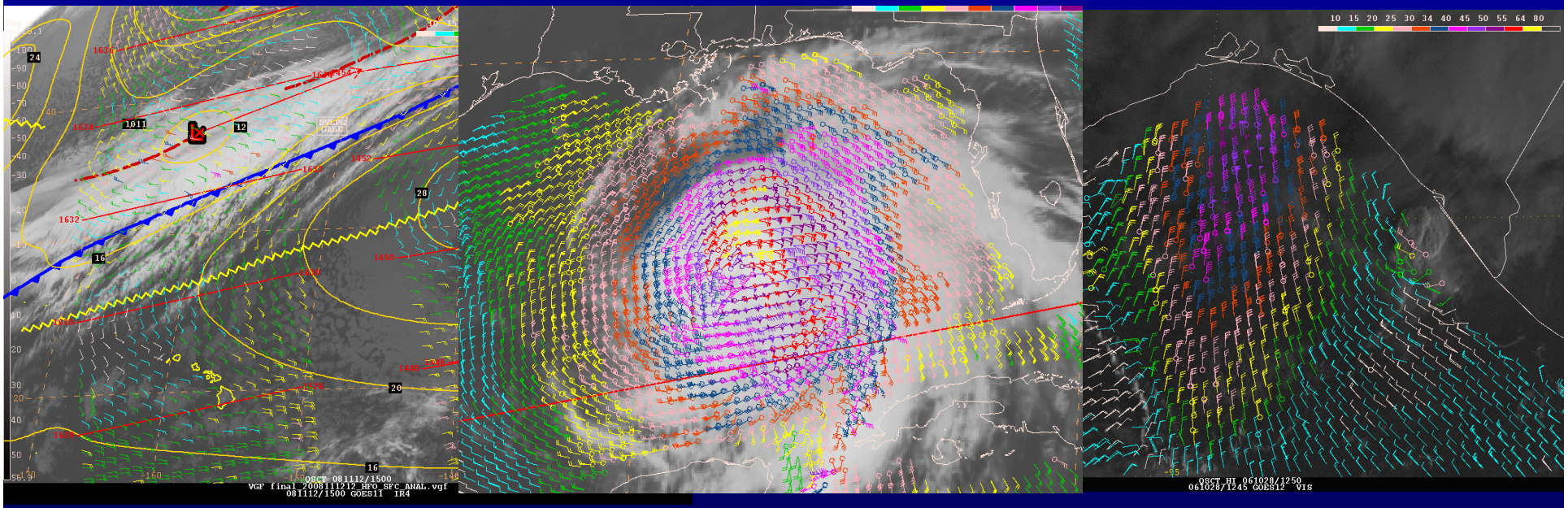
Operational Evaluation and Use of Satellite OSVW Data at the National Hurricane Center and Central Pacific Hurricane Center



Michael J. Brennan[1], Richard D. Knabb[2], Hugh D. Cobb, III[1],
Paul S. Chang[3], and Zorana Jelenak[3]

[1]NOAA/NWS/NCEP National Hurricane Center, Miami, FL

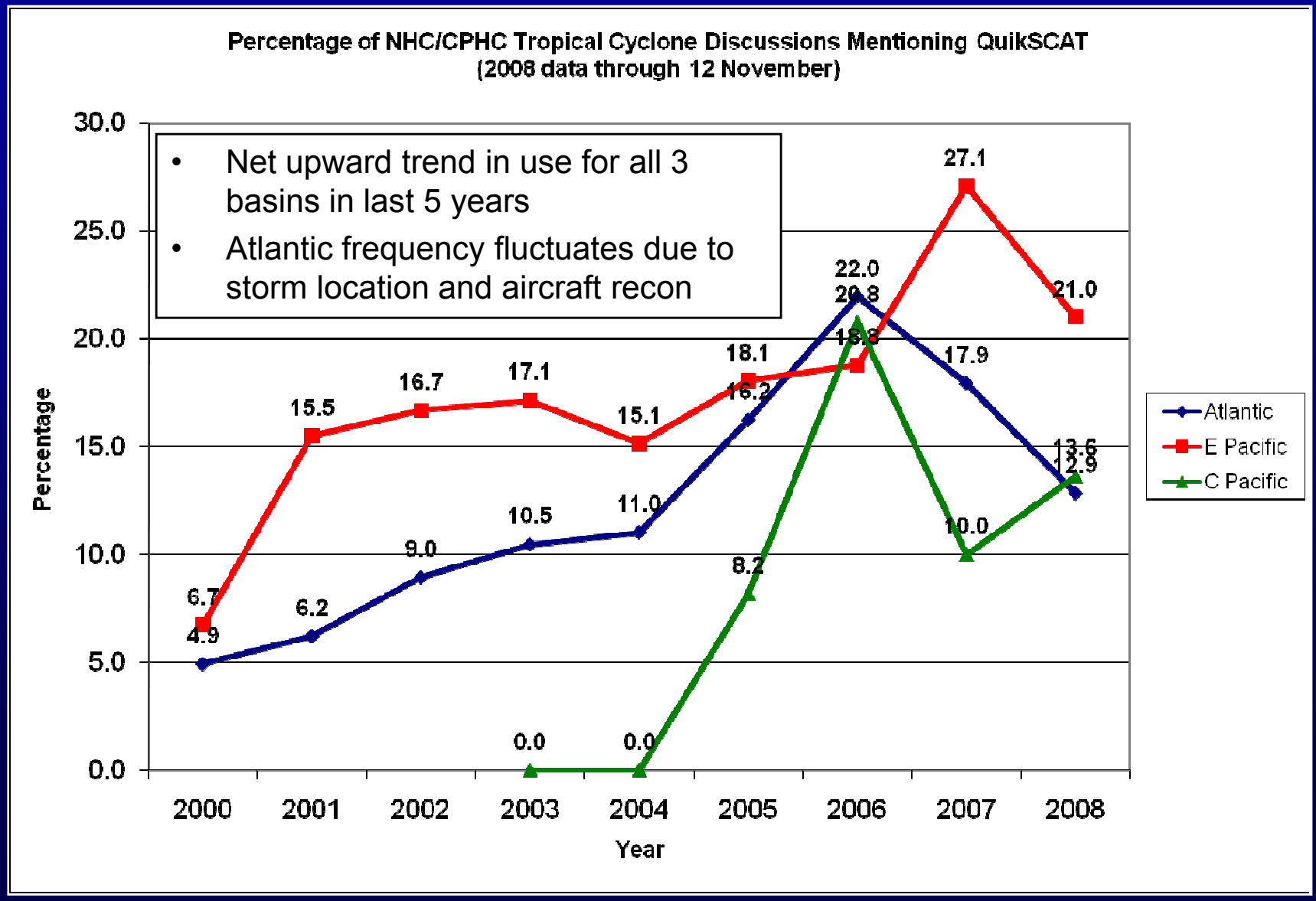
[2]NOAA/NWS/Central Pacific Hurricane Center, Honolulu, HI

[3]NOAA/NESDIS, Camp Springs, MD

NASA Ocean Vector Winds Science Team Meeting

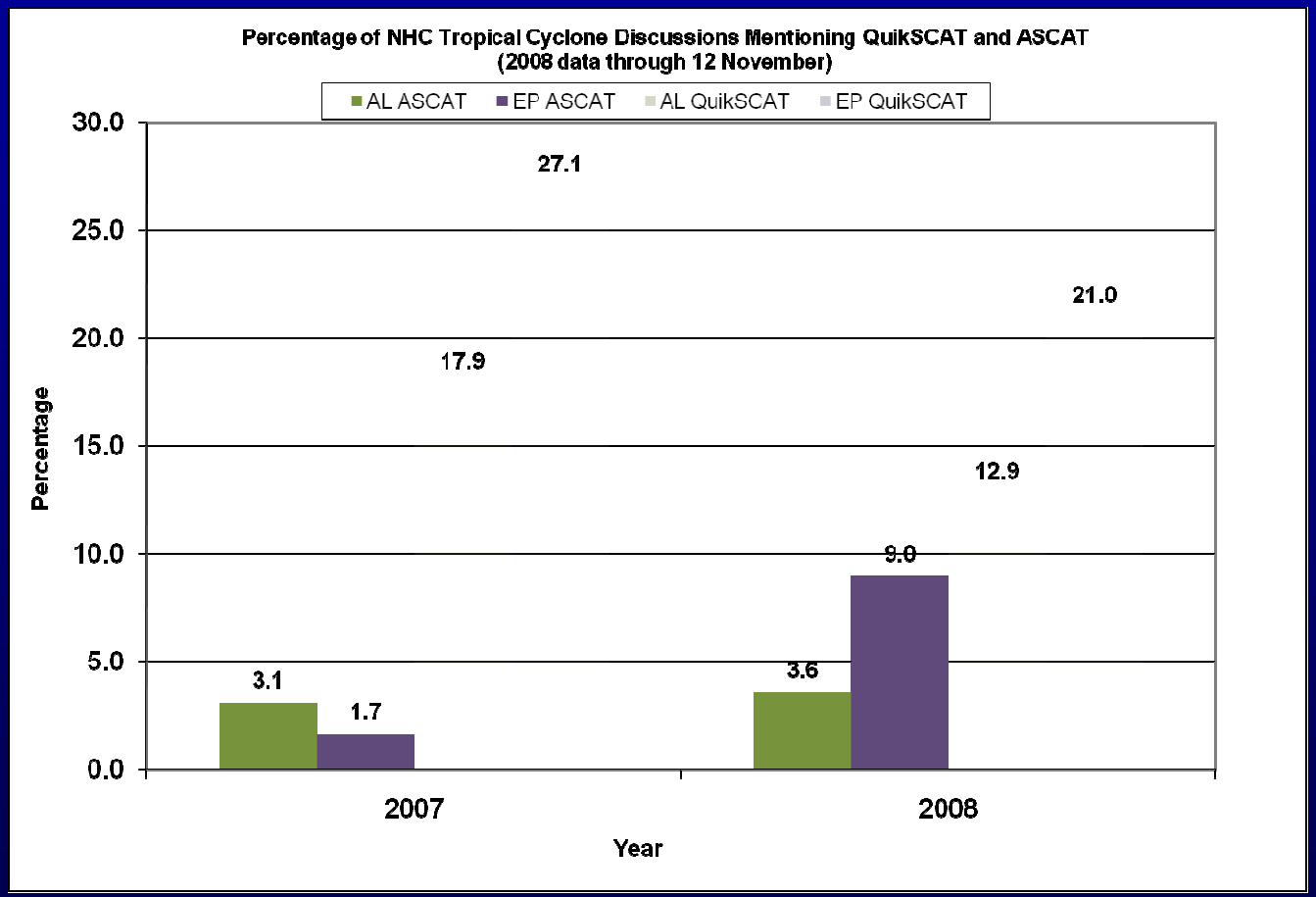
21 November 2008, Seattle, WA

Use of QuikSCAT in NHC and CPHC Tropical Cyclone Discussions 2000-2008



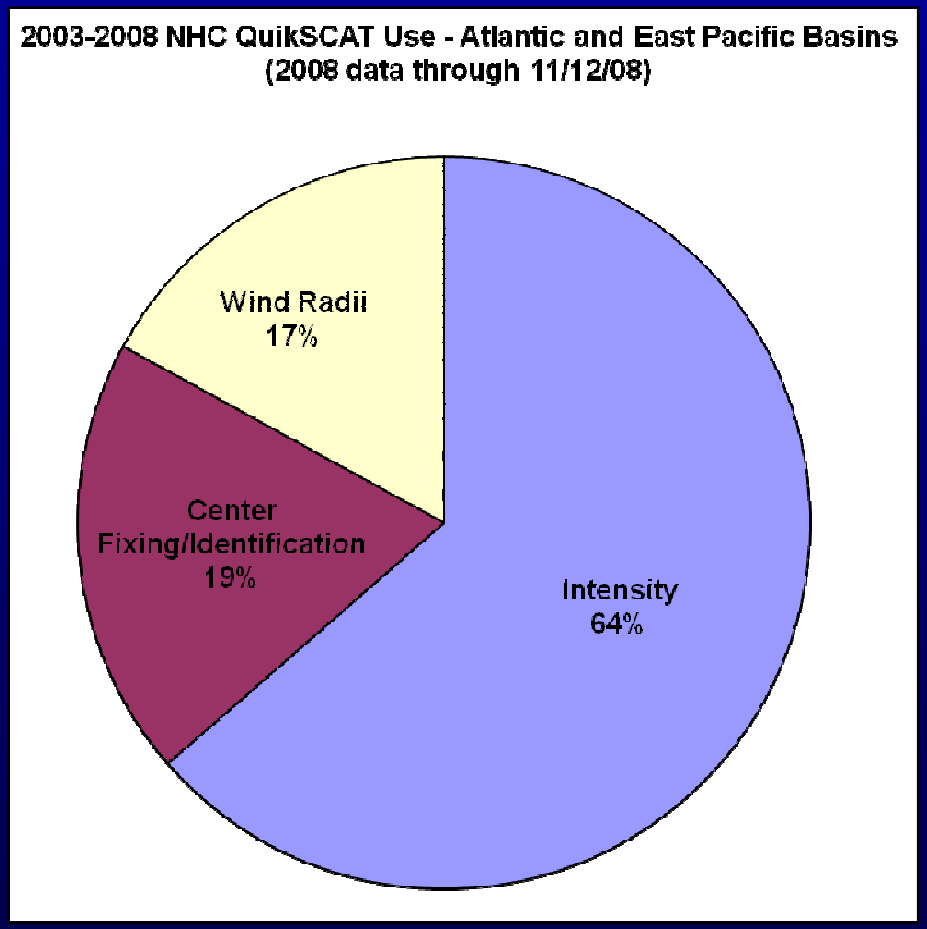
Use of ASCAT in TCs 2007-2008

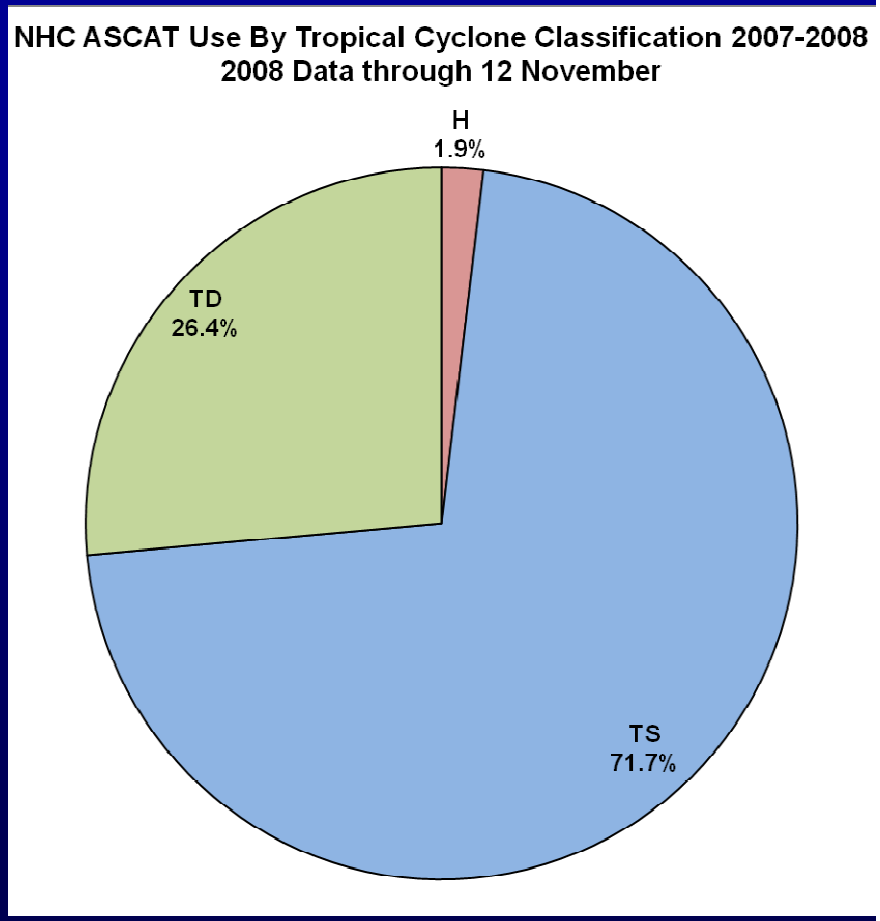
- Mention of ASCAT in TCDs has increased to nearly 10% in the East Pacific
- Impressive for instrument with less data coverage
- Underscores great need for wind data in that basin when aircraft recon not available
- Quite useful in TDs and TSs where rain inflation is mitigated by C-band



•2007 – ASCAT data available in N-AWIPS only after 27 June
•2008 – Data through 12 November

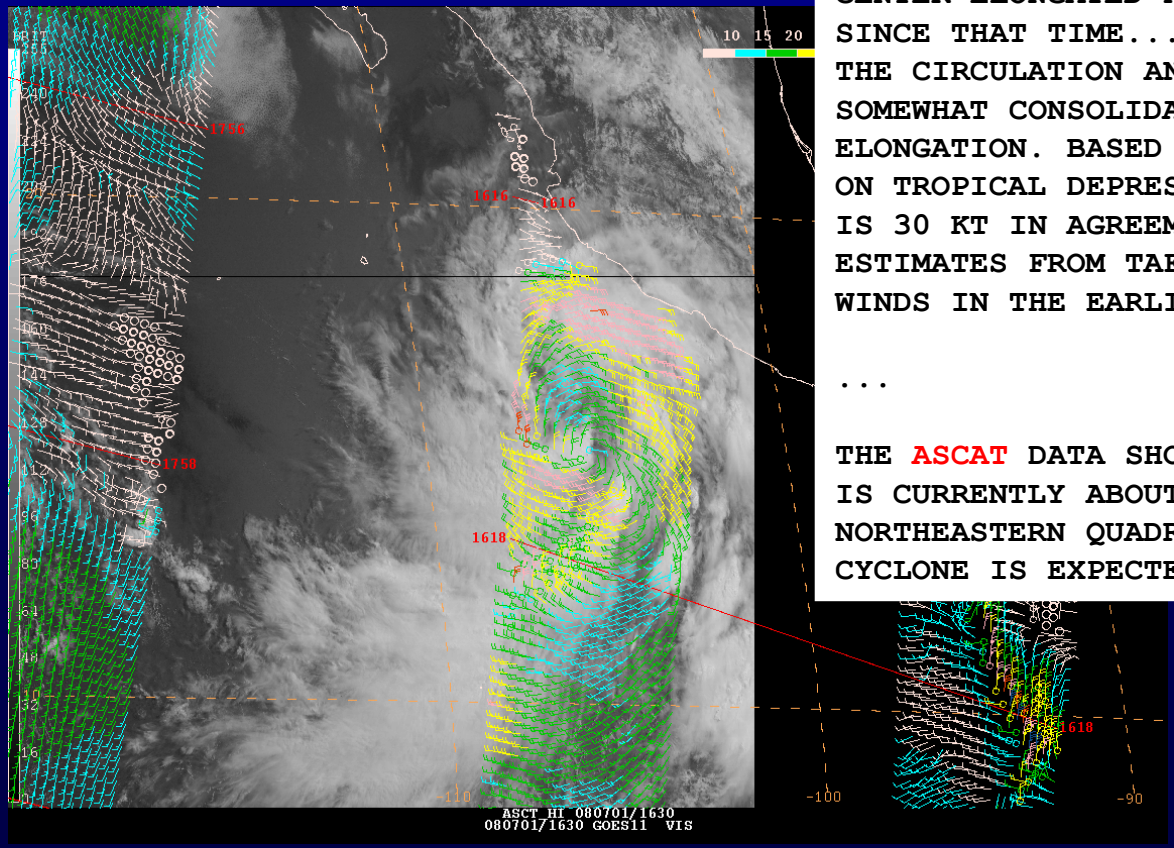
Use of QuikSCAT and ASCAT





Example of ASCAT Use

- Used as justification to initiate advisories on TD Four-E (later TS Douglas) and set initial intensity



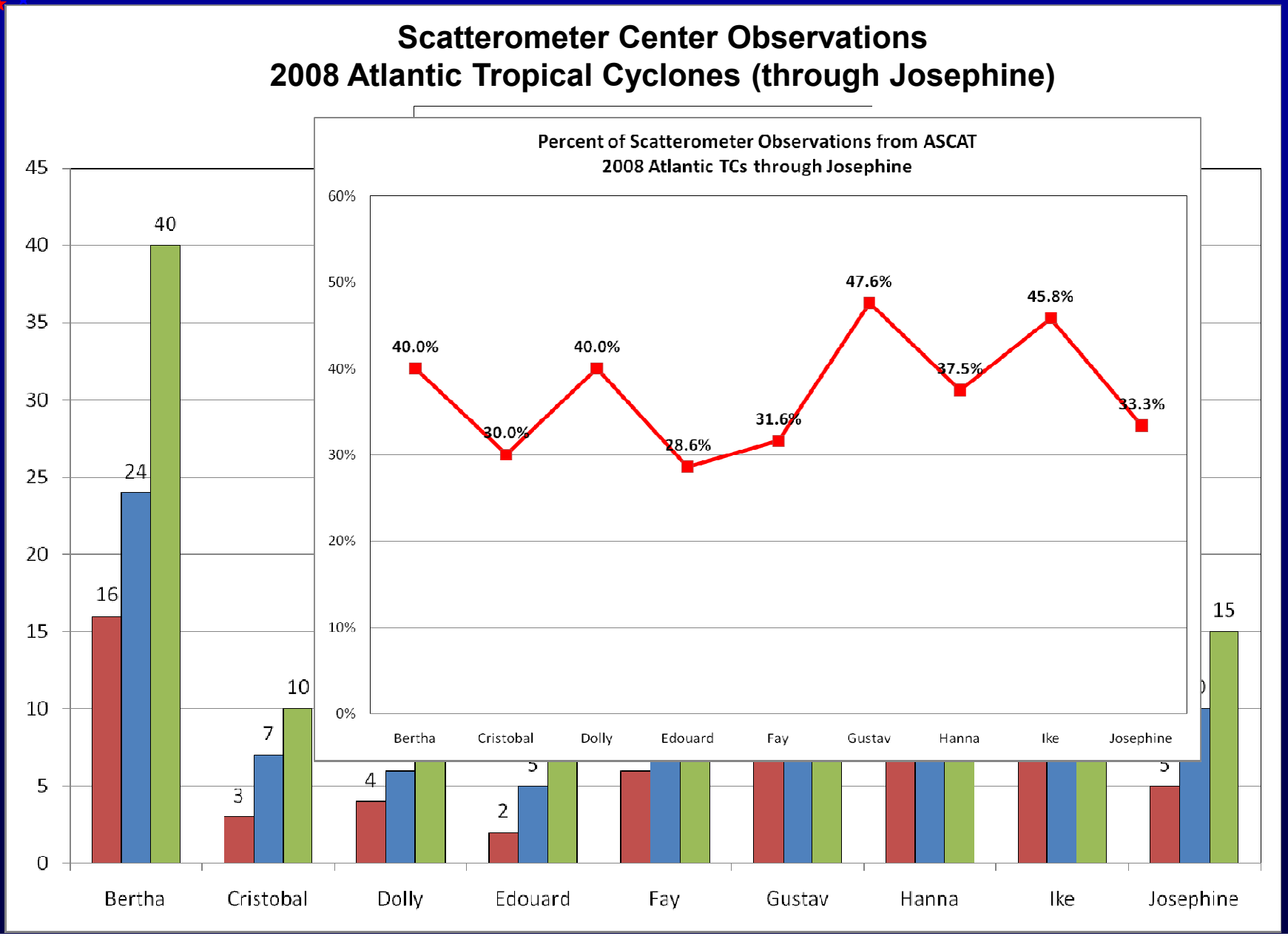
ZCZC MIATCDEP4 ALL
TTAA00 KNHC DDHHMM
TROPICAL DEPRESSION FOUR-E DISCUSSION NUMBER 1
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL EP042008
800 PM PDT TUE JUL 01 2008

ASCAT DATA AT AROUND 16Z SHOWED THAT THE LOW PRESSURE AREA SOUTHWEST OF MANZANILLO MEXICO HAD A BROAD CENTER ELONGATED NORTH-NORTHWEST TO SOUTH-SOUTHEAST. SINCE THAT TIME...SATELLITE IMAGERY INDICATES THAT THE CIRCULATION AND ASSOCIATED SHOWER ACTIVITY HAS SOMEWHAT CONSOLIDATED AT THE SOUTHERN END OF THE ELONGATION. BASED ON THIS...ADVISORIES ARE INITIATED ON TROPICAL DEPRESSION FOUR-E. THE INITIAL INTENSITY IS 30 KT IN AGREEMENT WITH SATELLITE INTENSITY ESTIMATES FROM TAFB AND SAB...AS WELL AS THE OBSERVED WINDS IN THE EARLIER ASCAT DATA.

...

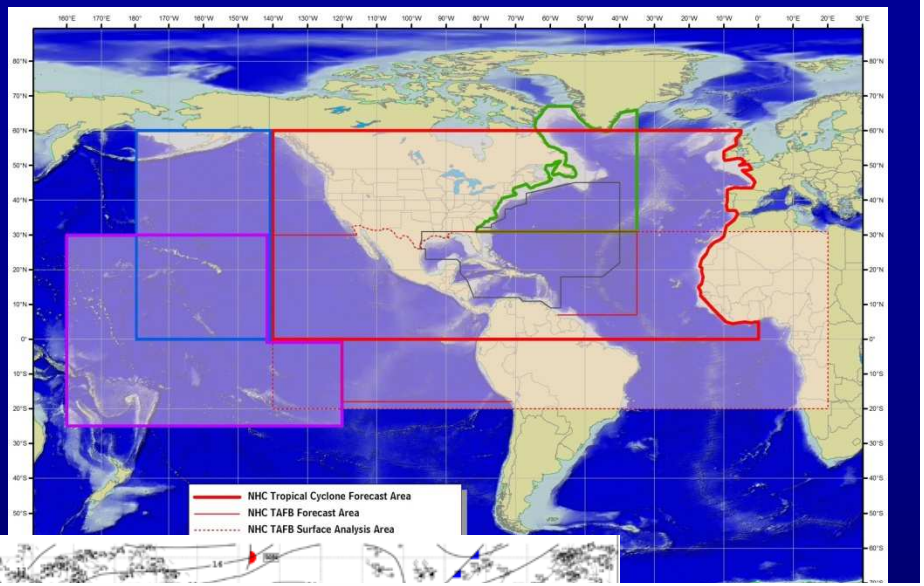
THE ASCAT DATA SHOWED 25-30 KT WINDS IN A BAND THAT IS CURRENTLY ABOUT 200 N MI FROM THE CENTER IN THE NORTHEASTERN QUADRANT. WHILE THE CENTER OF THE CYCLONE IS EXPECTED TO REMAIN WELL OFFSHORE...

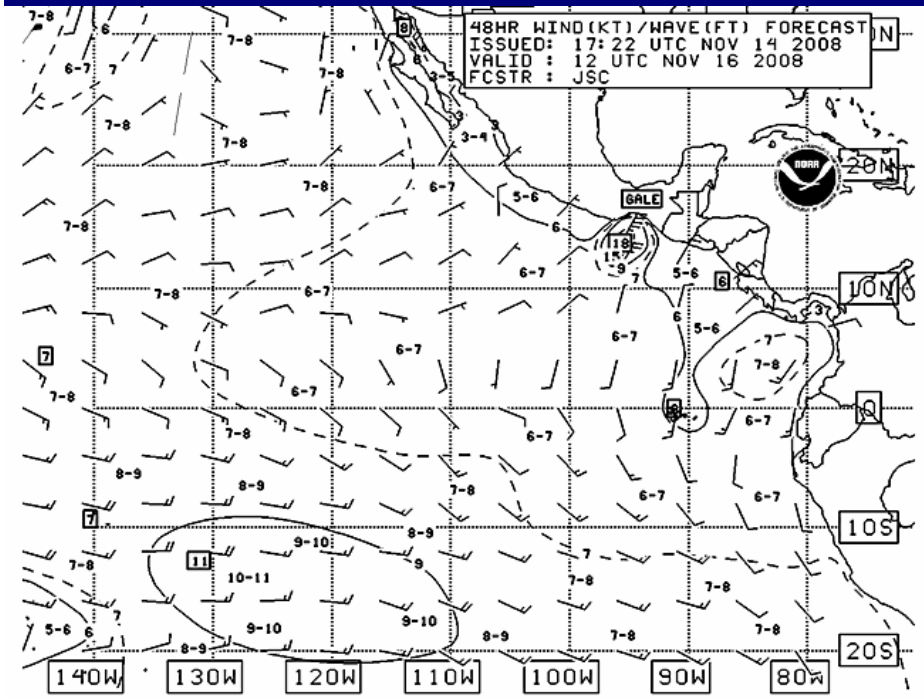
Observations over 2008 Atlantic TCs

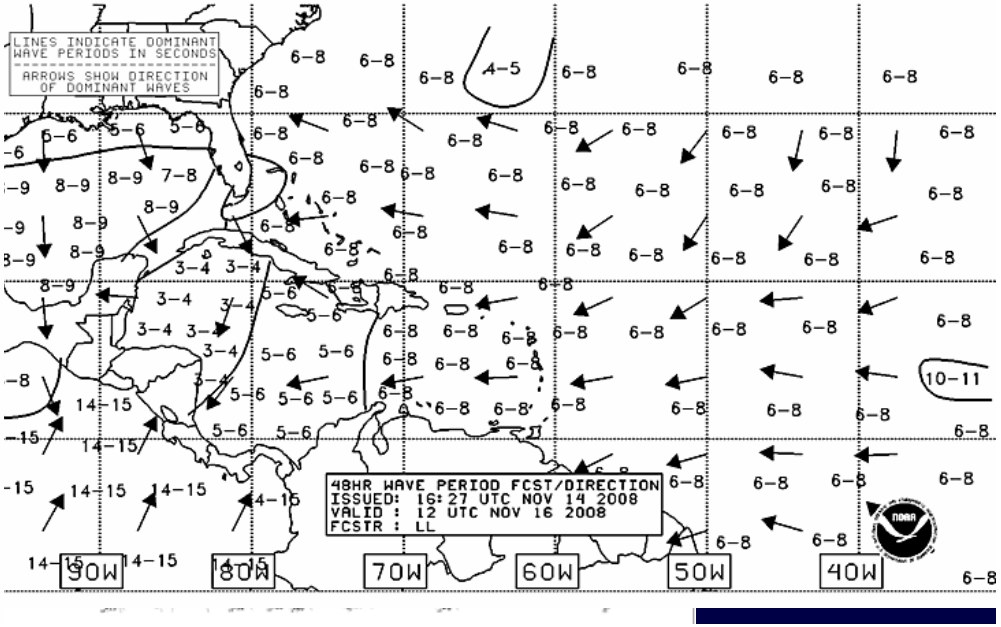


Tropical and Subtropical Marine Applications

- NHC's Tropical Analysis and Forecast Branch has high seas forecast and offshore waters forecast responsibility for much of the tropical eastern Pacific and Atlantic Oceans
- Analyses of surface features and sea state
- Forecasts of surface features, surface winds, wind waves, and swell

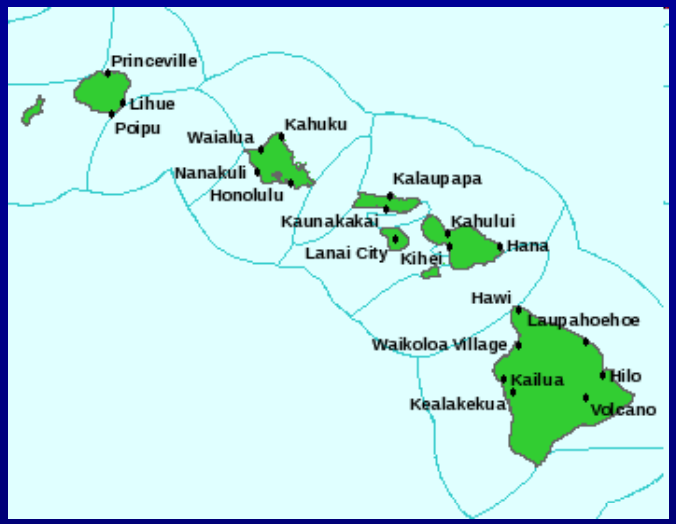


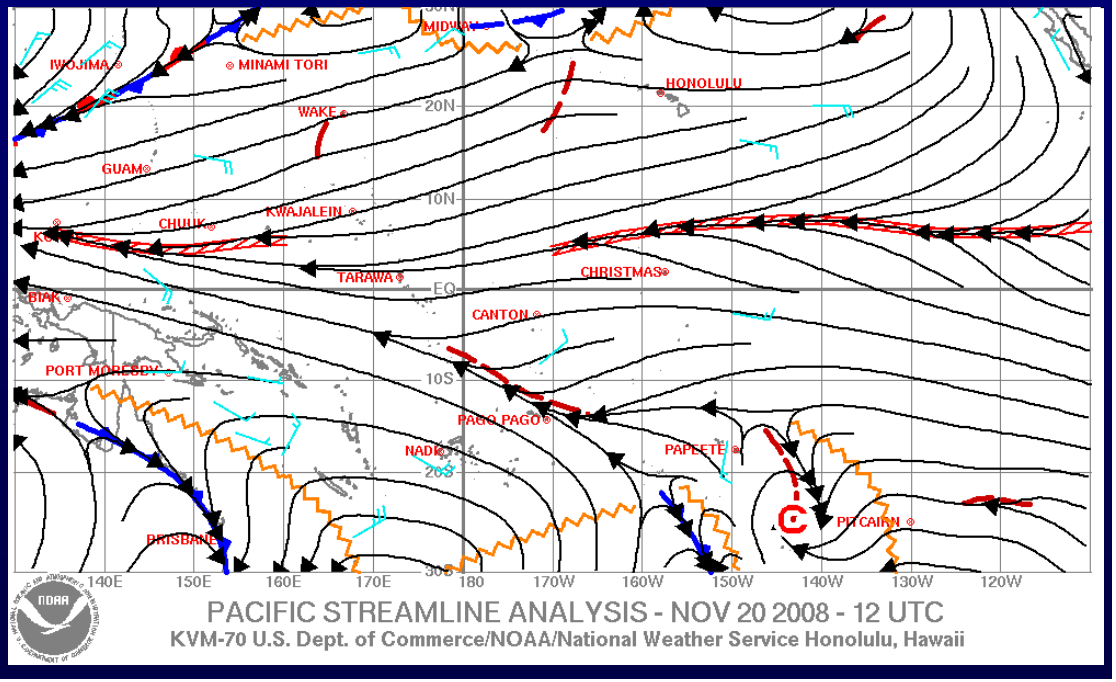




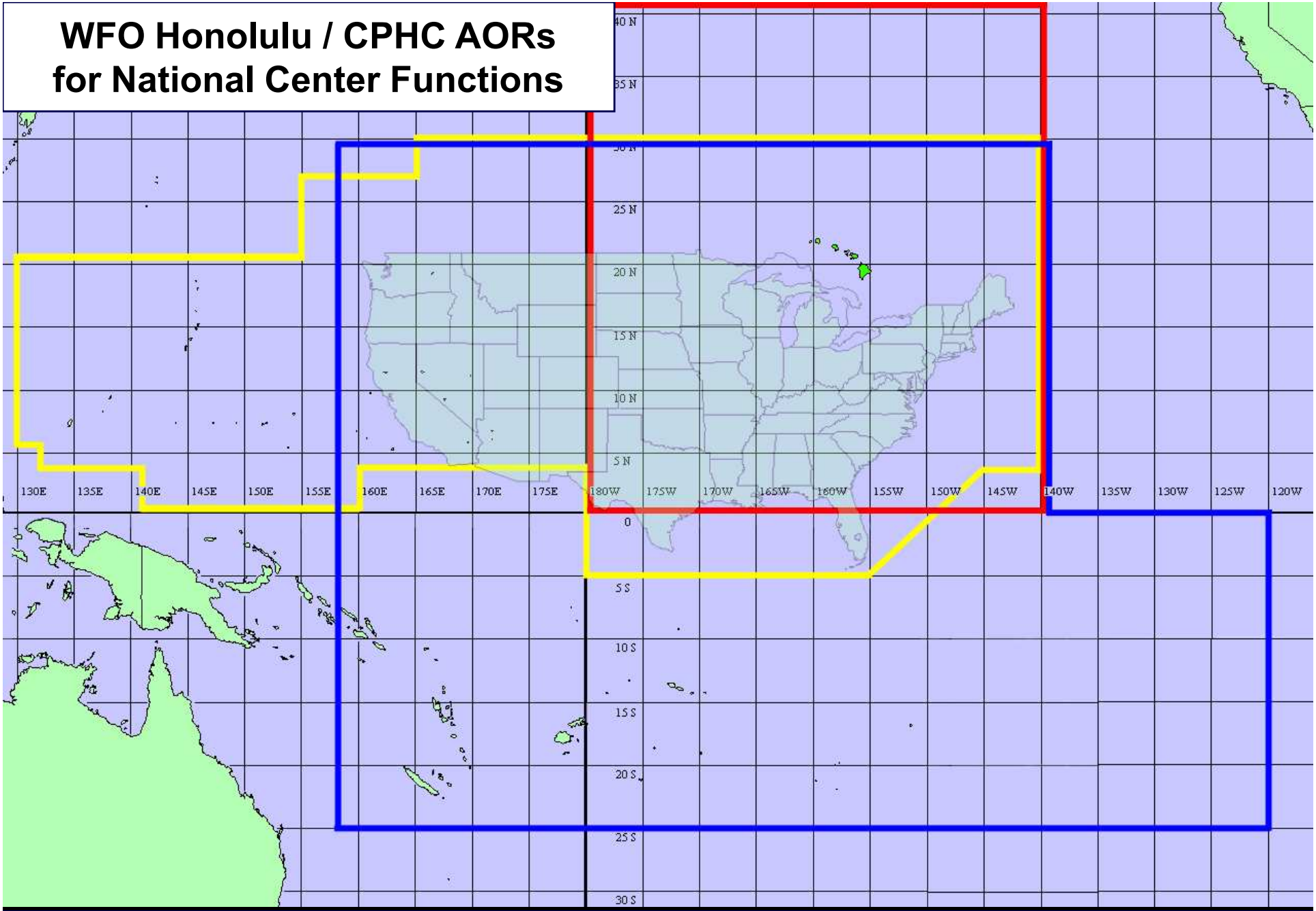
Weather Forecast Office (WFO) Honolulu, Central Pacific Hurricane Center (CPHC)

- Largest of the 122 WFOs in the US and its territories
- Central Pacific Hurricane Center (CPHC)
- National center functions for aviation and marine forecasting
- Co-located with University of Hawaii – Manoa Campus Meteorology Department



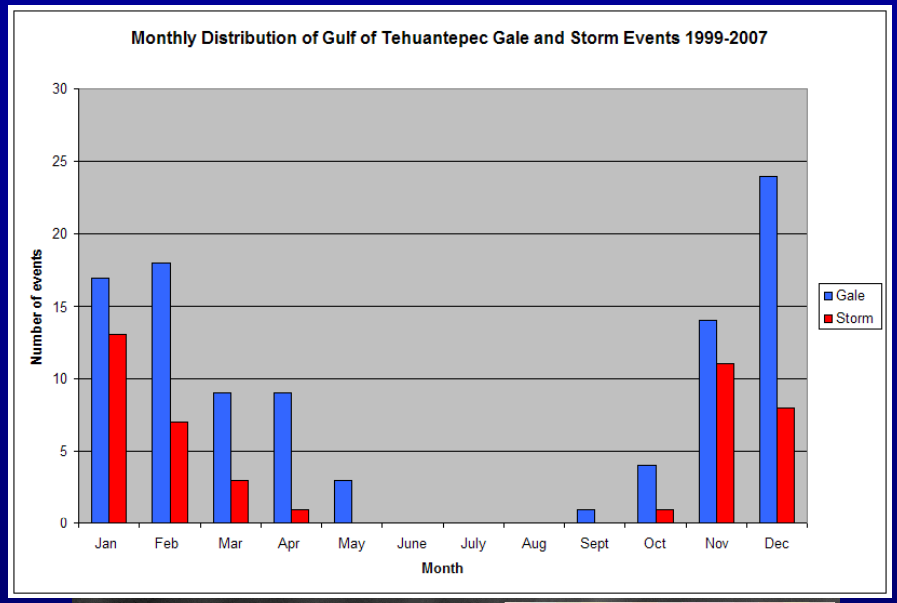


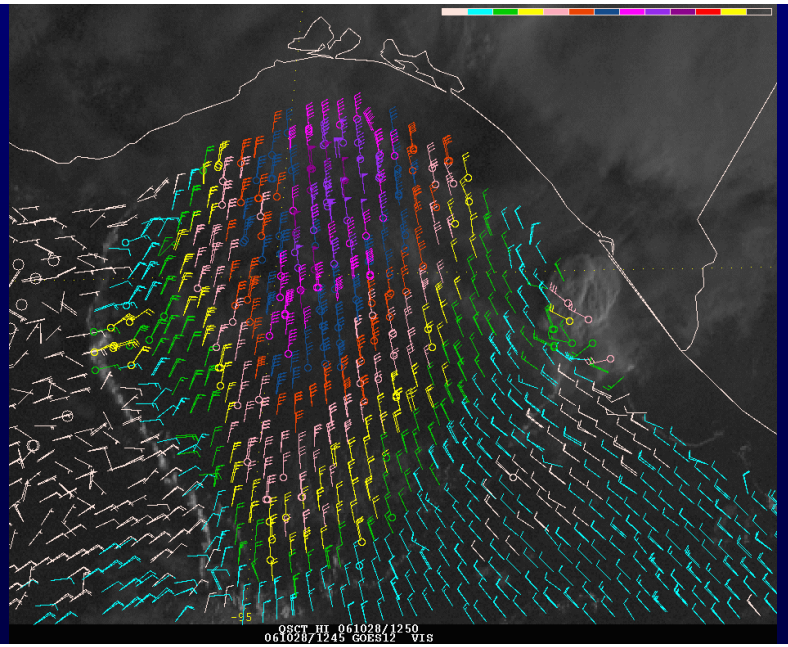
WFO Honolulu / CPHC AORs for National Center Functions



Gulf of Tehuantepec Gap Wind Events

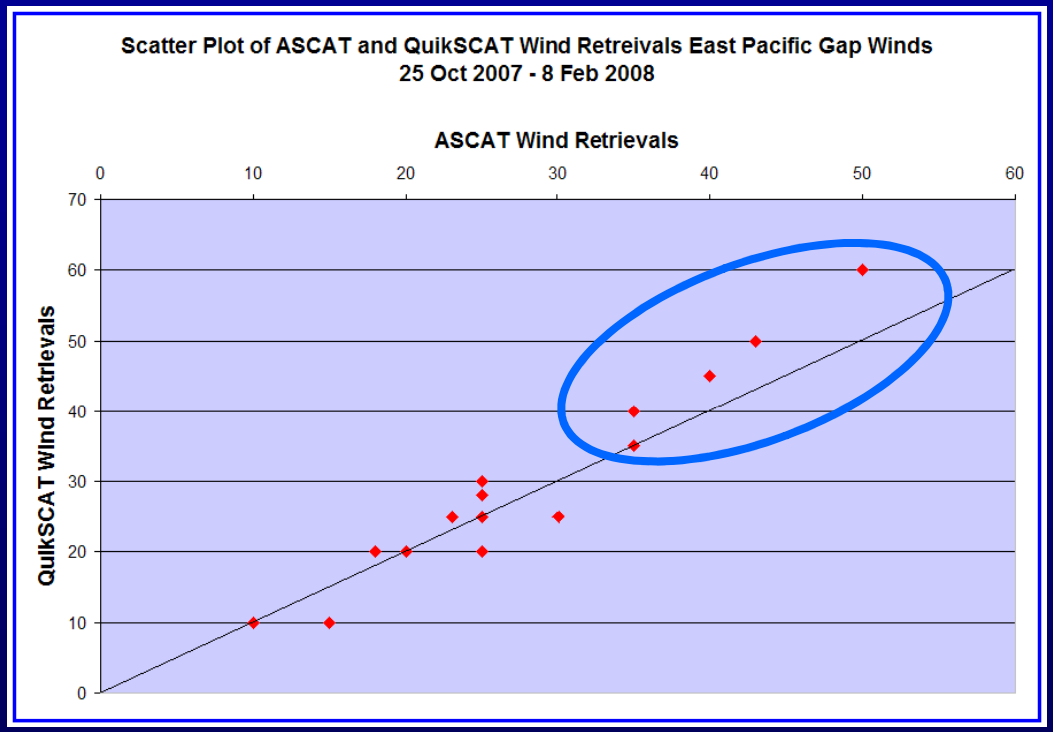
- Gap wind events in Gulf of Tehuantepec are most frequent storm-force wind events in this region outside of tropical cyclones
- Eight-year QuikSCAT-based climatology finds average of **12.4 gale-force** events and **5.5 storm-force** events per season
- Knowledge of frequency and intensity of Tehuantepec events greatly increased by long data record from QuikSCAT
- TAFB forecasters confidently issue warnings based largely on knowledge gained from QuikSCAT data
- Only 32% of storm-force Tehuantepec events since 1999 would have been identified by synoptic-hour ship observations





TAFB ASCAT Evaluation
2007-2008 Cold Season

- Narrower swaths and nadir gap make it much more difficult to use ASCAT for synoptic-scale analyses
- Larger frequency of "misses" for ASCAT passes over Gulf of Tehuantepec during 2007-2008 evaluation
- 2.33 ASCAT "misses" for every QuikSCAT miss



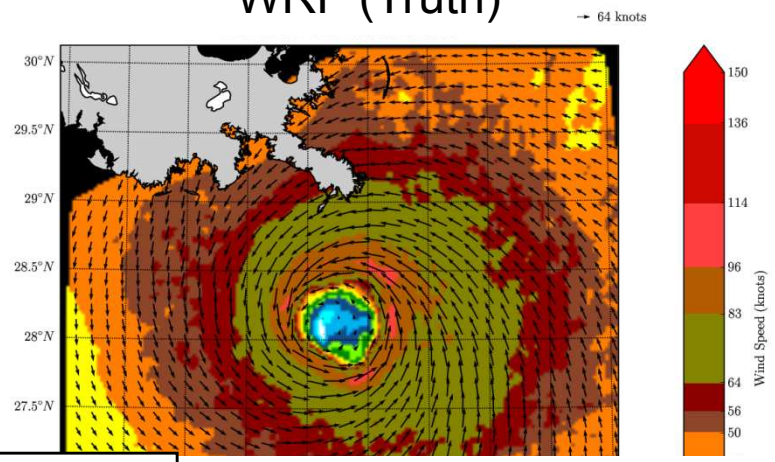
ASCAT Evaluation

- Impacts on TPC/NHC operations not as significant as QuikSCAT due to reduced data coverage
- ASCAT appears to reliably retrieve surface wind speeds of about 25-30 kt in all weather conditions
  - Improvement over QuikSCAT rain-contaminated retrievals at low speeds in areas of rain
- ASCAT retrievals ~ 5-10 kt < QuikSCAT at winds ≥ 30 kt

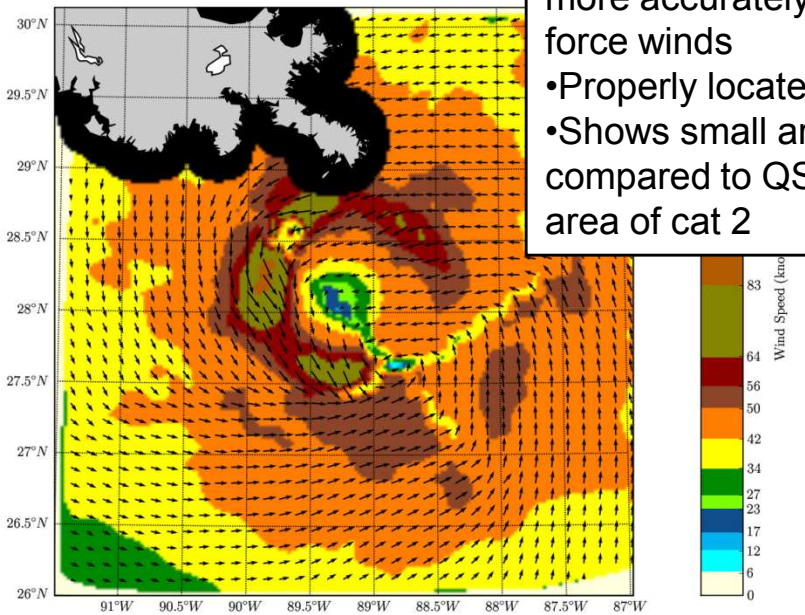
Katrina Example
0830 UTC 29 Aug. 2005

- NHC and CPHC participated in a user impact study comparing retrievals from XOVWM and QuikSCAT
- Evaluated wind field structure, maximum wind, and center location compared to model output (“truth”)

WRF (Truth)

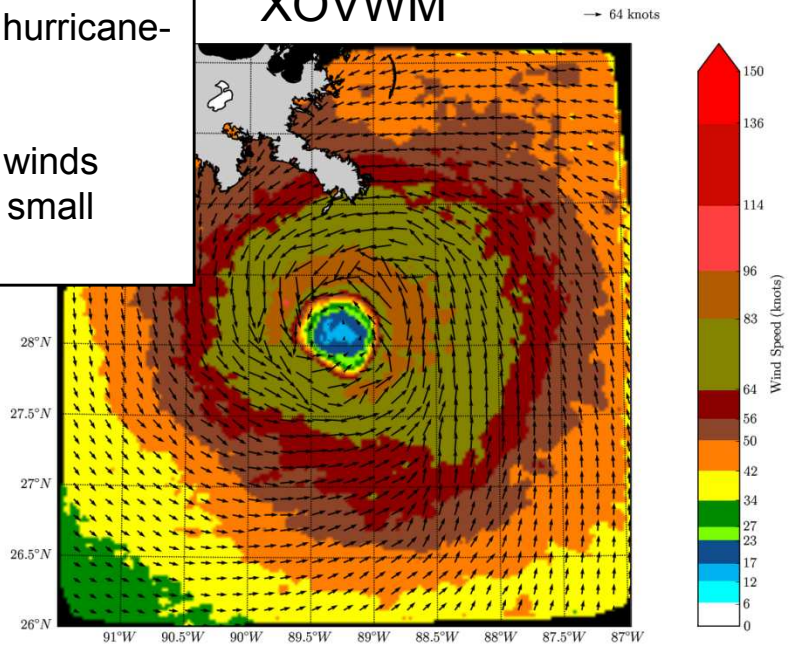


QuikSCAT



- XOWVM captures entire wind field much more accurately – note radius of hurricane-force winds
- Properly locates center
- Shows small area of cat 3 force winds compared to QS, which only has small area of cat 2

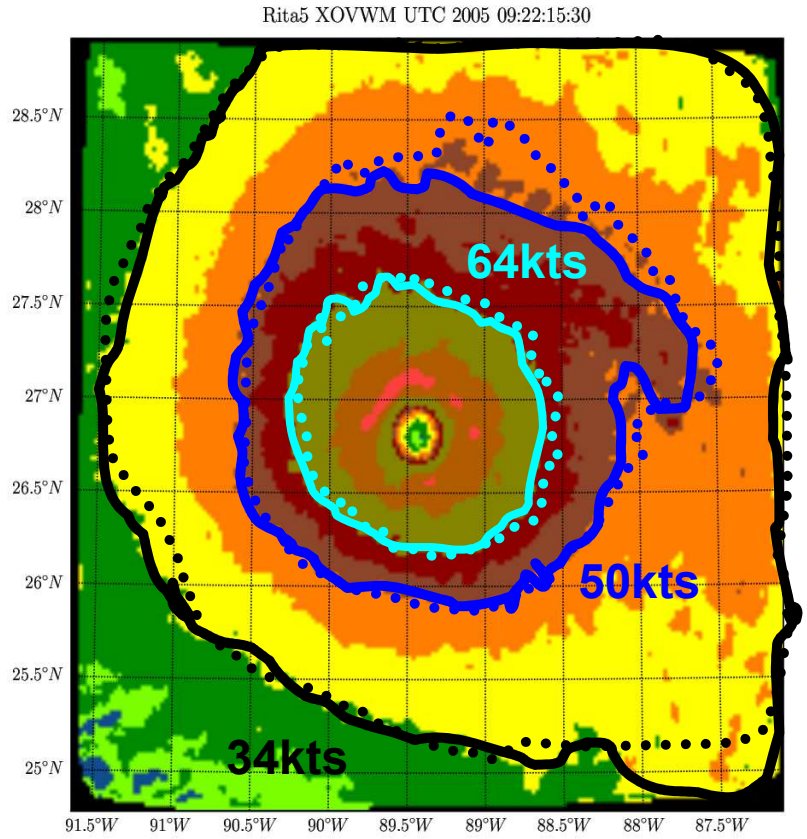
XOVWM



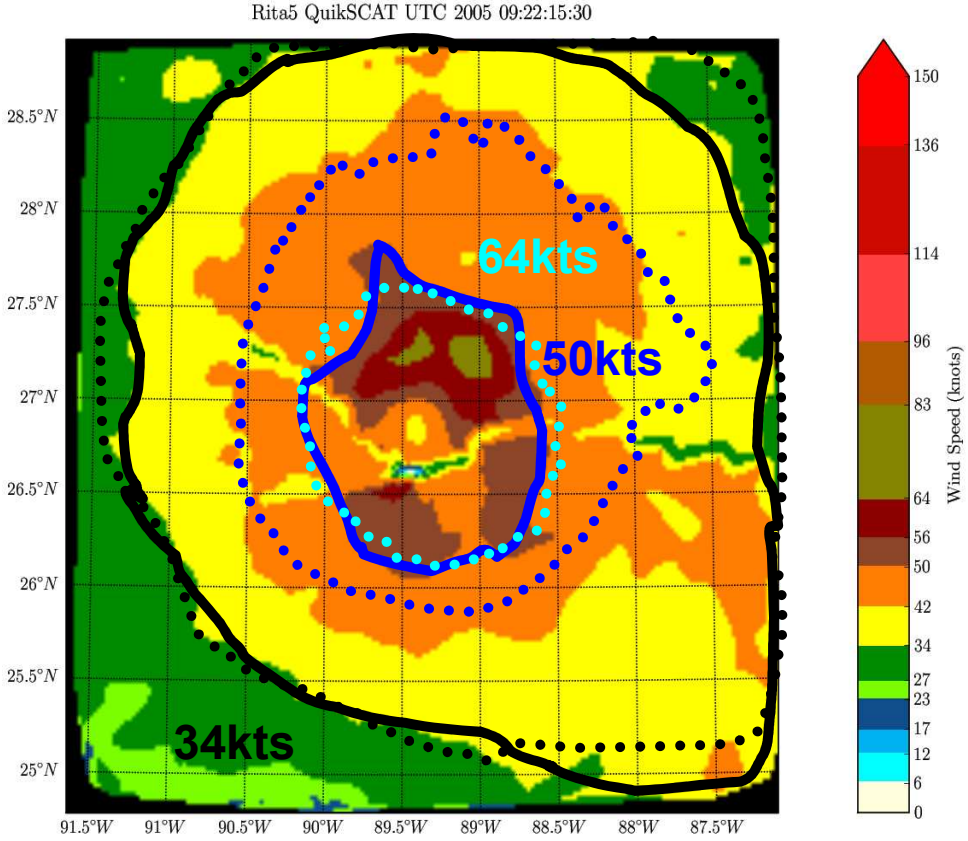
Wind Radii Example

Rita – 22 Sep 2005

XOVWM



QuikSCAT



34kts

50kts

64kts

WRF

Summary of NHC Feedback

User Impact Study

- "…there is just no comparison between XOVWM and QuikSCAT"
- "XOVWM simulations are clearly superior to QuikSCAT for estimating hurricane intensity"
- "Improved intensity estimates from XOVWM would not only improve hurricane analysis in NHC's areas of responsibility, but also in other tropical cyclone basins of the world where aircraft reconnaissance is rarely, if ever, available"
- "…if XOVWM involves a comparable or an acceptably greater cost, risk, and development time, it is the highly preferred choice due to the tremendous benefits the more advanced platform would provide."

Summary

- Operational use of QuikSCAT in TC and marine applications continues
- ASCAT use increasing
  - Supplements QuikSCAT nicely
  - Improved wind speed retrievals in rainy, weak TCs
  - Use growing most quickly in east Pacific TCs
  - Forecasters recognize low bias in ASCAT wind speeds relative to what they are used to seeing with QuikSCAT
  - Still need to assess utility of ASCAT ambiguities for TC center-fixing and better intensity estimation
- Look forward to working with others in NOAA and the OSVW community to advocate for improved capability with ultimate goal being XOVWM

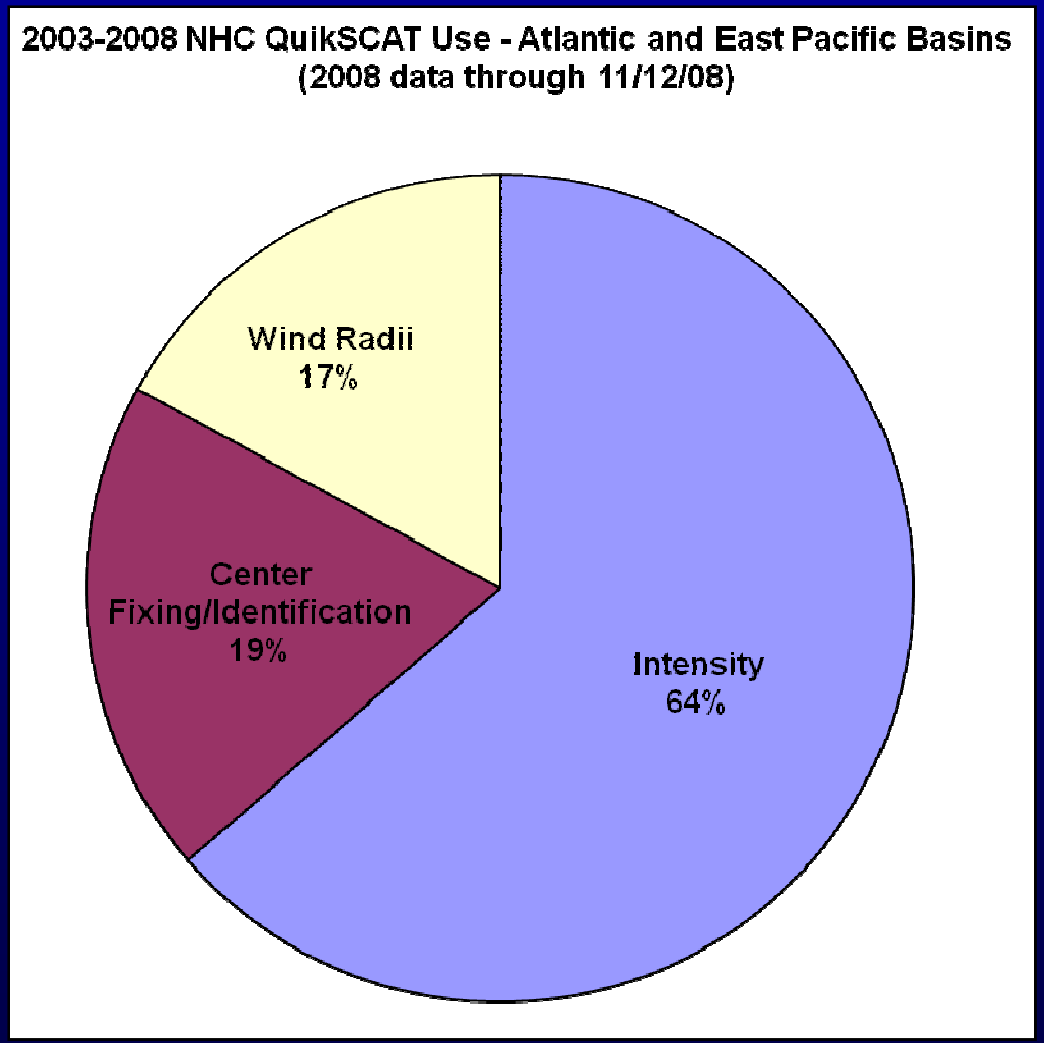
Beyond QuikSCAT

Ongoing/Future Activities

- Revising manuscript on operational use of QuikSCAT at NHC prepared and submitted to *Weather and Forecasting*
  - Conditionally accepted pending revisions

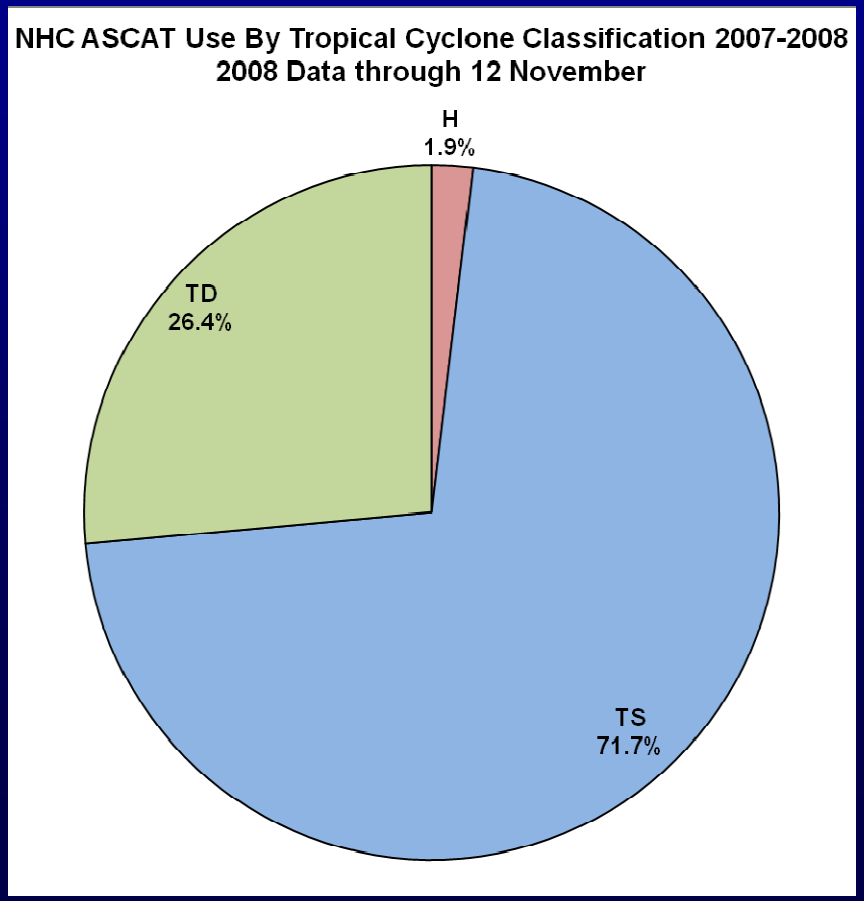
Use of QuikSCAT in Tropical Cyclone Discussions 2003-2008

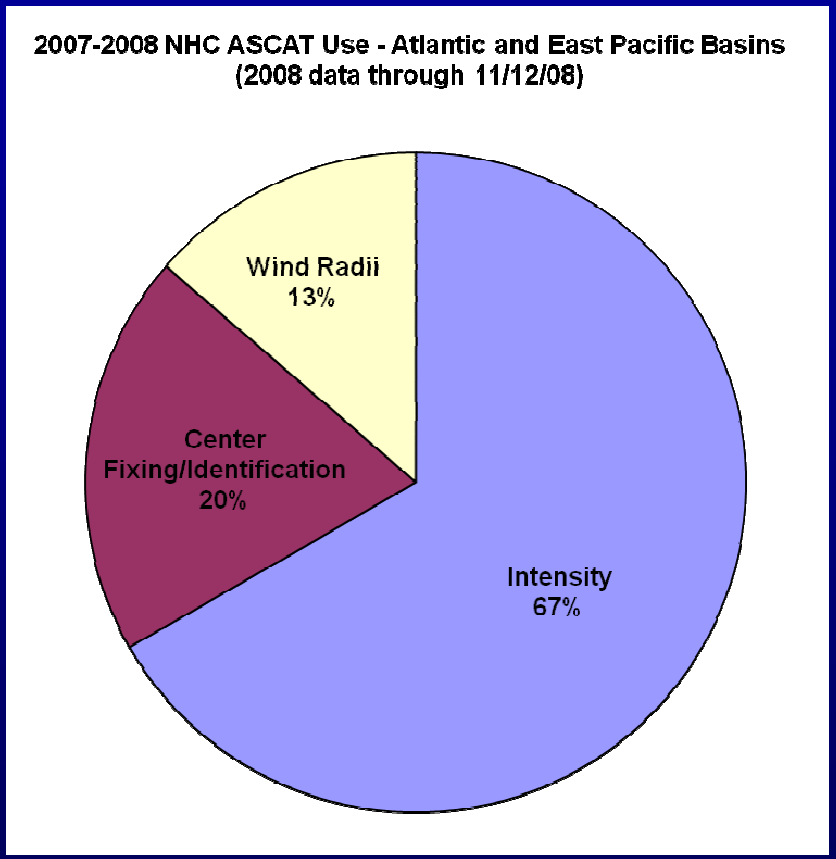
- QuikSCAT still most often used to make some judgment about TC intensity
  - Particularly in tropical depressions and tropical storms not sampled by aircraft recon
- Ambiguity analysis used to assist in location/identification of center in weaker TCs
  - Used to justify initiation and/or discontinuation of advisories
- 34-kt wind radii often well-defined in QuikSCAT in major hurricanes
  - Heavily used in east Pacific where aircraft recon rare



ASCAT Usage

- So far, use of ASCAT mirrors that of QuikSCAT quite closely
  - Most often used for intensity estimates
  - Less often for wind radii – likely due to narrower swath

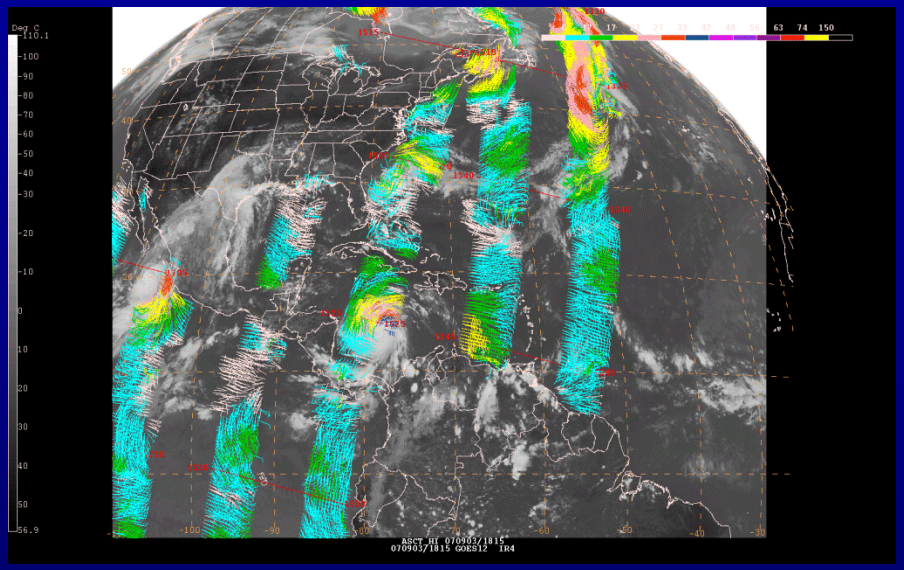




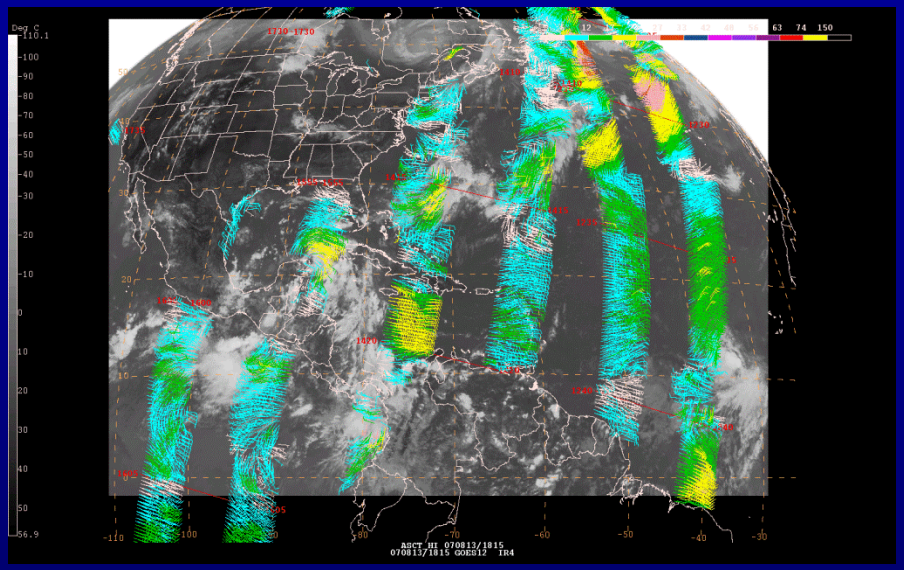
- ASCAT most often used in tropical storms and tropical depressions
- Rarely used in hurricanes

ASCAT and TCs

A “hit or miss” Experience



Hurricane Felix (2007)



Hurricane Dean (2007)

- Some TCs travel in ASCAT “gaps” through their entire life cycle
- Narrow swaths and nadir gap make it difficult for entire TC to be sampled in a single pass
- ASCAT does nicely supplement QuikSCAT observations in many TCs

QuikSCAT Follow-On User Impact Study

- NHC and CPHC participated in a user impact study comparing retrievals from XOVWM and QuikSCAT
- Evaluated wind field structure, maximum wind, and center location compared to model output (“truth”)