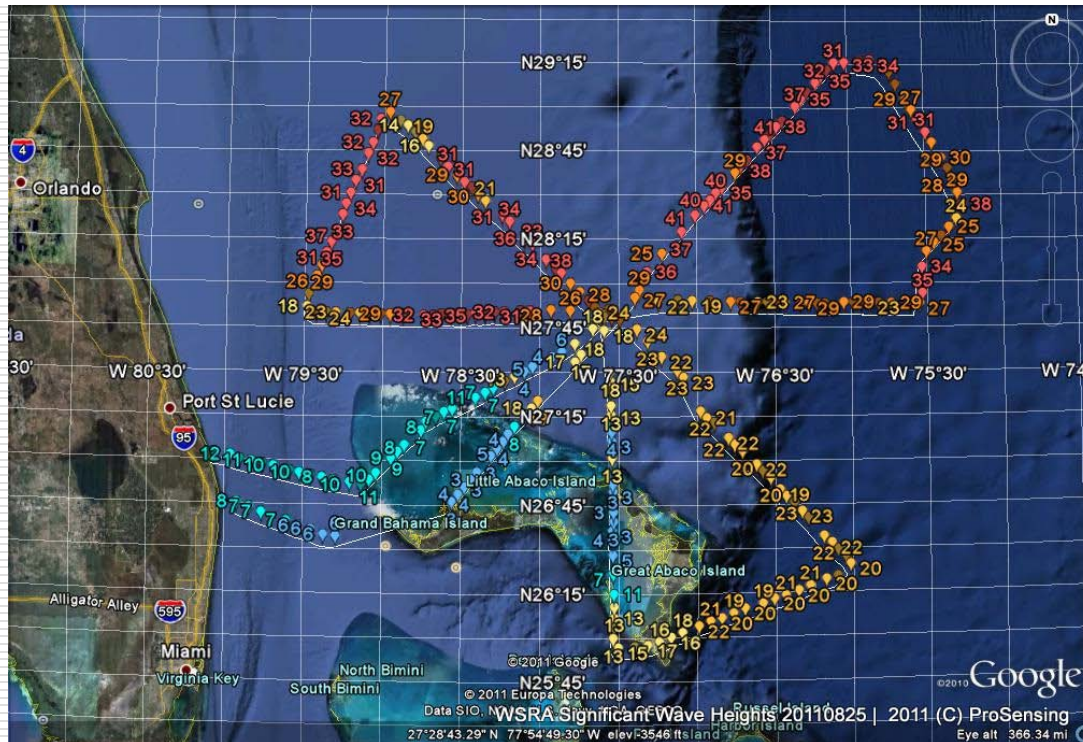# Operation of the Wide Swath Radar Altimeter (WSRA)
2011 Hurricane Season
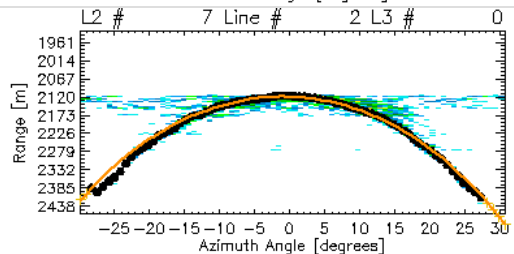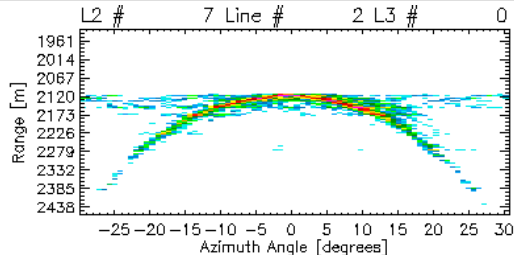
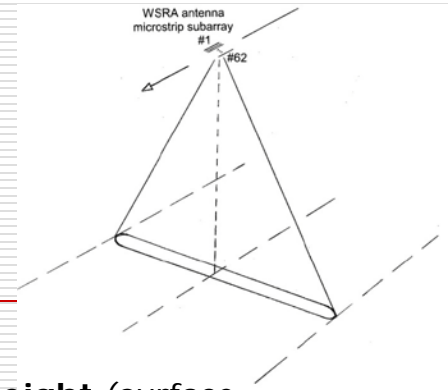**Ivan PopStefanija**
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PROSENSING

Operational WSRA Data products
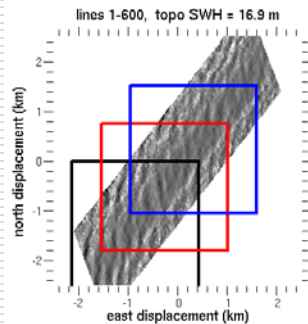
- Mapping **ocean significant wave height** (surface topography) which helps assessing radius of 12-foot seas

- Measurement of **ocean directional wave spectra** (poster P11)

- Estimate of **rain rate** (poster P12)

- Operational, targeted measurements of **storm surge**

Technology Description:

- ☐ Digital beam-forming antenna
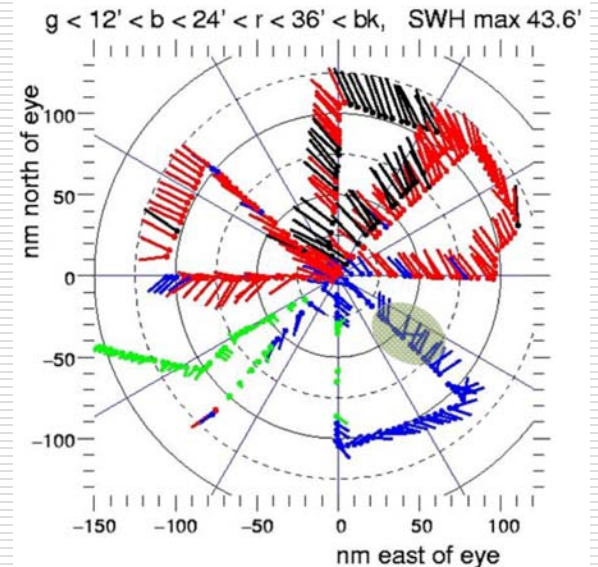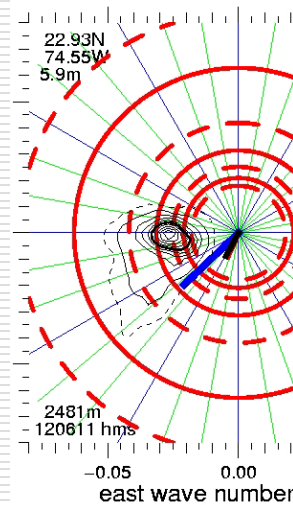 - ■ Microstrip planar antenna array
  - ■ Comprised of 62 sequentially-sampled subarrays
  - ■ Size: 30 in x 30 in x 2 in

- ☐ Transmitter
  - ■ 20 W solid-state transmitter
  - ■ Pulse compression processing
  - ■ Compression ratio of 1000:1 (at a flight altitude of 500 m) to over 6000:1 (at a flight altitude of 3 km)
  - ■ 10-60 kW effective peak power
- ☐ Digital Receiver
  - ■ WSRA DAQ Hardware: Echotek ECDR-2-12210-PMC 210 digitizer embedded in a single board dual quad core Pentium processor

2011 (C) ProSensing
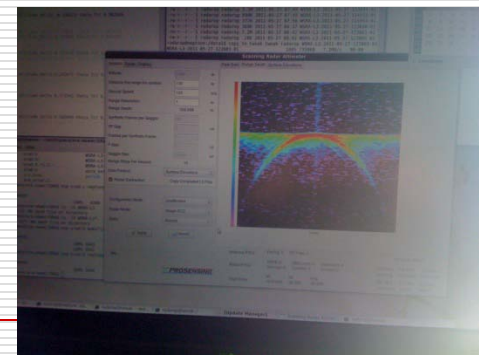
WSRA Data Flow
Processing, Transfer & Display   =>   Real-time Reporting

- ☐ WSRA data products processed in-flight

- ☐ Receives VORTEX messages to provide the hurricane track to resolve the 180° ambiguity of the ocean directional wave spectra

- ☐ WSRA spectra automatically transmitted from aircraft to FTP site at AOC

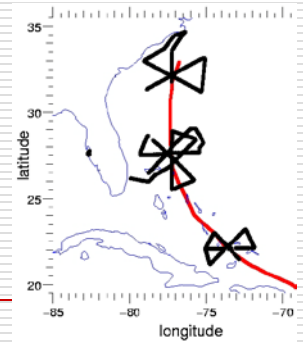- ☐ WSRA application running at NHC on the JHT server (Muskie) pulls spectra as they become available on the AOC FTP site.

- ☐ WSRA data displayed on NMAP2 within NAWIPS

RADAR

Radar configuration

Radar signal processor
Pulse compression (FFT)
Corner turn memory
Beam forming (FFT)
Non-coherent averaging

WSRAd (server & radar signal processor)

L2 data

Surface elevation extraction algorithm

WSRA.exe

L3 data

2d ocean wave spectra
Significant Wave height
Rain rate
WSRA L3 processor

VORTEX

Removal of artifact lobes
Doppler correction

WSRA L3 processor

WSRA data displayed on NMAP2 within NAWIPS

Data products

Display application

WSRA data Transfer to NHC JHT server(PULL)

Data products

WSRA transfer to NOAA / AOC server (PUSH)

Data products

Transfer scripts and display developed and tested under JHT Funding FY08 to Dr. Walsh

WSRA operation in the 2011 Hurricane Season

☐ Test flight on May 27th 2011

  ■ Purpose: to test unattended operation of WSRA

  ■ Encountered problems (in-flight processing of the VORTEX message, hard drive speed, correct configuration of the data transfer command, etc.) subsequently resolved.

☐ WP-3D N42 first mission of the 2011 Hurricane season into **TS Don (20120728H)**

  ■ ProSensing staff operated WSRA in-flight

  ■ All aspects of the automated WSRA operation were successful.

  ■ Data transmitted to NOAA/AOC ftp site and from there to the JHT computer located at NHC-Miami
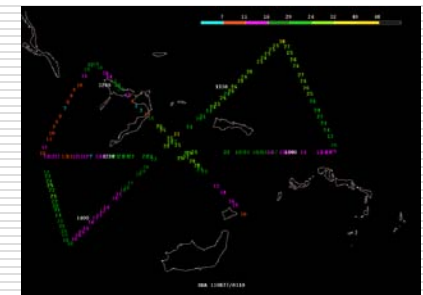
WSRA operation in the 2011 Hurricane Season

- ☐ Hurricane Irene
  - ■ Three 12-hour missions on August 24th, 25th and 26th
    - ☐ 20120824H
    - ☐ 20120825H
    - ☐ 20120826H
  - ■ WSRA operated without ProSensing staff onboard the aircraft
  - ■ After start up by NOAA AOC staff, WSRA operated unattended for the entire duration of the flight
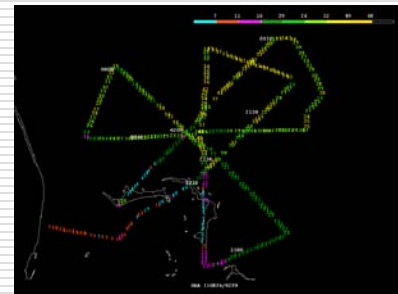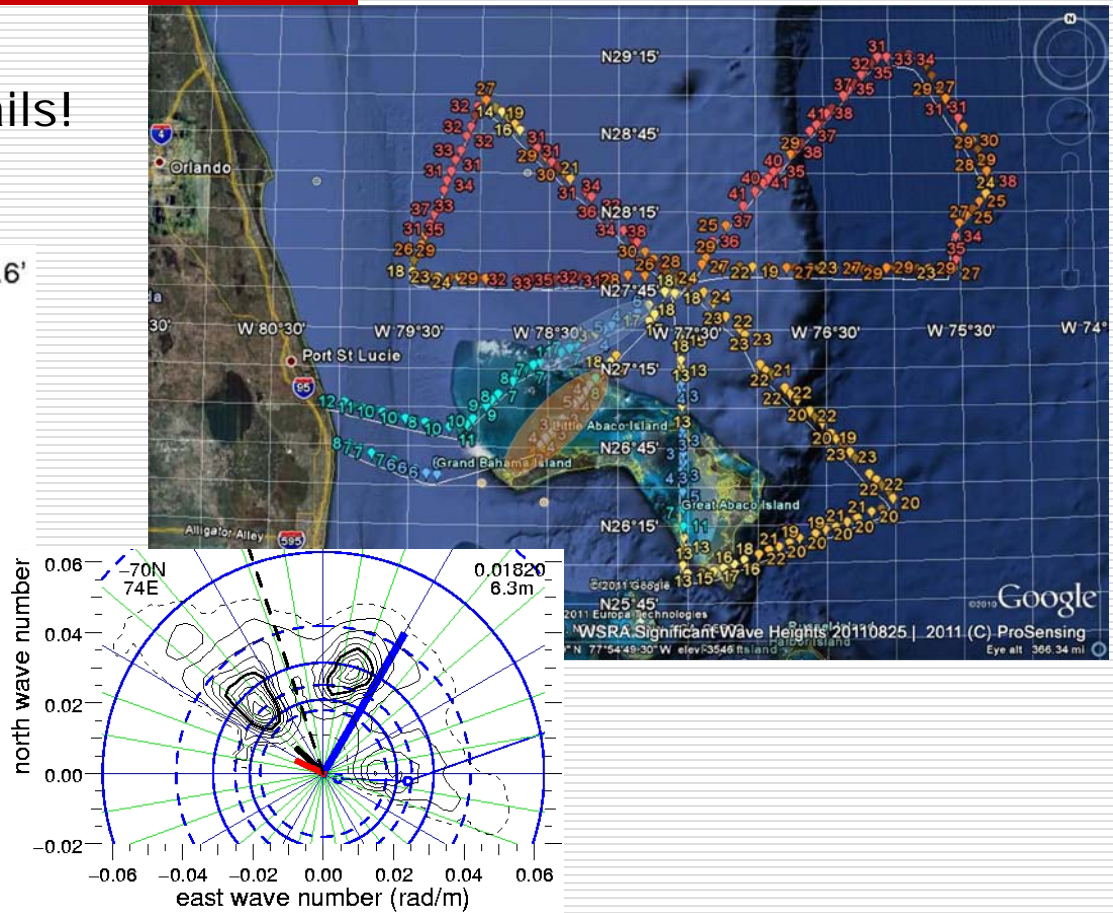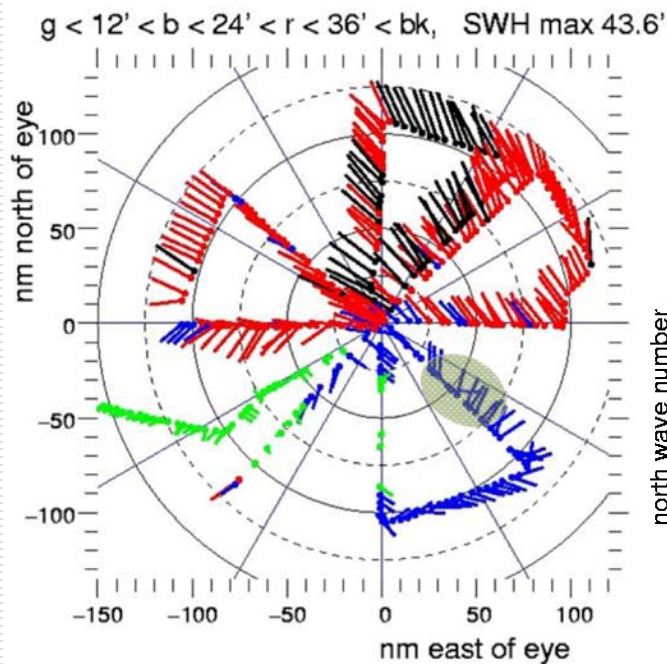

- ☐ Tropical Depression 13 in Central Gulf
  - ☐ 20120901H

Real-time Directional Wave Spectra from the NOAA Wide Swath Radar Altimeter

See poster for more details!

Po$$ible WSRA improvements for 2012 season



☐ Incorporate WSRA radar returns from grating lobes
  - improve the quality of the ocean surface topography data during high roll angle aircraft maneuvers or when flying through turbulent regions such as in the hurricane's eye wall

☐ Web-based WSRA data display application.
  - compatible with popular web browsers such as IE and Firefox
  - should be distributed to the researchers within NOAA interested in reviewing WSRA data products either in real-time or post-mission. Ease of access is important to ensure maximum dissemination and utility of the unique data the WSRA provides.


☐ Improvements in managing unattended operation of the WSRA

  - on-board WSRA code to process the radar data without requiring any hurricane track information
  - not requiring interaction with the operator
  - two-dimensional ocean wave spectra transferred from the aircraft will contain artifact lobes and will not be Doppler-corrected.
  - part of the WSRA processing will be executed on a ground-based computer, to which hurricane track information could be provided over a more stable Internet connection.
  - provide a WSRA data product file in the same format as expected by the existing WSRA ingest application executed on the NHC computers for display on the NOAA/NCAP N-AWIPS.
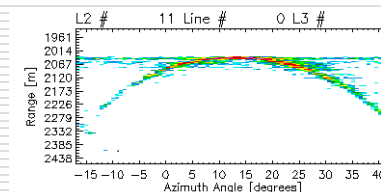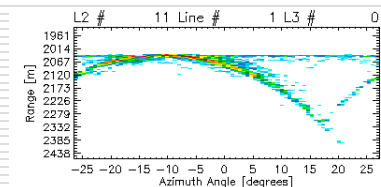
WSRA path forward
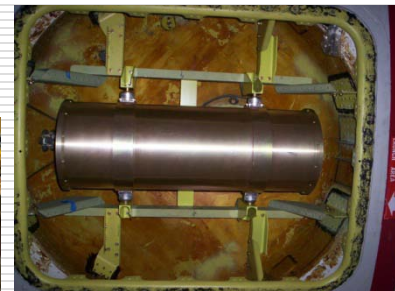
- ☐ Re-design of WSRA antenna electronics for wing-pod installation.

  - ■ RF cylinder (gold) would fit with the SFMR pod on C-130J or WP-3D

  - ■ Antenna and switching matrix electronics to be installed into new lightweight pod (30 x 30 x 3 inches)

  - ■ New antenna array pod would mount on to the existing pod