Eddies have important consequences for physical phenomena and significant influences on biogeochemical properties (Robinson, 1983). The objective of this work is to understand the characteristics of eddies and their impacts on the waters north of Oahu, Hawaii, by developing a catalog of the eddies that pass through this region. We focus on the region surrounding Station ALOHA, the deep-ocean site of the Hawaii Ocean Time-series (HOT) Program.

Station ALOHA is a 10 km radius circle centered on 22°45' N and 158° W, 100 km north of Oahu. The HOT Program has been conducting monthly shipboard sampling at this site since 1988. Eddies have noticeably affected the physics and biogeochemistry measured during some cruises (Letelier et al. 2000).

Eddies are detected and tracked using a variation on an algorithm developed by Chelton et al. (2007). This method isolates areas of closed sea surface height (SSH) anomaly contours from unfurled gridded AVISO satellite altimetry data during OCT 1992 - DEC 2006. Eddies are then identified from these isolated regions by stepwise partitioning the SSH field in 1 cm increments at each time step. Amplitude, effective radius, translation speed and axial speed are also calculated. This method limits the effective radius to about 200 km and the minimum lifetime is 4 weeks.

Seventy six (36 anticyclonic and 40 cyclonic) eddies were found to intersect Station ALOHA. All of these eddies had lifetimes of at least 4 weeks, a center that passed through the 2°x2° square surrounding ALOHA and a radius that overlapped Station ALOHA.

These eddies have an average amplitude of 7 cm, average radius of 100 km and an average translation speed of 6 cm/s. The figure below shows the spatial distribution of eddy activity north of the Hawaiian islands.

The first EOF mode of Station ALOHA water mass variability describes 12 eddies, all of which formed well east of the Hawaiian islands. These anomalous water properties are indicative of bolus transport, through some eddies appear in several modes, indicating multiple types of variability, such as lateral entrainment.

Eddies in marine science are extremely dynamic and difficult to characterize. Subjective analysis showed that eddy-eddy and eddy-island interactions are an important part of eddy dynamics, in both the physical and the biogeochemical realms.

References