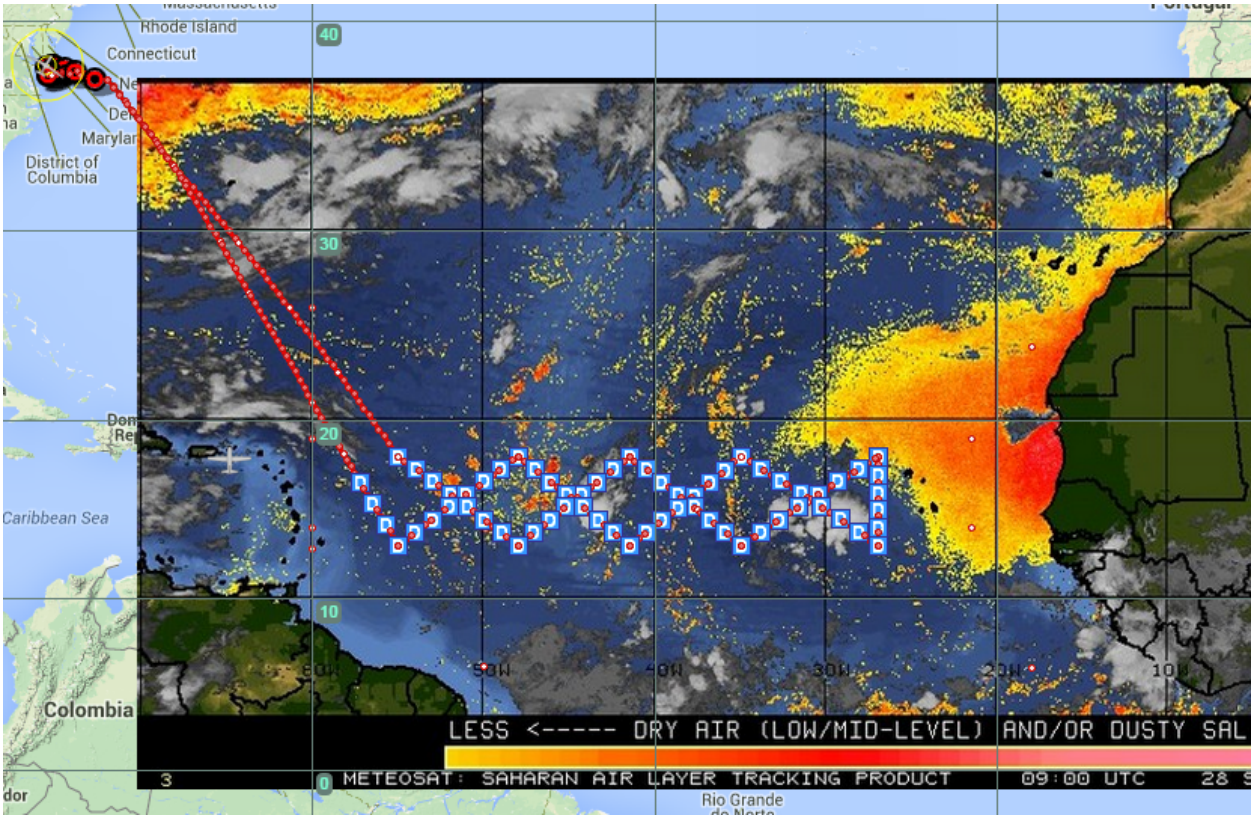
Hurricane and Severe Storm Sentinel (HS3) Mission

HS3 2014-09-28 Flight Report: GLOBALHAWK AV-6 Main Development Region Survey

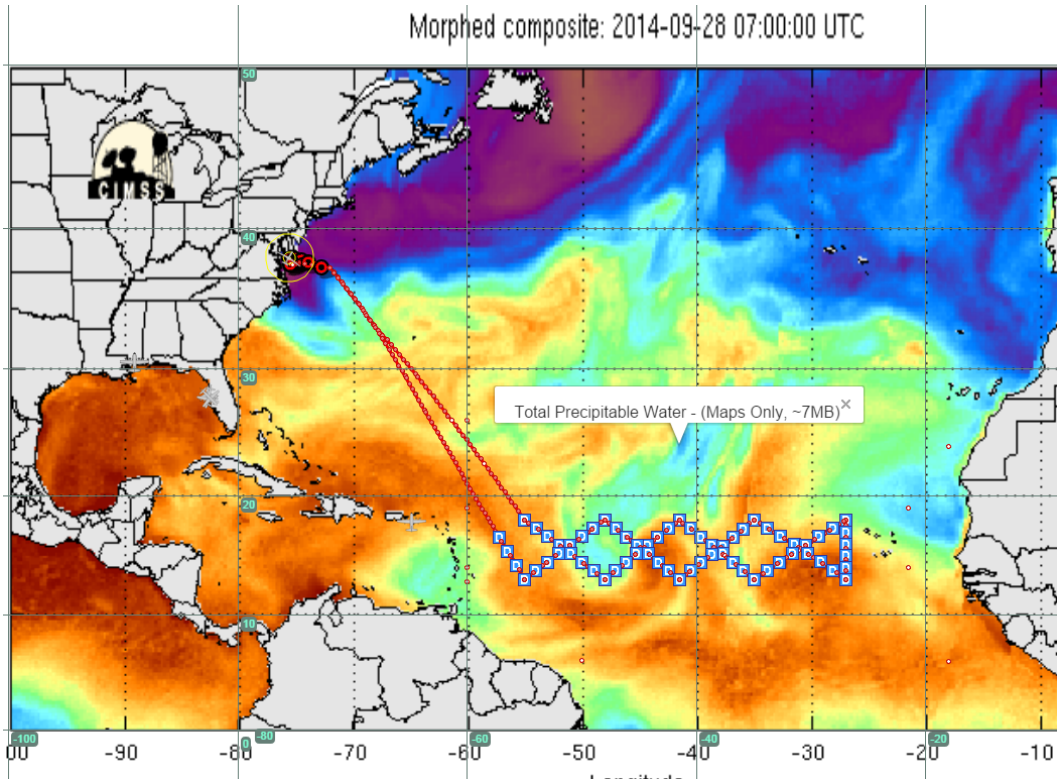
Flight Scientist shifts:

Name	Time
Colarco	1000-1400 UTC
Newman	1400-1800 UTC
Black	1800-2200 UTC
Sippel	2200-0200 UTC
Hendricks	0100-0500 UTC
Didlake	0400-0800 UTC
Braun	0800-1200 UTC

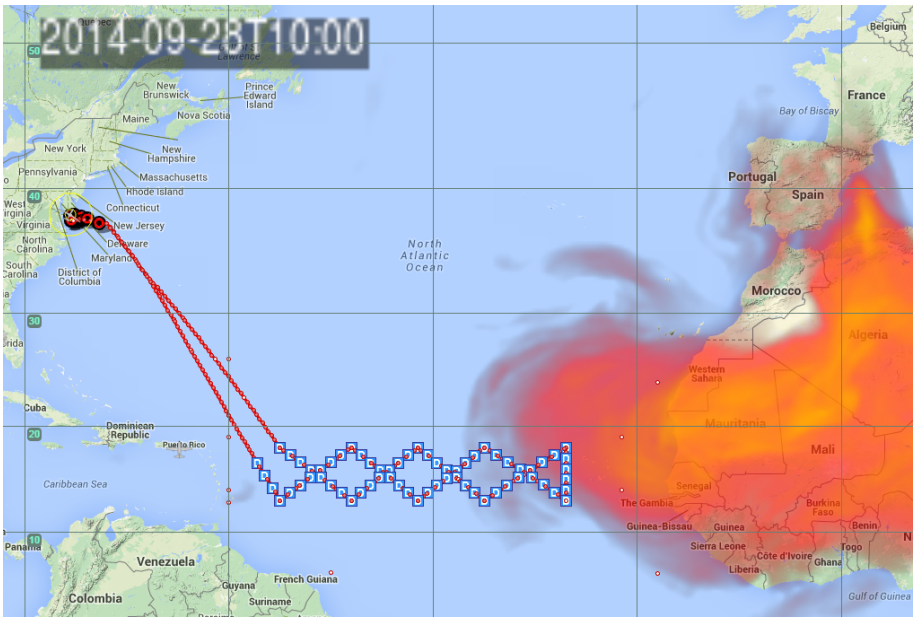
Mission goal: Survey of the main development region with additional coverage. Flight pattern consists of two saw tooth legs between 13 – 18 N, extending east to 27 W, pattern begins at about 55 W. See image below. A total of 65 dropsondes used about evenly across the pattern.



0900 GOES SAL product shows a broad region of dry air to the north and east of eastern end of route.

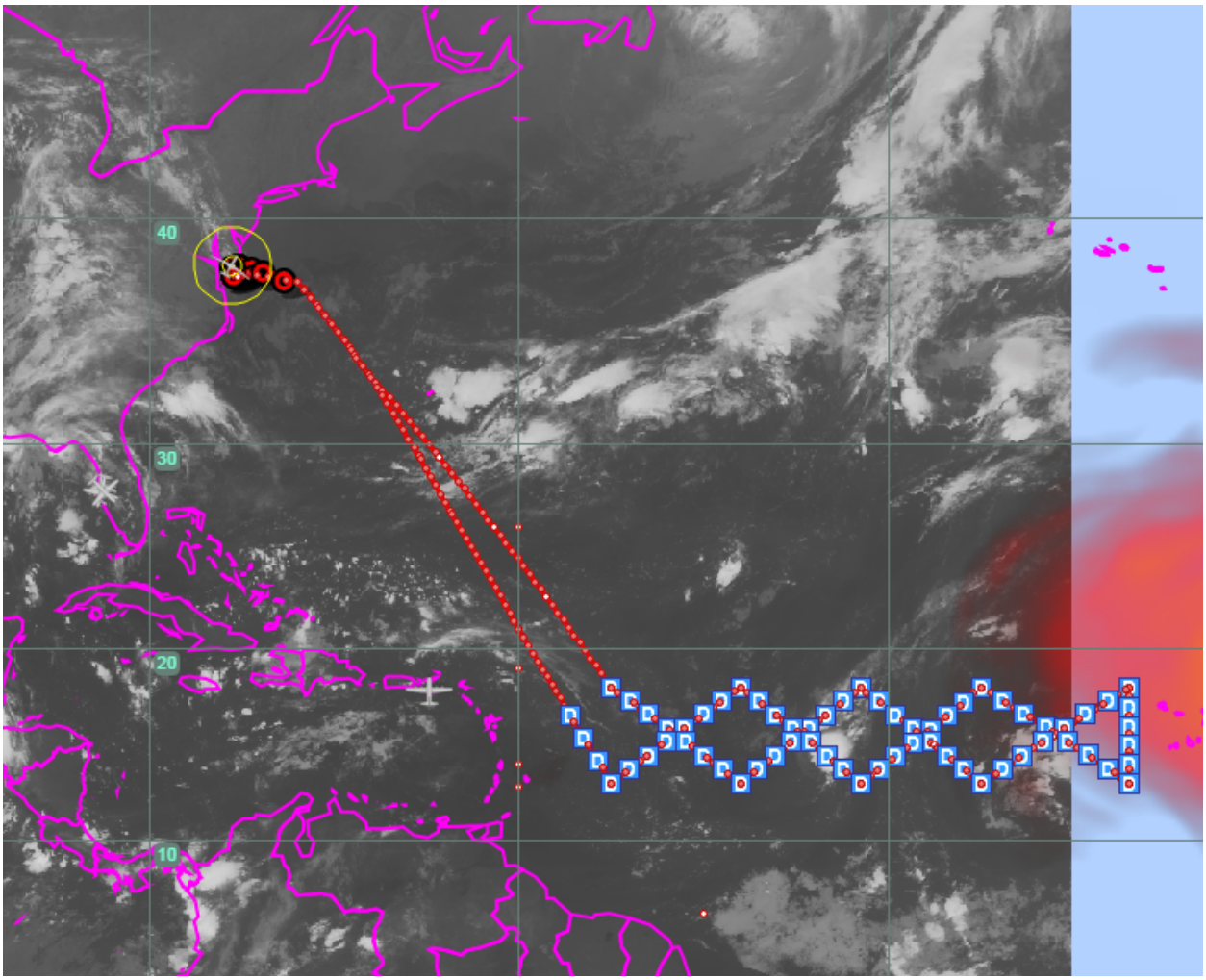


0700z MIMIC-TPW analysis of TPW. East end of flight pattern takes us just west of Cape Verdes.



GEOS-5 dust AOT shows weak dust intrusion on east end of track.

1048 Engine start



1052 Shows 0900UTC GOES IR image. Sawtooth pattern goes right over P42L at middle point of pattern (current location, of course) and P41L at eastern point of track.

1115 Starting taxi

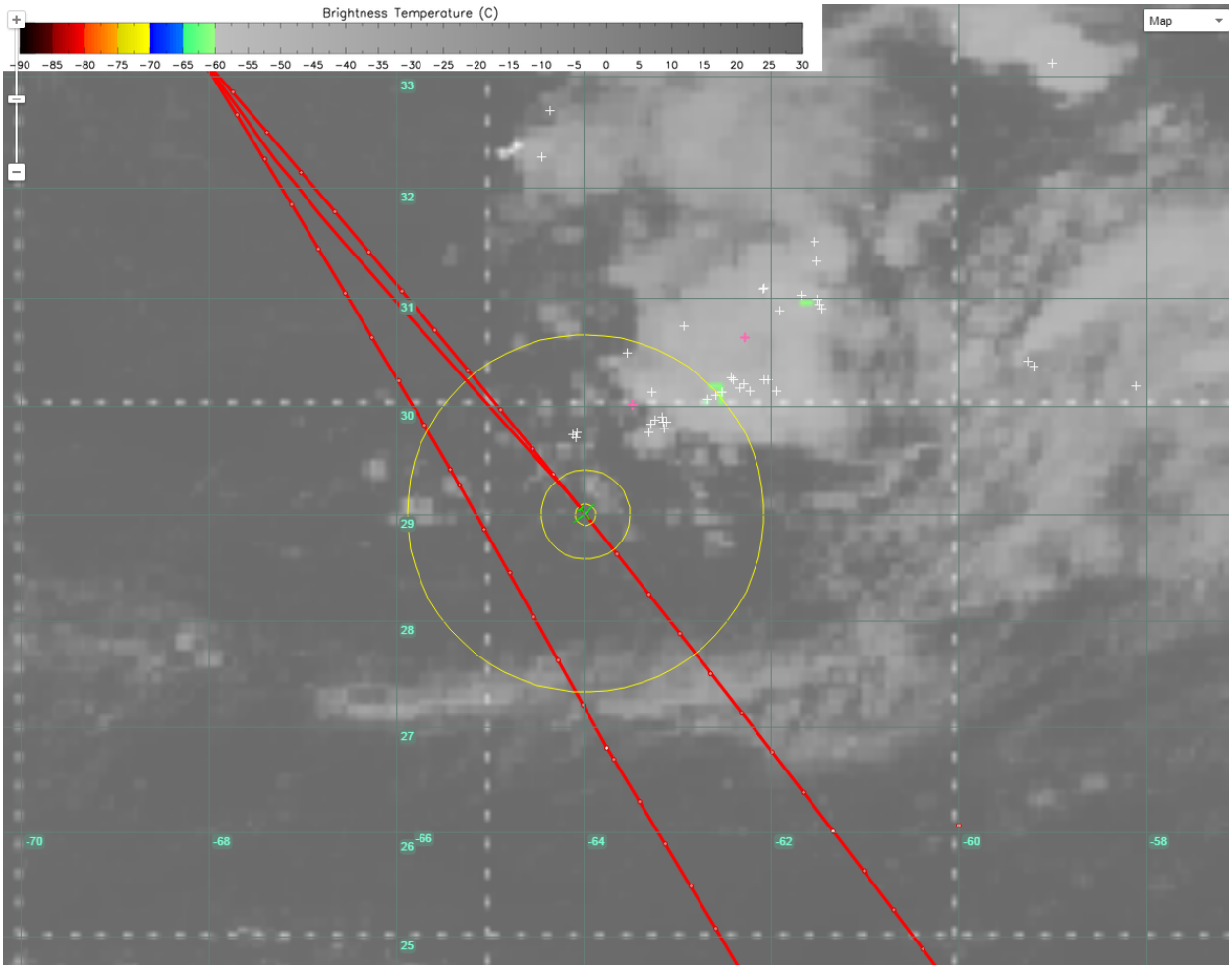
1119 Take off

1220 Seems like the plane encountered some turbulence which tripped an air speed warning fault. Talking to mission director Matt the plane doesn't measure turbulence directly but infers from changes in air speed. Air speed changed too rapidly, throwing a fault. Pilots did a control check maneuver and recovered from this, so we're back on track.

1311 Discussing planned change to track to get P42L position. Right now plan is to exit first leg a bit early at D07 and track ESE to 13N 45 W and then straight up to D15 position and pick up track again.

1343 A bit of fun at Fratello's expense from the pilots re: functionality of HD-VIS. Sigh.

1414 Overflying some cirrus from convection to our east. A good deal of lightning associated with these low clouds. See GOESE IR BT below.



1544 Pretty uneventful ferry to the zig-zag pattern.

1635 D01 released.

1648 D02

1700 D03

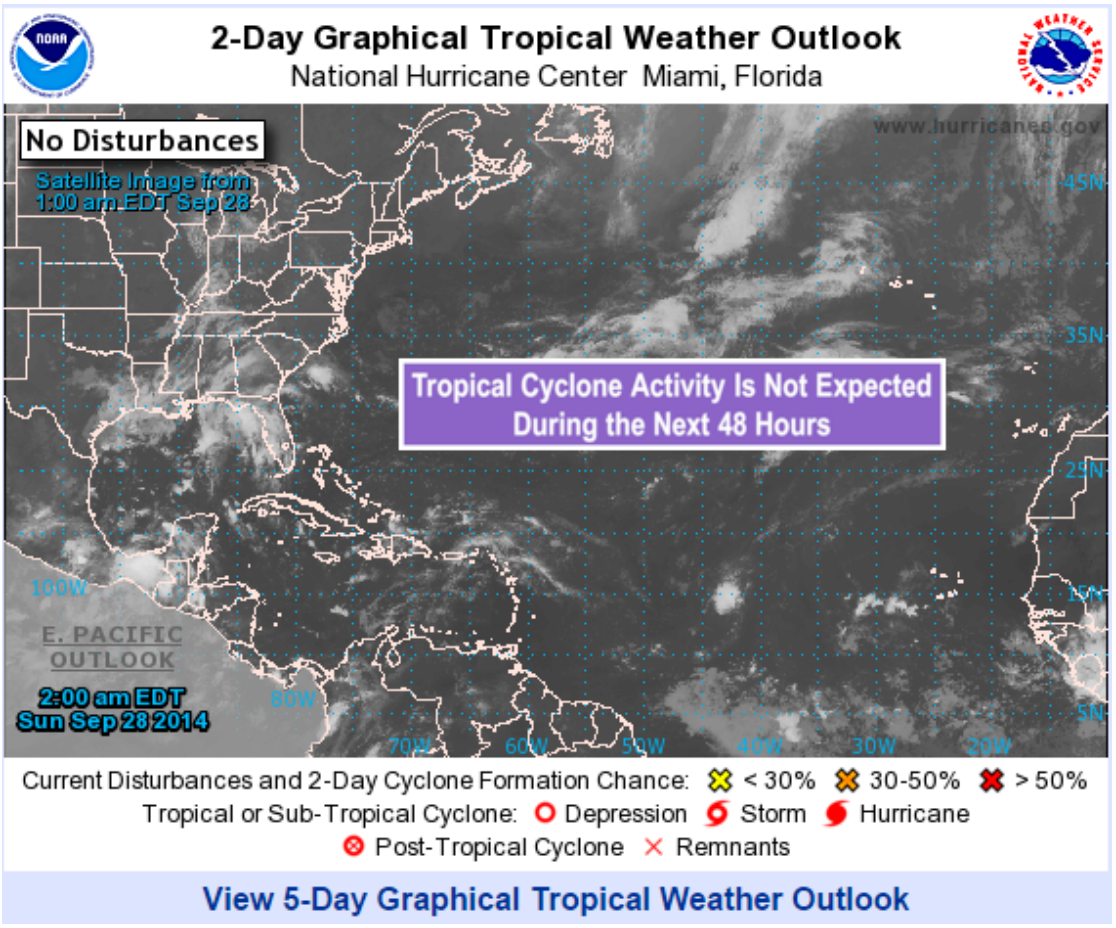
1713 D04

1726 D05

1739 D06

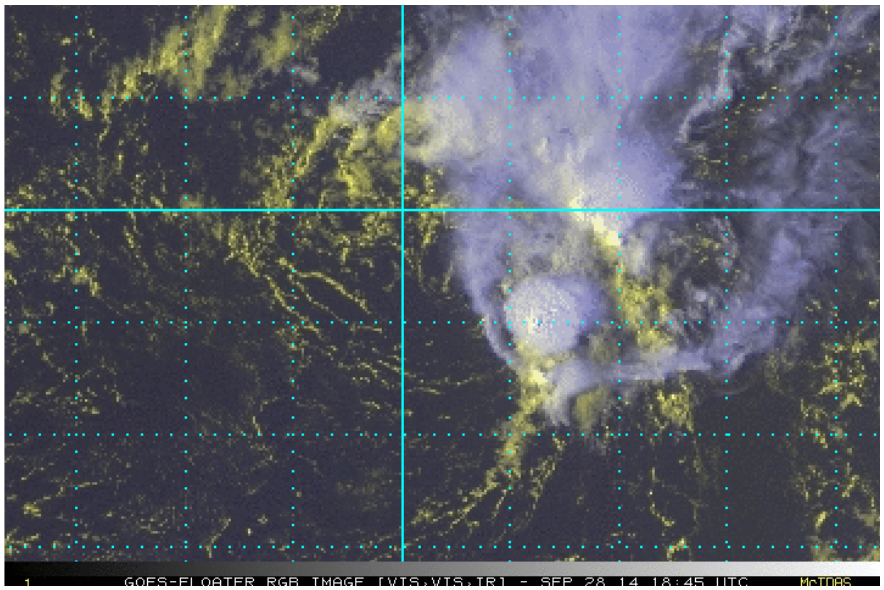
1752 D07

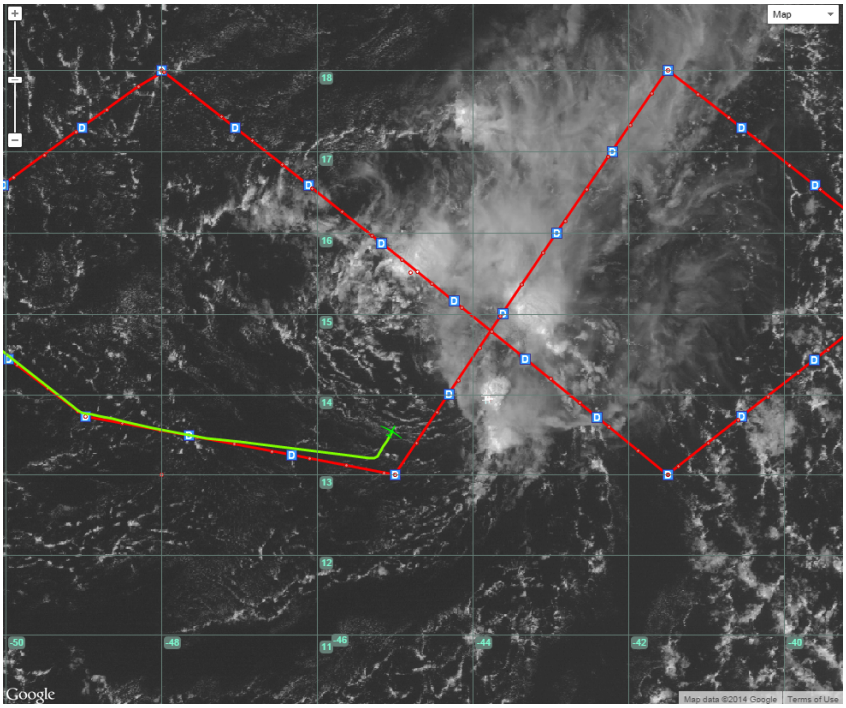
1805 D08



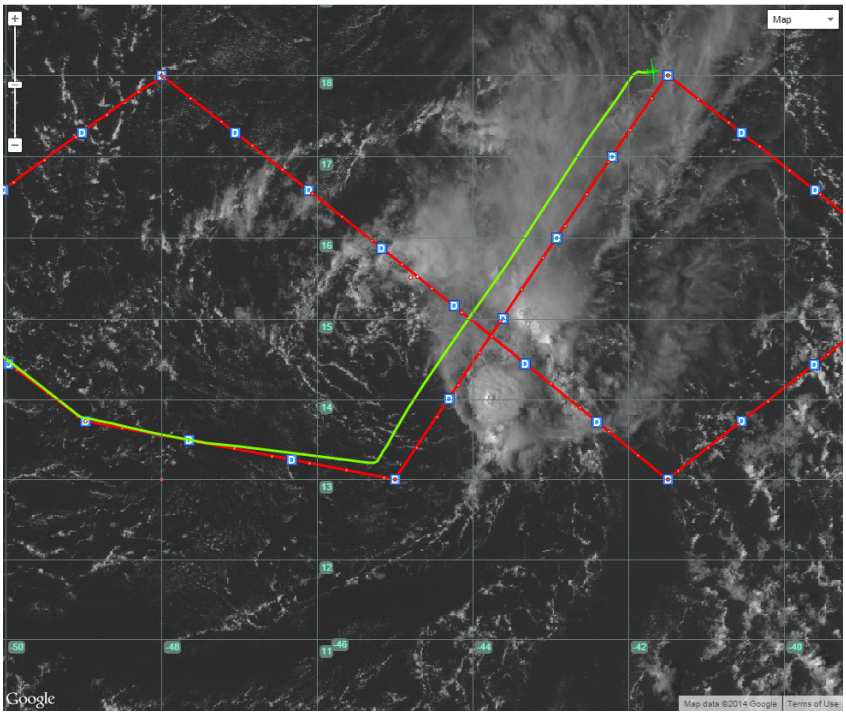
1133 Above- NHC outlook…

Drops D11 – D14 adjusted West ~20 nm. Dropped on lat line of original line. D11 adjusted to fall just south of center shown best on VIS/IR RGB image. D11 dropped at 1845Z, same time as image. MTS VIS seems frozen- more than 1-hr old images.



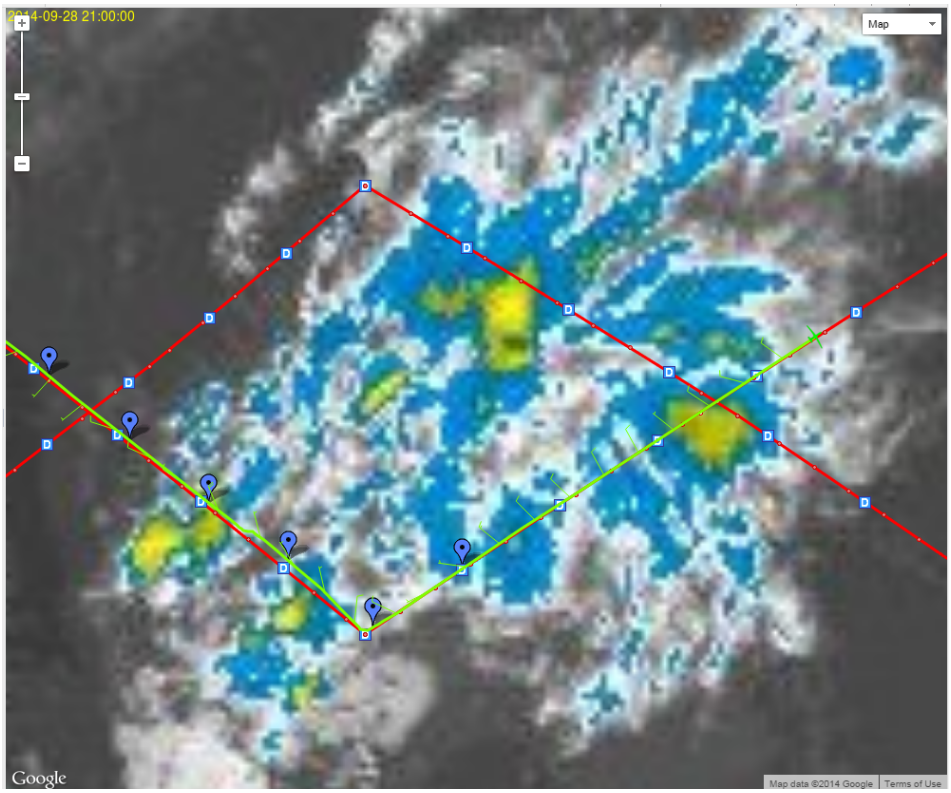


True time 1835Z, image time 1735Z

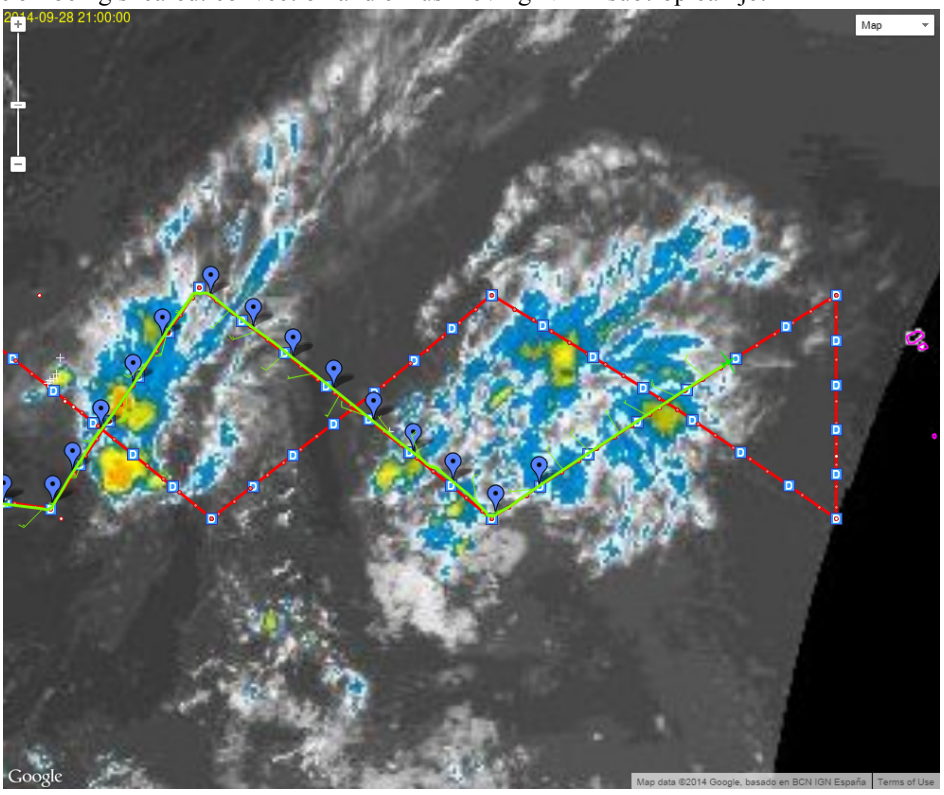


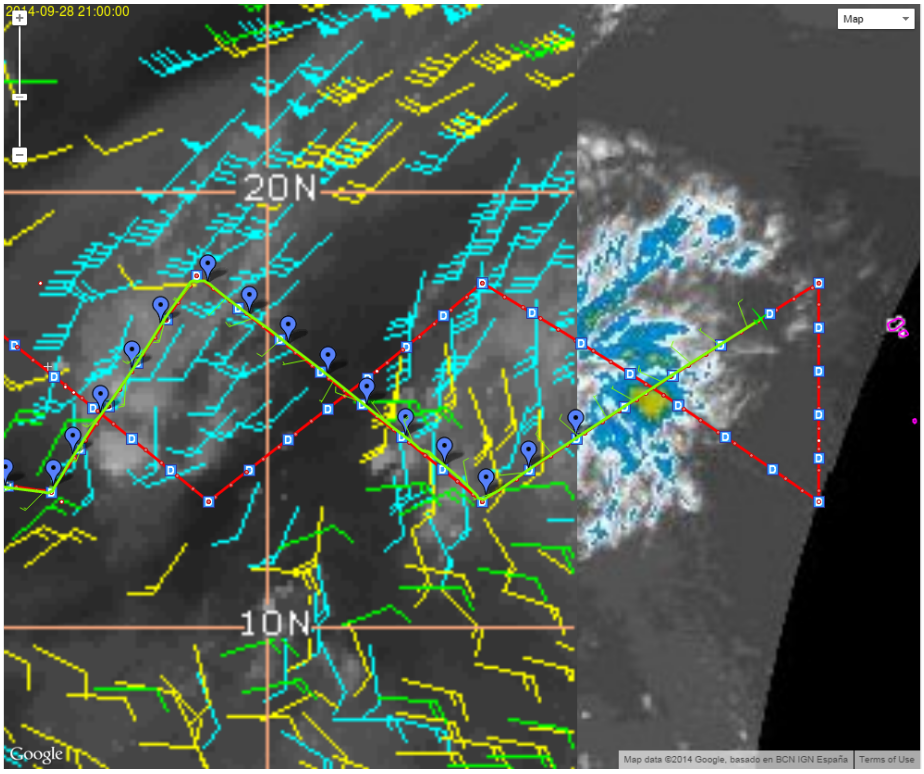
True time 1935Z, image time 1835Z, 96L

1hr 40 min to traverse P42L: 2025-2206Z:

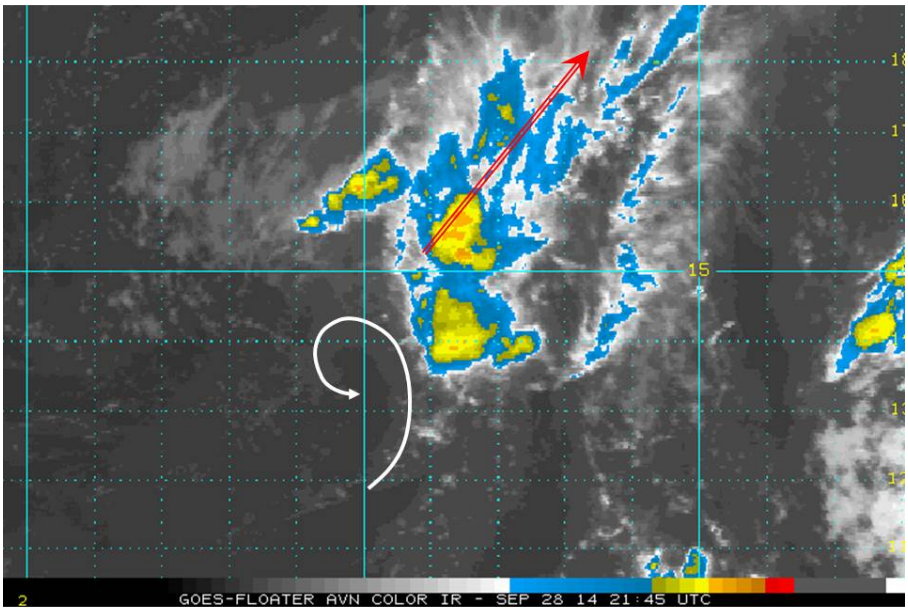


96L being sheared: convection and cirrus moving NE in subtropical jet

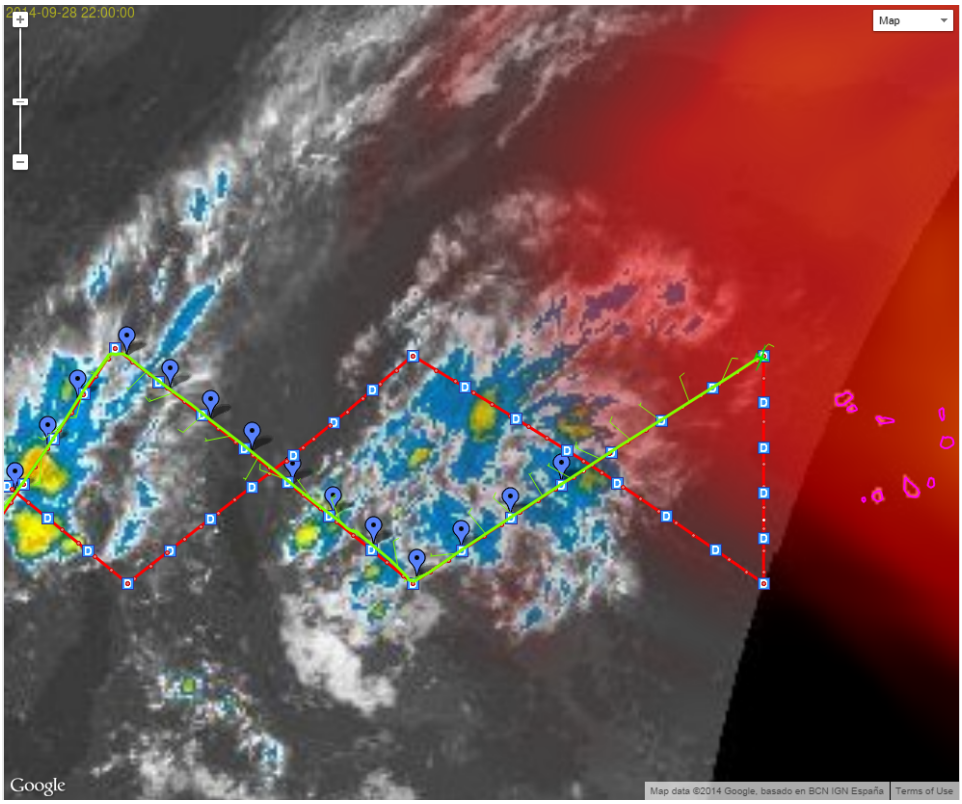




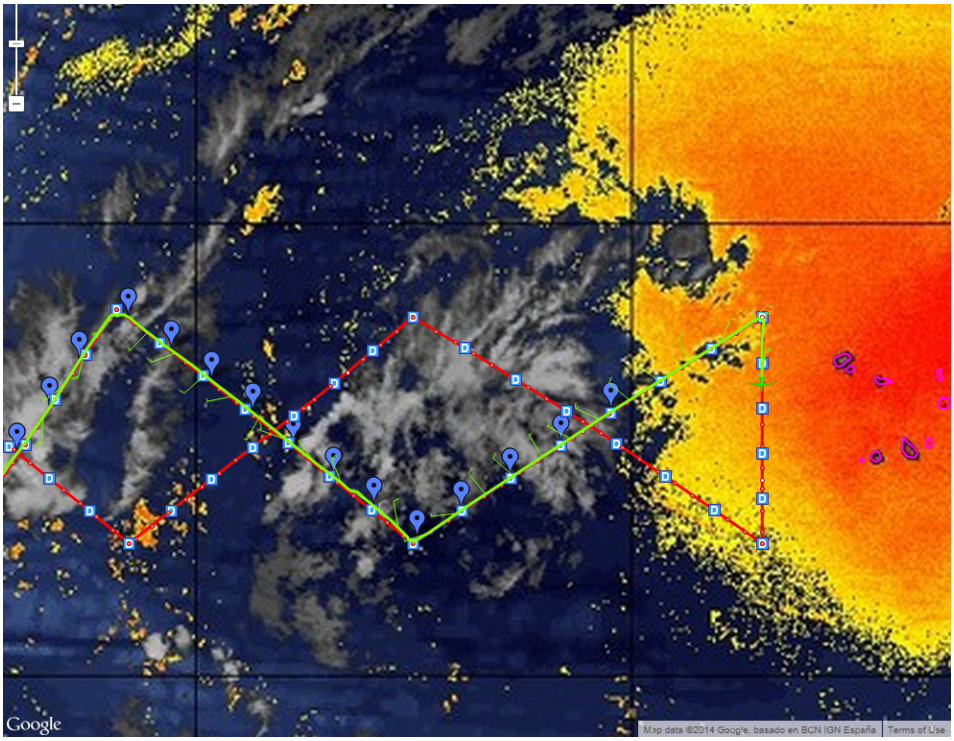
Upper AMVs 1800Z



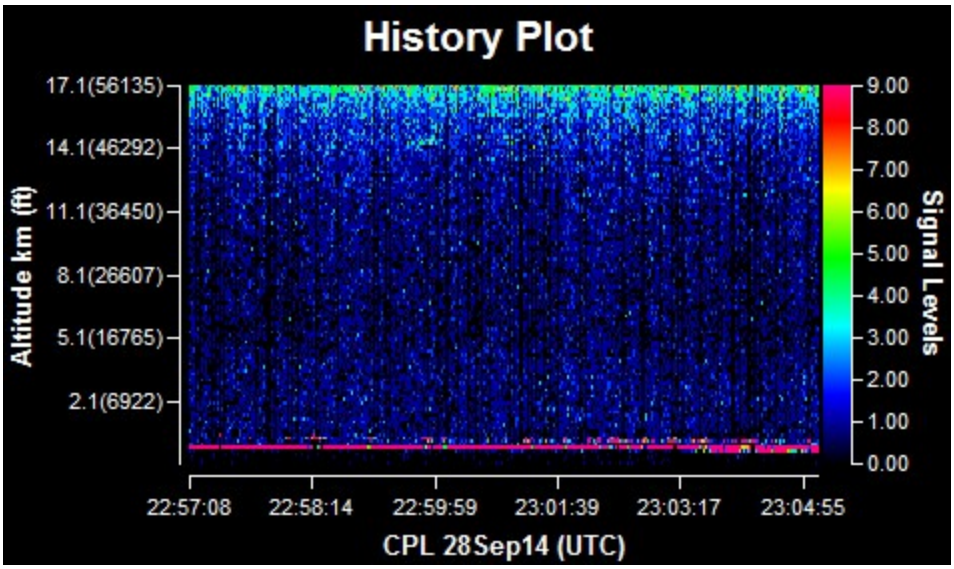
AVN IR 2145Z upper cloud convection mvg NE low lvl cyclonic WV feature mvg W

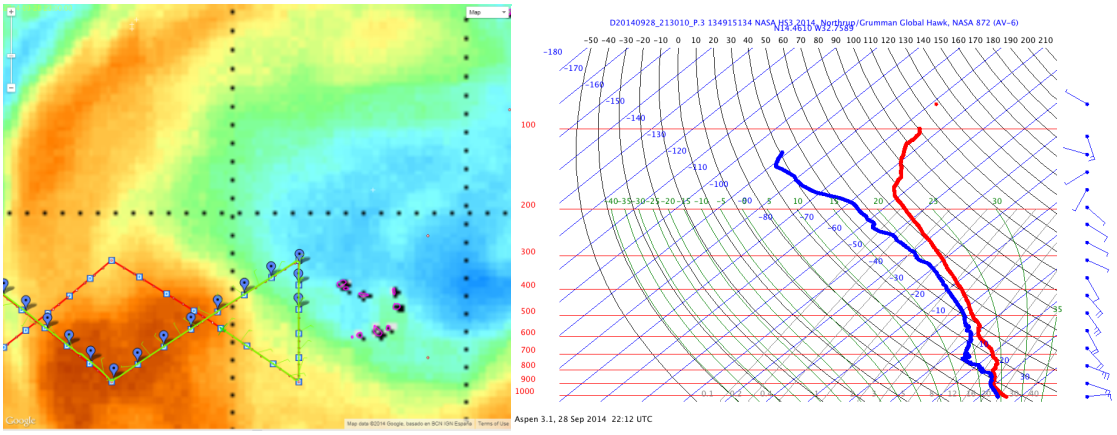


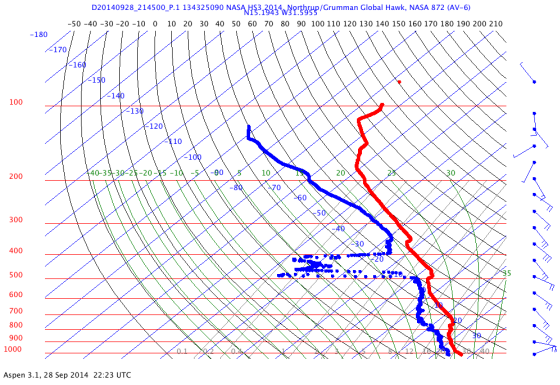
GEOS dust extinction AVN IR 2200Z P42L

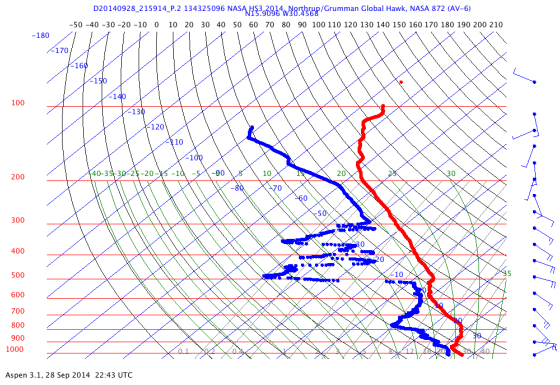


CIMSS SAL Meteo-10 2200Z

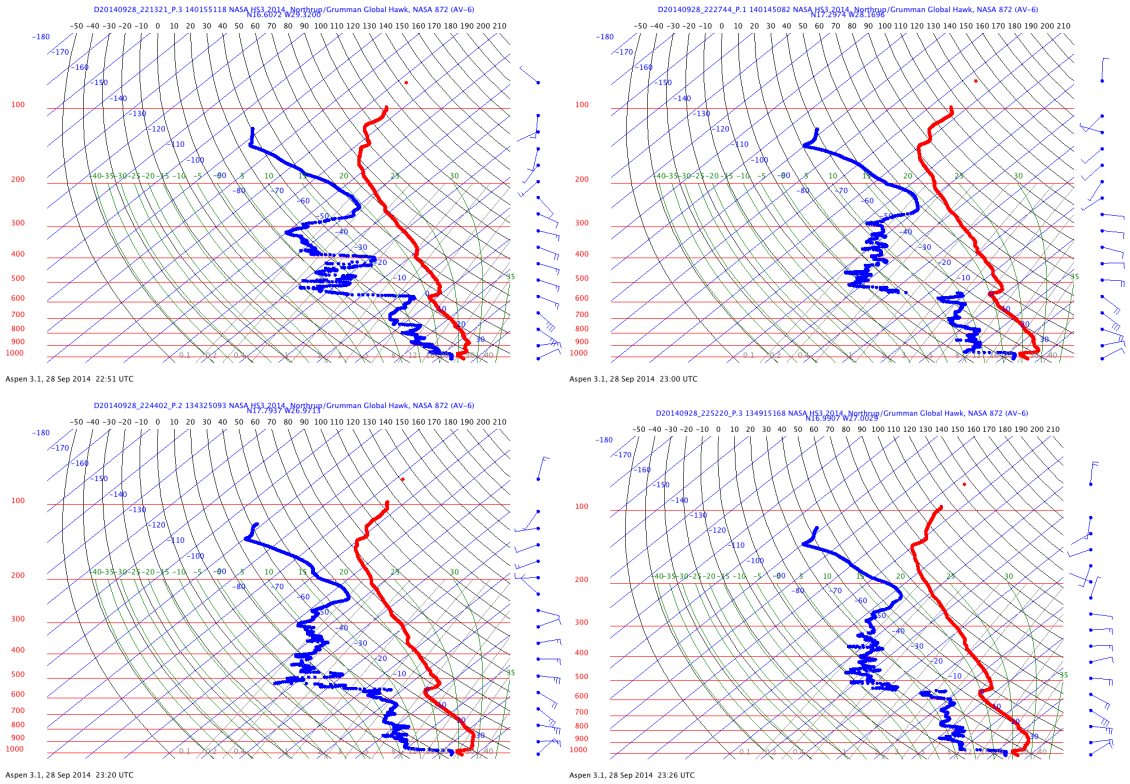




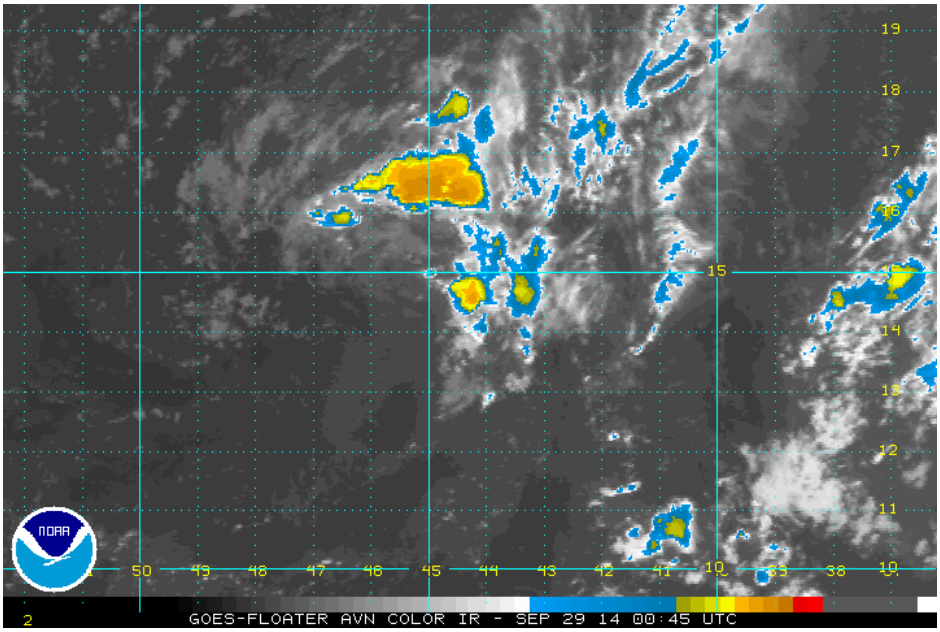




The sonde on the right is the third dropped on the long SW/NE leg in the image on the left. Despite the high-tpw airmass, a low-level inversion is evident, which appears to be restricting convection. Is this a thin layer of SAL air getting into the wave? The GOES dust extinction suggests that dust occupies much of this wave. The inversion strengthens to the northeast along the leg (subsequent sondes shown), and an additional mid-level inversion becomes apparent.



Four of most northeastern sondes show a double inversion. Lower inversion associated with SAL, higher inversion is likely subsidence driven.

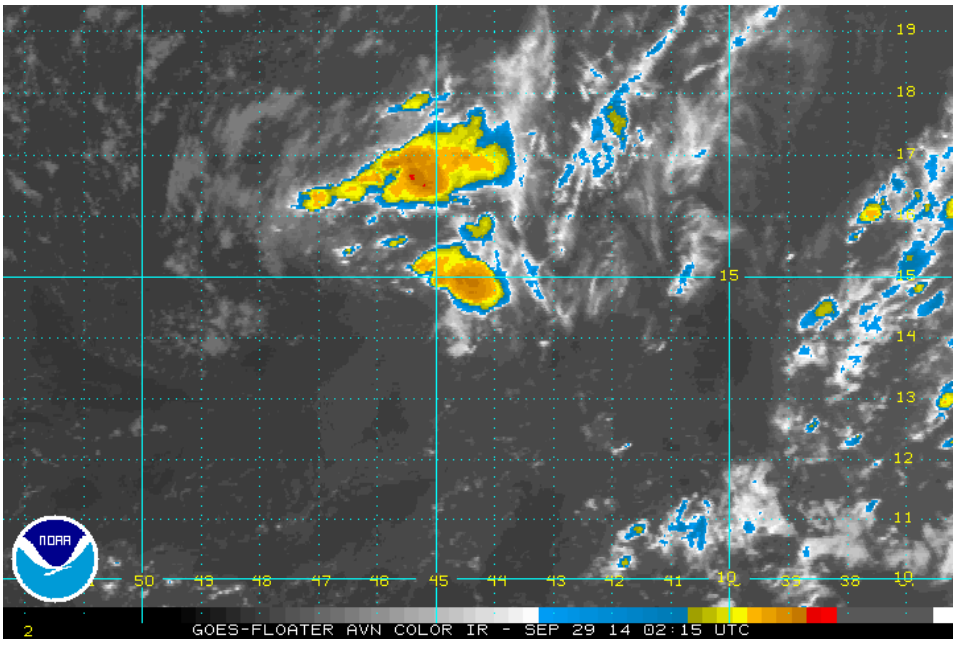


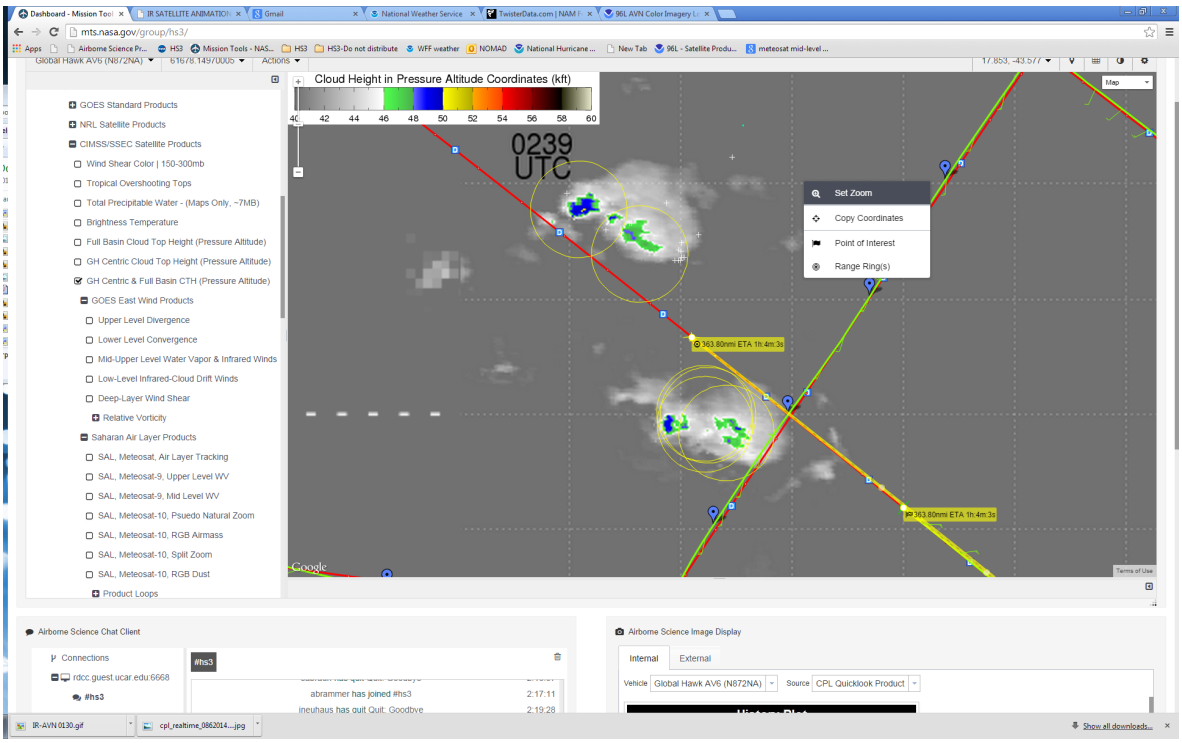
Some decent convection just east of our flight path. Active lightning, but cloud tops less than 50 kft.

D47 Pitched Out at 0222Z.

D48 Pitched Out at 0237Z

D49 Pitched Out at 0247Z

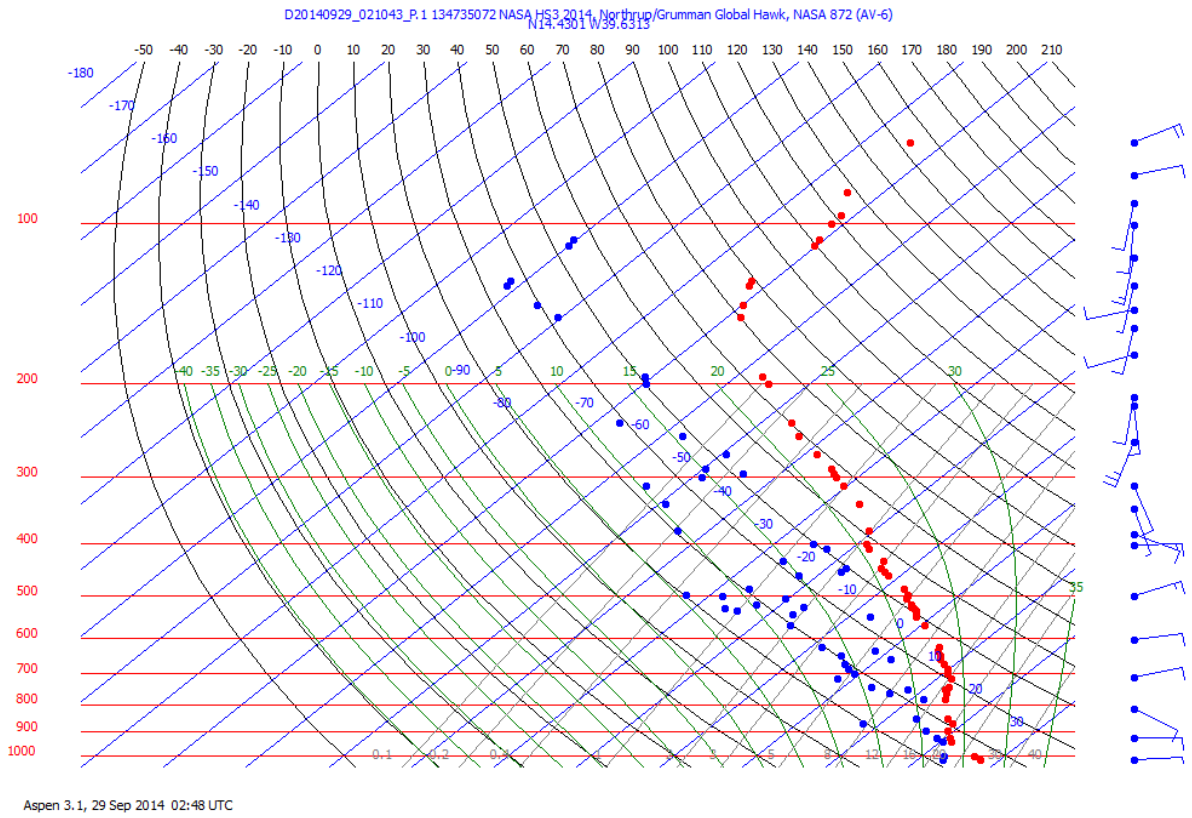




This shows the GH approaching both convective cells of 96L, cloud top heights are below 50 kft. These cells have been producing frequent lightning.

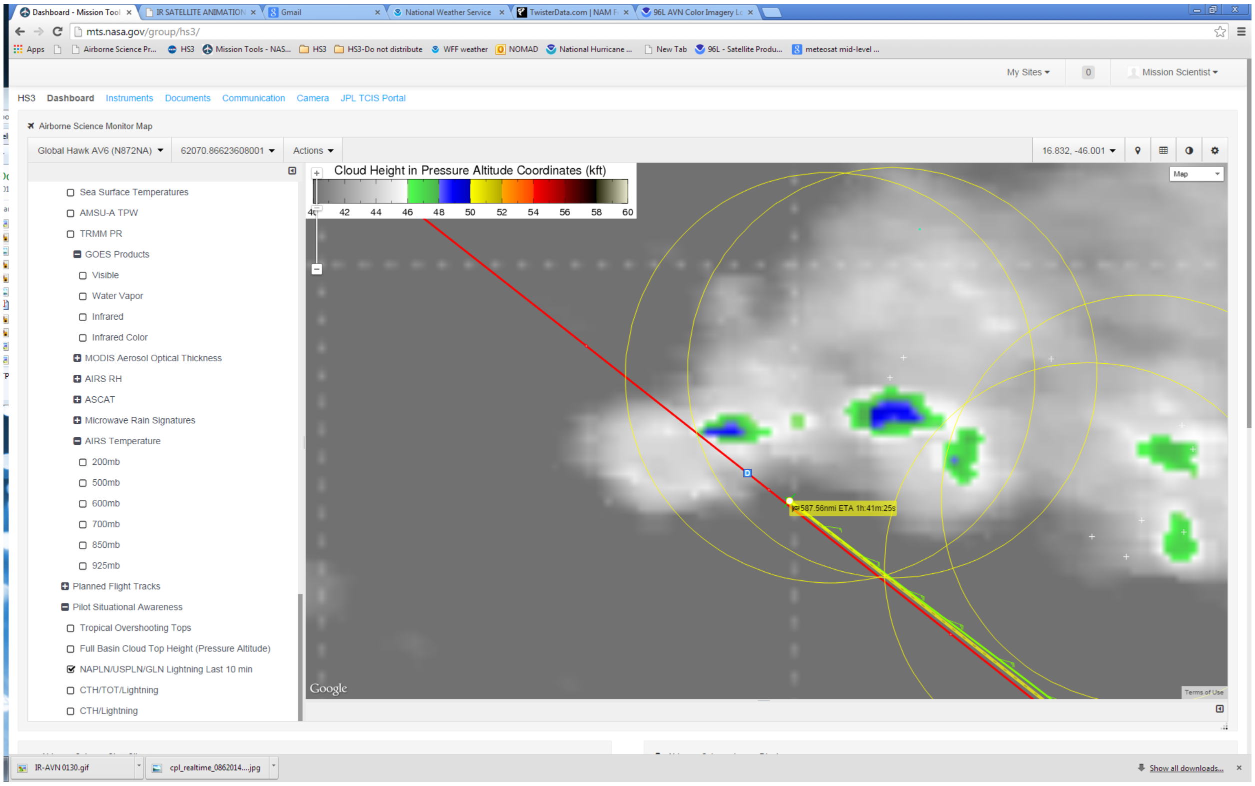
D50 Pitched Out at 0259Z.

D46 possible fast drop – see below.



D51 Pitched Out at 0311Z.

D52 Pitched Out at 0322Z


Dashboard - Mission Tool
mts.nasa.gov/group/hs3/
My Sites
Mission Scientist
HS3
Dashboard
Instruments
Documents
Communication
Camera
JPL TCIS Portal
Airborne Science Monitor Map
Global Hawk AV6 (N872NA)
62070.86623608001
Actions
16.832, -46.001
Map
Cloud Height in Pressure Altitude Coordinates (kft)
40 42 44 46 48 50 52 54 56 58 60
Sea Surface Temperatures
AMSU-A TPW
TRMM PR
GOES Products
Visible
Water Vapor
Infrared
Infrared Color
MODIS Aerosol Optical Thickness
AIRS RH
ASCAT
Microwave Rain Signatures
AIRS Temperature
200mb
500mb
600mb
700mb
850mb
925mb
Planned Flight Tracks
Pilot Situational Awareness
Tropical Overshooting Tops
Full Basin Cloud Top Height (Pressure Altitude)
NAPLN/USPLN/GLN Lightning Last 10 min
CTH/TOT/Lightning
CTH/Lightning
Google
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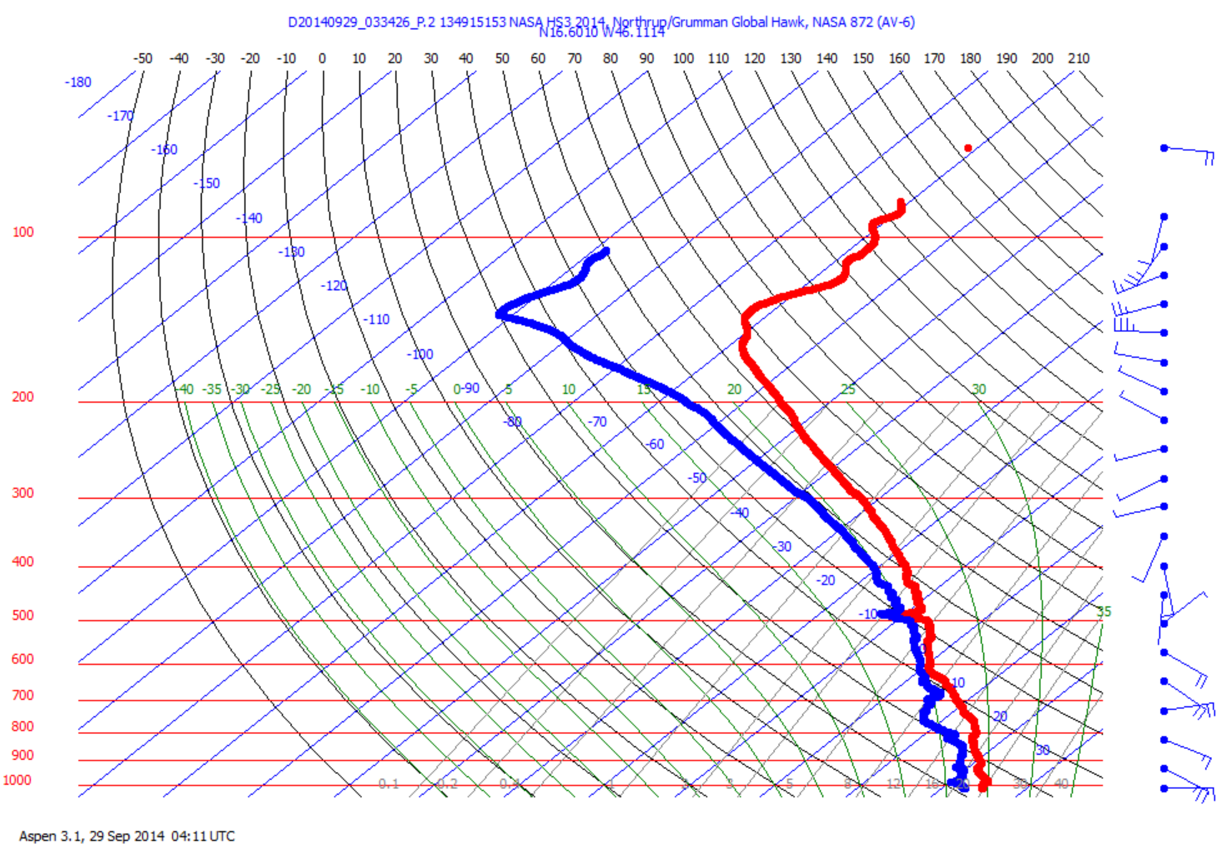
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N16.6010 W46.1114
-50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210
100
200
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500
600
700
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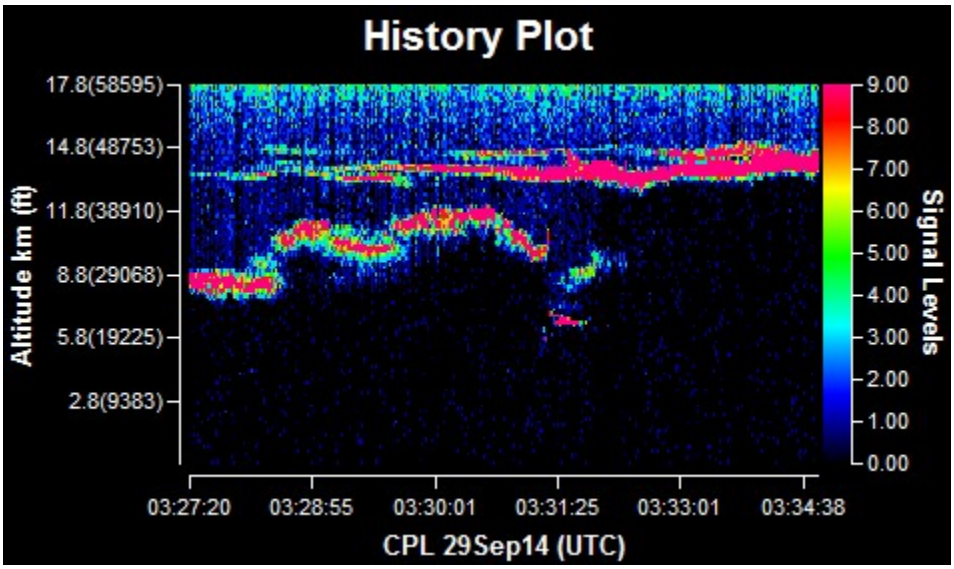
1000
Aspen 3.1, 29 Sep 2014 04:11 UTC

D53 Right near a convective cell. Interesting kink feature at -10C, not sure what to make of it.

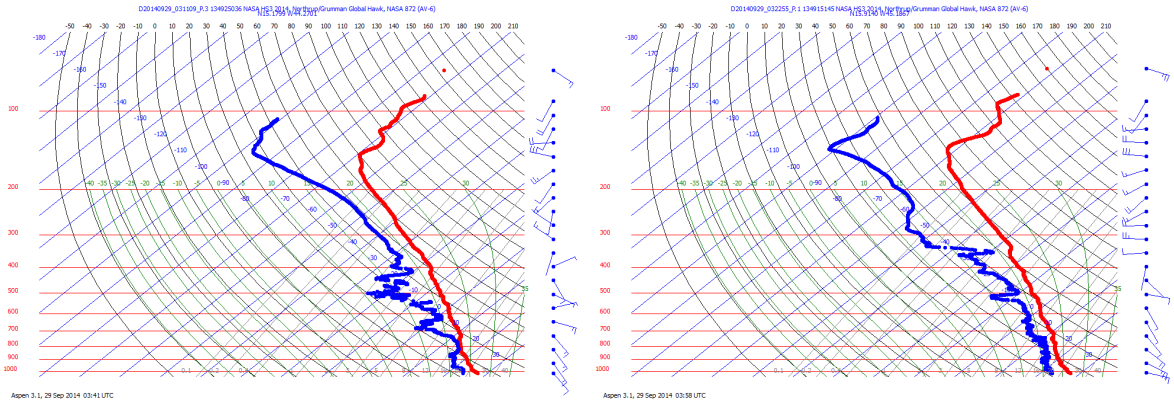
D53 Pitched Out at 0334Z.



CPL image from the pass near the convective cell.

D54 Pitched Out at 0346Z.

D51/D52 Soundings, environment of deep convection associated with 96L, unstable sounding, good shear.



D55 Pitched out at 0358Z.

D56 Pitched Out at 0410Z.

D57 Pitched Out at 0423Z.

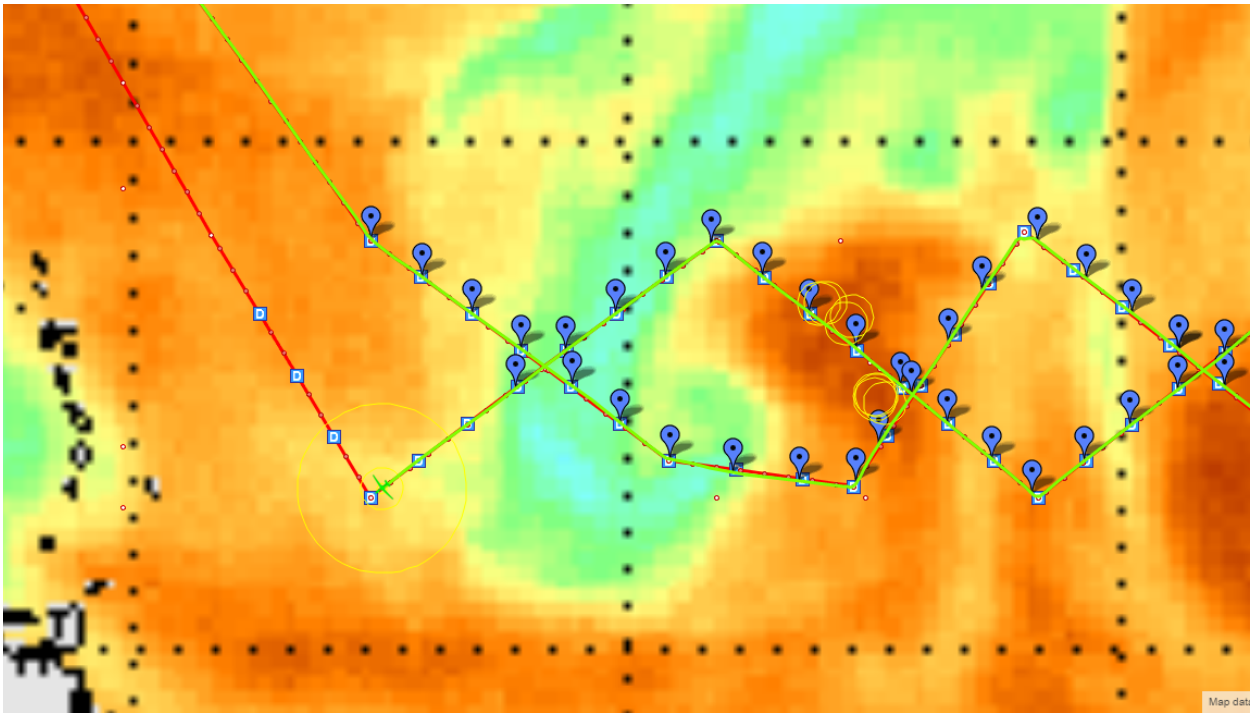
D58 Pitched Out at 0436Z.

D59 Pitched Out at 0449Z

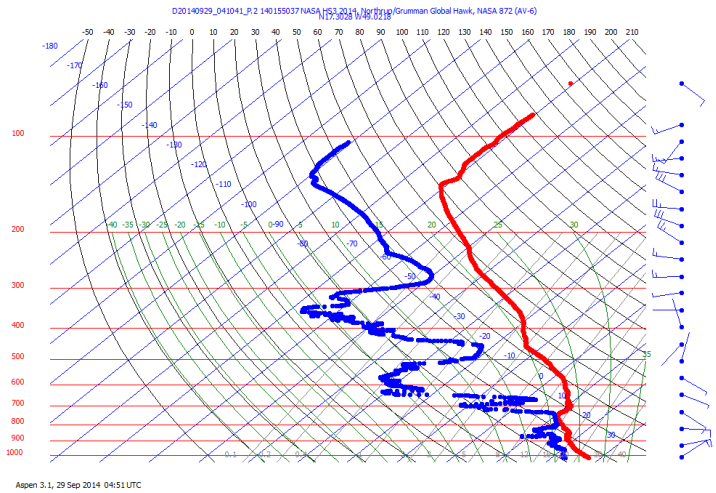
D60 at 0502Z.

D61 at 0514Z.

D62 at 0527Z.



0526 MIMIC TPW shows tongue of dry air wrapping around to the west of P42

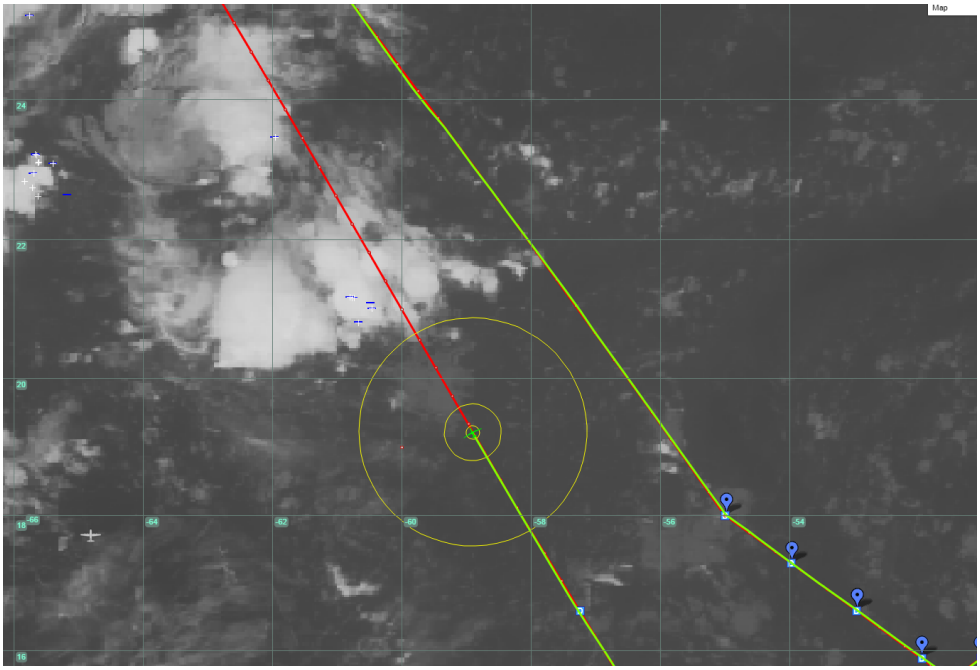


Dropsonde at 0410Z was in the middle of that dry slot. Shows subsidence occurring above the inversion at 700mb. The changes in dew point and temp around 450mb indicates possible separate layer of subsiding air.

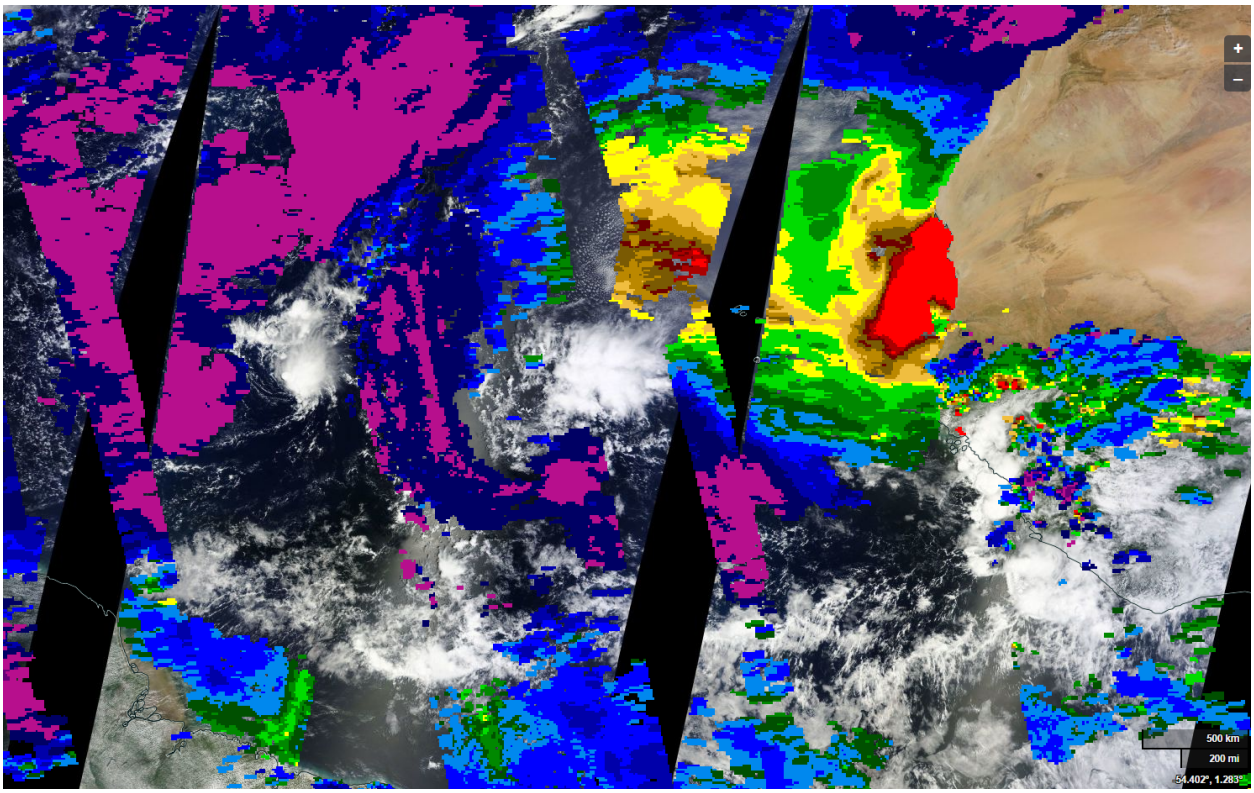
D63 at 0540Z.

D64 at 0554Z

D65 at 0609Z

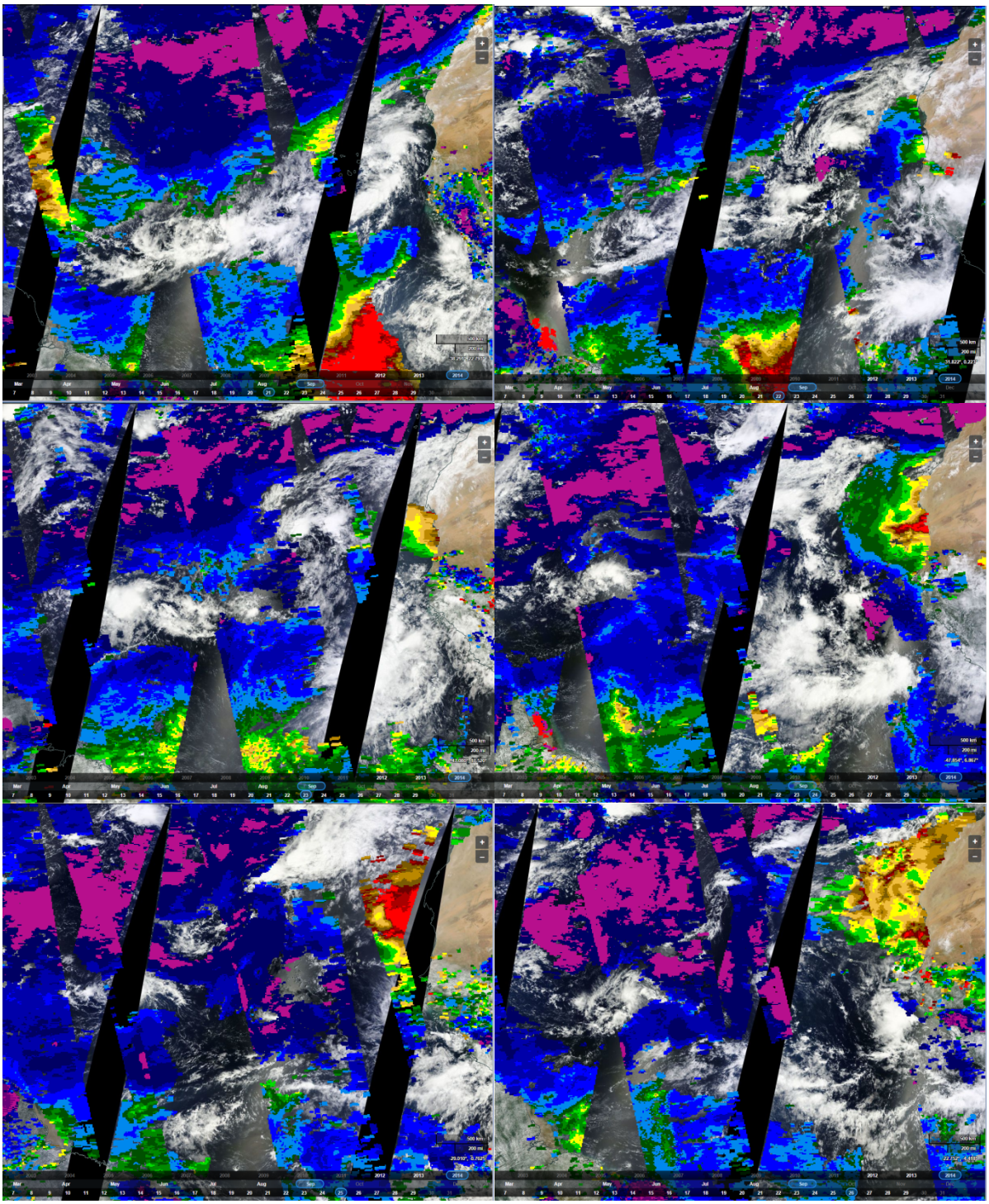


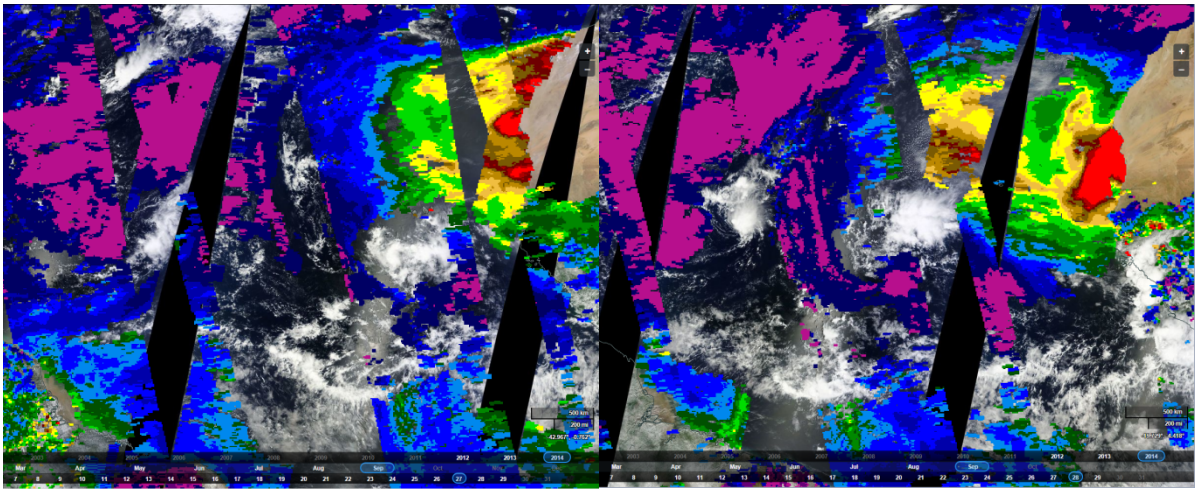
0642Z Approaching eastward moving clouds on the ferry back. Cloud top heights are remaining below 50kft. There is non-frequent lightning and plane is at 62kft, so no weather diversion necessary.

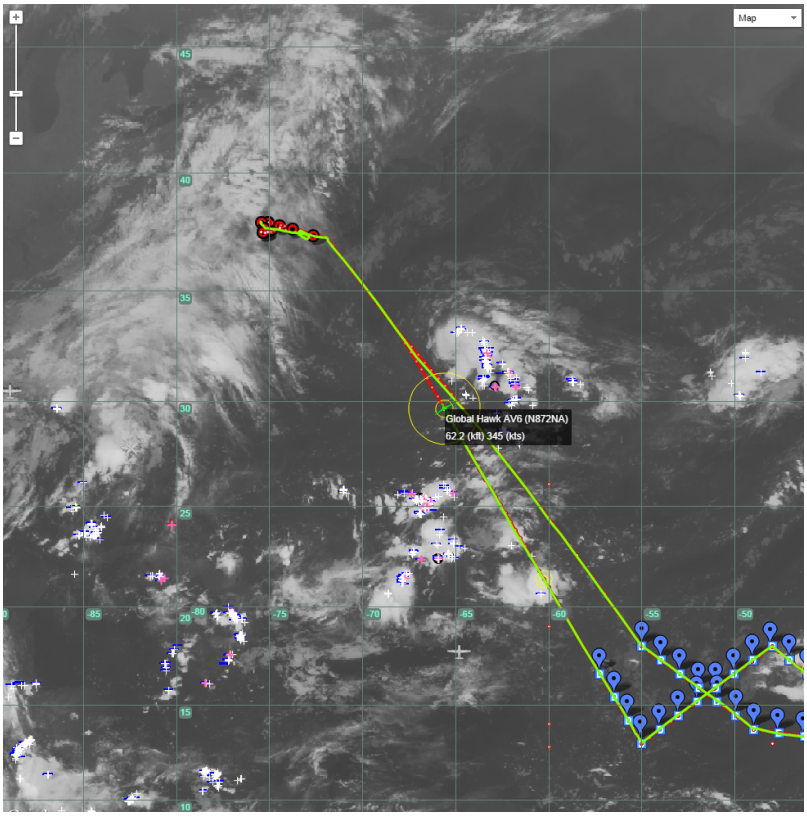


NASA Worldview real-time plot of MODIS AOD for Sept. 28. P42 is the western cloud system, P41 is the system in the middle of the image. A Significant outbreak of Saharan dust is seen north and west of P41, but the very dry air that we have been seeing wrapping into P42 is dust free and therefore likely of non-Saharan origin.

The time series of AOD images below, from Sept. 21-28, shows that on Sept. 21 there was a small amount of dust very close to P42L and a suggestion that higher AOD had moved westward away from the disturbance. Over the next 3 days, the amount of dust detected gradually diminished until ~Sept. 25-26, when the environment near the system became essentially dust free. One can also see the progression of dust-free air moving southward to eventually dominate the environment around the storm.





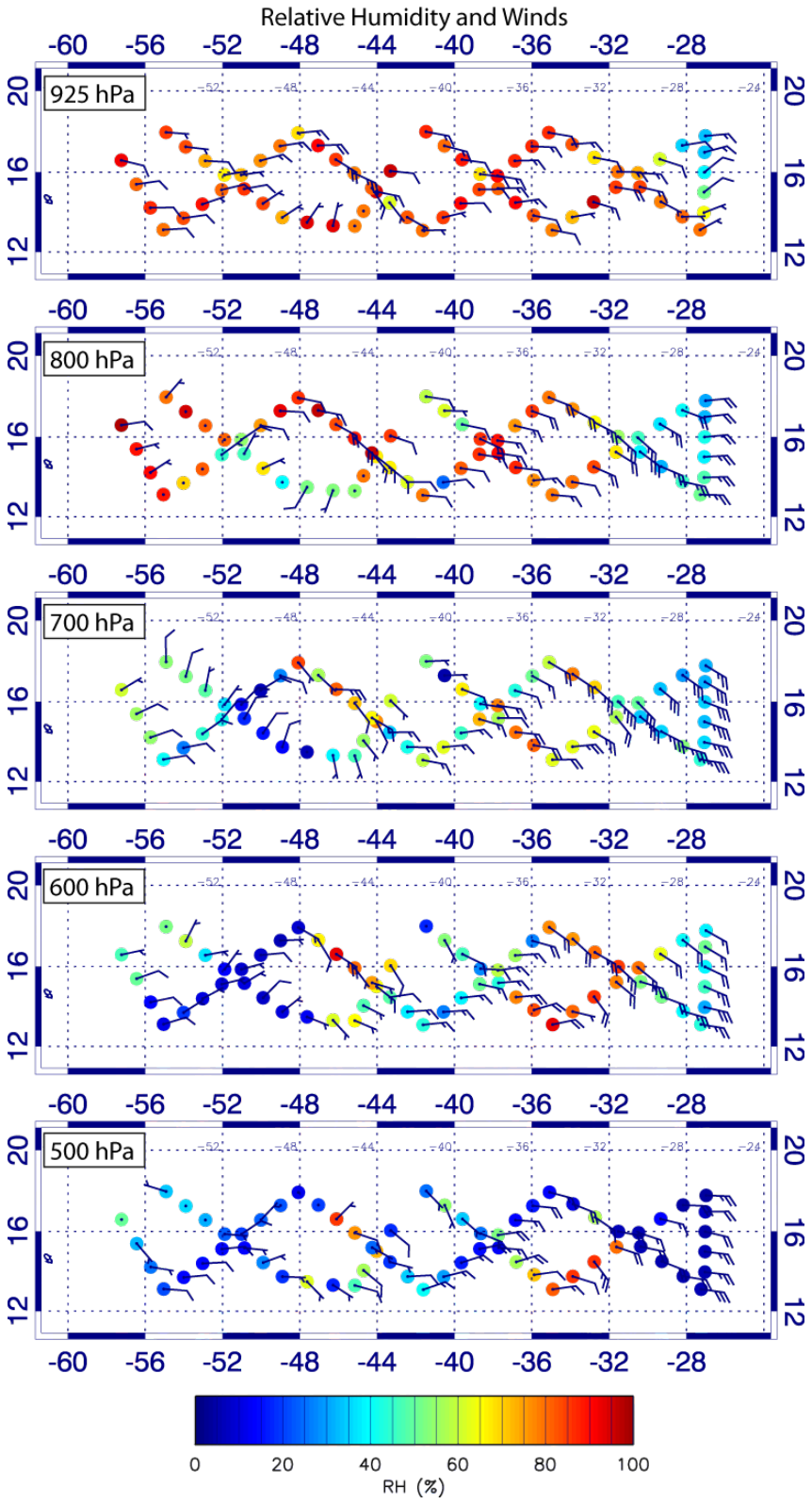


0847 Passing between two highly convective areas associated with a low pressure system that the NHC is now giving a 20% chance of developing in 2 days, but will get picked up by the next baroclinc wave to move offshore later tonight or tomorrow morning.

1038 Starting descent to 45 kft

1106 Starting descent to 12 kft

1132 AV6 has landed.



The above plots show relative humdity at the indicated levels for the MDR survey. Dry Saharan air was seen at low levels in the eastern Atlantic and became even drier near the top and above the SAL (500 mb

and above). In the westen MDR, dry air was seen at low levels but became even drier than the SAL at 700 and above.

Instrument Reports

AVAPS

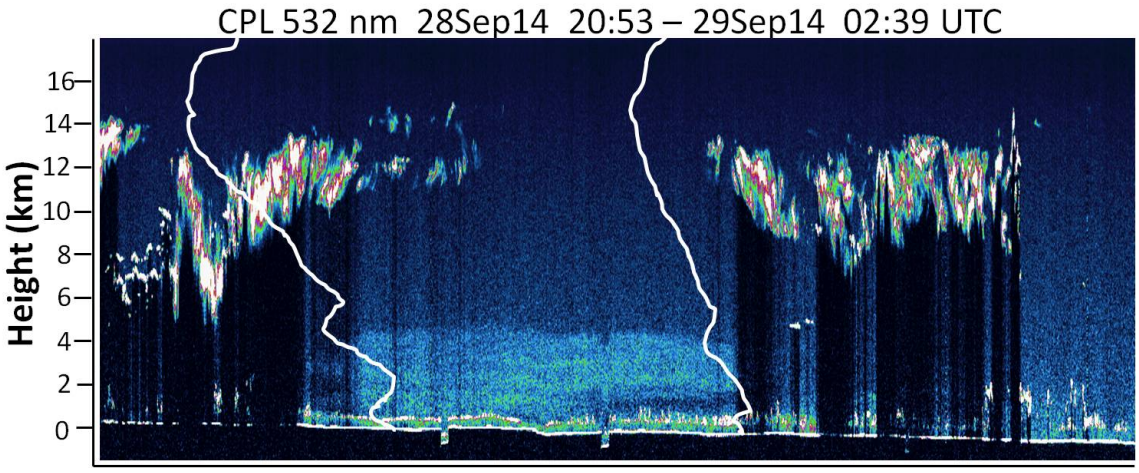
AVAPS loaded and successfully deployed 65 sondes during RF10 which was the second mission through the MDL. Operationally AVAPS performed extremely well and the only immediately obvious data issue was an apparently faulty temperature sensor on a single sonde (drop 14). Both temperature and humidity data were rejected in real-time processing. All data were processed and transmitted in real-time though the graphics for drop 42 were not visible on the ESRL server at the end of the mission. Further enhancements were completed to the automated data transfer methods that now can account for dropouts in Ku satellite coverage during data relay to the ground. Post flight system testing revealed no issues and the system is ready for the dropsonde intercomparison planned for the aircraft transit back to AFRC.

Sondes Allocated		**750**	
Remaining		**109**	**14.53%**
Released		**641**	**85.47%**
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
RF06	9/14/2014	80	352
RF07	9/16/2014	88	264
RF08	9/18/2014	50	214
RF09	9/22/2014	40	174
RF10	9/27/2014	65	109

CPL

CPL performed well during this science flight. No problems encountered other than the continued ringing of the 1064 channel. That problem seemed worse this flight than the last. All data was captured to disk and have been processed with products available on the CPL website. We did see some dust in the extreme eastern part of the flight path, though it was not optically

thick or too extensive. The attached 532 image shows the dust layer and some dropsonde temperature plots superimposed. One can easily see the SAL in the soundings and its correspondence to the aerosol layer. Interesting how shallow the marine boundary layer is in this region. 500 m at most I would say. CPL data spans 12:49 28Sep to 10:29 29Sep14 UTC.



S-HIS Summary for AV6 Science Flight #10, September 28-29 2014

J. Taylor; SSEC, University of Wisconsin-Madison

This flight was the second Atlantic MDR survey flight. While the prior flight took AV-6 directly eastward at 18 N, this flight employed a saw-tooth pattern for the outbound and return legs. The flight path is illustrated in Figure 1. Sondes were deployed at 13-minute intervals for the survey. Tropical wave activity continued to be weak, but the transits did intersect with the Saharan Air Layer (SAL), primarily at the eastern extreme of the flight path. The flight path on both the outbound and return legs sampled P41L and P42L.

The S-HIS operated nominally for the full duration of the flight.

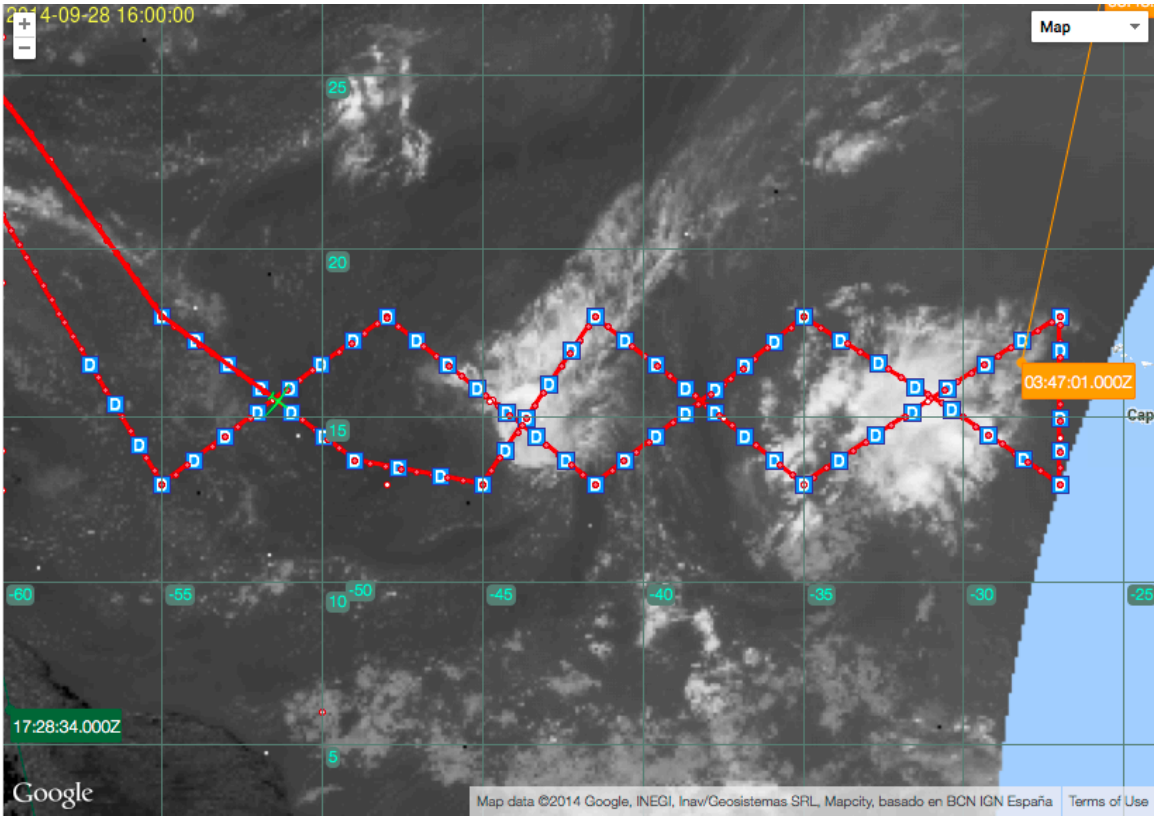


Figure 1: AV-6 flight path.

While the primary SAL region was at the easternmost portion of the flight path, the METOSAT split window SAL imagery generated by CIMMS/SSEC also indicated patches of dry air west of P42L (Figure 2).

The CIMSS/SSEC SAL products showing mid-level and top-level water vapor along with the pseudo natural image are provided in Figure 3. The extent of the mid-level dry air is notable, and also evident in the S-HIS RH profiles. The S-HIS retrieved nadir RH profile for the beginning of this region as well as the northern end of the north-south leg are provided in Figure 4 and Figure 5, respectively. The S-HIS and AVAPS skew-T comparison plot for the 2244 UTC (2014-09-28) dropsonde is provided in Figure 6. This sounding was noted to be a classic ENATL SAL sounding with a dry slot from ~955-550 mbar.

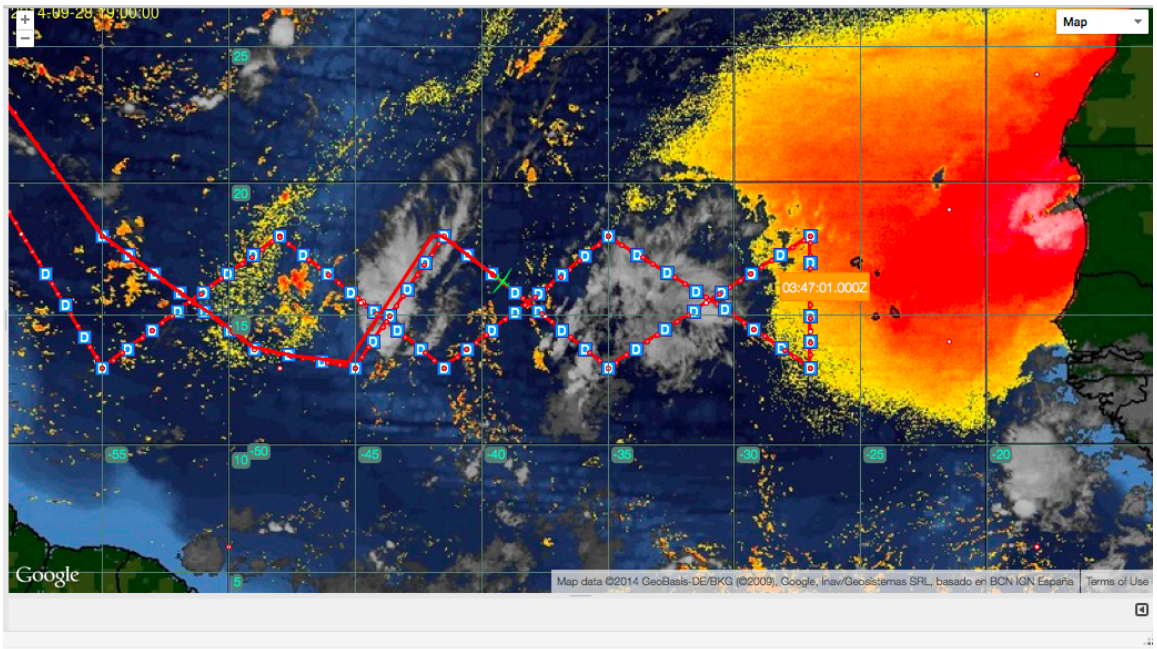
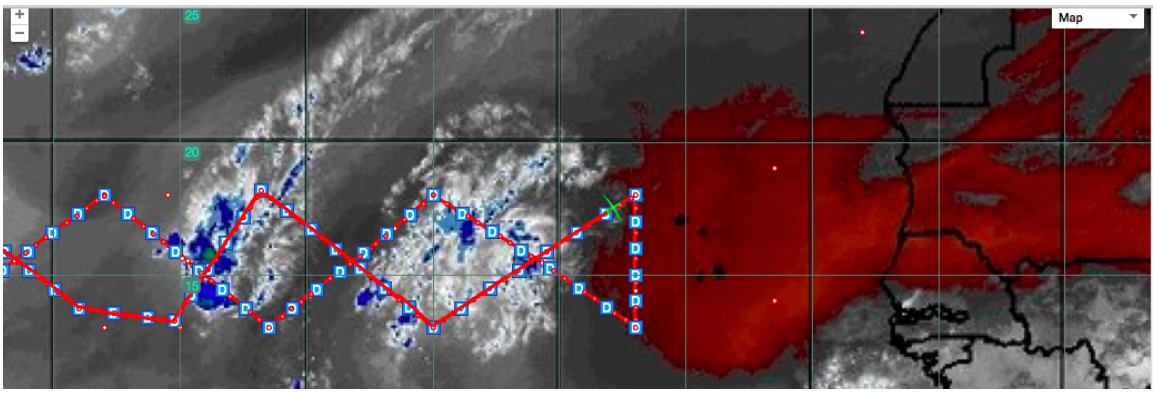
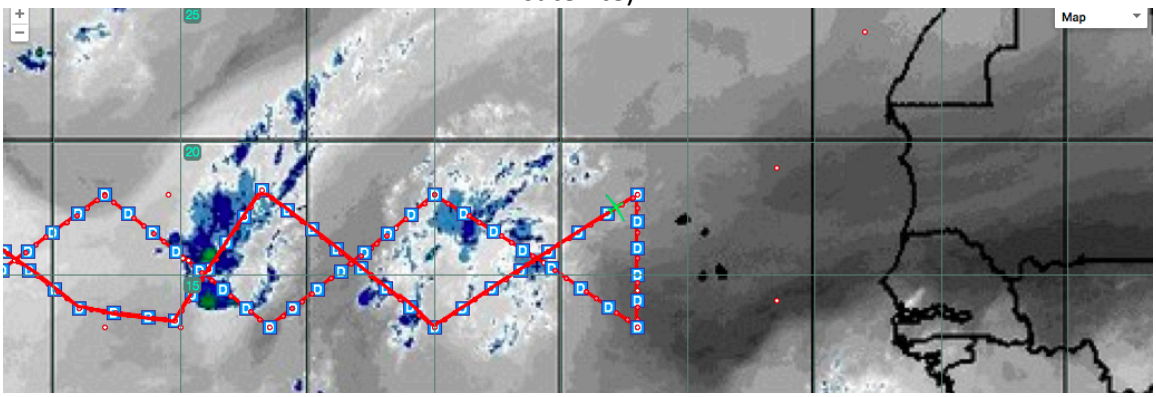


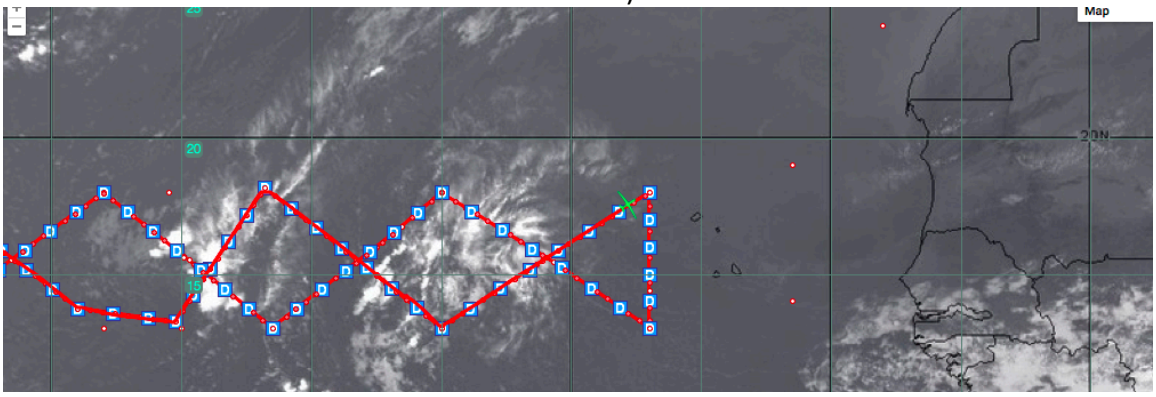
Figure 2: METEOSAT split window SAL imagery overlaid by AV-6 flight track. Small patches of SAL air are indicated west of P42L, but only the easternmost portion of the flight path samples the primary outbreak.



(a) Mid-level water vapor (constructed using the 7.3µm channel on the Meteosat-8 satellite)



(b) Upper-level water vapor (constructed using the 6.2µm channel on the Meteosat-8 satellite)



(c) Pseudo natural color

Figure 3: CIMSS/SSEC imagery in MTS (a) Mid level water vapor; (b) Upper level water vapor; (c) pseudo natural color.

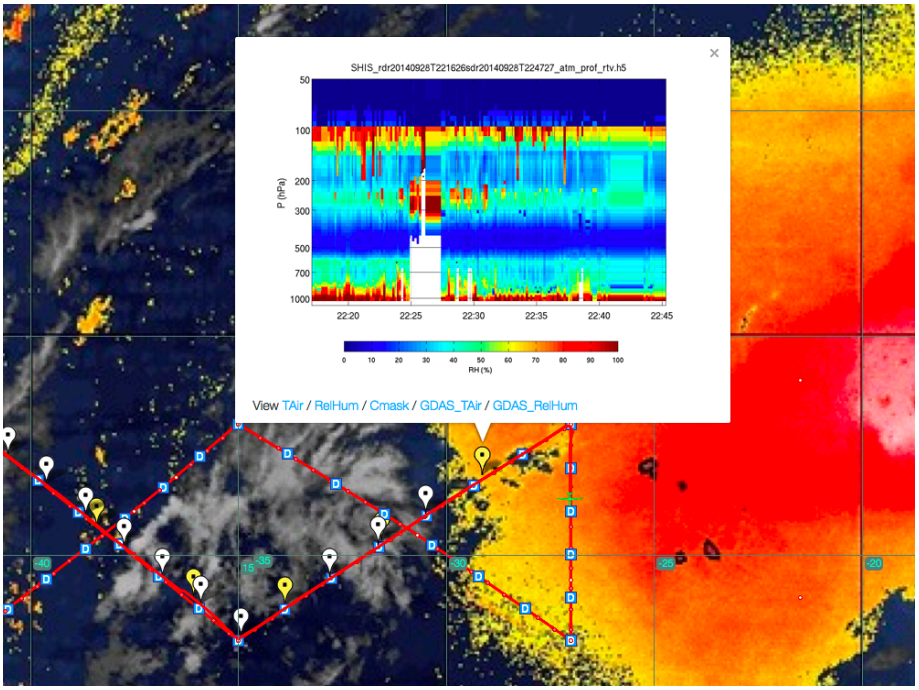


Figure 4: S-HIS retrieved RH profile 2215 – 2245 UTC (2014-09-28). Note the extremely dry mid-level layer.

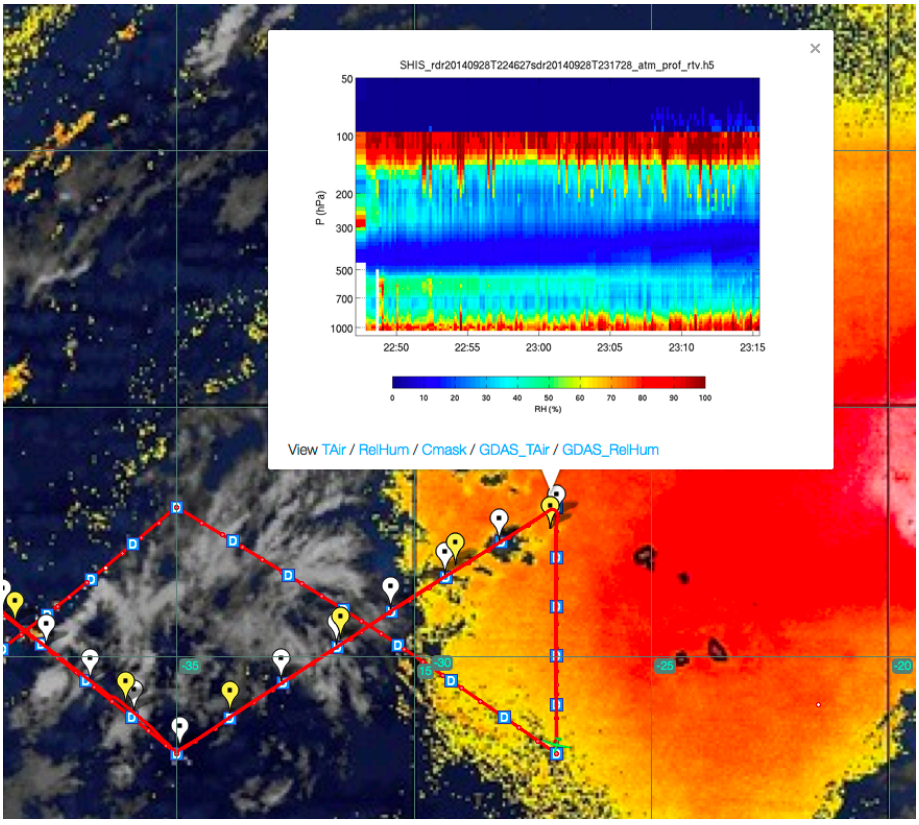


Figure 5: S-HIS retrieved RH profile 2245 – 2315 UTC (2014-09-28). Note the extremely dry mid-level layer.

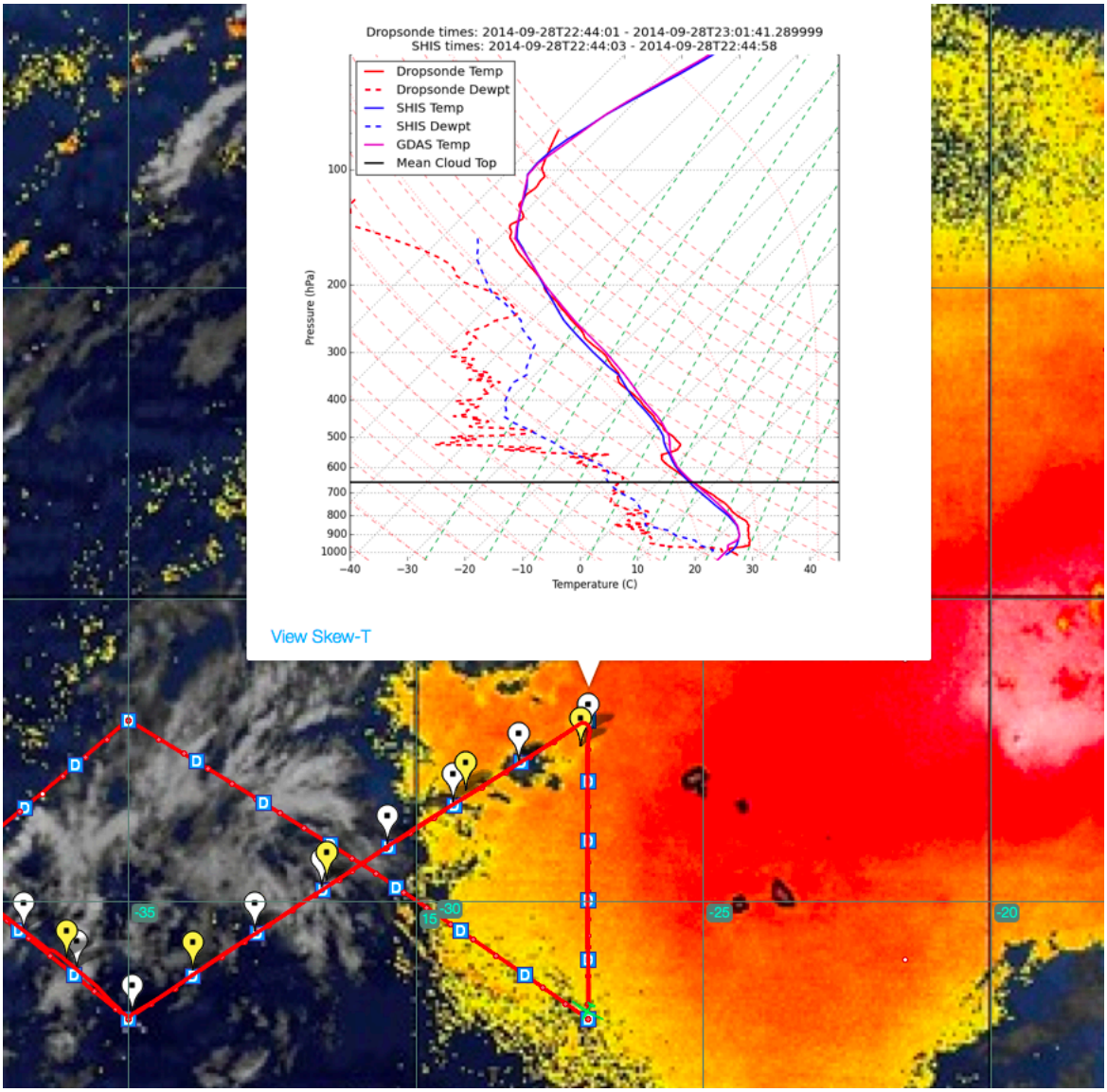


Figure 6: S-HIS and AVAPS skew-T comparison plot for 2244 UTC (2014-09-28). This sounding was noted in the #HS3 room to be a classic ENATL SAL sounding with a dry slot from ~955-550 mbar, and 20-30% RH at 600-900 mbar.

Instrument Summary

The Scanning-HIS operated very well throughout the flight. No instrument power cycles were required, and the detector temperature remained at the setpoint for the duration of the flight. The detector temperature plot is provided in Figure 7.

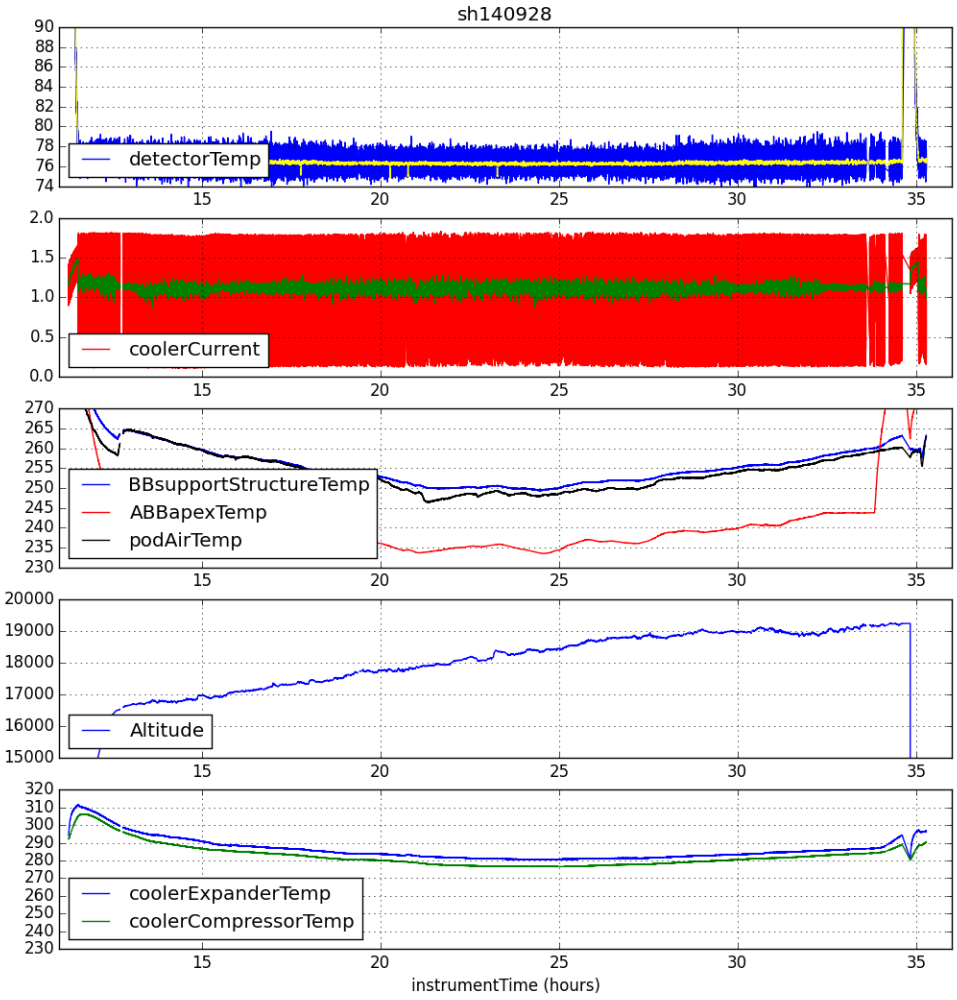


Figure 7: Scanning-HIS detector temperature plot produced in real-time during the flight.