Using a clustering-based approach to characterize water bodies from an autonomous underwater vehicle dataset in Monterey Bay, California

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Introduction

During periods of active upwelling, wind and local topography cause an upwelling shadow in Monterey Bay, California (Graham & Largier, 1997). This feature is separated from offshore waters by a front which is difficult to recognize due to the dynamic nature of the coastal environment and the presence of small-scale features within the frontal zone (Ryan et al., 2014). Autonomous underwater vehicles (AUVs) are efficient in these regions as they continuously capture physical, chemical, and biological parameters (Zhang et al., 2016).

Objective: Develop a clustering method to distinguish water masses across the upwelling shadow front using a long-term AUV dataset maintained by the Monterey Bay Aquarium Research Institute.

These results will be used to identify regions that covary with phytoplankton populations.

Methods

AUV missions traverse Monterey Bay in a diamond pattern, from 2016-present.

- **Upwelling shadow**: The opaque region represents the upwelling shadow, and the yellow transect between Stations M1 and N is the focus for this study as it passes directly through the upwelling shadow front (dashed line).

- **Clusters**: Plots were created using Balanced Iterative Reducing and Clustering Using Hierarchies (BIRCH) clustering (Zhang et al., 1996).

**Monterey Bay AUV Missions**

Future work:

- These results use the AUV-recorded temperature and salinity values, but oxygen and nitrogen will also be incorporated into the water masses moving forward.

- Long-term phytoplankton monitoring at Stations M1 and N, along with eDNA from samples captured by the AUV, will be compared to the clusters to determine any covariances between water masses and phytoplankton populations.

References

- Ryan et al. (2014). Deep Sea Research. doi: 10.1016/j.dsr.2014.05.017

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