ICOADS the Global Marine Surface Reference Dataset

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Topic Outline

International Comprehensive Ocean-Atmosphere Data Set (ICOADS)

- Status, Current and future Releases
- ICOADS Value Added Database (IVAD)
- Data Access

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Current Release, 2.5, 1662-2013

- Delayed Mode Processed Data, 1662-2007
  - 50 + historical data sources
- Near Real-time Processed Data, 2008 – Now
  - Based on NOAA NCEP GTS
- Metadata on each record
  - Source Identification
  - Platform / instrument type
  - VOS characteristics from WMO, 1966-2007

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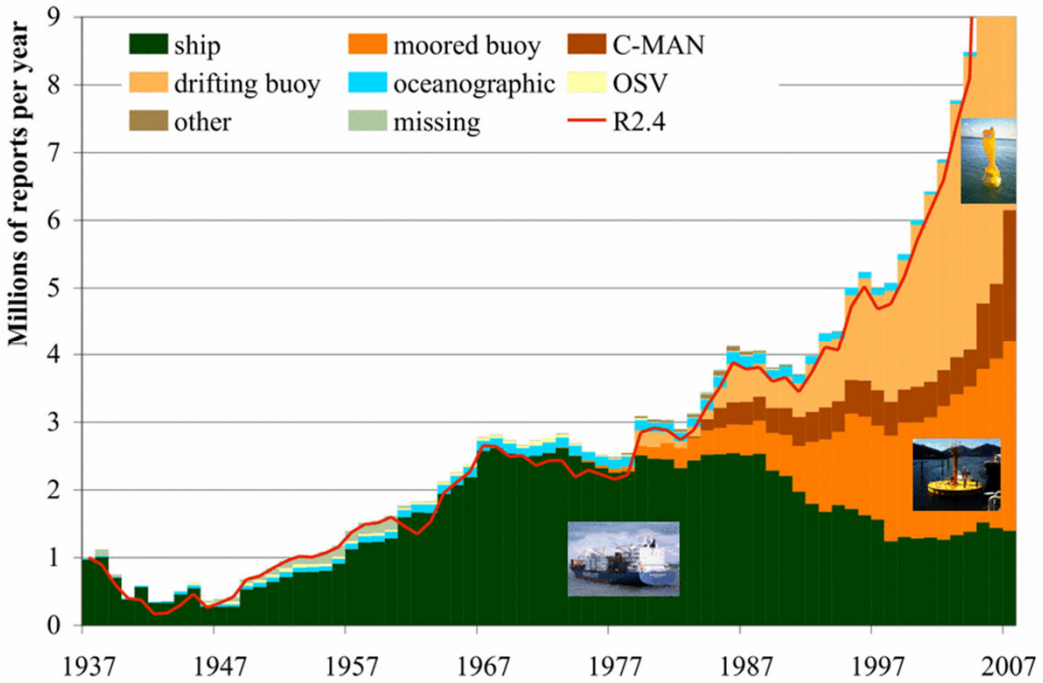
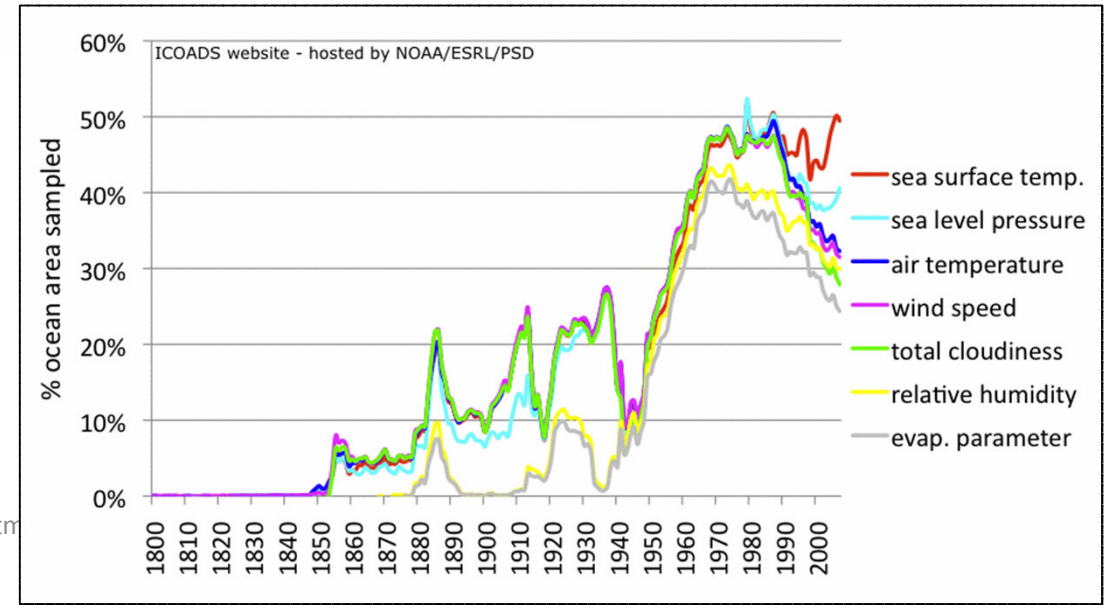
R2.5 Basic Characteristics

Evolution platform mixture (1937-2007)



% Ocean Coverage by Variable



Release 3.0, in development

- Completion target date: late 2014
- Collaborations w/ international partners
  - National Oceanography Centre, UK
  - Met Office, UK
  - CRU, University of East Anglia, UK
  - Deutscher Wetterdienst (DWD), Germany
  - Center for Earth Systems Research and Sustainability, U. Hamburg, Germany
  - Atmospheric Circulation Reconstructions over the Earth (ACRE), Global Participants

Release 3.0

Important archive format expansions

Permanent unique identifier (UID) on each record

- Provides absolute record tracking mechanism
  - Enables inclusion of feedback from re-analyses
- Makes user interactions (consulting) easier
- Simplifies data contributions from partners

Release 3.0

Important archive format expansions

Near-surface ocean attachment *(Nocn)*

- Depth referenced data
  - Salinity, Temperature, Nutrients, pCO_2, DIC etc.
- World Ocean Database 2013
- Possible other TSG surface data:
  - SAMOS, GOSUD, R2R, etc.

R3.0, Historical Additions

- Extended WWI Royal Navy Ship's Logs: 1914-23
- Data digitized under ACRE/OldWeather: ~1700-1946
- US Lightship Collections: 1916-1982
- German Maury Collection: 1845-67
- English East India Co.: 1789-1834

R3.0, Data Replacements / Improvements

- World Ocean Database 2013
- Merge two NOAA GTS feeds, NCEP + NCDC
  - Recover masked (deleted) ship IDs
- ISDM/Canada global drifting (moored) buoy archive
- ? Tropical moored buoy arrays: (PMEL, NDBC, JAMSTEC, etc.)
- ? NDBC near-coastal moored buoy/C-MAN

ICOADS Value Added Database (IVAD)

A system to manage ICOADS observations in parallel with expert developed adjusted data values.

Major sources of inhomogeneity in ICOADS

- Measurement differences between platforms
- Changes in observing systems over time
- Biases created by specific platforms
- Biases created by methods and coding practices
- Undetected systematic location errors

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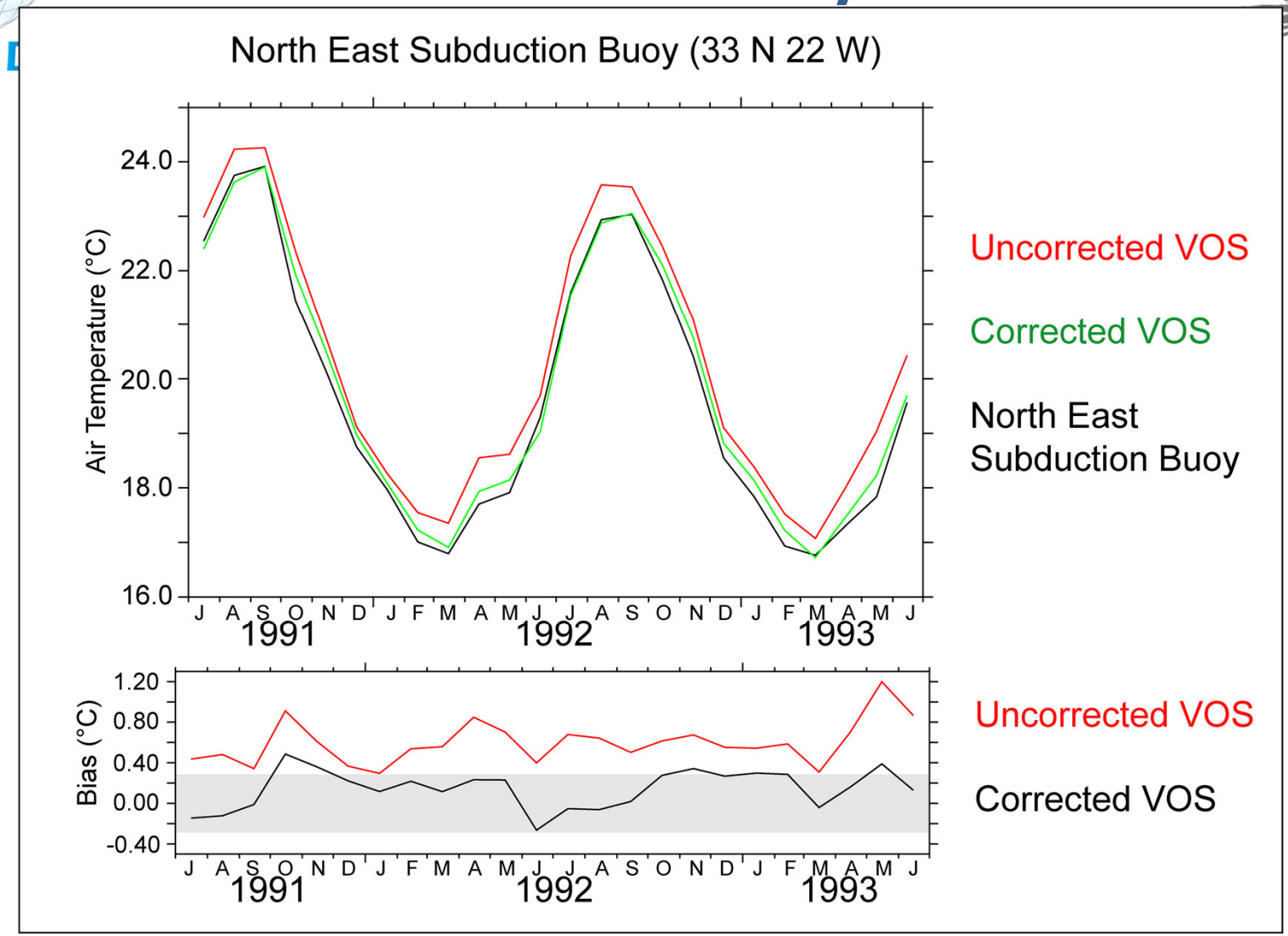
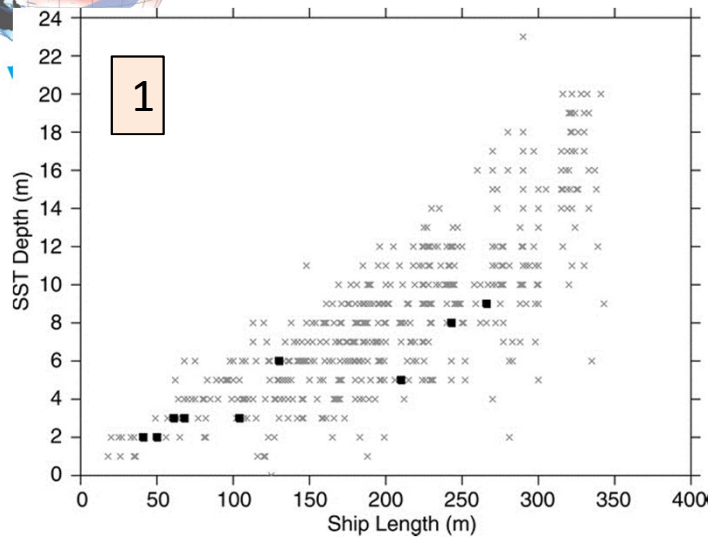
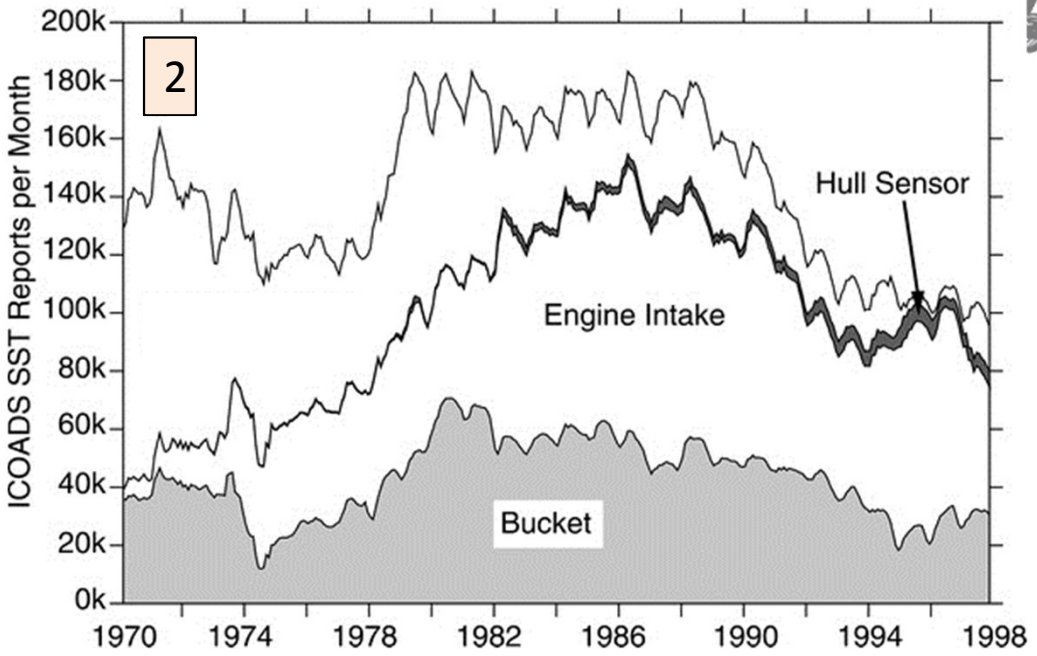
Ship AT heating bias relative to research buoy

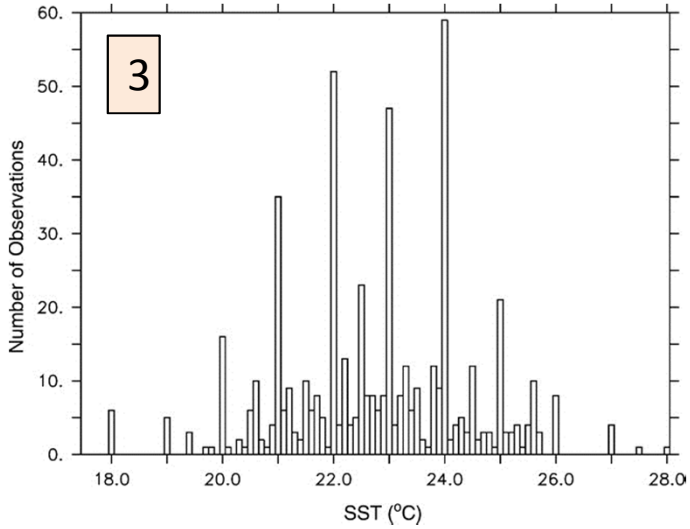


Berry, D.I., E. C. Kent, and P. K. Taylor, 2004: An analytical model of heating errors in marine air temperatures from ships. *J.Tech.*, **21**(8), 1198-1215.

Ship SST Challenges







1. SST sample depth versus ship length, engine intake and hull for 1997 data
2. Methods: Hull Sensor, Engine Intake, Bucket for 1970-1997
3. Coding resolution, whole degrees, July 1995 10 degree box.

Kent, E. C. and P. K. Taylor, 2006: Towards estimating climatic trends in SST. Part 1: methods of measurement. *J. Atmos. Oceanic Technol.*, **23**(3), 464-475

IVAD; the technical pieces

- Design a data format attachment *(Ivad)*, that is optional for every ICOADS record.
  - Allow for multiple *Ivad* attm. per record
- Manage all records, ~ 300M, in relational DB
  - UID on each record is key
- Major candidates for *Ivad*
  - Estimates of observational bias
  - Adjustments to standard measurement height/depth
  - Improved QC flag or measure method definition

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IVAD; the technical pieces

- Features of the *Ivad* process
  - Prepared and submitted by expert community
  - **Contains the adjusted data value**
  - Several data uncertainty values (optional)
  - Author reference code – pointer to method documentation

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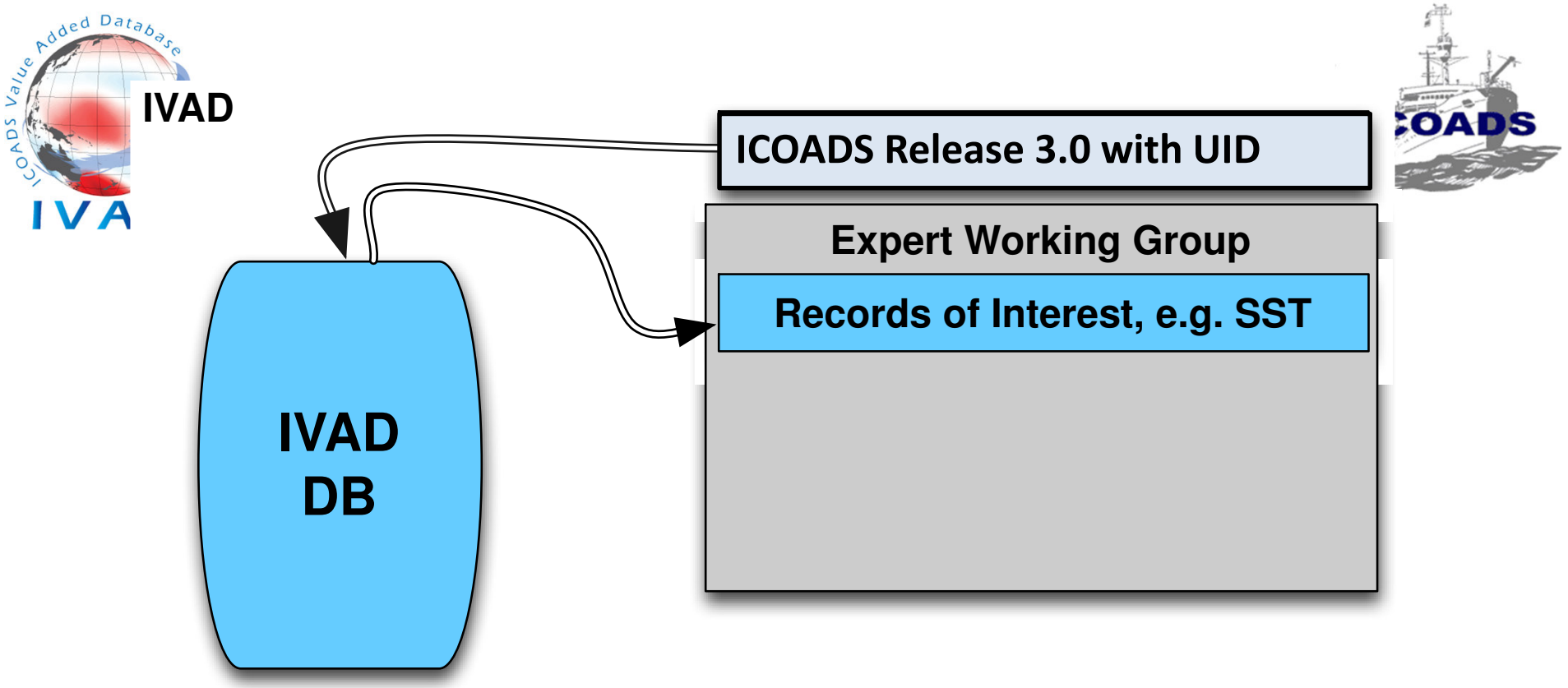
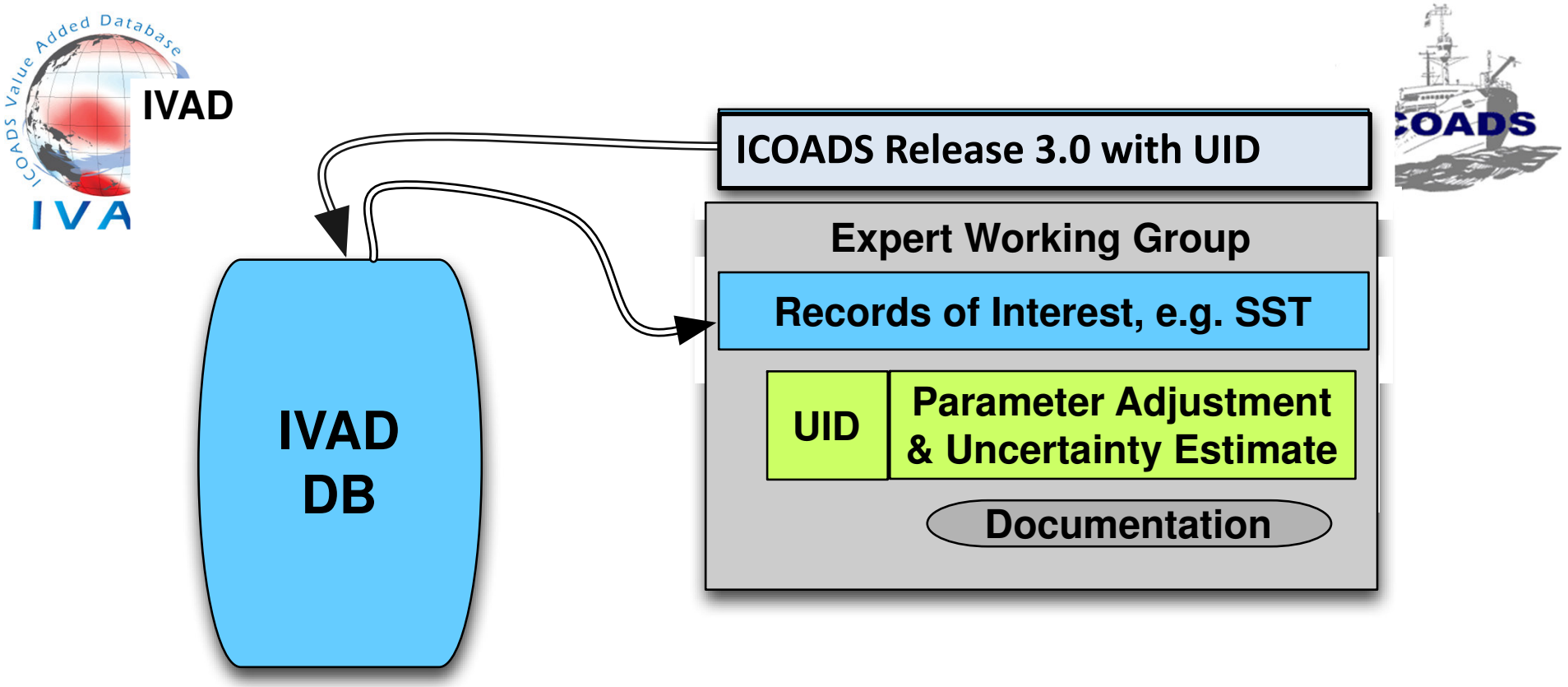
IVAD

ICOADS Release 3.0 with UID

IVAD
DB

NCAR


IVAD
ICOADS Release 3.0 with UID
Expert Working Group
Records of Interest, e.g. SST
IVAD
DB


IVAD
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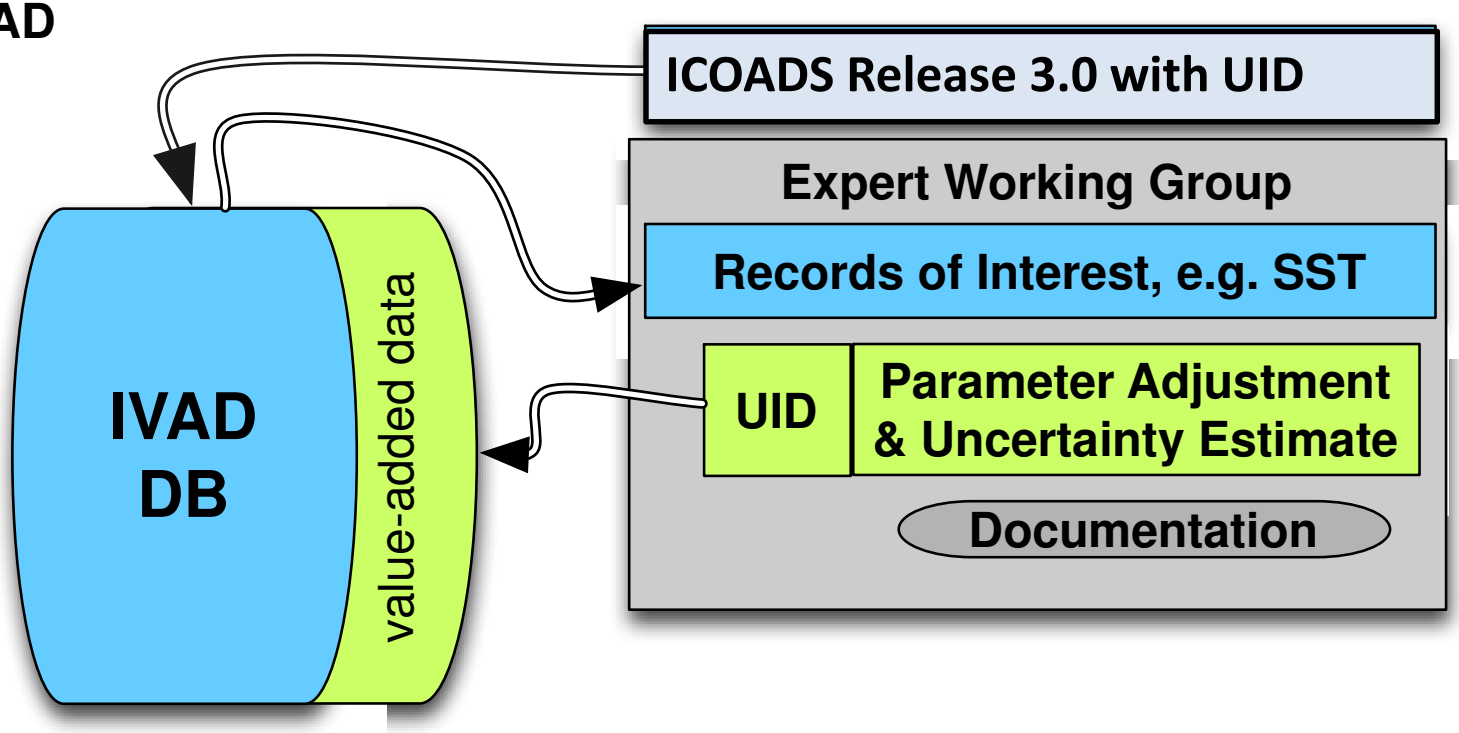
UID
Parameter Adjustment & Uncertainty Estimate
Documentation
IVAD DB

IVAD



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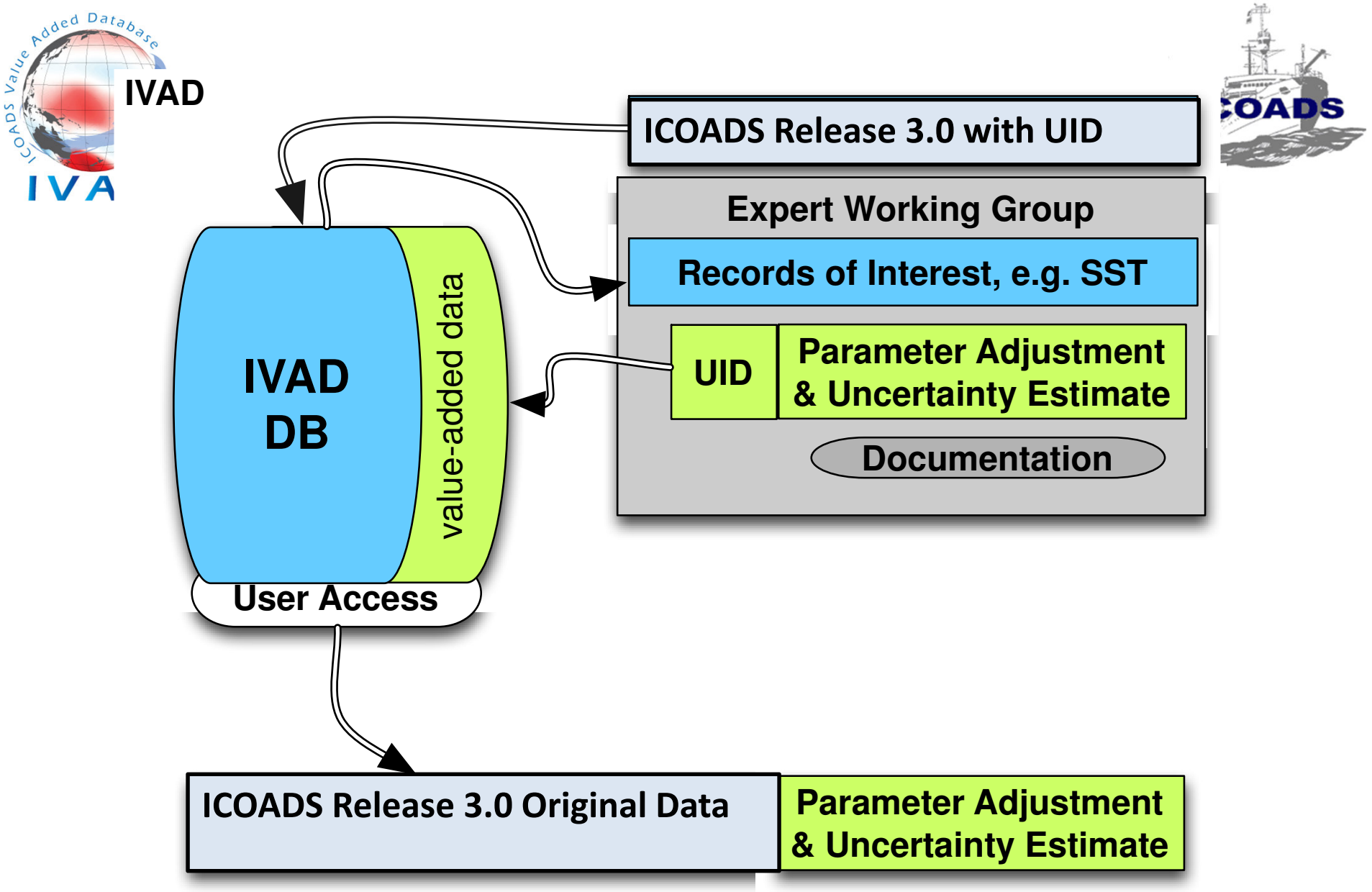
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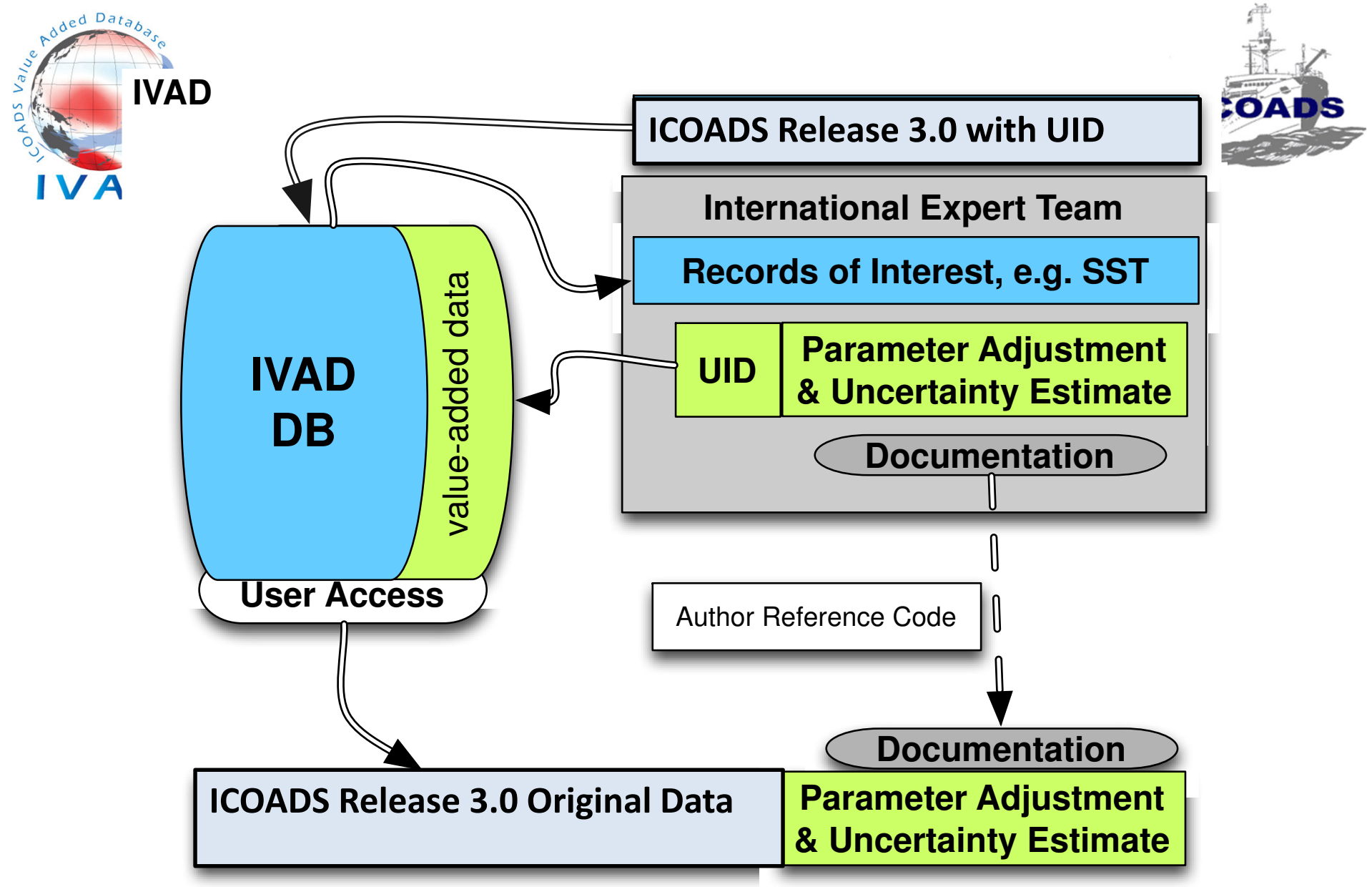
Documentation
IVAD DB
value-added data
User Access
ICOADS Release 3.0 Original Data
Parameter Adjustment & Uncertainty Estimate



Users have access to expert developed bias adjustments. More homogenous data.

ICOADS Products and Access

Partner Org.	Monthly Statistics 1°x1° (1960 →) 2°x2° (1800 →)	Observations (1662 →)
NCAR	1. Binary Files 2. GUI subsetting (t,x,y,var,σ) ASCII	1. ASCII Files 2. GUI subsetting (t,x,y,var,σ) ASCII
NOAA/PSD	1. NetCDF Files 2. Software	1. Software
NOAA/NCDC	1. Archive Backup	1. ASCII Files

- Very basic and reliable access for a diverse user community
- Desires for more standard and interoperable access
  - Re-design + make monthly statistics netCDF CF compliant
  - Publish monthly statistics in THREDDS catalog and service
  - Drive observation subsetting with IVAD DB and add netCDF output option.

Conclusions

- Working hard to prepare Release 3.0, 2014
  - Significant support from International partners
- IVAD is in testing phase
  - Adjusted data – more homogeneous, well documented
- Hope to achieve more standard and interoperable access

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ICOADS

- http://icoads.noaa.gov/

IVAD

- http://icoads.noaa.gov/ivad/

worley@ucar.edu

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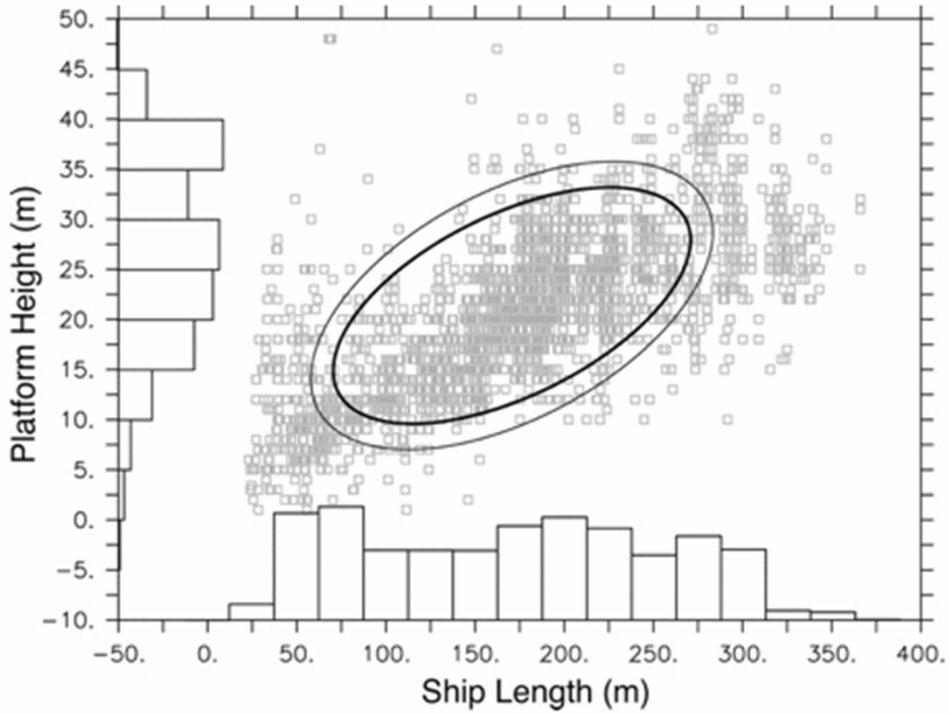
Example of ship heterogeneity

Measurement height versus ship length (1980-2002)



Kent, E.C., S.D. Woodruff and D.I. Berry, 2007: WMO Publication No. 47 metadata and an assessment of observation heights in ICOADS. *J. Atmos. Oceanic Technol.*, **24**, 214-234 (doi:10.1175/JTECH1949.1)

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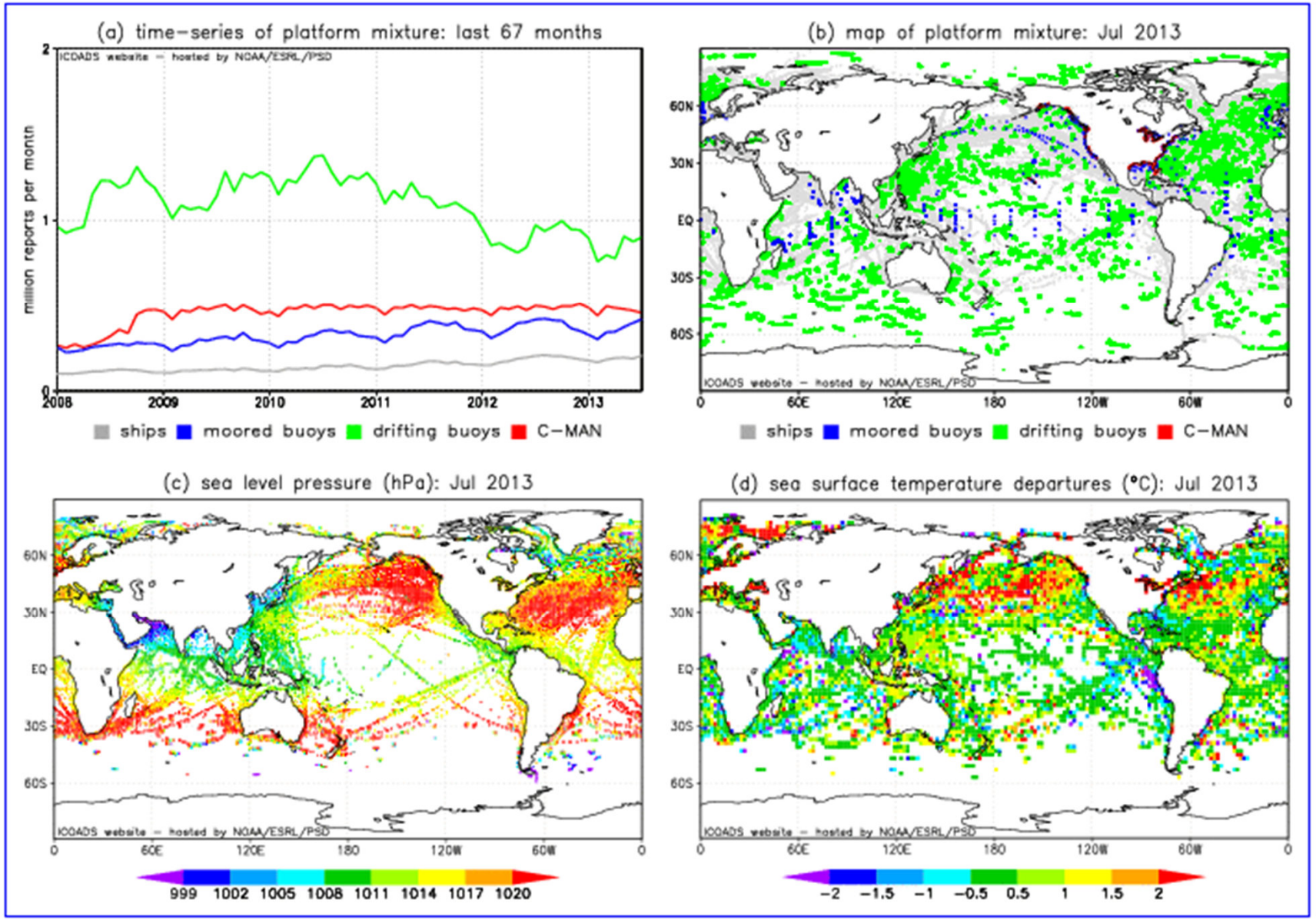
Monitoring


(a) time-series of platform mixture: last 67 months
ICOADS website – hosted by NOAA/ESRL/PSD
million reports per month
2
1
0
2008
2009
2010
2011
2012
2013
ships
moored buoys
drifting buoys
C-MAN
(b) map of platform mixture: Jul 2013
60N
30N
EQ
30S
60S
0
60E
120E
180
120W
60W
ICOADS website – hosted by NOAA/ESRL/PSD
ships
moored buoys
drifting buoys
C-MAN
(c) sea level pressure (hPa): Jul 2013
ICOADS website – hosted by NOAA/ESRL/PSD
999 1002 1005 1008 1011 1014 1017 1020
(d) sea surface temperature departures (°C): Jul 2013
ICOADS website – hosted by NOAA/ESRL/PSD
−2 −1.5 −1 −0.5 0.5 1 1.5 2

SST Sample buckets

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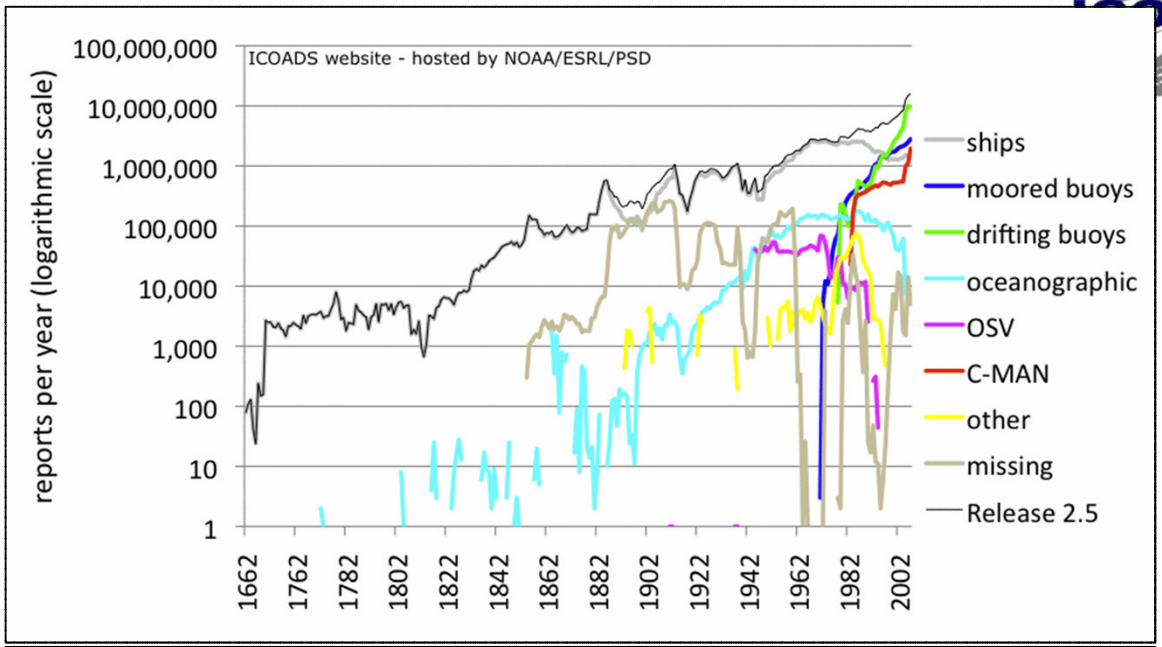
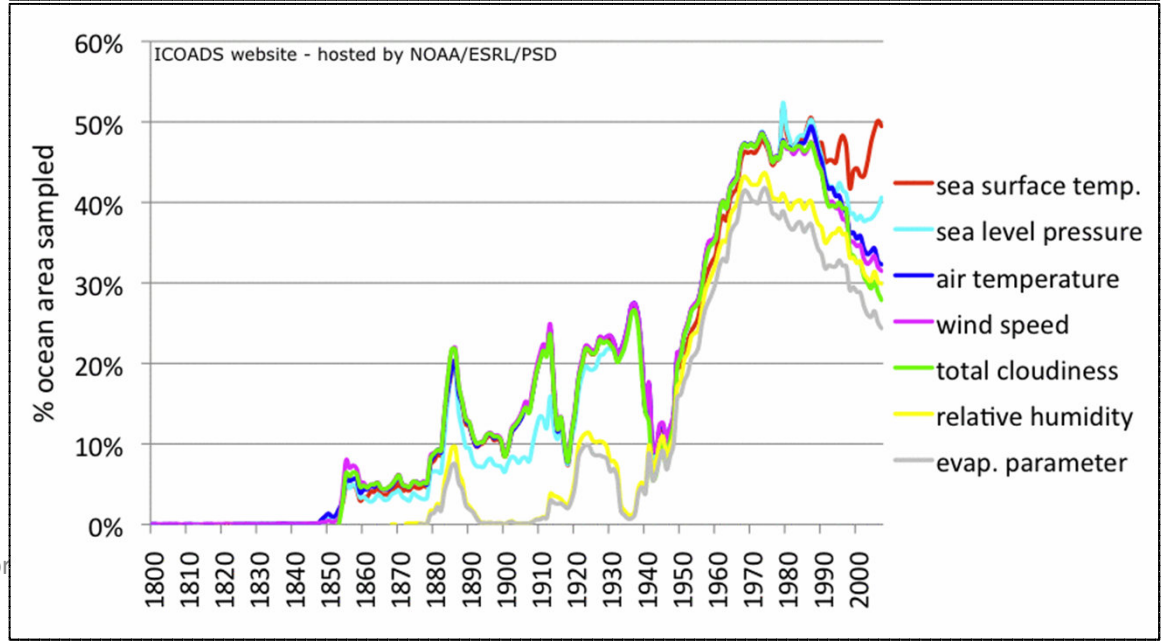
R2.5 Basic Characteristics

1. Surface marine observations
2. Basic gridded monthly products

Platform Mixture →



Variables →



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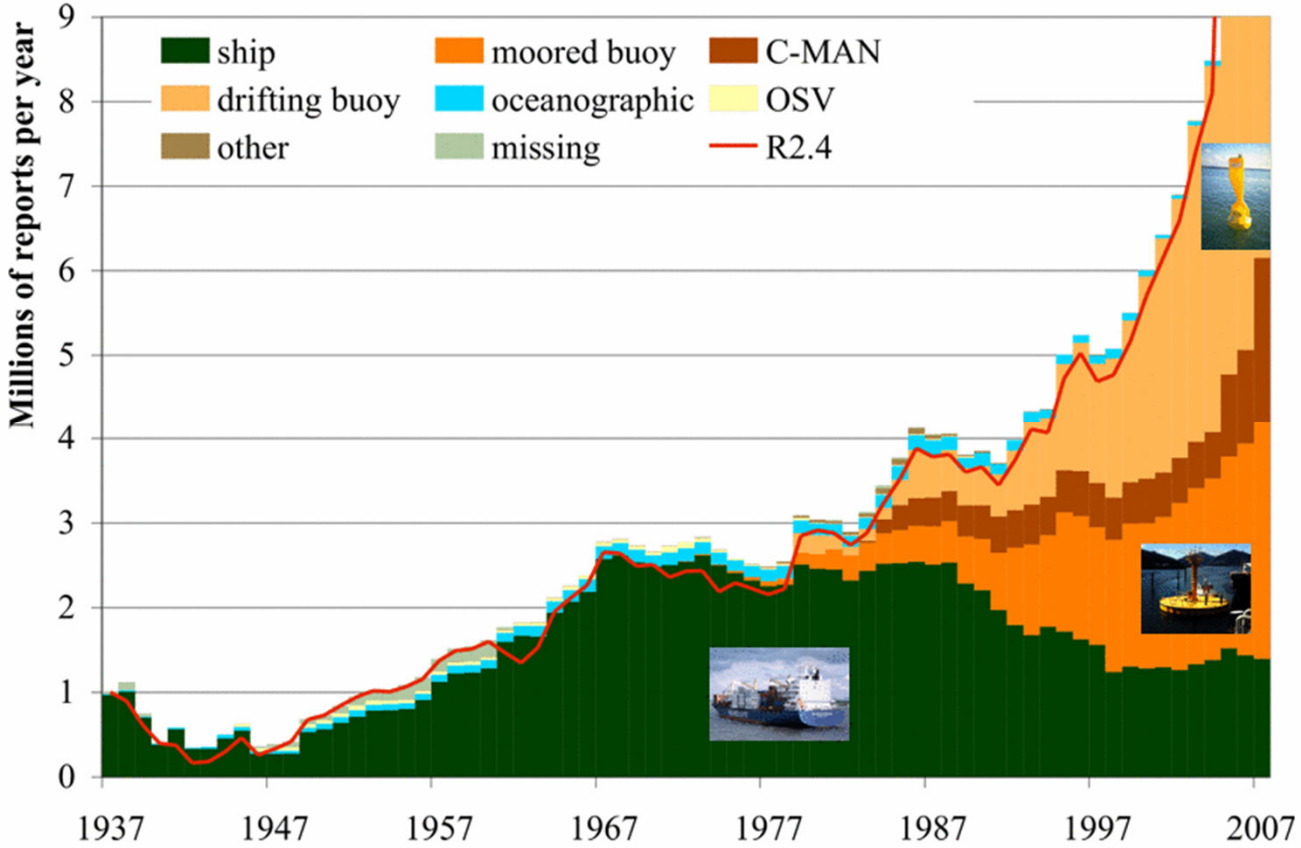

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