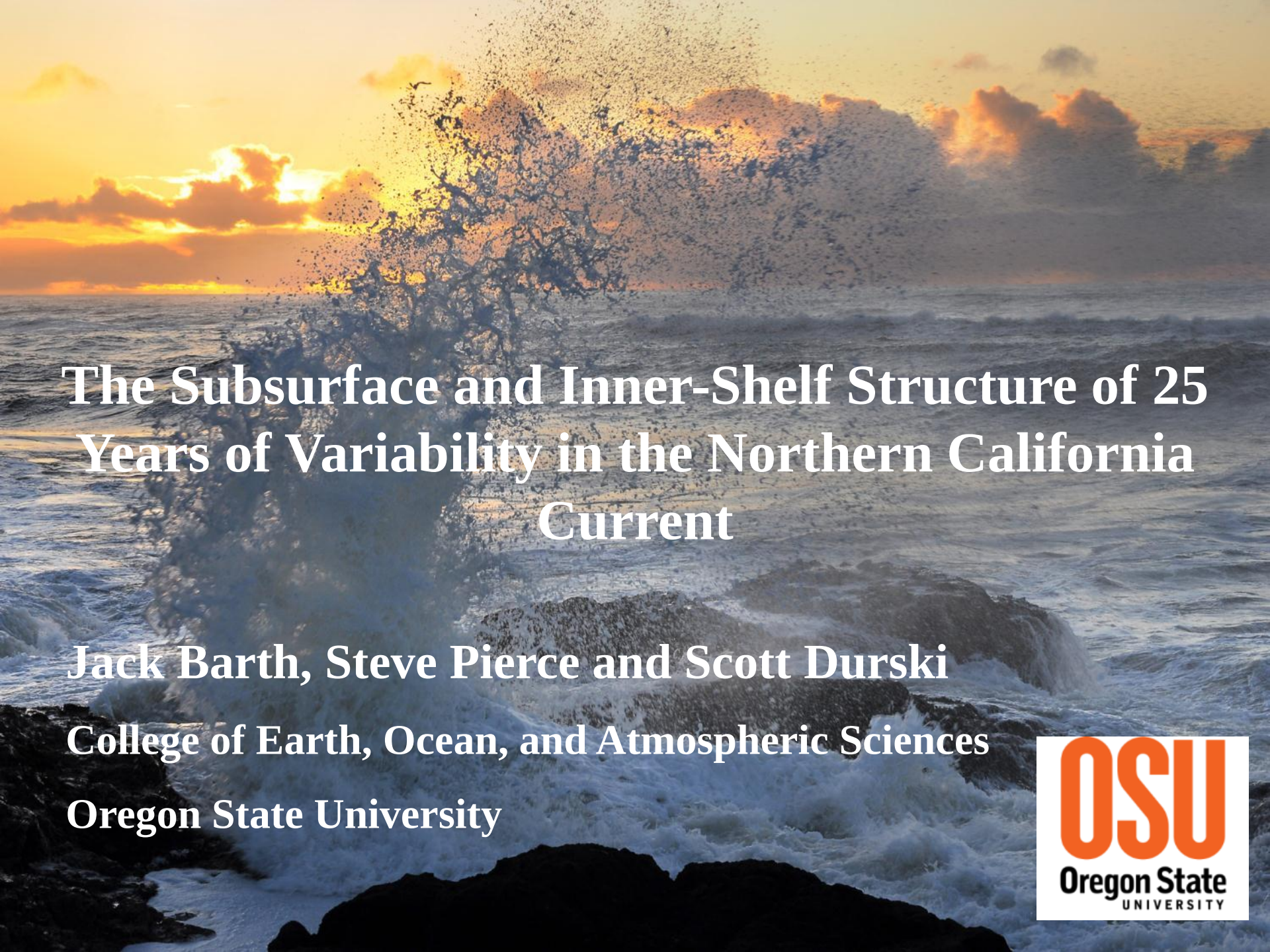
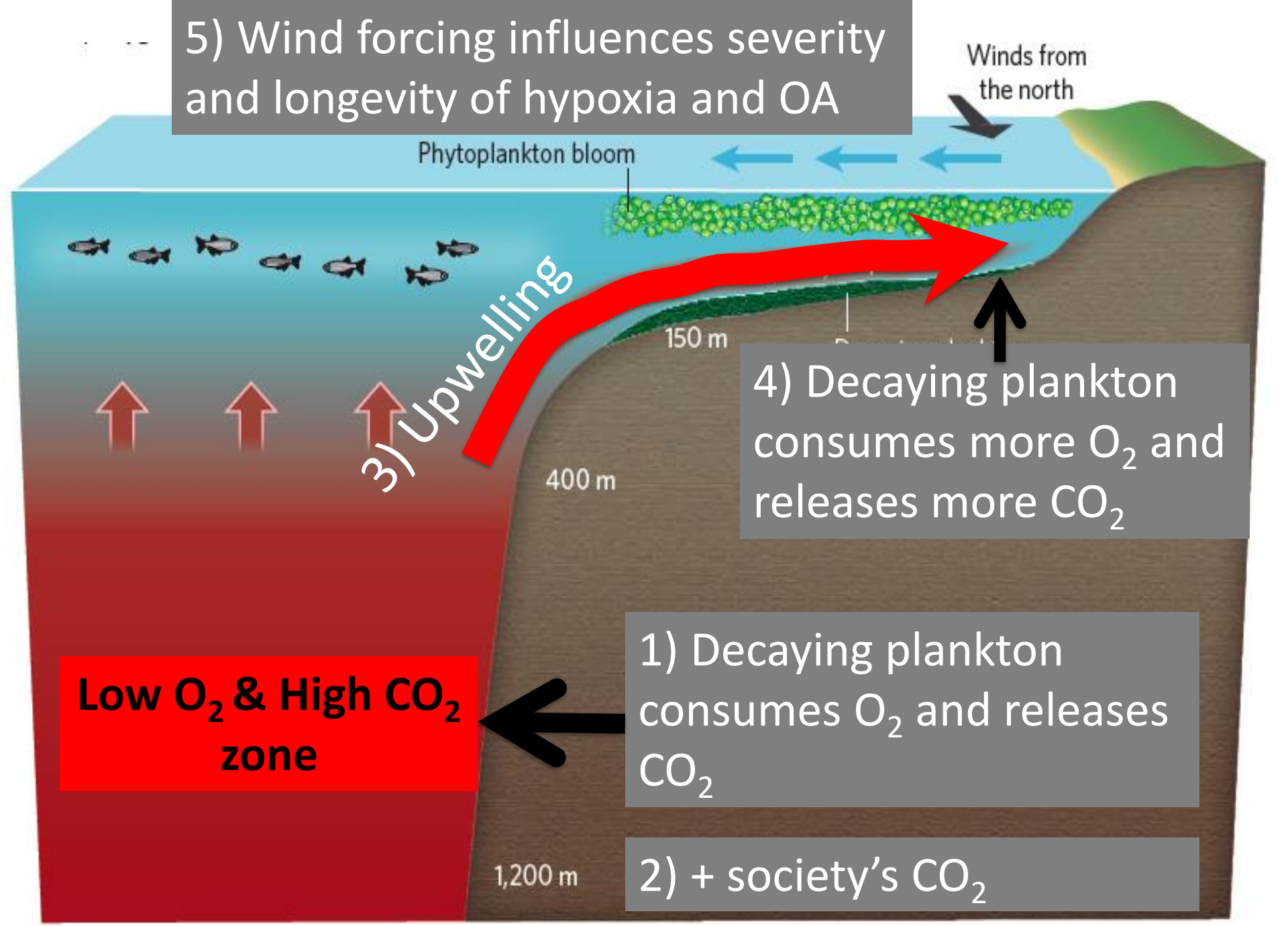


The Subsurface and Inner-Shelf Structure of 25 Years of Variability in the Northern California Current

Jack Barth, Steve Pierce and Scott Durski

College of Earth, Ocean, and Atmospheric Sciences

Oregon State University



Modified from Gewin (2011)

Shifts in the Jet Stream strongly influences the Northeast Pacific and Oregon's weather and ocean conditions

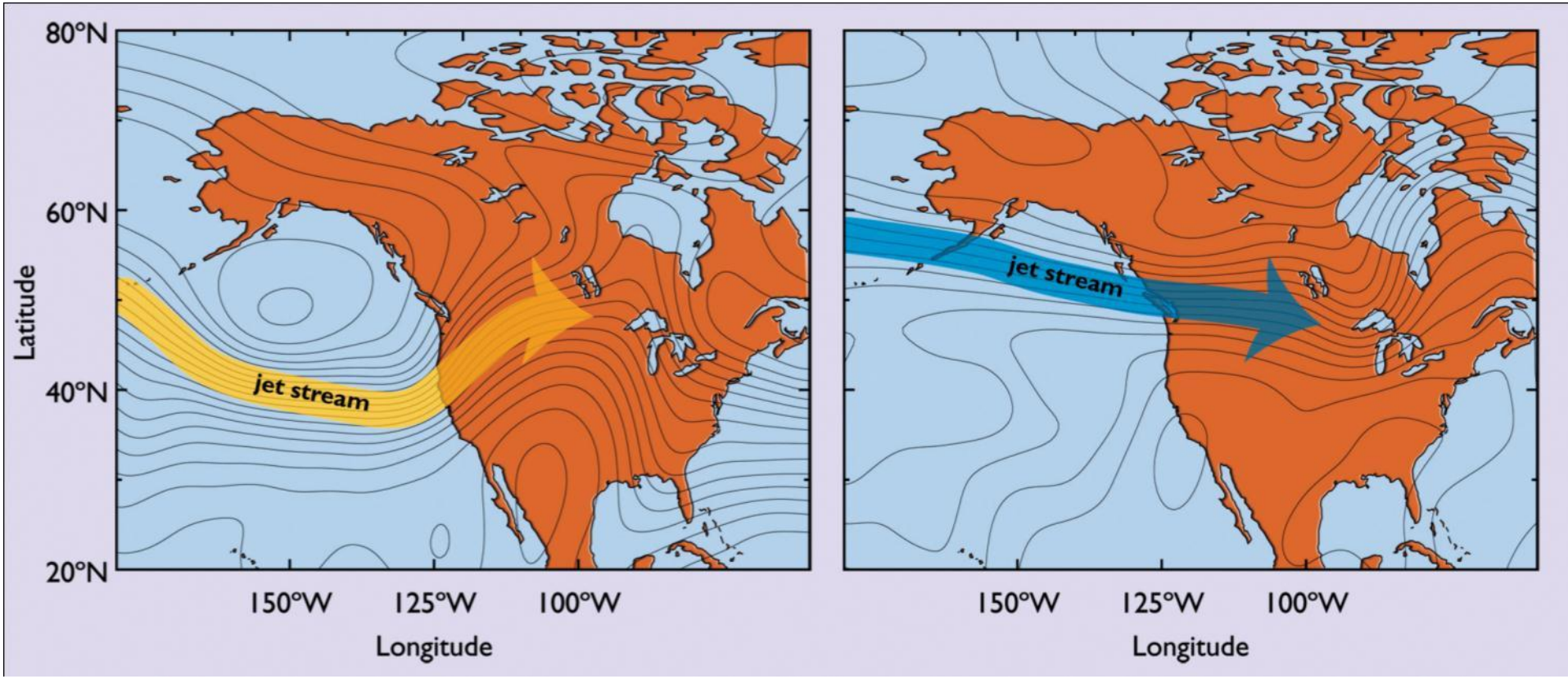
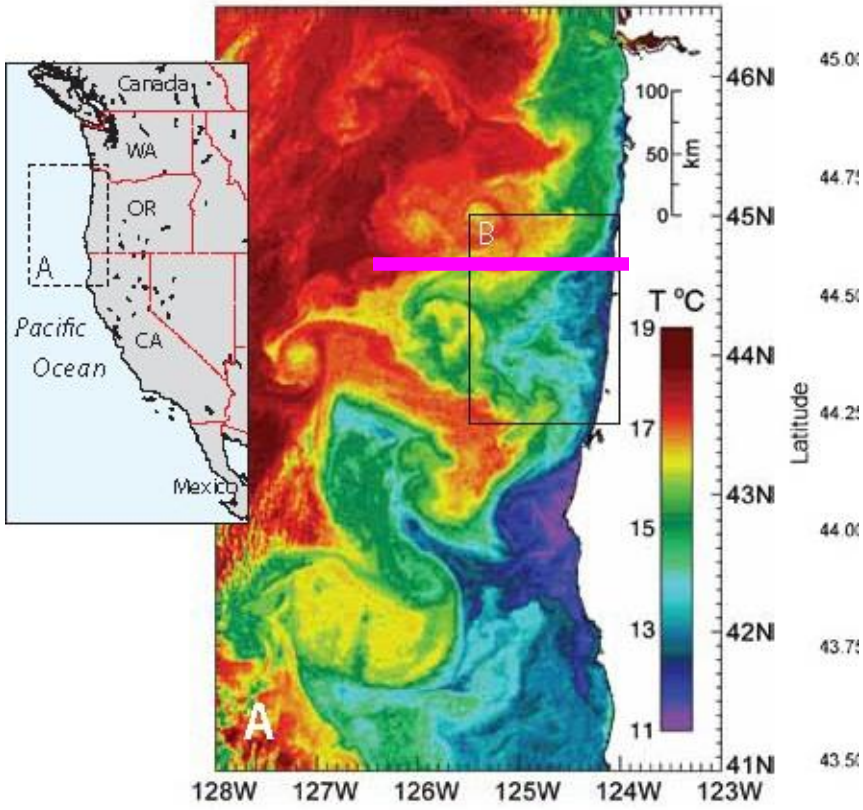
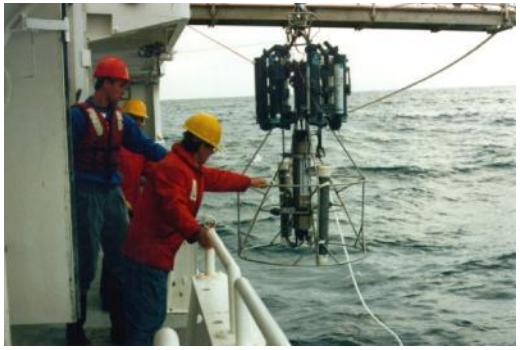


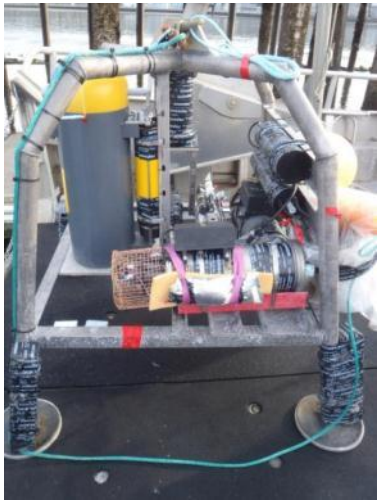
Figure by PISCO

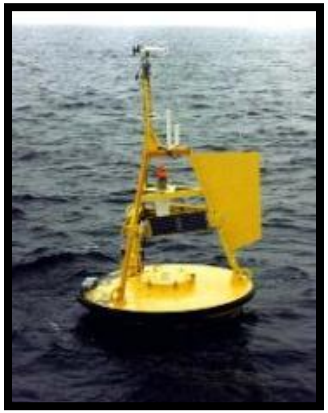


Data from

- 55-year Newport Hydro Line
- NOAA NDBC Buoy 46050
- 11 years of glider data
- moorings, bottom landers, …

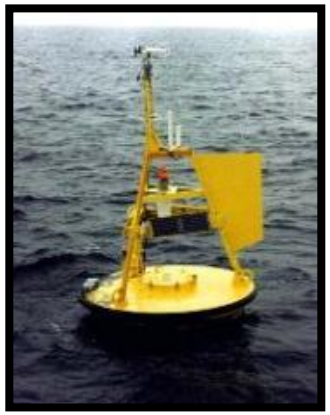


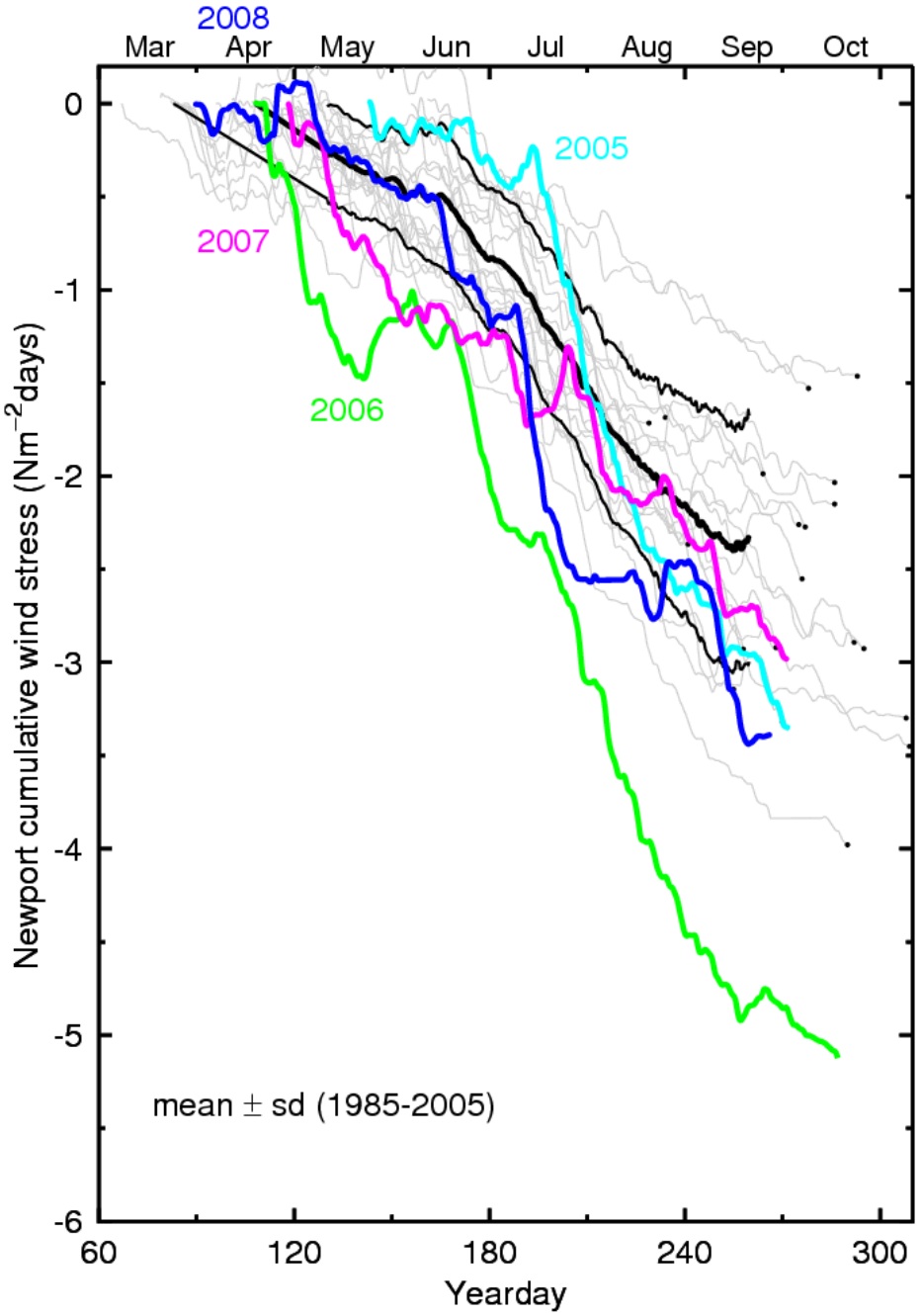




Interannual variability in wind stress

Cumulative wind stress since Spring Transition



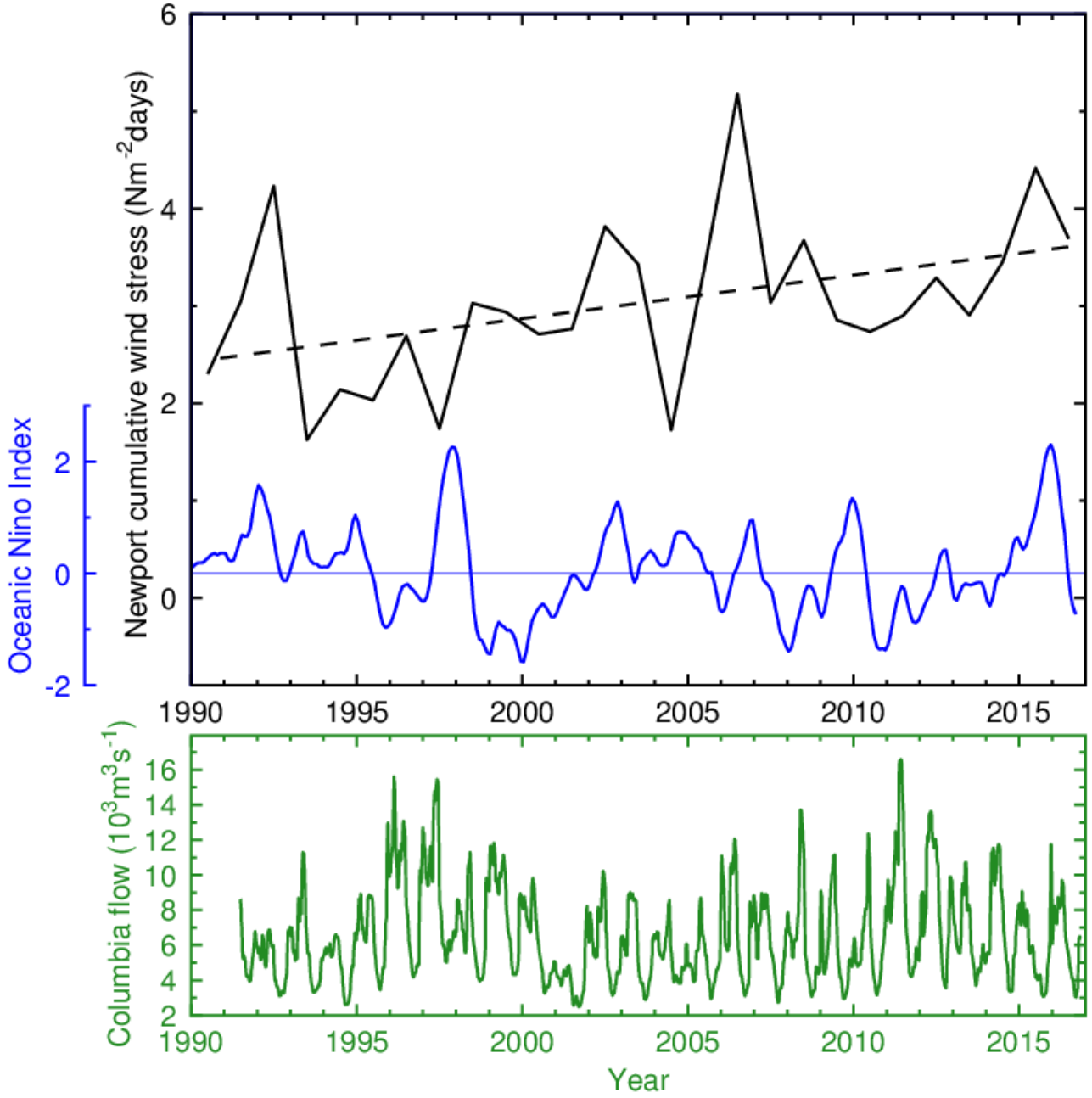


Equatorward, Upwelling favorable

Barth et al. (2007)

http://damp.coas.oregonstate.edu/windstress/

Interannual Variability during the PICES years



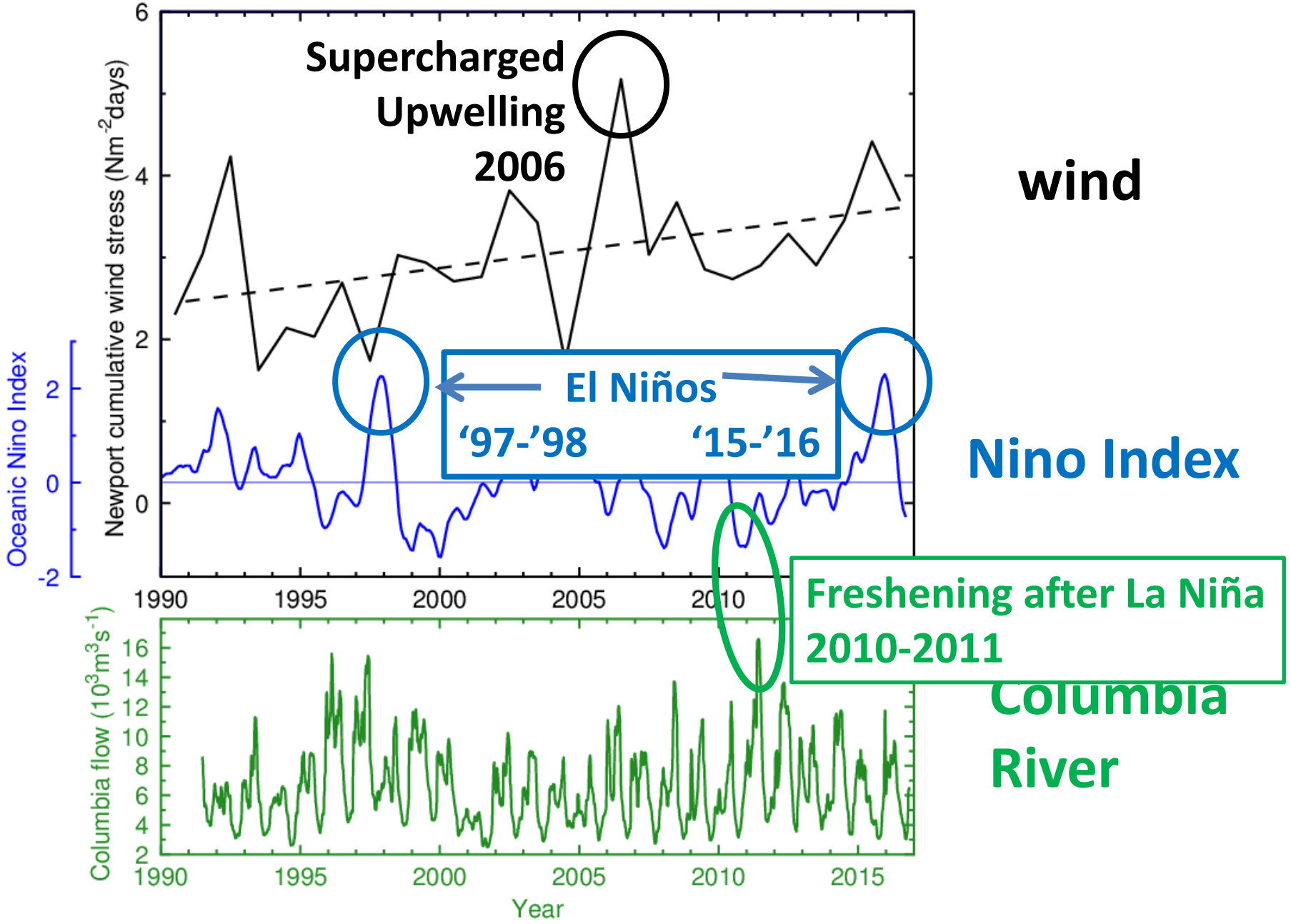
wind

Increase is
3 x 10^{-3} N/m^2/decade

Close to Varela et al.'s (2017) estimate of
4 x 10^{-3} N/m^2/decade
for northern California

Columbia River

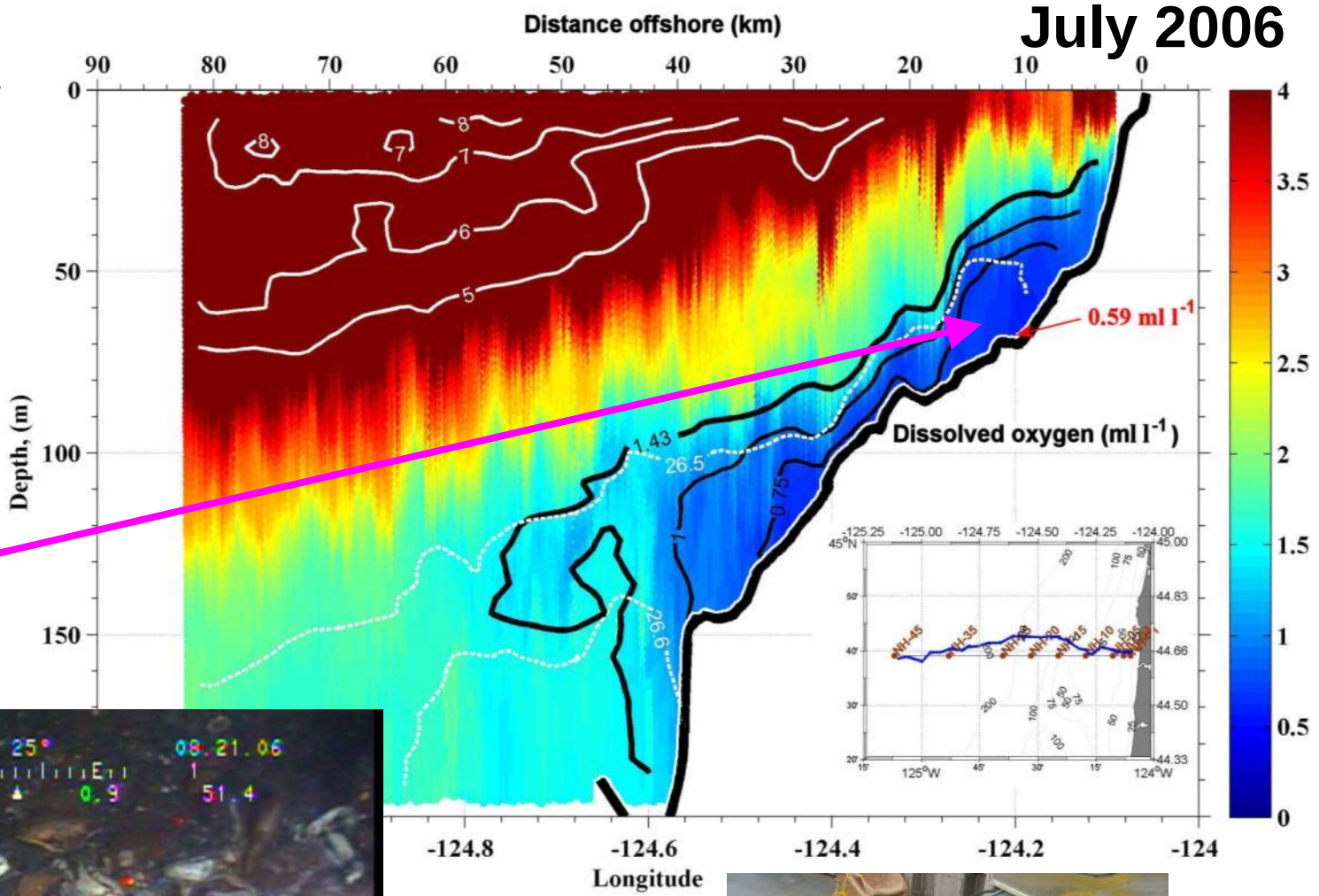
Interannual Variability during the PICES years



Dissolved Oxygen from glider

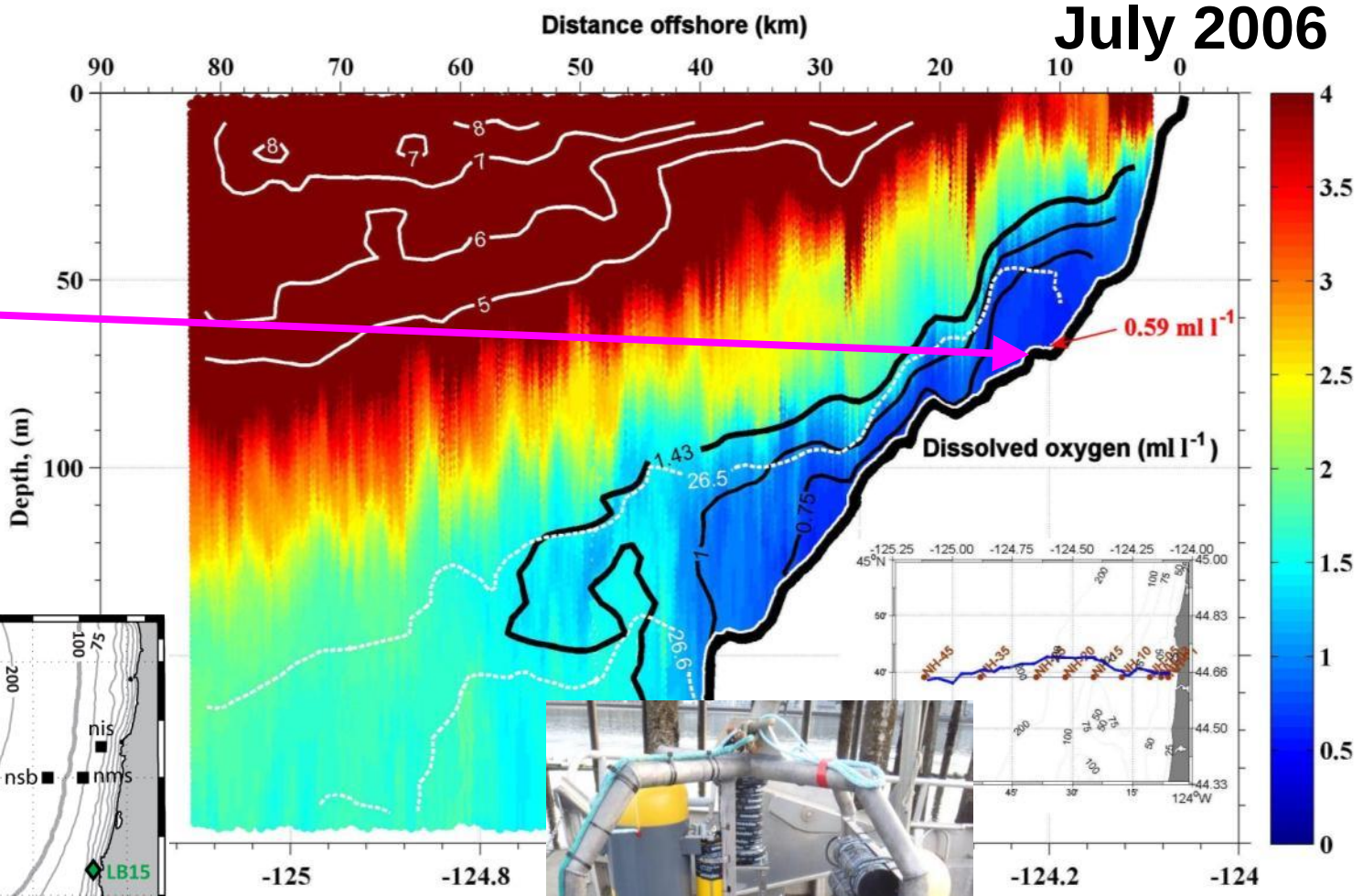
July 2006

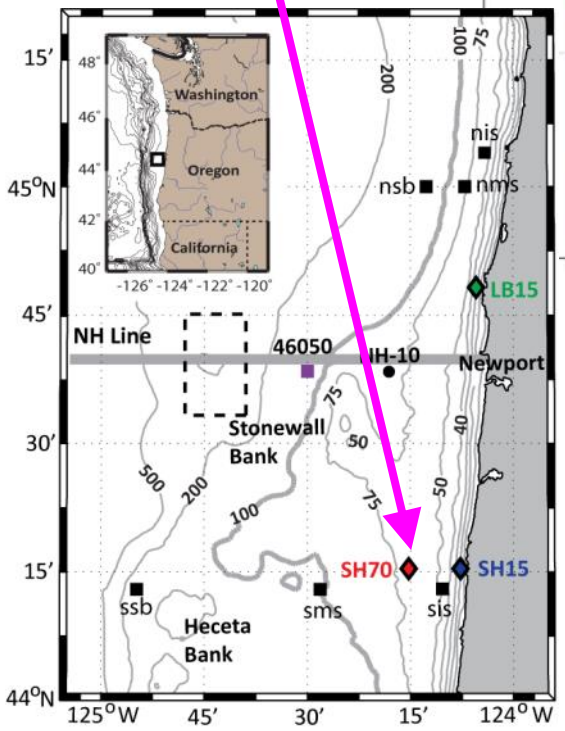
Hypoxia



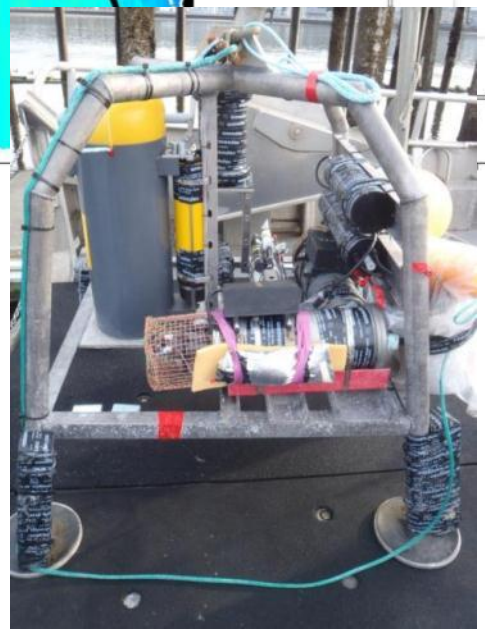
Barth, Shearman, Erofeev (OSU)

mid-shelf bottom lander



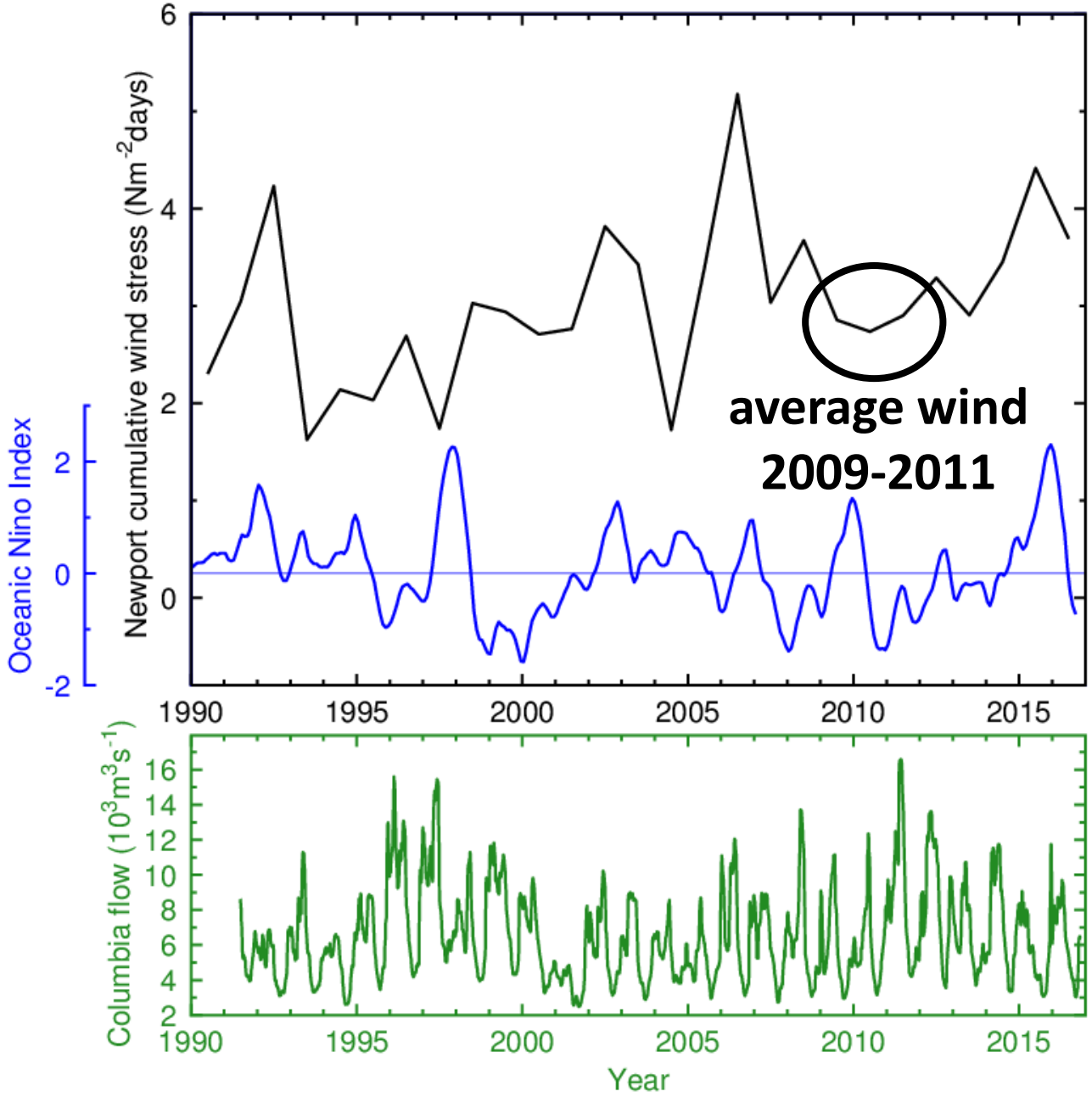


CTD
oxygen
Chl-fluorescence
light backscatter
ADCP
pCO2, pH



Adams, Barth and Chan (JGR, 2013)

Interannual Variability during the PICES years

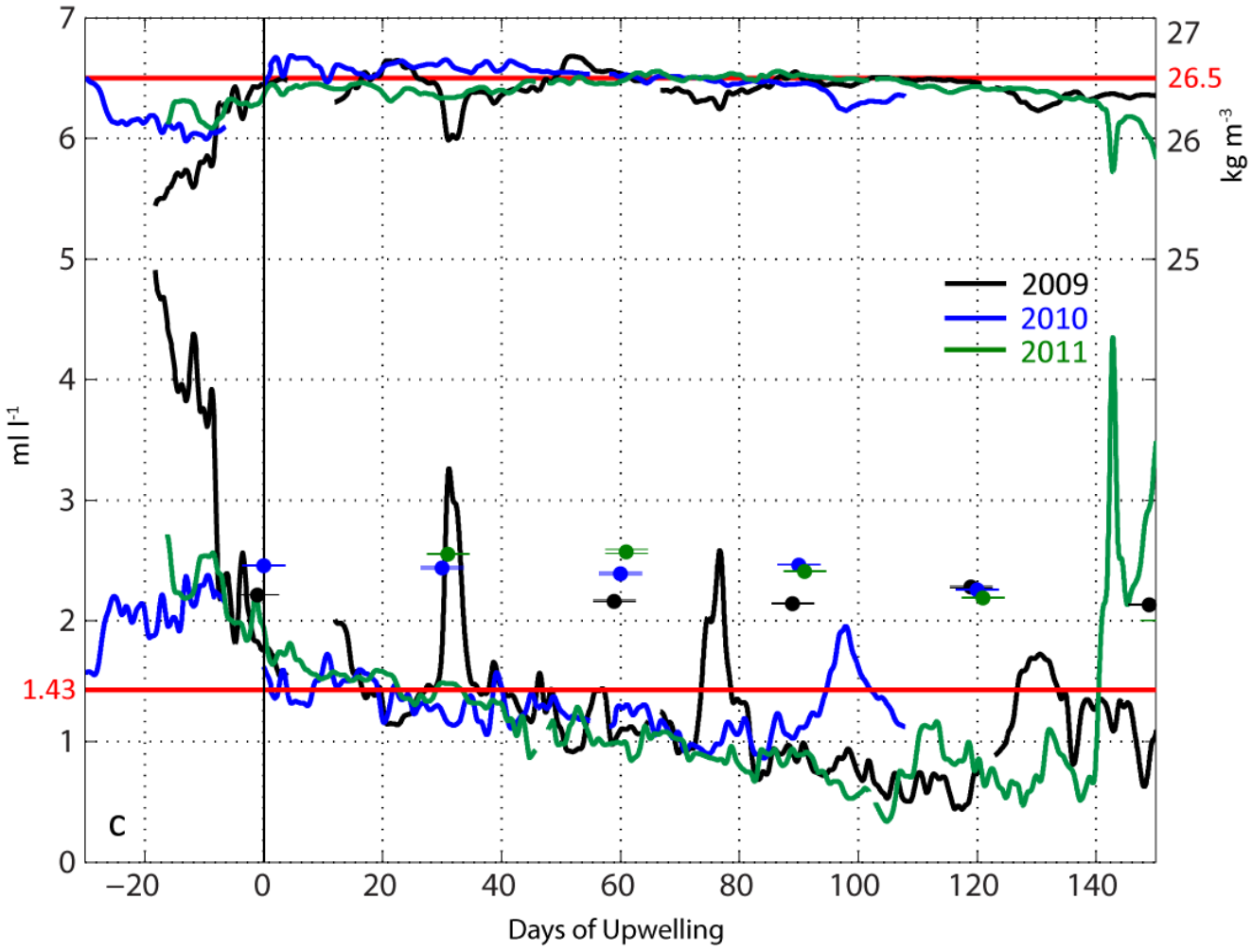


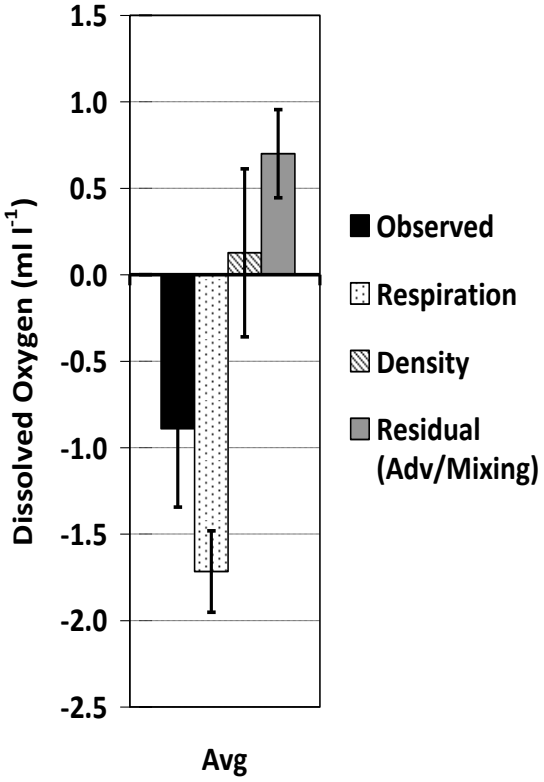
wind

Nino Index

Columbia River

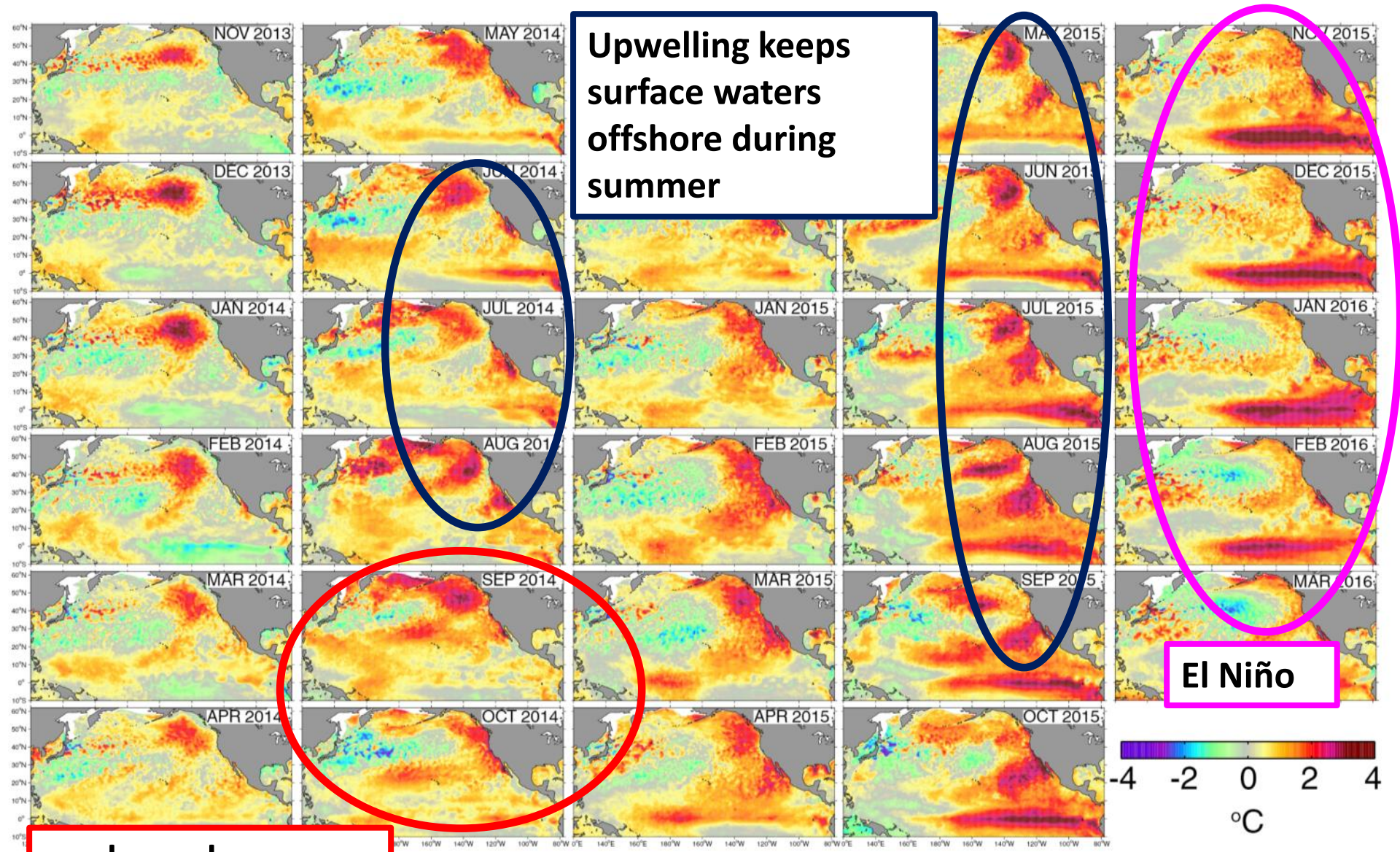
Oregon near-bottom time series … shifted by start of spring-summer upwelling season





Adams, Barth and Chan (2013)

The “Warm Blob” and El Niño



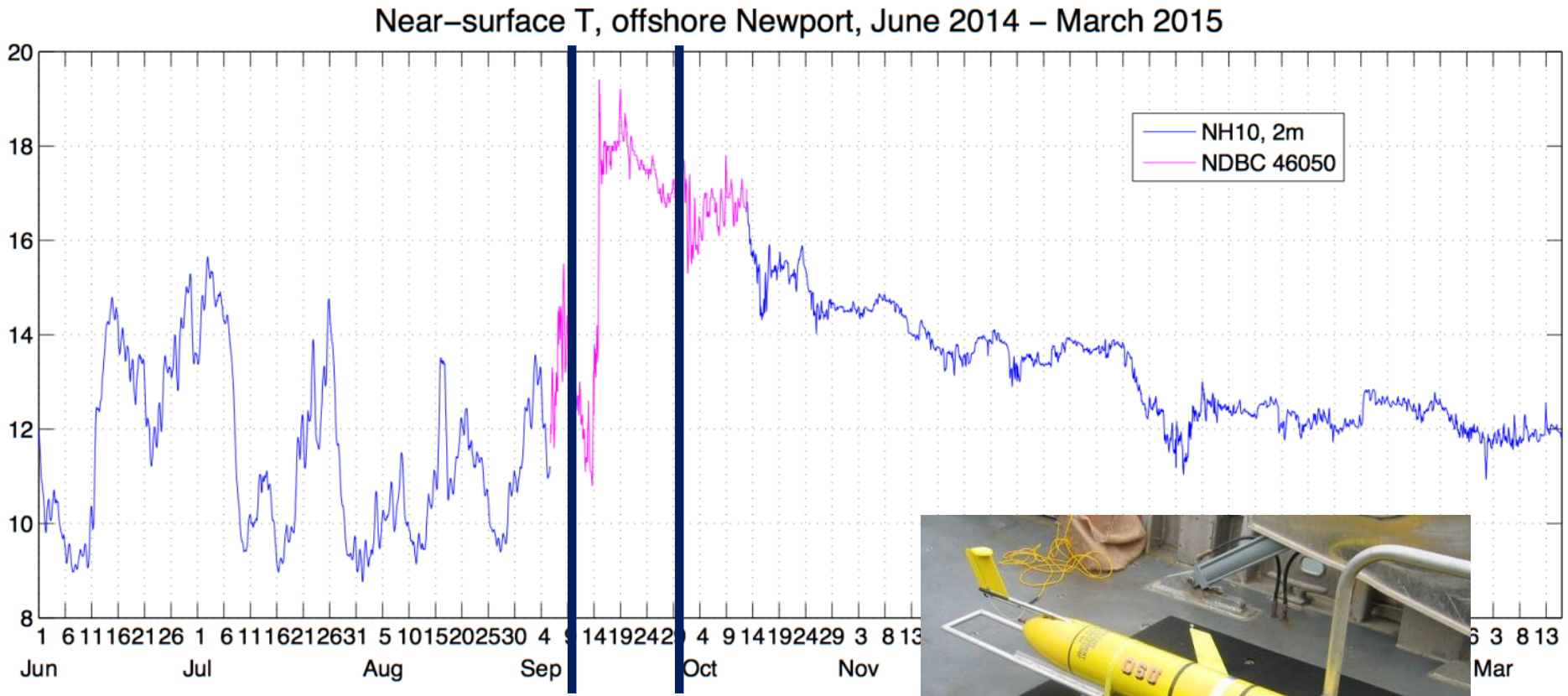
Upwelling keeps surface waters offshore during summer

El Niño

crashes ashore In September 2014

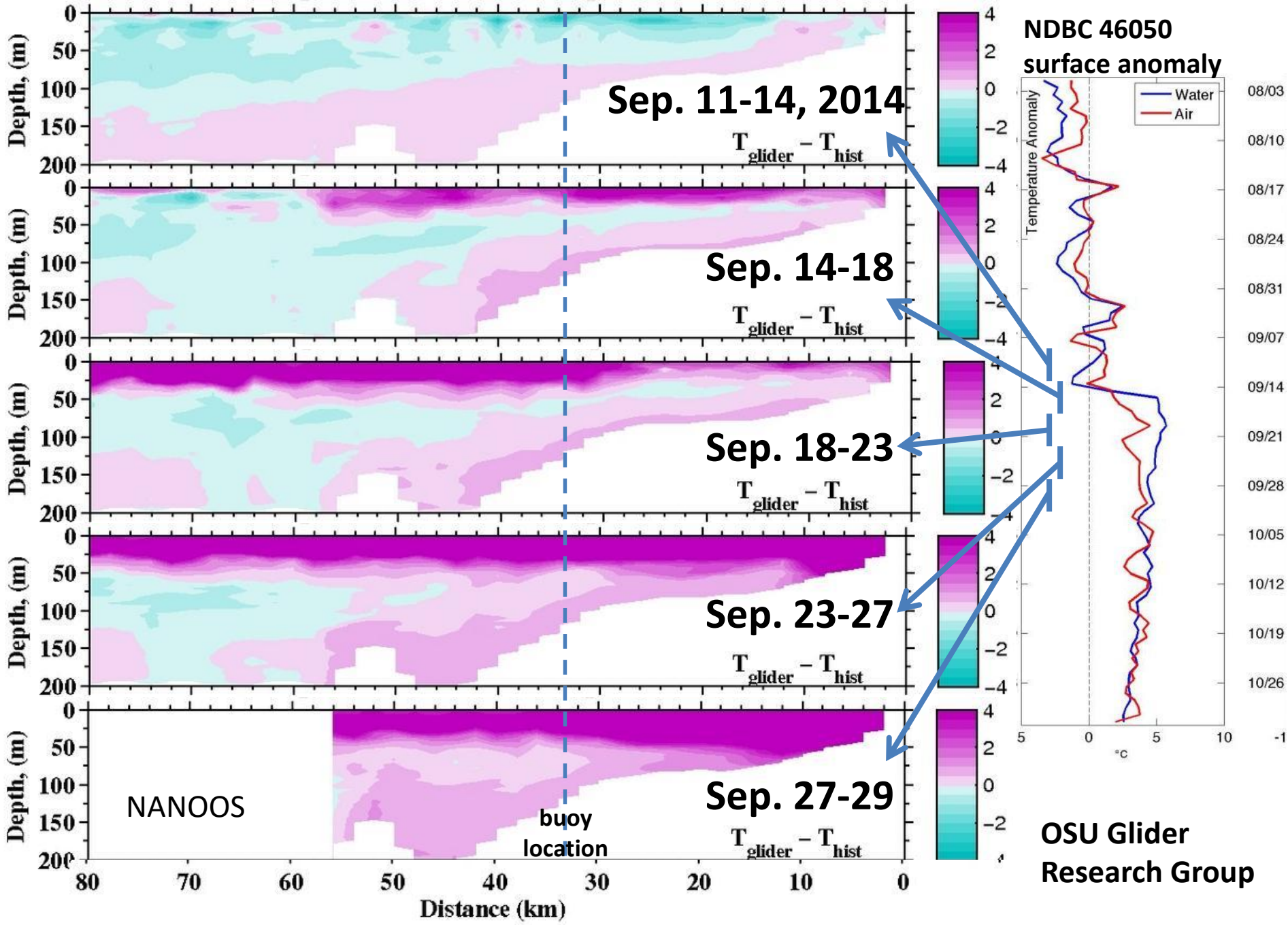
Plot by Craig Risien (OSU)

Surface Temperature on the Oregon shelf, 6/1/2014 – 3/14/2015



glider transects

Newport, Oregon, (44.65°N) Temperature Anomaly (°C)



Trinidad Head (41° 3'N) glider line

December 2014 – present

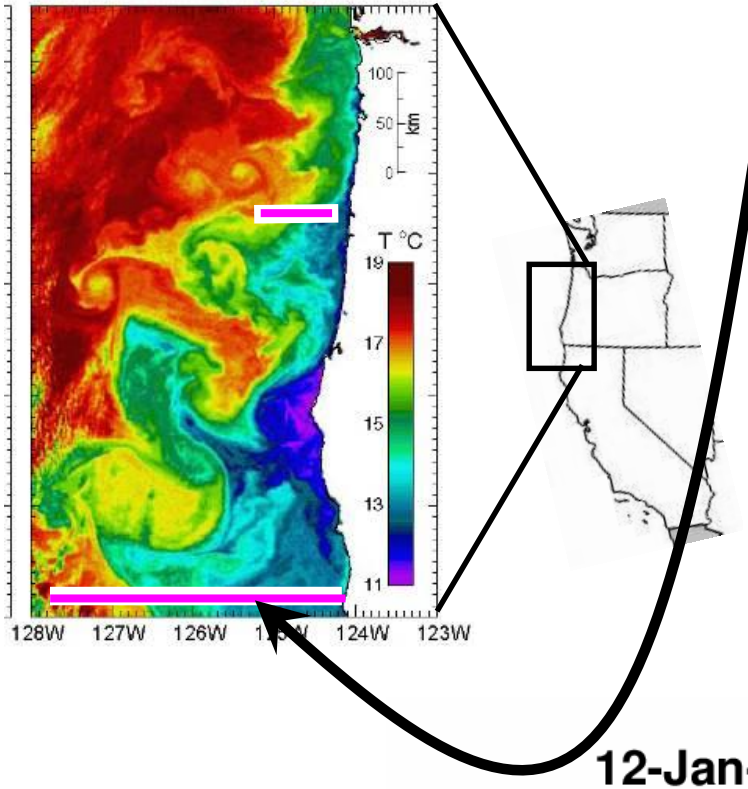
~100-m isobath to 500 km offshore

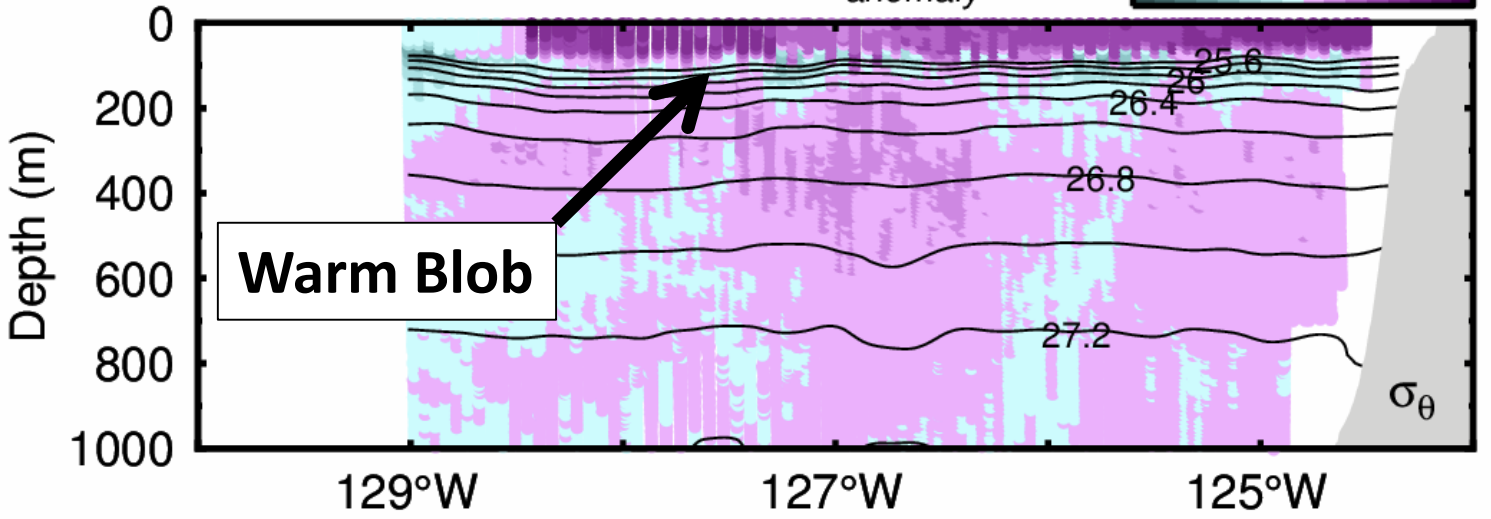
~1 month for each section; ~20 sections

Oregon State University

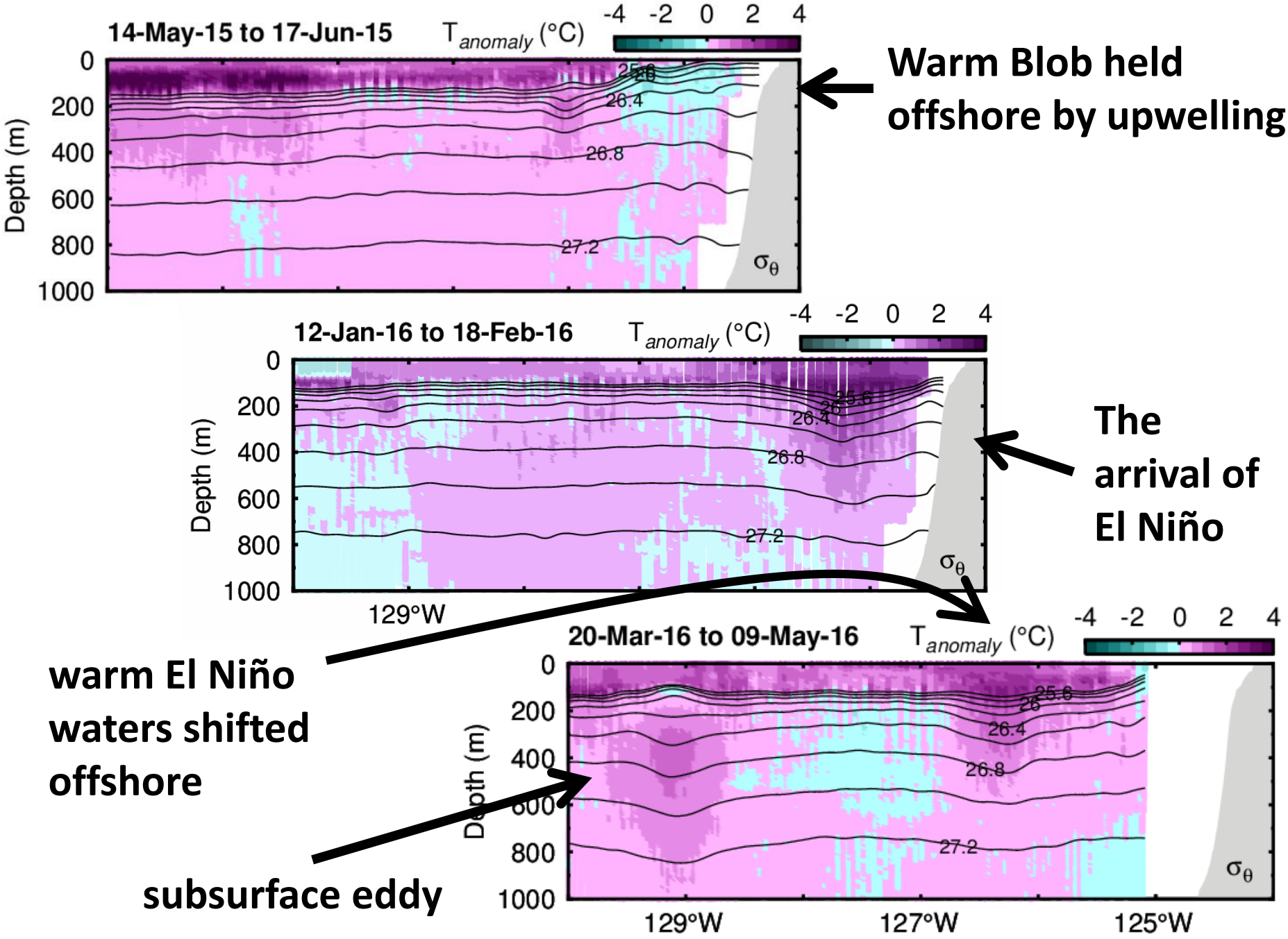
in collaboration with Eric Bjorkstedt (NOAA/HSU)

Jointly supported by NANOOS/CeNCOOS



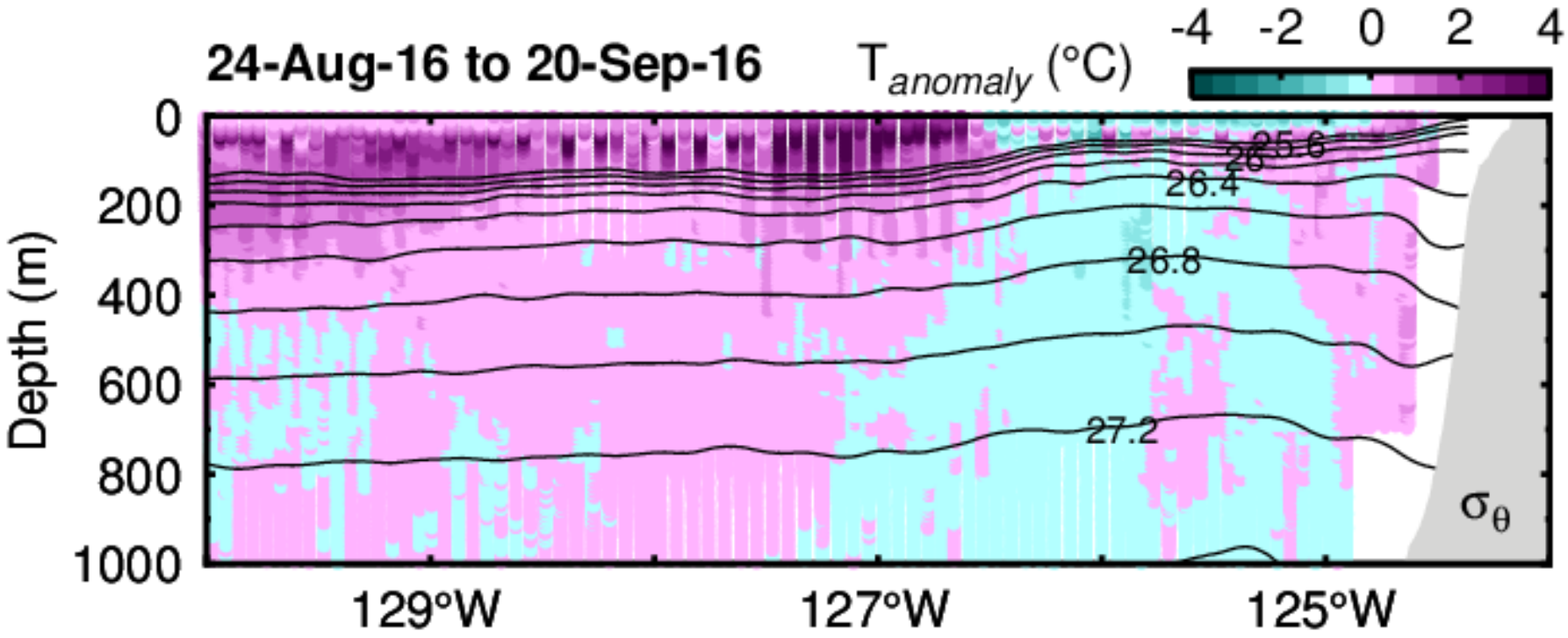


Barth, Shearman, Erofeev, Pierce, Bjorkstedt

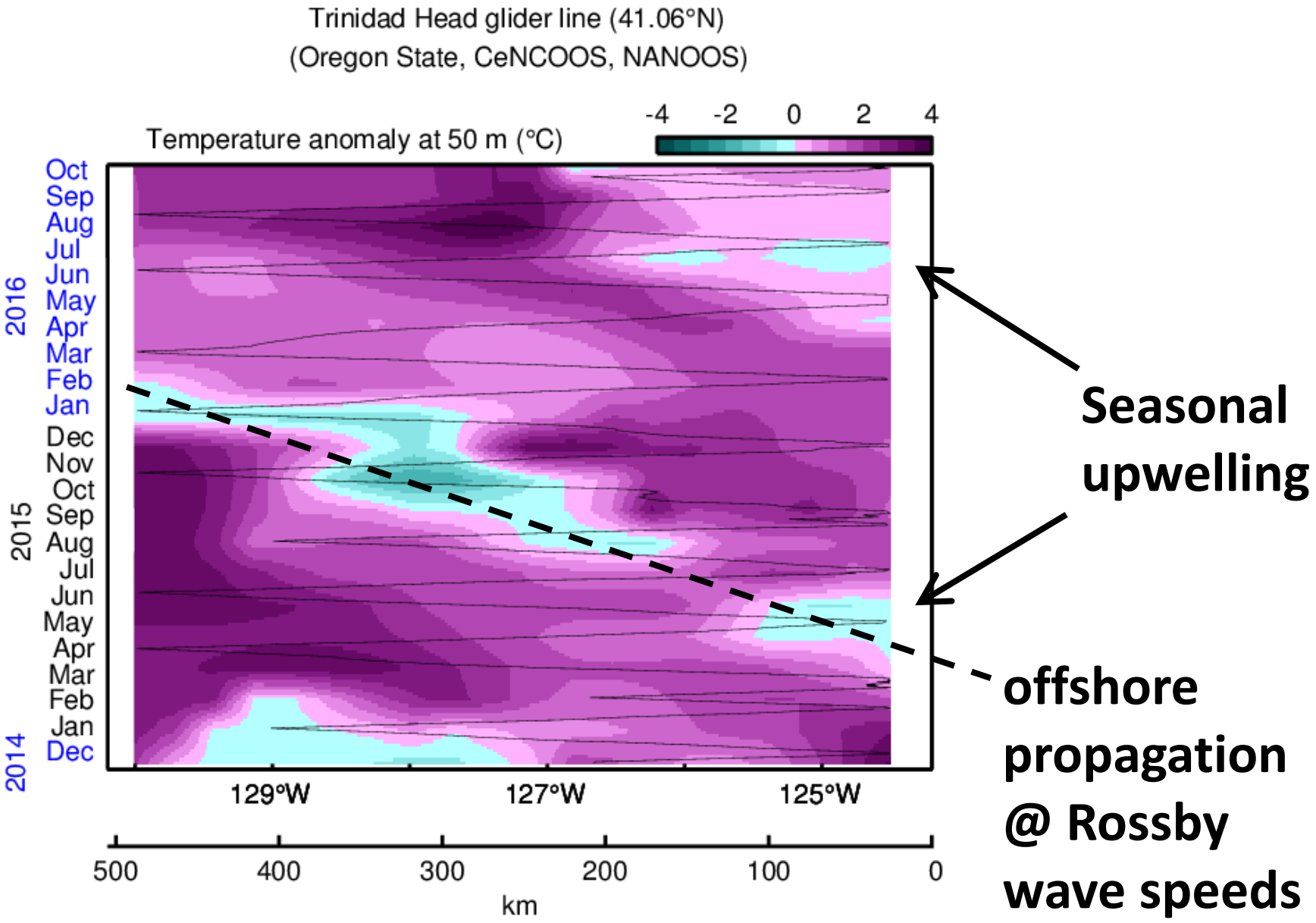


Barth, Shearman, Erofeev, Pierce, Bjorkstedt

most recent data



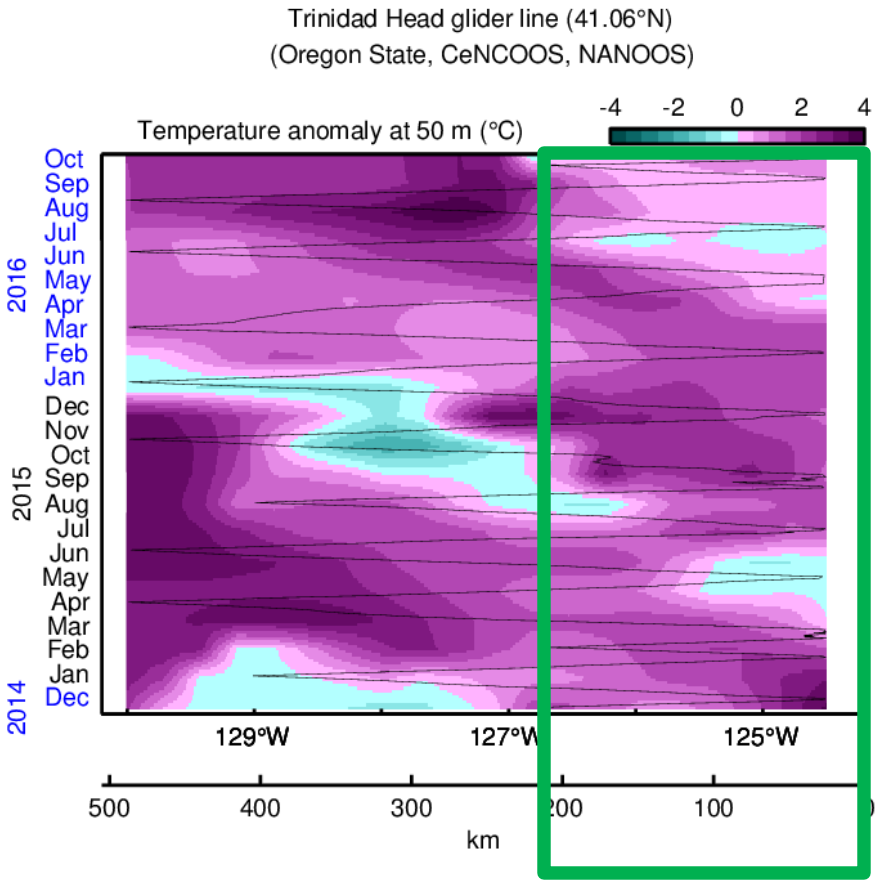
Barth, Shearman, Erofeev, Pierce, Bjorkstedt



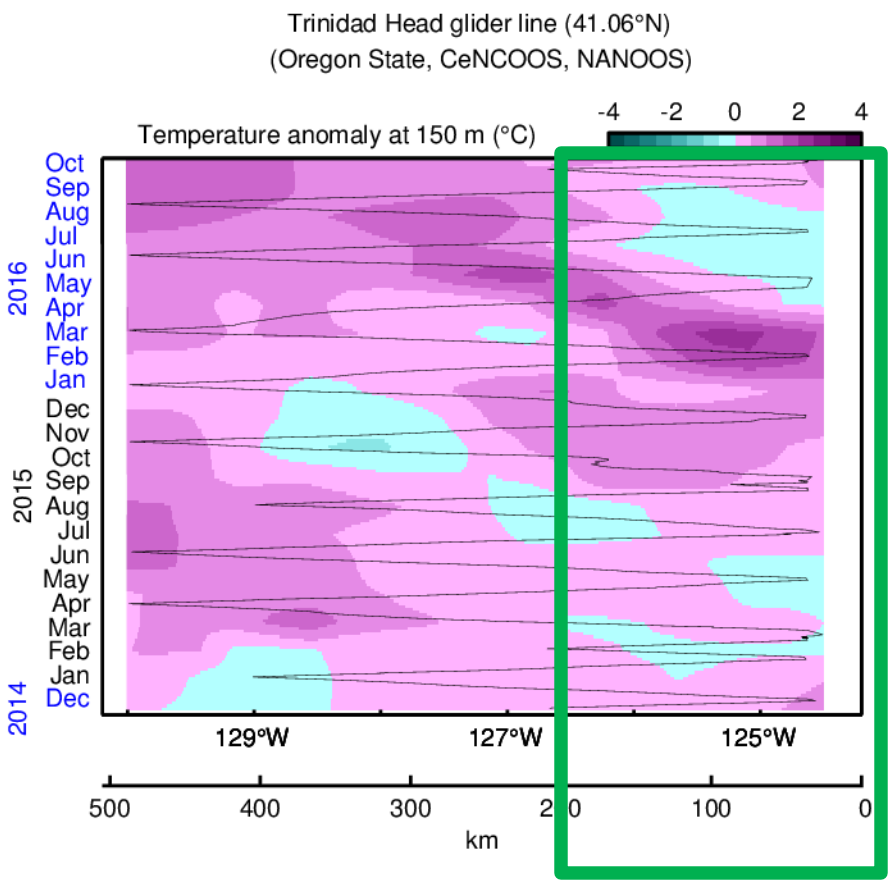
Barth, Shearman, Erofeev, Pierce, Bjorkstedt

Temperature anomaly

50 meters

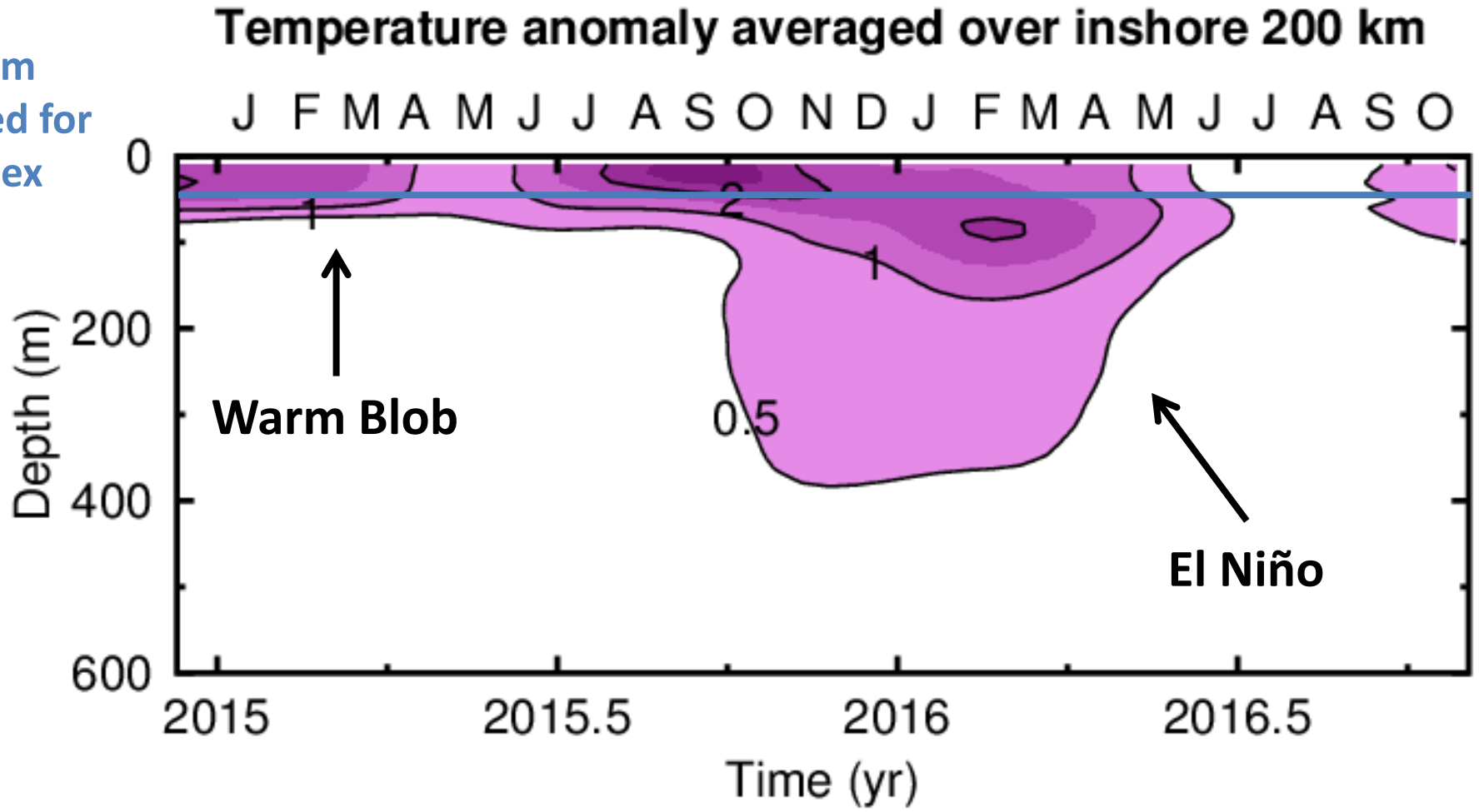


150 meters



Now average over 200 km closest to shore

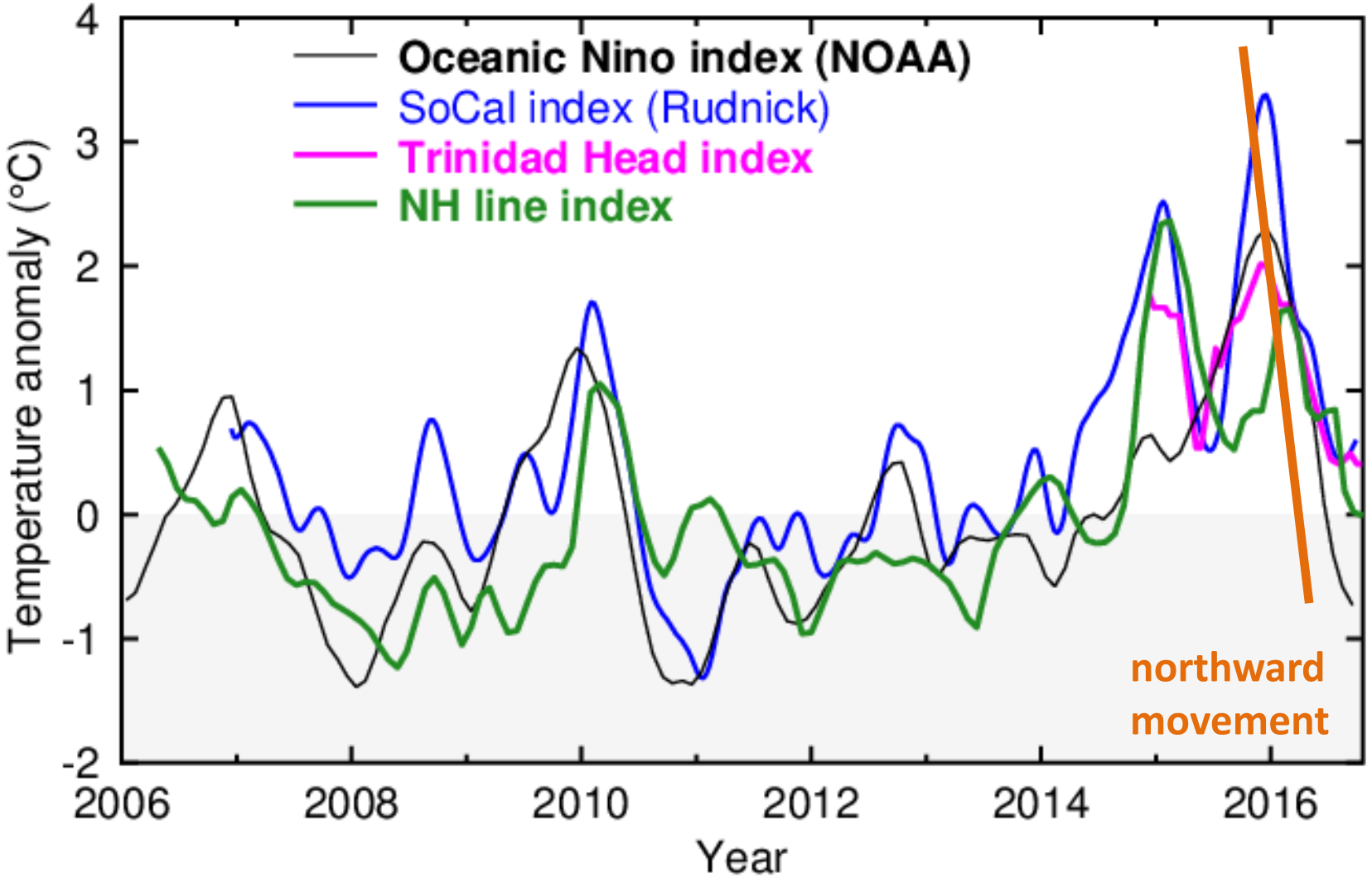
Barth, Shearman, Erofeev, Pierce, Bjorkstedt



50-m used for Index

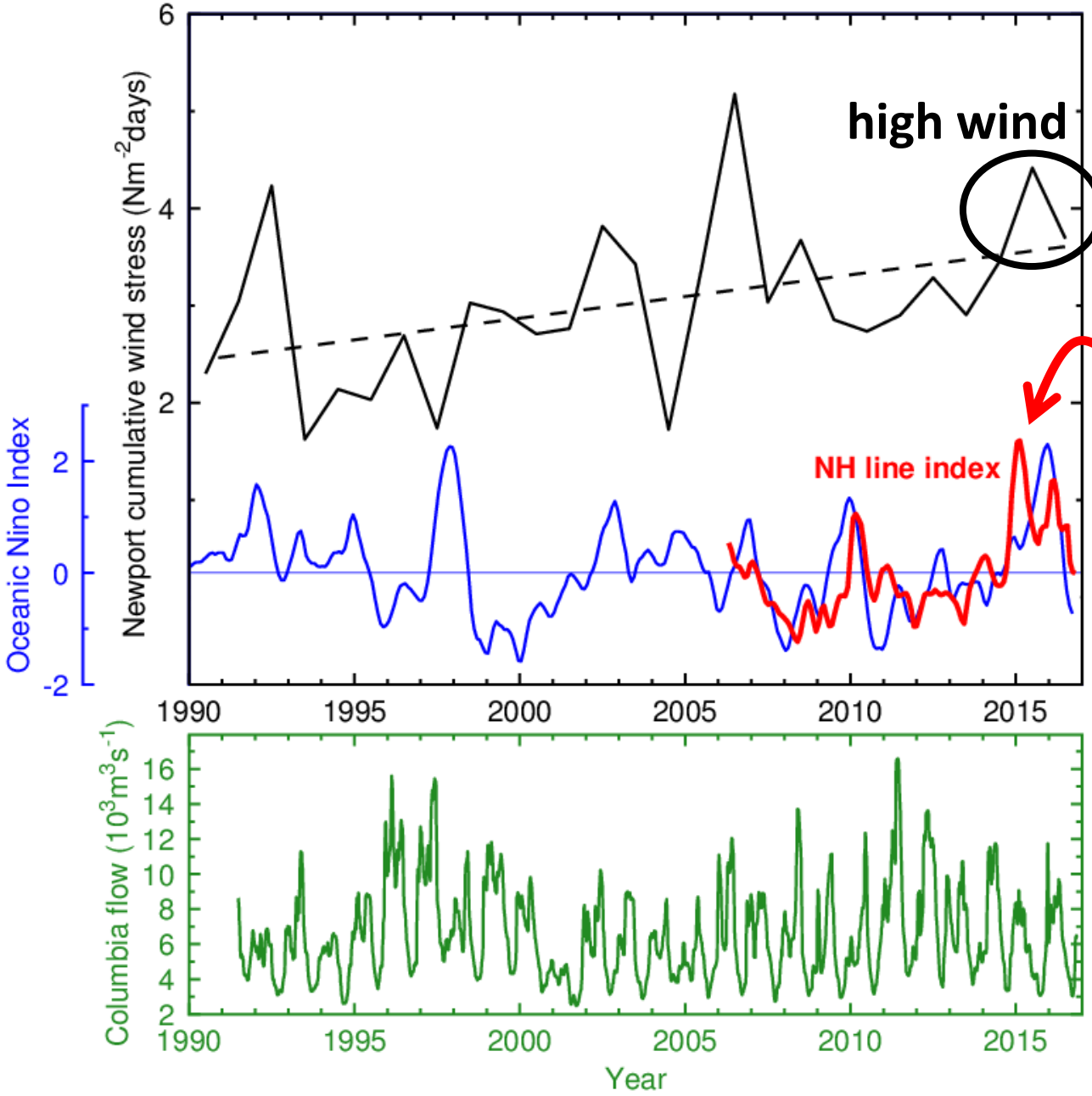
Barth, Shearman, Erofeev, Pierce, Bjorkstedt

50-m temperature anomaly averaged within 200 km of the coast (ala Rudnick)



Barth, Shearman, Erofeev, Pierce, Bjorkstedt

What about 2015 bottom oxygen during Warm Blob?



wind

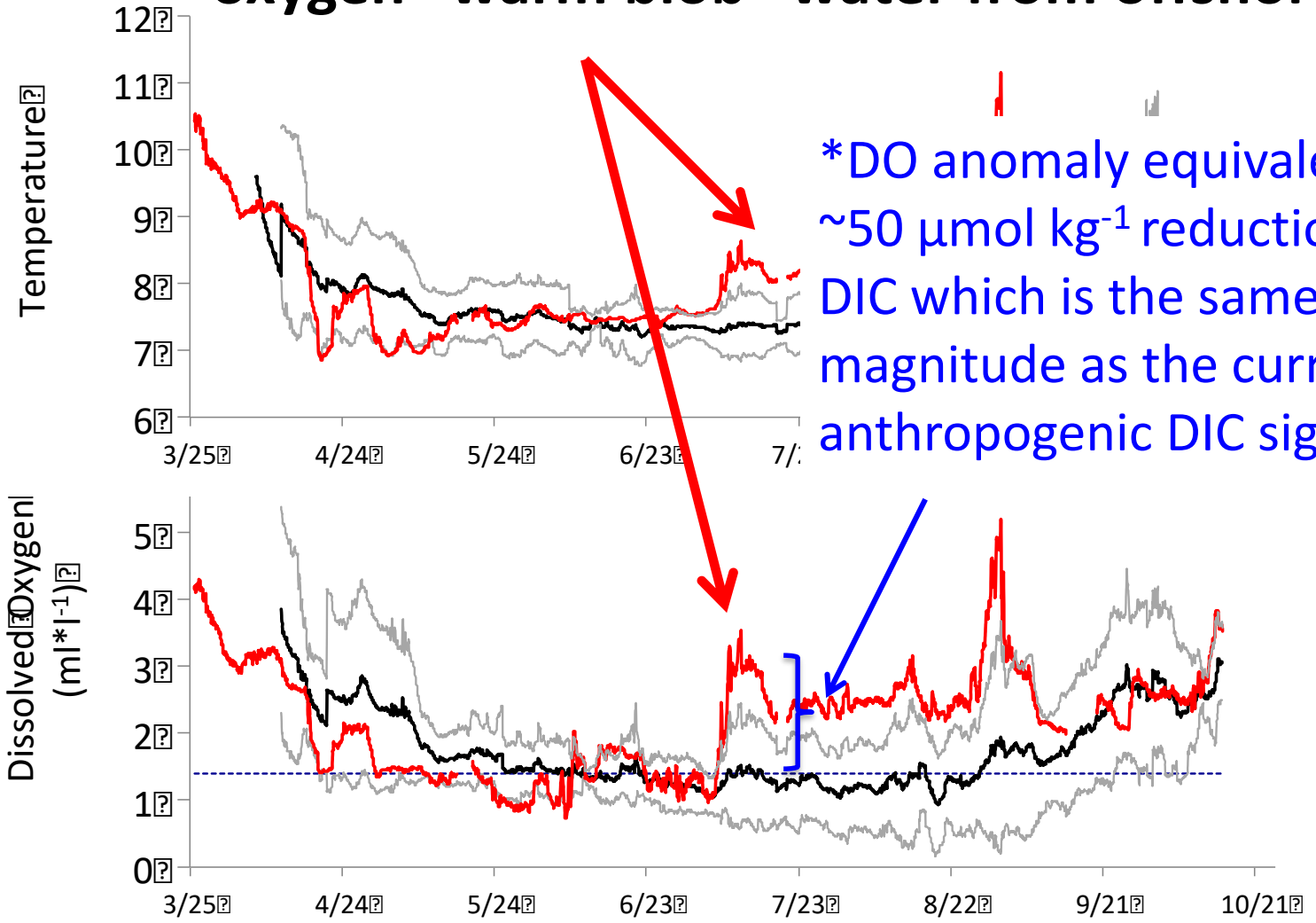
warm water offshore

Nino Index

Columbia River

What happened in 2015?

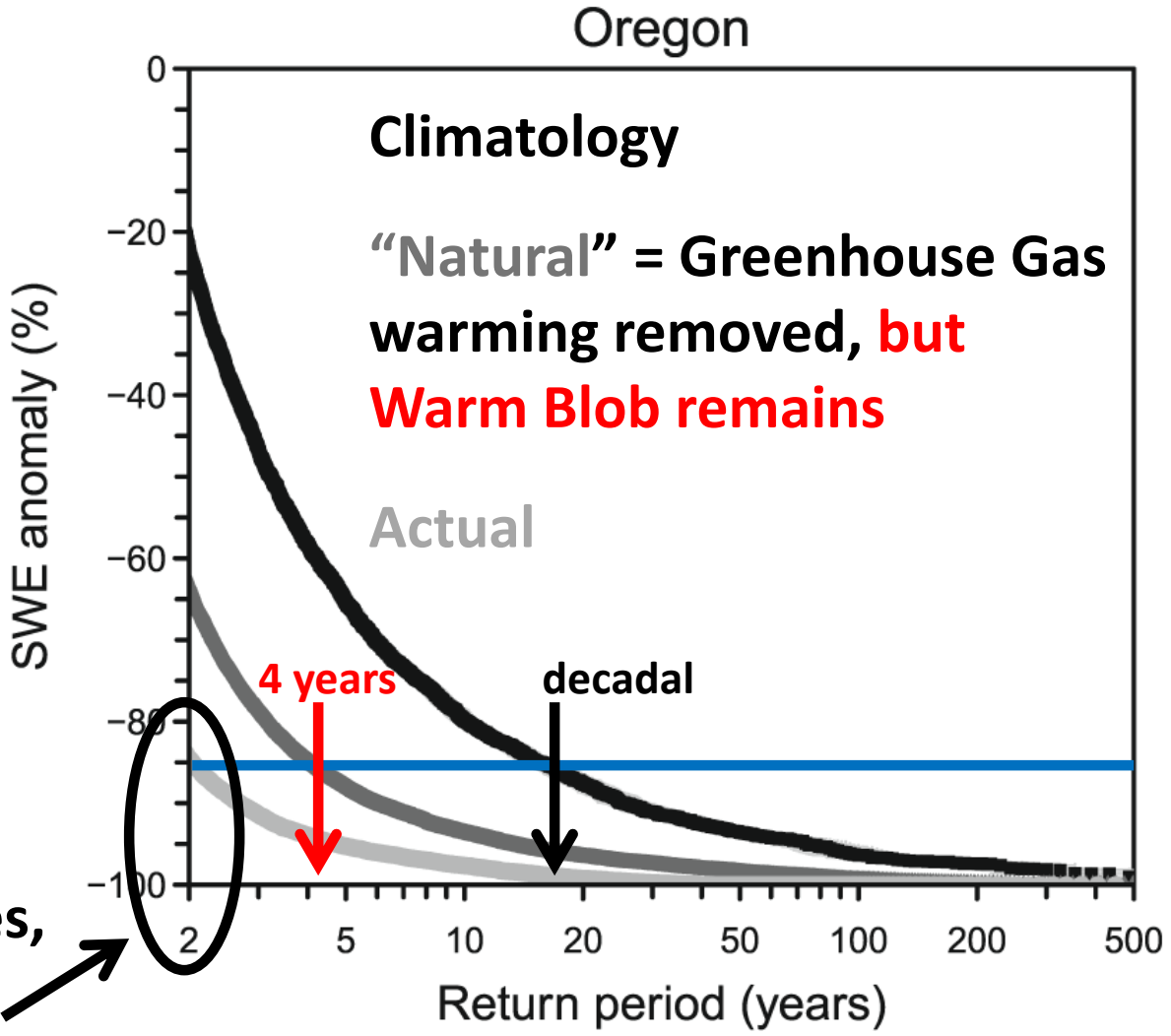
appearance of warm (fresh), high dissolved oxygen "warm blob" water from offshore



*DO anomaly equivalent to ~50 µmol kg^{-1} reduction in DIC which is the same magnitude as the current anthropogenic DIC signal

So are these big events really that unusual? Will they occur more frequently w/climate change?

Snow Water Equivalent Anomaly



with Greenhouse gases, return time gets even shorter

Mote et al., GRL, 2016

Concluding Remarks

- long-term time series are valuable
- subsurface measurements are key
- observe from deep ocean to shelf and inner-shelf habitats
- “unusual” events are the “norm,” especially at atmospheric transitions
- extreme event return periods may shorten under global warming

Thanks to generous long-term support!