QARTOD Status, Best Practices

Mark Bushnell, U.S. IOOS
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QARTOD Manuals, Manual Maintenance

Manual for Real-Time Quality Control of Dissolved Oxygen Observations

Manual for Real-Time Quality Control of In-Situ Current Observations

Manual for Real-Time Quality Control of Water Level Data

Manual for Real-Time Quality Control of In-Situ Temperature and Salinity Data

Manual for Real-Time Quality Control of Wind Data

Manual for Real-Time Quality Control of Ocean Optics Data

Manual for Real-Time Quality Control of Dissolved Nutrients Observations

Manual for Real-Time Quality Control of Phytoplankton Data

Manual for Real-Time Quality Control of Passive Acoustics Data

Manual for Quality Control of Temperature and Salinity Data Observations from Gliders

QARTOD Project Plan
Accomplishments for 2012-2016 and Update for 2017-2021
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.


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.

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?
**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
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

Ocean best practices
Global Best Practice System

Participating Organizations and Programs

- ODIP
- AtlantOS
- JERICO-NEXT
- FixO
- IMOS
- Ocean Crawler
- MARUM
- National Oceanography Centre
- SOCIOT
- Biscarrosse Island Coastal Observing and Forecasting System
- IFREMER
- IOODA
- jcomm
- WMO
- GCOOS
- IOOS
- ICES
- CIEM
- IODE
- WOCE
- OCEAN Crawler

Peer Review Journal
Repository
Internet Crawling

Advanced Discovery and Access Technology
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
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
• QARTOD is broadly accepted, and implementation partnerships might be more widely explored.
• Ocean Best Practices is worthy of your consideration.
• How can we prepare ourselves for the next decade of RT QC?

Thanks!