Integration of CeNCOOS Data and Moored Ocean Instruments into the Oceanography Senior Capstone Course Sequence at Cal Poly Humboldt

Tamara Beitzel Barriquand, Jeffrey Abell, Heath Boulanger, Karina Bernbeck, Lauren Gaul, A. Ayse Macknight, Joelle Mattos, and Vanessa Pacheco

Department of Oceanography, Cal Poly Humboldt, 1 Harpst Street, Arcata, CA, USA

Overview

As part of the Oceanography major at Cal Poly Humboldt, students work collaboratively on a year-long research project for their senior capstone course. This field course is designed to provide students with the opportunity to apply their accumulated knowledge to real-world applications. The use of ocean observing platforms have been key in the both the 2021 and 2022 research projects, presented here. The 2021 cohort examined time-series data from the Central and Northern California Ocean Observing System (CeNCOOS) sensors to understand the role of tides, biological productivity and carbonate dissolution in controlling pH on various timescales. Differences in pH, dissolved oxygen (DO), chlorophyll, and temperature between an in-bay sensor and an offshore sensor are plotted below. The 2022 cohort is also using CeNCOOS data, in an effort to compare offshore upwelling to nearshore biological productivity. To look at offshore upwelling, this class designed and deployed a mooring along the Trinidad Head Line (Figure 1).

Figure 1. Humboldt Bay is located on the coast of Northern California and is the only enclosed deep draft harbor between Coos Bay, Oregon and San Francisco, California. The Trinidad Headline (yellow station markers) are located just north of Humboldt Bay.

Mooring Deployment

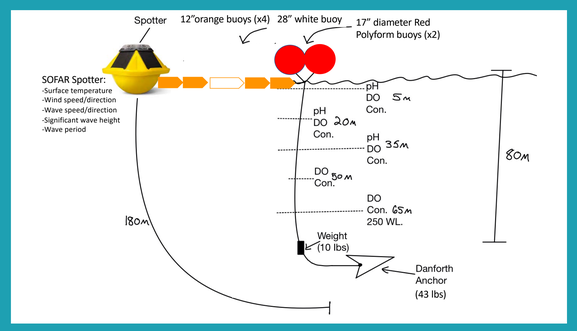

Figure 2. The mooring designed and deployed by the 2022 cohort. The schematic of the mooring design (below) and a picture of the successfully deployed mooring (above) at TH02 on the Trinidad Head Line (THL).

Initial Mooring Data

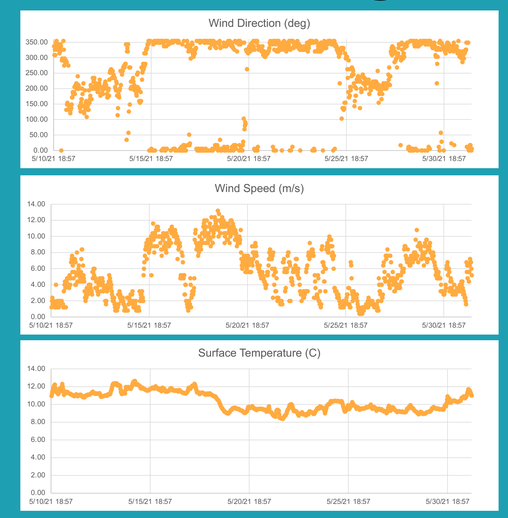

Figure 3. Data from the first three weeks of the mooring deployment from the SOFAR spotter: wind direction, wind speed, and surface temperature. Strong northerly winds line up with a drop in surface temperature, indicating potential upwelling events.

CeNCOOS data plots of pH anomalies v. controlling factors inside the bay (A) and at Trinidad Pier (B)

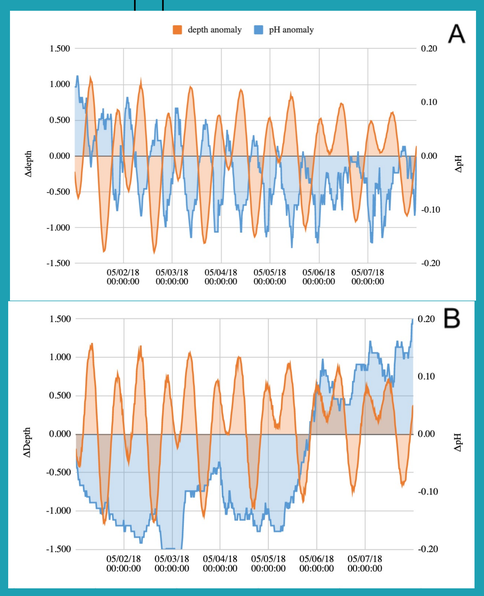

Figure 4. pH anomaly (blue) and depth anomaly (orange) at Chevron Dock in Humboldt Bay (a) and Trinidad Pier (b). Data used here was obtained from CenCOOS sensors which are continuously deployed at each site to collect pH and depth data every 15 minutes. Anomalies were calculated by subtracting the monthly mean from each value. is the boxed station, fourth from the left.

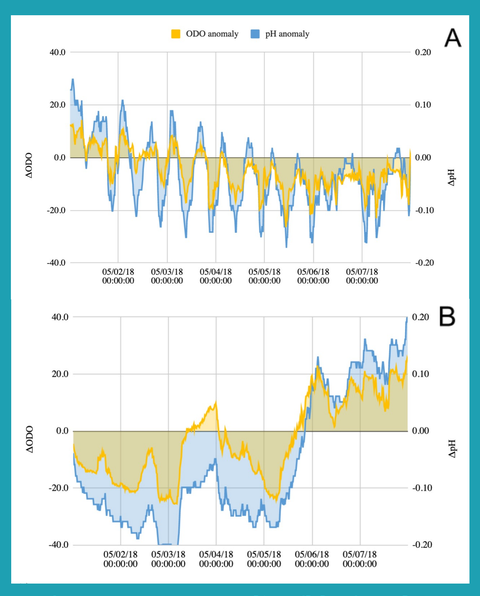

Figure 5. pH anomalies (blue) and DO anomalies (yellow) were collected during the month of May 2018 at Chevron Dock in Humboldt Bay (a) and in Trinidad Pier (b). Data used here was obtained from CenCOOS sensors which are continuously deployed at each site to collect pH and DO every 15 minutes. Anomalies were calculated by subtracting the monthly mean from each value..

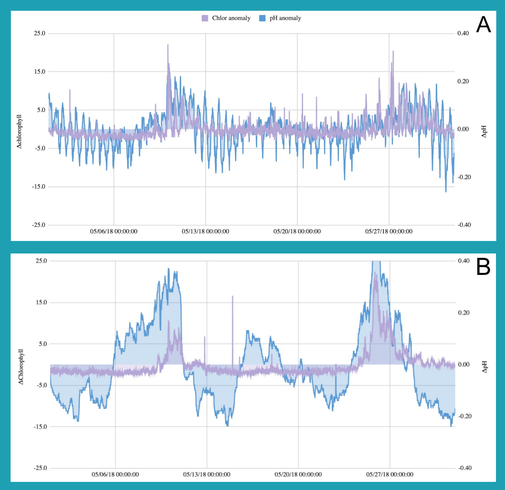

Figure 6. pH anomalies (blue) and chlorophyll anomalies (purple) were collected during the month of May 2018 at Chevron Dock in Humboldt Bay (a) and in Trinidad Pier (b). Data used here was obtained from CenCOOS sensors which are continuously deployed at each site to collect pH and chlorophyll every 15 minutes. Anomalies were calculated by subtracting the monthly mean from each value.

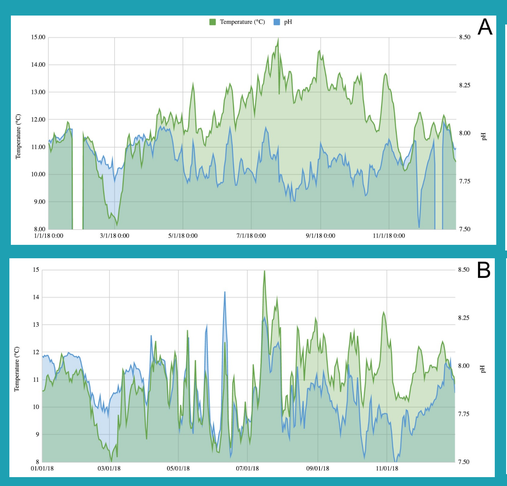

Figure 7. Yearly trends of pH (blue) and temperature (green) vs time for Humboldt Bay (a) and Trinidad (b). The graphs use daily averages of the CeNCOOS temperature and pH data. The daily averages were calculated by taking the mean of each day's values, which were taken roughly every fifteen minutes. The periods of time where the temperature/pH immediately drops to zero represents maintenance on the sensors.

Figure 8. Yearly trends for pH (blue) and Turbidity (red) vs. time for Humboldt Bay (a) and Trinidad (b). The graphs use daily averages of the CeNCOOS turbidity and pH data. The daily averages were calculated by taking the mean of each day's values, which were taken roughly every fifteen minutes.