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J. Ross Rottier

Johns Hopkins University Applied Physics Laboratory, ross.rottier@jhupl.edu

C. Reid Nichols

Marine Information Resources Corporation

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Ocean Surface Roughness

J. Ross Rottier^{1)*}, C. Reid Nichols²⁾

¹⁾ Johns Hopkins University Applied Physics Laboratory

²⁾ Marine Information Resources Corporation, Ellicott City, MD

*Corresponding author: ross.rottier@jhuapl.edu

1. Introduction

Wind generated waves have many impacts beyond ride quality for mariners and damage to breakwaters and off-shore structures. While numerous air-sea interaction investigators [1], [2], and [3] have shown that waves can influence wind direction and influence storm intensity, Johns Hopkins University Applied Physics Laboratory (JHUAPL) researchers are looking at the influence of ocean waves on radar propagation. Researchers at JHUAPL have shown how clutter results from the interaction of the radar signal with the sea surface as the signal propagates from the radar to the target and back [4]. Effective detection of the target hinges on the design of appropriate clutter filters that separate the target signature from unwanted clutter.

In order to understand how surface waves impact RF propagation and sensor performance for air and surface defense problems, JHUAPL researchers have used the TRIAXYSTTM Mini Directional Wave Buoy, which was first developed for use by the U.S. Navy. JHUAPL researchers have used this small (0.6m diameter) and lightweight (60kg) buoy, which is easily deployed by two people from the R/V CHESSIE, torpedo recovery boats, and patrol boats to accurately characterize ocean surface roughness. An example of this buoy is shown in Fig. 1 and a deployment diagram is provided in Fig. 2. Data includes time, location, average wave height, mean spectral period, maximum wave height, significant wave height, significant period, mean wave period, peak period, and wave steepness.

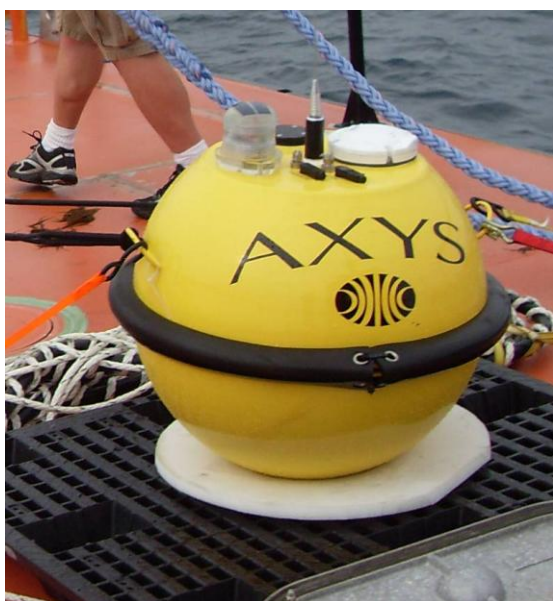


Figure 1. TRIAXYSTTM Mini Directional Wave Buoy aboard a torpedo recovery boat

Measurement of wind waves are important since they are a primary contributor to ocean surface roughness, which is of critical importance to the interpretation of air-sea interaction processes. TRIAXYSTTM Data Viewer Software is used to evaluate the frequency content of the waves, which permits partition of swell (low-frequency energy) and wind chop (high frequency energy).

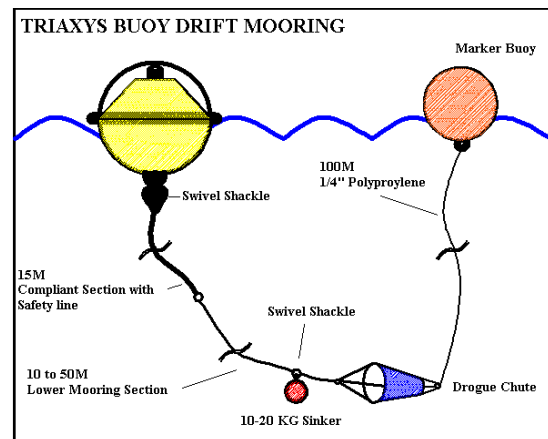


Figure 2. TRIAXYS Buoy Drift Mooring.

2. Conclusions

Understanding ocean surface roughness supports the development of physics-based models that evaluate radar scattering from small surface targets. Surface roughness measures are used in APL's radar propagation model, the Tropospheric Electromagnetic Parabolic Equation Routine (TEMPER), along with characterization of atmospheric refraction to compute propagation factors that are used in radar simulations and system performance studies.

3. References

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