



---

# **NOAA AMSR-2 Oceanic Environmental Products: Operational Utilization and User Impact**

Zorana Jelenak, Paul Chang, Ralph Ferraro and Patrick Meyers  
NOAA/NESDIS/STAR  
Michael Brennan  
NOAA/NWS/NHC  
Joseph Sienkiewicz  
NOAA/NWS/OPC  
Peter Black  
NRL

Zorana.Jelenak@noaa.gov



**“... Initiatives/technologies like this always seem to be on the internet first and then some day they shows up in our Work Stations. Then when we get it, only some use it. We see that data can be useful but also that it has problems and we have no knowledge to sort through them...”**

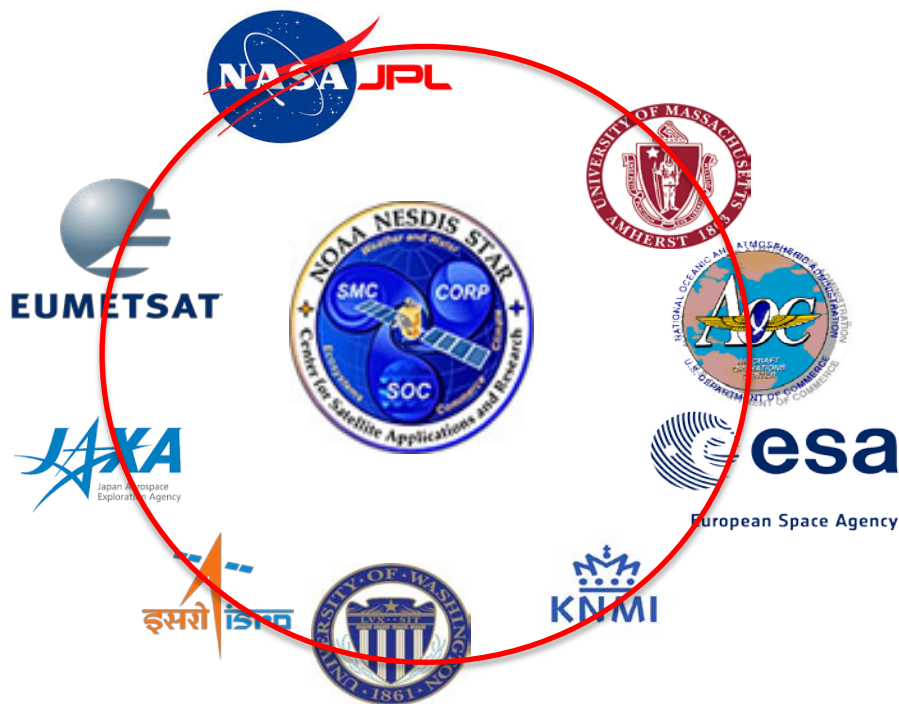
Picture courtesy  
of Dr R. Knabb



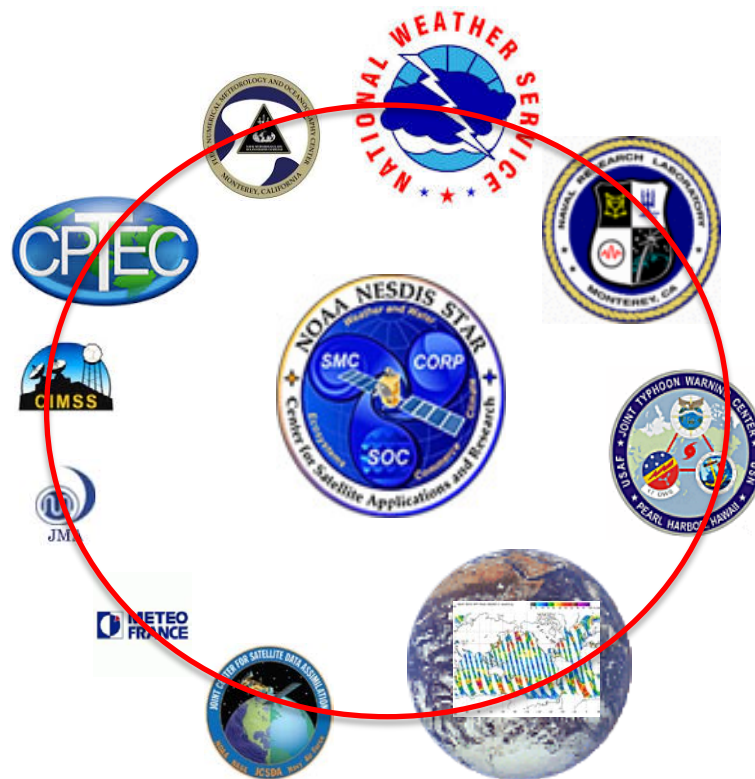
# External Partnerships and Collaborations are Central to Success!



## Data and Product Providers

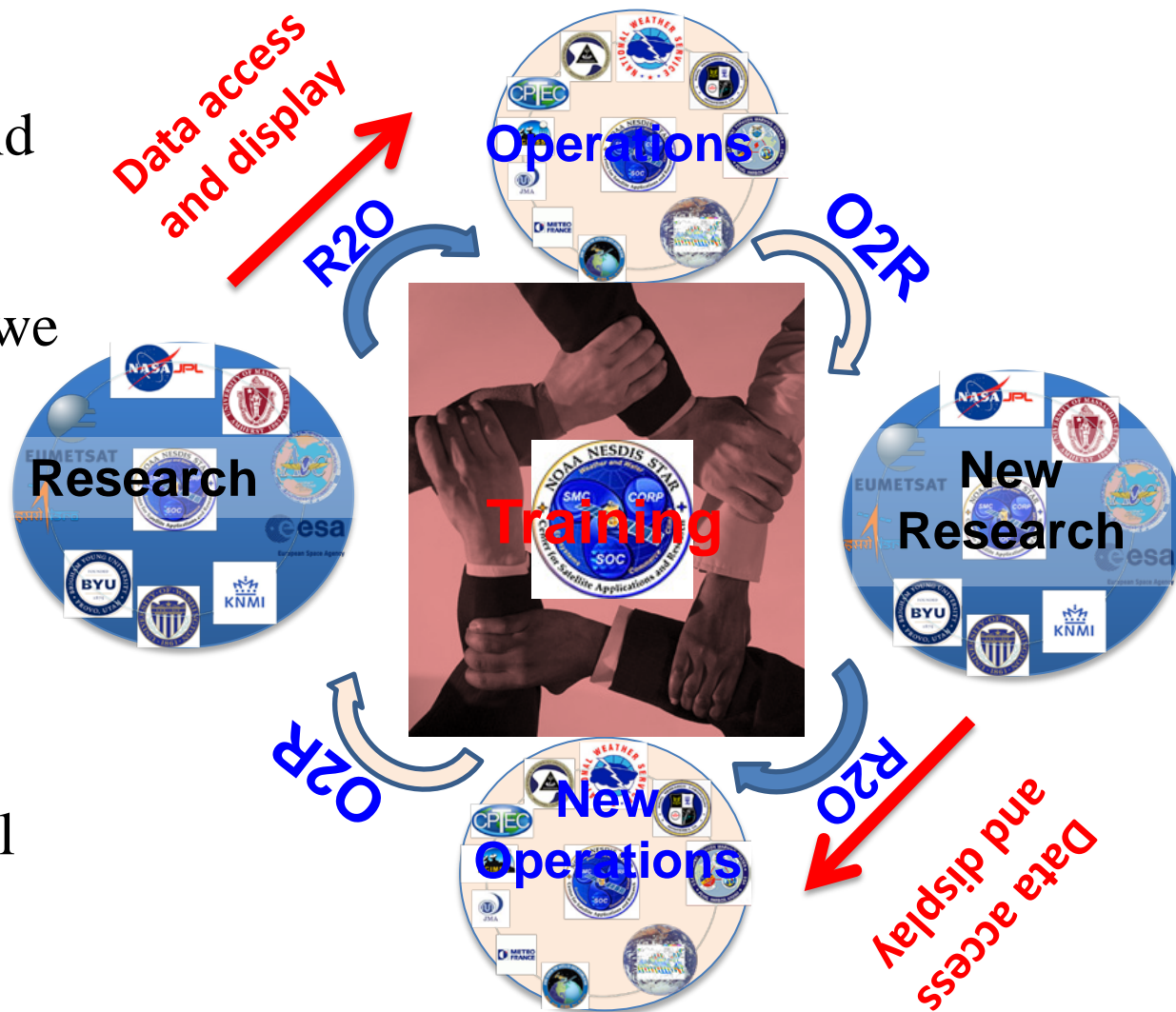


## Data Users



- Help us understand Wants
  - Improve data and products
  - Design new product
  - Design new missions

- Process has to be adaptable, flexible and persistent
- In cooperation with EumetSat and NWS we provide training on:
  - Data access
  - Data display
  - Data use for:
    - Forecasting
    - Data assimilation
    - Research
- We train users as well as trainers



# Wants vs Needs

**“...Satellite ocean surface vector wind data are our revolutionizing operational marine weather warnings, analyses, and forecasts...”**

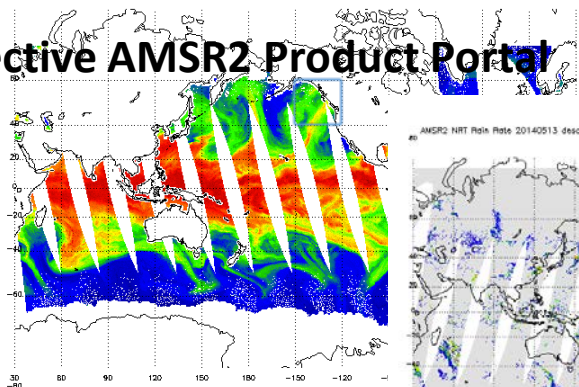
**“...Satellite ocean surface vector wind data is our bread and butter...”**



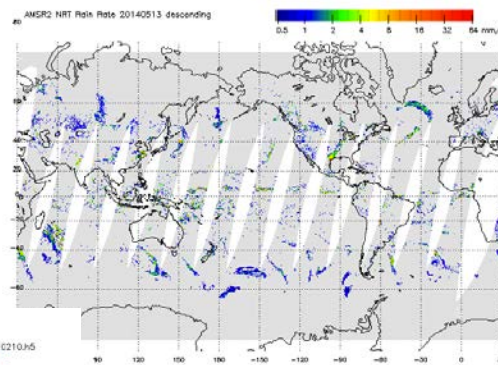
Picture courtesy  
of Dr R. Knab

## Near Real-Time and Retrospective AMSR2 Product Portal

AMSR2 NRT Water Vapor May 14 13:22 UTC 2014 ascending



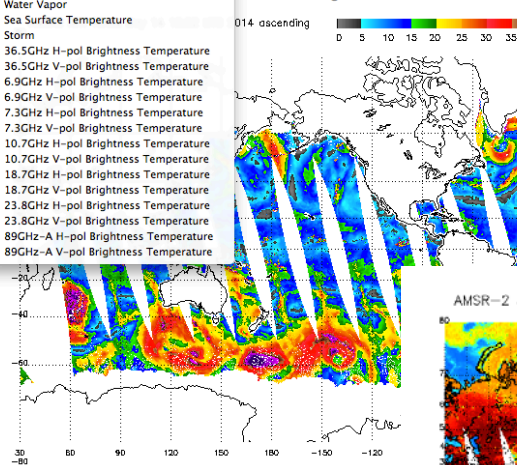
Descending Pass



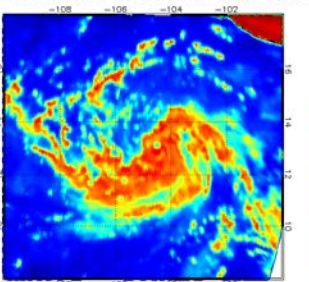
Data from Satellite/Instruments: GCOMW1

- Additional Products
- Wind Speed
  - Rain
  - Cloud Water
  - Water Vapor
  - Sea Surface Temperature
  - Storm
  - 36.5GHz H-pol Brightness Temperature
  - 36.5GHz V-pol Brightness Temperature
  - 6.9GHz H-pol Brightness Temperature
  - 6.9GHz V-pol Brightness Temperature
  - 7.3GHz H-pol Brightness Temperature
  - 7.3GHz V-pol Brightness Temperature
  - 10.7GHz H-pol Brightness Temperature
  - 10.7GHz V-pol Brightness Temperature
  - 18.7GHz H-pol Brightness Temperature
  - 18.7GHz V-pol Brightness Temperature
  - 23.8GHz H-pol Brightness Temperature
  - 23.8GHz V-pol Brightness Temperature
  - 89GHz-A H-pol Brightness Temperature
  - 89GHz-A V-pol Brightness Temperature

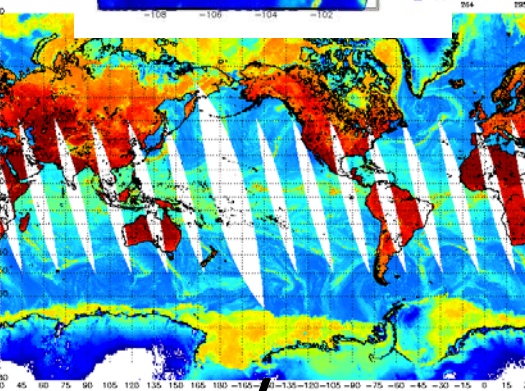
Ascending Pass



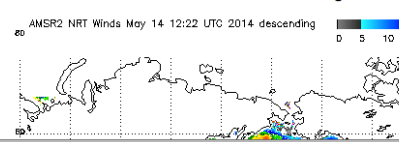
AMSR-2 36.5GHz H-pol  
Date: 20150602-11:30 UTC Storm Name: BLANCA  
AMSR2 L1B File: CH1AM2L\_201506020828\_0308\_L15NFEBR\_2210210105



AMSR-2



Descending Pass



- Ocean NRT Products
  - MW brightness temperature
    - Tropical Cyclone forecasting
    - Data assimilation
  - SST, Wind Speed, Cloud liquid water, Water Vapor, Rain Rates
    - Blended Products
    - NWP Model validation
    - Climate studies
    - Research



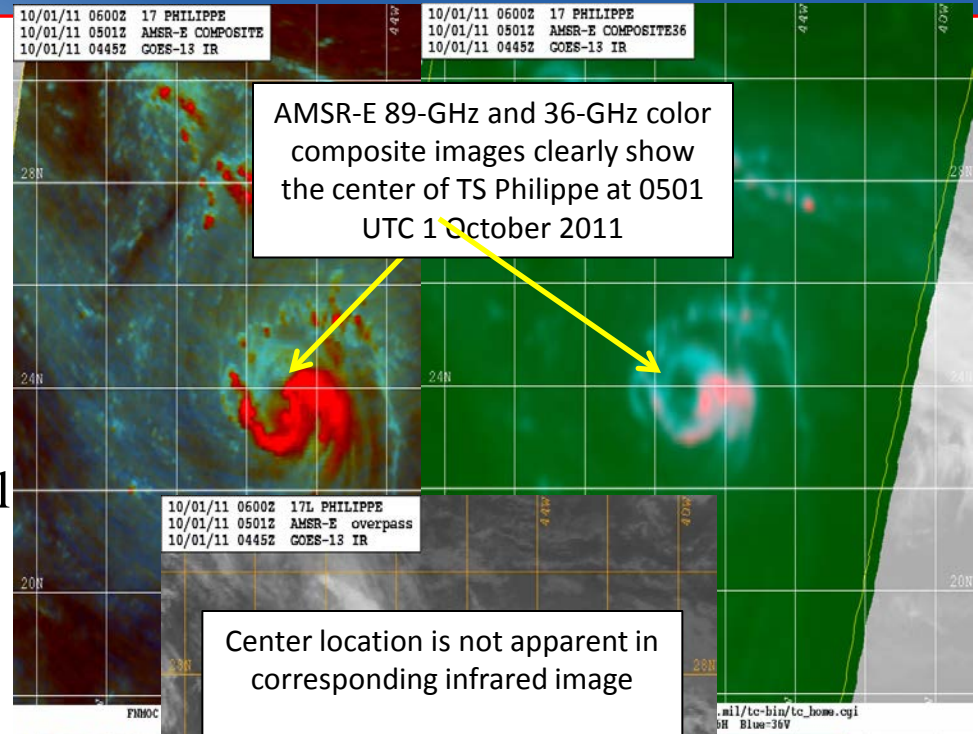
---

# AMSR-2 Usage at NHC

# Uses of Microwave Imagery

## Overview

- Determining if a formative system has a well-defined center, a requirement to initiate advisories
- Locating the center of TCs when the center is not apparent in conventional visible or infrared imagery, especially for weaker systems at night
- Assessing trends in TC structure and intensity, such as eyewall formation and eyewall replacement cycles







# Helping Forecast Rapid Intensification



## TROPICAL STORM AMANDA DISCUSSION NUMBER 6

NWS NATIONAL HURRICANE CENTER MIAMI  
FL EP012014

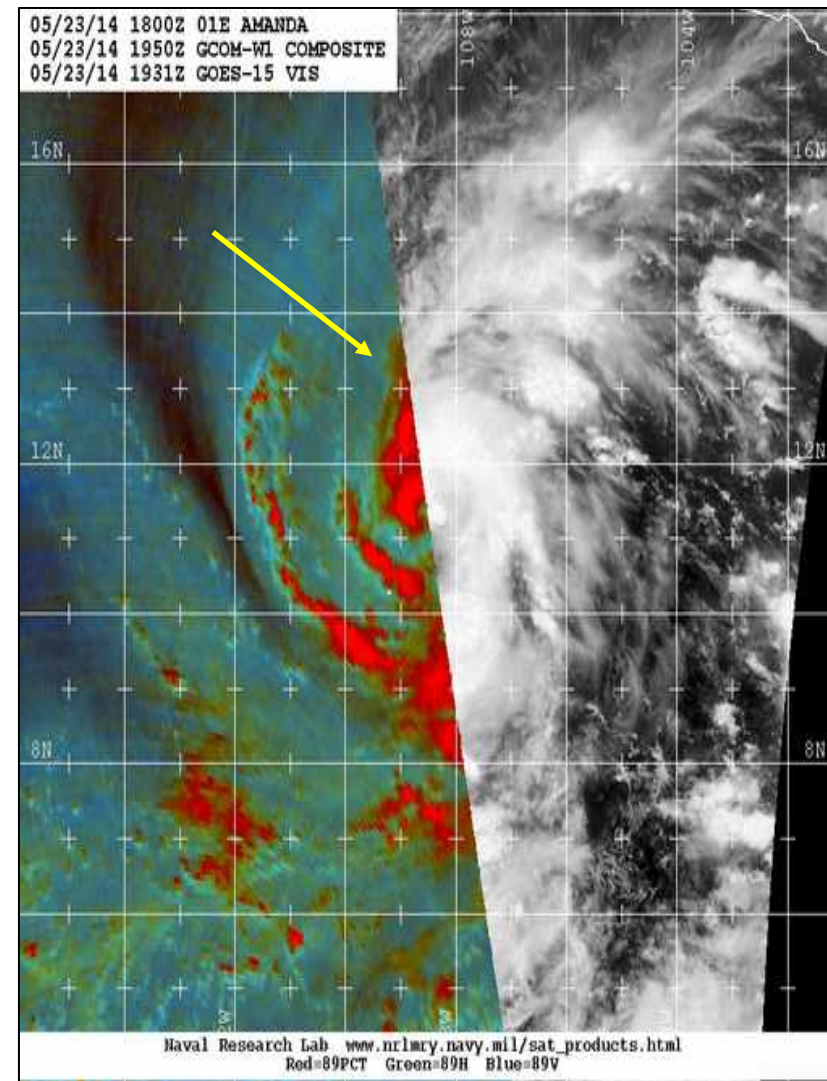
800 PM PDT FRI MAY 23 2014

Amanda has organized quickly over the past few hours. Deep

convection now wraps more than halfway around the estimated center position, and **an AMSR-2 microwave pass a few hours ago showed the development of a mid-level eye feature.** Based on the latest ADT estimate from UW-CIMSS the initial intensity has been increased to 50 kt.

Now that Amanda is developing inner-core structure, it seems likely that the cyclone will be able to take advantage of the favorable environment and intensify, possibly rapidly, during the next day or so.

24 h later Amanda was a 100-kt  
hurricane





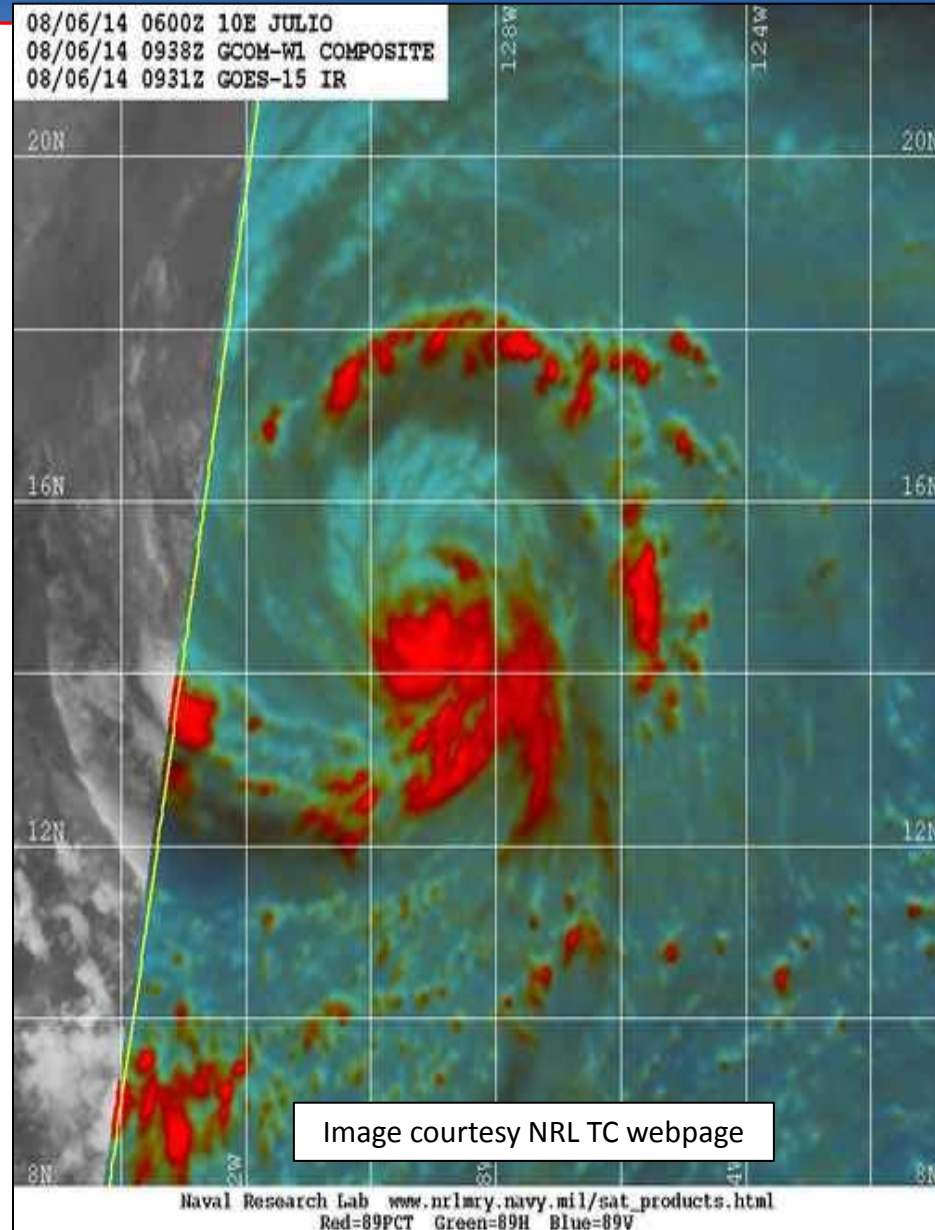
# Helping Understand of Structural Changes



HURRICANE JULIO DISCUSSION NUMBER 11  
NWS NATIONAL HURRICANE CENTER MIAMI  
FL EP102014

800 AM PDT WED AUG 06 2014

Julio has a somewhat ragged appearance in satellite imagery this morning. **While cloud tops near the center are about -80C, AMSR-2 microwave imagery a few hours ago showed that the eyewall was open to the north. That, combined with a large arc cloud seen moving northward away from the center, suggests that dry air entrainment is occurring on the north side.** Satellite intensity estimates are 77 kt from TAFB and 65 kt from SAB. Given the current appearance, the initial intensity remains 65 kt. The cirrus outflow is good over the southwestern semicircle and poor elsewhere.

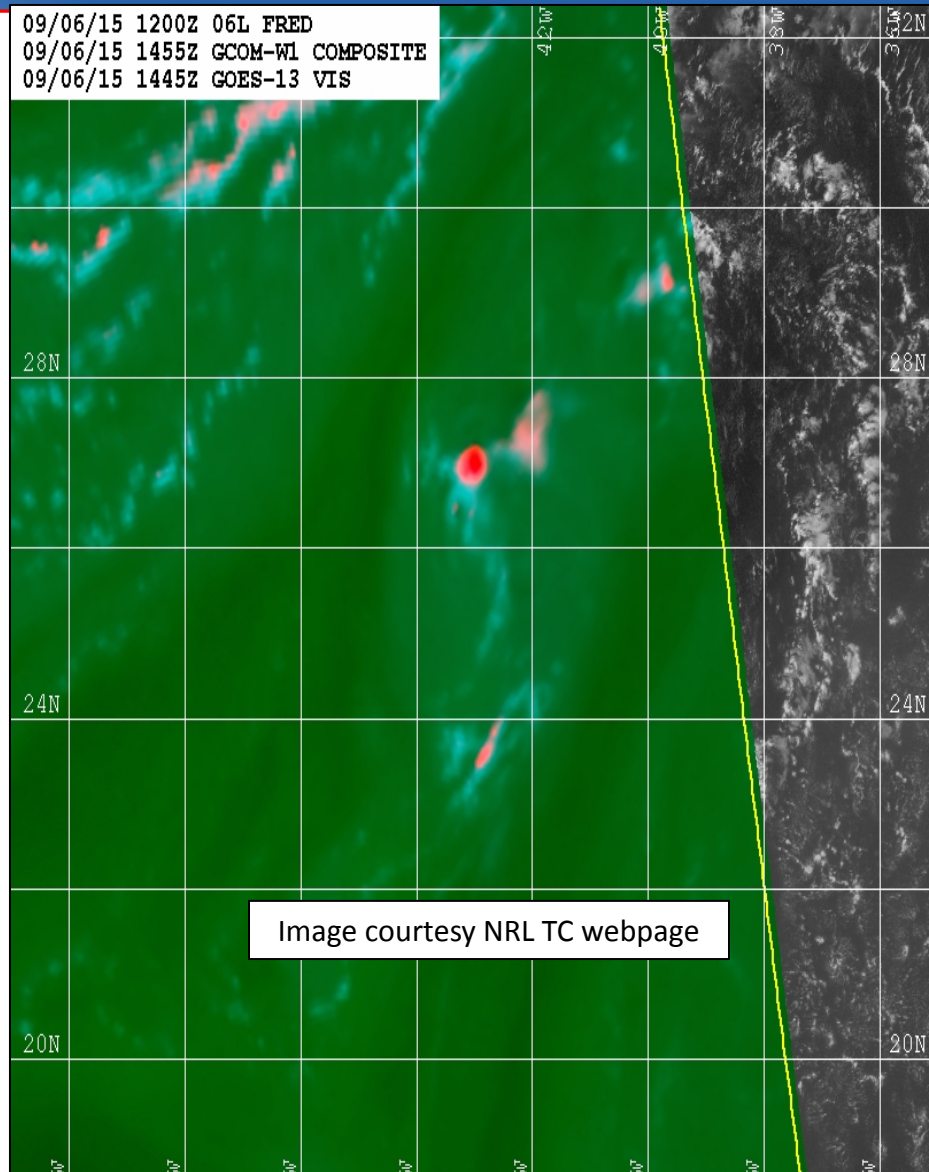


## REMNANTS OF FRED DISCUSSION NUMBER 32

NWS NATIONAL HURRICANE CENTER  
MIAMI FL AL062015

500 PM AST SUN SEP 06 2015

High-resolution visible satellite imagery indicates that the low-level circulation had become elongated and ill-defined. **This is further reinforced by a 37 GHz GCOM microwave image showing that the system lacks a well-defined center.** Therefore, Fred is no longer a tropical cyclone and advisories are being discontinued.

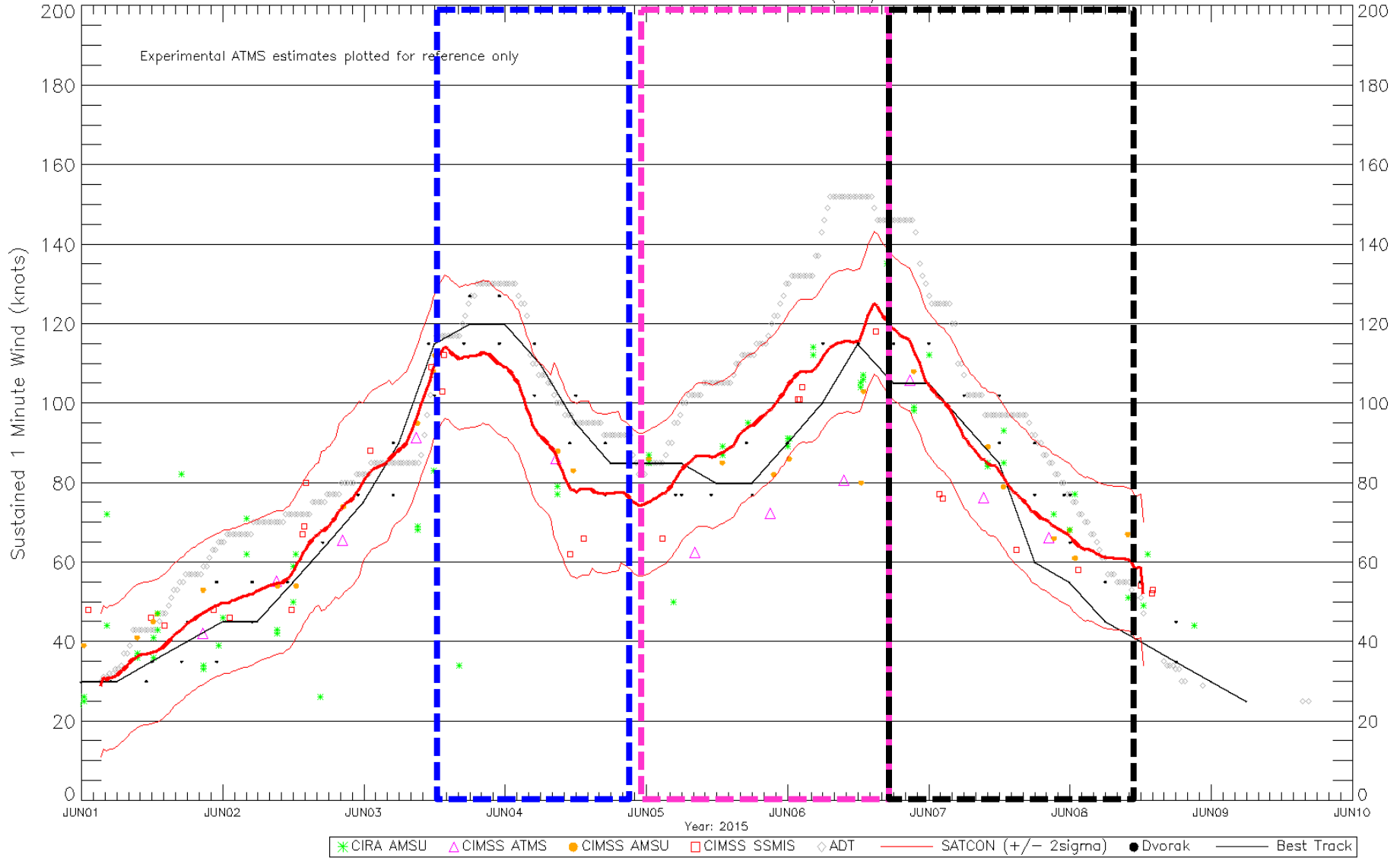




# East Pacific Case Study

## Hurricane Blanca Jun 2015

### CIMSS TC SATCON Wind for BLANCA (02E) 2015





# Tropical Storm Blanca

## 2 June 2015



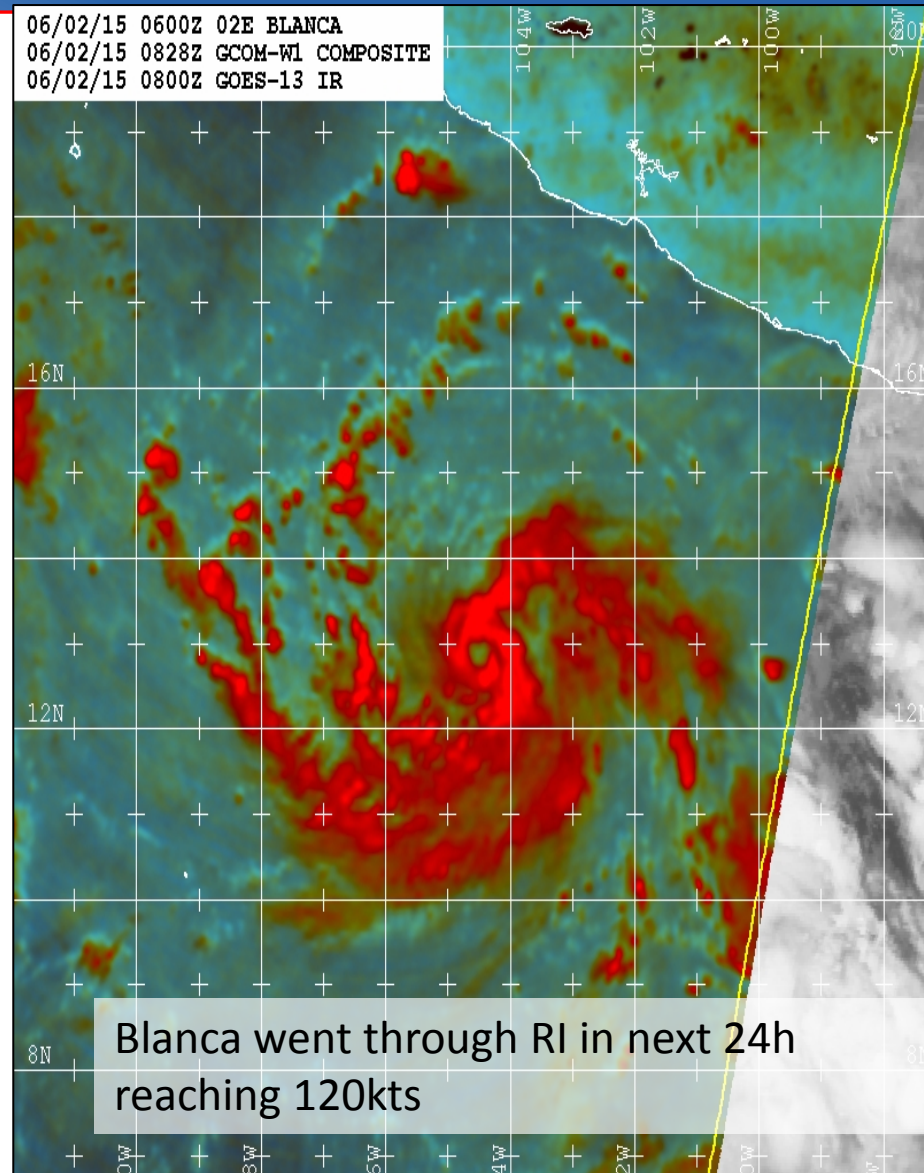
### TROPICAL STORM BLANCA DISCUSSION NUMBER 8

NWS NATIONAL HURRICANE CENTER MIAMI FL  
EP022015

1000 AM CDT TUE JUN 02 2015

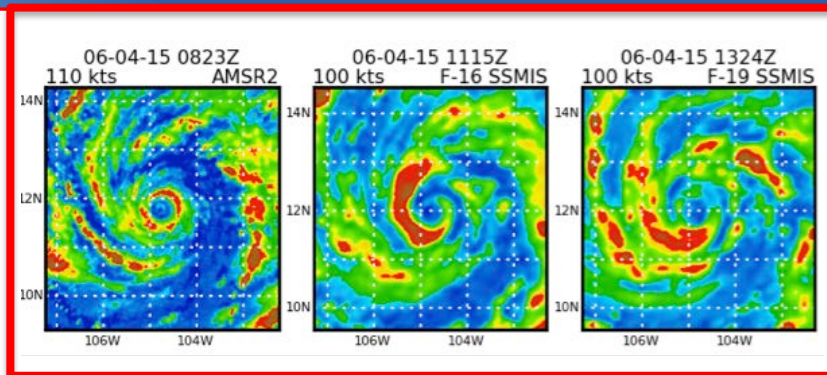
Blanca is intensifying. Geostationary imagery shows a CDO and prominent banding features, and a **0828Z AMSR-2 image from GCOM-W1 showed a low- and mid-level eye feature**. The latest Dvorak estimates from TAFB and SAB are T3.5/55 kt, and the latest ADT is T4.5/77 kt. The initial intensity is set to 60 kt for this advisory. **Given that Blanca has developed the inner-core features seen in microwave imagery and the shear is now below 10 kt, the cyclone appears to be poised for a period of rapid intensification.**

The NHC forecast is near the highest guidance, showing Blanca becoming a major hurricane tomorrow, and conditions appear favorable for continued strengthening through 72 hours, when the SHIPS, LGEM and FSU Superensemble all show a peak near 120 kt. However, even this forecast could be conservative given that the SHIPS RI index shows a 95 percent chance of a 40-kt increase in the first 24 hours.



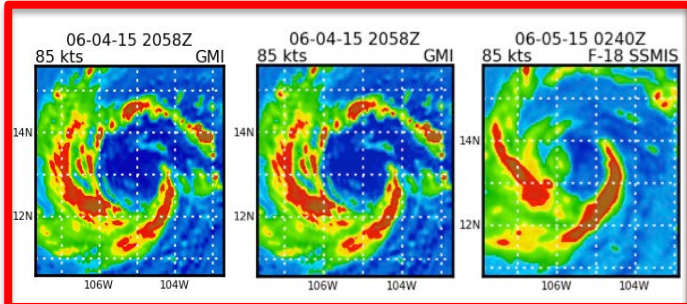
# Blanca's Development through MW Imager Eyes

## Pinhole Eye Development      Eyewall Replacement Cycle



### Eyewall Collapse during Rapid Decay

### Second RI with Single Eye Formation

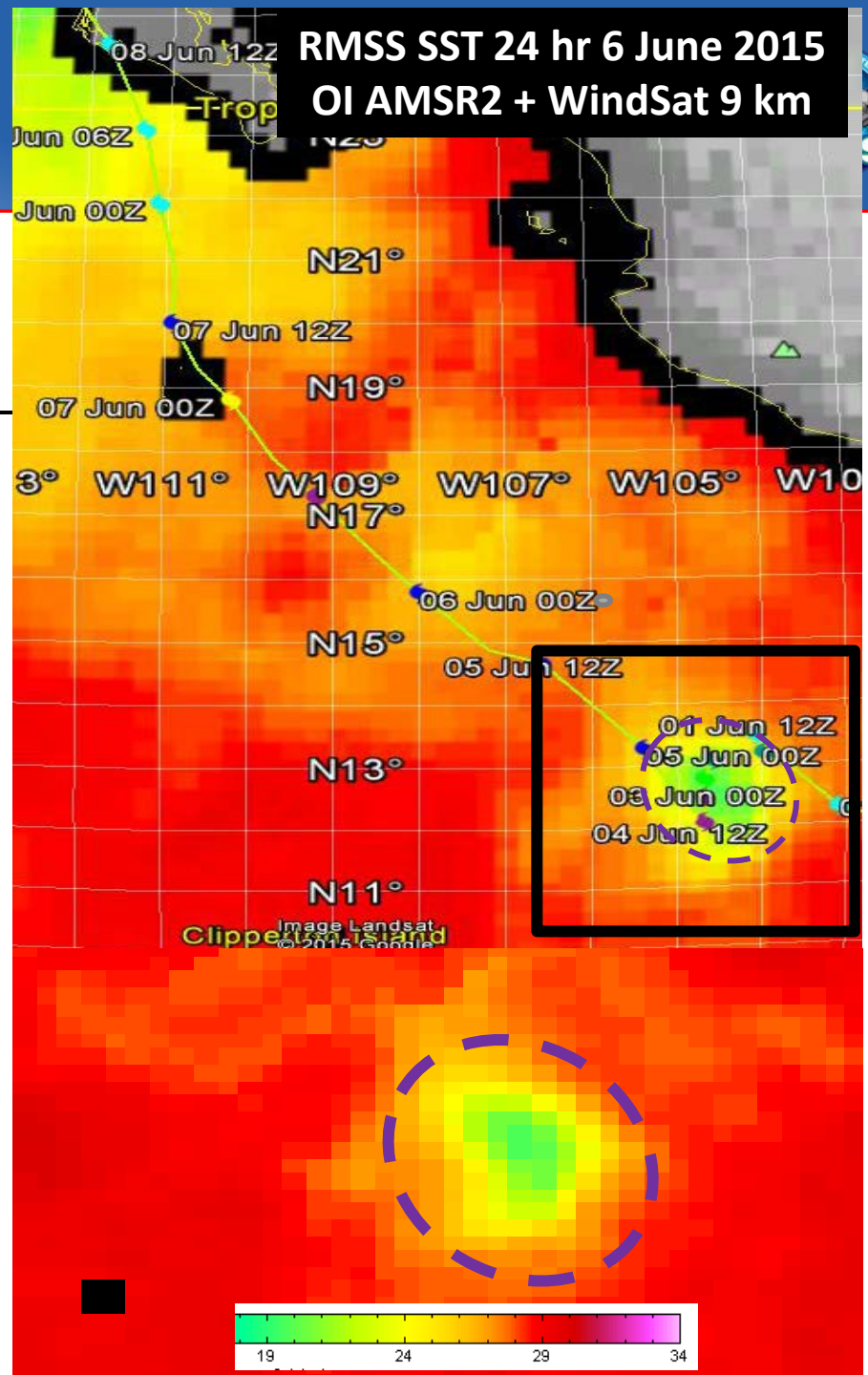
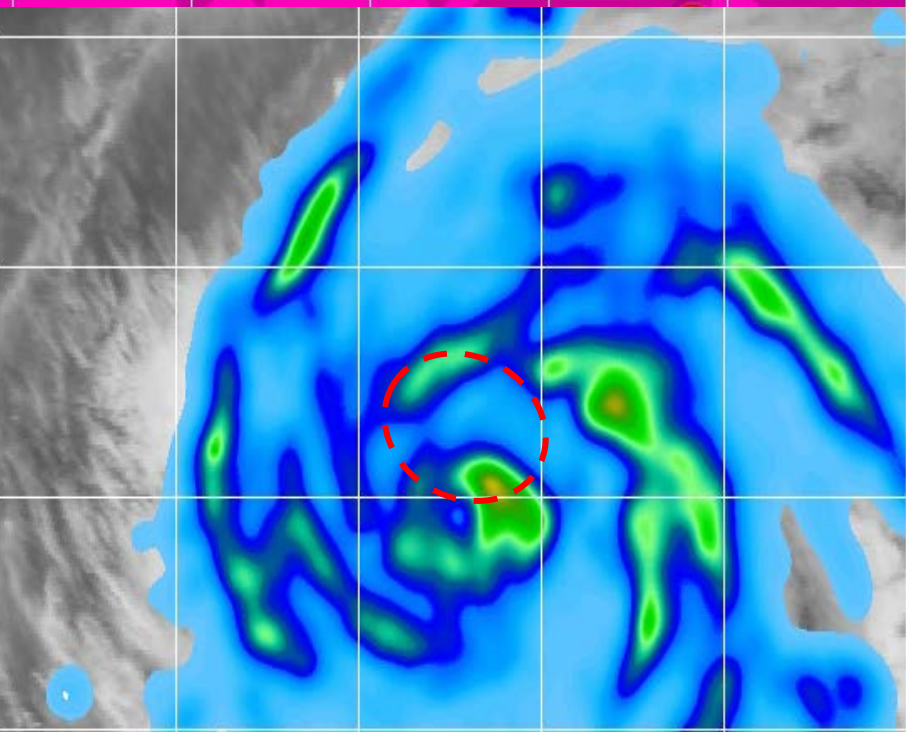
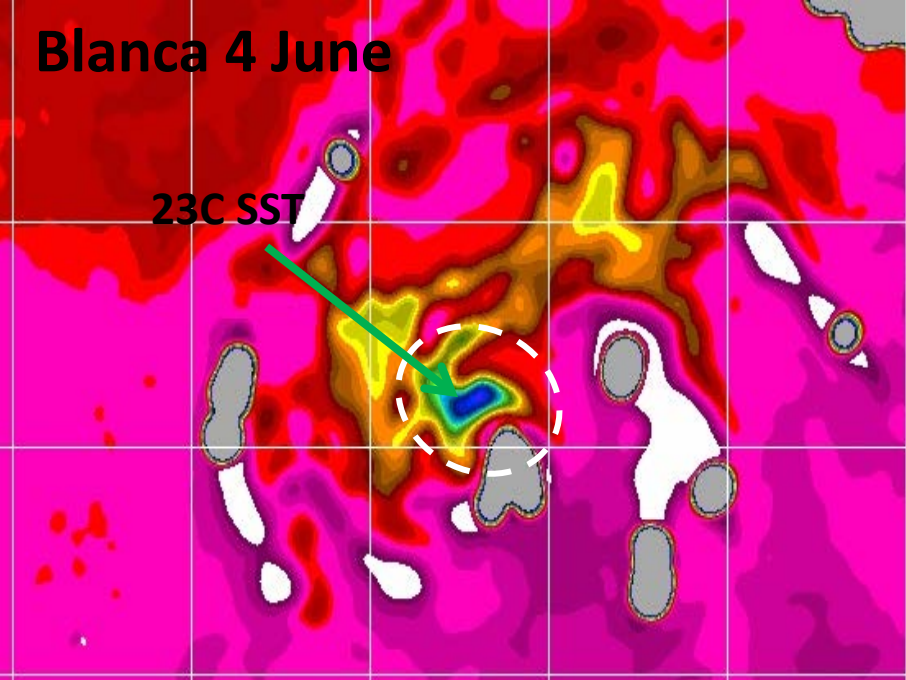


### Asymmetric Decay over cold water prior to Landfall



# Blanca 4 June

23C SST

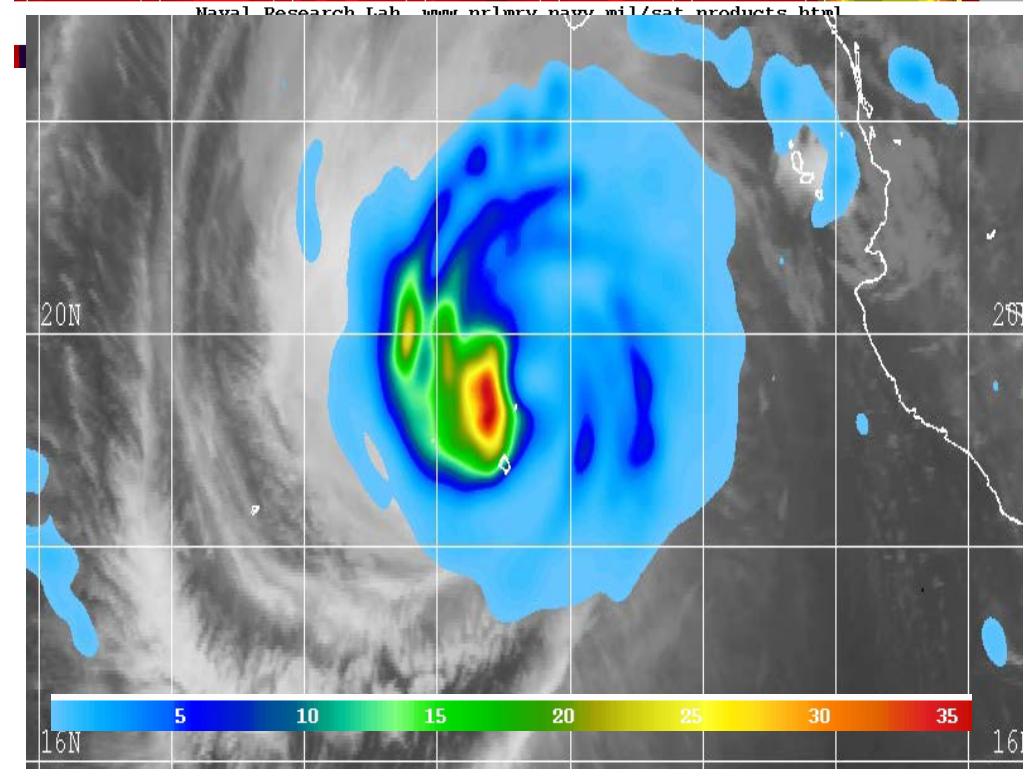
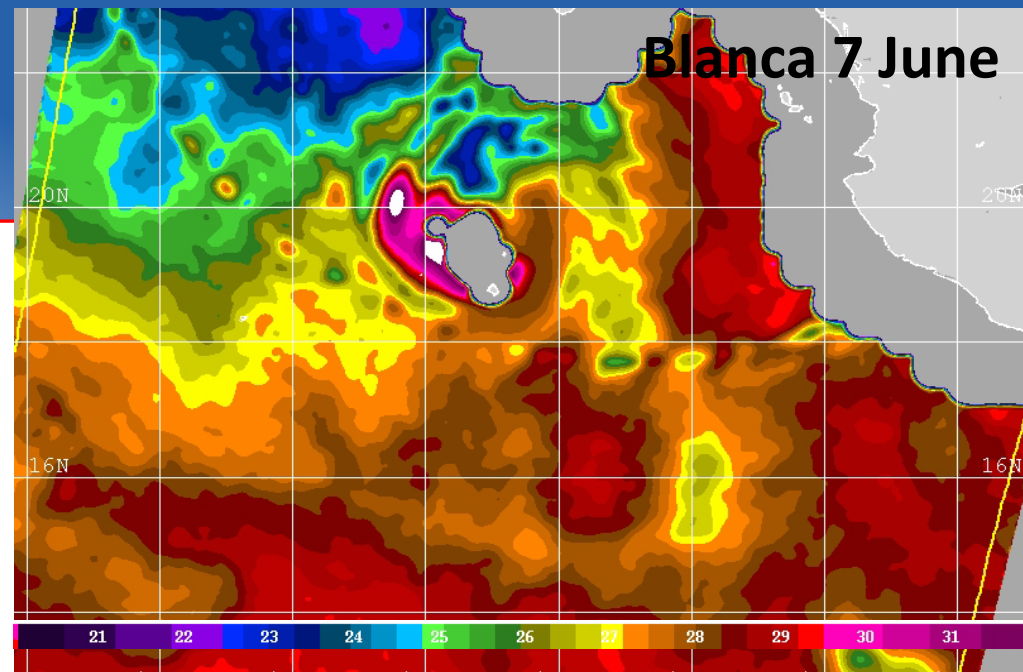






# ASMR-2 SST indicate possibility of Rapid Decay

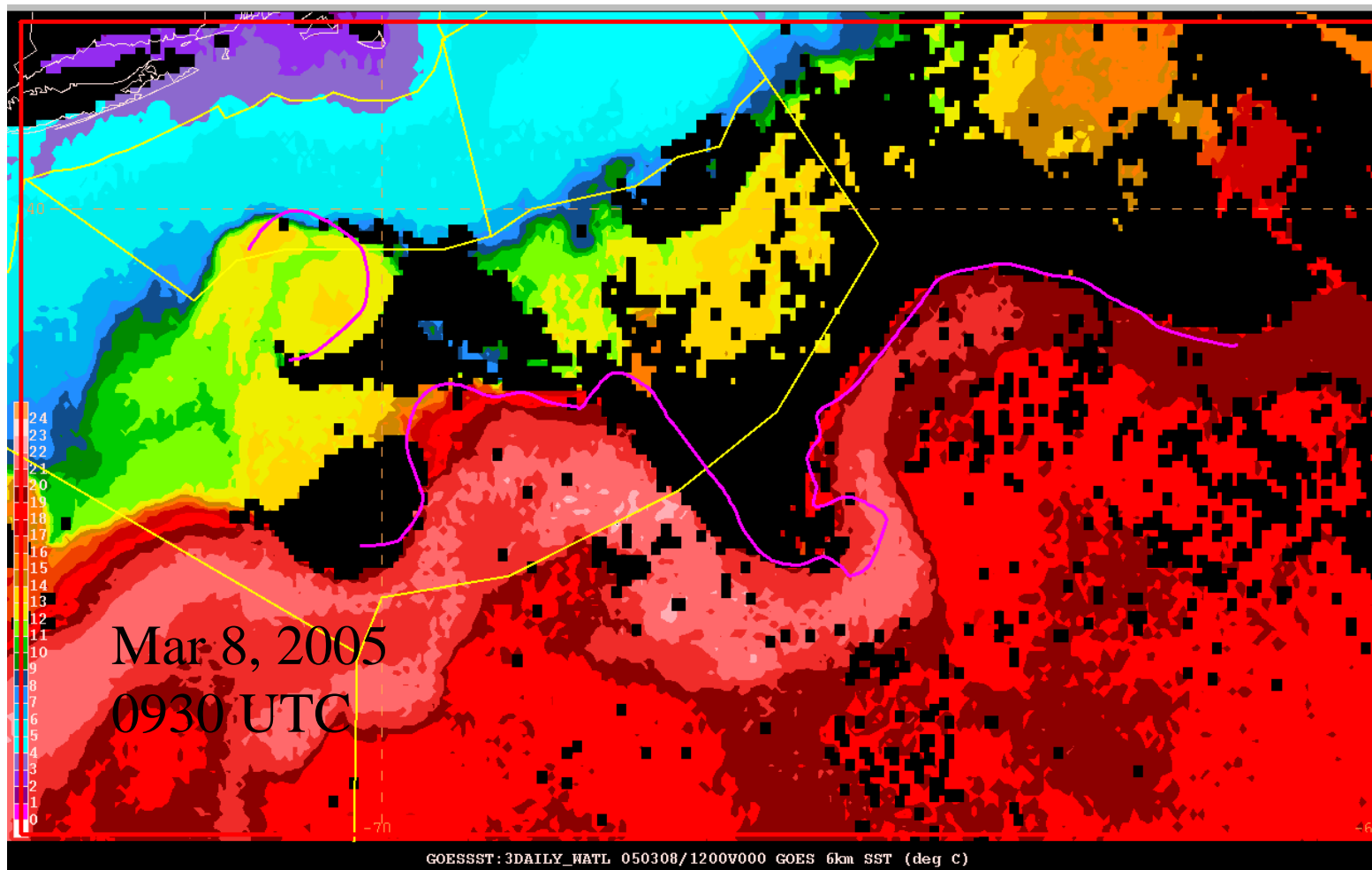
- Second rapid decay occurred as Blanca crosses San Lucas front into cold SSTs < 26C and landfall on Baja detected by AMSR-2 SST
- “Only rain rates greater than about 10 mm/hr (dark blue) impair SST estimation”
  - Flagging scheme doesn’t need to be too conservative for forecasting uses as required by data assimilation



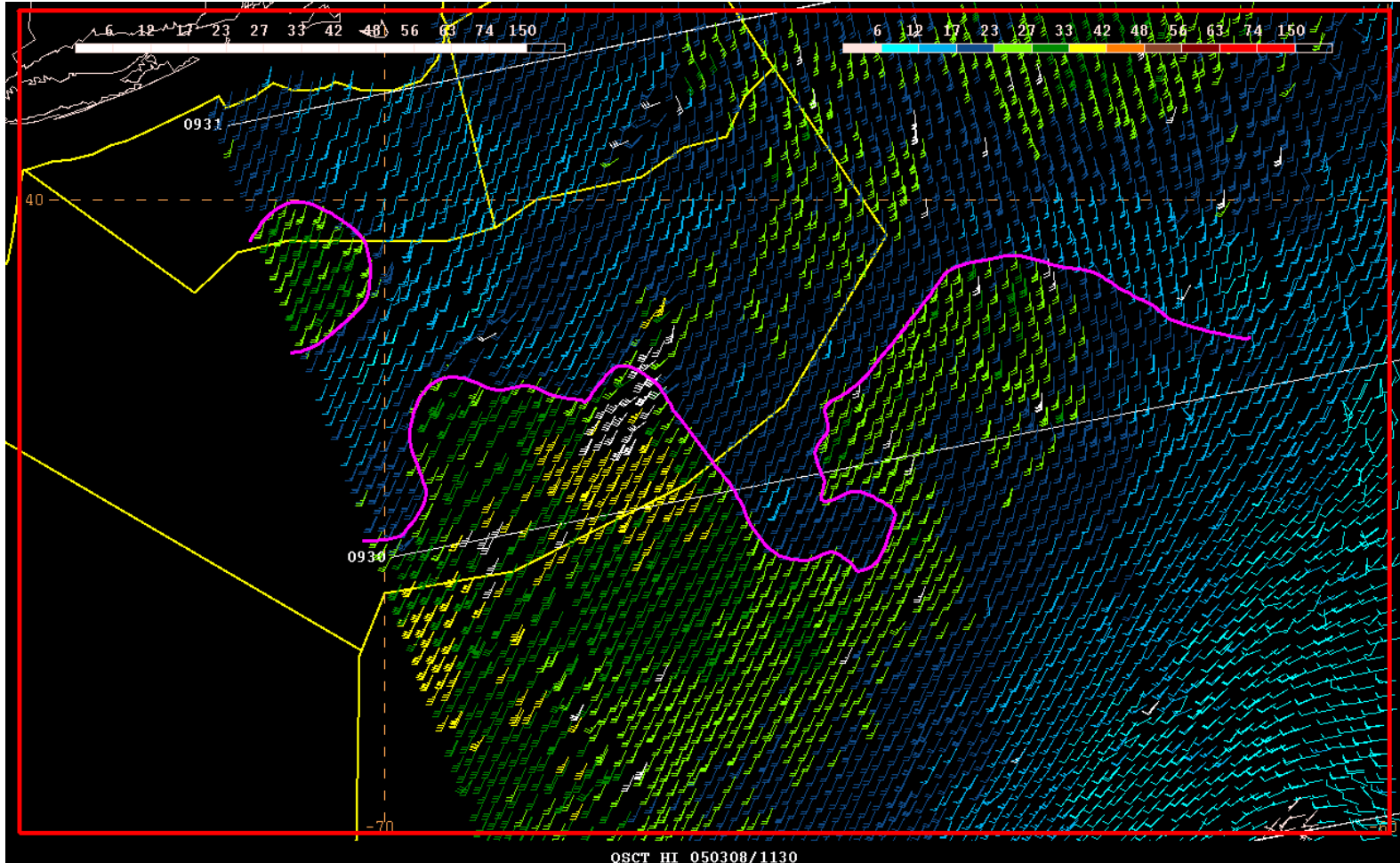


# Towards Understanding of NWP Model Winds

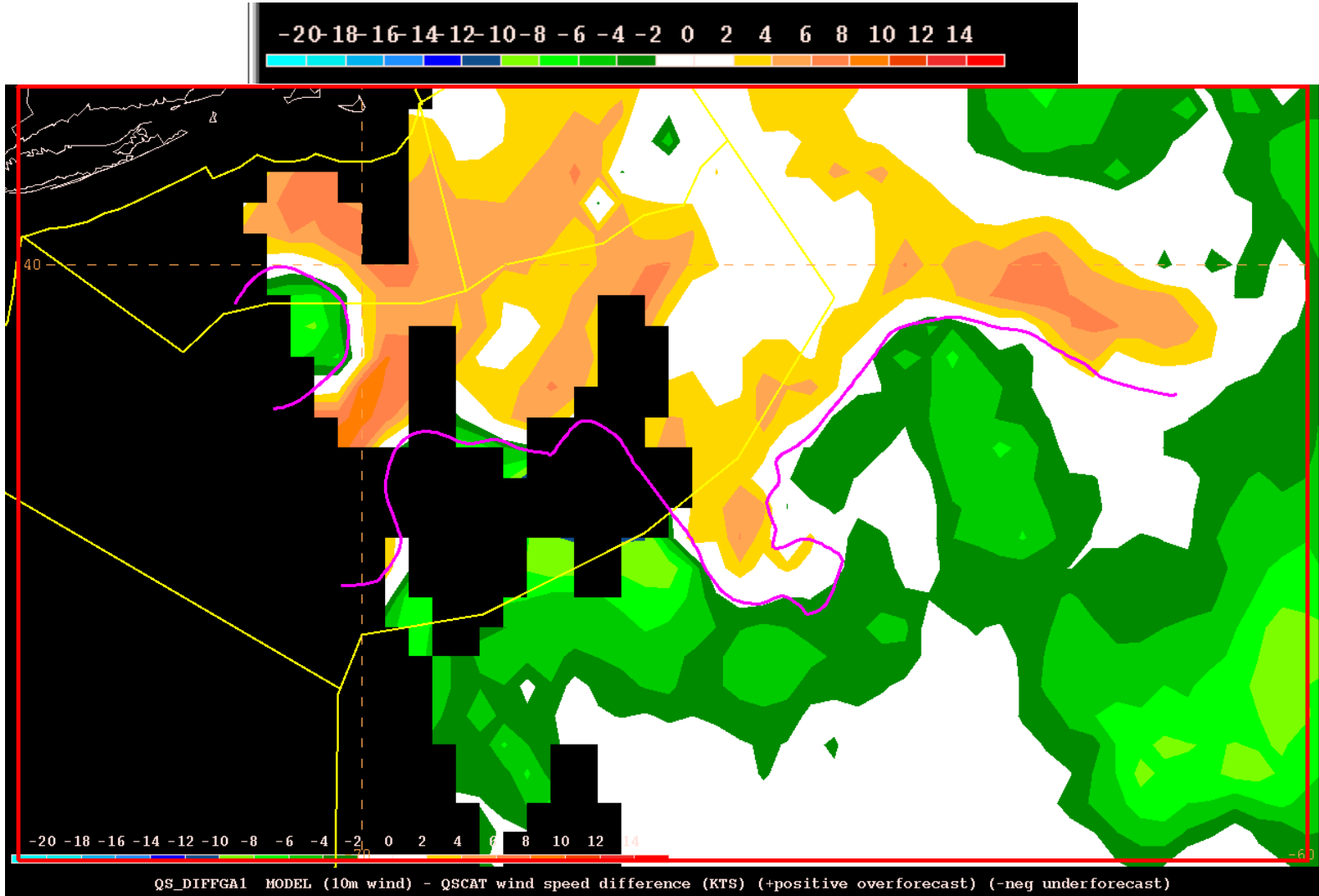
# Using SST to Validate Model Winds



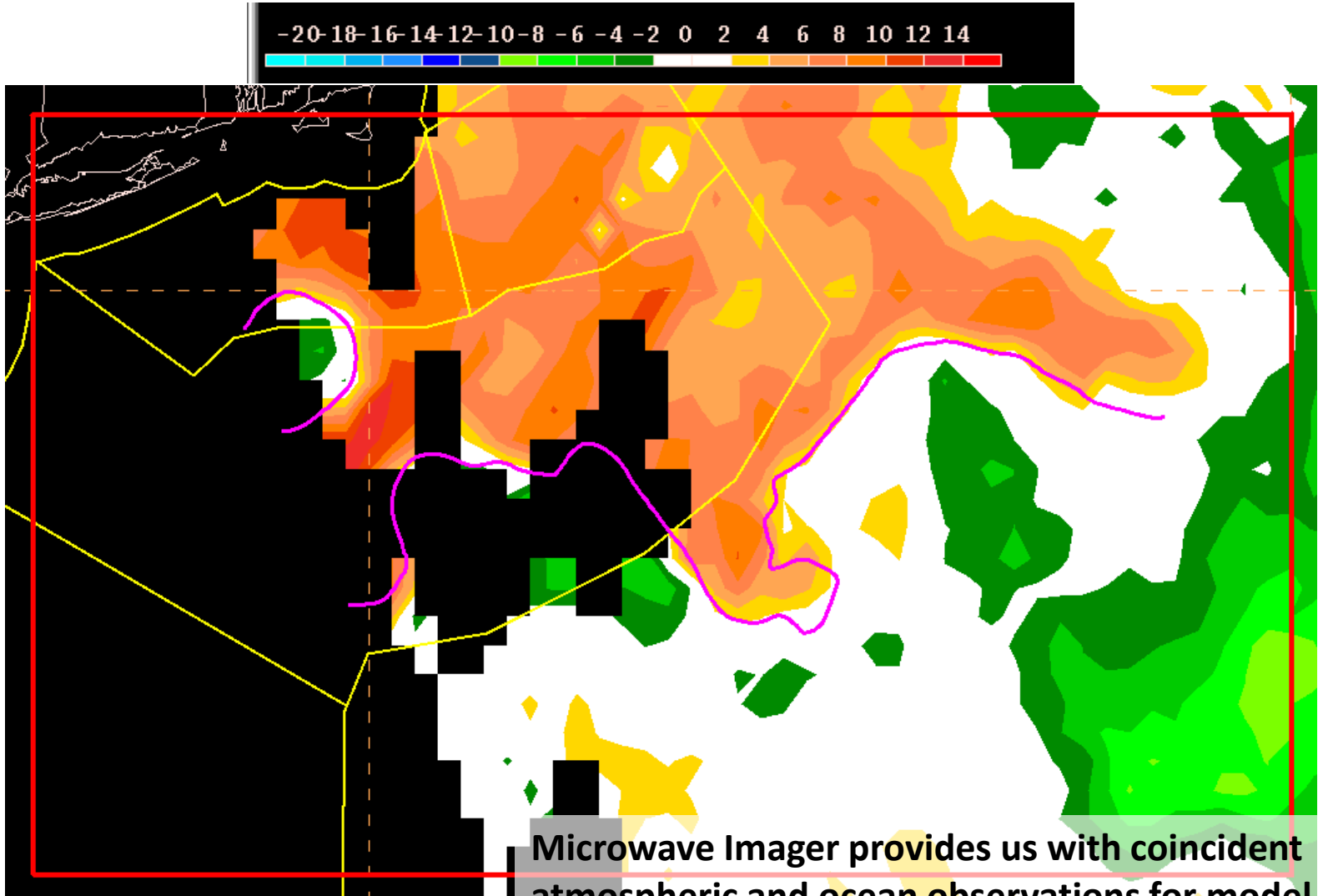
# Scatterometer Winds Over SST Front



# 10m GFS – Scatterometer Wind



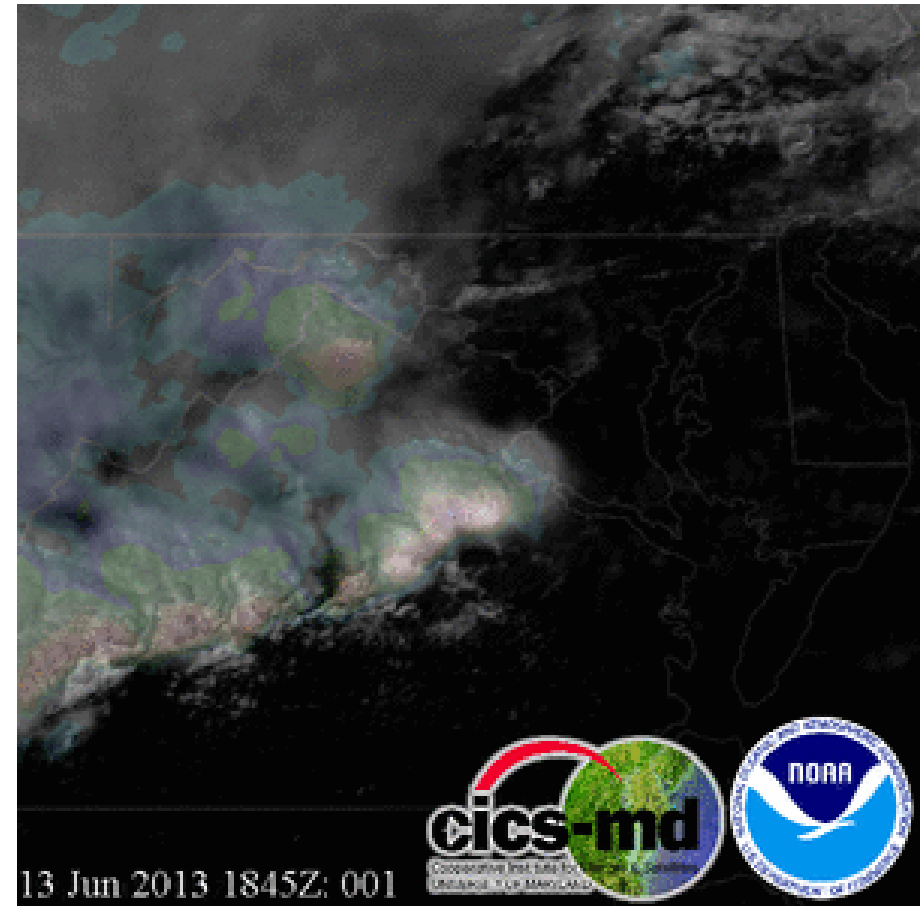
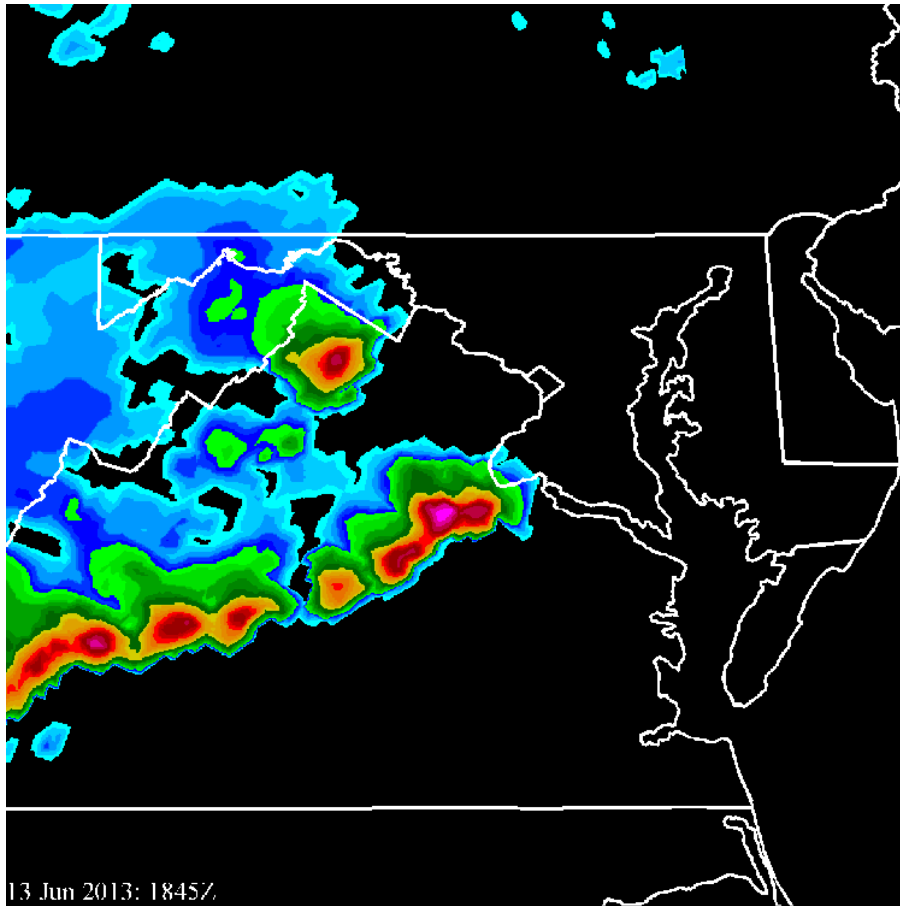
# 30m GFS – Scatterometer Wind



**Microwave Imager provides us with coincident atmospheric and ocean observations for model interpretation and validation**



# Tornado Outbreak 13 June 2013





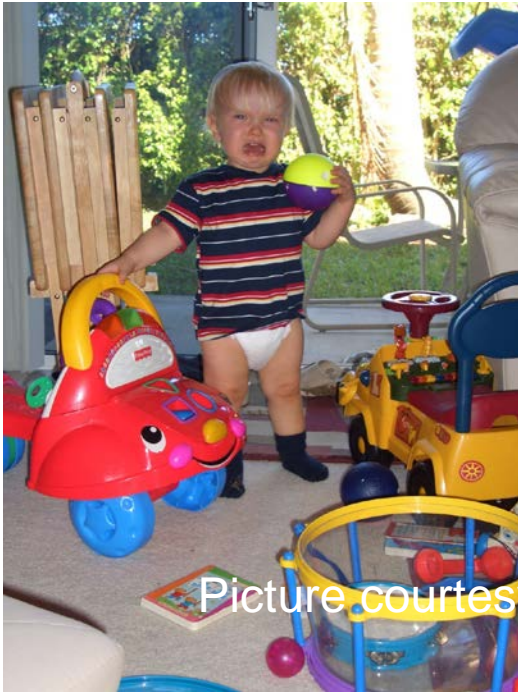
# Conclusions



- AMSR-2 provides:
  - Brightness temperature that carry critical information about tropical cyclone structure underneath the clouds and inputs for NWP
  - Almost all weather sea surface temperature and wind speed
  - High spatial resolution rain rate and total precipitable water aiding in predicting heavy rain fall events and fresh flood potential
  - Sea ice monitoring through clouds
  - Soil moisture for monitoring agricultural conditions and input in NWP



# Wants vs Needs



Picture courtesy of Dr R. Knabb

Thank  
You!

Zorana.Jelenak@noaa.gov