Upper 50m alkalinity, TCO2, nutrient data in a global model from 2011-2013 (Climatological Mean Distribution of pH project)

Website: https://www.bco-dmo.org/dataset/3963
Version:
Version Date: 2013-06-10

Project
» Climatological Mean Distribution of pH in Surface Waters in the Unified pH Scale and Mean Rate of changes in Selected Areas (Climatological Mean Distribution of pH)

Program
» Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

This dataset was assembled for the purpose of testing the mutual consistency of the TA-TCO2-pCO2 observations in surface ocean water using an inorganic carbon chemistry model.

The potential alkalinity-salinity relationships in 33 oceanic regions were obtained using this datasat. These relationships were used to map the distribution of the total alkalinity (= potential alkalinity - nitrate concentration) over the global oceans.

Associated dataset: LDEO surface gridded carbon parameters.

Maps of global estimated pH

Methods & Sampling

Carbon-nutrient database assembled from the GLODAP, CARINA and LDEO data sets for surface ocean.

[table of contents | back to top]

Data Files

File
pH_obs_bydate.csv (Comma Separated Values (.csv), 1.54 MB) MD5:fc7dcd5eff2a4aa6e924ecdf2fc62c39 Primary data file for dataset ID 3963

[table of contents | back to top]

Parameters

Parameter	Description	Units
lat	Latitude; North is positive	decimal degrees
lon	Longitude; East is positive	decimal degrees
day	Day of the month	unitless
month	Month of the year (Jan = 1 Feb = 2 etc.)	unitless
year	Calendar year	unitless
press	Pressure	decibars
temp	Temperature	degrees Celsius
sal	Salinity (Practical Salinity Scale)	unitless
O2_umol_kg	dissolved Oxygen	micromoles per kilogram seawater
NO3	Nitrate	micromoles per kilogram seawater
NO2	Nitrite	micromoles per kilogram seawater
SiO3	Silicate	micromoles per kilogram seawater
PO4	Phosphate	micromoles per kilogram seawater
Freon_11	Freon 11	picomoles per kilogram seawater
Freon_12	Freon 12	picomoles per kilogram seawater

TCO2_kg	Observed Total CO2	micromoles per kilogram seawater
TALK	Observed Total Alkalinity	microequivalents per kilogram seawater
PCO2	Observed Partial Pressure of CO2 at temp_PCO2 temperature	microatmospheres
temp_PCO2	Temperature at which pCO2 was measured	degrees Celsius
PCO2_sst	Partial Pressure of CO2 at seawater temperature	microatmospheres

[table of contents | back to top]

Deployments

Takahashi_LDEO

Website	https://www.bco-dmo.org/deployment/59042
Platform	LDEO
Start Date	2011-01-01
End Date	2013-12-31

[table of contents | back to top]

Project Information

Climatological Mean Distribution of pH in Surface Waters in the Unified pH Scale and Mean Rate of changes in Selected Areas (Climatological Mean Distribution of pH)

In this project, researchers at the Lamont-Doherty Earth Observatory of Columbia University will obtain the global distribution of surface ocean pH in a single unified scale based on the observations for pCO2, total alkalinity and total CO2 ion concentration (DIC) in surface waters. They will utilize three decades of their own pCO2 and DIC data, which are based on David Keeling's (and successor Pieter Tans at ERL/NOAA) WMO manometric CO2 standard, and the well-calibrated alkalinity data from the WOCE program (Dickson et al., 2003) and the time-series stations including BATS, HOT and ESTOC. These data will allow establishment of a global ocean pH and carbonate concentration baseline anchored firmly to the international CO2 standards common to the atmospheric and oceanic CO2 measurements. The pCO2 and DIC data obtained in different years will be corrected to a reference year 2000, and a climatological distribution of monthly mean pH in the total hydrogen ion scale and carbonate ion concentrations will be computed using the dissociation constants for carbonic and boric acids of Lueker et al. (2000) and Dickson (1990). This will serve as a world ocean baseline distribution for the characterization of future ocean acidification. In some data-rich areas of the North Atlantic, North Pacific and Southern Ocean, the rate of change will be demonstrated.

Because of calibration problems associated with direct pH measurements, an observation-based global ocean pH distribution map is not possible; presently the information is based on ocean GCM studies without land interactions. The research team's ongoing analysis of the alkalinity data shows, however, that its distribution differs from the open oceans in the broad regions of land interactions such as in the Bay of Bengal, Arabian Sea, Gulf of Alaska and Bering Sea. This suggests that the model results are biased by the omission of rivers and land interactions. The results of our proposed investigation will be used for the validation of global biogeochemical ocean models and will help to place the global ocean acidification study on a much firmer base.

Broader Impacts: Baseline information is needed for accurate characterization of global environmental changes. The purpose of this study is to provide a global surface ocean baseline for pH and carbonate ion concentration in waters computed in a uniform pH scale using an extensive pCO2, alkalinity and DIC database obtained for past several decades. This should serve as a reference level, against which the future and past changes may be referenced.

[table of contents | back to top]

Program Information

Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Website: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477

Coverage: global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

Solicitations issued under this program:
NSF 10-530, FY 2010-FY2011
NSF 12-500, FY 2012
NSF 12-600, FY 2013
NSF 13-586, FY 2014
NSF 13-586 was the final solicitation that will be released for this program.

PI Meetings:
1st U.S. Ocean Acidification PI Meeting(March 22-24, 2011, Woods Hole, MA)
2nd U.S. Ocean Acidification PI Meeting(Sept. 18-20, 2013, Washington, DC)
3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA – Tentative)

NSF media releases for the Ocean Acidification Program:

Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification

Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?

Discovery nsf.gov - National Science Foundation (NSF) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation (NSF)

Press Release 12-179 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation (NSF)

Press Release 13-102 World Oceans Month Brings Mixed News for Oysters

Press Release 13-108 nsf.gov - National Science Foundation (NSF) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation (NSF)

Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants

Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation (NSF)

Press Release 14-010 nsf.gov - National Science Foundation (NSF) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation (NSF)

Press Release 14-116 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: NSF awards $11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation (NSF)

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1038891

[table of contents | back to top]