International Comprehensive Ocean-Atmosphere Data Set (ICOADS) Project

Scott Woodruff
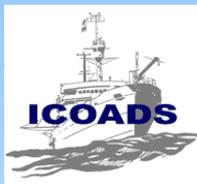**NOAA Earth System Research Laboratory**
Boulder CO 80305
303 497- 6747; Scott.D.Woodruff@noaa.gov

Outline

- Brief Project Overview
- Approach (2 slides)
- Results/Accomplishments (3 slides)
- Validation Strategy/Results (2 slides)
- Algorithm/Product Maturity
- Issues/Risks & Work-Off Plans
- Schedule
- Research-to-Operations or Delivery Plan
- Resources

NCAR

Overview

▪ Goals – ICOADS is the world's most extensive global surface marine meteorological archive. Goals include: continuing to add scientific value to the observations, products, and metadata, as well as to strengthen the cooperative enterprise – joint in the US between NOAA and NCAR – via expanded linkages to international initiatives and organizations.

▪ Source Data – Voluntary Observing Ships (VOS), drifting and moored buoys, and a wide range of other marine data

▪ Deliverables – Individual marine observations, and monthly summary products (2˚x2˚ since 1800, 1˚x1˚ since 1960)

▪ ECVs – sea surface temperature (SST), sea-state and sea-ice, air temperature, humidity, sea level pressure (SLP); clouds and weather also are critical for marine climatology

▪ Current/expected user communities – climate studies and assessments; many other avenues of research and education

NCAR

Approach (1)

Worley, S.J. et al. 2009: The Role of ICOADS in the Sustained Ocean Observing System. *OceanObs09 Community White Paper*
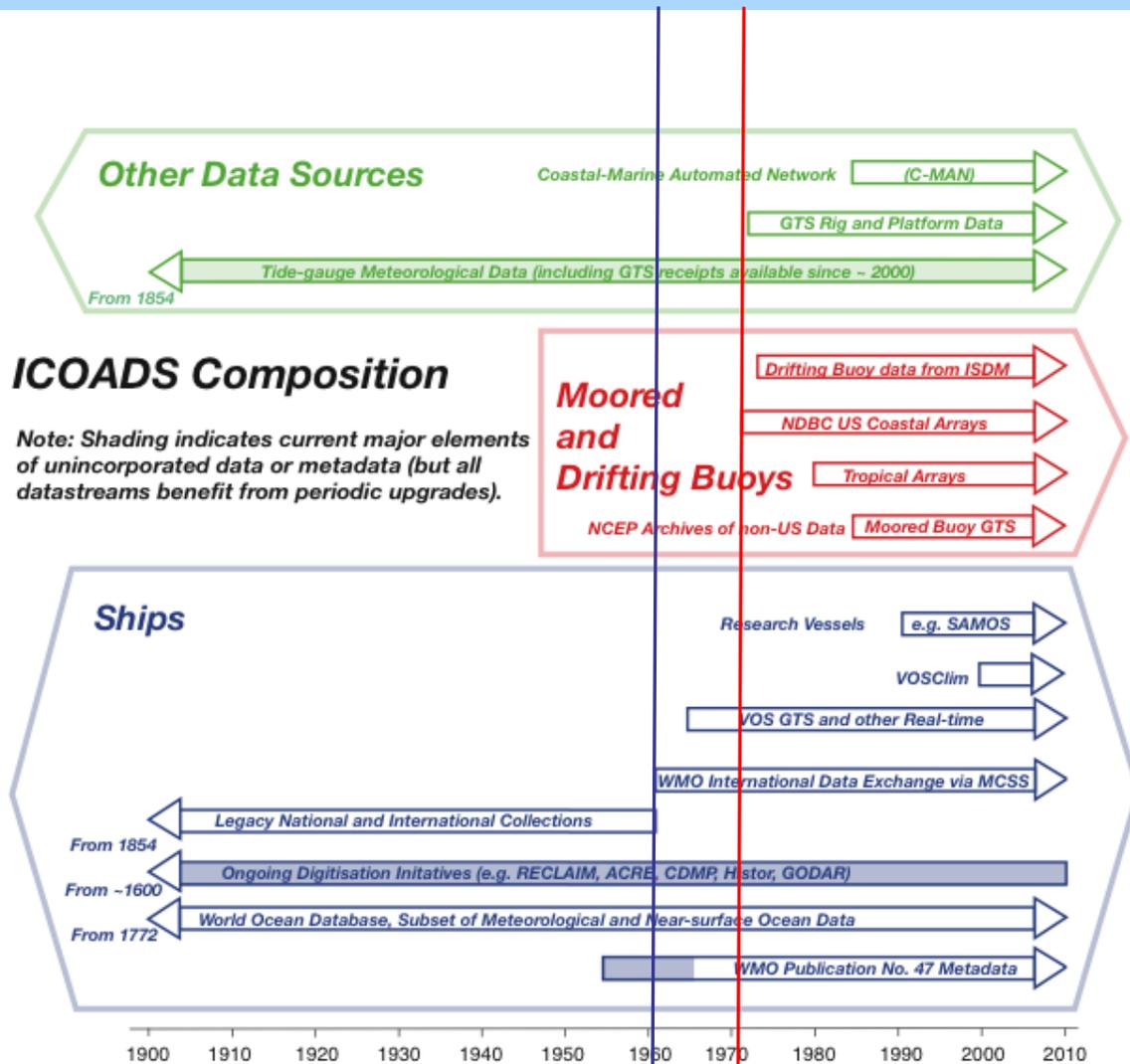
- "The objectives of ICOADS remain: to collect as much original estimated (non-instrumental) and measured surface *in situ* data as possible; to treat each observation systematically—preserving data source identification and measurement metadata with each record, and converting units and coding schemes to a uniform set; to perform basic quality checks; and to freely distribute the data and products worldwide."

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

- "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"

NCAR

Approach (2)

From: Woodruff et al. 2009: Surface In situ Datasets for Marine Climatological Applications. *OceanObs09 CWP*

Other Data Sources
- Coastal-Marine Automated Network — (C-MAN)
- GTS Rig and Platform Data
- Tide-gauge Meteorological Data (including GTS receipts available since ~ 2000)
- From 1854

ICOADS Composition

Note: Shading indicates current major elements of unincorporated data or metadata (but all datastreams benefit from periodic upgrades).

Moored and Drifting Buoys
- Drifting Buoy data from ISDM
- NDBC US Coastal Arrays
- Tropical Arrays
- NCEP Archives of non-US Data — Moored Buoy GTS

Ships
- Research Vessels — e.g. SAMOS
- VOSClim
- VOS GTS and other Real-time
- WMO International Data Exchange via MCSS
- Legacy National and International Collections — From 1854
- Ongoing Digitisation Initatives (e.g. RECLAIM, ACRE, CDMP, Histor, GODAR) — From ~1600
- World Ocean Database, Subset of Meteorological and Near-surface Ocean Data — From 1772
- WMO Publication No. 47 Metadata

1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010
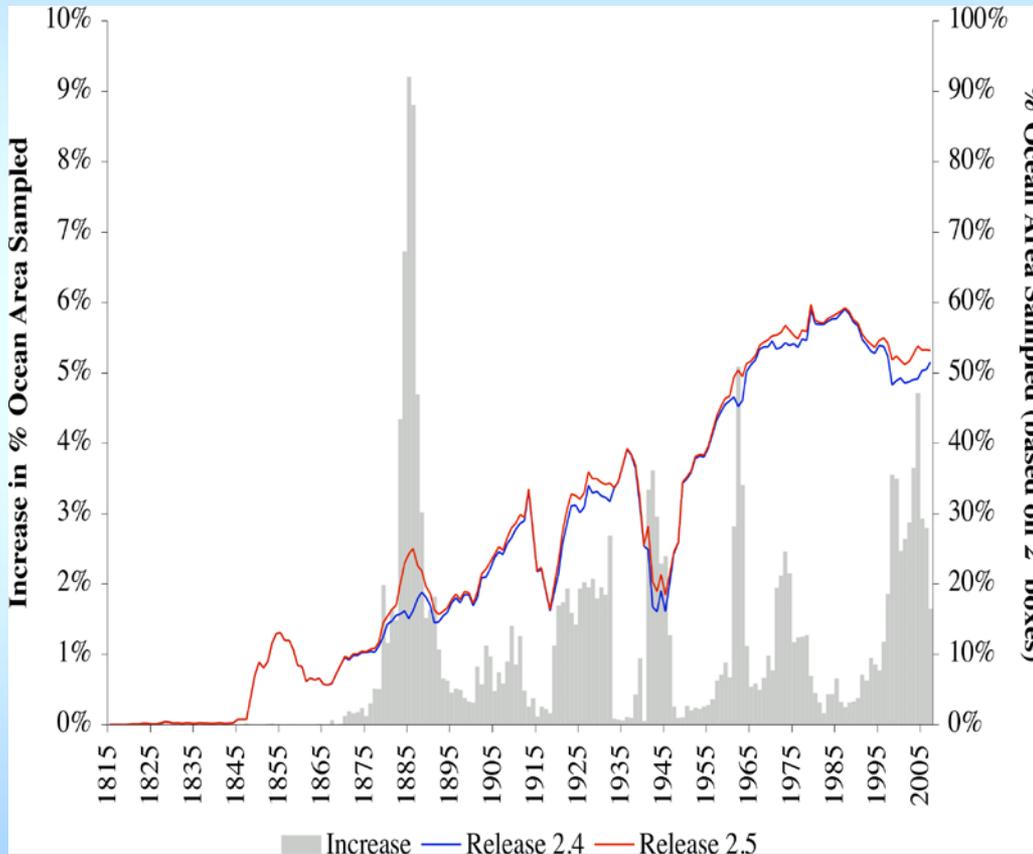
buoy/ODAS

WMO logbook exchange

5

Results/Accomplishments (1)

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, 2009: ICOADS Release 2.5: Extensions and Enhancements to the Surface Marine Meteorological Archive. *Int. J. Climatol.* (submitted).
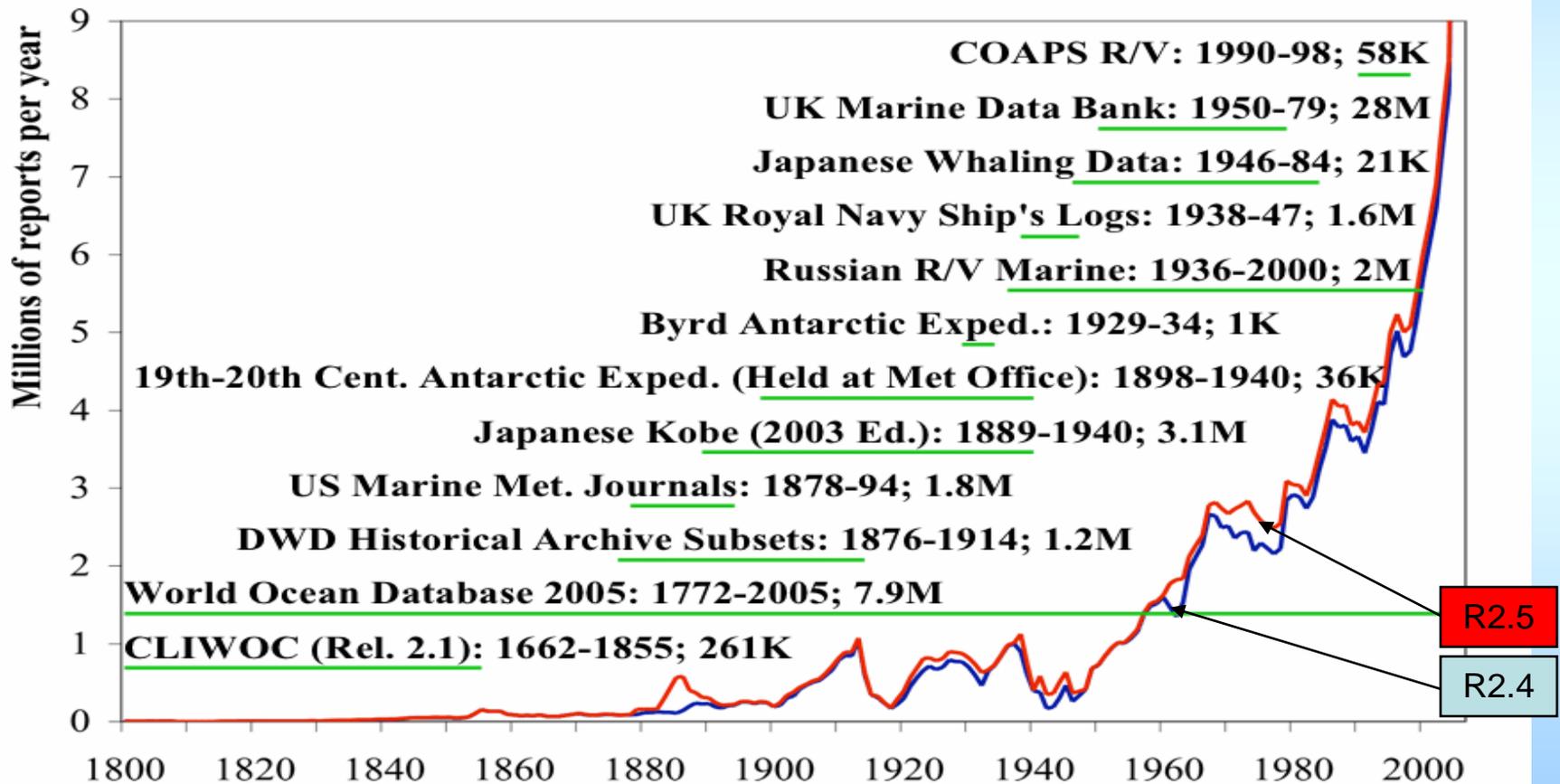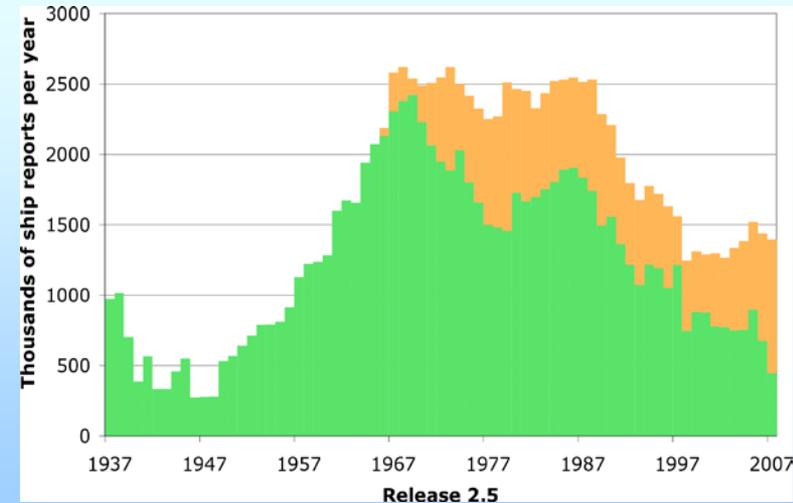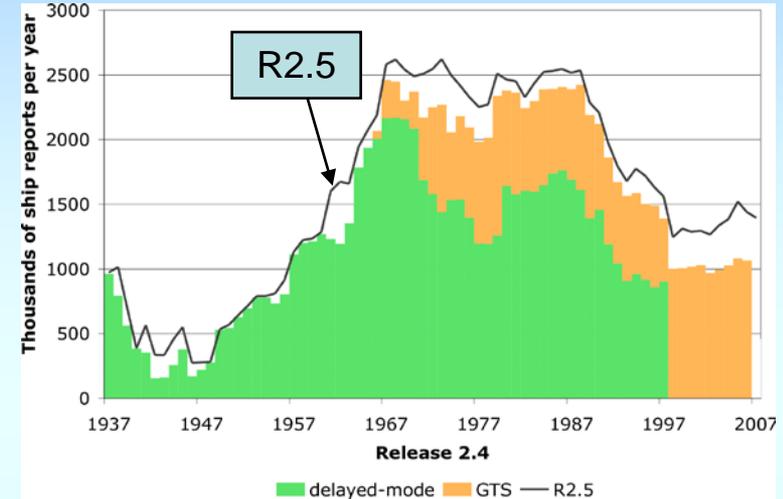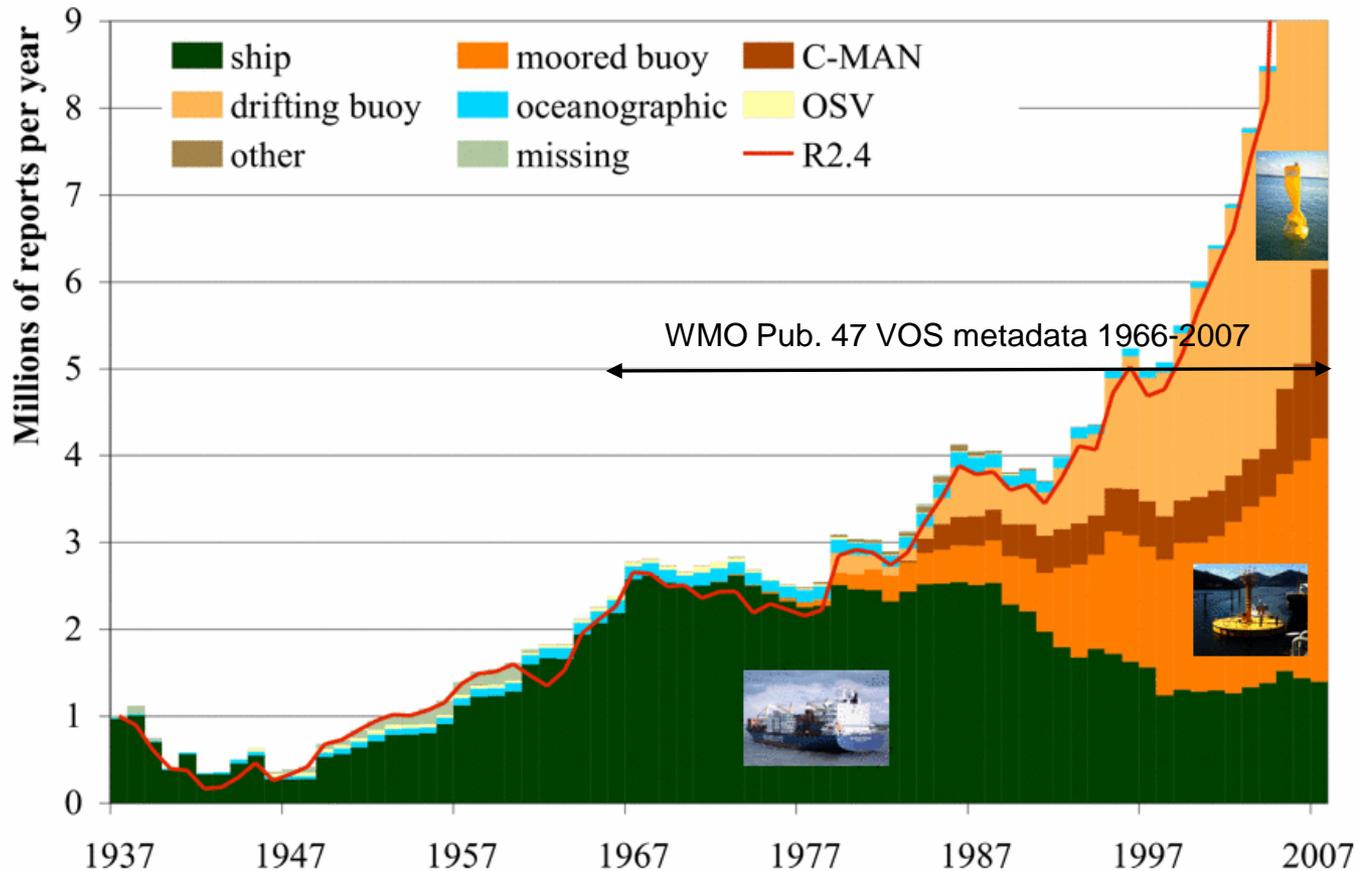
Results/Accomplishments (2)

Replacement of GTS w/ DM VOS data

Improvements in ocean area coverage

Results/Accomplishments (3)

Addition of VOS platform/instrumental metadata; with help from UK NOCS

WMO Pub. 47 VOS metadata 1966-2007

The official R2.5 period (1662-2007) is now extended monthly with "preliminary" real-time data and products based (currently) on NCEP GTS data

Validation Strategy/Results (1)

*International Maritime Meteorological Archive (IMMA) format:
core + optional "attachments"*

core	icoads	immt	meta	model	. . .	suppl

- Emerging international standard

- Planned development of new attms for:

  - ✓ "historical" attm (e.g. Beaufort wind)

  - ✓ reanalysis feedback information

- Contribution of data in IMMA format:

  - ✓ COAPS, UK, KNMI, etc. (so far)

Key requirement:
attm of original
("suppl.") data

jcomm OCEANOGRAPHY & MARINE METEOROLOGY

Experience demonstrates format translations frequently:

  ▪ contain small (or large) errors

 ▪ or are incomplete

NCAR

Validation Strategy/Results (2)

Systematic tracking of data sources and routine comparisons for data changes

R1
1985

HSST data
(abbrev. fmt.)

R2.0
2002

R2.5
2009
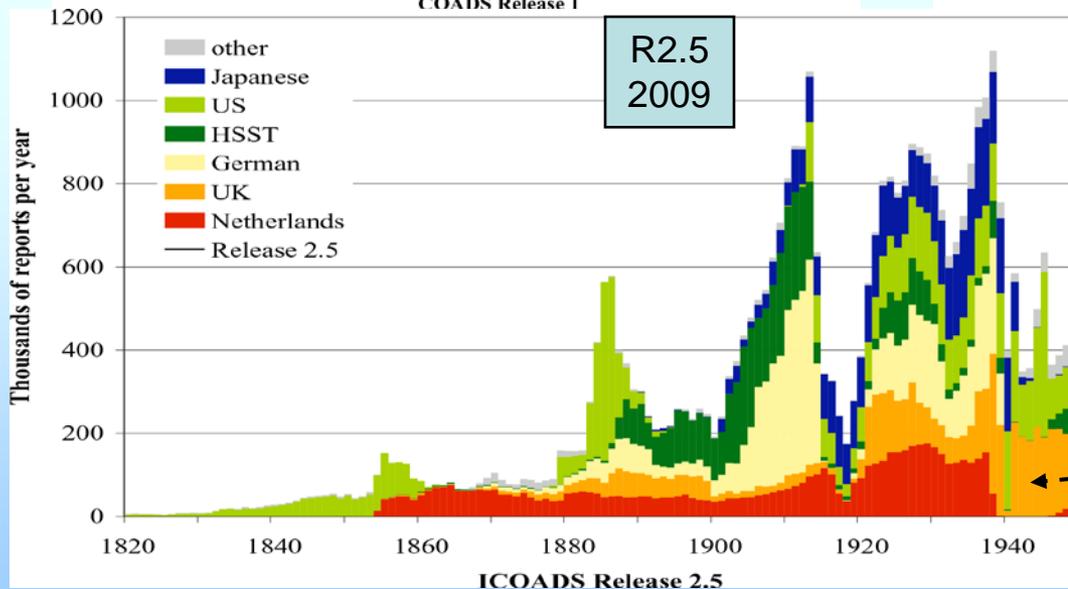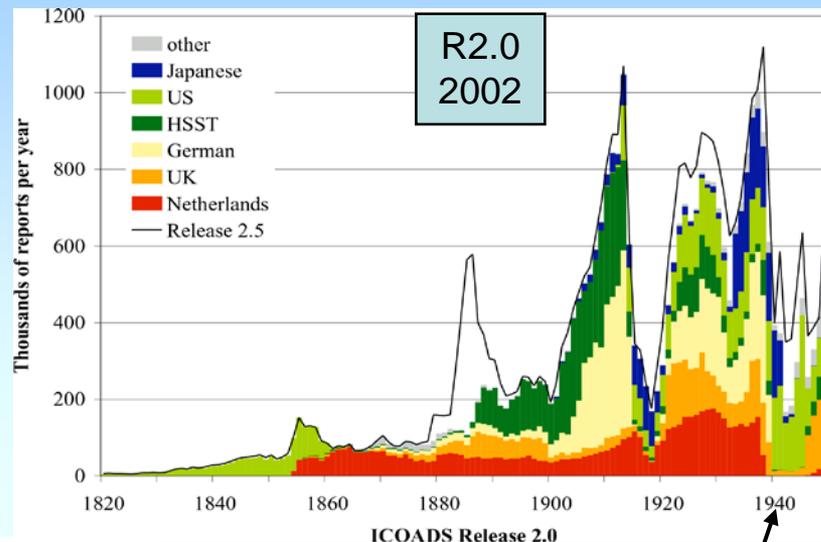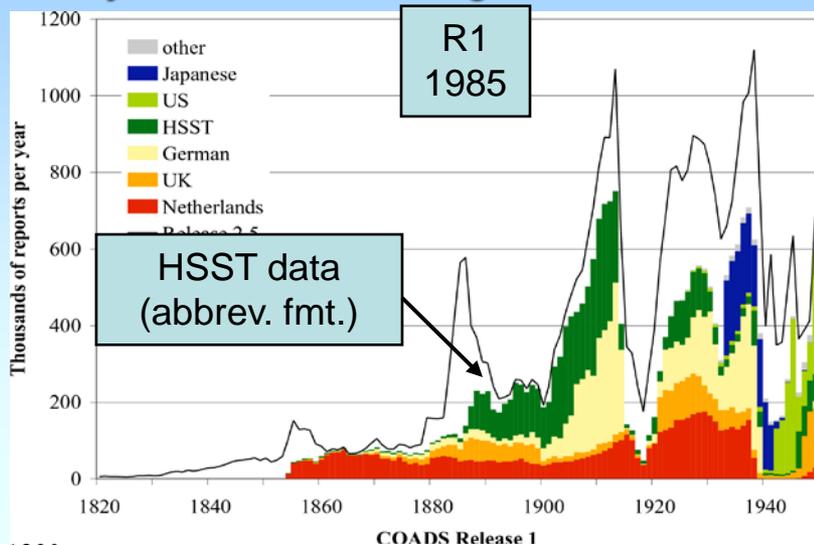
Thompson et al.
2008, *Nature*: A
large discontinuity
in the mid-C20th in
observed global-
mean surface temp

Issues/Risks & Work- Off Plans

- **ERSL Senior Marine Programmer**
  - current funding: <50% FTE
- **New delayed-mode ICOADS update urgently desired by October 2010 for historical reanalysis (Compo et al.)**
  - above 50% FTE insufficient
- **ICOADS QC modernization still needed**
  - Out-of-date algorithms and QC limits
  - Can be insufficently responsive to genuine climate extreme signals

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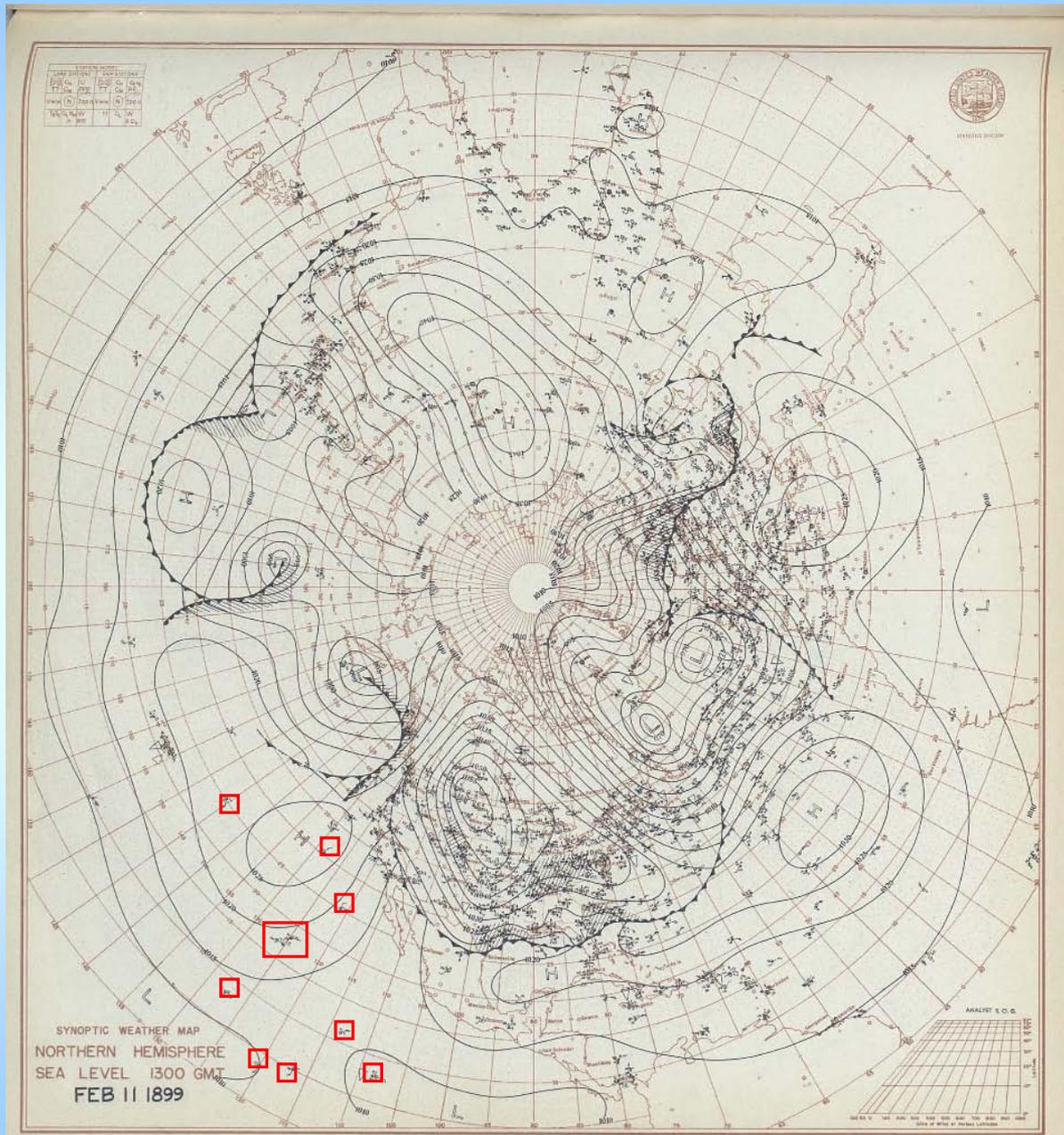
11 Feb 1899 ~12Z Sea Level Pressure (SLP)

Ensemble Mean SLP and SLP spread (hPa) 1899021112
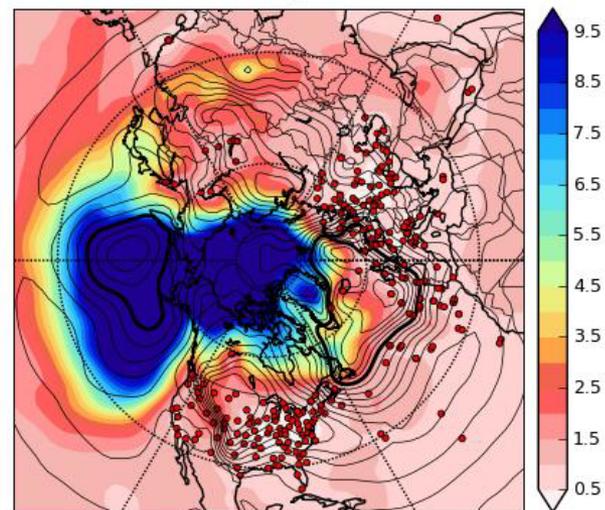
C20th Reanalysis:
- colors = range of uncertainty
- red dots = obs locations

Schedule

- *October 2010: Completion of next delayed-mode update desirable*

    ✓ *Many new data sets continue to become available internationally: CDMP, UK, REcovery of Logbooks And International Marine Data (RECLAIM) project, Atmospheric Circulations for the Earth (ACRE)*

- *Real-time: Resource dependent schedule. Additional progress planned towards transitioning processing to NCDC (competing with above goals).*

Proposed "Pipelining"

(a) Imaging

(b) Digitizing (keying)
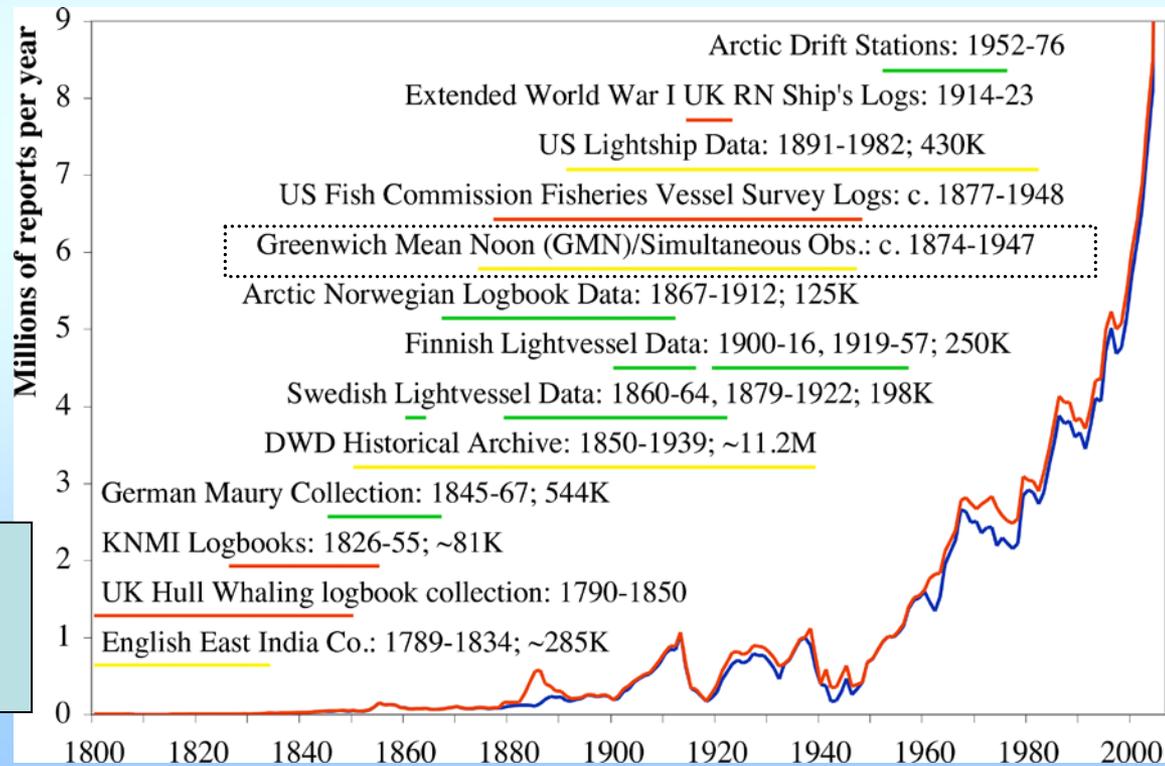
(c) IMMA translation

Green =digitized
Yellow =partially
Red =undigitized
Note: all require translation

Research- to- Operations or Delivery Plan

- **Many contemporary and historical real-time (RT) and delayed-mode (DM) data sources are now flowing regularly (NCDC to NCAR)**
  - alternative GTS sources (redundancy is valuable)
  - historical records digitized by CDMP, etc.
- **Responsibility for RT updates is being transitioned to NCDC as resources permit**
  - Blending of WMO Pub. 47 metadata also suggested for porting from UK NOCS to NCDC
- **DM updates not suitable for operations**
  - Longer term efforts to port generalized software

Resources

- Number of personnel employed for project
  - S. Lubker, ESRL (Senior Marine Programmer)
  - Plus ESRL, NCDC, NCAR contributions
- Key collaborating projects or personnel
  - S. Worley, NCAR
  - NCEP (operational center); COAPS/FSU
  - UK NOCS and Met Office; DWD; JCOMM
- NOAA points-of-contact or collaborators, as applicable
  - R. Reynolds, NCDC; E. Freeman, NCDC/CDMP
- Target NOAA Data Center:
  - NCDC