These results, obtained with a new method for getting information on sparsely charted ocean regions, show the evolution of temperature anomalies (color) and the stream function (contours) at 236 m depth from July 20 through September 21, 1997, in the Kuroshio Extension front, a region that strongly affects Pacific Ocean climate. The evolution was obtained by assimilating TOPEX/Poseidon altimeter data and acoustic travel-time observations into a numerical model of oceanic circulation. Five autonomous acoustic transducers (stars), positioned at a depth of 1075 m, provided the mean temperature data along the ray paths connecting the transducers. Satellite data (solid slanted lines) provided the data on the sea surface height. Together with hydrographic measurements obtained during deployment and recovery of the transducers (arrows denote velocity observations) and dynamical information provided by the model, these data sets are sufficient to monitor eddy dynamics and estimate oceanic property fluxes across the Kuroshio Extension front. This type of analysis is an important advance in assessing the evolution of the large-scale ocean circulation and its impacts on global climate.