MULTIPATH RADAR PROPAGATION MODELING: ASSESSMENT OF THE MILLER-BROWN APPROXIMATION FOR A VERTICALLY POLARIZED LINE SOURCE

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In order to reliably predict over the horizon radar coverage within an ocean environment, one must accurately account for the effects of ocean roughness on radar propagation. One widely used class of approximations defines a roughness reduction factor in terms of an ensemble average over surface heights of a Rayleigh phase factor. The Miller-Brown approximation is one specific example from this class of approximations that is often used for computing the coherent field reflected by a rough surface. For this purpose, the Miller-Brown approximation is often incorporated into sophisticated numerical propagation models such as the Fourier split step algorithm of the parabolic wave equation. Recently, a first step was taken to systematically and rigorously assess the accuracy of the Miller-Brown approximation for the case of a horizontally polarized (Hpol) field (D. E. Freund, N. E. Woods, H.-C. Ku, and R. S. Awadallah, IEEE Transactions on Antennas and Propagation, **54**, 1292-1304, 2006). In this presentation, we take this initial assessment one step further and consider the complementary case of a vertically polarized (Vpol) field. To do this, we use a rigorous numerical method of moments (MoM) solution to compute the propagation factor, η, for a rough ocean surface and then compare the MoM results with the corresponding predictions for η obtained using the Miller-Brown approximation. The particular MoM technique used here combines an accelerated spectral (steepest decent path) method and a multigrid iterative approach and will be referred to simply as the multigrid iterative approach (MGIA).

All calculations are performed at *S* band (f = 3 GHz) using a vertically polarized line source (cylindrical wave) for the incident field. A Monte-Carlo approach was used for the MGIA calculations in which the ensemble average of the propagation factor is computed for 100 rough sea surface realizations. In particular, for each of the three wind speeds 5 m/s, 10 m/s, and 15 m/s, 100 1-D realizations of rough sea surfaces were generated using the 1-D Bjerkaas-Riedel surface-wave spectrum. A temperature and salinity-dependent Debye relaxation model was used to assign all surfaces dielectric properties in accordance with seawater. Comparisons between η_{MGIA} and η_{MB} for Vpol are presented as a function of elevation angle at fixed ranges of 1km and 5km from the source. Finally, comparison between the previous Hpol results and the current Vpol results are made that, in general, indicate the Miller-Brown approximation is more accurate for Vpol radiation.