POLARIMETRIC PASSIVE REMOTE SENSING OF OCEAN WIND VECTORS

S. H. Yueh, **W. J.** Wilson, S. V. Nghiem, **W. K.** Li, and W. B. Ricketts

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

We present aircraft radiometer measurements of polarimetric brightness signatures of sea surfaces. Our K-band (19.35 GHz) polarimetric radiometer (WINDRAD) was able to measure all four Stokes parameters and was mounted on the NASA DC-8 aircraft. A set of aircraft radiometer flights was successfully completed in November 1993. We performed circle flights over NDBC moored buoys deployed of the northern California coast, which provided ocean wind measurements. The DC-8 was banked at several angles to obtain data at incidence angles of 30, 40, 50, and 70 degrees. The first WINDRAD flight was made on November 4, 1993. There was clear weather with a wind speed of 12 m/s at 330 degrees around the Pt. Arena buoy. We circled the buoy at three incidence angles, and all data when plotted as functions of radiometer azimuth angles show clear modulations of several degrees Kelvin. At 40 degrees incidence angle, there was a 5 degrees Kelvin peak-to-peak signal in the second Stokes parameter Q, and a 4 degrees Kelvin signal in the third Stokes parameter U. The Q data maximum is in the upwind direction and U has a 45 degrees phase shift - as predicted by theory. There is also an upwind/downwind asymmetry of 2 degrees Kelvin in the Q data and 1 degree Kelvin in the U data. Additional flights were made on **12, 15,** and **17** November under varying wind and atmospheric conditions. Data taken at a wind speed of 8 m/s show that at 40 degrees incidence Q and U have a smaller azimuthal modulation of 3 degrees Kelvin, probably due to the lower wind speed. Data collected at other incidence angles also show reduced azimuth modulations at lower wind speeds. We found that Q and U data were insensitive to clouds, though the first Stokes parameter increased by a few degrees Kelvin when the radiometer beam passed over clouds. The results of our aircraft flights clearly indicate that passive polarimetric radiometry is a viable option in space remote sensing of ocean surface wind direction **as** well **as** wind speed.