CLIMATE NARRATIVE, February 2020 and as noted

UNITED STATES WEST COAST AND NORTH PACIFIC

During late February 2020, US west coast (20-150 km offshore) satellite **derived sea surface temperatures** (SST_F) showed positive SST_F anomaly (≤ 2°C) from northern Mexico northwestward to Point Conception (34.4°N), where SST_F was 15°-18°C. Increasing negative SST_F anomaly (≥ -2.0°C) in areas off northern California extended northwest into the Gulf of Alaska, then westward along the Aleutian Island chain to the Kamchatka Peninsula (150°E). An area of negative SST_F anomaly extended westward off Mexico and California to 140°W at 20°-30°N. Positive SST_F anomaly (≤2.5°C) variable between 25°-50°N was found across millions of km^2 of the North Pacific from 140°N to the coasts of Japan and China (120°E). A second zonal band of positive anomaly occurred between 5°S-20°N from 150°W to Indonesia and the Philippines (110°E). https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html (current)
https://coastwatch.pfeg.noaa.gov https://climatereanalyzer.org/wx/DailySummary/#sstanom (current)
https://www.ospo.noaa.gov/Products/ocean/sst/contour/index.html

Sea Level Height Anomaly (SLA) analyses of the Pacific Ocean from 30°S to 40°N, show north Pacific SLA contours similar to those from the SST_F analyses. Positive SLA anomaly (≤25 cm) north of 30°N extended from 140°W to the coast of Japan (140°E). Positive anomaly (≤15 cm) occurred off Central America south of 10°N and from 120°W to 160°E across the Equatorial Pacific (EP). Areas of negative SLA anomaly (≥ 18 cm) between 7° and 22°N reached across the Pacific from 90°W to Indonesia. This zonal area of negative SLA was continuous with areas extending north beyond 40°N along the eastern Pacific margin. Eastern Pacific, negative SLA anomaly (≥ -18 cm) occurred along the coast from northern Mexico northward beyond 40°N. During 8-10 February the west coast of the of the US experienced some of the largest tidal ranges expected in 2020.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif
https://wsg.washington.edu/community-outreach/hazard-resilience-and-climate-adaptation/king-tides/calendar/

February satellite imagery of the US west coast showed that between the Santa Barbara Channel (34°N) and Vancouver Island (50°N) surface **chlorophyll-a** (chl-a) of 0.1- 0.4 mg/m^3 marked filaments and eddies reaching 200-700 km offshore. Inshore (200-400 km), concentrations as high as 1.5 mg/m^3 were observed and concentrations 2-4 mg/m^3 marked local coastal processes from the shore out to 50-100 km. Offshore water (≤ 0.2 mg/m^3) entered the Southern California Bight from the south and southwest. Derived surface layer chl-a concentrations may vary depending on satellite sensors and compositing techniques.
https://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowserWW180.jsp#
https://coastwatch.pfeg.noaa.gov/erddap/griddap/erdVHNchla8day.graph?chla[(2020-02-28T00:00:00Z)][(0.0)][(83.65125):(-0.10875)][(-193.76625):(-110.00625)]&.draw=surface&.vars=longitude%7Clatitude%7Cchla&.colorBar=%7C%7C%7C%7C%7C&.bgColor=0xffccccff
https://www.star.nesdis.noaa.gov/sod/mecb/color/ (current)

Monthly sea temperature list from shore stations and **near-shore buoys,**

The list gives shore and nearshore water temperature measurement locations in decreasing latitude. Each line begins with a shore station or buoy abbreviation followed by latitude. Temperature values are in brackets with the average of available monthly values first (followed by the range) in parens and change from previous monthly mean.

Averages for the (first, second and third) third of the month (tercile), are within the second parens, followed by the multiyear monthly average, where available. Subscripts H and L indicate the tercile that contains the Highest and Lowest monthly temperatures. Predictably, average monthly temperature generally decreased in February, however at northern stations including the San Francisco Buoy (SFrn) the highest temperature occurs in the first monthly tercile. To the south, the highest monthly temperature does not occur in the first tercile.

List for February 2020

Amphitrite Point, B.C. 48.9°N

Neah,48.5°N,124.7°W [8.4 (7.3-10.0)-0.5(8.9$_{LH}$, 8.3, 8.2)7.9°C]

Cape Flattery 48.4°N

NeBy,48.4°N *[8.3(7.4-9.4)0.0(8.8$_H$,8.1$_L$,7.9)°C]*

CpEz,47.4°N,124.7°W [9.1(8.0-10.2)-0.7(9.8$_H$,9.1$_L$,8.5$_L$)8.6°C]

TlMk,46°N,125.8°W [9.2(9.0-9.8)-0.6(9.3,9.1$_L$,9.3 $_H$)10.1°C]

Cape Blanco 42.8°N

PrtO,42.7°N *[9.2(7.9-11.4)-1.4(10.6 $_H$,8.4 $_L$,8.6)°C]*

CCty,41.7°N *[9.9(8.8-11.4)-0.5(10.7$_H$,9.3$_L$,9.7)°C]*

EelR,40.7°N,124.5°W [10.0(8.8-11.5)-0.4(10.9 $_H$, 9.5$_L$,9.6)11.2°C]

Point Arena 39°N

ArCv,38.9°N *[10.1(9.1-11.7)-1.3(10.2$_{LH}$,10.0,10.2)°C]*

Point Reyes 38°N

SFrn,37.8°N,122.8°W [11.6(11.1-12.7)-0.7(11.7$_{LH}$,11.4$_L$,11.6)11.8°C]

Mtry,36.6°N *[13.2(12.6-14.6)-0.1(13.3 $_L$,13.1$_L$,13.4$_H$)°C]*

PrtS,35.1°N *[13.5(12.4-14.9)0.1(13.0$_L$,13.2$_L$,14.3$_H$)°C)]*

PtCn,34.5°N,120.8°W [14.2(12.6,17.1)-0.2(13.6 $_L$,14.4,14.6$_H$)°C]

Point Conception,34.4°N

SBCh,34.3°N,119.9°W [15.0(13.9-16.4)0.1(14.9$_L$,14.9,15.2 $_H$)13.7°C]

Smca,34°N *[15.5(13.3-17.1)0.2(14.6$_L$,15.5$_L$,16.3 $_H$)°C]*

Tory,32.9°N,177.4°W [14.5(13.7-16.2)-0.2(14.3$_L$,14.3$_H$,14.7)°C]

LaJo,32.9°N *[15.4 (14.0-16.5)-0.6(15.4$_L$,15.3$_H$,15.7)°C]*

Point Loma, 32.7°N

Shore measurements (italics), taken at fixed depths below the lowest tide at NOAA **tide stations**, are indicated by: *NeBy* (9443090), *PrtO* (9431647), *CCty* (9419750), *ArCv* (9416841), *Mtry* (9413450), *PrtS* (9412110), *Smca* (9410840), *LaJo* (9410320) in. (Numbers) lead to detailed location and station descriptions, https://tidesandcurrents.noaa.gov/stations.html?type=Physical%20Oceanography. Nearshore buoy measurement details are obtained from number designations: Neah (46087), CpEz (46041),TlMk (46089),EelR (46022), SFrn (46026), PtCn (46218), SBCh (46053), Try (46225). https://www.ndbc.noaa.gov/station_page.php?station=46087

EQUATORIAL AND SOUTH PACIFIC (late February and as noted)

Surface and subsurface temperatures suggest trend toward mild El Niño conditions, but the majority of coupled models suggest that the current El Niño-neutral state is likely to persist through the next 3-6 months. Positive SST_F anomaly (≤2°C) extended, with local interruption at 120°W, across the Equatorial Pacific (EP) during late February. Eastern EP upper 300 m heat content anomaly persisted positive through February. Positive subsurface temperature anomalies (≤2.5°C) increased in the EP above 150 m depth between 110°W and 170°E and negative subsurface anomalies (≥-2°C) increased in the eastern and western EP. Where north Pacific SST_F descriptions indicate zonal continuity, north of 50°S the south Pacific has a degree of meridional continuity with average to negative SST_F anomaly more common east of 140°W and large areas of positive anomaly in the west. South of 50°S areas of negative SST_F anomaly developed intermittently from 120°W to 90°E in the central Indian Ocean.
http://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf
https://www.ospo.noaa.gov/Products/index.html
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/

South Pacific **sea level height anomaly** (SLA) patterns were similar to those of January. Negative SLA (≤-15cm) occurred along the eastern Pacific boundary from 30° to 3°S. This area extended west to 120°W at 12°S. At the western boundary, negative SLA occurred from Australia to the East Asian marginal Seas (20°S-40°N) and was continuous with areas southeastward and across the south Pacific at 10°-20°S. Positive SLA (≤10 cm) was typical of the EP at the date line and south to 16°S. SLA was positive (≤10 cm) east of Australian coastal waters.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/

The NOAA **Oceanic El Niño Index** (ONI) (3-month running mean of SST anomalies in the Nino 3.4 region) increased to 0.5 for October-November-December (OND), 0.5 for NDJ and 0.5 for DJF giving three consecutive El Niño-like values.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf
https://climatedataguide.ucar.edu/climate-data/multivariate-enso-index (alternate El Niño index)

The January NOAA/NCEI **Pacific Decadal Oscillation Index** (PDO), calculated from ERSST.v4 was -1.40 January, then -1.35 in February. Each of these values have greater magnitude than any calculated in 2019. https://www.ncdc.noaa.gov/teleconnections/pdo/ ,

The **Pacific / North American Teleconnection Index** (PNA), computed from atmospheric pressure over the Pacific Ocean and North America had near neutral daily PNA during February. https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml (computational alternatives).

February monthly ERD/SWFSC coastal **Upwelling Indices** (UI) indicated downwelling conditions from 45°-60°N and upwelling favorable conditions at 39°N to 24°N. Strongly positive UI anomalies occurred at 36°- 42°N, indicating stronger than seasonal upwelling conditions (coastal winds from the northwest). UI computed daily for 39°N shows that many values indicate conditions strongly favorable to coastal upwelling.
https://upwell.pfeg.noaa.gov/products/PFELData/upwell/monthly/table.2002
https://oceanwatch.pfeg.noaa.gov/products/PFELData/upwell/daily/p09dayac.all (39°N)
https://oceanwatch.pfeg.noaa.gov/products/PFELData/upwell/daily/p10dayac.all (36°N)
https://oceanview.pfeg.noaa.gov/products/upwelling/dnld (current to yesterday)

PRECIPITATION and RUNOFF (late February and as noted)

Southern Oregon and northern and central California had rain in February, but rain (water)-year totals remained between 35 and 70% of normal. Little precipitation occurred in southern California. Seasonal precipitation deficits remain throughout central Washington, but coastal Washington and Puget Sound received early February rains to equal the third wettest winter, for date, on record. However, the remainder of February was not particularly rainy on the Washington coast.

West Coast River near-ocean discharge

Fraser River discharge, measured in late February at Hope (130 km upriver from Vancouver, B.C.) was 930 m^3/s (32,840 cubic feet /sec or cfs), down from 1,280 m^3/s in early February. Late February multi-year median for Hope is 825 m^3/s.
https://wateroffice.ec.gc.ca

Washington Rivers,

The **Puyallup** at Puyallup was flowing at 2,620 cfs [2,710 -historical median as cfs in brackets]. **Skagit** flow was 13,900 [13,400 cfs] near Mount Vernon. **Stillaguamish** discharge was 1,130 [1,710 cfs] at Arlington. The **Columbia** transport was 170,000 [164,000 cfs] at Vancouver.

Oregon Rivers

The **Columbia** at the Dalles, OR was 167,000 [131,000 cfs], The **Wilson** at Tillamook, was flowing at 663 [1,380 cfs]**.** At Elkton, **Umpqua** transport was 4,370 [10,200 cfs]. **Rogue** River flow was 1,640 [3,670 cfs] at Grants Pass and 2,540 [6,040 cfs] at Agness.

California Rivers

The **Klamath** near Klamath was transporting 7,500 [23,800 cfs]. **Smith** discharge was 1,320 [4,380 cfs] near Crescent City. The **Eel** at Scotia had 1,220 [9,660 cfs] transport. At the **Battle Creek,** Coleman National Fish Hatchery the flow was 292 [538 cfs]. **Butte Creek** at Chico had 182 [475 cfs] transport. **Sacramento** River transport was 10,700 [26,800 cfs] at Verona and 15,000 [32,100 cfs] at Freeport. **San Joaquin** flow was 2,780 [3,620 cfs] at Vernalis. **Pescadero Creek** transport was 6.5 [42 cfs] near Pescadero. **San Lorenzo** River discharge was 31.8 [203 cfs] at Santa Cruz. The **Pajaro** at Chittenden was flowing at 40.8 [84 cfs]. The **Salinas** near Spreckels had no measurable flow [94 cfs]. The **Carmel** at Carmel was flowing at 35.8 [128 cfs]. The **Big Sur** River near Big Sur, CA discharged at 43.8 [120 cfs] at the end of February.
https://waterdata.usgs.gov/ca/nwis/current/?type=flow
https://www.cnrfc.noaa.gov/awipsProducts/RNOWRKCLI.php= (current)

https://wateroffice.ec.gc.ca/search/real_time_results_e.html
https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml
https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5

Notes

On February 28 the Oregon Department of Agriculture and the Oregon Department of Fish and Wildlife opened **recreational and commercial razor clam** harvesting on the Oregon coast between the Columbia River and the north jetty of the Siuslaw River at Florence (44°N). Recent samples taken from the area indicate the marine biotoxin domoic acid has dropped below the closure limit. Recreational and commercial razor clamming remains closed due to unsafe domoic acid concentrations in razor clams from the south jetty of the Siuslaw River to the California border. The recreational harvest of razor clams remains closed from the California border through Del Norte and Humboldt counties because these razor clams have had domoic acid concentration exceeding human health alert levels for more than a year.
https://myodfw.com/crabbing-clamming
https://www.wildlife.ca.gov/fishing/ocean/health-advisories
https://www.cdph.ca.gov/Programs/CEH/DRSEM/CDPH%20Document%20Library/EMB/Shellfish/RazorClams_DA_Table110819.pdf

Researchers at the Santa Barbara Campus of the University of California continue studies on the ocean ecosystem effects of the millions of tons and ash and smoke settling offshore from **California wildfires.** In an American Geophysical Union Conference paper, Tanika Ladd and others presented studies meant to show possible ecosystem effects of ash that settled in Santa Barbara County during the Thomas fire that burned over 280,000 acres of forest and destroyed more than 1000 structures during December and January 2017-2018. Depending on atmospheric conditions, there was intermittent input of smoke and ash onto the surface of the Santa Barbara Channel and farther than 1000 km offshore. Through seasonal incubation experiments, natural phytoplankton communities were exposed to Thomas Fire ash leachate to investigate how primary producers might be affected. Preliminary results suggest ash increased productivity of natural ocean communities from the Santa Barbara Channel when nutrient concentrations were seasonally low. Forest fires have occurred in California for many thousands of years before the raise of the current industrial society. Ash and smoke from burning vegetation might be considered natural to the ecosystem, however incinerated industrial products are relatively recent environmental additions.
https://agu.confex.com/agu/osm20/meetingapp.cgi/Paper/636175
https://labs.eemb.ucsb.edu/iglesias-rodriguez/debora/members/ladd
https://eos.org/articles/could-wildfire-ash-feed-the-oceans-tiniest-life-forms

The **intent of this narrative** is to give, first some climate information about the North Pacific Ocean adjacent to the west coast of the United States, second to place this information in the context of the entire Pacific Ocean, third to give references for some of the many Internet sources of accurate environmental information and fourth to place singular and seasonal environmental events into these contexts. Contact Jerrold.G.Norton@noaa.gov , Phone:831-648-9031 with suggestions for achieving these goals. Past Narratives may be found, https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html