



PMEL

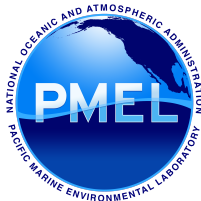
Pacific Marine Environmental Laboratory

Climate Research

Ocean Climate Research Division

Dr. Richard Feely

Senior Scientist





NOAA's Mission

Science, Service, and Stewardship

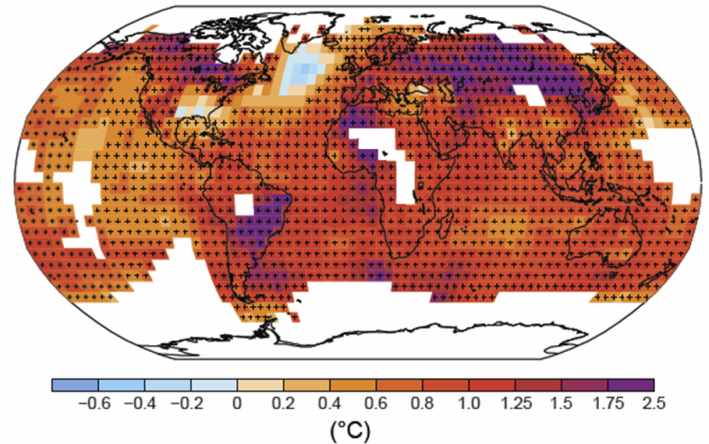
To understand and predict changes in climate, weather, oceans, and coasts, to share that knowledge and information with others, and to conserve and manage coastal and marine ecosystems and resources.

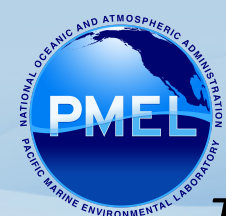
PMEL's mission is central to many of our nation's greatest challenges.

❖ The role of the ocean in climate change.

Estimated cost: \$500 - \$2500B per yr

Observed change in surface temperature 1901–2012





NOAA's Mission

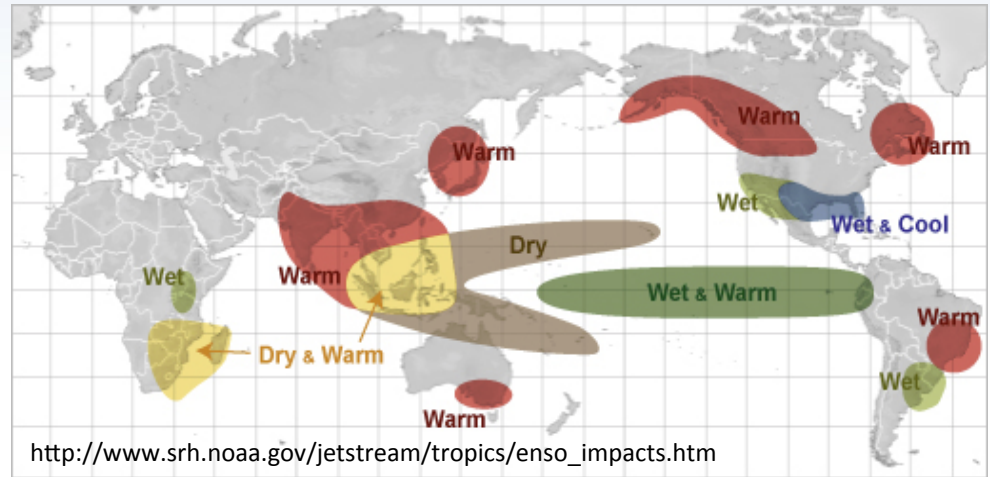
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- ❖ The role of the ocean in climate change.
- ❖ The effects of climate variability on weather and precipitation.

Estimated cost: \$10 - \$36B per event





NOAA's Mission

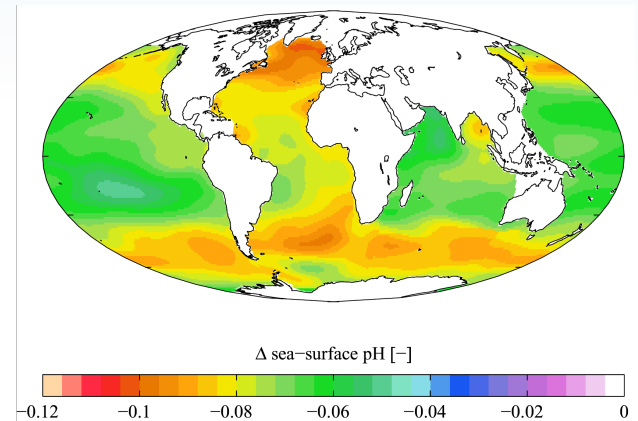
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- ❖ The role of the ocean in climate change.
- ❖ The effects of climate variability on weather and precipitation.
- ❖ The effects of ocean acidification on the chemistry and health of the oceans.

Estimated cost: \$1 – \$14B by 2060 in the US





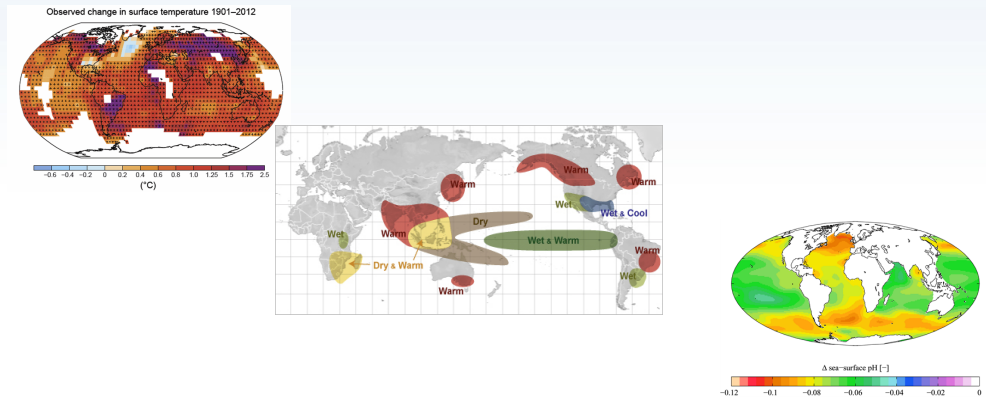
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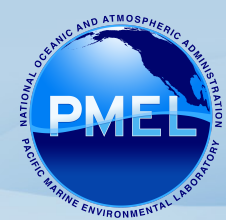
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- ❖ The role of the ocean in climate change.
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“Managing this interdependence requires timely and usable information to make decisions and the science that underpins our knowledge of these systems.”

-NOAA Next Generation Strategic Plan, 2014



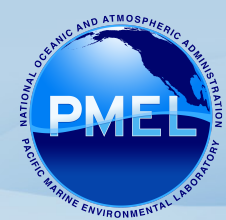
Climate Research Mission

Provide information for an informed society anticipating and responding to climate and its impacts.

-OAR Strategic Plan 2014

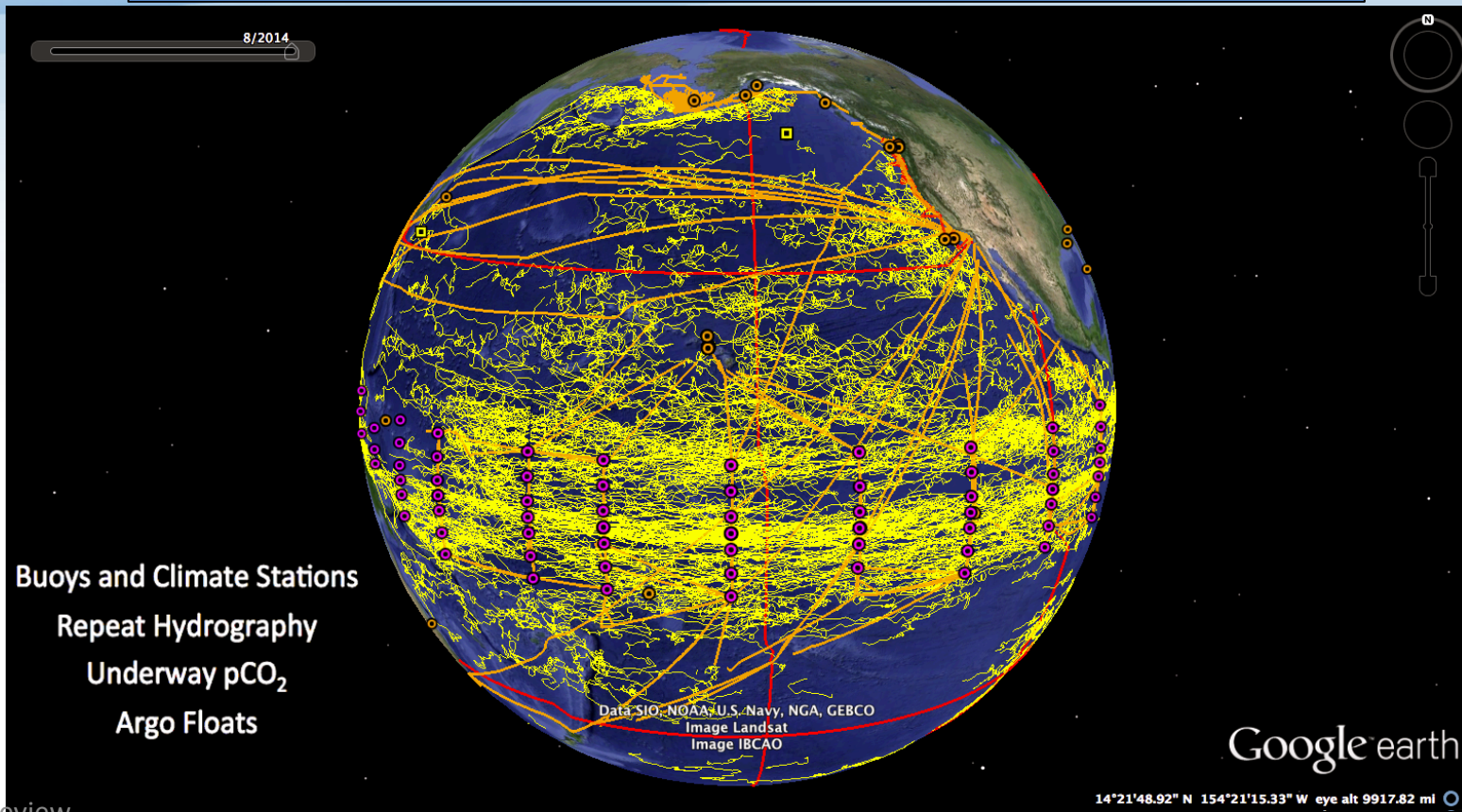
Overarching questions we are addressing at PMEL

1. What is the state of the ocean climate system and how is it evolving?
2. What causes climate variability and change on global to regional scales?
3. Will the ocean carbon sink keep pace with atmospheric CO₂ emissions?
4. How can PMEL best inform and support our nation's efforts to adapt to the impacts of climate variability and change?



High-Quality Sustained Climate Observations

Scientific Expertise + Partnerships + Engineering + Administration

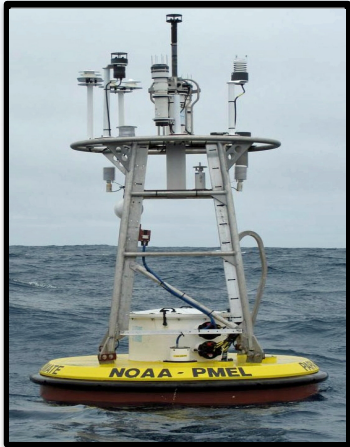




High-Quality Climate Observations

What Makes PMEL Function Well

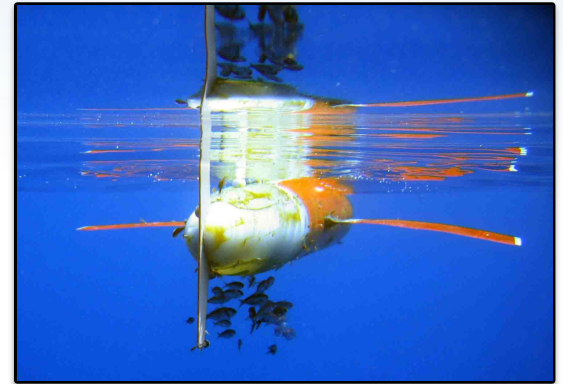
Scientific Expertise + Partnerships + Engineering + Management



Papa Climate Station



Atmospheric Monitoring



Profiling Glider in the Solomon Sea

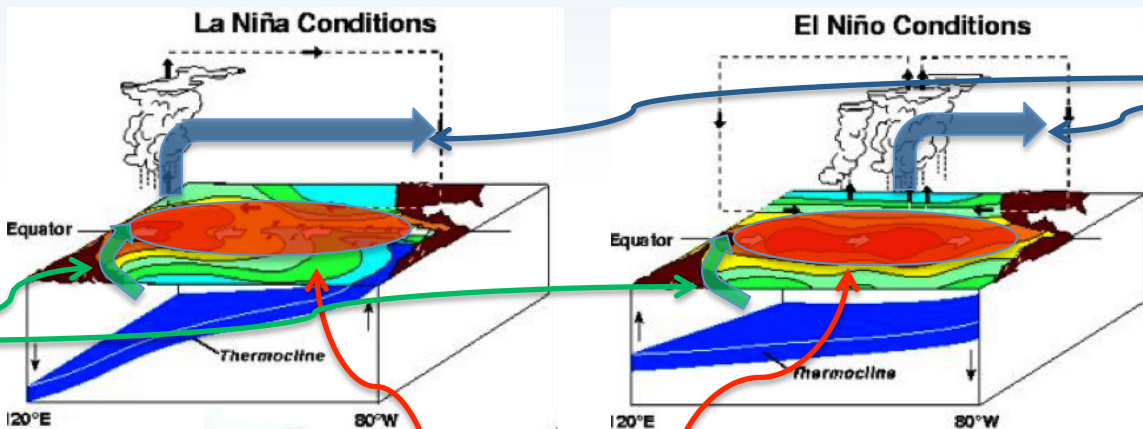
Accomplishments Over the Past 5 Years

Improved understanding of how ENSO events are initiated and maintained, and how they affect weather patterns throughout the world.



**Pacific Western
Boundary
Currents**

Billy Kessler



Tropical Moored Buoy Array

Michael McPhaden



**Thermal
Modeling
and Analysis
Project (TMAP)**

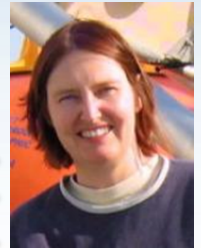
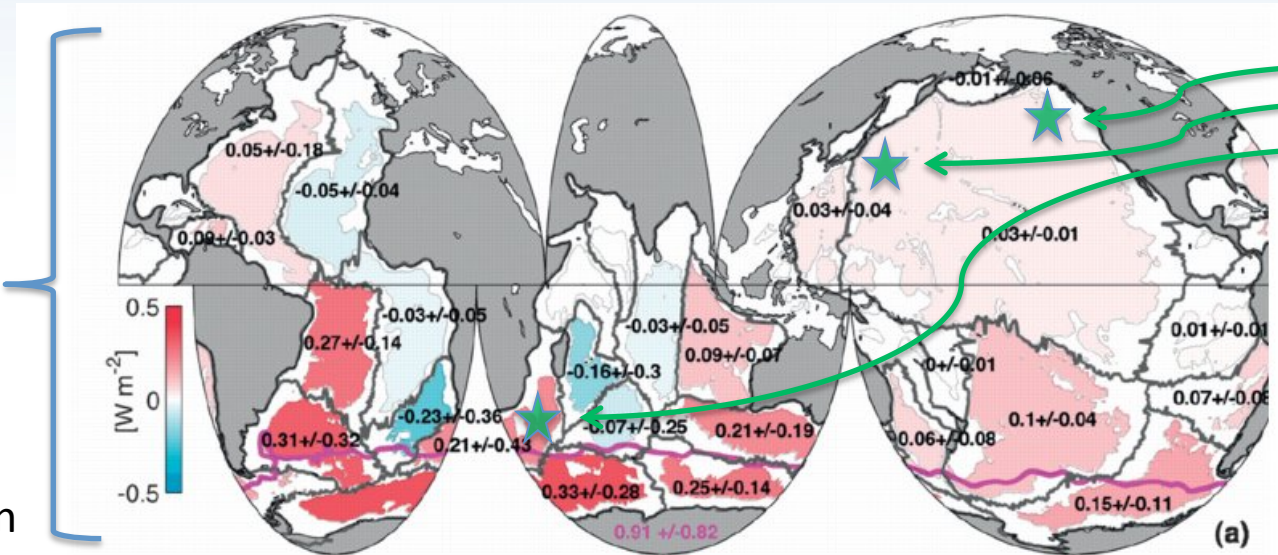
Ed Harrison

Accomplishments Over the Past 5 Years

Improved understanding of the ocean's role in the global heat balance, particularly with respect to western boundary currents and deep-ocean warming



**Large Scale
Ocean
Physics**
Greg Johnson



**Ocean
Climate
Stations**
Meghan Cronin

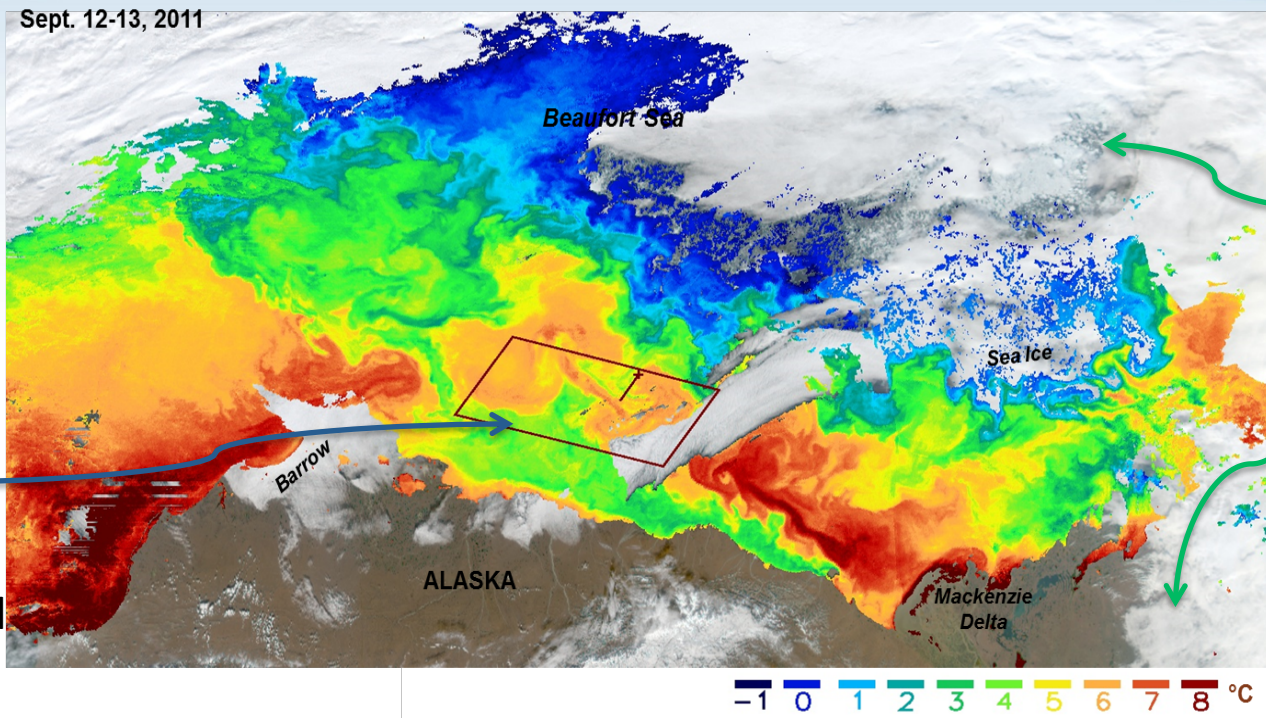
Accomplishments Over the Past 5 Years

Improved understanding of climate impacts on sea ice, snow cover and cloud formation



**Arctic
Climate
Dynamics**

James Overland



**Atmospheric
Chemistry**

Patricia Quinn

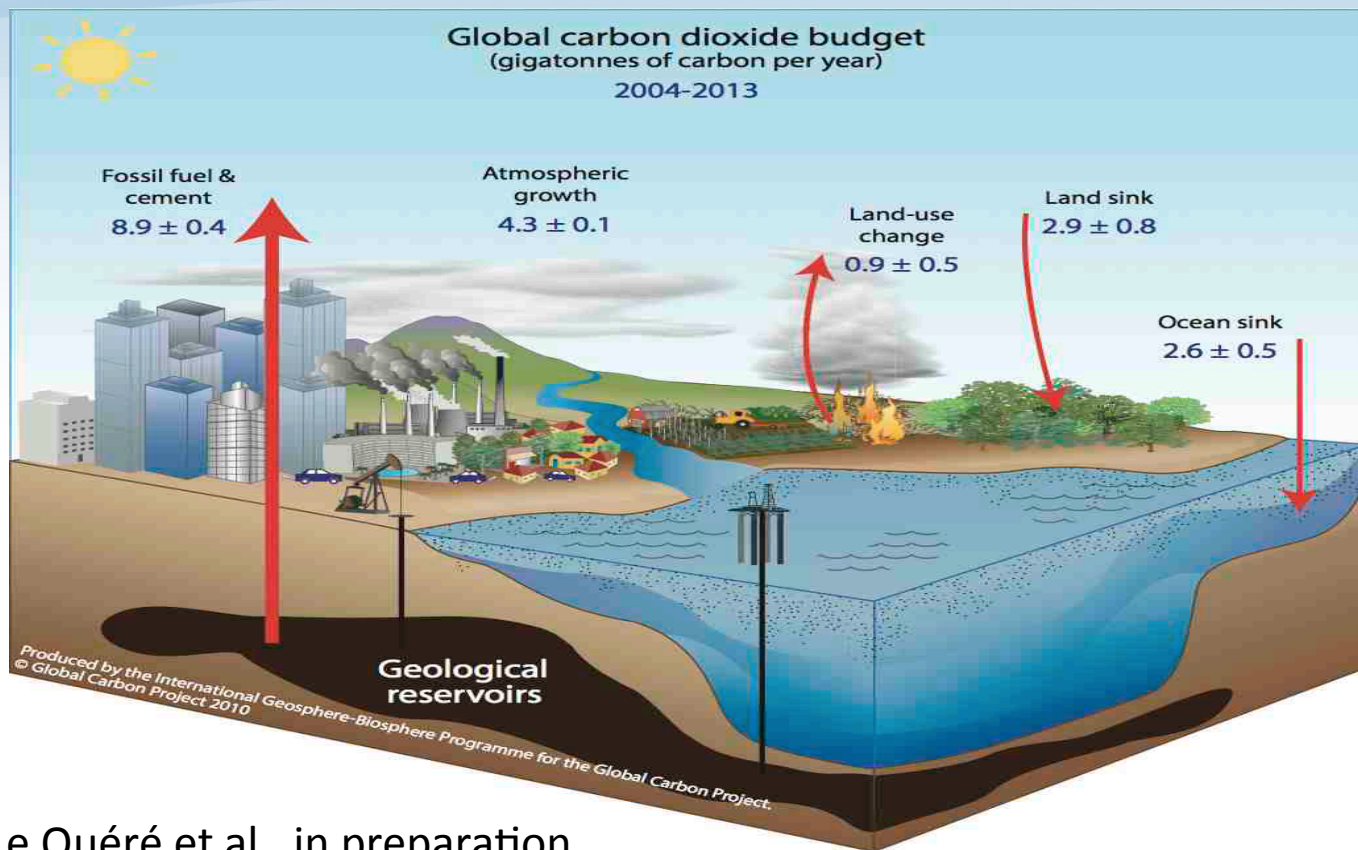
Accomplishments Over the Past 5 Years

Improved understanding of the ocean's role in the global carbon cycle

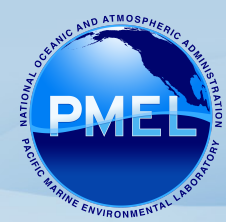


Ocean Carbon

Adrienne Sutton



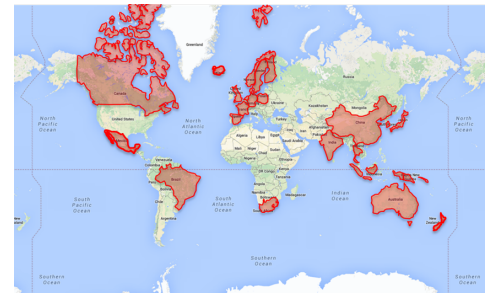
Le Quéré et al., in preparation

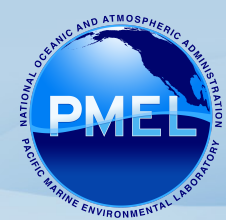


Collaborators

OAR Labs and Programs
 NOAA Line Offices
 Cooperative Institutes
 Universities and Academic Institutions
 U.S. Government Agencies and
 Departments
 International Partnerships

- | | | | |
|-----------|-----------|-------------|----------------|
| Australia | Germany | Mexico | South Africa |
| Brazil | Iceland | Netherlands | Spain |
| Canada | India | New Zealand | Thailand |
| China | Indonesia | Norway | United Kingdom |
| France | Japan | Poland | |

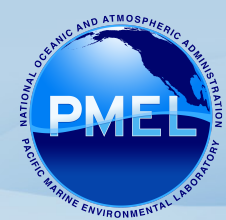




Performance

Research Leadership and Planning

- Michael McPhaden is a leader in tropical ocean dynamics, research, and the development of ocean observings systems for climate, and in serving the scientific community as President of AGU.
- Ed Harrison has been a central participant in the development of the only intergovernmentally agreed plan for sustained observing of the global ocean for climate research, forecasting and services, through the Global Climate Observing System's implementation plan.
- Billy Kessler is the co-chair of the planning activity for the future of the Tropical Pacific Observing System (TPOS).
- Gregory C. Johnson is a leader in global ocean observations, including Argo and Repeat Hydrography, as well as large-scale analyses of ocean temperature, salinity, oxygen, currents, and their variability.
- Meghan Cronin and Adrienne Sutton are members of the OceanSITES Steering Committee and have served on national and international working groups.
- James Overland is the Chair of the Atmospheric Working Group of the International Arctic Science Committee.
- Patricia Quinn is the co-chair of the Arctic Monitoring and Assessment Programme (AMAP) Expert Group on Short-Lived Climate Forcers.
- PMEL PIs have contributed to several IPCC and National Climate Assessments.



Climate Leadership Committees

Michael McPhaden

Member, International CLIVAR Global Synthesis and Observations Panel
Chairman, Tropical Moored Buoy Implementation Panel

D.E. Harrison

Chair OAR/CPO/COD Climate Observing System Council
WMO Commission on Climatology, Expert Team on Climate Change
Indices and Detection
Global Climate Observing System Steering Committee
Co-chair, International CLIVAR Task Team on Ocean Indices

William Kessler

International CLIVAR Pacific Panel
Co-chair, TPOS Scientific Steering Committee

Gregory Johnson

U.S. CLIVAR/CO₂ Repeat Hydrography Oversight Committee
Global Ocean Shipbased Hydrographic Investigations Program (GO-SHIP)
Committee

Meghan Cronin

OceanSITES Steering Team
Member, SCOR Working Group 136 on the Climatic Importance of the
Greater Agulhas System
Member, US CLIVAR High-Latitude Surface Flux Working Group

Member, Climate Expert Group AMAP (Arctic Monitoring and Assessment
Program) of the Arctic Council

Patricia Quinn

SOLAS (Surface Ocean Lower Atmosphere Study) Scientific Steering
Committee
AMAP (Arctic Monitoring and Assessment Programme) Expert Group on
Short-Lived Climate Forcers
NETCARE (Network on Climate and Aerosols) External Steering Committee

Richard A. Feely

Member, IOC/SCOR International Ocean Carbon Coordination Project
(IOCCP)

Member, International IMBER-SOLAS Ocean Acidification group
Co-chair, NSF/NOAA Repeat Hydrography Oversight Committee

Jeremy Mathis

Member, North America Carbon Program (NACP) Science Steering
Committee

Christopher Sabine

Ocean Carbon and Biogeochemistry SSC and Time-Series Advisory
Committee member
Member of the US CLIVAR/CO₂ Repeat Hydrography Oversight Committee
Chair of IOC/SCOR International Ocean Carbon Coordination Project
(IOCCP)



Quality

Recent Awards

NOAA Administrator Award 2014

- Dr. Christopher Sabine
- Dr. Greg Johnson
- Dr. James Overland
- Dr. Richard Feely

Fellows of the American Geophysical Union (AGU)

- Dr. Timothy Bates, 2007
- Dr. Richard Feely, 2007
- Dr. Gregory Johnson, 2013
- Dr. Michael McPhaden, 2014
- Dr. James Overland, 2014
- Dr. Patricia Quinn, 2010
- Dr. Christopher Sabine, 2013

AGU Ambassador Award, 2014

- Dr. James Overland

Fellows of the American Meteorological Society

- Dr. D.E. Harrison, 2013
- Dr. Michael McPhaden, 2007
- Dr. Dennis W. Moore, 2005

Georg Wüst Prize, 2013 and NOAA Research Employee of the Year Award, 2010

- Dr. Gregory Johnson

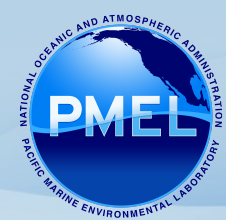
AGU President (2010-2012), Fridtjof Nansen Medal, 2010, and Priestly Lecture, 2012

- Dr. Michael McPhaden

Heinz Environmental Award, 2010

- Dr. Richard Feely

PMEL published 464 climate-related publications 2009 – 2014
Average H-index = 39 and > 62,000 Citations!



Future Directions

- Expand the vision, and the reality, of a fully-integrated physical, chemical and biological Global Ocean Observing System that provides the necessary data and information needed to understand how the oceans, and its vital ecosystem resources, are changing as a result of global climate change.
- Continue to develop initiatives that integrate NOAA programs and national and international partnerships to leverage resources, platforms and scientific expertise to carry out projects that lead to a better understanding of our ocean's role in climate.
- Continue to develop innovative approaches to utilize new autonomous sensors and platforms that increase the throughput, while at the same time reducing costs of global ocean observations.
- Continue to respond to specific stakeholder needs, especially in understanding natural variability and anthropogenic impacts of climate change.