Heatwaves of the NEP: Sampling Challenges



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Challenge 1:



- Using just satellite, you might not be able to distinguish between these two massive events
 - The "blob" had major impacts
 - While most of you may have not even heard of the 2020 event....

So, how do we differentiate, and why were the impacts so different?

Warm Blob (2014-2016) Impacts:

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Losers

Subarctic copepods, krill Lack of food reduced population, distribution moved northward

Market squid 2015-2016 Reduced in south as distribution moved far north





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ungeness crab and mussels Fishery closed due to taxicity

Salmon

Warm temperatures decreased recruitment for some species



Potential loss of habitat due to hypoxia



Baleen whales Expected to decline due to lack of food Tuna Increased abundances along coast with increased sport fishing

Orcas





FIGURE 5. Organisms observed to be positively and negatively impacted by the WWA. Negatively affected organisms are labeled as "Losers" (left column), while organisms positively affected are labeled as "Winners" (right column). Organisms are presented in both columns from lower (top of the column) to higher (bottom of the column) trophic levels.

Winners

Toxic phytoplankton Massive bloom closed important fisheries

Tropical, subtropical copepods Northward range expansion with warm water



Market squid 2014-2015 Increased fishery in north caused by range expansion



Nicole K. Yen, Michelle E. Zill, and Peter J.S. Franks, "Biological Impacts of the 2013–2015 Warm-Water Anomaly in the Northeast Pacific: Winners, Losers, and the Future" Article in Oceanography (Washington D.C.) · June 2016

Leticia M. Cavole, Alyssa M. Demko, Rachel



Challenge 1: feature differentiation



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There have been approximately 230 large marine heatwaves since 1982, with the "blob" and the events in 2019 and 2020 being essentially the same size.

The duration of the "blob" however, was much longer

This was not the only important factor....

Challenge 1:



- Using just satellite, you might not be able to distinguish between these two massive events
 - The "blob" had major impacts
 - While most of you may have not even heard of the 2020 event....

So, how do we differentiate, and why were the impacts so different? SUBSURFACE VERY IMPORTANT!!!!!!!

Subsurface importance:

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Data from ARGO floats for a large spatial average from the open NEP (35.5-51.5°N, 135.5-154.5°W)

The difference between the two events was part atmospheric, but also a difference in subsurface stratification

Scannell, H. A., Johnson, G. C., Thompson, L., Lyman, J. M., & Riser, S. C. (2020). Subsurface evolution and persistence of marine heatwaves in the Northeast Pacific. *Geophysical Research Letters*, 47, e2020GL090548. https://doi.org/10.1029/2020GL090548







Challenge 2:



• Getting the actual data for this!!!!

- Finding the right gliders
- Finding the right time span
- Finding the right spatial coverage

New OOI tool is extremely helpful!!!!

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The NEW OOI data explorer!!!! Its absolutely fantastic!



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The NEW OOI data explorer!!!! Its absolutely fantastic!

Гhe old toolnot nearly	v as handy		
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		IMAGE OF PLATFORM	~

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Even older tool, much worse....but was actually what I used to access the



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ERDDAP > tabledap

Tabledap lets you use the OPeNDAP constraint/selection protocol to request data subsets, graphs, and maps from tabular datasets (for example, buoy data). For a quick introduction, see this your video introduction to using tabledap @. For details, see ERDDAP's tabledap Documentation.

1236 matching datasets, listed in alphabetical order. View page: 1 (current) 2 . (Or, refine this search with Advanced Search 0)

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ERDDAP > tabledap

maps from tabular datasets You The video introduction to us

Tabledap lets you use the OPeNDAP constraint/selection protocol to request data subsets, graphs, and

Q: Why did I use this horrible thing?

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A: I use Matlab for analysis, and ERDDAP directly exports to Matlab Format

More importantly, I was able to use Matlab to batch-grab all the glider files I wanted, and then combine them into a single file for later analysis

However, I did use the OOI tools to explore the files ahead of time, so I knew what was there, and what was available....

...this has always been a stumbling point in using ERDDAD.

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Challenge 3:

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- Scientifically, do these OOI assets cover the right time span for this specific research project (e.g. heatwaves)?
 - Timespan needs to be long enough to create climatology
 - Need coverage of the "blob" but also nonblob years and last few events as well
 - Needs to cover adequate depth and crossshore dimensions
 - Again, the new OOI data explorer is ideal for addressing this part....

Example from Trinidad line

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- OOI Asset Strengths:
 - New web tool interface allows rapid assessment of time/space coverage
 - Glider data is really important for Heatwave Analysis (subsurface)
 - Cabled array subsurface data may also be useful (not tackled yet) for filling in gaps and higher temporal resolution

• OOI Asset Challenges:

- Still not as easy to get the data all at once from multiple deployments
- \circ ~ Some serious gaps in time/space in the glider data
- Are the datasets long enough for creating climatologies?
 - Will the same sampling schemes be continued in a consistent fashion?
 KEY ITEM FOR Longer-term climate change analysis