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ASSESSMENT OF RAINFALL INFLUENCE ON SEA SURFACE WIND RETRIEVED BY SPACEBORNE FULLY POLARIMETRIC MICROWAVE RADIOMETER AND THE WIND ACCURACY IMPROVEMENT

Abstract

The sea surface wind retrieval of satellite passive microwave radiometers under rain has been a long-lasting serious difficulty. Rain-free methods have been developed that are able to retrieve sea surface wind speeds with an accuracy of at least 1.2 m/s. However, the accuracy of these methods goes down sharply as soon as even only light rain is present. Three main problems dominant the difficulties of radiometer wind speed retrieval. a) The signal attenuation is the primary effect of the rain. The higher frequency, the more serious attenuation is. b) Difficulties on modeling. Rayleigh approximate doesn't work well on sea surface wind retrieval when it rains. The size and form of the rain drops are needed to develop a physical model based on Mie absorption theory, while they are not available at present. c) It's difficult to distinguish rain from wind. The rain causes the brightness-temperature attenuation which is the same as the wind. The rain-free methods always treat the rain as an increase of the wind speed. In order to improve the accuracy sea surface winds retrieved by the spaceborne fully polarimetric microwave radiometer, a wind field correction model based on Levenberg-Marquardt algorithm was constructed. Firstly, the WindSat sea winds and rainfall products coupled with buoy data from the National data buoy center which are ranging from 2003 to 2019 are evaluated, 17303 coupled samples are obtained. Then, the coupled samples from 2003 to 2014 are considered as training data and the rest samples as the test data. At last, the wind field correction model is trained to correct the WindSat wind field product. The results show that the wind speed under rain in WindSat product is severely overestimated. As the wind speed increases, initially, the speed error reduced from 6.3m/s to 2m/s, and then increases gradually, the wind direction error is reduced from 43.6 to about 20. The lowest wind speed error and wind direction error are in the vicinity of 10 m/s. The wind direction error increases with the increase of rain rate. After applying the wind field correction model, the error of low wind speed decreases obviously. The corrected wind speed accuracy is much higher than that of the WindSat product, regardless of the rain rate. The wind direction accuracy is slightly improved. The wind speed error is reduces from 2.5m/s to 1.7m/s, and the wind direction error is reduced from 25.7 to 24.8.