

# Hackathon : Marine Heat Wave Tracking

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Gaël FORGET, 2026/01/08

# Doing All This In Julia

## Progress Report (1/3)

- Climatology.jl (SST notebook)
- Gridded Sea Surface Datasets
- Time Series Analysis
- Tracking MHW with Polygons
- Four-Dimension Ocean Climatologies

## Climatology

[docs](#) [dev](#) [!\[\]\(0f848bbd71cef6b345273b16f905912a\_img.jpg\) CI](#) [passing](#) [!\[\]\(d873c0073cfd3b74a7c9b5ca09bad0c7\_img.jpg\) codecov](#) [80%](#) DOI [10.5281/zenodo.17890080](https://doi.org/10.5281/zenodo.17890080)

This package is currently focused on downloading, reading, visualizing, and analyzing gridded data sets and [ocean state estimates](#).

### Tutorial Notebooks

- [Sea Surface Temperature](#) ([⇒ code link](#))
- [Air Sea Fluxes](#) ([⇒ code link](#))
- [Sea Level Anomalies](#) ([⇒ code link](#)) sea level anomaly maps derived from altimetry. Sources : NASA/PODAAC, CMEMS.
- [Sea Level Time Series & Maps](#) ([⇒ code link](#))
- [Physical Ocean, Currents, & Climate](#) ([⇒ code link](#))
- [Marine Ecosystems & Biogeochemistry](#) ([⇒ code link](#))

Please refer to the [docs](#) for detail and additional examples.

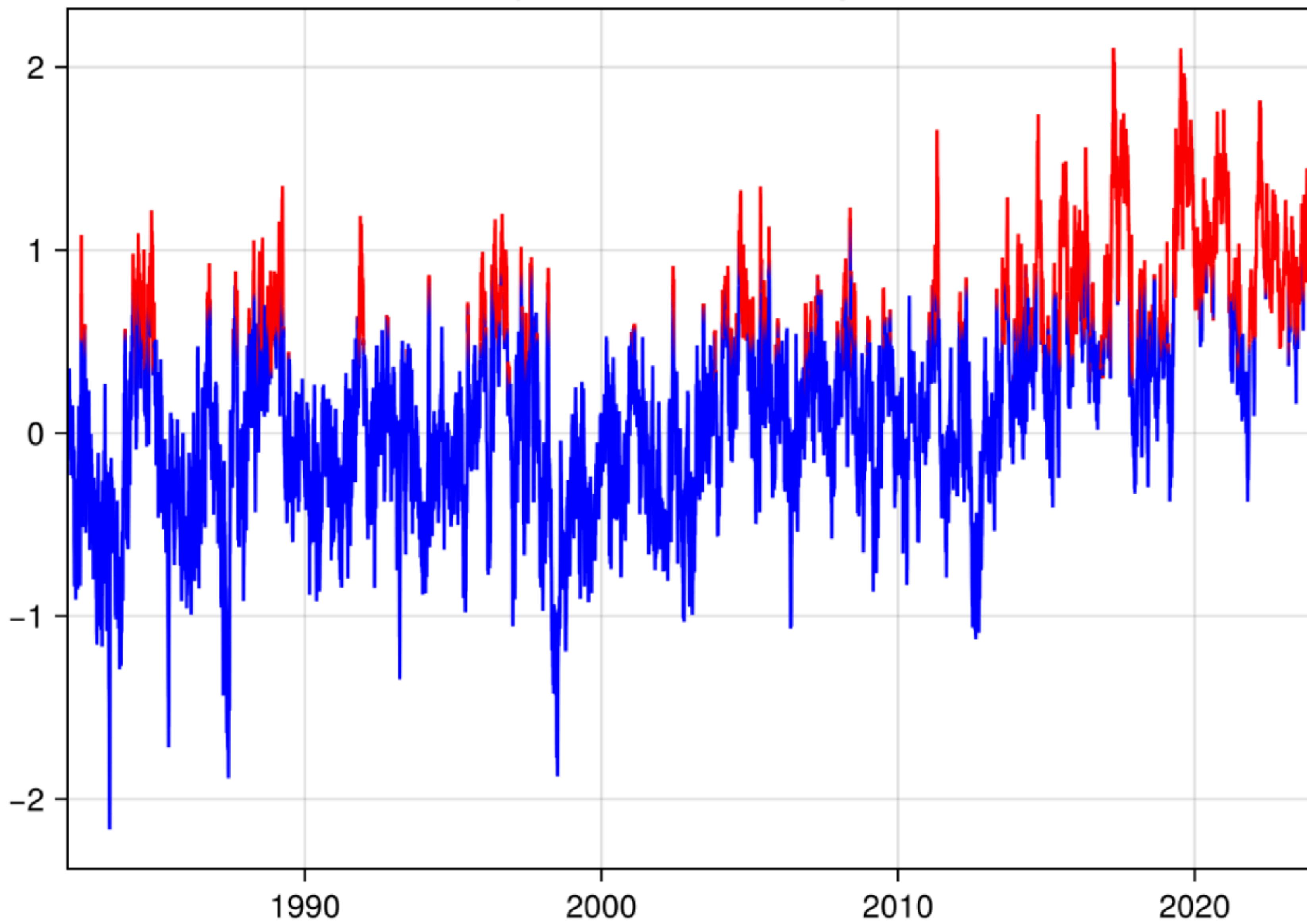
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### SST data

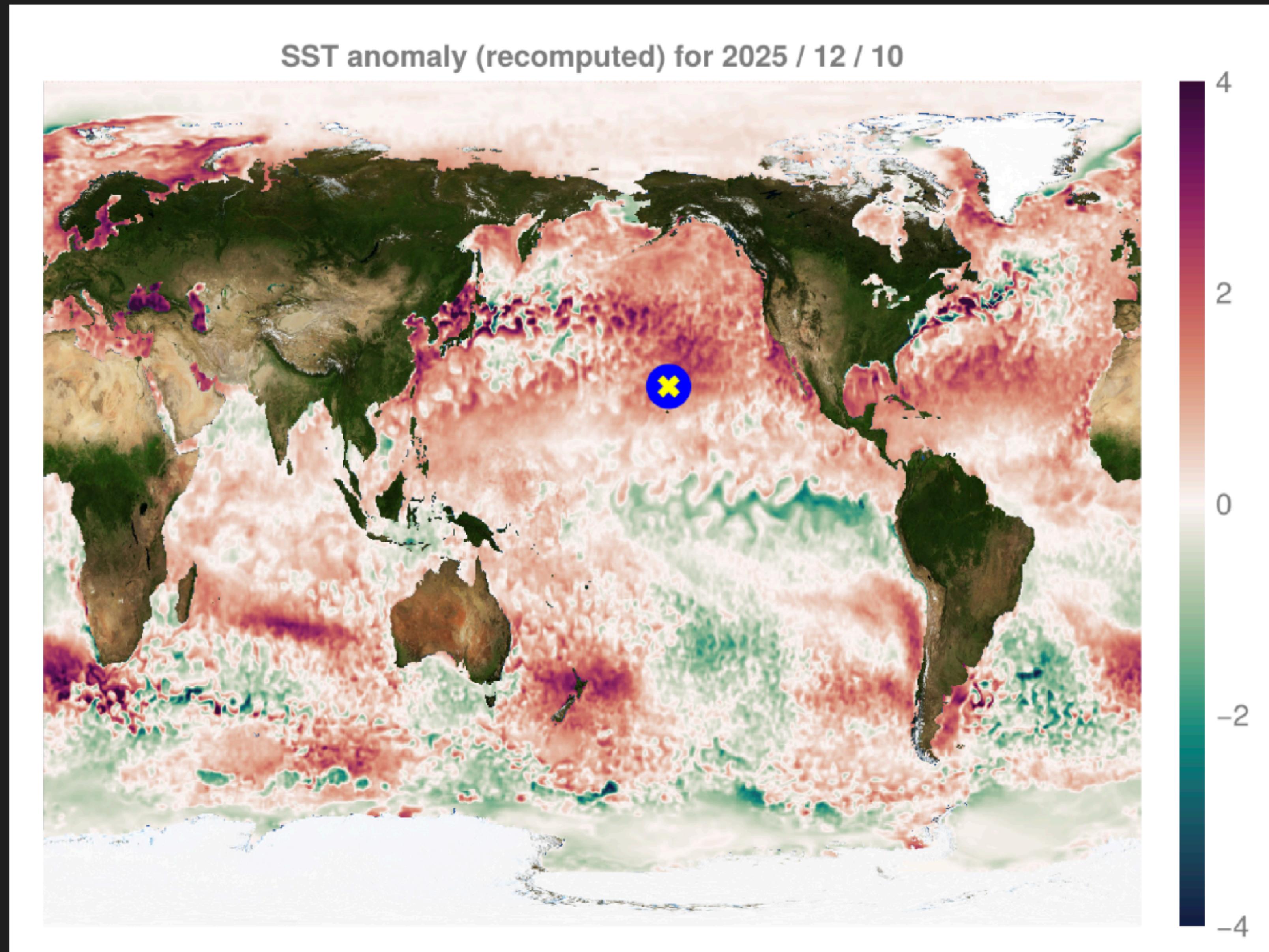
- OISST dataset
- OISST Anomaly Map
- Regional SST timeseries
- Zonal Mean Timeseries
- Global Mean Timeseries
- Marine Heat Waves

- Detection from Time Series
- Detection From Map
- ERSST Anomaly Map
- Climate Projection
- Appendix

SST anomaly with extreme warm periods in red



# OISST Anomaly Map



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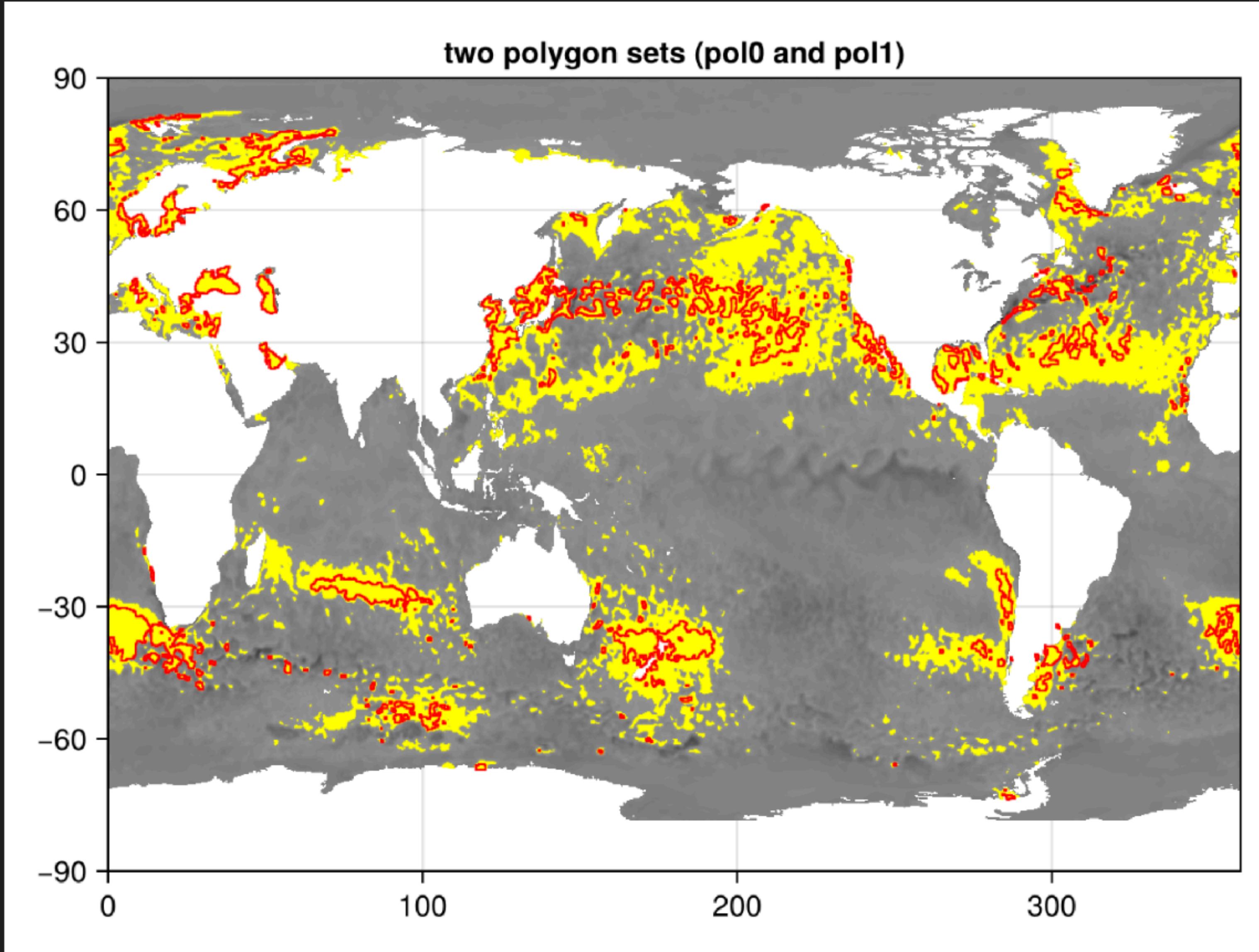
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## Detection From Map

Using `GeometryOps.polygonize` we derive the polygon contours for values in a chosen range, as typically done to delineate MHWs from SST maps.

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# Doing All This In Julia

## Progress Report (2/3)

### ExtremeTracker.jl

Julia 1.6+ License MIT

A comprehensive Julia package for tracking and analyzing marine/atmospheric heat wave events in spatiotemporal data. This package implements three state-of-the-art algorithms for heat wave detection, tracking, and composite analysis.

#### Overview

`HeatWaveTracker.jl` provides three complementary methods for heat wave analysis:

1. `hwtrack_nouniform` - Spatially Coherent Tracking (Sun et al., 2023)
2. `Tracker` (Octrac) - Spatiotemporally Coherent Tracking (Scannell et al., 2023)
3. `SpatialTemporalNormalization` - Spatial-temporal normalization for composite analysis (Zhao et al., in review)

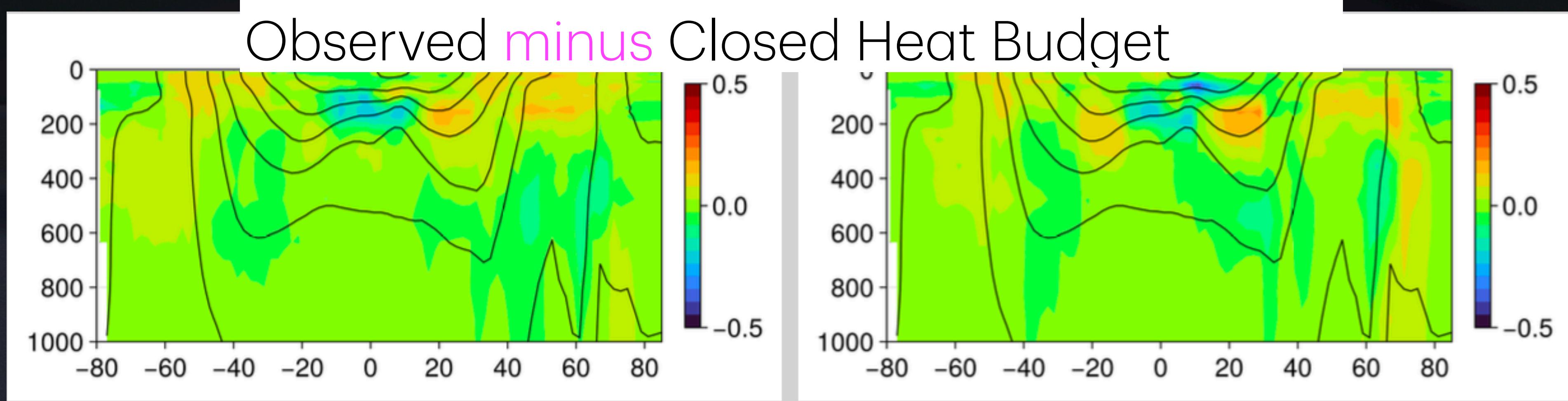
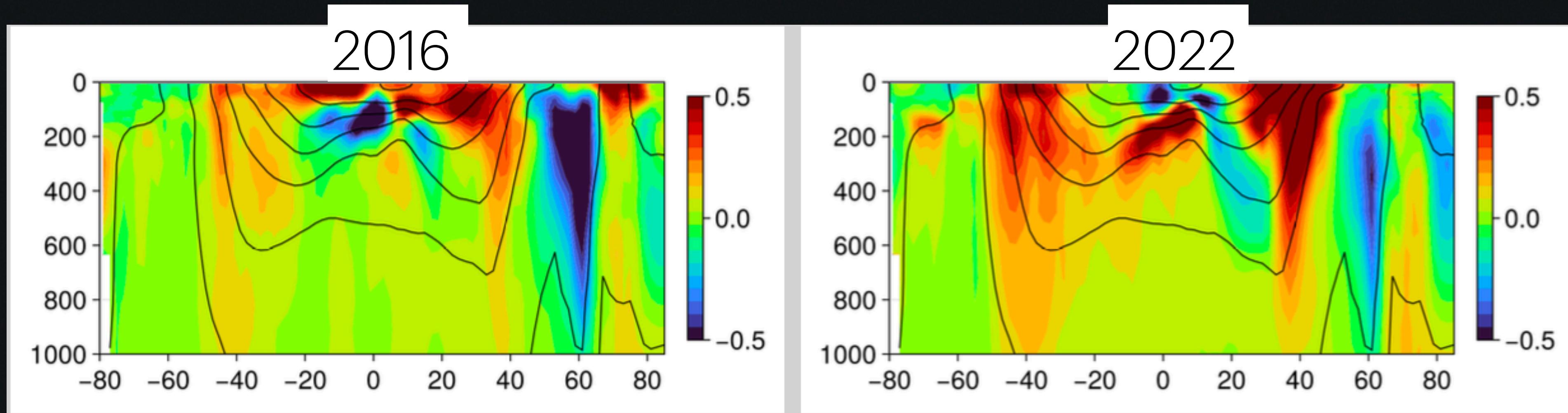
These methods can be used independently or combined to provide comprehensive heat wave event characterization from detection through composite analysis.

- New Package started by Zijie Zhao
- NOAA funded project (Drake, Forget, Zhao, Liu)

# Global Ocean Warming Estimation

Progress Report (3/3)

Forget (in prep)



# Hackathon

## Goals and Challenges

- Consolidate Marine Heat Wave methods (Polygons workflow)
  - Area differences
  - time series of overlapping polygons
  - Connectivity across dateline (2D->3D? Simpler?)
  - North Pole Singularity (2D->3D?)
- Implement Geo Interface for MeshArrays.polyarray
- ...

# Hackathon

## Goals and Challenges

- Add glider data to OceanRobots (<ftp://ftp.ifremer.fr/ifremer/glider/v2>)
- Interface to operational models @ <https://thredds.atlanticsense.com/thredds/catalog/atDatasets/Lusitania/catalog.html>
- Diskarrays and PyramidScheme on MITgcm/LLC4320 (Anshul, Alex)
- ComonDataModel interface to MITgcm run directory (Anshul, Alex)
- ...
- Integrated Functional Mock-up Interface into ClimateModels.jl
- Setup caches and “server/instance” to speed up testing via github action (Chris R)
- ...

# Hackathon

## Goals and Challenges

- Support for new model grids in MeshArrays.jl (incl. MOM6 and Oceananigans.jl)
- More extensions in ClimateModels.jl (incl. ClimaOcean.jl & SpeedyWeather.jl)
- Add global set up for oceananigans in ClimateModels.jl
- Analysis pipeline for Oceananigans via MeshArrays (Grid support)
- Try out using oceananigans with metal and float32 (needed for metal) on my laptop
- Build MITgcm as a shared library via MITgcm.jl (Simone S)