

Surface irradiance measured on the roof of the Monterey Bay Aquarium (36.62 °N, 121.90 °W) from June to October 2018

Website: <https://www.bco-dmo.org/dataset/822517>

Data Type: Other Field Results

Version: 1

Version Date: 2020-08-29

Project

» [Collaborative Research: RUI: Building a mechanistic understanding of water column chemistry alteration by kelp forests: emerging contributions of foundation species](#) (Kelp forest biogeochemistry)

Contributors	Affiliation	Role
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Abstract

Surface irradiance measured on the roof of the Monterey Bay Aquarium (36.62 °N, 121.90 °W) from June to October 2018.

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Coverage

Spatial Extent: Lat:36.62 Lon:-121.9

Temporal Extent: 2018-06-07 - 2018-10-04

Dataset Description

These data are published in Hirsh *et al.*, see related publications section.

Acquisition Description

Surface irradiance measured from June to October 2018. Weather station located on the roof of the Monterey Bay Aquarium (36.62 °N, 121.90°W), approximately 310 m from the kelp mooring site. Eric Kingsley provided weather station data from the Monterey Bay Aquarium

Total solar radiation (surface irradiance) was measured by an Eppley Model Precision Spectral Pyranometer (PSP), at 2-minute intervals.

Processing Description

Raw data, no processing.

BCO-DMO processing notes:

- Converted Timestep to ISO format, and timezone from Pacific Standard Time (PST) to UTC
- Added latitude and longitude of sampling location

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Related Publications

Hirsh, H., Nickols, K., Takeshita, Y., Traiger, S., Monismith, S. G., Mucciarone, D. A., & Dunbar, R. B. Drivers of biogeochemical variability in a central California kelp forest and implications for local amelioration of ocean acidification. *Journal of Geophysical Research: Oceans*.
Results

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Parameters

Parameter	Description	Units
ISO_DateTime.UTC	Sampling date and time in ISO format (yyyy-mm-ddThh:mm:ssZ) in UTC (coordinated Universal Time)	yyyy-MM-dd'T'HH:mm:ss'Z'
Irradiance	Surface irradiance	umol/m2/s
Latitude	Latitude of sampling location, south is negative	decimal degrees
Longitude	Longitude of sampling location, west is negative	decimal degrees

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Instruments

Dataset-specific Instrument Name	Eppley Model Precision Spectral Pyranometer
Generic Instrument Name	Precision Spectral Pyranometer
Dataset-specific Description	Total solar radiation (surface irradiance) was measured by an Eppley Model Precision Spectral Pyranometer (PSP), at 2-minute intervals.
Generic Instrument Description	This radiometer measures sun and sky irradiance in the range of wavelengths 0.285 to 2.8 microns, including most of the solar spectrum. The PSP is intended to weight the energy flux in all wavelengths equally. It is a "hemispheric receiver" intended to approximate the cosine response for oblique rays. The Eppley Precision Spectral Pyranometer (PSP) is primarily used where high accuracy is required or where it is used to calibrate other pyranometers. The PSP outputs a low level voltage ranging from 0 to a maximum of about 12mV depending on sensor calibration and radiation level. An instruction manual provided by Eppley contains the sensor calibration constant and serial number. The Precision Spectral Pyranometer is a World Meteorological Organization First Class Radiometer and comes with a calibration certificate traceable to the World Radiation Reference and a temperature compensation curve. More information is available from Eppley Labs.

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Project Information

Collaborative Research: RUI: Building a mechanistic understanding of water column chemistry alteration by kelp forests: emerging contributions of foundation species (Kelp forest biogeochemistry)

Coverage: Central California 36.6 N 122 W

NSF abstract: Kelp forest ecosystems are of ecological and economic importance globally and provide habitat for a diversity of fish, invertebrates, and other algal species. In addition, they may also modify the chemistry of surrounding waters. Uptake of carbon dioxide (CO₂) by giant kelp, *Macrocystis pyrifera*, may play a role in ameliorating the effects of increasing ocean acidity on nearshore marine communities driven by rising atmospheric CO₂. Predicting the capacity for kelp forests to alter seawater chemistry requires understanding of the oceanographic and biological mechanisms that drive variability in seawater chemistry. The project will identify specific conditions that could lead to decreases in seawater CO₂ by studying 4 sites within the southern Monterey Bay in Central California. An interdisciplinary team will examine variations in ocean chemistry in the context of the oceanographic and ecological characteristics of kelp forest habitats. This project will support an early career researcher, as well as train and support a postdoctoral researcher, PhD student, thesis master's student, and up to six undergraduate students. The PIs will actively recruit students from underrepresented groups to participate in this project through Stanford University's Summer Research in Geosciences and Engineering (SURGE) program and the Society for Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS). In addition, the PIs and students will actively engage with the management community (Monterey Bay National Marine Sanctuary and California Department of Fish and Wildlife) to advance products based on project data that will assist the development of management strategies for kelp forest habitats in a changing ocean. This project builds upon an extensive preliminary data set and will link kelp forest community attributes and hydrodynamic properties to kelp forest biogeochemistry (including the carbon system and dissolved oxygen) to understand mechanistically how giant kelp modifies surrounding waters and affects water chemistry using unique high-resolution measurement capabilities that have provided important insights in

coral reef biogeochemistry. The project sites are characterized by different oceanographic settings and kelp forest characteristics that will allow examination of relationships between kelp forest inhabitants and water column chemistry. Continuous measurements of water column velocity, temperature, dissolved oxygen, pH, and photosynthetically active radiation will be augmented by twice-weekly measurements of dissolved inorganic carbon, total alkalinity, and nutrients as well as periods of high frequency sampling of all carbonate system parameters. Quantifying vertical gradients in carbonate system chemistry within kelp forests will lead to understanding of its dependence on seawater residence time and water column stratification. Additional biological sampling of kelp, benthic communities, and phytoplankton will be used to 1) determine contributions of understory algae and calcifying species to bottom water chemistry, 2) determine contributions of kelp canopy growth and phytoplankton to surface water chemistry and 3) quantify the spatial extent of surface chemistry alteration by kelp forests. The physical, biological, and chemical data collected across multiple forests will allow development of a statistical model for predictions of kelp forest carbonate system chemistry alteration in different locations and under future climate scenarios. Threshold values of oceanographic conditions and kelp forest characteristics that lead to alteration of water column chemistry will be identified for use by managers in mitigation strategies such as targeted protection or restoration.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737096
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737176

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