Monthly Regional Cumulative Upwelling Index (Ekman transport) for California and Benguela Ecosystems from 1979-2014

Website: https://www.bco-dmo.org/dataset/674979
Data Type: Other Field Results
Version: 1
Version Date: 2017-01-17

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 at Austin (UT Austin)	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, Contact
Sydeman, William	Farallon Institute for Advanced Ecosystem Research	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Monthly Regional Cumulative Upwelling Index (Ekman transport) for California and Benguela Ecosystems from 1979-2014/

Table of Contents

Coverage

Temporal Extent: 1979-01 - 2014-12

Dataset Description

Monthly Cumulative Ekman Transport for three regions in the Benguela and California Current Ecosystems from 1979-2014.

Methods & Sampling

Monthly Cumulative Ekman Transport (reported in units of m3/s/100m) was determined for three regions in the Benguela and California Current Ecosystems.

Regions defined as (all along-shore):
Northern California: 40-45 N
Central California: 35-40 N
Southern California: 30-35 N
Northern Benguela: 15-30 S
Southern Benguela: 30-35 S
Agulhas Bank: 32-35 S, 20-30 E

Daily averaged NCEP-DOE Reanalysis 2 wind vectors with spatial resolution of 2.5x2.5 degrees were used to calculate these upwelling indices. These wind data were available from 1979 to 2014.

Data Processing Description

Data processing:
Alongshore components of wind were calculated (rotated wind vectors) for each 2.5x2.5 coastal grid cell, and transformed to wind stress. For each grid cell, daily offshore Ekman transport was calculated in m3/s/100m. Monthly cumulative upwelling index was calculated by summing all adding positive offshore transport during a month and then averaging within each region.

wind stress = $\boldsymbol{\tau} = \boldsymbol{\rho}_a * C_d * |v| * v$
$\boldsymbol{\rho}_a$ is the density of air,
C_d is the drag coefficient, following Large and Point (1981, J. Phys. Oceanogr.), and Trenberth et al. (1990; J. Phys Ocenogr.)
v is alongshore wind component (m/s)

Ekman transport = Upwelling Index = UI = $\boldsymbol{\tau} / f$
f is the Coriolis parameter

BCO-DMO Processing:
- modified parameter names to conform with BCO-DMO naming conventions;
- replaced NaN with nd ("no data").

[table of contents | back to top]

Data Files

File
upwelling.csv(Comma Separated Values (.csv), 19.55 KB) MD5:f36e7636a3ae2d00fe739cfd19c270d6 Primary data file for dataset ID 674979

[table of contents | back to top]

Parameters

Parameter	Description	Units
year	Four-digit year	unitless
month	One- or two-digit month (1-12)	unitless
Northern_CA	Northern California (40-45 N) Ekman transport	cubic meters per second per 100-meters (m3/s/100m)
Central_CA	Central California (35-40 N) Ekman transport	m3/s/100m
Southern_CA	Southern California (30-35 N) Ekman transport	m3/s/100m
Northern_Benguela	Northern Benguela (15-30 S) Ekman transport	m3/s/100m
Southern_Benguela	Southern Benguela (30-35 S) Ekman transport	m3/s/100m
Agulhas_Bank	Agulhas Bank (32-35 S, 20-30 E) Ekman transport	m3/s/100m

[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]