66th Interdepartmental Hurricane Conference Booklet
Session 2a: JHT Project Updates, Part 1
Abstract

Operation of the Wide Swath Radar Altimeter (WSRA) 2011 Hurricane Season

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The WSRA is a novel digital beamforming radar altimeter developed with funding from the NOAA SBIR and JHT program, with additional support from the University of Massachusetts and DARPA. The WSRA system provides continuous real-time reporting of several data products: (1) directional ocean wave spectra, (2) significant wave height, helpful in assessing the radius of 12' seas, and (3) rain rate. All the data products are transmitted in real-time from the NOAA P-3 aircraft to the National Hurricane Center (NHC) through a satellite data link. Throughout the spring and summer of 2011, ProSensing engineers worked on the implementation of the script that was managing WSRA processing software modules to achieve the unattended operation. The script for managing unattended operation performs following tasks: (1) synchronizing the operation of all the software modules; (2) monitoring the aircraft's altitude and reconfiguring the radar hardware accordingly; (3) receiving and processing VORTEX messages contain the hurricane eye fixes which helps resolving the 180 ambiguity of the ocean wave spectra; and (4) transferring the final WSRA data products to an ftp site at NOAA AOC facilities from which they are automatically extracted by a server at NHC.

With support from NOAA AOC, in May of 2011 ProSensing conducted an 8-hour test flight with WSRA installed on NOAA WP-3D N42. The main focus of this test flight was testing the unattended operation of WSRA. Several issues and problems with unattended operation have been discovered during the test flight. All the encountered problems (in-flight processing of the VORTEX message, hard drive speed, correct configuration of the data transfer command and etc.) helped improve the robustness of all data processing modules. These improvements allowed for a robust unattended data collection up to an aircraft altitude of 10,000 feet, which is the typical hurricane reconnaissance altitude.

On June 28th, 2011 ProSensing supported the WSRA operation on WP-3D N42 aircraft in its first mission of the 2011 Hurricane season into TS Don. On June 28th TS Don was located in the Gulf of Mexico just south of New Orleans. All aspects of automated WSRA operation were successful. Data were transmitted to NOAA/AOC ftp site and from there to the computers located at the NOAA NHC facilities in Miami.
During the month of August WP-3D N42 with WSRA had four mission flights, three in hurricane Irene (each 12-hour missions on August 24th, 25th and 26th) and one in the tropical depression 13 in the Gulf (8-hour mission). On these flights WSRA was operated without the presence of ProSensing staff onboard the aircraft. After the startup by NOAA AOC staff, WSRA would operate unattended for the entire duration of the flight.

Operation of the WSRA during the 2011 hurricane season would have not been a success if it did not receive the full support from the NOAA Aircraft Operation Center. ProSensing is specifically acknowledging the support of Joe Bosko, Terry Lynch and Jim Roles.

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Poster Session Abstracts

Real-Time Directional Wave Spectra from the Wide Swath Radar Altimeter

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During reconnaissance flights into Hurricane Irene on August 24th, 25th and 26th, 2011, the NOAA Wide Swath Radar Altimeter (WSRA) generated real-time maps of sea surface topography and processed the topography into directional wave spectra. Wave spectra and other extracted parameters were transmitted from the aircraft via satellite link to a FTP site at the NOAA Aircraft Operations Center. A software script running on the Joint Hurricane Testbed (JHT) server at the National Hurricane Center from automatically pulled the WSRA data from the NOAA AOC computers. The WSRA software executed on the JHT server converted the spatial distribution of the WSRA estimated wave height into a NAWIPS format to make available for forecasters to superimpose on their other hurricane display software.

The posters will present the WSRA directional wave spectra from the three flights as Hurricane Irene went from the Turks and Caicos Islands, through the Bahamas, and approached the shores of North Carolina. This expansive three-day collection of WSRA data documents the wave field perturbations caused by sheltering islands and shoaling water. The important ability of the WSRA system is that it provides real-time information on the spatial variation of a hurricane wave field. These observations are used to verify and improve the numerical wave models which are used for the short and long term forecasts of a hurricane's evolution.

Real-Time Rain Rate from the Wide Swath Radar Altimeter

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The WSRA determines rain rate by measuring the absorption of the radar signal during its round trip from the aircraft to the sea surface. If the sea surface backscatter coefficient is unchanged when the aircraft encounters rain, the loss of signal will determine the rain rate to high accuracy. A great advantage of the WSRA is that it measures of the variation of backscattered power with incidence angle, allowing it to document and compensate for any change in the sea surface backscatter coefficient.

During reconnaissance flights into Hurricane Irene on August 24th, 25th and 26th , 2011, the NOAA Wide Swath Radar Altimeter (WSRA) generated real-time estimates of rain rate which went to the National Hurricane Center along with the directional wave spectra and extracted wave parameters. The poster will present WSRA rain rate estimates from the flight on August 26th, with the aircraft data put in context by comparison with the Quantitative Precipitation Estimation (QPE) spatial maps of precipitation rates from the NEXRAD radars located near the Carolina coastline.