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Listening to the Oceans: Autonomous Acoustic Imaging of Oceanic Structure

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Sub-mesoscale variability in the ocean is poorly understood. The challenge is to observe oceanic thermohaline structures on sufficiently fine space and time scales. One promising approach is seismic oceanography, which applies acoustic reflection techniques, as originally developed by the hydrocarbon industry, to image temperature and salinity gradients within the water column. Here, we present a preliminary analysis for both oceanographic data (CTD and mooring) and a 3D seismic survey from the narrowest part of the Mozambique Channel. Through eddy interactions, the channel is thought to act as a 'pacemaker' for the Agulhas Current system and plays an important role in global heat transport. In addition, we discuss the implementation of autonomous technology for acoustically mapping oceanic structure. Such techniques are key for enabling both the horizontal and vertical structure of the ocean to be mapped at resolutions of O(10 m), while avoiding the expensive use of more traditional seismic data acquisition. Furthermore, autonomous instrumentation could overcome the current difficulties of extracting temporal variability and collecting coincident acoustic and oceanographic data. The Mozambique data will be used to forward model potential autonomous seismic sources. Possible autonomous vessels for towing sources include wave gliders, combined with an array of moored or autonomous hydrophones and gliders.