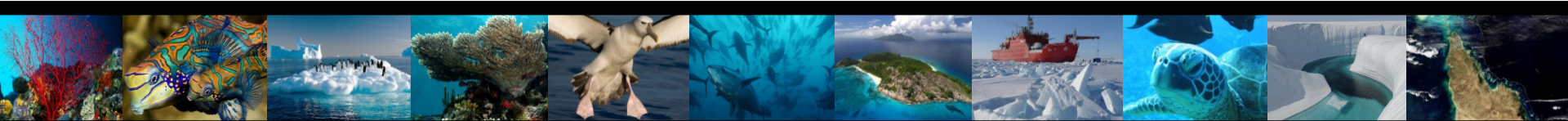


The IQuOD initiative

International **Q**uality-Controlled **O**cean **D**atabase



Janet Sprintall, Scripps Institution of Oceanography, U.C. San Diego
presenting on behalf of IQuOD SSC co-chairs

Rebecca Cowley, CSIRO Marine and Atmospheric Research, Australia

Catia Domingues, Antarctic Climate Ecosystem CRC, Australia

Current international partners: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Japan, Mexico, Norway, Russia, Senegal, Spain, South Africa, UK, USA.

What is IQuOD about?

Mission statement

IQuOD aims to produce, freely distribute and curate the highest quality, most complete and consistent global subsurface ocean temperature* profile database possible.

IQuOD will include intelligent metadata and assign an estimated uncertainty to each individual observation.

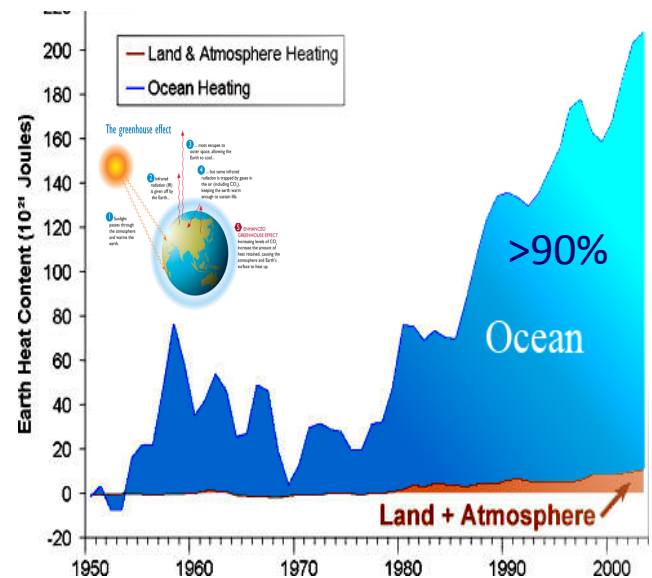
The power of IQuOD: Ability to pull together the expertise from the international research community (producers/users) and to focus that combined effort into a single “best” dataset.

Societal needs: Broad Spectrum of Users

Useful/actionable information on:

- How climate is changing (observations) and how it will change (predictions)
 - Regional impacts (socio-economic-environmental)
-
- Understanding climate variability and change (**Earth's energy balance, water cycle and sea level**) is the **most challenging application** of subsurface ocean temperature and salinity observations (*EOV or ECV*).
 - Modern changes in the context of past changes (e.g., mean trends, **extremes**)
 - Separate **anthropogenic drivers** from **natural climate modes of variability** (e.g., **ENSO, NAO, IOD, SAM, PDO, AMO**, etc).
 - Evaluate, constrain, initialize, assimilate into **numerical models** to investigate physical mechanisms and causes of **past/current changes**, and to **predict/project future changes**.

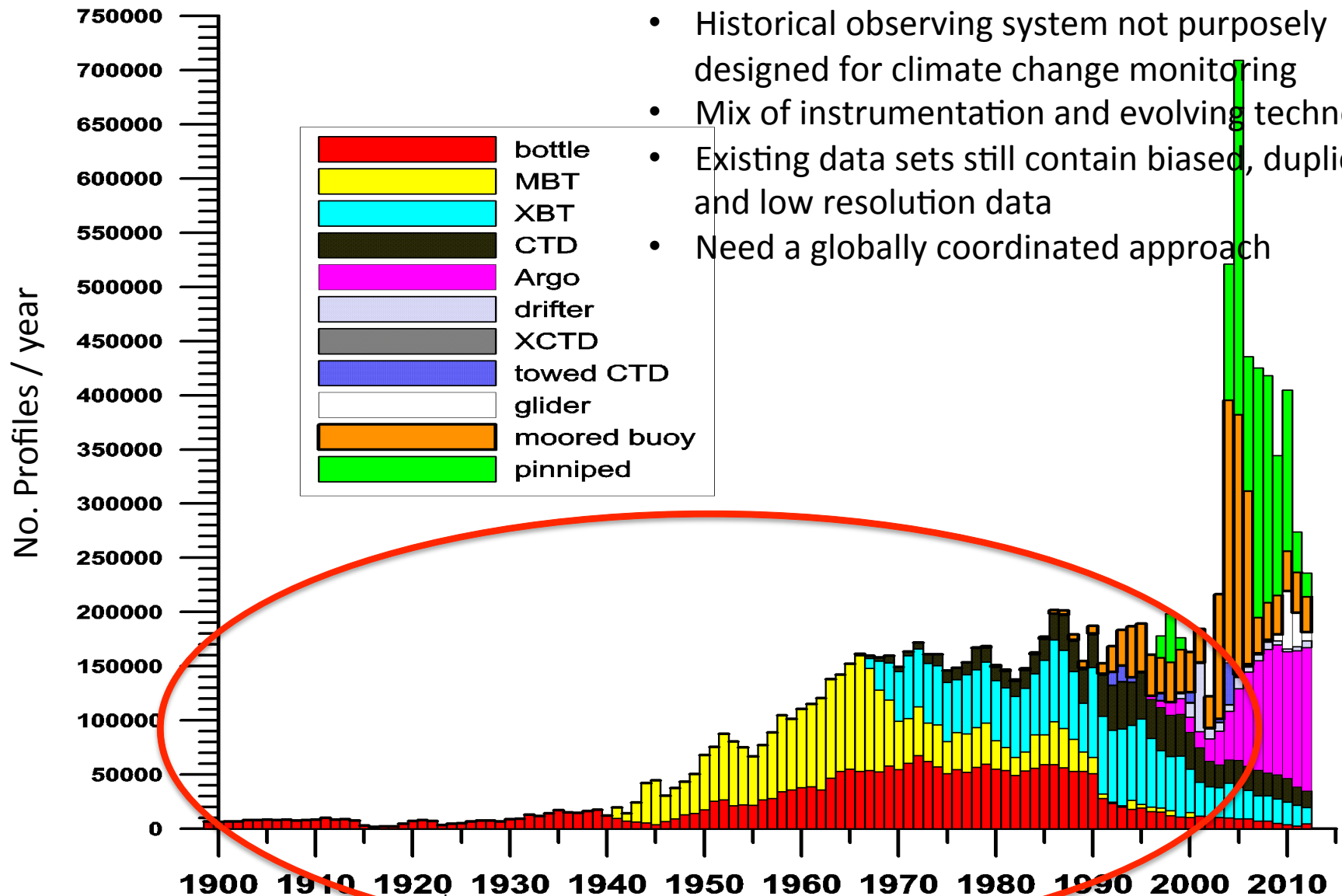
Earth's total heat content



Rhein et al. (2013)

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

- Millions of T profiles == \$\$ Tens of Billions!
- Historical observing system not purposely designed for climate change monitoring
- Mix of instrumentation and evolving technology
- Existing data sets still contain biased, duplicated and low resolution data
- Need a globally coordinated approach

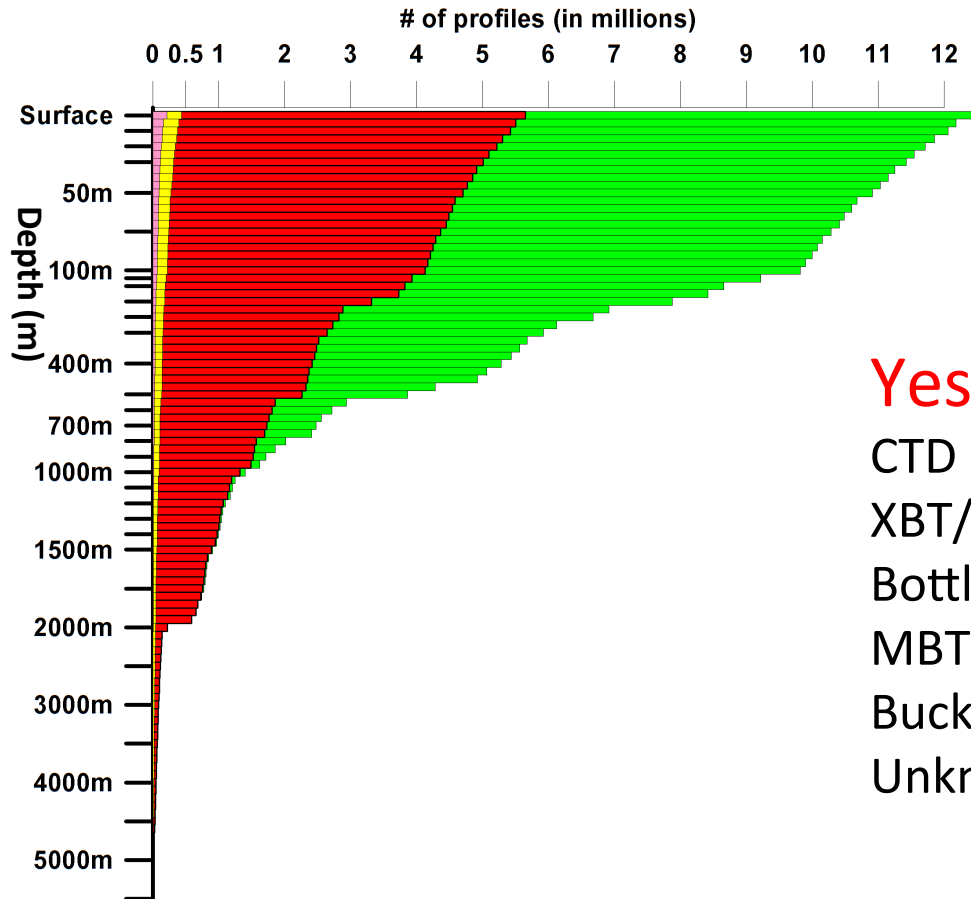


Courtesy of Tim Boyer, IQuOD 2nd Workshop, June 2014

Why focus on temperature?

Measurements vs. Depth WOD13

Courtesy of Tim Boyer, IQuOD 2nd Workshop, June 2014



Green – Temperature
Red – Salinity
Yellow – Silicate
Pink - Chlorophyll

Yes

CTD

XBT/XCTD

Bottle

MBT

Bucket

Unknown

No

Argo

Glider

Drifters

TSG

Maybe

Pinniped

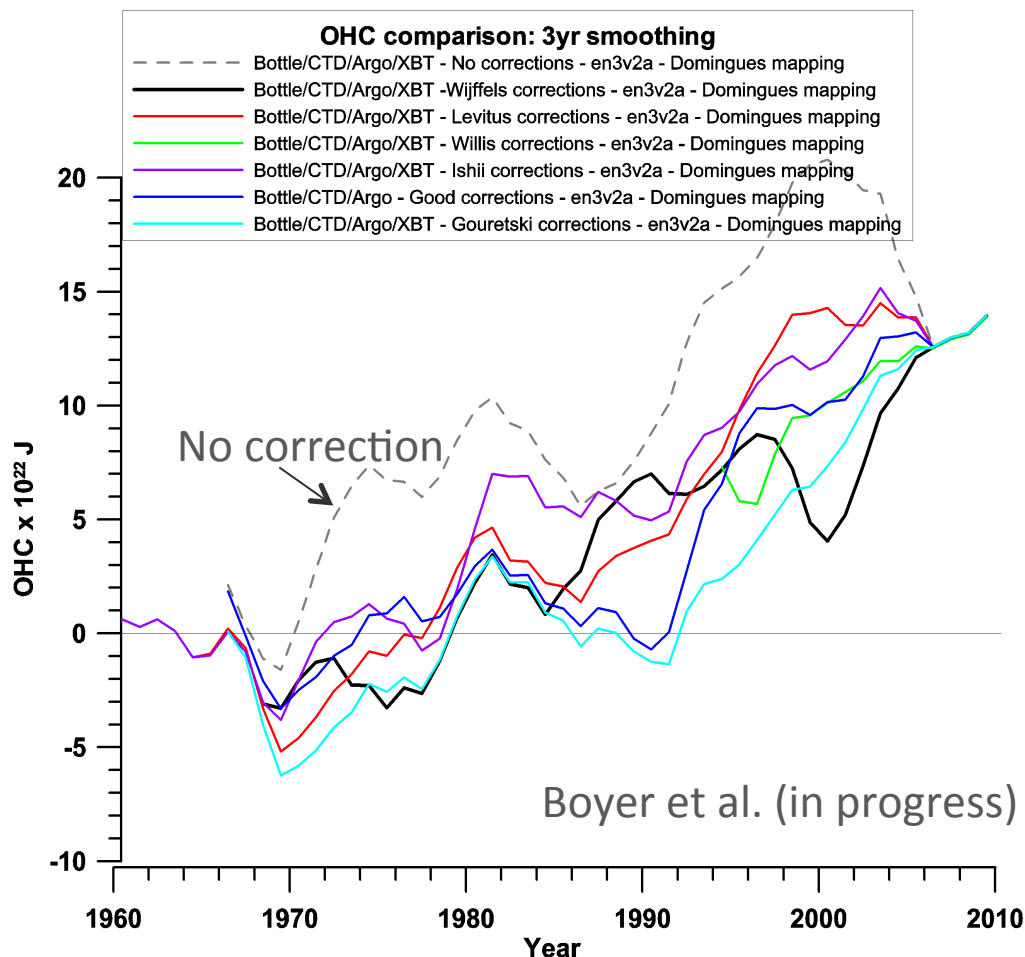
Moored buoy

Others?

Build on and augment existing QC efforts

Impact of time-dependent XBT bias corrections

Fall rate and other biases: small but systematic enough to affect OHC estimates



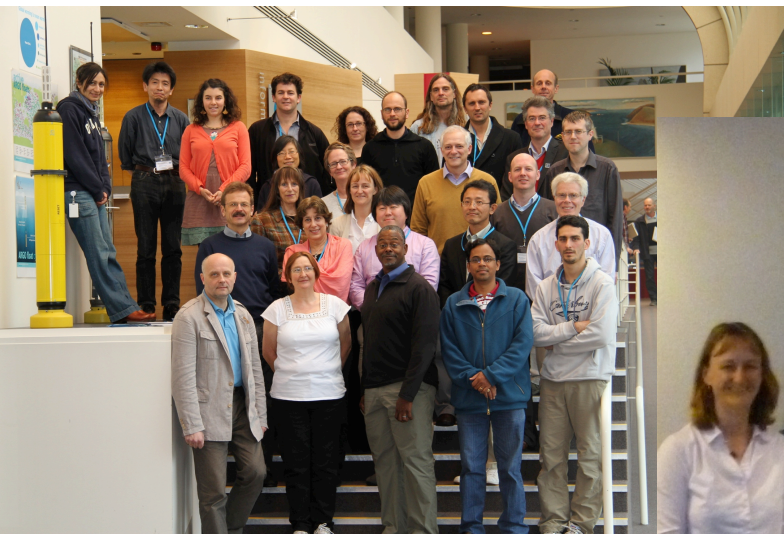
- OHC content estimates using different XBT corrections from various groups, but using Domingues et al (2007) mapping – extreme example!
- Why so many XBT corrections proposed?
- Can we improve the situation?

YES – By pooling resources and expertise into a single best practices IQuOD community effort!

Who will be involved?

International collaboration/cooperation is the key to success

- QC experts (automated/manual)
- Data management experts
- Historical/modern *in situ* instrumentation experts
- Regional oceanography experts
- Program managers
- Ocean Reanalyses experts (users)
- Climate model experts (users)



1st IQuOD Workshop,
Hobart, June 2013

2nd IQuOD Workshop, Silver Spring, June 2014



How will IQuOD work?

Co-Chairs: Catia Domingues, Rebecca Cowley

Steering committee

Tim Boyer, Ann Thresher, Simon Good, Matt Palmer, Susan Wijffels, Gustavo Goni, Janet Sprintall, Alison Macdonald, Toru Suzuki, Steve Diggs, Viktor Gouretski

Task Team 1
GDAC
(Tim Boyer)

Task Team 2
Auto QC
(Bec Cowley)

Task Team 3
Manual QC
(Ann Thresher)

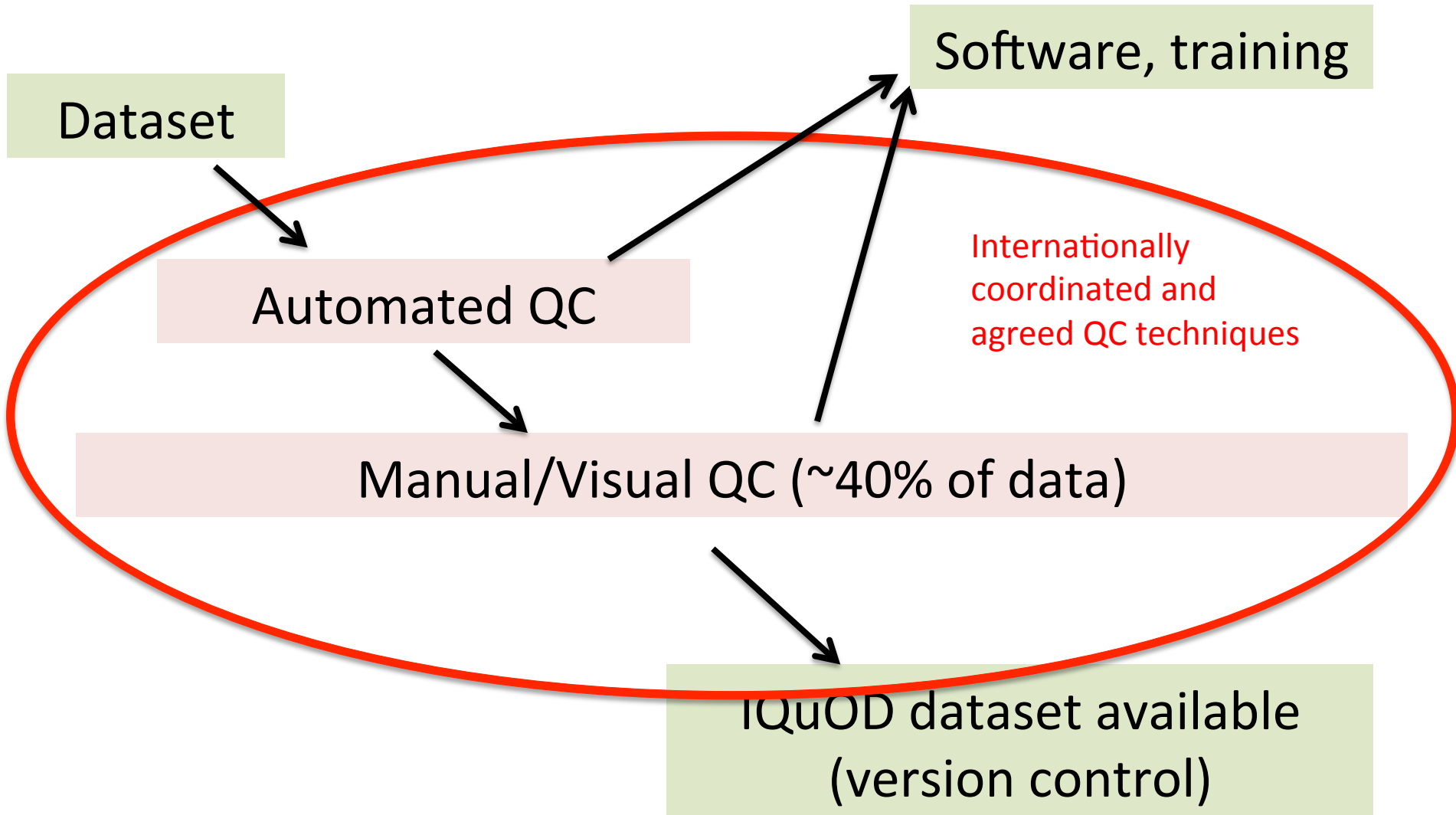
Task Team 4
Uncertainties/Formats
(Simon Good)

Task Team 5
Aggregation
(Catia Domingues)

Auto-QC benchmark testing has begun with encouraging results.

Manual QC group to hold workshops later this year to define visual QC methods

What makes IQuOD unique?



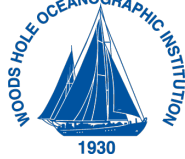
Summary

IQuOD will: Over the next 3-5 years provide a unique ocean temperature profile dataset essential for climate application and model validation

Outcomes:

- **Development & implementation of international standard practices for automated & manual quality control of historical (and modern) temperature data.**
- **Free and easy access to historical data, (intelligent) metadata and uncertainties.**
- Have held Town Halls at OS2014; developing a website and funding strategies – looking for community feedback
- **Numerous downstream applications of the IQUOD dataset for Earth system/climate-related research and services of great societal benefit,** including future CLIVAR (*e.g. Science Plan notes “a key strategy is to assess the adequacy of historical data records and the existing ocean observing system, to sustain and evolve critical observing capabilities”*) and WCRP (*Grand Challenge on Sea Level Rise and Regional Impacts*) activities.
- **Template for future efforts:** e.g. to improve the quality, consistency and completeness of the historical salinity observations etc.

Thank you



Coriolis



TOHOKU
UNIVERSITY



ANTARCTIC CLIMATE
& ECOSYSTEMS CRC



Instituto Mediterraneo
de Estudios Avanzados



CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS
UTB
Universitat de les
Illes Balears



Australian Government
Bureau of Meteorology



Met Office
Hadley Centre



Marine Information Research Center, Japan Hydrographic Association
Since 1971



OCEAN.RU

Russian Academy of Sciences
P.P. Shirshov Institute
of Oceanology



IOC



World Climate Research Programme



Integrated Marine
Observing System

clisap

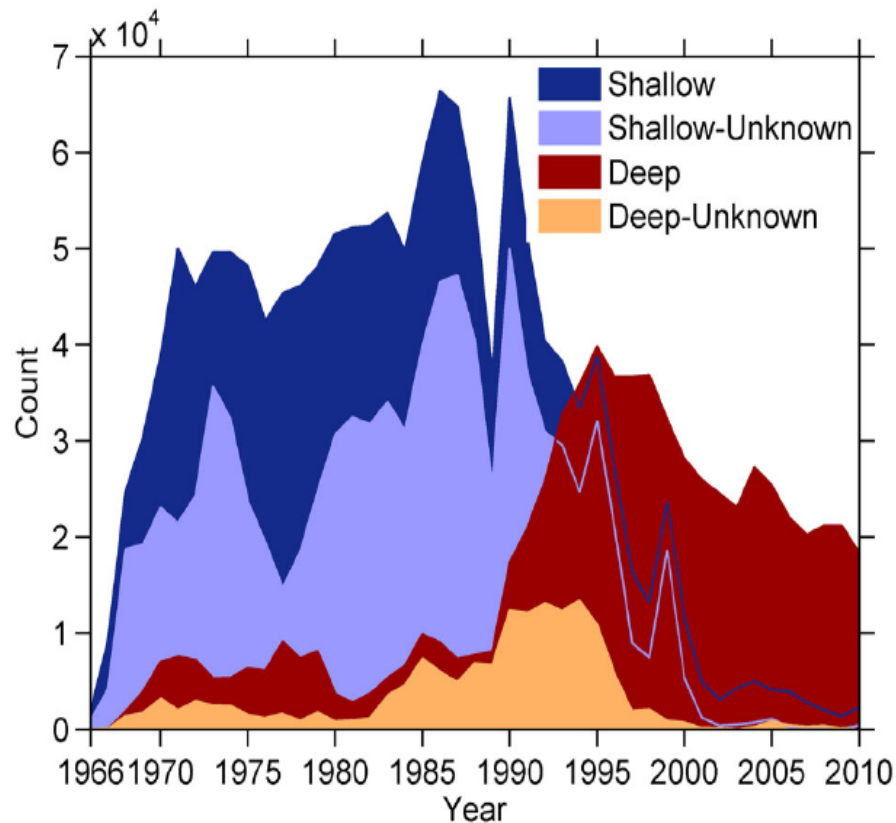


The Global Ocean Observing System

	OSD	CTD	PFL	APB	MBT	XBT	MRB
Depth Range, km	0-8	0-8	0-2	0-2	0-0.3	0-1.9	0-4
Measurement uncertainty for T (random error), degr. C	~0.02-0.1	~0.001-0.01	~0.005	~0.05	~0.2	~0.2	?
Measurement uncertainty for Sample Depth (random error), m	1-5%	< 0.015%	? Sensor drift?	? Sensor drift?	1-3%	2%(5m)	?
Temp. Bias, degr. C	?	?	?	?	O(0.1)	O(0.1)	?
Depth Bias, m	?	?	?	?	1-5%	1-5%	?
Metadata Availability	poor?	Good?	Good?	?	Very poor	Poor	?
Manufacturers	?	?	?	?	?	2 (4)	?

A major problem: missing metadata & original profiles

Number of known & unknown
XBT profiles per year



Proportion of unknown
XBT profiles (shallow)

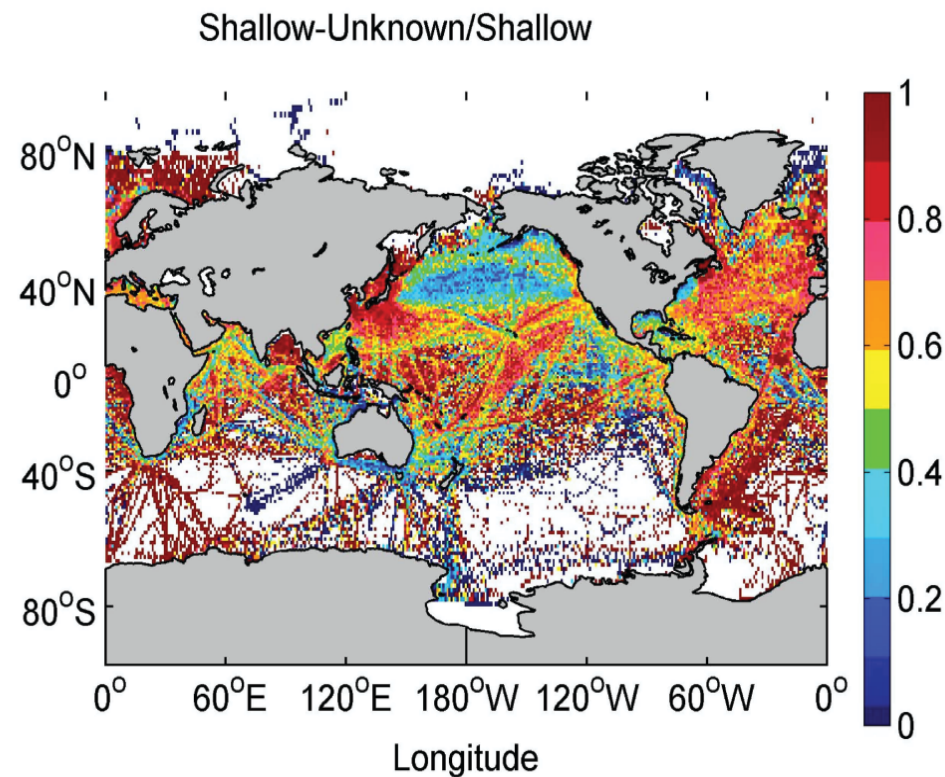
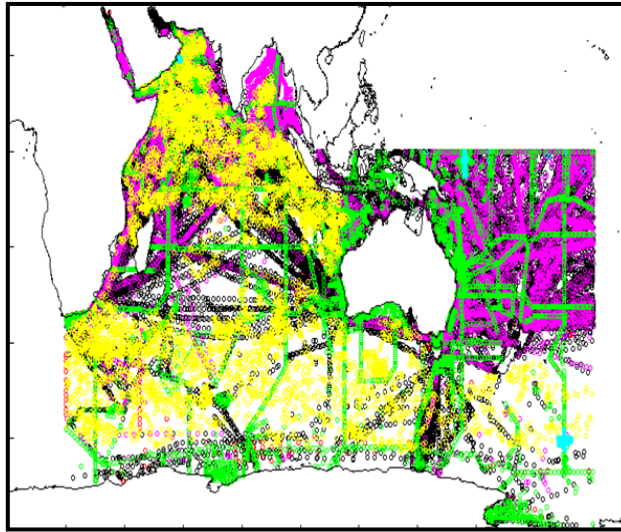


Figure 2. Total number of shallow (dark blue) and deep (deep red) XBT profiles per year and the number of these for which the type is unknown (shallow = light blue; deep = orange).

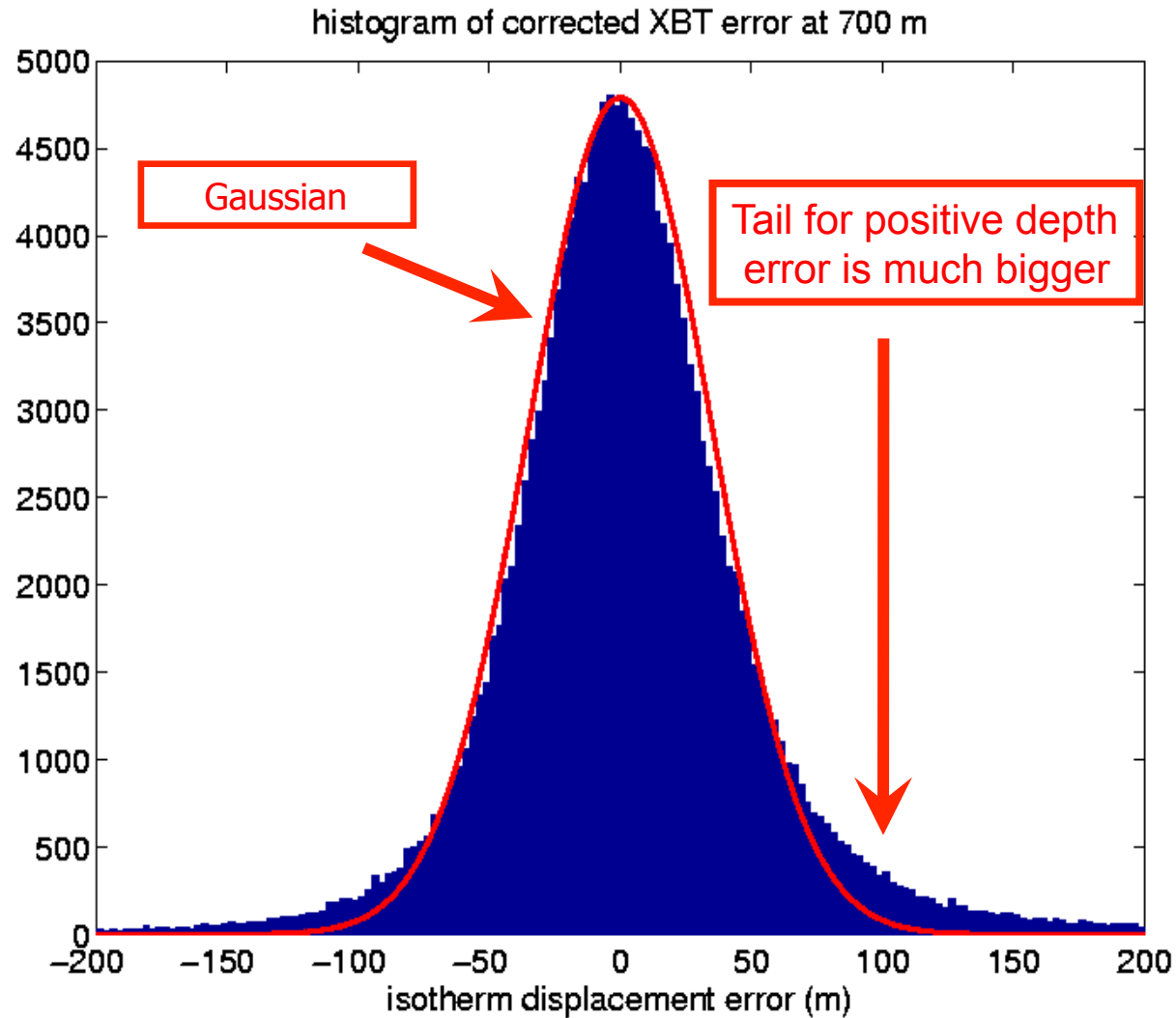
Abraham et al. (2013)

Another major problem: manual QC reveals warm biases



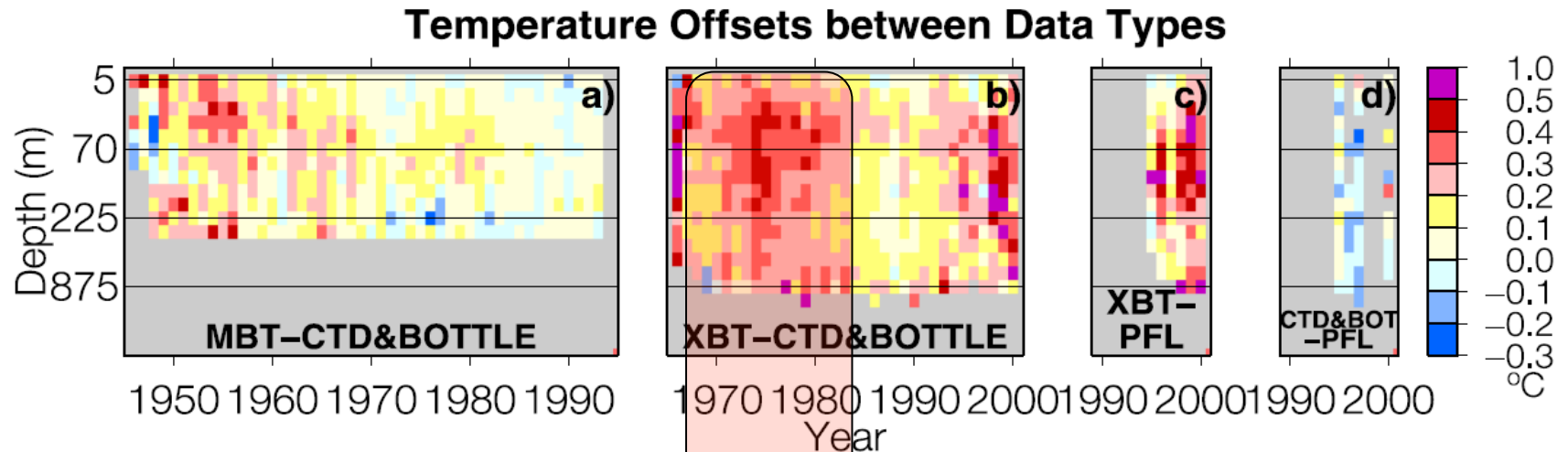
Pilot test:
Indian Ocean/SW Pacific

Gronell and Wijffels (2008)

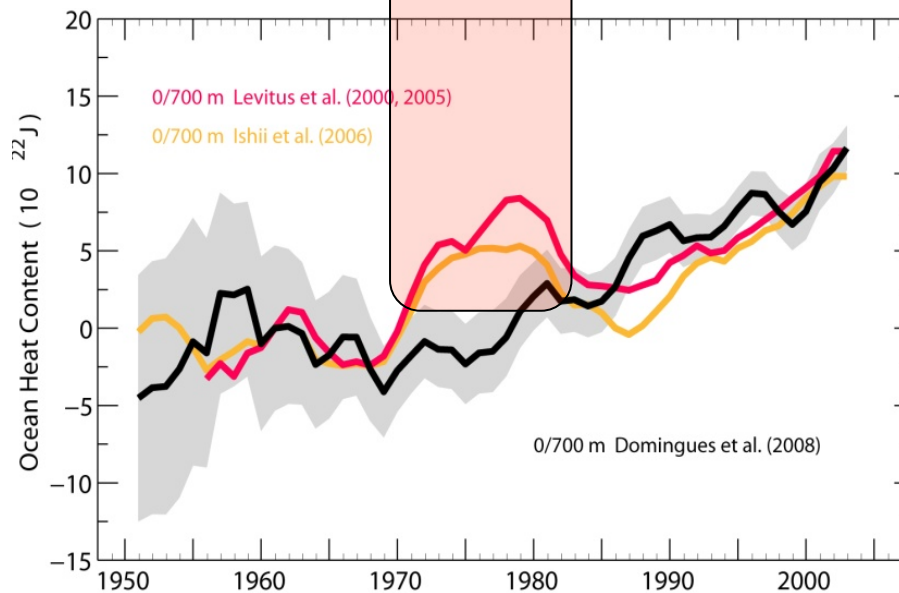


World Ocean: about 1.5 million **BAD** temperature profiles

Instrumental (time-dependent) biases – MBTs/XBTs



Closer scrutiny: Gouretski and Koltermann (2007)



Implications for
ocean warming
variability and trend

Wijffels et al. (2008)
Domingues et al. (2008)

Notes

- Availability of data and metadata v important
- Open access.
- JCOMM has a 10-year vision to develop the MCDS (Marine climate data system)
- MCDS will make high quality marine data accessible.
- Identifying gaps in the state of marine climate data component of global climate observing system.
- Outcome will be a paper in international journal of climatology
- Figure with task groups and structure, some pics too.
- Thermocline feedback
- Alliances etc get established, but what work happens? IQUOD has outcomes.
- Added value of datasets: fishing/weather prediction
- Essential observations.