

Acoustic Remote Sensing of Large-Scale Temperature Variability in the North Pacific Ocean

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Abstract: Acoustic measurements of large-scale, depth-averaged temperatures are continuing in the North Pacific Ocean in a follow-on to the Acoustic Thermometry of Ocean Climate (ATOC) project. Long-range acoustic transmissions resumed in January 2002 from a low-frequency acoustic source located north of Kauai to U.S Navy receivers distributed throughout the North Pacific Ocean. The source previously transmitted for about two years (1997-1999) as part of the ATOC project. Both the source and receivers are connected to shore by cable, providing near-real time data. It is anticipated that transmissions will continue for five years, as part of the North Pacific Acoustic Laboratory (NPAL) project.

At these ranges acoustic methods give integral measurements of large-scale ocean temperature that provide the spatial low-pass filtering needed to observe small, gyre-scale signals in the presence of

much larger, mesoscale noise. The paths to the east, particularly those paths to the California coast, show cooling relative to the earlier data. A path to the northwest showed modest warming until early 2003, when rapid cooling occurred. The acoustic rays sample depths below the mixed layer near Hawaii, but extend to the surface near the California coast and north of the Subarctic Front. The acoustic data will be compared to and ultimately combined with upper-ocean data from ARGO and sea-surface height data from satellite altimeters to detect changes in abyssal ocean temperature and to test the complementarity of the various data types. Acoustic travel-time data have been used previously in simple assimilation experiments and are now shown in comparison with assimilation products from state-of-the-art efforts from the ECCO (Estimating the Circulation and Climate of the Ocean) Consortium. [This research is supported by the Office of Naval Research.]