K.-Band Ocean Backscatter Functions for Surface Wind Retrieval

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Abstract

For remote sensing of ocean surface wind, Ku-band scatterometer technology has been demonstrated and will be used to monitor global ocean wind fields from spaceborne sensors such as the **NASA** Scatterometer (N SCAT). Algorithms for wind velocity retrieval from scatterometer data utilize absolute radar returns as well as relative azimuth modulations of backscatter. The accuracy of wind measurements with scatterometer techniques depends on the particular geophysical model function used in the retrieval algorithm. Among the existing geophysical model functions are RADSCAT, SASS-I, and SASS-II developed based on aircraft and satellite backscatter data acquired in the: 1970s. Discrepancies among existing model functions will result in differences in retrieved wind fields. An extensive data set over a wide range of wind conditions is needed for a more accurate study of azimuth modulations in ocean radar backscatter.

In this paper, KU-band backscatter functions of neutral wind are studied based on the NUSCAT-SWADE data base. NUSCAT is an airborne K_u-band scatterometer developed by the Jet Propulsion Laboratory ancl used to measure ocean backscatter during the Surface Wave Dynamics Experiment (SWADE). Ten flights resulted in 30 hours of data collection were conducted on the NASA Ames C130 aircraft, during SWADE in February and March of 1991 off the coast of Maryland and Virginia over several ocean buoys. NUSCAT data together with buoy wind speeds and directions are used in this analysis. To account for modulations an cl fluctuations in incidence angles, an algorithm independent of a priori geophysical model functions was developed, tested, and implemented. Results for backseat ter azimuth modulations in terms of upwind, downwind, and crosswind radar returns are compared to airborne RADSCAT results and to SASS-1 and 11 geophysical model functions versus neutral wind speed. NUSCAT-SWADE results are closest overall to SASS-II values, fit best with SASS-I at 10° incidence angle, and are significantly higher than R.ADSCAT. Coefficients of empirical relations between backscatter and neutral wind speed are derived for 10° to 40° incidence angles at both horizontal and vertical polarizations. An analysis of modeling errors of the derived relations show an overall deviation factor in the order of 1 dB for ocean signatures inducting uncertainties in surface conditions.