The Development of a C-Band Advanced Scatterometer (ASCAT) Geophysical Model Function at NOAA/NESDIS

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A geophysical model function (GMF) is empirically derived for the C-Band Advanced Scatterometer (ASCAT) using a collocation dataset of ASCAT 50-km normalized radar cross section (sigma-0) and near-real-time QuikSCAT 25-km wind field over four months of observations. The GMF is modeled as a harmonic cosine series plus a dc term. The average sigma-0 are sorted by combining left- and right-swaths into 21 wind vector cell (WVC) bins, where the mean incidence angles vary from the inner-to-outer swath approximately 27°-63°. For a given WVC, the sigma-0 is normalized to the mean value of the incidence angle within the bins. Since the fore- and aft-beam are 90° apart in azimuth, the average of the fore- and aft-beam sigma-0s approximately cancel the harmonic terms resulting only in a dc term. The dc sigma-0 is plotted as a function of QuikSCAT wind speed for each incidence angle bin from the fore- and aft- beams, which spans 37°-63°, and from the mid-beam, which spans the lowest end of the incidence angles 27°-36°. A regression analysis is done using a simple equation for wind speed up to 50 m/s. Another regression analysis is done for each of the coefficients found previously as a function of incidence angle to complete a dc term model function. For the higher harmonic terms, the functional forms and coefficients are adopted from CMOD5 to complete our revised GMF.

New ASCAT wind retrievals were generated using above GMF and subsequently validated. The resulting wind speed histogram is shown to be dependent on WVC bins, which means the GMF needs further adjustments. Instead of correcting the sigma-0, we are rather correcting the retrieved wind speeds that align the wind speed histograms at different WVC bins. After applying the wind speed corrections, a validation analysis shows that wind speed retrievals are improved for wind speed > 15 m/s and are better by 5 m/s for the same standard deviation error of 2 m/s than the original wind speed, while wind direction retrievals remain the same for all wind speeds as expected.