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3-D long-range modeling of underwater sound triggered by submarine earthquakes

Underwater low-frequency sound triggered by submarine earthquakes (5 to 20Hz) can travel great distances in the oceans, and it can be detected at thousands of kilometers from the epicenter. As a variety of geological and physical oceanographic features can cause horizontal refraction, reflection, and diffraction, 3D underwater sound models are required for accurately predicting global scale sound propagation. However, solving accurately the long-range propagation of sound from submarine earthquakes in fully 3D environments involves important scientific challenges. In this work, based on the simulation of sound propagation triggered by a Southern Mid-Atlantic Ridge earthquake, a set of recommendations to improve 3D global scale underwater sound modeling are proposed. A comparison between single frequency and broad-band 3D parabolic equation (PE) model results with sound recorded by IMS hydroacoustic network near Ascension Island and SW06 experiments (1000 and 8600 km from the earthquake epicenter, respectively) is presented. Likewise, single frequency results from a 3D Normal Mode model (Kraken 3D) are discussed. Overall, model results show the importance of 3D effects induced by the Mid-Atlantic Ridge and Atlantic Islands on low-frequency long-range sound propagation.

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