Acoustic measurements of large-scale, depth-averaged temperature have been made in the North Pacific Ocean over the last eight years. A source located on the slope of the central California current (intermittently) is received distributed throughout the North Pacific Ocean from 1992 through 1999 as part of the Acoustic Thermometry of Ocean Climate (ATOC) project. The ATOC data are now continuing as part of the North Pacific Acoustic Thermometry (NPAT) project, and have to date provided six-year time series. The Kaiser source typically transmits six times per day at four-day intervals. The source and receiving system have been essentially unchanged.

BASICS

Sound travels faster in warm water than in cold. By measuring the travel time of sound over a known path, the sound speed for that path can be determined. When representing that travel time as a function of path length, it inherently averages these properties of the ocean, heavily filtering along-path horizontal scales smaller than the path length. A 1°C change in temperature roughly corresponds to a 4-m/s change in sound speed, although this scale factor is somewhat temperature dependent. Over a 1000-km range, a depth-averaged temperature change of 1°C can translate into a 1500-km variation in the travel path, making measurement of the travel time in each direction along a path, the absolute water velocity can be determined. But this is a much smaller effect than the path length.

Sound speed is also weakly affected by salinity. A 1 ppt change in salinity corresponds to a 0.1 m/s change in sound speed.