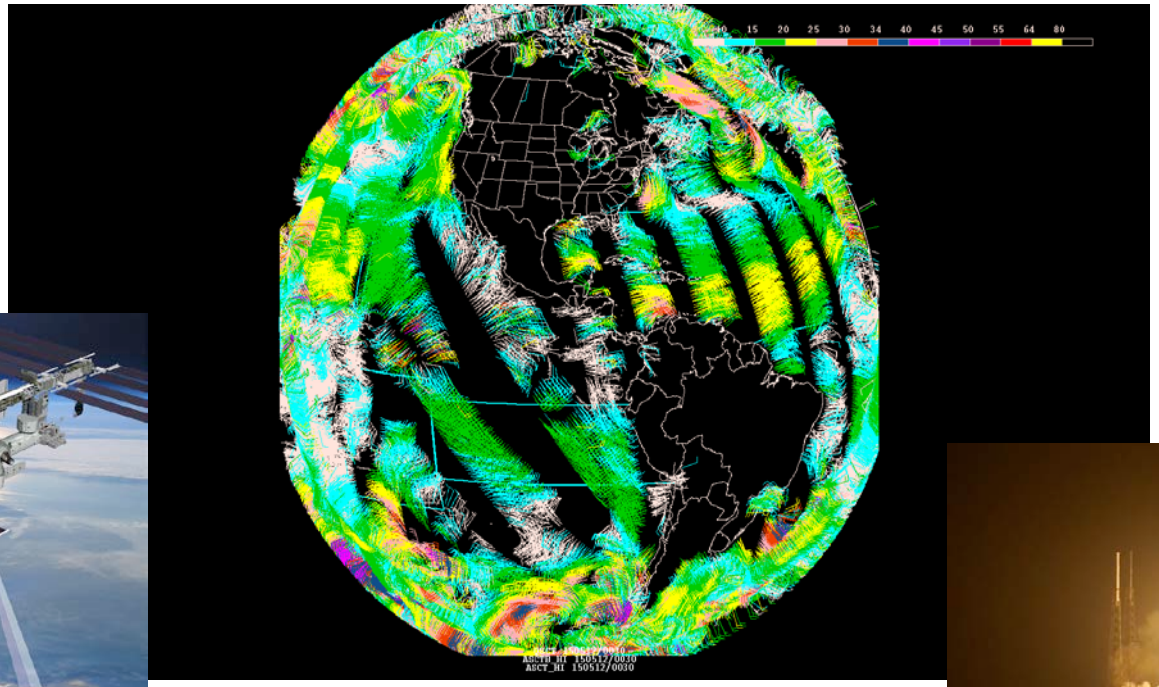
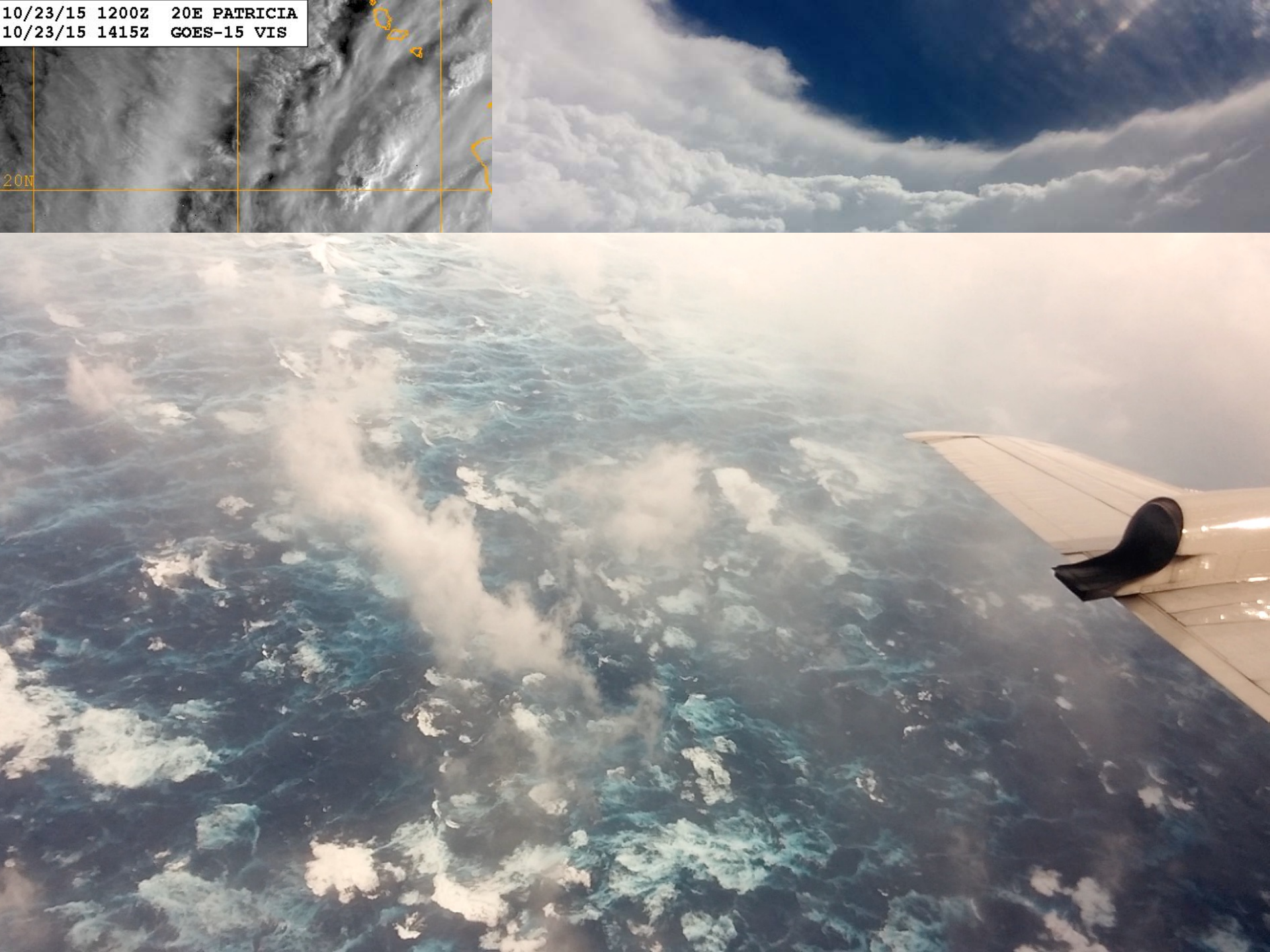
Operational Utilization of Ocean Surface Vector Winds From RapidScat



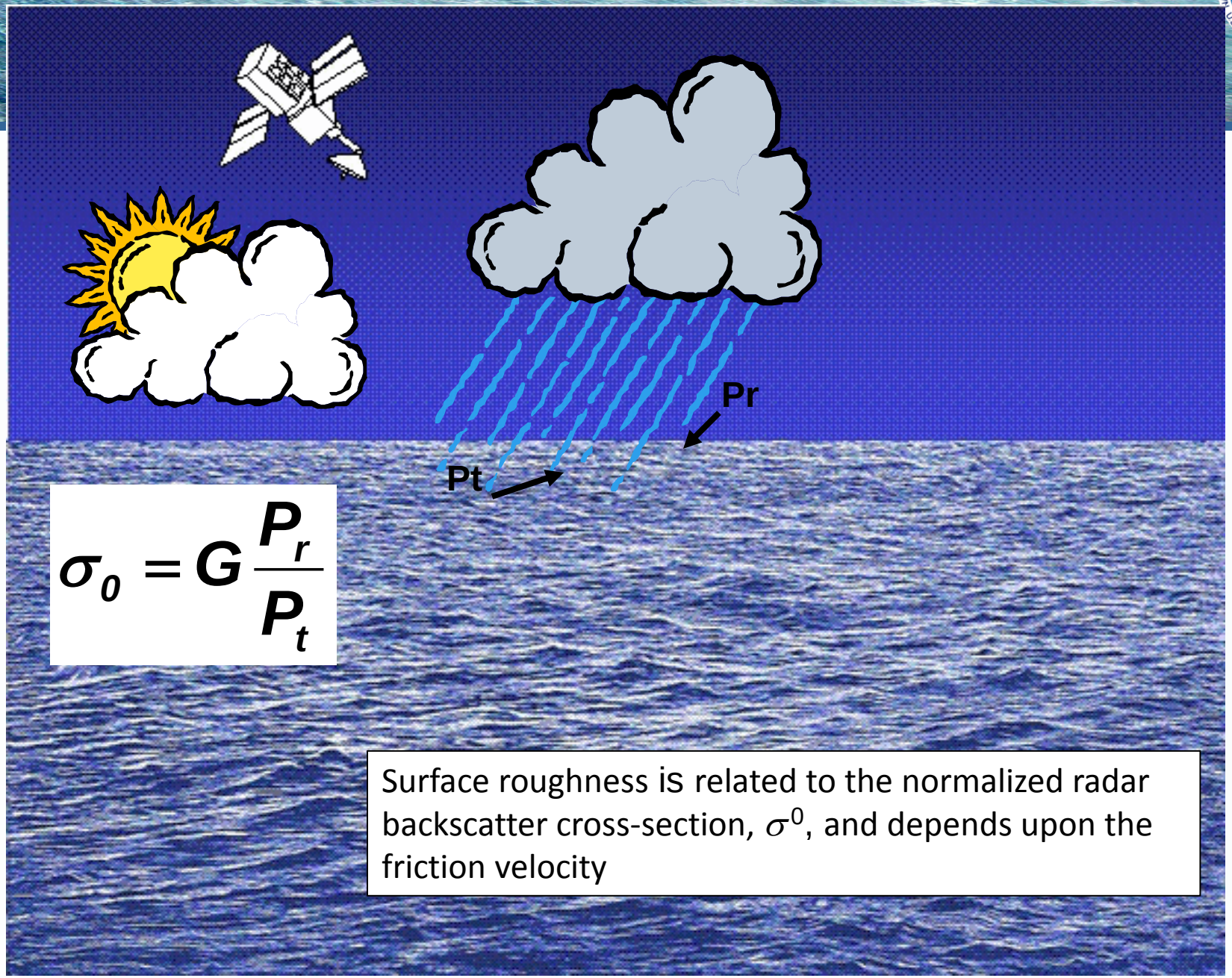
Paul S. Chang, Zorana Jelenak,
Seubson Soisuvarn and Faozi Said
NOAA/NESDIS
Center for Satellite Applications and Research

Asia/Oceania Meteorological Satellite Users' Conference
November 9-13, 2015
Tokyo, Japan


10/23/15 1200Z 20E PATRICIA
10/23/15 1415Z GOES-15 VIS
20N

Outline

- What is Ocean Surface Vector Wind Scatterometry
- What is RapidScat
- Utilization Examples
  - Extraptropical Cyclones
  - Tropical Cyclones



$$\sigma_0 = G\frac{P_r}{P_t}$$

Surface roughness is related to the normalized radar backscatter cross-section, σ^0, and depends upon the friction velocity

What is RapidScat?

- First Earth science dedicated instrument on the ISS
- Hardware built by JPL from left-over components from the QuikSCAT scatteromerer
- Conically scanning dual-polarized ku-band radar
- A gap filler to mitigate the loss of the NASA QuikSCAT mission and compliment the international scatterometer constellation
  - Launched September 21, 2014
  - Data production started October, 2014
  - Will operate through early 2017
  - Overlaps with EUMETSAT ASCAT
  - Will overlap with ISRO's ScatSat-1 mission

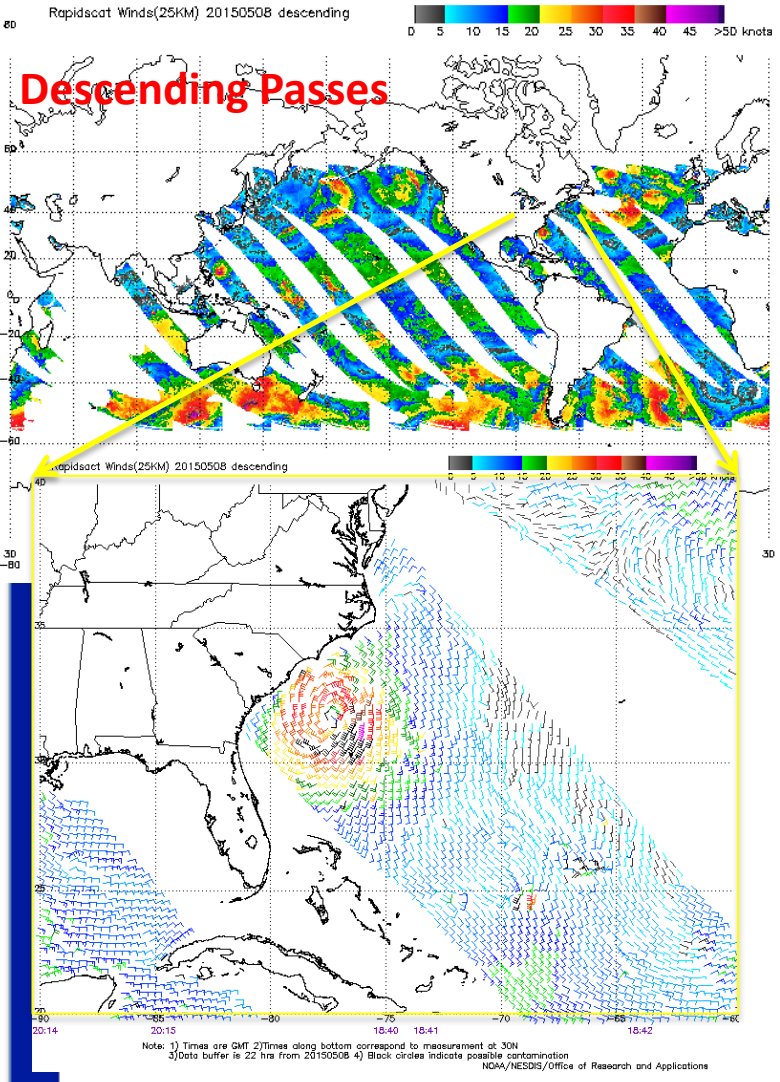
ISS-RapidScat Objectives

- **Provide ocean vector winds to improve weather forecasting and complement data collected by the international ocean vector winds constellation.**
  - The tropical coverage of the ISS will provide additional observations of storms that may develop into hurricanes or other tropical cyclones (typhoons, etc.)

- **Provide direct wind cross-calibration for the international ocean vector winds constellation.**
  - The ISS orbit will enable coincident measurements in space and time with each of the satellites in the constellation (ASCAT, OSCAT, QuikSCAT, and, ScatSat)

- **Improve estimates of the global diurnal ocean vector wind cycle and determine the semi-diurnal cycle.**
  - Variation of wind across different times of the day may be the cause of major discrepancies between measurements and models.

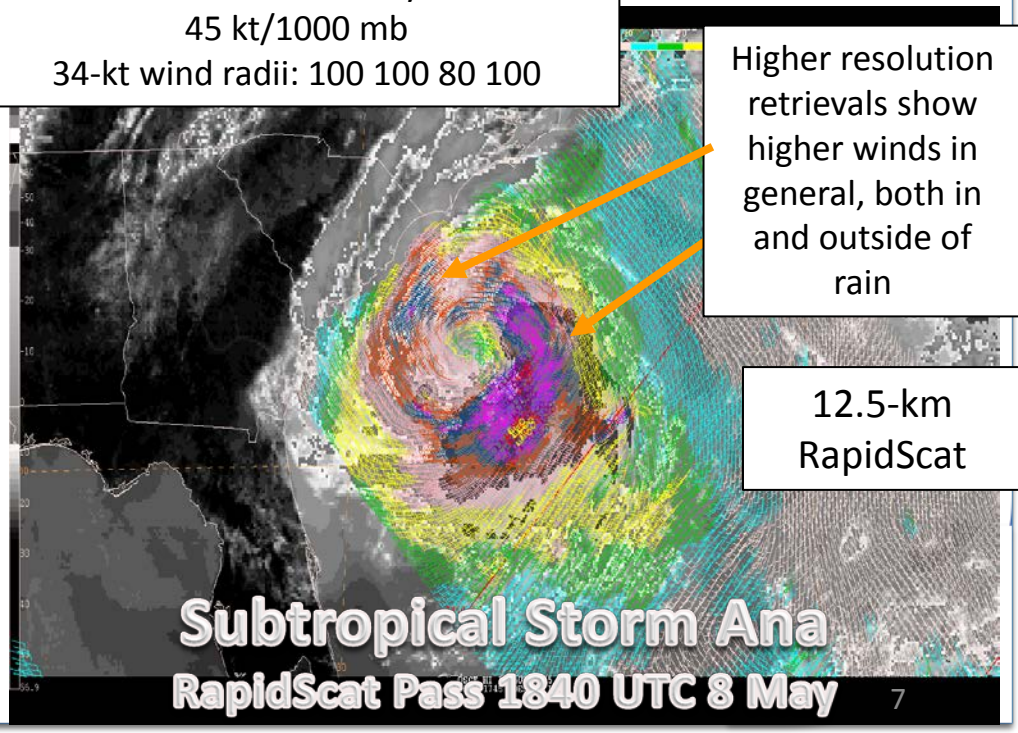
http://manati.star.nesdis.noaa.gov/rapidscat



Provided in near real-time for:

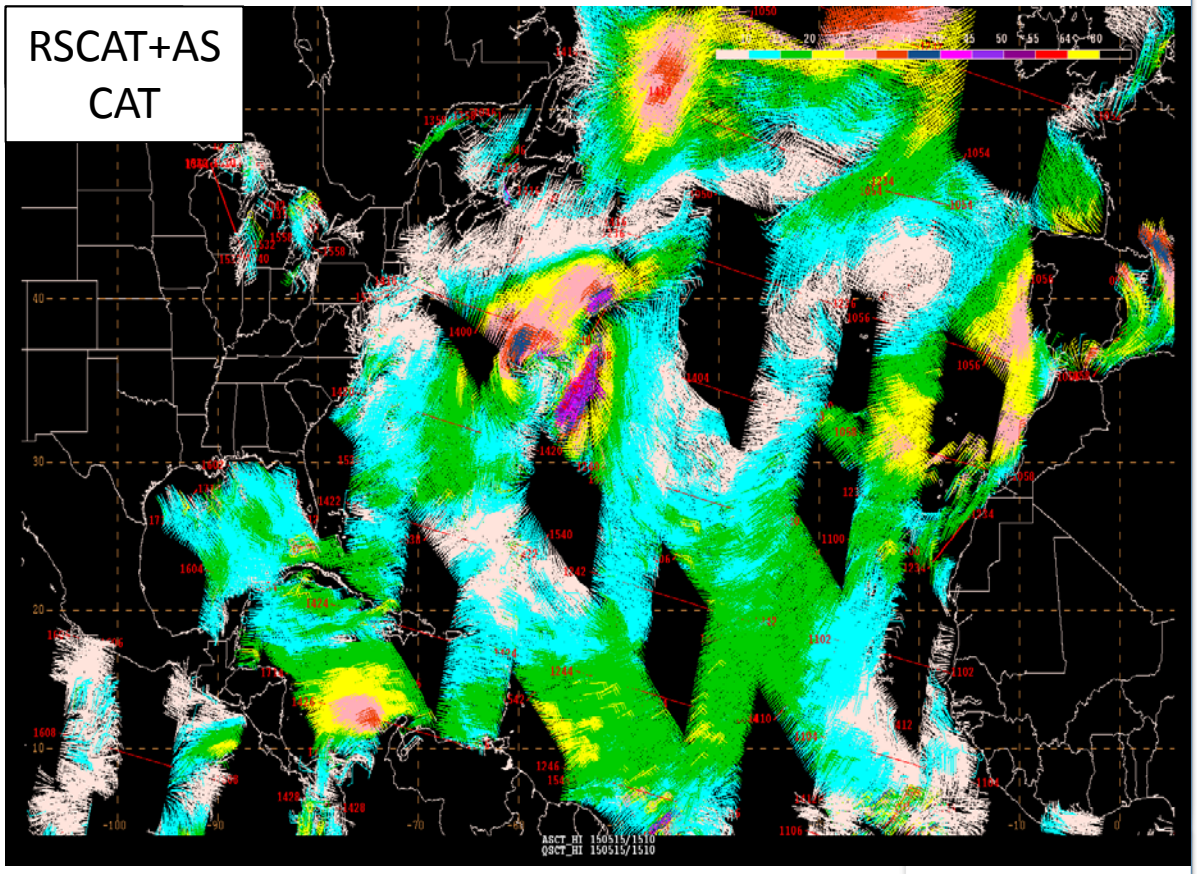
- NAWIPS environment for the NWS National Centers
- The JSCDA for data assimilation
- Web portal for NWS WFO's and broader community

Ana Best Track Intensity
1800 UTC 8 May
45 kt/1000 mb
34-kt wind radii: 100 100 80 100



Currently Utilized Ocean Vector Wind Products

- NOAA users are currently using ASCAT-A, ASCAT-B, and RapidScat in their operations
- ISS orbit provides swaths cutting SE/NW or NW/SE across the extratropics and tropics
- These orbits cut across ASCAT swaths and help fill gaps in coverage especially at lower latitudes



Daily Coverage - ASCAT and RapidScat

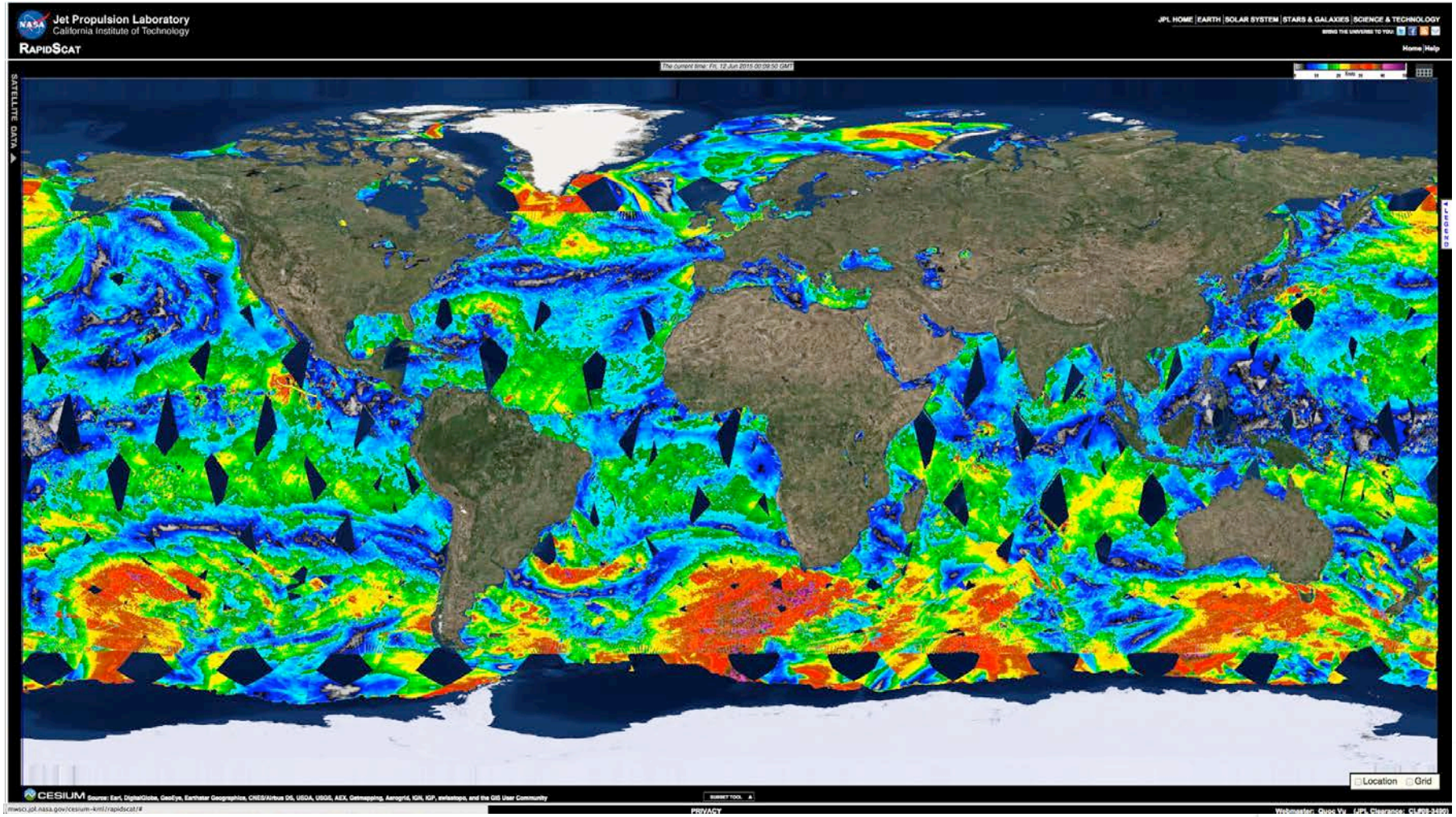
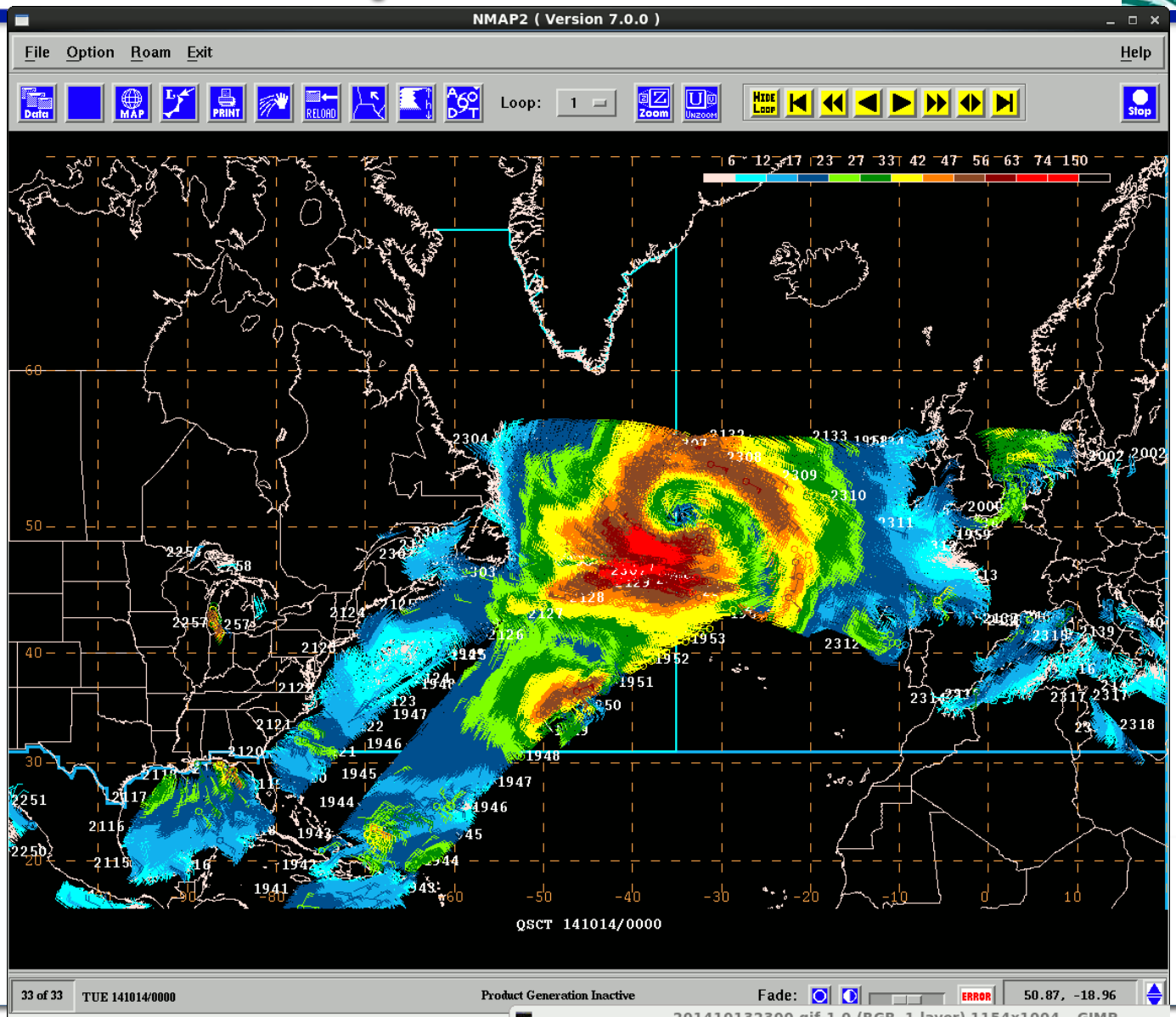


Image courtesy of NASA/JPL

RapidSCAT Use for Extratropical Cyclone Observations

The RapidSCAT Orbit Aligns with Extratropical Storm Tracks

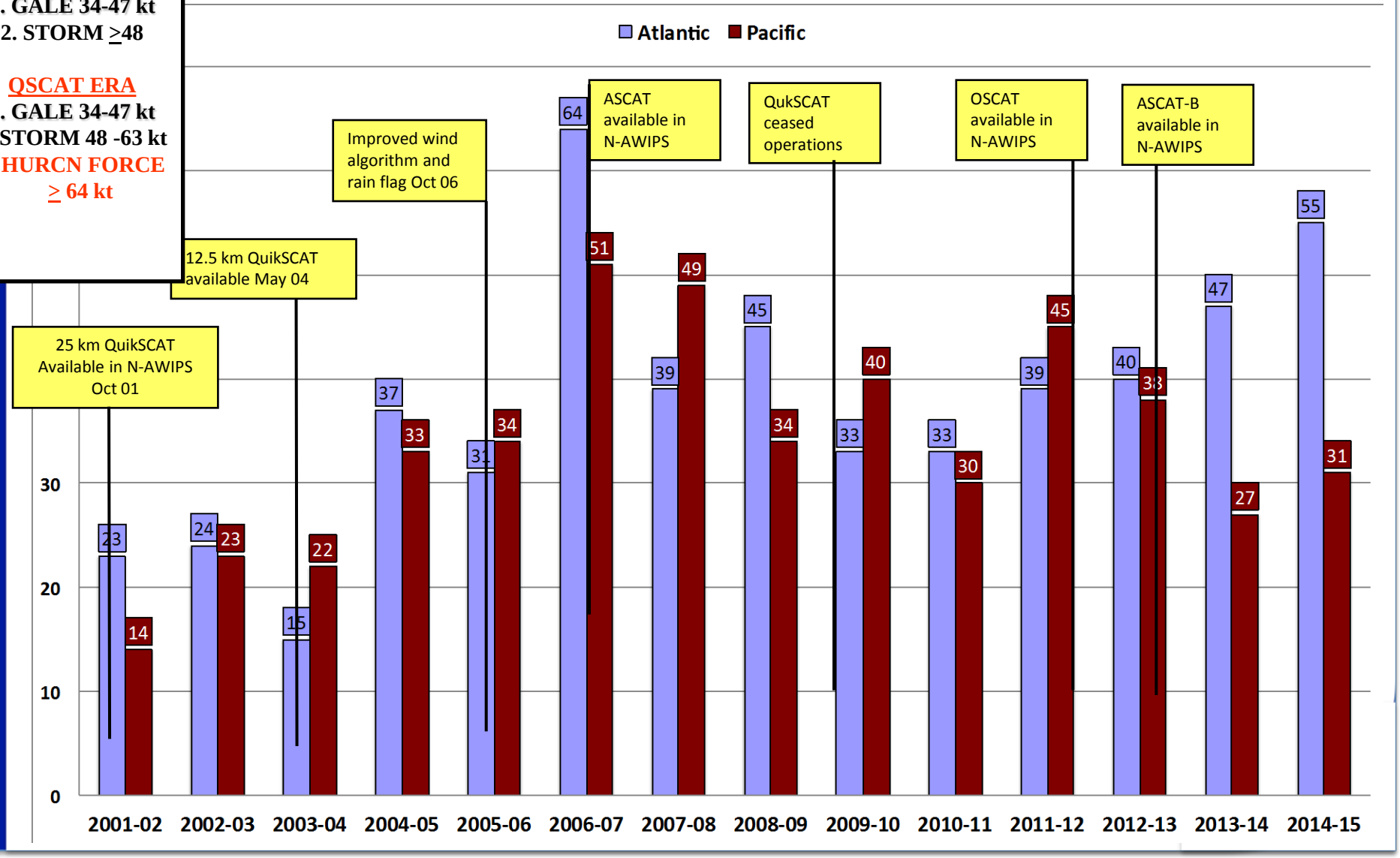


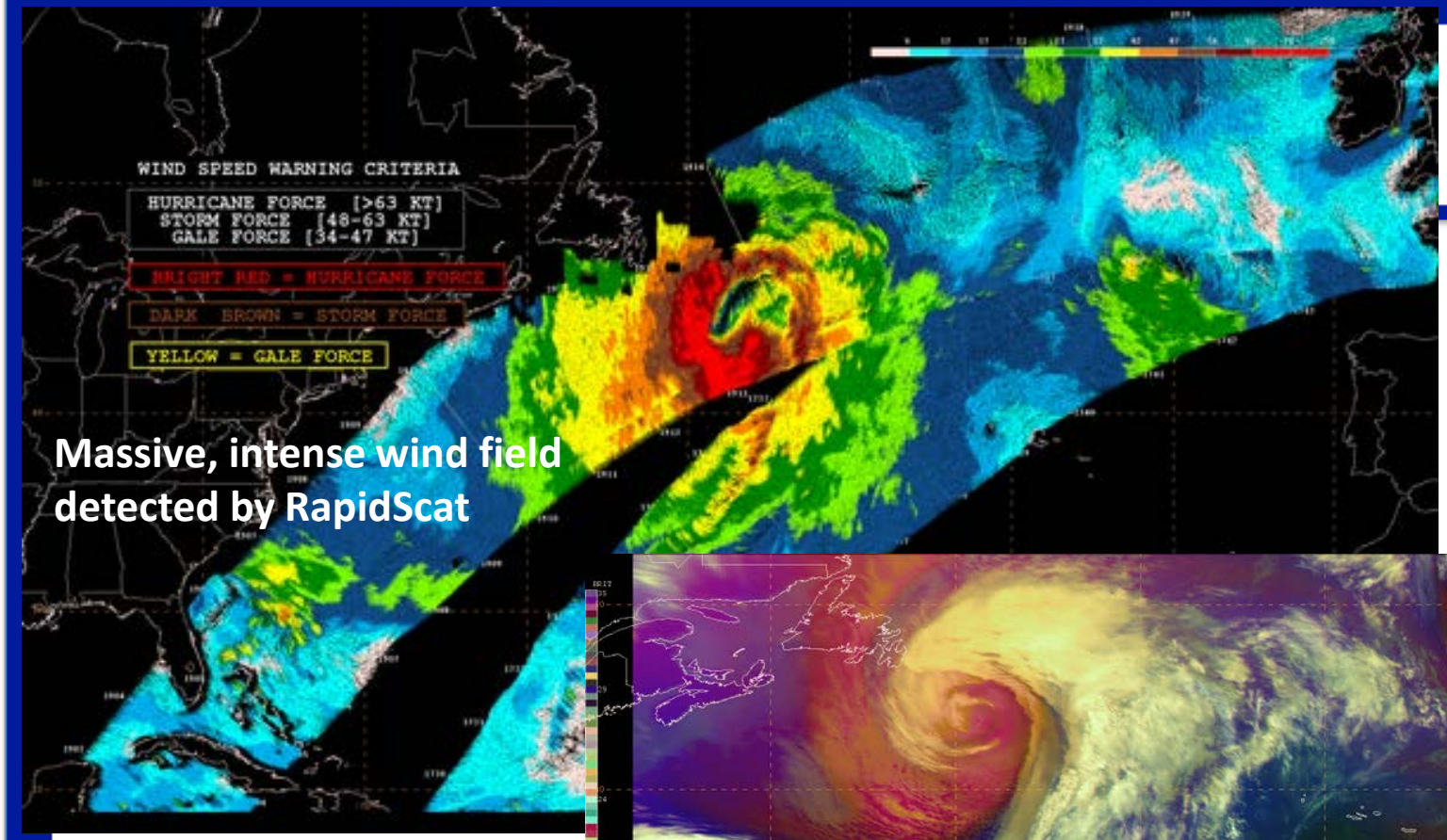
Hurricane Force Wind Observations in Extratropical Cyclones

WARNING CATEGORIES

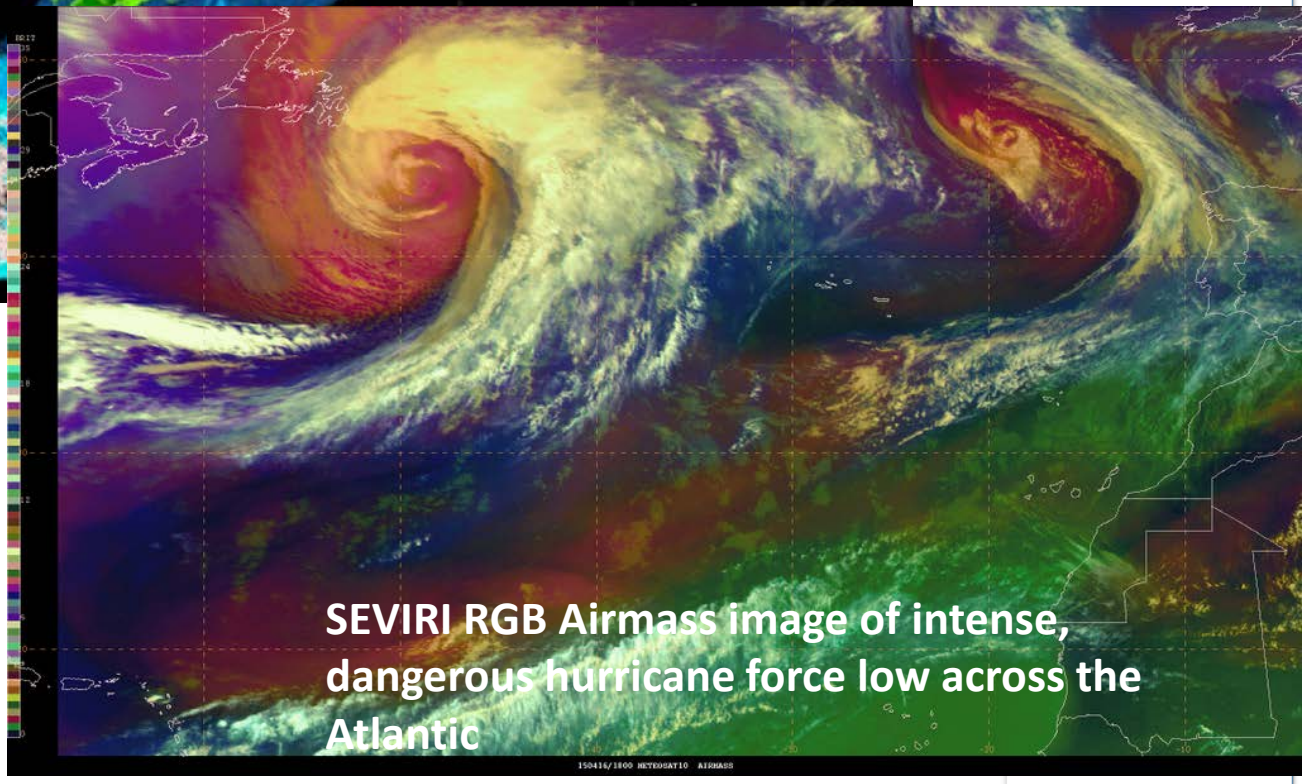
Pre- QSCAT
1. GALE 34-47 kt
2. STORM ≥48

QSCAT ERA
1. GALE 34-47 kt
2. STORM 48 -63 kt
3. HURCN FORCE ≥ 64 kt





Massive, intense wind field detected by RapidScat



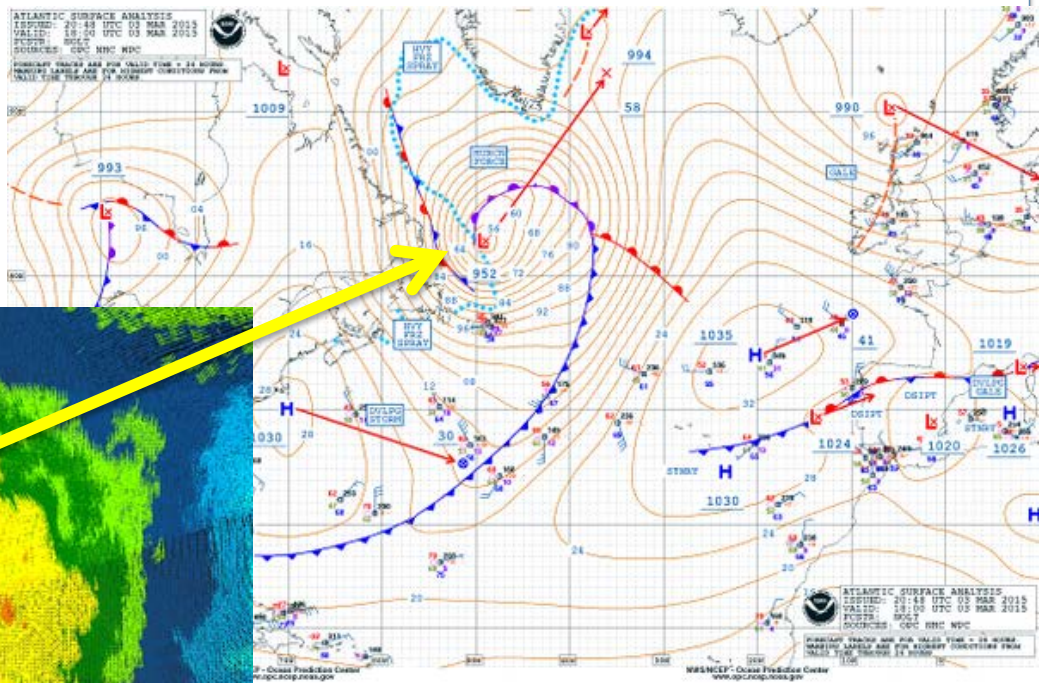
SEVIRI RGB Airmass image of intense, dangerous hurricane force low across the Atlantic

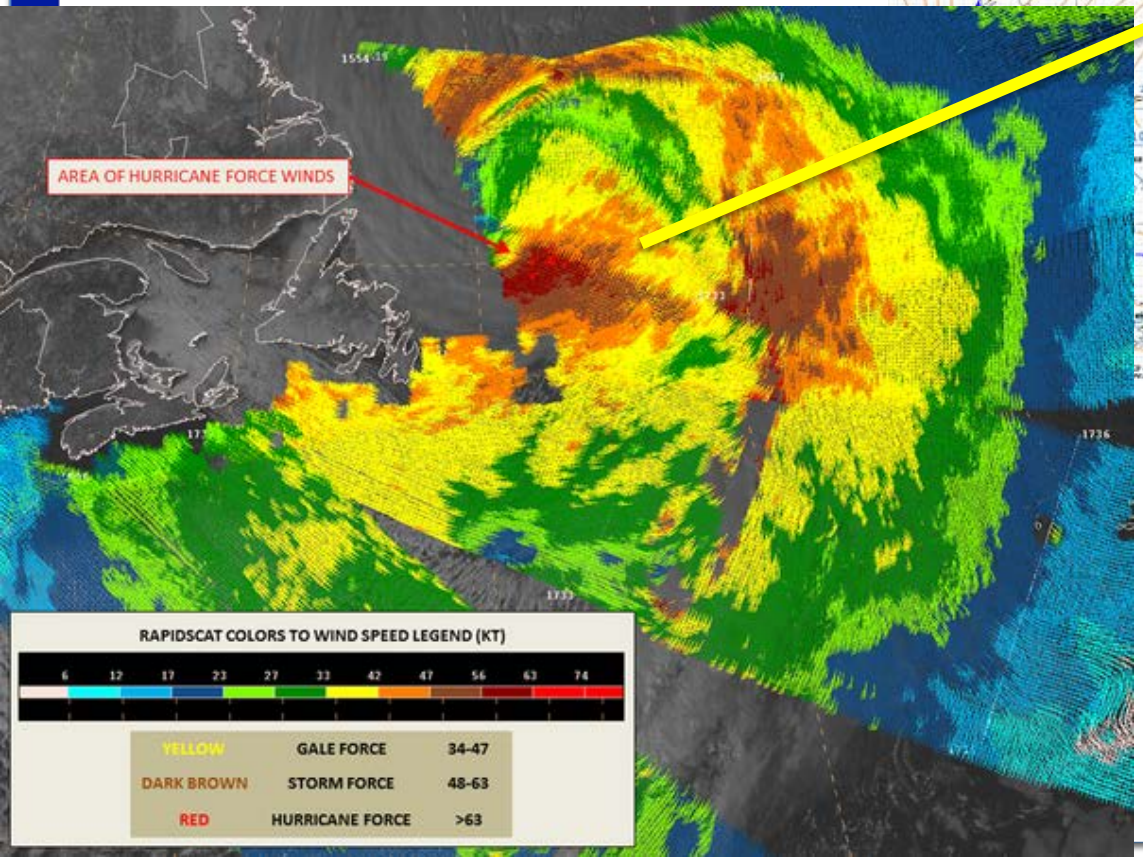
"…very dangerous conditions -- winds to 75KT, phenomenal seas to 44FT -- continue this eve beneath intense 963mb low…"

April 16th, 2015

RapidScat Detected Hurricane Force Winds in a North Atlantic Extratropical Cyclone
OPC Ocean Surface Analysis Updated

03/03/2015 hurricane force winds detected in south quadrant of 952mb low by RapidScat. OPC analysis upgraded to indicate HF status



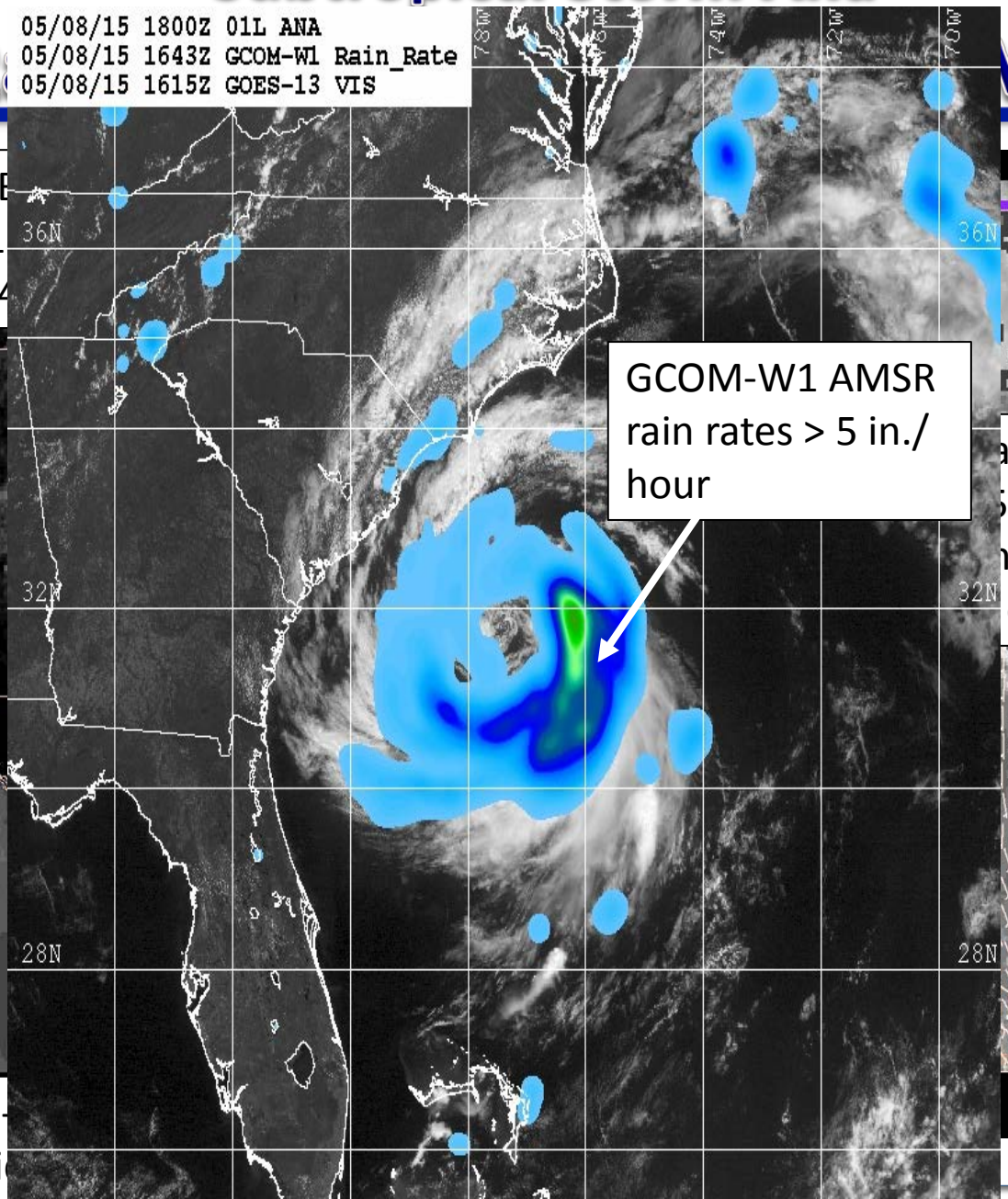


RapidSCAT Use for Tropical Cyclone Observations

Tropical Cyclone Ana
May 7th – 10th, 2015

Subtropical Storm Ana

R… May



Ana E…
1…
4…

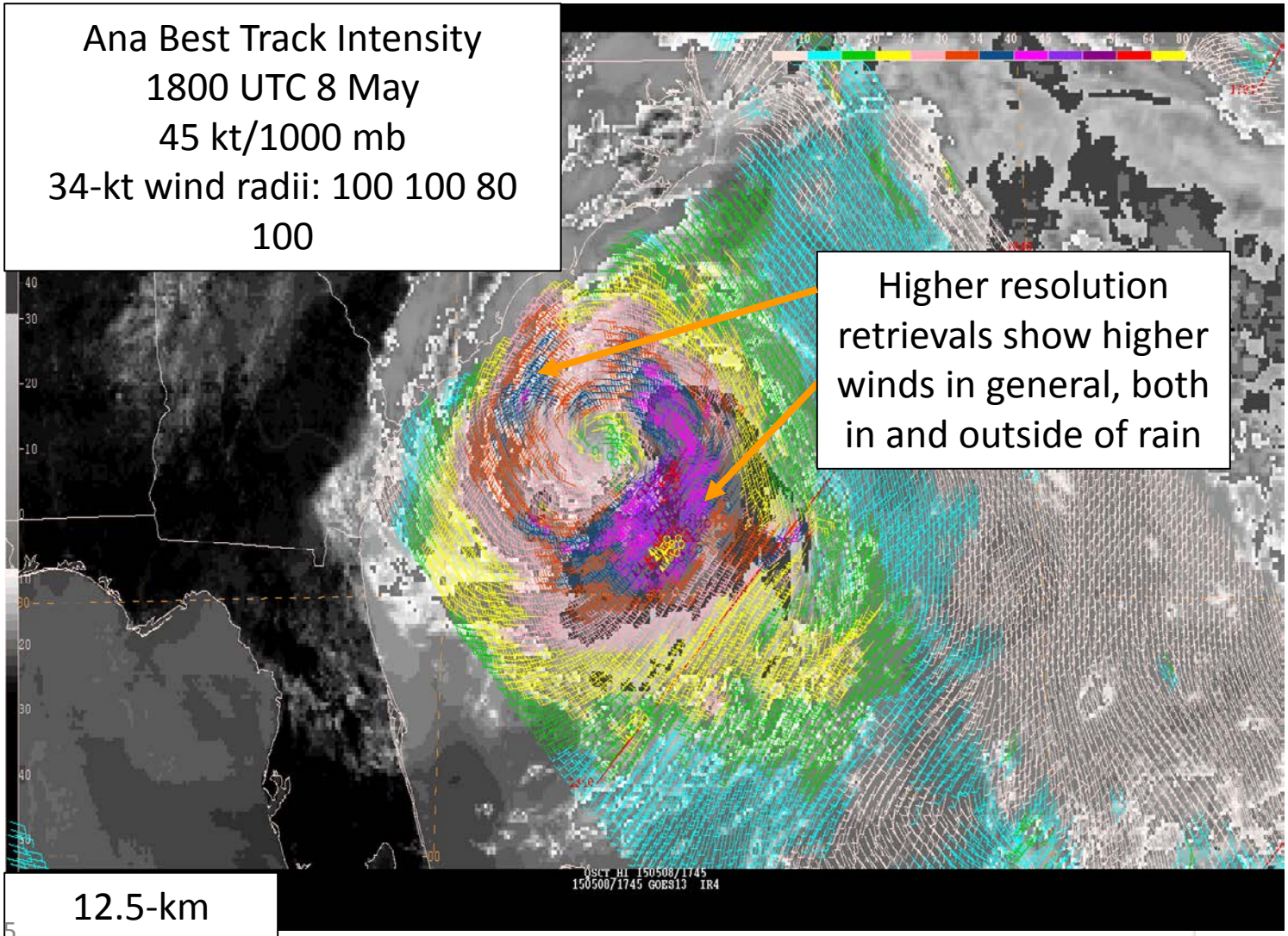
GCOM-W1 AMSR rain rates > 5 in./ hour

…agged wind …50-55 kt) in …nvection … of center

25-… Rapi…

Subtropical Storm Ana
RapidScat Pass 1840 UTC 8 May

Ana Best Track Intensity
1800 UTC 8 May
45 kt/1000 mb
34-kt wind radii: 100 100 80 100

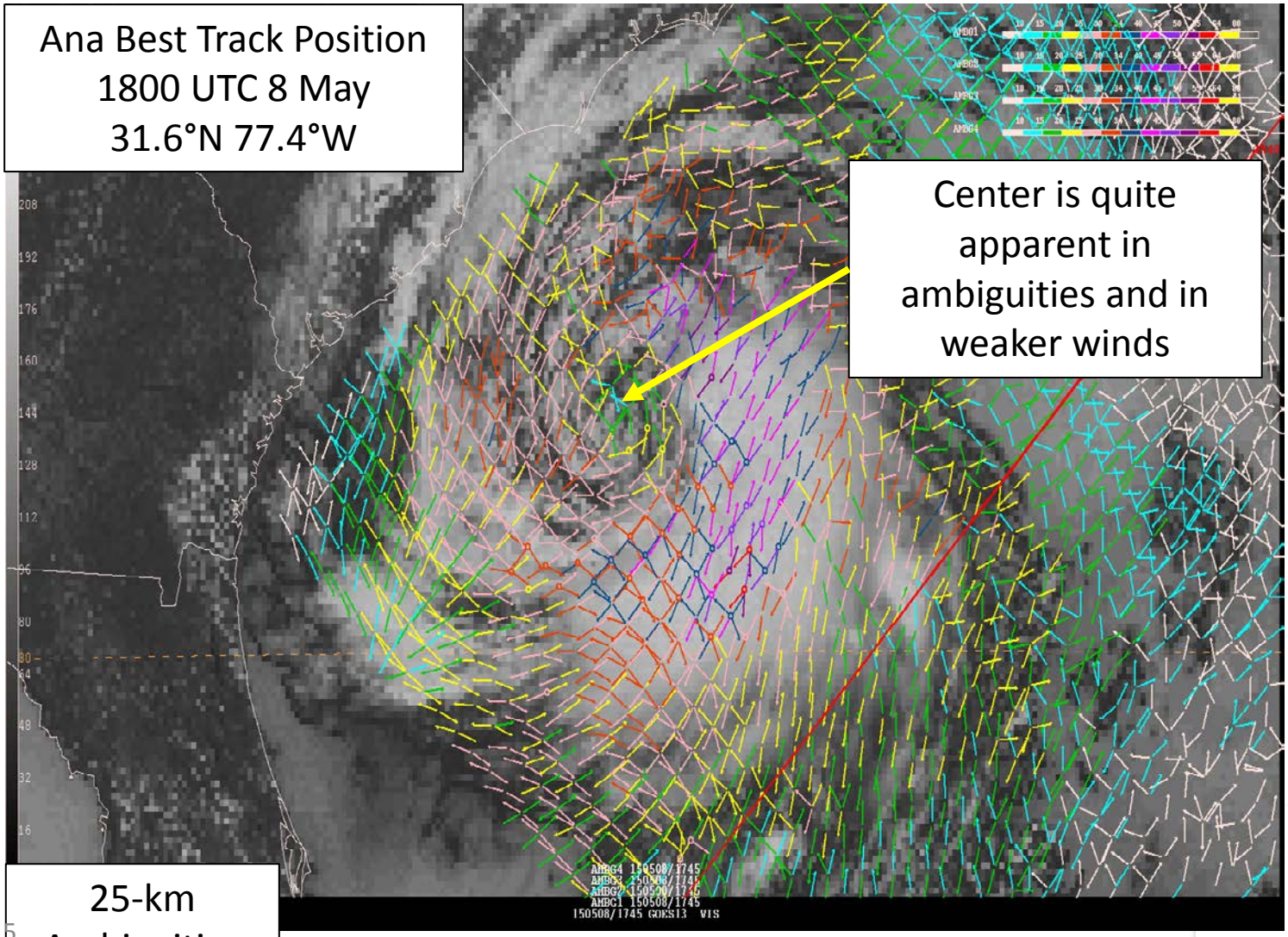


Higher resolution retrievals show higher winds in general, both in and outside of rain

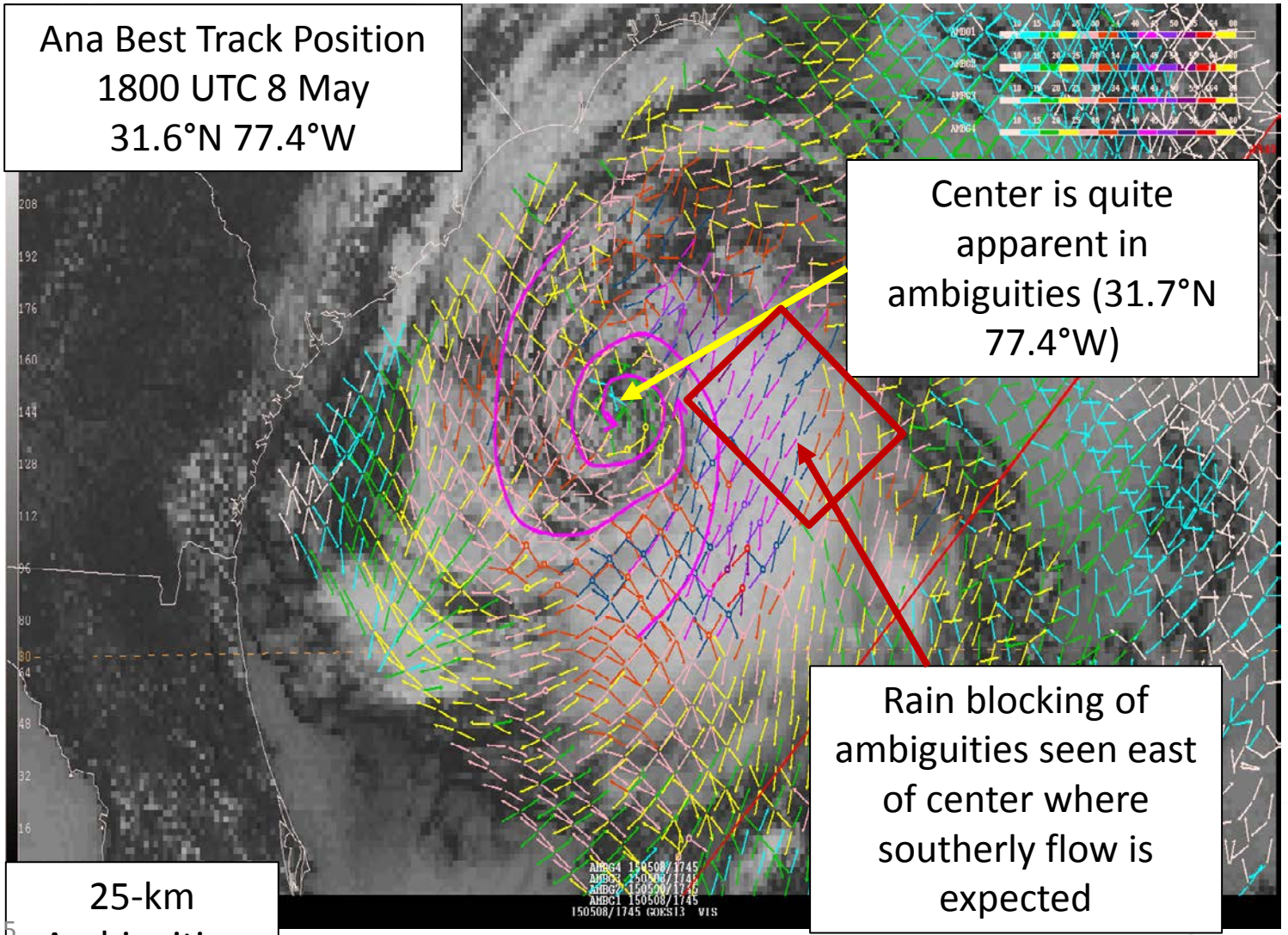
12.5-km RapidScat

Subtropical Storm Ana
RapidScat Pass 1840 UTC 8 May

Ana Best Track Position
1800 UTC 8 May
31.6°N 77.4°W



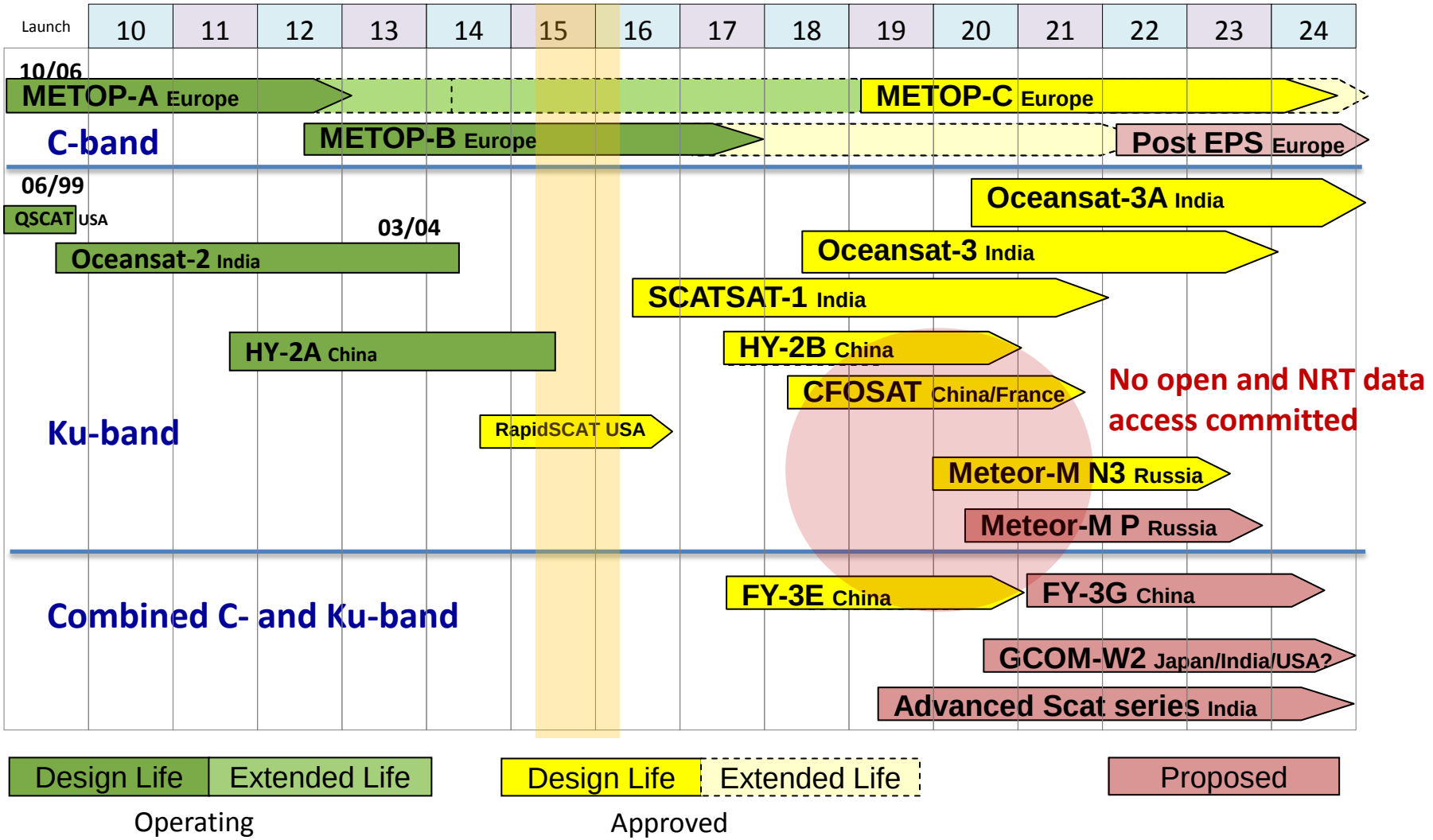
Subtropical Storm Ana
RapidScat Pass 1840 UTC 8 May



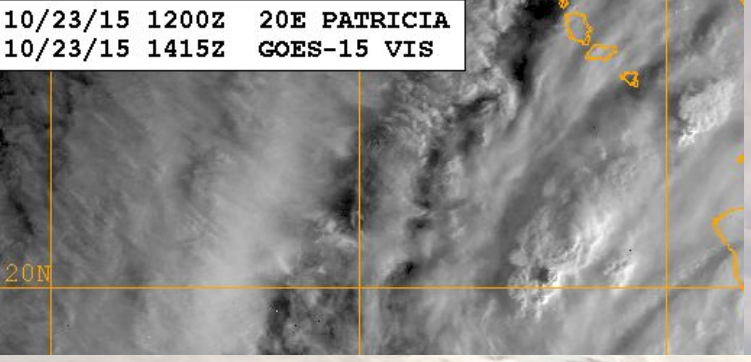
Final Thoughts

- Satellite OSVW data are deeply integrated into NOAA's National Weather Service (NWS) marine, tropical and extratropical cyclone operations
  - **Timely and open data availability**
  - **User training**
  - **Data in their workstation environment**
- Near real-time RapidScat 12.5km products are available in the NWS NAWIPS/NMAP environment and are being used to support the forecasting, analaysis and warning process at NOAA
- The ISS orbit provides a unique opportunity to cross-calibrate satellite scatterometers and characterize the diurnal variability of OSVW.

CEOS Ocean Surface Vector Wind - Virtual Constellation (OSVW-VC)
Satellite constellation status and outlook – NRT data access



Source: WMO OSCAR database and direct interactions with agencies



Questions?

paul.s.chang@noaa.gov