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Weather and Coastal Conditions



2012

2012 - Monthly

Recent marine weather and coastal conditions

2012 - Summary

A yearly review of atmospheric and oceanic conditions

Figure Explanation

Figure Explanation and data sources



“Boundary conditions play an important role for water quality in Puget Sound and our coastal Bays

Note: Weather data for this presentation are summarized from external sources.

www-k12.atmos.washington.edu/k12/grayskies/nw_weather.html



Weather

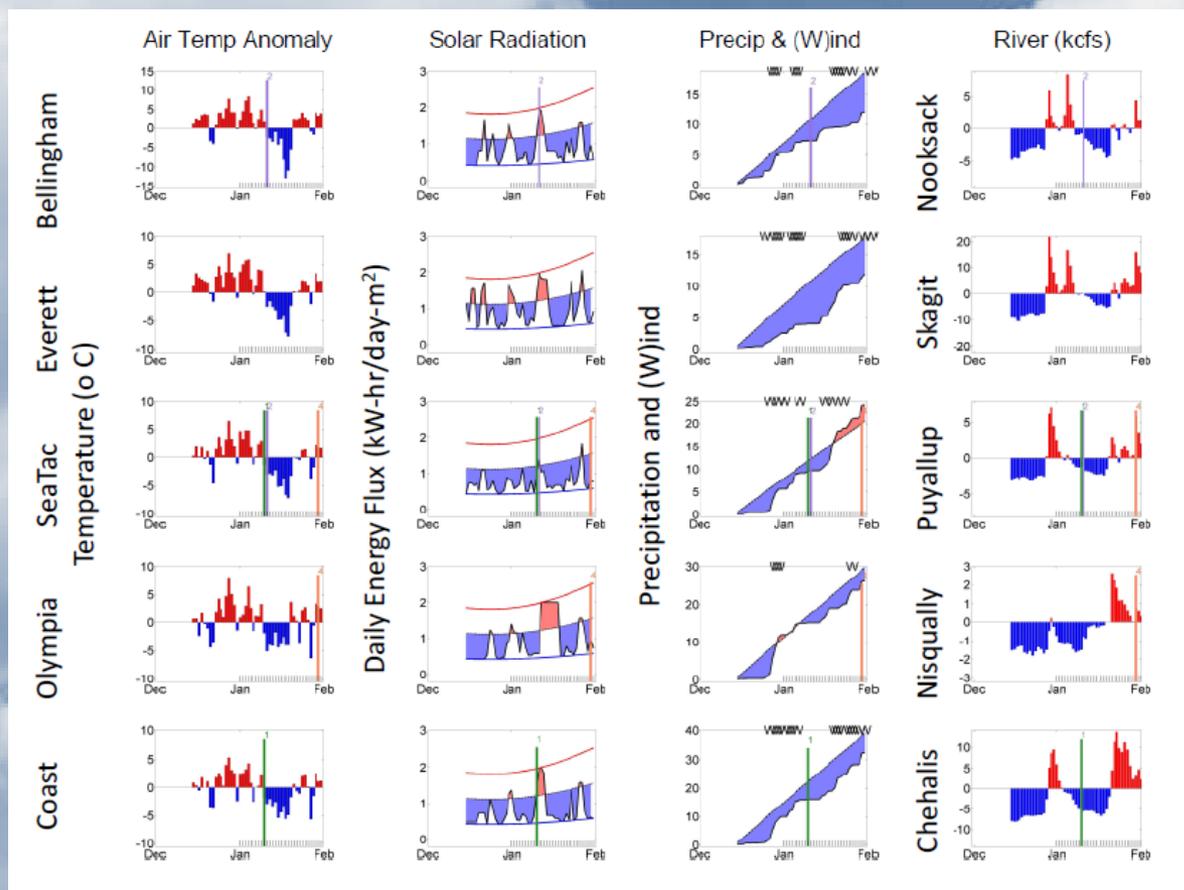


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

January 2012 started out warm, but got cold and snowy in the Puget Sound lowlands by mid-month, then warm again for the last week. Most rivers started lower in flow and ended high. Sunlight was strongest in the days after the storm when the wind came out of the north.



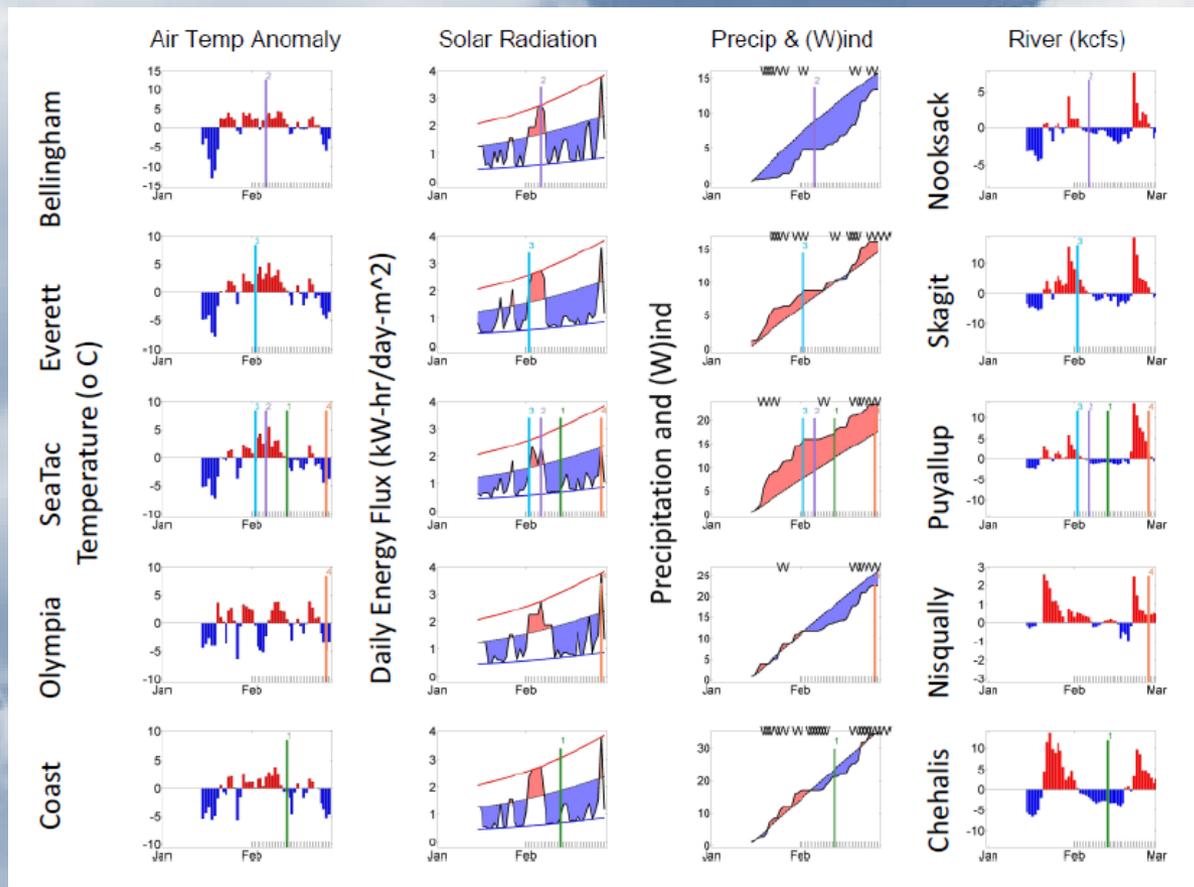


Weather Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

February was generally warmer-than-normal for the first half and then colder for the second, although cold air remained in place over South Puget Sound lowlands during the first week. River flows trended below normal for the first part of the month, and became above normal during the second half of the month. Precipitation was above normal in the Central Sound but below normal to the North and South. Sunshine prevailed in the first week of the month followed by cloudy conditions.





Weather

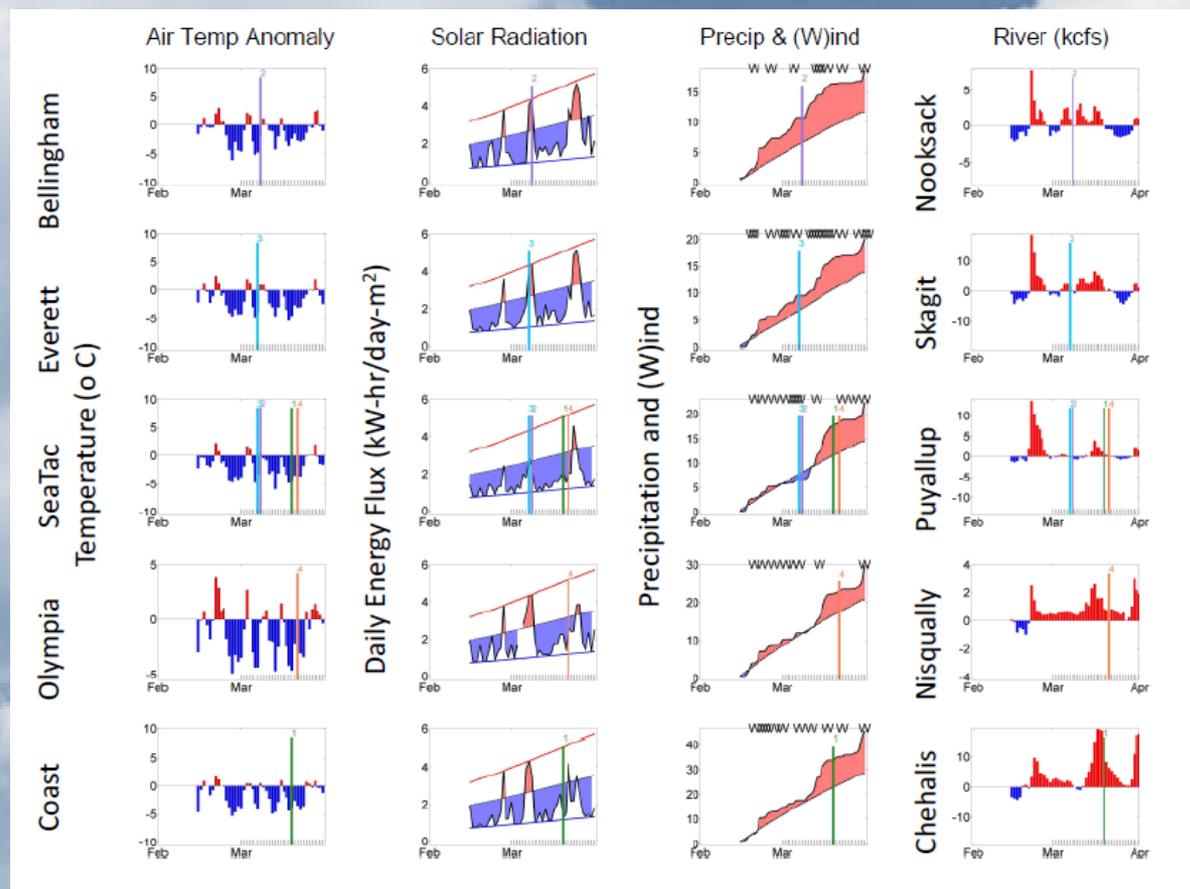


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

In general March was cool, cloudy, and dry with a few sun breaks around the 7-8th and 23-24th March. River flows began the month above average but went below normal to the north past mid-month, while staying high or above normal on the Coast and to the South.





Weather

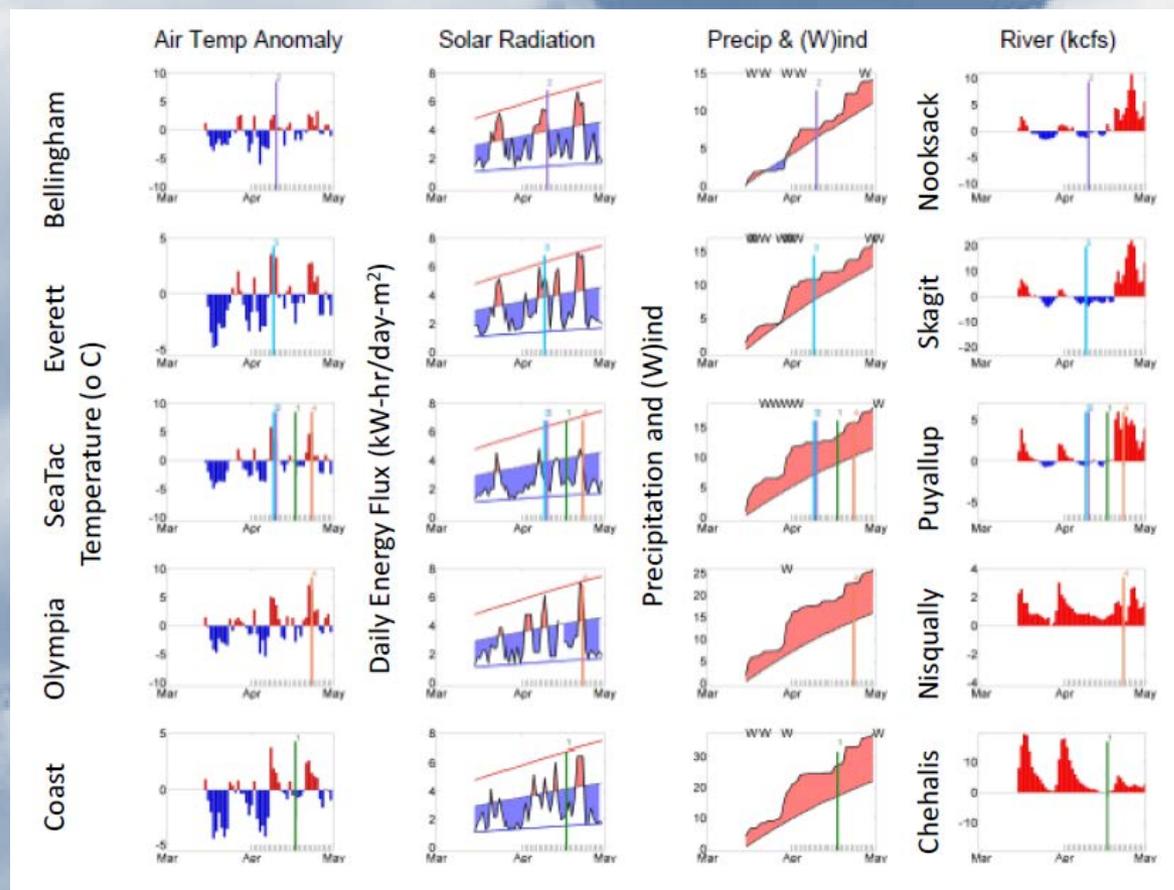


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

April got off to a cold start and finished generally warmer-than-average throughout Washington. Precipitation was above average everywhere and river flows became higher toward the end of the month due to high precipitation but also snowmelt.





Weather

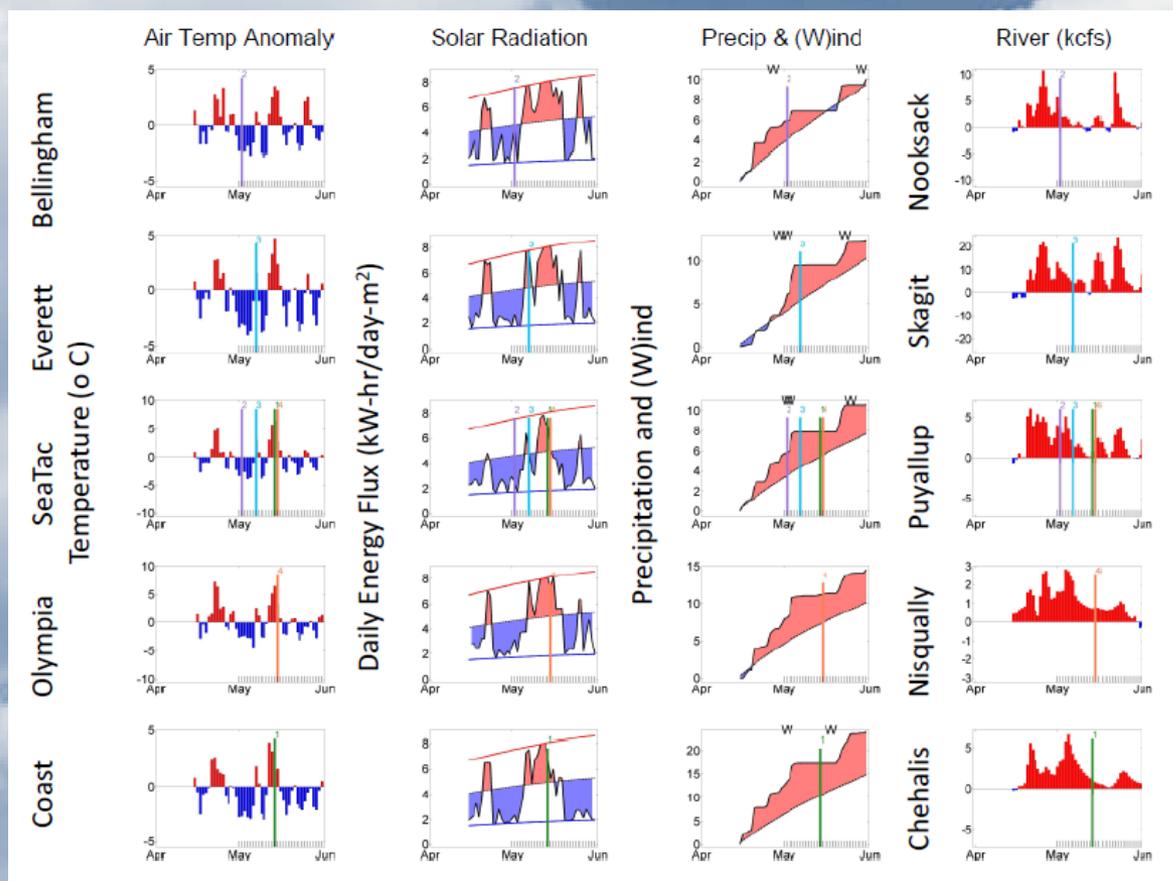


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

May got off to a cool and cloudy start, then became warm and sunny through mid-month, and finished cool and cloudy again. River flows were generally above normal though out the region with a mid-month freshet on snowmelt fed rivers, and a second spike toward the end of the month in all rivers corresponding to precipitation.





Weather

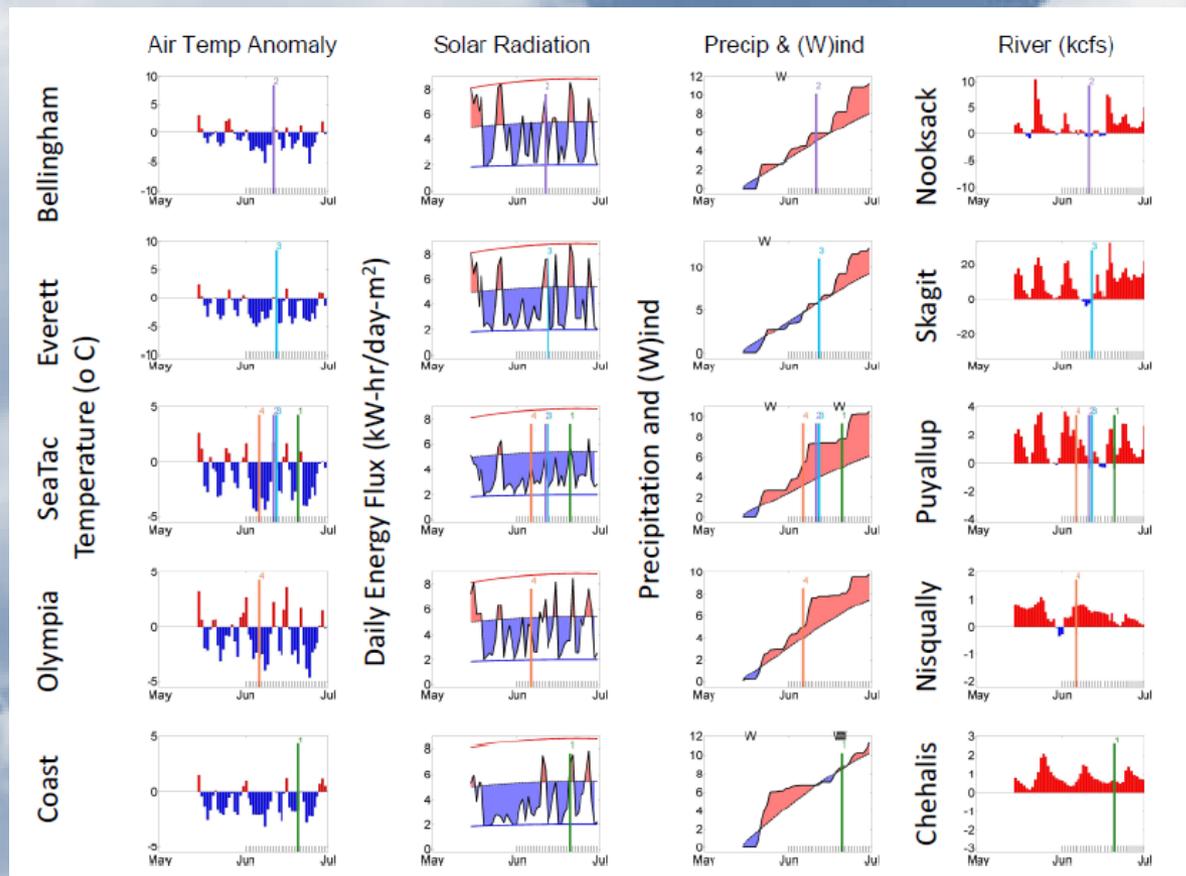


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

June was generally cool, cloudy and wet, especially in the South Puget Sound where a persistent marine layer prevailed for much of the daytime.





Weather

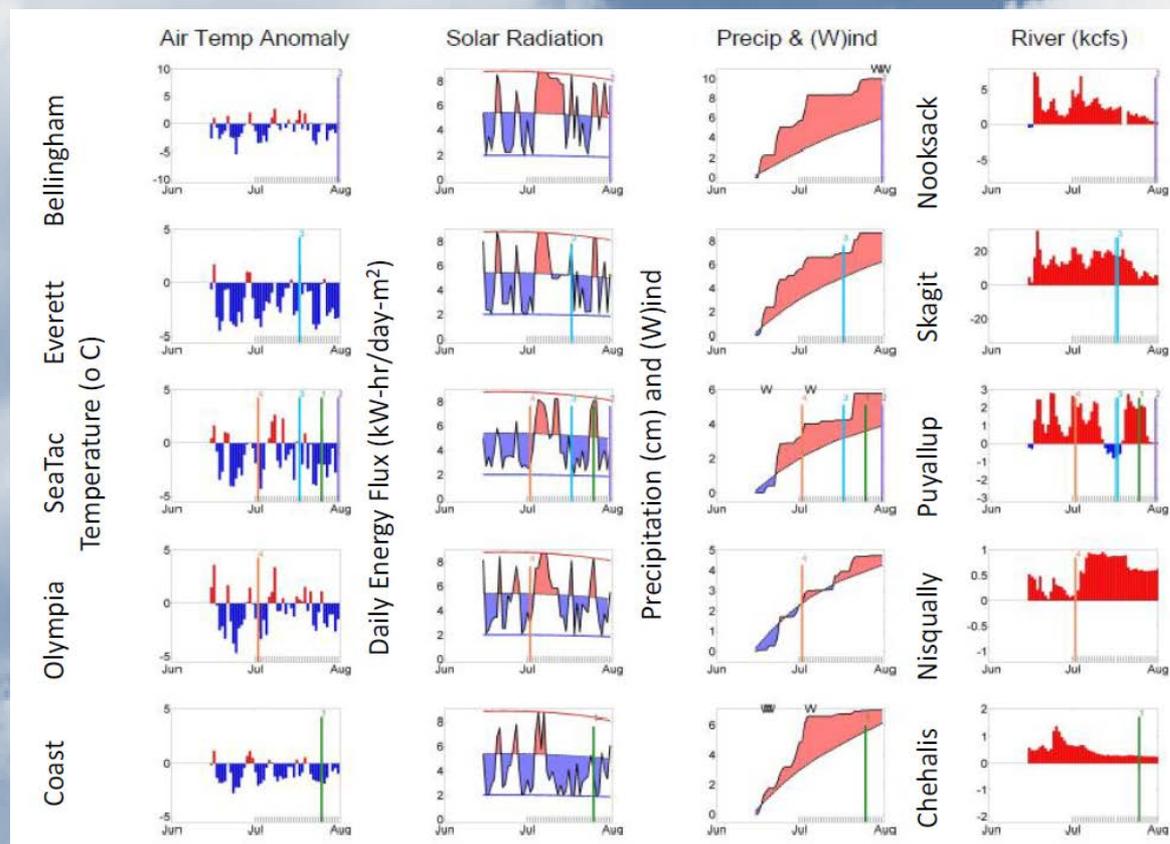


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

The second week in July was warm and sunny, the rest of the month has mostly seen below average temperatures and sunlight with a persistent marine layer to blame. River flows are mostly above normal.



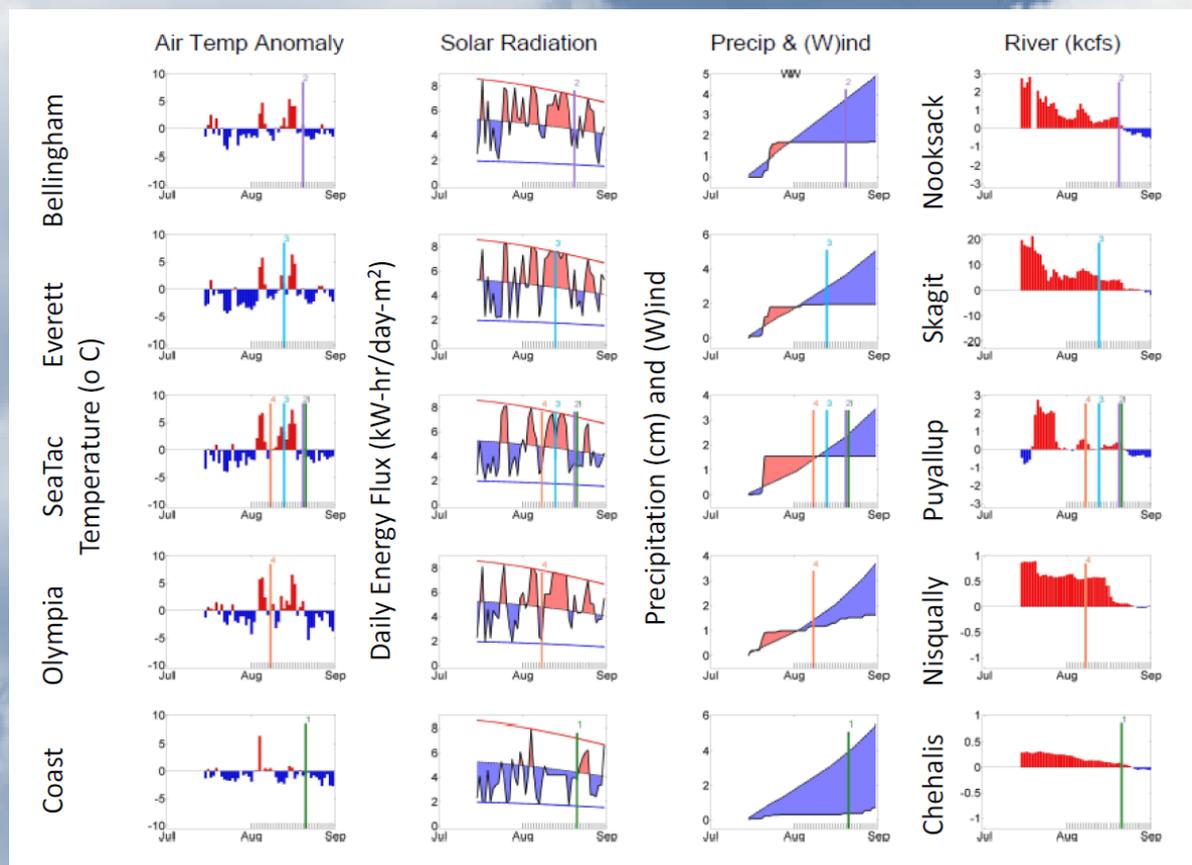


Weather Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

After a cool end to July, the first half of August was warm and generally sunny with occasional blankets of marine air keeping the overnight temperature warm. In the second half, air temperatures were on average cooler because skies were clear and night time temperatures were cold. Precipitation was below normal and river flows dropped below normal.





Weather

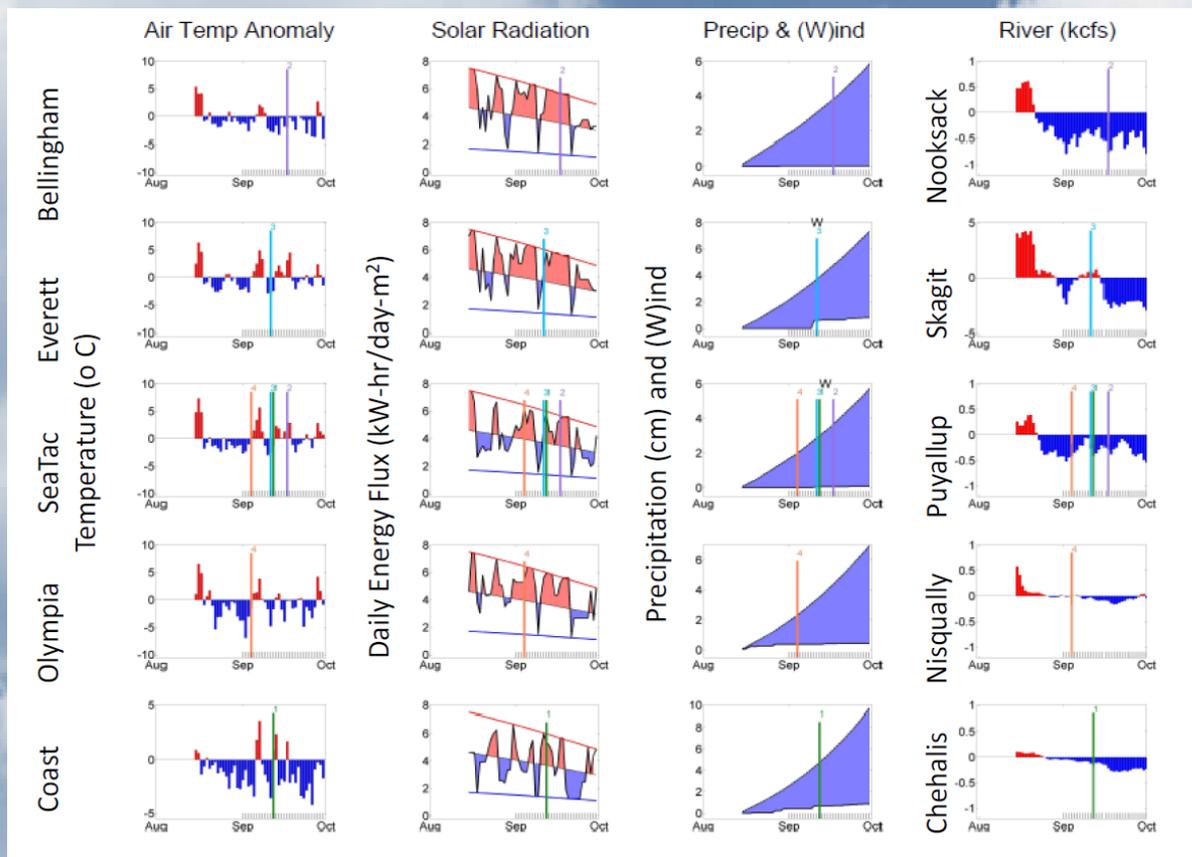


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

Dry conditions occurred throughout Western Washington with rivers running below normal and trending lower. Winds were upwelling-favorable out of the north except in the extreme north near Bellingham (real?). Skies were mostly clear with warm sunny afternoons and cold nights. Air temperatures were cooler overall.





Month

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec



Weather

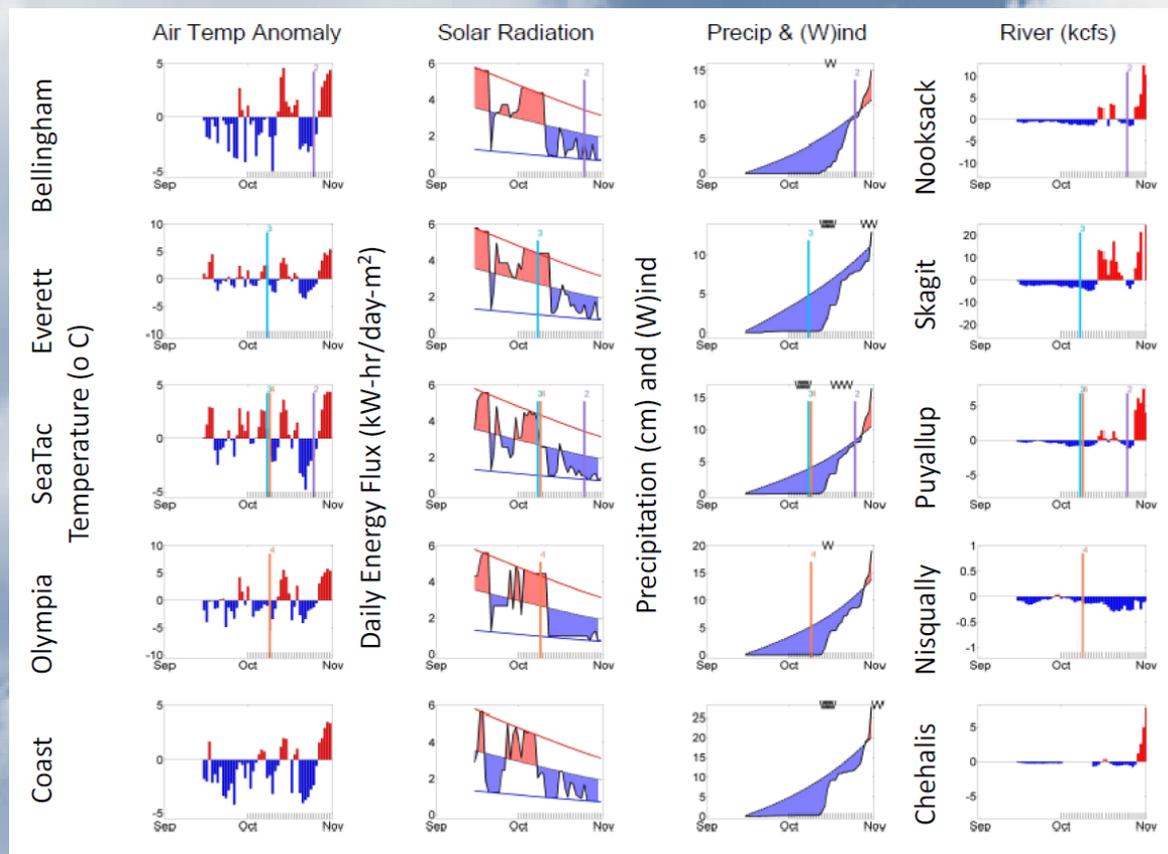


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

The first third of October had sunny days with warm daytime temperatures cooling off considerably at night. From 10 October onward it became seasonably stormy and air temperatures were warm, cool, and then warm again. River flows were below normal transitioning to above normal with low flows continuing in the Nisqually.





Weather

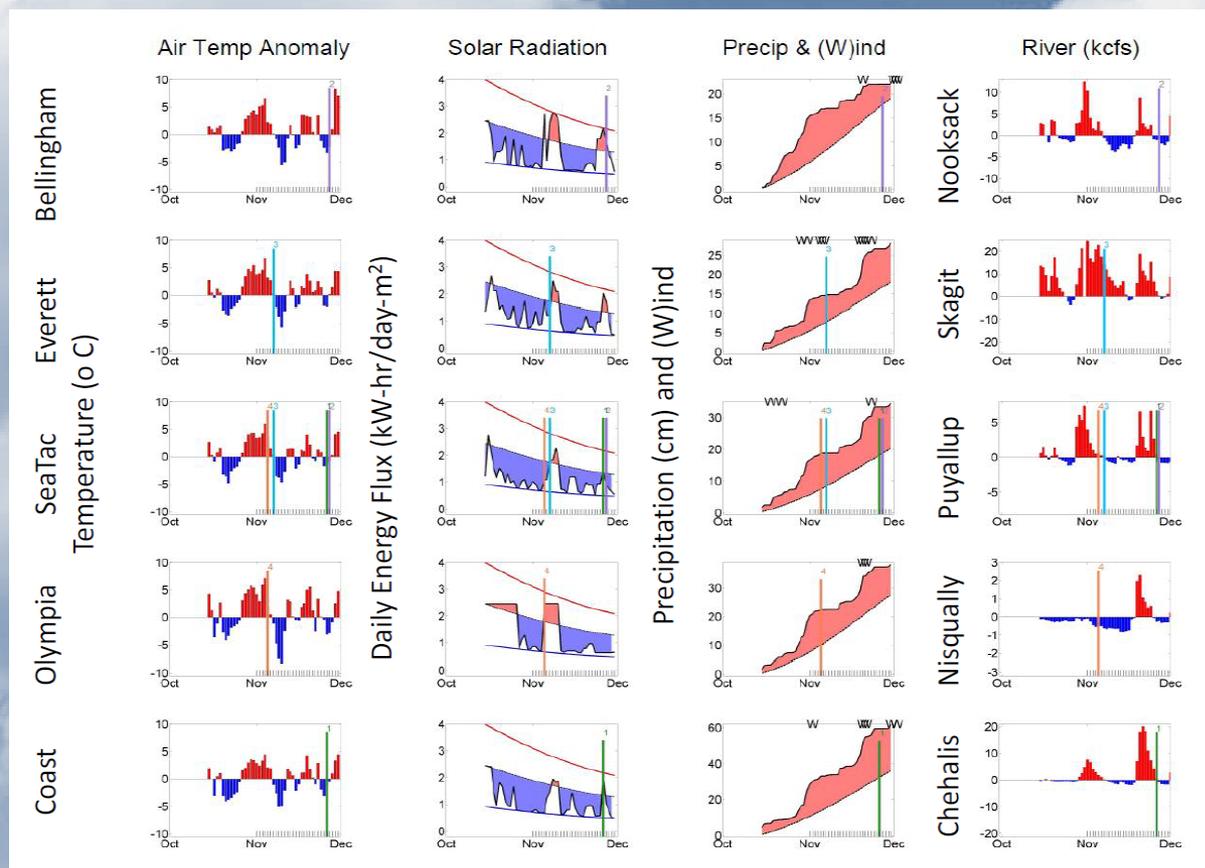


Coastal conditions

Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

Initially sunnier, drier, cooler and rivers running below normal. A switch to a stormy winter pattern with southerly winds occurred on the 10th and increased cloud cover, temperatures and precipitation. In response rivers are running higher (except Nisqually which retains low flow, maybe due to dams or snow precipitation).





Weather



Coastal conditions

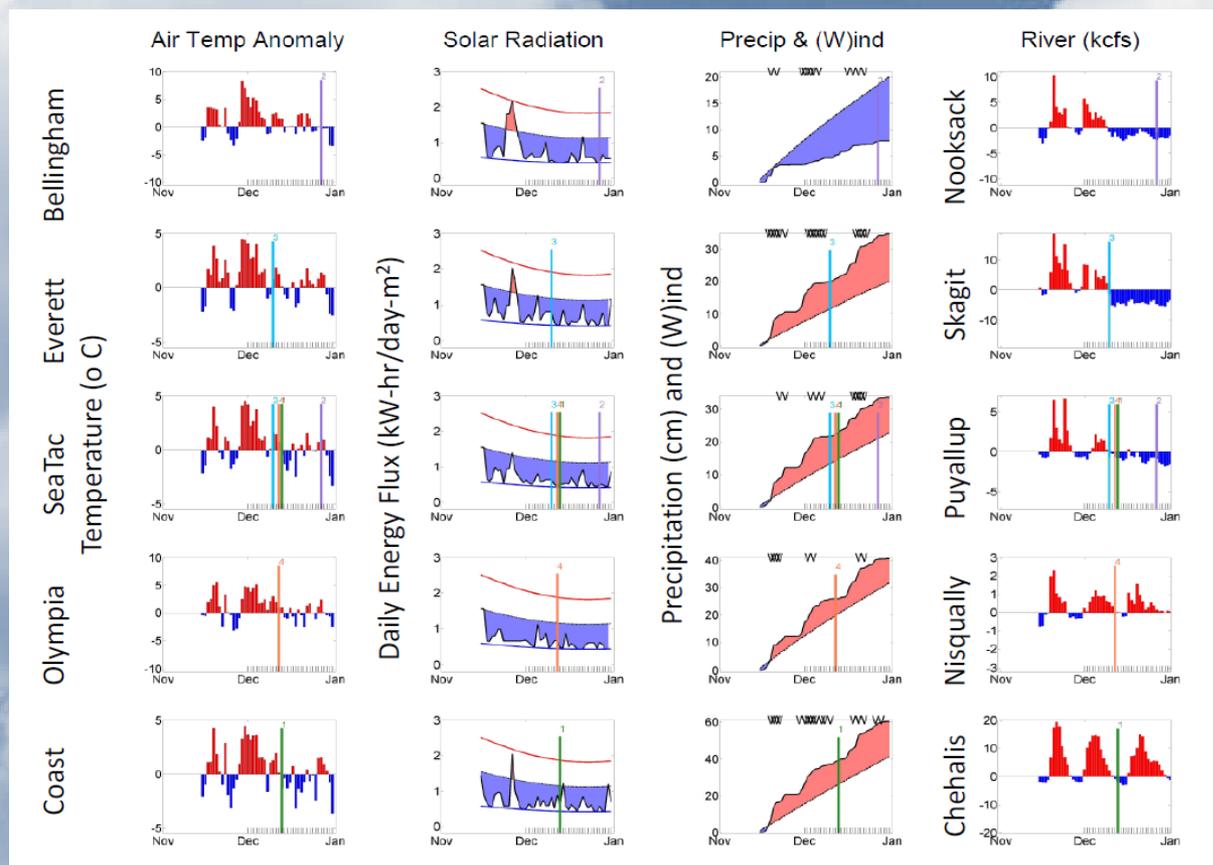
Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

The first half of December was warmer than normal, but the last half was more typical.

December was cloudy with higher than average precipitation.

River flows were above normal to the south, trending to slightly below average to the north by the end of the month.





Weather

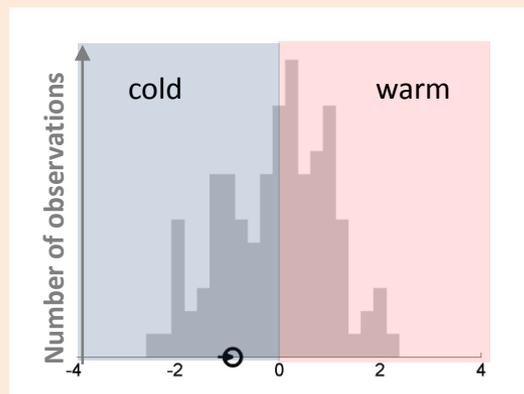


Coastal conditions

Pacific Decadal Oscillation

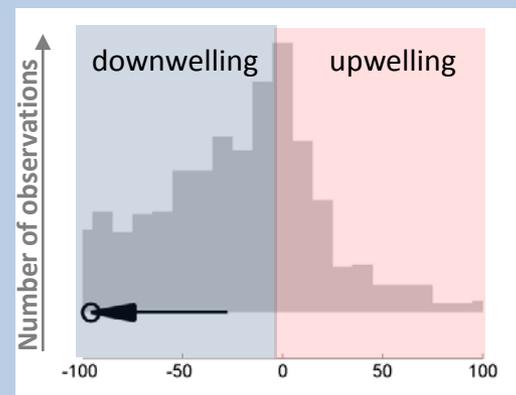
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

January PDO Index scores are predominantly neutral over all years. For January, 2012 PDO Index score was cold phase weakly trending warmer.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically January has downwelling. January 2012 was downwelling favorable, trending more extreme.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather



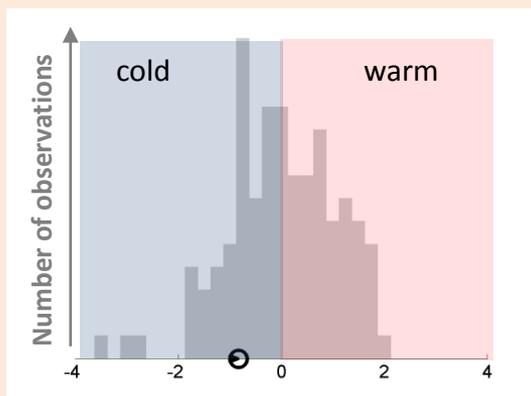
Coastal conditions

Ocean-cold/warm and upwelling dominate year-to-year variability in Puget Sound.

Pacific Decadal Oscillation

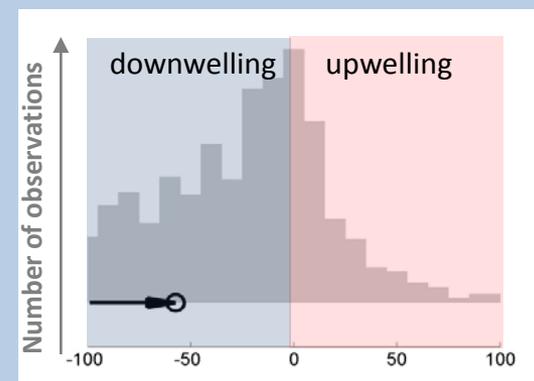
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

February PDO Index scores are predominantly neutral over all years. For February, 2012 PDO Index score was cold phase weakly trending slightly warmer.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically February has downwelling. February 2012 was downwelling-favorable, trending less extreme.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

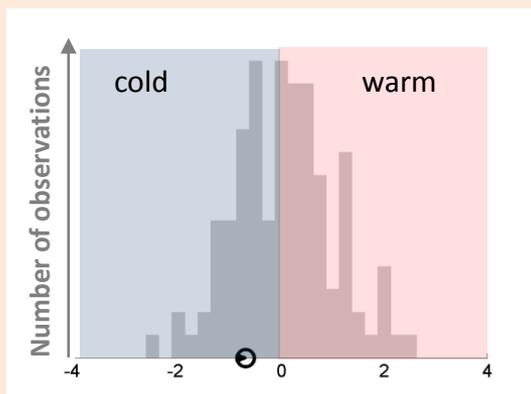


Coastal conditions

Pacific Decadal Oscillation

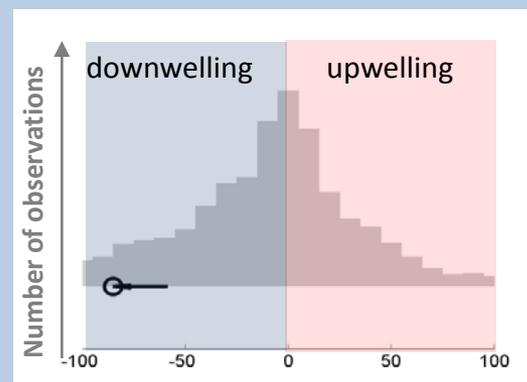
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

March PDO Index scores are predominantly neutral over all years. For March, 2012 PDO Index score was cold phase weakly trending slightly warmer.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically March has a fairly even distribution of upwelling and downwelling. March 2012 was downwelling-favorable, trending more extreme.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

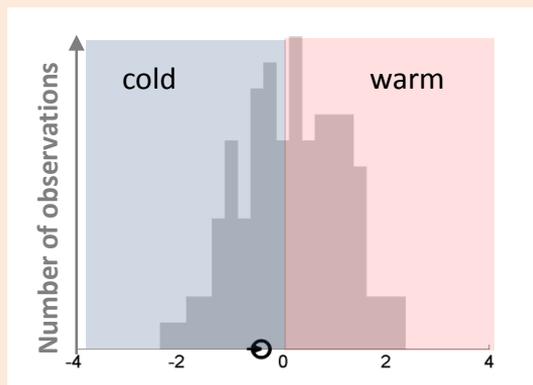


Coastal conditions

Pacific Decadal Oscillation

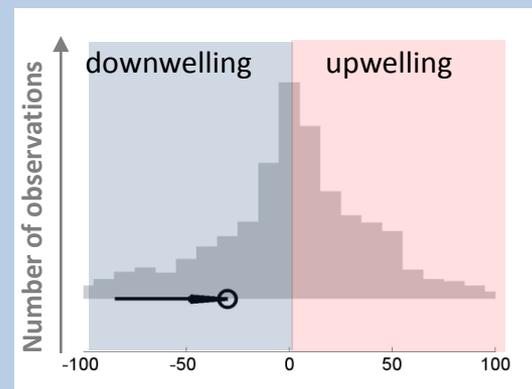
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

April PDO Index scores are predominantly neutral over all years. For April, 2012 PDO Index score was cold phase weakly trending slightly warmer.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically April has a fairly even distribution of upwelling and downwelling. April 2012 was downwelling-favorable, trending less extreme.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Weather



Coastal conditions





Weather

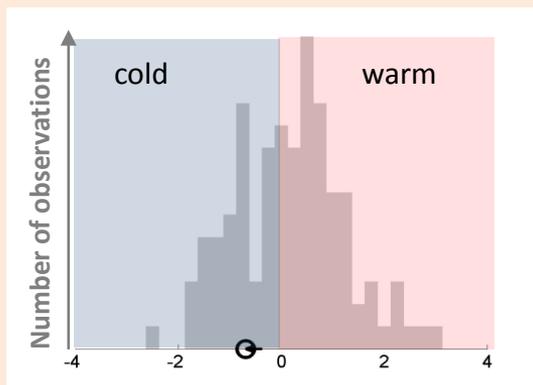


Coastal conditions

Pacific Decadal Oscillation

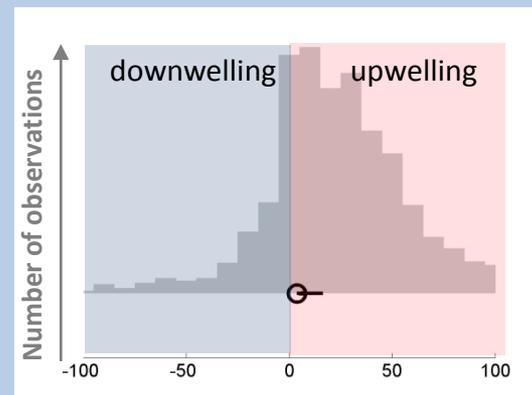
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

June PDO Index scores are predominantly neutral over all years. For June, 2012 PDO Index score was cool phase weakly trending slightly cooler.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically June has upwelling. June 2012 trended to neutral from upwelling-favorable in the month prior.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

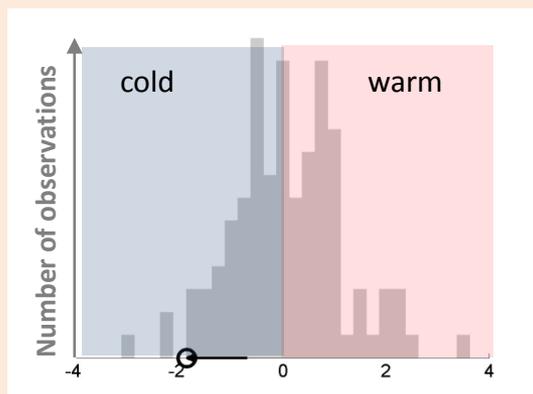


Coastal conditions

Pacific Decadal Oscillation

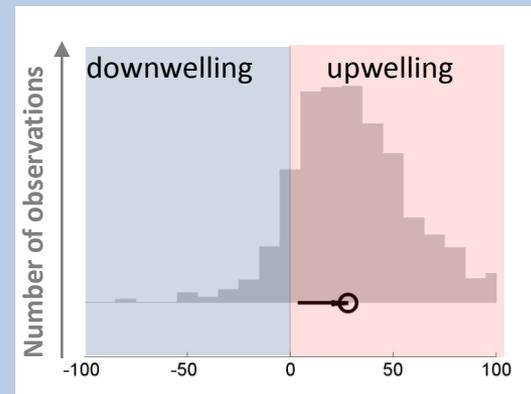
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

July PDO Index scores are predominantly neutral over all years. For July, 2012 PDO Index scores are cooler and trending colder.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically July has upwelling. July 2012 became more upwelling-favorable from neutral conditions in the month prior. However, the overall higher upwelling strength was expected.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

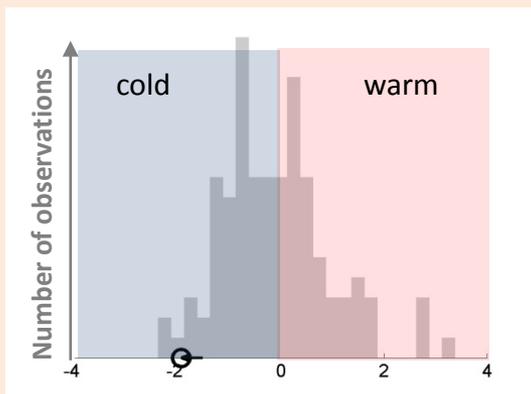


Coastal conditions

Pacific Decadal Oscillation

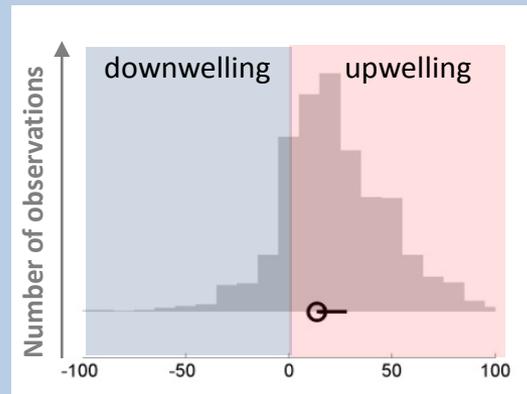
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August PDO Index scores are predominantly neutral over all years. For August, 2012 PDO Index scores are cooler and trending colder.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically August has strong upwelling. Upwelling in August was expected.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

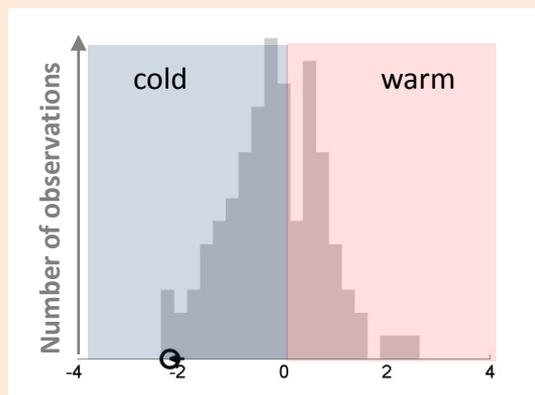


Coastal conditions

Pacific Decadal Oscillation

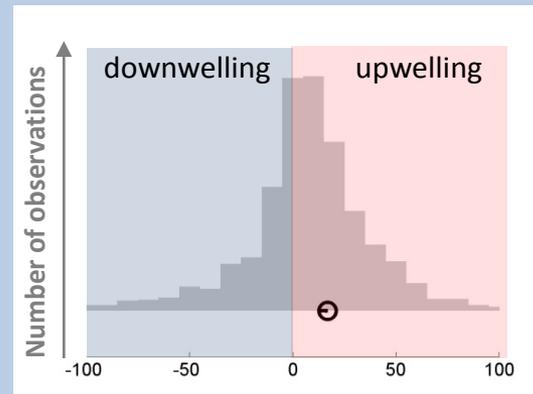
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

September PDO Index scores are predominantly neutral over all years. For September, 2012 PDO Index scores are cooler with little trend.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically September has positive upwelling. Upwelling this September was expected.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

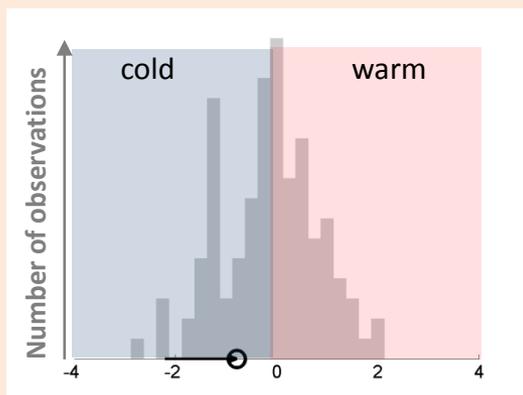


Coastal conditions

Pacific Decadal Oscillation

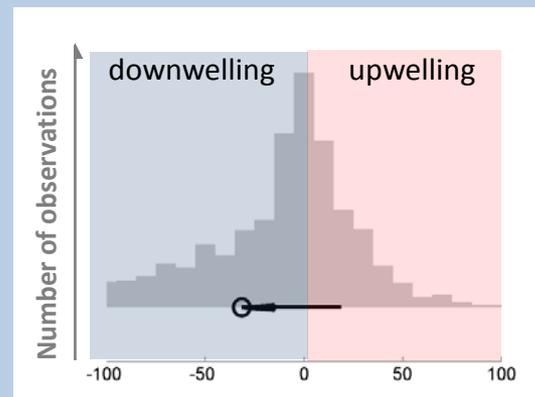
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

For October PDO Index scores are predominantly neutral over all years. For October, 2012 PDO Index scores are cooler and trending warmer.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically October data have upwelling neutral conditions.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

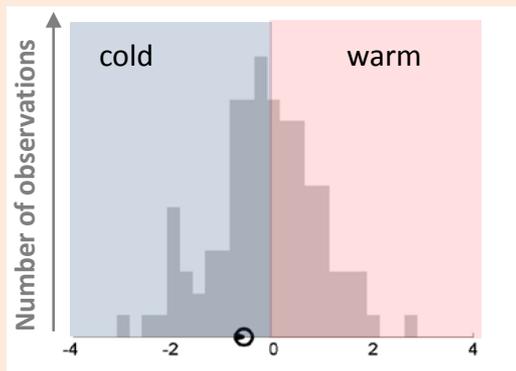


Coastal conditions

Pacific Decadal Oscillation

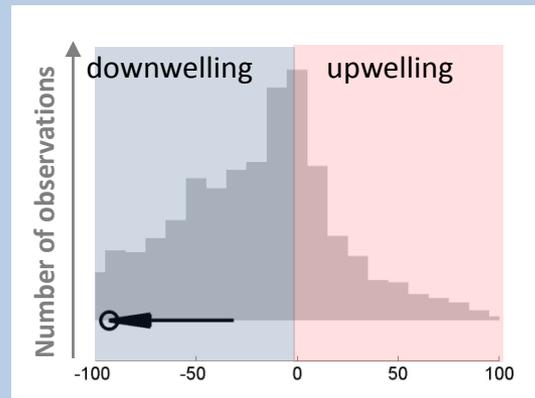
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

November PDO Index scores are typically slightly negative. In November PDO index scores were expected.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

Typically November data have downwelling-favorable conditions. Downwelling in November intensified.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



Weather

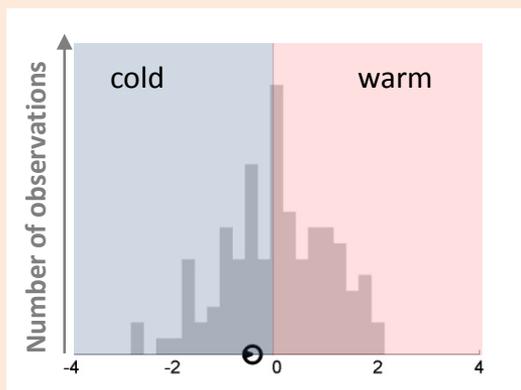


Coastal conditions

Pacific Decadal Oscillation

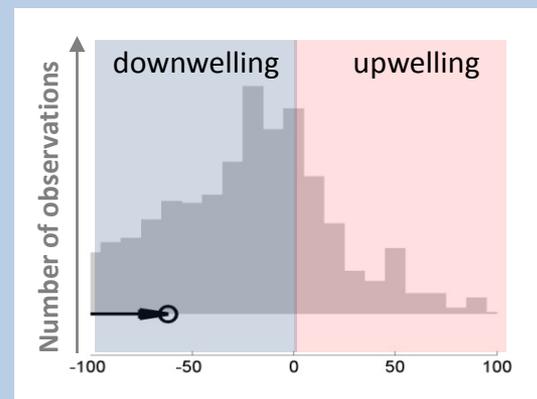
Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature and Sea Level Pressure and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The arrow shows a trend from the prior month.

December PDO Index scores generally are PDO neutral in December. This December PDO data still fell slightly below expected values.



Histogram of PDO Index scores

Upwelling Index



Histogram of Upwelling Index scores

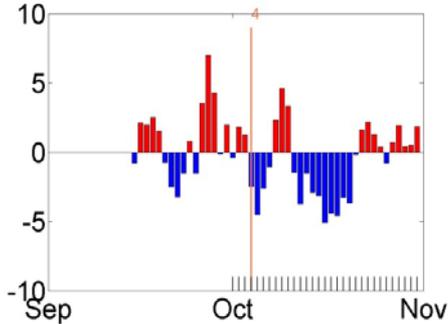
Typically December data have downwelling-favorable conditions. Stronger downwelling in October is weakening and moving towards expected values for December.

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling, and negative for downwelling conditions. The histogram shows all values of the current month in the historical record since 1967. The arrow shows a trend from the prior month.



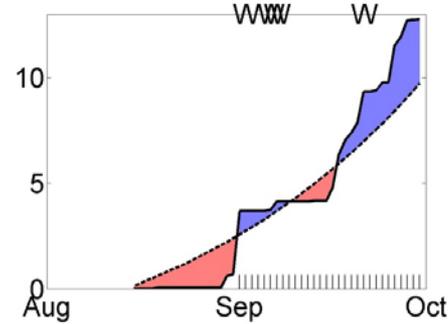
● Weather ○ Coastal conditions

Anomalies in Air Temperature



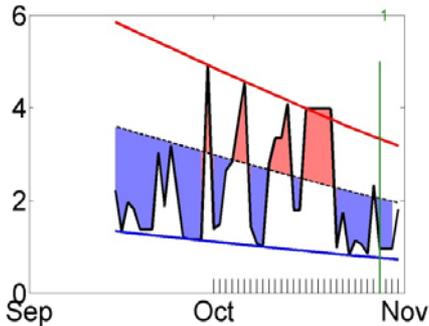
Departure of daily mean temperature from 30+ year climatology; red for warmer than normal, blue for cooler than normal.

Anomalies in Cumulative Precipitation



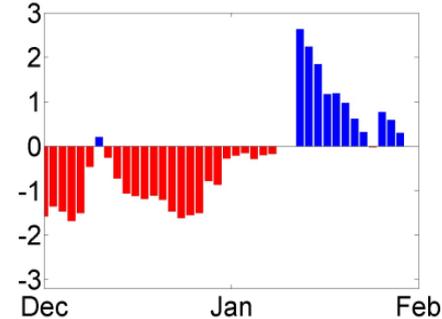
Anomalies (red=less blue=more) in cumulative daily precipitation compared against a seasonally expected precipitation curve (dotted black).

Anomalies in Solar Energy



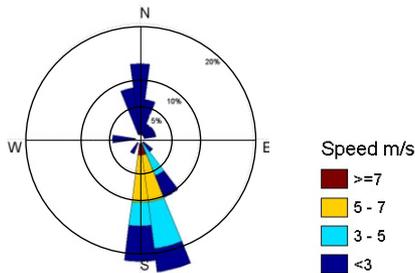
Solar energy anomalies (red=positive, blue negative) in relation to expected seasonal values (black). A seasonal envelope is given as colored lines.

Anomalies in River Flow



Anomalies in daily mean river flow. Lower-than-normal river flows are plotted in red, and higher-than-normal flows are plotted in blue.

Wind Compass Rose



The radius of the circles (black) shows the percentage of observations in a given month. The radius of each sector is proportional to the frequency of the wind blowing from a particular direction. The largest sector indicated the predominant wind direction of the last month.

Superimposed on each sector is the relative intensities of the wind coming from a particular direction. Warmer colors indicate stronger winds, cooler colors indicate weaker winds. Strong winds tend to occur less frequently than weaker winds. This can be used in the geometry of the sectors. The area of each sector becomes smaller towards the tip (center of graphic), the frequency is scaled to the area of the sector. Less frequent but strong winds are therefore plotted at the tip of each sector.

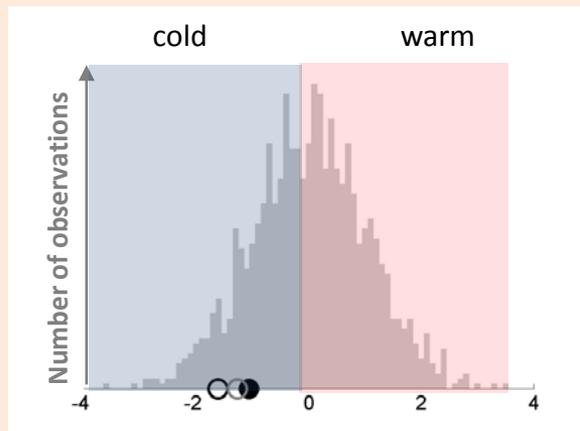


Weather



Coastal conditions

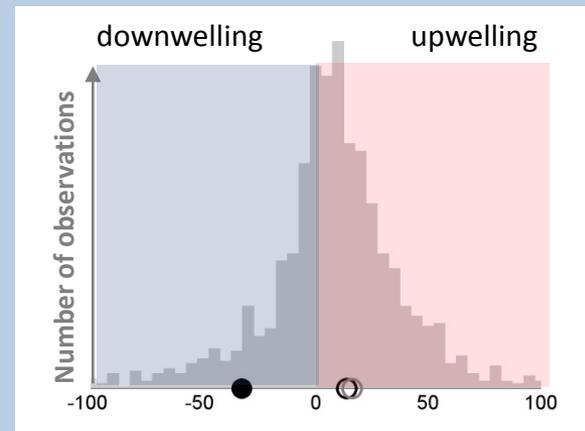
Pacific Decadal Oscillation



Histogram of PDO Index scores

Pacific Decadal Oscillation (PDO) indices are derived from observed Pacific Sea Surface Temperature (SST) and Sea Level Pressure (SLP) and are dimensionless; they are available monthly back to 1900. Unlike El Niño indices, a positive value indicates a warm-phase. The solid dot shows the current month, the hollow black dot shows the previous month, and the hollow gray dot is from two months ago.

Upwelling Index



Histogram of Upwelling Index scores

The NOAA Pacific Fisheries Environmental Laboratory Upwelling Index (PFEL) is positive for upwelling of deeper ocean water, which is caused by northerly winds in the PNW, and negative for downwelling conditions. The histogram shows all values in the historical record since 1967 for the current month. The solid dot shows the current month, the hollow black dot shows the previous month, and the hollow gray dot is from two months ago.

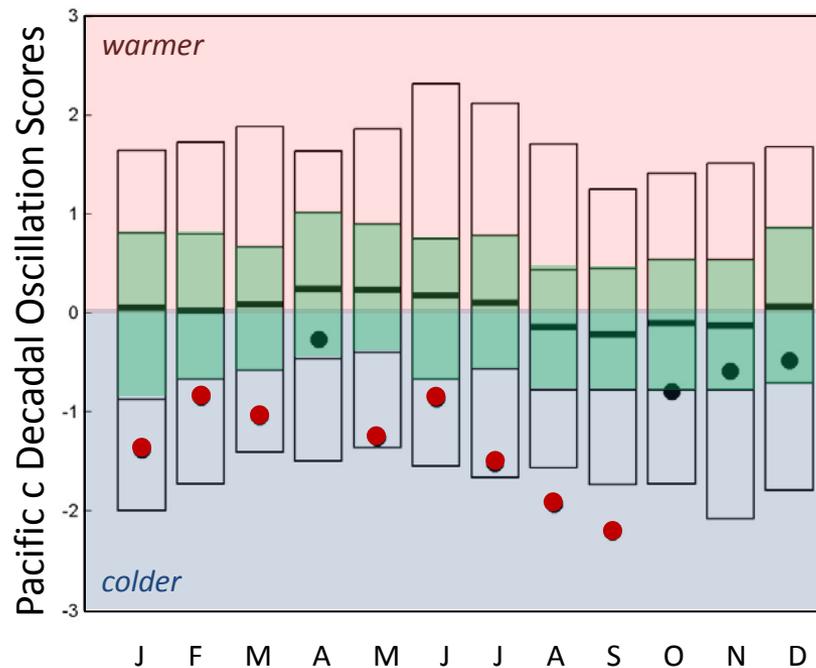


Weather



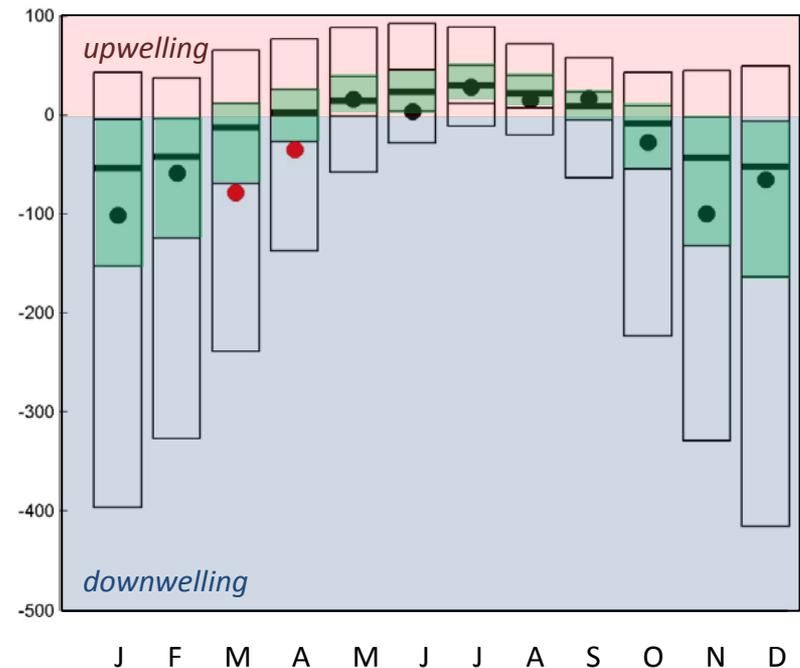
Coastal conditions

Monthly Pacific Decadal Oscillation and Anomalies



Sea surface temperatures were lower than expected for 2012 falling below median expected values for all months. Significantly lower temperature falling below the IQR of historic observations were observed in eight of the first nine months of the year

Monthly Upwelling Index and Anomalies



Upwelling generally fell below expected median historic values but well within expected historic ranges. Exceptionally strong downwelling occurred in March and April



● Weather ○ Coastal conditions

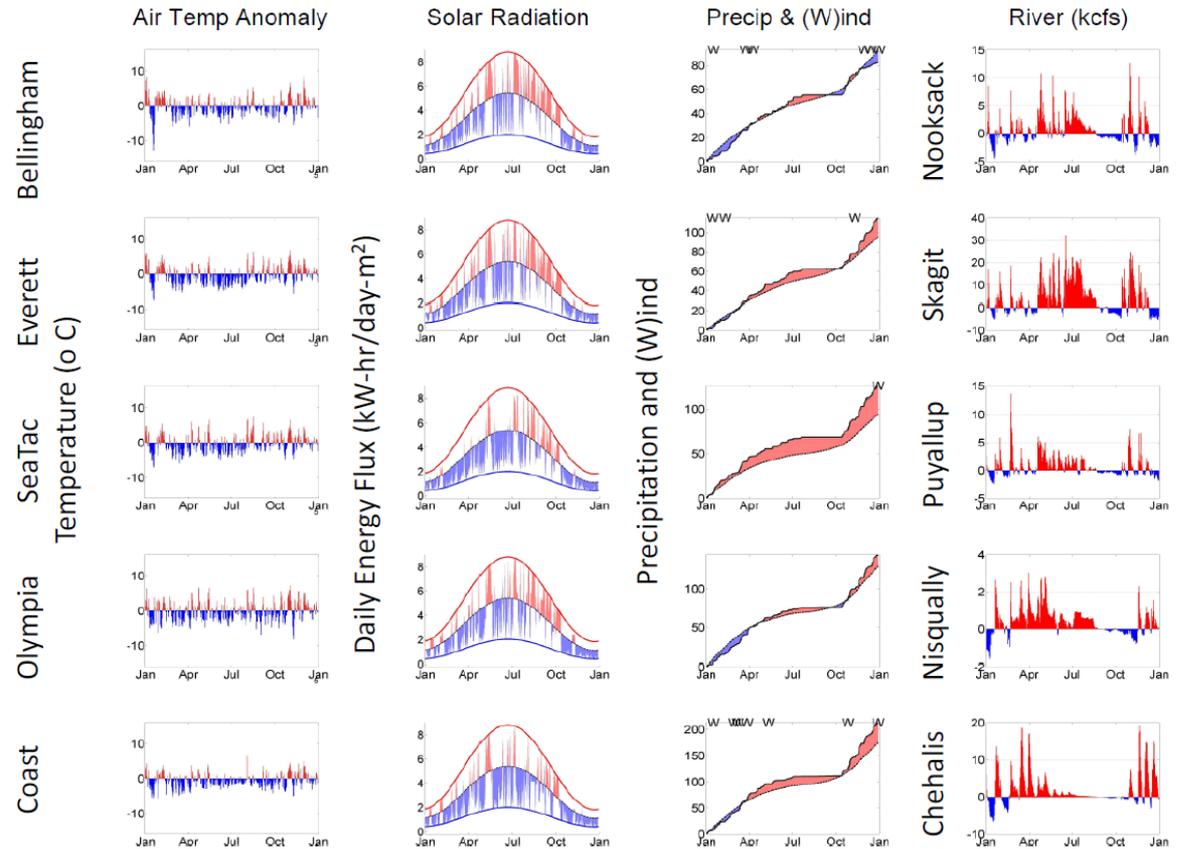
Meteorological conditions typically explain up to half of the variance in observed marine variables (Moore et al. 2008), particularly in shallower waters like those of South Puget Sound. The specific conditions prevalent during the past two weeks, from north to south, are shown below.

Summary:

Air temperatures were generally below normal with the exception of late-July to early October when sunlight was also quite strong.

Rivers were generally running above normal except during the mid-summer dry spell.

Wind was mostly downwelling favorable from the south. Upwelling-favorable wind from the north persisted from May into mid-October.



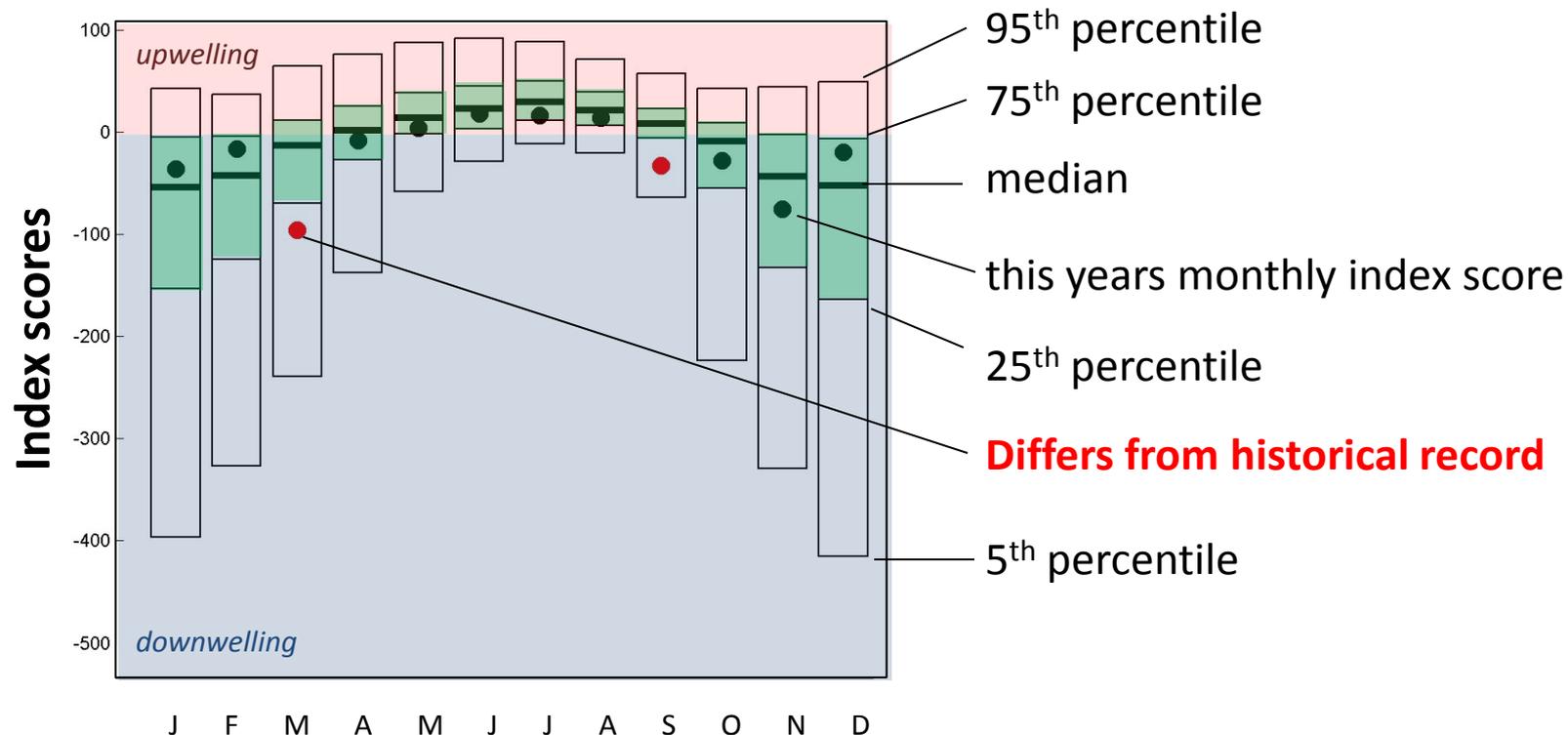


Weather



Coastal conditions

Monthly Index Scores and Anomalies



Comment: Monthly values of the coastal upwelling index at 48°N and 125°W (filled circles). Median historical values are depicted by the solid black lines the green area represents the interquartile range of observations for each month. The larger box surrounding the median and interquartile range represents the 5th (lower) and 95th (upper) percentiles.