Status and Plans for the International Comprehensive Ocean-Atmosphere Data Set (ICOADS)

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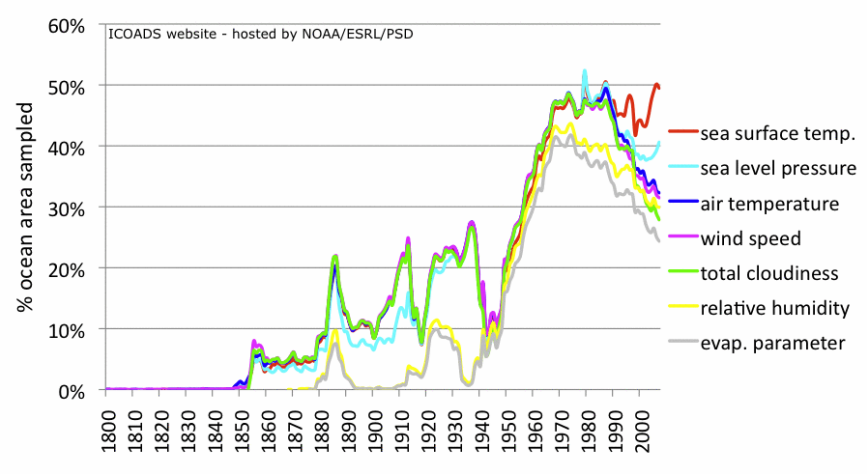
Third International *Workshop on Advances in the Use of Historical Marine Climate Data* (MARCDAT-III), ESA-ESRIN, Frascati, Italy, 2-6 May 2011

Topics



- ICOADS project
  - Background – Objectives
- Status
  - Release 2.5 (R2.5)
    - major delayed-mode (DM) update: 1662-2007
  - "Preliminary" near-real-time updates
- Plans to:
  - Complete R2.6 (next DM update): ~2012
    - Contingent on resources (e.g. NOAA)
  - Improve
    - linkages with satellite (ref. Worley) and land (ref. Thorne)
    - QC and bias adjustment
  - Seek further internationalization
    - possibility to share more of the workload?

ICOADS

Background

- Original COADS project initiated in 1981
  - Joint in US between NOAA (ESRL and NCDC) & NCAR
- In 2002 renamed “ICOADS” in recognition of extensive *International* contributions including:
  - DWD, JMA, KNMI, UK Met Office and National Oceanography Center, Southampton
- Data, metadata, and product access
  - ✓ NCAR, NCDC, and ESRL all provide complementary capabilities serving a diverse range of customers
  - ✓ E.g.: ~400 unique users per year just from NCAR
  - ✓ Project web portal: http://icoads.noaa.gov/

✓ Formal links to JCOMM proposed

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ICOADS

Objectives

- Collect *in situ* marine meteorological data
- Treat each observation systematically
- Preserve original provenance information, data, and metadata
- Convert units and coding schemes to a uniform set
  - ✓ International Maritime Meteorological Archive (IMMA) format
- Perform basic quality control
- Freely distribute the data and products worldwide

From: Worley, S.J. et al. 2009: The Role of ICOADS in the Sustained Ocean Observing System. *OceanObs09 Community White Paper*

IMMA: A Robust and Extensible Observational Data Format

- International Maritime Met. Archive (**IMMA**) format (ASCII)
- Core + optional "attachments"
- Includes fields for VOS metadata and model feedbacks
- Plans to include sea surface salinity
- Suitable for long-term archiving
  - ✓ **Carefully validated translations form *foundation* for all subsequent work**

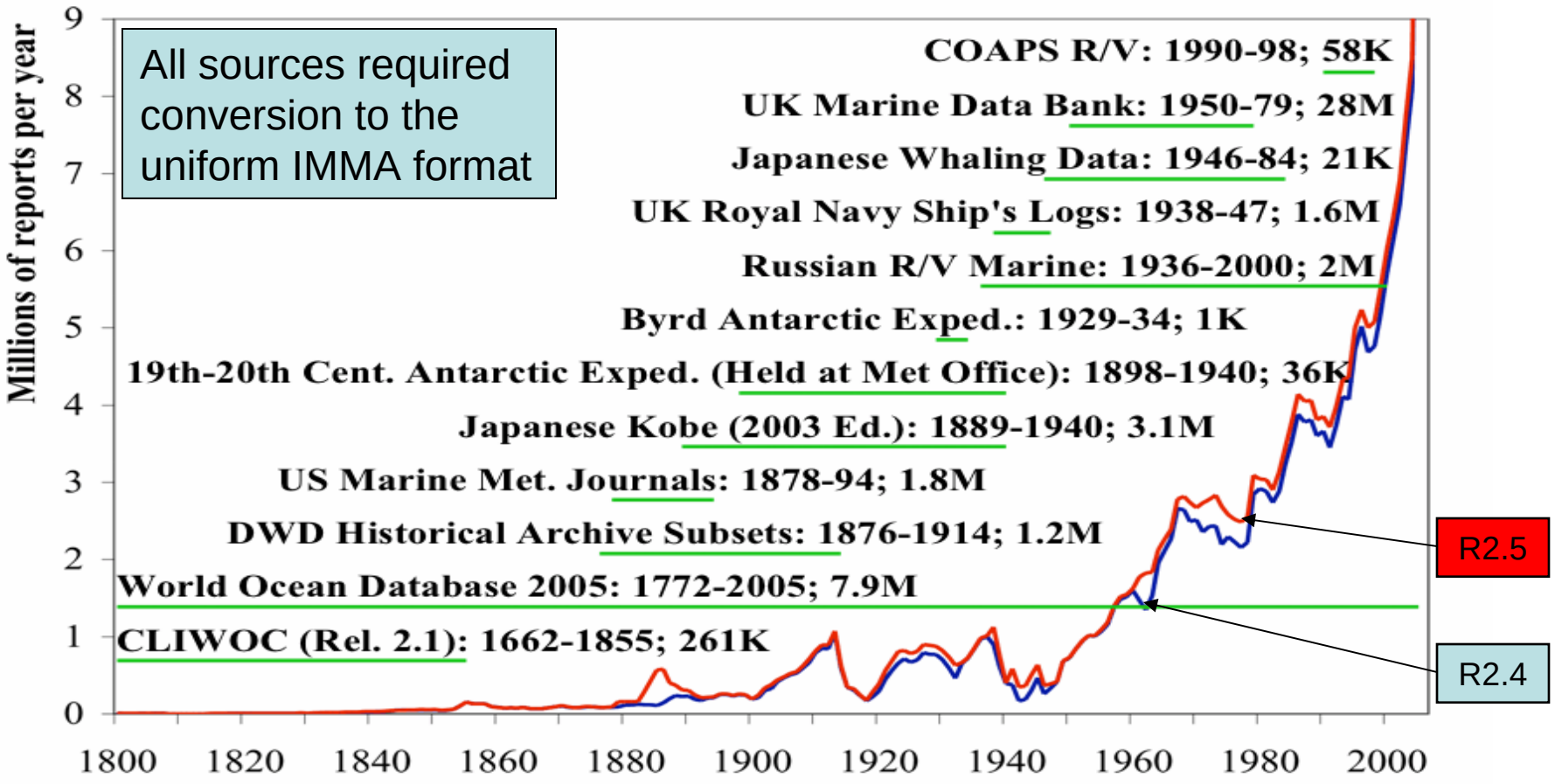
Key requirement:
attm of original data forms: experience demonstrates format translations frequently contain errors or omissions

Advantage:
exact copy of original permits re-translation and cross-checks at any time

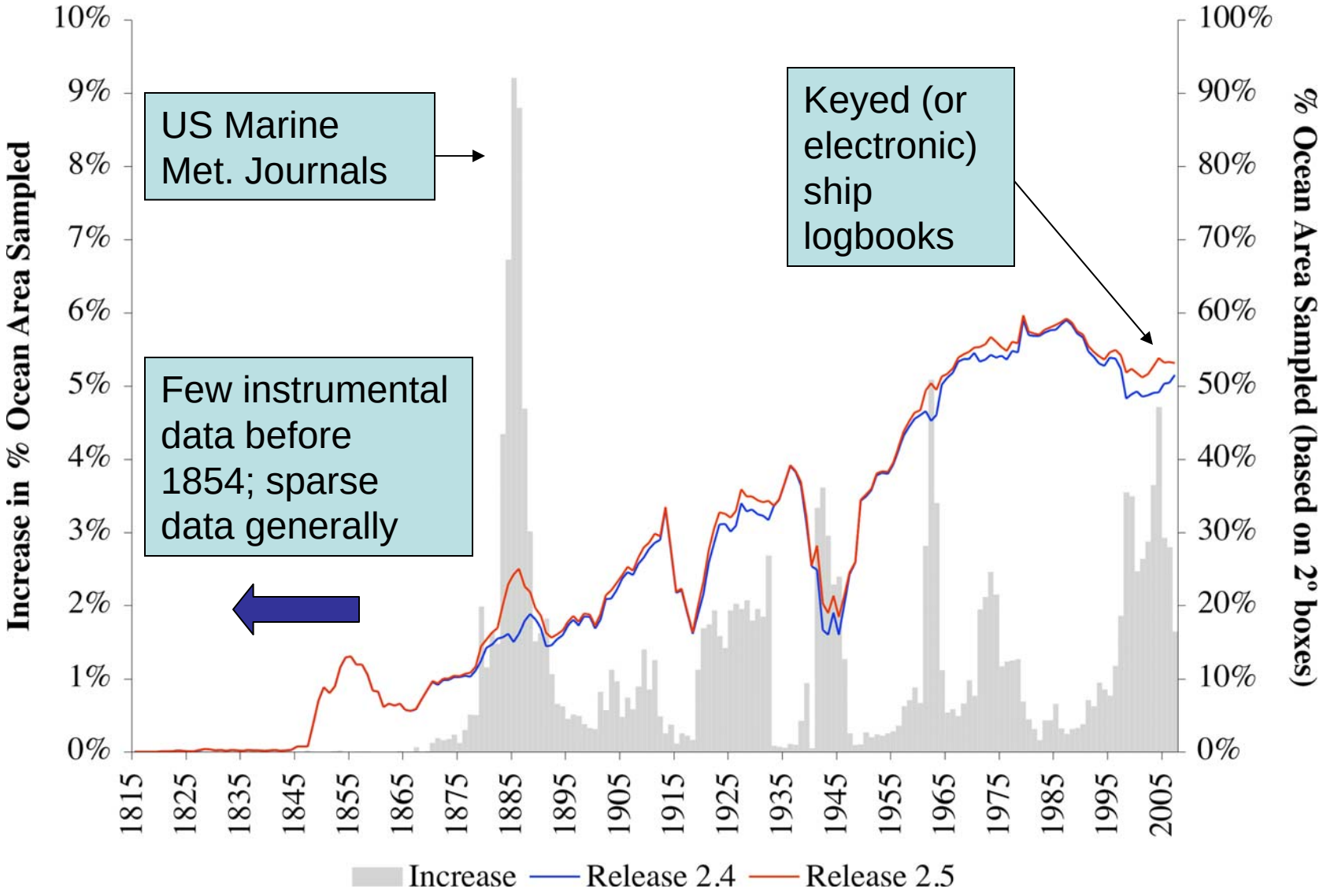
R2.5: 1662-2007

Major delayed-mode update: completed in July 2009
261M output marine reports

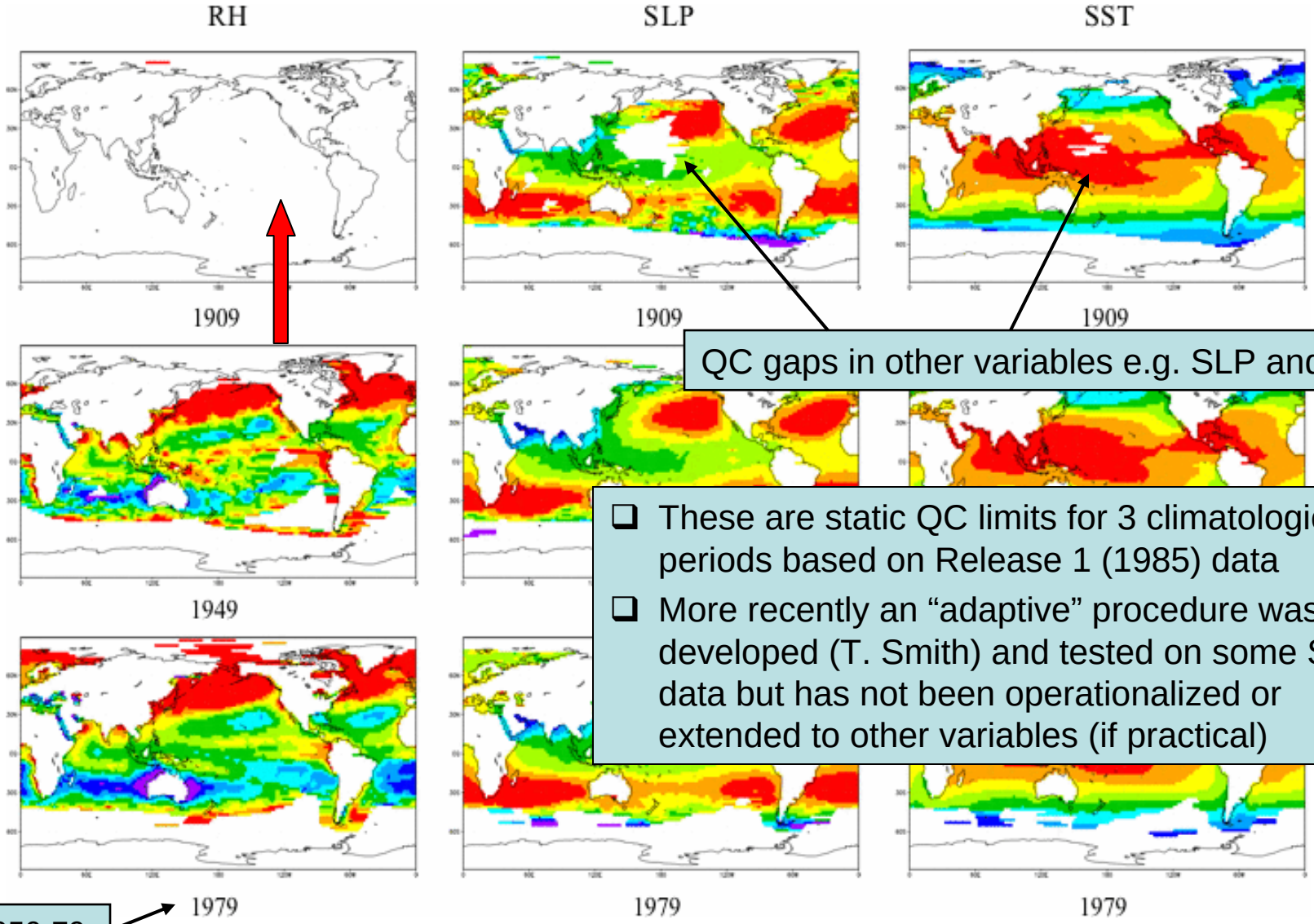
Woodruff, S.D., S.J. Worley, S.J. Lubker, Z. Ji, J.E. Freeman, D.I. Berry, P. Brohan, E.C. Kent, R.W. Reynolds, S.R. Smith, and C. Wilkinson, 2011: ICOADS Release 2.5: Extensions and Enhancements to Sfc Marine Met. Archive. *Int. J. Climatol.* (CLIMAR-III Special Issue, in press).



R2.5: gains in ocean area coverage



R2.5: Ad Hoc QC Modification: Trimming Limits (e.g. July) for RH: Used 1910-49 for 1854-1909

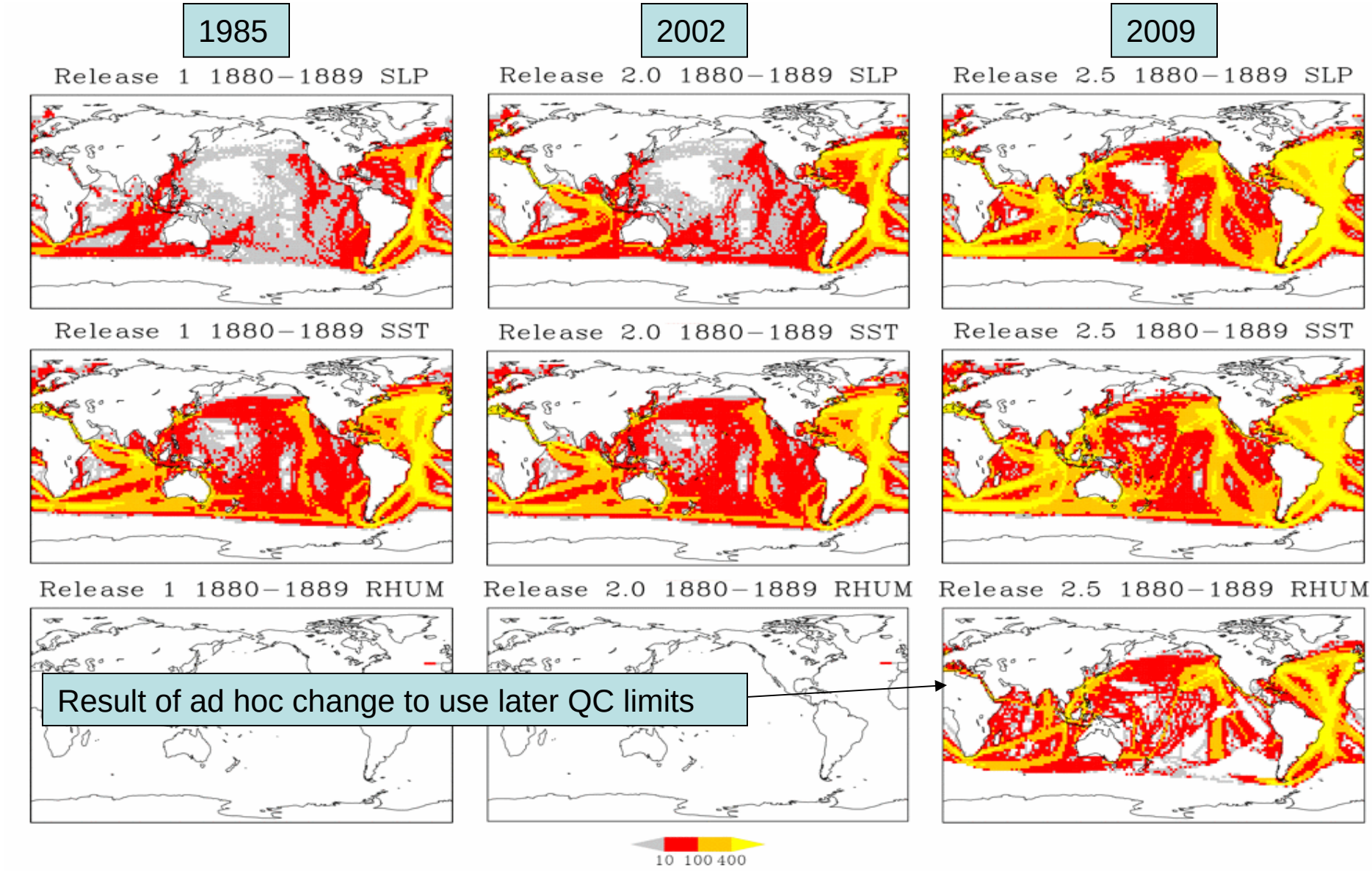


QC gaps in other variables e.g. SLP and SST

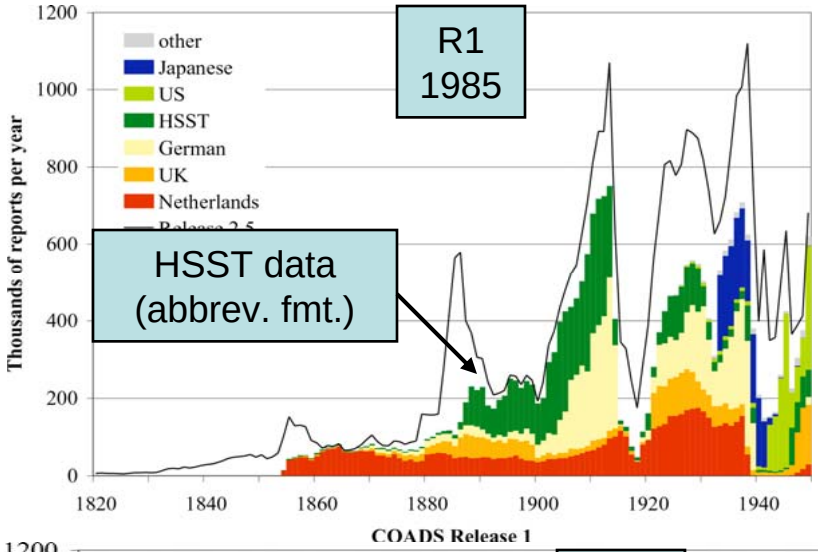
- These are static QC limits for 3 climatological periods based on Release 1 (1985) data
- More recently an “adaptive” procedure was developed (T. Smith) and tested on some SST data but has not been operationalized or extended to other variables (if practical)

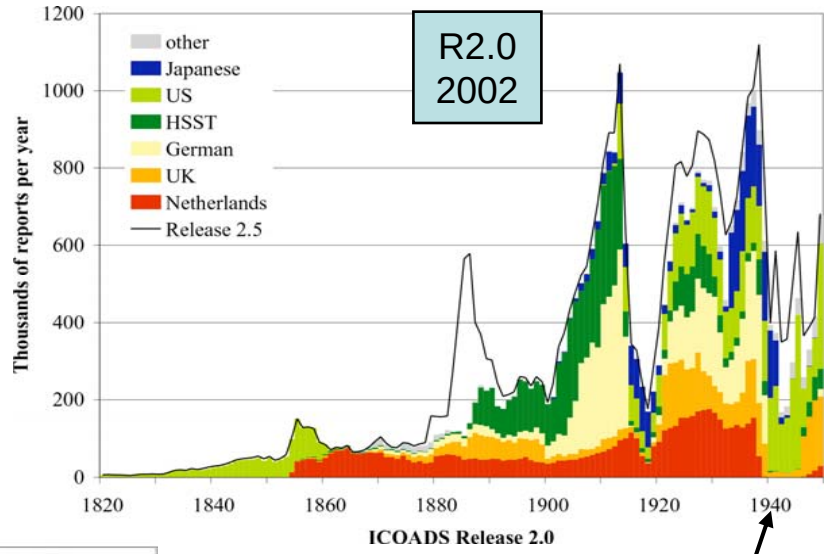
i.e. 1950-79

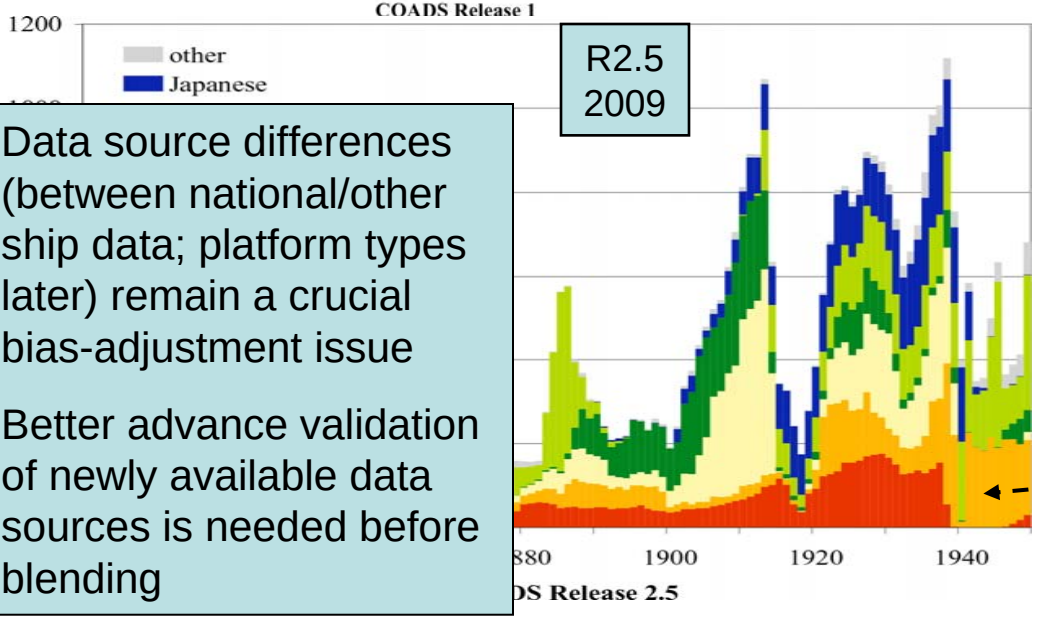
R2.5: spatial enhancements



Early Data Mixture Changes: Homogeneity Impacts





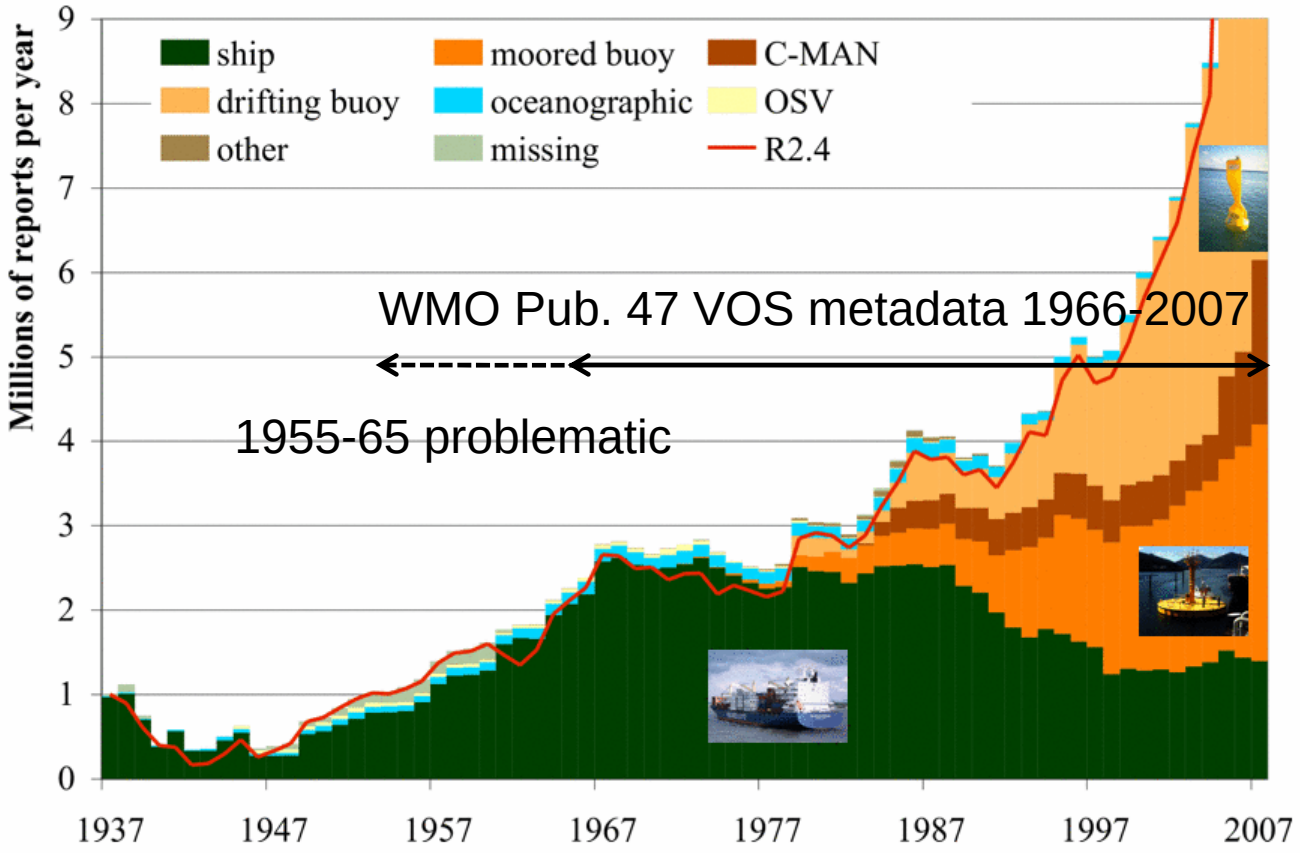


- Data source differences (between national/other ship data; platform types later) remain a crucial bias-adjustment issue
- Better advance validation of newly available data sources is needed before blending

Thompson et al. 2008, *Nature*: A large discontinuity in the mid-C20th in observed global-mean surface temp

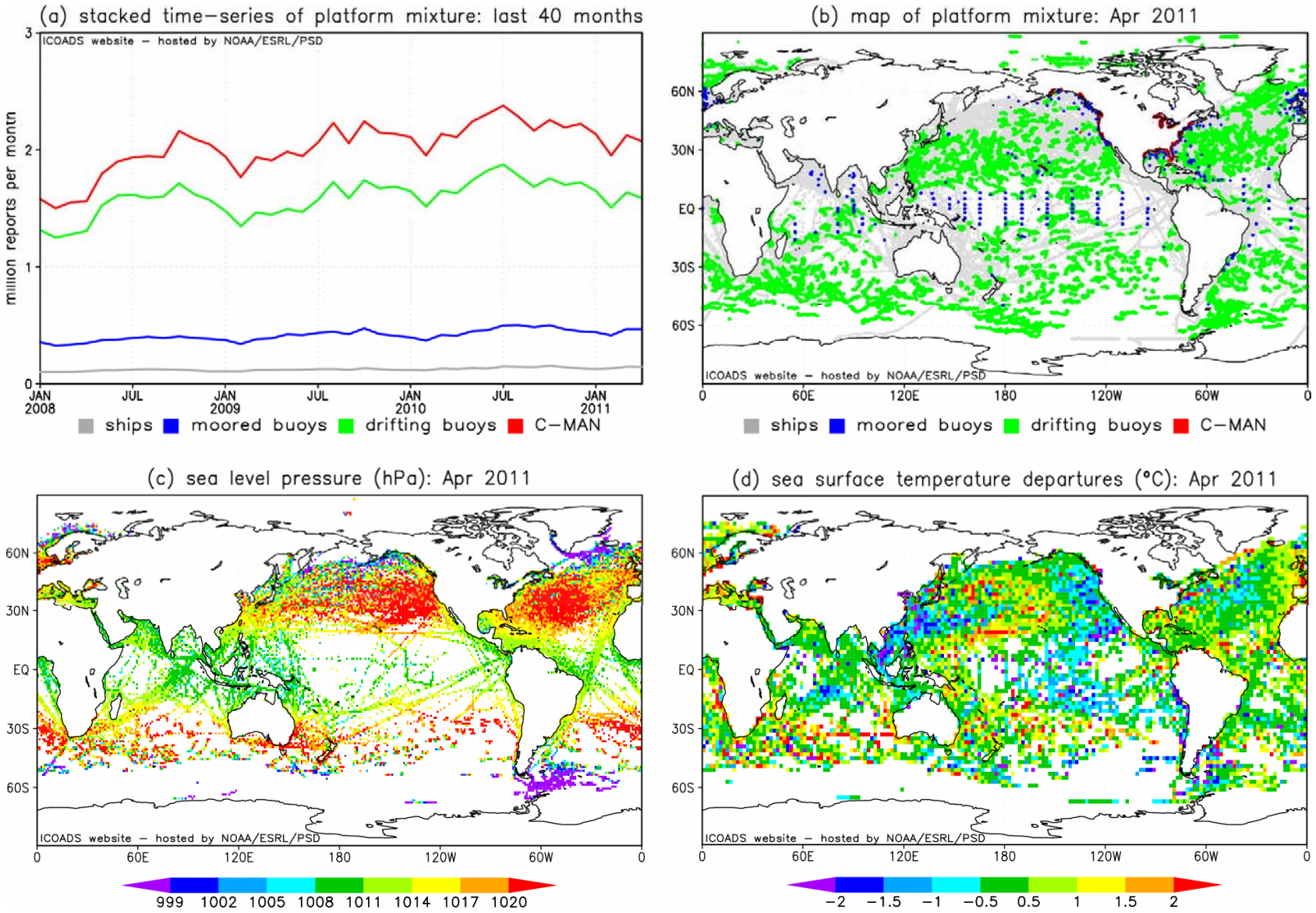
R2.5: Recent platform mixture

- Voluntary Observing Ships (VOS) plus drifting and moored buoys, and other marine platform types
- VOS metadata (with help from UK NOCS)



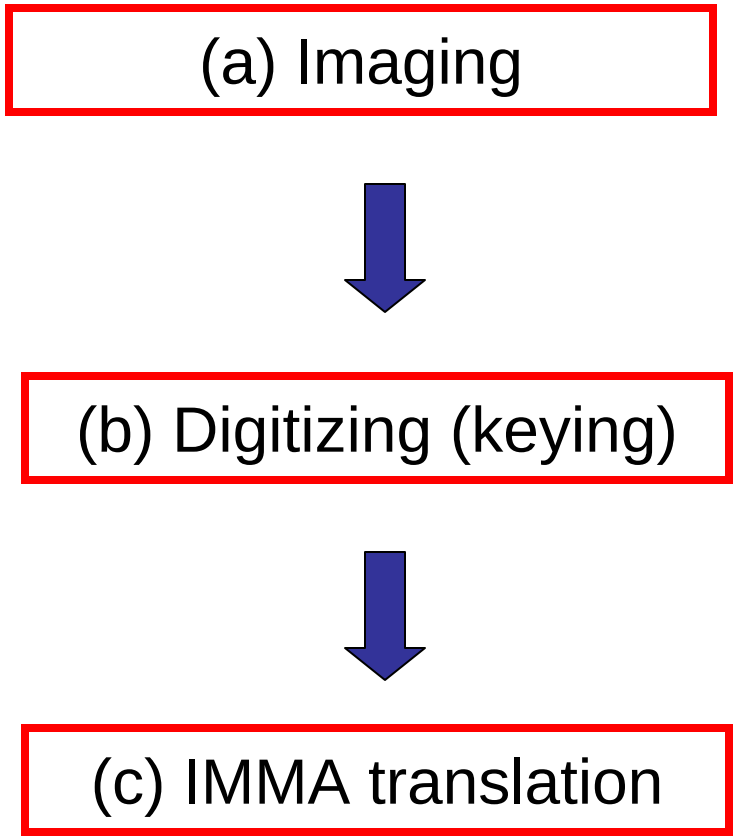
The official Release 2.5 period (1662-2007) is now extended monthly with “preliminary” real-time data and products based on GTS data

Preliminary data flow monitoring



Data Rescue Best Practices: Proposed pipelining

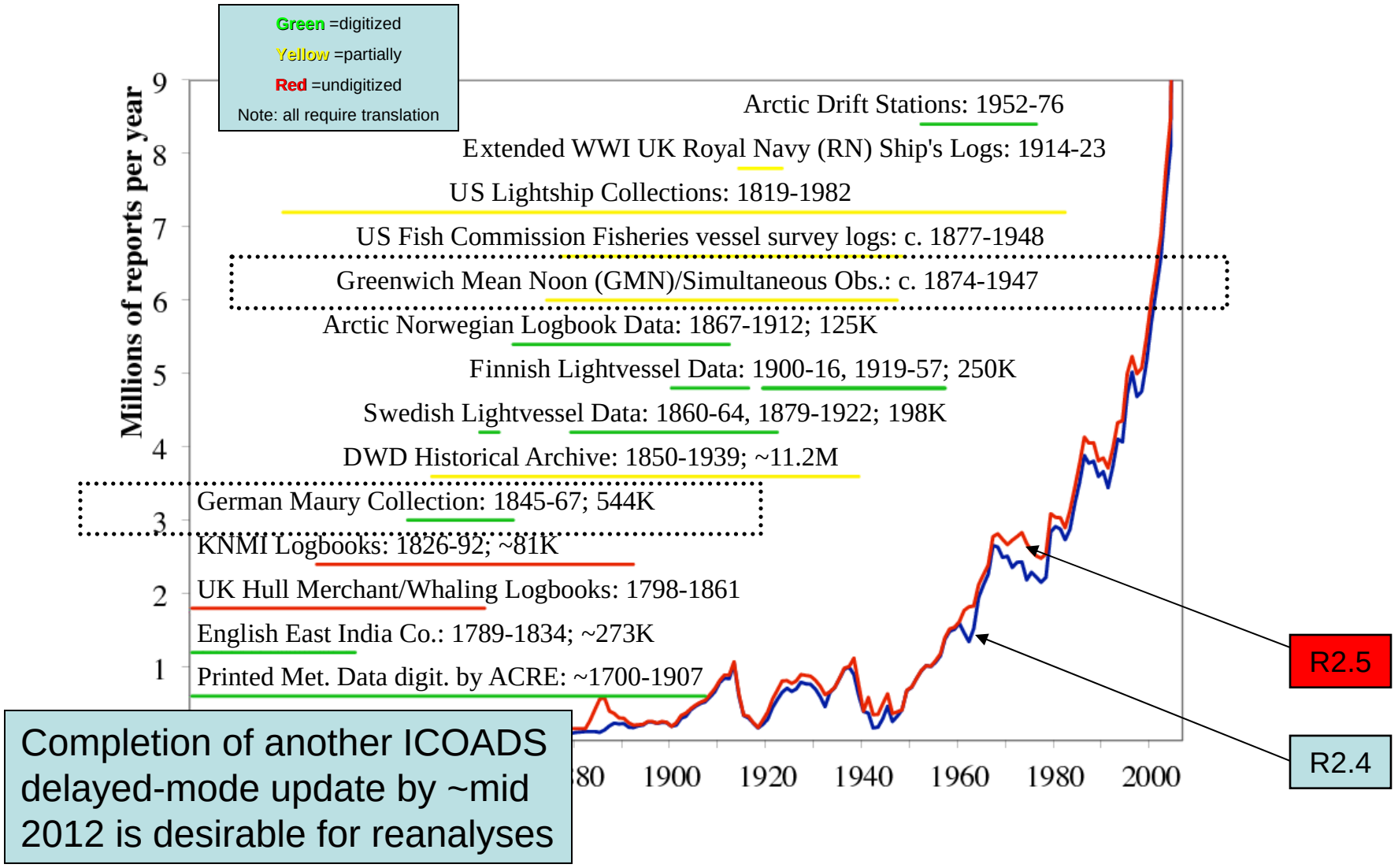
- As practical, initiate concurrent processing:
  - (b) prior to completing (a)
  - (c) prior to completing (a-b)
- Can be helpful to explore data quality/characteristics in advance (e.g. dups)
- Translation into IMMA format
- Among IMMA benefits:
  - suitability for permanent archival (contrast e.g. WMO's BUFR)



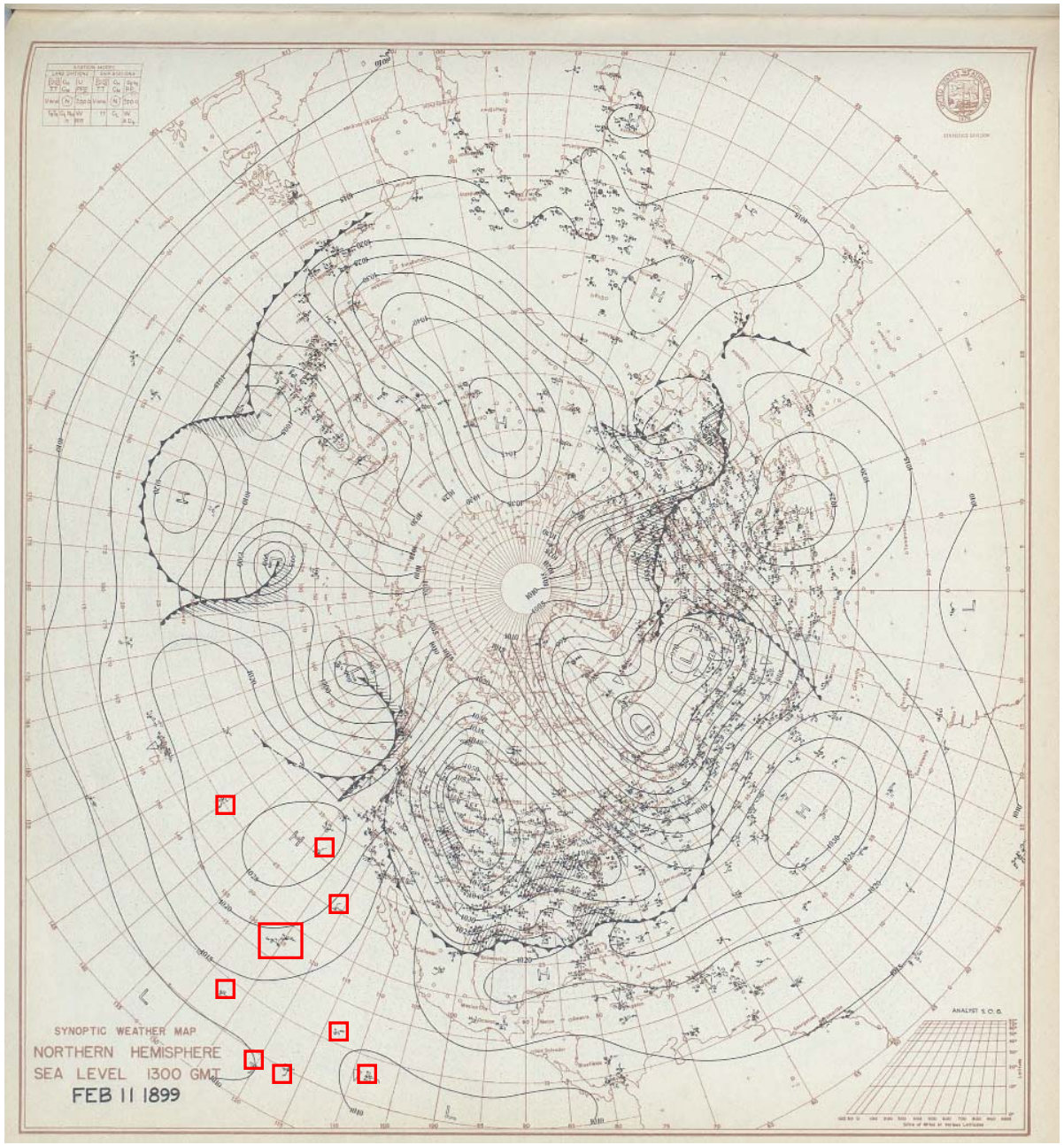
Critical resource bottleneck: the translation of data in unique formats to IMMA is very expensive and presently not adequately resourced

Current Data Rescue Candidates for Blending

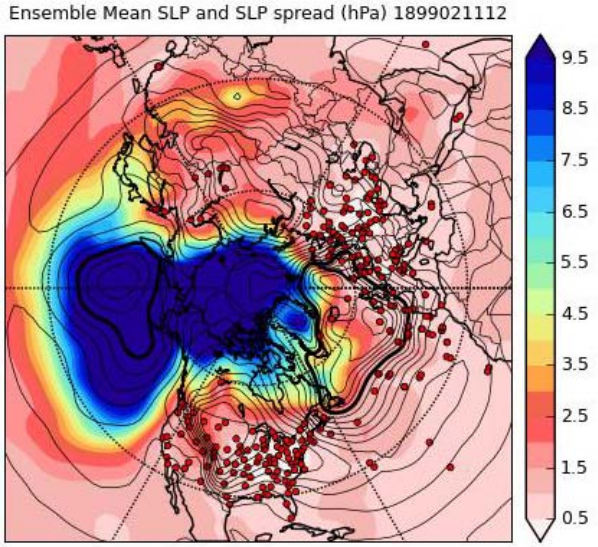
Major contributions from NOAA/CDMP (Freeman – poster) (US funding issues)
RECovery of Logbooks And International Marine Data (RECLAIM) Project (Wilkinson)
Atmospheric Circulation Reconstructions over the Earth (ACRE) (Allan)



Completion of another ICOADS delayed-mode update by ~mid 2012 is desirable for reanalyses



11 Feb 1899 ~12Z Sea Level Pressure (SLP)

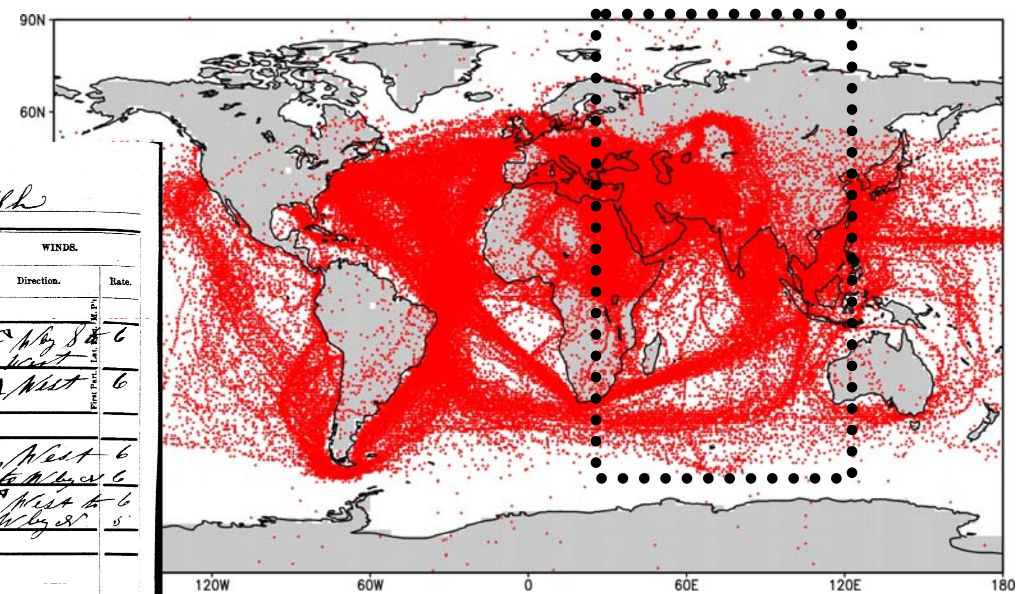


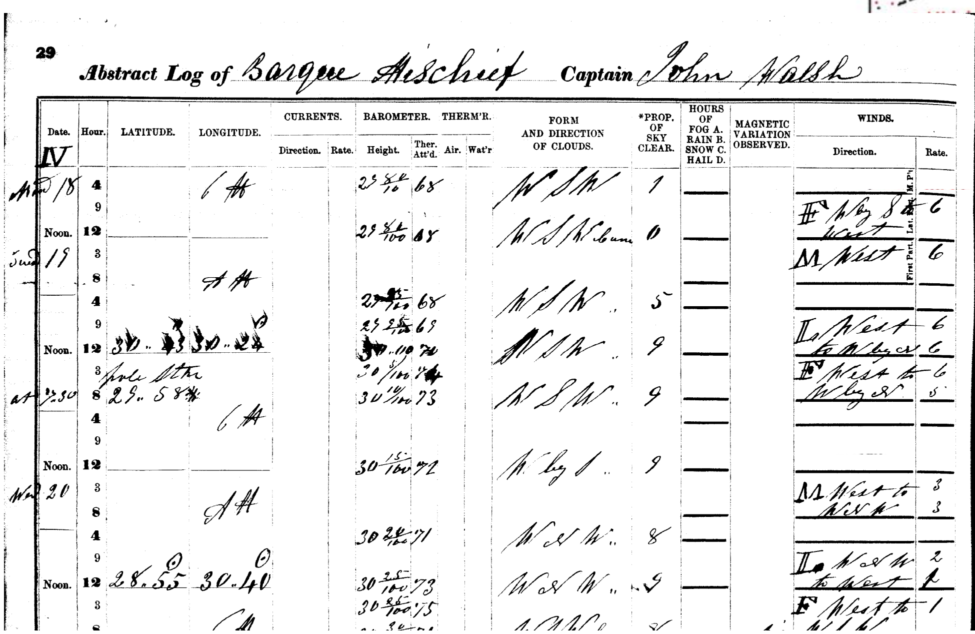
C20th Reanalysis:

- colors = range of uncertainty
- red dots = obs locations

German Maury (1845-67)

- 850 logbooks loaned by DWD
- Imaged and digitized by CDMP; ~544K reports
- QC and translation into IMMA ongoing
  - ✓ problems with interpretation of time elements and location
- SLP biases in other data from this era (research needed)





Other Contemporary Data Challenges (in JCOMM Framework)

- VOS callsign encryption: since ~Dec 2007
  - ✓ Impacts NCEP datastream now used for ICOADS
  - ✓ Arising from commercial and security concerns
- Need for improved international metadata for rigs and platforms
  - ✓ Also possible open data access issues
- UK Real-Time Monitoring Center (RTMC) providing model feedbacks for GTS data (beyond “VOSClim” project)
  - ✓ existing IMMA attm dedicated to these feedbacks
  - ❑ similar storage of e.g. 20CR reanalysis feedbacks?
- Mandated WMO BUFR format (complex binary) transition (2012)
  - ✓ could be disruptive to data quality and continuity

Resource Issues

- Data archaeology and quality control are Cinderella sciences
- QC of historical archives requires expert manpower and is thus expensive
- It is a pre-requisite for reconstructing past history of the ocean state – the community is investing large amounts in reanalysis/assimilation machinery – we need comparable investment in assembly and QC of the feeder data sets

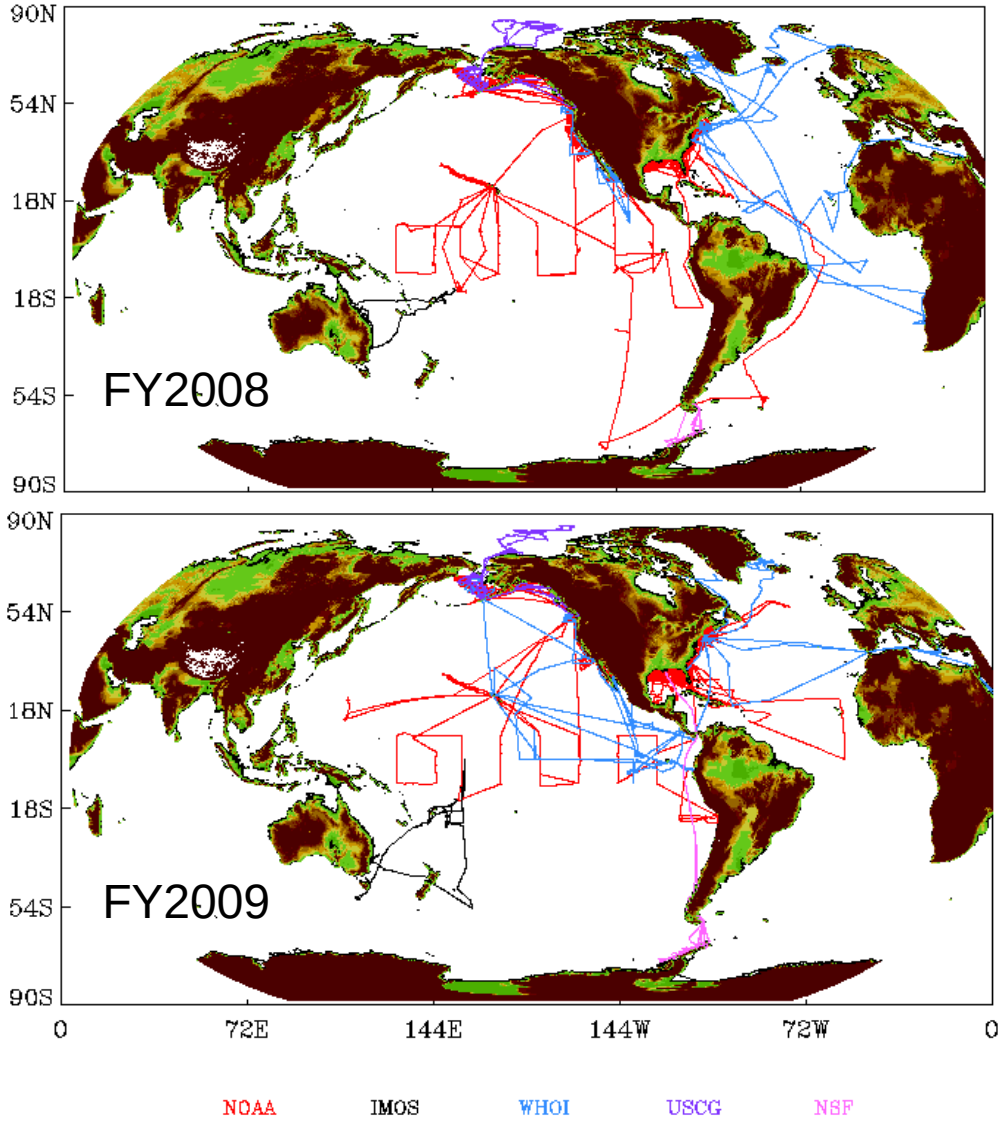
From: Wijffels, S. et al. 2009: Ocean Temperature, Heat Content and Thermosteric Sea Level Rise. *OceanObs09 Plenary Paper*

- NOAA funding pressures
  - Larger planned role for NCDC (operational center)
  - Blending NCDC GTS data (possibly other sources) could partly resolve callsign masking
- Historical (CDRs) updates not suitable for “operations”

Adding SAMOS Data to ICOADS

- SAMOS data center has QC'd marine R/V data since 2005
- Data at 1-minute intervals
- Will be sub-sampled to hourly and converted to IMMA
- Method used to provide earlier R/V data to ICOADS
- Est.: ~300K new obs.; 27 RVs
- Once implemented, updates can be sent to ICOADS on monthly basis as part of routine archival process with NODC

SAMOS ship tracks



Proposal for Formal WMO-IOC Recognition through JCOMM

- To establish a network of mirrored WMO-IOC Centres for Marine-meteorological and Ocean Climatological Data (**CMOC**)
- Proposed requirements:
  - ✓ Host standardized formats and QC processing
  - ✓ Reliably mirror data and products
  - ✓ Open data access; **WIS (WMO Information System)** interoperability
- Benefits e.g. historical data exchange
  - Countries can be reluctant to exchange historical data without assurance of formal international repository

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Conclusions

- Regular MARCDAT/CLIMAR workshops (~every 2 yr)
  - ✓ data focus; help drive progress & develop shared ownership
- Involvement with satellite projects and the surface temperature (land) initiative offers an important new avenue for closer linkages between communities

✓ E.g. interoperable tracking of data provenance (UID)

- QC and bias-adjustment improvements needed

✓ e.g. static QC limits extensively missing for high-latitude data

✓ link with “IVAD” proposal (Shawn Smith, next)

- How to quantify data rescue benefits (e.g. reanalyses, SST, ecology) remains an important challenge


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