NOAA West Watch

Reporting Regional Environmental Conditions & Impacts in the West

September 10, 2019

Call Agenda

- **Project Recap & Updates (Dan McEvoy and Kevin Werner)**
- The emerging Marine Heat Wave of 2019: Toby Garfield
- Regional Climate and ENSO brief (Dan McEvoy)
- IOOS Nearshore Conditions brief (Jan Newton, Alex Harper, Clarissa Anderson)
- Discussion - Environmental conditions and impacts reporting (All)
  - Additional impacts to share?

Project Recap and Updates

- NOAA West Watch bi-monthly webinars are a project of the NOAA Western Regional Collaboration Team (NOAA West), in partnership with the Western Regional Climate Center with standing contributions from the three Integrated Ocean Observing System Regional Associations.

- Initiated in 2015, evaluated in 2016 and re-instated as a bi-monthly offering in 2018. Current goals:
  - Serve as forum for bring together NOAA staff and partners from across the agency and region to share information about regional scale environmental observations and impacts on human systems.
  - Help facilitate interdisciplinary connections and the exchange of information among agency staff and partners on regional climatic and oceanic conditions, particularly departures from normal.

These webinars are not formal public releases of data.

Project Recap and Updates

- NOAA West provided funding to the Western Regional Climate Center to offer three webinars in Fiscal Year 2019 (November, January & September).

- The Western Regional Climate Center has agreed to provide funding to support a quarterly NOAA West Watch in 2020 in January, April, July, and October. The NOAA West Watch will be reassessed again at the end of 2020.

- Request: If you find these webinars helpful, or if you have ideas of in-region entities that may be open to taking on this webinar please let me know: (mcevoyd@dri.edu).

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The emerging Marine Heat Wave of 2019

NOAA West Watch

Toby Garfield*

SWFSC

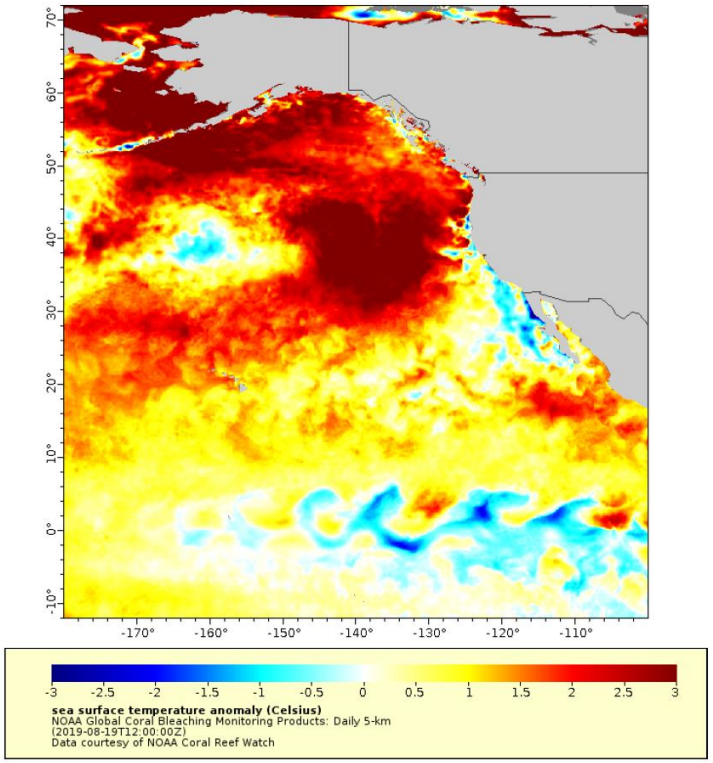
10 September, 2019

* A whole gaggle of folks contributed, led by Chris Harvey, Nate Mantua, Andy Leising, Mike Jacox, Eric Bjorkstedt, Greg Williams, Brian Wells, John Field, Kym Jacobson, Dale Robinson, Elliott Hazen, Tom Good, Dean Roemmich, Alex Tardy, Michael Milstein and more

Marine Heatwave update, September 2019

The NE Pacific has been experiencing a new Marine Heatwave (MHW) since mid-June 2019, with similarities to "The Blob" of 2013-2016

Image from August 19, 2019



What defines a Marine Heatwave (MHW)?

Hobday et al. (2018): Any parcel of water with a Sea Surface Temperature (SST) > 90% of the climatological mean for > 5 days

- This is taken strictly from the land-based definition for heatwaves, yet lacks the terrestrial concept of a "region", e.g. just because its warm at my house for 5 days does not mean my state is experiencing a heatwave

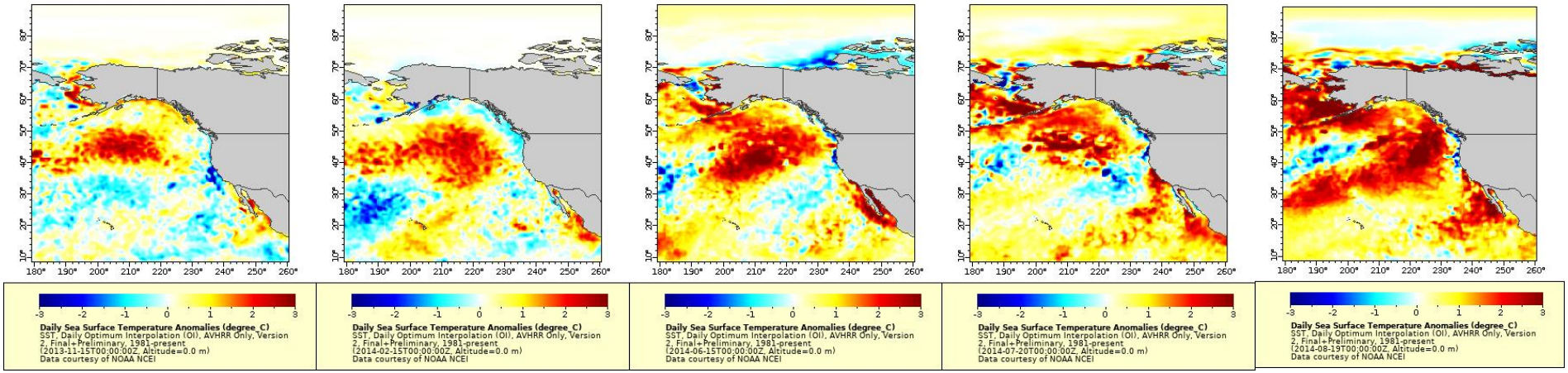
Leising (CCIEA 2019) proposed: Contiguous region > 500,000 km^2 in area, normalized SST anomaly > 95% of the data, and lasting > 6 days

- These adjustments are proposed to account for advection of features, natural oceanic temporal scales of variability, adds a "regional" spatial component, allows for tracking individual features, and selects only the top 5% of SSTa data.

Current MHW vs. “The Blob”: SST anomalies

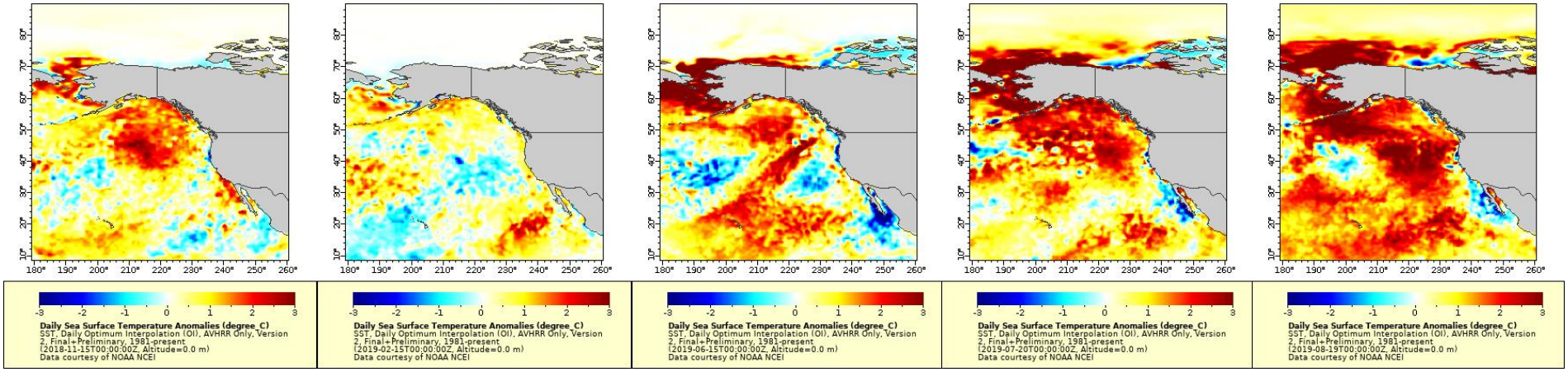
The Blob

October 2013 | February 2014 | June 2014 | July 2014 | Aug 19, 2014

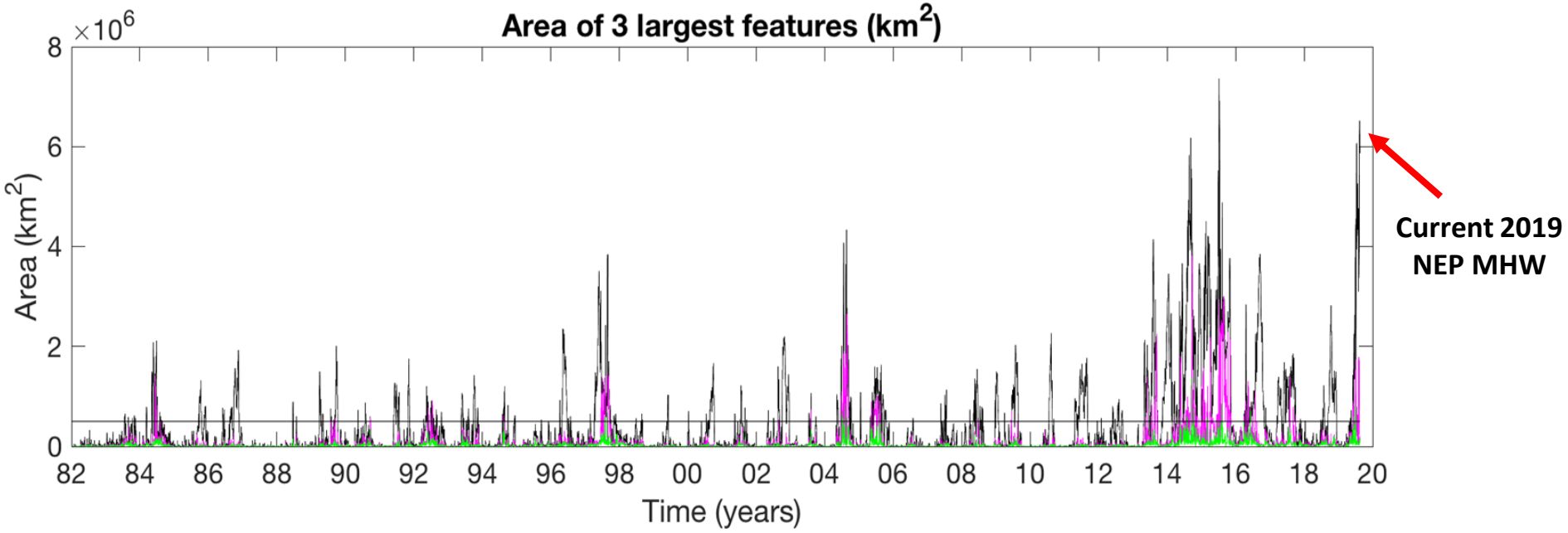


Current MHW

October 2018 | February 2019 | June 2019 | July 2019 | Aug 19, 2019

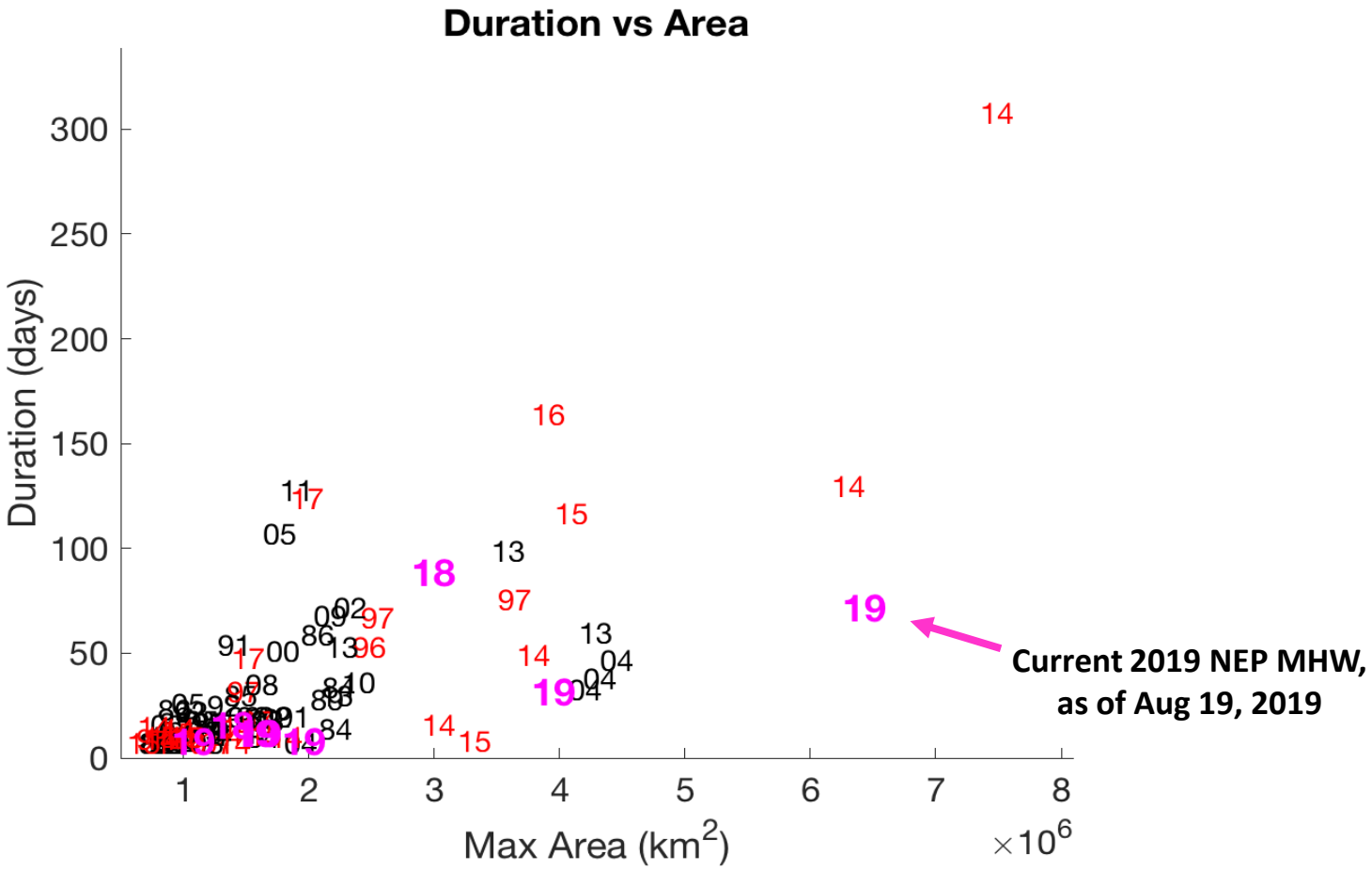


Areal extent compared to past MHWs in the NE Pacific



Area of MHWs in the NE Pacific over time. The different colors denote times when there were multiple, spatially separate MHWs on any given day. The horizontal line is for reference at 500,000 km^2, the proposed threshold for the "regional" portion of declaring a MHW.

This is the second-largest MHW on record for the NE Pacific (although it's still only a few months old)



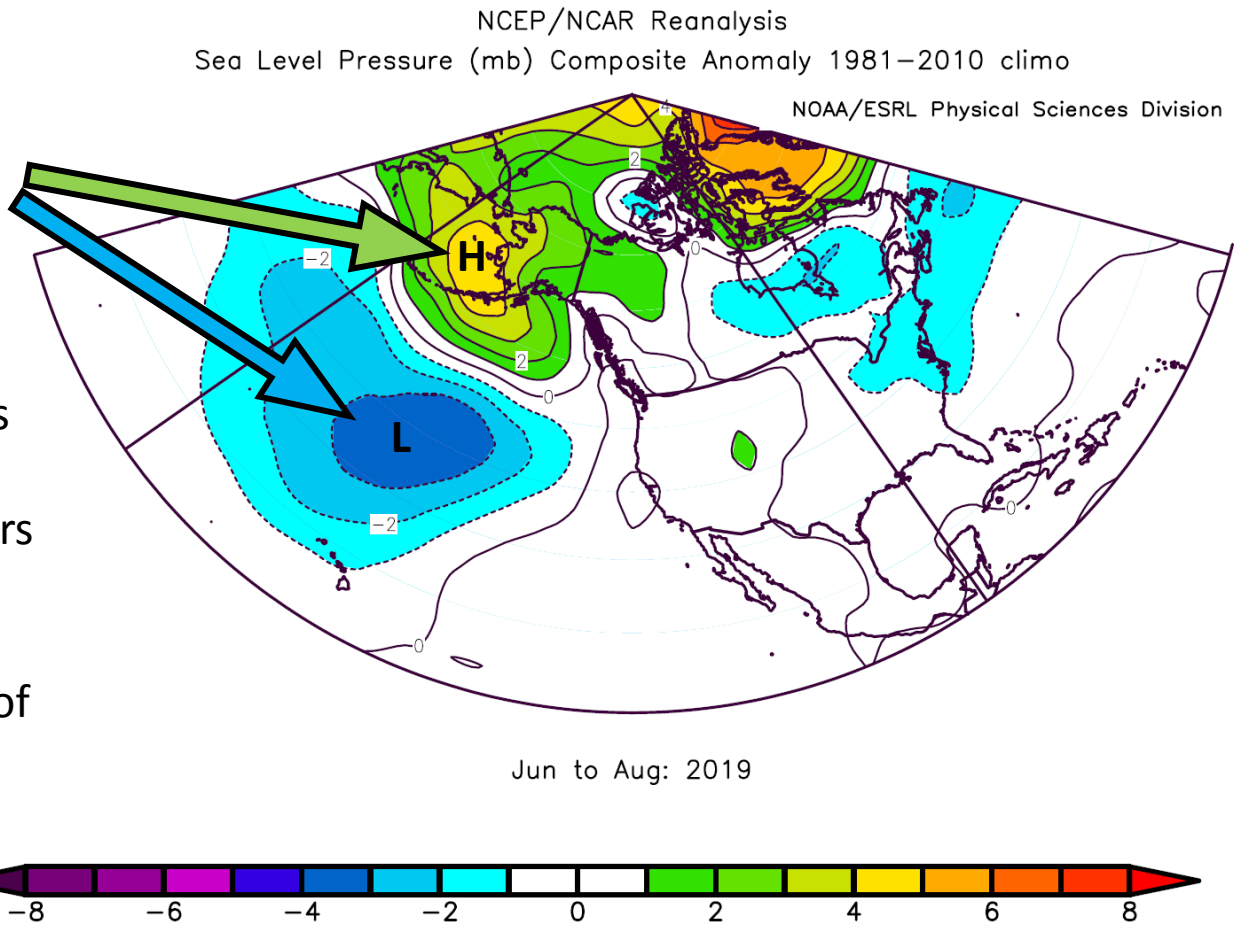
(Numbers indicate year in which each MHW began. Recent events in pink; "BLOB" years of 2014-2016 and the El Niño of 97 are in red)

Cause: persistent atmospheric pressure anomalies

Persistent high pressure over Gulf of Alaska, low pressure in NE Pacific in summer of 2019

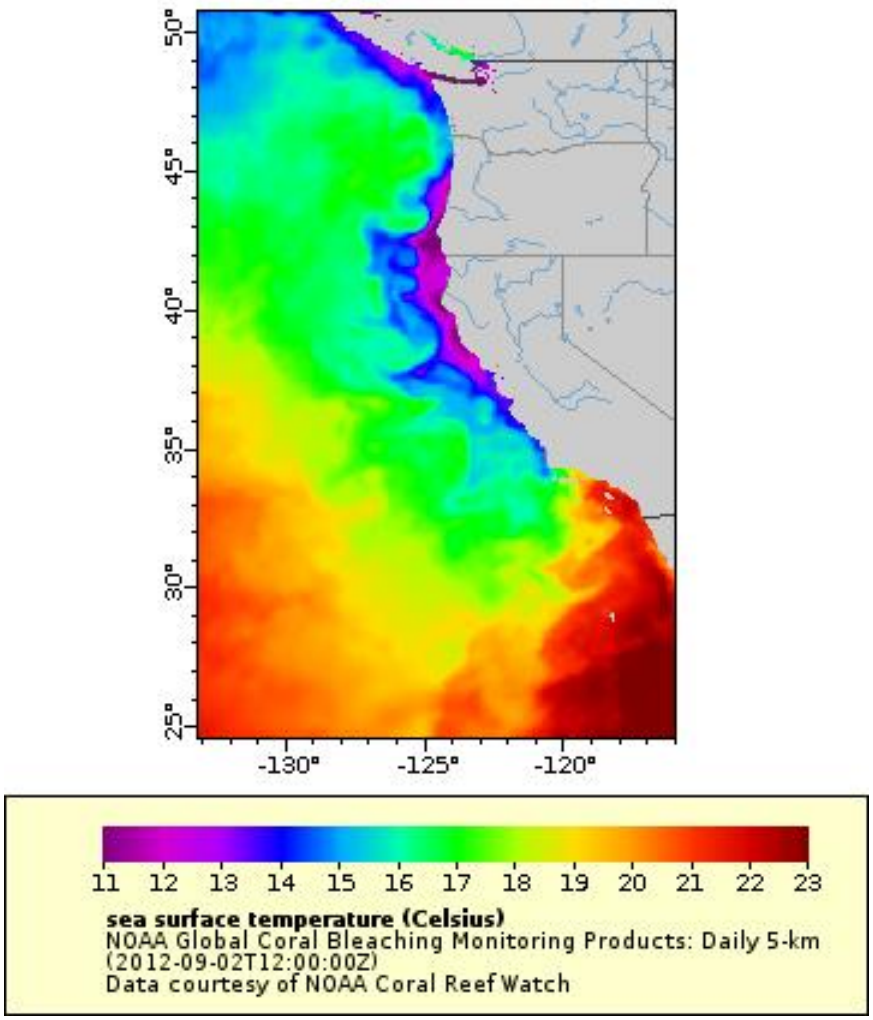
This combination has reduced winds over last several months that would otherwise extract heat and mix the surface waters with cooler waters below

Consequence: rapid warming of surface waters in NE Pacific

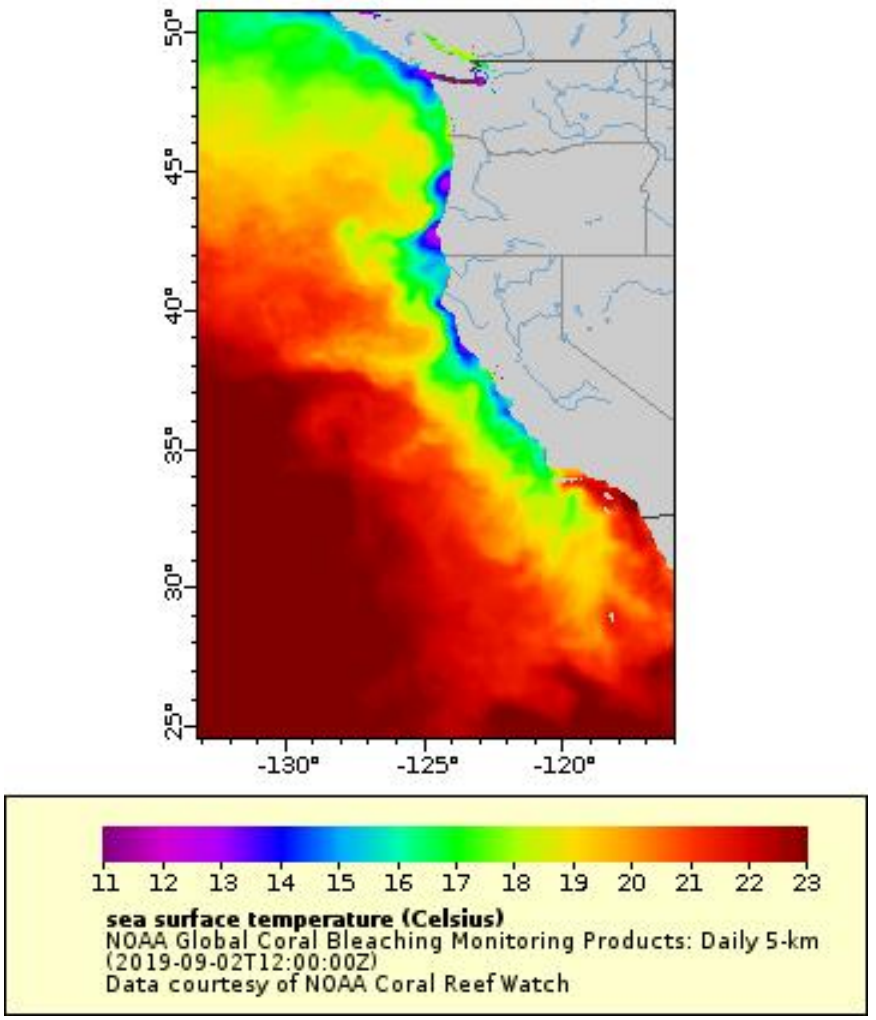


Satellite images of sea surface temperatures (SST) indicate serious coastal compression of cooler upwelling habitat:

Sept 2, 2012 “cool period”



Sept 2, 2019 “MHW”

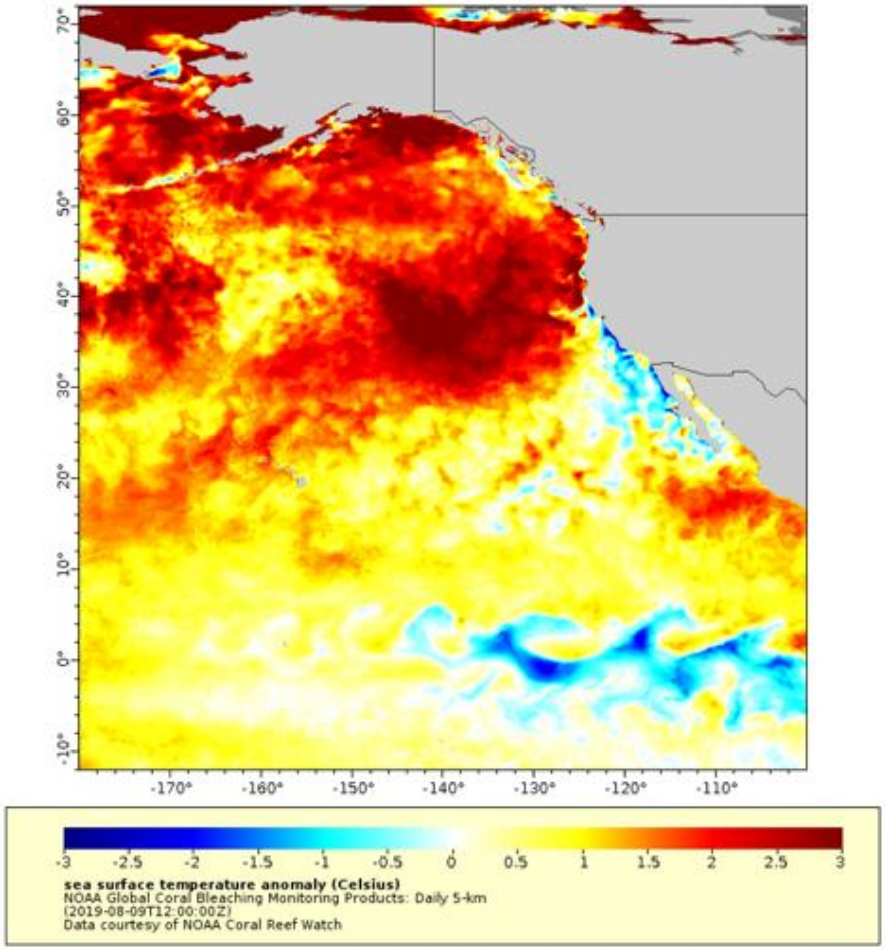


This is not a static feature!

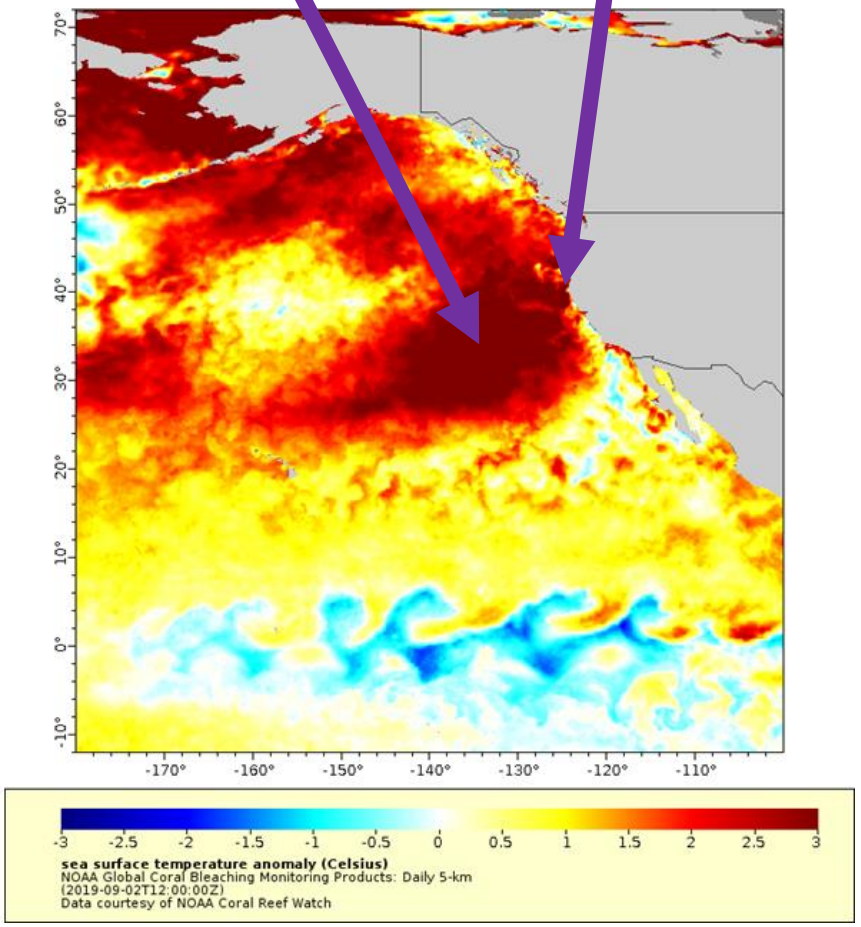
Offshore evolution

Trinidad evolution

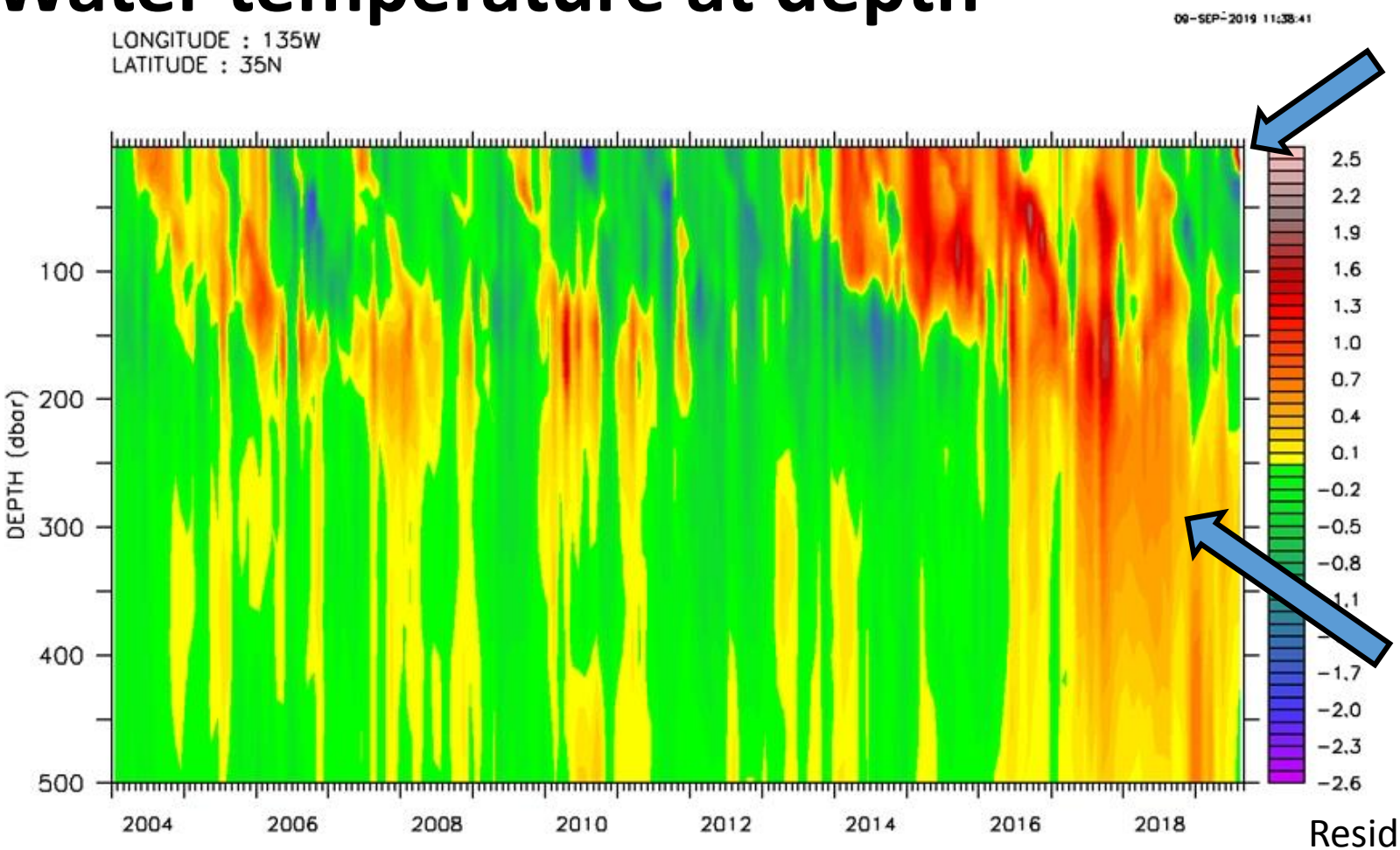
August 2019 marine heatwave



September 2019



Water temperature at depth

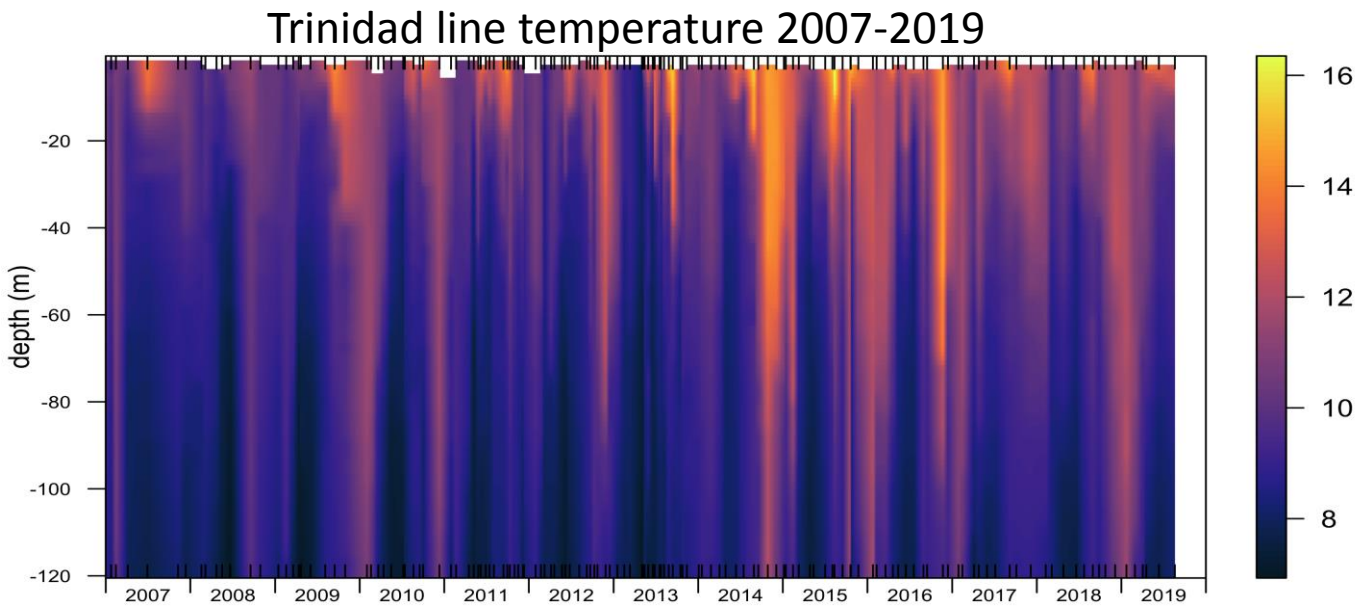


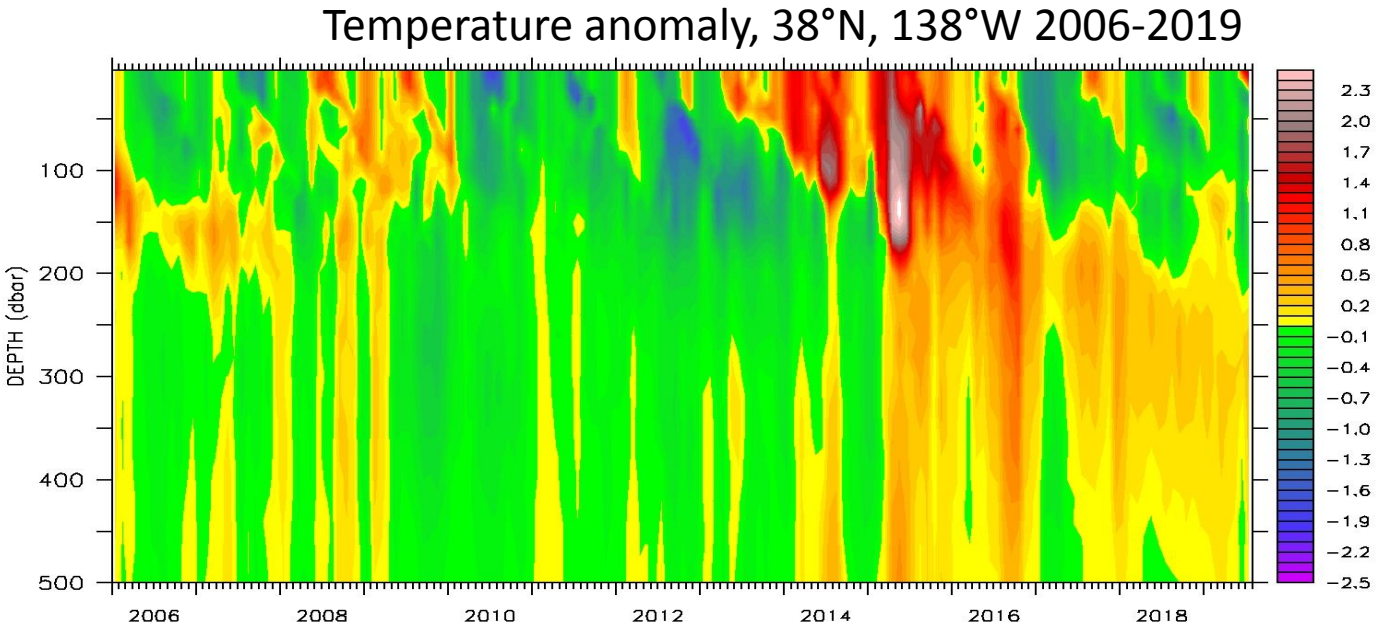
MHW (heat still only surface ~20 m)

Residual heat at depth possibly from the Blob/El Niño

Temperature anomaly from ARGO floats, 35°N 135°W, 2006-2019

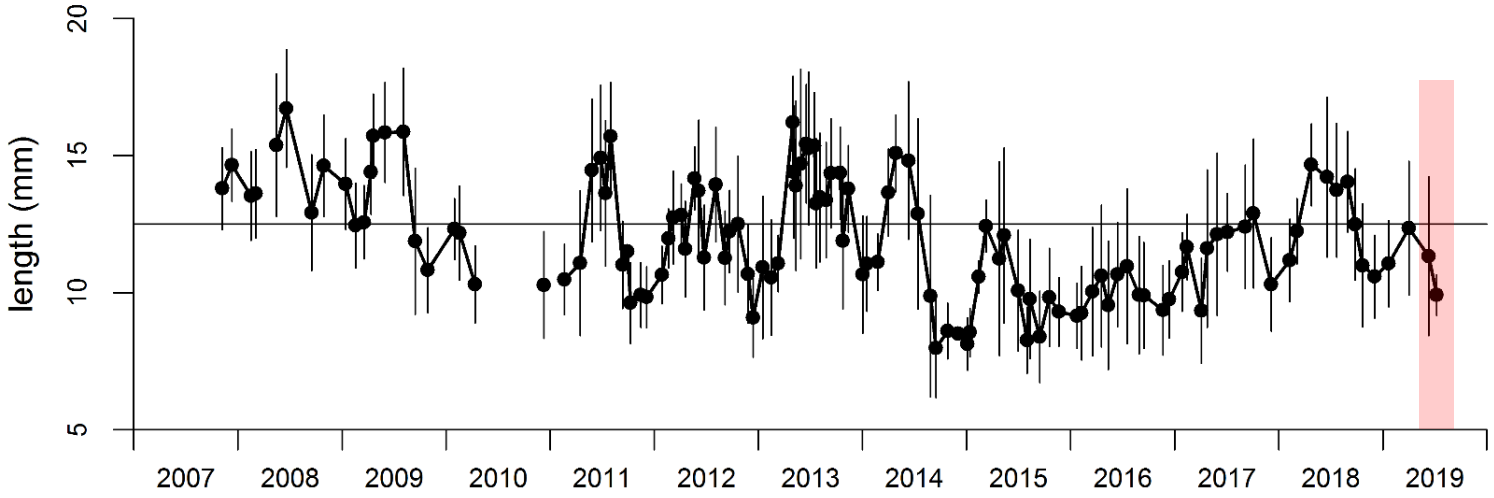
Water temperature at depth





Ecosystem responses?

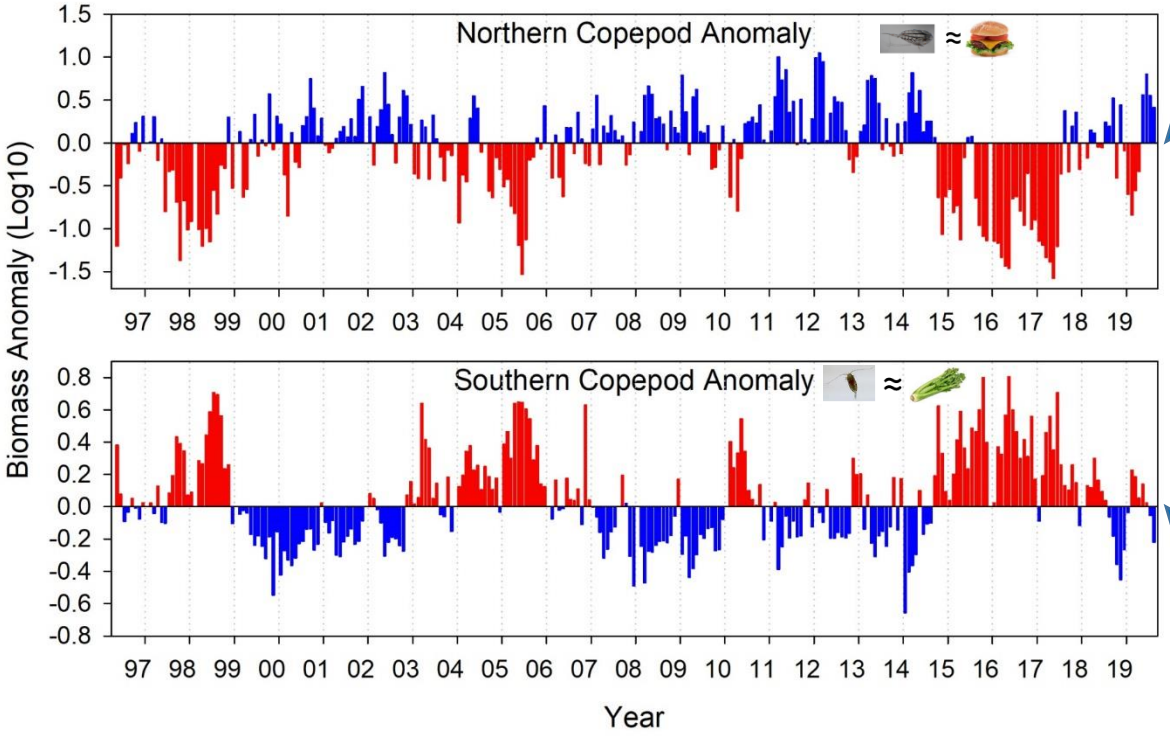
- Albacore much closer to shore in northern California Current
- Harmful algal blooms have recently closed shellfish fishing on Washington outer coast
- **Krill off Trinidad Head, CA are smaller than normal…**



…although that is also related to unusually warm coastal conditions last winter

Ecosystem responses?

- However, cool-water, lipid-rich northern copepods ("cheeseburger" copepods) still dominate off of Newport, OR, where water temperature remains normal for now



Copepod taxa collected 5 nautical miles off Newport have positive biomass anomaly for the northern, cold water, lipid-rich species and negative anomaly for southern species through August 25, 2019

- Salmon returns this year most likely influenced by conditions prior to 2019 MHW (though ocean fisheries have likely been influenced by this year's warmth)
- **Generally, it's too early to assign cause-and-effect impacts to MHW at this point, but its size, intensity and proximity are concerning**

Next steps

- **NOAA and partners will continue to closely monitor conditions**
  - Physical conditions and characteristics of MHW
  - Physics, chemistry and plankton off Newport every 2 weeks
  - Physics, chemistry and plankton off Trinidad Head every 4 weeks
  - Physics, chemistry and plankton from regional cruises (e.g. CalCOFI, cps, etc)
  - Overwinter growth and survival of CA sea lion pups at San Miguel Island
  - Partners in states will monitor domoic acid and other HAB-related indicators
  - Coastwide network of partners will monitor bird strandings on beaches

- **Some key questions in upcoming months:**
  - Will pressure patterns change & break up the MHW before it has major impacts?
  - Will the MHW come ashore when upwelling subsides in the fall?
  - Will major HABs occur in the spring when upwelling resumes?

- **We will provide further updates to the PFMC in November, in the IEA report in March 2020, through NOAA websites, and as needed**

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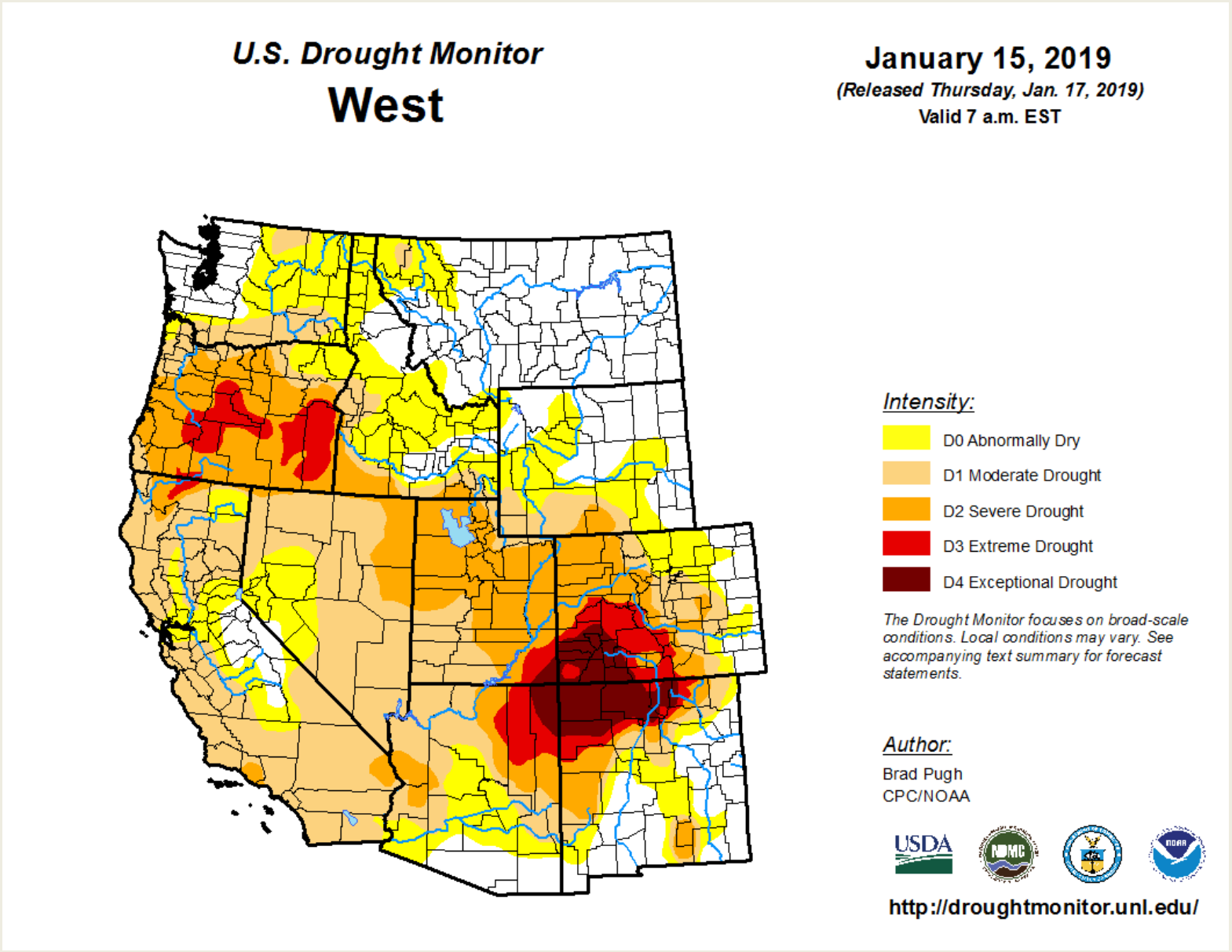
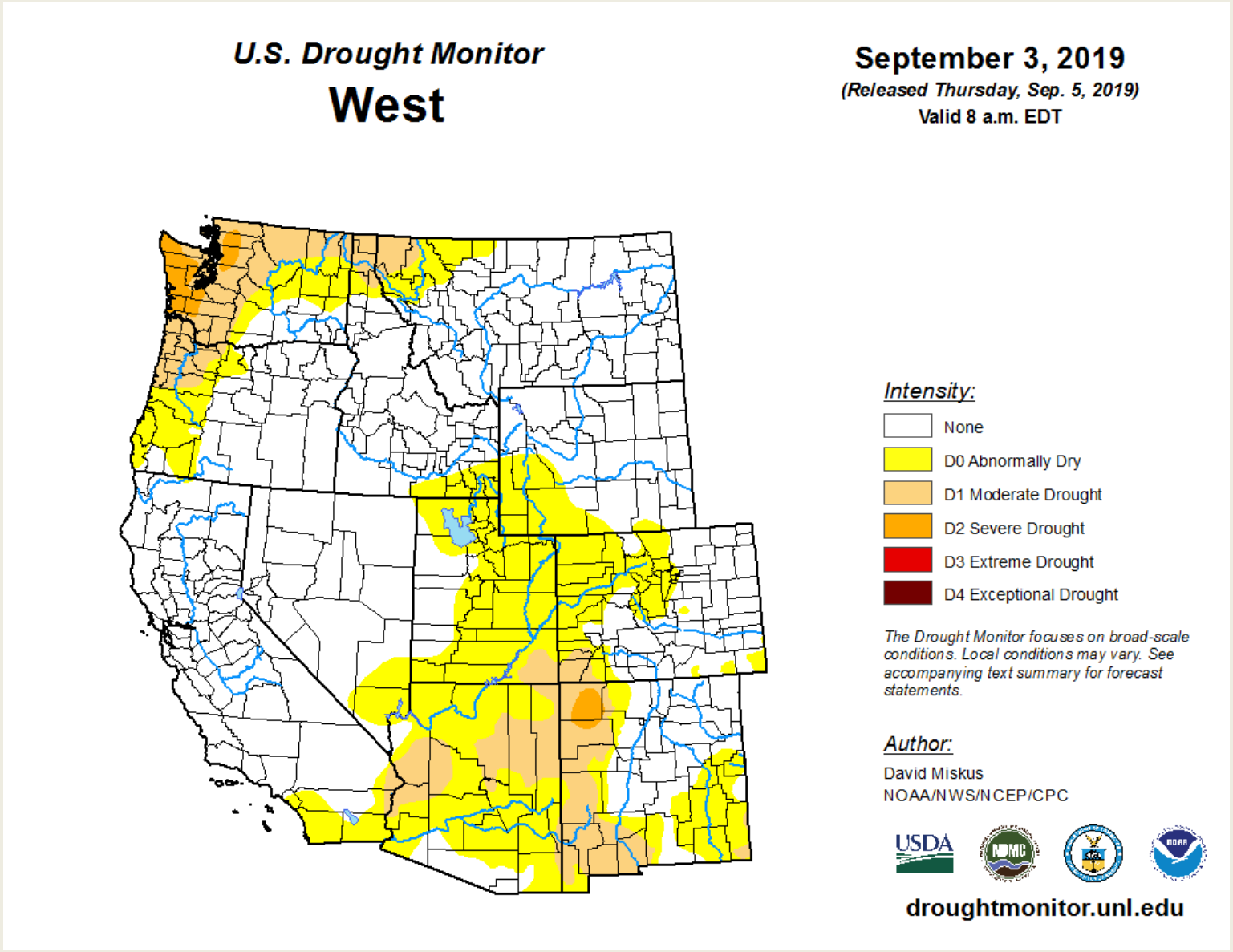
US Drought Monitor January 15, 2019

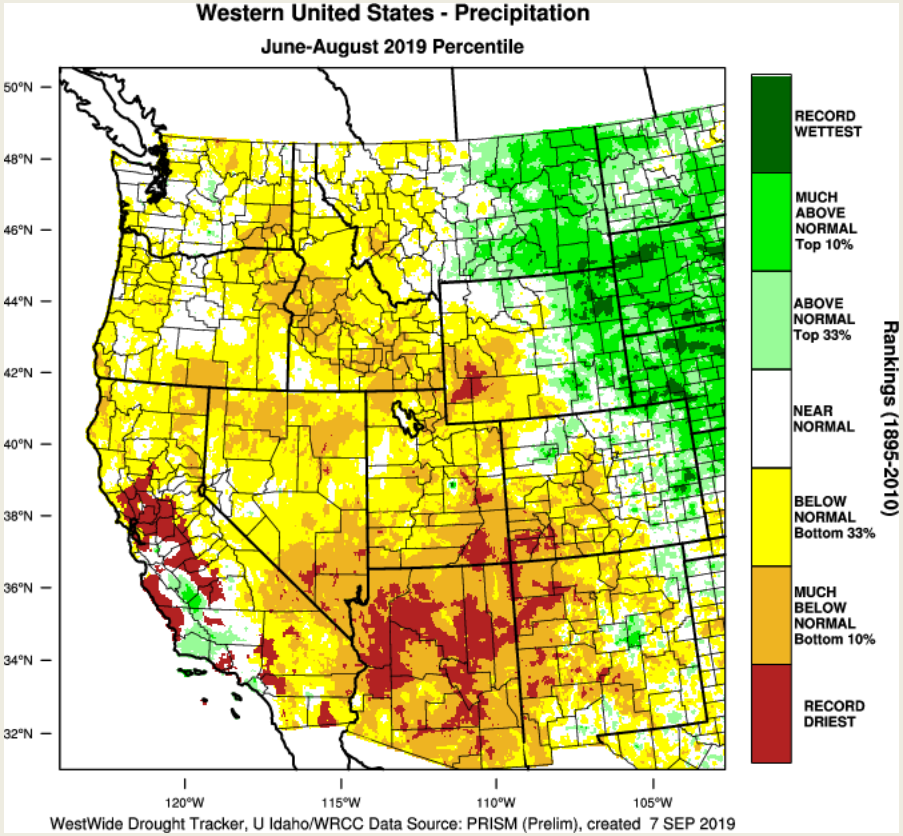


Current US Drought Monitor

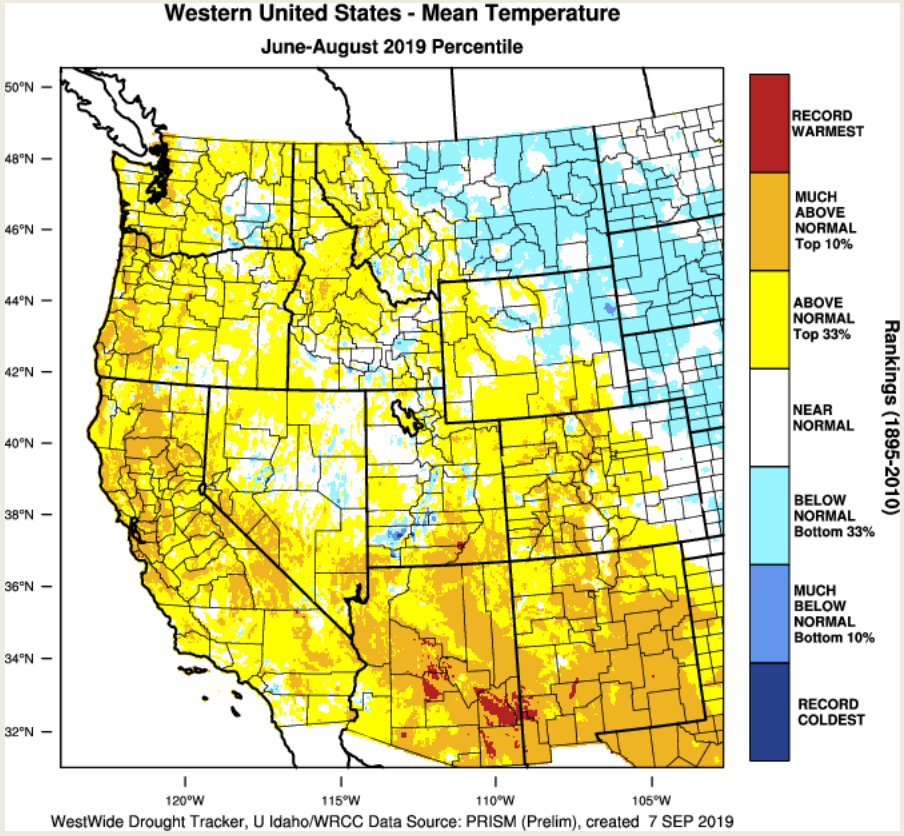


Summer Precipitation and Temperature

Precipitation Percentile
June-August, 2019

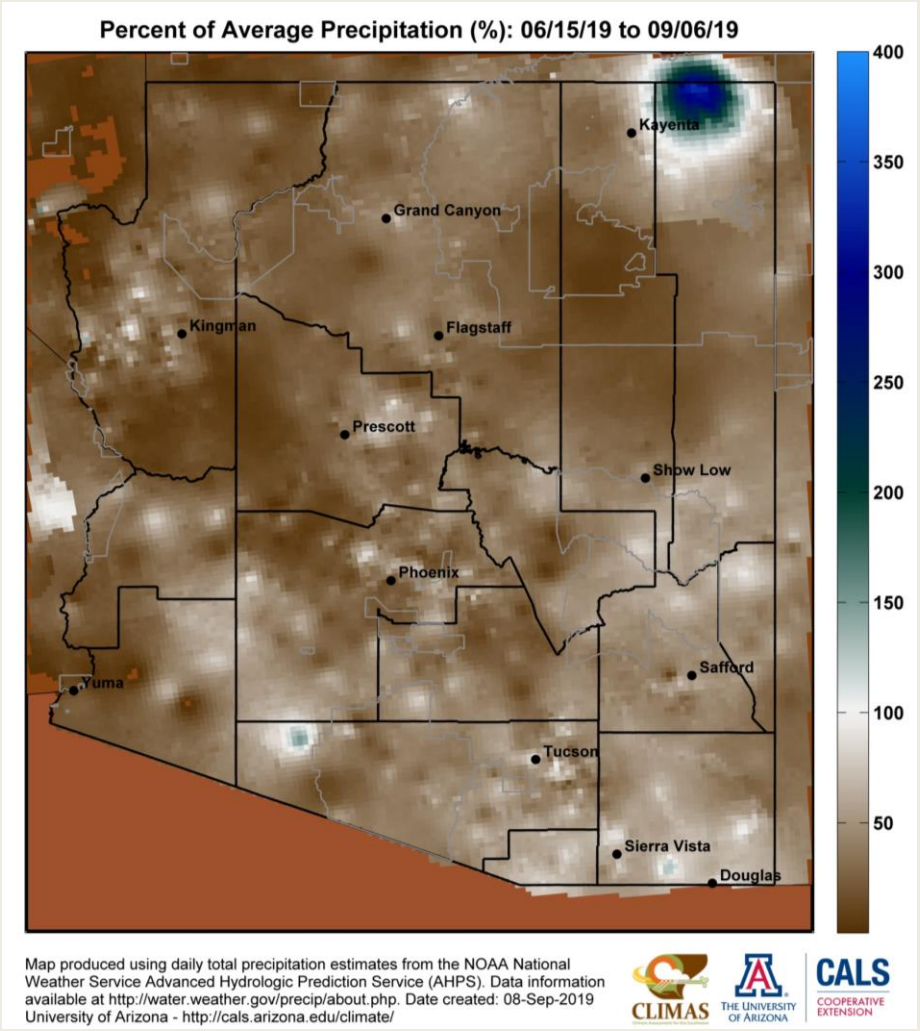


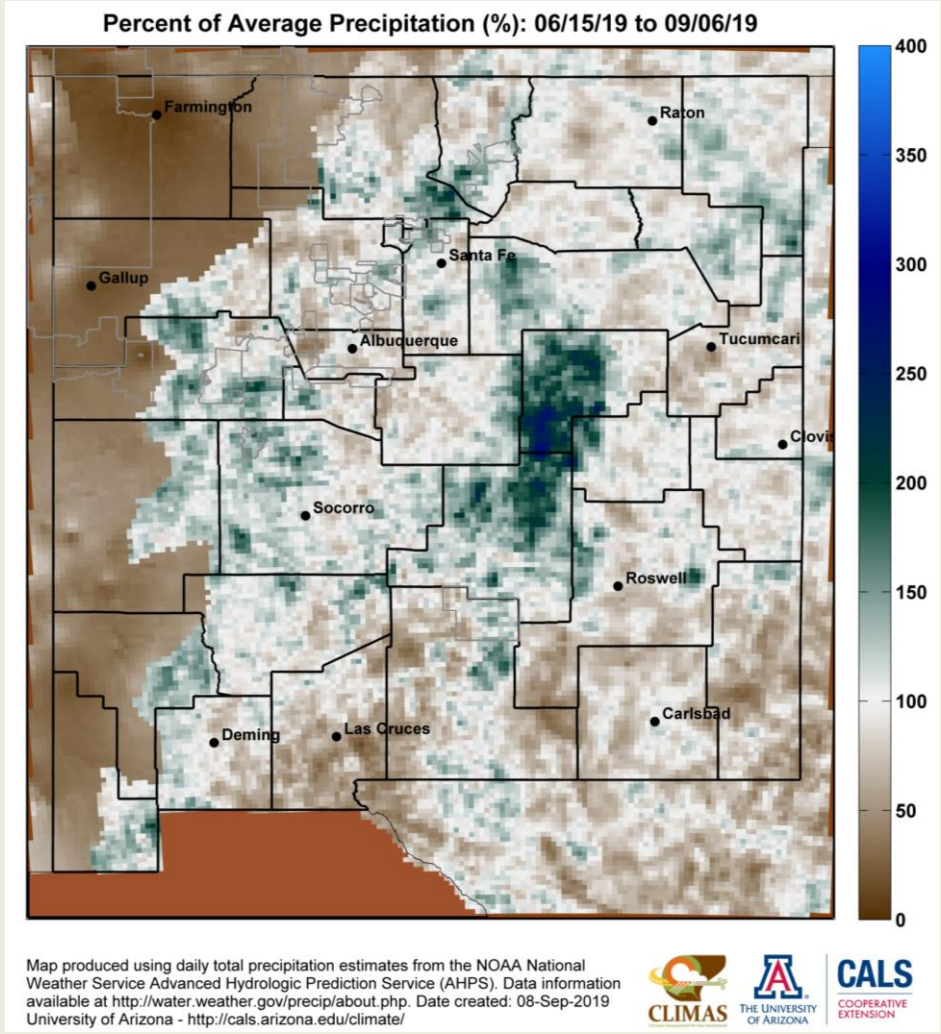
Temperature Percentile
June-August, 2019



https://wrcc.dri.edu/wwdt/

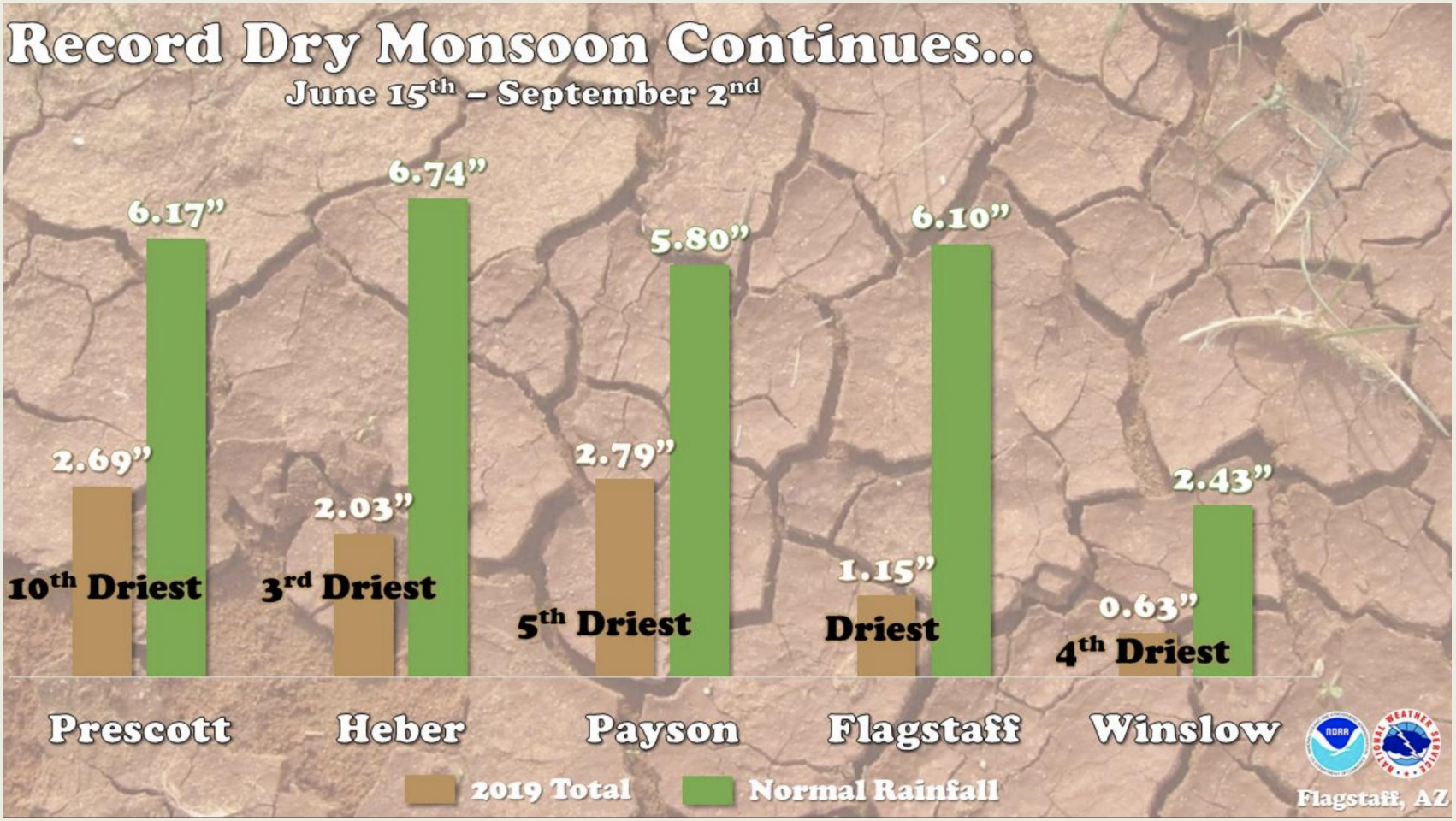
Nonsoon 2019





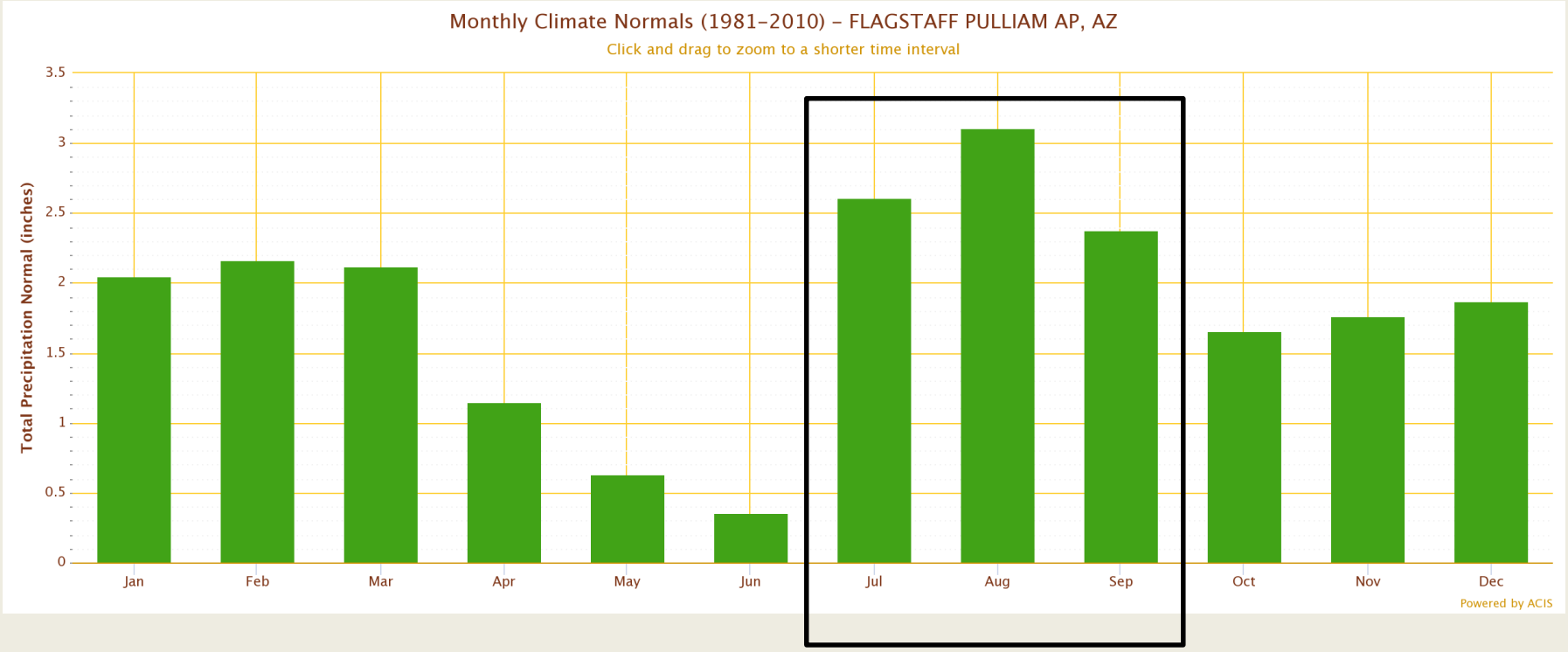
https://www.climas.arizona.edu/sw-climate/monsoon/tracker

Nonsoon 2019



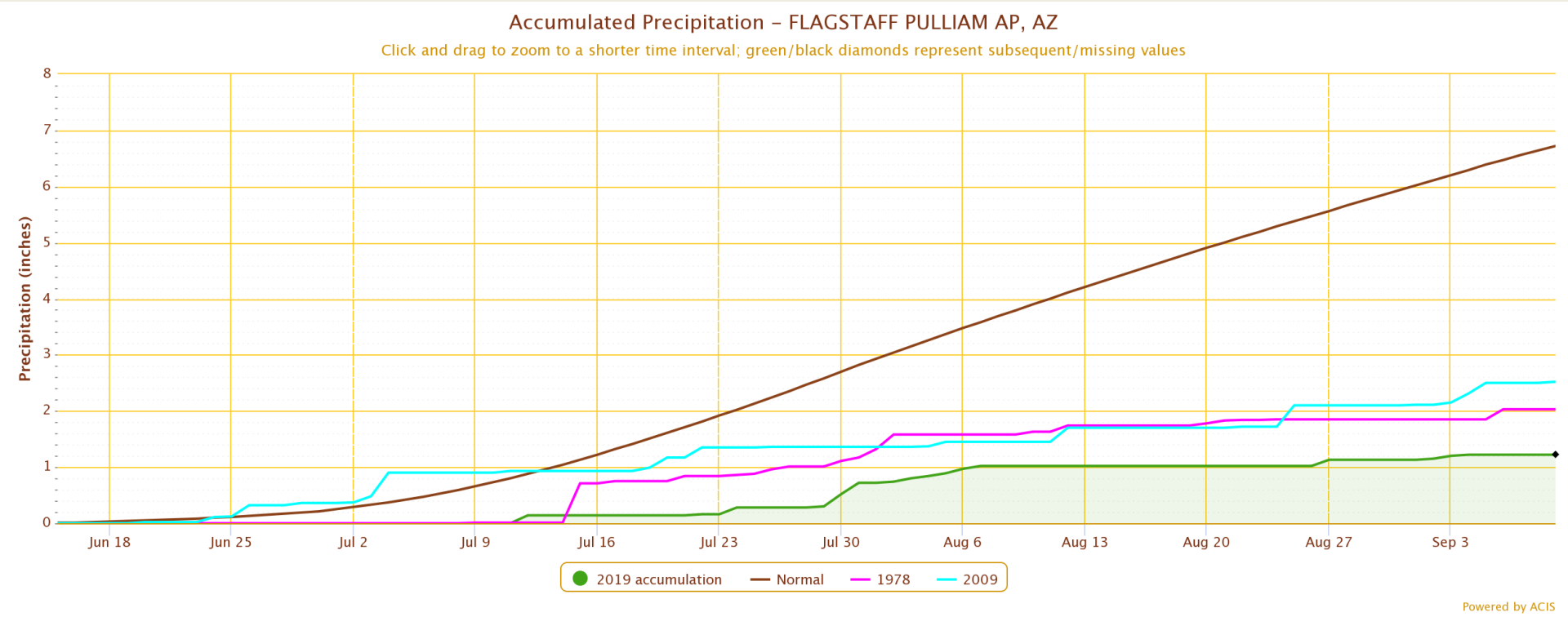
Source: National Weather Service, Flagstaff, Arizona

NonSoon 2019



NonSoon 2019

Flagstaff, Arizona accumulated precipitation June 15 – September 8

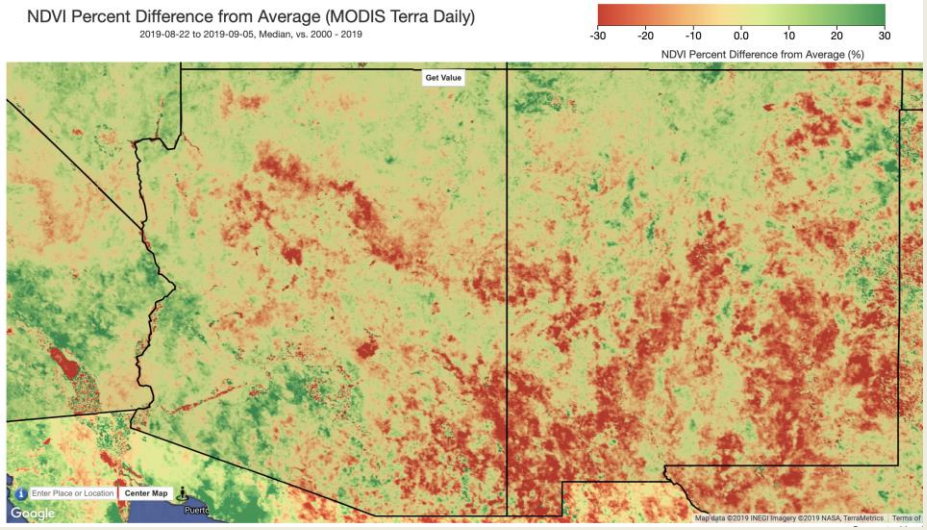


Normal: 6.64”

2019: 1.22”

http://scacis.rcc-acis.org/

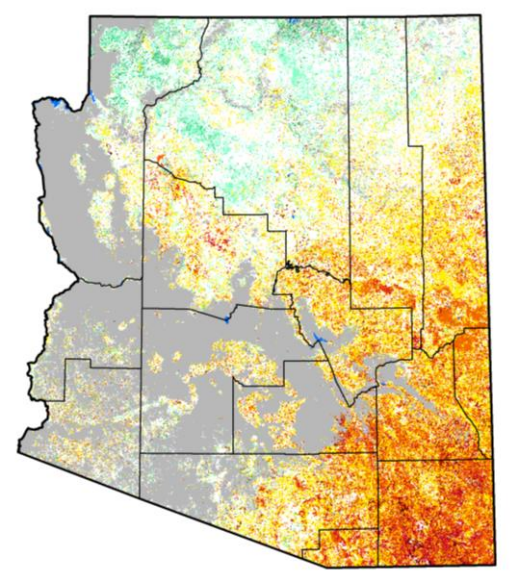
NonSoon 2019

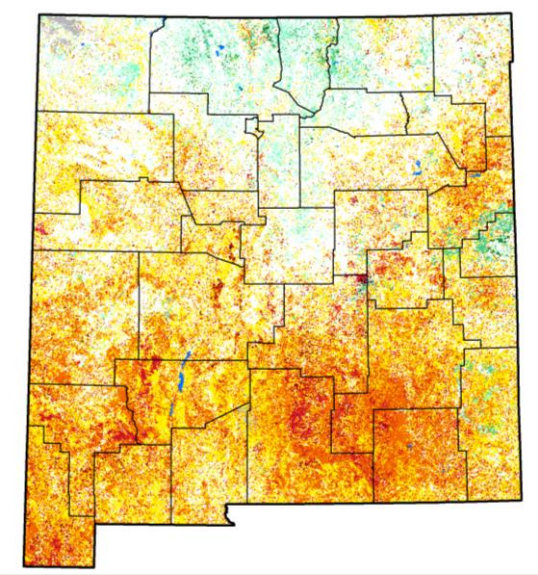


MODIS NDVI anomaly
August 22-September 5, 2019

Map:
https://app.climateengine.org/climateEngine

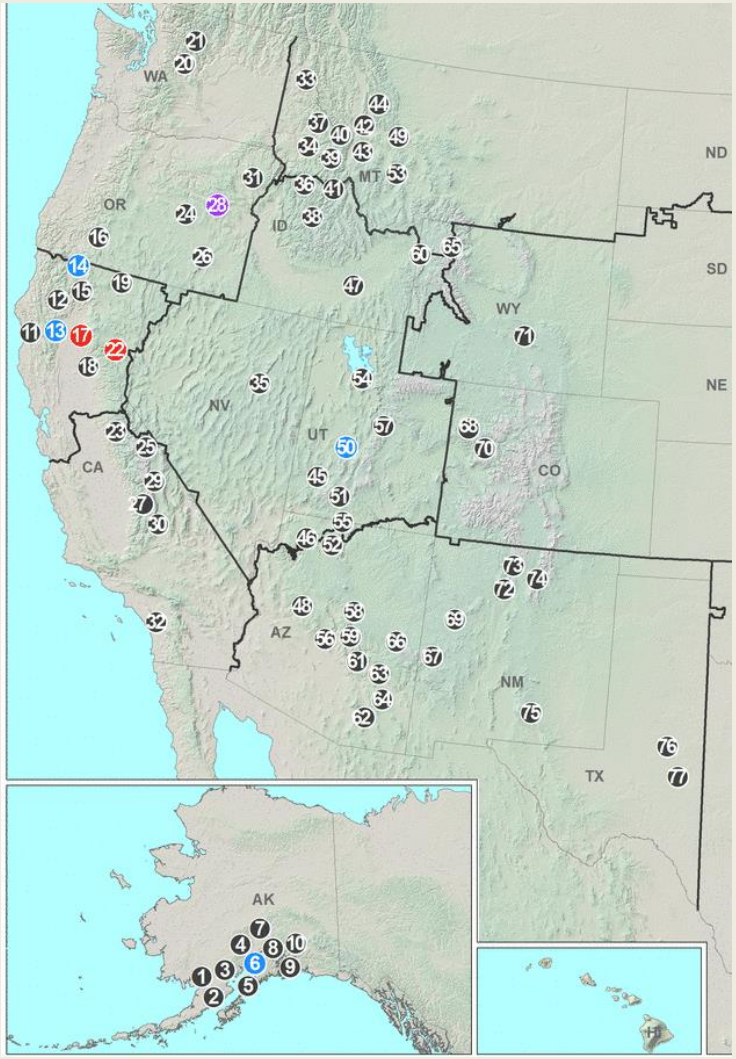
https://vegdri.unl.edu/Home.aspx





Vegetation Drought Response Index (VegDRI), September 8, 2019

Current Large Wildfires



2019 year-to-date (through 9/9/19):

- 35,605 fires
- 4,226,383 acres burned

10-year average (2009-2018) year-to-date (through 9/9):

- 46,964 fires
- 5,874,497 acres burned

Source: National Interagency Fire Center

ENSO Status September 9, 2019

- ENSO Alert System Status: Final El Niño Advisory
- ENSO-neutral conditions are present.*
- Equatorial sea surface temperatures (SSTs) are above average across the western Pacific Ocean and are below average in the eastern Pacific.
- The pattern of anomalous convection and winds are generally consistent with ENSO-neutral.
- ENSO-neutral is most likely to continue through Northern Hemisphere winter 2019-20 (50-55% chance).*

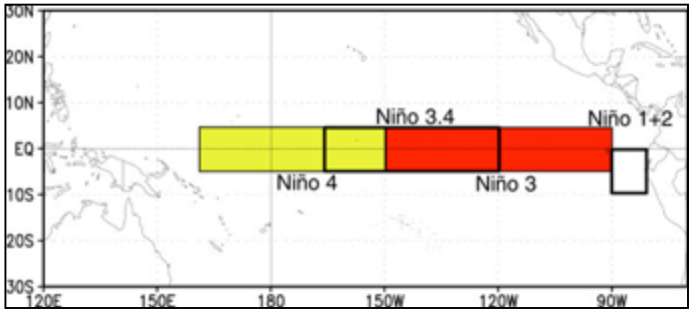
Credit: CPC

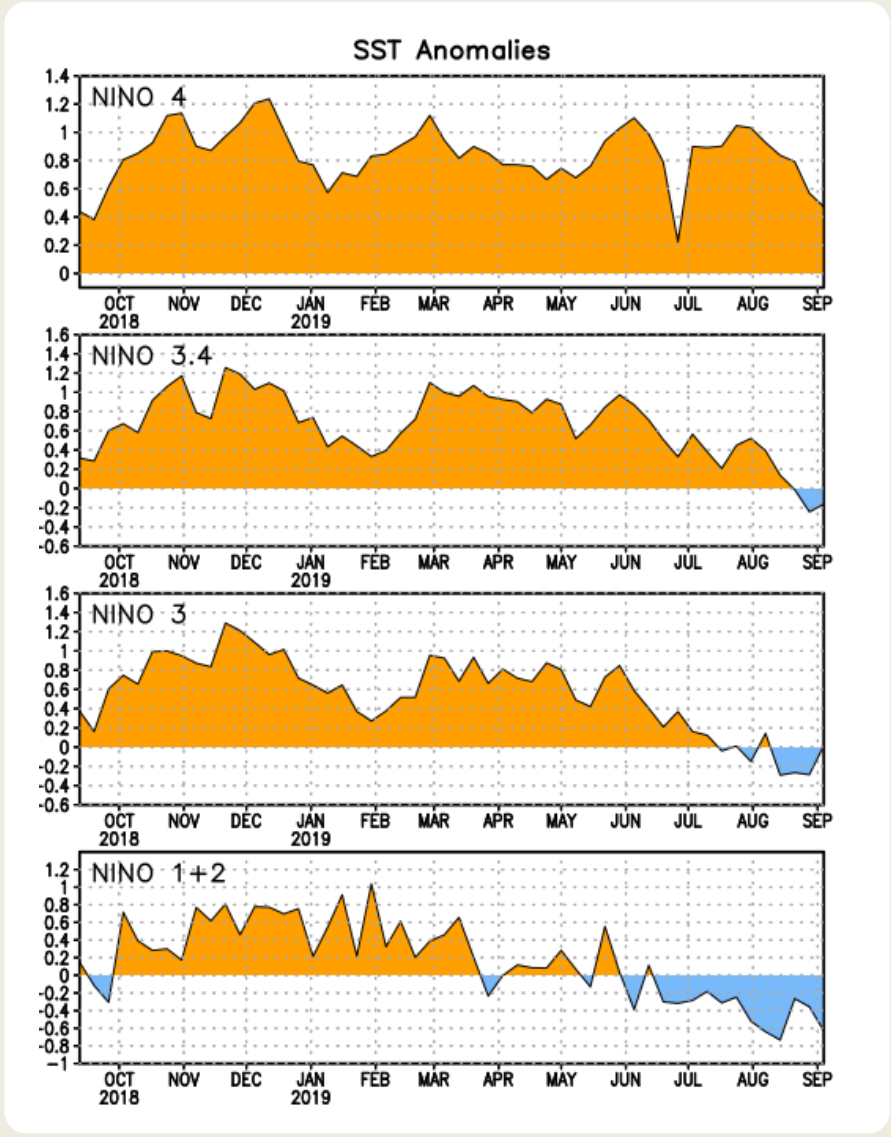
* Note: These statements are updated once a month (2nd Thursday) in association with the ENSO Diagnostics Discussion, which can be found here: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/.

Niño Region SST Departures (ºC) Recent Evolution

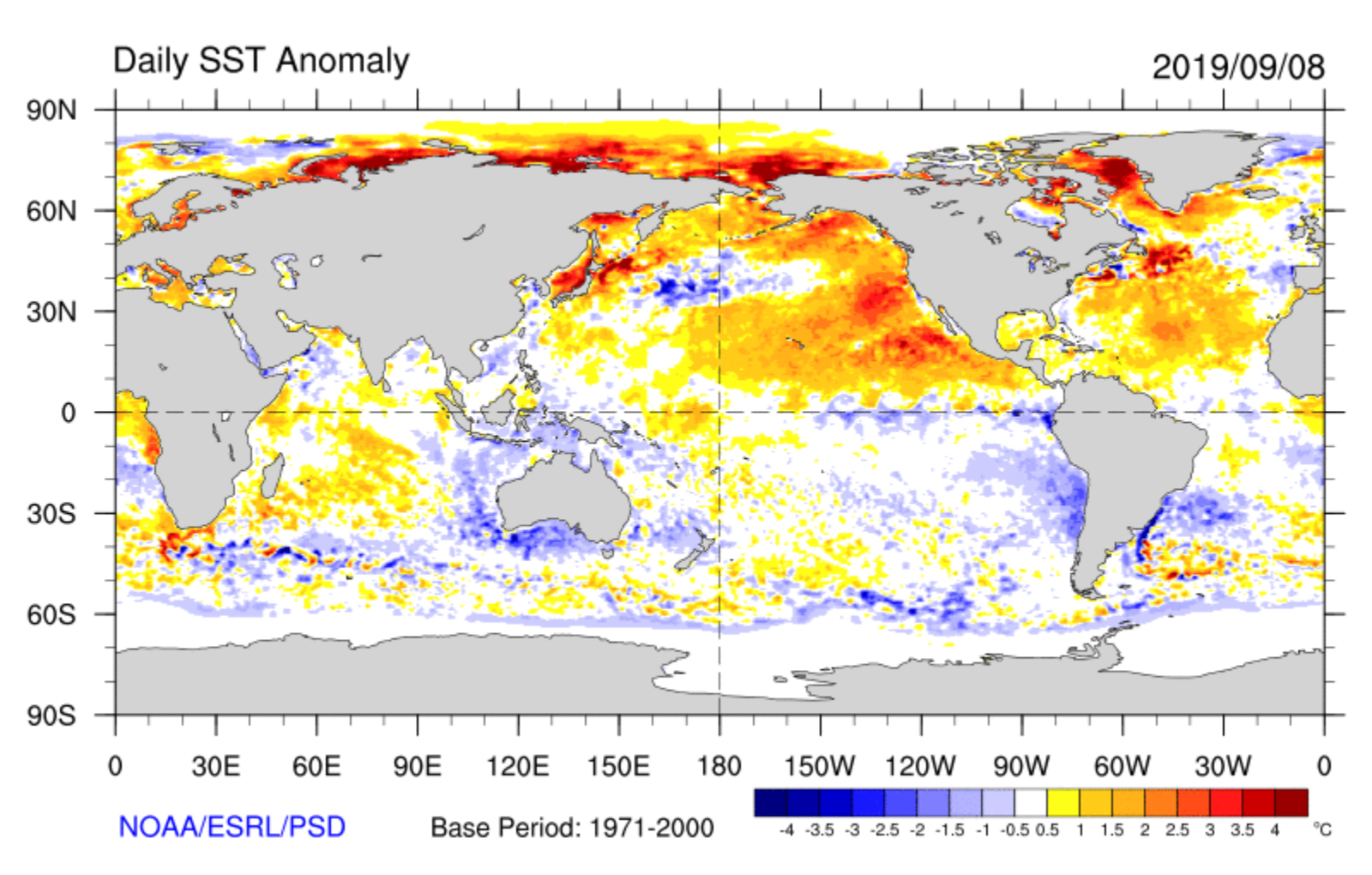
The latest weekly SST departures are:

Niño 4	**0.5ºC**
Niño 3.4	**-0.2ºC**
Niño 3	**0.0ºC**
Niño 1+2	**-0.6ºC**

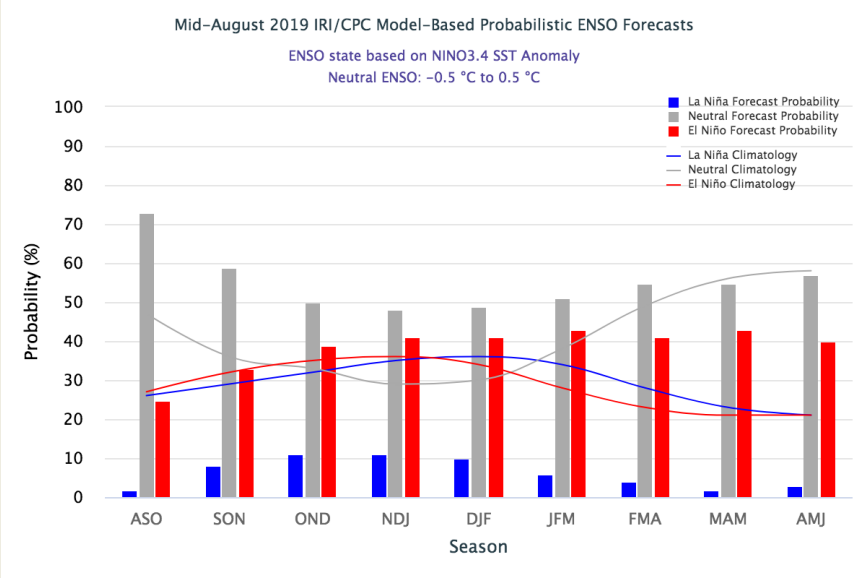


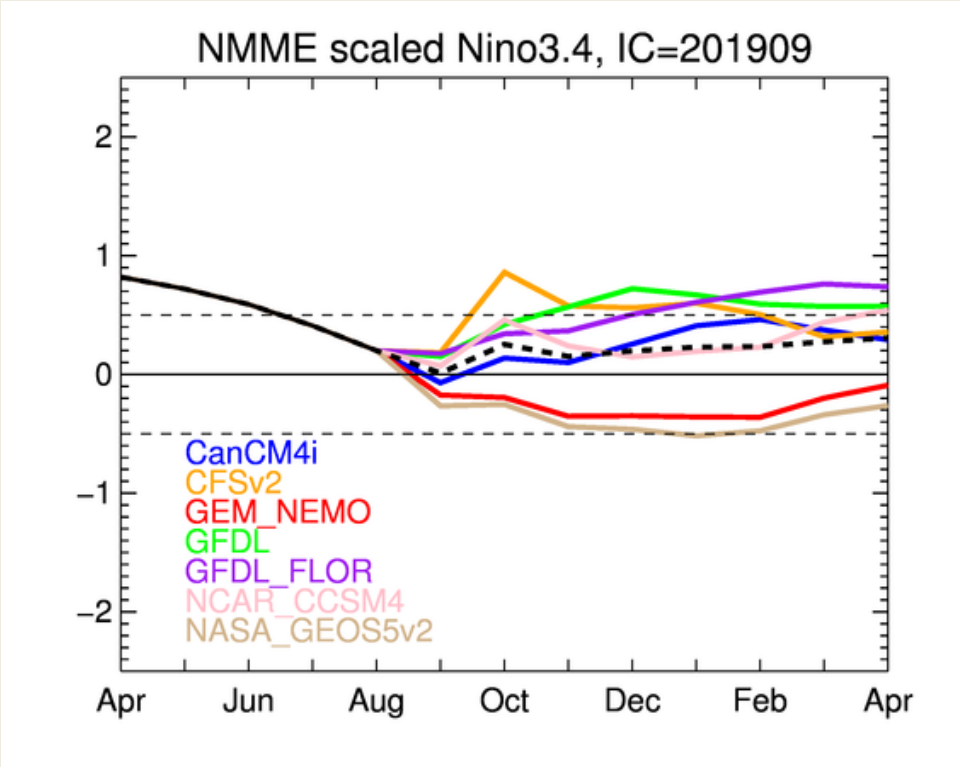


Current Sea Surface Temperatures



ENSO Forecasts





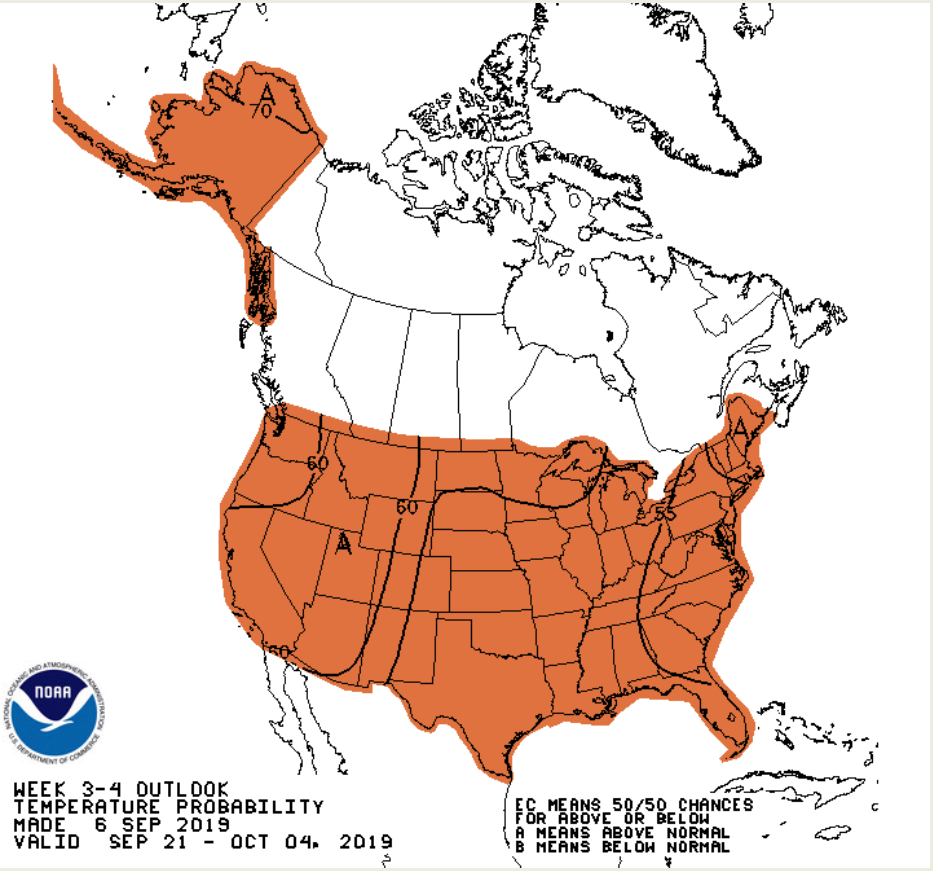
CPC/IRI El Nino forecast:

NMME models + other dynamical models + statistical models

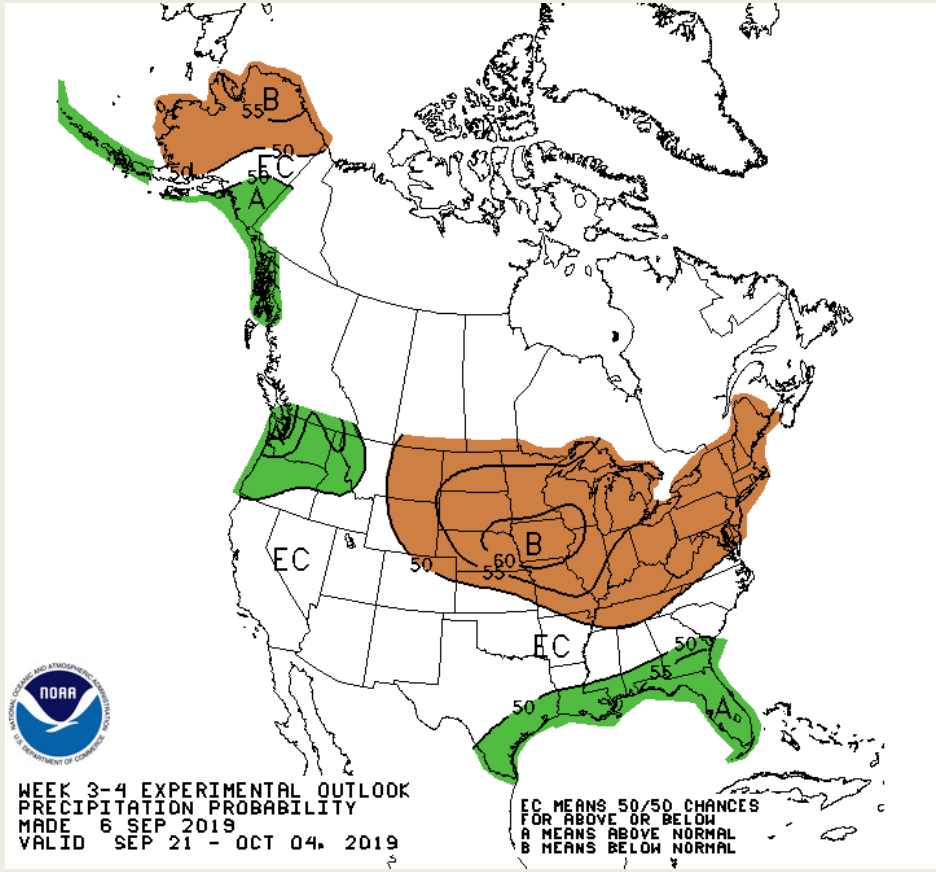
Source: CPC/IRI

September 21-October 4 U.S. Forecasts

Temperature Probability



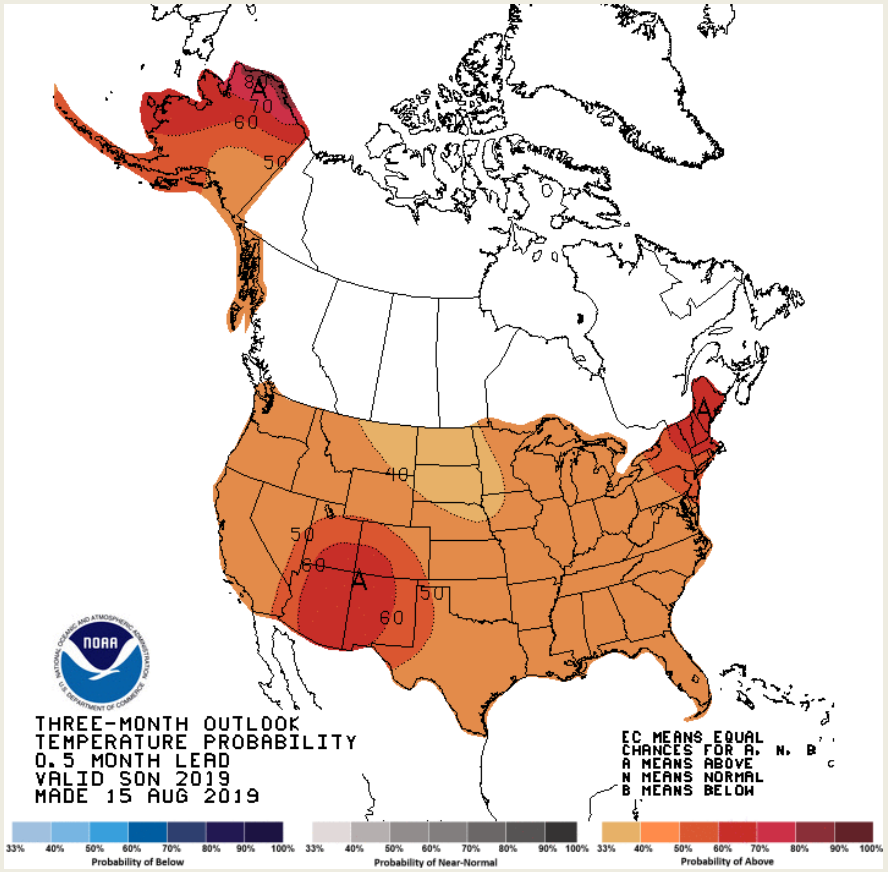
Precipitation Probability



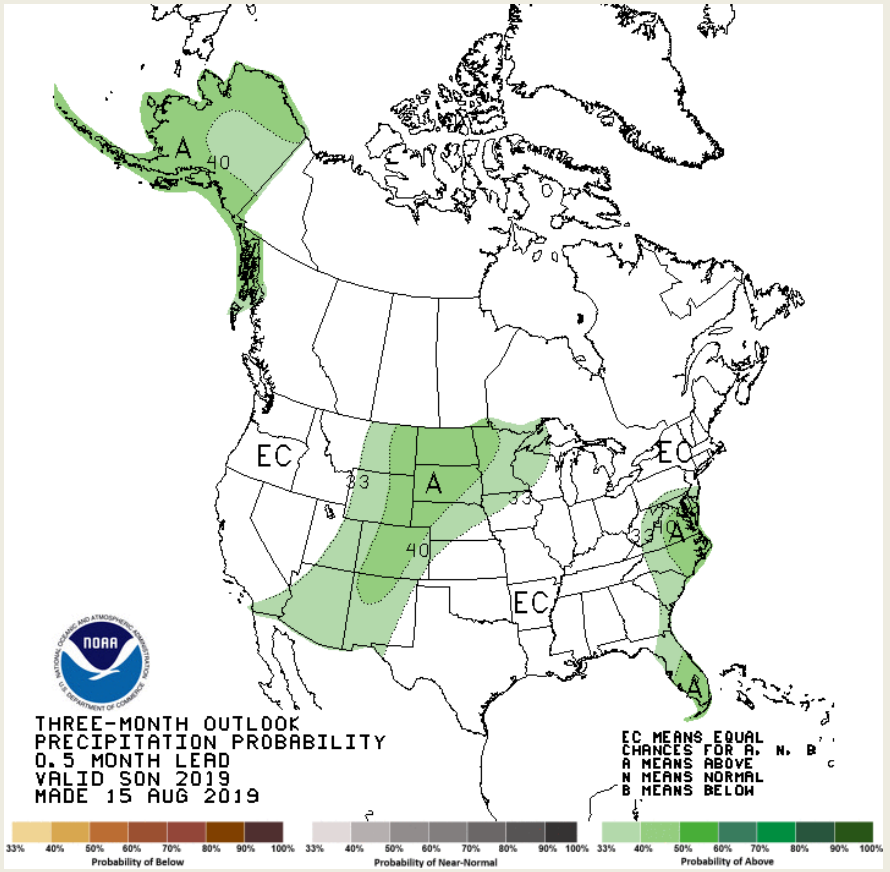
Source: NOAA/CPC

September-November Forecasts

Temperature Probability



Precipitation Probability



Source: NOAA/CPC

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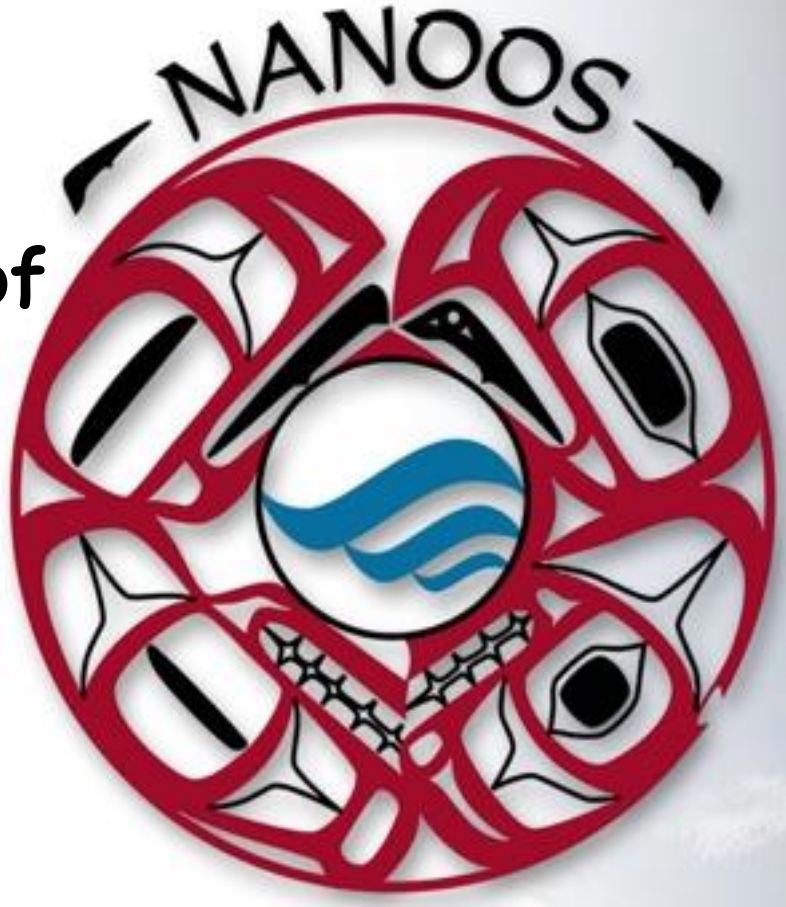
Northwest Association of Networked Ocean Observing Systems



NOAA West Watch Update 10 September 2019: Washington / Oregon Observations

Jan Newton, NANOOS Executive Director

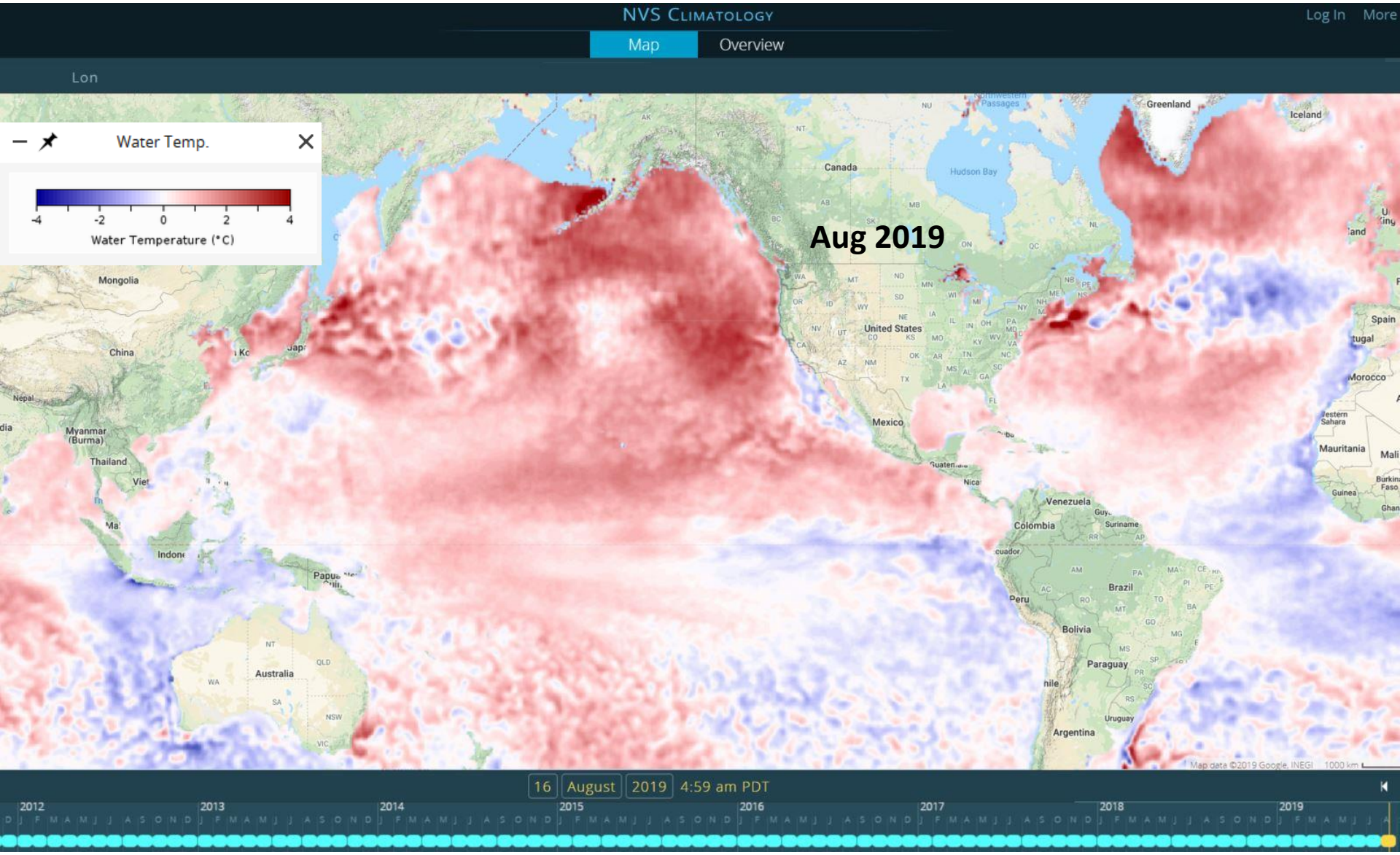
IOOS Integrated Ocean Observing System

www.nanoos.org

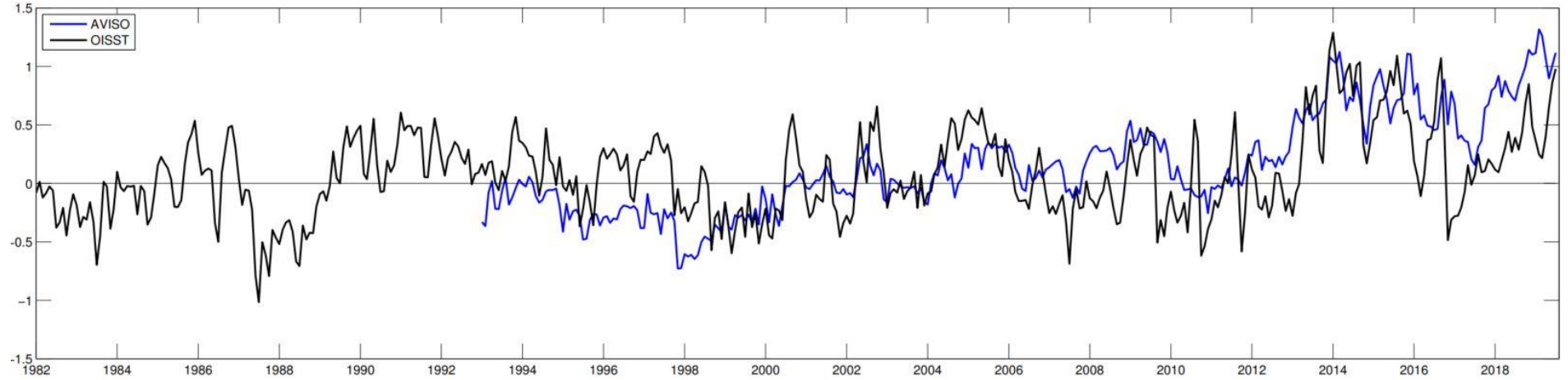
NANOOS: www.nanoos.org Climatology app

Sea Surface Temperature Anomaly

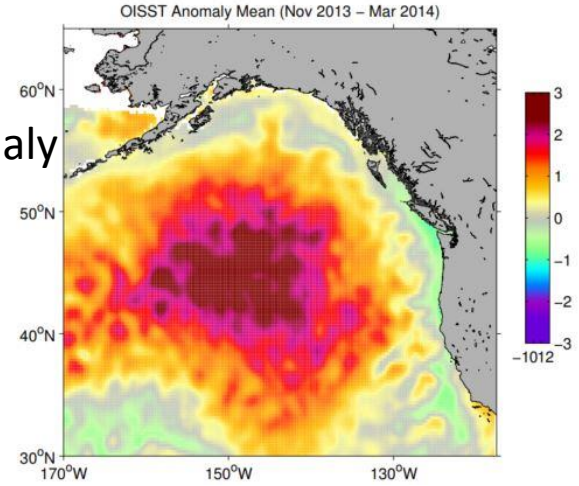
NCDC Optimum Interpolation SST



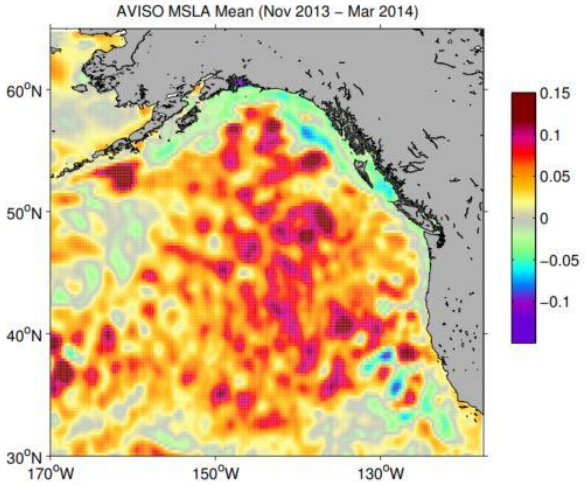
‘Blob’ Indices



SST anomaly



MSL anomaly

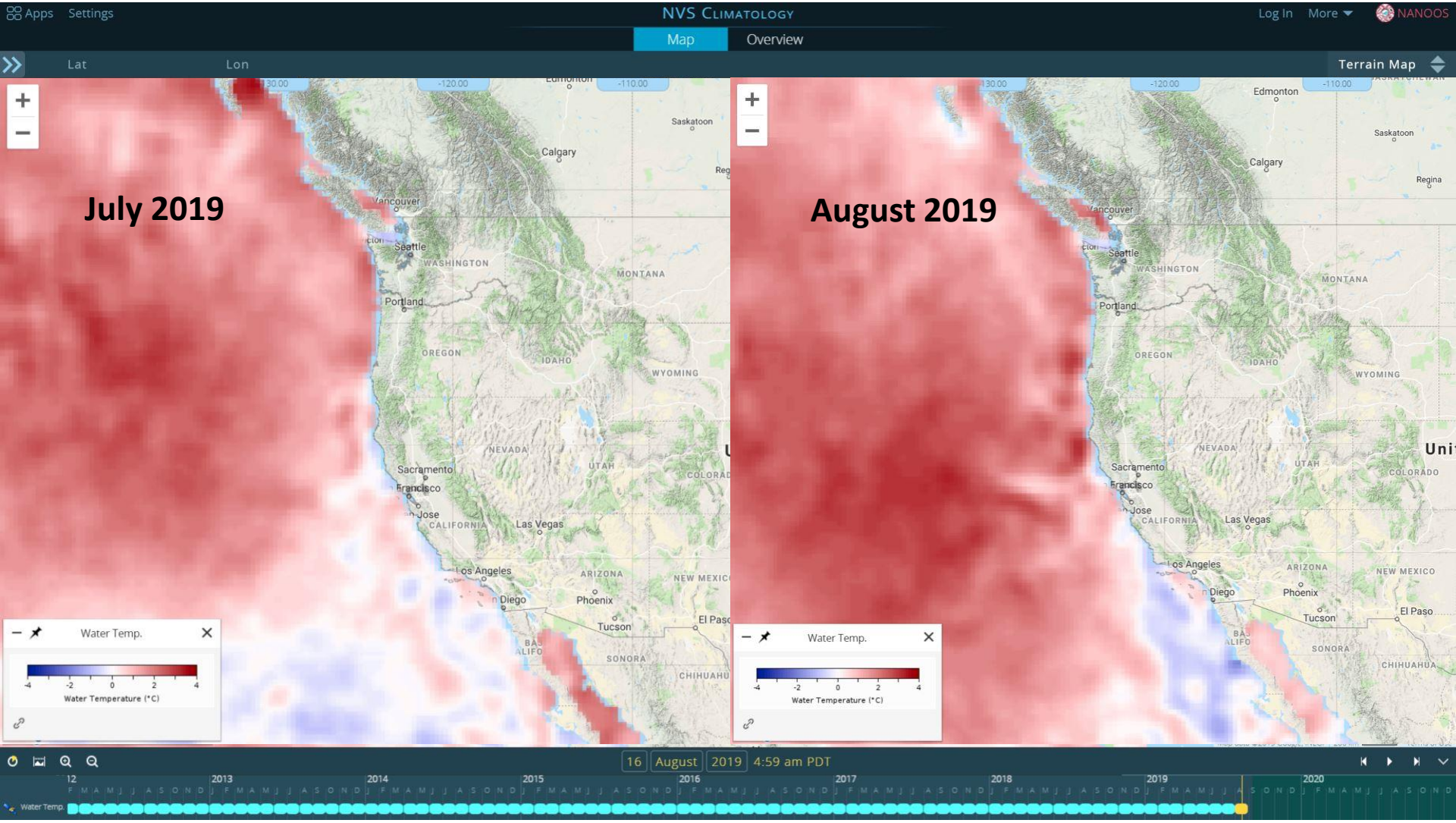


Figures and analysis by Dudley Chelton and Craig Risien, OSU

NANOOS: www.nanoos.org Climatology app

Sea Surface Temperature Anomaly

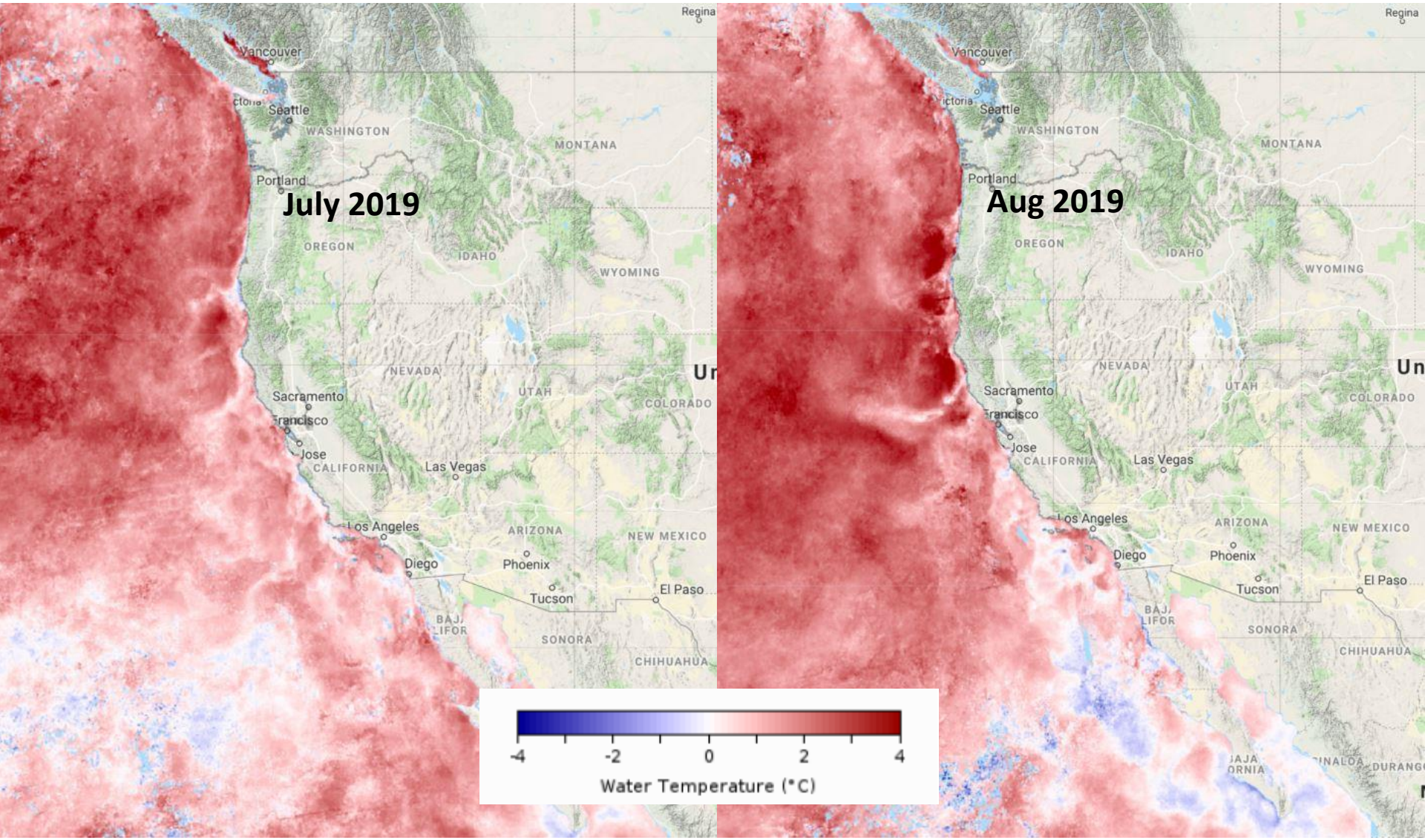
NCDC Optimum Interpolation SST



NANOOS: www.nanoos.org Climatology app

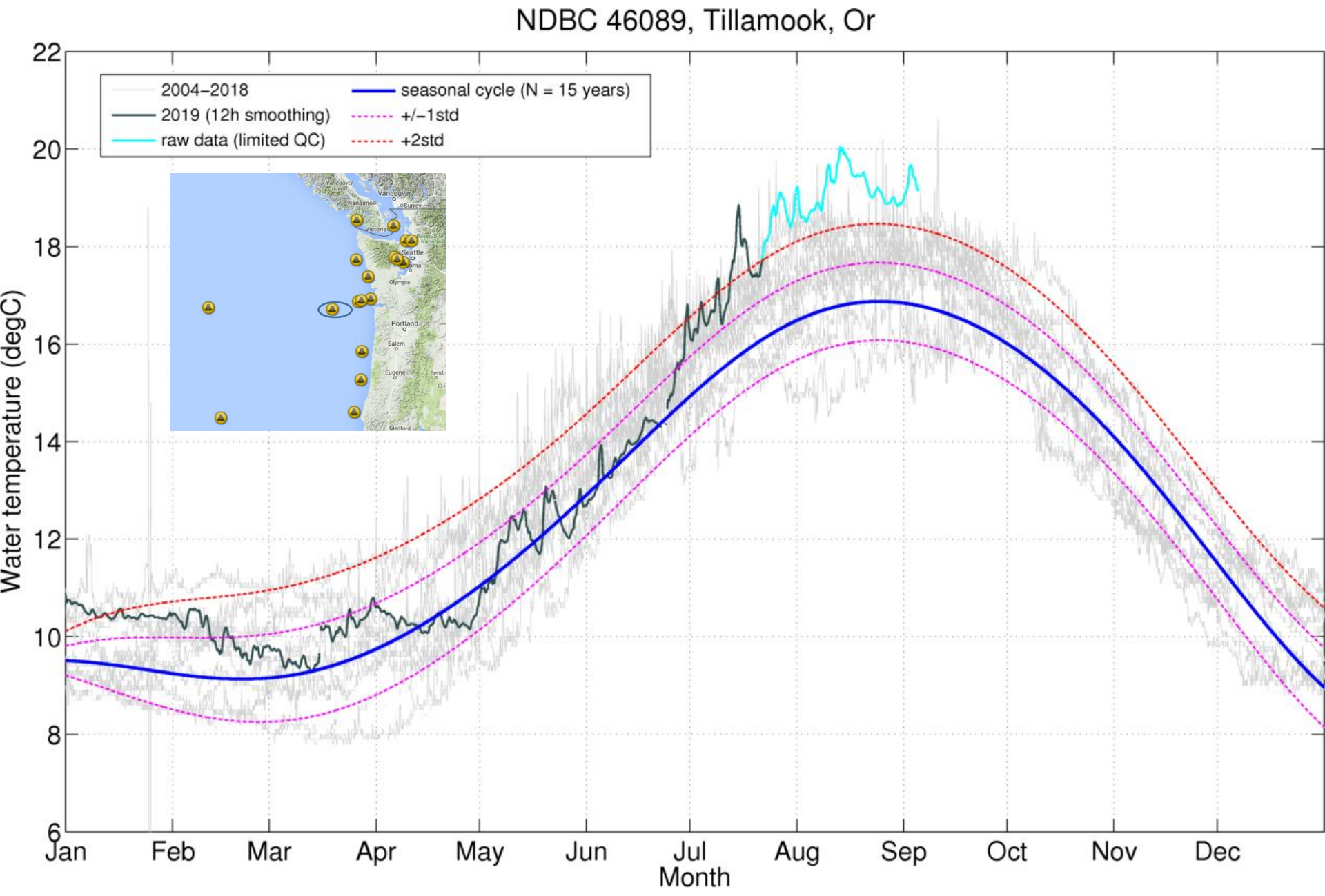
Sea Surface Temperature Anomaly

OSU Modis



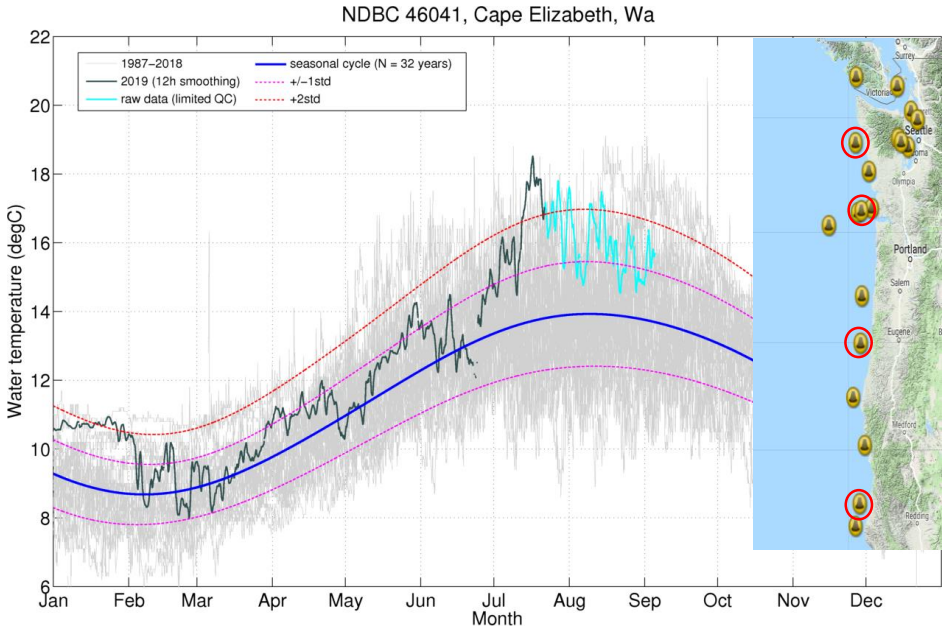
NANOOS: www.nanoos.org Climatology app

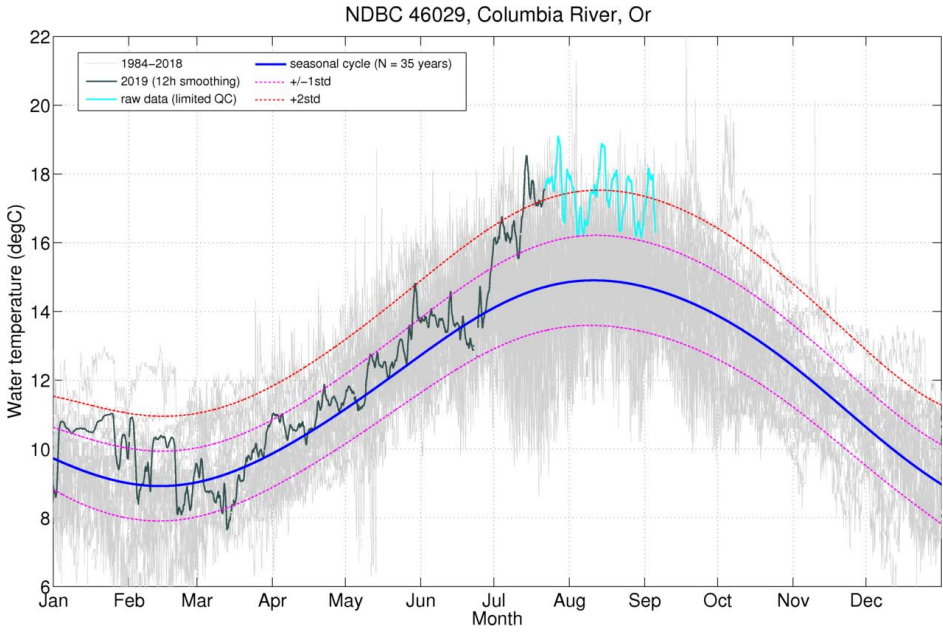
Sea Surface Temp

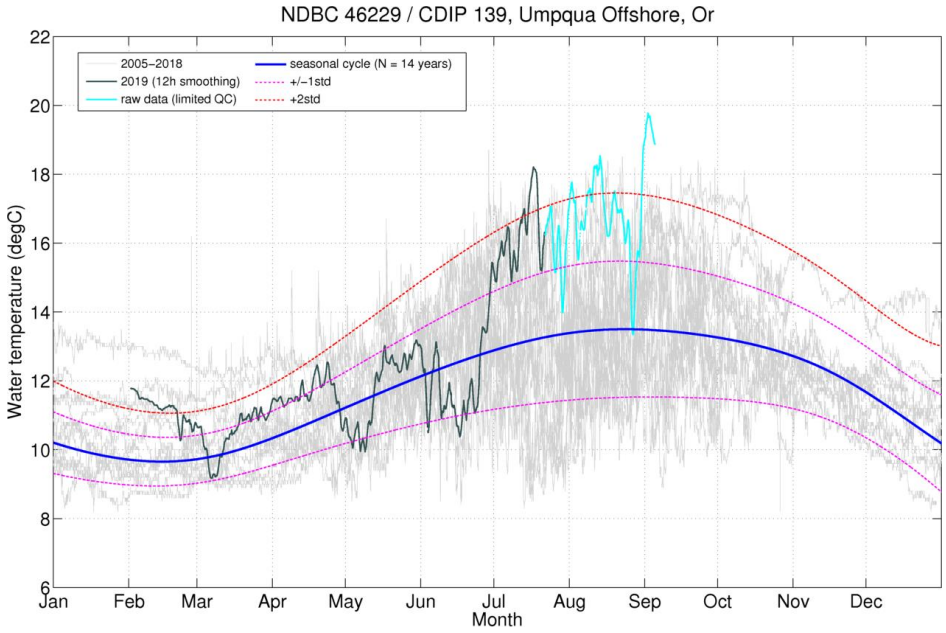


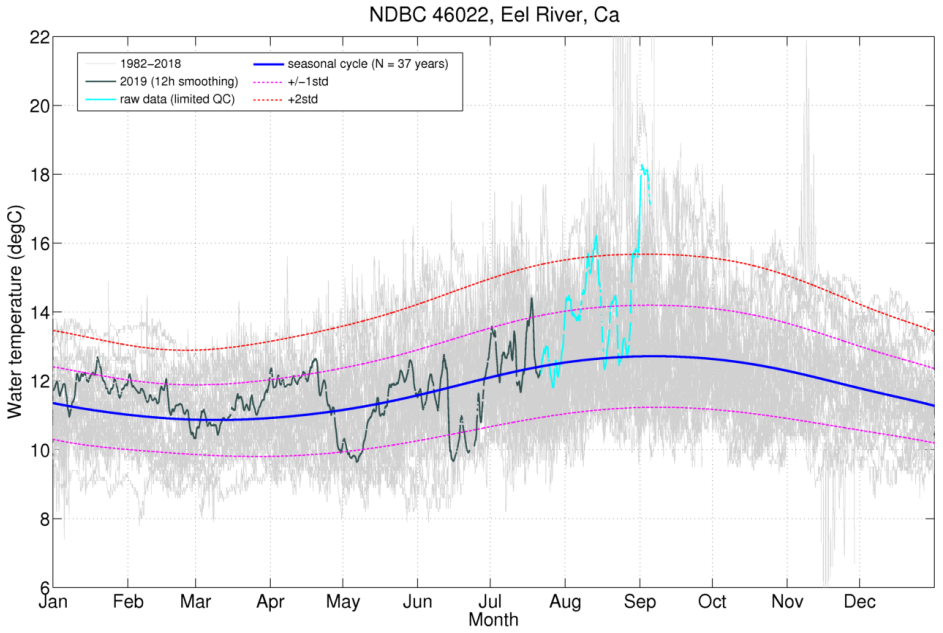
NANOOS: www.nanoos.org Climatology app

Sea Surface Temp



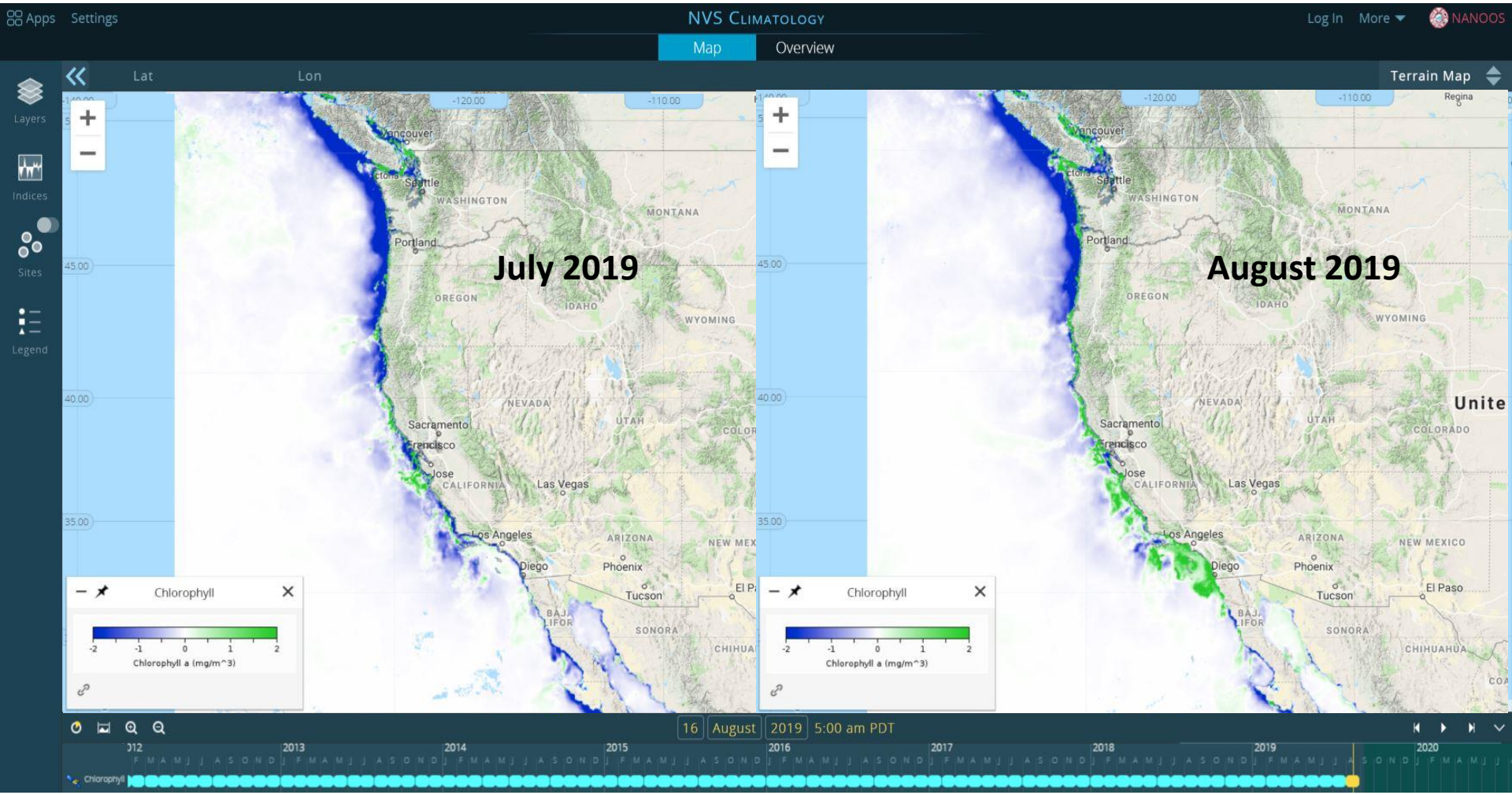






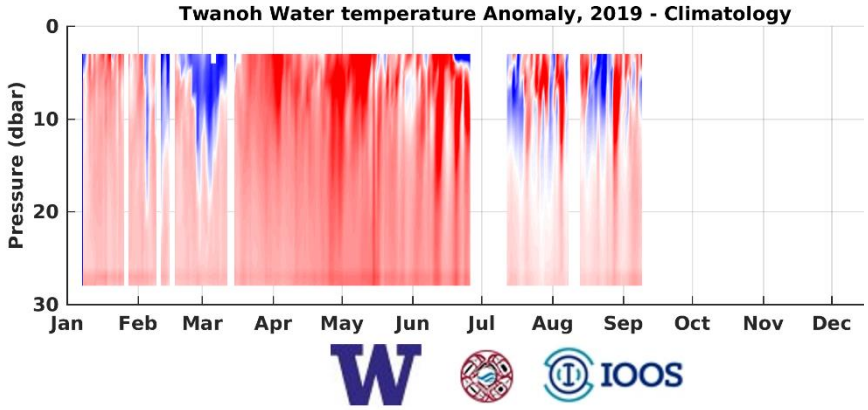
NANOOS: www.nanoos.org Climatology app

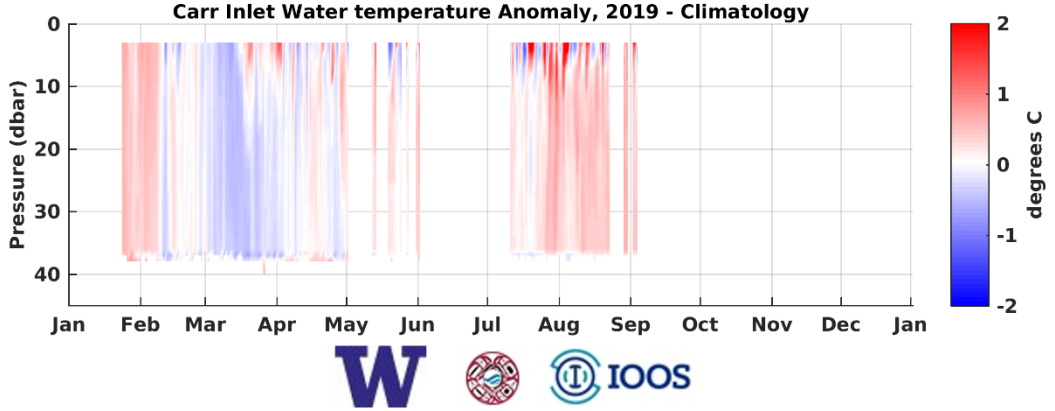
Chlorophyll Anomaly: *OSU Modis*

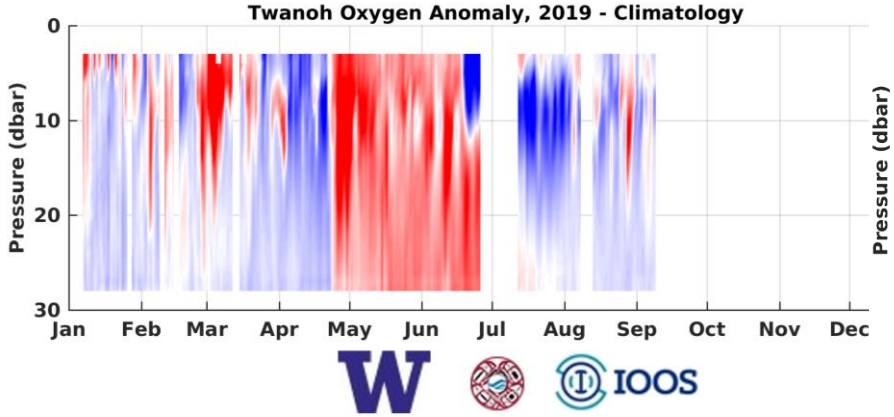


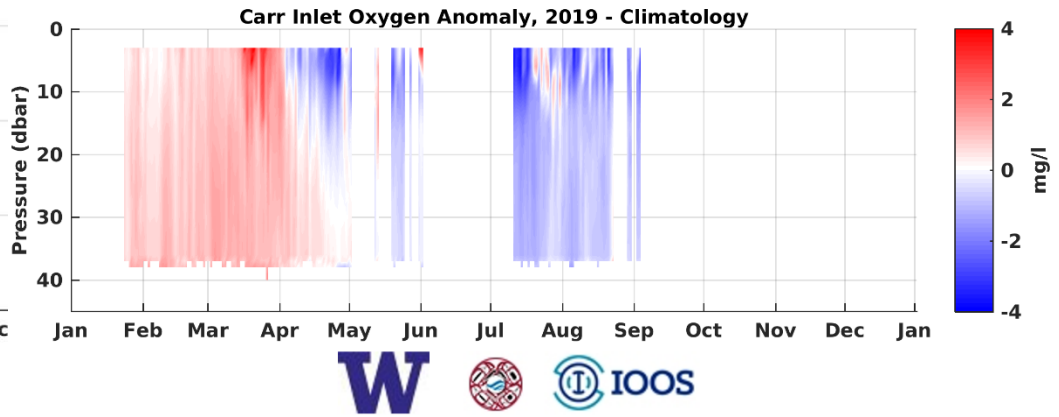
NANOOS: www.nanoos.org Climatology app

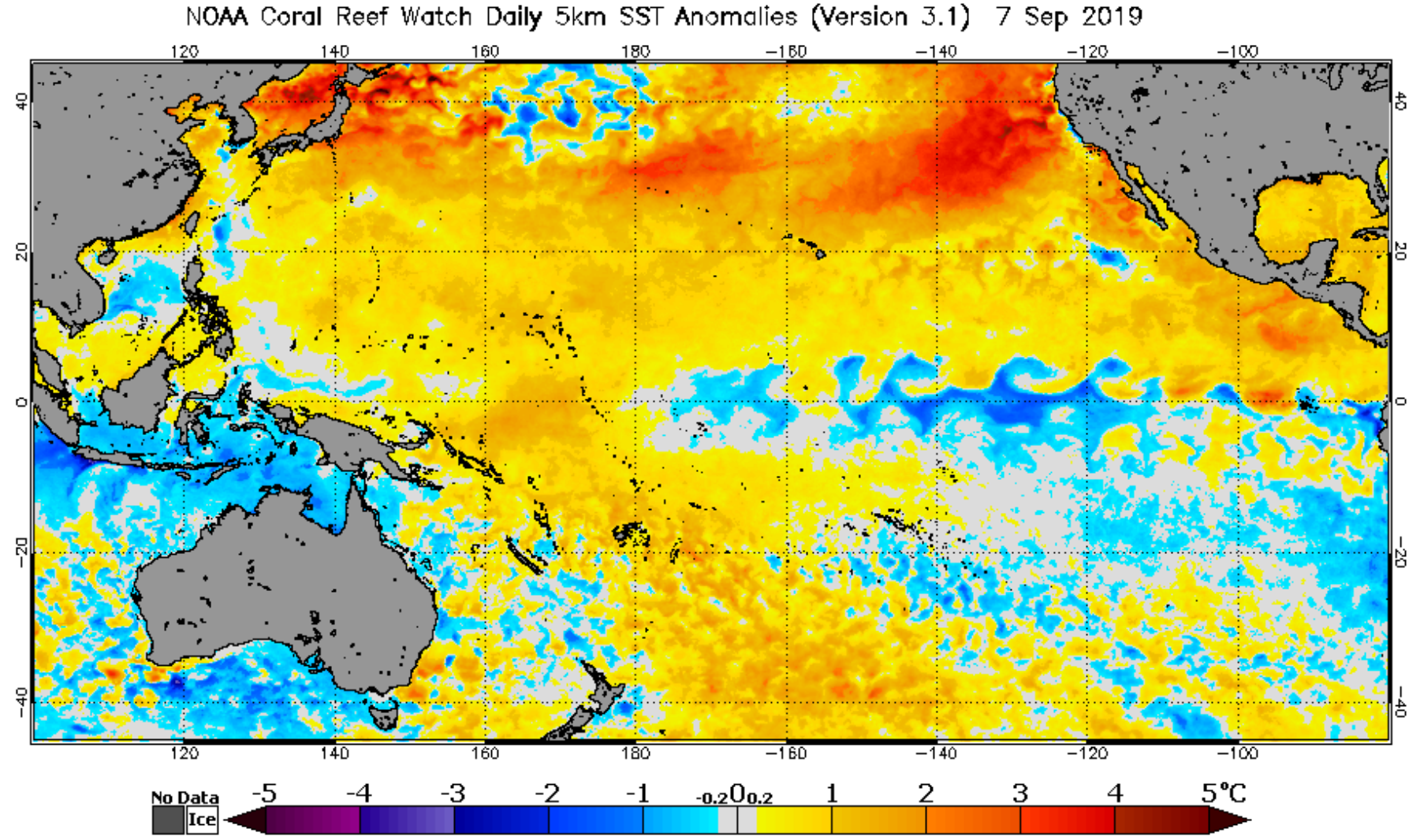
Puget Sound profiling buoys







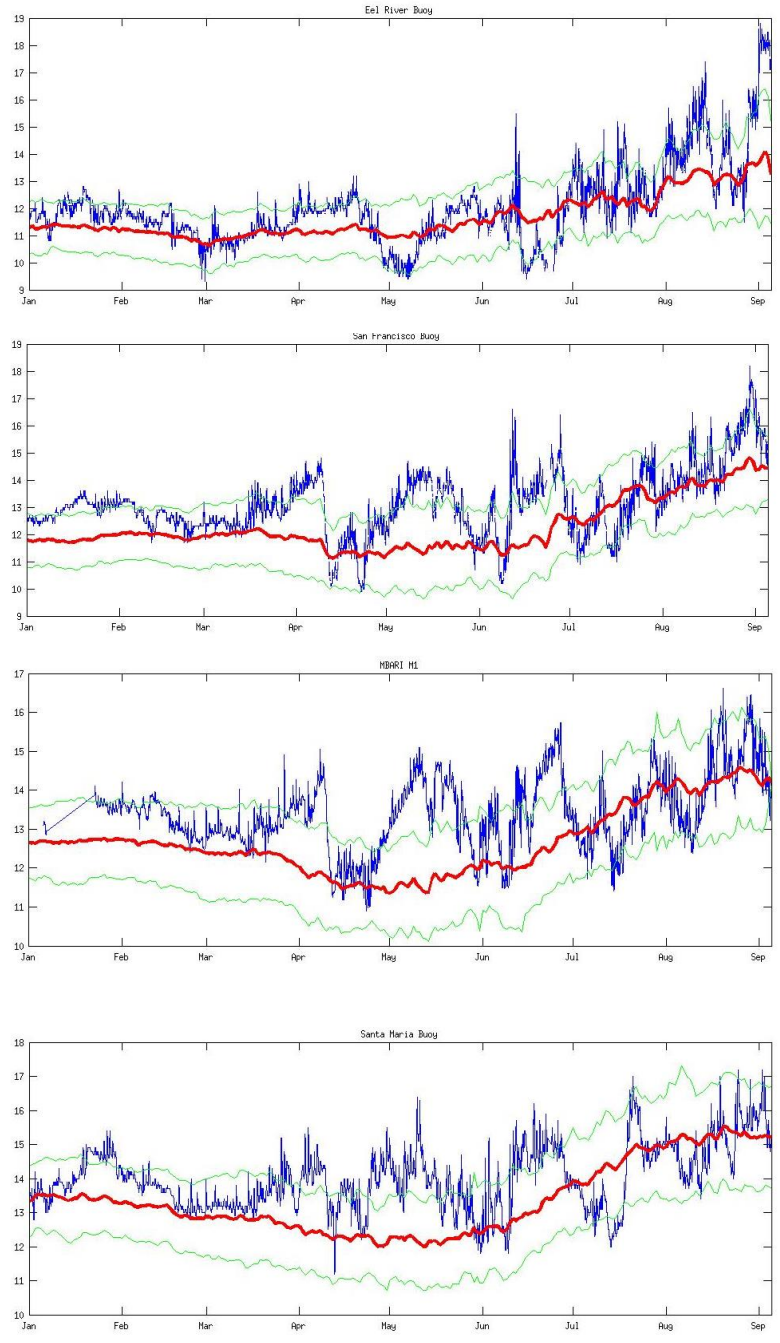


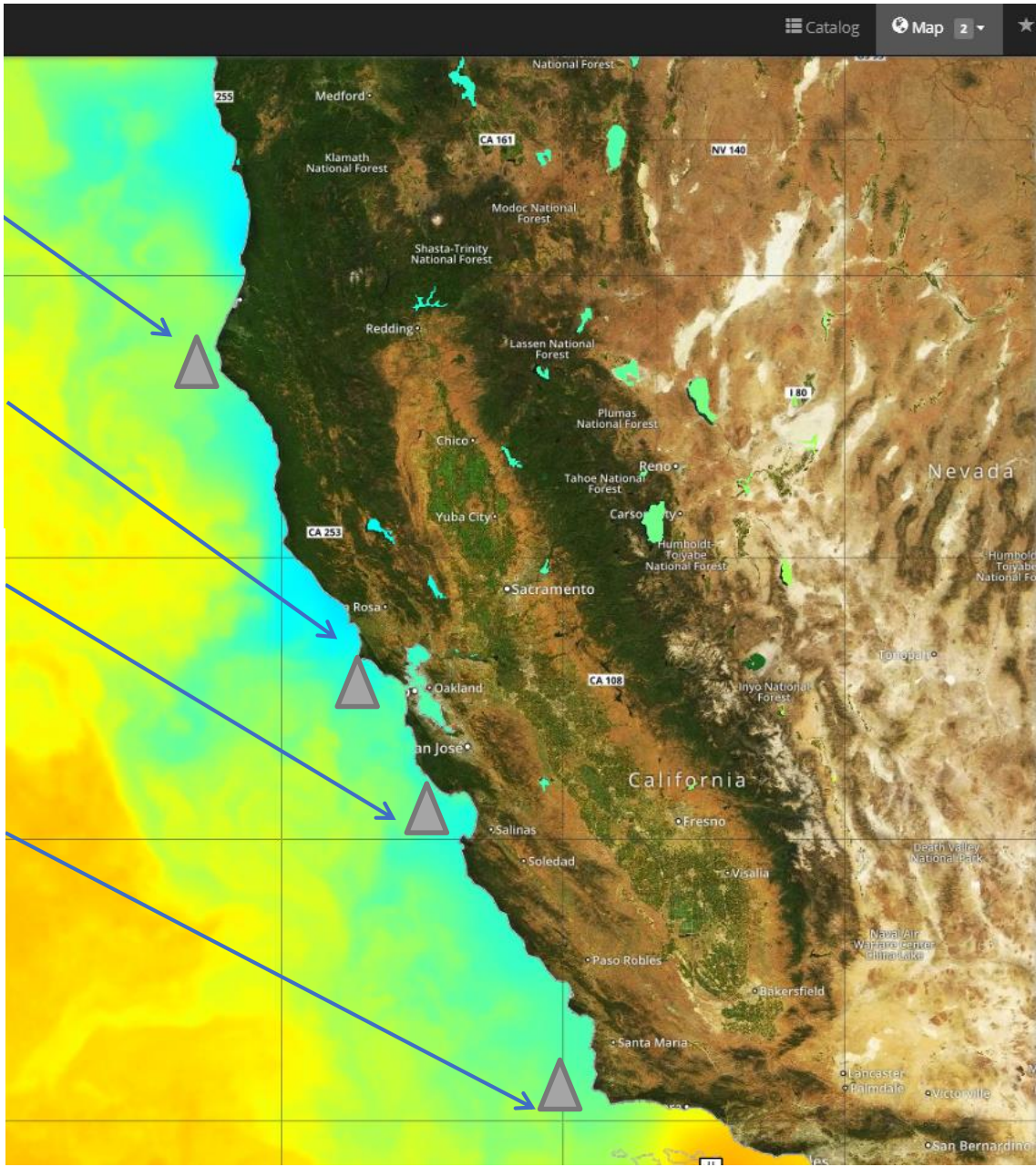


NOAA West Watch Update: Central & Northern California Update

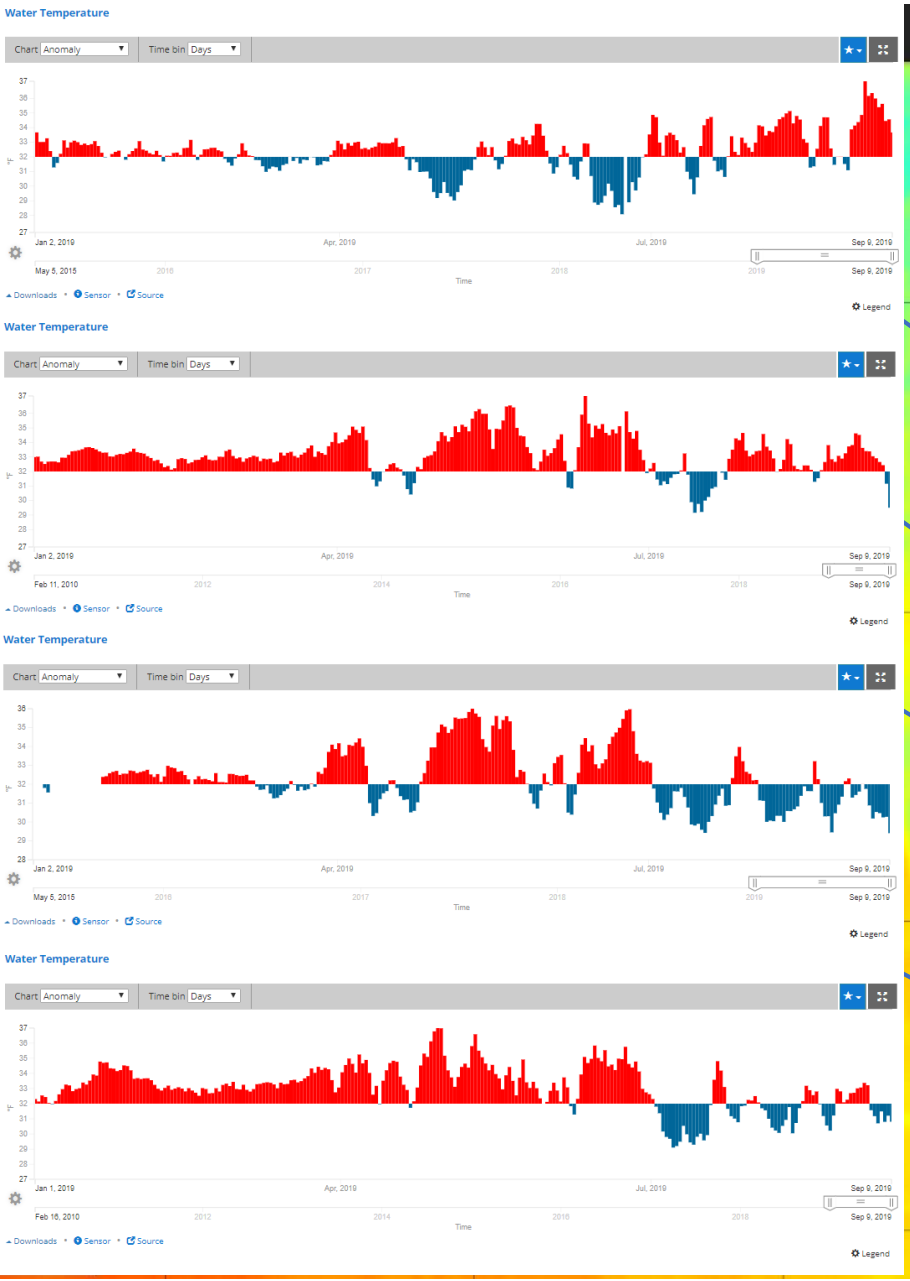
Presented by: Alex Harper, CeNCOOS Program Manager

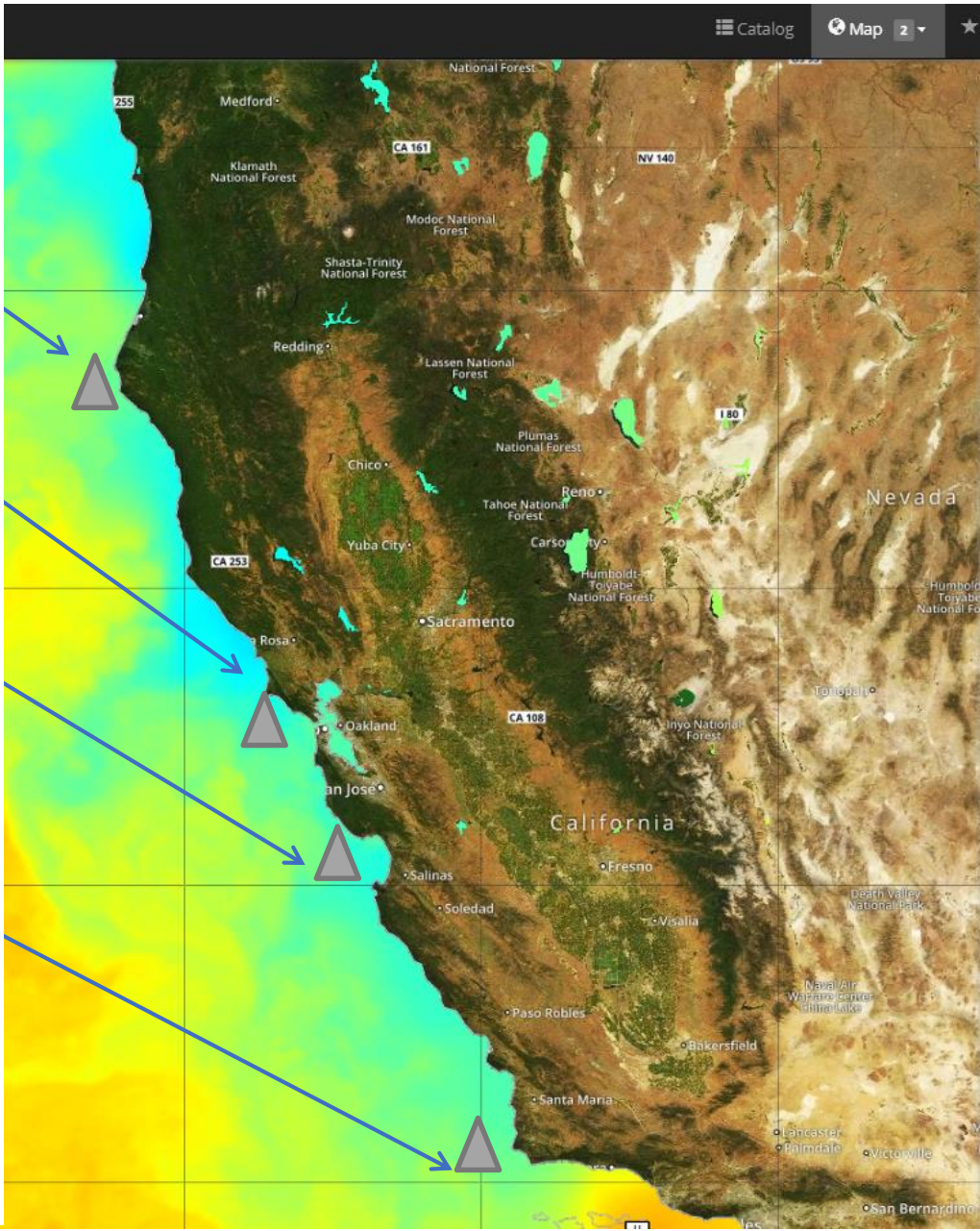
CeNCOOS Climatology





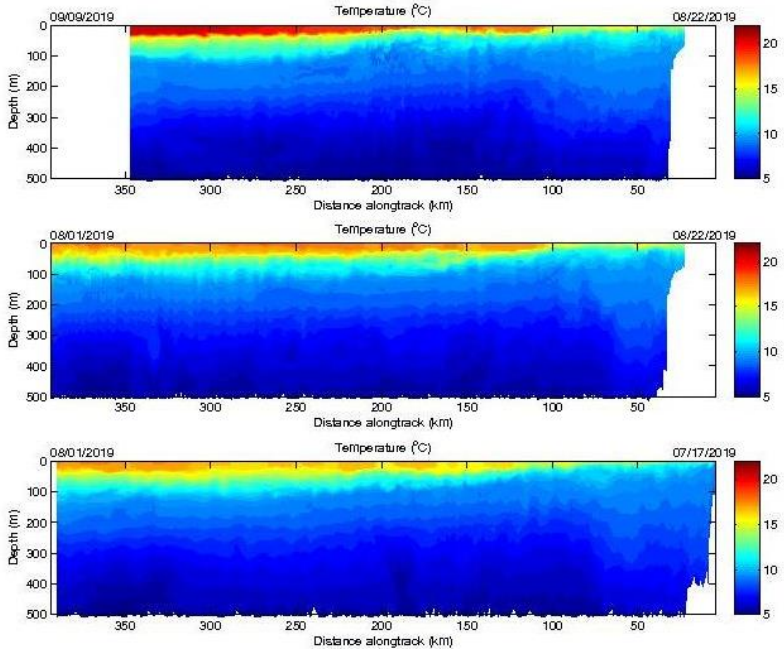
CeNCOOS Climatology



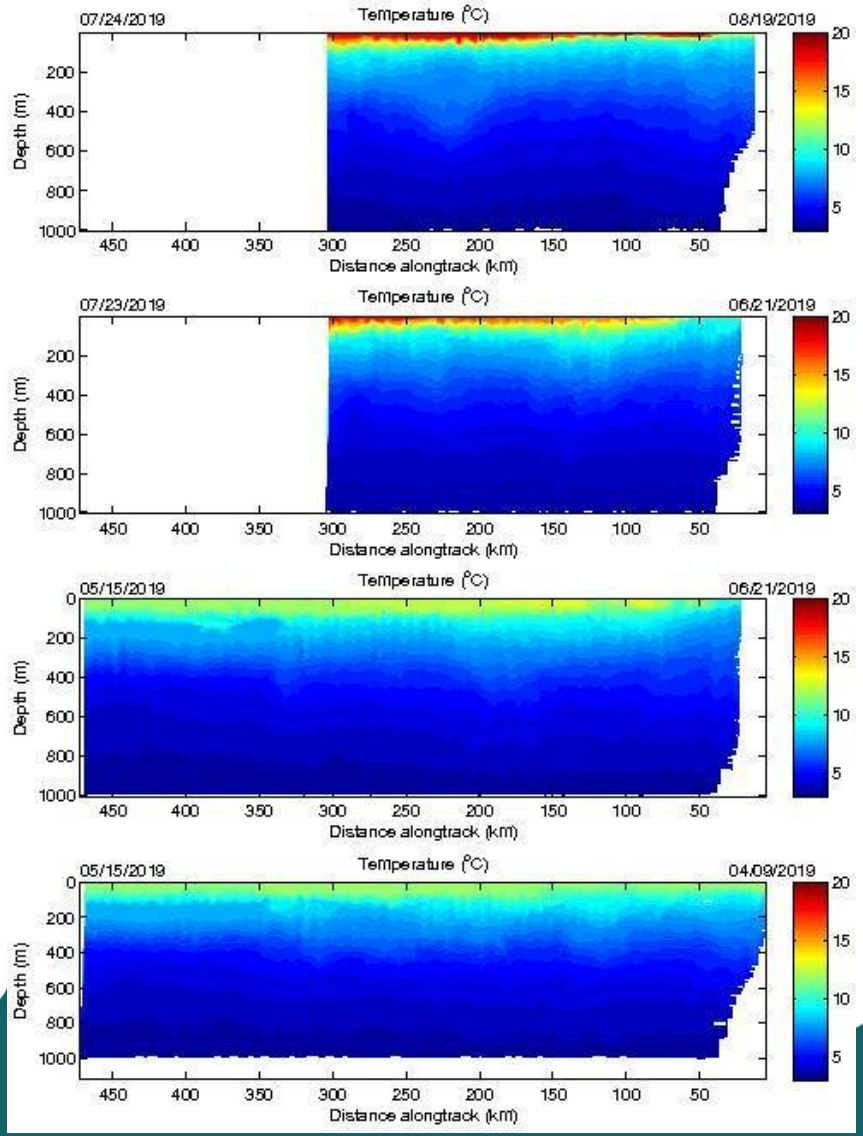


Central & North Coast Heat Content

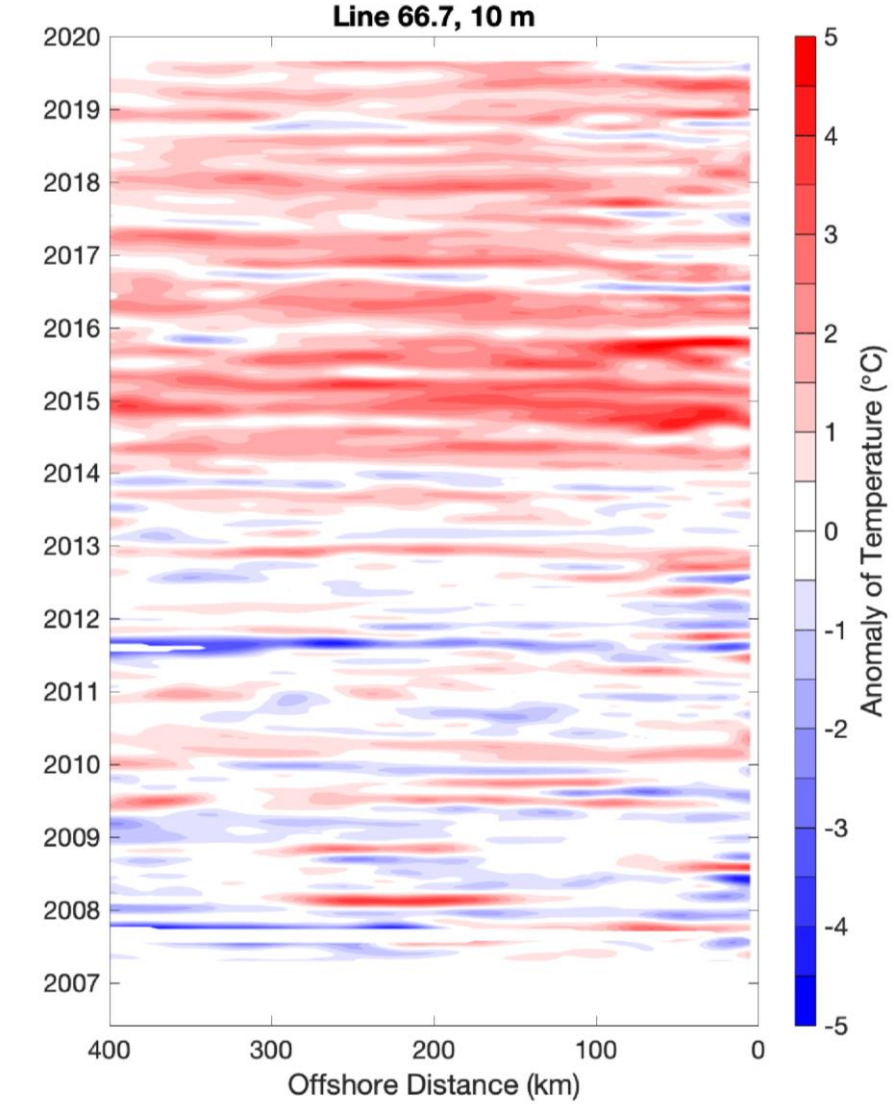
Line 66.7

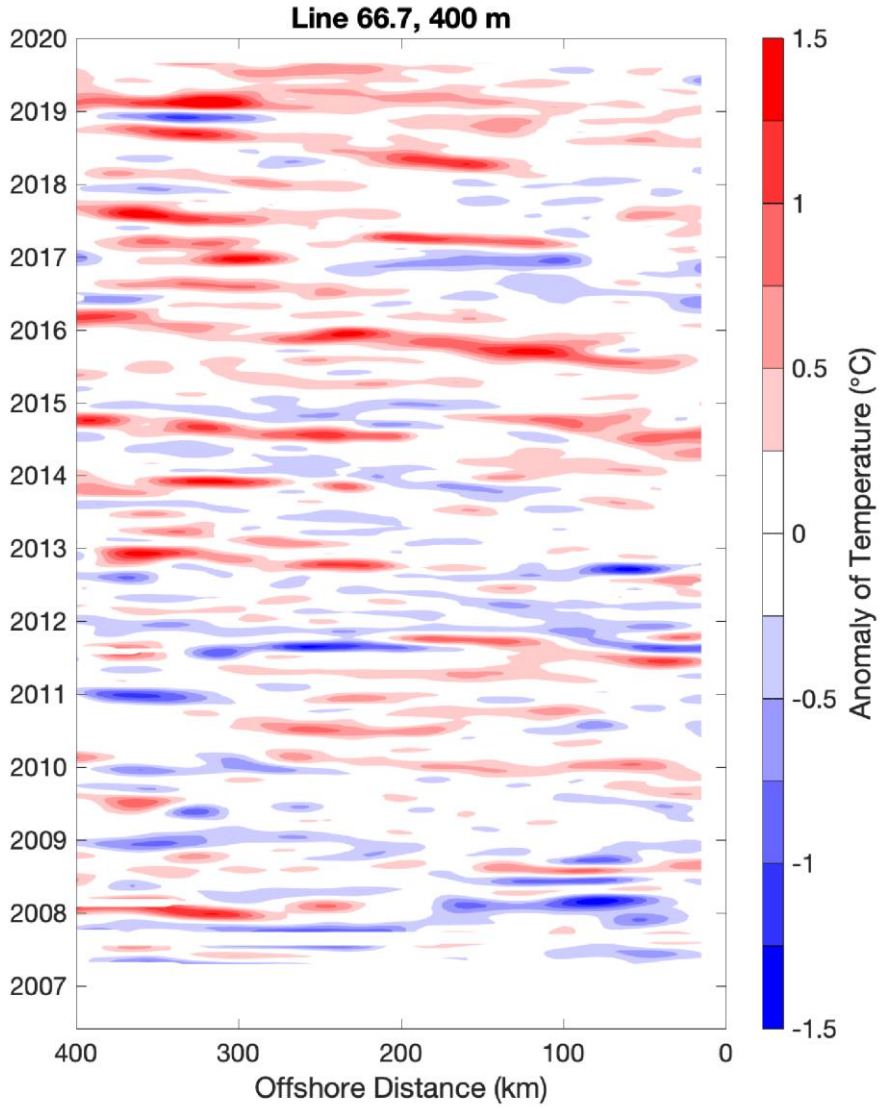


Trinidad

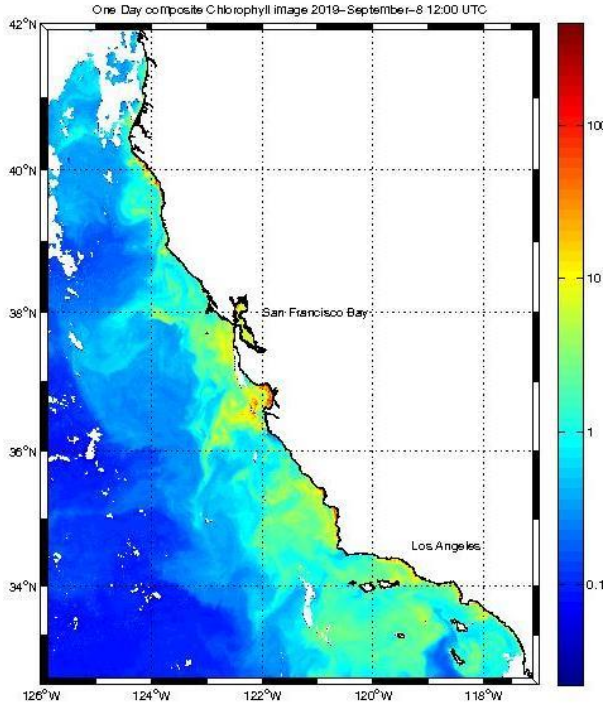


Central & North Coast Heat Content

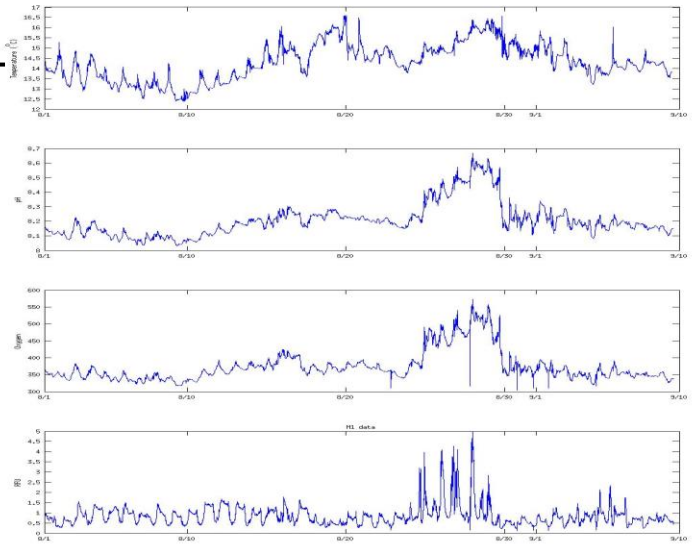




Monterey Bay Bloom

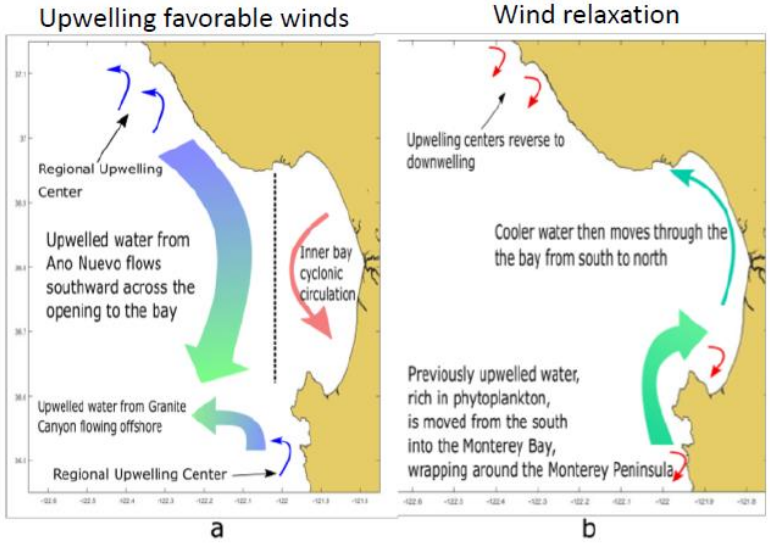


M1



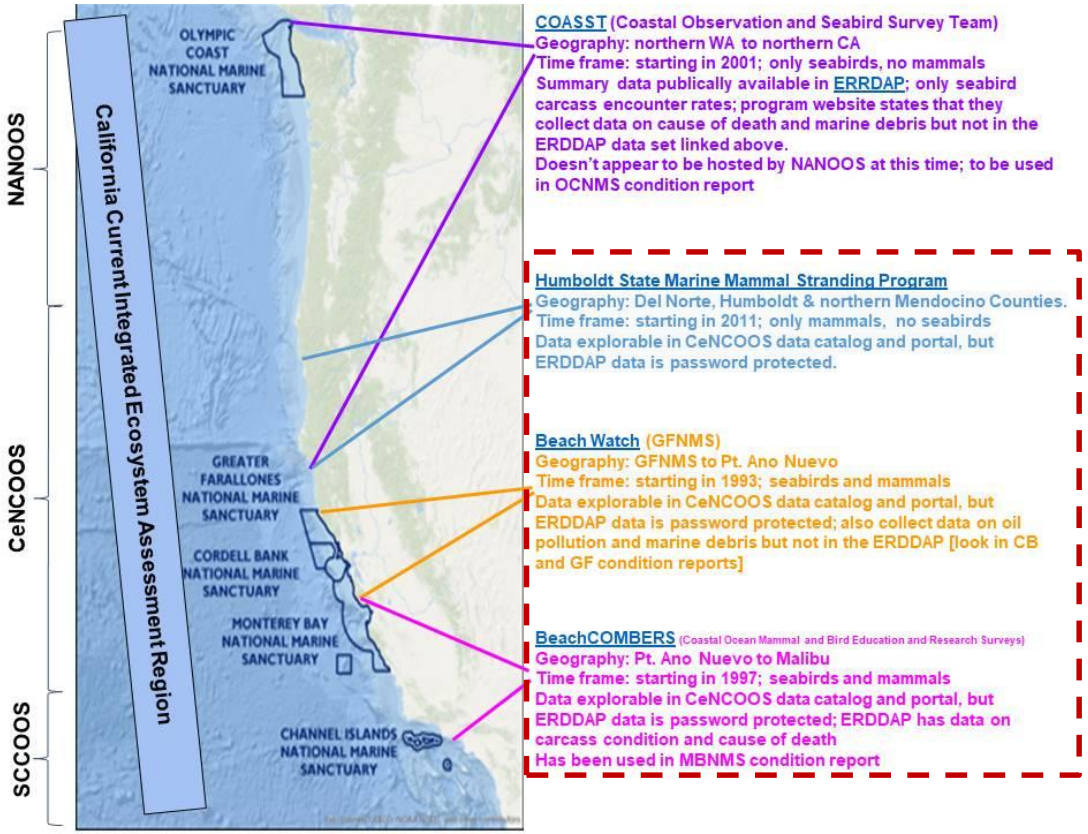
"Chlorophyll biomass was significantly higher compared to last sampling. As expected from the water color, dinoflagellates were still dominant this week. The diatom assemblage was sparse with Pseudo-nitzschia spp. only observed in a single live field" Aug 28, 2019

-Jason Smith, Ph.D., HABMAP PI/ MLML/ ACT



R. Manzer – MLML thesis 2017

New tool: Seabirds and Marine Mammals Surveys



COASST (Coastal Observation and Seabird Survey Team)
Geography: northern WA to northern CA
Time frame: starting in 2001; only seabirds, no mammals
Summary data publically available in ERRDAP; only seabird carcass encounter rates; program website states that they collect data on cause of death and marine debris but not in the ERDDAP data set linked above.
Doesn't appear to be hosted by NANOOS at this time; to be used in OCNMS condition report

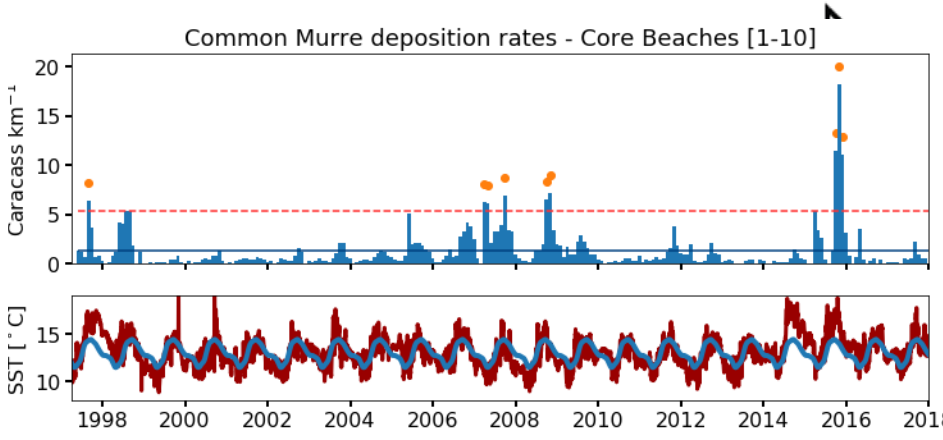
Humboldt State Marine Mammal Stranding Program
Geography: Del Norte, Humboldt & northern Mendocino Counties.
Time frame: starting in 2011; only mammals, no seabirds
Data explorable in CeNCOOS data catalog and portal, but ERDDAP data is password protected.

Beach Watch (GFNMS)
Geography: GFNMS to Pt. Ano Nuevo
Time frame: starting in 1993; seabirds and mammals
Data explorable in CeNCOOS data catalog and portal, but ERDDAP data is password protected; also collect data on oil pollution and marine debris but not in the ERDDAP [look in CB and GF condition reports]

BeachCOMBERS (Coastal Ocean Mammal and Bird Education and Research Surveys)
Geography: Pt. Ano Nuevo to Malibu
Time frame: starting in 1997; seabirds and mammals
Data explorable in CeNCOOS data catalog and portal, but ERDDAP data is password protected; ERDDAP has data on carcass condition and cause of death
Has been used in MBNMS condition report

Key features:

- View all beach segments being monitored or zoom in to the beaches of interest to you;
- Identify which seabirds and mammals are most commonly found on beaches;
- Explore when marine mammal and seabird strandings have peaked;
- Compare seabird strandings across Greater Farallones, Monterey Bay, and Channel Islands sanctuaries to explore if an event is local or regional in extent
- And much more!!



Thank you!

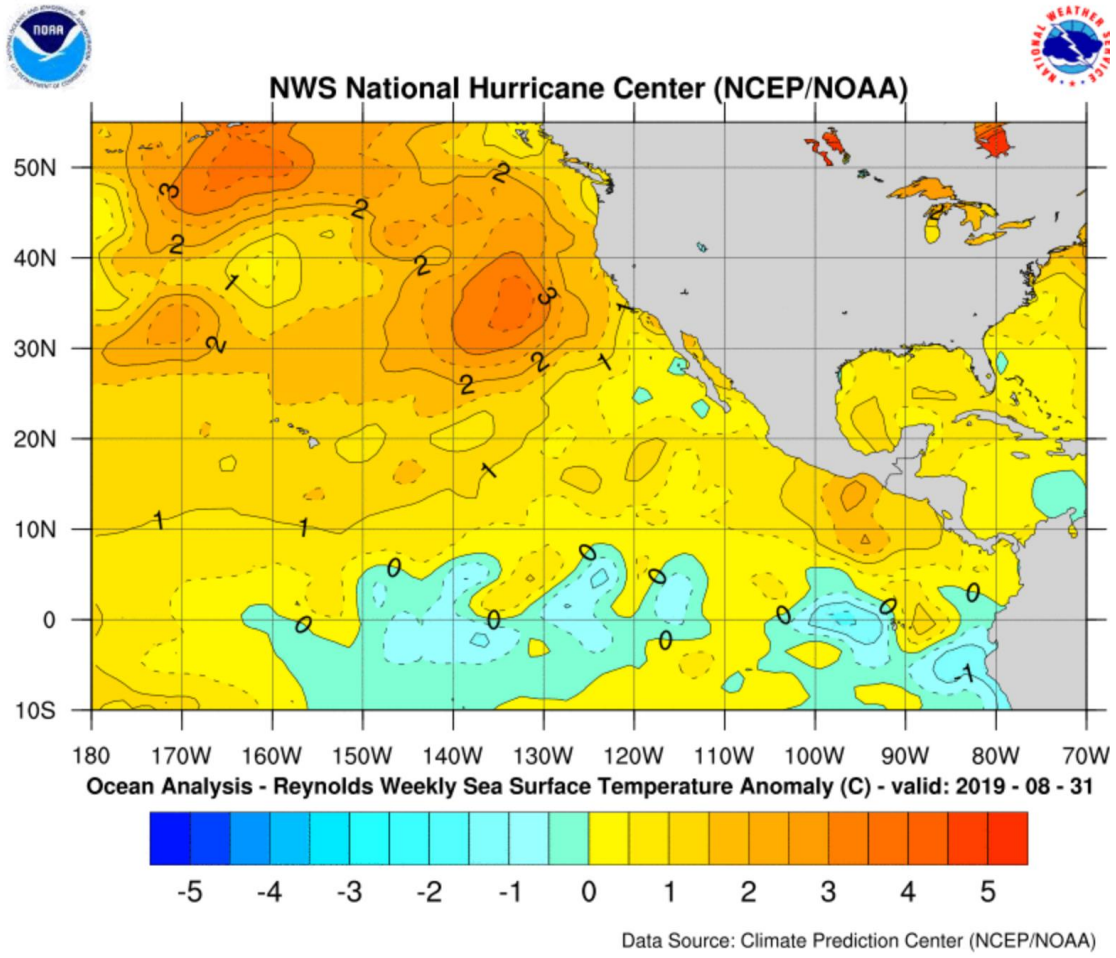
Email Alex Harper at aharper@mbari.org

NOAA West Watch Update:
Southern California Coastal Ocean Observing System (SCCOOS)

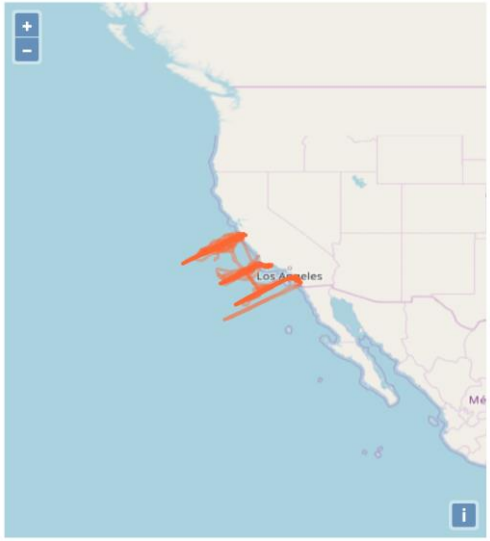
Clarissa Anderson

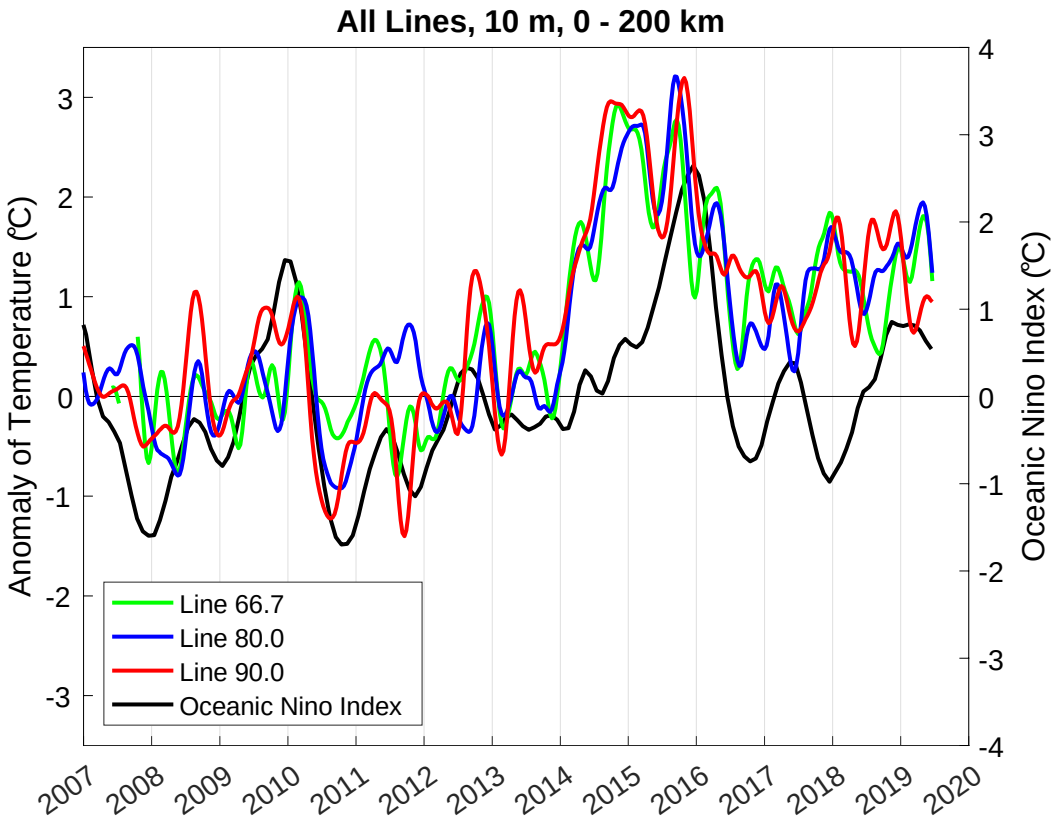
10 September 2019

www.sccoos.org



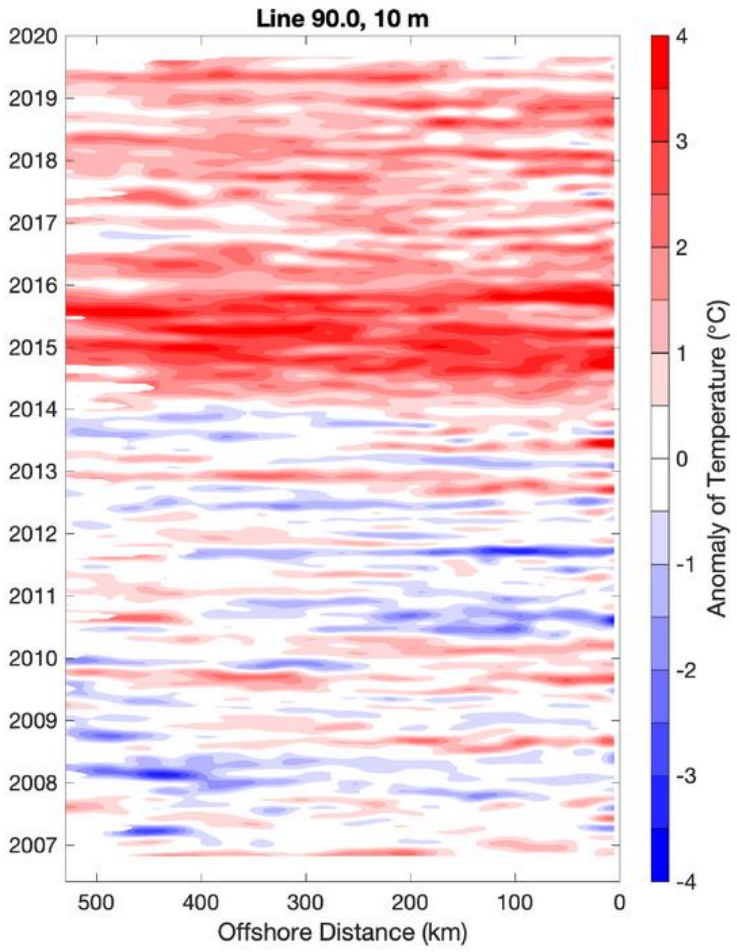
California Underwater Spray Glider Program

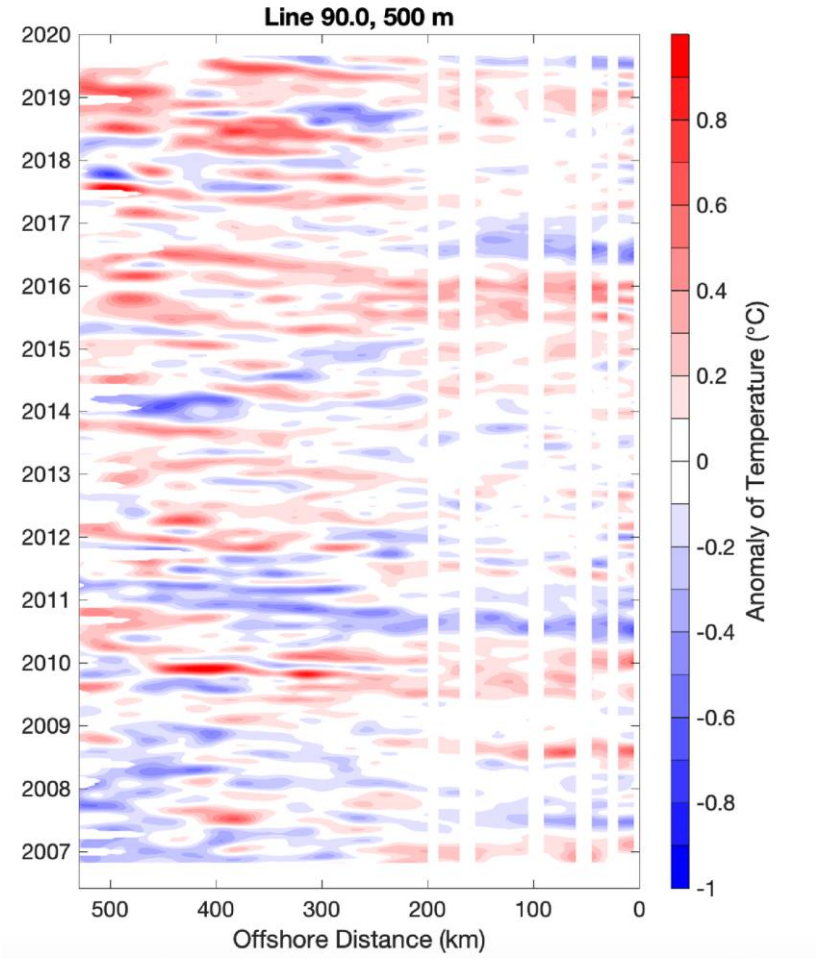




Temperatures at all glider lines continue to be decoupled from the Equatorial Pacific since the onset of the big warming event that started in 2014.

Persistence of the anomalously warm water since 2014 – return of the blob? Or the new normal?

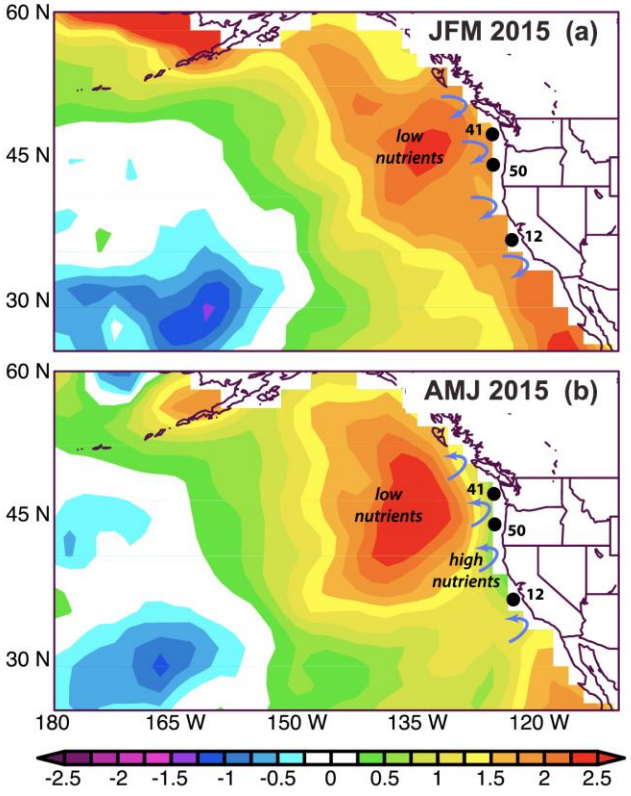




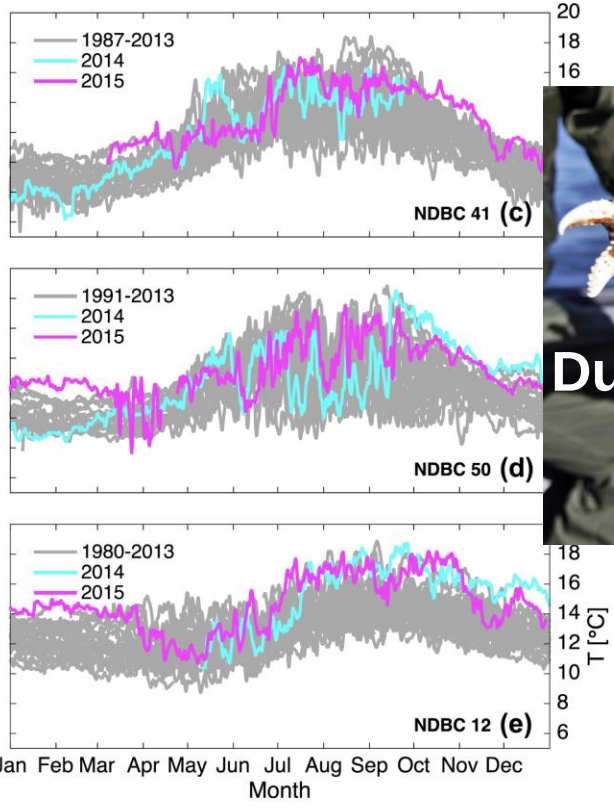
Will we see more HABs? Hard to say…

McCabe et al. *GRL* 2016

2014-2016: Things got Blobular



Temperature (NDBC)



Widespread Ecosystem Impacts!

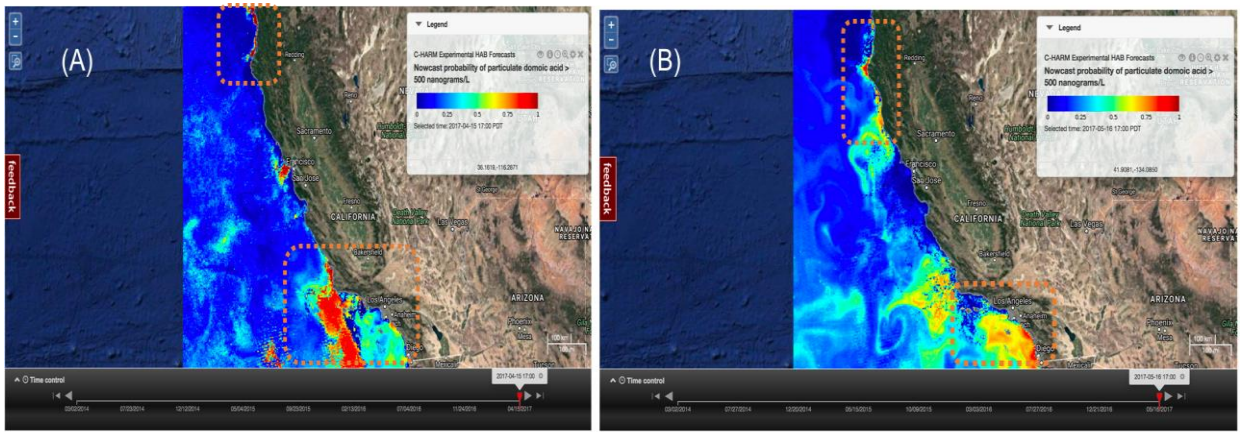
Why was the HAB only in Southern California in 2017?


Sea Lions Suffering From Domoic Acid Poisoning, Laguna Beach Rescue Says

"In large concentrations, (the algae) produces neurotoxins that can destroy the brain," Pacific Marine Mammal Center said.

By Ashley Ludwig (Patch Staff) - April 11, 2017 12:23 pm ET

Broad Impacts: **Animal Strandings/Death** [Sea Lions, Elephant Seals, Guadalupe Fur Seals, Seabirds (Common Murres, Grebes, CA Brown Pelicans);
Shellfish Advisories in Santa Barbara/Ventura Counties



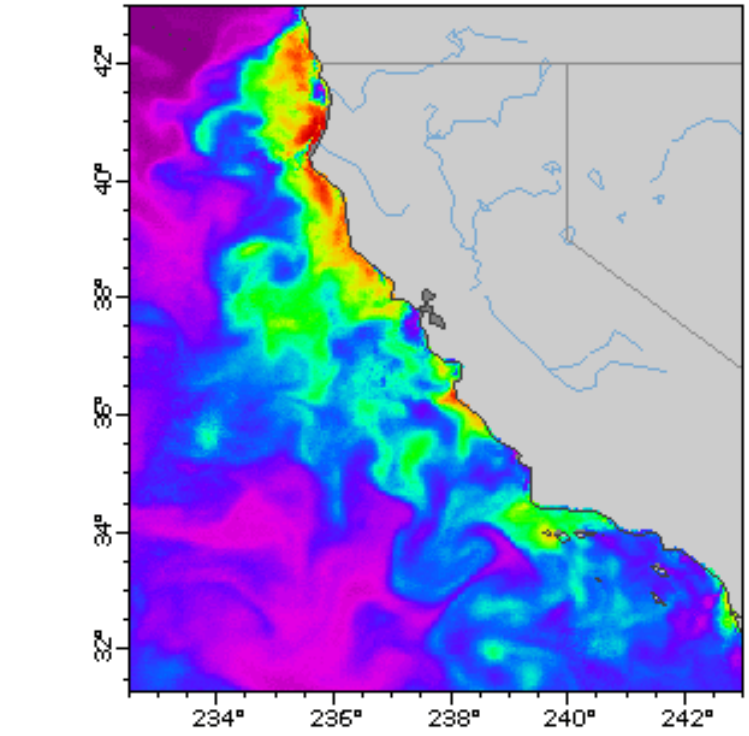
April 15 = HAB Onset

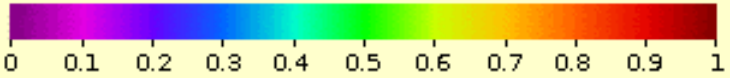
- Offshore Event
- Low toxins measured at piers
- Animals stranding in large numbers

May 17 = HAB moves South & North

- More Impacts felt near San Diego
- HAB persists in Santa Barbara Channel
- Rock Crab fishery closed in Nor Cal

California Harmful Algae Risk Mapping (C-HARM) System
Cellular Domoic Acid

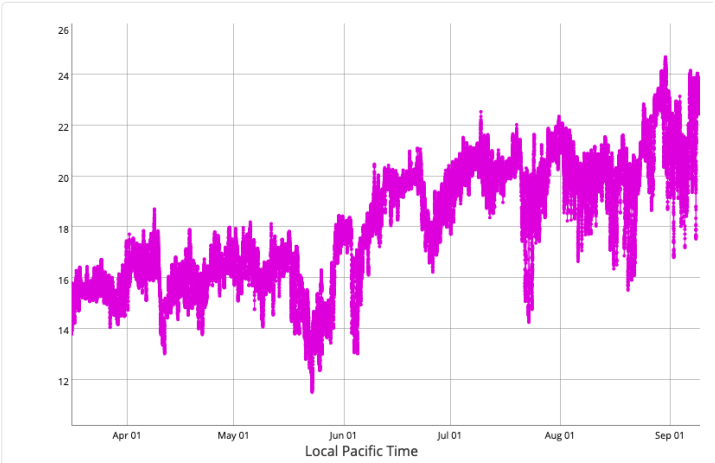




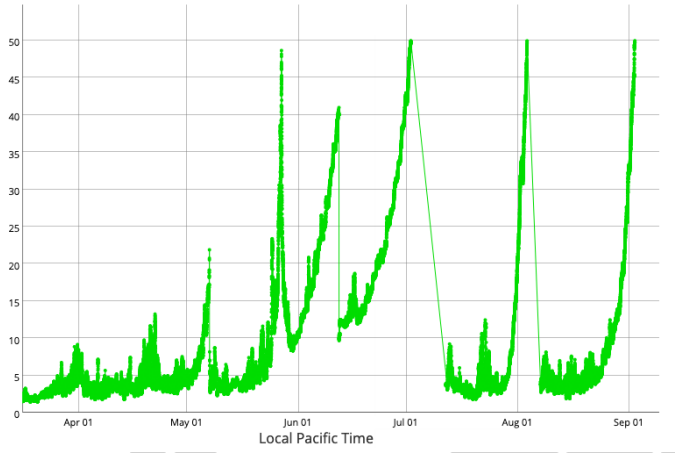
Probability of Cellular Domoic Acid > 10 picograms/cell (1)
C-HARM Nowcast: Pseudo-Nitzschia, cellular domoic acid, and particulate domoic acid probability, California and Southern Oregon coast
(2019-07-01T12:00:00Z)
Data courtesy of UCSC, UCSD

Newport Pier- Automated Shore Station + HABMAP Sampling

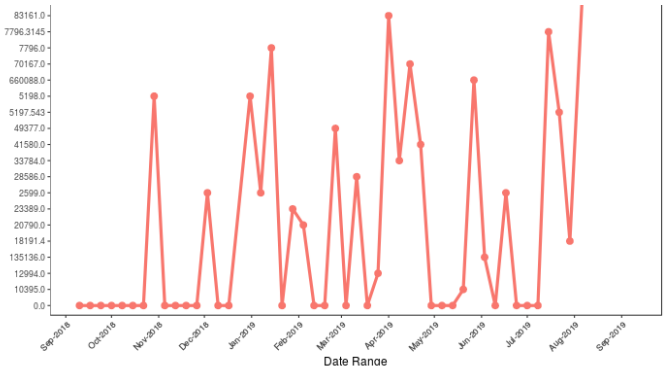
Temperature (deg C)



Chlorophyll-*a* (mg m^{-3})



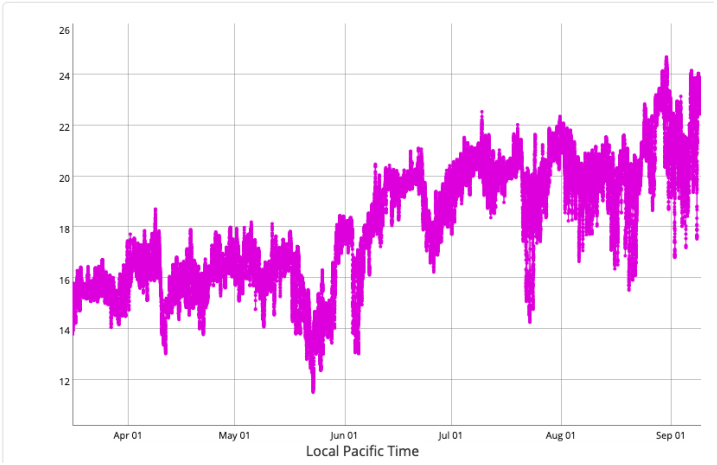
Pseudo-nitzschia seriata group abundance (cells/L)



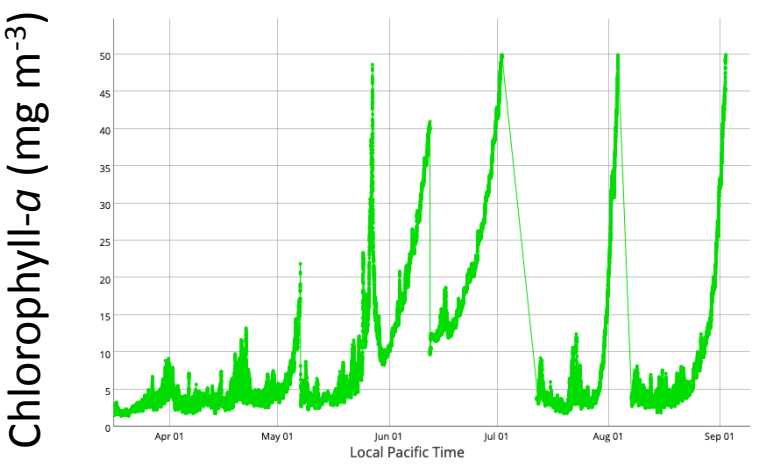
Rise in the abundance of potentially toxigenic species of *Pseudo-nitzschia* at Newport Pier

Newport Pier- Automated Shore Station + HABMAP Sampling

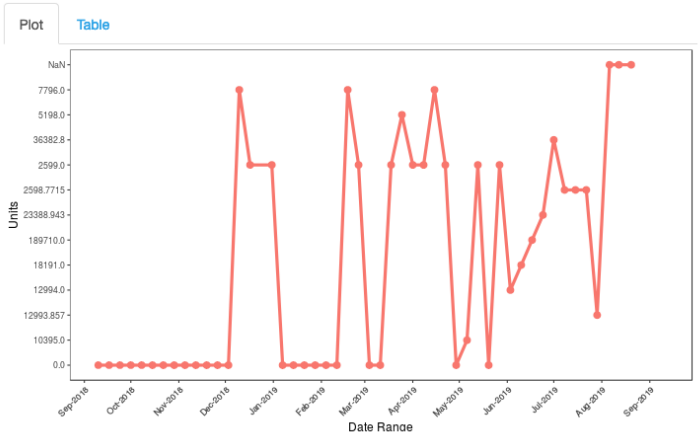
Temperature (deg C)



Chlorophyll-*a* (mg m^{-3})



Aexandriium polyedra abundance (cells/L)



Rise in the abundance of "red tide" forming dinoflagellates, *L. polyedra* and *Prorocentrum* spp.

Here's how phytoplankton are turning the tides red in Manhattan Beach

By Laylan Connelly Sep 9, 2019 Updated 17 hrs ago

1 of 2

Red tide, from an algal bloom, made an appearance over the weekend in Manhattan Beach at 36th Street. (Photo courtesy Wayne Powell)

Call Agenda

- Project Recap & Updates (Dan McEvoy and Kevin Werner)
- The emerging Marine Heat Wave of 2019: Toby Garfield
- Regional Climate and ENSO brief (Dan McEvoy)
- IOOS Nearshore Conditions brief (Jan Newton, Alex Harper, Clarissa Anderson)
- **Discussion - Environmental conditions and impacts reporting (All)**
  - **Additional impacts to share related to the marine heat wave?**

- **Next webinar: Tuesday, January 9th 2020**

THANK YOU!