Physical indicators of winter climate variability (coastal upwelling, sea level, precipitation) influenced by the winter North Pacific High (CalBenJI project)

Website: https://www.bco-dmo.org/dataset/686578
Data Type: Other Field Results
Version: 1
Version Date: 2017-03-28

Project
» Climate Change and Upwelling -- Comparative Analysis of Current and Future Responses of the California and Benguela Ecosystems (CalBenJI)

Contributors	Affiliation	Role
Black, Bryan	University of Texas - Marine Science Institute (UTMSI)	Principal Investigator
Bograd, Steven	National Oceanic and Atmospheric Administration - Southwest Fisheries Science Center (NOAA SWFSC ERD)	Co-Principal Investigator
Garcia Reyes, Marisol	Farallon Institute for Advanced Ecosystem Research	Co-Principal Investigator
Sydeman, William	Farallon Institute for Advanced Ecosystem Research	Co-Principal Investigator, Contact
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Physical indicators of winter climate variability (coastal upwelling, sea level, precipitation) influenced by the winter North Pacific High.

Table of Contents

Coverage

Temporal Extent: 1895 - 2015

Dataset Description

Physical indicators of winter climate variability (coastal upwelling, sea level, precipitation) influenced by the winter North Pacific High. The data are all anomalies (normalized to a mean of 0 and std dev of 1) and thus have no units.

Data include:
North Pacific High: Mean Jan-Mar Hadley Centre HadSLP2 sea level pressure anomaly for the region 25N and 35N by 145W and 125W. Data were acquired through: http://www.metoffice.gov.uk/hadobs/hadslp2/

River Discharge: Water year discharge (Oct 1-Sep 30) anomaly for seven rivers, and the mean of these anomalies. Data acquired from the United States Geological Survey https://waterdata.usgs.gov/nwis/rt

Sea Level: Winter (Jan-Mar) anomaly of sea level at five locations along the west coast of North America as well as their mean. All linear trends have been removed. Sea level data were acquired from the University of Hawaii Sea Level Center. http://uhslc.soest.hawaii.edu/

Upwelling: Winter (Jan-Mar) upwelling anomaly for eight upwelling stations (30N, 33N, 36N, 39N, 42N, 45N, 48N, 51N) along the west coast of North America as well as their mean. Upwelling data were acquired from the NOAA Pacific Fisheries Environmental Laboratory. https://www.pfeg.noaa.gov/products/PFEL/modeled/indices/upwelling/NA/upwell_menu_NA.html

Precipitation: Winter (Jan-Mar) precipitation anomaly for thirteen NOAA climate divisions in western North America, as well as their mean. Precipitation data were acquired from the NOAA Climatic Data Center https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp

Methods & Sampling

Time series were screened for a North Pacific High (NPH) correlation at values of $r < -0.4$ for river discharge, $r > 0.4$ for upwelling, $r < -0.5$ for sea level and NOAA divisional precipitation, and $r < -0.6$ for CRU gridded precipitation over the interval 1948-2015. These time series were then analyzed for trends in variance and synchrony, as described in Black *et al.* Rising synchrony in North American Ecosystems (submitted to *Nature Climate Change*).

Data Processing Description

These data are all anomalies in which the time series had been standardized to a mean of zero and standard deviation on one. Linear trends have been removed from sea level data to remove possible geological or anthropogenic sea level rise signals.

BCO-DMO Processing:
- modified parameter names (column headers) to conform with BCO-DMO naming conventions;
- replaced blank spaces/missing data with "nd" ("no data").

[table of contents | back to top]

Data Files

File
physical_indicators.csv (Comma Separated Values (.csv), 48.47 KB) MD5:c3c04edd37f6a5d440fd0ec83c8b4b54 Primary data file for dataset ID 686578

[table of contents | back to top]

Parameters

Parameter	Description	Units
year	Four-digit year	unitless
NPacific_High	North Pacific High: Mean Jan-Mar Hadley Centre HadSLP2 sea level pressure anomaly for the region 25N and 35N by 145W and 125W. Data were acquired through: http://www.metoffice.gov.uk/hadobs/hadslp2/	unitless

RivDis_g11152000	River discharge (Oct 1-Sep 30) anomaly for USGS site 11152000 ARROYO SECO NR SOLEDAD CA (36.28, -121.32)	unitless
RivDis_g10263500	River discharge (Oct 1-Sep 30) anomaly for USGS site 10263500 BIG ROCK C NR VALYERMO CA (34.42, -117.84)	unitless
RivDis_g11058500	River discharge (Oct 1-Sep 30) anomaly for USGS site 11058500 E TWIN C NR ARROWHEAD SPRINGS CA (34.18, -117.27)	unitless
RivDis_g11230500	River discharge (Oct 1-Sep 30) anomaly for USGS site 11230500 BEAR C NR LAKE THOMAS A EDISON CA (37.34, -118.97)	unitless
RivDis_g11264500	River discharge (Oct 1-Sep 30) anomaly for USGS site 11264500 MERCED R A HAPPY ISLES BRIDGE NR YOSEMITE CA (37.73, -119.56)	unitless
RivDis_g11266500	River discharge (Oct 1-Sep 30) anomaly for USGS site 11266500 MERCED R A POHONO BRIDGE NR YOSEMITE CA (37.72, -119.67)	unitless
RivDis_g11383500	River discharge (Oct 1-Sep 30) anomaly for USGS site 11383500 DEER C NR VINA CA (40.01, -121.95)	unitless
RivDis_mean	Mean of river discharge (Oct 1-Sep 30) anomalies for the previous seven rivers	unitless
SeaLev_SF	Winter (Jan-Mar) anomaly of sea level at San Francisco (37.80, -122.47)	unitless
SeaLev_Astoria	Winter (Jan-Mar) anomaly of sea level at Astoria (46.22, -123.77)	unitless
SeaLev_LaJolla	Winter (Jan-Mar) anomaly of sea level at La Jolla (32.87, -117.25)	unitless
SeaLev_LA	Winter (Jan-Mar) anomaly of sea level at Los Angeles (33.72, -118.27)	unitless
SeaLev_SanDiego	Winter (Jan-Mar) anomaly of sea level at San Diego (32.71, -117.17)	unitless
SeaLev_avg	Average winter (Jan-Mar) anomaly of sea level for the five previous locations	unitless
Upwelling_30N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 30 degrees N	unitless
Upwelling_33N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 33 degrees N	unitless
Upwelling_36N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 36 degrees N	unitless

Upwelling_39N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 39 degrees N	unitless
Upwelling_42N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 42 degrees N	unitless
Upwelling_45N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 45 degrees N	unitless
Upwelling_48N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 48 degrees N	unitless
Upwelling_51N	Winter (Jan-Mar) upwelling anomaly for the upwelling station at 51 degrees N	unitless
Upwelling_mean	Mean winter (Jan-Mar) upwelling anomaly for the eight upwelling stations	unitless
Precip_CAwinter7	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division California 7	unitless
Precip_CAwinter6	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division California 6	unitless
Precip_CAwinter4	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division California 4	unitless
Precip_AZwinter6	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division Arizona 6	unitless
Precip_CAwinter2	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division California 2	unitless
Precip_UTwinter2	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division Utah 2	unitless
Precip_CAwinter5	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division California 5	unitless
Precip_AZwinter7	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division Arizona 7	unitless
Precip_AZwinter1	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division Arizona 1	unitless
Precip_AZwinter5	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division Arizona 5	unitless
Precip_AZwinter3	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division Arizona 3	unitless
Precip_AZwinter4	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division Arizona 4	unitless
Precip_CAwinter3	Winter (Jan-Mar) precipitation anomaly for the NOAA climate division California 3	unitless

Precip_avg	Average winter (Jan-Mar) precipitation anomaly for the thirteen NOAA climate divisions	unitless

[table of contents | back to top]

Project Information

Climate Change and Upwelling -- Comparative Analysis of Current and Future Responses of the California and Benguela Ecosystems (CalBenJI)

Coverage: California Current Ecosystem and Benguela Current Ecosystem

Desciption from NSF award abstract:
Along the west coasts of North and South America, Africa, and Iberia, alongshore equatorward winds bring nutrient-rich waters to the sunlit surface of the ocean, stimulating phytoplankton blooms that support robust, rich and diverse ecosystems. This process is known as "upwelling". Because upwelling is driven by winds, and winds are related to atmospheric conditions, upwelling is highly vulnerable to the effects of climate change. However, the potential impacts of climate change on upwelling and biology remain largely uncertain. In earlier work in the California Current upwelling system, off the west coast of the United States, researchers found that upwelling occurs in distinct winter and summer "modes" that have different impacts on biology. In this project, oceanographic and atmospheric data from the Benguela Current system, off South Africa and Namibia, will be analyzed for similar seasonal patterns and relationships with the ecosystem. Comparisons between these two upwelling systems will allow researchers to investigate if previous findings of regional climate impacts on biology are applicable at a global scale and consider how these systems may change in the future. The project will facilitate collaboration between researchers from South Africa, Namibia, and the United States, integrating a team of young and senior scientists from the three countries and providing them with opportunities for broad-scale scientific synthesis early in their careers.

This project will be a comparative analyses of climate forcing and biological responses in the California Current (CCS) and Benguela Current systems (BCS), the two upwelling systems with the most similar time series of atmospheric and oceanographic conditions, seabird demography, and lower (chlorophyll) and mid (forage fish) trophic data. The project will determine whether changes in the ecosystems can be attributed to regional or global climate processes. Growth-increment chronologies from fish in the BCS (deep-water hake) will be developed as indicators of upper-trophic fish growth, and compared to rockfish growth chronologies developed in the CCS. Mid-trophic level fish abundance will be modeled as indices of prey availability for integration between climate and upper-trophic-level parameters. Oceanographic and atmospheric data will be analyzed from global observational and reanalysis data sets, as well as from earth system model projections of climate change. The project will address the following questions:
1) are seasonal upwelling modes (winter and summer) discernible in the BCS as they are in the CCS?
2) are upwelling modes forced by similar or contrasting atmospheric forcing mechanisms?
3) is there evidence of coherence/covariance among mid-trophic fish, upper-trophic fish, and seabirds (and at which lags) within and between the CCS and BCS?
4) will the positioning and amplitude of the atmospheric pressure systems that result in upwelling-favorable winds change coherently between ecosystems under various climate-change scenarios? and
5) what are the fisheries and wildlife management implications for variability in the seasonality and spatial distribution of upwelling in a changing climate?

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1434732

[table of contents | back to top]