Statistical Analysis of Real Sea Clutter Data Measured by a High Resolution Radar at Low Grazing Angles

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Abstract: The exact knowledge of the sea clutter properties is of great importance for a modern maritime surveillance radar because they are directly involved in the optimization of the detection process, mainly through the CFAR processor design. Although sea clutter has been investigated by many authors for many years, a generally accepted model still does not exist.

Gaussian models are the most used as they arise from the central limit theorem and lead to simple processing architectures. They match indeed quite well the sea clutter behavior whenever the radar resolution is poor and the grazing angle is large enough, but they become inadequate when any of these two requirements is not fulfilled anymore. The sea clutter becomes mainly spikier, which results in a false alarm rate much more important than those predicted by a Gaussian model. Hence, other models which are able to take into account this different behavior have to be considered.

Our paper performs the statistical analysis of a large data base of sea clutter real data recorded by THALES NCS France. The measurements have been done with a high resolution radar at a low grazing angle. The sea clutter is very spiky and it doesn't obey at all to the Gaussian model, as we stated above.

The analysis procedure described in the paper allowed us to determine the correlation and statistical properties of the measured sea clutter data. We have found that the data distribution is matched the best by the K-compound pdf using three criteria: mean square difference, Kolmogorov test and Chi2 test. A new method for estimating the scale and the shape parameters of this distribution is proposed and its superiority over Raghavan and Watts methods is also demonstrated. The values of the mean decorrelation times in distance and azimuth have been found to be about 10 ms and 70 ns respectively.

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