MIM JOURNAL 2022 illuminate your work
Made in Millersville Journal | www.mimjournal.com

Analysis of the Northeastern Pacific Marine Heatwaves

Marissa Tripus

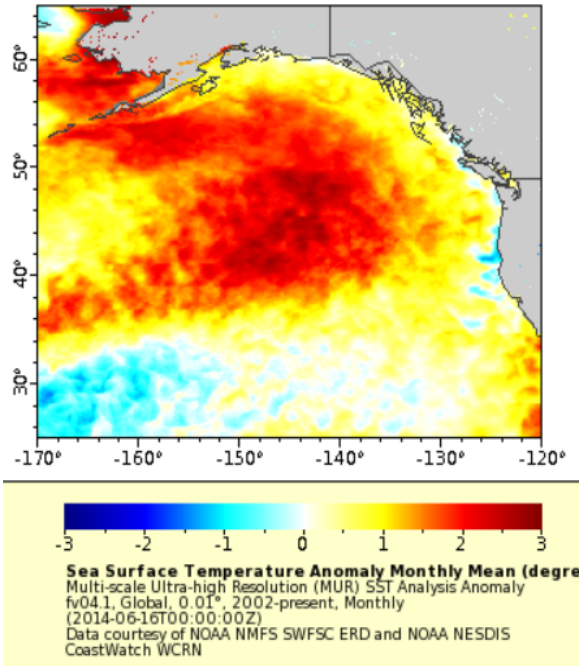
Abstract

Marine heatwaves have started to become an important phenomenon in ocean sciences. These events are doubling in frequency and are becoming more intense when they occur. The occurrences of marine heatwaves happen around the world, in every ocean basin. However, this specific investigation is focusing on the Northeastern Pacific, near the Gulf of Alaska. With the use of data via satellites, a top-down view of the basin analyzes the sea surface temperatures. Sea surface temperature data will serve as a stepping-stone towards a further analysis of marine heatwaves. An important aspect of these events are the consequences and impacts on the affected environments. Marine heatwaves impact the ecosystems and environments they occur in similarly to heatwaves' impact on humans when occurring over land. Organisms flee the environments under these harsh conditions, leading to species leaving their native waters and migrating to new locations—this can ultimately hurt the food chain in these regions. With the documented increase in the frequency of marine heatwaves, there are going to be more disturbances in the ecosystems. To be more prepared, we need to better understand the delicate nature of marine heatwaves.

Over the summer of 2021, I was looking into numerous topics for my Honors thesis. I had a list of several topic ideas to go through with my advisor when the Fall 2021 semester got underway. Around the time of my advisor meeting, I had learned of an entirely new research field in my Climate Dynamics class. This topic was marine heatwaves. As soon as I learned about this field, I knew this was the project for me. After my meeting with my advisor, Dr. Ajoy Kumar, the thesis topic I selected was marine heatwaves. An important piece to understand about this project is that it is still under investigation.

This project entails an investigation into the most recent marine heatwave in the Northeast Pacific Ocean basin. One of the more notable marine heatwaves in this region was 'The Blob' which occurred in 2013 and lasted into 2015. Then in 2019 into 2020 another heatwave occurred in the same region—this one named 'The Blob 2.0'. Since these events, there has been close monitoring of the west coast sea surface temperature (SST). SST is the primary parameter in focus when dealing with

marine heatwaves, but there are other aspects to include. However, there is not enough known in the field about the nature and behavior of marine heatwaves.



The project uses in-situ instrumentation and satellite derived parameters. A key measurement/calculation needed to identify a marine heatwave is SST anomaly. This parameter allows us to calculate how far the current SST is from an average SST for that time of year. To do this, I utilized the National Oceanic and Atmospheric Administration (NOAA) CoastWatch. I was able to retrieve monthly plots of the SST anomaly from CoastWatch for all of 2020, 2021, and even the beginning or 2022. The in-situ instrumentation is from Argo floats; in-situ measurements are collected from an actual location on earth. Argo floats have been in the ocean since the late 1990s, and they have allowed for a wide range of data. The floats also are unique because they are deployed into the ocean for as long as their battery allows for. While deployed they move within the currents of the ocean. But while they are moving with the currents, the instruments dive into the water column and collect data on the descent to about 2000m and ascend back to the surface. After the data processes and uploads to the dashboard, it is available for the public to use. The main parameters of interest from the Argo floats are subsurface temperature and salinity—these subsurface measurements are collected from anything below the surface of the ocean down to the depth of the descent.

The project's goal is to see if there is anything specific to marine heatwaves or if it is different every time they occur. This poses the questions: how does the heat of the heatwave penetrate to the same depth of every event or, is the depth of the heat dependent on the strength of the event? Another question could be: is the heat's depth dependent on how the heatwave formed? This then leads to dozens of more questions. However, the focus of the project is on the depth of the heat and the salinity of the water as well. Again, this project is still in the final stages, so it is hard to explain the goal when that is varying based on the availability of the data and the accessibility of the data as well.

Our understanding of marine heatwaves is insignificant compared to other fields in ocean science, but this makes the field more intriguing. The scientific community still has a loose definition of what classifies as a marine heatwave, and I hope to one day contribute to this field. Hopefully in the future, there will be a more defined definition and we know what properties to expect when the next event occurs. This project will hopefully have conclusions by the end of May 2022, but until then there are not any concrete results to report on.