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COADS Updates Including Newly Digitized Data and the Blend with the UK Meteorological Office Marine Data Bank

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1. Introduction

The Comprehensive Ocean-Atmosphere Data Set (COADS) is the most extensive set of surface marine meteorological data presently available for the world ocean, now covering 1854-1997. Surface meteorological observations from ships of opportunity are available for the entire period-of-record. These are supplemented in more recent years by increasing amounts of data from moored and drifting buoys, oceanographic research vessels (R/Vs), and fishing vessels.

We have nearly completed long-term efforts toward a full replacement and update of COADS Release 1 (1854-1979) (Slutz et al., 1985; Woodruff et al., 1987), including improved observational and summary products. The improvements include many new sources of newly digitized historical data (Diaz and Woodruff, 1999), plus a blend of COADS with the UK Meteorological Office (UKMO) Marine Data Bank (MDB).

2. Recent updates

Release 1a products, originally completed for 1980-92 (Woodruff et al., 1993), have been updated and extended several times in response to requirements from the user community for updated products. The most recent update, completed in June 1999, involved a complete reprocessing of the previously available 1980-95 period, plus an extension through 1997. This included the blend with the UK MDB for 1980-94, plus other data additions and improvements (e.g., quality controlled versions of moored and drifting buoy data, and of near-surface sea temperatures extracted from the uppermost levels of oceanographic profiles).

Release 1b (1950-79; completed in November 1996) pre-dated our work on the blend with the UK MDB (to be fully implemented in a future update of this time period), but provided improvements in data quality and coverage in comparison to previously available Release 1 data for 1950-79. Russian data were added, for example, from their large marine (MARMET) archive and from "North Pole" (drifting ice) stations. Also, many significant data corrections were made, including for widespread temperature biases in Global Telecommunication System (GTS) records (see Woodruff et al., 1998).

Release 1c (1784-1949), the last of these partial updates, is almost finished. This update will blend UK MDB data for 1854-1949 (including 0.5M newly keyed 1935-39 UK merchant data), and extend COADS for the first time prior to 1854. Recently digitized data are also being included from: Japan's Kobe Collection (1890-1932; 1M reports; Manabe, 1999), the US Maury Collection (1784-1863; 1.3M), the Norwegian Logbook Collection (1867-1889; 201K), the US Merchant Marine 1912-46 Collection (3.5M), and the Russian S.O. Makarov Collection (1804-1891; 3,500 reports).

Figure 1 illustrates the international makeup of Release 1c data, and highlights the continuing importance of Dutch (deck 193; 1854-1938) data, which were also included in Release 1. Spatial coverage improvements achieved for Release 1c are contrasted in Figure 2 for sea surface temperature (SST) and sea level pressure (SLP). Improvements in both variables stem from newly available data sources, augmented for SLP through the recovery (i.e., conversion to hPa from mm, and gravity adjustment) of previously untapped supplementary data from deck 193.

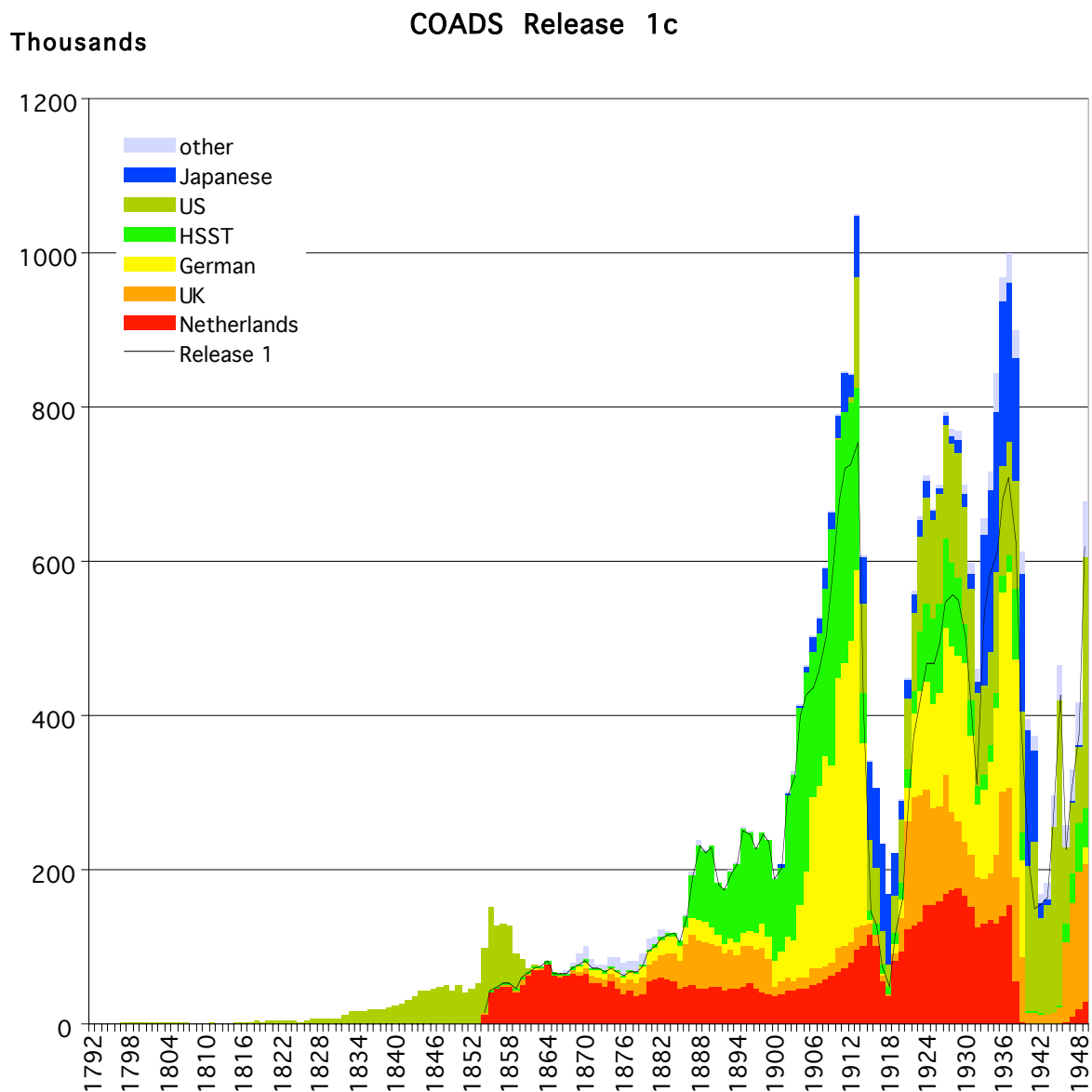
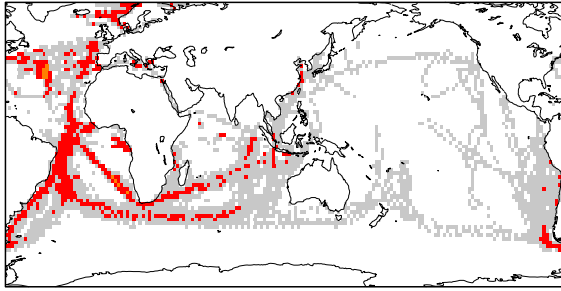


Fig. 1: Global source “deck” makeup of COADS Release 1c, grouped according to roughly national categories, plus Historical Sea Surface Temperature (HSST) Project data (color bars; thousands of marine reports per year). Note the importance of Netherlands data, e.g., during 1860-80. For comparison, the line shows the amount of data previously available in Release 1.

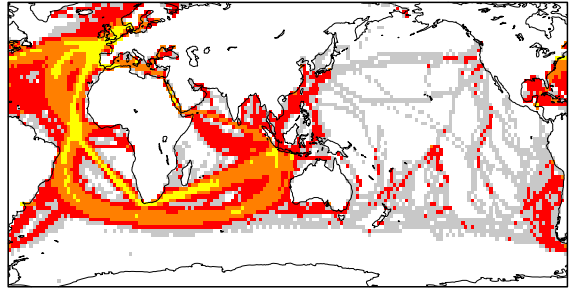
Release 1

Release 1c

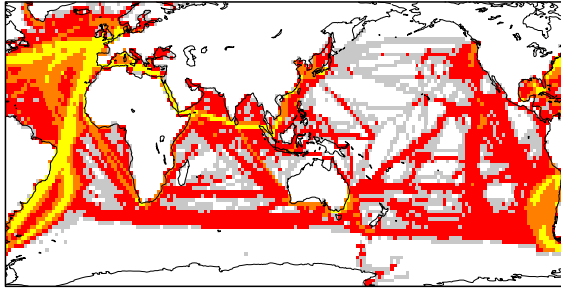
1870–1879 slp



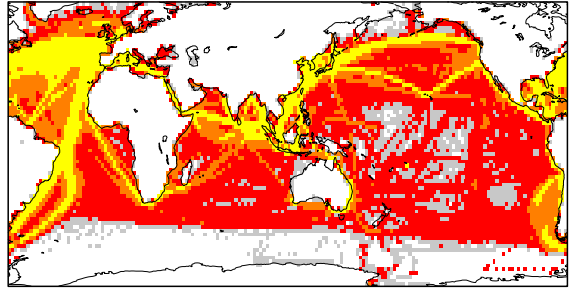
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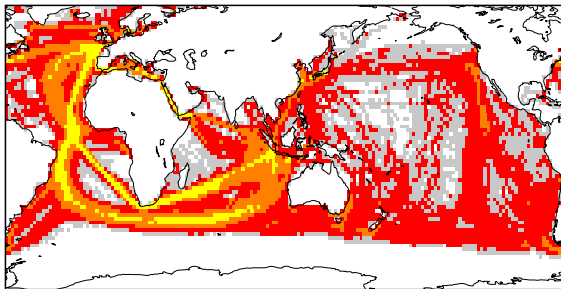
1910–1919 slp



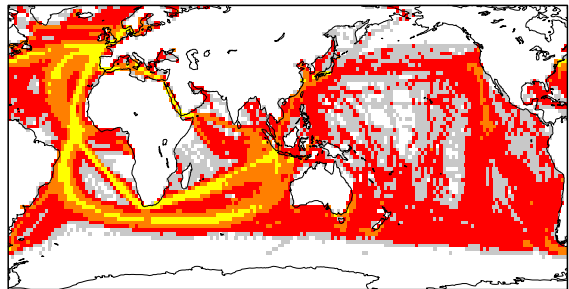
1910–1919 slp



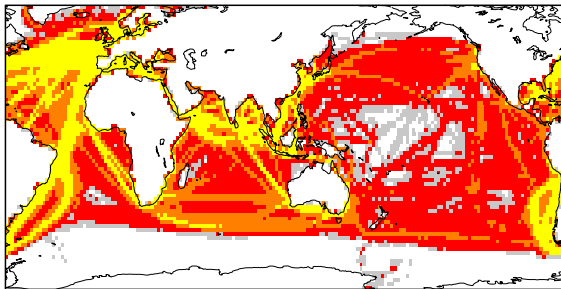
1870–1879 sst



1870–1879 sst



1910–1919 sst



1910–1919 sst

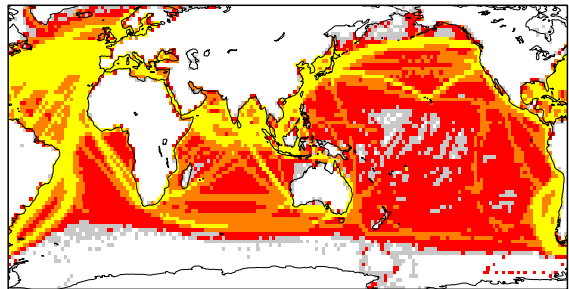


Fig. 2: Decadal totals of sea level pressure (SLP) and sea surface temperature (SST) observations (70°N - 78°S ; 68°W - 68°W) for two decades (1870-79 and 1910-19). Older data available in COADS Release 1 are shown on the left; those plus new data added for Release 1c are shown on the right. The colors show the number of observations in a 2° box per decade. Grey indicates 1-9; red indicates 10-99; orange indicates 100-399; yellow indicates 400 or more.

3. Products: observations, summaries, metadata

Completion of Release 1c will make the entire archive (1784-1997) available in uniform observational and summary formats (Table 1). We note that a highly abbreviated ascii format is also available to meet requirements for observational data more recent than are available in COADS (i.e., now later than 1997). These near-real-time data are updated monthly by NOAA's National Centers for Environmental Prediction (NCEP), and offered for access via the COADS Website.

Table 1. Upcoming COADS product availability, temporal and geographic availability, and latitude \times longitude box resolution.

Product*	Period	Domain	Resolution
Observations	1784-1997	global	(individual marine reports)
Summaries	1800-1997	global	2° \times 2°
Summaries	1960-1997	global	1° \times 1°
Summaries	1960-1997	equatorial belt†	1° \times 1°

* The individual marine reports (e.g., from ships and buoys) provide 72 observational fields, plus quality control flags. The monthly summaries provide 10 statistics for each 22 observed and derived variables.

† 10.5°N-10.5°S, with gridding offset 0.5° from the global product and a row of 1° boxes straddling the equator.

Improved metadata are also being made available as part of these updates. The COADS Website (<http://www.cdc.noaa.gov/coads/>) provides links to, or information about how to request data and metadata products. Major enhancements to the COADS Website were completed in June 1999. These included software, electronic documentation (e-doc), and inventories for currently available products; selected publications on-line (see the references for examples); and annual ship instrumental metadata available in digital form since 1973 gathered in WMO's publication No. 47 (1955-). The WMO47 files from 1973-94 were reprocessed by Elizabeth Kent of the UK Southampton Oceanography Centre. The metadata available on the Website will continue to grow in the future. Our plans are to add early UK and US documentation that is not readily available, discussions and descriptions of data problems that we analyze, and answers to frequently asked questions.

4. Future plans

The updated COADS data are providing crucial inputs for Intergovernmental Panel on Climate Change (IPCC) Scientific Assessments, and internationally for several centers computing Global Atmospheric Reanalyses. COADS products are distributed openly and without restriction; this has been a critical element in developing broad international participation, and provides a relatively uniform database for a wide variety of scientific investigations.

When Release 1c and the COADS-MDB blend are completed we will be in a position to process the full archive (1784-1997) and better address these problems. This is an important development phase for COADS. We are targeting a completion date near the end of 2001 for what will be called Release 2.

To be successful Release 2 will require better user access to metadata and data, and improved quality controls. In conjunction with new ascii-format products, temporal and spatial subsetting of the global long-term archive will be offered. As discussed in Woodruff

et al. (1998), we plan to concentrate metadata improvements and bias adjustments on the individual observations. In conjunction with this, an International Maritime Meteorological Archive (IMMA) format has been proposed (JCOMM, 2000), building on many lessons learned in COADS, for the more effective exchange of historical marine data and metadata. However, calculations of some new $2^{\circ}\times 2^{\circ}$ and $1^{\circ}\times 1^{\circ}$ statistical products including nighttime air temperatures will be developed; further separations such as by platform types and source decks may also be desirable.

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