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The potential of QuikSCAT and WindSat observations for the estimation of sea surface wind vector under severe weather conditions

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The physics of remote sensing sea surface measurements is still poorly understood under severe weather conditions. Wind vector algorithms are usually developed for nonprecipitating atmospheres and for wind speeds less than 20 m/s. In this study, we analyze observations from the QuikSCAT Kuband scatterometer collocated with the WindSat full polarimetric microwave radiometer to estimate the potential of these two instruments for sea surface wind retrieval under severe weather conditions. The Jason altimeter provides independent measurements of wind speed and rain rate for comparison purposes.

The sensitivity of the radar crosssections and brightness temperatures to the wind speed and direction is directly studied from the observations and compared with semi empirical models. This study clearly demonstrates that wind vector retrieval under extreme condition is feasible. Comparisons between QuikSCAT and WindSat coincident observations evidence a better sensitivity of the active mode to low and moderate winds and more sensitivity to high wind speeds in the passive mode. Although the WindSat observations are affected by water vapor, cloud, and rain, especially at and above 18 GHz, the measurements are sensitive to wind speed even at high wind speeds. Contrarily to the active instrument, there is no saturation at high winds. The sensitivity clearly tends to increase for winds above 15 m/s. For the wind direction, the amplitude

of the azimuthal modulation in the active mode decreases with increasing wind speed, while it increases for the passive measurements. The development of specific wind retrievals under severe weather conditions is encouraged and a simple illustration is provided.