The High Wind Speed Model Function from Space

Ernesto Rodriguez, Svetla Veleva
Jet Propulsion Laboratory
California Institute of Technology

Scatterometers are playing an increasingly important role in monitoring high wind events, such as tropical and extra-tropical cyclones. However, there is significant uncertainty regarding the geophysical model function (GMF) that should be used to convert cross section measurements into winds. Airborne measurements have provided some indication that C-band, especially H-pol (and to a lower degree V-pol), exhibits sufficient sensitivity to retrieve high winds. Nevertheless, some attempts at reproducing this sensitivity from spaceborne measurements seem to give conflicting answers. There are three factors that complicate the retrieval of the high wind speed model function from space: 1) the measurement spatial resolution; 2) the presence of rain; and, 3) the resolution of the "ground truth". In this presentation, we examine the limits set by each of these factors on the retrieval of the GMF. Since reliable ground truth data at high spatial resolution, and including the required rain measurements are not available, we simulate the scatterometer return based on WRF simulations three tropical and extra-tropical cyclones: Katrina, Rita, and Helene. These high-resolution simulations, which were driven by the best available boundary conditions, show a great deal similarity with the analysis wind fields and the patterns of rainfall. We assume that the model function is known, and set it equal to the one estimated from airborne measurements, which shows sensitivity at high winds. We also assume that the drop-size distribution is known, and calculate the attenuation and scattering rain contributions. As a starting point, we study the spatial resolution effects by estimating the GMF in the absence of rain. We next add the rain effects and show the effects both on the GMF speed sensitivity and directional modulation. Finally, we examine the effect due to the spatial resolution characteristics of the ground truth. The implications of these results for future airborne scatterometers, such as the dual-frequency scatterometer proposed as part of the JAXA GCOM-W2 mission, will also be examined.