SPACEBORNE MICROWAVE RADIOMETERS DESIGNS AND PERFORMANCE EVALUATION FOR OCEAN WIND REMOTE SENSING

S. H. Yueh, W. J. Wilson, F. K. Li, and S. V. Nghiem

Jet Propulsion laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, CA 91109
Tel:(818) 354-3012, Fax:(818) 393-5285

Global measurements of near surface ocean wind are crucial for many oceanographic and atmospheric studies. The near surface wind, generating the momentum flux that affects ocean circulation ant] mixing, is the key driving force in air-sea interaction processes. Numerous spaceborne scatterometers have been launched or are being implemented for this application.

Recent SSM/I data analysis (Wentz, GRS, Sep. 1 992) and aircraft radiometer flights over ocean surfaces carried out at the incidence angle range of **3(I** to 70 degrees (Yueh, Wilson, Nghiem, Li, and Ricketts, IGARSS, 1994) have show II that microwave brightness temperatures of sea surfaces are sensitive to both wind speed and wind direction, indicating that passive microwave radiometry is a new, viable option in space remote sensing of ocean surface wind vectors.

This paper presents design and performance studies of spaceborne wind radiometers, including single-look polarimetric, two-look dual-polarization, and two-look polarimetric radiometer systems. We evaluate their wind measurement performance using a simulation approach: We simulate the radiometer measurements under a set of radiometer design parameters for known, input ocean wind fields based on the preliminary geophyiscal model functions reduced from SSM/I dual-polarization data, our aircraft polarimetric brightness measurements, and a two-scale ocean model. Subsequently, we invert the wind vectors from the simulated measurements, and compare the retrieved and input wind vectors to quantify the wind measurement performance. Simulations are repeated over the design parameter space to find the optimum incidence angles, polarization combinations, and frequencies for spaceborne radiometers. Sensitivities of other environmental parameters including sea surface temperature, atmospheric water vapors, and cloud water content are also considered. The results of this study will be useful for the future development of spaceborne radiometers, such as the SSM/I, for ocean wind remote sensing.