National Academy of Sciences
Decadal Survey of Ocean Sciences *for the*
National Science Foundation

Public/Private Partnerships for Ocean Science: Collaboration all along the instrument to information chain

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National Oceanic and Atmospheric Administration

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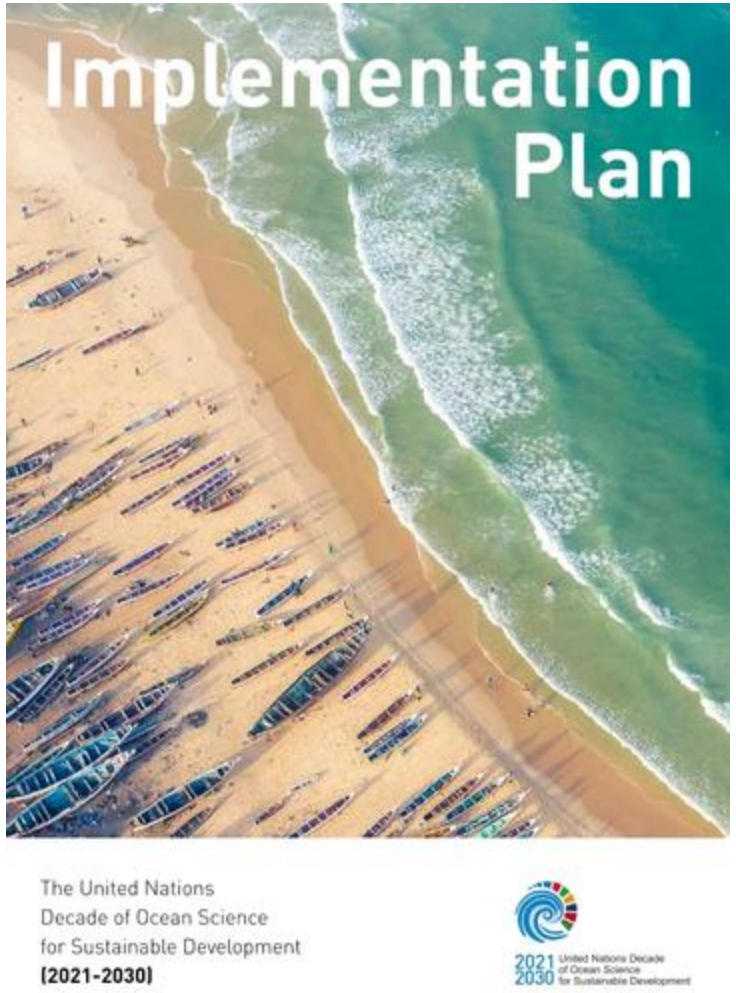
U. N. Decade of Ocean Science for Sustainable Development



A Productive Ocean

Implementation Plan (left) includes facilitation of public-private partnerships to meet seven Decade outcomes, including 'A Productive Ocean' (right)

World Ocean Database and Atlas *(WOD/WOA)*

World Ocean Database

Archive/preservation

INTEGRATE

- GTSPP
- Argo
- Moored arrays
- Ships/gliders +

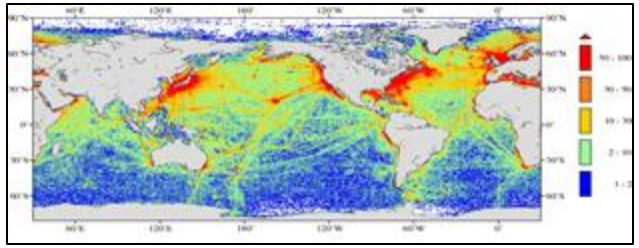
ENHANCE

- Common format
- Metadata
- Duplicate resolution
- Grid (WOA)

ASSESS

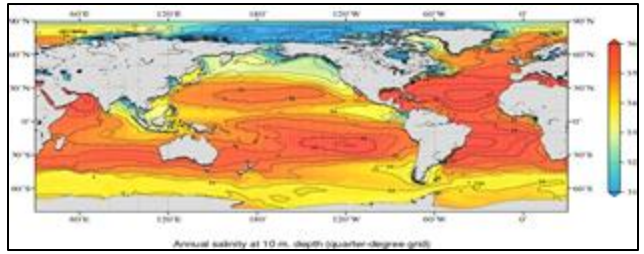
- Uniform purpose based automated quality control
- Expert essential ocean variable QC

TAILORED PRODUCT/SERVICE



World Ocean Atlas

BENEFIT TO THE NATION

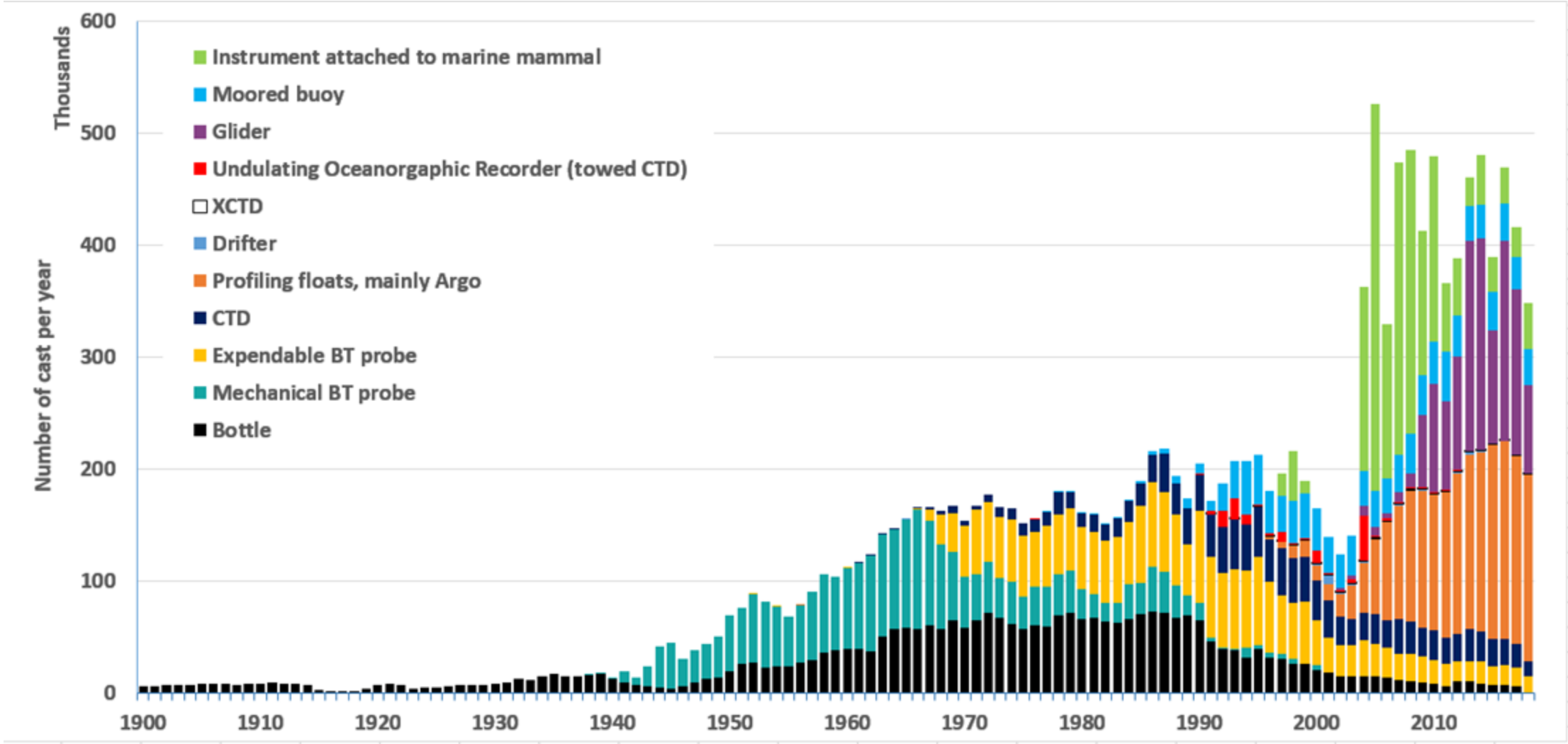


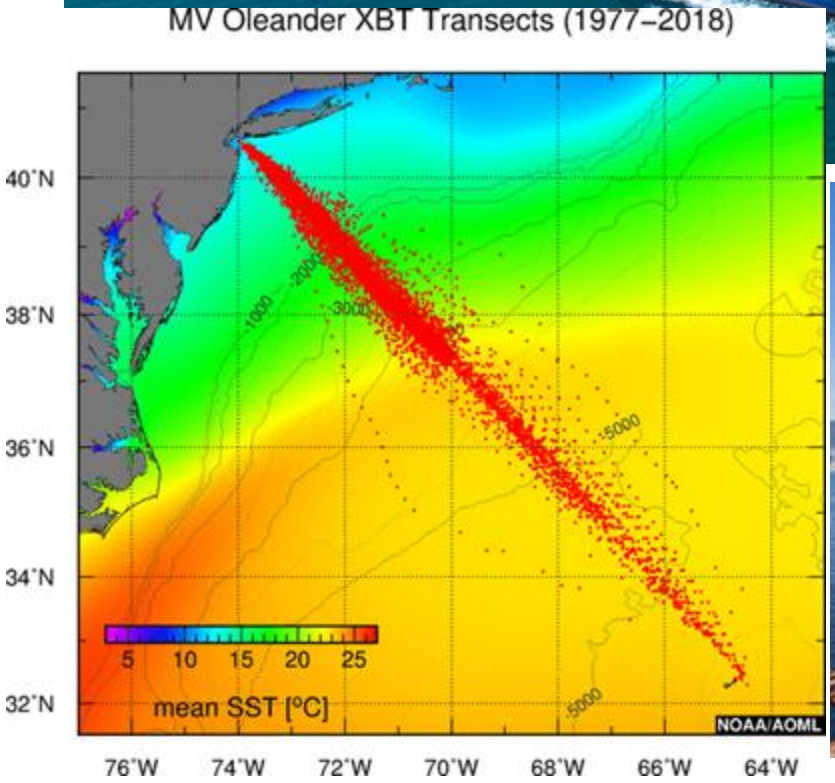
Integrated Ocean Climate Information

Ocean Observing Community

Meeting goals of U. N. Decade is contingent on ocean monitoring; equitable data access; tools for transforming data into accessible information

Historical Profiles from World Ocean Database





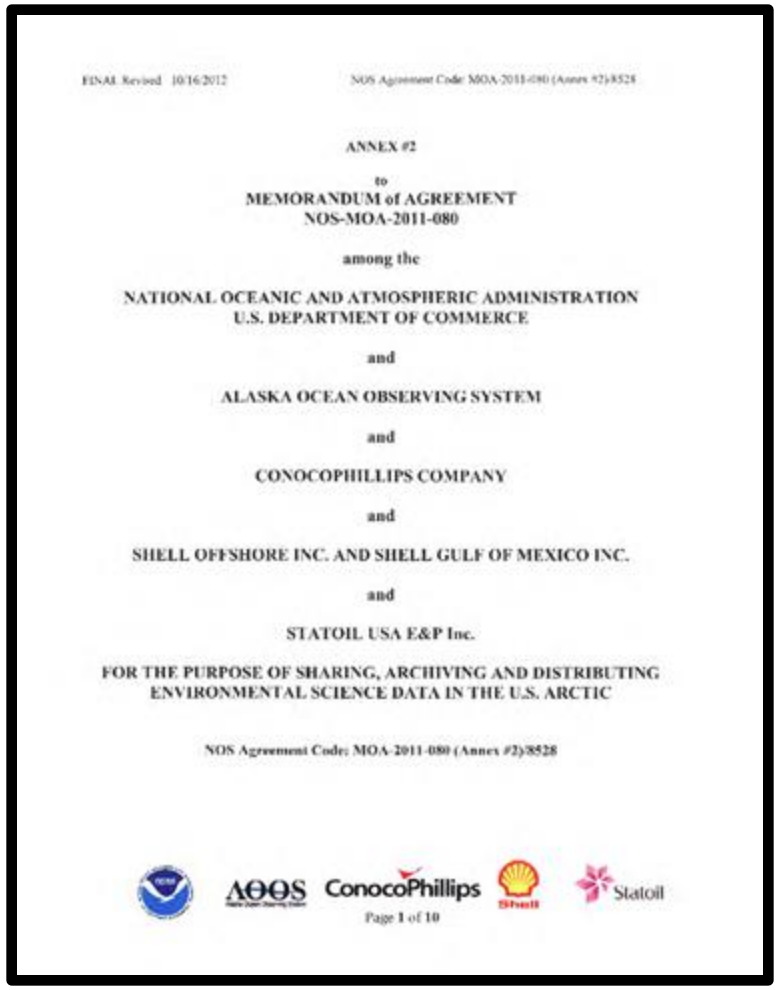
High Interest in Understanding the Ocean from Merchant Shipping Lines/other private sector

Top: Oleander merchant ship retrofit to accommodate oceanographic instruments (https://doi.org/10.5670/oceanog.2019.319)

Bottom Left: 50 years of data across the Gulf Stream from the Oleander (NOAA Oleander Project)

Bottom Right: The Falkor and Falkor Too Research vessels from the non-profit Schmidt Oceanographic Institute (https://schmidtocean.org/)

Data Exchange Agreements with Private Companies



FINAL Revised 10/16/2012 NOS Agreement Code: MOA-2011-080 (Annex #2)/8528

ANNEX #2

to

MEMORANDUM of AGREEMENT
NOS-MOA-2011-080

among the

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

and

ALASKA OCEAN OBSERVING SYSTEM

and

CONOCOPHILLIPS COMPANY

and

SHELL OFFSHORE INC. AND SHELL GULF OF MEXICO INC.

and

STATOIL USA E&P Inc.

FOR THE PURPOSE OF SHARING, ARCHIVING AND DISTRIBUTING
ENVIRONMENTAL SCIENCE DATA IN THE U.S. ARCTIC

NOS Agreement Code: MOA-2011-080 (Annex #2)/8528

AOOS ConocoPhillips Shell Statoil

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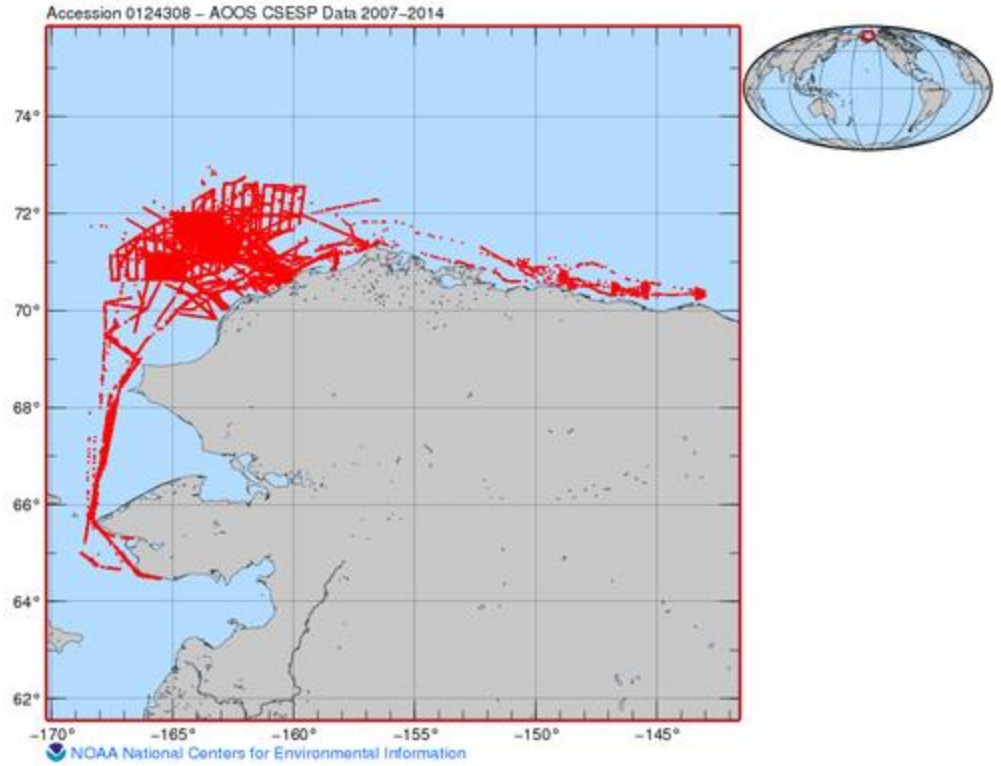
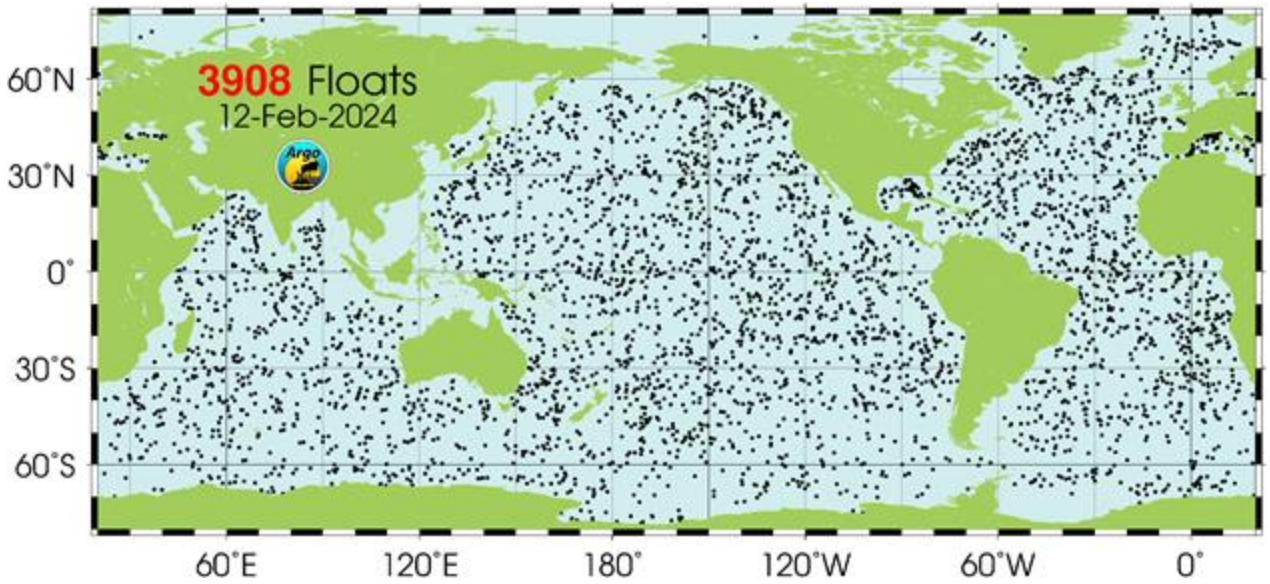


- in situ subsurface oceanographic data is difficult to measure, often leaving gaps in our understanding of areas of the ocean
- Partnering with private sector data collectors can help to fill these gaps – to the benefit of private and public interests
- Left: Memorandum of Understanding between NOAA Alaska Ocean Observing System and oil companies on data sharing
- Right: Data distribution from NCEI archive of data made public through the agreement

Argo Program: Public – Private Collaboration



Argo: Main subsurface ocean observing system for essential ocean variables temperature and salinity + biogeochemical variables. Publicly funded (NOAA US Argo in the United States)

Float design developed by Academic institutions : commercial manufacture by private sector: US Argo groups continue to routinely test and monitor the technology for quality control and continued development

SOLO II developed at Scripps Institute (photo Instrument Development Group - Scripps) – commercial model S2A by MRV Systems. ALTO developed at Woods Hole Oceanographic Institute, commercial model by MRV systems

WHOI has worked with MRV/RBR to test, improve and pilot the RBR ArgoCTD for use in the global program to reduce single supplier risk

Commercial model photos from MRV website: mrvsys.com
Argo distribution map from argo.ucsd.edu

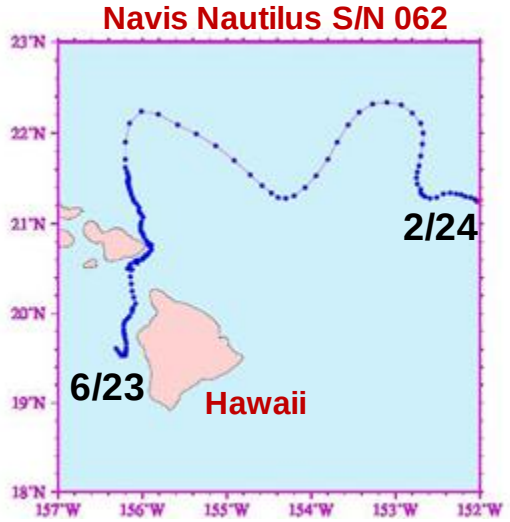
A New Profiling Float: the Navis Nautilus

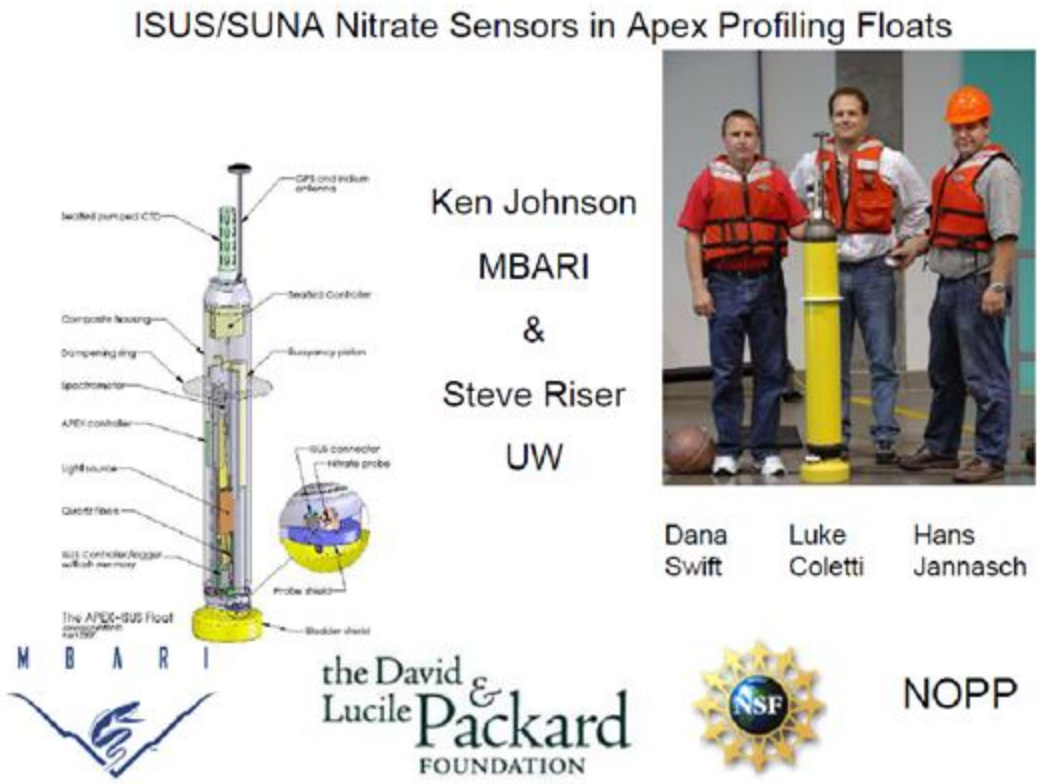
- Developed as a collaboration between SeaBird Electronics and the University of Washington, in addition to several other collaborators

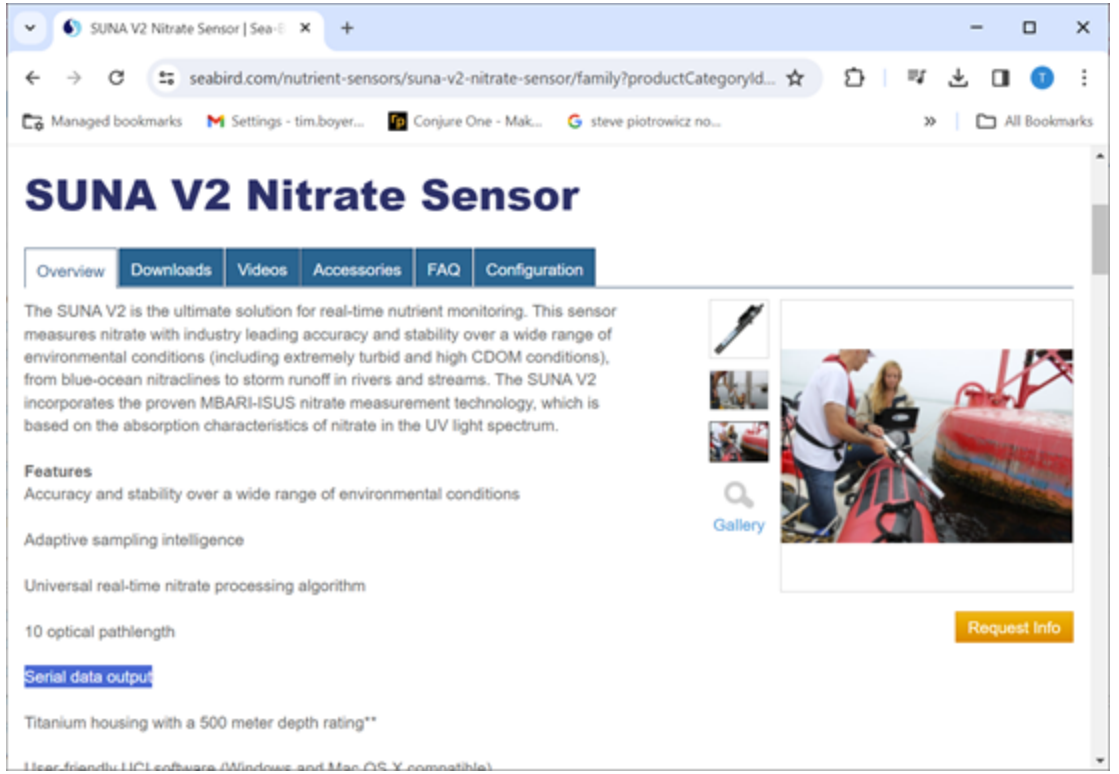
- Funded via NOAA and SeaBird Scientific, through the National Ocean Partnership Program (NOPP); suitable for use in Argo, GO-BGC, and other profiling float programs

- A 6-sensor Biogeochemical Float (CTD + oxygen, nitrate, pH, chlorophyll fluorescence, particle backscatter, and optical radiometry), designed for 250-30 profiles, 0-2000 m; a complete update of previous models, with an improved buoyancy engine and additional battery packs

- Prototypes deployed near Hawaii and working well



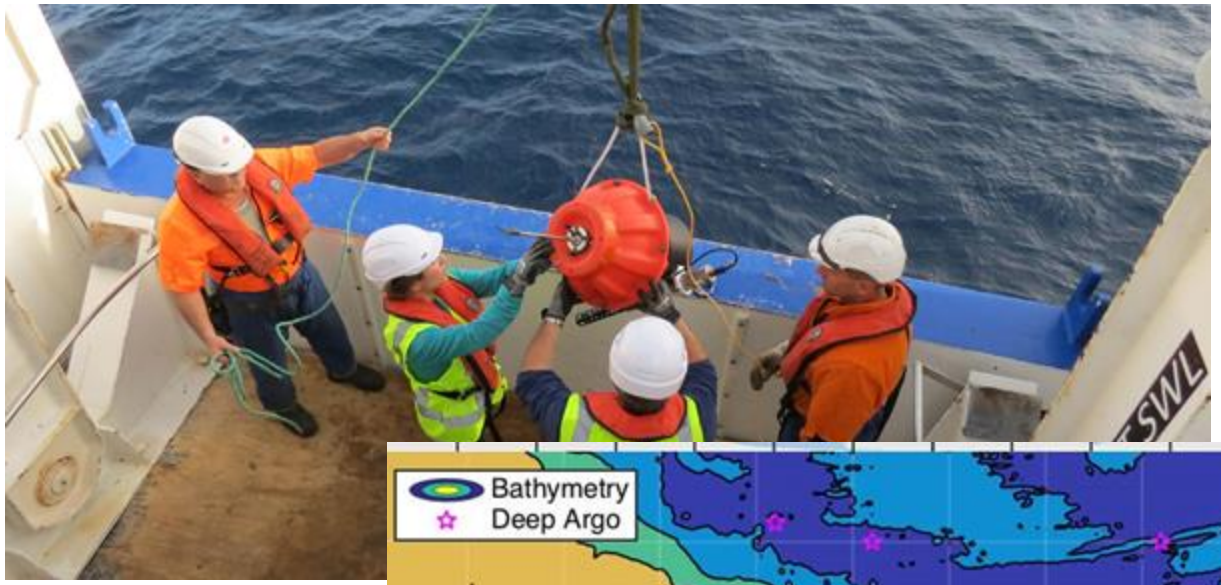


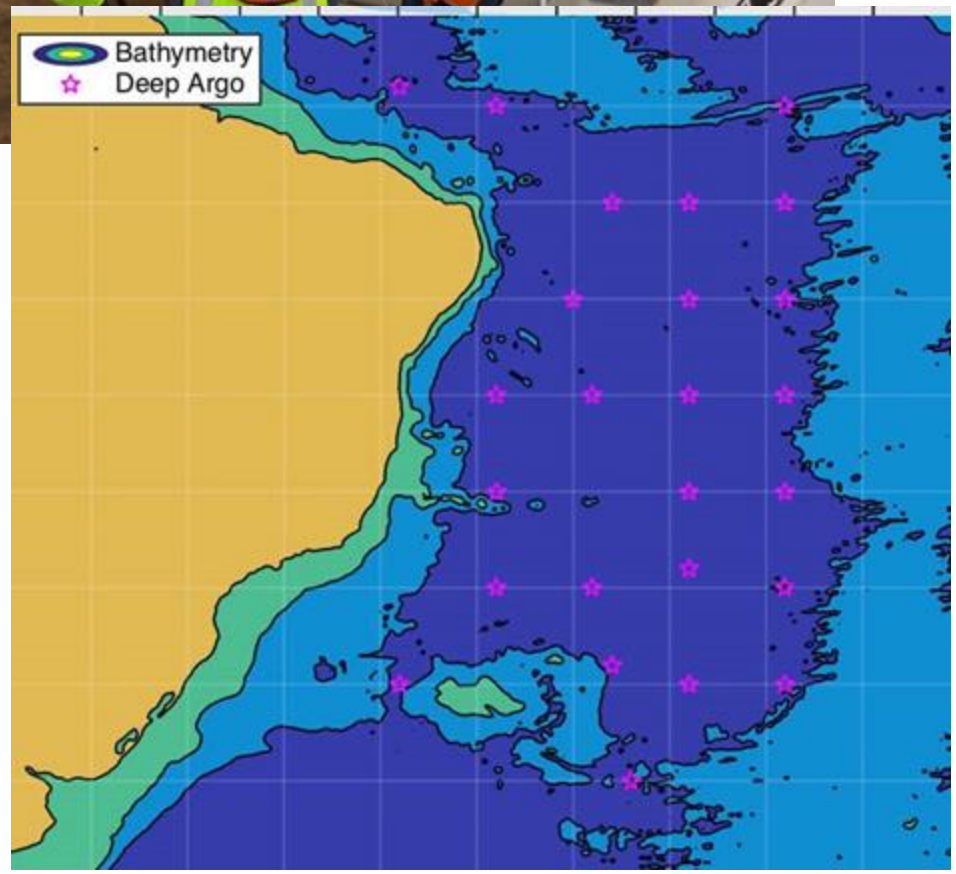


Biogeochemical Argo: sensors on Argo floats for monitoring of chemical and biological essential ocean variables

Academic development of sensors : Commercial manufacture of sensors : Operational testing and feedback on sensor performance/improvement

Left: from presentation on Nitrate sensors for Argo floats, courtesy Ken Johnson;
Right: latest Nitrate sensor description page from Seabird Scientific (seabird.com)





Deep Argo: Autonomous floats measuring essential ocean variables over the full depth of the ocean.

Critical to understanding the state and circulation of the deep ocean and for monitoring change

Deployments in area of interest Brazil to West Africa funded by Paul G. Allen Foundation under the scientific lead of Dr. Greg Johnson (NOAA Pacific Marine Environmental Lab)

Maintenance of the array will be the responsibility of the Argo program

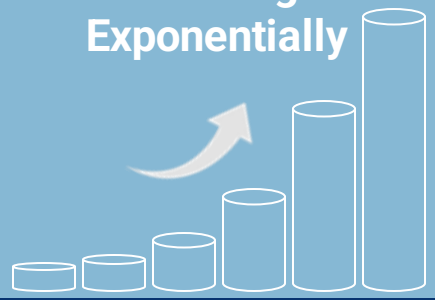
Images from https://www.noaa.gov/media-release/noaa-teams-with-paul-g-allen-philanthropies-to-expand-deep-ocean-observations
Top Image credit: Learnz

NODD Disseminates NOAA Line Office Data

Open and Free, with Value to the Public:

- From NOAA Line Offices via NODD to public cloud buckets of three CSPs =
  - An exponential number of users can access
- Harnesses the scalability of the cloud to improve data access
  - No egress costs for users or the agency
- No use restrictions or user registration
- Appropriate Metadata included

NOAA Data is Growing Exponentially



TECHNOLOGY MODERNIZATION

Reduces stress on NOAA's on-premise dissemination systems

Improves services for users

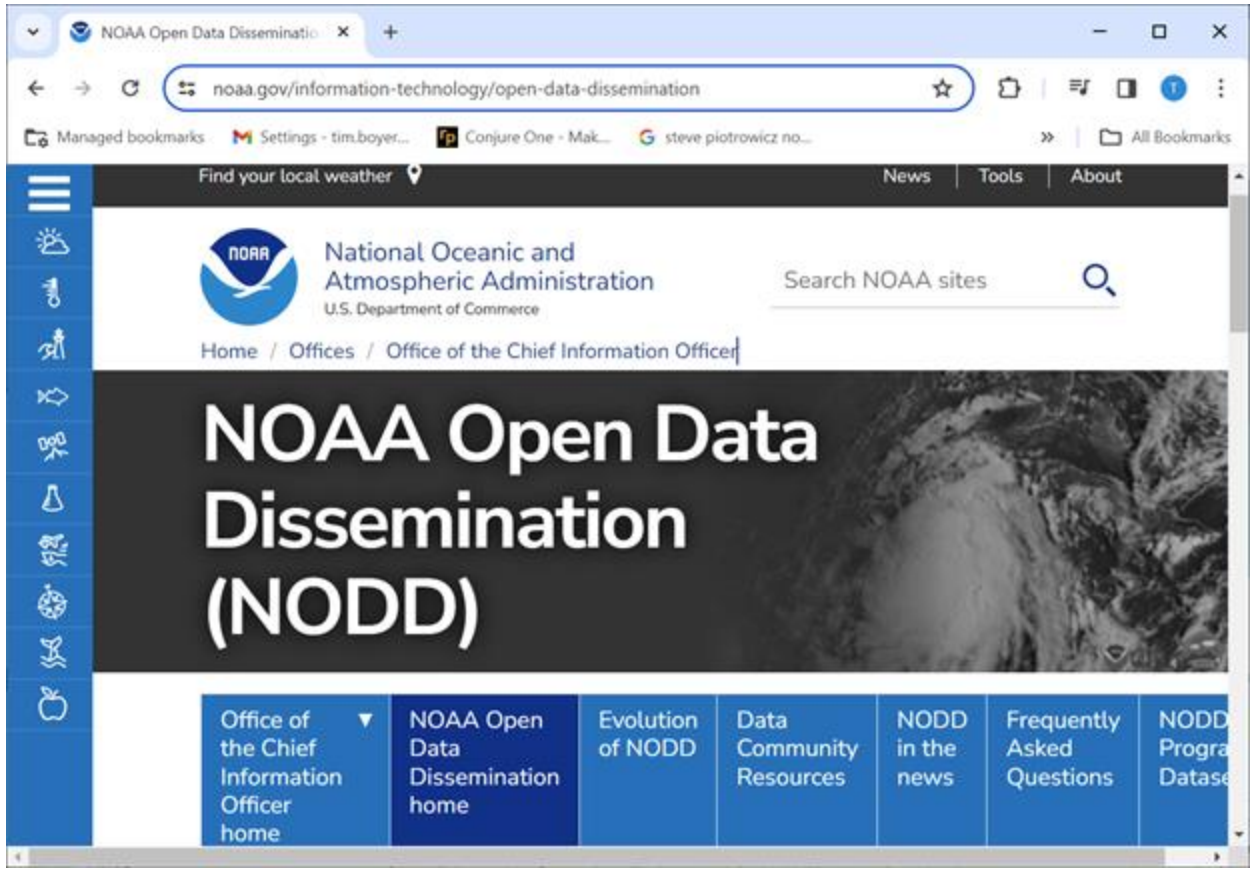
FULL & OPEN PUBLIC ACCESS

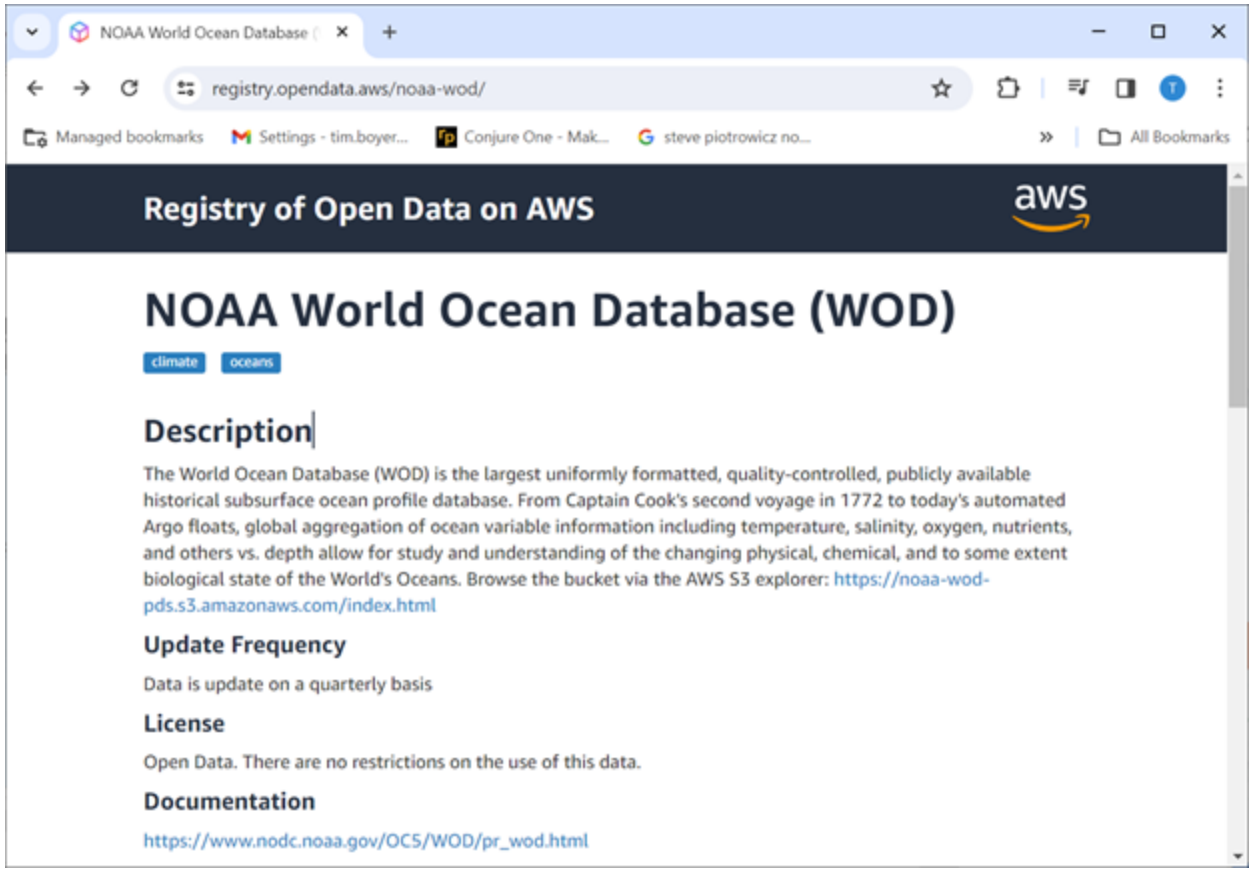
Supports Federal Data Strategy & Evidence Act Requirements
No egress costs

ENABLES & ENGAGES USERS

Catalyzes innovation in environmental services

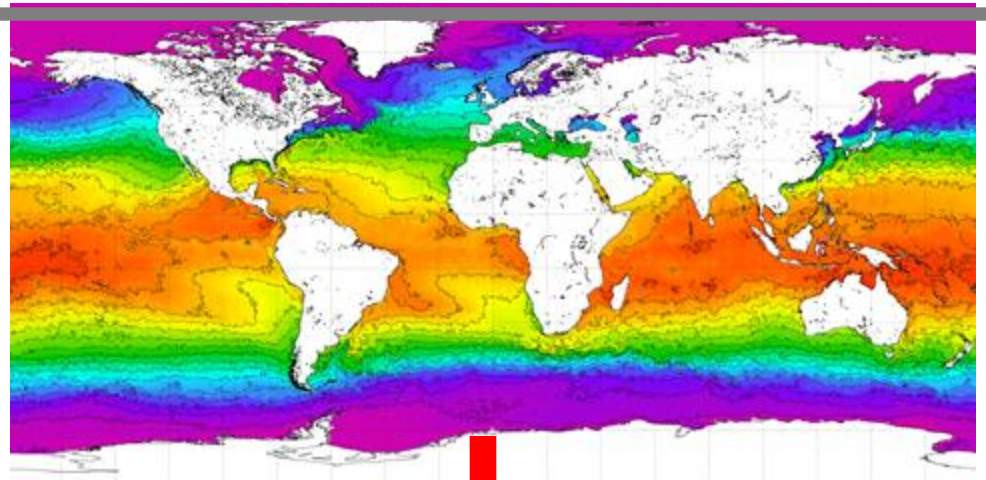
Enables interoperability



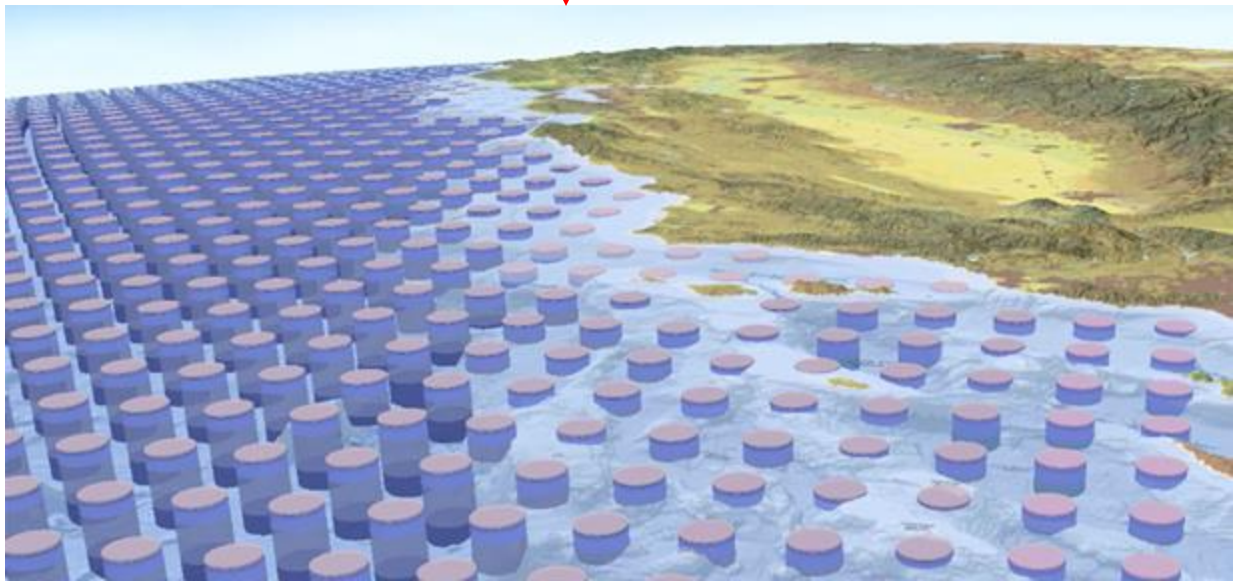


NOAA Open Data Dissemination (NODD) in partnership with cloud providers facilitates the open access to important environmental data sets such as the World Ocean Database

Public-private collaboration producing information for understanding and monitoring Ocean Ecosystems



World Ocean Atlas: NCEI gridded product based on World Ocean Database



Esri Ecological Marine Units: Value added product for understanding marine ecosystems. Public Private partnership between US Geological Survey and Esri

Summary

- **in situ oceanographic observations have been and will be into the foreseeable future more sparse than are necessary to fully understand and monitor critical essential ocean and climate variables. Partnerships with private business and organizations with an interest in the ocean can support and enhance global ocean observing systems**

- **Public-private partnerships are critical to develop and maintain a supply of reliable scientific instrumentation/platforms for ocean observations**

- **Current volume and demand for equitable access to oceanographic data can be facilitated through public-private partnerships**

- **Data from public and private sources best serves the community through free and open access. Quality assurance, metadata standards, formatting for best utilization should take into consideration best practices established by the community (public) as well as considerations of operability within available dissemination and analysis tools (private)**

- **Analysis tools and products from the private sector can bridge the gap between the observation/research community and decision makers/general public.**