Extreme weather events are now commonly reported and analyzed thanks to satellite-based observations. These measurements are critical for short-term forecasting, but also offer means to better question the role of extreme conditions for the state of the ocean at local and global scales and effects on ocean circulation and ocean heat transport. Estimating climate trends from actual data sets covering long time periods and assimilating measurements from different sensors is a tricky task since homogeneity of the data is rarely insured. In combination with other sensors and numerical models, the available 15 years of altimeter data can certainly offer more homogeneous data sets that can be used to better analyze extreme phenomena and their year to year variability. The ORPHEO project aims to fulfill several objectives: 1) better interpretation of satellite-borne scatterometer signals in extreme surface conditions; 2) better understanding of the ocean-atmosphere coupling under such conditions; 3) evaluation of distributions / statistics related to extreme events 4) set-up of a tool at Cersat giving access to the collected information combined in a handful way.

Feature tracking and co-location tools to characterize extreme event properties and to derive a database for air/sea interactions and climate studies

Wide-swath SAR measurements to map swell properties, kinematic properties of the shorter waves, and features such as cyclone eye size and radius of maximum winds.

This SAR image in hurricane Katrina illustrates the potential of SAR measurements. The hurricane eye is clearly located and important parameters can be estimated, such as the eye size and radius of maximum winds. The primary eyewall and rainbands are depicted from the radar cross-section attenuation. Long swell properties are mapped to help storm surge forecasting, but also to help intensity analysis although the wind seas are not properly retrieved. However, new insight on these wind seas has been recently obtained with the use of the Doppler information, which is linked to the surface kinematic properties (currents, waves, Chapron et al., 2005).

This figure above shows the data (satellite, aircraft) used to estimate the Wilma category 5 hurricane, an unprecedented event for an Atlantic tropical cyclone. In the span of just 24 hours, Wilma had intensified from a 60-kt tropical storm to a 150-kt hurricane, 882 mb, and the eye of the hurricane contracted to a diameter of 2 nautical miles, the smallest eye known to National Hurricane Center. In the span of just 6 hours, 101h55UTC.

Discussion

Extreme events intensity analysis is a major challenge triggered by climate change concerns. Still, uncharacterized errors are associated with maximum surface wind estimates derived from Dvorak analysis and aircraft measurements. Altimeter measurements at nadir show less saturation with increasing wind speed than obtained from scatterometer-like measurements, and sensor resolution and algorithm limitations explain the differences in absolute values. Maximum 1-min surface winds of 62.7 m/s (120 knt) have been estimated, to compare with the 135 knt aircraft estimate.

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