GOA-ON

Global Ocean Acidification Observing Network

The Global Ocean Acidification Observing Network

Jan Newton, University of Washington, USA

28 August 2014, Apia, Samoa

IOOS Integrated Ocean Observing System

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

UK Ocean Acidification Research Programme

IAEA

Ocean Acidification International Coordination Centre

OA-ICC

NOAA

GOOS Global Ocean Observing System

BLUE PLANET Oceans and Society

International Ocean Carbon Coordination Project

Why is a global approach needed ?

We need information and data products that can **inform policy and the public with respect to OA and implications** for the overall ecosystem health (status) of the planet.

Processes are occurring at global scales; therefore we need to go beyond local measurements and **observe on global scales in order to understand OA and its drivers correctly.**

We need sufficient data and understanding to **develop predictive skills and early warning systems**. This requires coverage at appropriate scales, nesting local observations within global context.

OA is
a global condition
with
local effects

OA is
a global condition with local effects

- We need local through global scale observations **in order to get either correct**

- This issue demands our coordination, networked skill, and open analysis

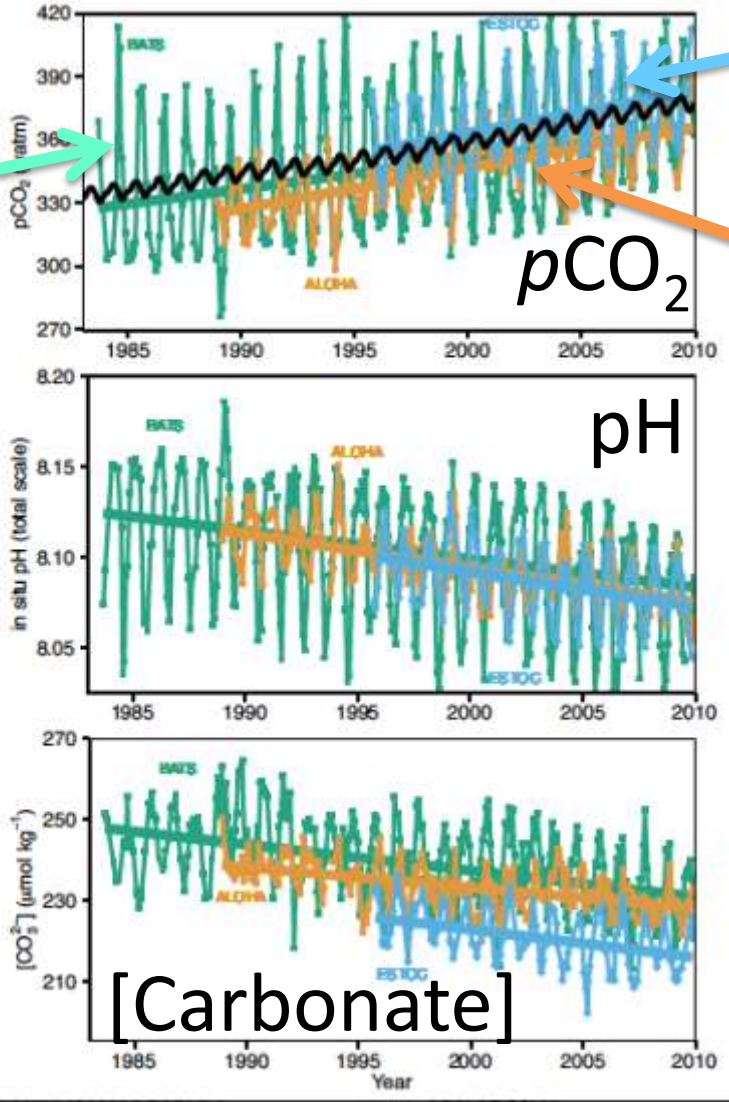
Global condition

OA trend consistent across ocean basins

Bermuda

Canary Is.

Hawaii



Source: IPCC 2013

Local effects

Shellfish Grower: Bill Dewey, Taylor Shellfish

Decision Maker: Christine Gregoire, former WA state Governor

Local effects

OA is
a global condition with local effects

- We need local through global scale observations in order to get either correct
- This issue demands **our** coordination, networked skill, and open analysis

How was GOA-ON made ?

- Two international workshops have convened to establish a coordinated approach to build an integrated global observing network for ocean acidification that addresses the requirements of nations affected by this emerging environmental problem.
- The first workshop held at the University of Washington in June 2012, was attended by **62 participants from 23 countries**.
- The second workshop, held at St. Andrews, UK, in July 2013 was attended by **87 participants from 26 countries**.
- These participants input have defined the goals, details, and focus of the global ocean acidification observing network.

To build the GOA-ON, the community has defined:

- The ***rationale, design, and locations of components for an international ocean acidification observing network,*** taking into account existing activities
- A ***minimum suite of measurement parameters***
- A ***strategy for data quality assurance*** and ***for data distribution***
- The ***requirements for international program integration***

GOA-ON goals

- Three high level goals form the foundation for establishing an integrated global ocean acidification observing network.

GOA-ON will provide:

Goal 1 An understanding of **<u>global OA conditions</u>**

Identify spatial/temporal patterns and assess generality of response; document and assess variation to infer driving mechanisms; quantify rate of change

Goal 2 An understanding of **<u>ecosystem response to OA</u>**

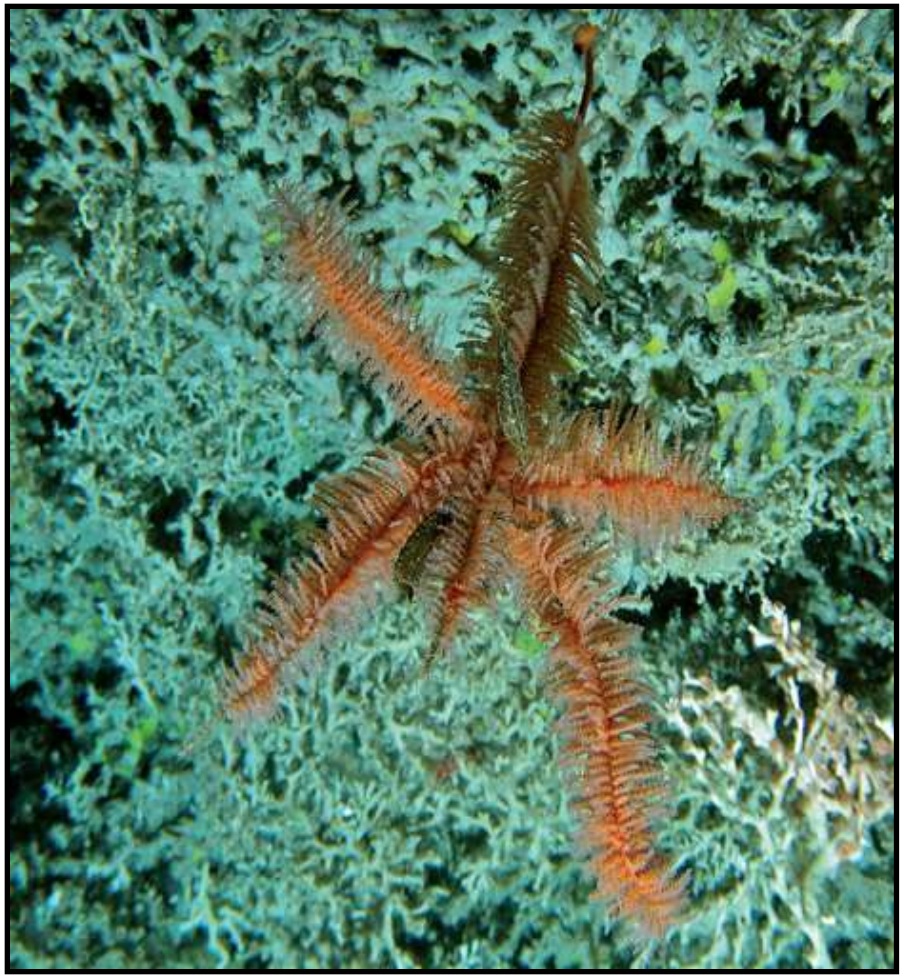
Measure biological responses to physical/ chemical changes; quantify rate of change and identify areas of vulnerability

Goal 3 Data needed to **<u>optimize modeling for OA</u>**

Provide spatially and temporally-resolved chemical and biological data to be used in developing models for societally-relevant analyses and projections

Observations across various ecosystems:

- Open ocean: polar, temperate, tropical
- Coasts and estuaries
- Coral reefs



Utilizing various platforms:

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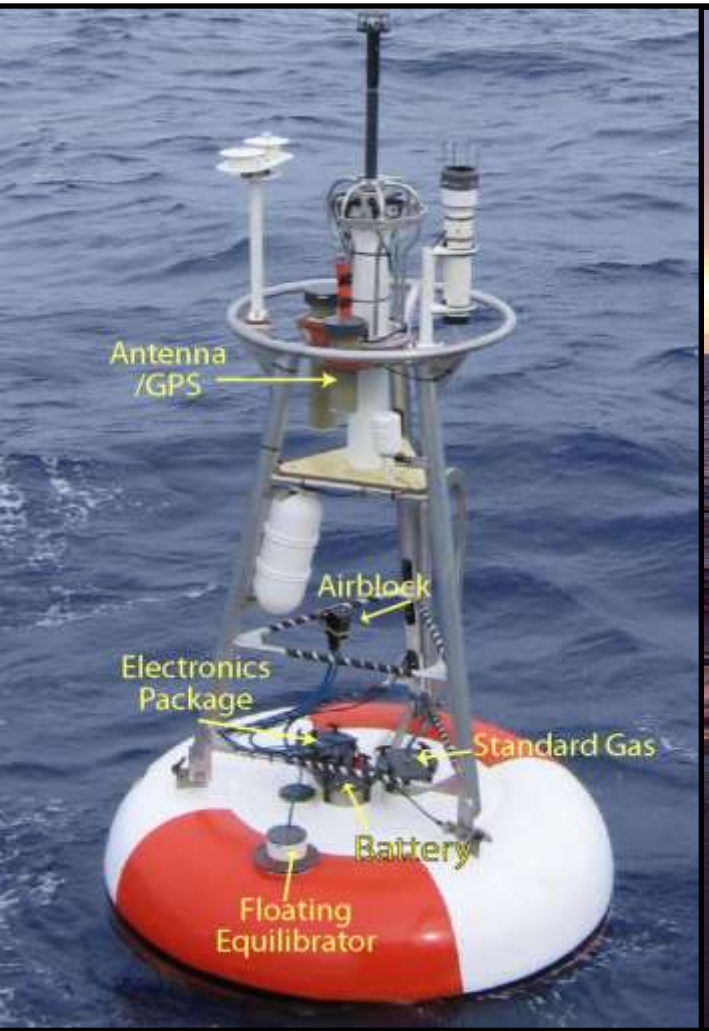
– Ship-based surveys & volunteer observing ships
– Moorings & piers
– Gliders & floats



100 m ↑ ↓ 2 m

GOA-ON will require:

Capacity for

- Physical infrastructure
- Operations and maintenance
- Data QA/QC
- Analytical and synthesis activities
- Intellectual infrastructure

GOA-ON defined two data quality objectives:

- '**Climate data**': of sufficient and defined quality to assess long term trends with defined level of confidence

  Detection of changes in OA state over multi-decadal timescales

- '**Weather data**': of sufficient and defined quality to identify relative spatial patterns and short-term changes

  Mechanistic interpretation of the ecosystem response to local, immediate OA dynamics

GOA-ON has a nested system design

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Global Ocean Acidification Observing Network

Coral reefs

Coasts & shelf seas

Open ocean

Goal 1 OA conditions	Goal 2 Ecosystem response	Goal 3 OA modeling
Level 1	*Level 1*	Inputs to models
Level 2	*Level 2*	
Level 3	*Level 3*	

GOA-ON has a nested system design

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Global Ocean Acidification Observing Network

Coral reefs

Coasts & shelf seas

Open ocean

Goal 1 OA conditions	Goal 2 Ecosystem response	Goal 3 OA modeling
L1: carbonate-system constraint, T, S, O, *fluorescence, irradiance* *L2:* nutrients, bio-optics, transport, meteorology, trace metals... *L3:* capability-specific	*L1:* biomass of functional groups (phytoplankton, zoo-plankton & microbes) *L2:* species; processes incl. growth, grazing & respiration *L3:* capability-specific	Inputs to models

GOA-ON observing assets:

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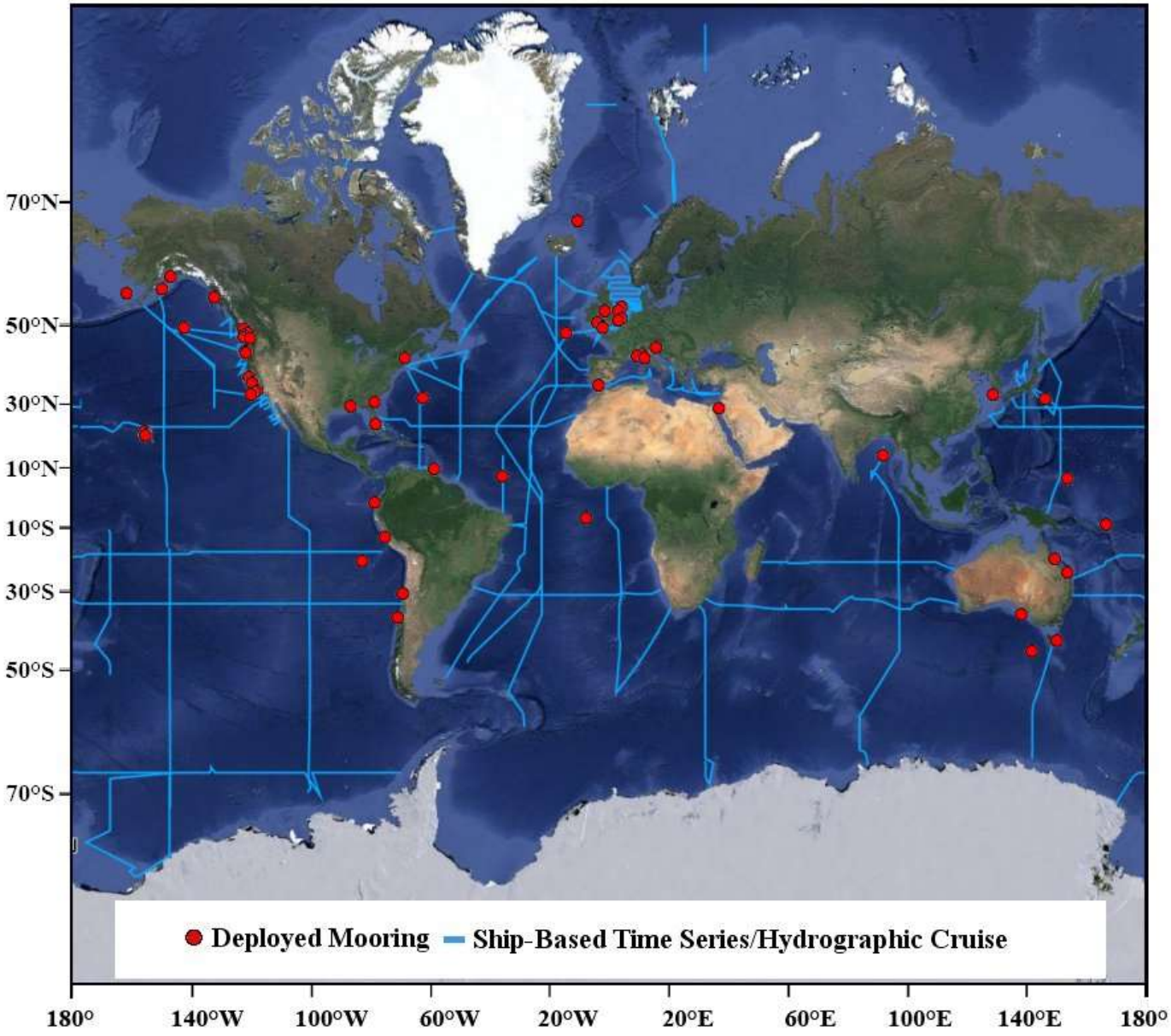
Global Ocean Acidification Observing Network



www.goa-on.org

Interactive map by Cathy Cosca, NOAA

GOA-ON observing assets:

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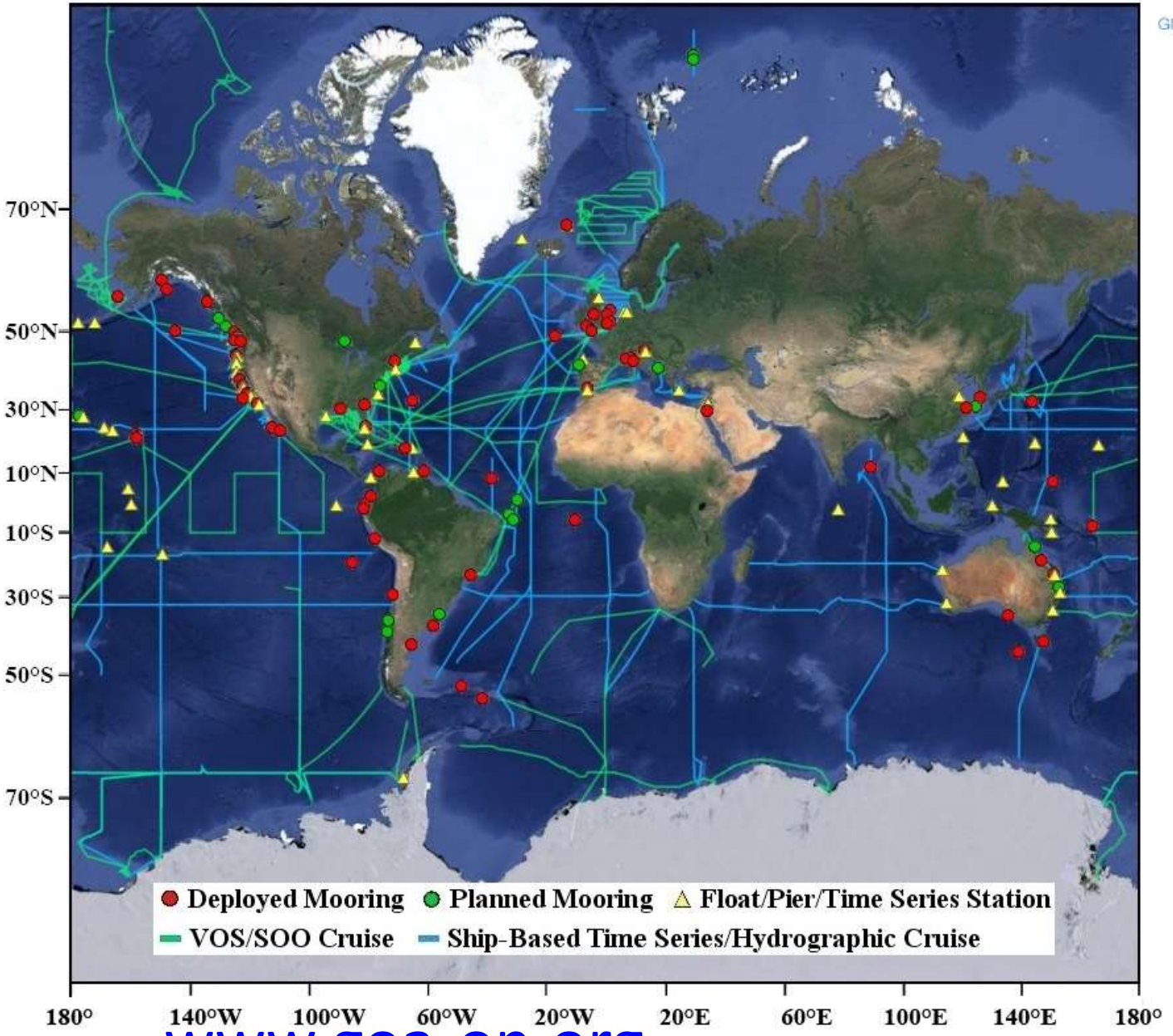
Global Ocean Acidification Observing Network



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Interactive map by Cathy Cosca, NOAA

GOA-ON observing needs assessment:

Open ocean: On global scale, significant building blocks are there, but network needs filling-in, enhancing and sustaining.

Coasts & shelf seas: On global scale, needs construction. On regional scale, there are some systems (with ability to leverage), but many gaps. Global design needs to be regionally coordinated and implemented.

Coral reefs: On a global scale, needs construction; on regional scale, some systems can serve as building blocks. Observing assets may not cover full variability range, hence need for detailed site-specific studies.

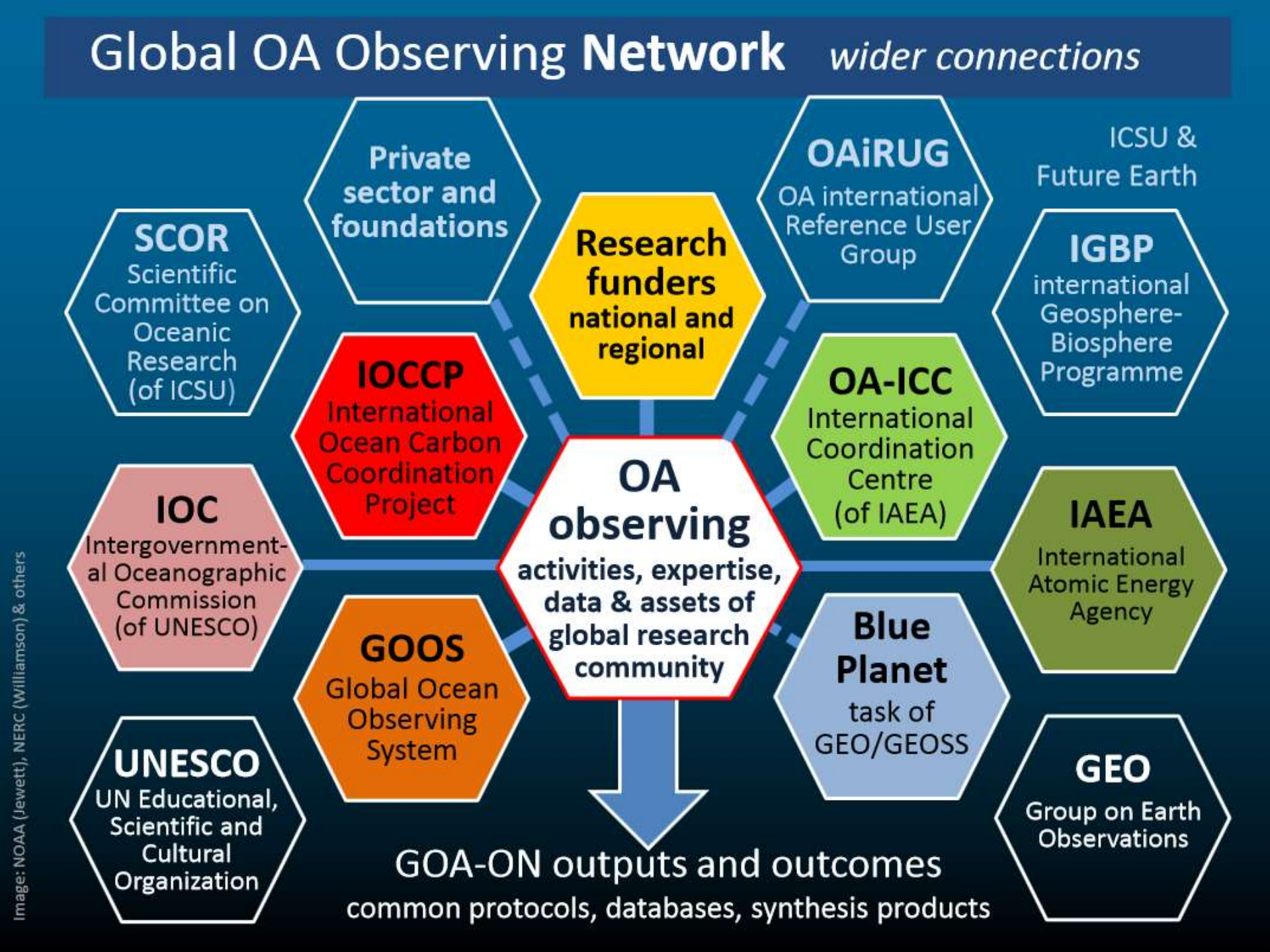
GOA-ON observing needs assessment:

Open ocean: On global scale, significant building blocks are there, but network needs filling-in, enhancing and sustaining. Poor coverage of southern hemisphere, Arctic Ocean and Southern Ocean

Coasts & shelf seas: On global scale, needs construction. On regional scale, there are some systems (with ability to leverage), but many gaps. Global design needs to be regionally coordinated and implemented.

Coral reefs: On a global scale, needs construction; on regional scale, some systems can serve as building blocks. Observing assets may not cover full variability range, hence need for detailed site-specific studies.

Need SIDS input


Global OA Observing Network wider connections
Private sector and foundations
OAiRUG
OA international Reference User Group
ICSU & Future Earth
SCOR
Scientific Committee on Oceanic Research (of ICSU)
Research funders
national and regional
IGBP
international Geosphere-Biosphere Programme
IOCCP
International Ocean Carbon Coordination Project
OA-ICC
International Coordination Centre (of IAEA)
OA observing
activities, expertise, data & assets of global research community
IOC
Intergovernmental Oceanographic Commission (of UNESCO)
IAEA
International Atomic Energy Agency
GOOS
Global Ocean Observing System
Blue Planet
task of GEO/GEOSS
UNESCO
UN Educational, Scientific and Cultural Organization
GEO
Group on Earth Observations
GOA-ON outputs and outcomes
common protocols, databases, synthesis products
Image: NOAA (Jewett), NERC (Williamson) & others

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GOA-ON

Global Ocean Acidification Observing Network

The Global Ocean Acidification Observing Network (GOA-ON) is a collaborative internation approach to document the status and progress of ocean acidification in open-ocean, coast and estuarine environments, to understand the drivers and impacts of ocean acidification o marine ecosystems, and to provide spatially and temporally resolved biogeochemical data necessary to optimize modeling for ocean acidification.

Approach and Goals

Detailed information about the GOA-ON background, design, implementation, and data strategy can be found here:

Global Ocean Acidification Observing Network: Requirements and Governance Plan (JA Newton, RA Feely, EB Jewett, P Williamson, J Mathis)

GOA-ON high-level goals:

Goal 1 - Improve our understanding of global OA conditions:

- Determine status and spatial / temporal patterns in carbon chemistry, assessing the generality of response to ocean

Interactive Map of Ocean Acidification Platforms

Building on the existing global oceanic carbon observatory network of repeat hydrographic surveys, time-series stations, floats and glider observations, and volunteer observing ships, the interactive map below offers the best information available on the current inventory of global OA observing platforms. This is a strong foundation of observations of the carbonate chemistry needed to understand chemical changes resulting from ocean acidification.

An International Effo

Network Members - Scientists from 30 countries are currently participating in th GOA-ON.

Workshops/Activities

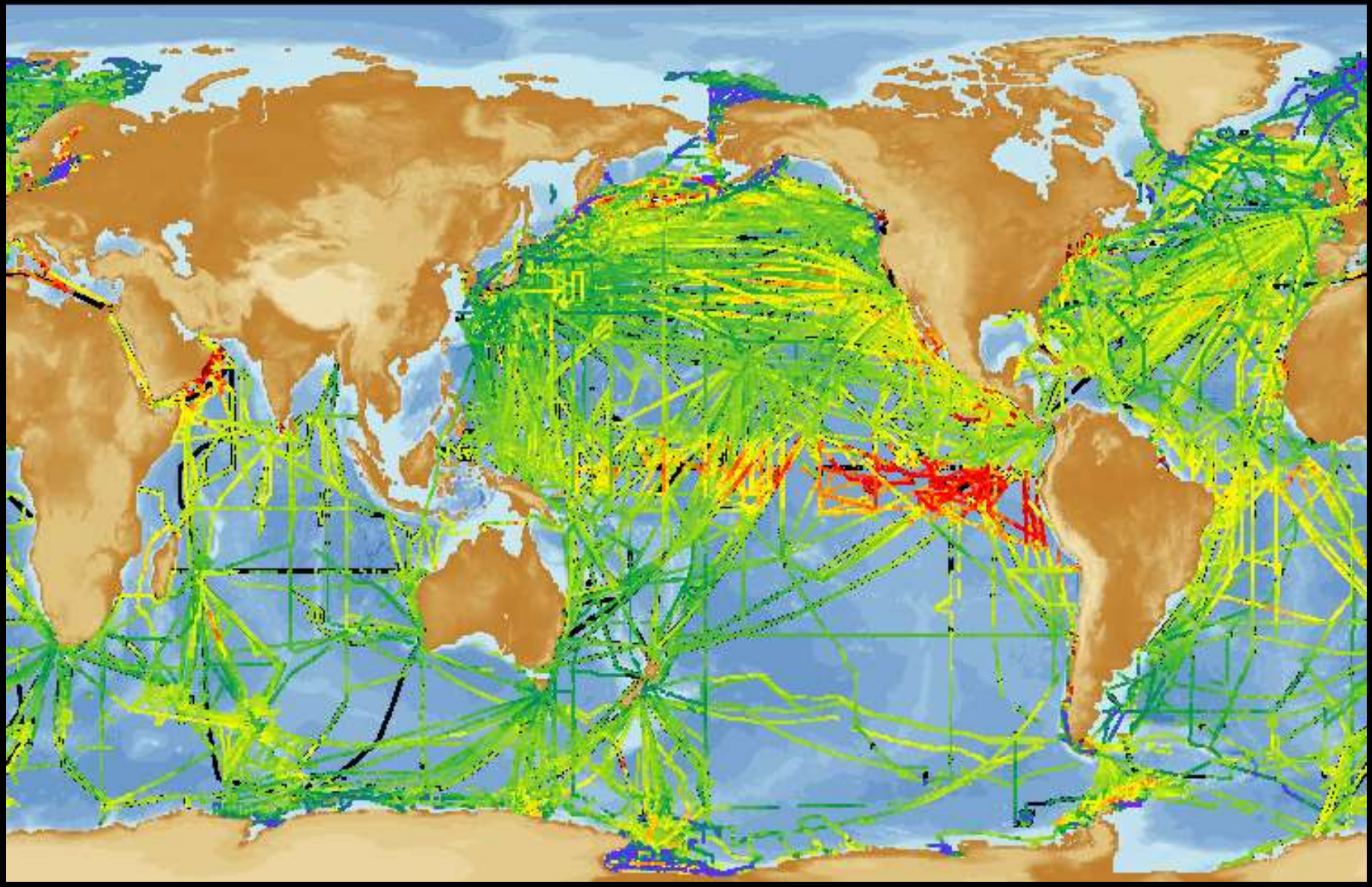
- GOA-ON 2012 Workshop, University of Washington ,Seattle, WA attended by participants from 22 countries
- GOA-ON 2013 Workshop, St. Andrews, UK attended by 87 participa from 26 countries
- GOA-ON Side Event at the GEO-X Plenary Session & 2014 Geneva Ministerial Summit
  Flyer Leaflet

GOA-ON Governance:

Outcomes from GOA-ON:

Globally distributed, high quality data, near-real-time data, and data synthesis products that:

- Facilitate research (new knowledge) on OA
- Communicate status of OA and biological response
- Enable forecasting/prediction of OA conditions



Surface Ocean CO_2 Atlas; www.socat.info

Scales

- Local
- Regional
- National
- Global

Must integrate

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ettings

IOOS Pacific Region Ocean Acidification

Data Explorer

Click for access to ocean acidification data and visuals for the Northeast Pacific Ocean

Welcome to the IOOS Pacific Region Ocean Acidification Data Portal

Ocean acidification refers to the change in the chemistry of seawater caused primarily by the ocean's absorption of carbon dioxide from the atmosphere.

From our data explorer, you can find data relevant to ocean acidification from partners in the Pacific region. This portal was funded by U.S. IOOS, with data streams contributed by regional IOOS observing systems in Alaska (AOOS), Washington and Oregon (NANOOS), Central and Northern California (CeNCOOS), Southern California (SCCOOS), and the Pacific Islands (PacIOOS) as well as through NOAA's Ocean Acidification Program (OAP) and Pacific Marine Environmental Laboratory (PMEL). Data presented here were funded though NOAA OAP, U.S. IOOS, or regional observing system collaborators. For further information about ocean acidification, follow these national and regional links, which include FAQs and videos on the basic understanding of and consequences from ocean acidification, as well as links to information on sensors (Alliance for Coastal Technologies, ACT) and practices (California Current Acidification Network, C-CAN) used to monitor ocean acidification status.

The seawater chemistry changes from ocean acidification affect the ecology and economy of marine communities, and this is projected to grow with time. We can better prepare for potential impacts to marine communities, fisheries, and livelihoods by learning more about how the ocean absorbs carbon dioxide. IOOS is committed to working with a diversity of partners to provide data about ocean acidification conditions.

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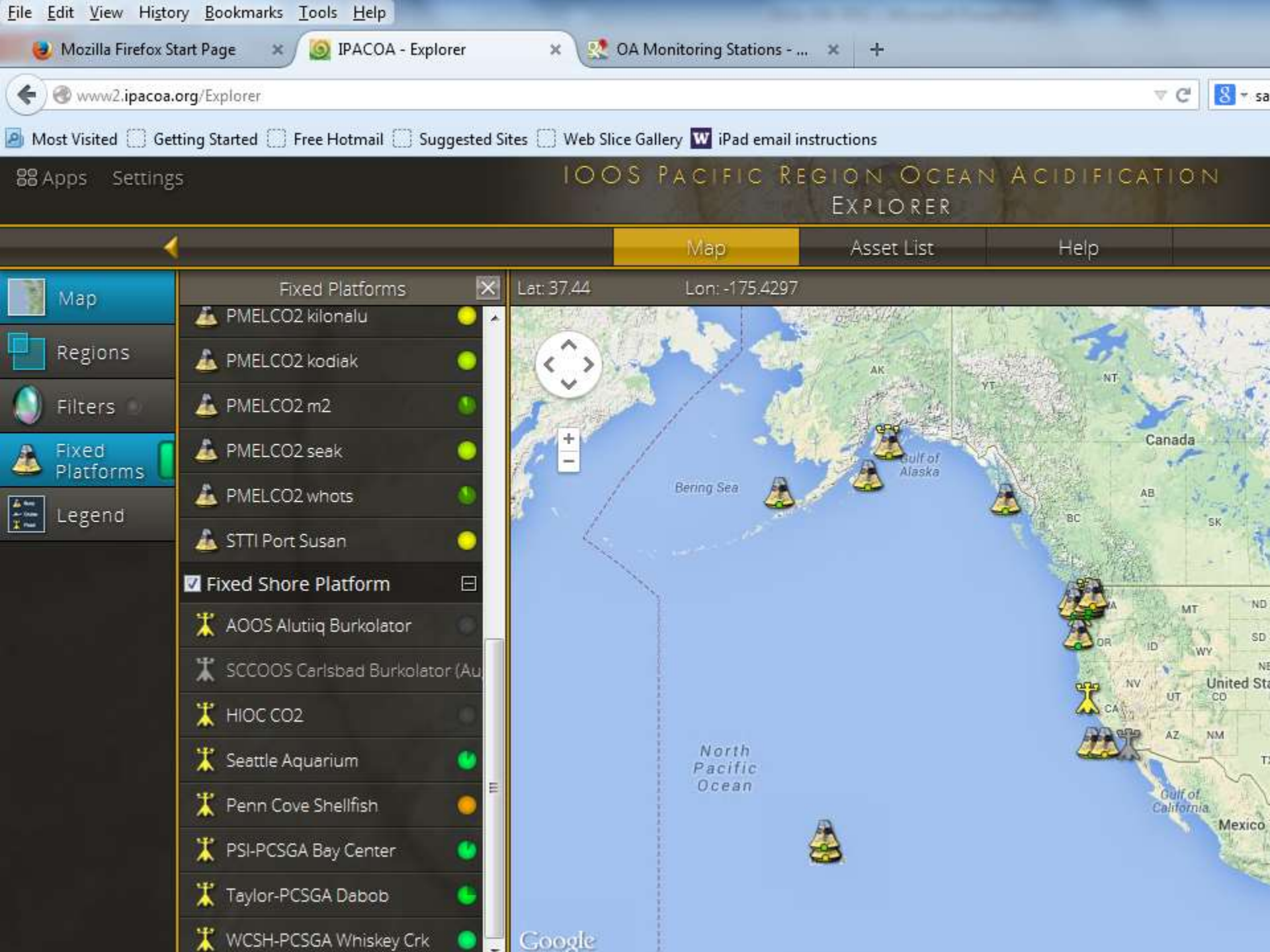
Lat: 62.5123 Lon: -39.5508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Fixed Platforms
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PMELCO2 kodiak
PMELCO2 m2
PMELCO2 seak
PMELCO2 whots
STTI Port Susan
Fixed Shore Platform
AOOS Alutiiq Burkolator
SCCOOS Carlsbad Burkolator (Au
HIOC CO2
Seattle Aquarium
Penn Cove Shellfish
PSI-PCSGA Bay Center
Taylor-PCSGA Dabob
WCSH-PCSGA Whiskey Crk
Lat: 37.44
Lon: -175.4297
Bering Sea
Gulf of Alaska
Canada
North Pacific Ocean
Gulf of California
Mexico
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Lat: 54.8513 Lon: -134.9121

Gulf of Alaska

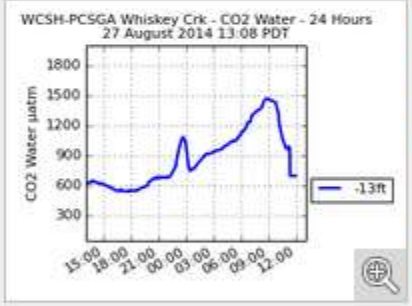
Google

PCSGA - Whiskey Creek Shellfish Hatchery, Netarts Bay

Observations | Details | History | Credits

Provider: WhiskeyCrShel

Data Updated: 27 Aug 2014 11:59 PDT



Alk_T (-13ft):	2224.4	µeq
CO2 Water (-13ft):	697.1	µatr
TCO2 (-13ft):	2121.7	µmc
Omega_ArgSat (-13ft):	1.4	
Oxygen Conc. (-13ft):	--.-	
Oxygen Pct. Sat. (-13ft):	97.4	%
pH (-13ft):	9.1	
Salinity (-13ft):	32.5	PSU
Water Temp. (-13ft):	60.5	°F

24 Hours | 7 Days | 30 Days | 60 Days

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Legend

Lat: 52.9089 Lon: -100.6787

Gulf of Alaska

Google

PCSGA - Whiskey Creek Shellfish Hatchery, Netarts Bay

Observations | Details | History | Credits

Provider: WhiskeyCrShel

Data Updated: 27 Aug 2014 11:59 PDT

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Lat: 53.1731 Lon: -135.2197

Gulf of Alaska

Google

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Observations | Details | History | Credits

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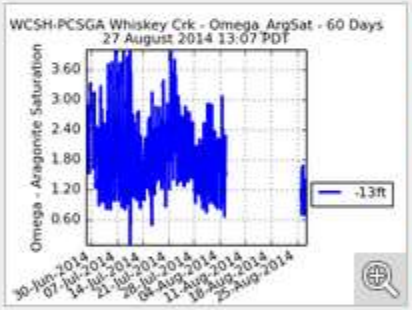
Data Updated: 27 Aug 2014 11:59 PDT



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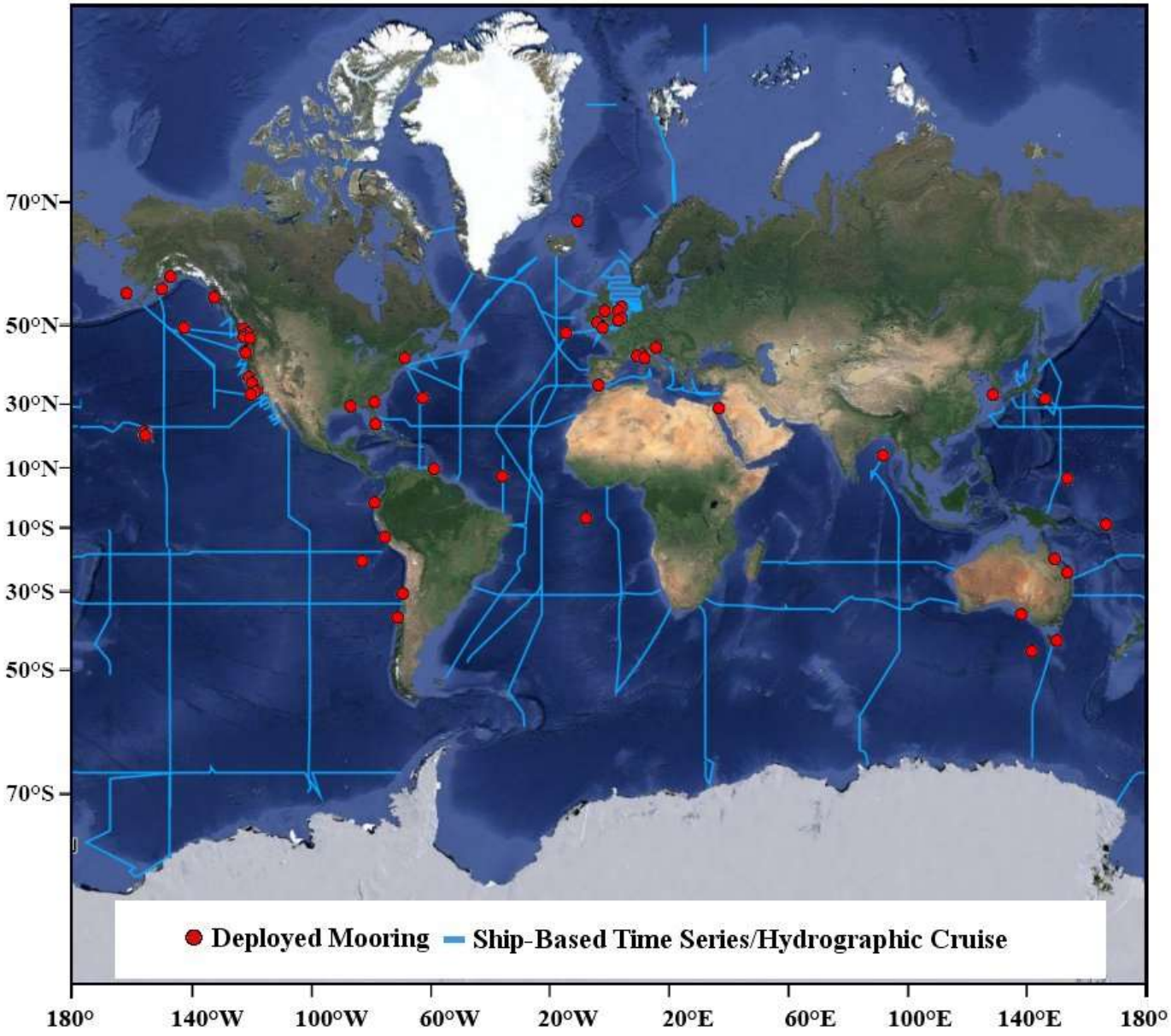
GOA-ON observing assets:

GOA-ON
Global Ocean Acidification Observing Network



www.goa-on.org

Interactive map by Cathy Cosca, NOAA

End-uses of GOA-ON products/data:

- Scientific inquiry
- International policy especially carbon emission policies
- Education and outreach, as related to forecasts
- Socio-economic impact forecasts
- Potential fisheries impacts
- Cultural impacts
- Insurance on fisheries yields
- Coral reefs and livelihood, especially developing countries
- Regulatory needs
- International food and economic security
- Shellfish aquaculture (widespread globally) adaptation strategies;
- Shore protection, tsunami protection as related to implications for coral reefs
- Tourism as related to coral reef and marine habitat degradation

GOA-ON is established

The Global Ocean Acidification Observing Network (GOA-ON) is a **collaborative international** approach

to **document the status and progress of ocean acidification** in open-ocean, coastal, and estuarine environments,

to understand the drivers and impacts of ocean acidification on marine ecosystems, and

to provide spatially and temporally resolved biogeochemical data necessary to **optimize modeling and forecasts of ocean acidification**.

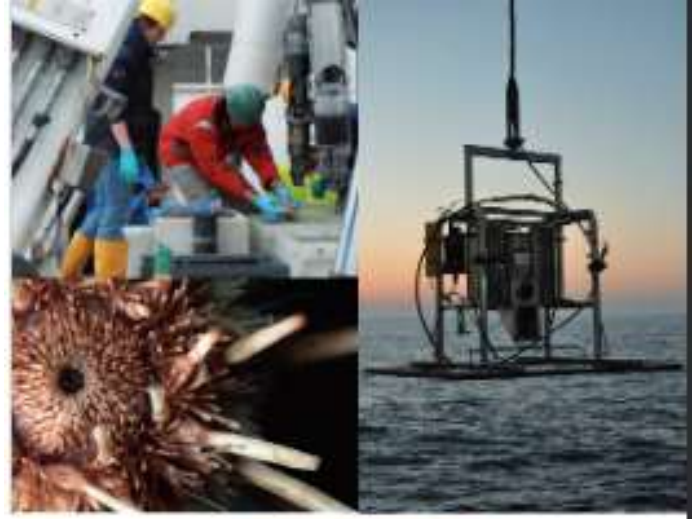
GOA-ON next steps

Broadcast the Plan: www.goa-on.org

Expand the network to regions undersampled

Entrain a wider participant group

We need you !



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Discussion

Your questions?
Comments?

Fa'afetai !