

QARTOD, QA, Best Practices



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**National Water Quality Monitoring Council Web Meeting
June 11, 2018**

QARTOD Manuals, Manual Maintenance

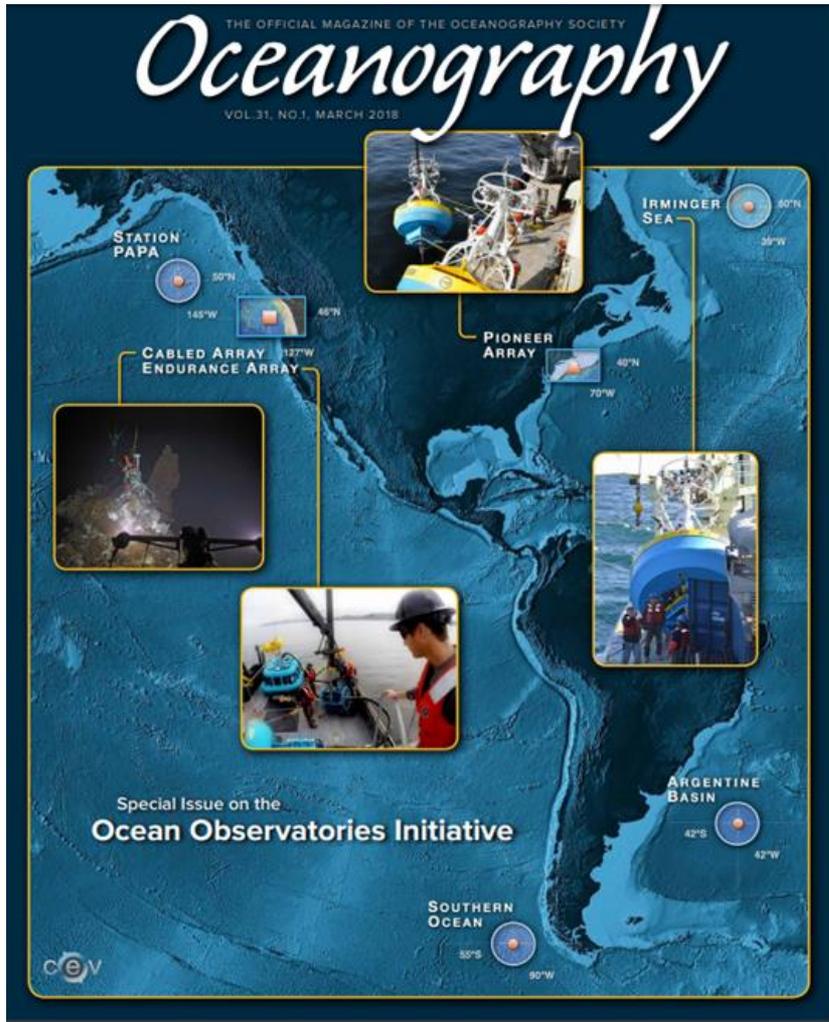


QARTOD Process



Adjudication matrix throughout

Who else is using QARTOD? 1



NSF Ocean Observatories Initiative

“**Data Quality Control Processes** - Oceanographic and engineering data throughout the OOI system are reviewed through manual (human in the loop) and automated quality control procedures. The overall goal is to ensure that the data and metadata delivered by the OOI meet community data quality standards. These standards were designed with the goal of meeting the Integrated Ocean Observing System (IOOS) Quality Assurance of Real Time Ocean Data (QARTOD) standards.”

Smith, L.M., J.A. Barth, D.S. Kelley, A. Plueddemann, I. Rodero, G.A. Ulses, M.F. Vardaro, and R. Weller. 2018. *The Ocean Observatories Initiative*. *Oceanography* 31(1):16–35, <https://doi.org/10.5670/oceanog.2018.105>.

After nearly **10 years** and **expenses of US\$386 million**, in June 2016, NSF announced that most OOI data were flowing in real time from more than **900 sensors at the 7 sites**. The **annual budget is approximately \$55 million**. Witze, Alexandra (2016-06-09). "US ocean-observing project launches at last". *Nature*. 534 (7606): 159–160. Bibcode:2016Natur.534..159W. doi:10.1038/534159a

Who else is using QARTOD? 2

U.S. Private Sector & University Classroom

- Jay Titlow / **Weatherflow** – Using wind tests for QC for their Caribbean installations
- Jeff Hansen / **WaveForce Technologies** - “We’ve applied QARTOD rules when rebuilding the USACE/FRF database.”
- Bruce Magnell / **Woods Hole Group** – “The QA/QC procedure implemented by WHG, in part follows QARTOD recommendations.”
- **Rutgers University** - Masters of Integrated Ocean Observing, a software/QA/QC boot camp informed by QARTOD.

International Use, Government & Private Sector

- British Oceanographic Data Centre - Global Sea Level Observing System (**GLOSS**) Quality Control Manual
- The **Southern Ocean Time Series** (SOTS) - Quality Assessment and Control Report
- **OMC International**, Australia - QC optimised for operational under keel clearance management purposes
- Mark Calverley / **Fugro UK** – “We've been advocating QARTOD in the oil and gas sector for quite a few years...”
- Carlos Garcia /SIMCosta – Implementing QARTOD in SIMCosta, the **Brazilian Coastal Monitoring System**.
- Christian Senet / **Bundesamt fuer Seeschifffahrt und Hydrographie** - “Have started to implement QARTOD wave QC testing.”

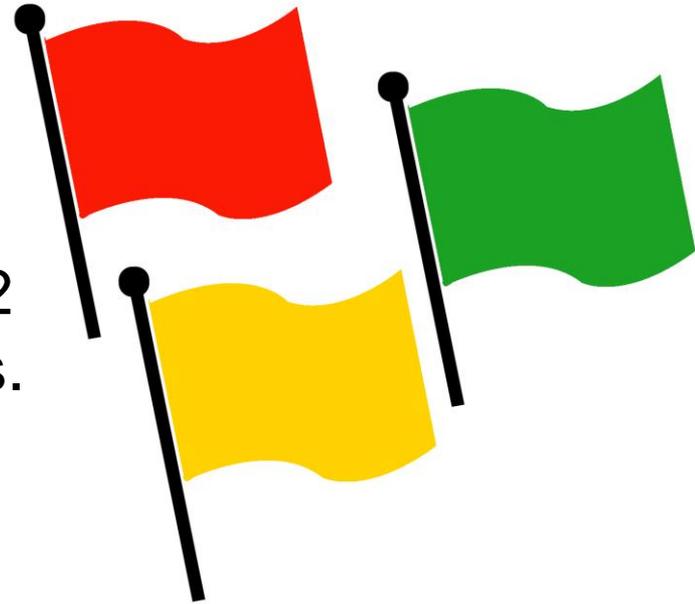
FY 2019 Tentative QARTOD Plans

- One new manual, perhaps pH
- Update two manuals
- Shift a bit toward QA, measurement uncertainty examples
- Continued international interaction
- Support for implementation, i.e. OMAO use aboard NOAA vessels, data flagging standards, others?

QC Data Flagging Implementation

Known

- Every real-time observation distributed to the ocean community must be accompanied by a quality descriptor.
- QARTOD (and IOC) suggest a Tier 2 flag for more detailed QC test results.



Unknown

- How standardized should RAs strive to be?
- How to meet NCEI data input constraints?
- How to meet User desires for various levels of QC?

Known issues:

Data , data flag

or

Data

Data flag

- Challenges (from Axiom, January webinar):
 - Transmitting quality flags around
 - Interface for displaying and communicating quality checks
 - Duplication of effort surrounding check implementations
 - Are flags served alongside the data? SOS/ERDDAP? NCEI?
 - Setting thresholds for third party stations
 - Documenting check configuration

Quality Assurance



- **Hard to discuss QA without considering QC, standards, best practices, etc.**
- **Hard to clearly separate these terms!**

Who We Are



Optimising and Enhancing the Integrated
Atlantic Ocean Observing Systems



The Plan

We plan to create a document that:

- Focuses on QA
- Establishes a framework for implementation
- Meets the needs of our four organizations and others
- Provides an example of an uncertainty calculation
- Addresses QC, standards, and best practices for Essential Ocean Variables and U.S. IOOS Core Variables, as applicable

Quality Assurance

- ISO standards to quantify data quality and uncertainty
- Gaps in current practices / methods
- General QA guidance topics
 - Instrument Selection
 - Manufacturer Guidance and User Manual
 - Calibration Essentials
 - Sensor Maintenance Procedures
 - Biofouling/Corrosion Strategies
 - Pre- and Post-Deployment Procedures
 - Record-keeping Strategies
 - Levels of Best Practices

What is a Best Practice?

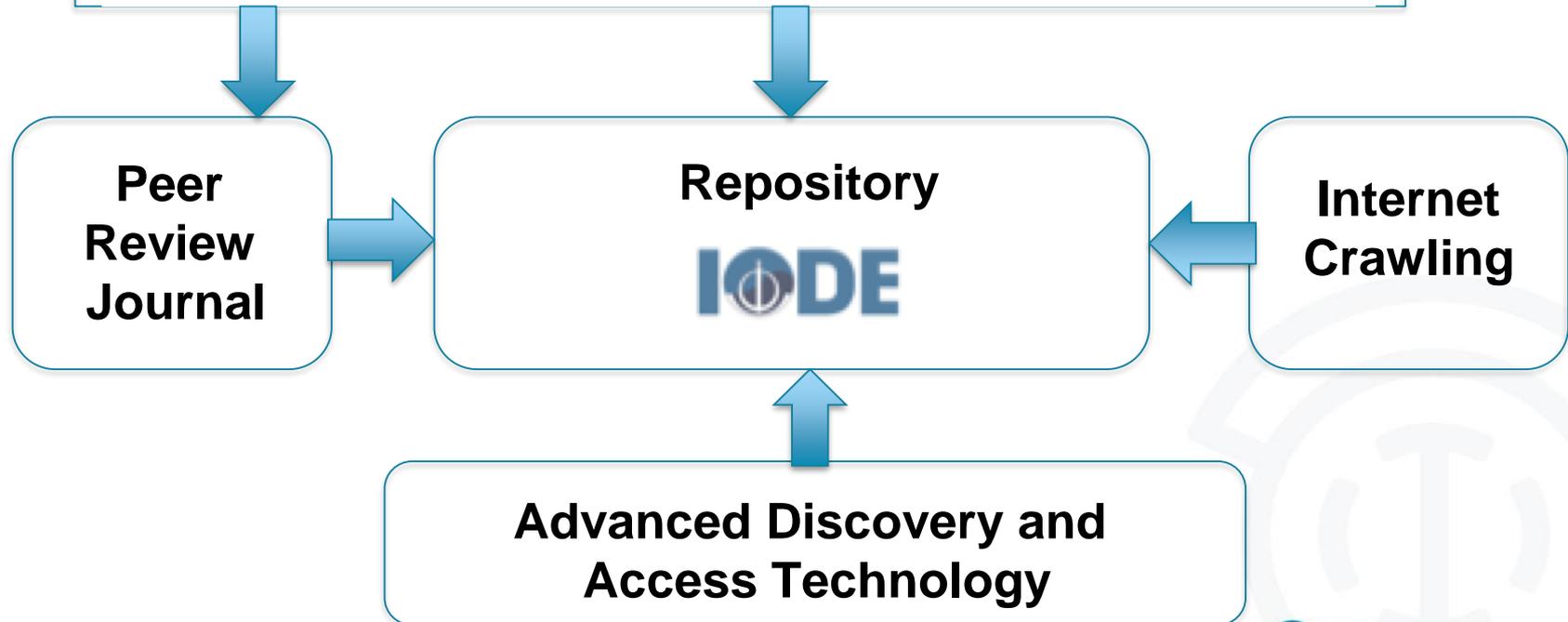
“A community best practice is a methodology that has repeatedly produced superior results relative to other methodologies with the same objective.

To be fully elevated to a best practice, a promising method needs to be adopted and employed by multiple organizations.”



Global Best Practice System

Participating Organizations and Programs



Underlying Assumptions

- Open access from central OBP Repository
- Multiple coordinated locations for documents possible
- Content owned by BP developer
- Range of documents accepted by OBP Repository: best practices, standard operating procedures, manuals, etc.
- Journal articles: method (description) papers with corresponding entry of full document in Repository
- Peer review optional but may be accepted in lieu of journal/expert review for large projects
- Provision for community dialogue (journal, Repository)

Best Practice System

- Expand IODE repository capabilities
 - Expand Permanent IDs through DOI, ORCHID
 - Implement Natural Language search drawing on marine vocabularies; compatibility with machine readability
 - Internet Crawling as inputs of additional practices
- Alignment with FAIR principles and open operations
- Introduction of community peer review including Research Topic in Frontiers in Marine Science



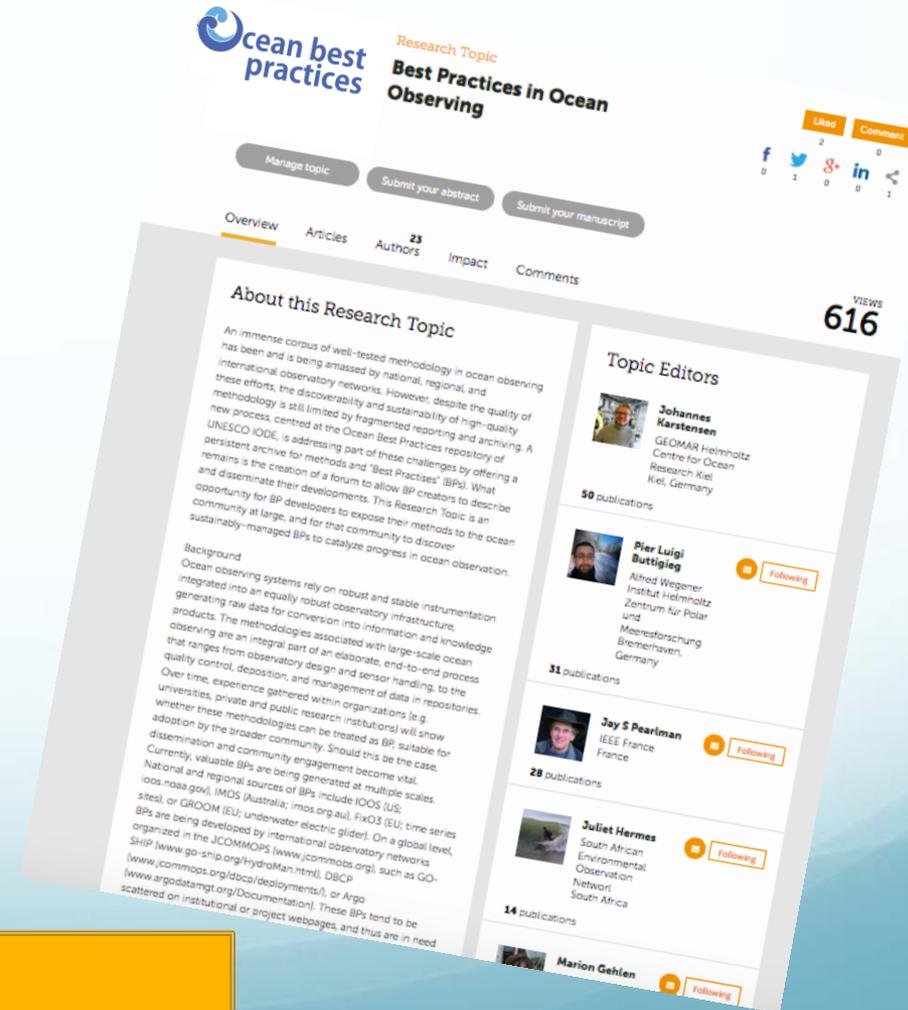
frontiers
in Marine Science

“Research Topic”

Best Practices in Ocean Observing



- Well recognized journal
- Open Access
- Affordable
- Linkable to BP repository
- Provision of a forum opportunity for dialogue
- Broad participation in BP reviews
- **1st submission deadline: 15. April 2018**
- **2nd submission deadline: 15. September 2018**



Ocean best practices Research Topic **Best Practices in Ocean Observing**

Manage topic Submit your abstract Submit your manuscript

Overview Articles 23 Authors Impact Comments

About this Research Topic

An immense corpus of well-tested methodology in ocean observing has been and is being amassed by national, regional, and international observatory networks. However, despite the quality of these efforts, the discoverability and sustainability of high-quality methodology is still limited by fragmented reporting and archiving. A new process, centred at the Ocean Best Practices repository of UNESCO IODE, is addressing part of these challenges by offering a persistent archive for methods and “Best Practices” (BPs). What remains is the creation of a forum to allow BP creators to describe and disseminate their developments. This Research Topic is an opportunity for BP developers to expose their methods to the ocean community at large, and for that community to discover sustainably-managed BPs to catalyze progress in ocean observation.

Background
Ocean observing systems rely on robust and stable instrumentation integrated into an equally robust observatory infrastructure, generating raw data for conversion into information and knowledge products. The methodologies associated with large-scale ocean observing are an integral part of an elaborate, end-to-end process that ranges from observatory design and sensor handling, to the quality control, deployment, and management of data in repositories. Over time, experience gathered within organizations (e.g. universities, private and public research institutions) will show whether these methodologies can be treated as BP, suitable for dissemination and broader community. Should this be the case, currently, valuable BPs are being generated at multiple scales. National and regional sources of BPs include IOOS (US: ioos.noaa.gov), IMOS (Australia: imos.org.au), FixOS (EU: time series sites), or GROOM (EU: underwater electric glider). On a global level, BPs are being developed by international observatory networks organized in the JCOMMOPS (www.jcommops.org), such as GO-SHIP (www.go-ship.org/HydroMan.html), DBCP (www.argodatamgt.org/Dbcp/deployments/), or Argo (www.argodatamgt.org/Documentation). These BPs tend to be scattered on institutional or project webpages, and thus are in need

Topic Editors

Johannes Karstensen
GÉOMAR Helmholtz Centre for Ocean Research Kiel, Germany
50 publications

Pier Luigi Buttigieg Following
Alfred Wegener Institut Helmholtz Zentrum für Polar und Meeresforschung Bremerhaven, Germany
31 publications

Jay S Pearlman Following
IEEE France France
28 publications

Juliet Hermes Following
South African Environmental Observation Network South Africa
14 publications

Marion Gehlen Following

Views 616

First newsletter!

Useful contacts



GOOD, BETTER AND BEST

A Newsletter for Practices of Ocean Observing & Applications

Issue 1: April 2018

WELCOME TO THE FIRST ISSUE!

This monthly newsletter shares information about new developments in Ocean Best Practices and the [Ocean Best Practice System \(OBP-S\)](#).

So, what is a best practice? We have been debating this a long time and last year, a workshop sponsored by the Best Practice Working Group settled on a definition:

"A community best practice is a methodology that has repeatedly produced superior results relative to other methodologies with the same objective. To be fully elevated to a best practice, a promising method will have been adopted and employed by multiple organizations."

Why do we need or use best practices? They help document methods for making measurements, archiving data and supporting applications. Best practices improve the reproducibility of science research, improve interoperability across disciplines and support community expansion for training and capacity building.

How is the OBP-S progressing?

Community outreach has played a big role in its requirements and implementation. A workshop of experts was held at IOC, Paris, in November 2017 that produced many excellent recommendations. The results are given in [proceedings](#):

- ✓ The BPWG has also achieved milestones in the last two months. The Repository has grown to 250 best practices and we are halfway to our long-term goal of 500.
- ✓ A pilot for an upgraded user portal has been created. It will start beta testing soon.
- ✓ A semantic-based search and document tagging capability has been developed and will be expanded using natural language processes.
- ✓ The OBP Repository started issuing DOIs in March to improve discoverability on the web
- ✓ A research Topic, [Best Practices in Ocean Observing](#), in the *Frontiers in Marine Sciences* is receiving papers for peer review and publication. Four abstracts were received last month.

<https://www.oceanbestpractices.net>

obpcommunity@oceanbestpractices.org

OUR MISSION

Create and implement a comprehensive, sustainable, easy to use Best Practices system for the ocean research and applications community. This includes:

- A sustained, open access, and internationally recognized repository with advanced indexing and search technology, also featuring DOI-based document IDs
- A peer-reviewed Best Practices in Ocean Observing Research Topic in *Frontiers in Marine Science*
- Community support for training and capacity building

OUR TEAM

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LINKS

[BPWG AND OBP-S](#)
[Frontiers Research Topic](#)

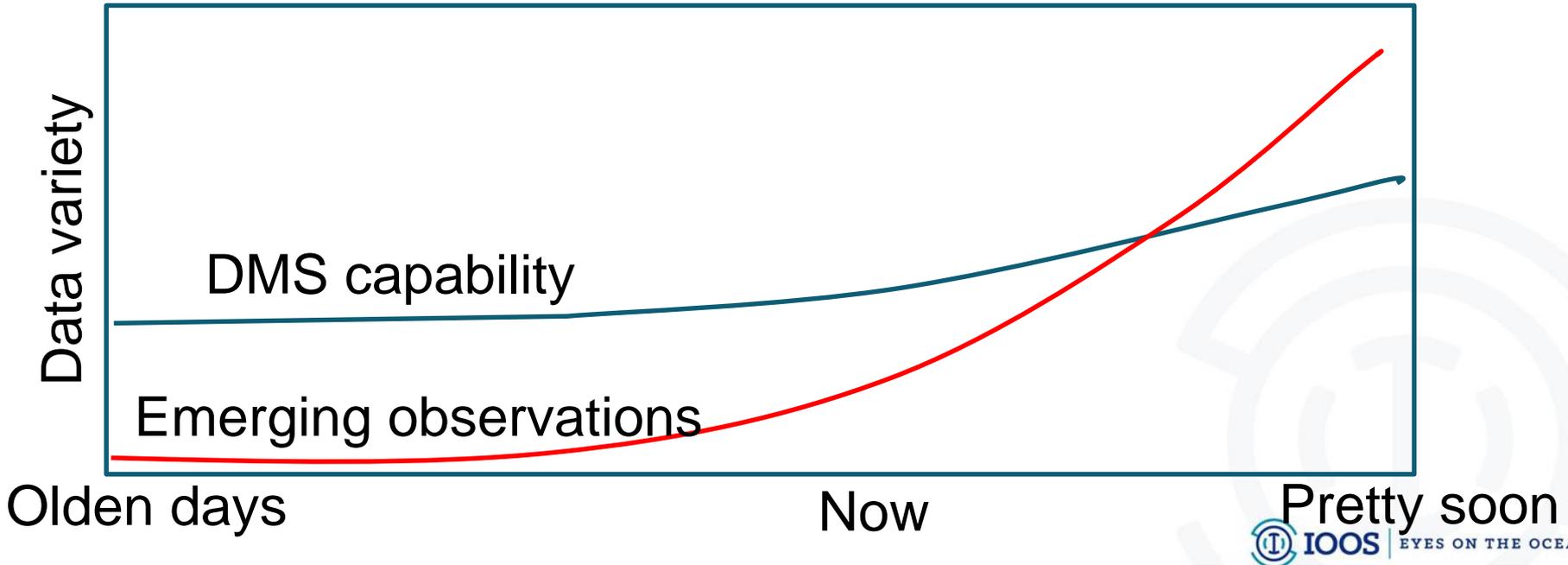
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Future Data Management Services RT QC – Thoughts?



- Technology is making it cheaper & easier for more observers to obtain new types of data
- Existing DMS can't absorb it – more specialized DMS entities emerge
- Decentralization is a challenge, but QC closer to data source is a good thing
- Big DMS must guide emerging DMS standards & requirements



Summary

- **QARTOD is a mature, broadly accepted project.**
- **Quality Assurance standards and measurement uncertainty estimates are needed.**
- **Ocean Best Practices is worthy of your consideration.**
- **How can we prepare ourselves for the next decade of RT QC?**

Thanks!

