Observations Team: Satellite Observation Update

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FY12 Satellite Milestones:

i. CIRA/RAMMB continue **maintaining and populating** real-time **TC website**, and **develop geostationary datasets** and Fortran90 code for reading: Storm-scale, Mercator projection (Atlantic, East Pacific, Central Pacific), IR channels 2-6; and full-disk, satellite projection, channels 3 and 4, both from GOES-East and West. (NESDIS)

ii. NRL continue **maintaining and populating real-time TC website**, and create NCODA-based **ocean heat content products** on 0.25 degree grid in near real-time. (NRL)

iii. CIMSS continue **maintaining and populating real-time TC website**; finalize transition newest version of **ADT to operations**; test and demonstrate objective consensus intensity method (**SATCON**), objective center fixing routine (ARCHER), and **experimental microwave rapid intensification predictors** for SHIPS model. (CIMSS)

Status Quo Satellite Observations

CIRA/RAMMB - NESDIS

- ✓ Maintain and populate real-time TC website
- ✓ Multi-Platform Tropical Cyclone Surface Wind Analysis (MTCSWA) operational at NESDIS
- ✓ Use GOES information for objective TC size metric (documentation under way)
- ✓ GOES-R RGB, MSG repository
- ✓ Local Microwave Integrated Retrieval System (MIRS) data pool for TC studies
- ✓ Suomi-NPP TC archive
- ✓ NCODA OHC used in SHIPS, LGEM in Atlantic, Eastern, Central and Western Pacific
- ✓ Collect geostationary datasets and provide Fortran90 code (see DeMaria for diagnostic use)
  - ✓ Storm-scale, Mercator projection, IR channels 2-6
  - ✓ Full-disk, satellite projection, channels 3 (Water Vapor) and 4 (IR Window), GOES-East & GOES-West

CIMSS

- ✓ Maintain and populate real-time TC website
- ✓ Transition newest version of ADT to operations, provide GOES-R HIE in real-time
- ✓ Test and demonstrate objective consensus intensity method (SATCON)
- ✓ Objective center fixing routine (ARCHER)
- ✓ Experimental microwave rapid intensification predictors for SHIPS

NRL

- ✓ Maintain and populate real-time TC website
- ✓ Providing NCODA-based ocean heat content products on 0.25 degree grid in near
- ✓ real-time to NHC/NCEP and JTWC.

Update on Tropical Cyclone Intensity Estimation from Satellites

Latest algorithm version (v8.1.4) of the Advanced Dvorak Technique (ADT), which operates on geostationary IR imagery, has been delivered by CIMSS to the NESDIS Satellite Analysis Branch.

- Directly accesses and incorporates available near real-time microwave (MW) radiance information from polar orbiters to supply structure information and supplement the IR-based intensity scheme.
- Expected to be tested and quasi-operational during the 2013 hurricane season.
- Next ADT versions (v8.2+) planned for transition/implementation in 2014/15 to include an updated auto-centering scheme (ARCHER), and a module currently under development that will allow the ADT to operate in an automated mode on pre-depression systems.
- Note: The ARCHER algorithm is being submitted by CIMSS as a transition candidate to NHC/TAFB as a JHT project

The GOES-R version of the ADT, to be called the Hurricane Intensity Estimation (HIE) algorithm, has been delivered by CIMSS to the GOES-R integration team.

- Expected to become operational at NESDIS/SAB after activation of GOES-R in 2015-2017 timeframe.
- A “working version” of the HIE is being maintained by CIMSS, that includes (and will include) all recent (future) upgrades to the ADT, and is being demonstrated to NHC through the GOES-R Proving Ground project.

Polar-orbiter microwave (MW) sounder-based intensity estimates from both CIRA and CIMSS continue to be made available in near real-time to NHC. CIMSS has adapted their AMSU-based method to SSMIS, and both institutes will be adapting their algorithms to the newly available ATMS aboard Suomi NPP as part of the JPSS program.

A satellite consensus-based TC intensity estimation algorithm (SATCON), which includes the above ADT and MW sounder estimates in a weighted scheme, continues to be made available in real time to NHC via the CIMSS TC web site. There is no formal plan for transition of this algorithm at this time.

Update on using passive microwave data in the forecasting of rapid intensification

- Several statistical models for rapid intensification (RI) (i.e., Kossin 2011) have been enhanced using structural predictors from passive microwave imagery (MI) at 19.4, 37.0, and 85.5 GHz.

- The MI-enhanced models are developed to run at synoptic times. The MI-based predictors are shown to improve the forecast skill of the statistical RI models.

- A real-time algorithm has been developed and is expected to be fully tested and run quasi-operationally during the 2013 hurricane season.

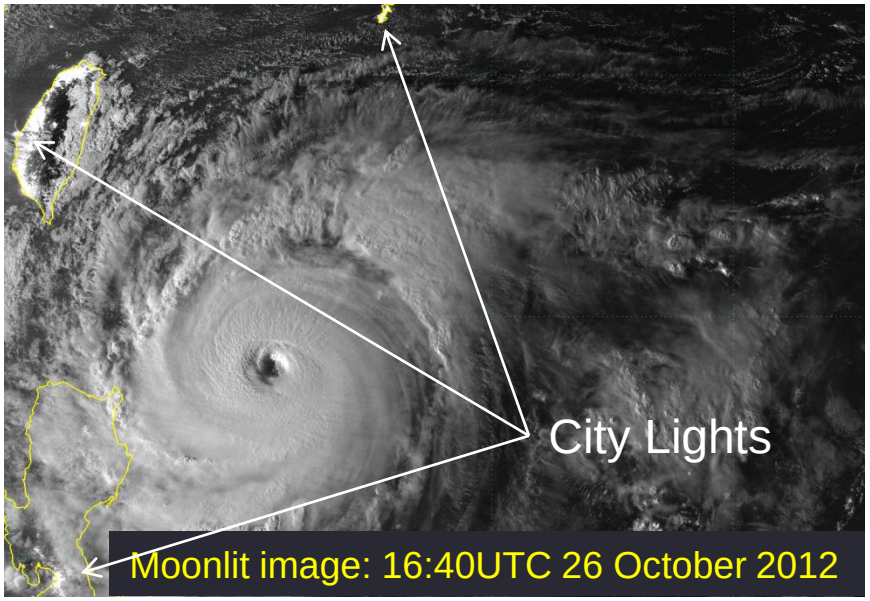
- Work has begun to access MI data on operational systems.

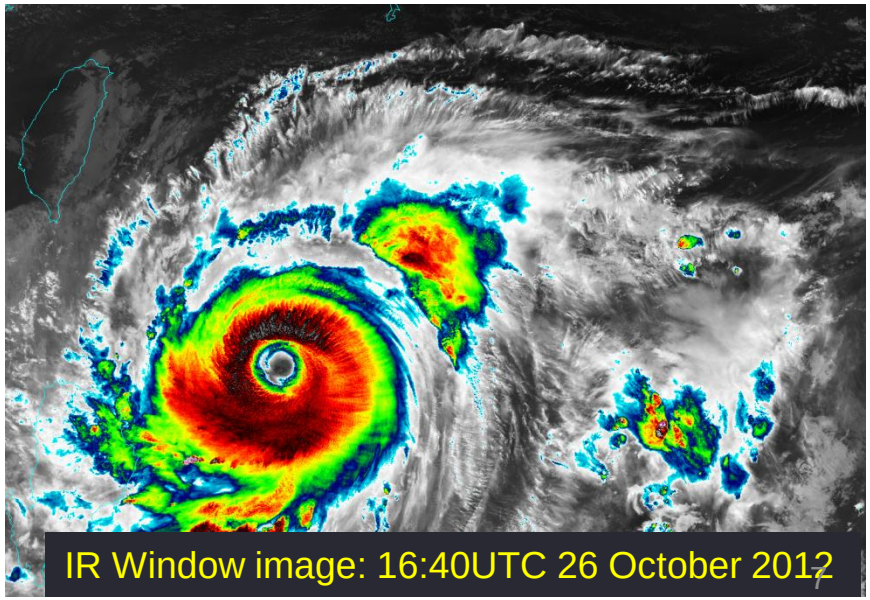
New Satellite Observations

- **Suomi – NPP** (NPOES Preparatory Project)
- **Megha-Tropiques**
- Two new scatterometers…**Ocean-Scat 2**, and **Metop-B A-Scat**
- Operational access to RedGreenBlue combinations via the GOES-R
- Microwave Integrated Retrieval System (**MIRS**)

Suomi – NPP

- Visible Infrared Imaging Radiometer Suite (**VIIRS**) is a scanning radiometer, collects visible and infrared imagery
  - Up to 325 m resolution
  - Day-night-band
- The Advanced Technology Microwave Sounder (**ATMS**) is a cross-track microwave scanner with 22 channels
  - 25 km resolution at NADIR
- The Cross-track Infrared Sounder (**CrIS**), a Fourier transform spectrometer with 1305 spectral channels, can produce high-resolution, three-dimensional temperature, pressure, and moisture profiles
- **CERES** for earth radiation budgets
- **OMS** for ozone measurements
- CIRA/RAMMB is saving VIS/IR/DNB data over global tropical cyclones.
- CIRA/RAMMB beginning work to utilize ATMS for TC intensity and structure estimates using the Microwave Integrated Retrieval System MIRS.





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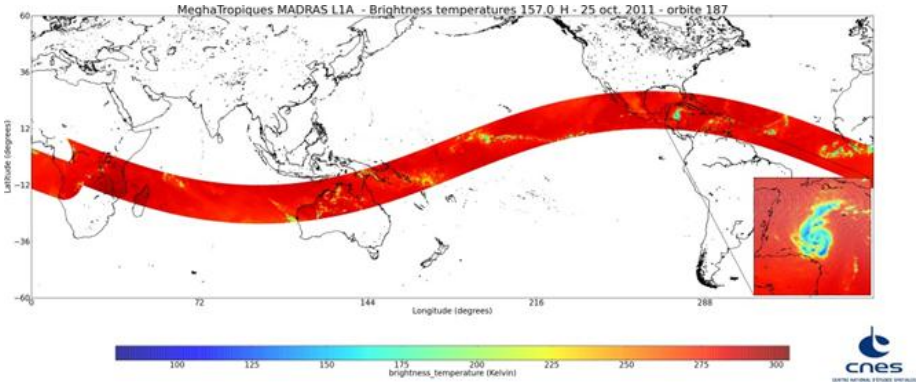
More New Satellite Data 2012

Megha-Tropiques

- Launched Oct 2011
- 20 degree inclination, sampling between 22N – 22 S, refresh 5 times per day.
- ~860km Altitude
- SSMI/TRMM like conical imager called MADRAS.
- Humidity Sounder called SAPHIR
- Data are becoming readily available



New Scatterometers

- Metop-B, second A-SCAT
  - C-band
- Oceansat 2
  - Ku-band (like QuickScat)

Both are becoming more available, Oceansat is currently be evaluated at NESDIS, thus far data look good!

Available at

http://manati.star.nesdis.noaa.gov/datasets/OSCATData.php/

And

http://www.nrlmry.navy.mil/TC.html

RGB Imagery

GOES-R Proving Ground activities at NHC and new JPSS Proving Ground activities

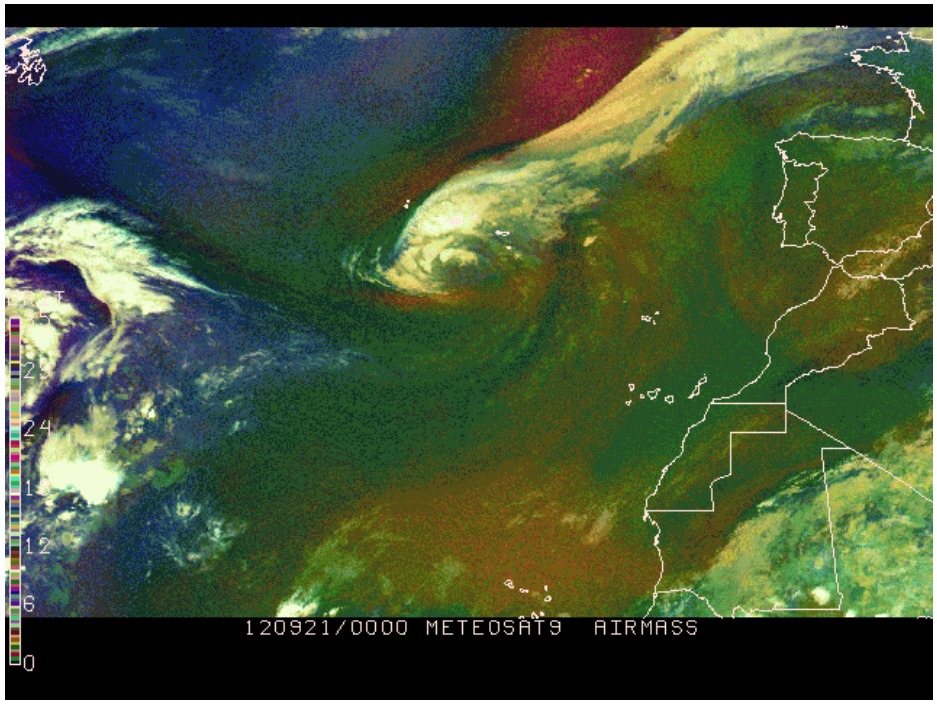
In N-AWIPS

RGB images (air mass example shown) are designed to provide increased information from a single satellite product

Archived at CIRA/HPC.

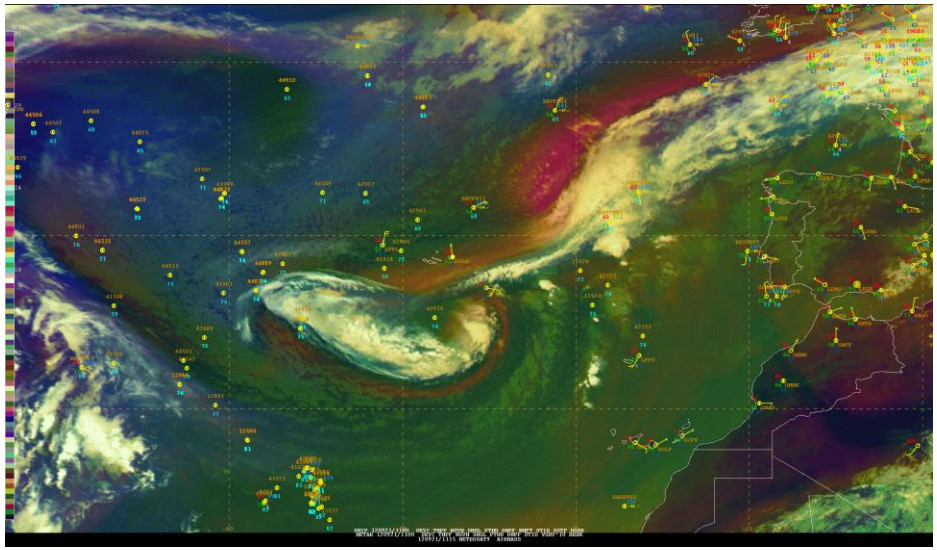
Examples provided to the left.

Credit – Michael Folmer (CICS), Michael Brennan (NHC)

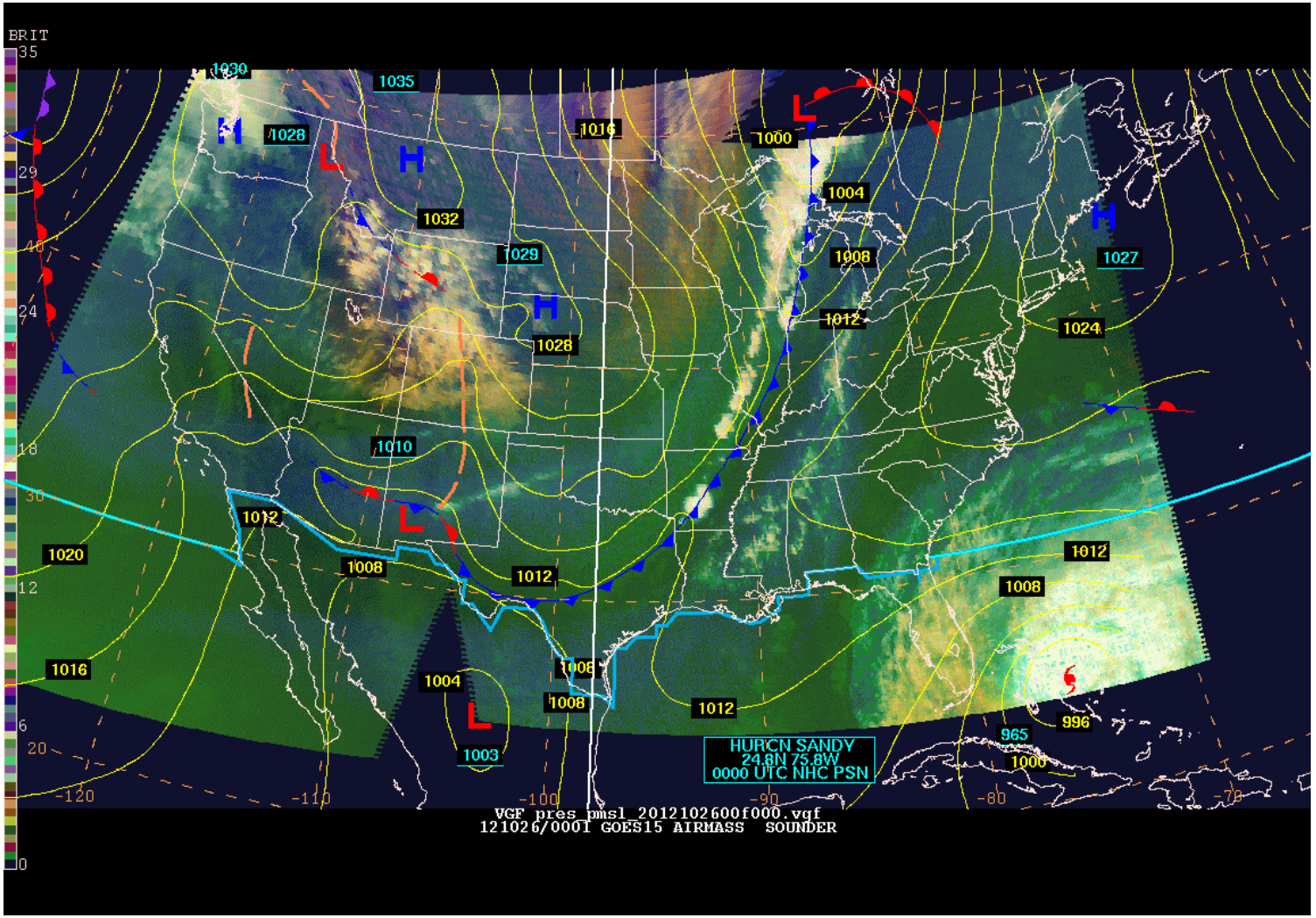


RGB Air Mass

SEVIRI RGB Air Mass animation of TS Nadine valid on 09/21/12.



Even the GOES Sounder



Hurricane Sandy (2012)
Credit – Michael Folmer (CICS), CIRA/RAMMB, SPoRT

Microwave Integrated Retrieval System (MIRS)

Mission Goal

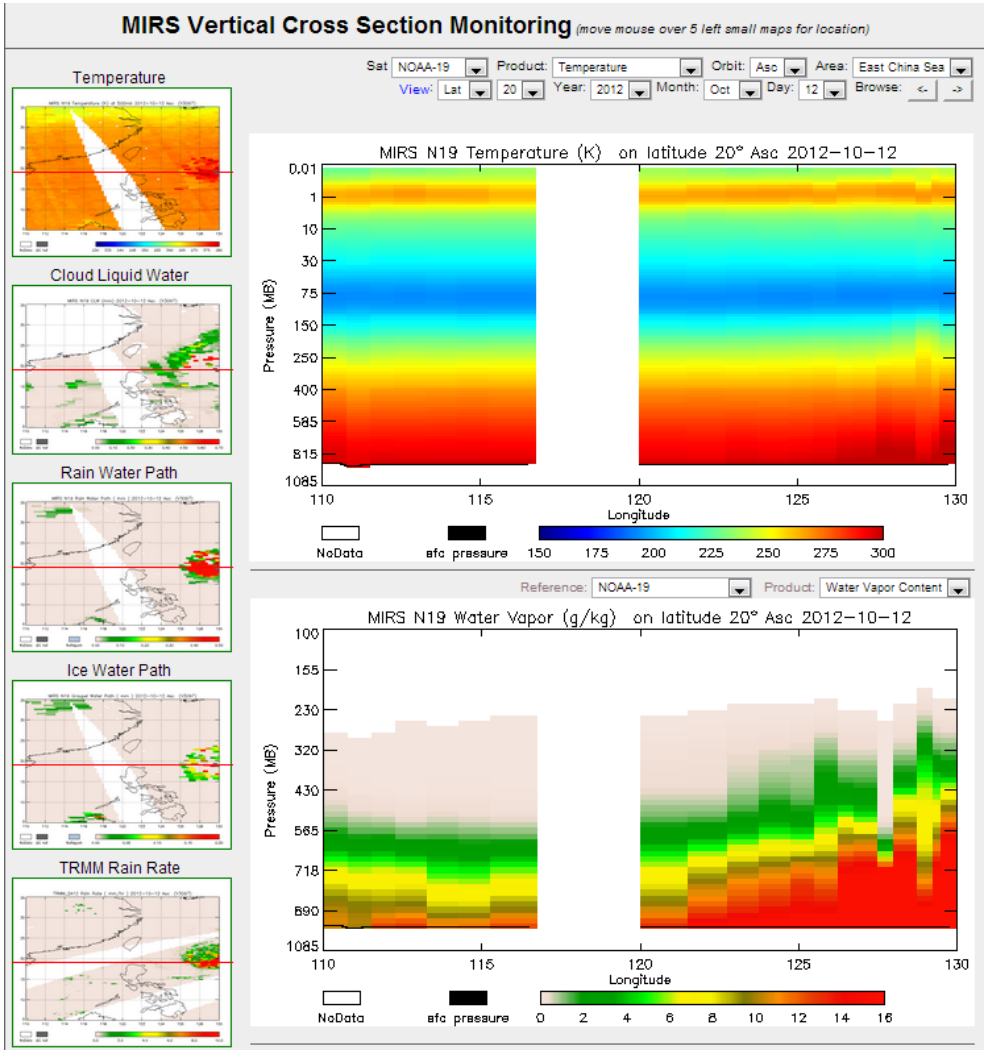
- MIRS aims at providing timely and effective acquisition and delivery of satellite-derived information. The integrated and generic natures of MIRS make it possible to significantly reduce the amount of time spent developing retrieval algorithms for new sensors, which in turn reduces dramatically the time needed to transition to operations.

Scientific Objectives

1. an improved temperature and moisture profiles retrieval,
2. the extension of the retrieved products to non-standard surfaces including sea-ice and snow-covered land,
3. the retrieval in all-weather conditions including cloudy and precipitating conditions and
4. an improved set of retrieved surface properties whose derivation is based on the retrieved emissivities instead of directly from the brightness temperatures.

Data Sources

- routinely running (NOAA-18 and METOP-A AMSU and MHS)
- in the process of being applied to (DMSP-F16/F17 SSMIS) or
- planned to be applied to when the sensor is flying (such as NPP/NPOESS ATMS, NPOESS MIS, etc)



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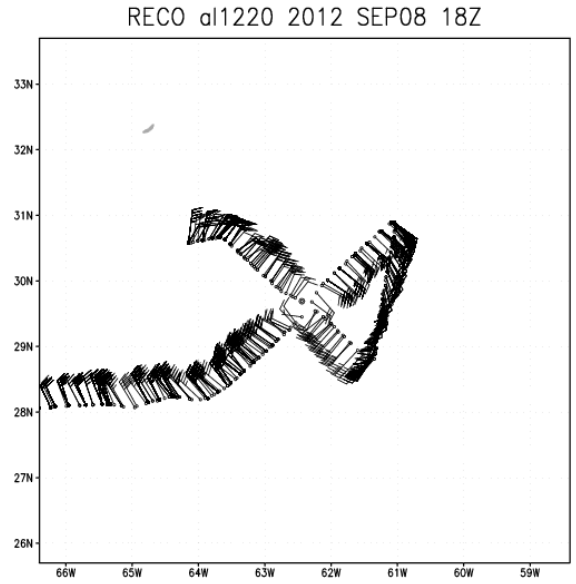
Aircraft-based Surface Wind Estimates

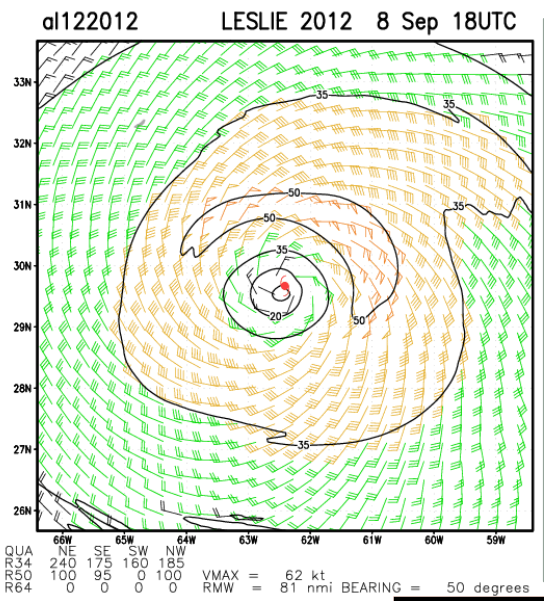
INPUTS

- HDOBS (30Hz) for 0-150km
  - Flight-level wind, height, temperature and dewpoint
  - SFMR wind speeds
- MTCSWA for 150 – 600 km
  - Satellite-based flight-level wind estimates

Output

- Surface wind field estimates
  - 2-d wind field
  - Max wind, location
  - Wind radii
- N-AWIPS grids, motion relative HDOBS
- ATCF Fix





ATCF FIX

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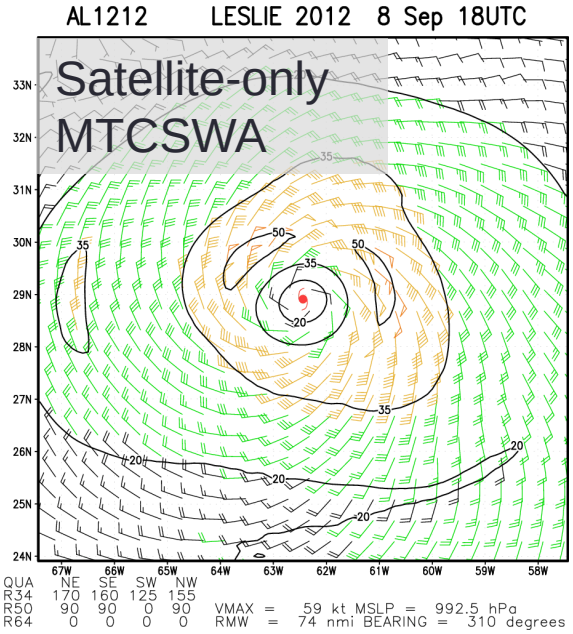
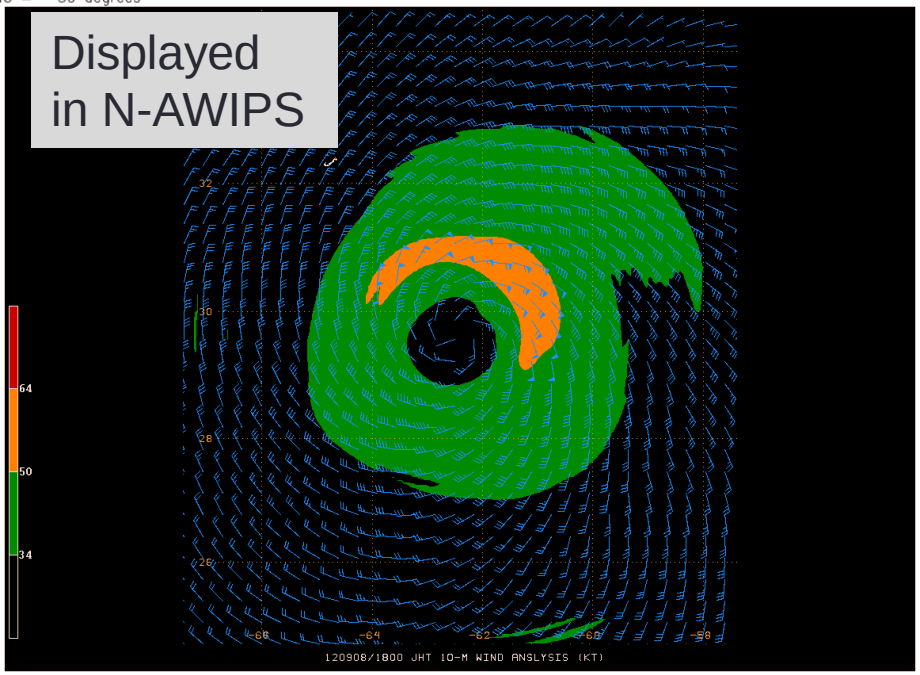
AL, 12, 201209081800, 70, ANAL, CIR, , 2967N, 6241W, 10 , 2, 62, 2, , 2, MEAS, 50, NEQ, 100, 95, 0, 100, , , , , 2, 81, , L, JHT, MPS, MPS, 201209081100, 201209080000, , , AIRCRAFT RECON + MTCSWA , JHT Surface Wind Analysis Project (EARLY)





View 2012 cases at http://rammb.cira.colostate.edu/research/tropical_cyclones/tc_surface_wind_analyses/

Knaff, DeMaria, RAMMB and Brennan, NHC