QuikSCAT Wind Retrievals for Tropical Cyclones

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Abstract: The use of QuikSCAT data for wind retrievals of tropical cyclones is described. The evidence of QuikSCAT s0 dependence on wind direction for >30 m/s wind speeds is presented. The QuikSCAT s0s show a peak-to-peak wind direction modulation of ~1 dB at 35 m/s wind speed, and the amplitude of modulation decreases with wind speed. The decreasing directional sensitivity to wind speed agrees well with the trend of QSCAT1 model function at near 20 m/s. A correction of the QSCAT1 model function for above 23 m/s wind speed is proposed. We explored two microwave radiative transfer models to correct the attenuation and scattering effects of rain for wind retrievals. One is derived from the collocated QuikSCAT and SSM/I data set, and the other one is a published parametric model developed for rain radars. These two radiative transfer models account for the effects of volume scattering, scattering from rain-roughened surfaces and rain attenuation. The models suggest that the s0s of wind-roughened sea surfaces for 40-50 m/s winds are comparable to the contributions of rain for up to about 10-15 mm/h. Both radiative transfer models have been used to retrieve the ocean wind vectors from the collocated QuikSCAT and SSM/I rain rate data for several tropical cyclones. The resulting wind speed estimates of these tropical cyclones show improved agreement with the wind fields derived from the best track analysis and Holland's model for up to about 15 mm/h SSM/I rain rate. A comparative analysis of maximum wind speed estimates suggests that other rain parameters likely have to be considered for further improvements.

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