Early Detection of Tropical Depression Imporves Hurricane Forecasting

W. Timothy Liu
Jet Propulsion Laboratory, California Institute of Technology
Pasadena, CA 91109

The radar scatterometer on Natiional Aeronautics and Space Administration (NASA) spacecraft QuikSCAT sends microwave pulses to the Earth's surface and measures the backscattered power. From the backscattered power the surface wind speed and direction, at 25 km resolution, can be derived over 90 percent of global ocean every day, under clear and cloudy conditions, night and day. It provides synoptic view of global atmospheric circulation and the details of marine storms, like tropical cyclones, not possible by operational numerical weather prediction models. For most of the Atlantic hurricanes in 1999, closed circulation with intensity meeting the criteria of a tropical depression were observed by QuikSCAT up to a few days before their identifications by the National Hurricane Center. QuikSCAT data were used to track the surface vortex of Hurricane Floyd all the way back to the African coast five days before it was identified as a tropical depression east of the West Indies. Because such vortices, in their early stages, are too small to be resolved by operational NWP products, and have no clear cloud signal, the scatterometer, with its high spatial resolution, is the best means to study these early vortices, their tracks across the Atlantic, and their evolution into full-blown hurricanes. The Tropical Rain Measuring Mission (TRMM) is a joint mission between NASA and the National Space Development Agency (NASDA) of Japan. It was launched in November 1997, with a microwave imager (TMI) and a precipitation radar (PR) on board. From TMI, a suite of parameters can be derived, including the sea surface temperature, surface wind speed, integrated water vapor, and rainfall over oceans. PR has the unique capability to measure the three-dimensional rainfall distribution over both land and ocean. By combining the measurements of TRMM and QuikSCAT, the thermodynamics of tropical cyclones, which governs the changes in the storm intensity and path, is being studied.