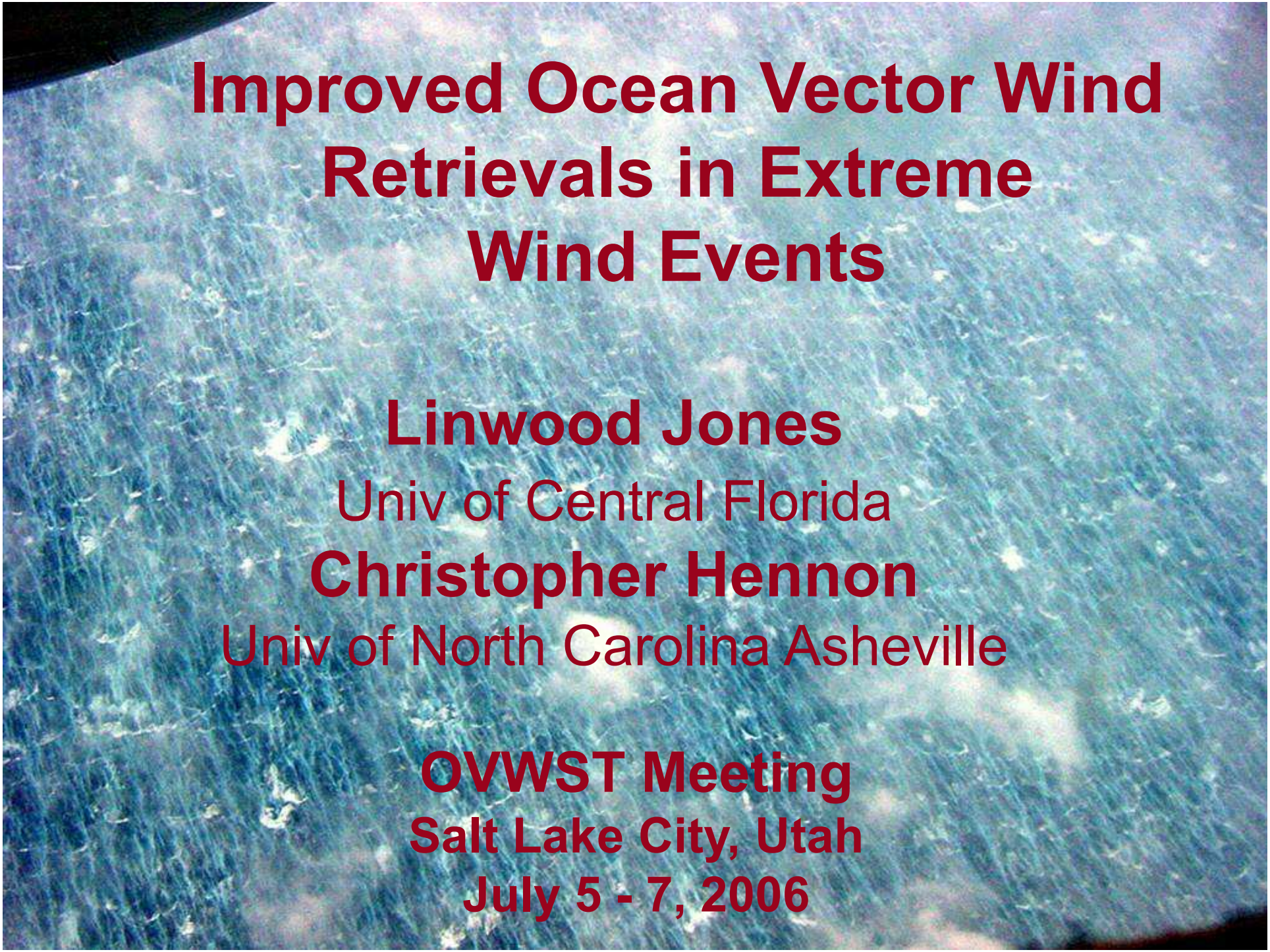
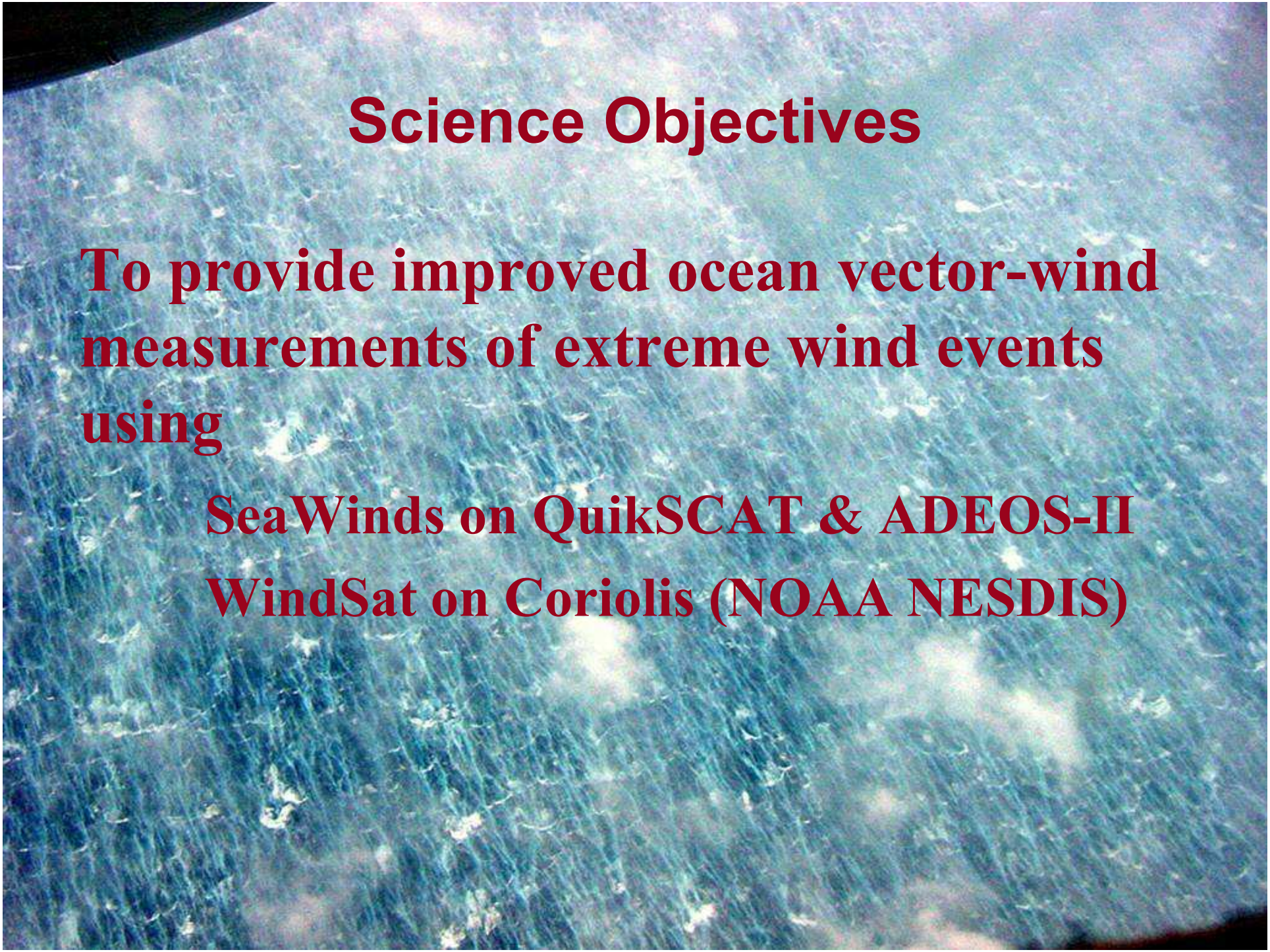


Improved Ocean Vector Wind Retrievals in Extreme Wind Events

Linwood Jones
Univ of Central Florida
Christopher Hennon
Univ of North Carolina Asheville

OVWST Meeting
Salt Lake City, Utah
July 5 - 7, 2006



Science Objectives

To provide improved ocean vector-wind measurements of extreme wind events using

SeaWinds on QuikSCAT & ADEOS-II

WindSat on Coriolis (NOAA NESDIS)

Science Objectives cont

- Develop and validate advanced vector wind products for extreme wind events
  - Tropical and extra-tropical cyclones
    - Quantify accuracy of vector winds
    - Use of H-Wind Analysis for surface truth
  - Develop rain detection techniques
    - Assess vector wind measurement accuracy in the presence of rain

Research Thrusts / Collaborations

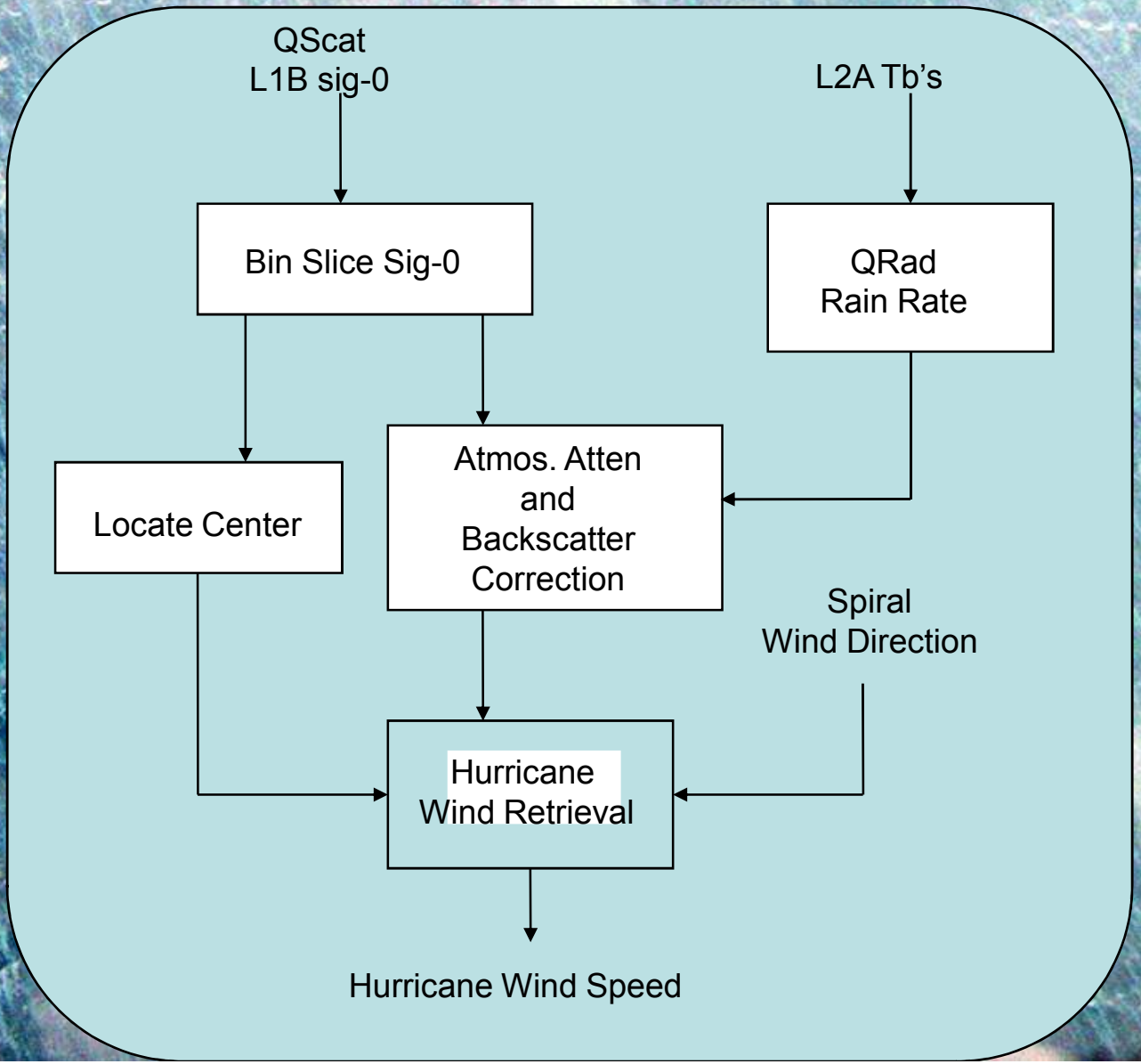
- **Scat OVW Retrieval**
  - **Linwood Jones**
- **Polarimetric Radiometer OVW Retrieval**
  - **Zorana Jelenak**
- **Extreme OVW Algorithm Validation**
  - **Chris Hennon & Paul Chang**
- **Rain Effect on Wind Retrievals Assessment**
  - **Linwood Jones & Peter Gaiser**
- **Near-Real Time OVW Hurricane Retrievals**
  - **Paul Chang & Zorana Jelenak**

Previous Research
SeaWinds Hurricane Wind Speed Retrievals

Issues with L2B Wind Vector Retrieval for Extreme Wind Events

- Rain has negative effects on wind measurements
- CFRSL Approach
  - Simultaneous rain measurement using QRad
  - Rain attenuation and volume backscatter correction provided
  - Rain Quality Flags Provided

SeaWinds (Active/Passive) Hurricane Wind Speed Algorithm



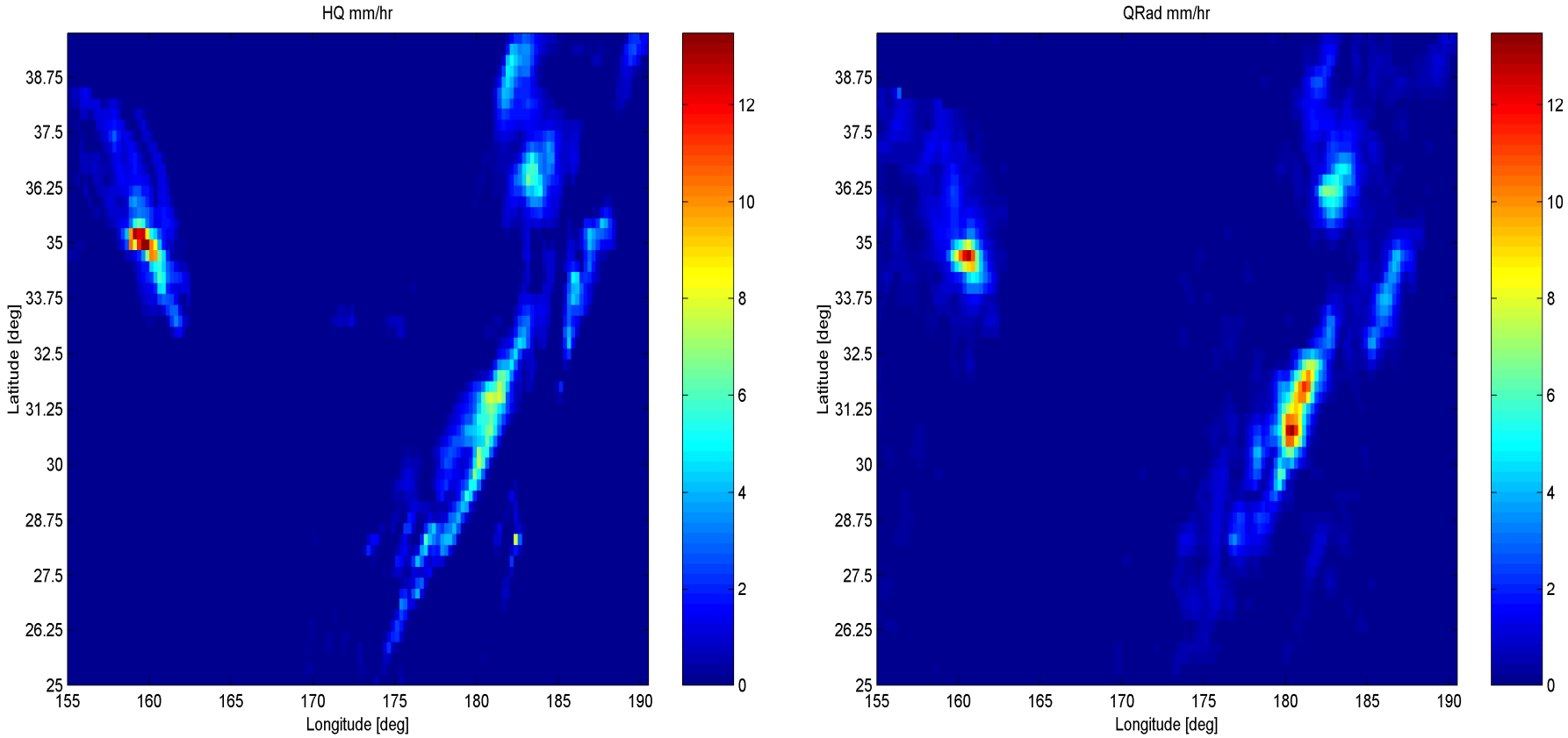
QRad/SRad Rain Algorithm

- Look at noise channel of scatterometer
  - Subtract echo channel
  - Calibrate radiometric temperature vs. TMI
- Empirical brightness temperature/rain rate relationship from TMI 2A12 rain rates
- Rain measurement is coincident with scatterometer measurement

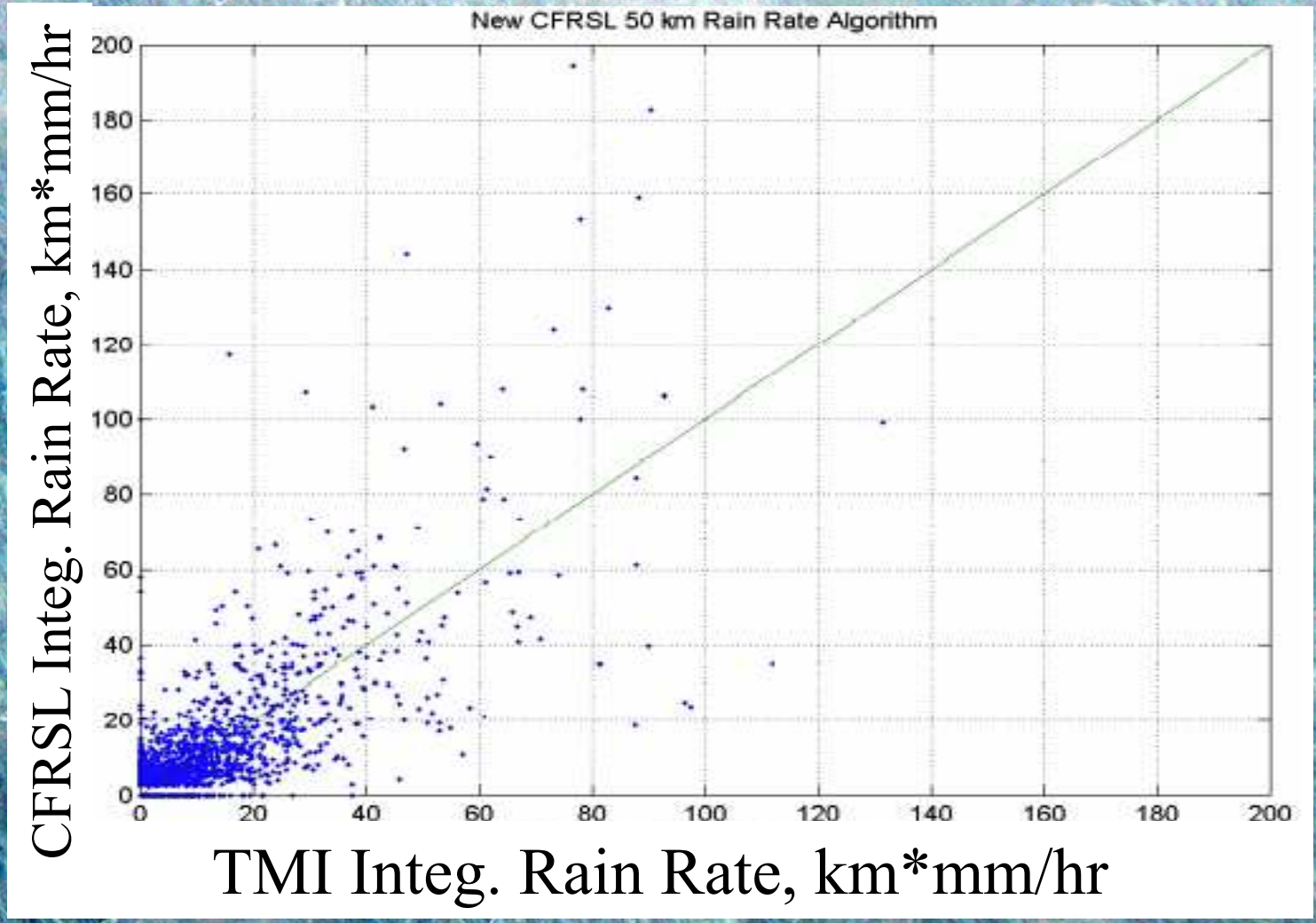
QRad – TRMM Simultaneous Moderate Rain Events

TMI

QRad

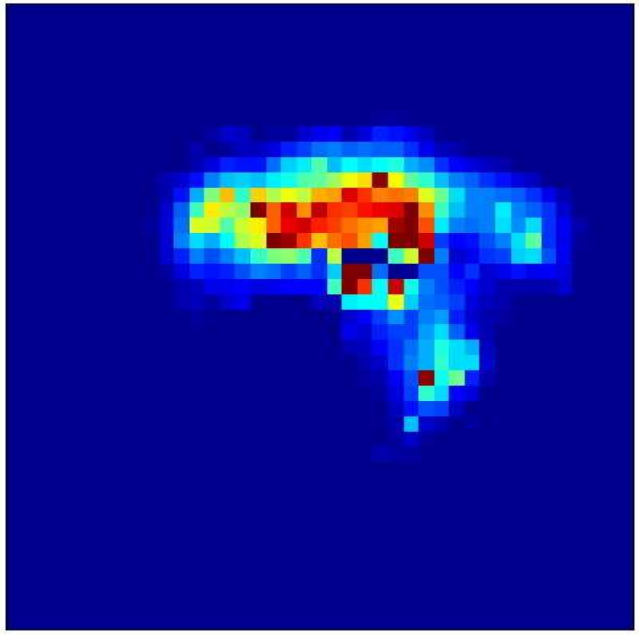


QRad & TMI Integrated Rain Rates for Simultaneous Events

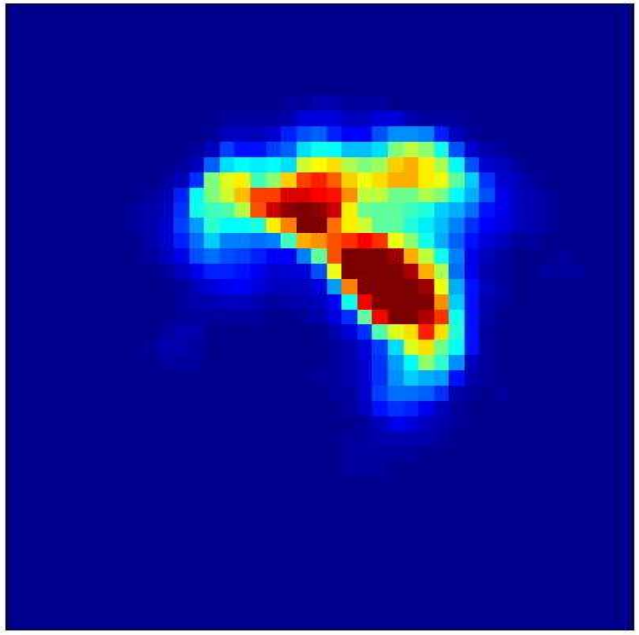


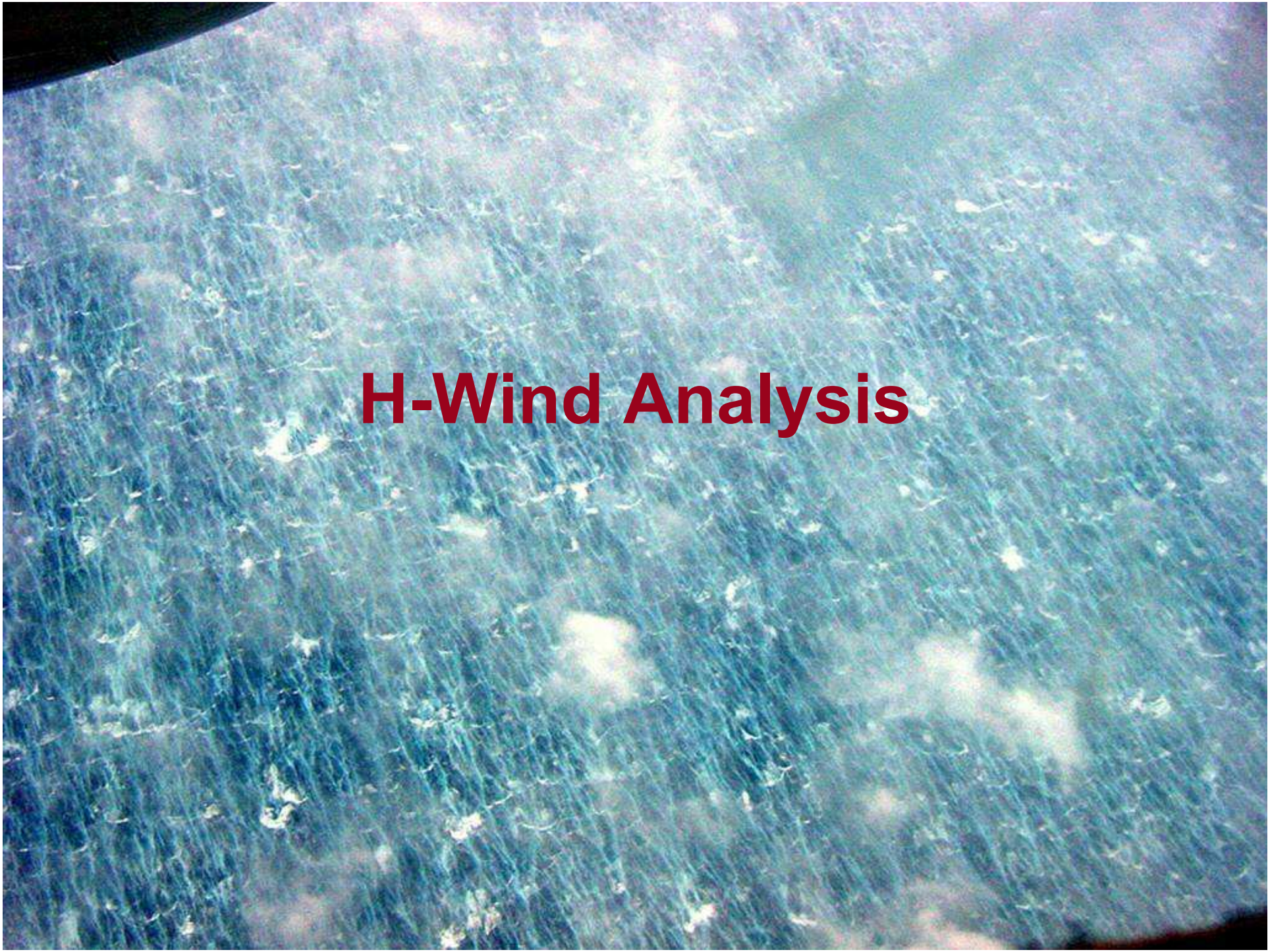
AMSR & SRad Path Attenuation, Horizontal Polarization

AMSR Attenuation



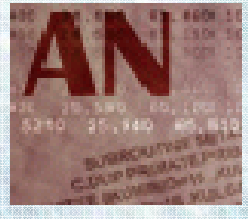
SRad Attenuation




H-Wind Analysis

Presentation Layer

Quality Control



Analysis

Products

Data Collection

satellite

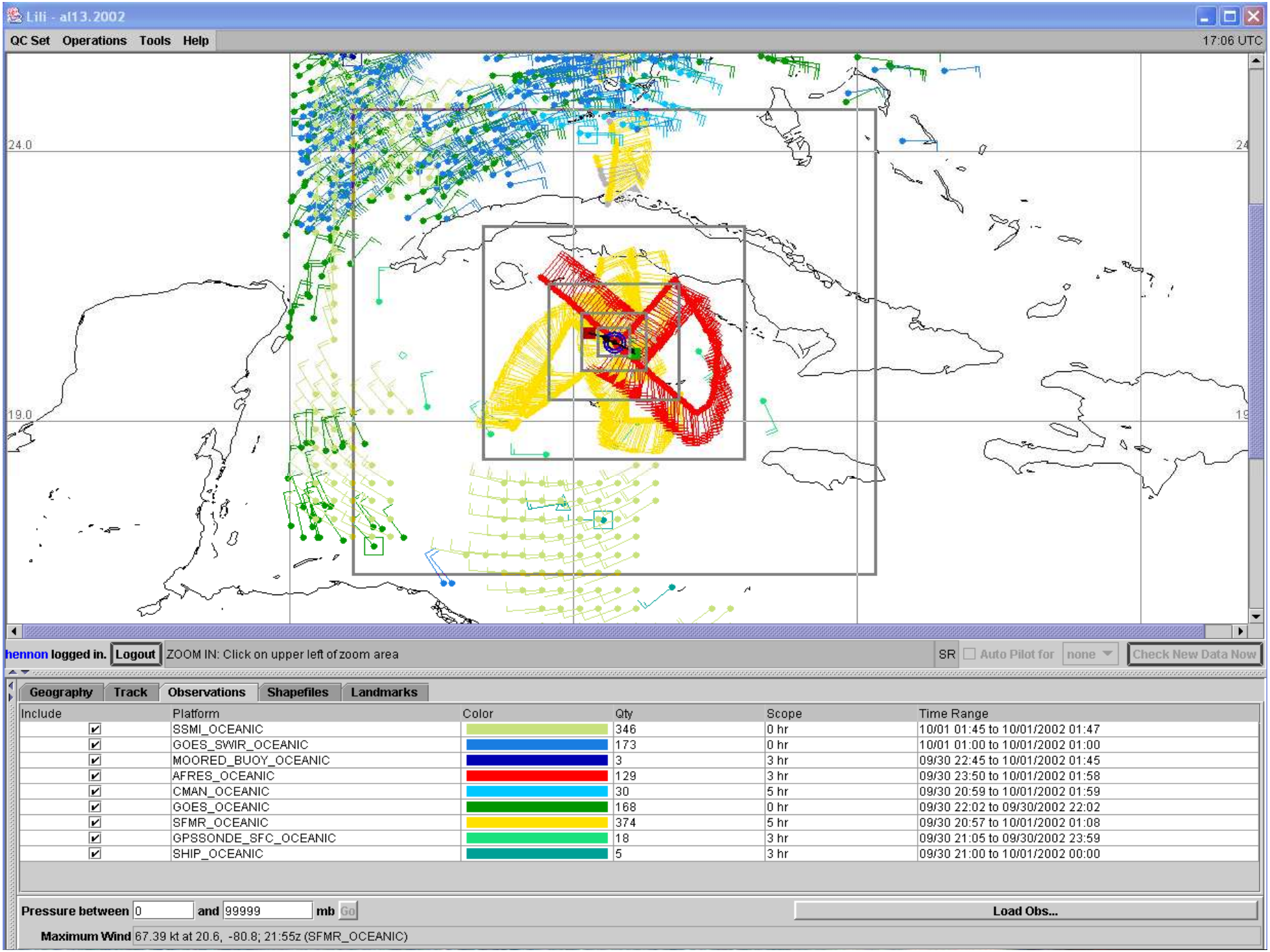
Air Force and NOAA Aircraft

Ships, buoys

+ more

Database Layer

Flowchart courtesy of Powell and Oterro (HRD)


Lili - al13.2002
QC Set
Operations
Tools
Help
17:06 UTC
24.0
19.0
hennon logged in.
Logout
ZOOM IN: Click on upper left of zoom area
SR
Auto Pilot for
none
Check New Data Now
Geography
Track
Observations
Shapefiles
Landmarks
Include
Platform
Color
Qty
Scope
Time Range
SSMI_OCEANIC 346 0 hr 10/01 01:45 to 10/01/2002 01:47
GOES_SWIR_OCEANIC 173 0 hr 10/01 01:00 to 10/01/2002 01:00
MOORED_BUOY_OCEANIC 3 3 hr 09/30 22:45 to 10/01/2002 01:45
AFRES_OCEANIC 129 3 hr 09/30 23:50 to 10/01/2002 01:58
CMAN_OCEANIC 30 5 hr 09/30 20:59 to 10/01/2002 01:59
GOES_OCEANIC 168 0 hr 09/30 22:02 to 09/30/2002 22:02
SFMR_OCEANIC 374 5 hr 09/30 20:57 to 10/01/2002 01:08
GPSSONDE_SFC_OCEANIC 18 3 hr 09/30 21:05 to 09/30/2002 23:59
SHIP_OCEANIC 5 3 hr 09/30 21:00 to 10/01/2002 00:00
Pressure between 0 and 99999 mb Go
Load Obs...
Maximum Wind 67.39 kt at 20.6, -80.8; 21:55z (SFMR_OCEANIC)

H*Wind Advantages

- Complete database of all available observations
- Observations can be Earth-relative or Storm-relative
- Produces a complete 6 km resolution grid of wind speed and direction
- User configurable
- Provides easy framework for validation against one platform

H*Wind Validation Concerns

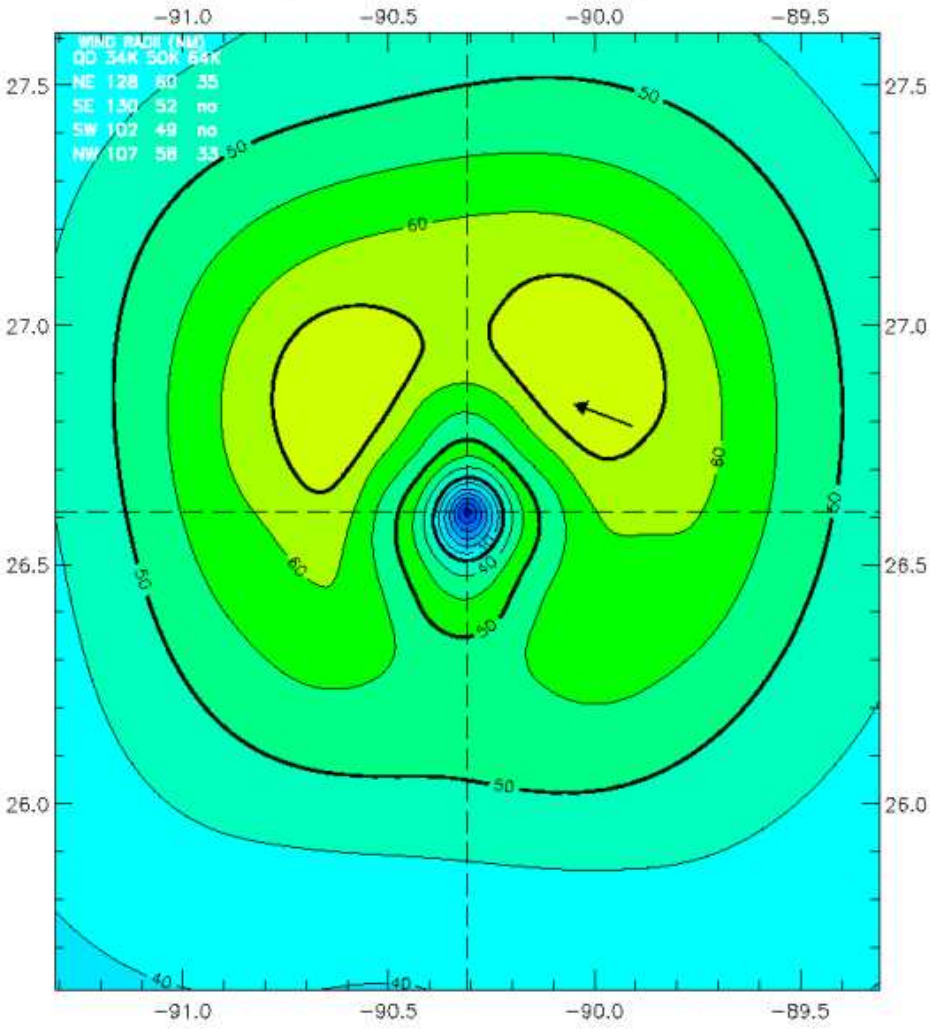
- Little wind direction data
  - Direction based on ‘ideal’ TC inflow
- Observations taken across sometimes large temporal window (up to 8 hours)
- Analysis smoothes data to produce grid
  - Wind speed errors ~ 10% - 20%
- Without aircraft (AF, NOAA), reasonable analysis not possible
- Sensitive to data types included

Hurricane Lili 0002 UTC 03 Oct 2002

Max 1–min sustained surface winds (kt) for marine exposure

Analysis based on SHIP from 2200 – 0500 z; SSMI from 0316 – 0316 z; CMAN from 2159 – 0504 z;
GPSSONDE_SFC from 2226 – 0103 z;
GOES from 2202 – 2202 z;
MOORED_BUOY from 2145 – 0145 z;

0002 z position interpolated from 0000 ATCF; mslp = 940.0 mb



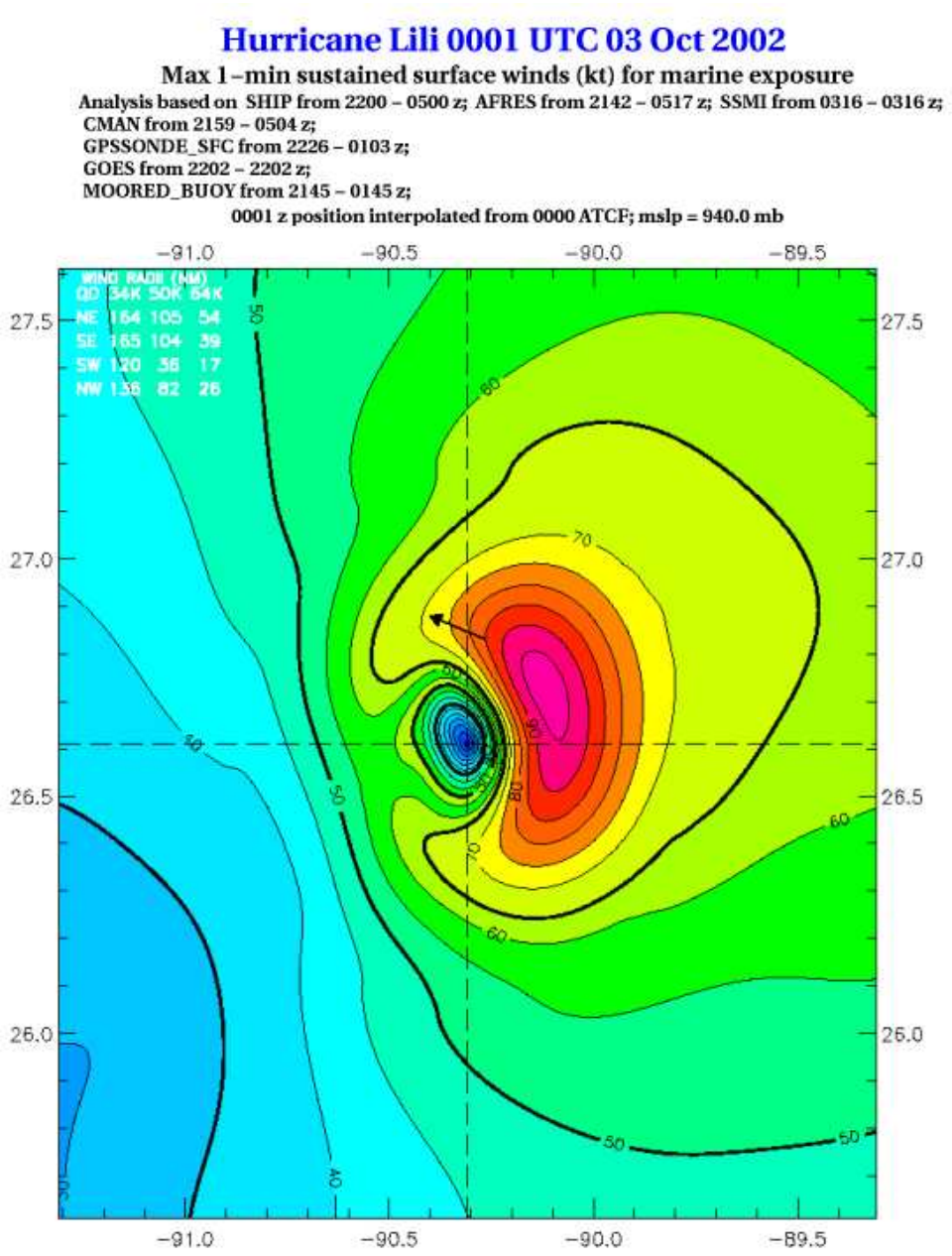
Observed Max. Surface Wind: 68 kts, 24 nm NE of center based on 0246 z MOORED_BUOY sfc measurement
Analyzed Max. Wind: 68 kts, 23 nm NE of center

Experimental research product of:

NOAA / AOML / Hurricane Research Division

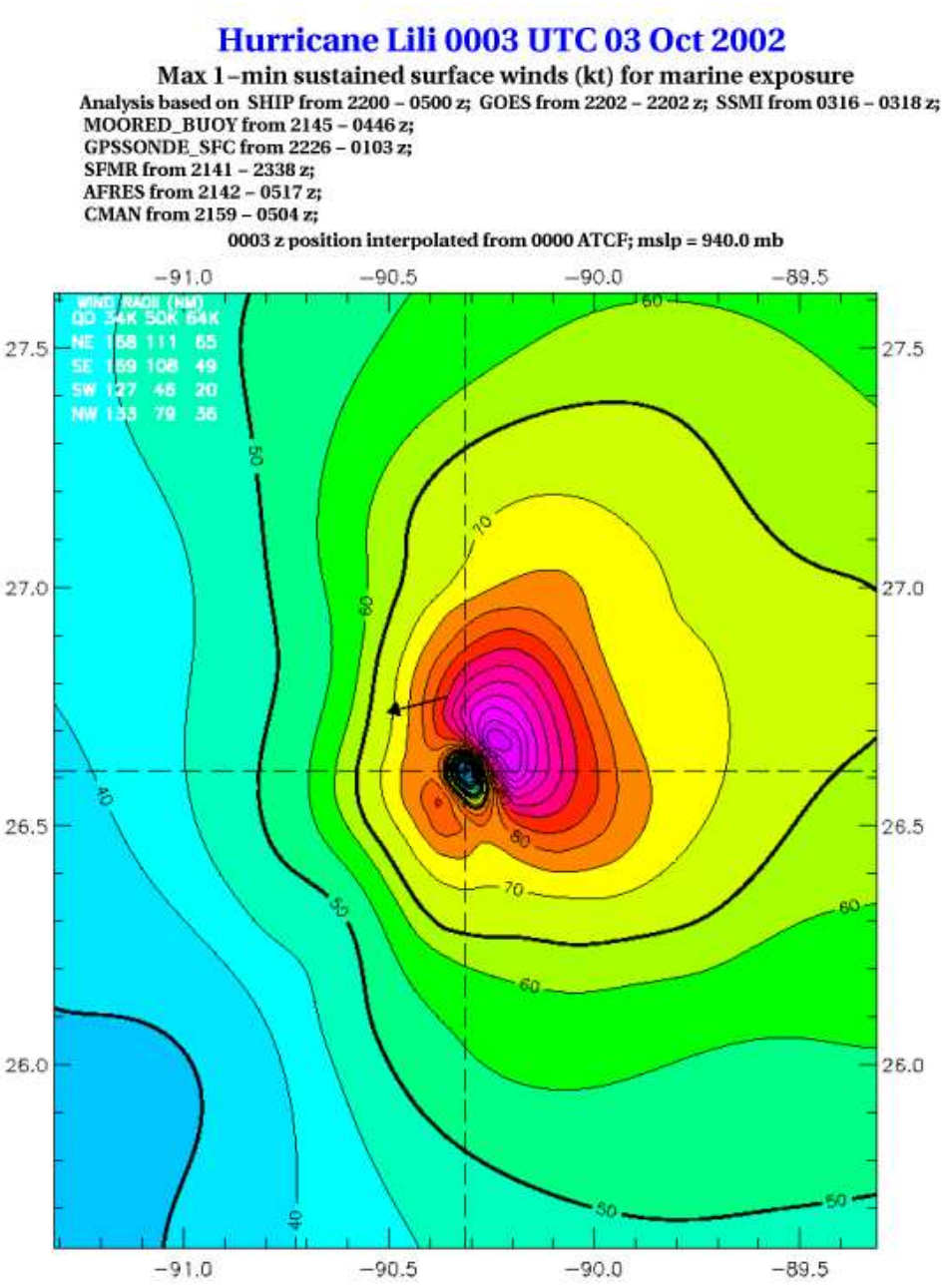
Max Wind = 34 m/s

Add Air Force flight level winds (reduced to surface)



Max Wind = 49 m/s

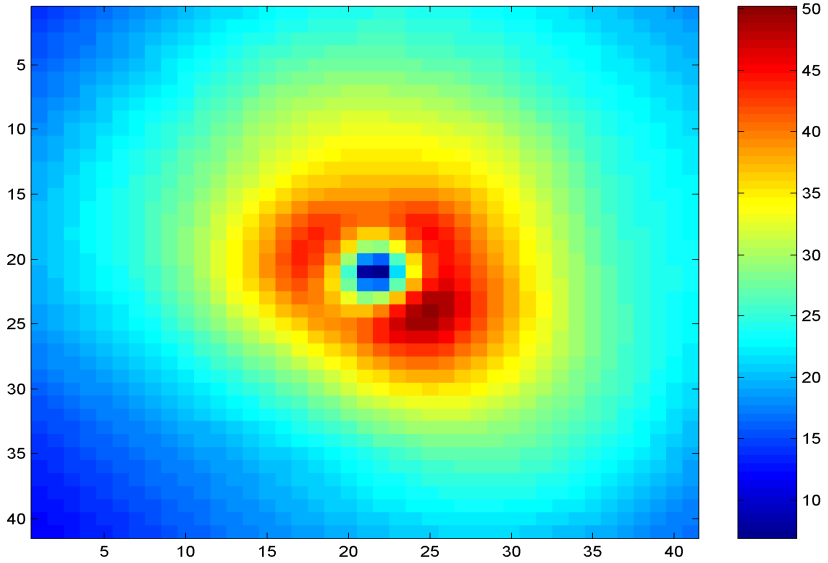
Add SFMR



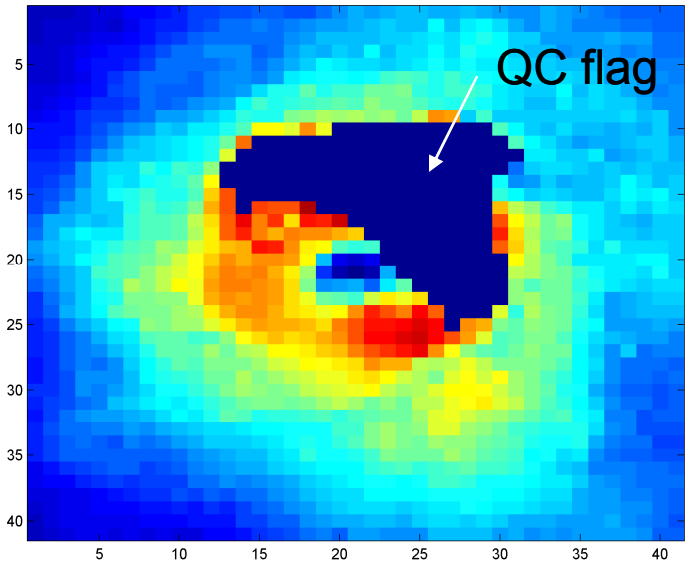
Max Wind = 62 m/s


Hurricane Wind Speed Retrieval
Example

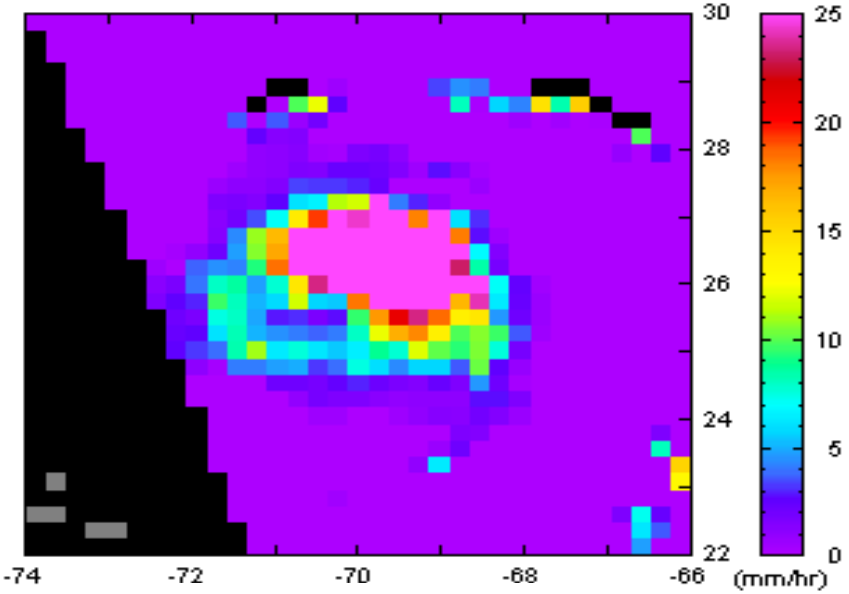
SeaWinds Rev. 03934, Sept 16, 2003 02:52 Z



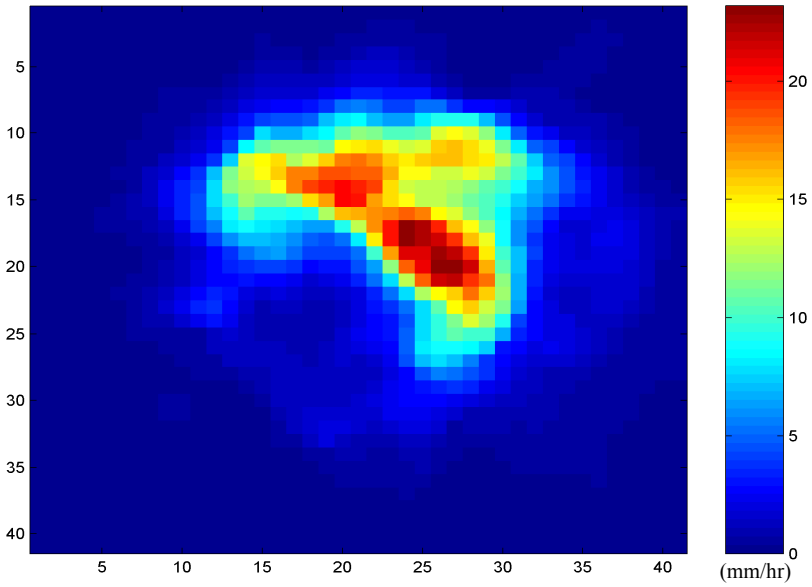
HRD Wind Field 01:30 Z



CFRSL Wind Retrieval

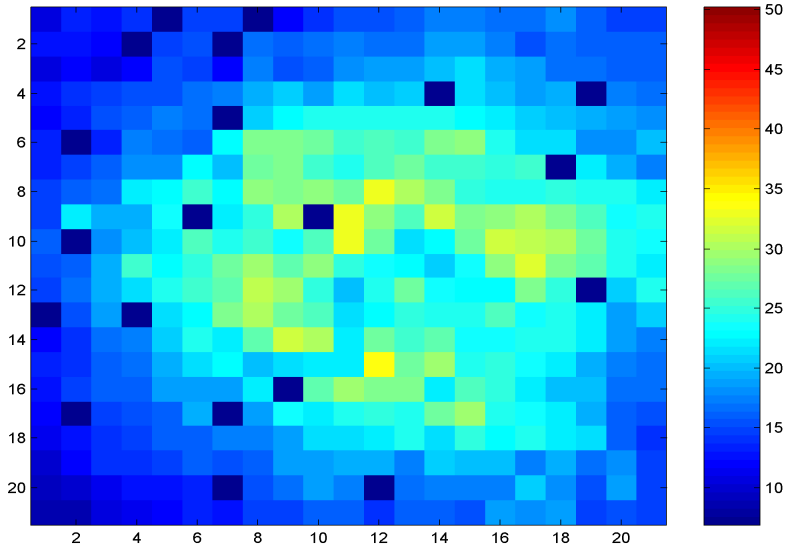


SSMI Rain Rate

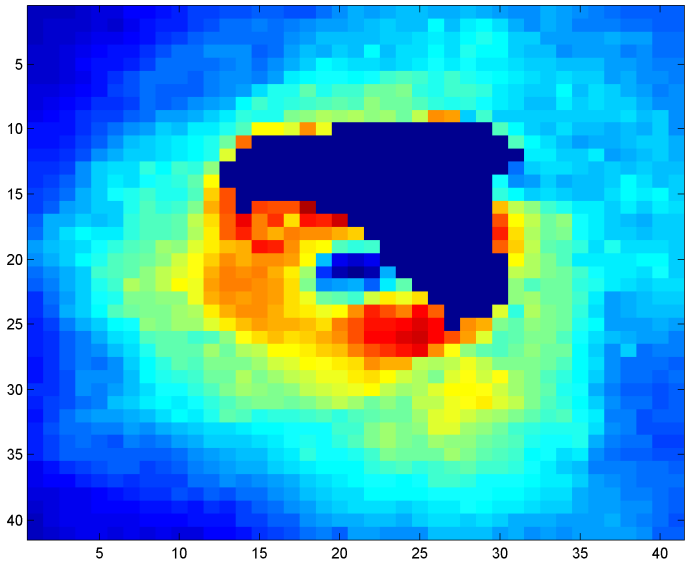


SRad Rain Rate

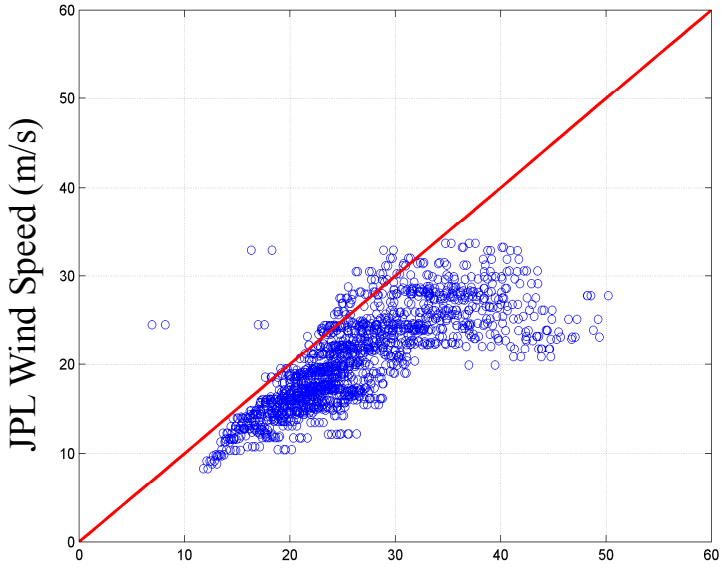
SeaWinds Rev. 03934, Sept 16, 2003 02:52 Z



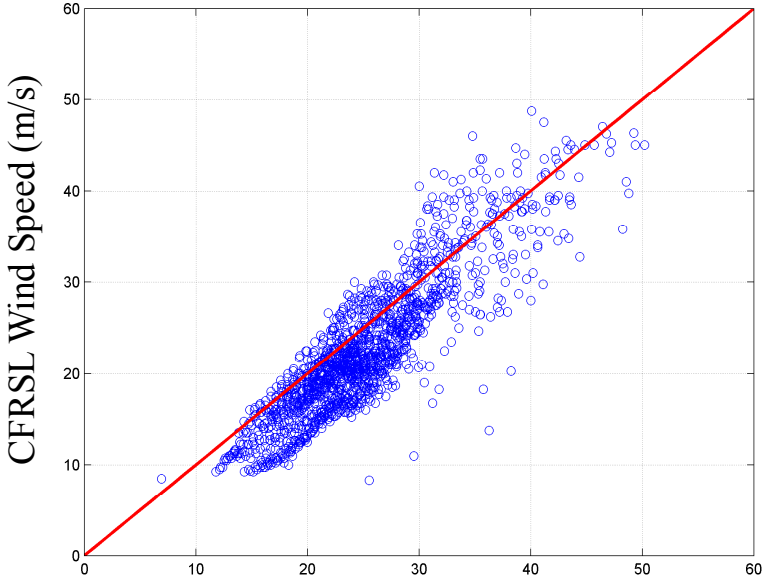
JPL (L2B) Wind Field



CFRSL Wind Retrieval



HRD Modeled Wind Speed (m/s)



HRD Modeled Wind Speed (m/s)

Summary: Proposed Research

Year-1

- Use SeaWinds on ADEOS-II to develop extreme winds OVW algorithm
  - Perform H-Wind hurricane surface wind analysis
  - Geophysical Model Development
    - SeaWinds
    - WindSat (NOAA NESDIS/Naval Research Lab)
  - SRad atmospheric attenuation & rain rate
    - Use AMSR atten & rain measurements
  - Wind vector retrieval

Year-2

- Validate OVW retrievals using QuikSCAT measurements

Recommendations

- Form an ad hoc extreme winds working group
  - Model Function
  - H-Wind surface truth
  - Case studies
    - Exchange of products
    - Algorithm intercomparison
  - Working group recommendations