

J-SCOPE Seasonal Forecasts of Pacific Northwest Ocean Conditions



Samantha Siedlecki and Isaac Kaplan

Al Hermann, Nick Bond, Tam

Nguyen, Greg Williams, Jan Newton,

Phil Levin, Bill Peterson,

Simone Alin, & Richard Feely

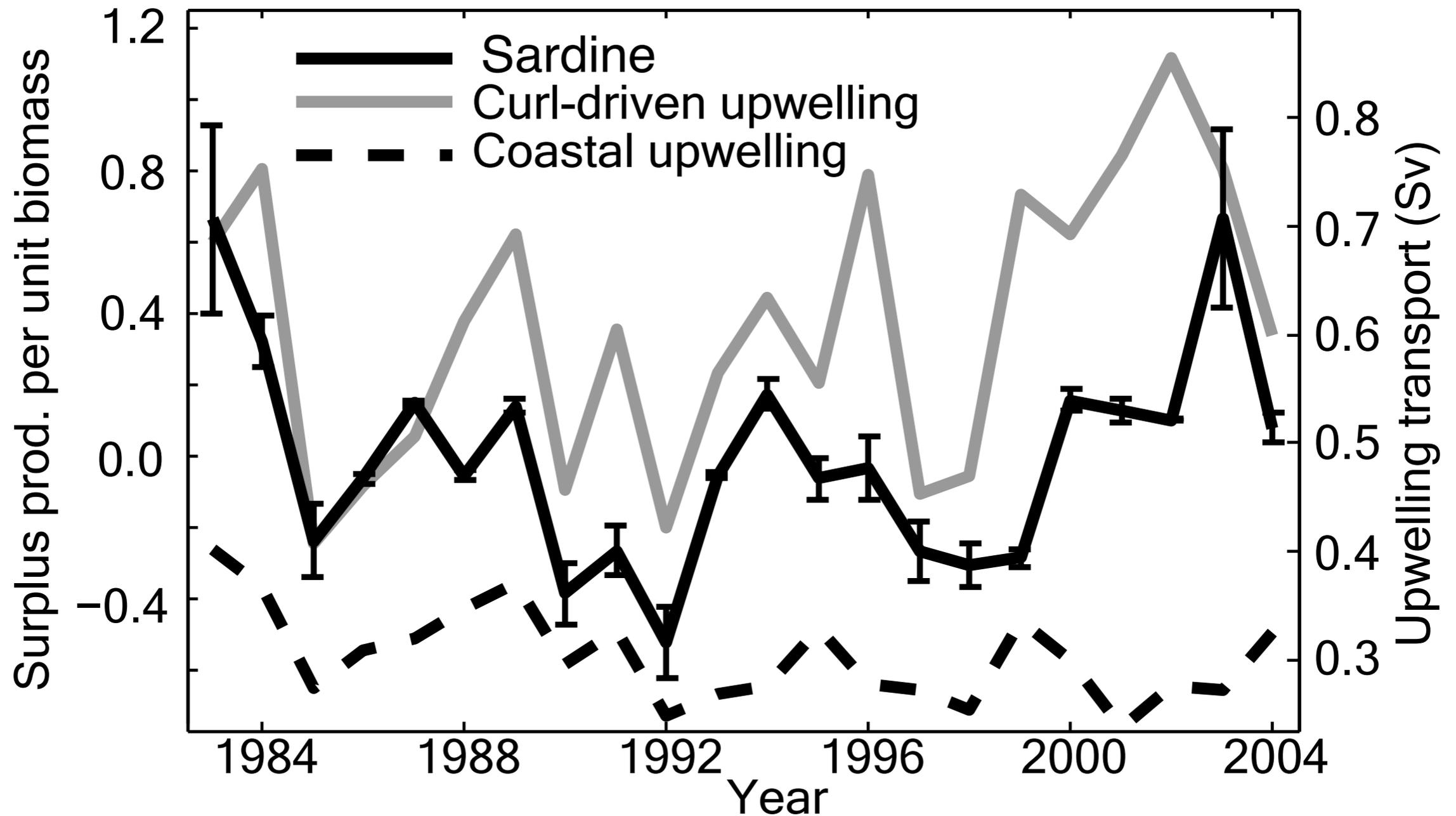


Check out our website:

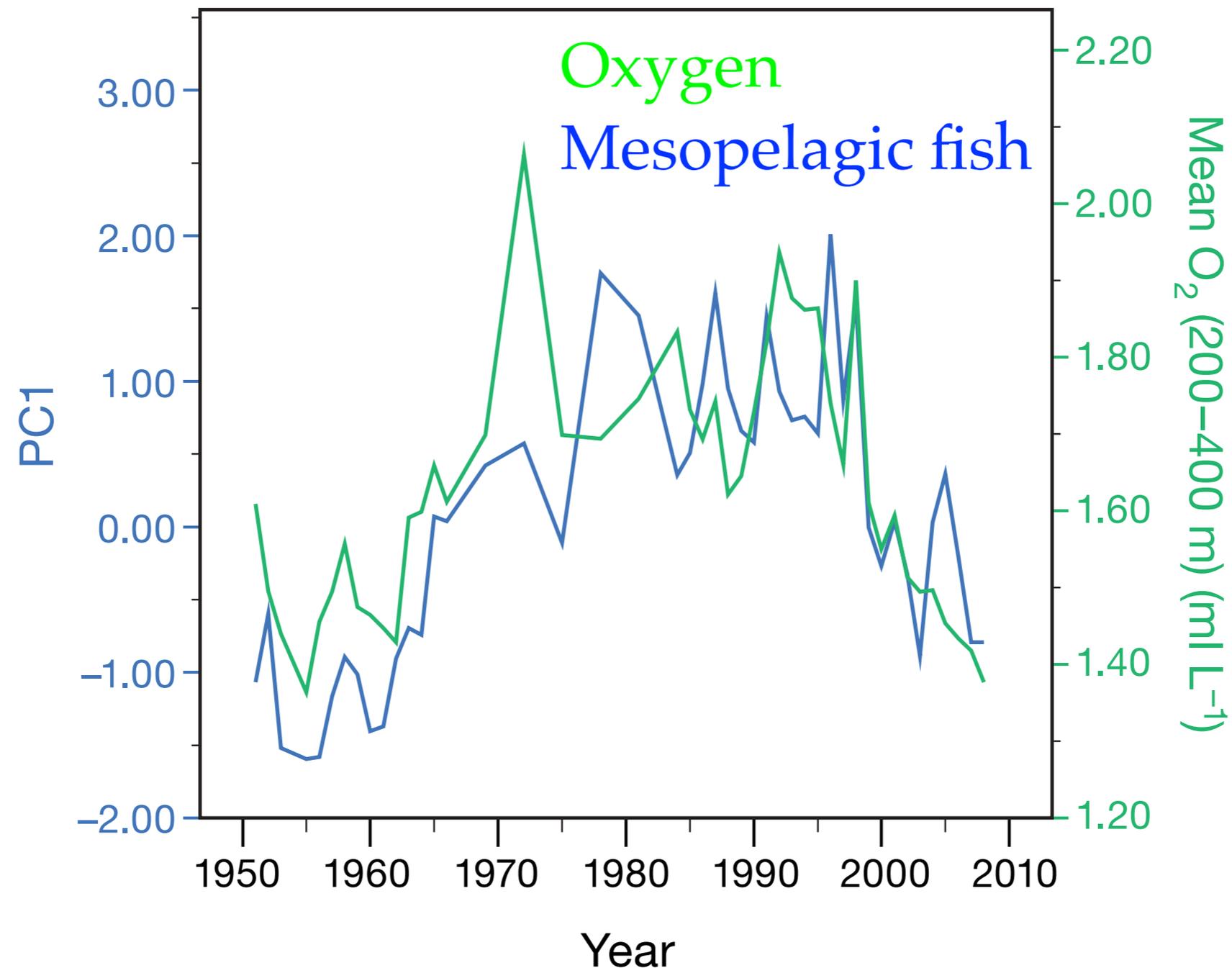
<http://www.nanoos.org/products/j-scope/home.php>



Fish of commercial interest have changed in abundance over the past several decades - some linked to environmental data

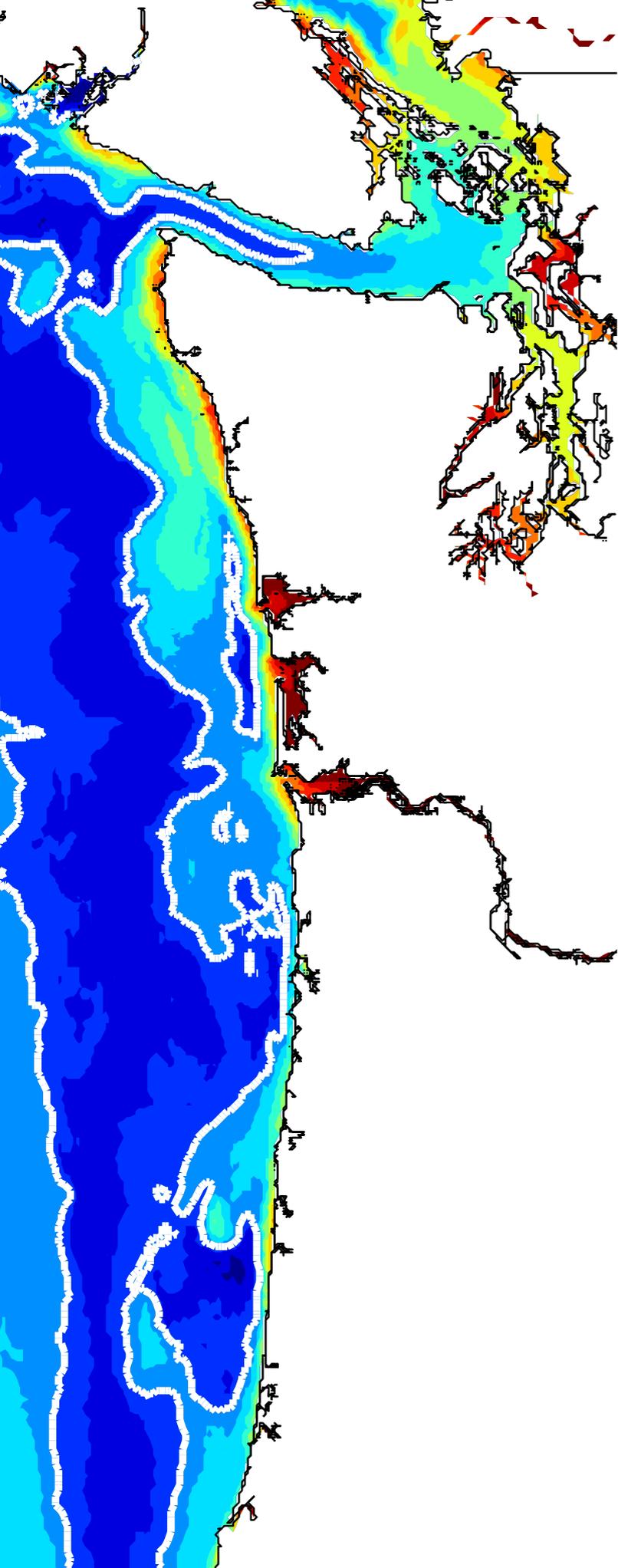


Fish of commercial interest have changed in abundance over the past several decades - some linked to environmental data



PC1= ichthyoplankton of mesopelagic fish (mainly)

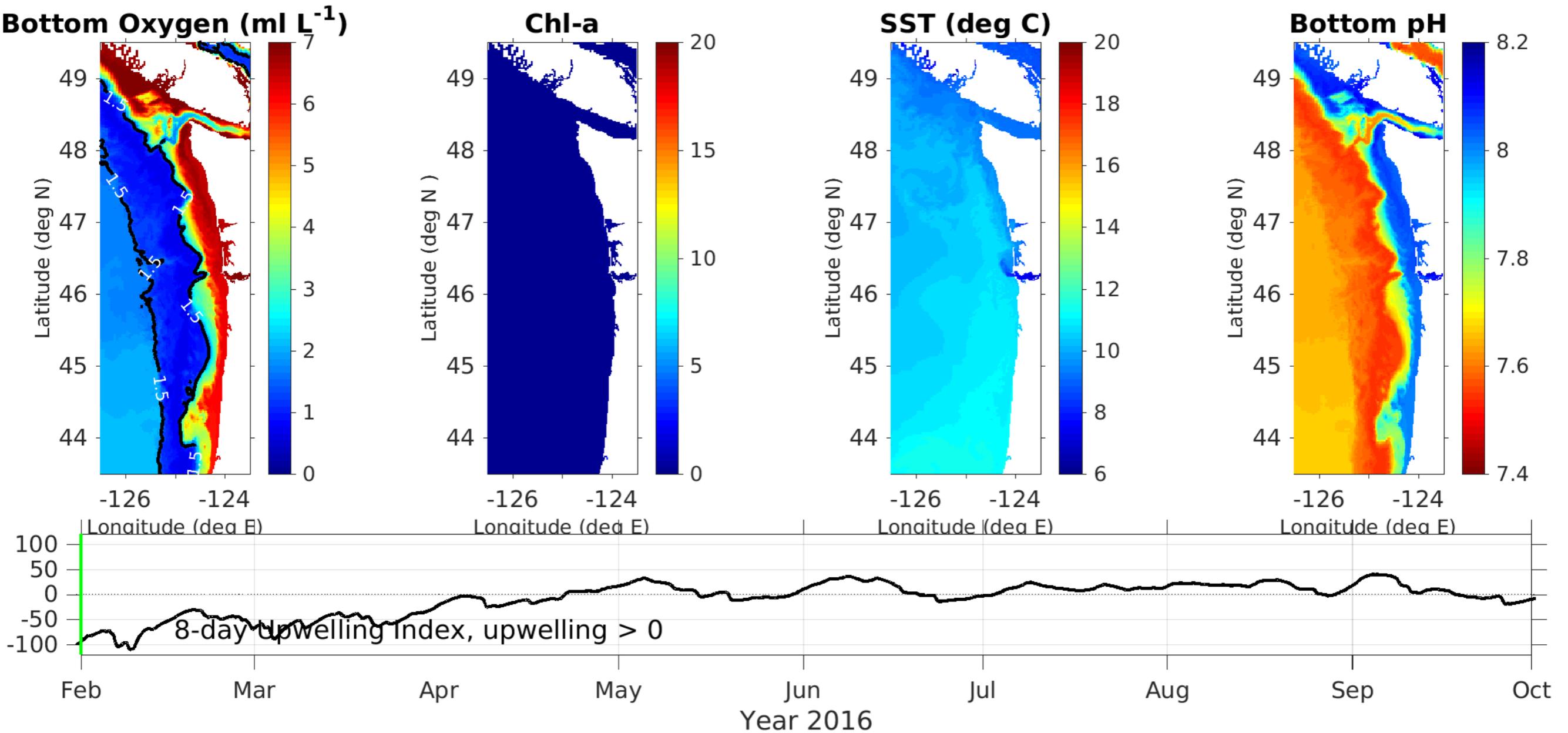
Koslow et al., 2011; 2013

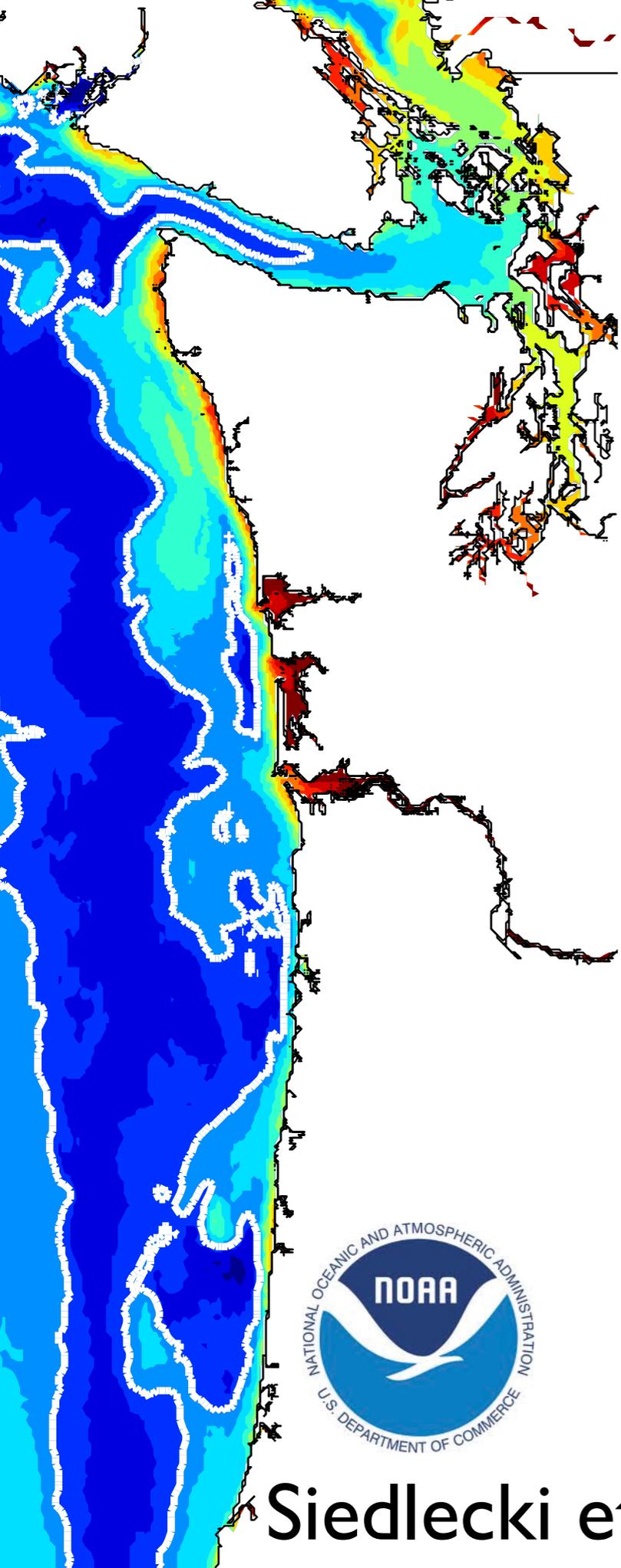


Goal: forecast up to 6-9 months of California Current ocean conditions

- Climate Forecast System (**CFS**) for coarse scale (50km) predictions of ocean physics, 6-9 months in advance
- Regional Ocean Modeling System (**ROMS**) is available to downscale these results

January 2016 forecast





JISAO's Seasonal Coastal Ocean Prediction of the Ecosystem (J-SCOPE)

Check out our website:

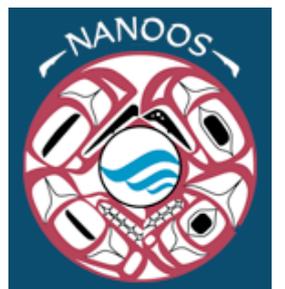
<http://www.nanoos.org/products/j-scope/home.php>



W UNIVERSITY of WASHINGTON

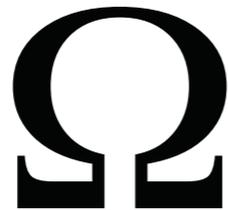
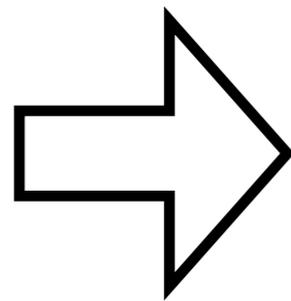
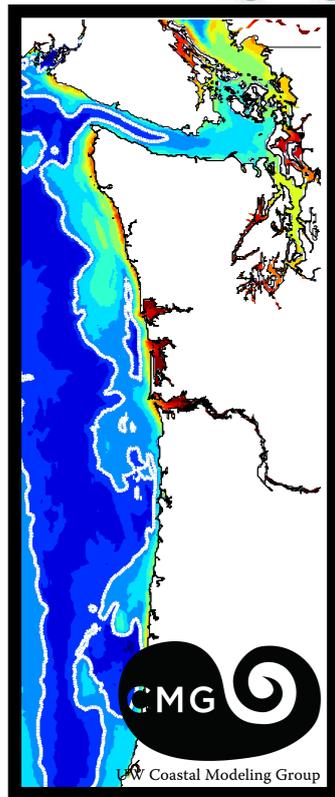
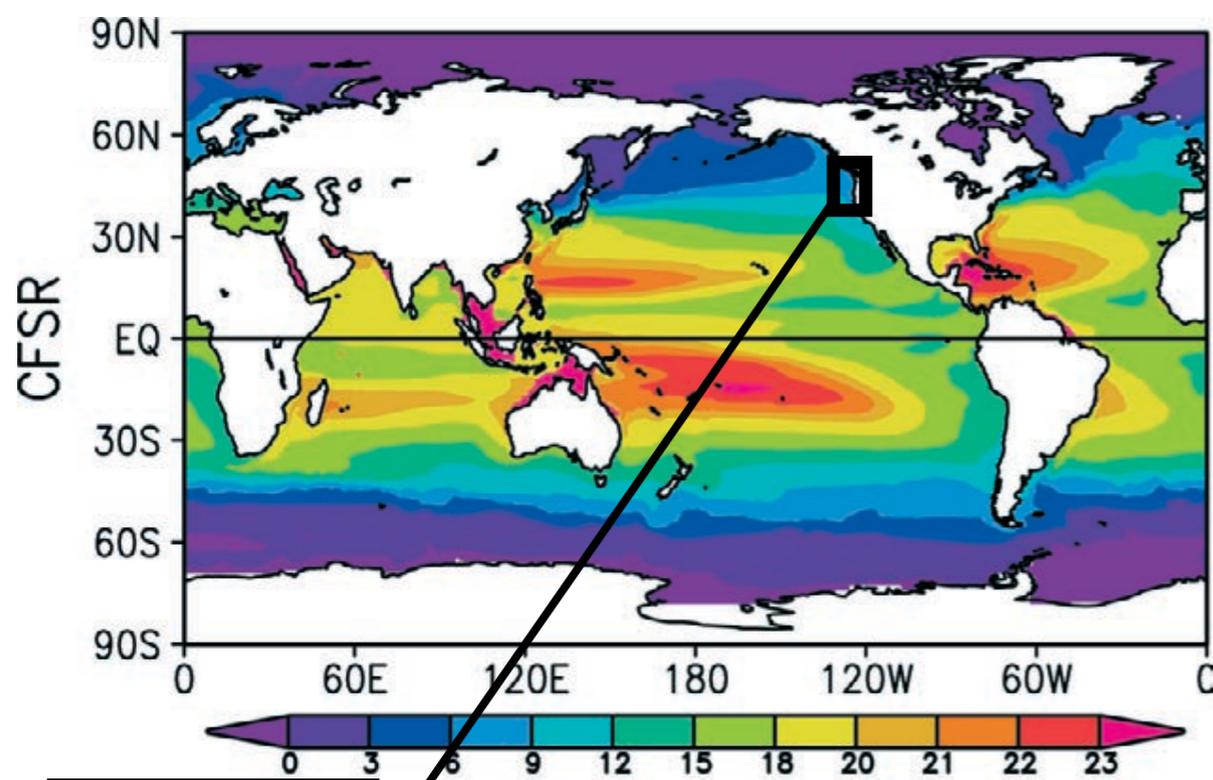


JISAO



Siedlecki et al, in revision

Building a Forecast System



Climate Forecast System (CFS) - ocean boundary conditions and atmospheric forcing (Ocean: ~50km, Atm: ~200km resolution)

CFS + UW CMG regional ROMS-based model with biogeochemistry (~1.5 km resolution, 40 vertical levels, with rivers and tides)

Empirical relationships from observations applied to the modeled fields to take those forecasts to the ocean health indices :

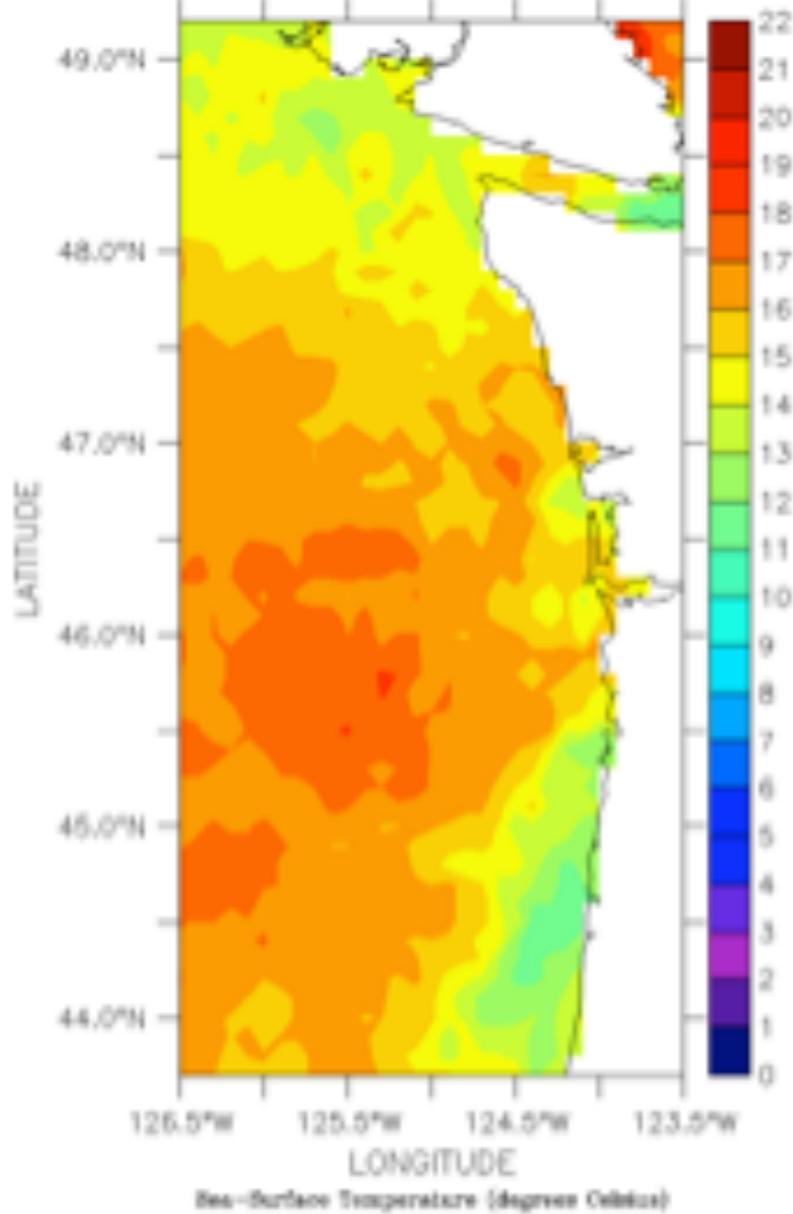
- pH (Alin et al, in prep; Alin et al, 2012)
- sardines (Kaplan et al, 2016)

UW Cascadia Model setup

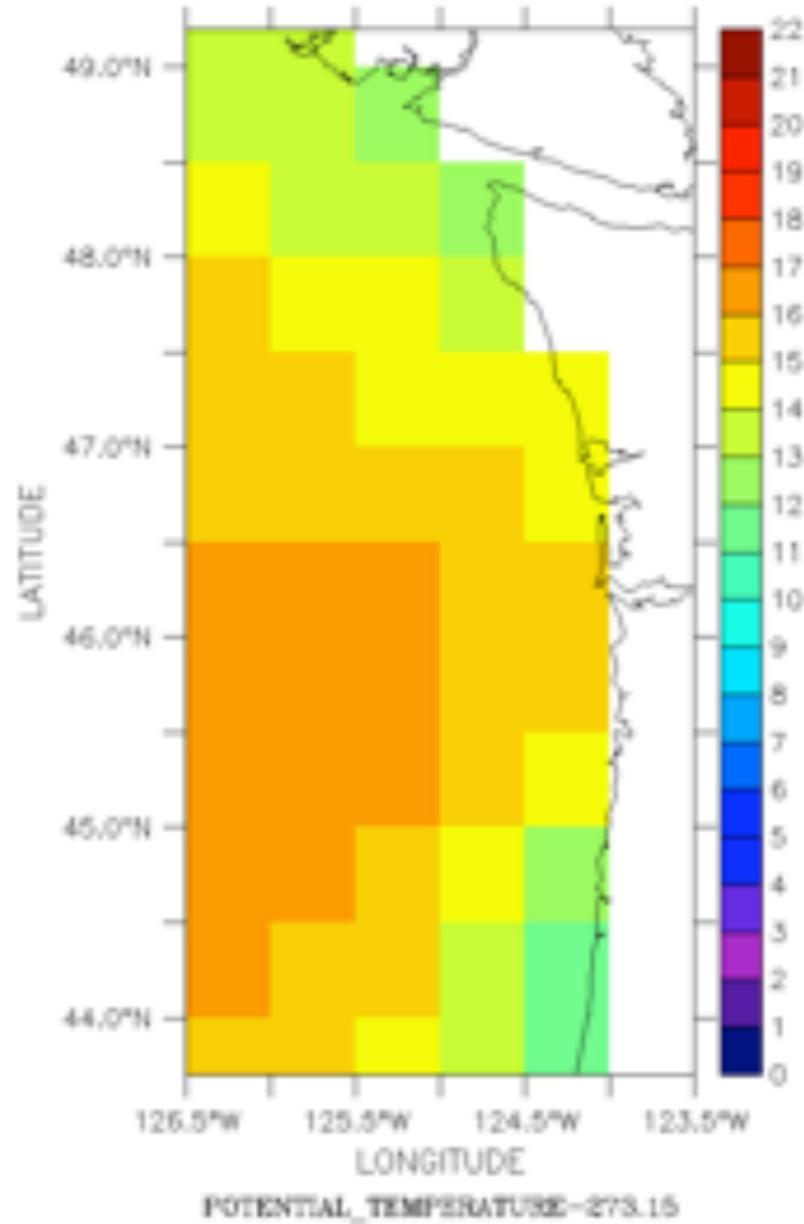
<http://faculty.washington.edu/pmac/cm/cm/cm.html>
and Giddings et al, 2014

Downscaled model captures N-S and onshore offshore SST trends

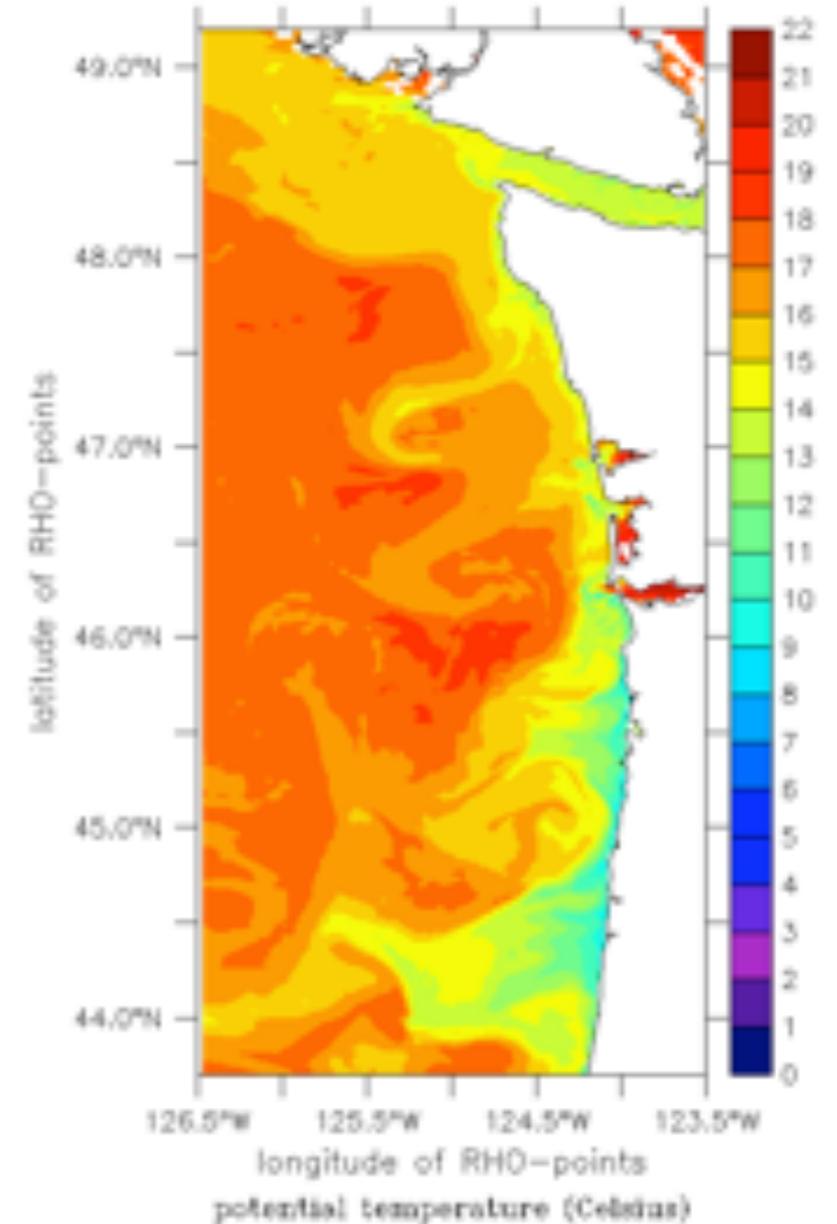
Satellite SST



CFS

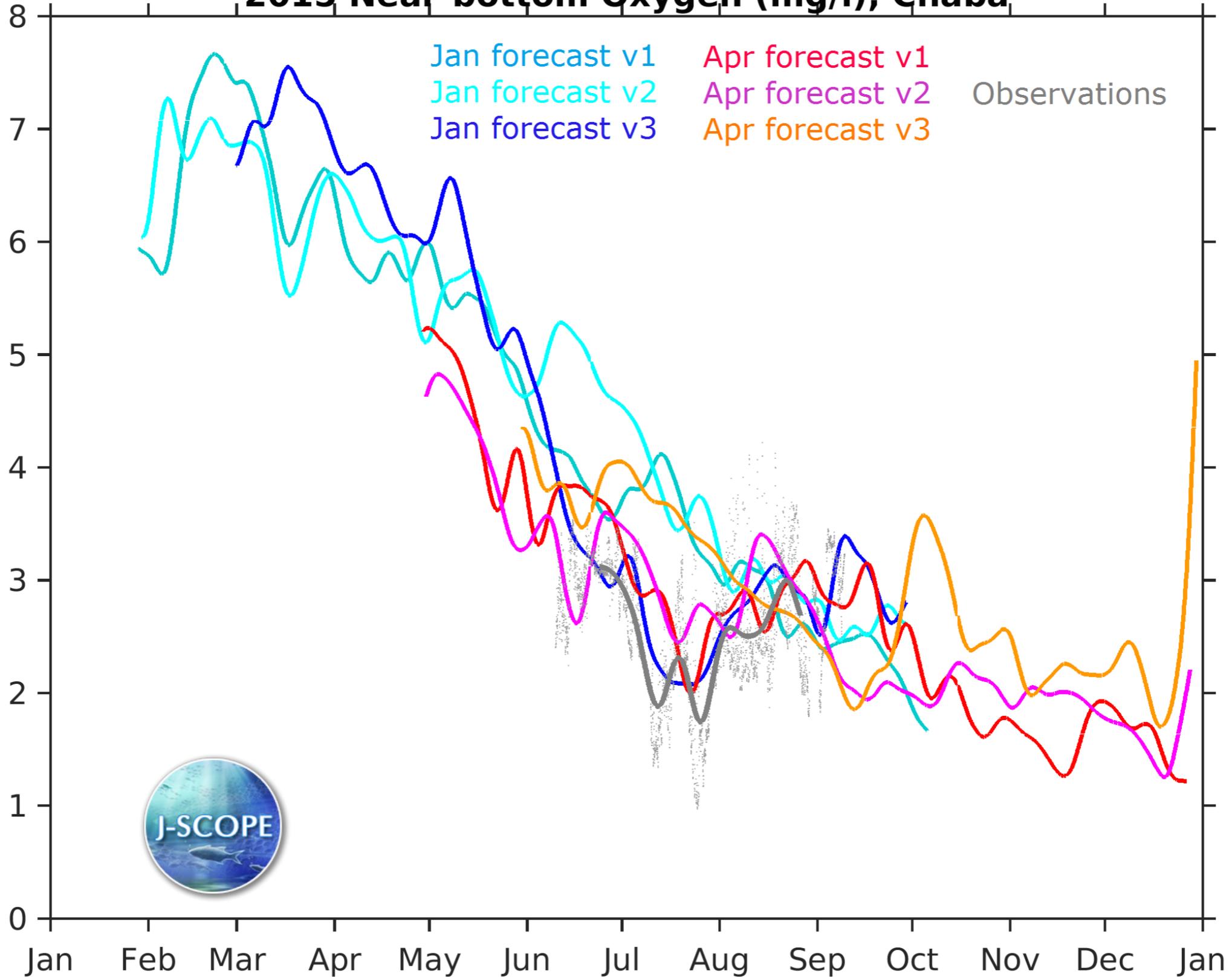


ROMS Forecast

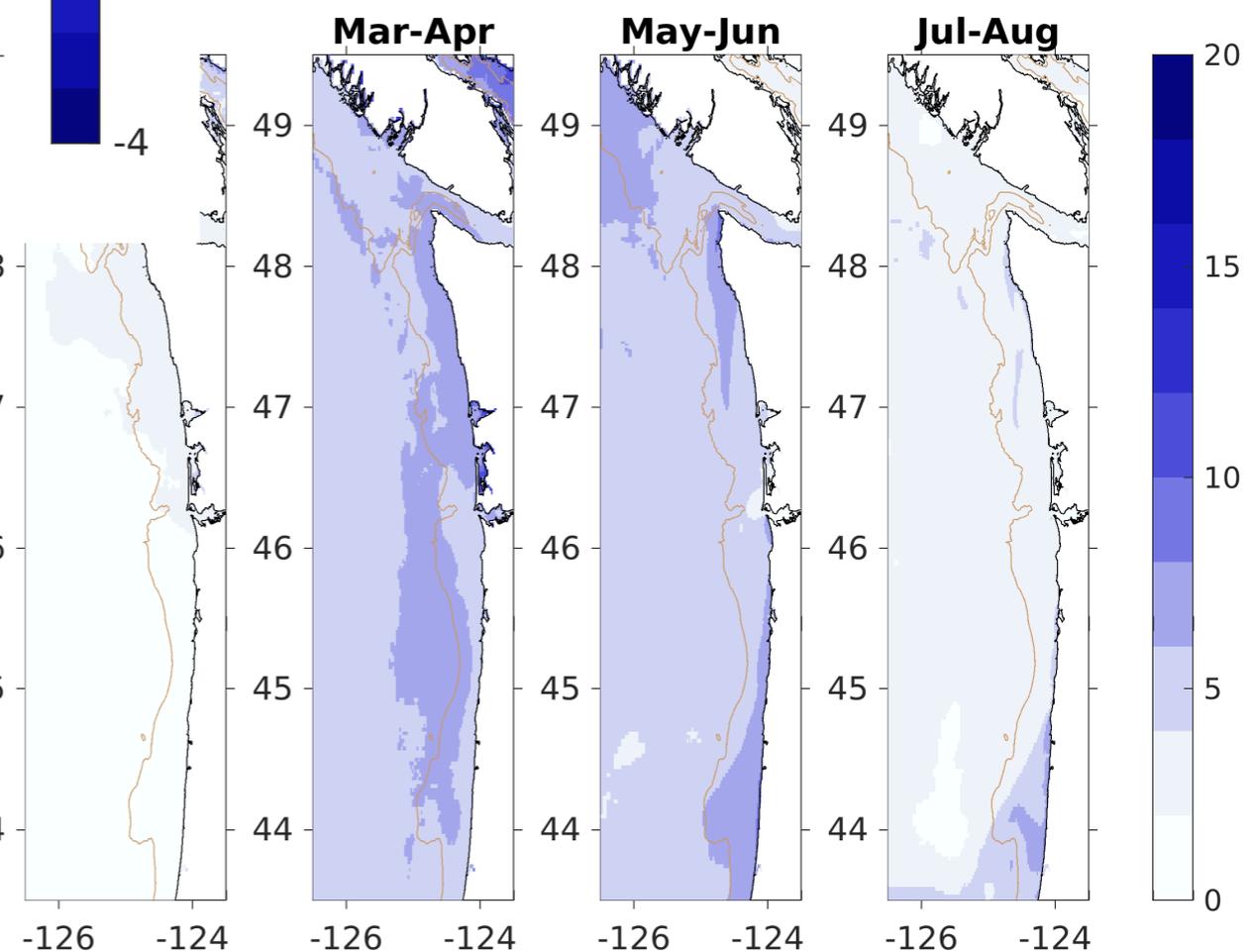
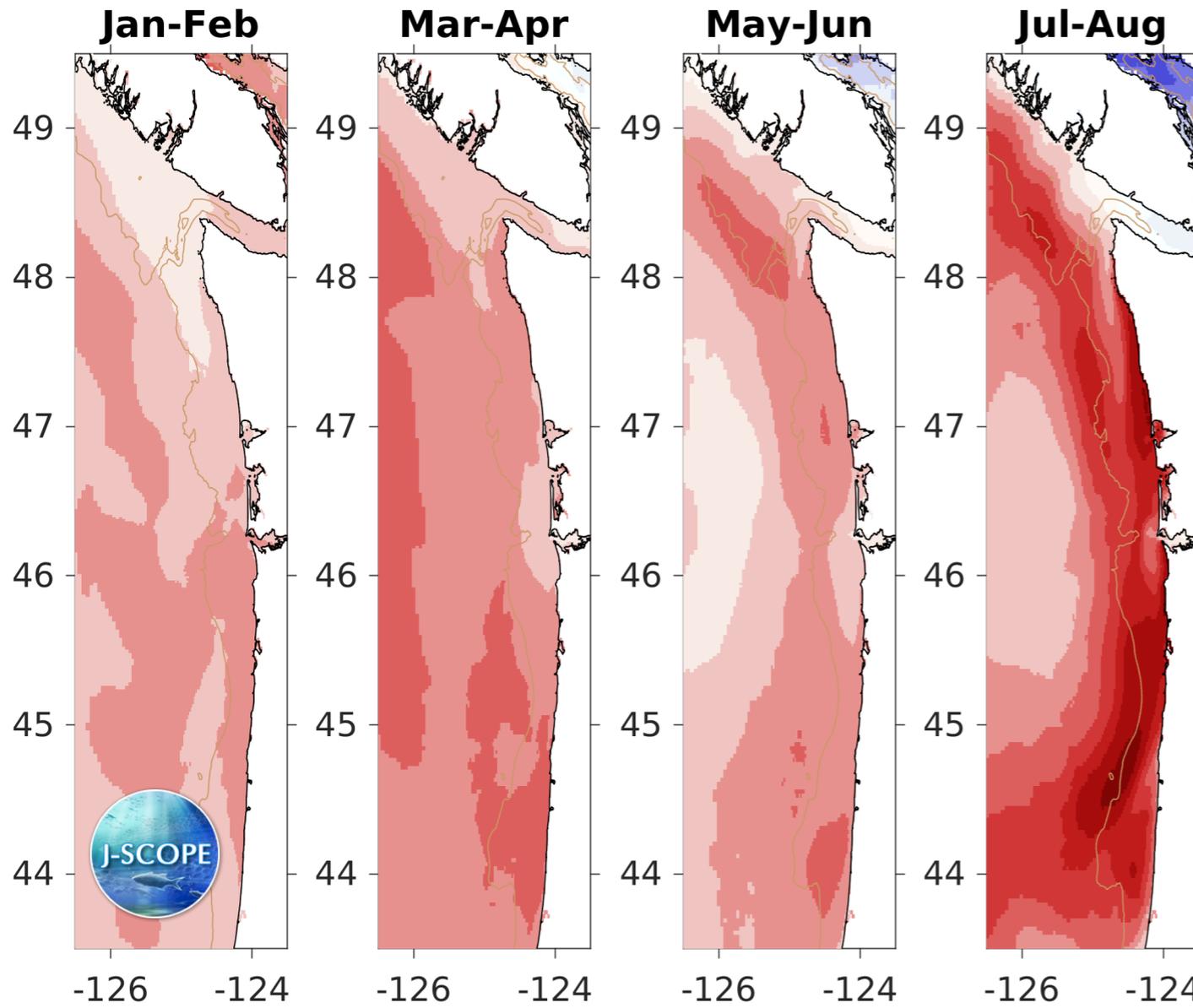


Mini-Ensemble Forecasts 2015-Onset of Oxygen decline at Cha'ba

2015 Near-bottom Oxygen (mg/l), Chaba

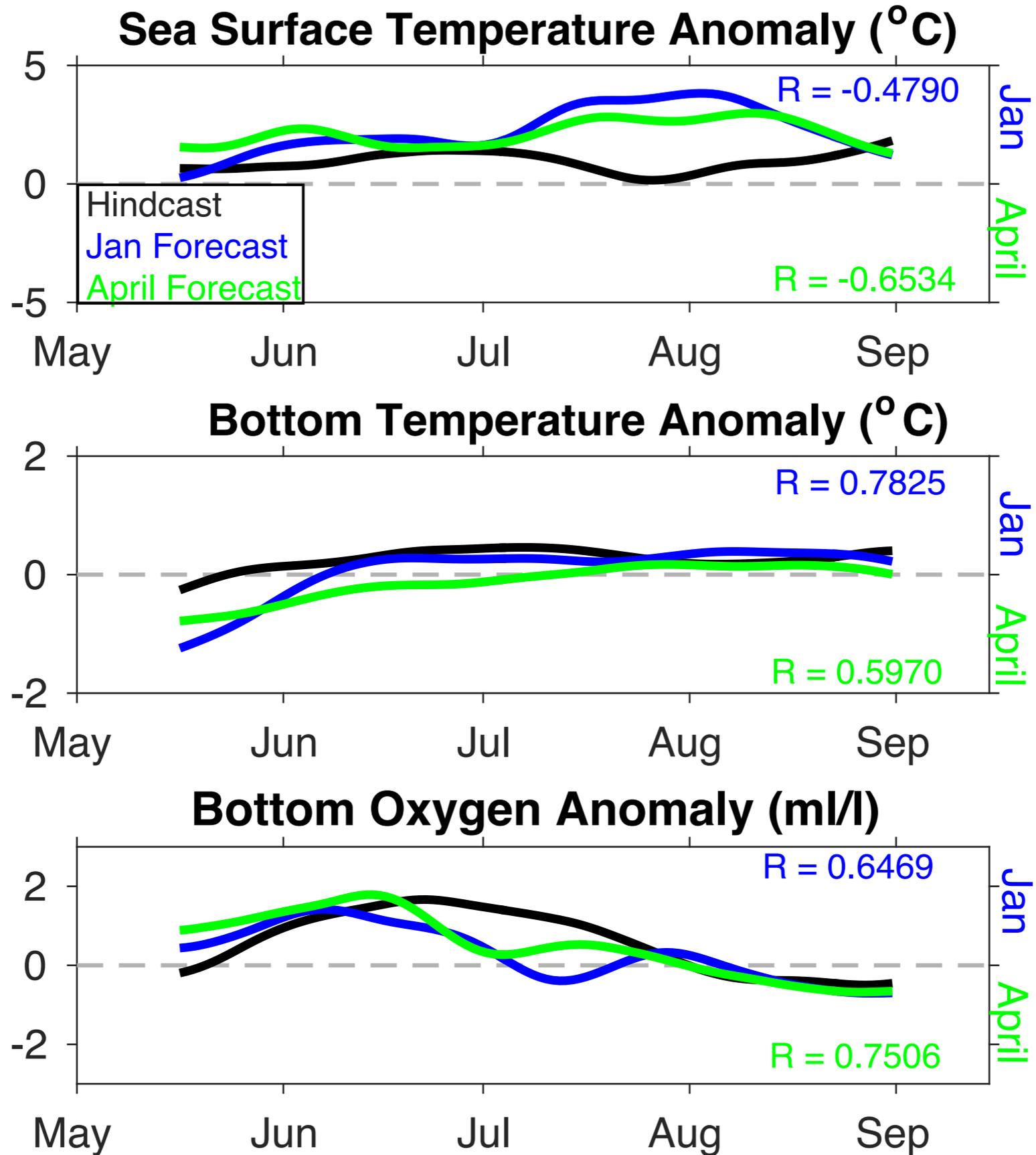


2016 Forecasted SST Anomaly (January Initialized)



Uncertainty

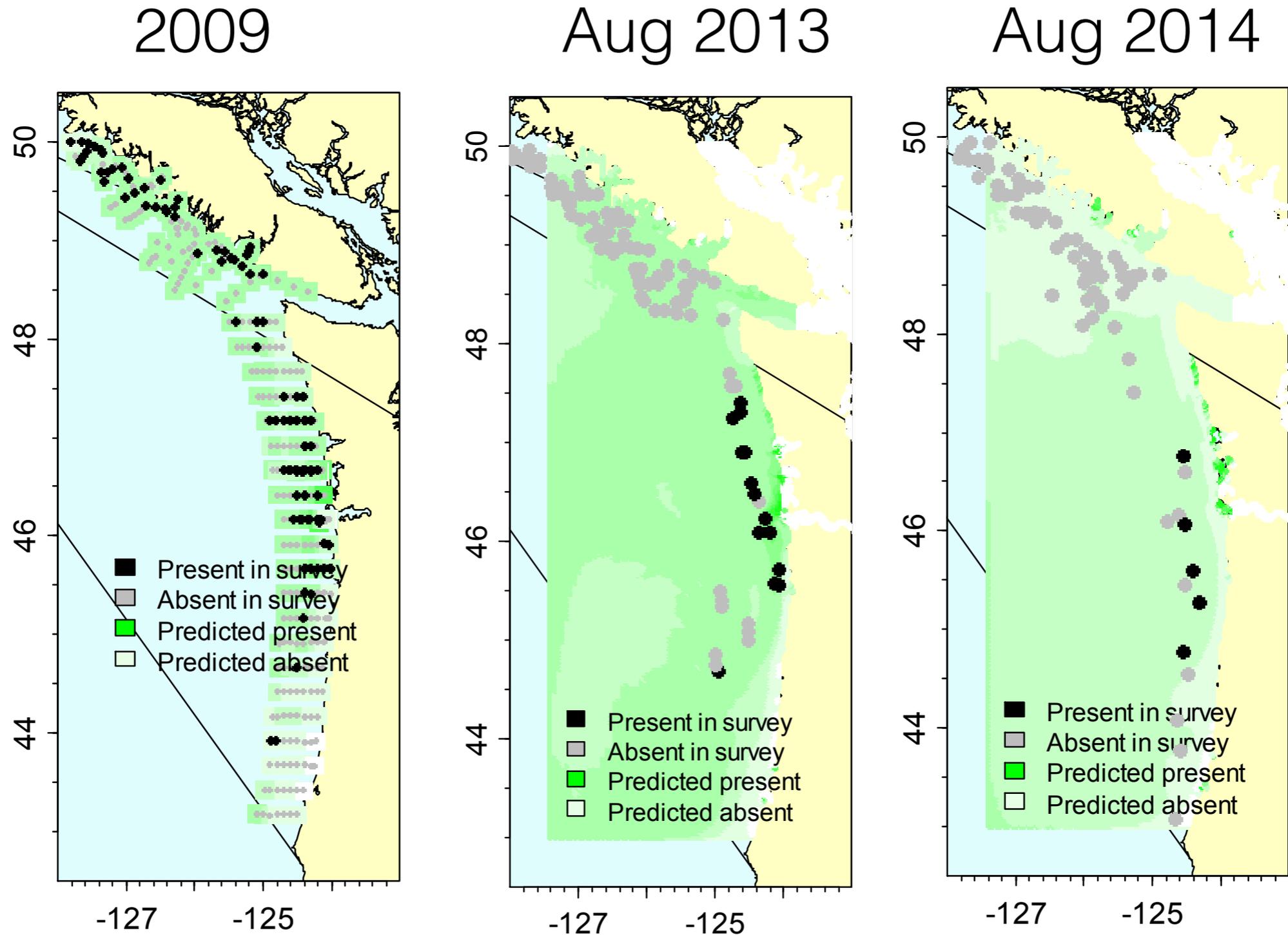
Forecasted Anomalies—2013



2013

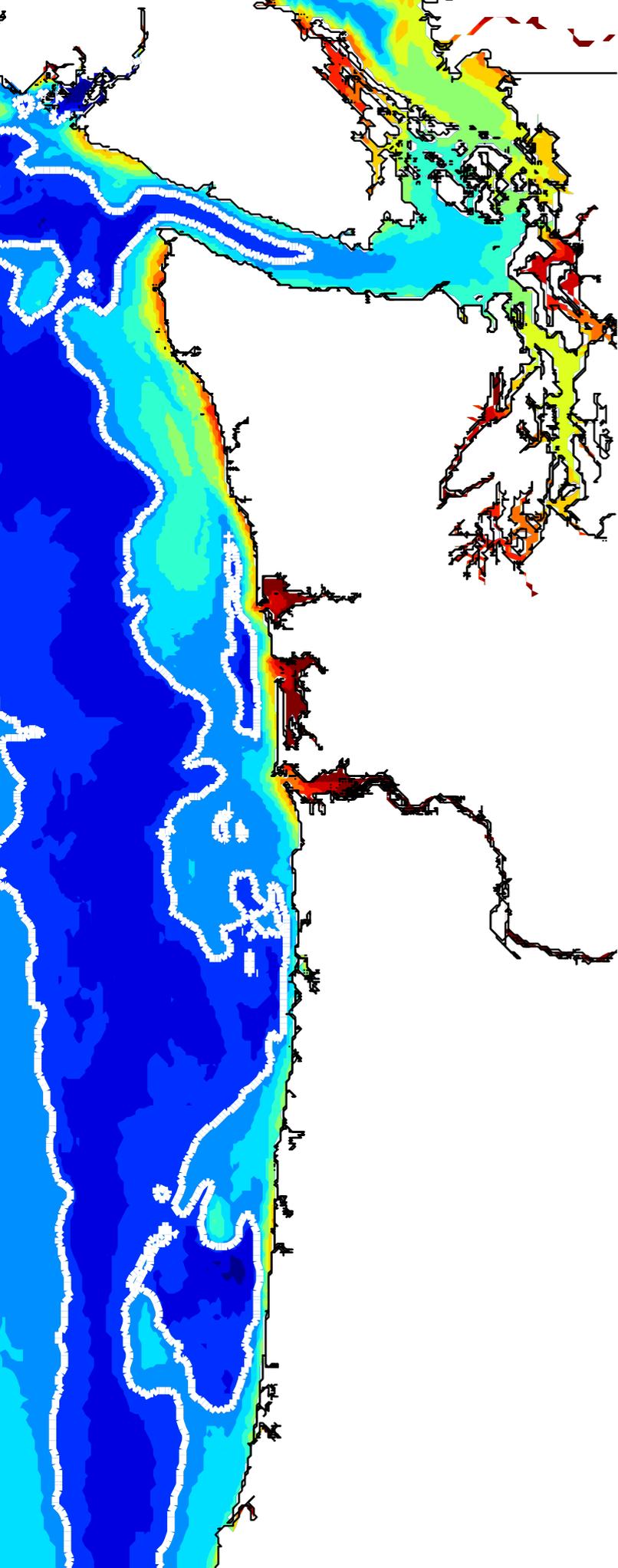
Siedlecki et al, in revision

Sardine Forecast



Kaplan, I. C., Williams, G. D., Bond, N. A., Hermann, A. J. and Siedlecki, S. A. (2016), Cloudy with a chance of sardines: forecasting sardine distributions using regional climate models. *Fisheries Oceanography*, 25: 15–27. doi: 10.1111/fog.12131

Conclusions

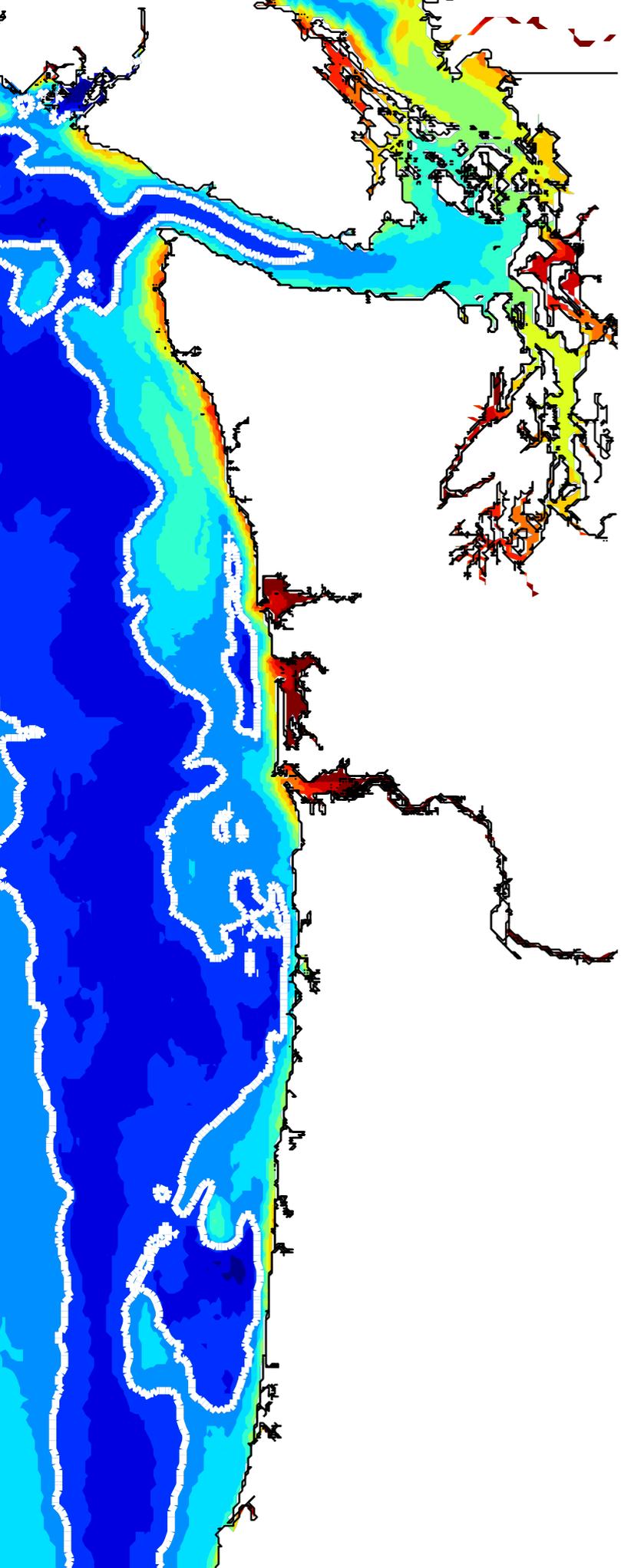


J-SCOPE forecasts (2009, 2013-2014) of subsurface ocean conditions have measurable skill on seasonal timescales, for variables relevant to management decisions for fisheries, protected species and ecosystem health.

These forecasts are possible through regional downscaling of CFS using ROMS

Forecasting efforts are aided by a relationship with local stakeholders and a real-time observational network

Challenges exist in terms of regional biases from the climate models (e.g. short-wave radiation, winds) that we are working to address within our domain



Next Steps

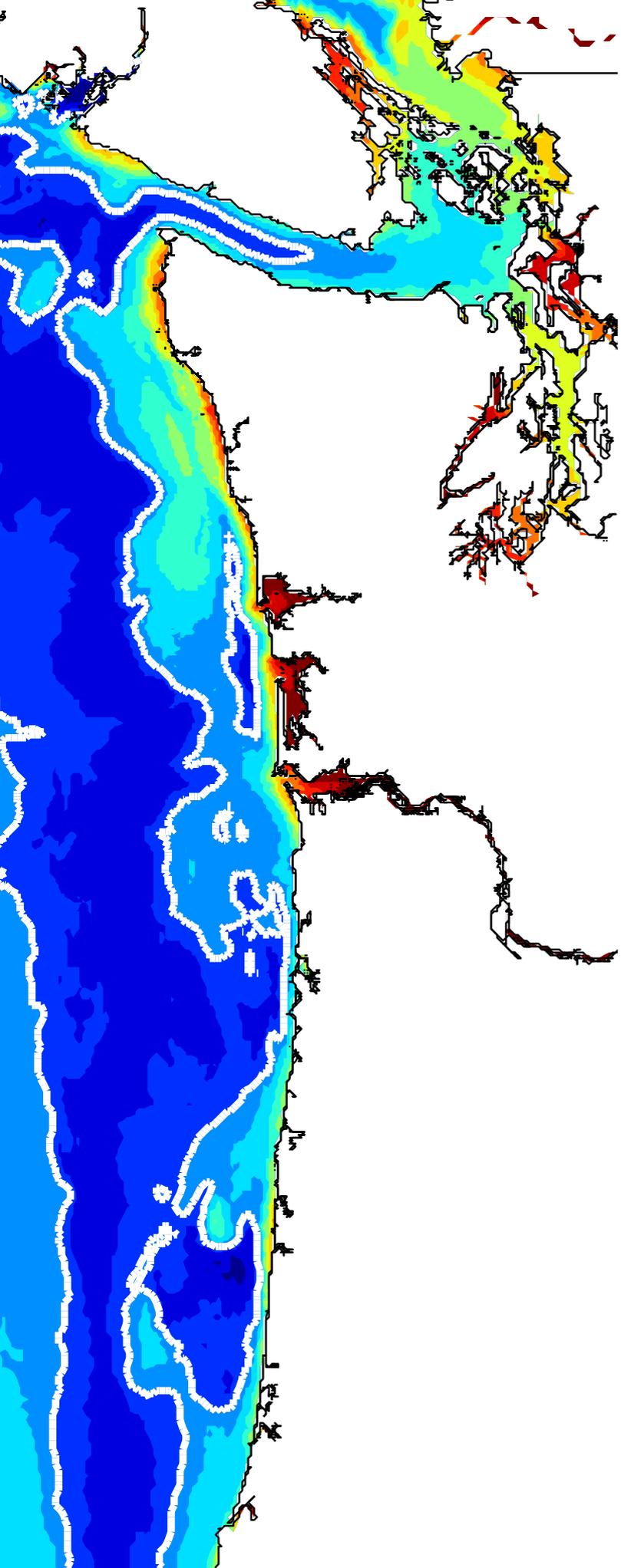
Expansion of predicted variable to include DIC and Total Alkalinity - allows us to extend to OA indices

Expand forecasts to Multi-Model Ensemble?

Providing output for Pacific Fishery Management Council via Integrated Ecosystem Assessment (IEA)

Applications to additional stakeholders:

- hake
- shellfish
- crab

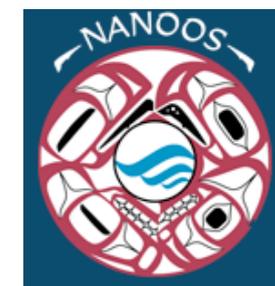


UNIVERSITY of WASHINGTON



Acknowledgements

Funding provided by NOAA
Fisheries And The
Environment (FATE) program
and NOAA OAP

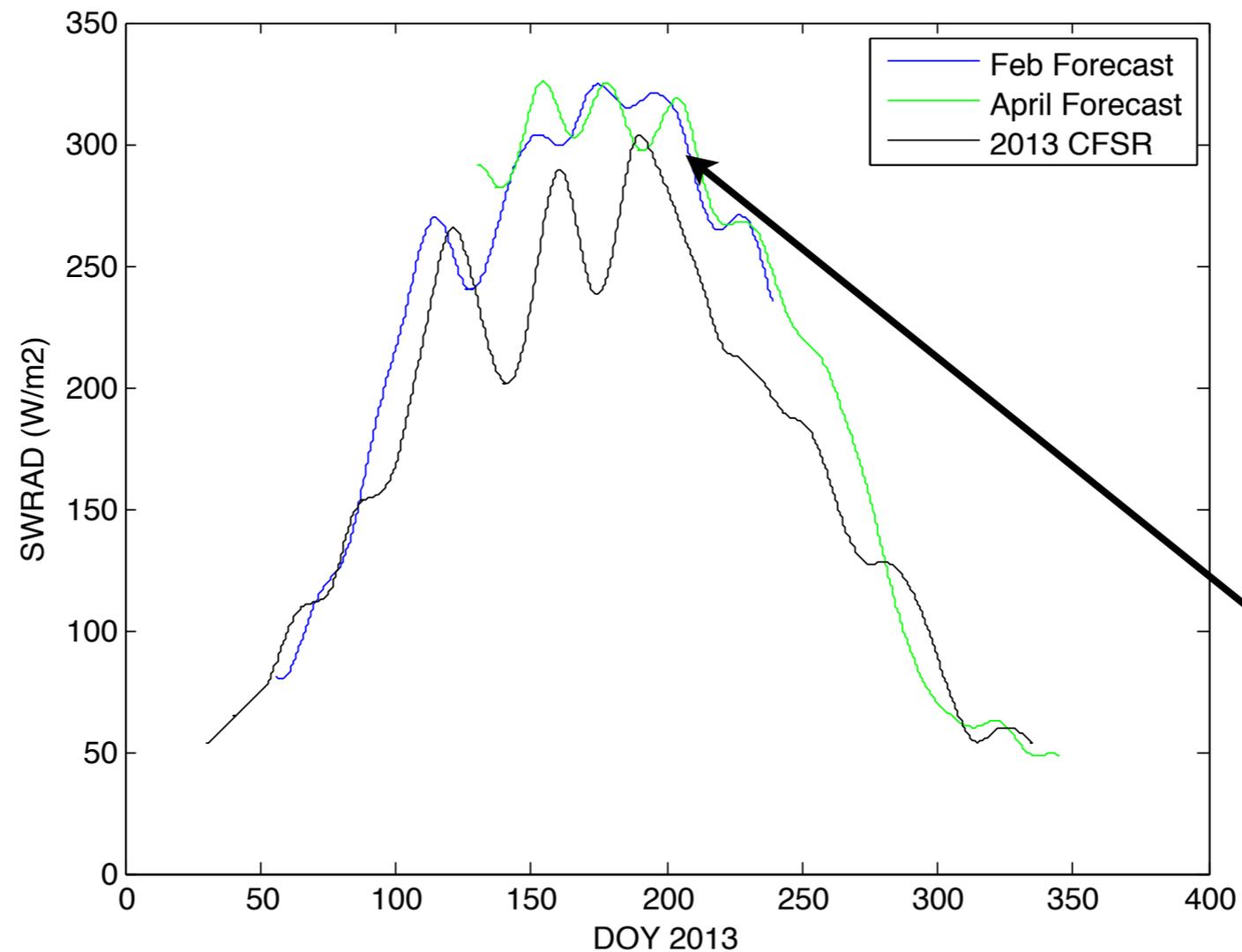


What is needed to build a regional forecast system for CCIEA?

- Observational network with real time data access capabilities.
- A working hindcast simulation - regional models that can predict oxygen and/or pH variability over timescale(s) of interest on the shelf, in the past
- Predictable winds on the timescale(s) of interest in the global model used to drive the regional model
- Predictable SST on timescale(s) of interest in the global model used to drive the regional model
- Stakeholder group(s) needs identified
- Metric of uncertainty
- Continued testing and comparisons with observations on varying time and space scales.... because these are works in progress!

Challenges / Obstacles?

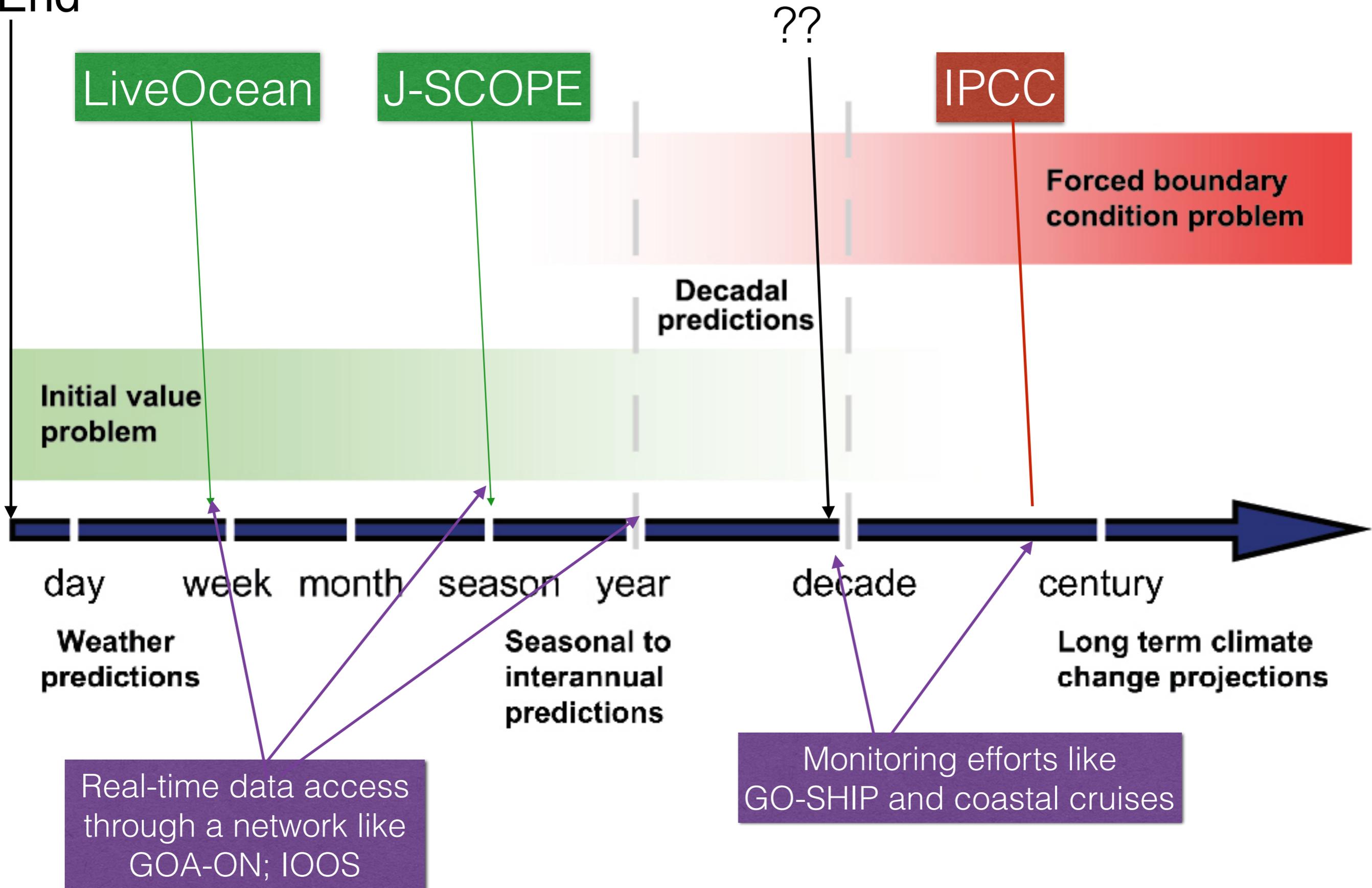
- Predicting Clouds
- Interdisciplinary problem - plagues all timescales



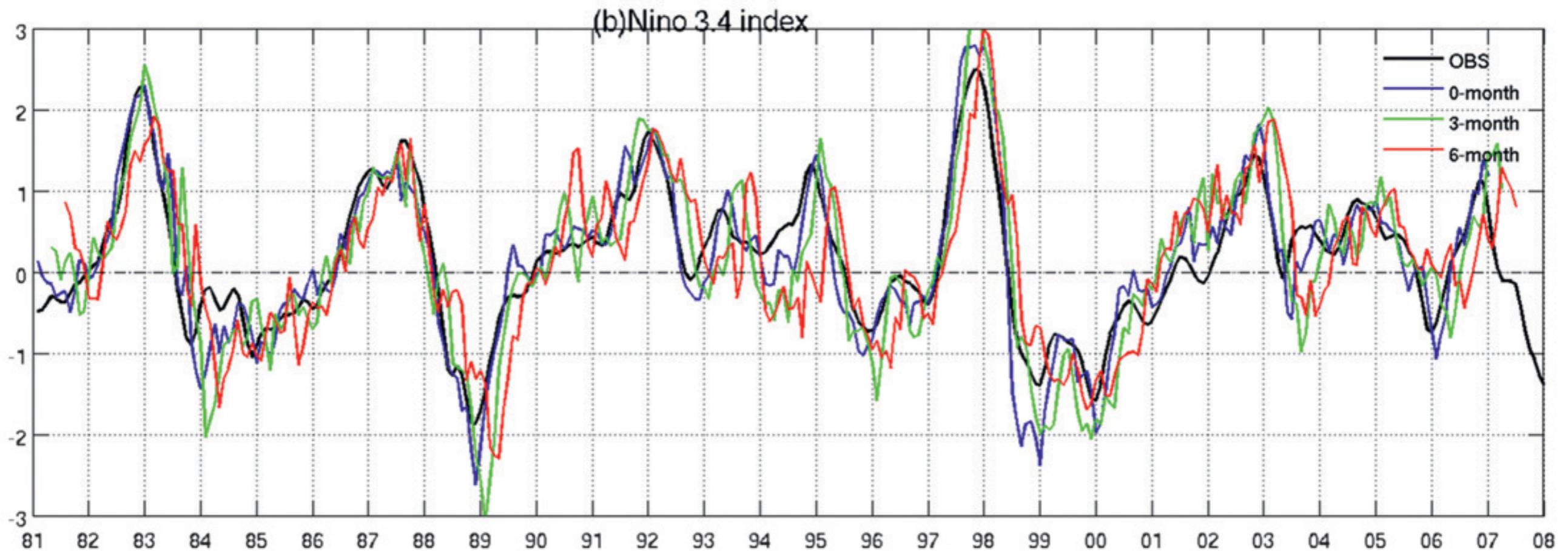
Nearly
100 W/m² in
2009 and a
around
50 W/m²
in 2013

Observations

End



Predictability on the 6-9 months timescale comes from El Nino



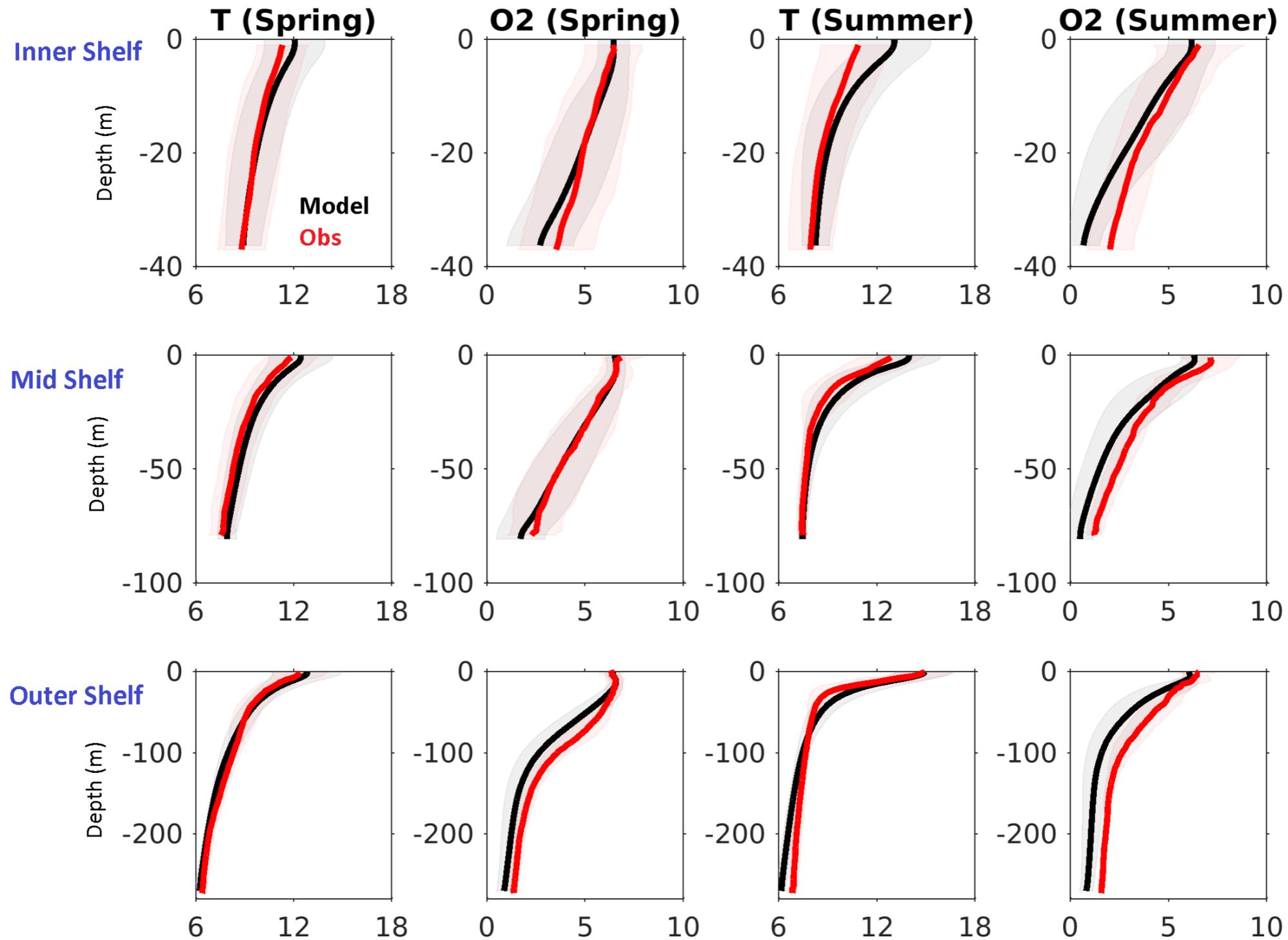
Wen et al, 2012

6 month lead 3 month lead 0 month lead observations

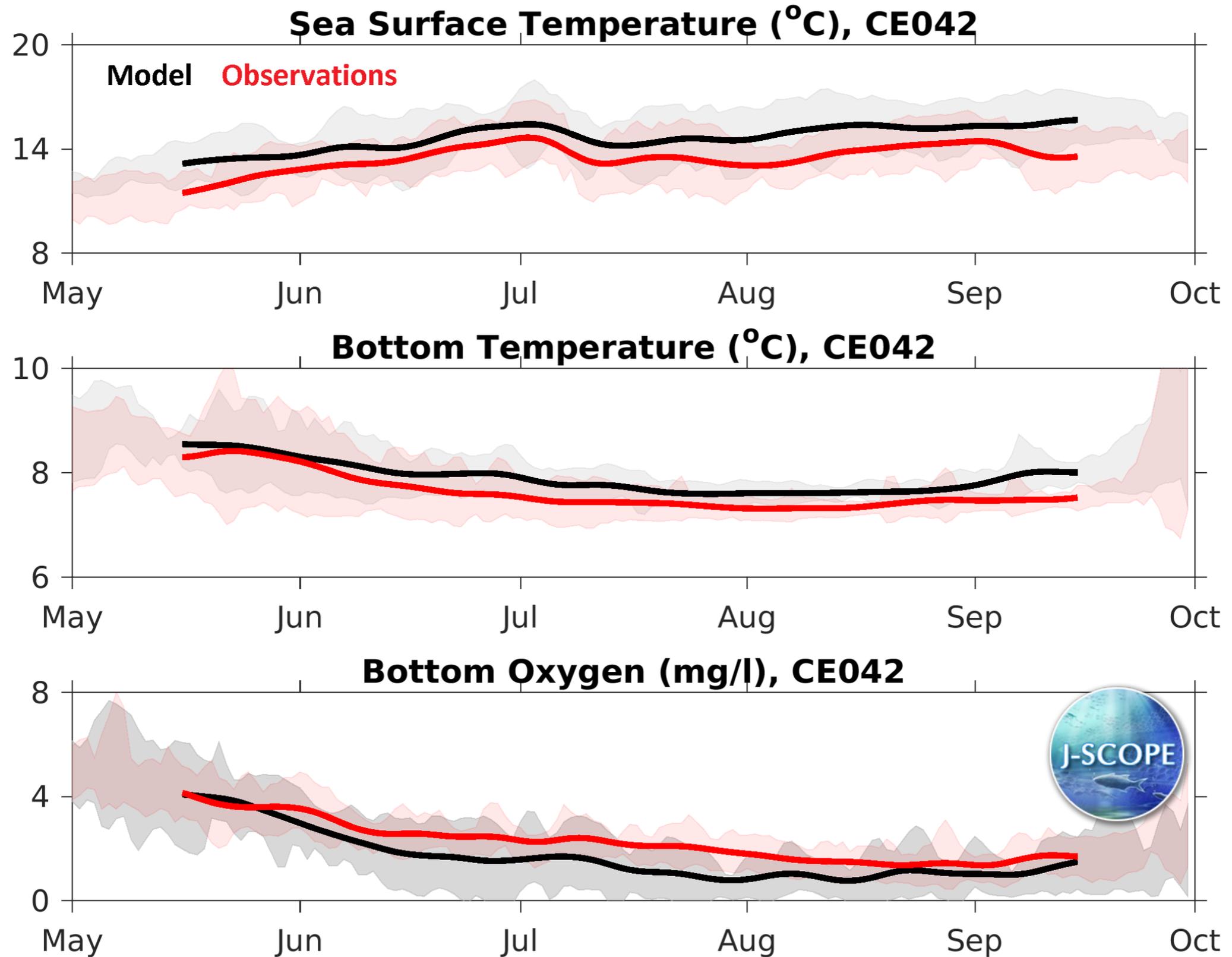
CFS forecast of Nino3.4 SST index does a pretty good job -
better with less lead time

Better during strong El Nino than neutral conditions

New Mini Model Climatology—2009-2014

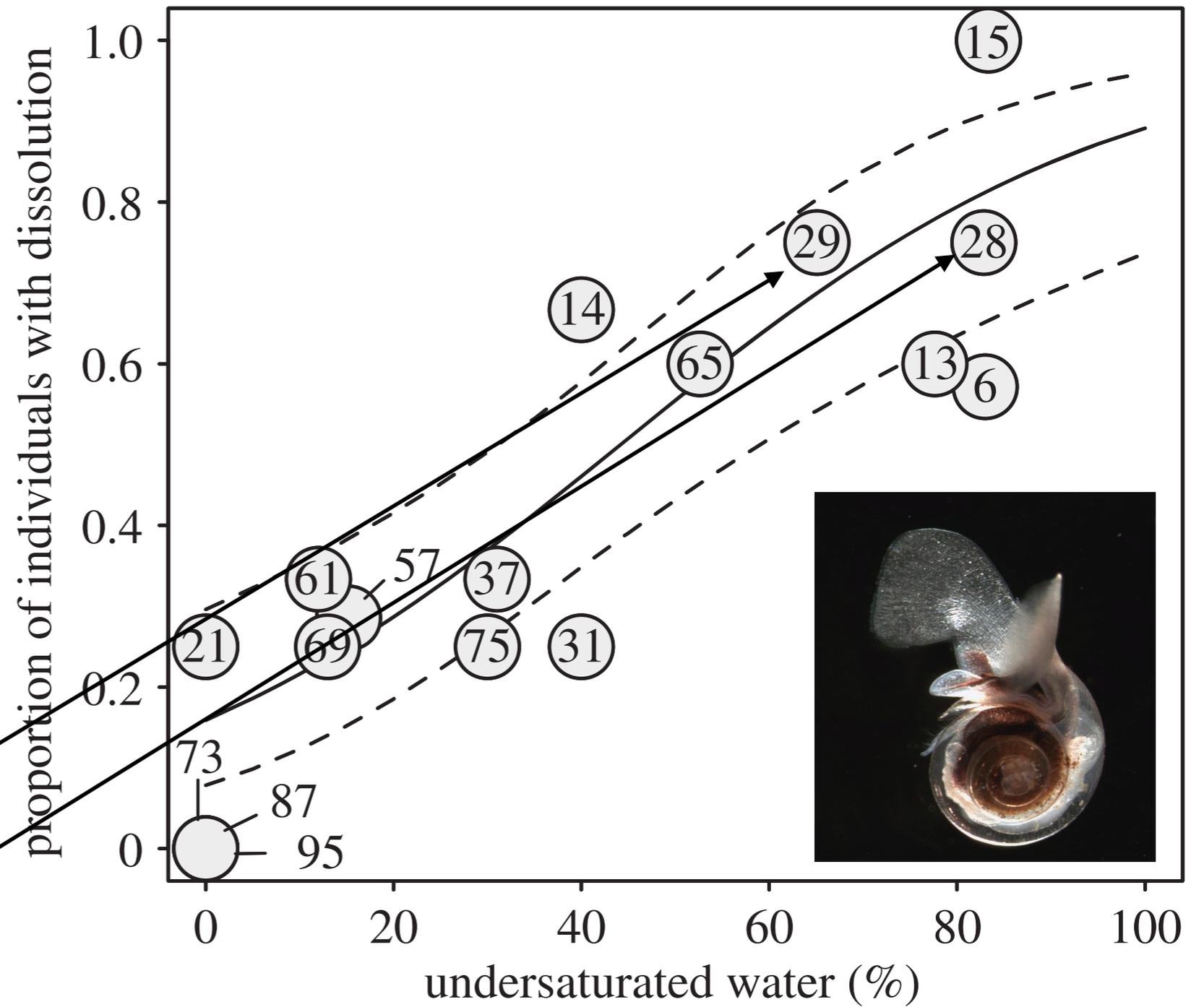
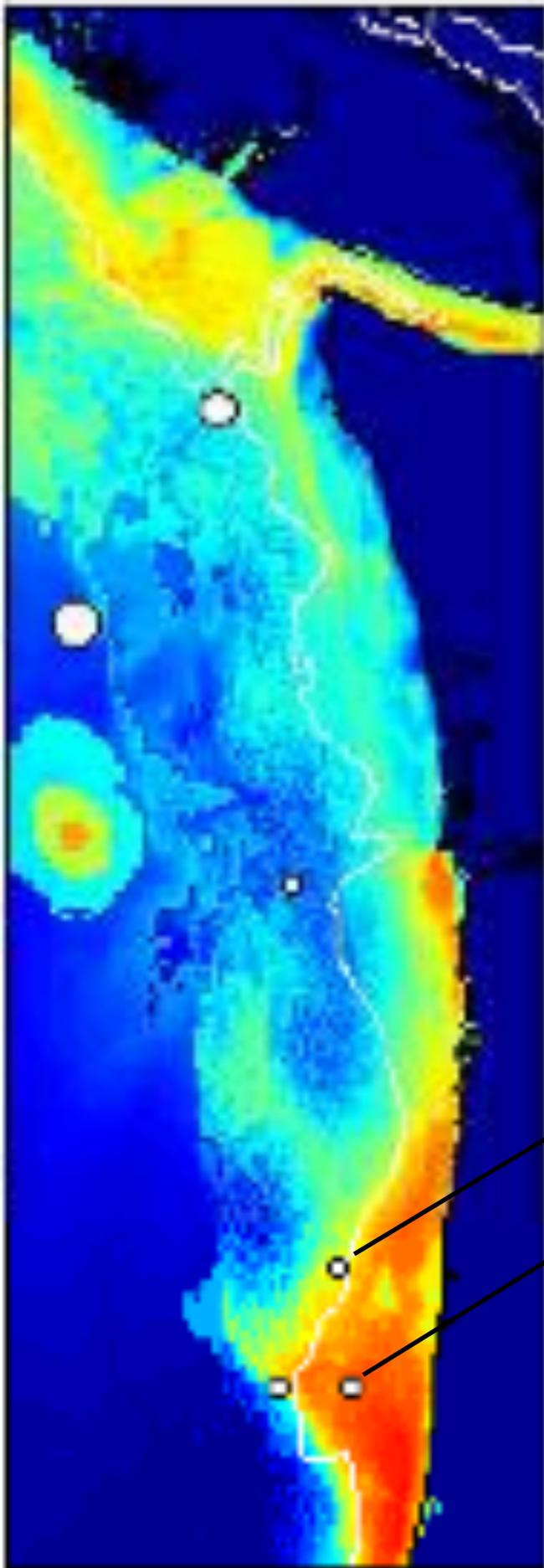


New Mini Model Climatology—2009-2014

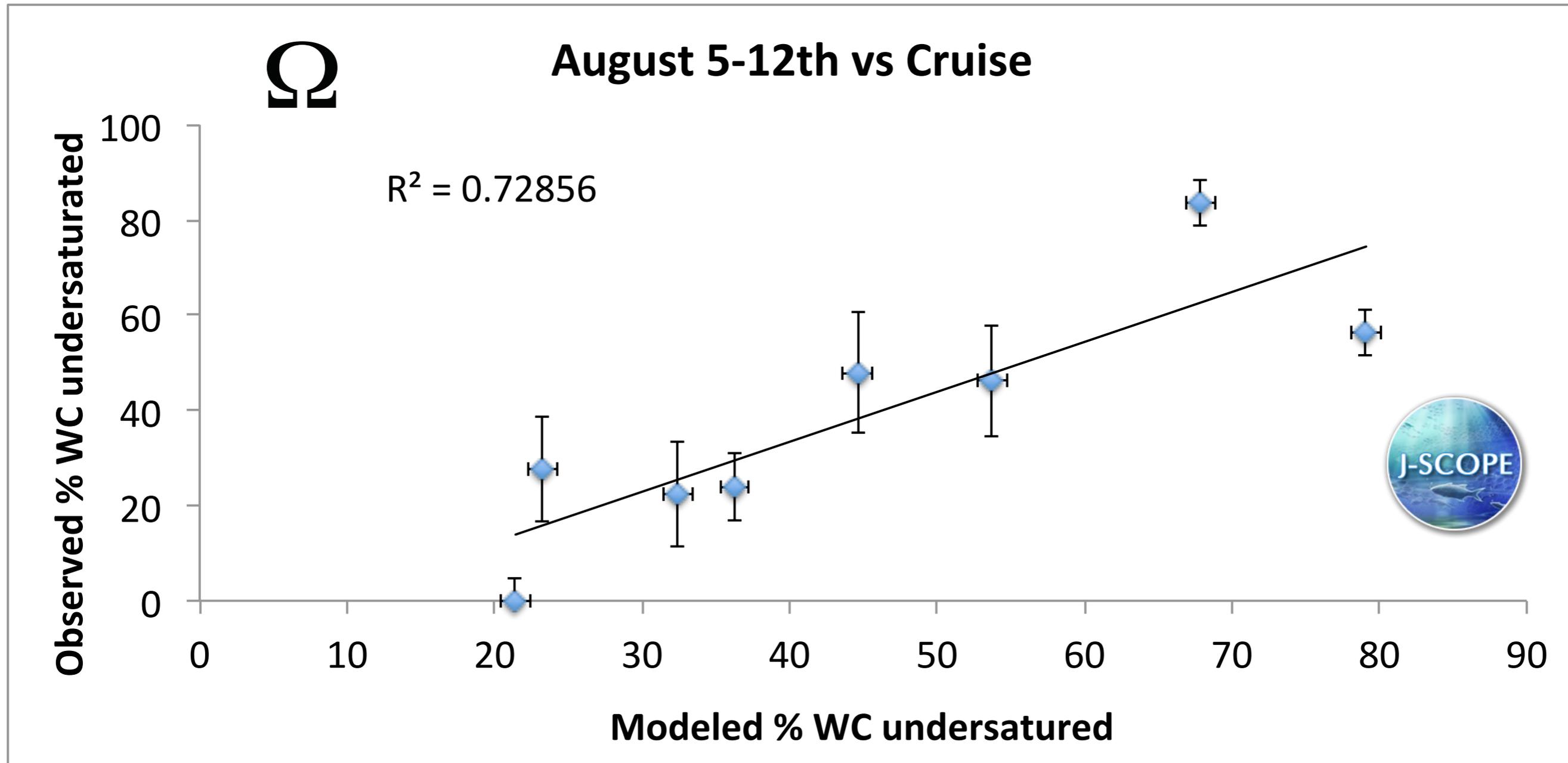


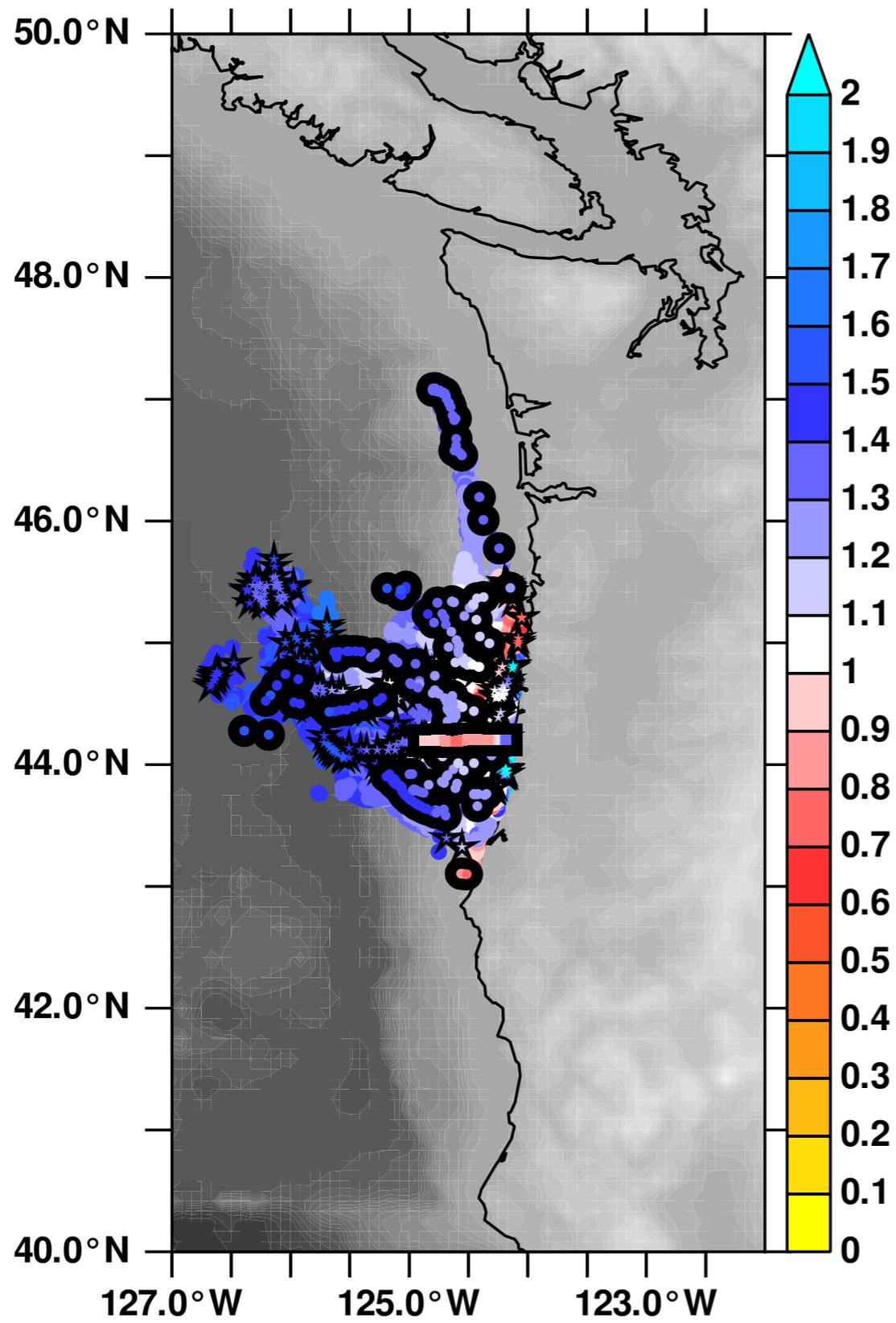
Siedlecki et al, in revision

Biological Response

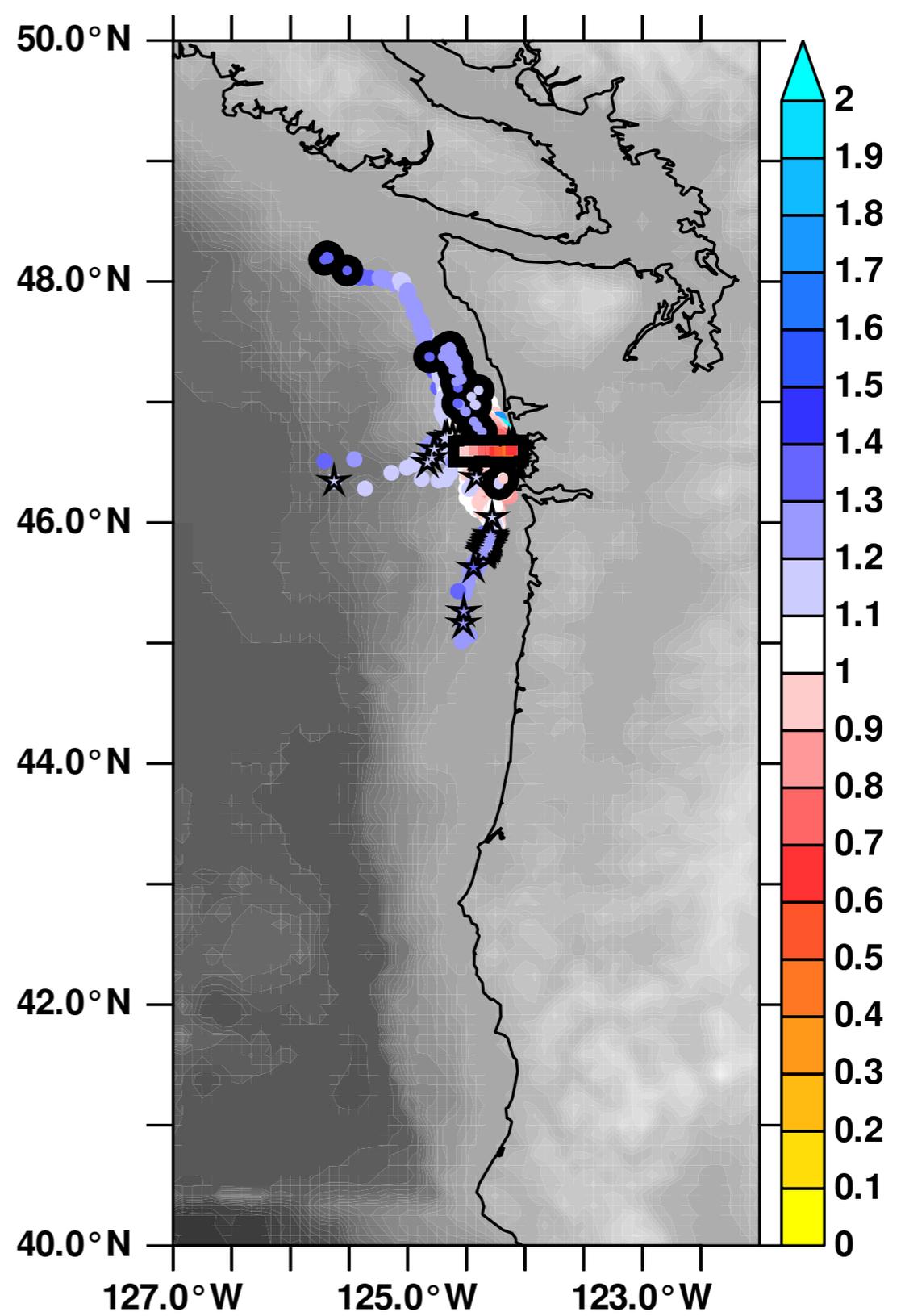


Model predicts Volume of Undersaturated water



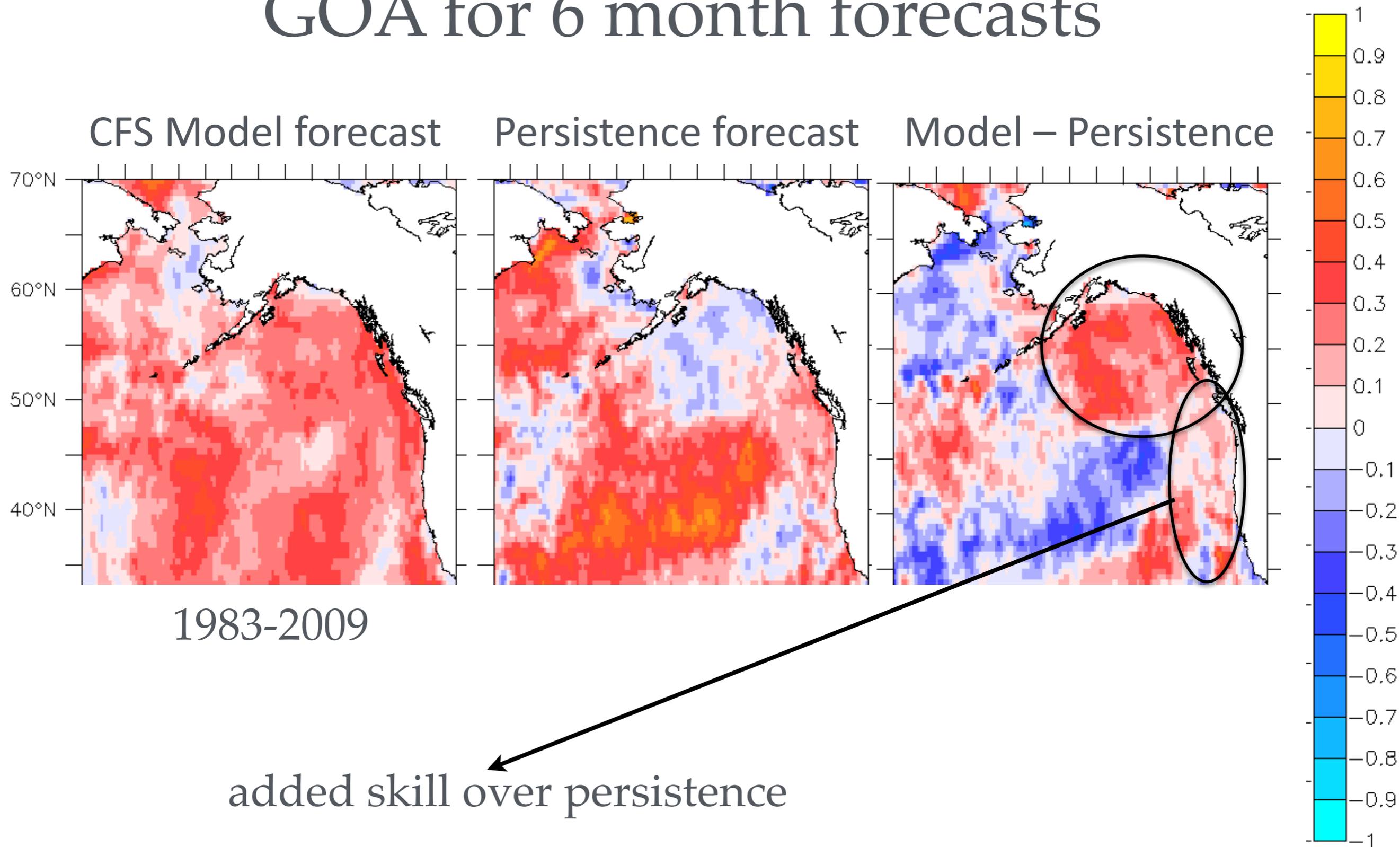


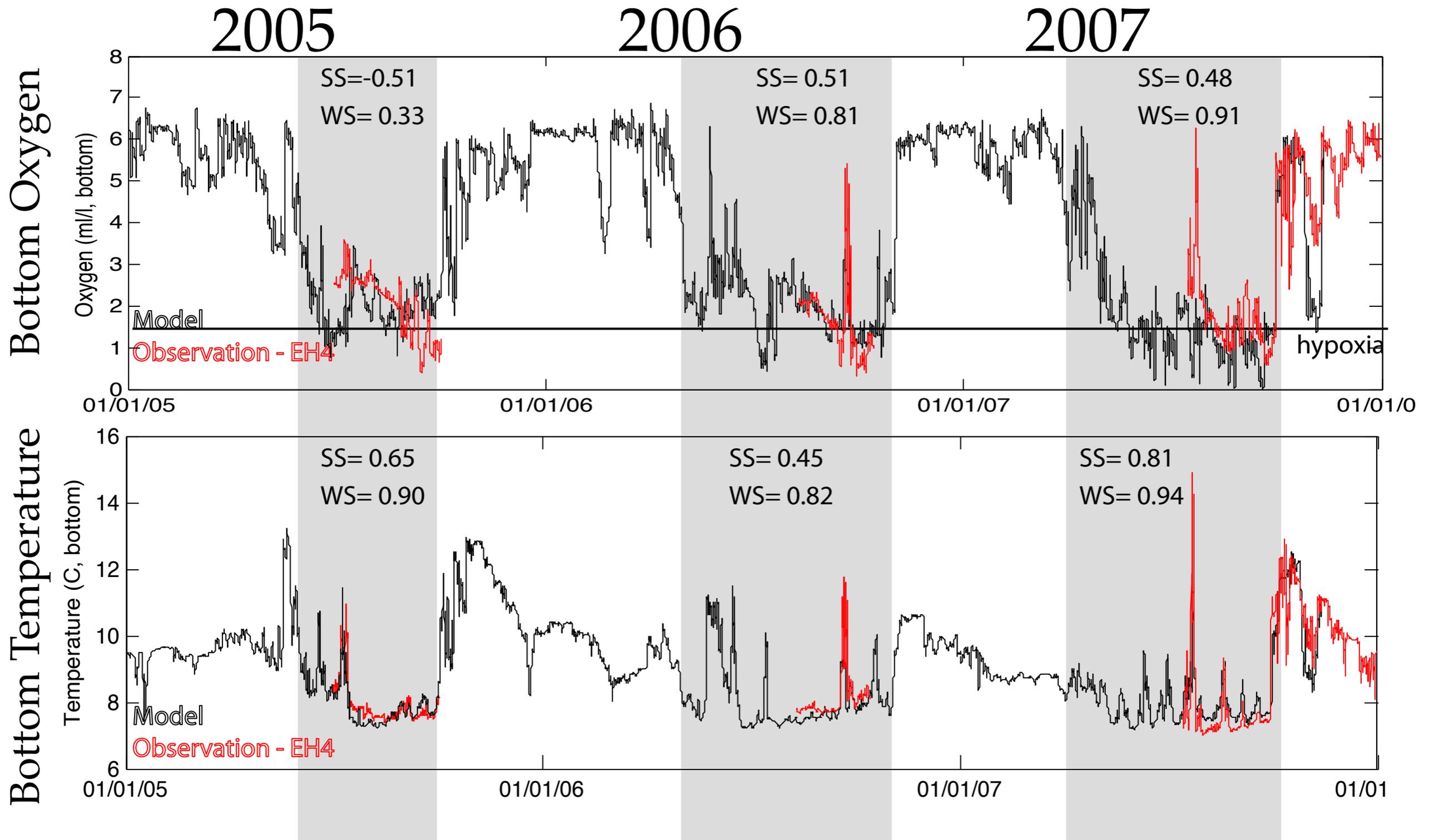
line 1



line 7

SST anomaly correlation for CFS: model adds skill along PNW coast and into GOA for 6 month forecasts





Model Hindcast compared to mooring from WA shelf in 32 m of water showcasing seasonal decline

