# WSRA README

The NOAA Wide Swath Radar Altimeter (WSRA) is a digital beamforming radar altimeter operating at 16GHz. It generates 80 narrow beams spread over ±30º from the overall antenna boresight to produce a topographic map of the sea surface waves and the backscattered power. The WSRA provides continuous reporting directional ocean wave spectra and quantities derived from this, including significant wave height, the sea surface mean square slope, and the height, wavelength, and direction of propagation of primary and secondary wave fields. Rainfall rate is also estimated from path-integrated attenuation.

The directional wave spectra calculated from data collected with WSRA inherently contain a 180-degree ambiguity of the wave propagation. Half the energy is deposited in the real spectral lobe and half is deposited in an identical artifact lobe propagating in the opposite direction. This 180° ambiguity present in the directional wave spectra can generally be eliminated using a rough estimate of a predicted dominant ocean wave direction at the location of the observation point. For completeness the stored WSRA Level-4 files contain directional wave spectra with and without artifact lobes.

## Description of WSRA Level-4 file variables

**The WSRA Level-4 data products are stored in a netCDF file.**

1. WSRA data products (variable names are highlighted in boldface):

- **directional_wave_spectrum** contains all (Level 4) directional ocean wave spectra from the flight. The artifact spectral lobes have been deleted in the Level-4 spectra and the real spectral lobes have been Doppler-corrected for the motion of the waves during the data acquisition interval and variance-corrected for distortions in the wave topography measured by the WSRA. Variance values are in m2.
- **directional_wave_spectrum_180 contains** directional wave spectra containing both real and artifact spectral lobes which have been Doppler-corrected and variance-corrected.
- **dominant_wave_direction** is the propagation direction of the dominant wave field in degrees. NORTH is 0 degrees; range = [-180, +180].
- **dominant_wave_heigh**t is the significant wave height of the ocean dominant wave field in meters.
- **dominant_wave_wavelength** is the peak wavelength of the ocean dominant wave field in meters.
- **peak_spectral_variance** is the peak spectral variance in m2 of the Level 4 directional ocean wave spectra.
- **rainfall_rate** - five independent values of rain rate (mm/hr) determined at -20, -10, 0, 10, 20 s displacements relative to the observation time.
- **rainfall_rate_median** - median value of the 5 values in rainfall_rate.
- **sea_surface_mean_square_slope** - five independent values of mean square slope (mss) determined at -20, -10, 0, 10, 20 s displacements relative to the observation time.

- **sea_surface_mean_square_slope_median** - median value of the 5 values in sea_surface_mean_square_slope
- **sea_surface_wave_significant_height** (SWH) in meters.
- **secondary_wave_direction** is the propagation direction of the secondary ocean wave field in degrees, if one exists. NORTH is 0 degrees; range = [-180, +180].
- **secondary_wave_height** is the significant wave height of the secondary ocean wave field in meters, if one exists.
- **secondary_wavelength** is the peak wavelength of the secondary ocean wave field in meters, if one exists.
- **wsra_computed_roll** is average WSRA computed roll determined at -20, -10, 0, 10, 20 sdisplacements relative to the observation time.

## 2. WSRA processing parameters:

- **dominant_to_secondary_partition_angle** indicates the North relative angle as boundary between the dominant and secondary wave fields if two have been identified. NORTH is 0 degrees; range = [-180, +180].
- **wave_direction_predicted** - predicted direction of propagation for eight wavelengths (91,102,116,135,160,197,256,366 m) computed to aid in deleting artifact lobes. NORTH is 0 degrees; range = [-180, +180].
- **swh_correction_ratio** – ratio of the corrected SWH to the SWH estimated from WSRA Level-2 data.

## 3. Ancillary data: (variable names are highlighted in boldface):

- **time** is the time of the observation in seconds since the start of the observation specified in the file's global attribute "time_coverage_start"
- **latitude** in degrees
- **longitude** in degrees
- **platform_course** is the North-relative aircraft track angle received from aircraft IWG1 in degrees.
- **platform_orientation** is North-relative aircraft heading received from aircraft IWG1 in degrees.
- **platform_radar_altitude** is the aircraft altitude in meters determined by the WSRA.
- **platform_speed_wrt_ground** is the aircraft ground speed received from aircraft IWG1 in m/s.
- **hurricane_eye_distance_east** is the distance east of the hurricane eye in km.
- **hurricane_eye_distance_north** is the distance north of the hurricane eye in km**.**
- **wind_direction** upwind direction at the aircraft altitude in degrees.
- **wind_speed** at the aircraft altitude in m/s.

## 4. Dimensions

- **trajectory** = UNLIMITED
- **wavenumber_east** = 65; // 65 spectral wavenumber values along the east axis within +/- 0.08 rad/m
- **wavenumber_north** = 65; // 65 spectral wavenumber values along the north axis within +/-

0.08 rad/m
- **wavelength** = 8;  // eight wavelengths (91,102,116,135,160,197,256,366 m)
- **obs** = 5;  //  -20, -10, 0, 10, 20 s time offset relative to the observation time.

For all additional clarification on the WSRA data products listed above and the rest of the parameters stored in the WSRA level-4 netCDF file, please contact Ivan Popstefanija at popstefanija@prosensing.com.