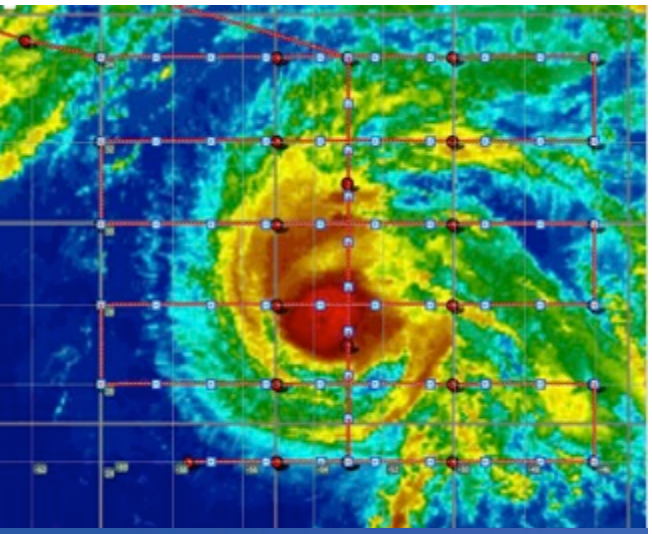
Hurricane and Severe Storm Sentinel (HS3)

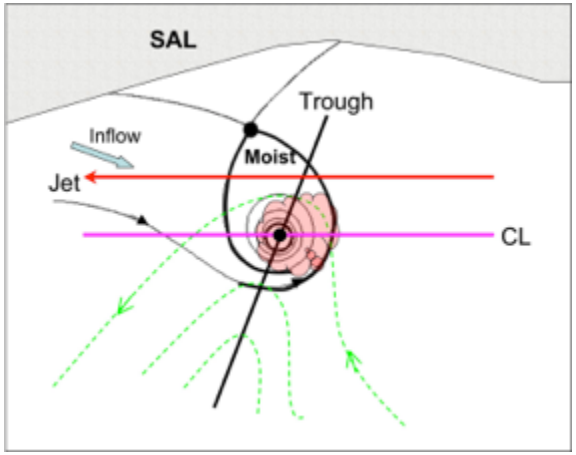
2012 Campaign Summary



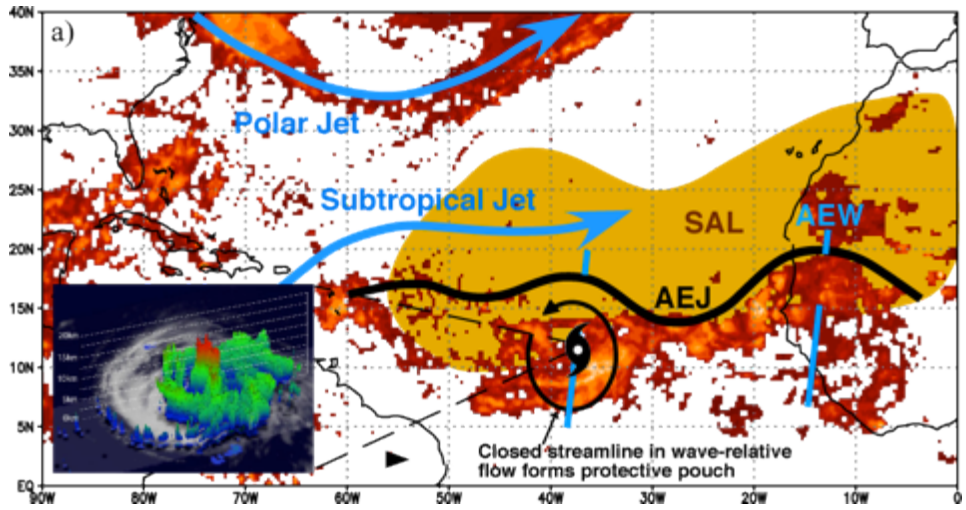
Scott Braun
Paul Newman
(NASA/GSFC)

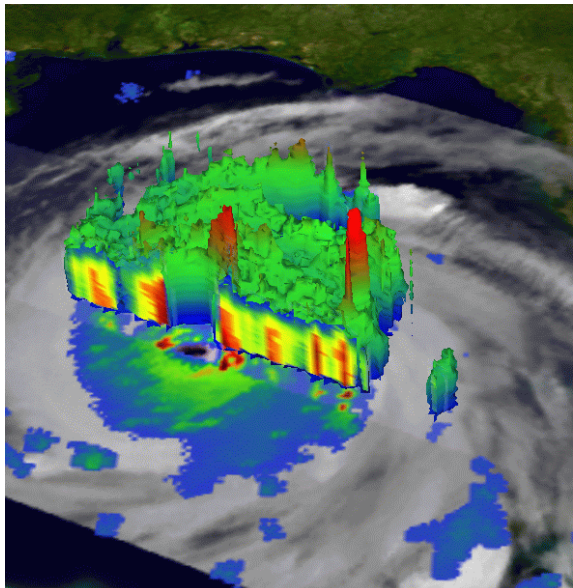
Marilyn Vasques
Bernie Luna
(NASA/ARC)

HS3 Science Questions



- What is the role of the Saharan Air Layer?
- What is the role of upper-level wind patterns?
  - Contribution to vertical wind shear
  - Interaction with storm outflow
- What is the role of the "pouch" in protecting storms from dry air?
- Are intense hot towers (convective bursts) fundamental building blocks for storm formation and intensification?





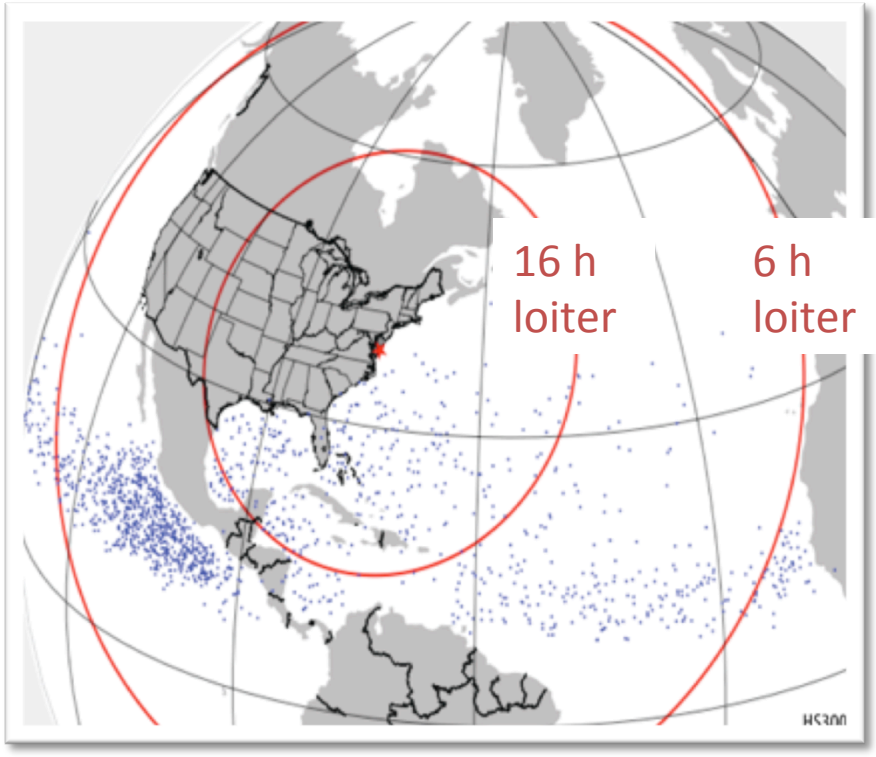
HS3 Mission Overview

- Two Global Hawks, one equipped for the storm environment, one for over-storm flights

- Deployments of GHs from the East Coast— Wallops Flight Facility in VA

- 4-5 week deployments in 2012, 2013, and 2014

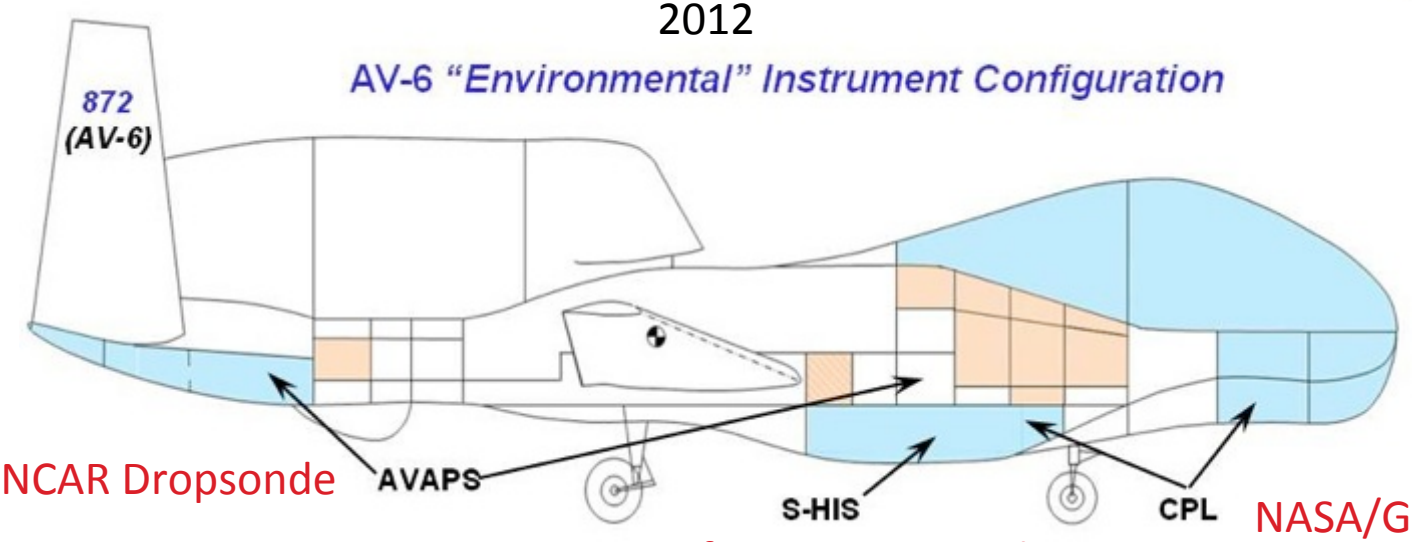
- 275 flight hours per deployment (10-11 flights)



Dots indicate genesis locations.
Range rings assume 26-h flights.

Payloads

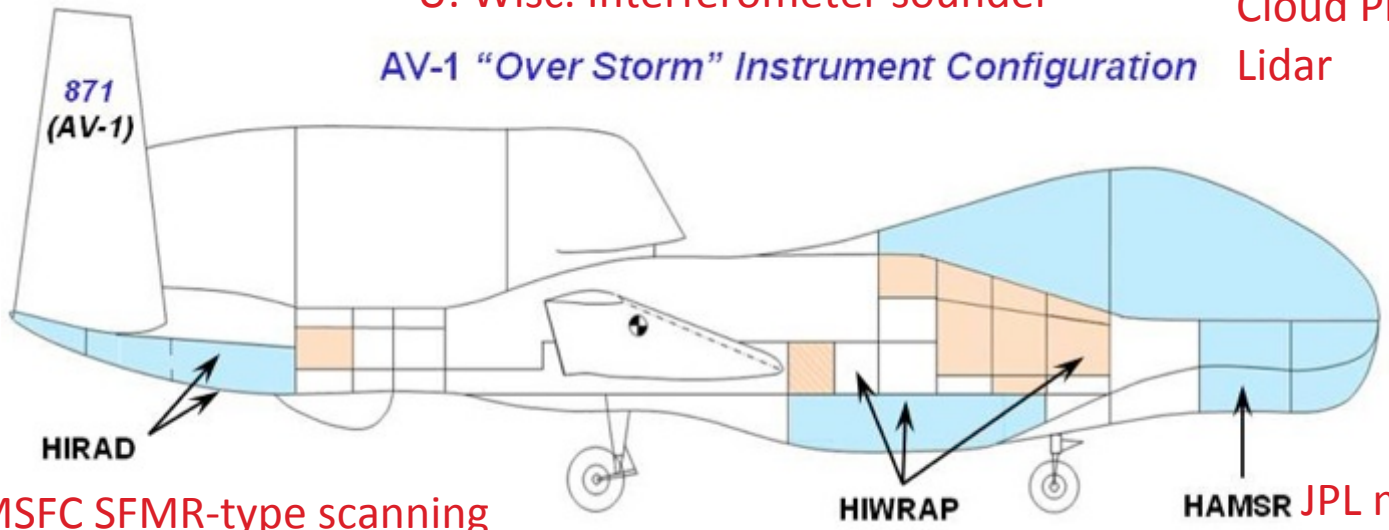
2012



NOAA/NCAR Dropsonde

U. Wisc. Interferometer sonder

NASA/GSFC Cloud Physics Lidar

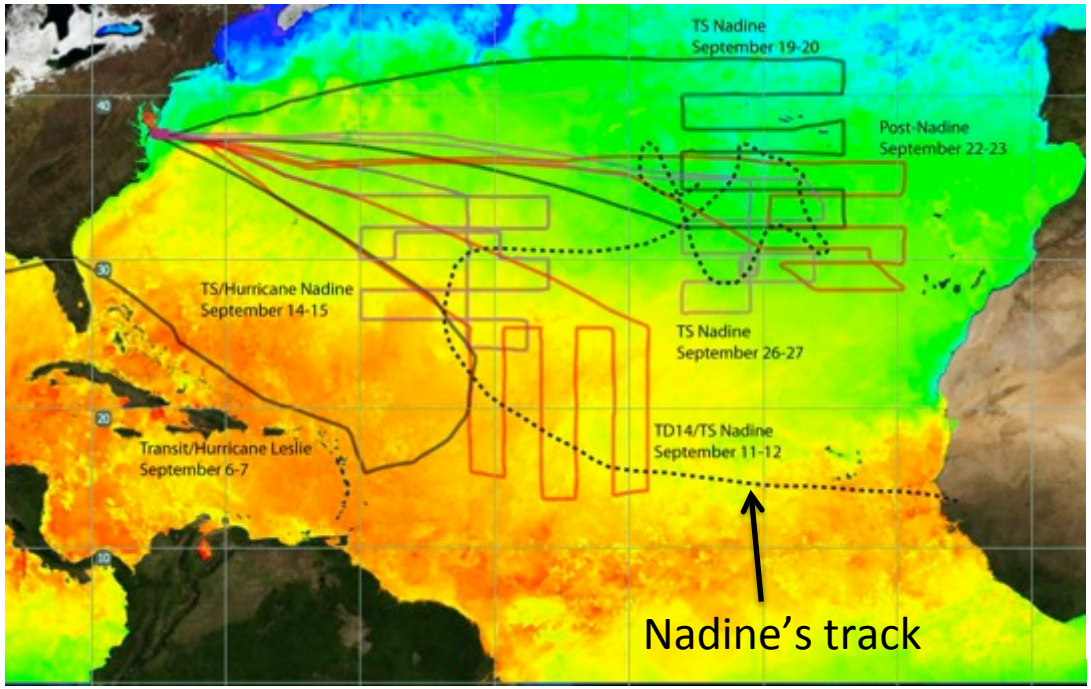


NASA/MSFC SFMR-type scanning radiomter

NASA/GSFC Doppler radar

JPL microwave sounder

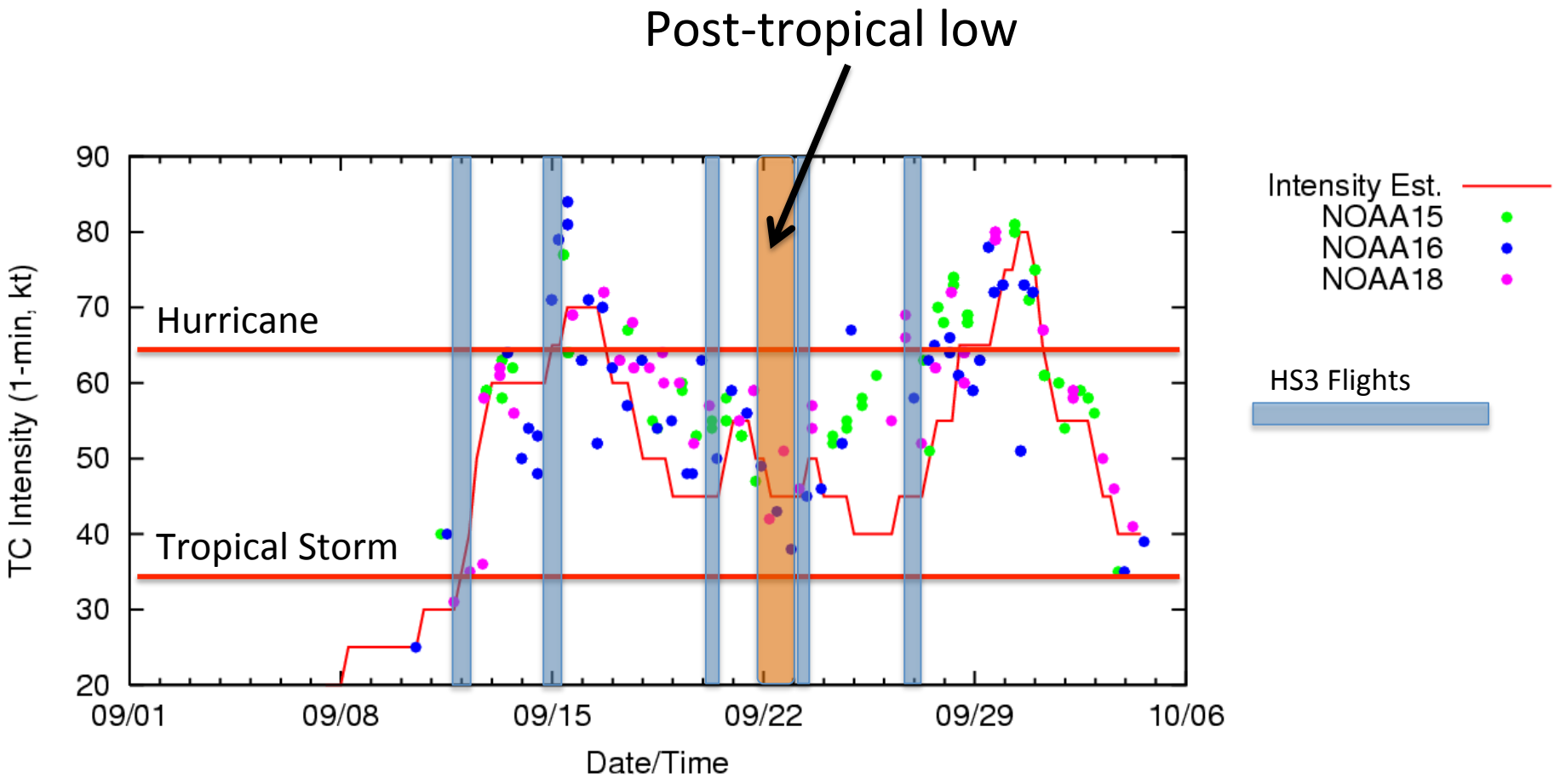
Hurricane and Severe Storm Sentinel (HS3)



NASA HURRICANE AND SEVERE STORM SENTINEL HS3 2012

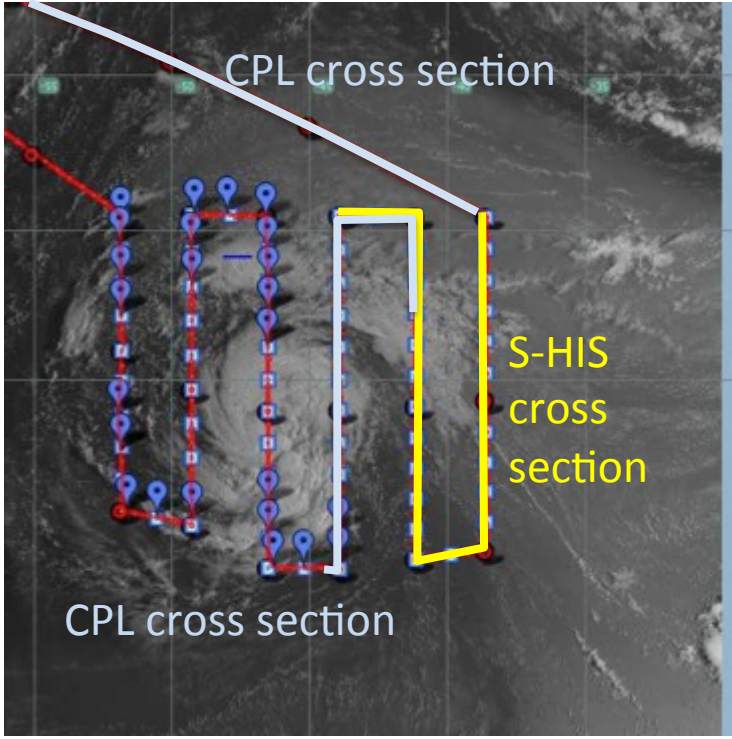
- **Sept.6-7**, Storm: Hurricane Leslie
  Goal: Transit to WFF, Leslie outflow structure
- **Sept. 11-12**, Storm: TD 14/TS Nadine
  Goal: Saharan Air Layer interaction with Nadine
- **Sept. 14-15**, Storm: TS/Hurricane Nadine
  Goal: Nadine intensification in strong shear
- **Sept. 19-20**, Storm: TS Nadine
  Goal: Maintenance of Nadine in strong shear and over colder waters
- **Sept 22-23**, Ex-Nadine/TS Nadine
  Goal: Redevelopment of Nadine in adverse conditions
- **Sept 26-27**, TS Nadine
  Goal: Potential re-intensification of Nadine

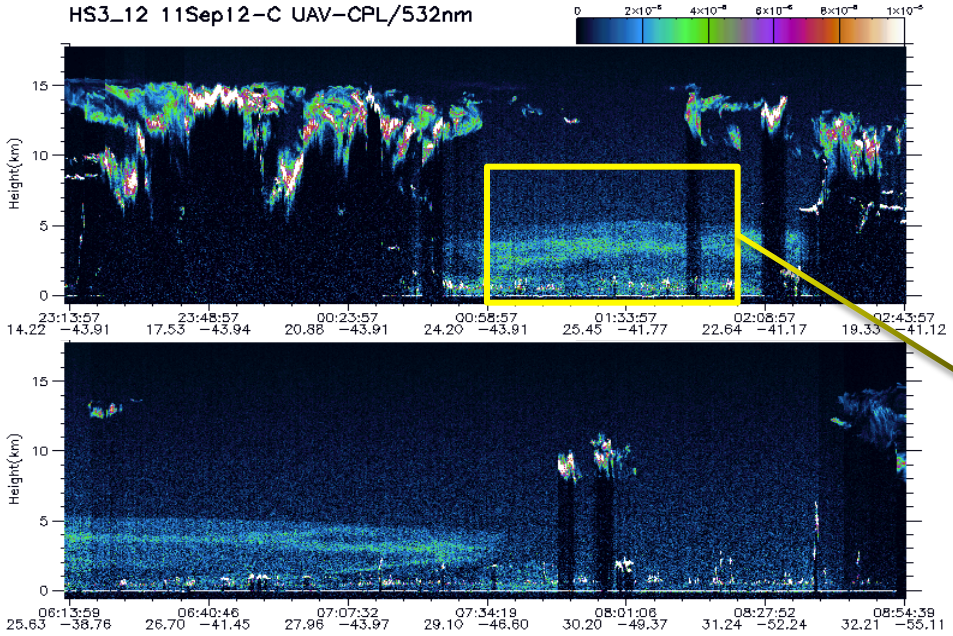
Flight Times As a Function of Storm Life Cycle



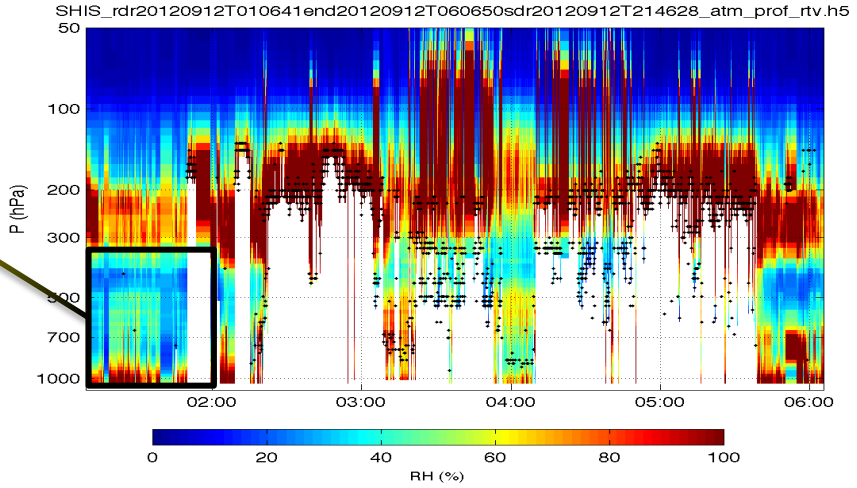
The Formation of Nadine (Sept 11-12)

- During flight, storm became Tropical Depression 14 and then Tropical Storm Nadine
- Goal was to examine interaction of Nadine with the Saharan Air Layer
- Instruments detected SAL air on the northern and eastern sides of Nadine.

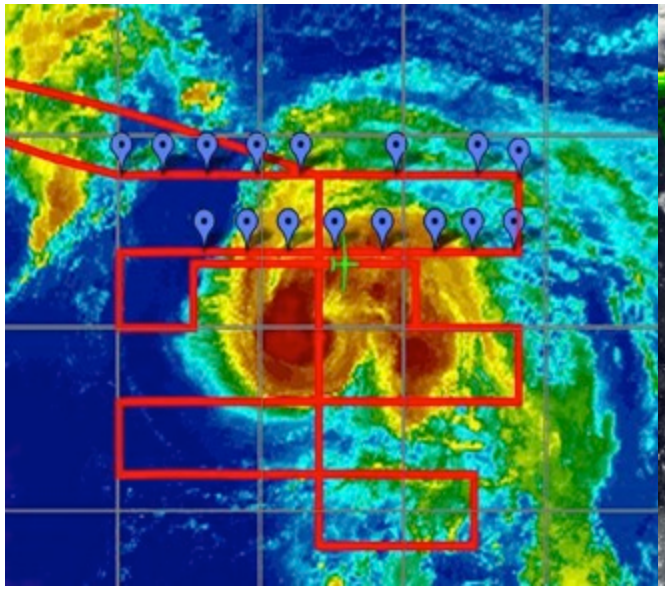




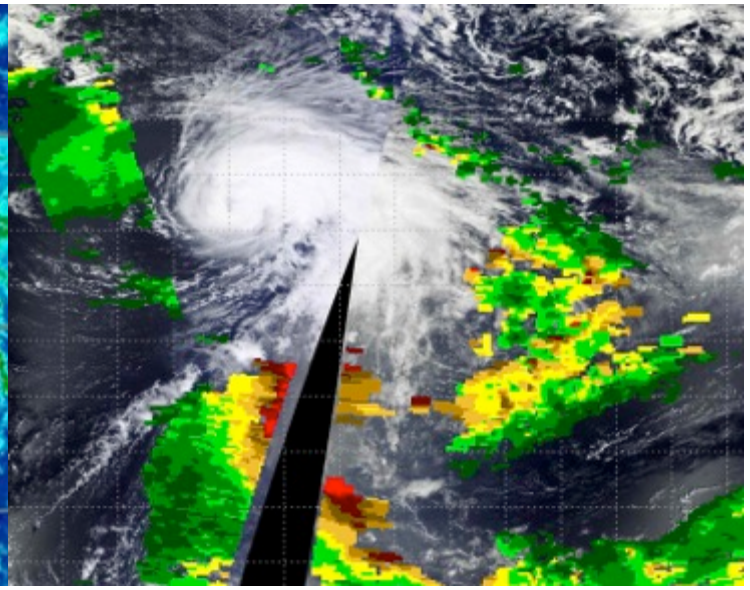
Near real-time SHIS RH Retrieval



Was SAL Air Getting Into Nadine on Sept 14-15?



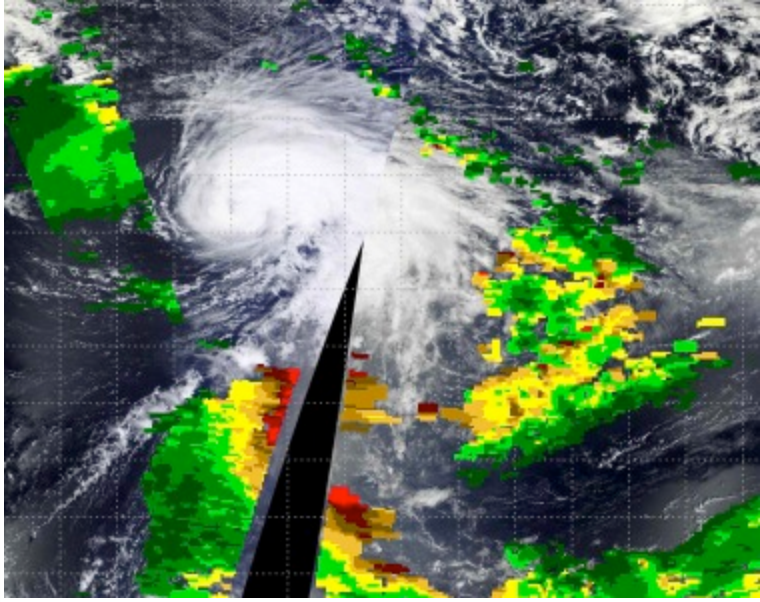
Flight Track Sept. 14-15

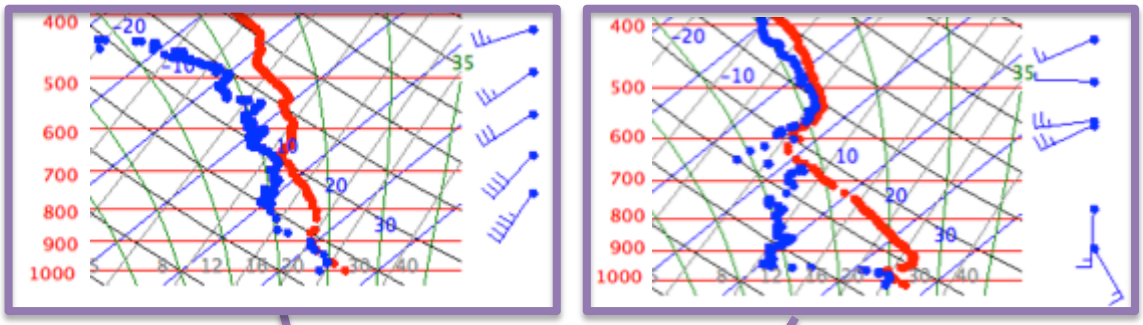


MODIS AOD Sept 15

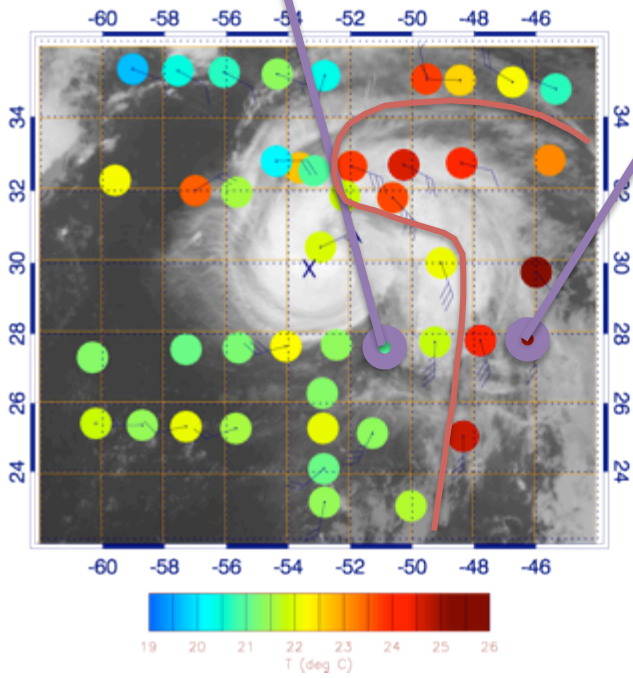
- During flight, Nadine became a Cat 1 hurricane
- Goal was to examine storm evolution in an environment with strong vertical wind shear and dry air
- SAL air detected on the northern and eastern sides of Nadine, but unclear to what extent it impacted intensity

Did SAL Air Get Into Nadine?

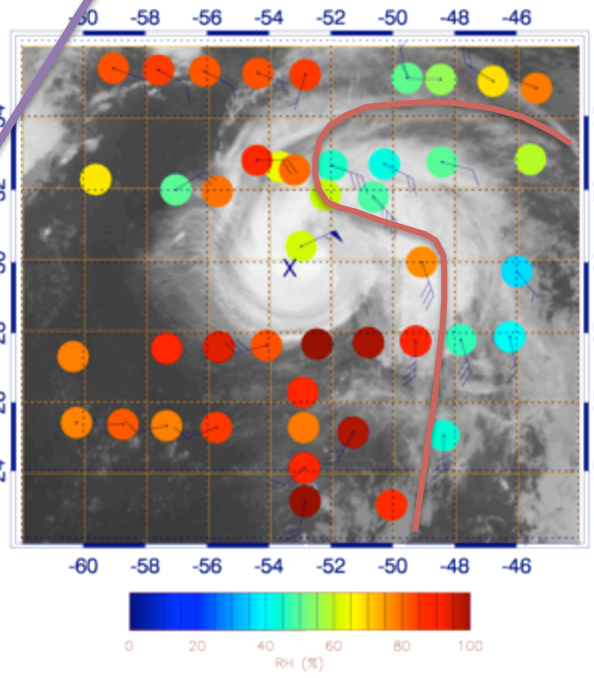




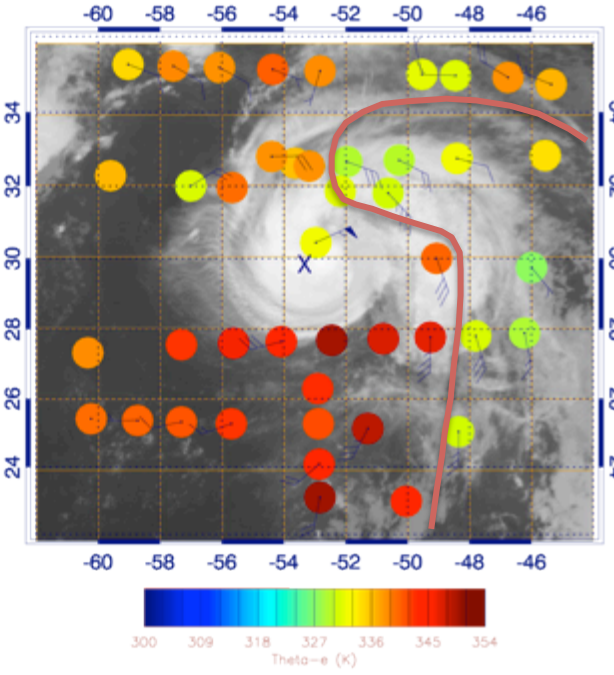
925 hPa Temperature

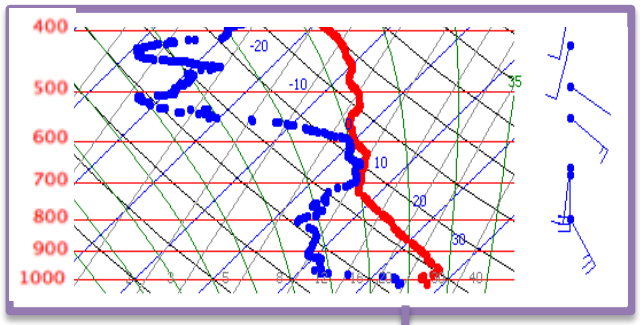


925 hPa RH



925 hPa θe

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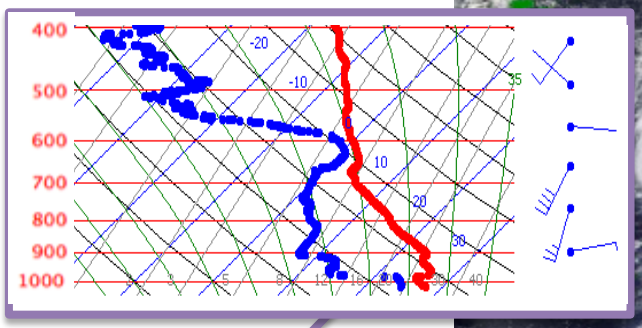
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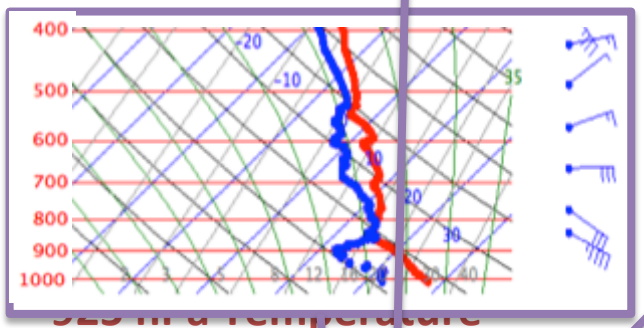
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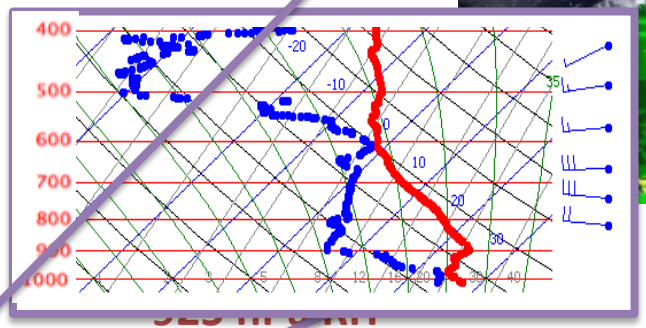
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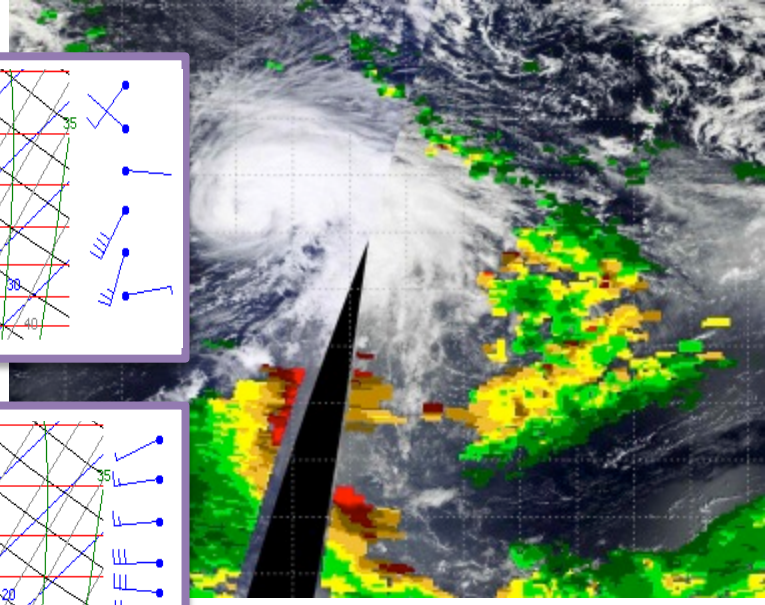
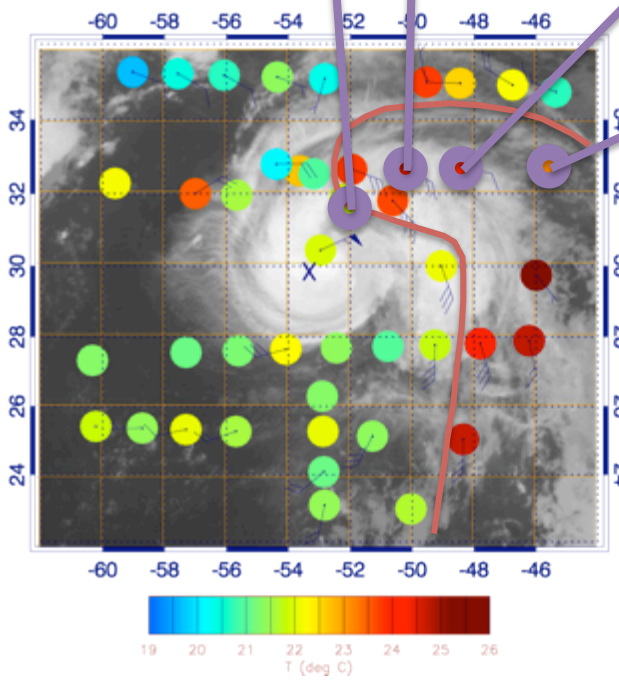
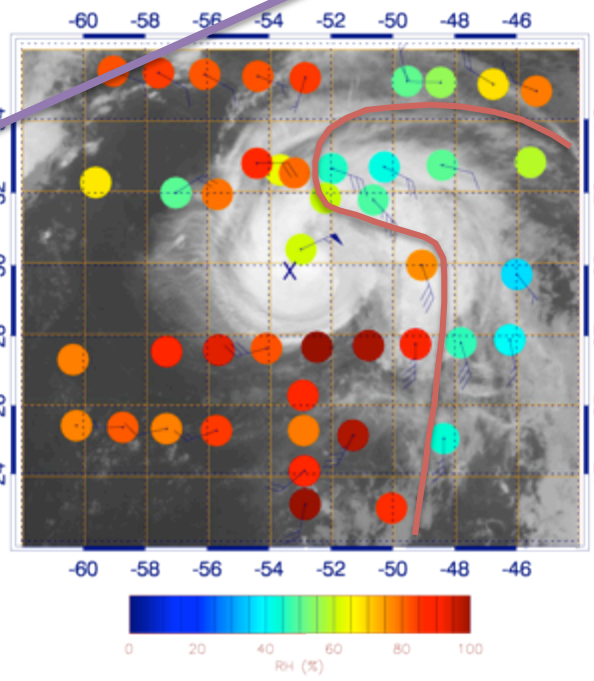
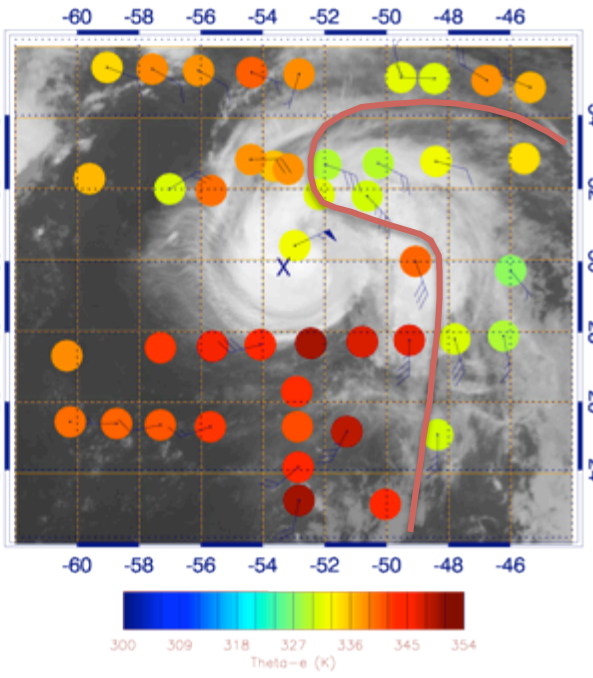


925 hPa θe

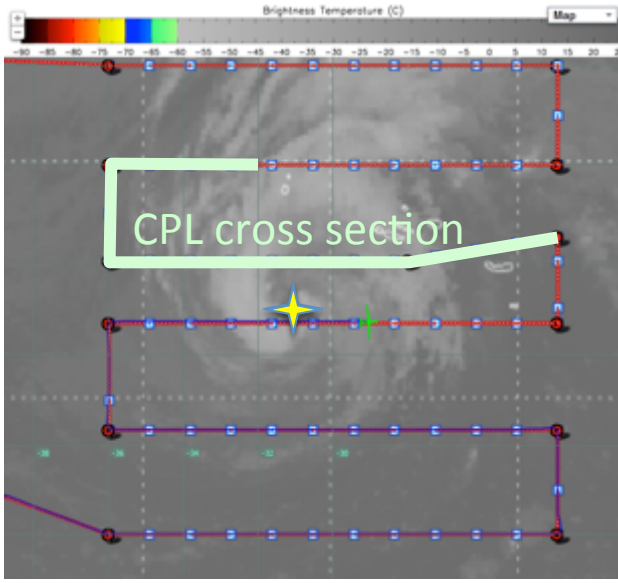

-60 -58 -56 -54 -52 -50 -48 -46
34 32 30 28 26 24
19 20 21 22 23 24 25 26
T (deg C)

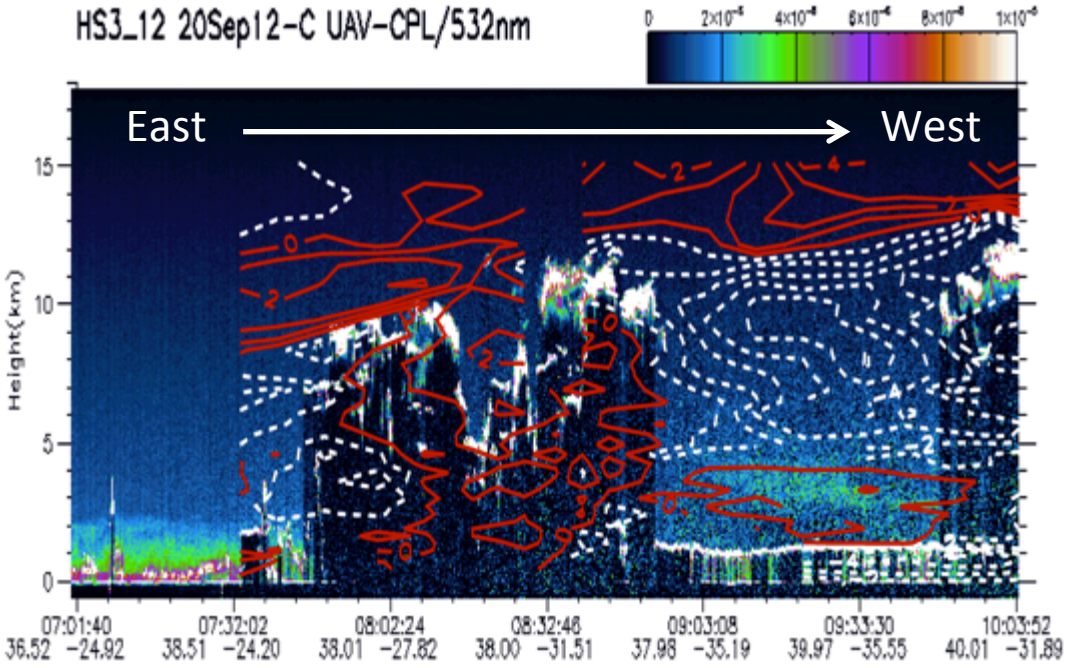

-60 -58 -56 -54 -52 -50 -48 -46
34 32 30 28 26 24
0 20 40 60 80 100
RH (%)

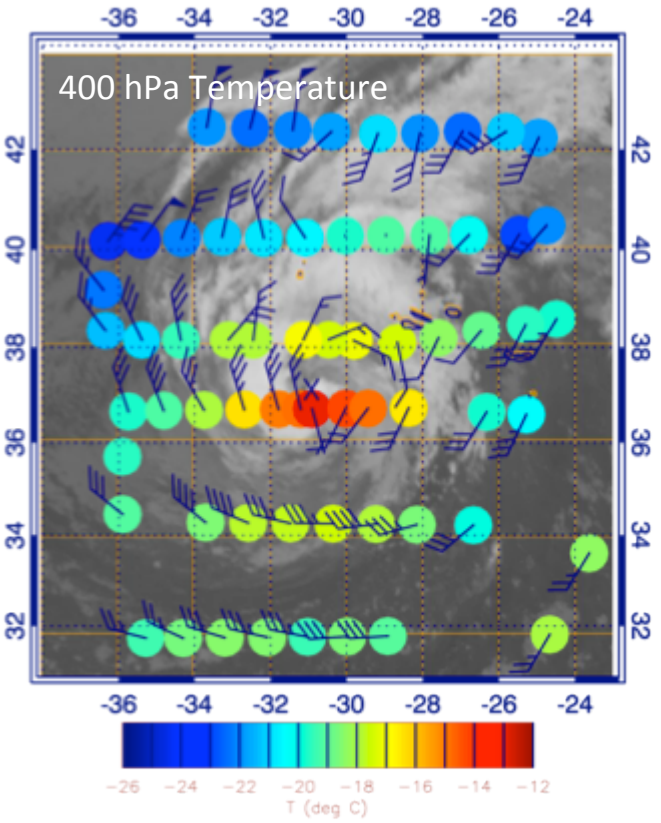

-60 -58 -56 -54 -52 -50 -48 -46
34 32 30 28 26 24
300 309 318 327 336 345 354
Theta-e (K)

Nadine Survives Despite Adverse Conditions (Sept 19-20)

- Despite strong vertical shear, dry air and low SSTs (~22-24°C), Nadine survives
- Dropsondes reveal warm core structure near center through most of the troposphere
- NHC uses HS3 observations to maintain Nadine as a tropical storm

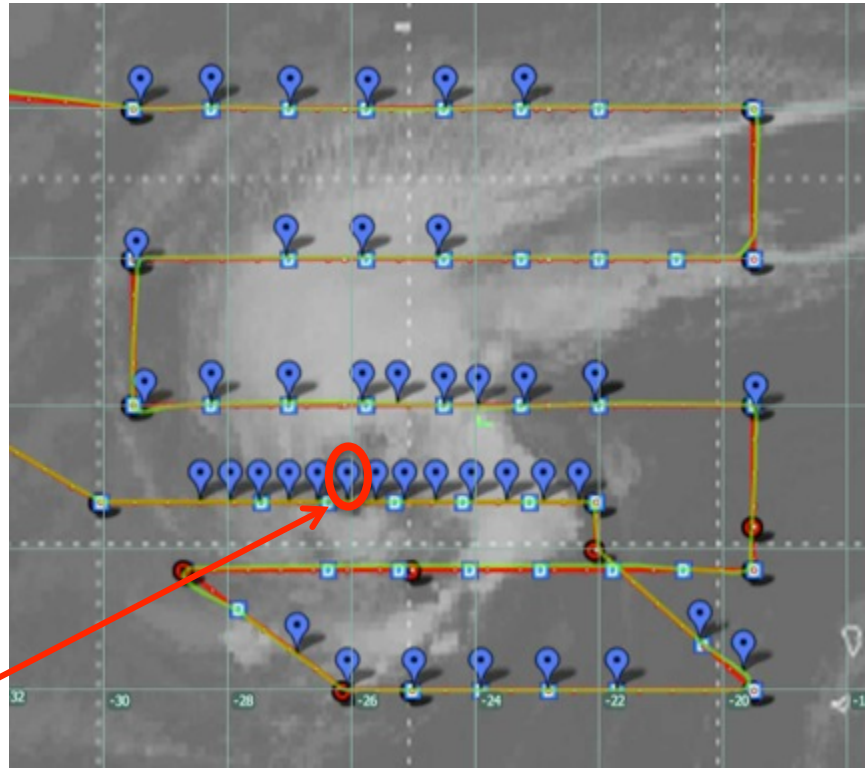




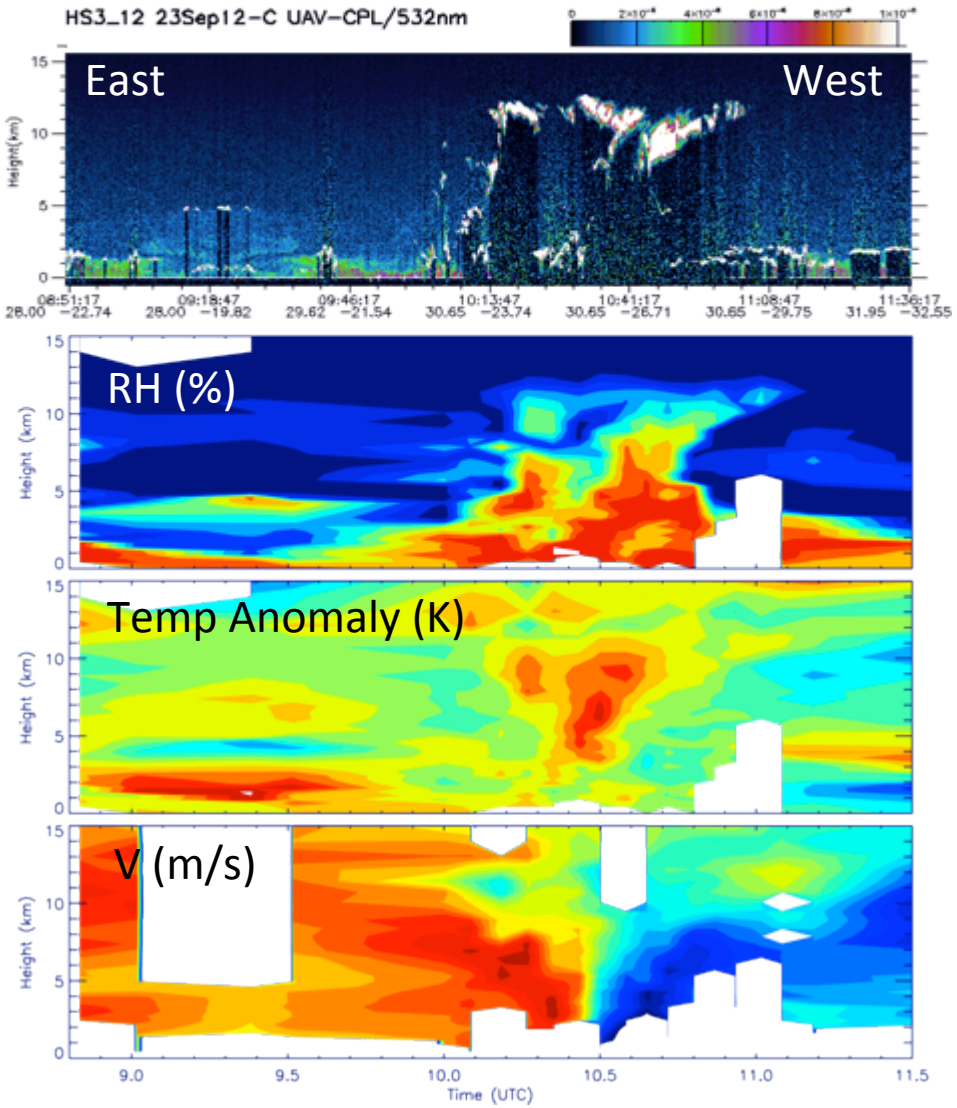


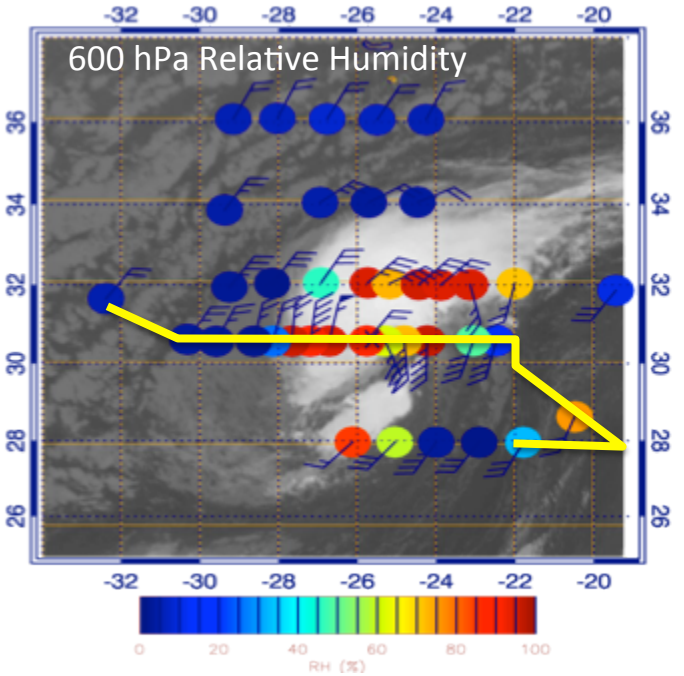
HS3 Shows That Nadine Is A Tropical Storm Again! (Sept 22-23)

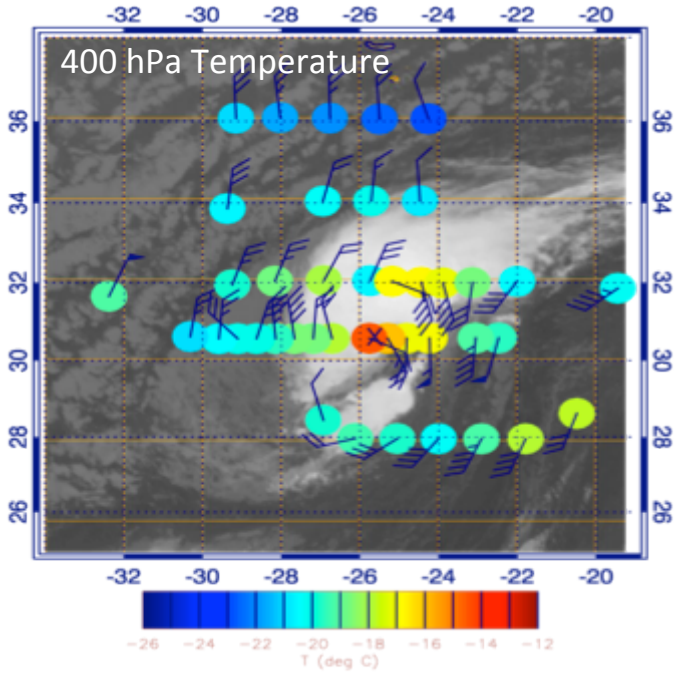
- Despite moderate but increasing shear, low SSTs (~24°C), and dry air, Nadine redevelops
- NHC uses HS3 observations (among others) to upgrade ex-Nadine back to a tropical storm
- 70 knot wind at 900 hPa



Nadine Vertical Structure (Sept 22-23)



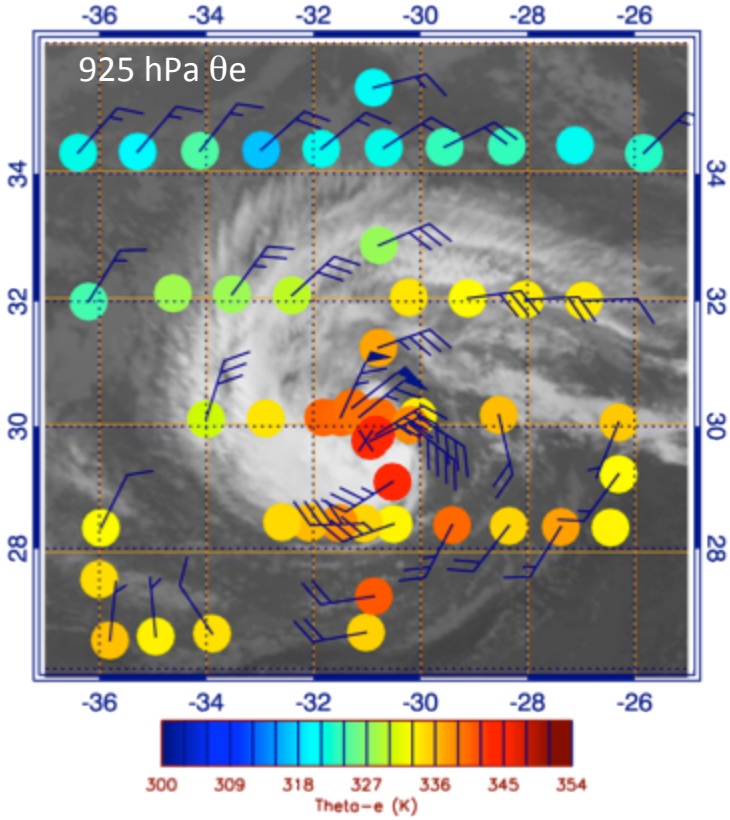


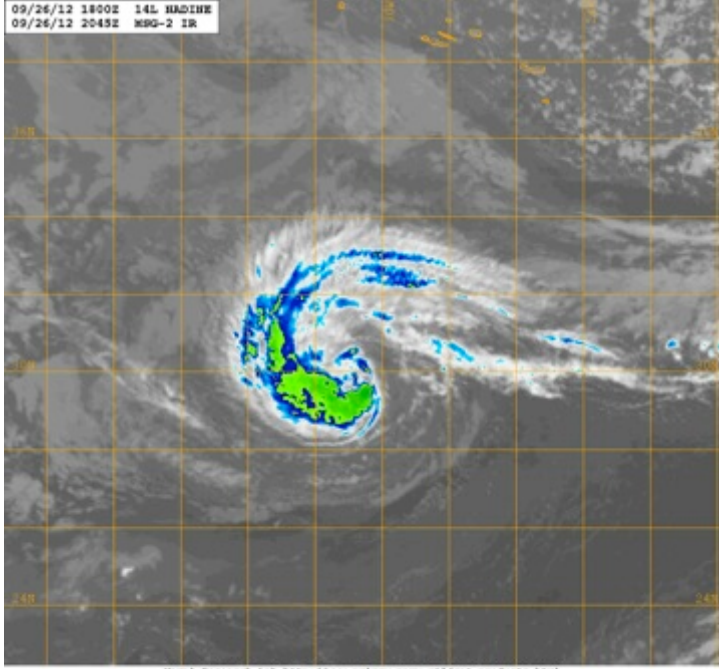


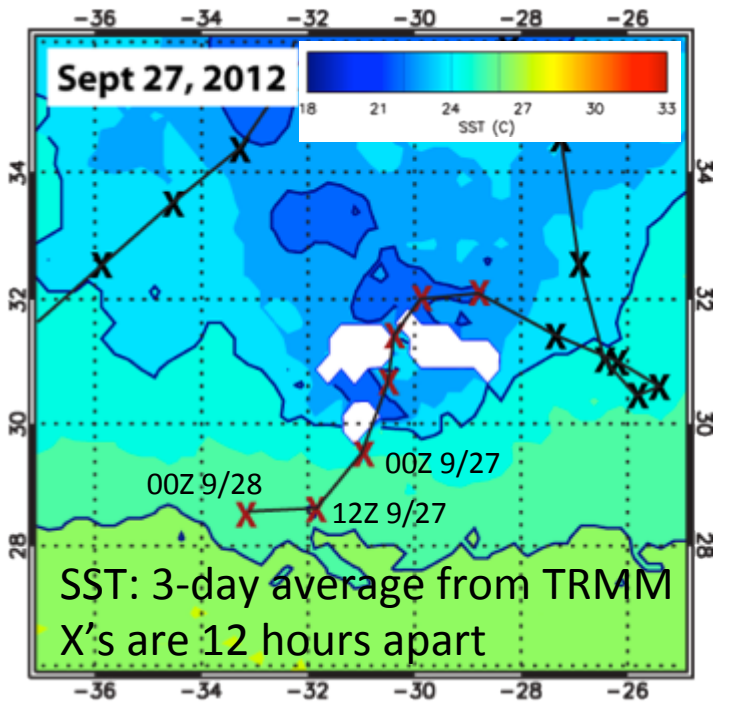
Precursor Conditions for Nadine's Re-intensification to Hurricane (Sept 26-27)

- Conditions improve: Weak but increasing shear, more moist mid levels, and movement over warmer SSTs (~26°C)

- Jump in θe values in the core as convection increases

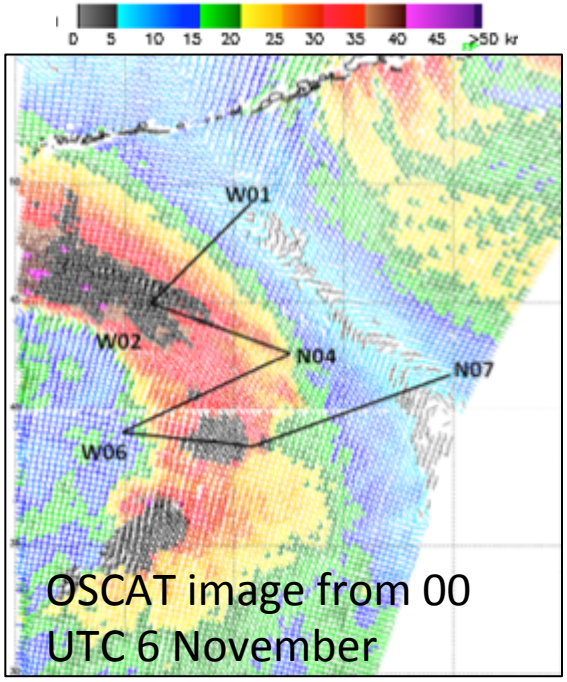




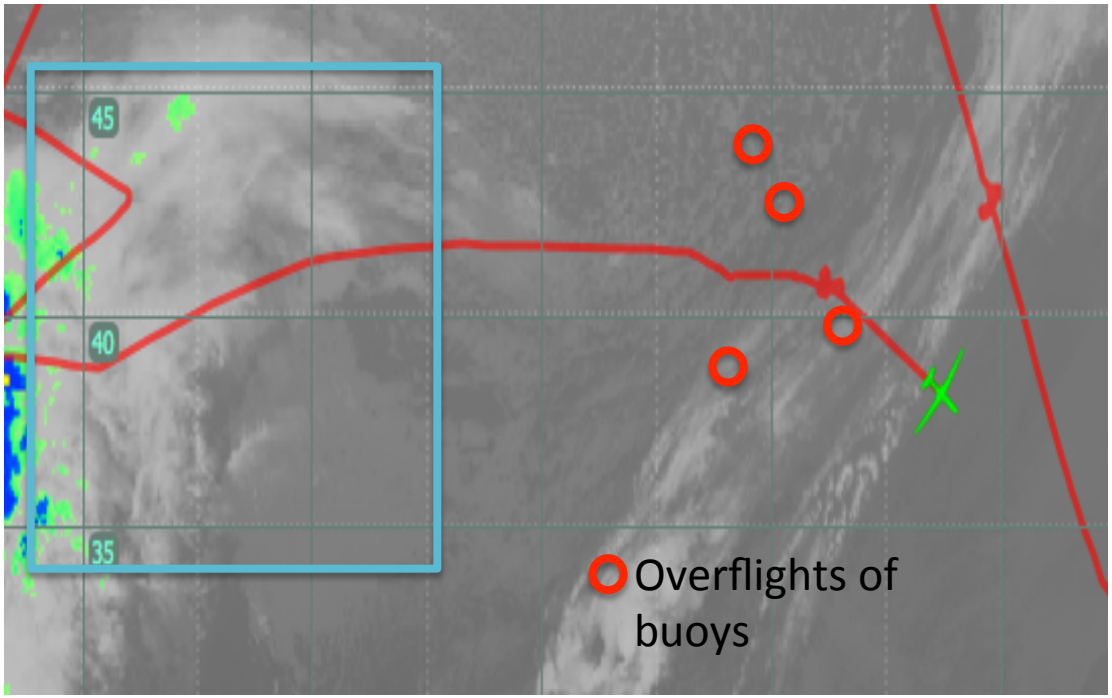


AV-1 Prep for 2013-2014

- AV-1 did not make the 2012 deployment due to aircraft issues
- Test flight in Pacific on Nov. 5-6
- In addition to HAMSR and HIWRAP, flying HIRAD for the first time



OSCAT image from 00 UTC 6 November



Overflights of buoys

HS3 Data

- Research products will be made available after QC/processing, possibly by end of Feb 2013
- CPL Data already available
- For complete information on HS3 and links to data, go to

  http://espo.nasa.gov/missions/hs3/

http://espo.nasa.gov/missions/hs3/

Questions?

First Global Hawk landing at Wallops Flight Facility, Sept. 7, 2012.