

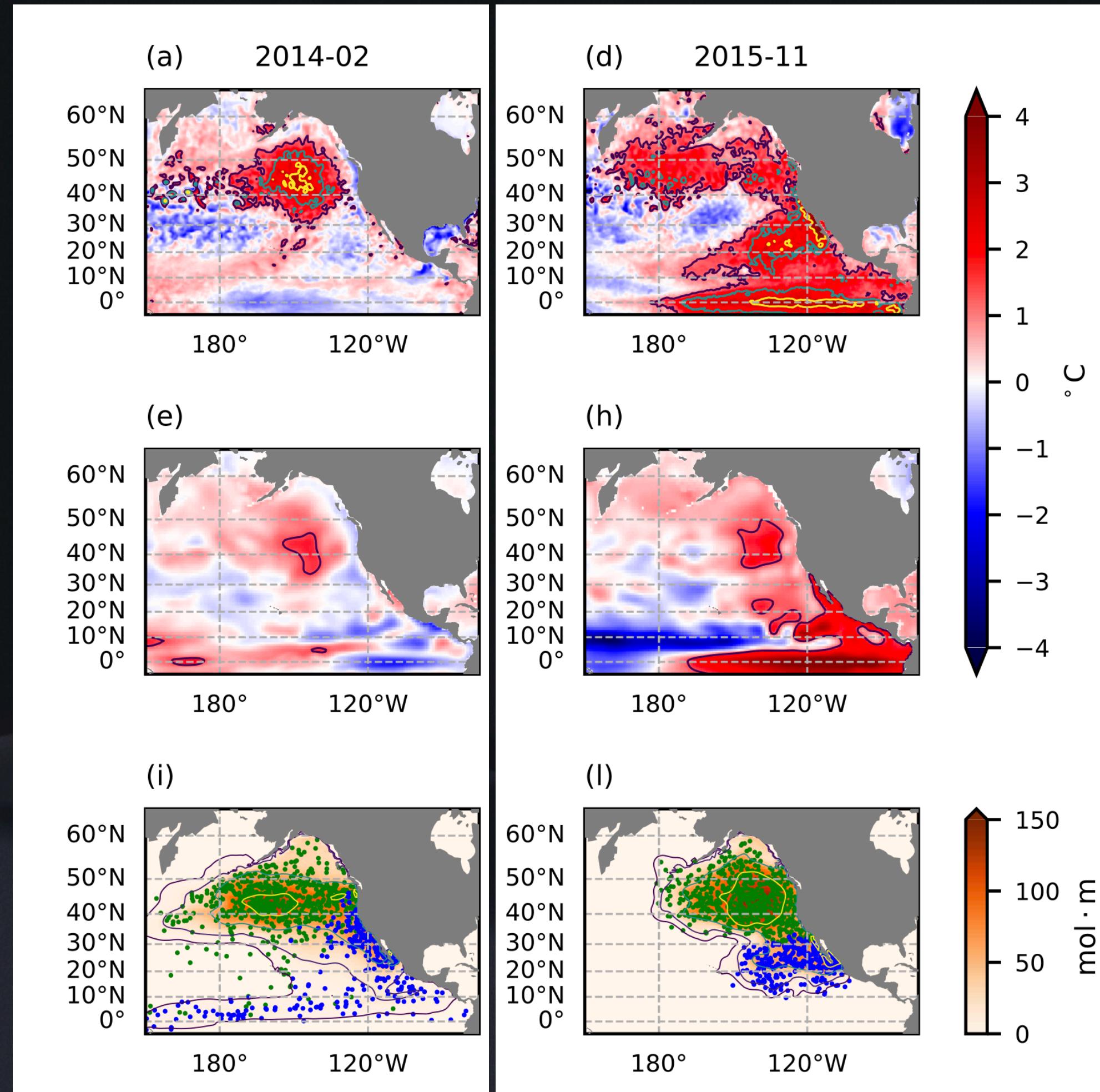
Hackathon : Marine Heat Wave Tracking

JuliaEO26, Terceira, Azores

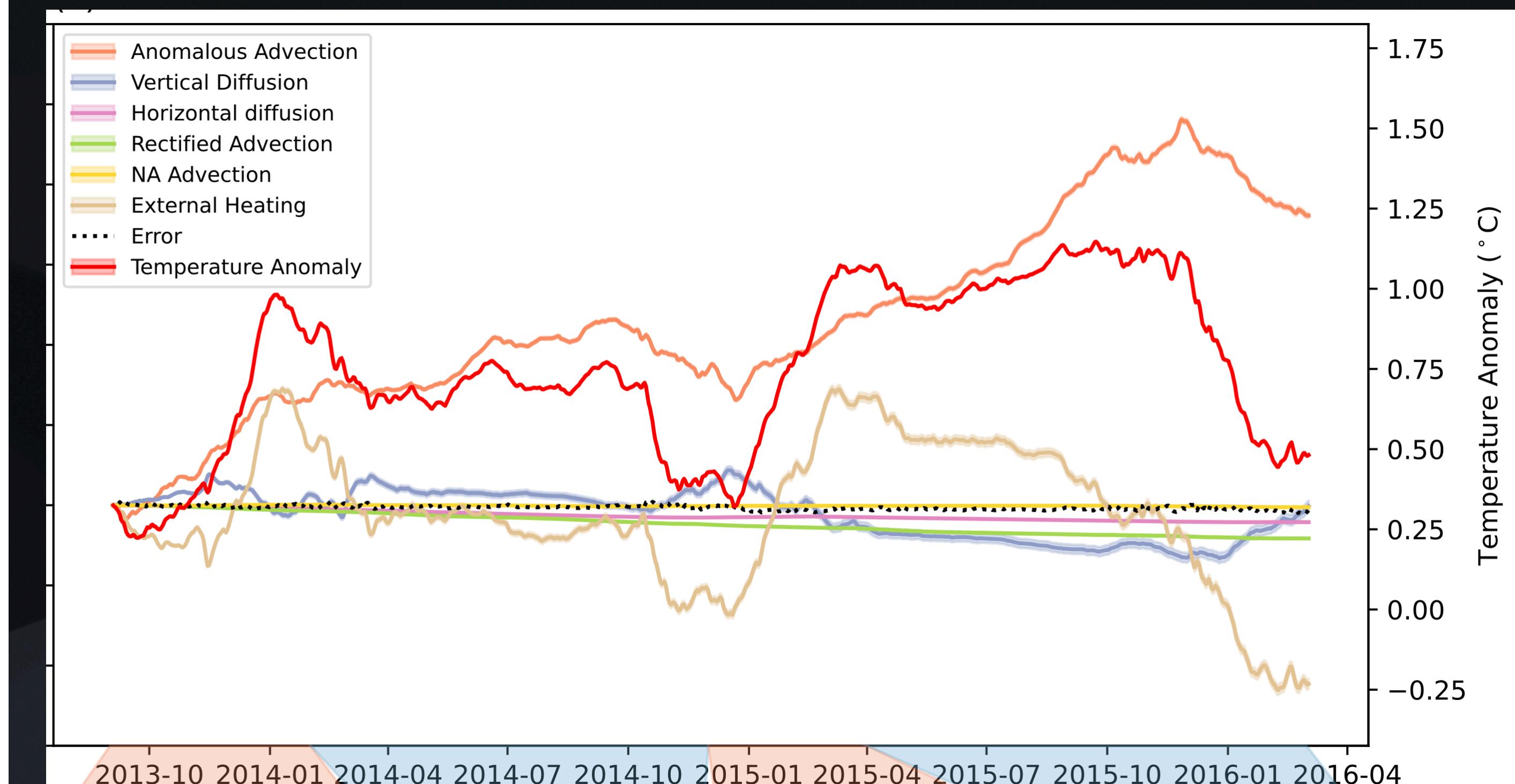
Gaël FORGET, 2026/01/08

Example : North Pacific in 2014-2015

Wenrui Jiang, G. Forget, Y. Song, T. Haine (Nat. Comm., under review)



- Marine Heat Wave ~ Moving 3D Object
- Scientific Challenge ~ Closed Heat Budget



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](#) [!\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\) CI](#) [passing](#) [!\[\]\(27df6be88af07602ea392719b144fe7f_img.jpg\) 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.

Table of Contents

SST data

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

Detection from Time Series

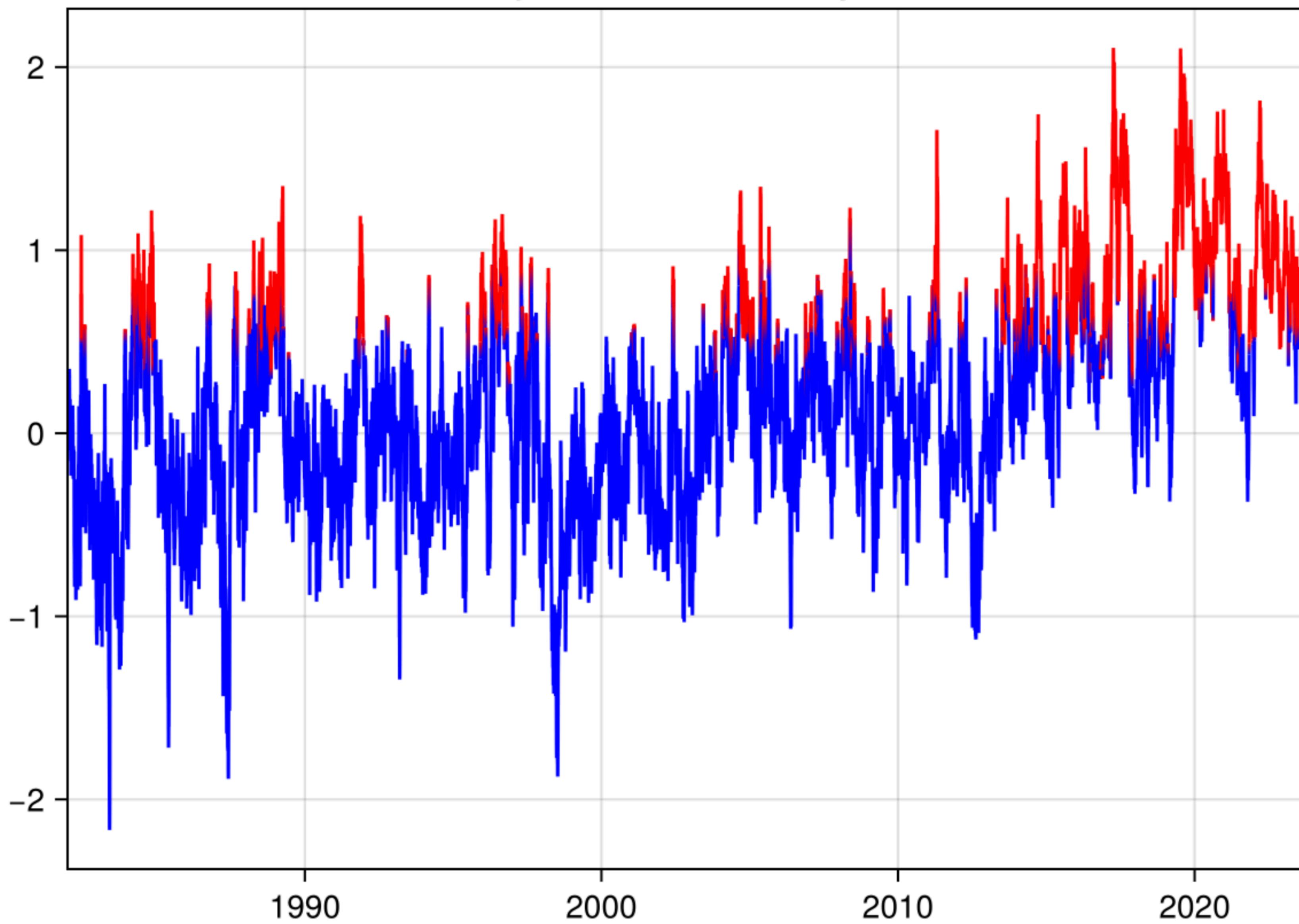
Detection From Map

ERSST Anomaly Map

Climate Projection

Appendix

SST anomaly with extreme warm periods in red



OISST Anomaly Map

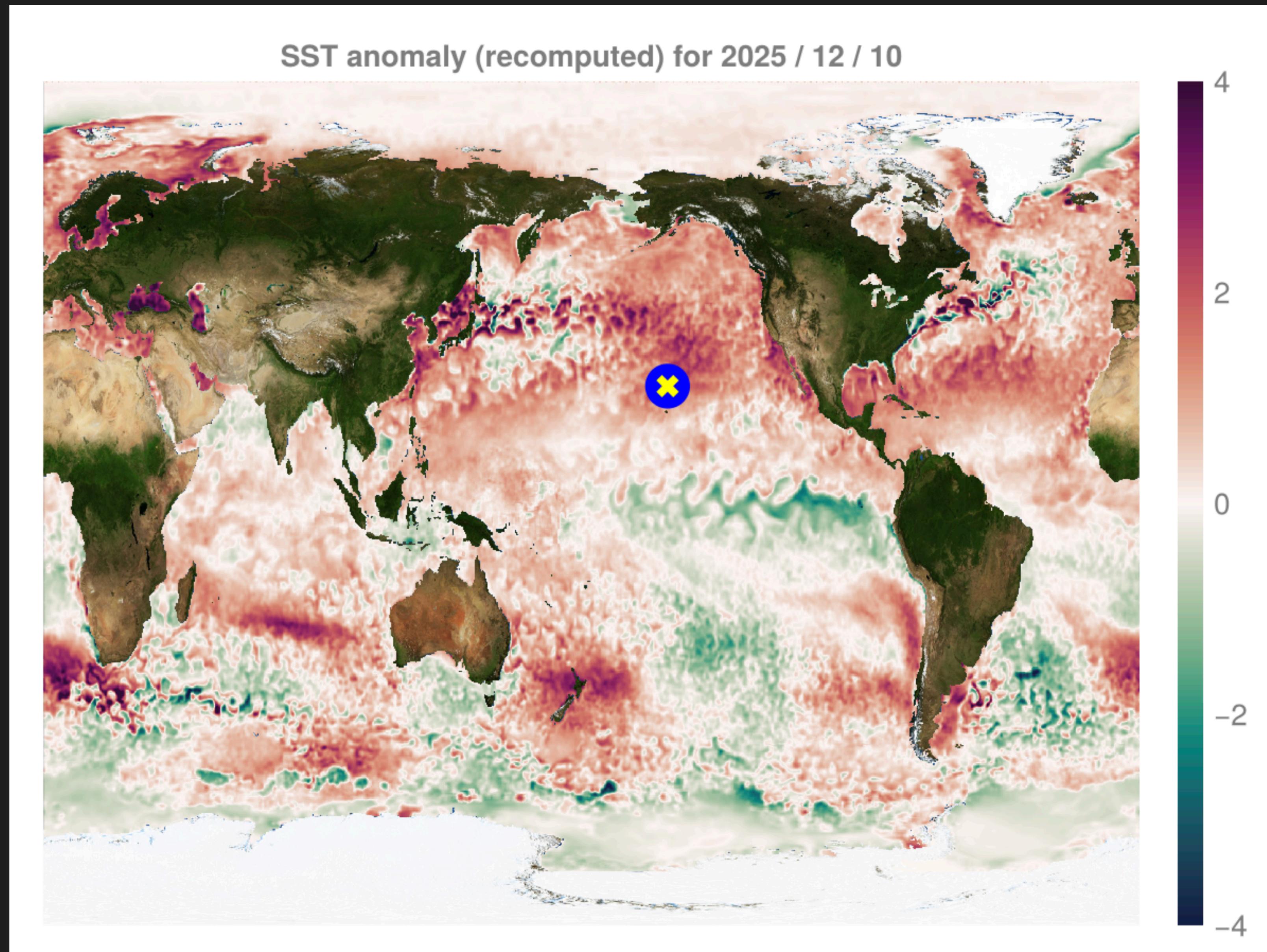


Table of Contents

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

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.

Pr

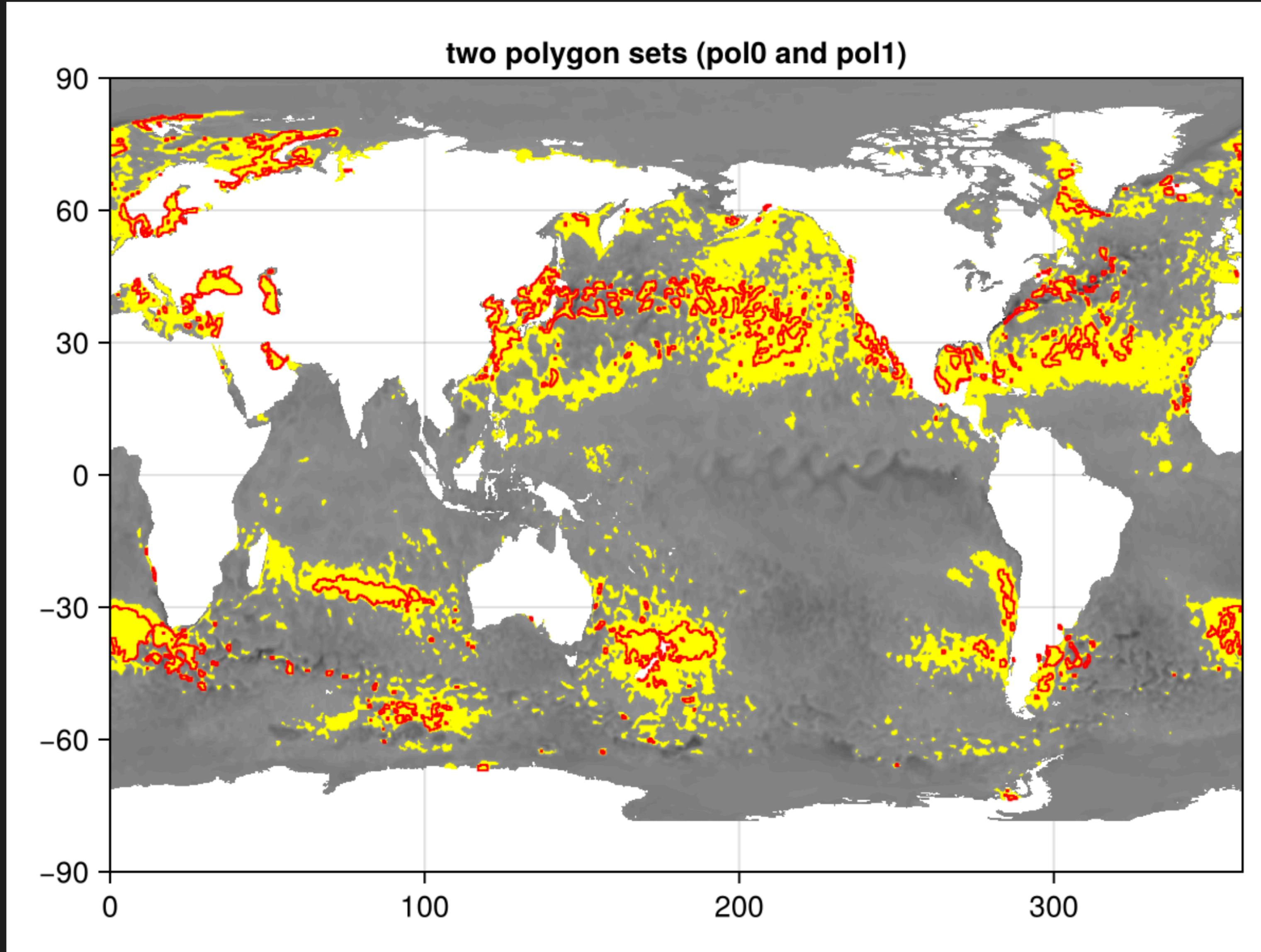


Table of Contents

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

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:

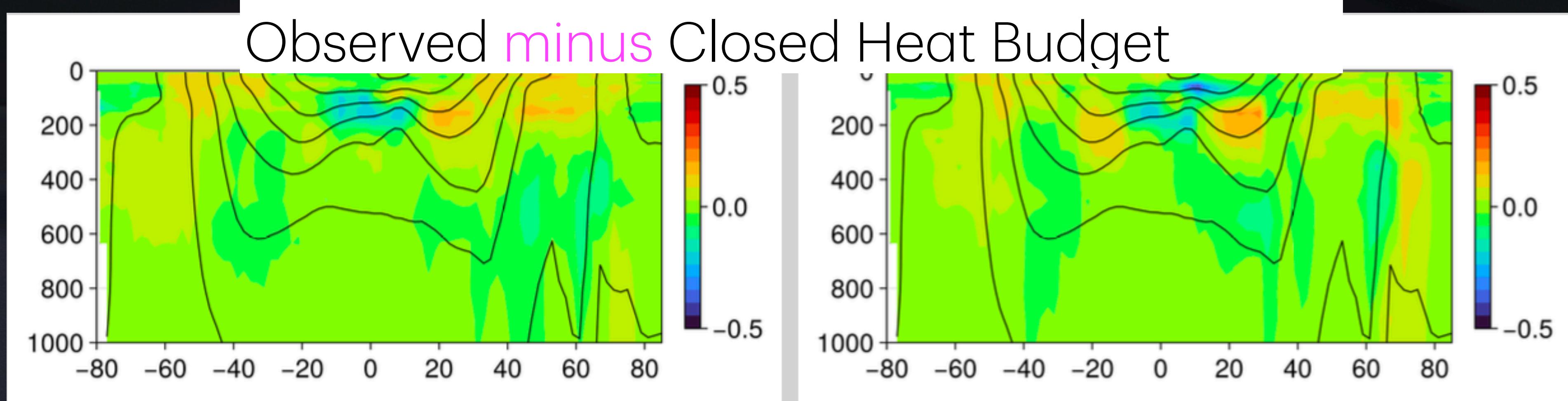
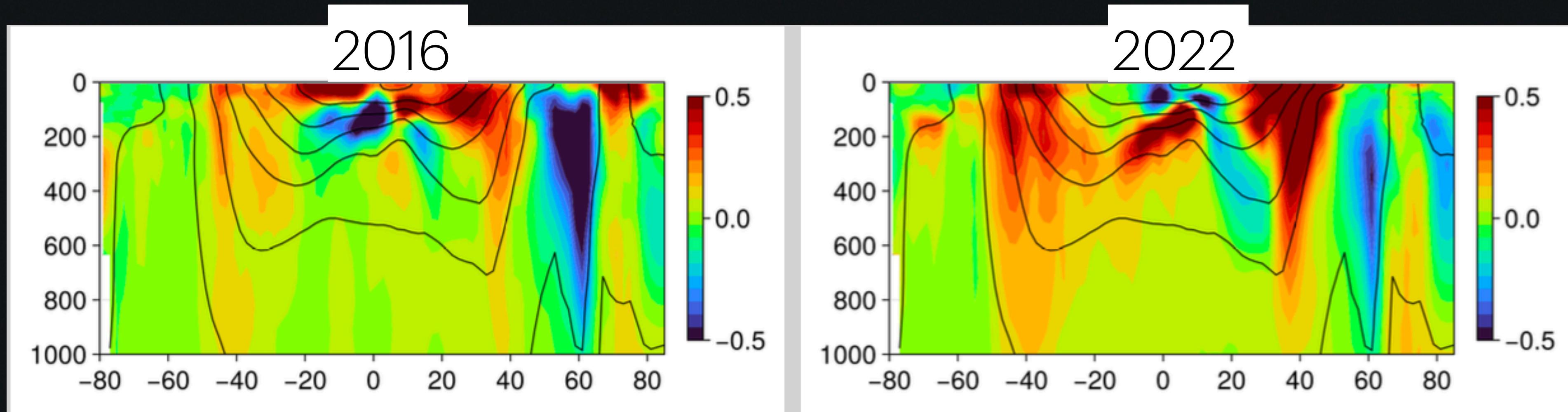
1. `hwtrack_nouniform` - Spatially Coherent Tracking (Sun et al., 2023)
2. `Tracker` (Ocetrac) - Spatiotemporally Coherent Tracking (Scannell et al., 2023)
3. `SpatialTemporalNormalization` - Spatial-temporal normalization for composite analysis (Zhao et al., in review)

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

Global Ocean Warming Estimation

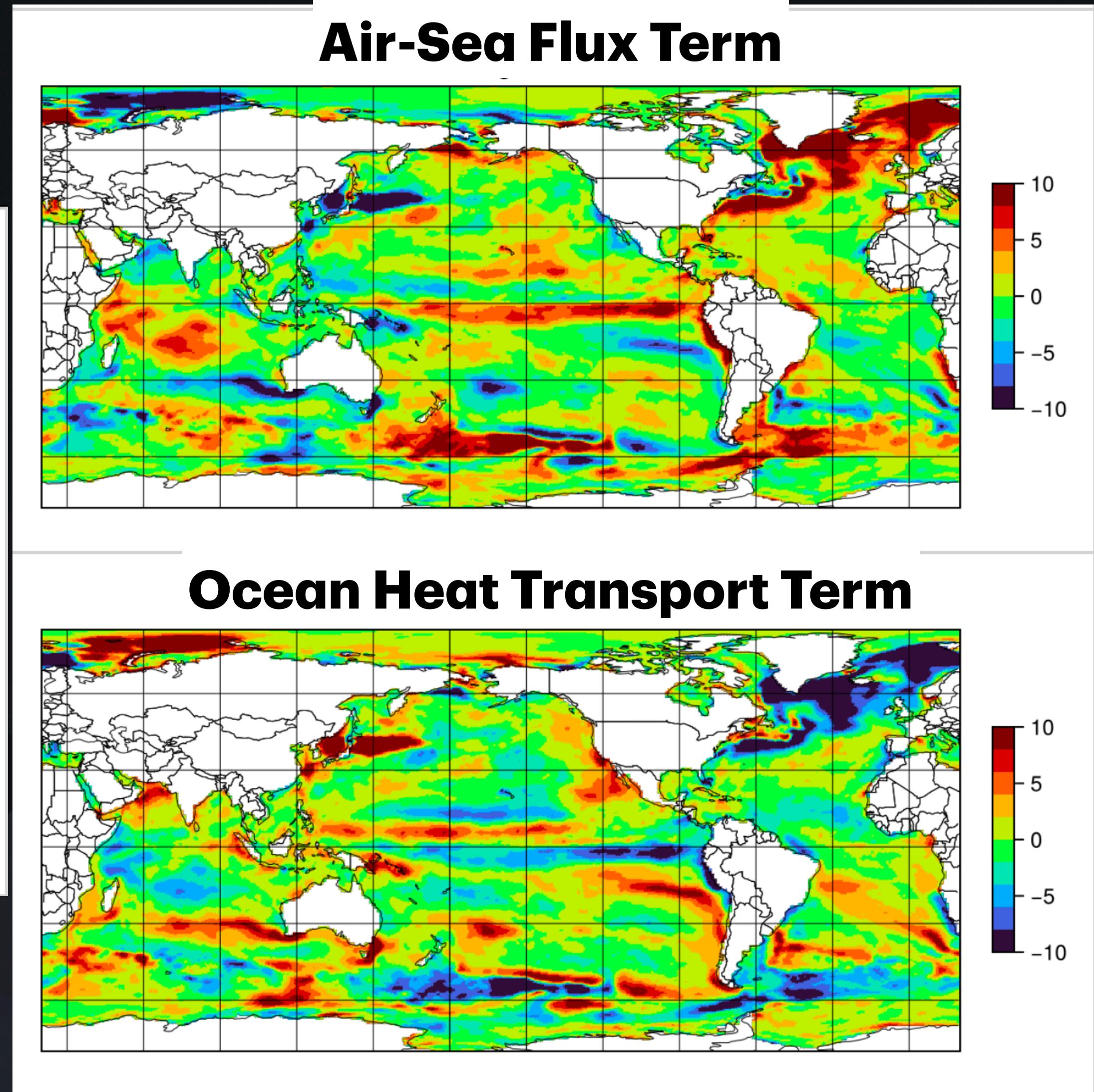
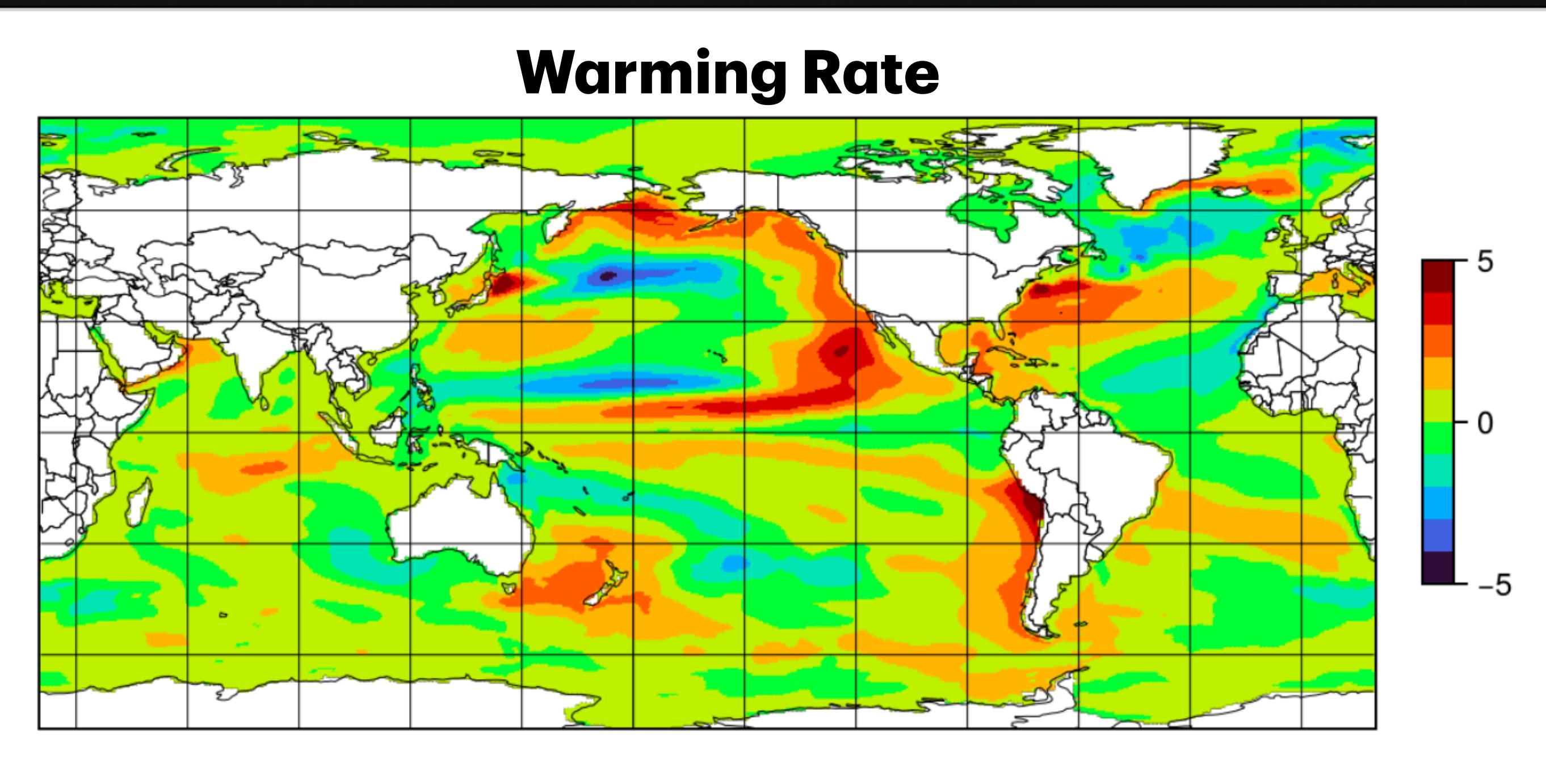
Progress Report (3/3)

Forget (in prep)



Closed Heat Budget Estimate

Forget (in prep)



Hackhathon

Goals and Challenges

- ...