



# Regional Environmental Conditions & Impacts Coordination

NOAA West  
February 29, 2016

# Call Agenda

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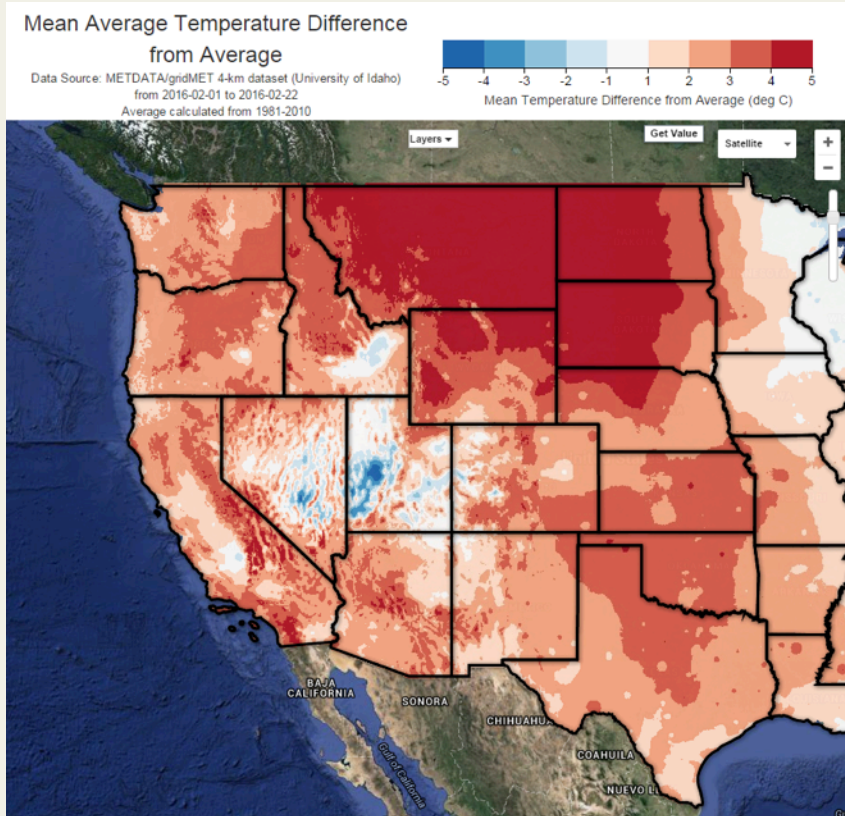


- Welcome
- El Niño and Regional Climate brief (D. McEvoy)
- Highlights:
  - NANOOS, regional monitoring & reporting updates
  - Dr. Bill Peterson, NOAA Fisheries
- Environmental conditions and impacts reporting update (T. Vann)
- Communications / “Stories” Update (M. Milstein)
- Discussion

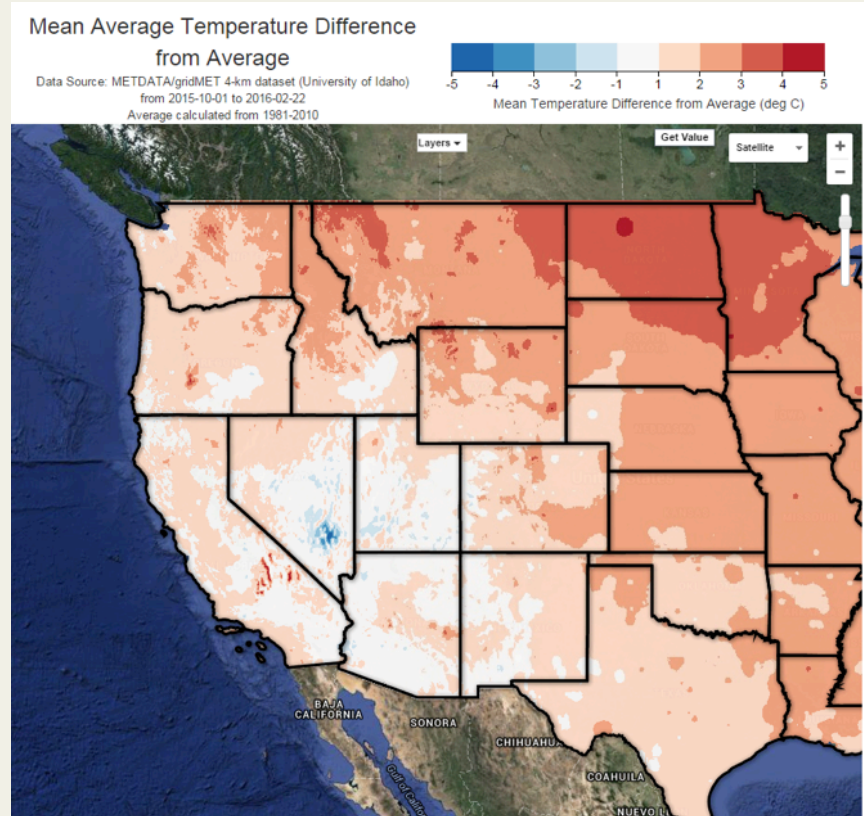
# Temperature



**Feb 1 – Feb 22, 2016**



**Oct 1, 2015 – Feb 22, 2016**



climateengine.org



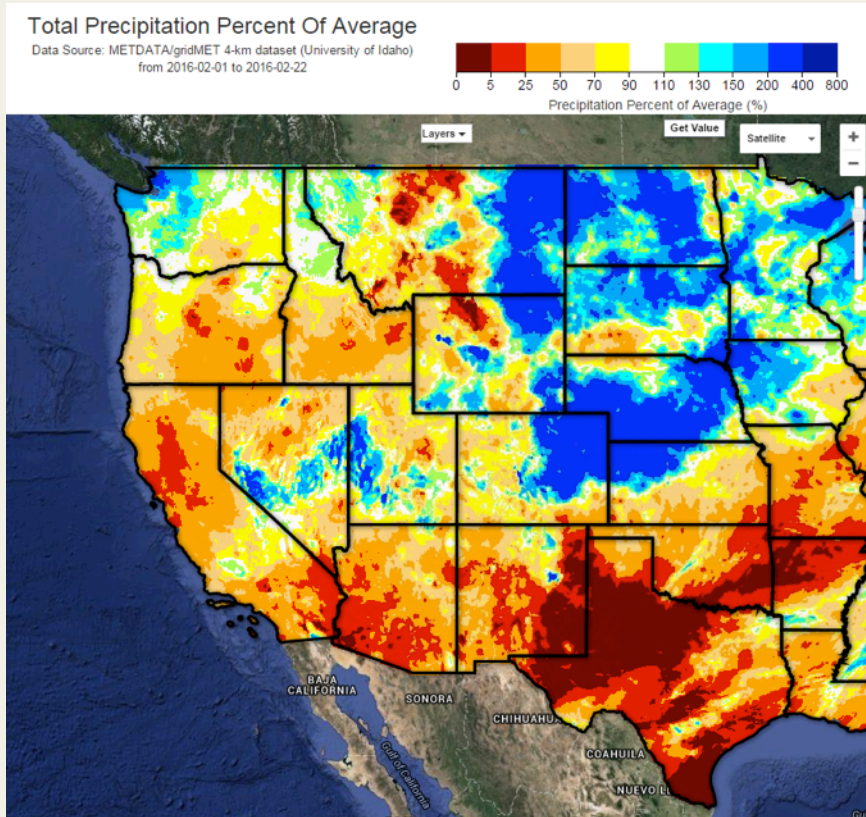
University of Idaho

**water year to date**

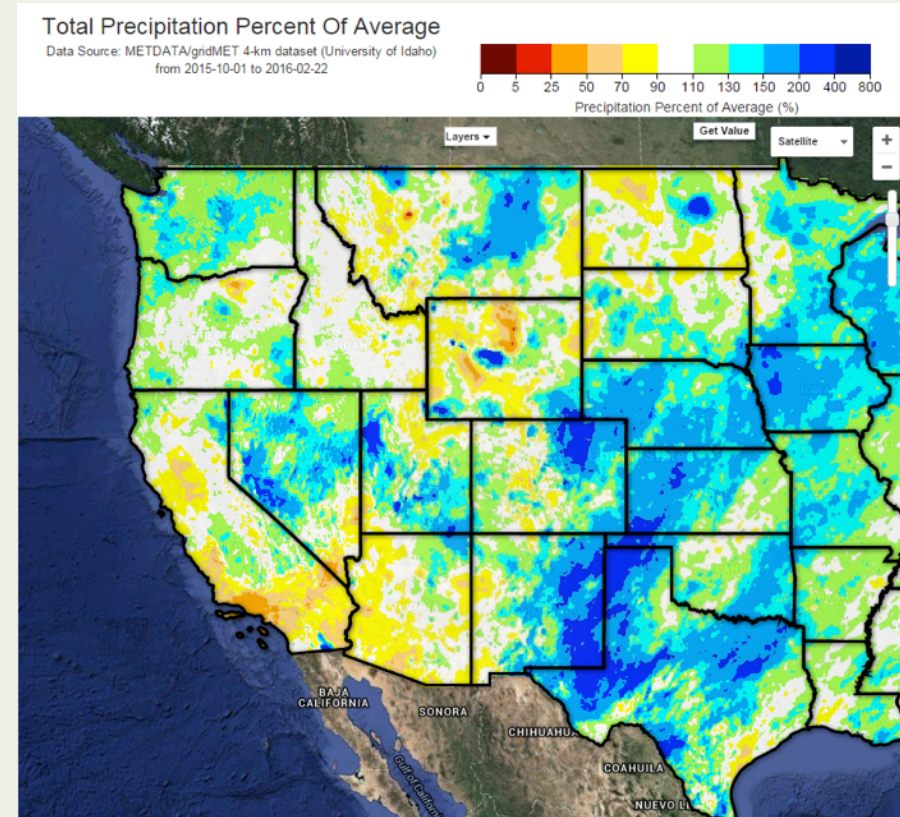
# Precipitation



## Feb 1 – Feb 22, 2016



## Oct 1, 2015 – Feb 22, 2016



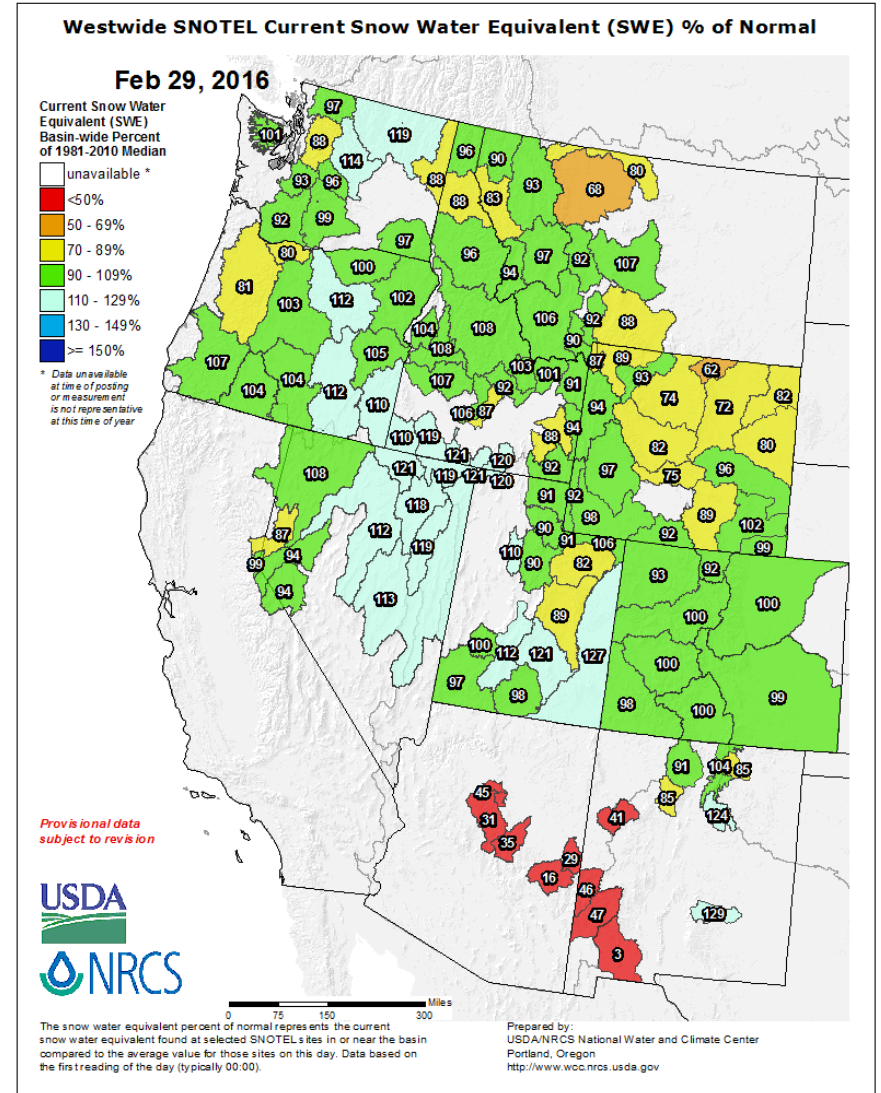
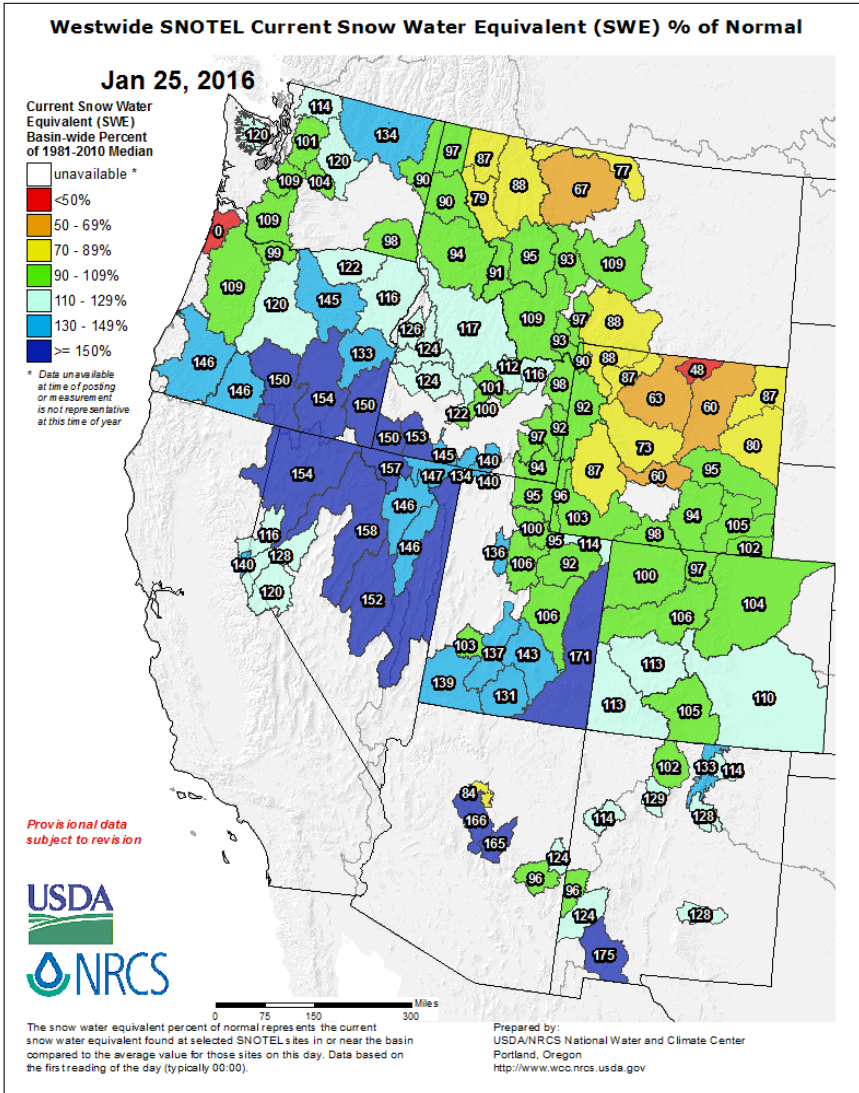
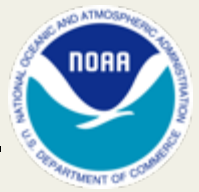
climateengine.org



University of Idaho

water year to date

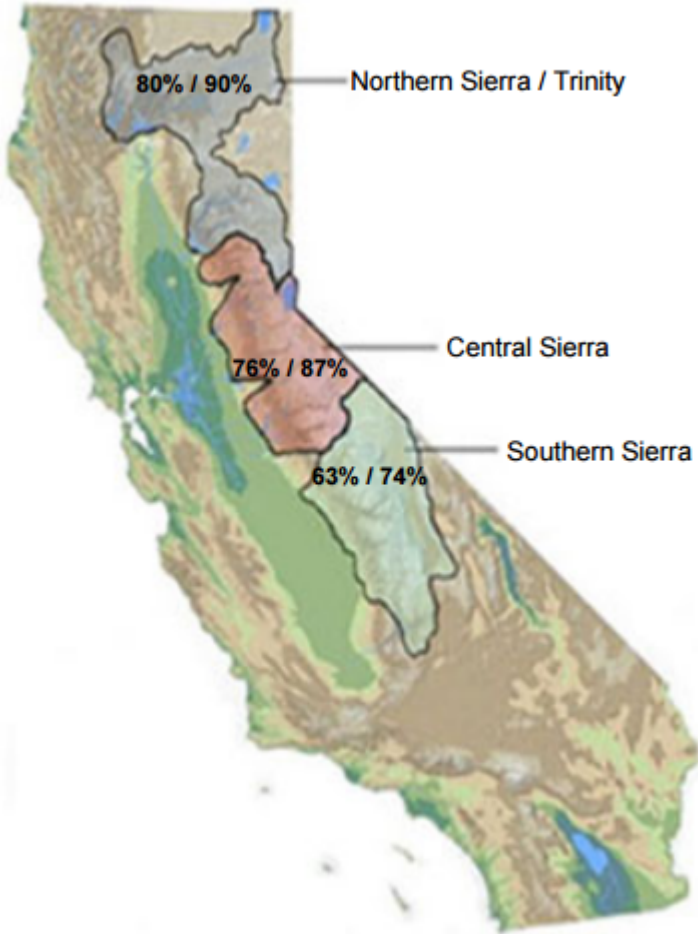
# Snow Water Equivalent



# Snow Water Equivalent



% of April 1 Average / % of Normal for This Date



NORTH	
Data as of February 29, 2016	
Number of Stations Reporting	28
Average snow water equivalent (Inches)	23.2
Percent of April 1 Average (%)	80
Percent of normal for this date (%)	90

CENTRAL	
Data as of February 29, 2016	
Number of Stations Reporting	40
Average snow water equivalent (Inches)	21.9
Percent of April 1 Average (%)	76
Percent of normal for this date (%)	87

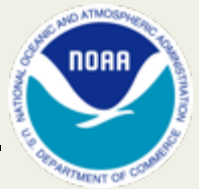
SOUTH	
Data as of February 29, 2016	
Number of Stations Reporting	29
Average snow water equivalent (Inches)	16.8
Percent of April 1 Average (%)	63
Percent of normal for this date (%)	74

STATE	
Data as of February 29, 2016	
Number of Stations Reporting	97
Average snow water equivalent (Inches)	20.8
Percent of April 1 Average (%)	74
Percent of normal for this date (%)	85

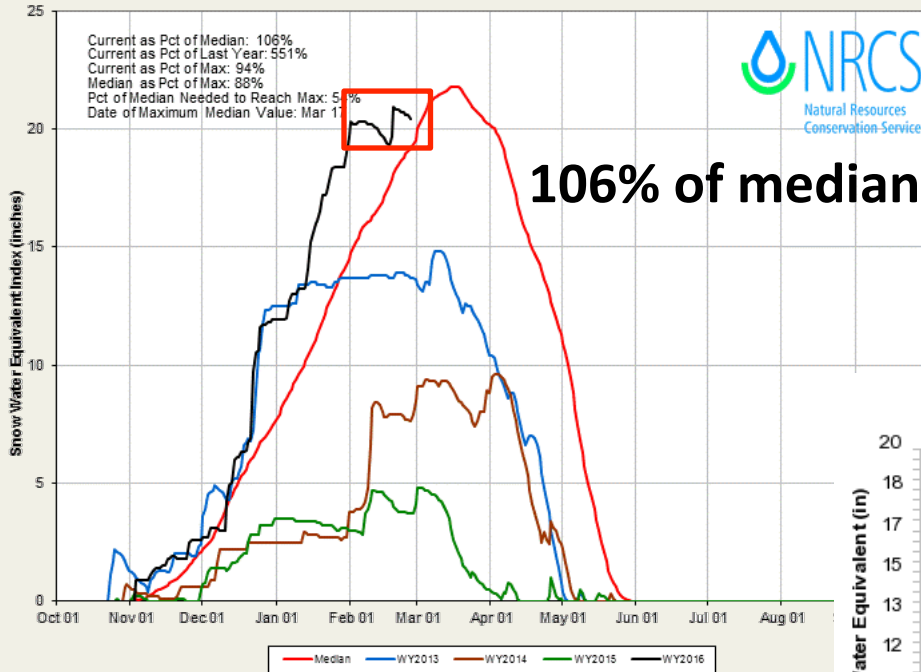
Statewide Average: 74% / 85%

Source: CA DWR

# Snow Water Equivalent



LAKE TAHOE Time Series Snowpack Summary  
Based on Provisional SNOTEL data as of Feb 26, 2016

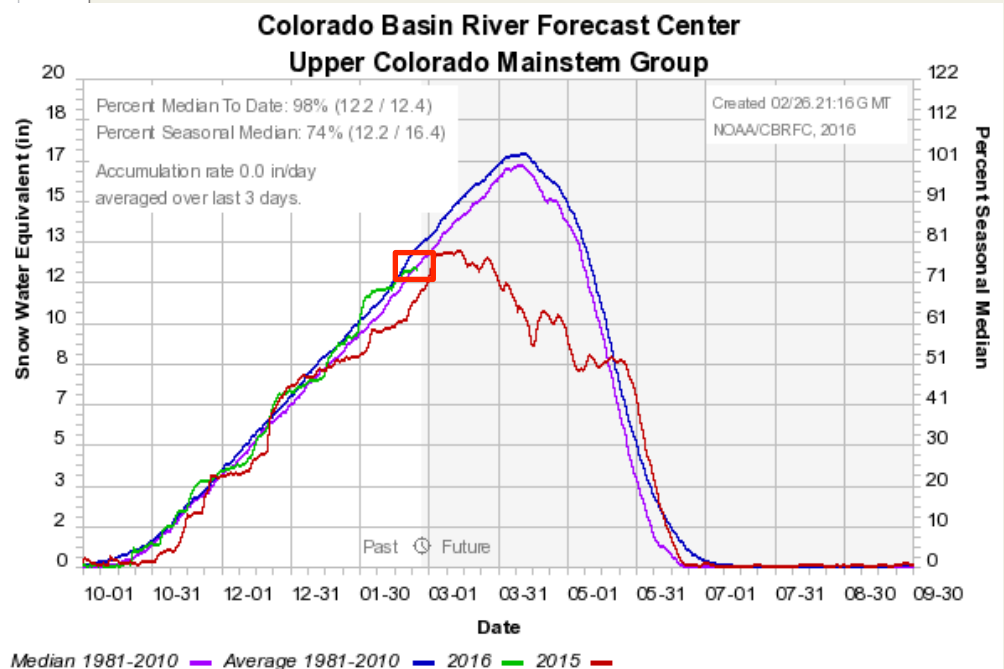


## Lake Tahoe Basin

**98% of median**

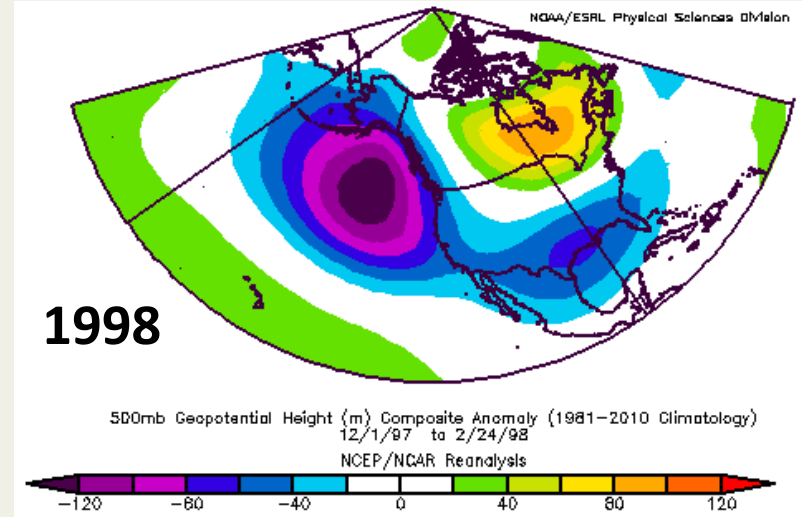
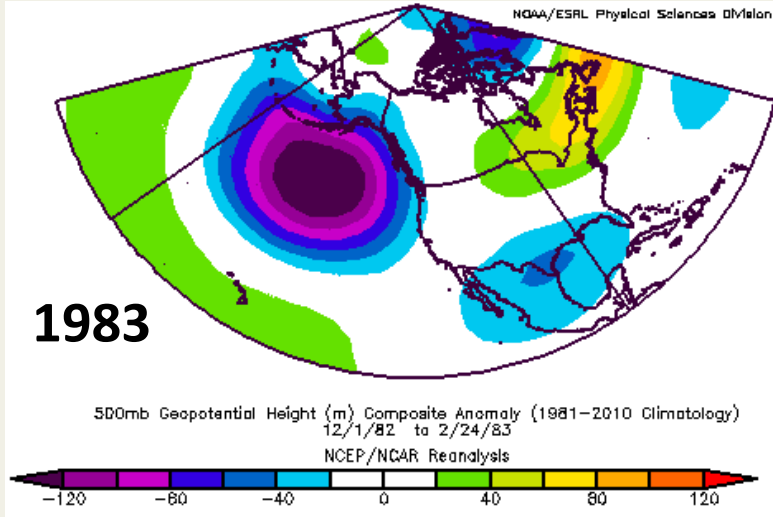
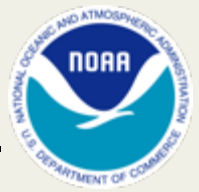
Source: NRCS

## Upper CO Basin

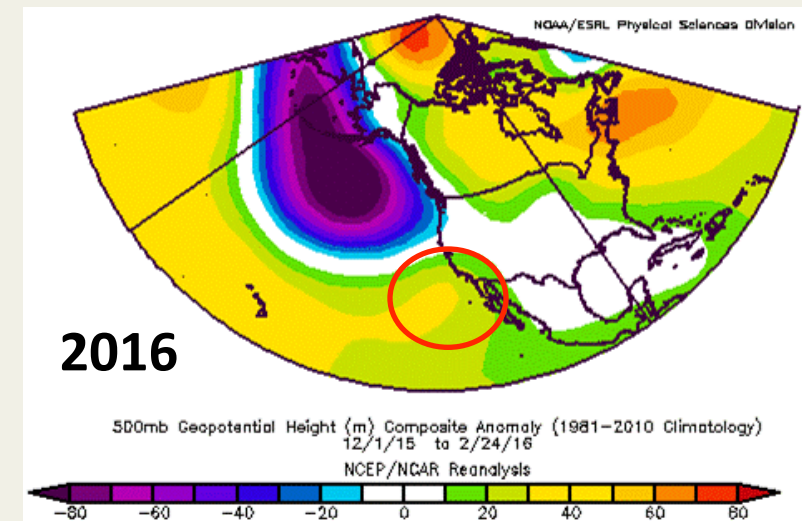


Source: CBRFC

# Very Strong El Nino Flow Patterns

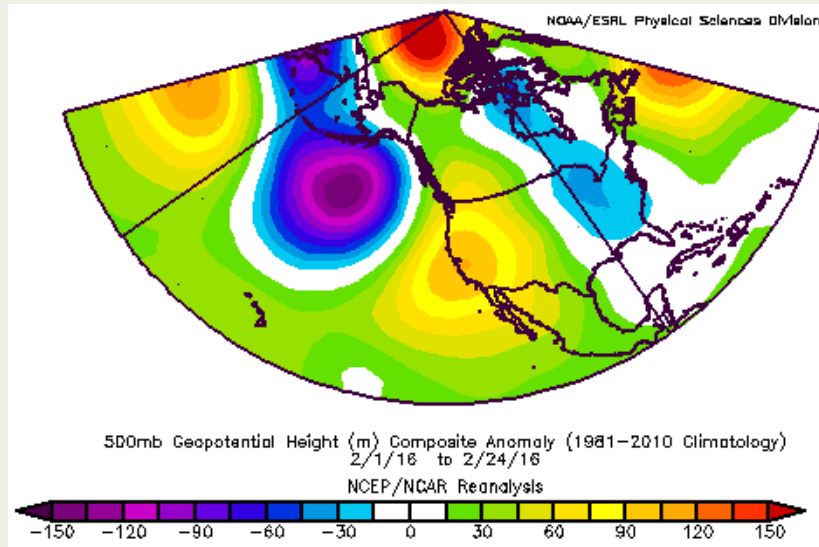
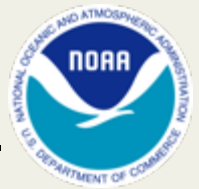


- 500 mb geopotential height anomalies
- Mid-troposphere high and low pressure
- December 1 – February 24 mean

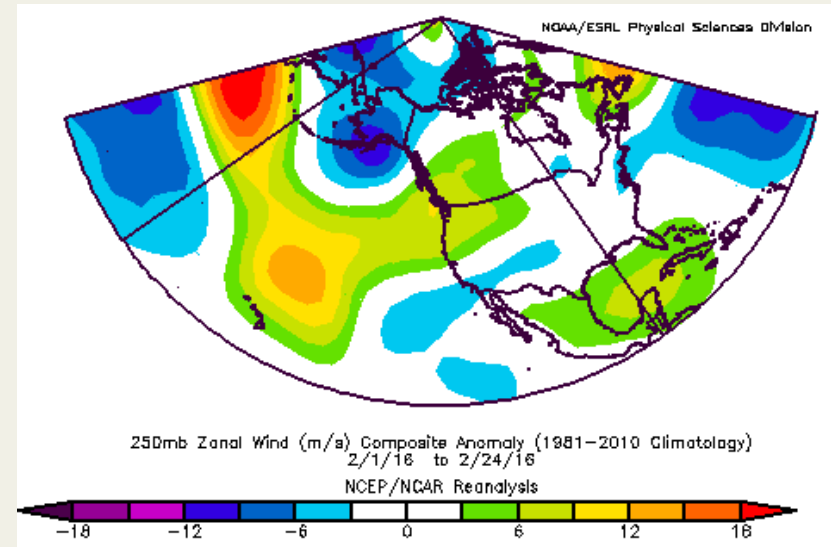




# Very Strong El Nino Flow Patterns



- 500 mb geopotential height anomalies
- Mid-troposphere high and low pressure
- **February 1 – February 24, 2016 mean**



- 250 mb zonal wind anomalies
- West to east jet stream level winds
- **February 1 – January 24, 2016 mean**

# El Nino Status

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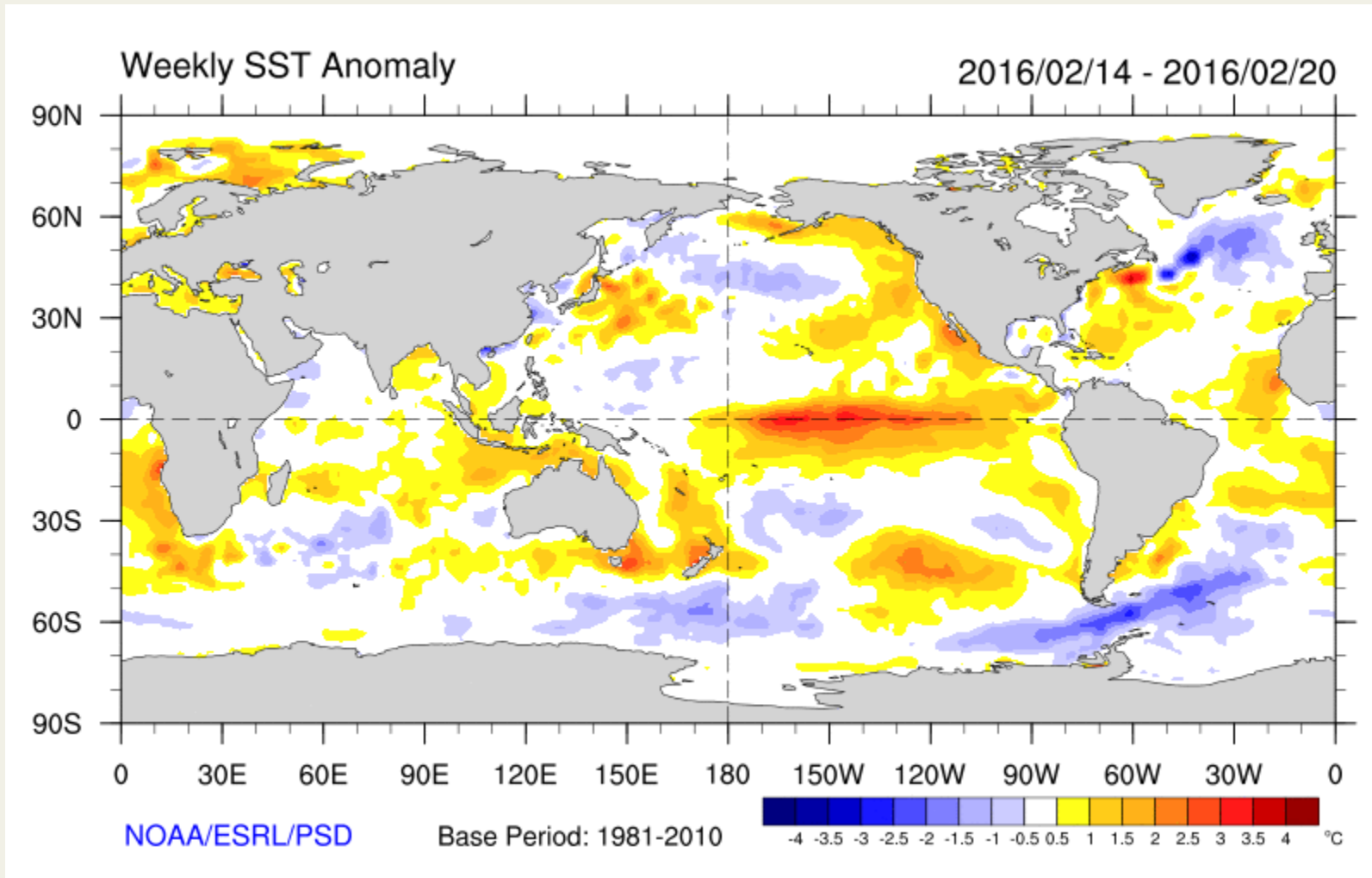


- ENSO Alert System Status: El Niño Advisory
- El Niño conditions are present
- Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.
- A transition to ENSO-neutral is likely during late Northern Hemisphere spring or early summer 2016, **with a possible transition to La Niña conditions during the fall.\***

Credit: CPC

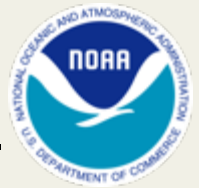
\* Note: These statements are updated once a month (2<sup>nd</sup> Thursday) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

# Current Sea Surface Temperatures



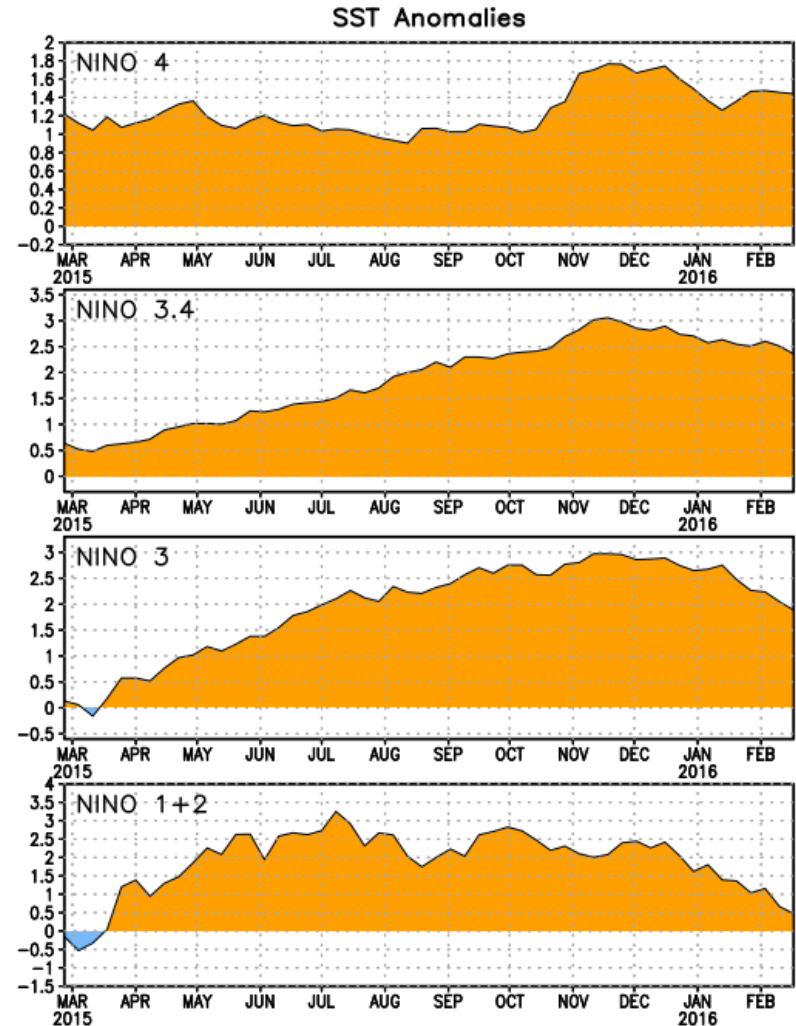
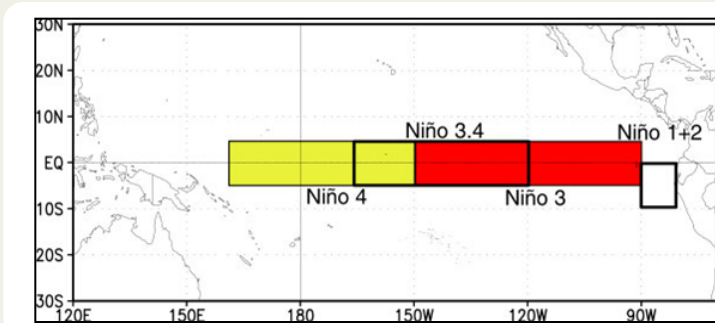
Source: NOAA/ESRL

# Niño Region SST Departures (°C) Recent Evolution

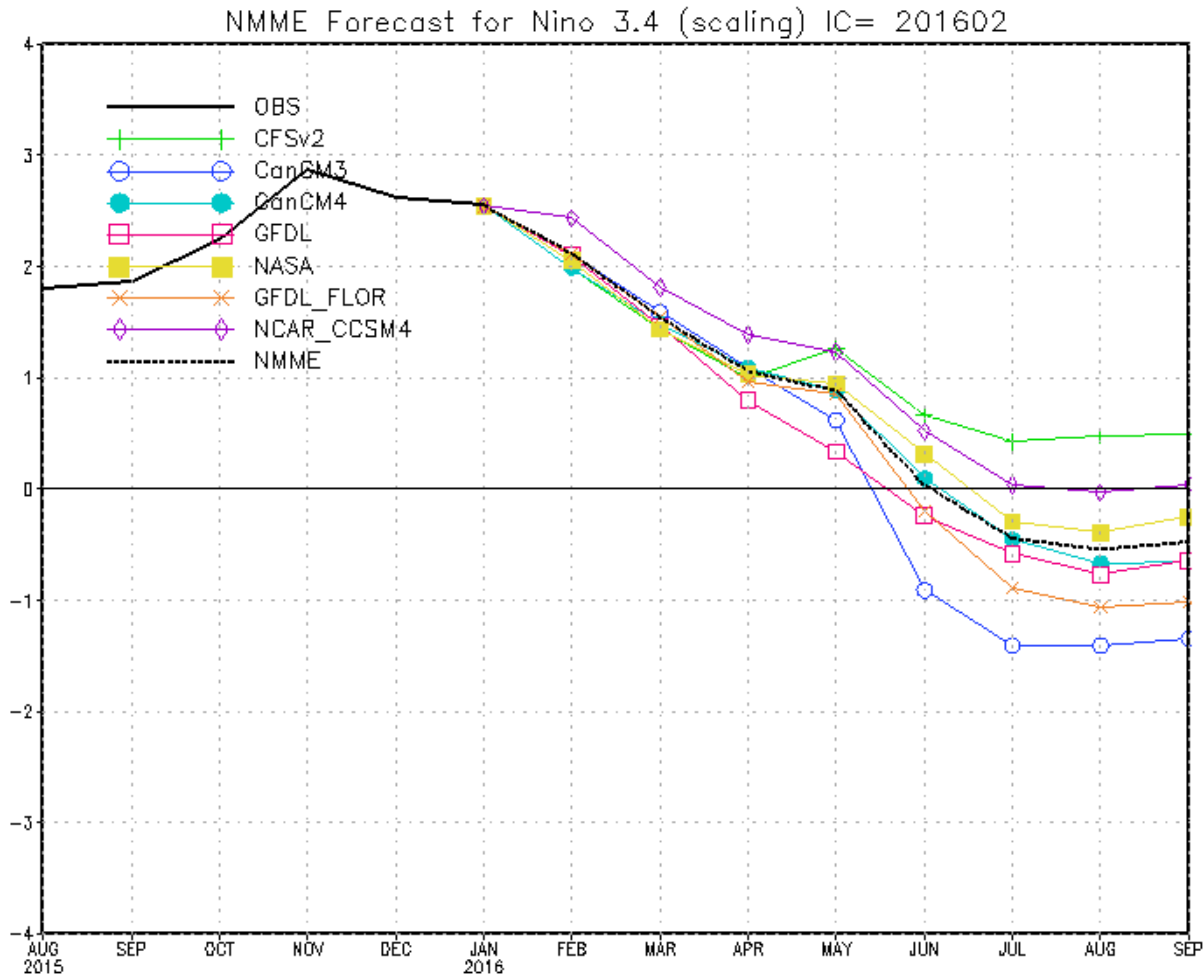


The latest weekly SST departures are:

Niño 4	1.4°C
Niño 3.4	2.4°C
Niño 3	1.9°C
Niño 1+2	0.5°C



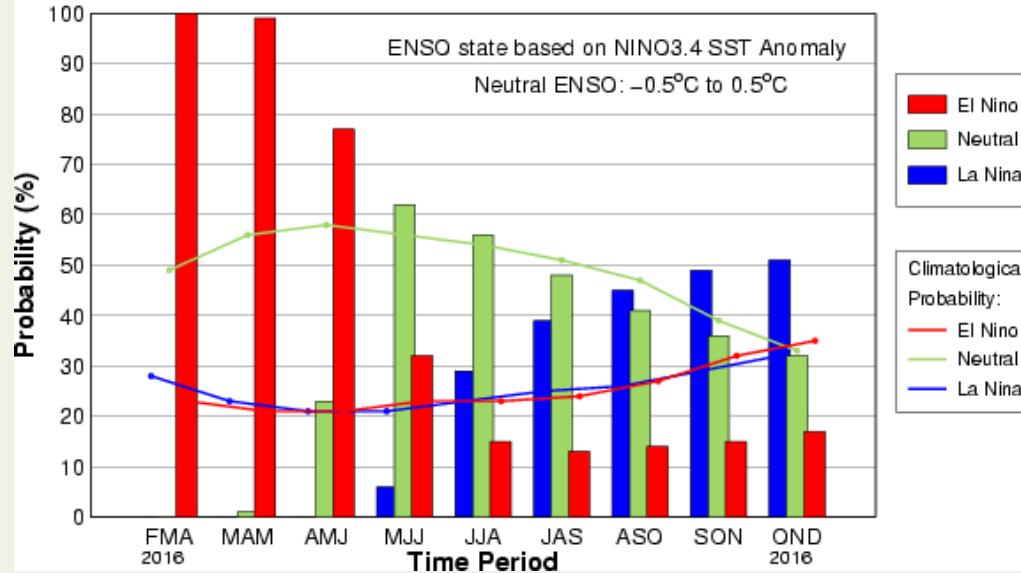
# ENSO Forecasts



# ENSO Forecasts



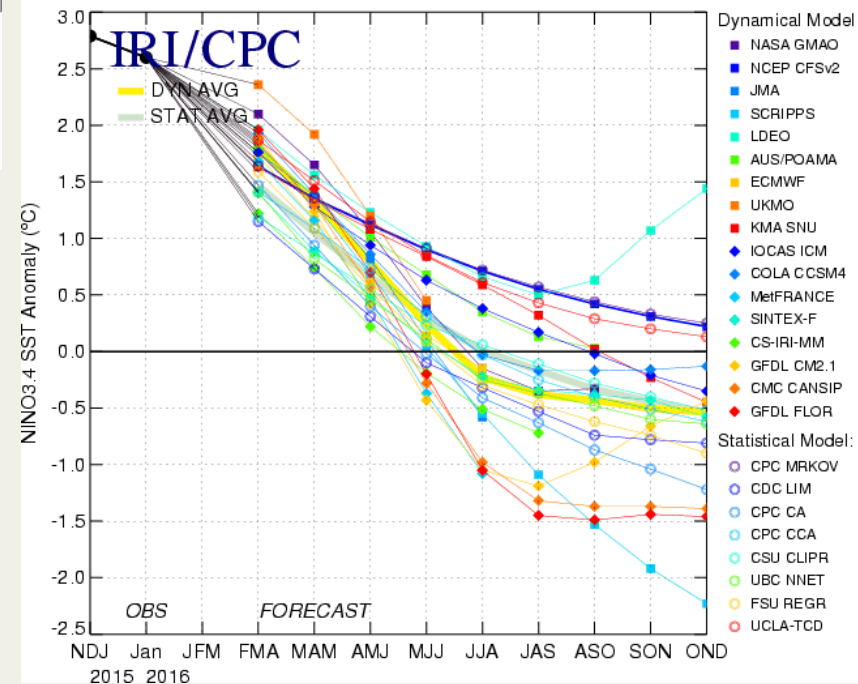
Mid-Feb IRI/CPC Model-Based Probabilistic ENSO Forecast



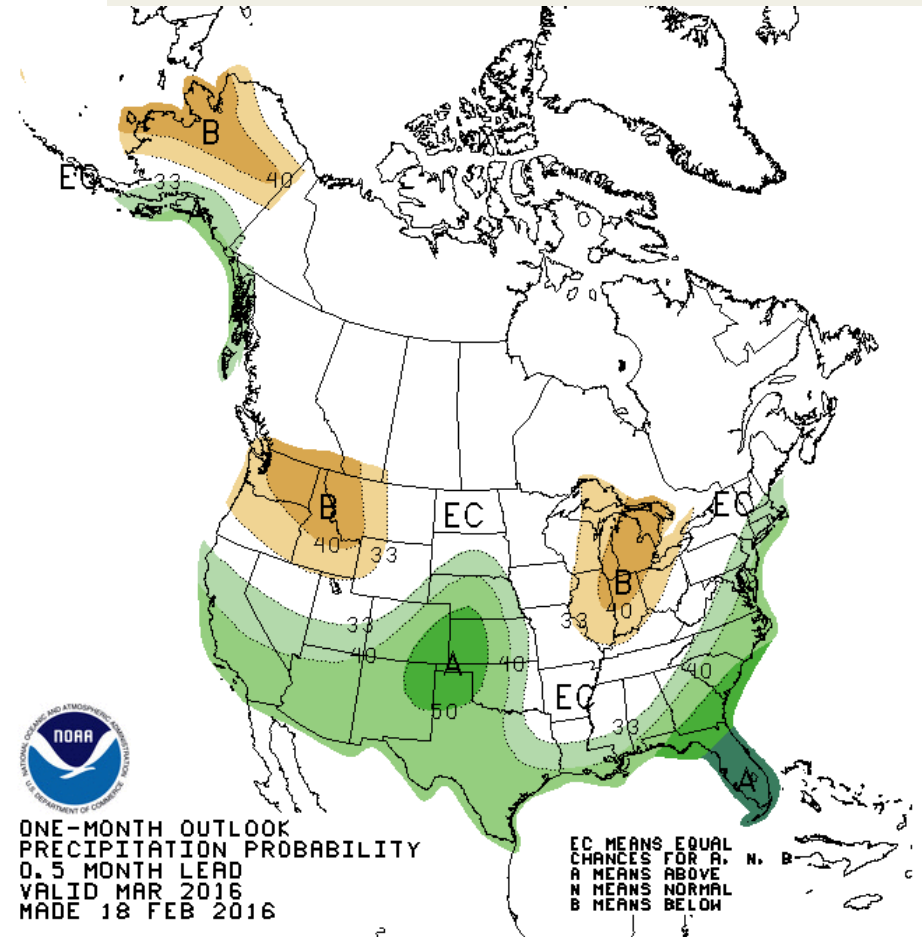
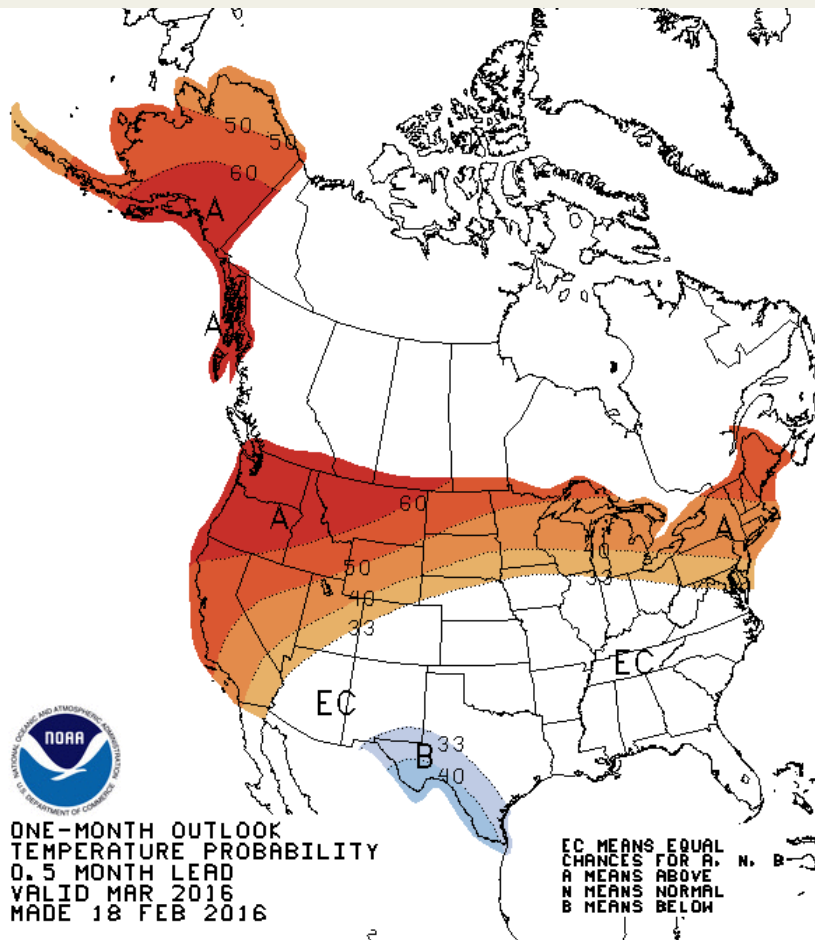
CPC/IRI El Niño forecast:

NMME models + other dynamical models + statistical models

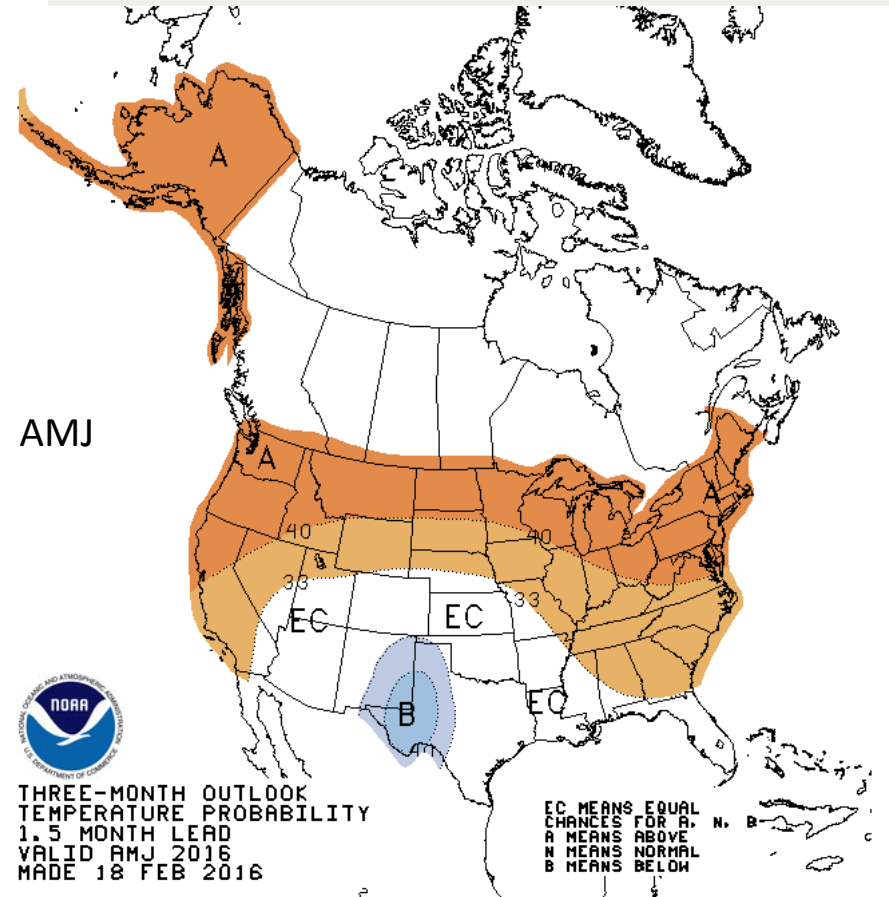
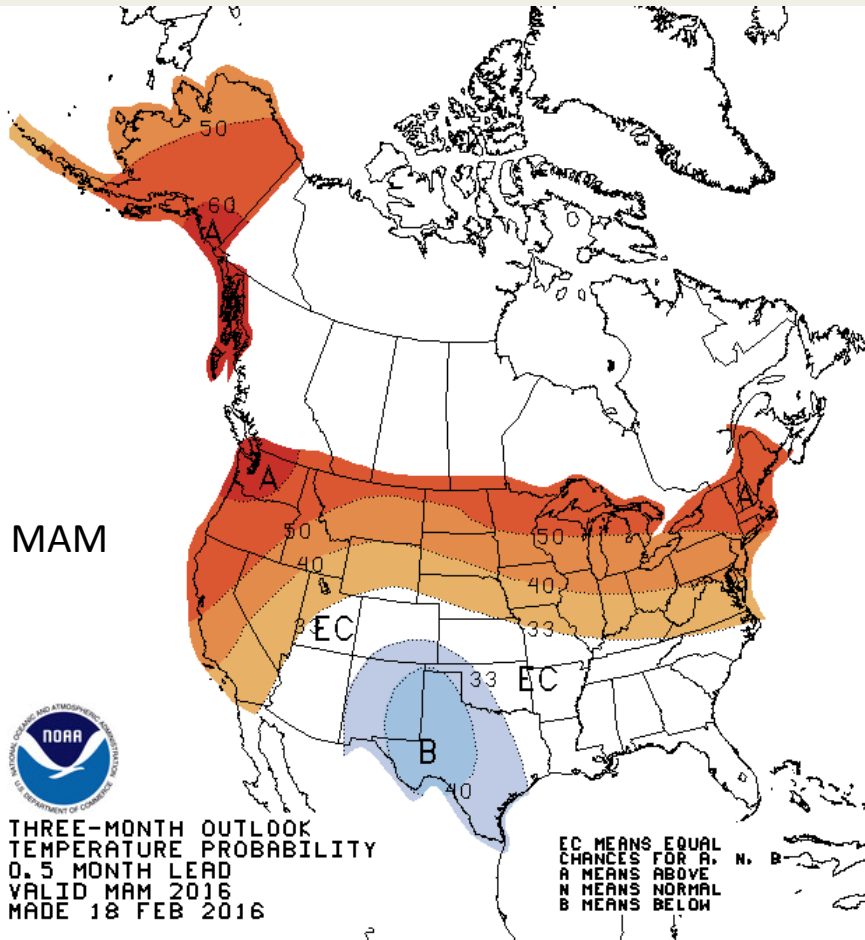
Mid-Feb 2016 Plume of Model ENSO Predictions



# March U.S. Forecasts

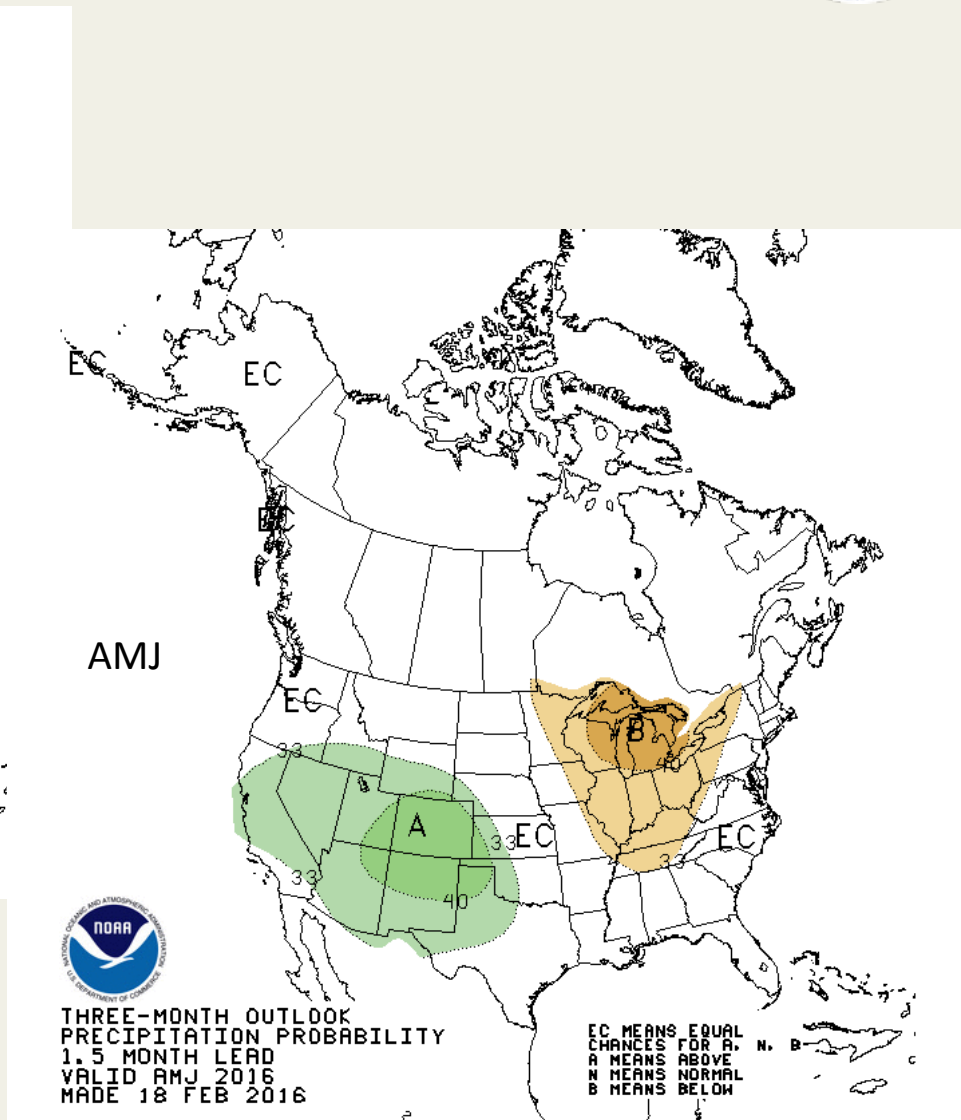
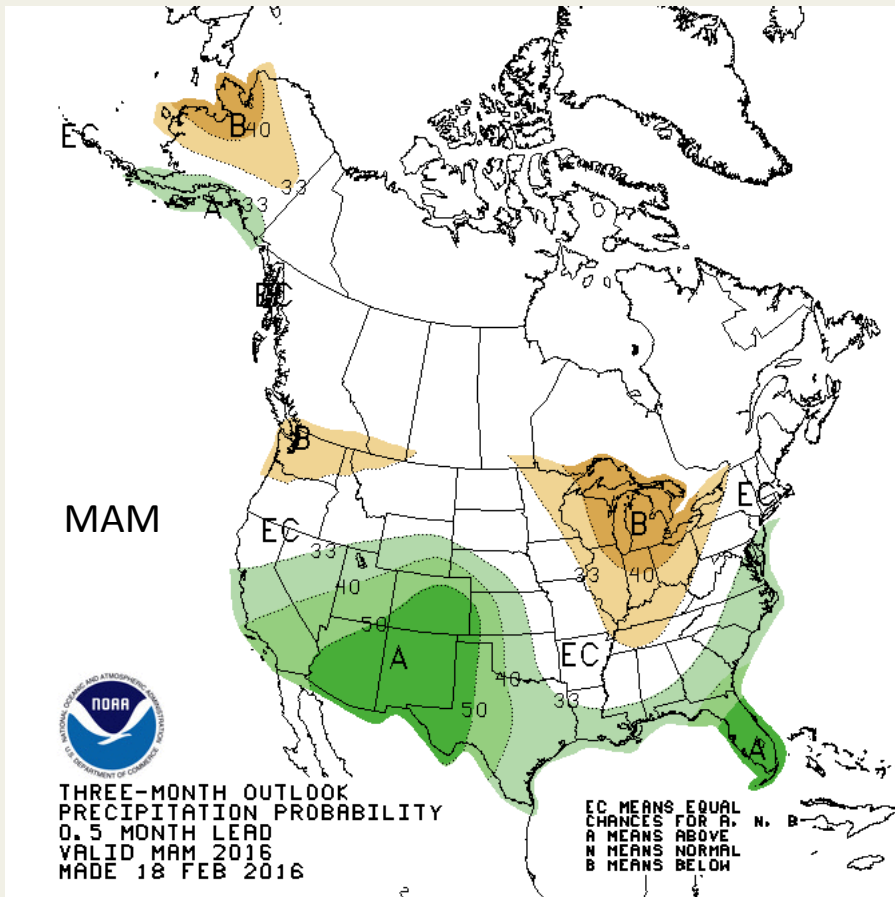


# U.S. Temperature Forecasts





# U.S. Precipitation Forecasts



# NANOOS

- Regions
- Sites
- Models
- Remote Sensing
- Legend

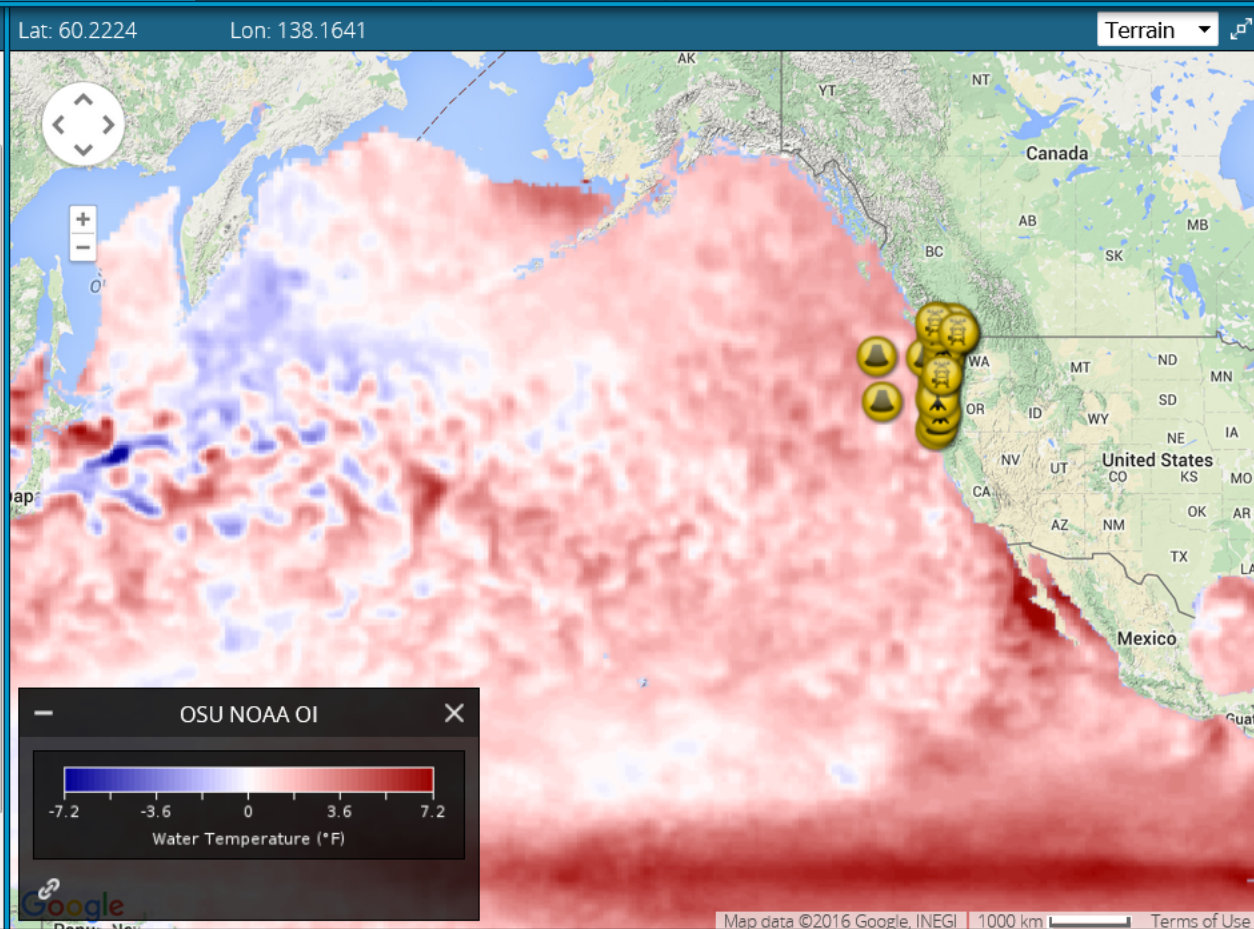
Remote Sensing

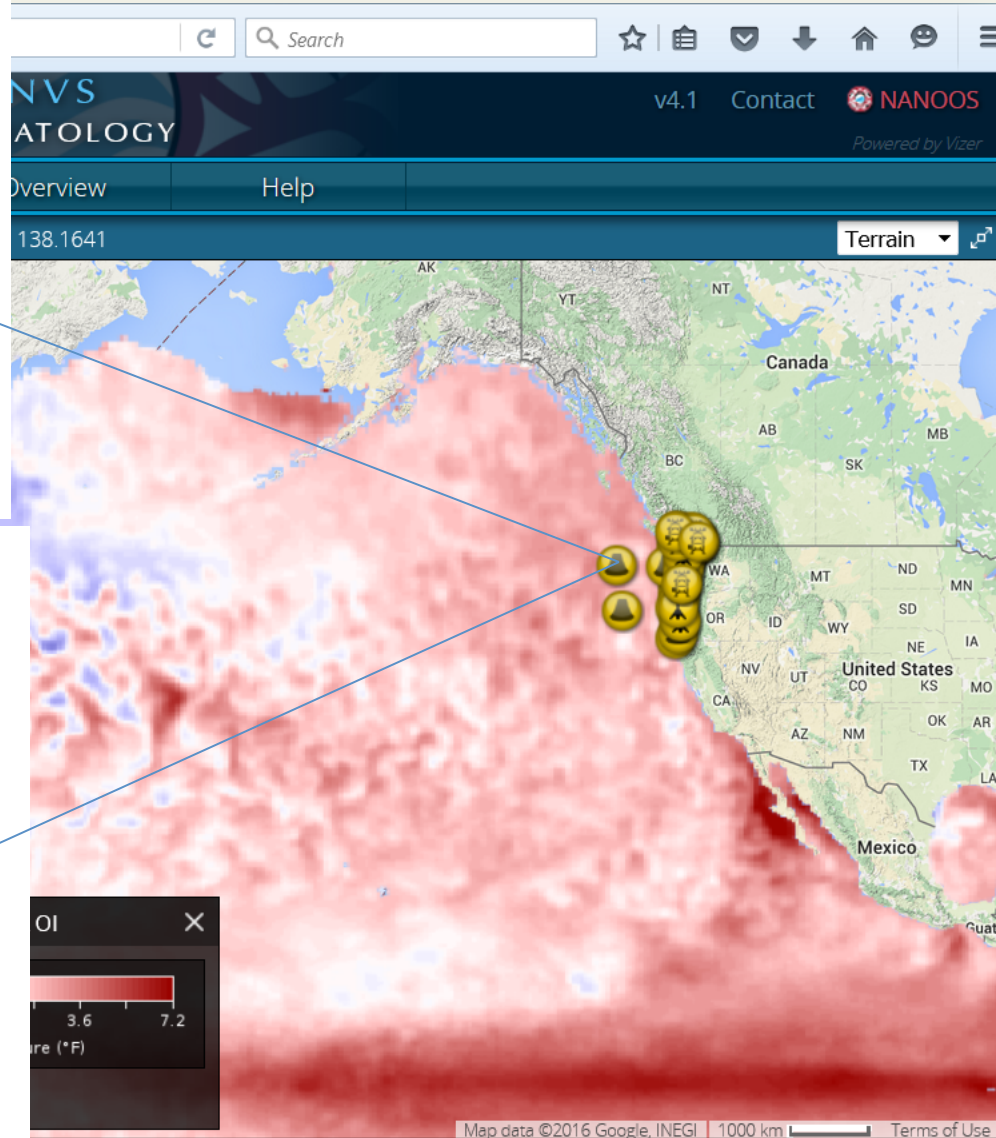
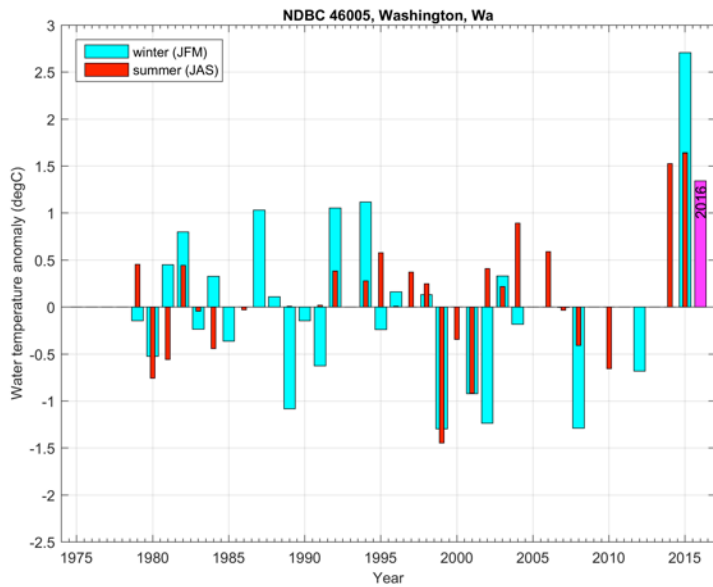
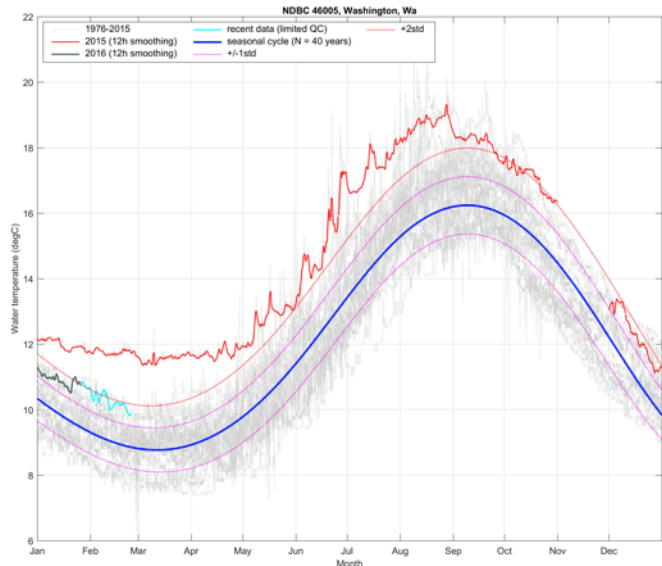
In-Situ

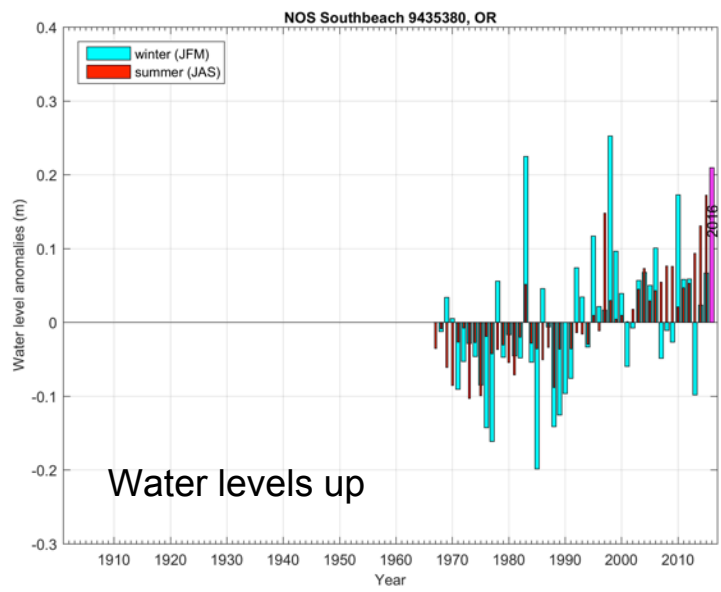
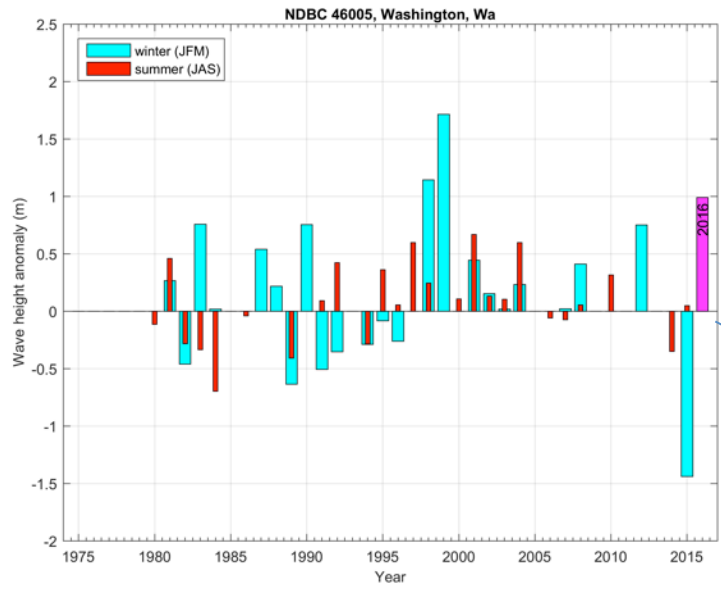
- NODC Ocean Atlas
- Atlantic Salinity (Climate)
- Pacific Salinity (Climate)

Satellite

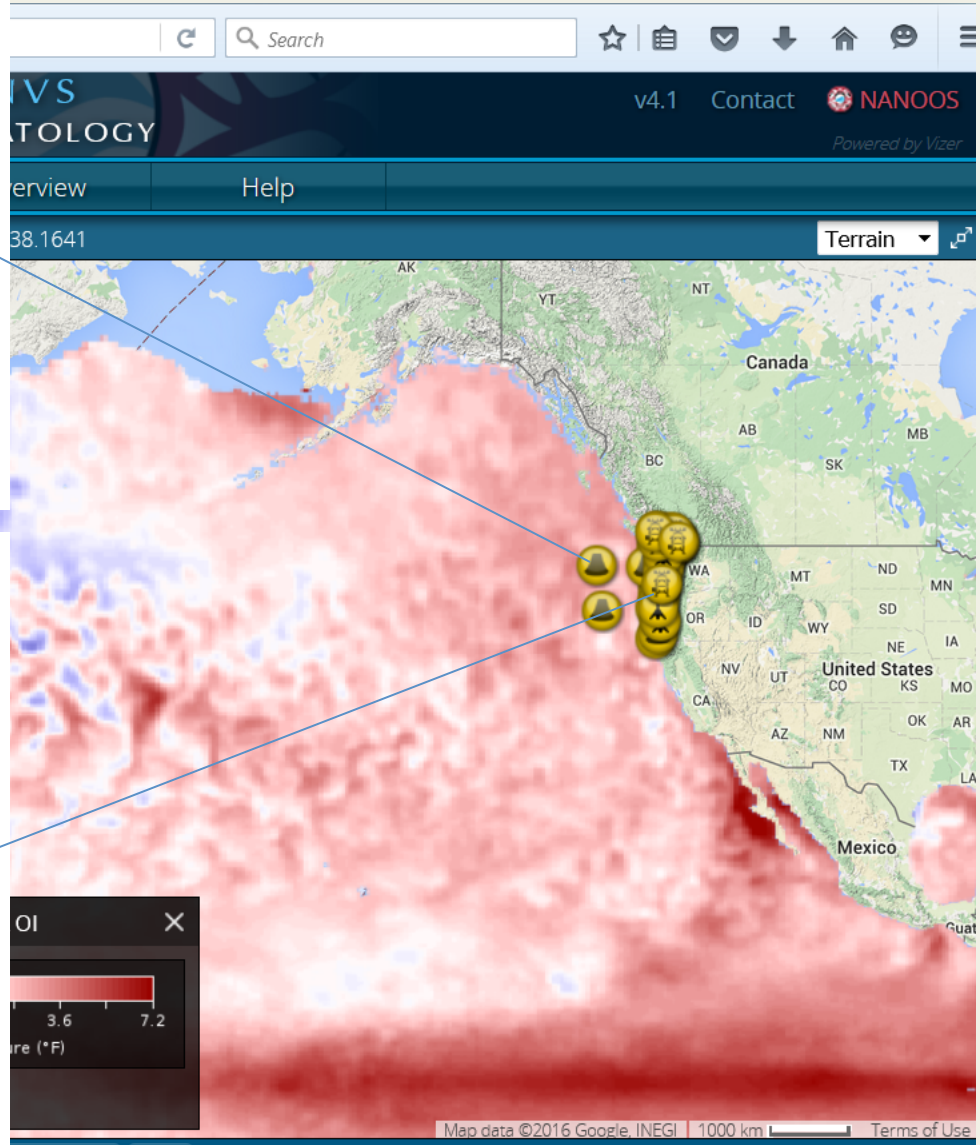
- NCDC OI SST
- Water Temp. (Climate)
- Water Temp. (Anomaly)
- OSU AVISO Climate
- Sea Level (Climate)
- Sea Level (Anomaly)
- OSU MODIS Climate
- Chlorophyll (Climate)
- Chlorophyll (Anomaly)







Water levels up



## State of the California Current 2014-15: Impacts of the Warm-Water “Blob”

Bill Peterson

Oceanographer and Senior Scientist

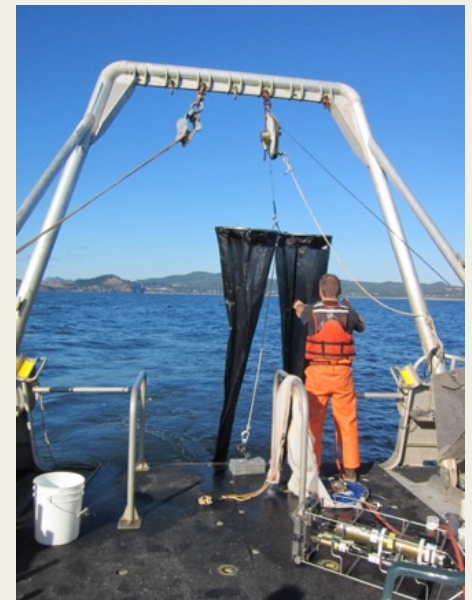
Northwest Fisheries Science Center

Newport OR



## What we do at Newport

- Long-term ocean observations from oceanographic cruises every two weeks, since 1996.
- Track oceanographic and ecosystem conditions
  - Water temperature, salinity, nutrients
  - Plankton samples for phytoplankton, zooplankton (copepods and krill) and fish eggs/larvae
  - Data are used to forecast salmon returns
- Why a focus on zooplankton?
  - The link in the food chain between the microscopic plants (phytoplankton) and fishes



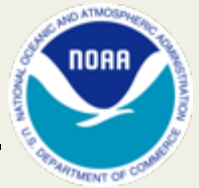
# Copepods and Krill

- Adult boreal cold water copepod species are large, ~ 2-8 mm
- Adult tropical warm water copepod species are smaller – think pencil leads or ball point pen: 0.5 mm or 0.7 mm
- Krill are much larger, 25 mm in length as an adult

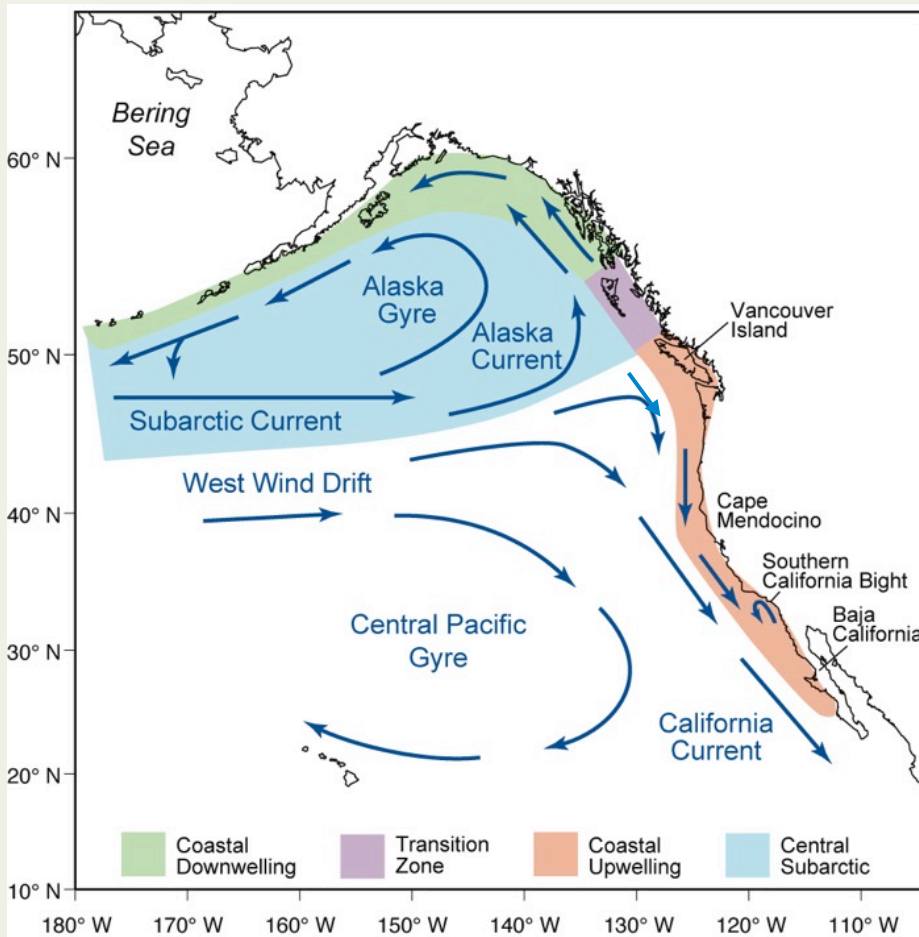


- Copepods are the most abundant metazoans on the planet
- Thus the world as we know it, would not be the world as we know it, without copepods.

# Ocean Circulation Patterns



Plankton are drifters thus their presence/absence provides information on variations in circulation patterns and source waters that feed the California Current



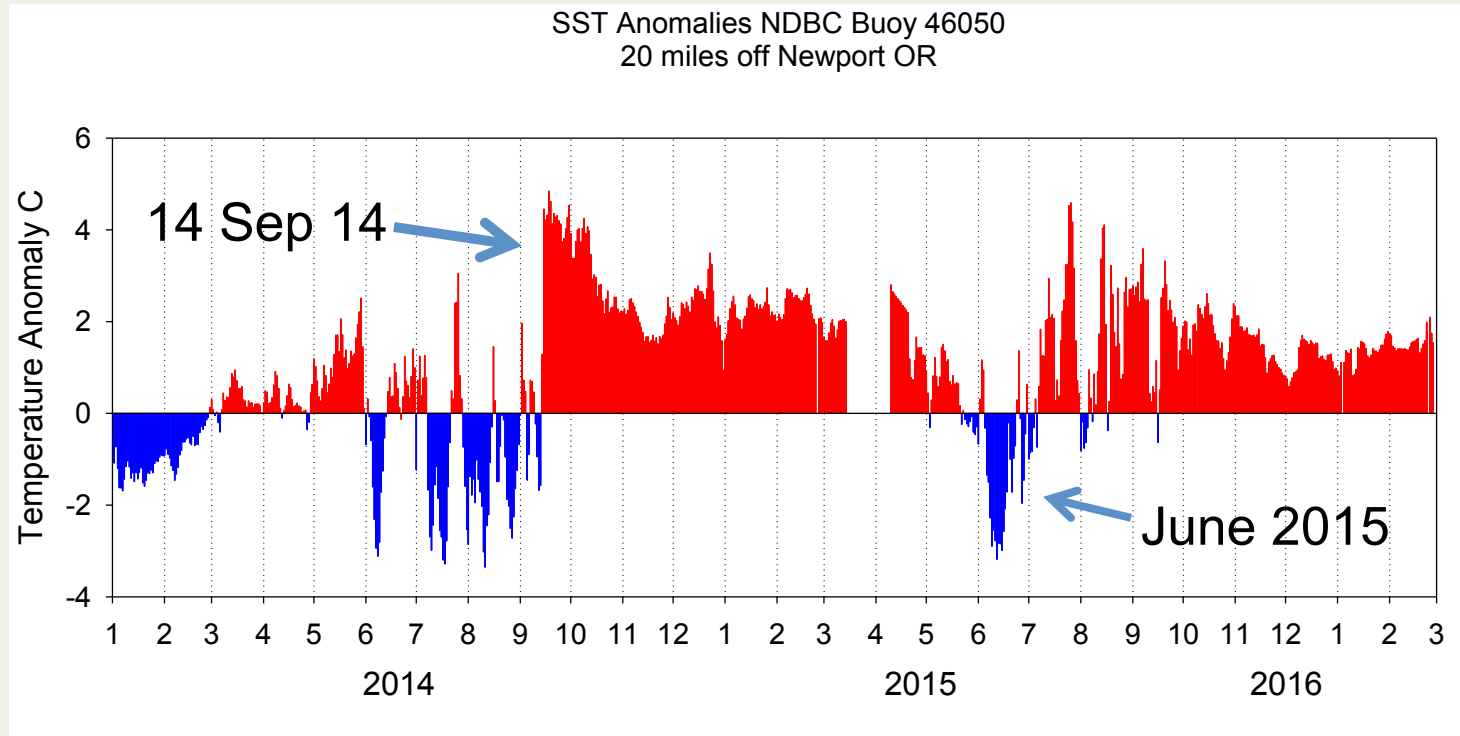
1. Subarctic Coastal Currents bring cold water and lipid-rich **"northern" copepod** species to the N. California Current; (Cheesburgers)
2. A weak California Current and onshore flow of the West Wind Drift brings warm subtropical water and lipid-poor **subtropical "southern" copepods** to the NCC (Popcorn)
3. Therefore, bioenergetics of the food chain is affected by the source waters which feed the Calif. Current



# The Blob

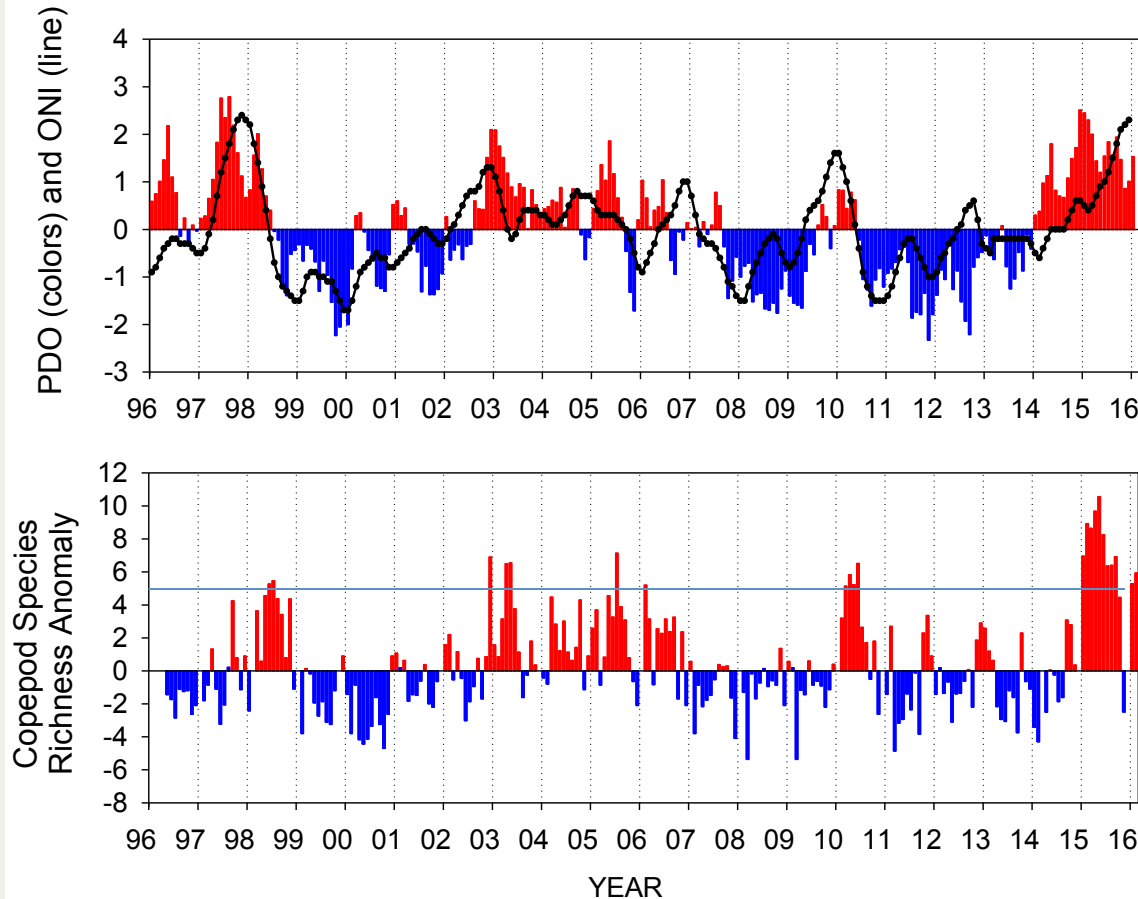


Daily sea surface temperatures at the NOAA Buoy 46050: 20 miles off Newport: Jan 2014 – Feb 2016



- Upwelling season very short in 2014 (June through early September)
- On 14 Sep 2014 upwelling winds weakened, the Blob came onshore and SST jumped 7°C in 6 hours.
- Anomalies of + 2°C during most of 2015 and + 4°C anomalies were seen off Newport in July and September 2015
- Upwelling in 2015 the 5<sup>th</sup> strongest in 70 years, but only upwelled nearshore

## PDO, ONI (upper) and Copepod Species Richness (lower)



- Copepods track PDO and ONI with ~ 4 month lag
- Higher richness = greater species diversity, due to warm water off Oregon
- Twice as many species in 2015 suggesting different origin of warm source waters

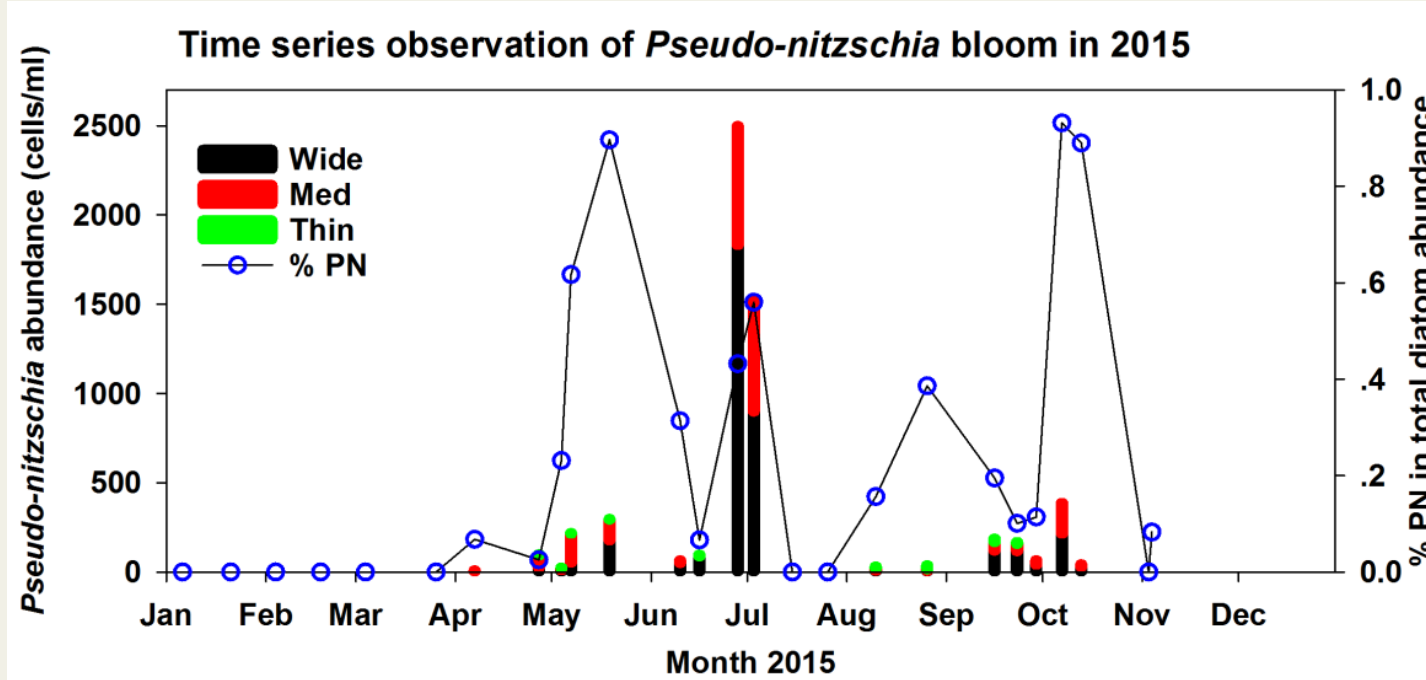
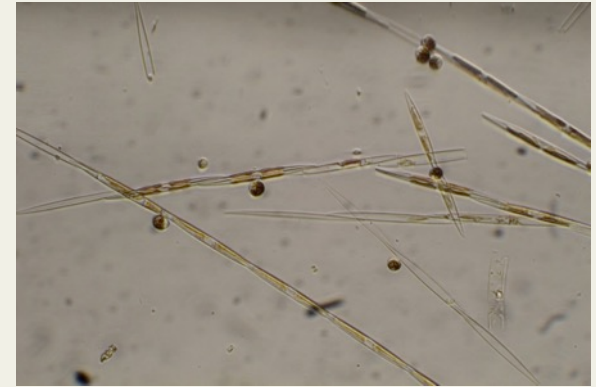
## Krill

- Still working up the data (finished sample analysis on Friday)
- Three key results
  - Coastal species = zero
  - Offshore species nearly zero
  - Those krill that were present were very small, 10-12 mm, but were mature adults



## Harmful Algal Bloom

- Wide-spread from CA to Alaska suggests a common trigger (The Blob?)
- Longest duration (May-November)
- Very toxic – domoic acid, a neurotoxin
- Have manuscript submitted to Proc. Natl. Acad. Sci.





## Impacts on Fisheries

- Chinook salmon returns to the Columbia River quite high but not a surprise because:
  - spring-run Chinook went to sea in 2013;
  - fall-run Chinook in 2012
- Sockeye returns in summer were initially near-record, however due to warm CR river temperatures, the run nearly failed
- Coho returns to CR in fall 2015 (went to sea in spring 2014) lowest since 1998 El Niño; coho returns to coastal streams poor in 2015
- Hake (whiting) harvest in 2015 poor
- Opening of Dungeness Crab fishery delayed until 4 Jan 2016 which impacted local economy in December



## Expectations for 2016

- Won't know about spring Chinook salmon until April/May for fish that went to sea in 2014; one year later for fish out in 2015.
- Copepod species richness is still very high and copepod abundance still very low, suggesting that Blob water is still present.
- Food chain still dominated by small, warm water, lipid-poor copepods; this is an "early warming indicator" that poor ocean conditions will likely continue.
- An environmental disaster looming, especially so if the food chain does not recover soon.

# Why is/was the Blob so different from an El Niño?

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- It seems that the North Pacific Gyre/Transition Zone shifted northward, bringing offshore tropical waters near to our coast, and this is the water that came onshore
- Therefore, it was eastward transport of subtropical warm water, not northward of subtropical water, that has given us all of this interesting “biology” (first sightings of many species of copepods (but not krill), reptiles, fish and birds) and the potential for the birth of an ecological nightmare that has not yet gone away.
- What about the 2016 El Niño? Most recent cruise (on the F/V Shimada, mid February) showed that the Blob zooplankton continue to dominate and no “El Niño” plankton have appeared yet.
- ONI index is still very strong and many impacts have been seen elsewhere (but not in the California Current). Different from past major El Niño events (although the 1972 event did not show itself in the northern California Current).

Northwest Fisheries Science Center webpage [www.nwfsc.noaa.gov](http://www.nwfsc.noaa.gov)

Two buttons of interest:

- Newportal Blog
- Salmon Forecasting

Home | Research | Hot Topics

## Ocean Indicators and Salmon Forecasting

Since 1996, the Center has been monitoring the ocean environment off the Washington and Oregon coasts, its interaction with the California Current, and how ocean conditions affect salmon. This ongoing research is helping us better understand some key relationships between climate, oceanography, and biology that largely determine the fate of salmon entering the ocean during specific years.

**What is the ocean index?**

NWFSC scientists have developed a novel ocean index tool that combines a suite of oceanographic data, such as sea surface temperature, with biological indicators, such as the amount of salmon prey. Together, these indicators can capture the dynamics of a changing ecosystem and allow us to predict the relative abundance of Chinook and coho harvests far enough in advance for decision makers to plan for good, average, or poor-year years. The accuracy of such predictions is invaluable to state and federal fishery managers in setting harvest limits and allocations and for tracking recovery of endangered or threatened salmon runs.

Recent salmon forecasts

**Explore More**

Annual salmon forecasts

Learn more about ocean indicators

NWFSC top story: Predicting salmon runs (2008)

## Newportal Blog

*A gateway to oceanographic adventures from the Newport Line and beyond*

We are a group of NOAA Fisheries and Oregon State University scientists that sample the Newport Line fortnightly to understand changing ocean conditions.

Follow us as we share the fun things we learn about this region and other areas of the North Pacific Ocean.

Enter no. of points to graph (490 max.):  go

Data above are from 50 m water depth from a station located 5 miles off Newport, OR. Dashed lines are the summer (blue) and winter (red) averages from 1996 - present. (Click chart to enlarge)

November 3, 2015 (Click image to enlarge, click arrow to view a different data.)

**Any Questions?**



# Regional Impacts Summary – 01/23 to 02/26

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## Reporting Status:

- 196 entries since July 1, 2015
- Last reporting period: 40 environmental conditions & human/ecosystem system impacts

*Reminder:* To insert a regional impact, click on the [Google Doc](#), or email Timi Vann or Michael Milstein

## Environmental Conditions Capture:

- El Niño
- Warm ocean temperatures
- Record breaking air temperatures
- Domoic acid toxin
- Positive snow pack
- Drought

## Human & Ecosystem Impacts:

- Coastal erosion; property loss
- Coral bleaching
- Fisheries (crab; salmon return)
- Increased energy costs (electricity)
- Forestry (die off; invasive species; wildfire)
- Sick and starved marine mammals
- Sea star wasting disease
- Water supply (water delivery estimates & curtailments; reservoir operations)

# Headlines



## OCEANS:

Warming waters boost disease -- studies

**Seals Suffer Tough Ocean Conditions**

**Unusually Warm Ocean Water Is Literally Making Sea Lions Sick**

**Warm Waters Linked To Sea Star Wasting**

Ochre sea stars have suffered a 95 percent die-off in SLO County

**Lowest salmon return since 1939**

**Gov. Brown requests federal disaster aid for California crabbers**

**Northern California salmon run devastated, again, by drought**

Dry February could bring problems for drought-stricken Valley

Drought's hardest-hit sectors may need years of support

Oregon's Snowpack Shows Huge Improvement From Year Ago

**Good news for dry times — Sierra snowpack highest in 4 years**

**California to release more reservoir water thanks to El Niño storms**

Rains restore flows to the San Joaquin River, benefiting fish, communities and farmers

**Has El Niño abandoned L.A.?**

El Niño's not done yet: Weeks of dry weather ahead, but more rain expected after that

## RISING SEAS:

El Niño pummels coast in preview of warmer world

Buoyed by recent rains, Folsom Lake levels triple

Sacramento agencies ask: Why release water from Folsom Lake during drought?

## FORESTS:

Drought could devastate Calif. ecosystems -- USFS

## ELECTRICITY:

Calif. drought raised power prices by \$2B

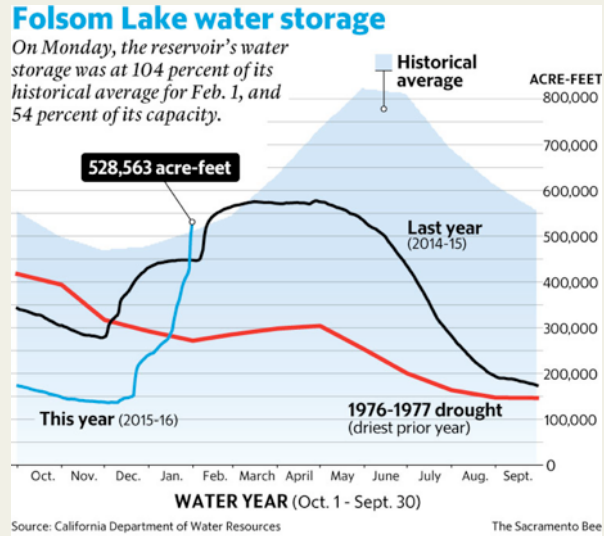
## DROUGHT:

Los Angeles looks to capture stormwater

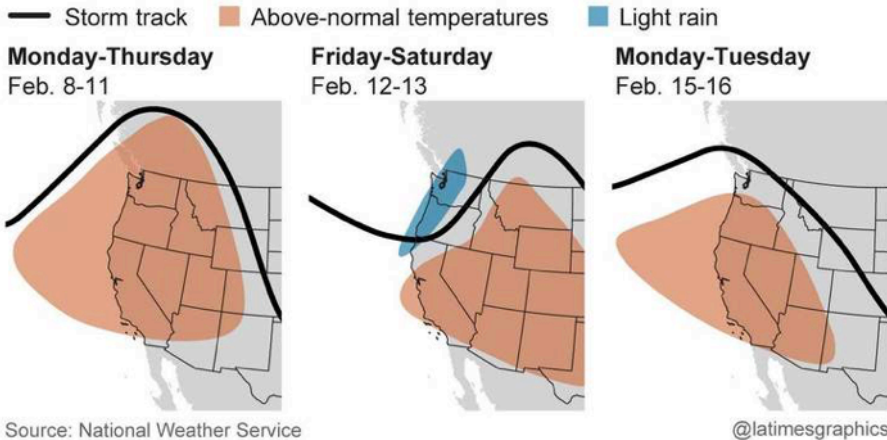
# Impacts in Pictures



Feb. 9: Folsom, CA. Reservoir operators are nearly doubling the amount of water outflow from Folsom dam to make room for the above average Sierra snowpack and future storms.



## El Niño-fueled storms steering clear of California



Feb. 8: San Diego, CA. Temperatures soared 20 degrees above the average for this time of year. Roland Lizarondo/KPBS

# Impacts in Pictures



While this year's strong El Niño has yet to produce many drought-busting storms, it is accelerating erosion up and down California's coast, including at the University of California, Santa Barbara.



Feb. 8: Gov. Brown asked the Obama Administration to declare California's crab fishery a federal disaster. Fisherman Joe Tomasello on his boat in Santa Cruz, CA.



Star wasting disease has occurred before, but not at the magnitude or extent currently observed – the “largest observed die-off of a wild animal in the ocean”. Scientist now link the die-off to warming ocean.



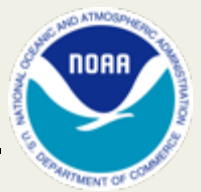
Pacific Grove, CA: Females aren't ready to give birth and struggle to nurse pups.

# Death Valley “Superbloom”

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# Telling Regional Stories - Update



## NOAA West Watch

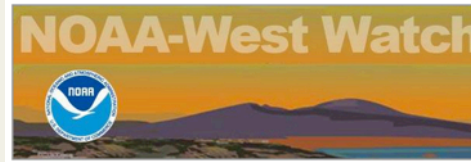
**What it is:** A periodic collection of stories documenting how environmental change is affecting people and places in the western United States.

**What it isn't:** Scientific assessment of cause and effect, or forecast or "outlook" product. We are not attributing impacts to specific causes; these stories may help inform future lines of inquiry and research.

### What will we do with these?

- Utilize stories to help develop a retrospective seasonal report.
- Communicate impacts of changing environmental conditions within the region via compelling "special interest" stories.
- Broadly share stories.

***Please help share these stories, and provide us with your ideas!***

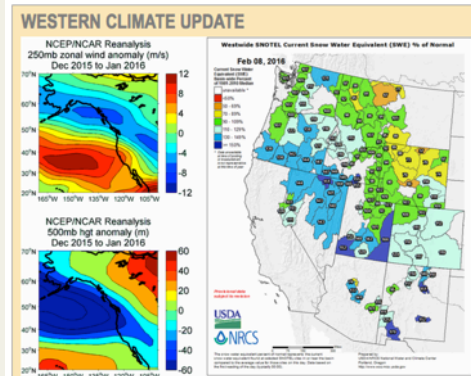


### Welcome

This is the inaugural edition of NOAA-West Watch, a periodic collection of stories documenting how environmental change is affecting people and places in the western United States. If you have a story suggestion, please contact Michael Milstein ([michael.milstein@noaa.gov](mailto:michael.milstein@noaa.gov)) or Timi Vann ([timi.vann@noaa.gov](mailto:timi.vann@noaa.gov)).

### In this issue:

- [Western Climate Update](#)
- ["The year we'd like to forget" for whiting fishery](#)
- [West Coast kelp forests declining](#)
- [Early salmon returns signal lean ocean conditions](#)



Over the last two months, an active eastern Pacific storm track led to above normal precipitation and snowpack over much of the western United States, with the exception of the central and northern Rockies of Wyoming and Montana (right panel); blue is above normal snowpack and yellow/red is below normal snowpack). The top left panel shows anomalies in jet stream level winds (positive anomalies are yellow and red and indicate a stronger than normal jet stream) with a core centered off California and to the northeast of Hawaii. The bottom left panel shows anomalous pressure patterns with blue indicating low pressure and yellow and red indicating high pressure. The result of this wind and pressure pattern has been consistent storminess from about central California into the Pacific Northwest during December and January, with southern California receiving several short lived but potent periods of active weather. An active strong El Niño, one of the

### "The year we'd like to forget" for whiting fishery

After some of the most productive fishing on record for whiting, or hake, in recent years in the Pacific Northwest, commercial fisheries came up almost empty when fishing for the prolific species in the fall of 2015, according to officials of American Seafood Co. in Seattle. The almost complete absence of hake in what had been the most productive areas off Washington and Oregon corresponded with increases in typical water temperatures. Water temperatures that had hovered around 58 to 62 degrees F in previous seasons came close to 64 degrees F this fall. Fishing vessels searched up to 190 miles offshore, far beyond the typical area where they find hake, but found none. Some vessels harvested only around 60 tons over the course of 10 or more days, when they had previously produced close to 1,500 tons in the same period. The whiting fishery did not come close to catching its full quota and left tens of thousands of tons of the available quota in the water. The poor fishing had ripple effects throughout the industry as customers that expected a big whiting catch suddenly had to look elsewhere. "A lot of product that a lot of people were waiting for turned out not to be there," said Roger Mjeltevik of American Seafood Co. in Seattle. "It was the year we'd like to forget."



The American Seafood Co. ship Ocean Rover on whiting fishing grounds off the Pacific Northwest. Courtesy American Seafood Co.

The difficulty the fishing industry encountered in finding hake last fall made NOAA Fisheries' first-ever winter hake survey especially timely (although the survey was not directly related or in response to the reduced harvest). On Jan. 9 the survey set out from Newport, Ore., aboard the NOAA research vessel Bell M. Shimada for a month to map the distribution of hake and collect biological data in the winter, when the species spawns. The spawning distribution and behavior of hake has been poorly understood, in large part because of a lack of winter data. The survey was a trial run to assess whether scientists could locate and gather winter information on hake, one of the largest commercial fisheries in Northwest waters.



Two-year-old hake collected by offshore survey. NOAA Fisheries/NWFSC.

The winter survey located hake, but much farther offshore than the fish usually occur in summer and fall, according to chief scientist Sandy Parker-Stetter, who has documented the survey's progress on the Northwest Fisheries Science Center's [Newport Blog](#). Research biologist Allan Hicks suggested that hake may have been very widely distributed last fall and not present in the dense feeding aggregations the fishing fleet typically pursues. He noted that fishing vessels did catch hake, but not in the high volumes the vessels had become used to in recent seasons. Hake do tend to

move north in winter, and Canadian fishing vessels also caught low volumes. Scientists were as surprised as anyone by the low catches, he said. NOAA survey data from 2015 showed that West Coast hake are doing well, and remain present in large volumes, said Hicks, who serves on the [Joint Technical Committee](#) that analyzes hake data.

### West Coast kelp forests declining

Kelp forests along the West Coast from Northern California to Oregon and Washington are declining significantly after more than two years of unusually warm water and a major increase in purple sea urchins that consume the underwater vegetation. While kelp growth commonly fluctuates on a seasonal basis and has declined during previous warm El Niño periods, the current decline is more widespread and severe than scientists have seen before, said Laura Rogers-Bennett of the California Department of Fish and

# Telling Regional Stories - Update

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## **Possibilities for the next NOAA West Watch story collection:**

- High waves, storm impacts: Coastal erosion, flooding, effects on marine transportation
- Nexus of drought, wildfire & invasive species

*Help us identify and explain other impacts – send your story ideas! We seek to include stories that span the region – the 11 Western States (not just the West Coast).*

# Announcements & Open Discussion

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1. Next WRECIC call: March 21, 1pm – 2pm (Pacific).
2. Open Discussion or Parting Comments