The IQuOD initiative

International Quality-Controlled Ocean Database

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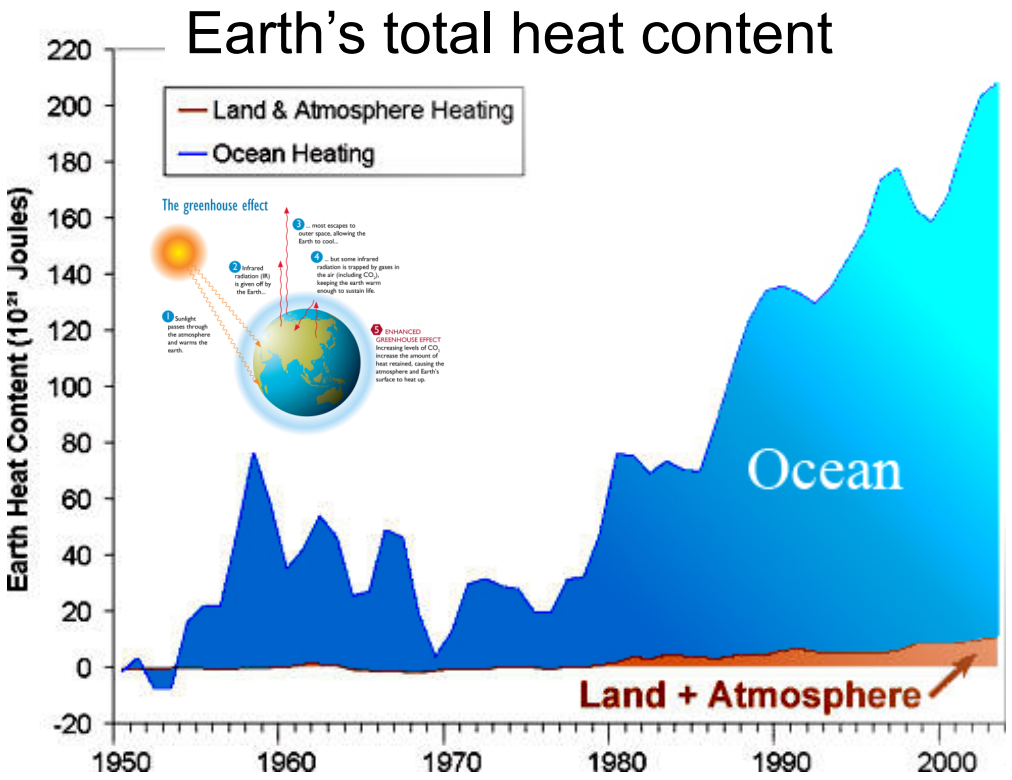
w/ support from CLIVAR GSOP & IQuOD members (not at Ocean Sciences)

Earth climate variability and change: ocean's role

Ocean temperature/salinity observations are essential to understand variability and change in the **Earth's energy and water cycle**, and to discriminate between **natural and anthropogenic drivers**, particularly now in the context of **global change and regional impacts.**



=> Impacts: socio-economic-enviromental

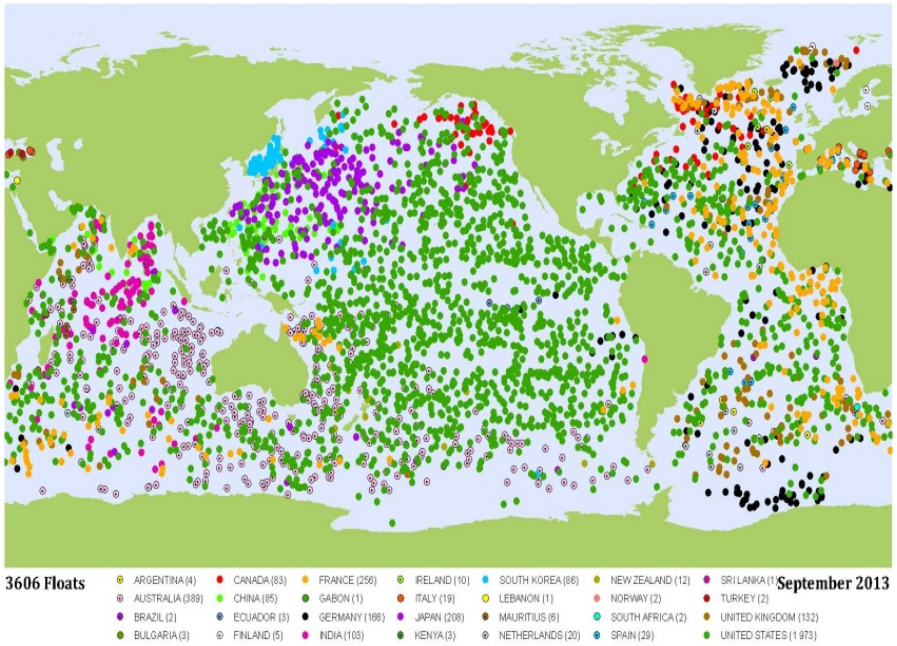
Over 90%: ocean heat storage

AR4: Bindoff et al. (2007)
AR5: Rhein et al. (2013)

Society demands improved understanding on how climate is changing (observations) **and how it will change** (short/long term predictions).

2000s: International Argo profiling floats array

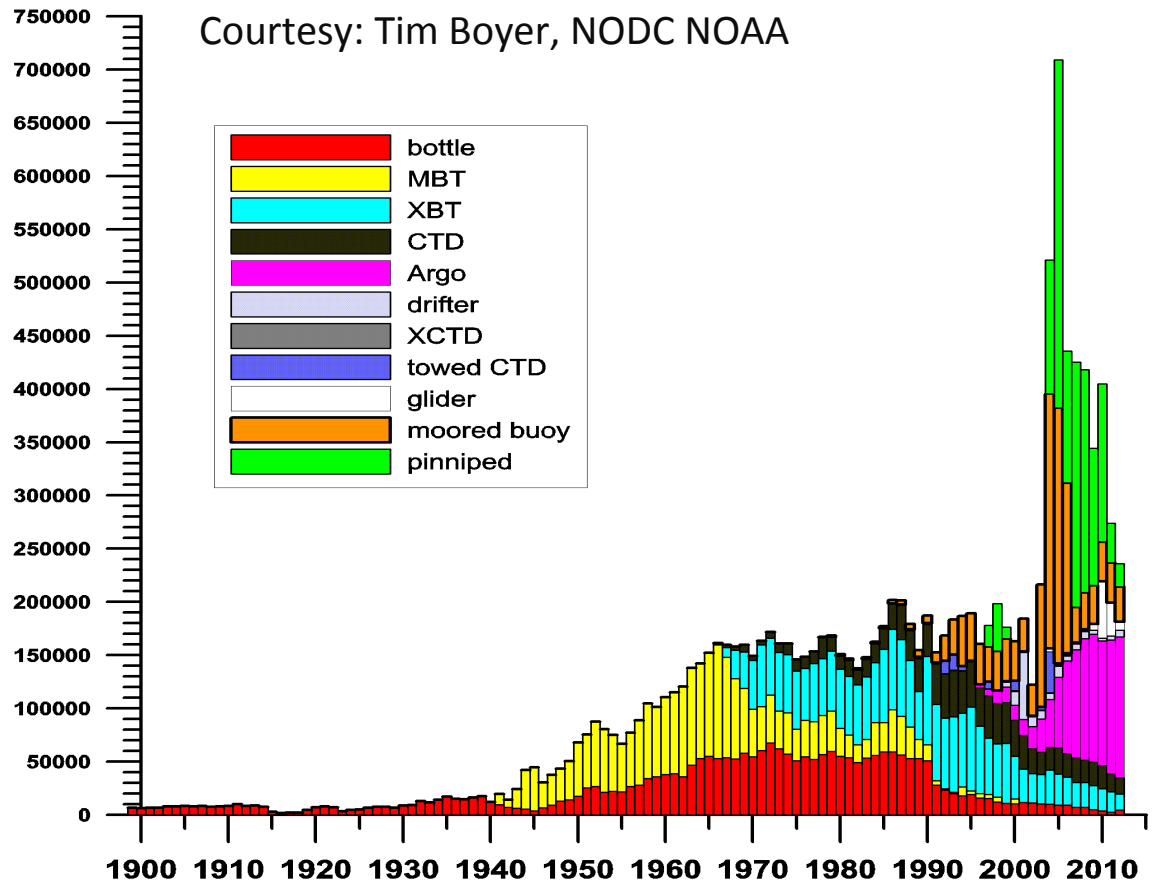
Observing system designed to monitor climate variability and change



Argo float
(autonomous CTD "robot")

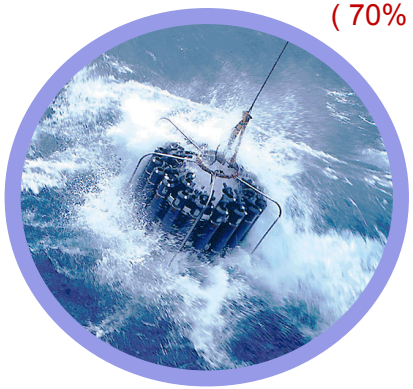
- **Societal benefits: tracking use (e.g., not only climate research/services but also operational and educational)**
- 3,000 floats active (3x3 deg array design), upper 2000 m
- 10-day profiling cycle / satellite transmission
- 3-5 year life cycle
- T/S data publically available (web US/mirrors)
- Quality: real-time/delayed mode

Long –term context: past/modern changes (variability/trends/drivers)



MBT & XBT

(70% historical data base)



Bottle & CTD (OSD)

(most accurate & expensive)

Global database: Millions of temperature profiles

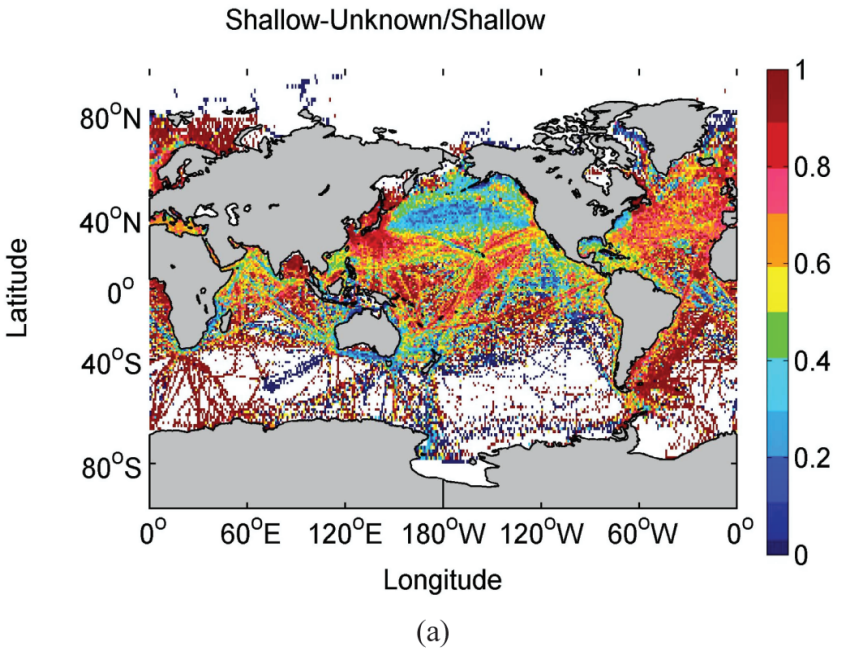
Mix of instruments/evolving technology (various accuracies & biases).

Cost $$: Tens of Billions dollars

However … not purposely designed for climate monitoring

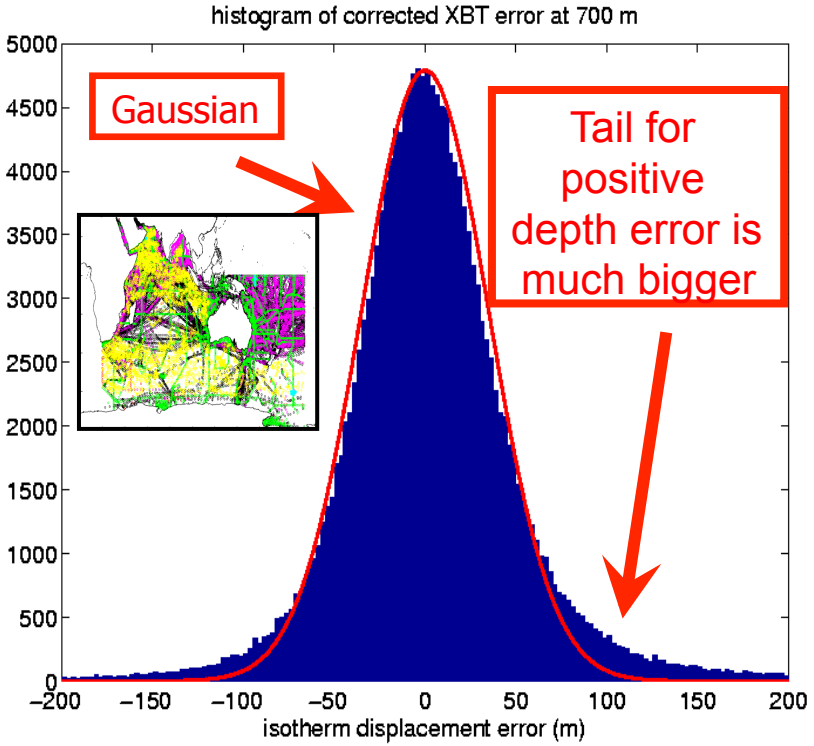
Historical subsurface ocean database in ***sub-optimal shape (e.g., quality, completeness, consistency)*** for climate-related studies & applications.

Missing metadata/uncertainties?
Abraham et al. (2013)



(a)

Manual QC/pilot test in Indian/ SW Pacific reveal warm biases
Gronell and Wijffels (2008)



If same % bad data maintained for world ocean : **~1.5 million BAD temperature profiles**

In sum, what is **IQuoD** about?

Challenge: Historical database still contains a large fraction of biased, duplicated and substandard quality (e.g., lack of original and full-resolution) data/metadata.

Implications: Efforts to analyse past changes (e.g., EOV: ocean heat content) in the context of modern changes as well as to discriminate between the influence of natural/ anthropogenic factors can be confounded, as can be the use of ocean reanalyses or the evaluation of climate models used to predict/project future changes and assess regional impacts.

IQuoD Goal: To realise the **full potential** of a **long-term and irreplaceable subsurface ocean temperature archive** (tens of millions of temperature profiles/worth tens of billions of dollars) to **a wider range of climate & oceanographic applications of societal benefit.**

More specifically

Over a period of **3-5 years**,
the **IQuOD initiative** aims to **assemble** the **highest-quality** historical subsurface ocean temperature **public** database, along with the **most complete (intelligent) metadata** and **assigned uncertainties**.

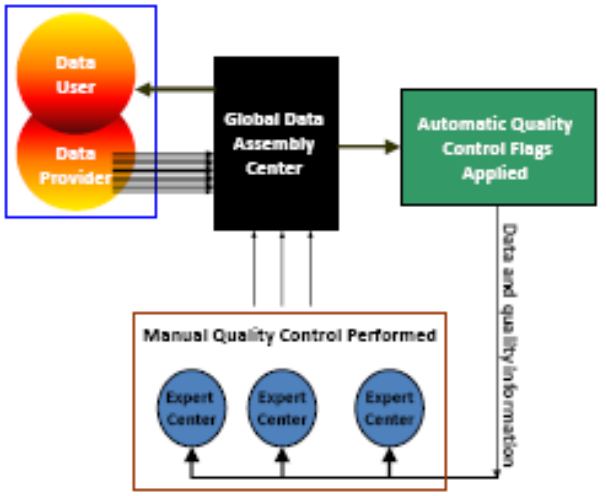
No equivalent internationally-coordinated effort has ever been undertaken with this purpose.

No single group has the expertise/resources to complete such a task over 3-5 years.

How?

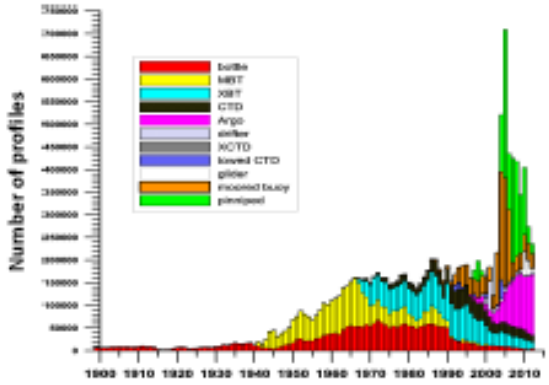
To tackle such a big problem in a consistent manner and to avoid waste of resources/duplication efforts, the IQuOD initiative will be underpinned by the **development of an internationally-coordinated framework.**

IQuOD Information Stream

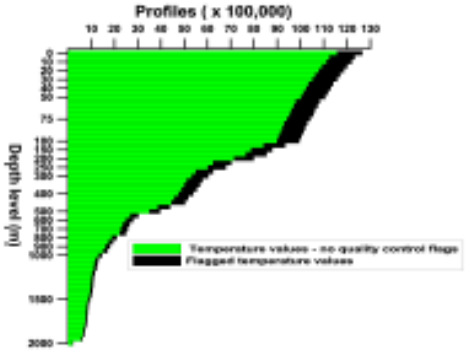


1. A Global Data Assembly Center to both supply data to the IQUOD system and quickly and easily disseminate results.
2. A standardized internationally agreed upon set of automatic quality control for *in situ* ocean profile data.
3. A network of centers of excellence with specialized local knowledge in specific temperature profile data and the ability to produce high-quality reliable datasets.
4. A uniform quality-controlled baseline historical temperature profile database with uncertainty estimates for oceanographic and climate studies.

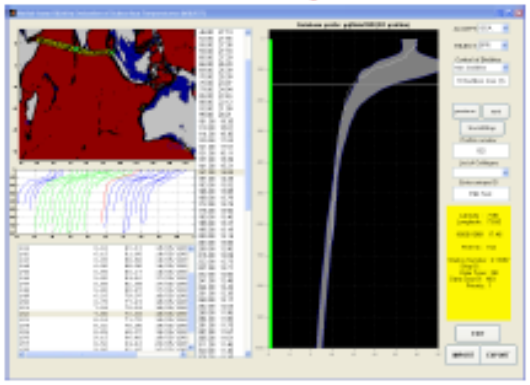
1. Global Data Assembly Center



2. Automatic Quality Control



3. Manual Quality Control



Who? IQuOD partners

- **QC experts** (automated/manual)
- **Data management experts**
- **Historical/modern In situ instrumentation (RS) experts** (e.g., Bottles, CTDs, MBTs/XBTs, Gliders/Argo profiling floats, Seal-tagged sensors, SST)
- **Regional oceanography experts**
- **Program managers**
- **Ocean Reanalyses experts**
- **Climate model experts**

Some of the expected outcomes

1. Development/Implementation of **international standard practices** for automated/manual **quality control** of historical temperature data and provision of **metadata and uncertainties**. This involves agreement on best practices; software development/ documentation/deployment; training personnel (capacity building); application of QC procedures/audits.

2. **Template for future efforts**: great community interest in improving the quality of the historical **salinity observations and other ocean variables**.

3. **Important data legacy** (e.g., raw and interpolated products) and **numerous downstream applications of the IQUOD data set** for climate-related research and services of great societal benefit.

Early stages activities

1st wokrshop mid 2013, Hobart:

Start initiative/discussions

Organizing groups (aggregation, auto QC, manual QC, assembly/ distribution, metadata/uncertainties)

2nd workshop mid 2014, Washington DC (GTSPP meeting/Belgium):

Evaluation of auto QC benchmarking tests

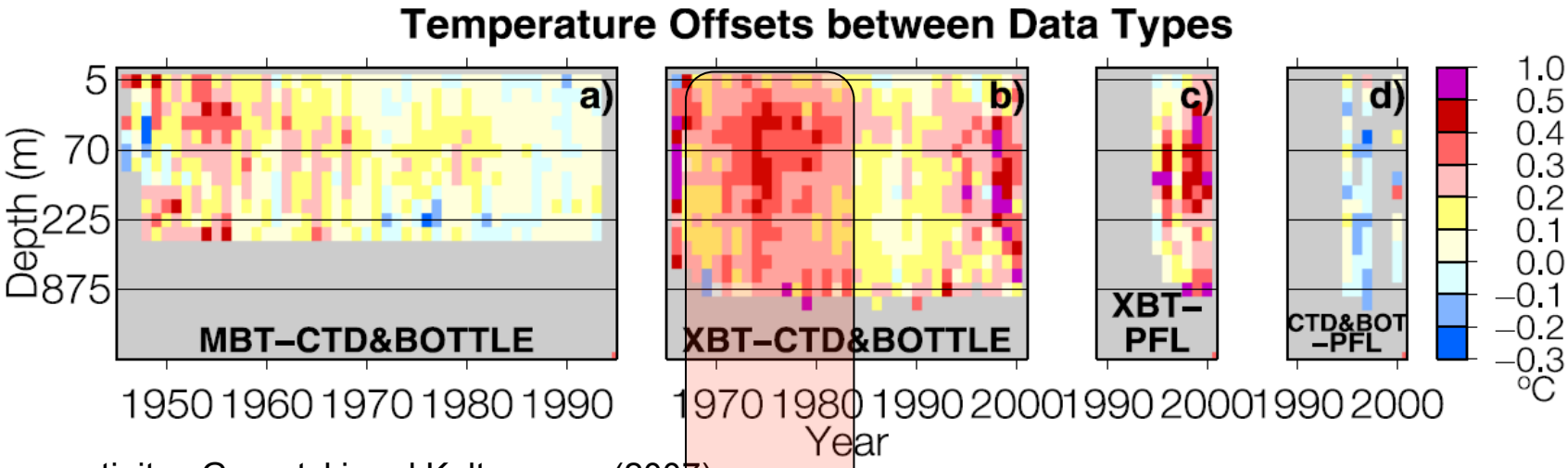
Discussion Scientific/Implementation plans (outline/sharing/timeline)

- Ongoing approach international research groups/ related-communities/organizations for potential contributions to the project proposal.

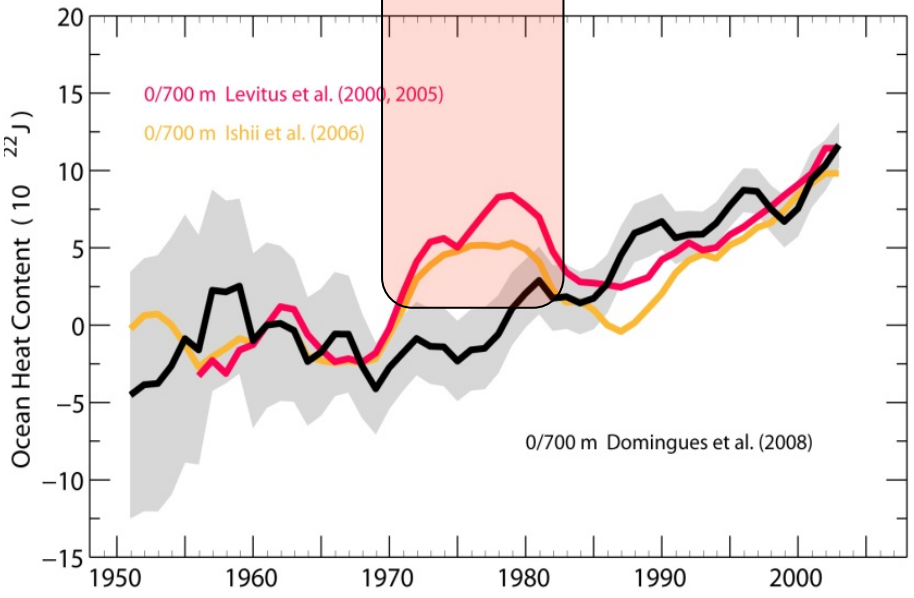
- Planning website : **www.iquod.org**


Thank you

Instrumental (time-dependent) biases – MBTs/XBTs



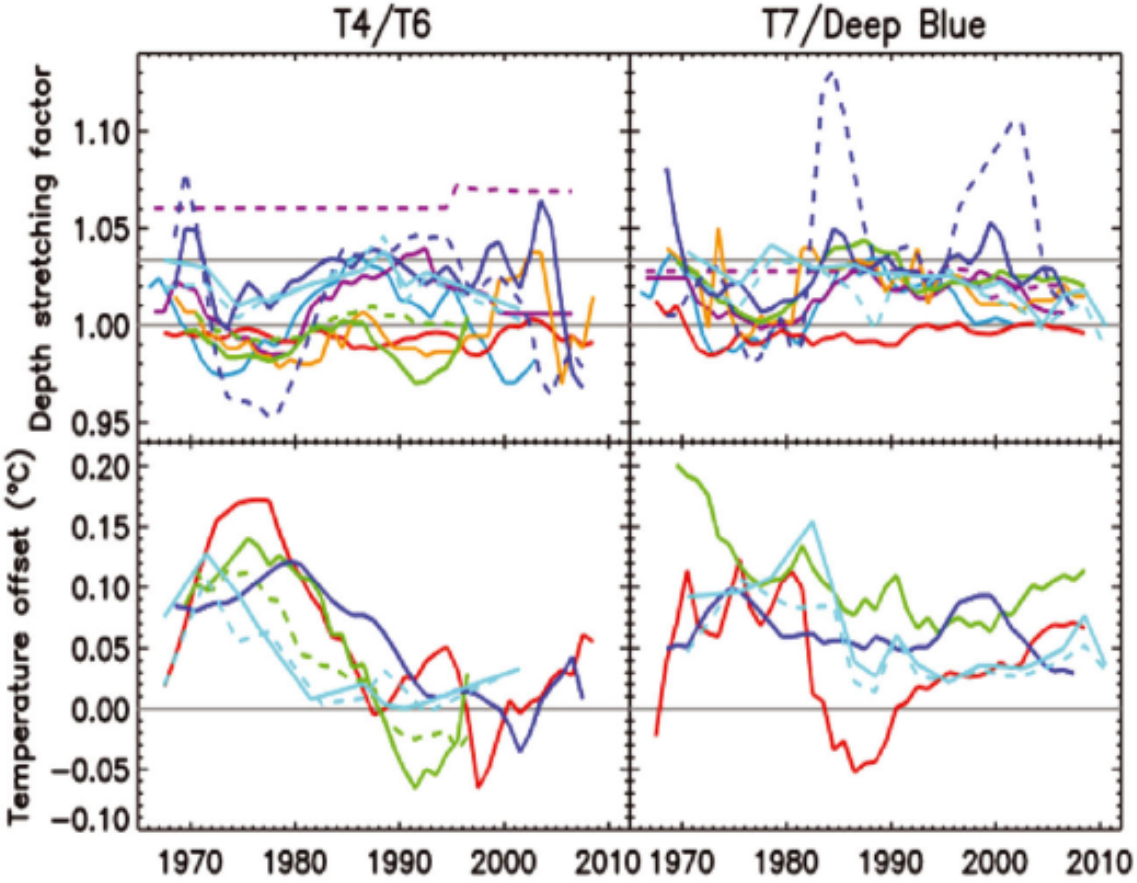
Closer scrutinity: Gouretski and Koltermann (2007)



Implications for ocean warming variability and trend

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

Several proposed XBT corrections



FAQ:
Which to use?

Abraham et al. (2013)