CHARACTERIZATION OF THE AZIMUTHAL DEPENDENCE OF THE MICROWAVE EMISSION FROM FOAM GENERATED BY BREAKING WAVES

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Wind speed has been retrieved reliably from SSM/I radiometric measurements since 1990 with a precision of better than ±2 m/s. However, the dependence of brightness temperature on the azimuth angle of observation with respect to the wind direction is at most 2-3 K peak-to-peak, much smaller than the dependence of brightness temperature on wind speed, Both WindSat, now on orbit, and the NPOESS Conical Microwave Imager/Sounder (CMIS), planned for launch in 2009, have as a primary objective the retrieval of the ocean surface wind vector. Since foam substantially increases the brightness temperatures measured by a microwave radiometer, there is an urgent need to understand the role that breaking waves play in determining scene-averaged microwave brightness temperatures. Knowledge of the microwave emissivity of foam generated by breaking waves can be obtained through near-surface observations of the azimuthal dependence of microwave emission from breaking waves on seawater.

During the Polarimetric Observations of the Emissivity of Whitecaps EXperiment (POEWEX) in 2002, radiometric measurements of reproducible breaking waves were performed at 10.8, 18.7 and 37 GHz, along with boresighted video measurements of foam coverage. The increase in brightness temperatures due to breaking waves on the open ocean is an aggregate effect of both actively breaking crests and decaying bubble plumes. This experiment demonstrated that brightness temperature increases due to breaking waves vary with respect to the direction of wave breaking.

A second experimental campaign will be conducted during the fall of 2004 to characterize precisely the azimuthal dependence of the microwave emission from reproducible breaking waves. In addition to the WindSat frequencies of 10.8, 18.7 and 37 GHz, a 6.8 GHz radiometer will be included for more complete comparison with WindSat measurements. In-situ measurements of the instantaneous wave field in the radiometers field of view will be used to estimate the effect of long wave slopes on the polarimetric microwave emission. The resulting measurements and models of the azimuthal dependence of the emissivity of breaking waves and foam are expected to improve forward models needed for physically-based wind vector retrieval algorithms, especially at wind speeds of 7 m/s and higher.

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2. F - Wave Propagation and Remote Sensing

3. (a)

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5. No special instructions