EMI Detection and Classification of Underwater MUNITIONS: Study at sequim bay Test Site

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Electromagnetic induction (EMI) sensing is a promising technique for detection and characterization of metallic items in the marine environment. However, the EMI response of a target of interest can be significantly obscured or distorted by a strong, variable background responses arising from the conductive seawater. In addition, accurate estimates of sensor positions are difficult to achieve underwater, particularly when marine EMI surveys are collected in a dynamic, continuous acquisition mode. In this presentation, we report on our efforts to address these technical difficulties with marine surveys. Our exposition includes an integral equation-based characterization and modeling of responses of a multilayer marine environment, the calibration of EMI measurements and effective background removal via the layered model, the enhancement of target detectability by a synthetic aperture technique, and the robust inversion of underwater EMI data by accounting for sensor positioning errors. These improved methods are integrated into a complete marine processing strategy. This processing strategy was evaluated with UltraTEM Marine data acquired at the Sequim Bay test-site. Calibration and Blind Grid results demonstrated that our approach was effective in accurately recovering principal axis polarizabilities of targets of interest and in classifying items as either targets of interest or clutter.