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Energy Propagation in the Ocean Along Areas of Strong 4-Dimensional Sound Speed Variability

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The ocean is subject to complex dynamics that can produce time variant sound speed gradients with horizontal scales with potential to impact medium to high frequency acoustic propagation. Some of these features can critical grazing angles that may result in horizontal sound refraction, producing areas of stronger and weaker energy, time delays in the acoustic arrivals and changes on multi-path characteristics. The operational ocean forecast systems have skills to resolve some of these processes, but the acoustic propagation modeling solutions need to be able to handle these complex sound speed fields in order to reproduce the resulting sharp loss/gain changes along levels and directions (3D effects). These features can impact the accuracy of algorithms estimating source localization or doing ocean tomography and data assimilation. This work outlines a framework to diagnose when sound speed variability may be strong enough to trigger these 3-D effects following a risk management approach. It uses real-time ocean model forecasts, to build diagnostic variables estimating the possible acoustic impacts of ocean frontal systems and instabilities. The resulting analysis can be used to select numerical solution approaches and/or to create awareness regarding possible errors in the interpretation of acoustic signals in areas subject to strong dynamics.

Promotional text

This work includes a contribution relevant to the analysis of acoustic wave speed and attenuation, used for locating seismoacoustic disturbances in the oceans

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