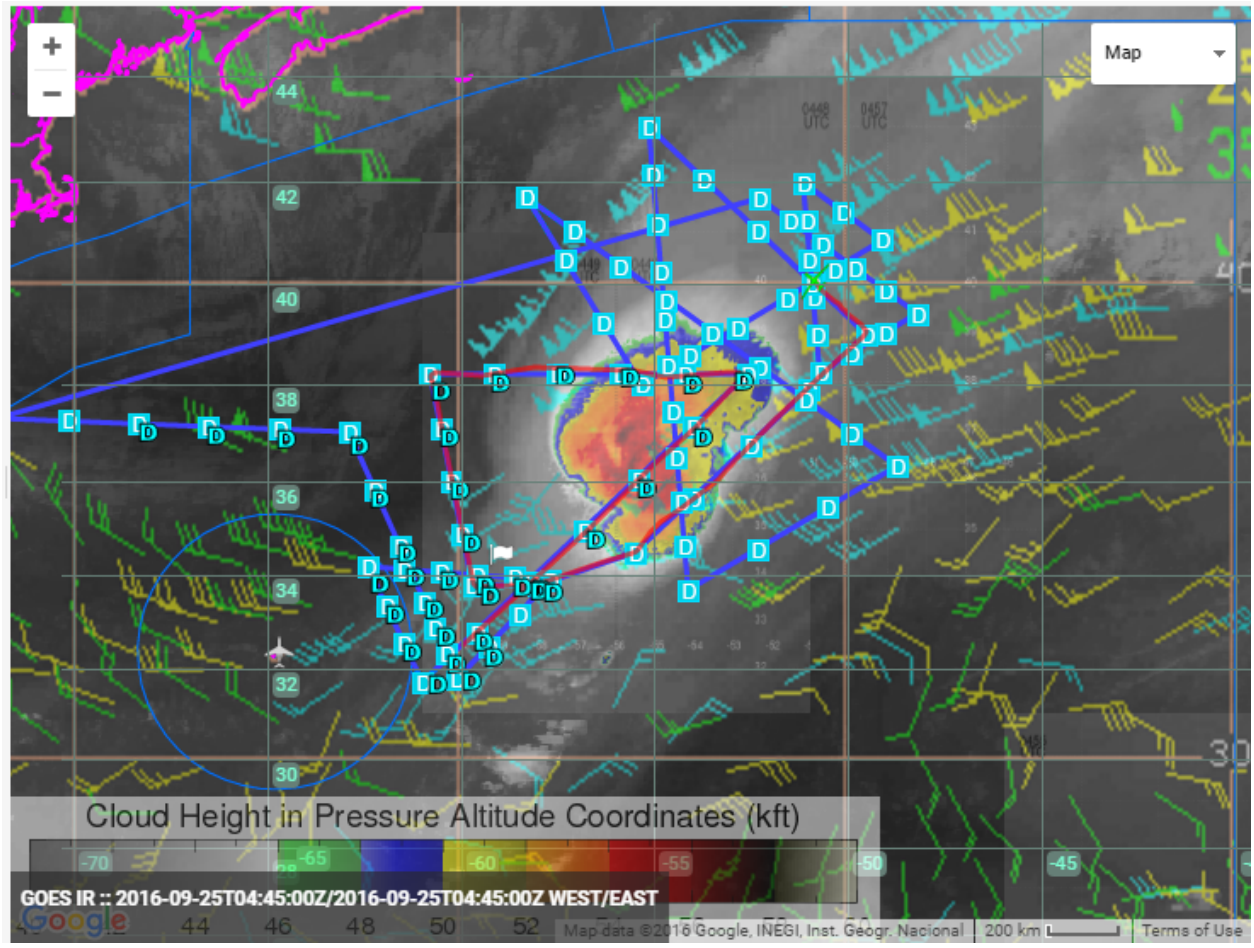


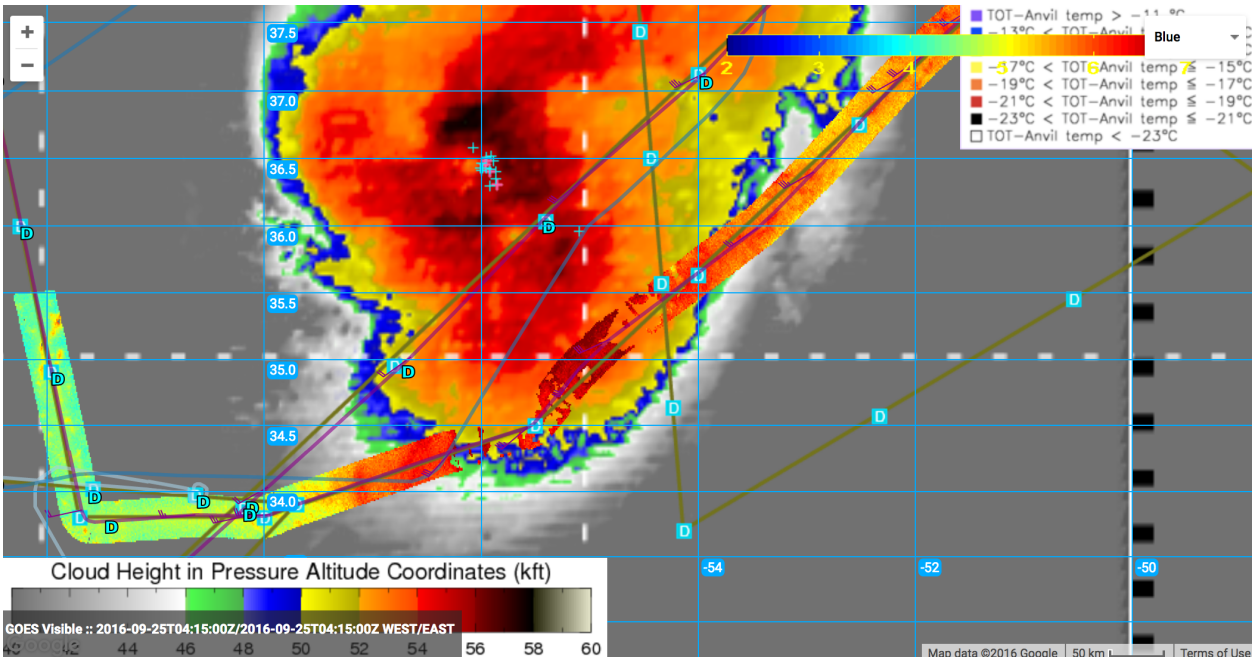
AMVs showing 220 kt wind!!! Hoping to sample this area at end of next leg which extends to 43N (location 47).



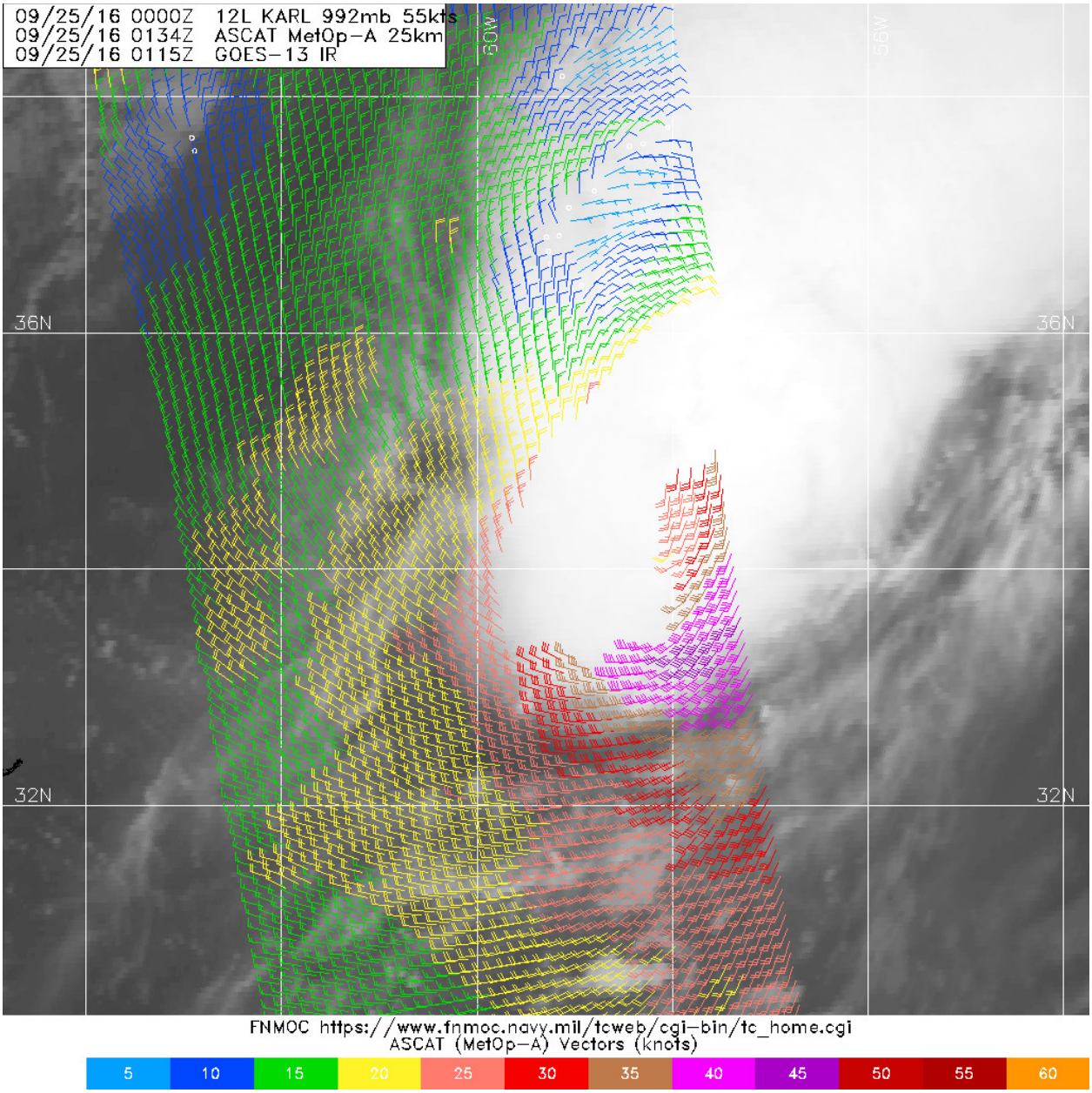
0435Z: 24/18z COAMPS-TC forecast of 200 mb winds and heights, valid at 25/06z. Predicting winds of >85 m/s at end of the next SE-NW leg into core of jet. Commercial air traffic could give us some trouble, as they want to ride that jet to Europe.

0437Z: Drop 41 at location 42; good drop.


Map
Cloud Height in Pressure Altitude Coordinates (kft)
GOES IR :: 2016-09-25T04:45:00Z/2016-09-25T04:45:00Z WEST/EAST
Map data ©2016 Google, INEGI, Inst. Geogr. Nacional
200 km
Terms of Use


Blue
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
Cloud Height in Pressure Altitude Coordinates (kft)
GOES Visible :: 2016-09-25T04:15:00Z/2016-09-25T04:15:00Z WEST/EAST
Map data ©2016 Google
50 km
Terms of Use

HAMSR Total precipitable water overlaid with cloud heights. Shows dry air to the west (as indicated by dropsondes), and moister air mass to its east.

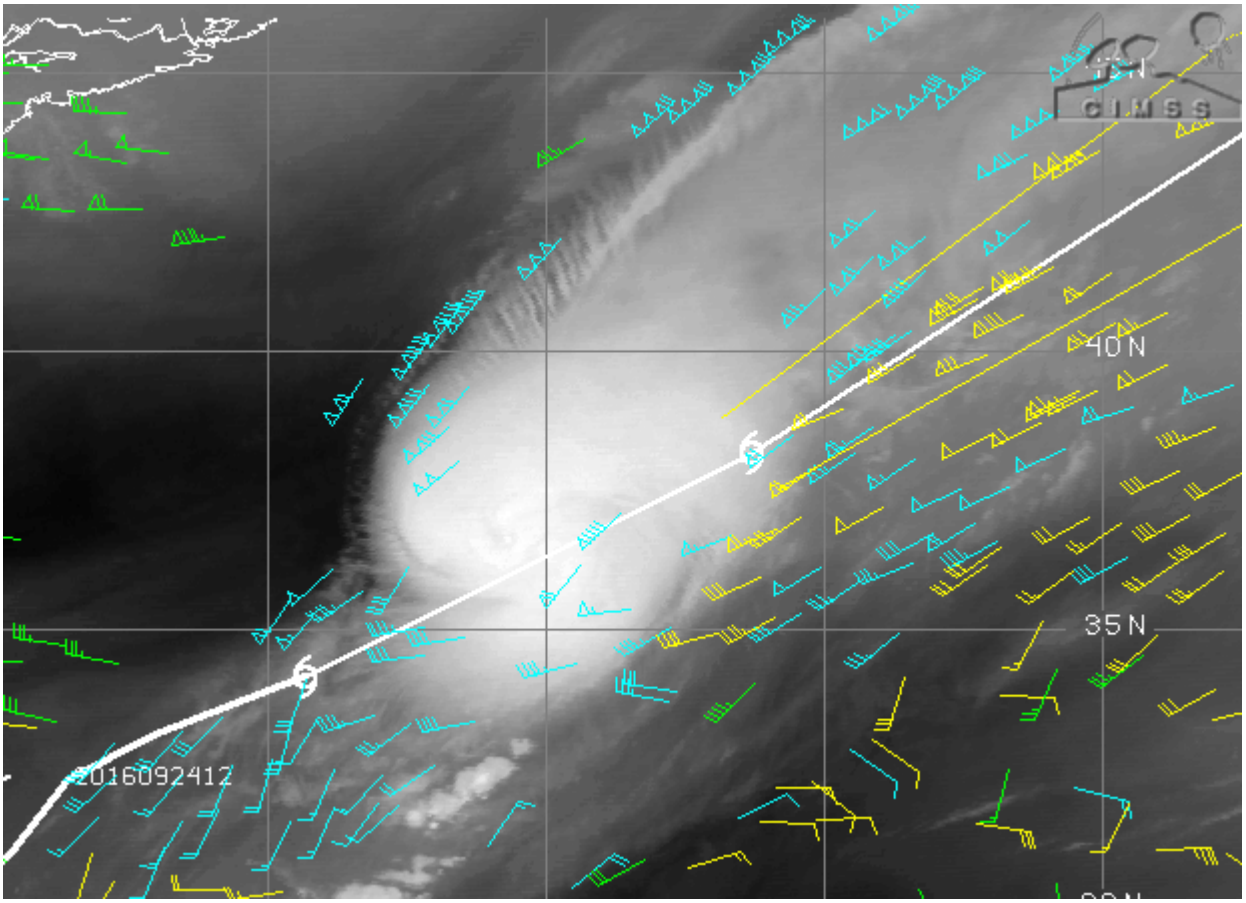


ASCAT pass from 0134Z. Strongest low-level winds appear to be along SE edge of convective mass.

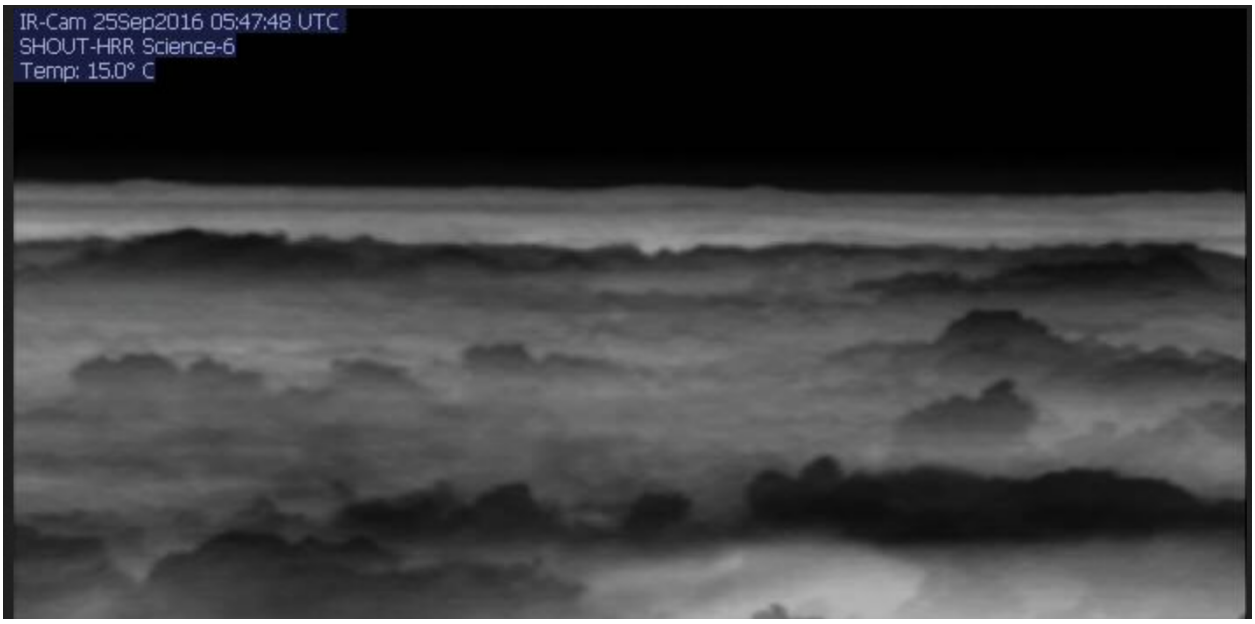
0454Z: Drop 42 released 8 nmi NW of location 43 (after turn); good drop

0508Z: Drop 43 at location 44; good drop

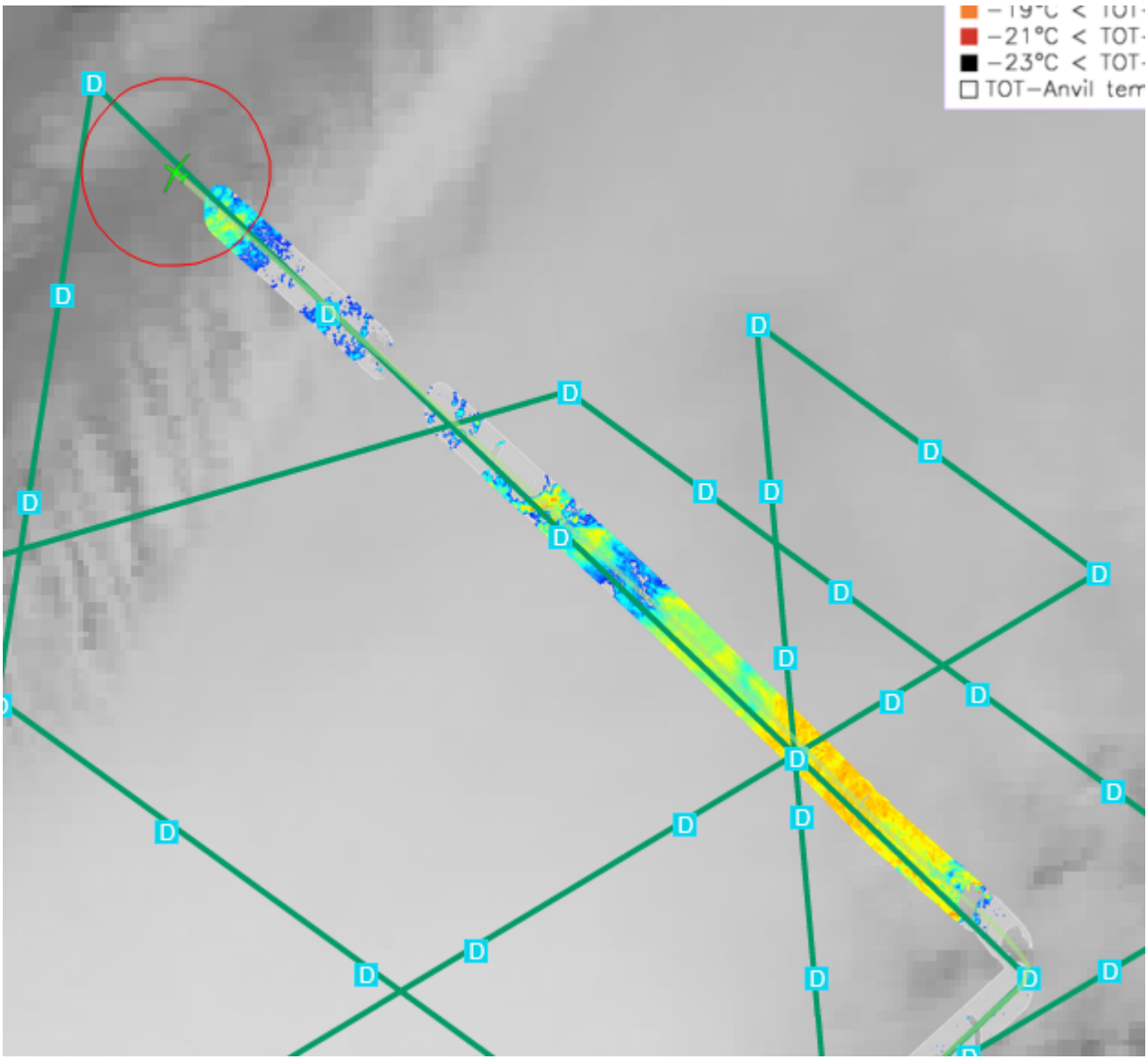
0525Z: Drop 44 at location 45; good drop
0541Z: Drop 45 at location 46; good drop



0542Z: AMVs and water vapor image; GH is dropping near 150 kt AMV near 42N 55W.

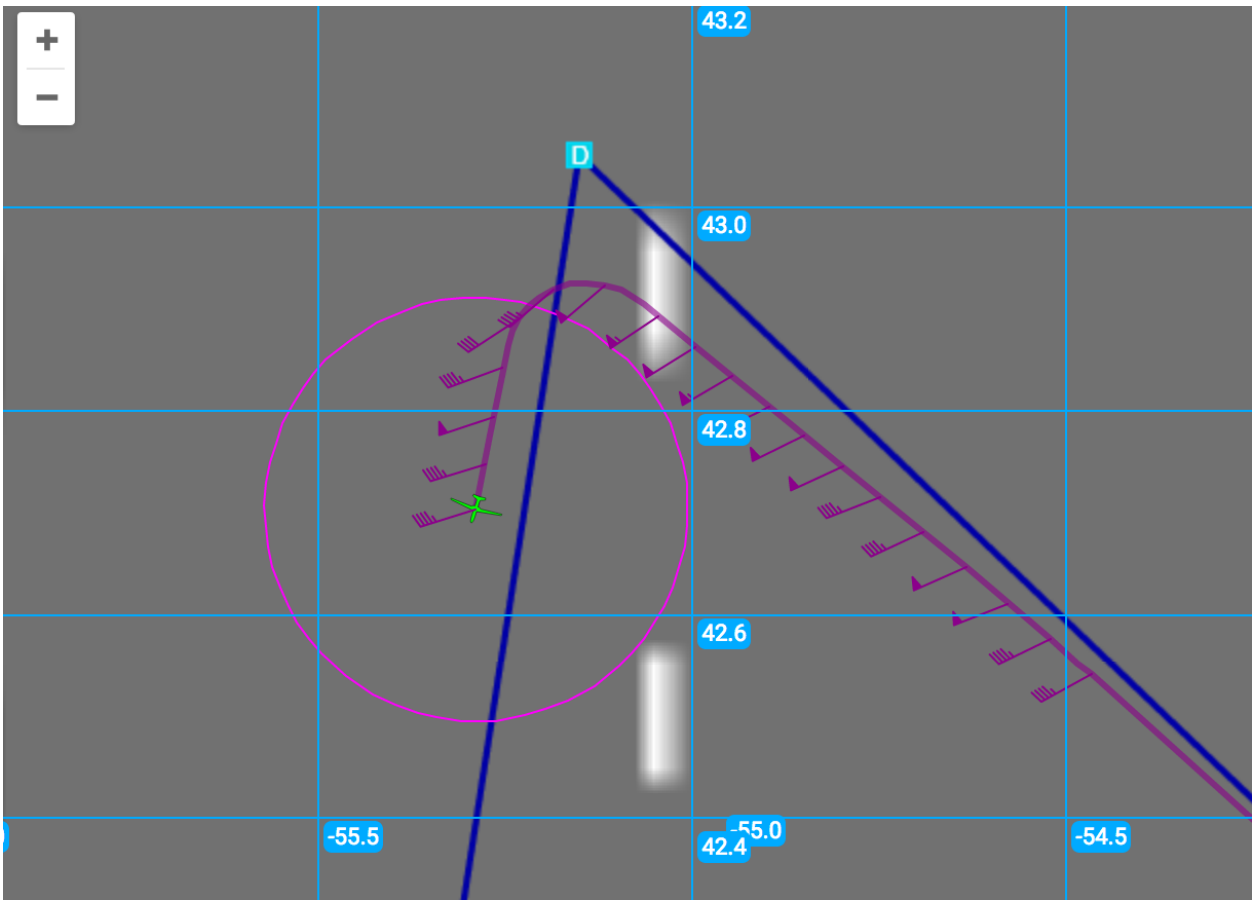


IR Camera at 0547Z. Looking to the NW as approaching the northernmost point in pattern.



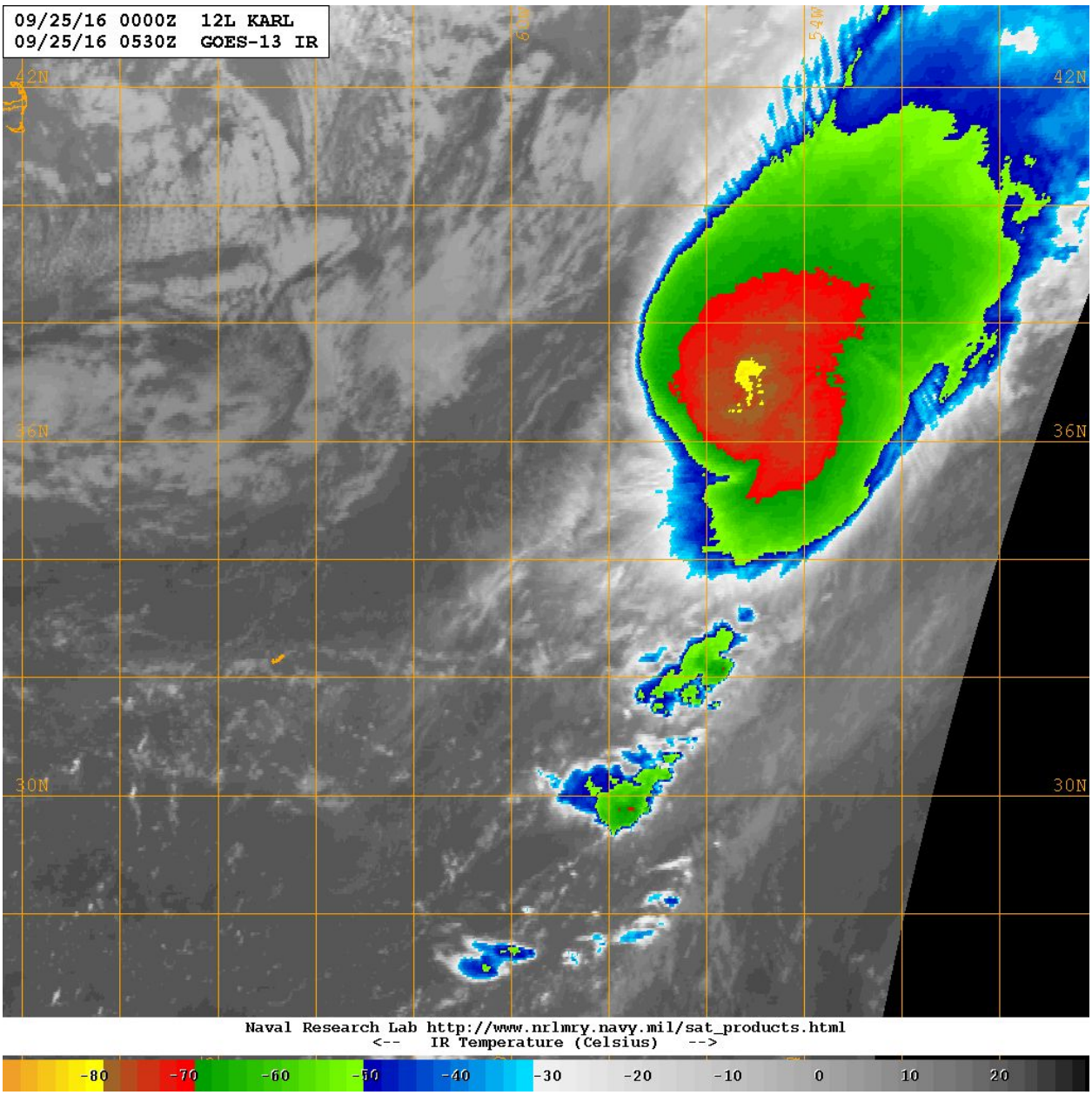
0551Z: HIWRAP Ka band at 3000 m showing belt of precip crossed during ongoing SE to NW flight leg

0558Z: Drop 46 13 nmi SSW of location 47 (after turn); good drop



GH measures 50-55 kt peak winds at flight level in this northern part of the pattern above the jet. FL58.2 kft at this point. This is near the location of the 150 kt winds. Be interesting to see the drop at location 47.

Air traffic conflicts. Will miss drop locations 48 and 49.

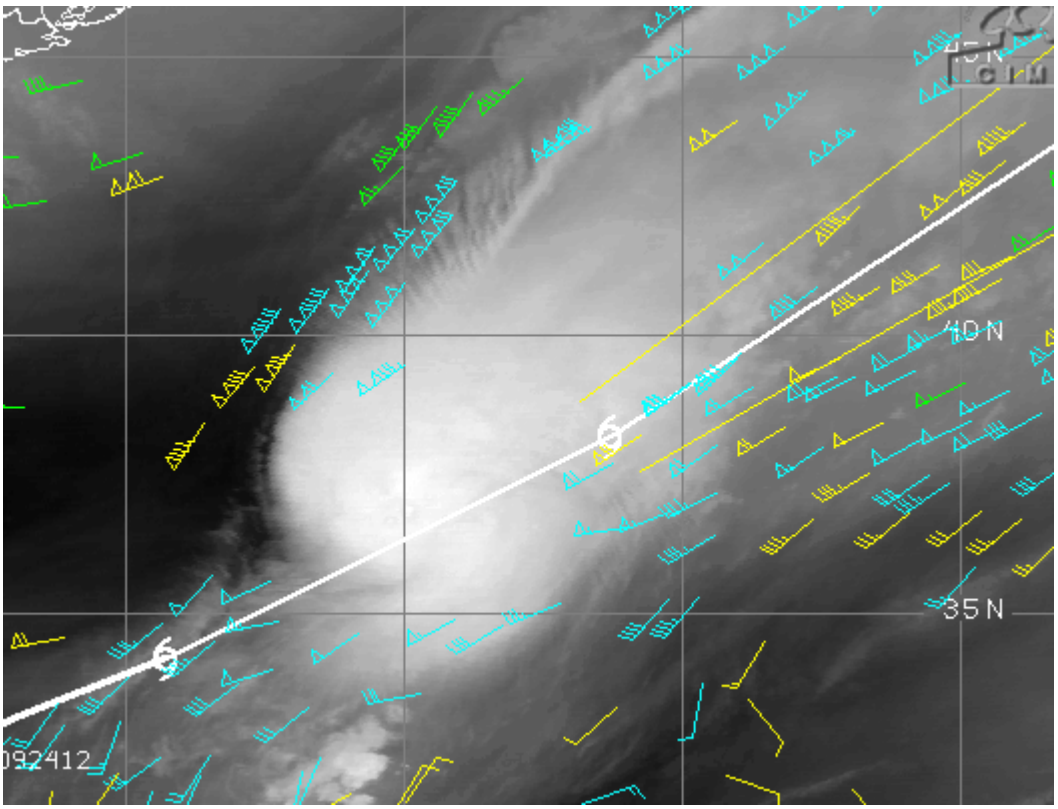


0530Z: Still seeing cloud top temperatures below -80 deg C in GOES-13 IR, but intensity of convection appears to be waning somewhat with time now.

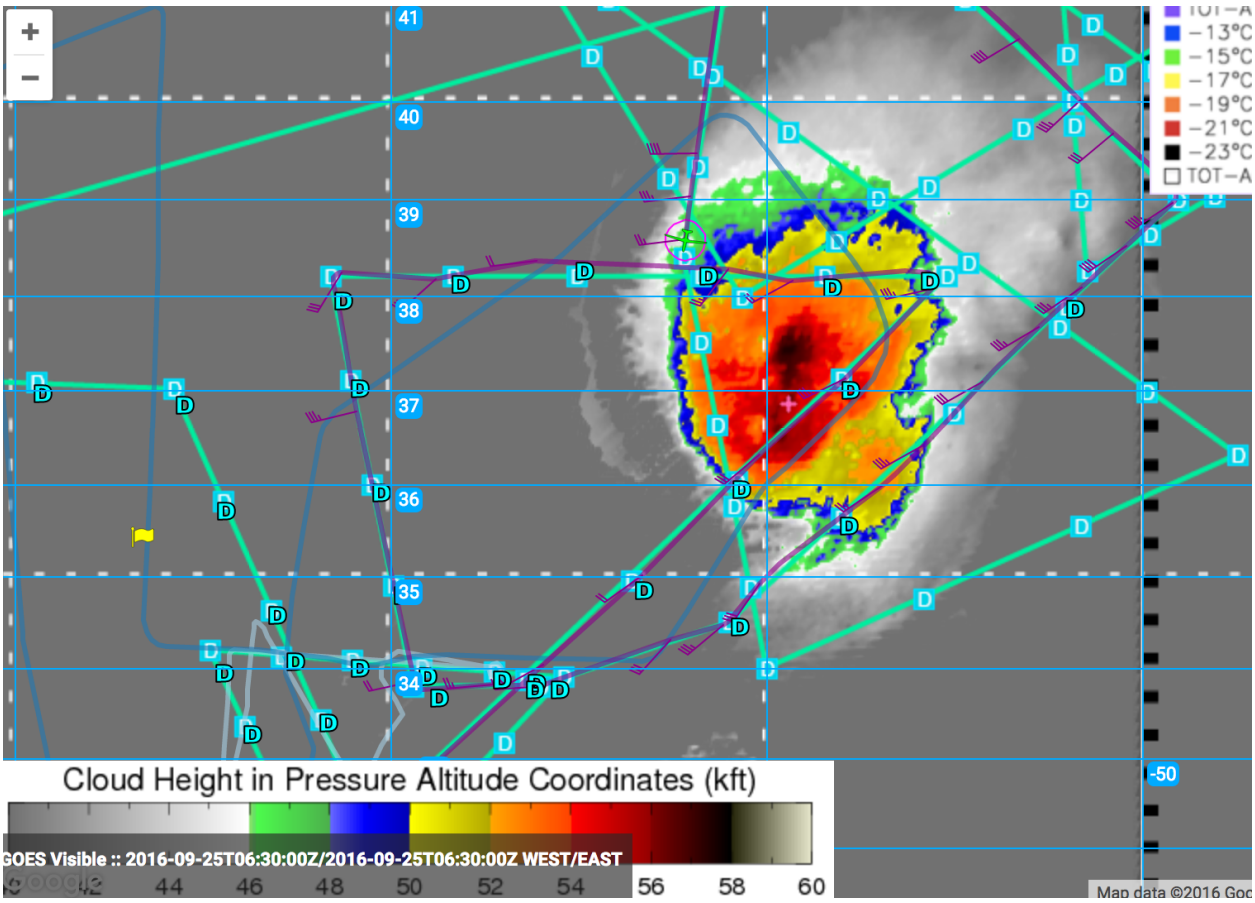
0622Z: Drop 47 about 25 nmi SSW of location 49; good drop

0627Z: Drop 48 at location 50; good drop

0638Z: Drop 49 at location 51; good drop



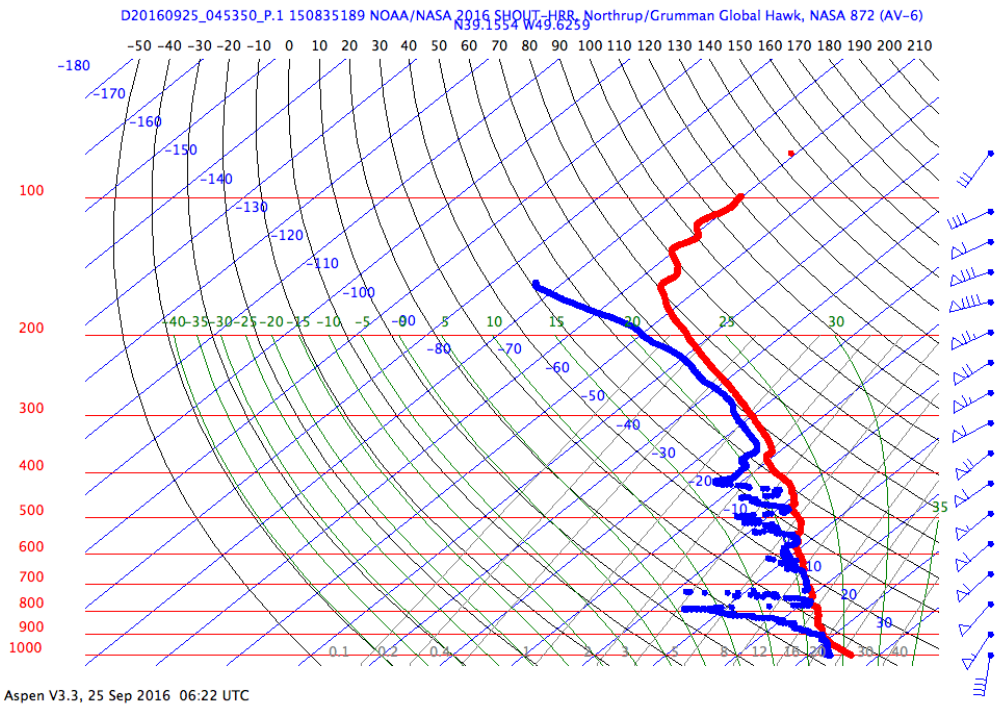
0644Z: Latest AMVs and water vapor image.



Slight track adjustment made to avoid high cloud tops, update 13.

0648Z: Drop 50 at location 52. Good drop.

Location 43 Dropsonde shows generally moist air with strong westerly to southwesterly winds throughout most of depth.

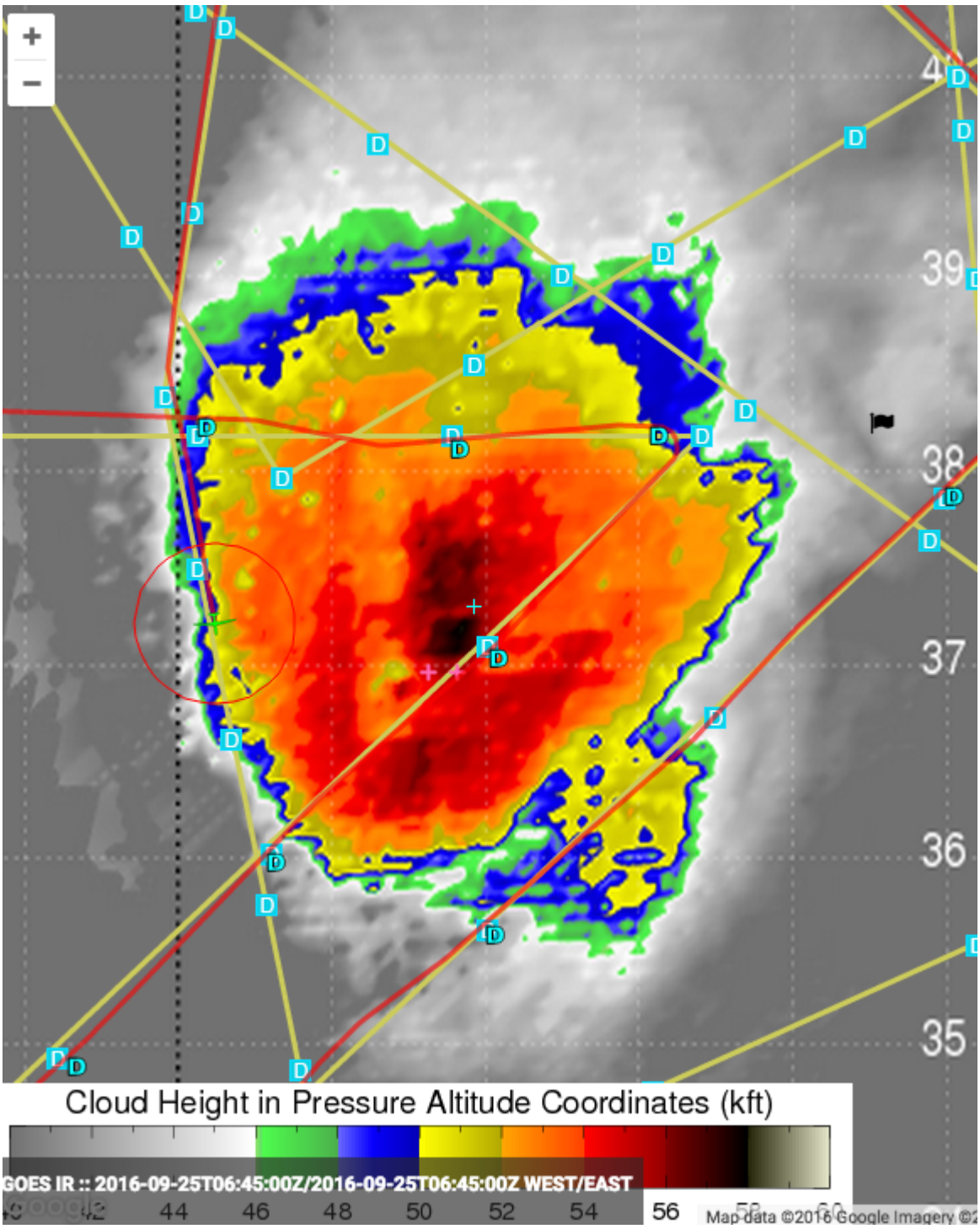


0657Z: Drop 51 at location 53; good drop.

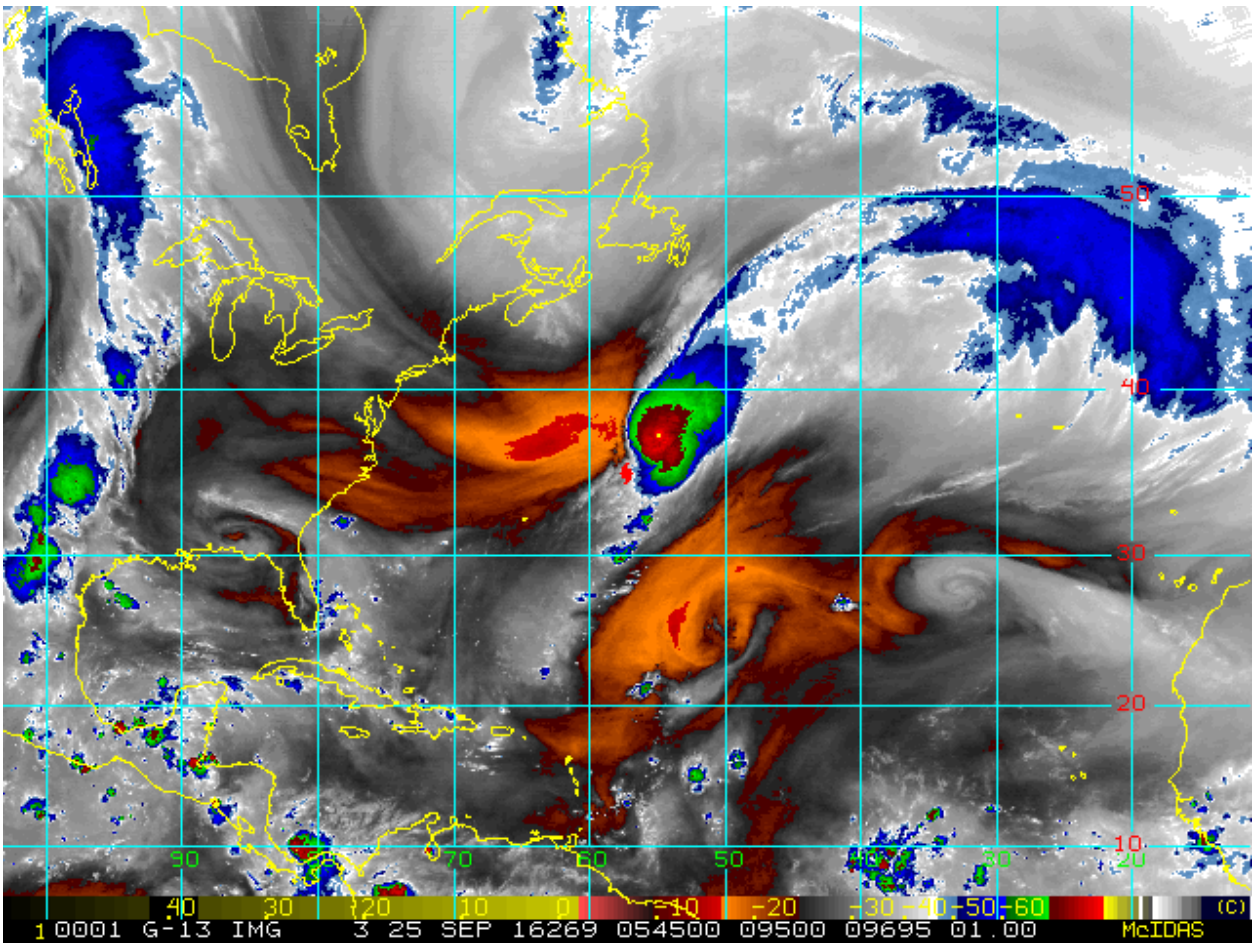
0708Z: Drop 52 at location 54; good drop.

0717Z: Drop 53 at location 55; good drop.

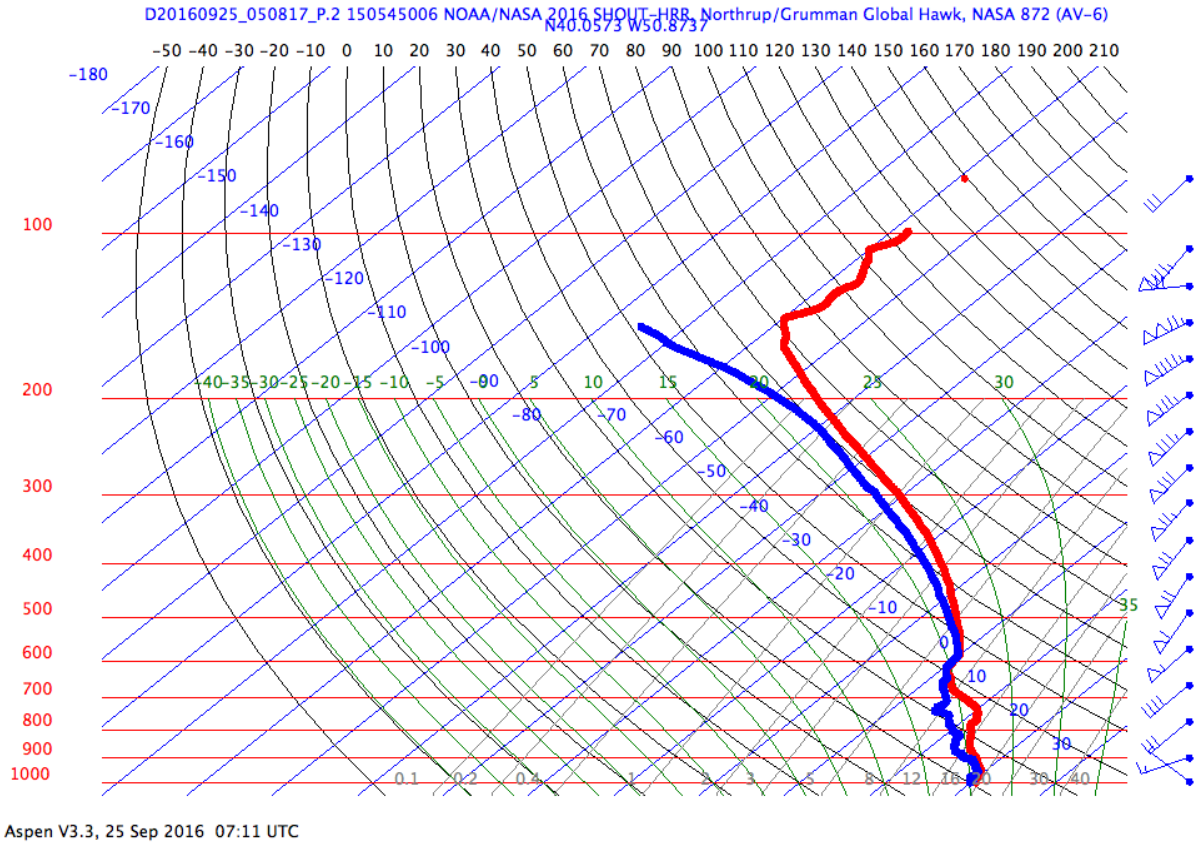
0727Z: Drop 54 at location 56; good drop.



0701Z: Skirting the western edge of the high cloud tops. CTH image from 0648. Convection now seems to be holding its own, with occasional lightning and tops still maxing out at 58,000 ft



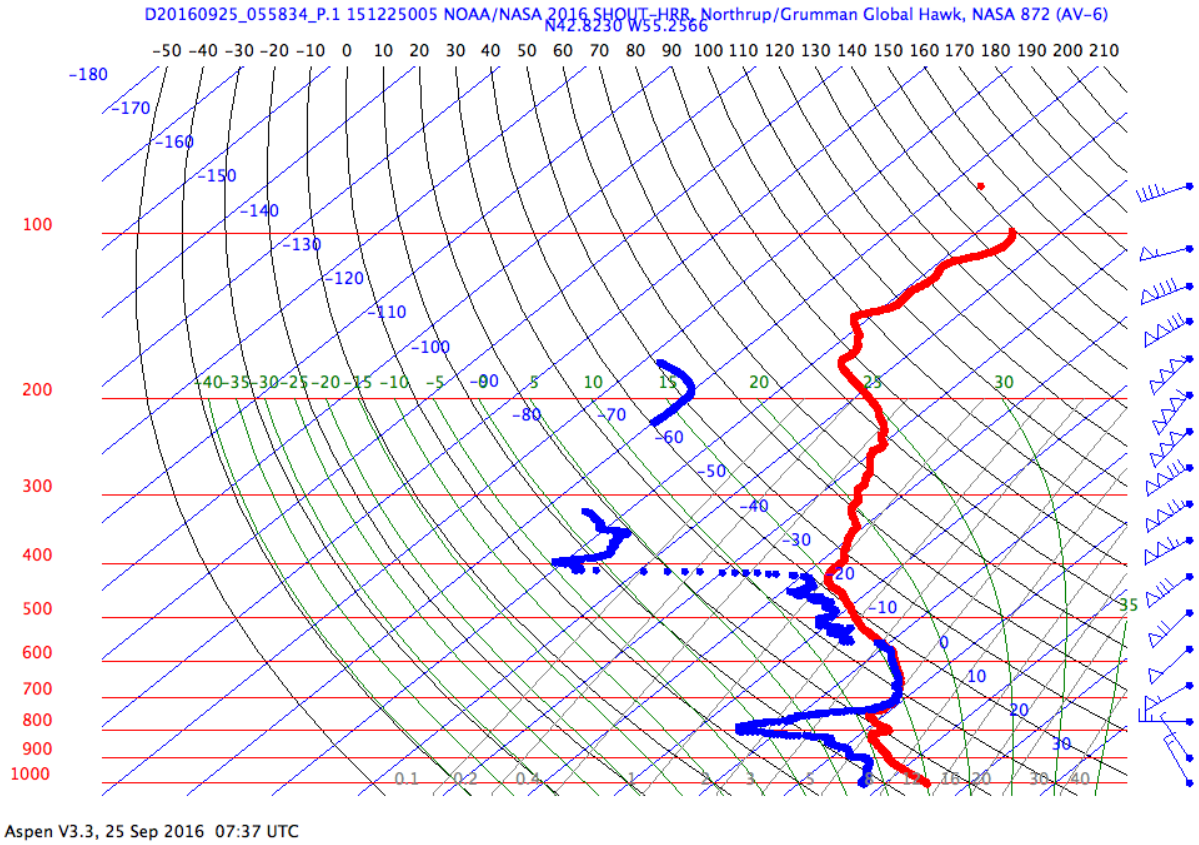
Water vapor image from 0545Z shows Karl's plume of upper-level outflow/water vapor extending across Atlantic towards Europe, building downstream ridge



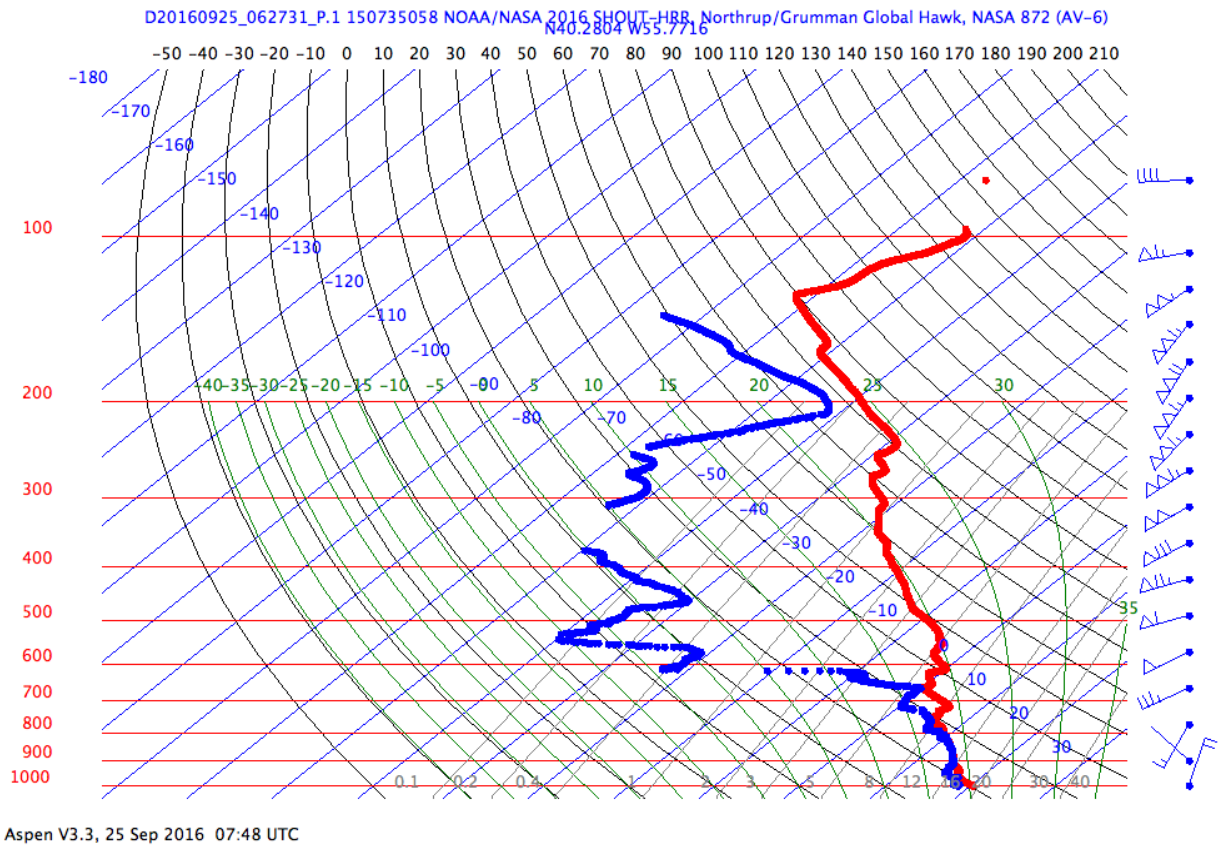
Sonde 44 depicting 125 kt winds at upper levels (135 kts in full profile according to Stan Goldenberg)

0737Z: Drop 55 just east of location 57; good drop

0754Z: Drop 56 at location 58; good drop.



Drop 46 at location 47. 160 kt peak winds in plot. Perhaps a little higher in data.



Drop 47, which occurred between the locations of drop 49 and 50. Here we are on the northwestern edge of the TC, with outflow at 200 mb pushing NW and joining up with the environmental flow. RH is high near 200 mb and winds from SW rather than WSW.

0812Z; Drop 57 at location 59; good drop

0820Z: Gary and Jason stepping in

0828Z: AVAPS having an issue with load for location 60

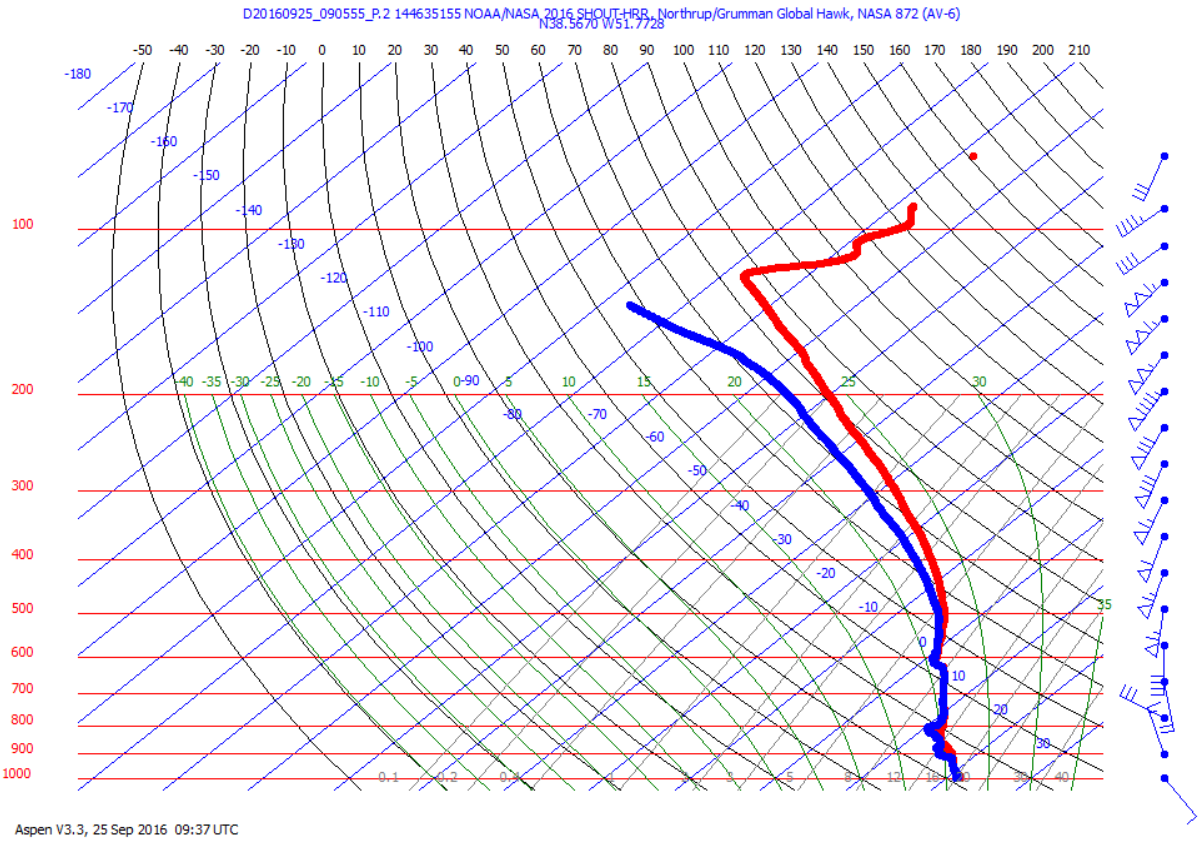
Missed drop at location 60. Missing drop at location 61 also - AVAPS still debugging.

Had sondes in carriage - one had rolled into launch tube. Was able to kick out in inactive mode Sonde 58 was dead sonde

0858Z: Sonde 59 at location 62+; Good drop

Not out of woods with AVAPS; Still might have sondes loose in carriage.

0905Z: Sonde 60 at location 63; good drop



0914Z GH Data made it into the 5 AM NHC discussion:

000
WTNT42 KNHC 250840
TCDAT2

TROPICAL STORM KARL DISCUSSION NUMBER 44
NWS NATIONAL HURRICANE CENTER MIAMI FL AL122016
500 AM AST SUN SEP 25 2016

Karl continues to produce a large mass of cold-topped convection sheared to the northeast of the low-level center. Some of the cloud tops are as cold as -83 deg C, which is unusual for that far north. Earlier NASA/NOAA Global Hawk aircraft dropsondes measured surface winds as high as 54 kt, and recent satellite intensity estimates from TAFB and UW-CIMSS ADT are 60 kt and 57 kt, respectively. Based on these data, and given that Karl is now moving at a forward speed of at least 40 kt, the initial intensity has been conservatively increased to 60 kt.

The initial motion estimate is now 055/40 kt. Karl should continue to move northeastward at 45-50 kt ahead of a broad deep-layer trough

until the cyclone is absorbed by a larger extratropical low in about 36 hours. The new official forecast track is just an update of the previous advisory and remains near the middle of the tightly packed guidance envelope, close to the consensus model TVCN and the consensus of the GFS and ECMWF global models.

Karl is currently located over a ridge of anomalously warm water with SSTs of 27C to 27.5C, which likely explains the unusually deep and cold-topped convection associated with the cyclone. Karl has about another 6 hours or so over SSTs greater than 26C, which could allow the cyclone to strengthen into a tropical hurricane before it reaches much colder waters. By 12 hours and beyond, Karl will be moving over sea-surface temperatures colder than 20C north of 40N latitude, which will result in the cyclone losing its deep convection and tropical characteristics. However, interaction with the aforementioned deep-layer trough and associated baroclinic energy should help Karl to strengthen into a powerful post-tropical low pressure system possessing hurricane-force winds. By 36 hours, the system should be absorbed into a larger extratropical low to its northwest. The new NHC intensity forecast and wind radii are based on input from the NOAA Ocean Prediction Center.

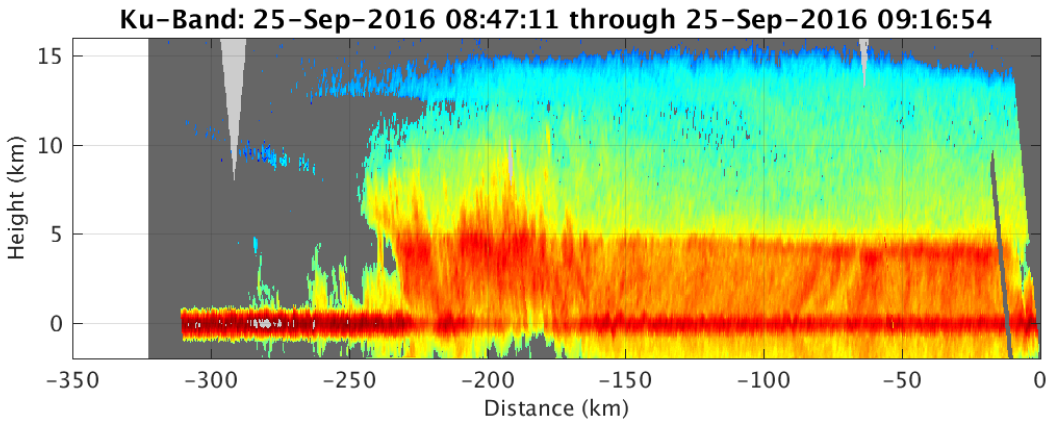
FORECAST POSITIONS AND MAX WINDS

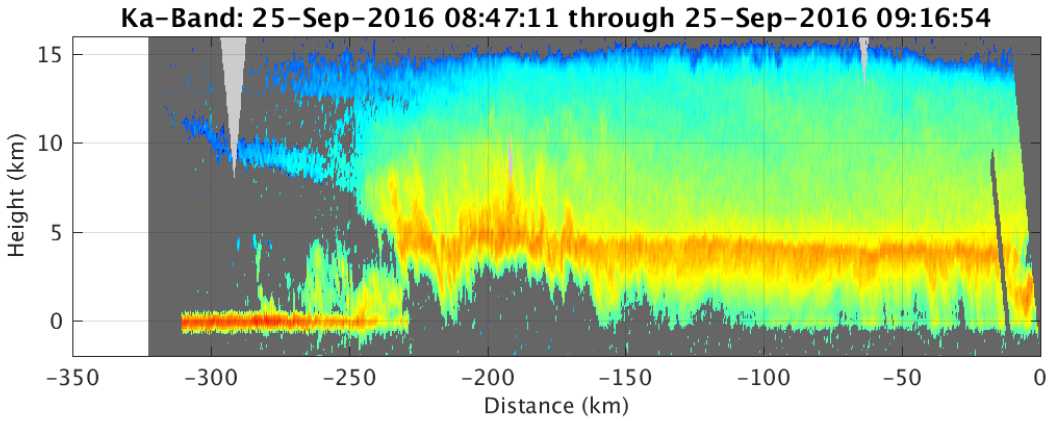
INIT 25/0900Z 37.5N 53.5W   60 KT 70 MPH
 12H 25/1800Z 41.3N 46.3W   70 KT 80 MPH...POST-TROPICAL
 24H 26/0600Z 48.3N 35.5W   60 KT 70 MPH...POST-TROPICAL
 36H 26/1800Z...ABSORBED BY LARGER EXTRATROPICAL LOW

$$
Forecaster Stewart

0917Z: Dave suspects has 2 sondes loose in the tray - could still cause problems

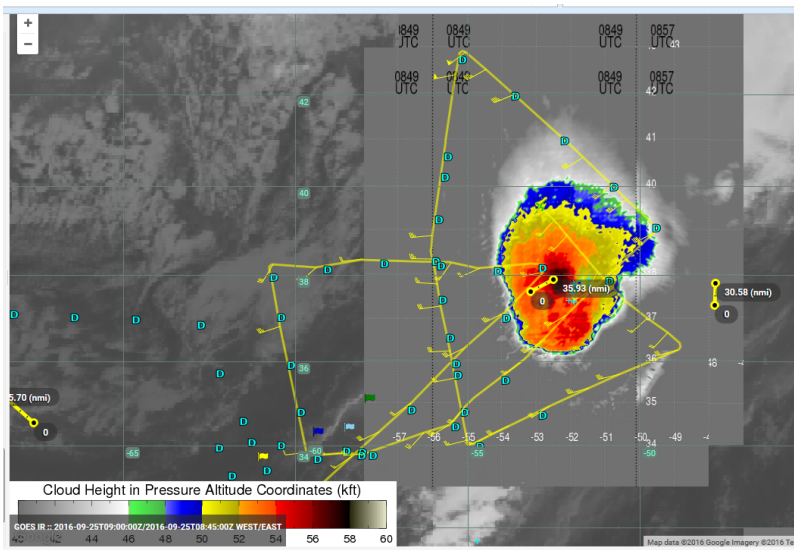
HIWRAP Cross section from ongoing pass over convection





0917Z: Sonde 61, location 64; Good drop

0919Z: Cloud top height (image time 0849Z) for current pass. Did see notable lightning to left of track causing diversion to the N



0923Z - had dead sonde in launcher - Sonde 62 released - will be no data

Would mean now maybe one sonde loose in carriage. Dave is trying to see if he can force out

0930Z - AVAPS trying to do a regular load - did not get loose one into launcher

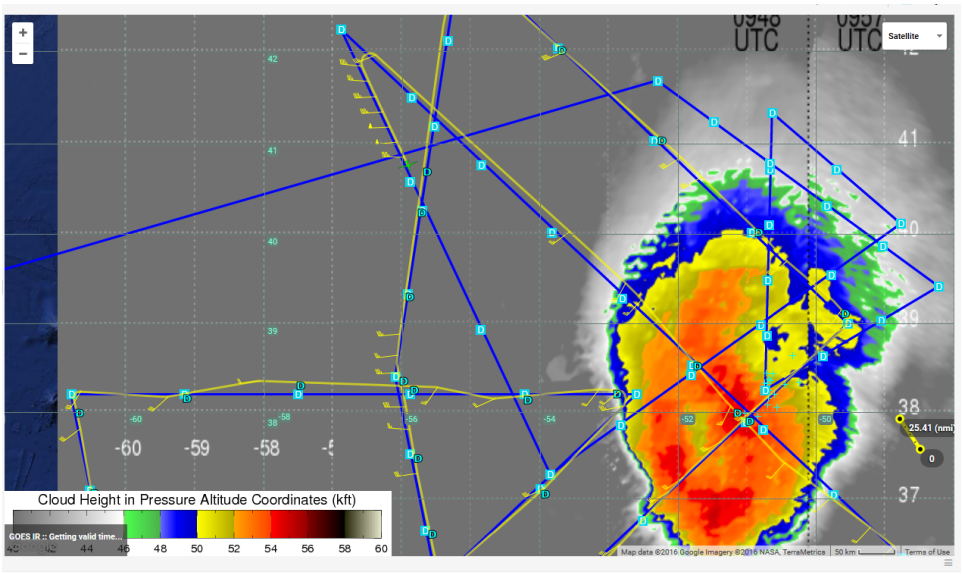
0931Z: Sonde 63 at location 65+; Good drop

0940Z: Sonde 64 at location 66; Good sonde

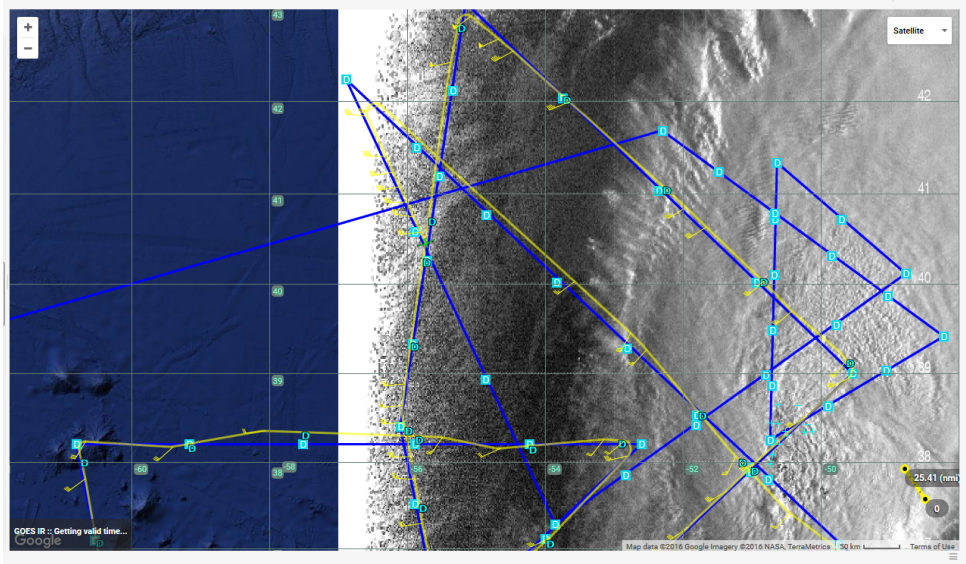
0952Z: Sonde 65 at location 67; Good drop

1002Z: Drop 66 at location 68; Good drop

1013Z (0948Z image time) Cloud top height as checking alignment of next line. Tops dropping, but still seeing active lightning that will need to watch



Corresponding first glimpse of visible image

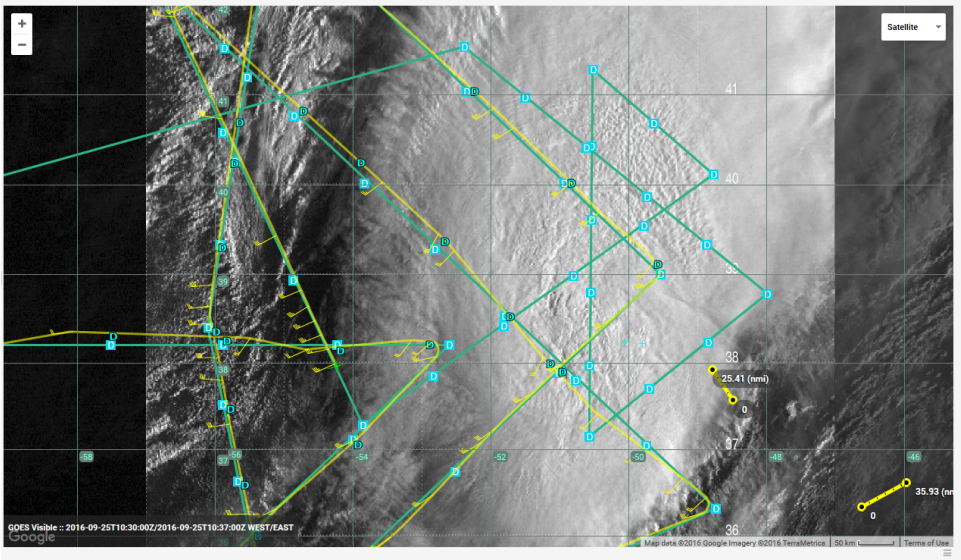


1015Z: Sonde 67 at location 69; Good drop

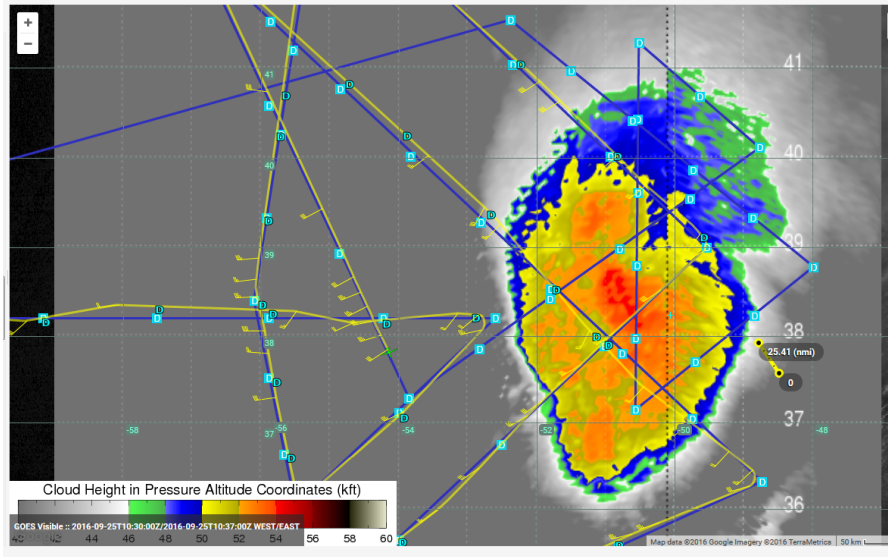
Observed that HAMSR real time products had not been updated recently. Called Shannon at hotel and he found that one of update scripts had failed. He said he restarted.

1034Z: Sonde 68 at location 70; Good drop

1045Z: Visible satellite imagery starting to be better illuminated - Show here on larger scale

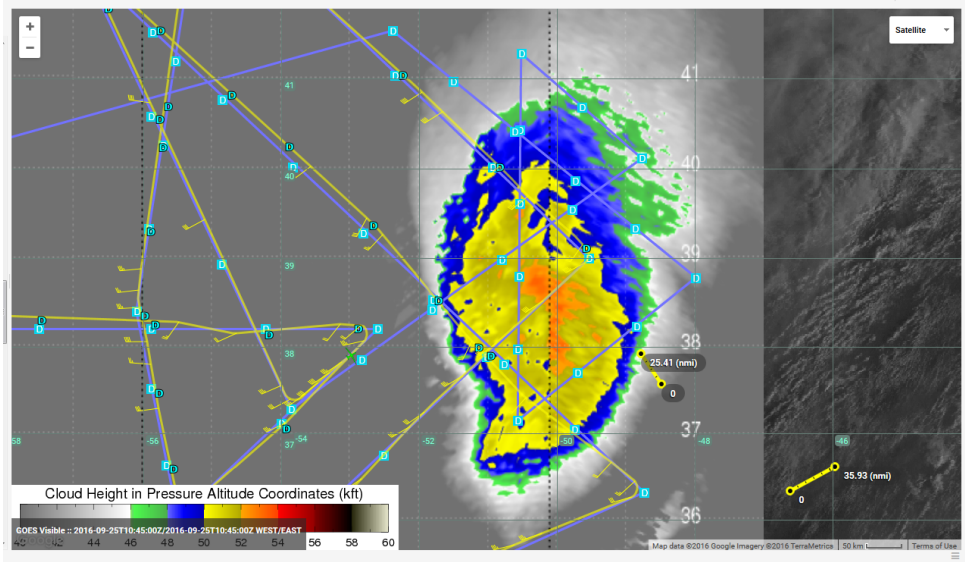


Cloud height imagery from 1018Z - See convection dying down and have also seen falloff in lightning. Will shoot for storm center on this next pass. Chris Velden notes that we are right on the edge of the GOES/Meteosat image splice and can see edge



1054Z: Sonde 69 at location 71; Good drop

Update from Cloud top height at 1048Z



1101Z: Sonde 70 at location 72; Good drop

1111Z: Sonde 71 at location 73; Good drop

1120Z: Sonde 72 at location 74; Good drop

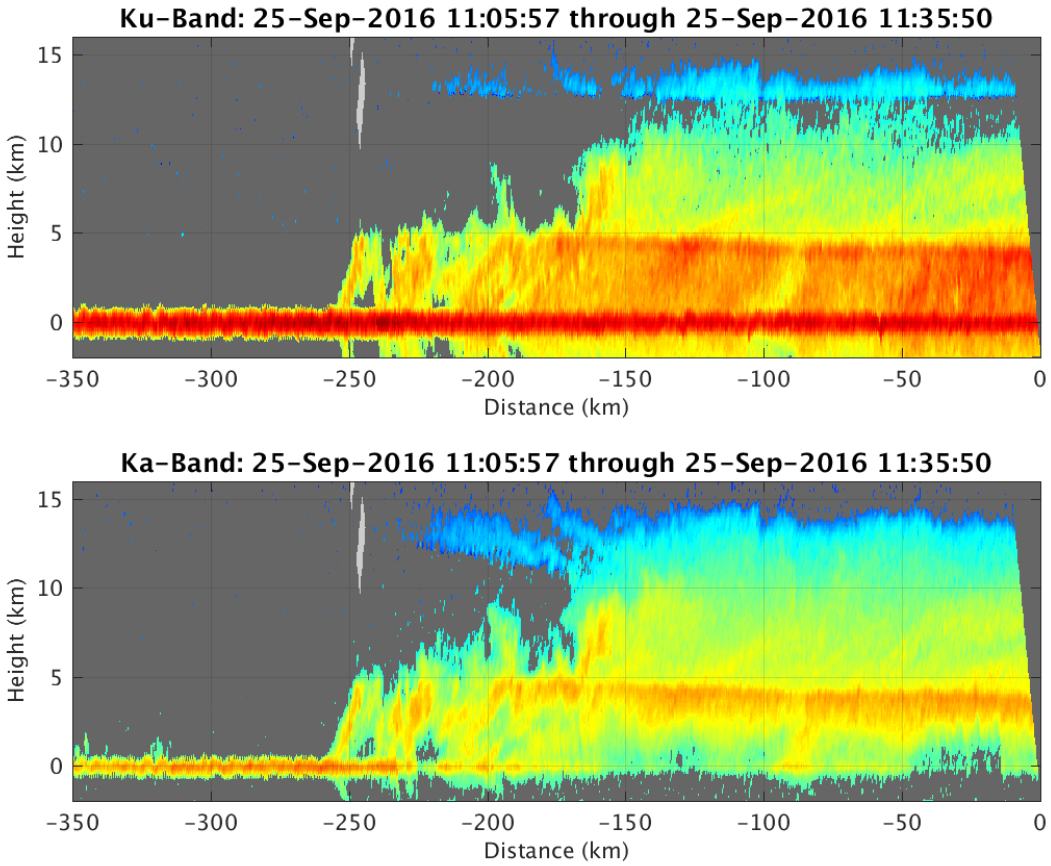
From cvelden: this leg looks almost perfectly downshear so will be good to look at warm core tilt; nice track setup JD!

1129Z: Sonde 73 at location 75A; Good drop

With latest line extension, location 75 has been duplicated - we are using this to add another sonde. Next location will be called 75B

1134Z: Sonde 74 at location 75B; Good drop

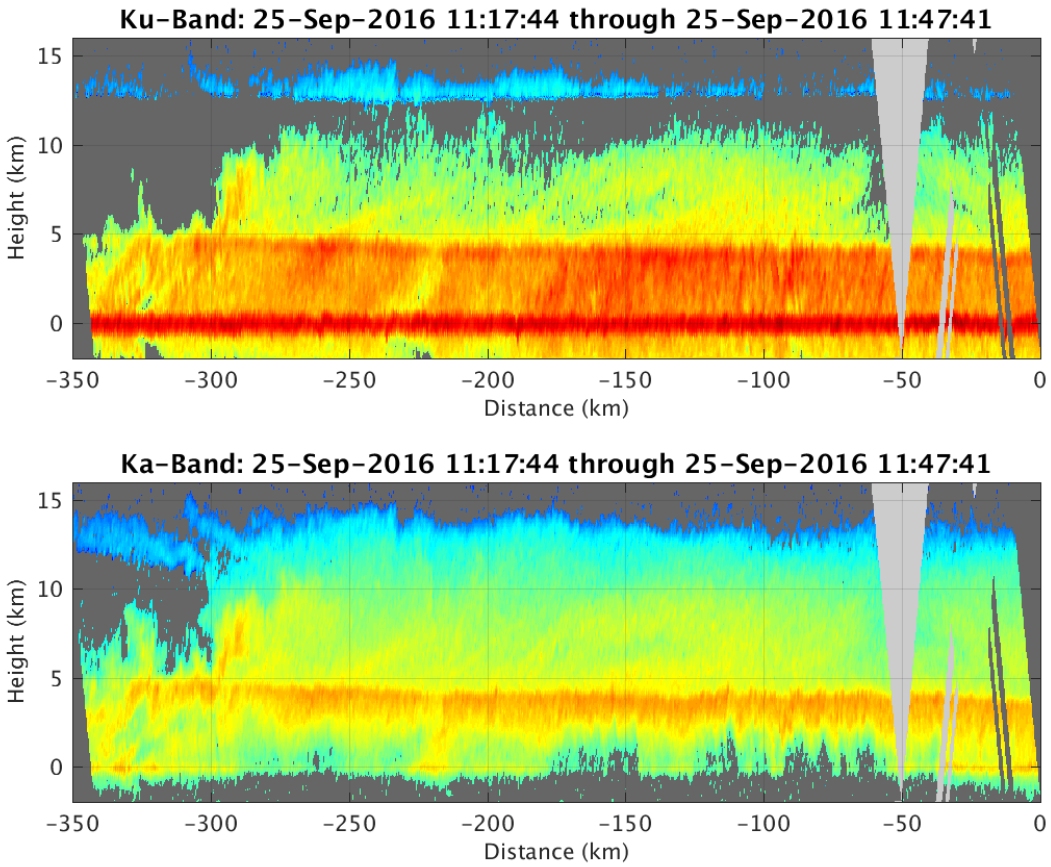
1137Z HIWRAP Section: From G Heymsfield: Tops were under 50kft on this pass.



From CVelden: CTH shows just over 50kft Gerry--could be a little bias from high lat

Gerry says convection dying out quickly - all stratiform. Chris replies thinks rapid ET underway

Adding a bit more to HIWRAP

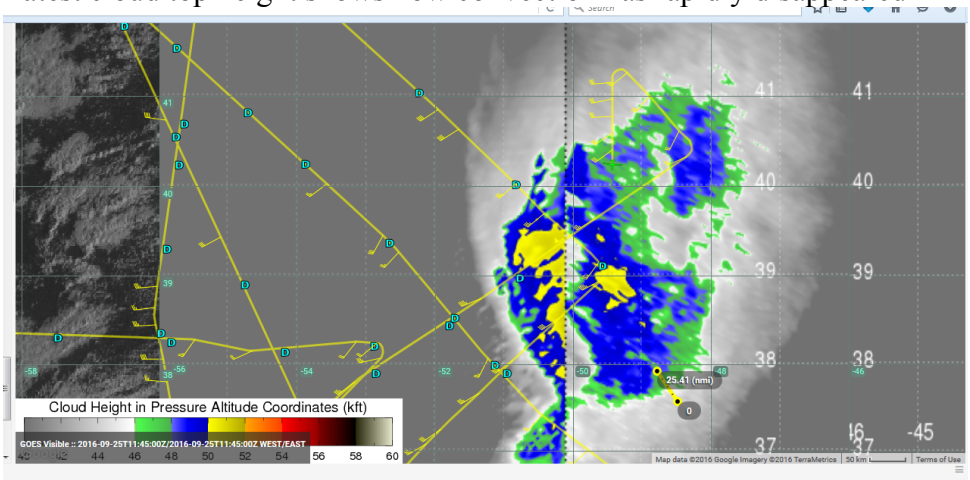


1145Z: Sonde 75 at location 76; Good release

1150Z: Sonde 76 at location 77; Good drop

1158Z: Sonde 77 at location 78; Good drop

Latest cloud top height shows how convection has rapidly disappeared

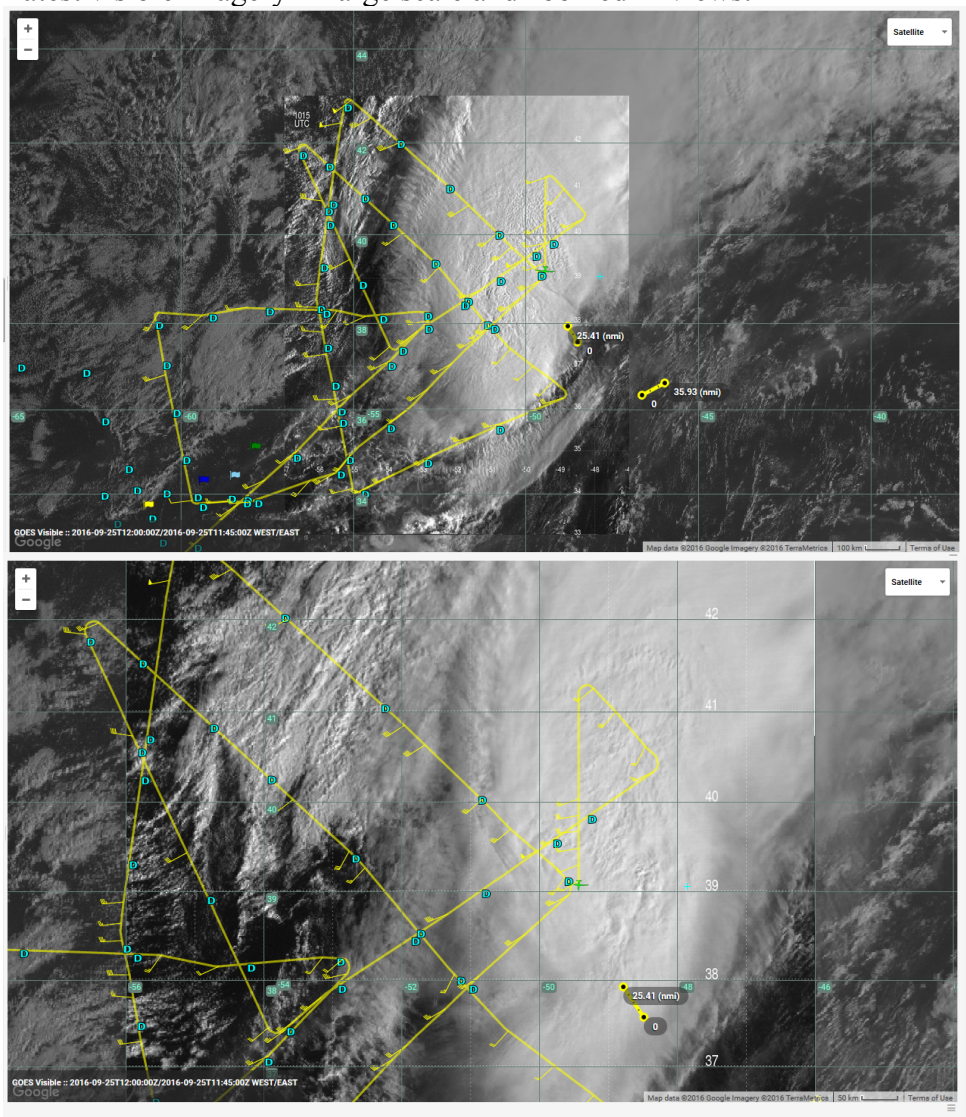


Lined up to hit what convection there is

1203Z: Sonde 78 at location 79; Good drop

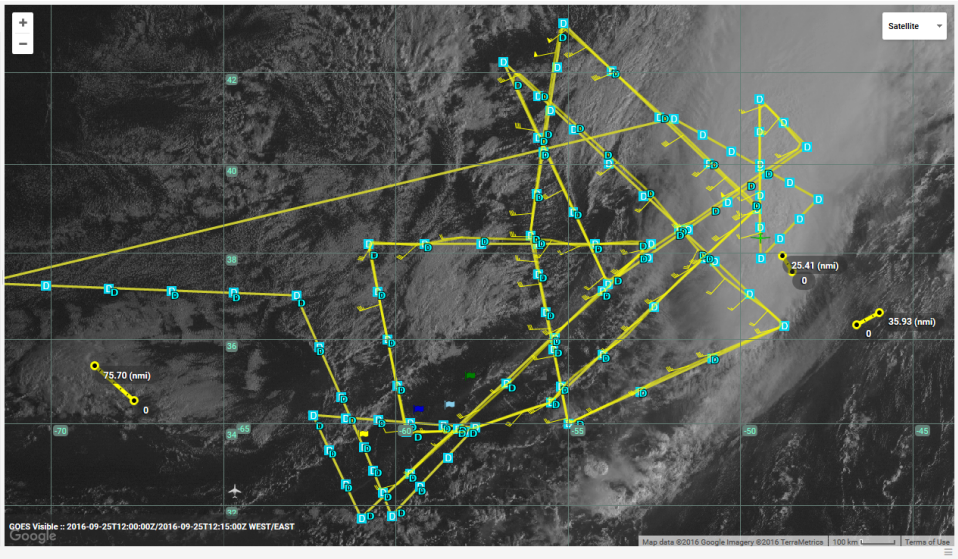
1210Z: Sonde 79 at location 80; Good drop

Latest visible imagery in large scale and zoomed in views:



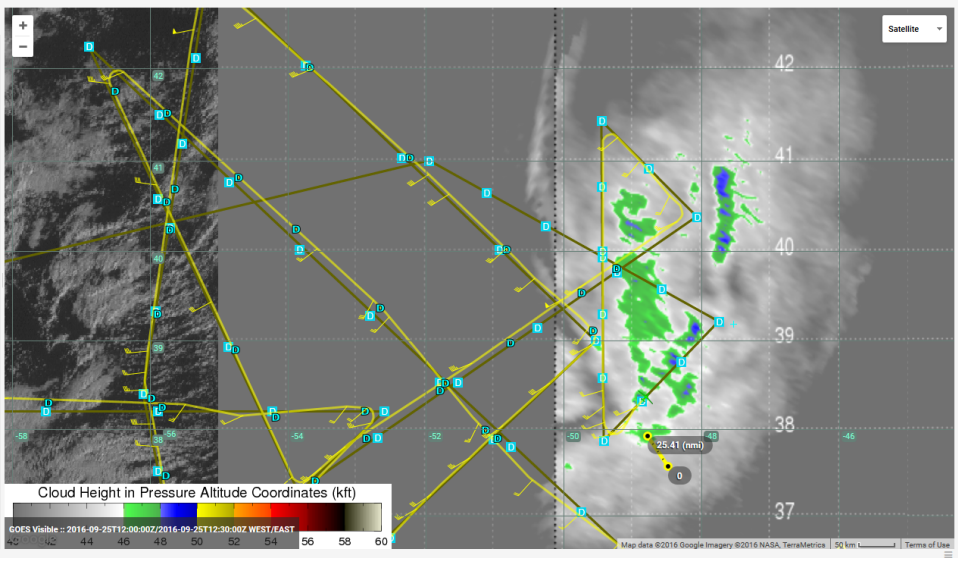
1218Z: Sonde 80 at location 81; Good drop

Current visible image with full mapped track



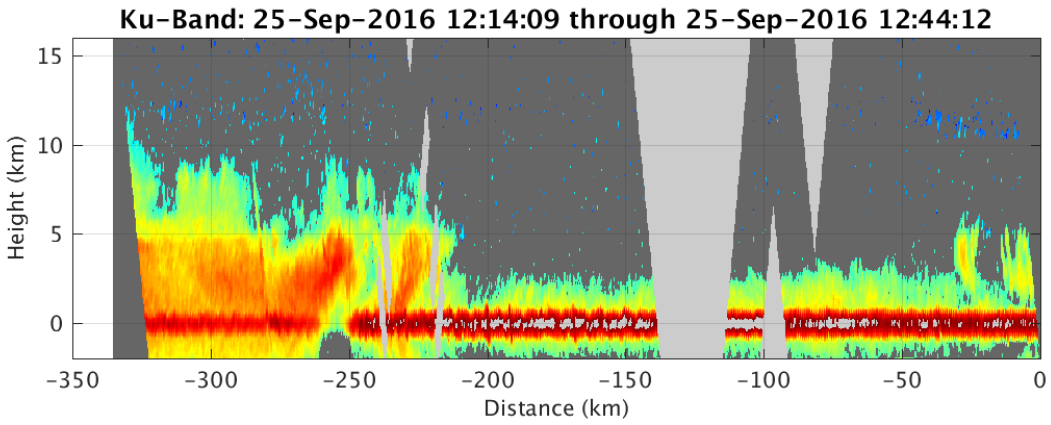
Starting in to the problematic bin 8 on AVAPS. Had fault on load - debugging now. Missed location 82. Made turn at location 83 - AVAPS still debugging.

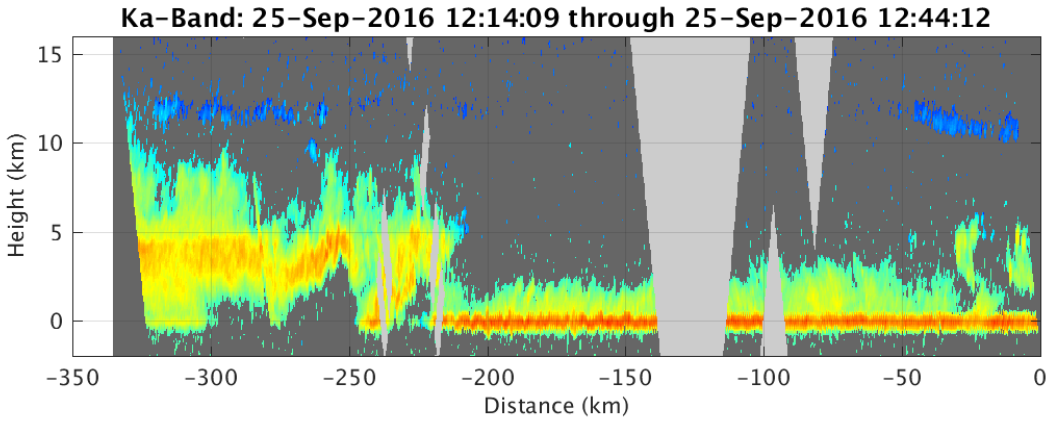
1227Z: Cloud top height look just come in. Had been a couple of lightning flashes at the end of this line, but cloud tops have all dropped to below 50 kft



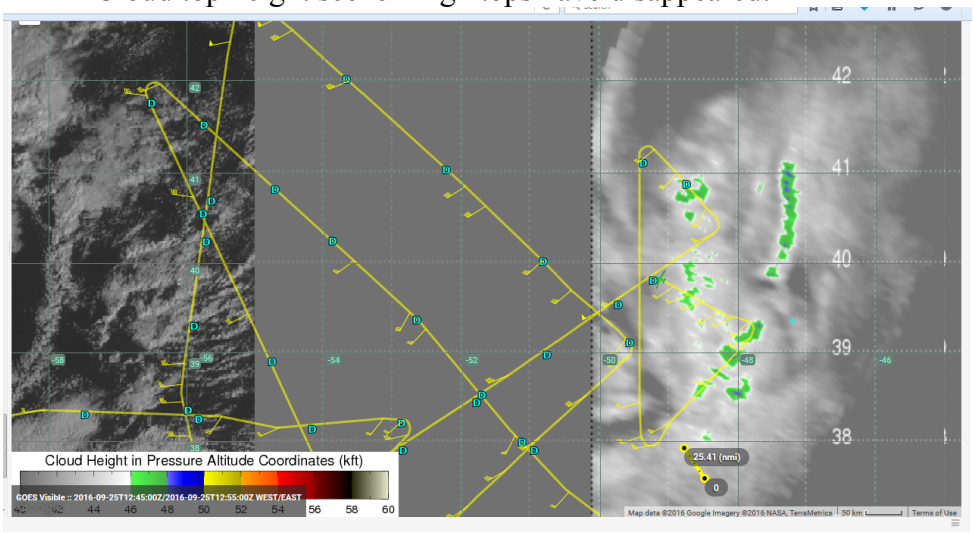
1243Z AVAPS launched inactive sonde. Just short of planned location 85

HIWRAP as completing leg prior to final storm crossing



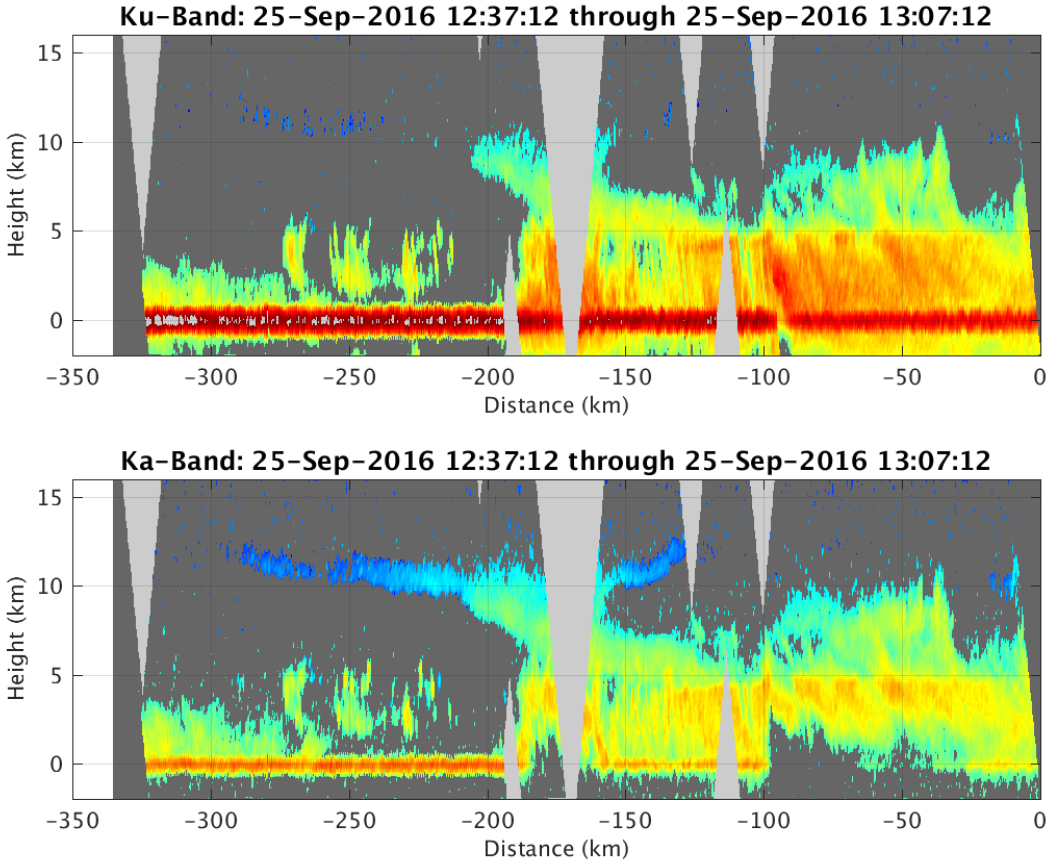


1242Z Cloud top height scene- High tops have disappeared:

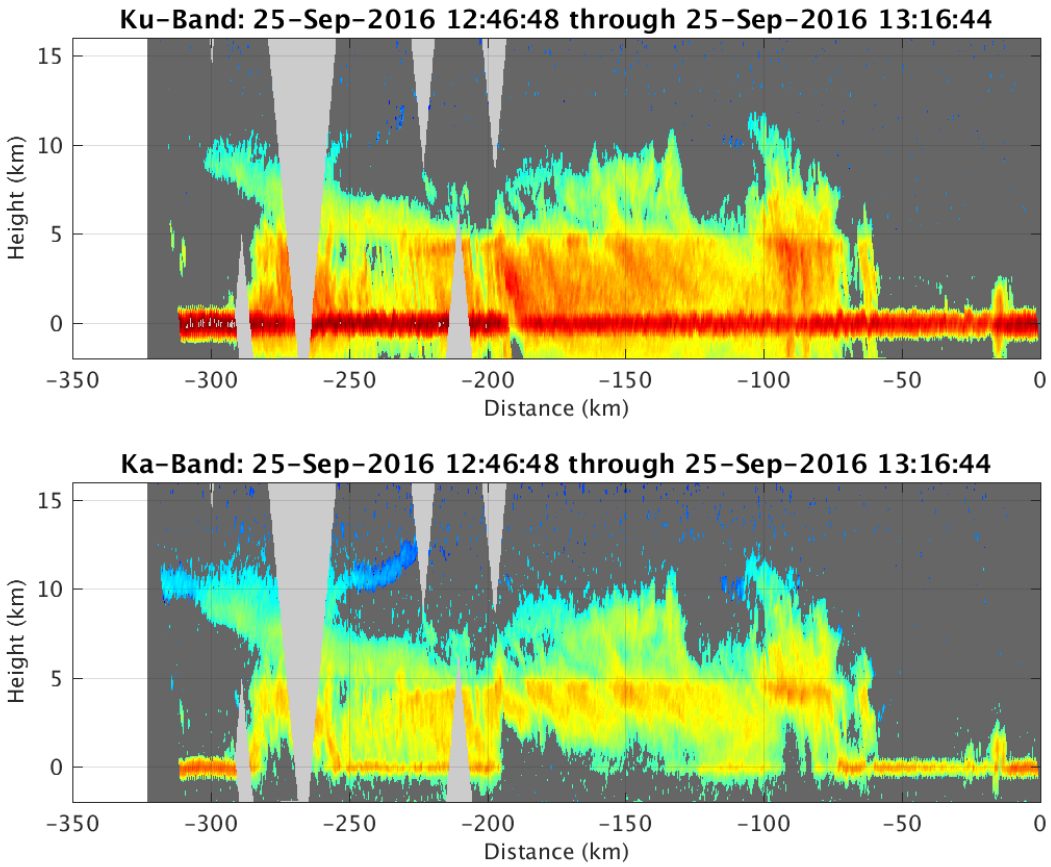


1248Z: AVAPS reports that suspects that bin 8 dropped in its entirety. They had one sonde fall into the launch tube and that was the inactive launch above. Currently bin 8 reports empty and no sondes available for further load. Dave Costa reports launch tube is clear, shuttle at home position, but likely all sondes loose in tray area.

1308Z: HIWRAP cross section from ~midpoint of final butterfly crossing:

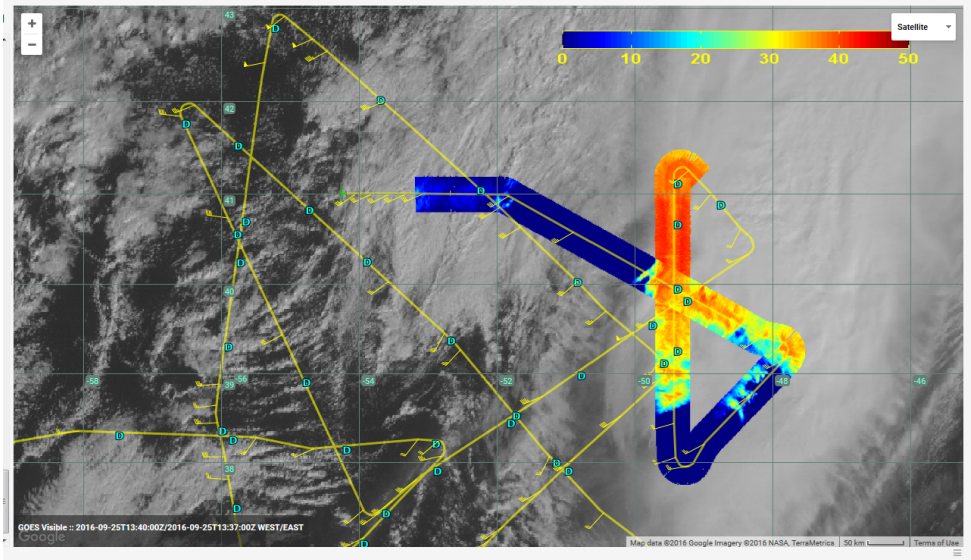


1317Z Last HIWRAP grab as ending final leg of sampling:



1331Z: GH making turn towards home from last butterfly leg. Have advised pilots we have no preferred routing home. Pilots' discretion

1351Z: HAMSR 6km reflectivity from last butterfly (HAMSR RT scripts only catching up recently)



1733Z: Landing