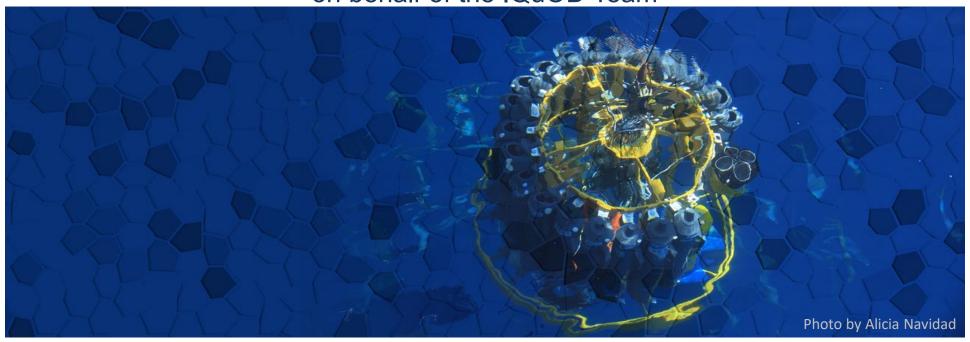
International Quality-controlled Ocean Database (IQuOD)

Lijing Cheng, Guilherme Castelao, Rebecca Cowley, on behalf of the IQuOD Team







IQuOD "Mission Statement"

To maximize the quality, consistency and completeness of the long-term global subsurface ocean temperature database

I **O** IQuOD includes intelligent metadata for XBTs and has uncertainties assigned to each individual temperature observation. Some uncertainties have been assigned to depth and salinity.

u

IQuOD will soon include Automated QC flags from the IQuOD community A-QC benchmarking tests. Many duplicates have been identified in the WOD/IQuOD and have been removed.



The power of IQuOD: Ability to pull together the expertise from the international research community (producers/users) and to focus that combined effort into a single "best" dataset.

Happy 10th Birthday to IQuOD!

- Inaugural meeting was June 2013 in Hobart, Australia.
- Agreed aim was to work towards:

2013

A high-quality historical subsurface ocean temperature (salinity) global dataset, along with the most complete metadata information and formal error measurements for climate research needs.



2023

Tokyo, Japan, USA, 2016

Five other workshops...



Silver Spring, USA, 2014



Hamburg, Germany, 2014

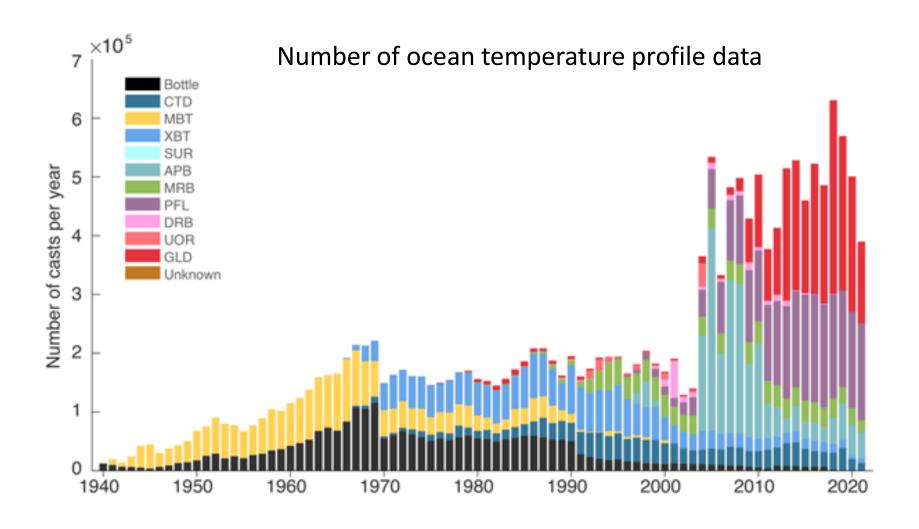


Oostende, Belgium, 2018

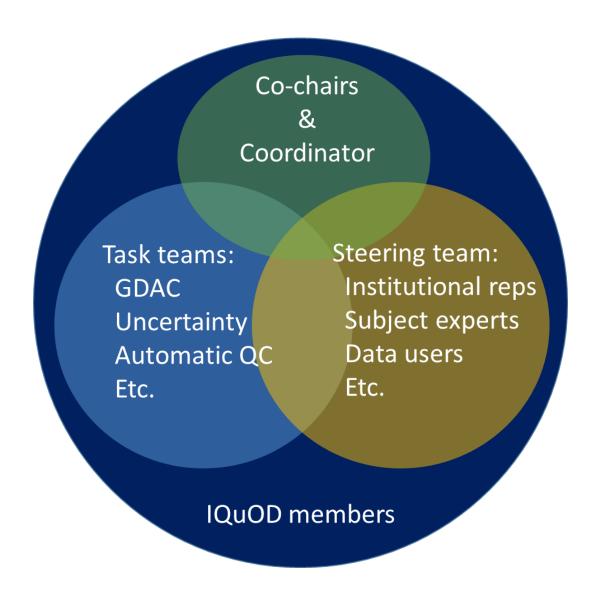


Brest, France, 2019

Today's big challenge: 'Climate quality' ocean database



Current IQuOD structure



- Co-chairs since May:
 - Gui Castelao;
 - Lijing Cheng.

- Coordinator:
 - Rebecca Cowley

 Vote to formalise Gui and Lijing's appointments in July 2023.

- The community agreed best practice for benchmarking temperature profiles AutoQC
- IQuOD AutoQC flag



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SPECIALTY SECTION

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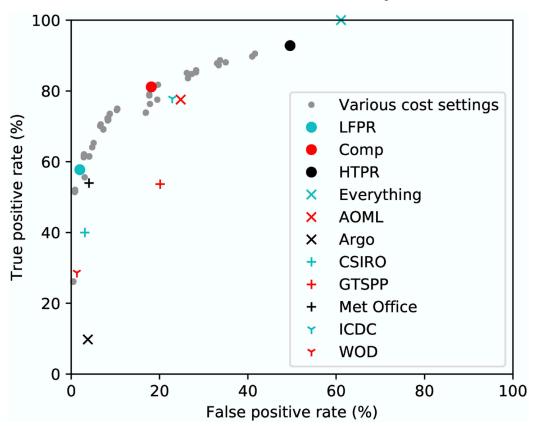
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Benchmarking of automatic quality control checks for ocean temperature profiles and recommendations for optimal sets

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Evaluation of different QC systems



- Assign instrumental uncertainty to each individual temperature measurement
- The provision of a consistent set of observation uncertainties will provide a more complete understanding of historical ocean observations used to examine the changing environment.

International Quality-Controlled Ocean Database (IQuOD) v0.1: The Temperature Uncertainty Specification

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Cowley et al. 2021

TABLE 2 | IQuOD v0.1 uncertainty assignments.

Instrument type	Temperature (°C)	Depth/Pressure
Bottle/Reversing thermometer	0.02	5%
CTD uncalibrated and calibration status unknown	0.01	0.08%
CTD calibrated	0.002	0.015%
CTD animal mounted	0.005	-
CTD towed, UOR	0.01	-
OBT	0.05	-
Profiling Drifting Buoy	0.01	N/A
Glider	0.002	-
MBT	0.3	3%
MBT deployed from Soviet Union flagged ships	0.1	3%
MicroBT	0.002	-
Moored buoy	0.3	-
Profiling floats (pre-Argo)	0.005	-
Profiling floats (Argo***)	0.002	2.4 dbar
STD	0.002	5 m
XBT manufacturers other than Sippican and TSK and unknown manufacturer/type	0.2	≤230 m: 4.6 m; >230 m: 2%
XBT deployed from submarines or Tsurumi-Seiki Co (TSK) manufacturer	0.15	≤230 m: 4.6 m; >230 m: 2%
XBT Sippican manufacturer	0.1	≤230 m: 4.6 m; >230 m: 2%
XCTD (pre-1998)	0.06	4%
XCTD (post-1998)	0.02	2%

***Argo profiling float data provides a standard error for each measurement for delayedmode (quality controlled) cycles. This information was used for the IQuOD uncertainty value when available. The largest standard error for a variable for a cycle was applied to each measurement of that variable in that cycle. -, Pending assignment. N/A, Not applicable. IQuOD uncertainty assignment

Assign XBT probe type using a machine learning approach, which is often missing.

Diagram of machine learning pipeline for processing XBT profiles

SEPTEMBER 2022 HADDAD ET AL. 1367

Improved Infilling of Missing Metadata from Expendable Bathythermographs (XBTs) Using Multiple Machine Learning Methods

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(Manuscript received 6 September 2021, in final form 4 May 2022)

ABSTRACT: Historical in situ ocean temperature profile measurements are important for a wide range of ocean and climate research activities. A large proportion of the profile observations have been recorded using expendable bathythermographs (XBTs), and required bias corrections for use in climate change studies. It is generally accepted that the bias, and therefore bias correction, depends on the type of XBT used. However, poor historical metadata collection practices mean the XBT probe type information is often missing, for 59% of profiles between 1967 and 2000, limiting the development of reliable bias corrections. We develop a process of estimating missing instrument type metadata (the combination of both model and manufacturer) systematically, constructing a machine learning pipeline based on thorough data exploration to inform these choices. The predicted instrument type, where missing, will facilitate improved XBT bias corrections. The new approach improves the accuracy of the XBT type classification compared to previous approaches from a recall value of 0.75–0.94. We also develop an approach to account for the uncertainty associated with metadata assignments using ensembles of decision trees, which could feed into an ensemble approach to creating ocean temperature datasets. We describe the challenges arising from the nature of the dataset in applying standard machine learning techniques to the problem. We have implemented this in a portable, reproducible way using standard data science tools, with a view to these techniques being applied to other similar problems in climate science.

KEYWORDS: Ocean; Data quality control; Profilers, oceanic; Software; Classification; Data science; Decision trees; Machine learning

Select labelled Unlabelled WOD data Preprocess Component Key data data Processing Intermediate Labelled Step data **Project** Input data Train/validation Select Test data validation data Cross-validatio Resample n train/test fold equally per selection Predict single classifier CV Balanced training training Add imeta Instrument type fallback classifications Train ML algorithm Classifier Select max Trained probabilities probability ensemble classifier from votes Save Load trained Predict single state from trained classifier state to file Algorithm Evaluate accuracy metrics Classifier state file metrics (for each in ensemble)

● IQuOD-v1 online, publicly available through NOAA/NCEI service



International Quality-controlled Ocean Database (IQuOD) version 0.1 - aggregated and community quality controlled ocean profile data 1772-2018 (NCEI Accession 0170893)



Show more...

This dataset includes subsurface ocean profiles of temperature, salinity, oxygen, nutrients, ocean tracers, optics, and biology (chlorophyll, plankton) taken from 1772 to 2018 in the global ocean using bottles, CTD, XBT, MBT, profiling floats, moored buoys, ice drifting buoys, gliders, towed profilers, and instrumented pinnipeds. This dataset was prepared at NCEI in CF compliant netCDF ragged array format under the direction of the International Quality-controlled Ocean Database (IQuOD) project. The IQuOD effort is being organized by the oceanographic community, and includes experts in data quality and management, climate modelers and the broader climate-related community. The primary focus of IQuOD is to produce and freely distribute the

Dataset Citation

Dataset Identifiers
ISO 19115-2 Metadata

Access Time & Location Documentation Description Credit Keywords Constraints Lineage

Download Data

HTTPS (download)
Navigate directly to the URL for data access and direct download.

FTP (download)
These data are available through the File Transfer Protocol (FTP). FTP is no longer supported by most internet browsers. You may copy and paste the FTP link to the data into an FTP client (e.g., FileZilla or WinSCP).

IQuOD activities in 1-2 years

- 1 Publish a data description/evaluation paper for next release of IQuOD dataset, there will be a regular update of IQuOD data (every 1-2 years)
- ② Develop new data processing and data QC techniques, including bias corrections (MBT, bottle, marine mammal data); Expert-QC; Duplicate check; code optimization, and machine-learning approach application.
- (3) Improve uncertainty definition/quantification, including instrumental error and representative error.
- 4 Increase outreach and international collaboration, e.g. OTGA.
- **⑤** Pilot activity for salinity.
- **6** Reframe IQuOD steering group.

Thanks!

IQuOD is an international group bringing together worldwide researchers working to improve ocean temperature and salinity data quality, which could support various applications from synopsis to climate scales.

Website:

www.iquod.org

Bibliography:

https://scholar.google.com/citations?user=qYD 0r8AAAAJ&hl

Also have a publication collection at Ocean Best Practices:

http://repository.oceanbestpractices.org/handle/11329/1590

Github:

https://github.com/IQuOD



