Analysis of Rain effect on Wind Retrievals from Passive Satellite Microwave Radiometers

Hamideh Ebrahimi[(1)], and Alireza Mahmoudian[(2)]
(1) University of Florida, Gainesville, FL, USA, 328611,
(2) Interamerican University of Puerto Rico, Bayamon, PR, USA

The measurement of ocean surface wind speeds under rain has been a long outstanding problem for passive satellite microwave radiometers. Algorithms have been developed that are able to measure ocean surface wind speeds with an accuracy of at least 1 m/s as long as the scenes are free of rain. Unfortunately, these algorithms break down completely as soon as even only light rain is present. Because rain increases the atmospheric attenuation, especially at higher frequencies, and, It is very difficult to accurately model brightness temperatures in rain. Because of the high variability of rainy atmospheres, the brightness temperatures depend on cloud type and the distribution of rain within the footprint. Also, the brightness temperature signals of rain and wind are very similar. Therefore the rain free wind speed algorithm tends to treat an increase in rain the same way as an increase in wind speed.

For accurate radiometer retrievals of wind speeds in rain it is essential to use brightness temperature signals at different frequencies, whose spectral signature makes it possible to find channel combinations that are sufficiently sensitive to wind speed but little or not sensitive to rain. Here we discuss, the wind speed retrieval accuracy of an algorithm that utilizes C-band frequencies and is trained for tropical cyclones for light and heavy rain. The wind direction retrieval accuracy degrades from light rain to heavy rain. We compare the performance of wind vector retrievals under rain from the WindSat which is a satellite-based polarimetric microwave radiometer developed by the Naval Research Laboratory Remote Sensing Division and the Naval Center for Space Technology for the U.S. Navy and the National Polar-orbiting Operational Environmental Satellite System (NPOESS). Also, we compare the results with the retrievals from the Cyclone Global Navigation Satellite System (CYGNSS) which is a NASA Earth System Science Pathfinder Mission that will collect the first frequent space−based measurements of surface wind speeds in the inner core of tropical cyclones. We discuss advantages and shortcomings of different instruments. Also we present the differences of the retrievals from these instruments for recent tropical Cyclones.