

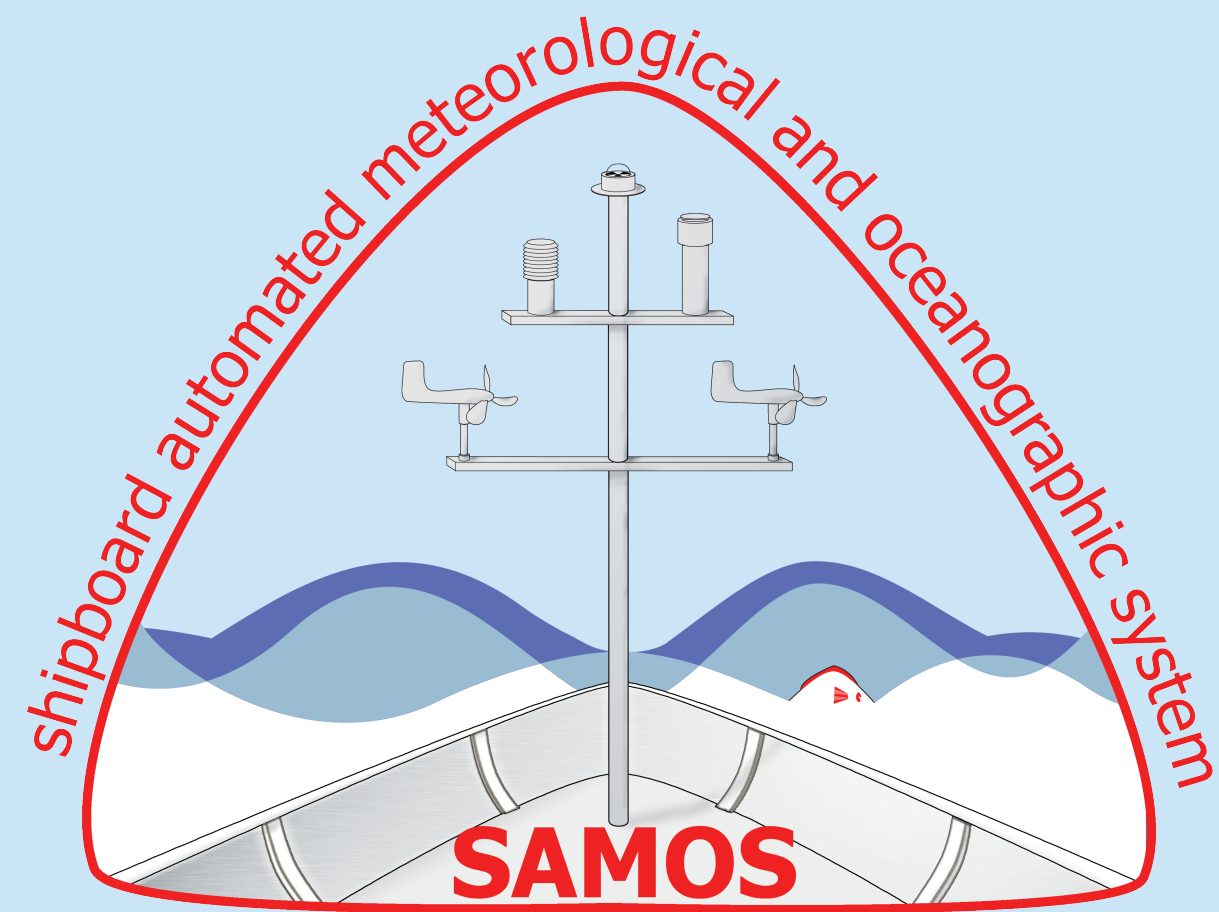
Shipboard Automated Meteorological and Oceanographic System Initiative

Progress of the Data Assembly Center

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Objectives

The shipboard automated meteorological and oceanographic system (SAMOS) initiative aims to improve the quality of meteorological and near-surface oceanographic observations collected in-situ on research vessels (R/Vs) and select voluntary observing ships (VOS). Scientific objectives of SAMOS include:

- ◆ creating quality estimates of the heat, moisture, momentum, and radiation fluxes at the air-sea interface
- ◆ improving our understanding of the biases and uncertainties in global air-sea fluxes
- ◆ benchmarking new satellite and model products
- ◆ providing high quality observations to support modeling activities (e.g., reanalysis) and global climate programs

To achieve the science objective, the SAMOS initiative seeks to:

- ◆ improve access to quality assured SAMOS data for scientific and operational users by providing free and open access to data and metadata
- ◆ expand availability of SAMOS observations collected in remote ocean regions (e.g., Southern Ocean)
- ◆ improve the accuracy and calibration of SAMOS measurements
- ◆ provide standards for data and metadata collected on SAMOS equipped vessels
- ◆ ensure routine archival of SAMOS data at world data centers
- ◆ develop documentation and training materials for use by data collectors and the user community
- ◆ support comparison studies between in-situ platforms (e.g., R/Vs, VOS, buoys)
- ◆ develop partnerships within the international marine community

What is a SAMOS?

SAMOS typically are a continuously recording, computerized data logger connected to sensors that record navigation, meteorological, and near-surface ocean parameters while the vessel is at sea. To achieve the science objectives of the SAMOS initiative, the desired interval between sequential observations is one minute. The SAMOS initiative does not specify the types of sensors used to collect data. Different systems currently exist on research vessels (Figure 1)

Figure 1: Meteorological instrumentation on the (a) R/V Ronald Brown, (b) RSS Discovery, and (c) R/V Knorr. Photos credits: R. Wanninkhof, B. Moat, and B. Walden.



Data Center History

The data assembly center (DAC) at FSU has been evaluating R/V meteorological observations for over a decade.

- 1993: Established as center for marine meteorological data from TOGA/COARE
- 1994: Began evaluating marine meteorological data from World Ocean Circulation Experiment (WOCE) cruises
- 2002: Published final (version 3.0) WOCE data set including over 80% of completed cruises
- 2003: Hosted first High-resolution Marine Meteorology (HRMM) workshop in Tallahassee
- ◆ Established objectives for SAMOS initiative

- 2004: NOAA OCO hosted Second HRMM Workshop
 - ◆ Adopted SAMOS acronym
 - ◆ Developed implementation plan
- 2004: SAMOS DAC established at FSU
 - ◆ Developed data and metadata standards
 - ◆ Established ship profile database
- 2005: Pilot data project resulted in daily transfers from two WHOI vessels (Figure 2a)
- 2007: Recruited additional vessels from NOAA and NSF (Figure 2c)

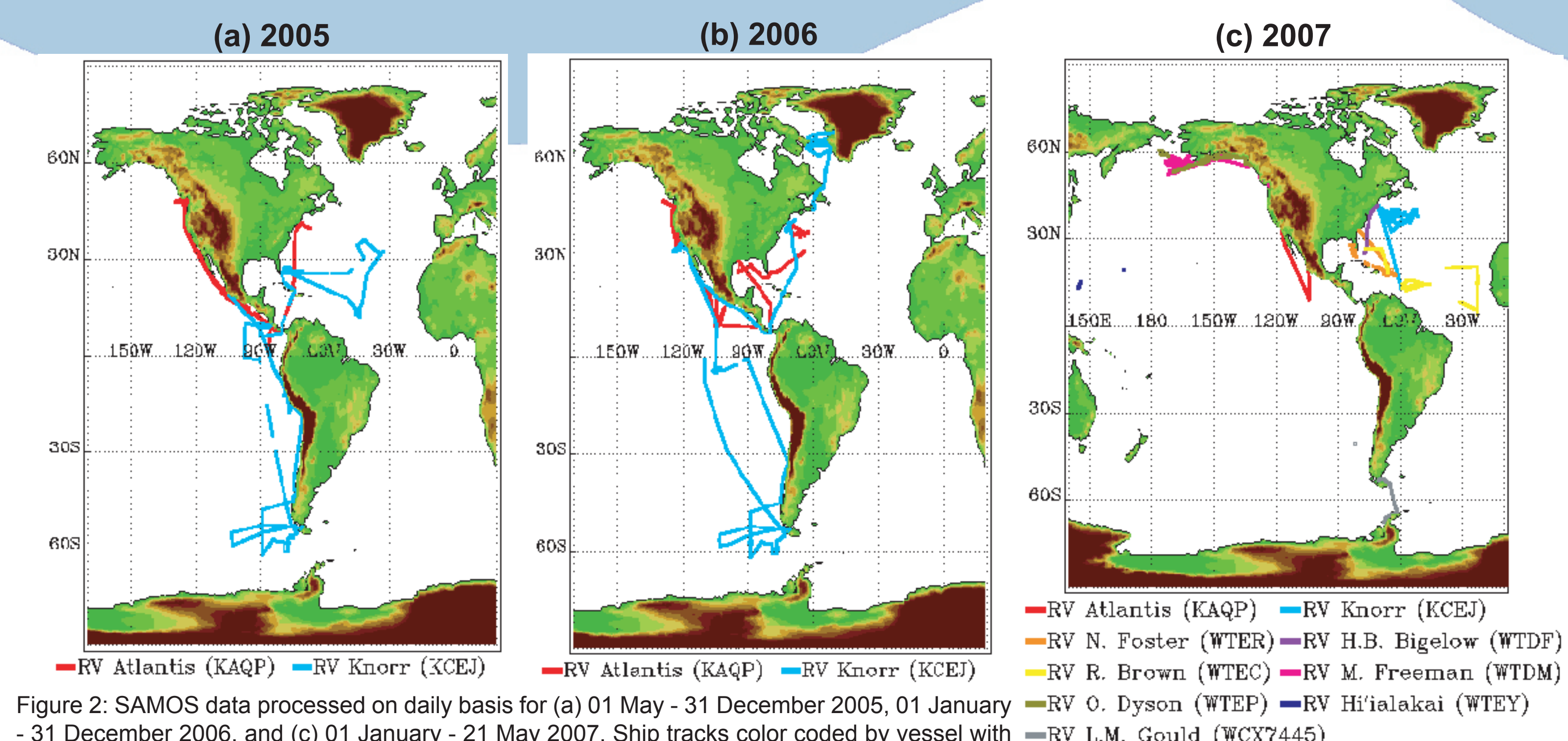


Figure 2: SAMOS data processed on daily basis for (a) 01 May - 31 December 2005, 01 January - 31 December 2006, and (c) 01 January - 21 May 2007. Ship tracks color coded by vessel with number of recruited vessels increasing from 2 to 9 in 2007.

Data Access

All preliminary data (with DQE flags) along with meta-data for each participating vessel can be accessed through the SAMOS web page:

<http://samos.coaps.fsu.edu/>

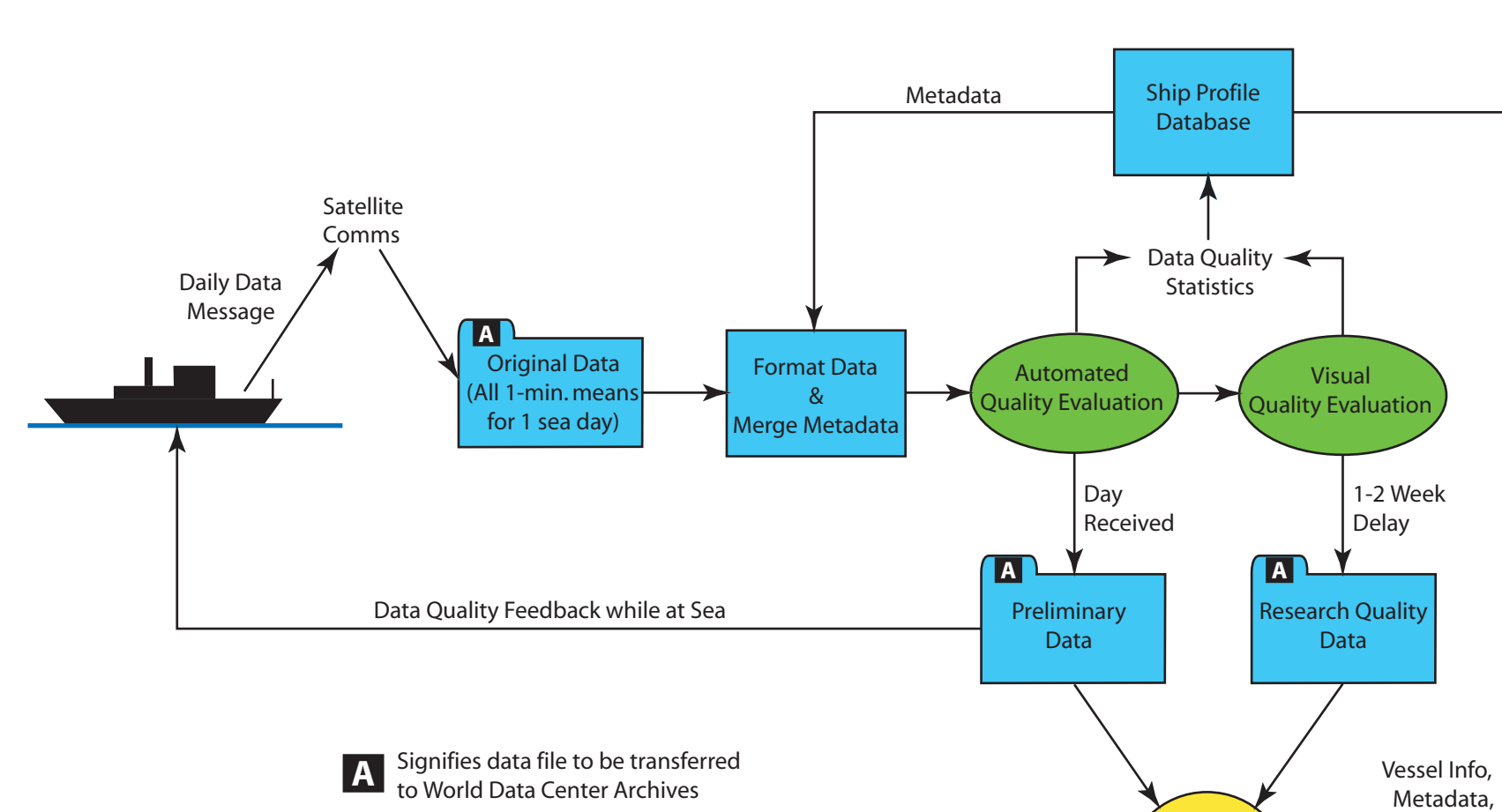


Figure 3: Schematic showing SAMOS data flow.

SAMOS Data Flow

- ◆ Protocol includes daily transmission of SAMOS data from a vessel at sea to the DAC (Fig. 3).
 - File transmission via email attachments
 - Files contain all 1-min. averages sampled during one day at sea
 - Using SAMOS version 1 data exchange format
 - Daily transfers occur just past 0000 UTC
- ◆ Email generation and transmission scripts developed by each vessel operator
- ◆ Data arriving at DAC undergo common formatting, metadata augmentation, and data quality evaluation (DQE)
- ◆ Data are evaluated upon arrival and vessels are notified at sea via email when problems are discovered
- ◆ Preliminary and research DQE are now operational
- ◆ Initial archival to be implemented with NODC and NCAR in 2007

Data Metrics

The SAMOS DAC has been steadily recruiting new vessels to participate in the initiative. Since 2005 the DAC has been receiving and processing daily data messages.

Ships

As of May 2007, nine ships were operationally contributing to the SAMOS initiative.

WHOI: Knorr, Atlantis

NOAA: Henry Bigelow, Hi'Ialakai, Miller Freeman, Oscar Dyson, Ronald Brown, Nancy Foster

Raytheon Polar Services (RPS): Lawrence M. Gould

Currently the NOAA ship *Ka'imimoana* and USCG *Healy* are either in testing or the early stages of recruitment

Future vessels (pending positive recruitment efforts):

UNOLS: 16 global, intermediate, & regional class vessels

RPS: Nathaniel Palmer

NOAA: 12 additional research & fisheries vessels

International: 4 French research vessels (via GOSUD)

Data Volume:

- ◆ Typical vessel reports 20 parameters in each 1-min report (navigation, meteorology, and thermosalinograph)
- ◆ Approximately 800,000 observations per vessel per month
- ◆ Reporting varies due to number of sea days for each vessel. Gap in Oct/Nov 2005 due to lay-up of both WHOI vessels (Figure 4).

Data Quality

Both automated and visual DQE are conducted for all observations received by the DAC.

- ◆ Two way email communication with shipboard techs provides both feedback on data quality and notification of instrument problems (Figure 5).
- ◆ Quality statistics (Figure 6) are stored in ship database and are accessible via the SAMOS web page.
- ◆ Evaluating method for analyst to flag data with known malfunctions during preliminary processing (currently only possible in research DQE).

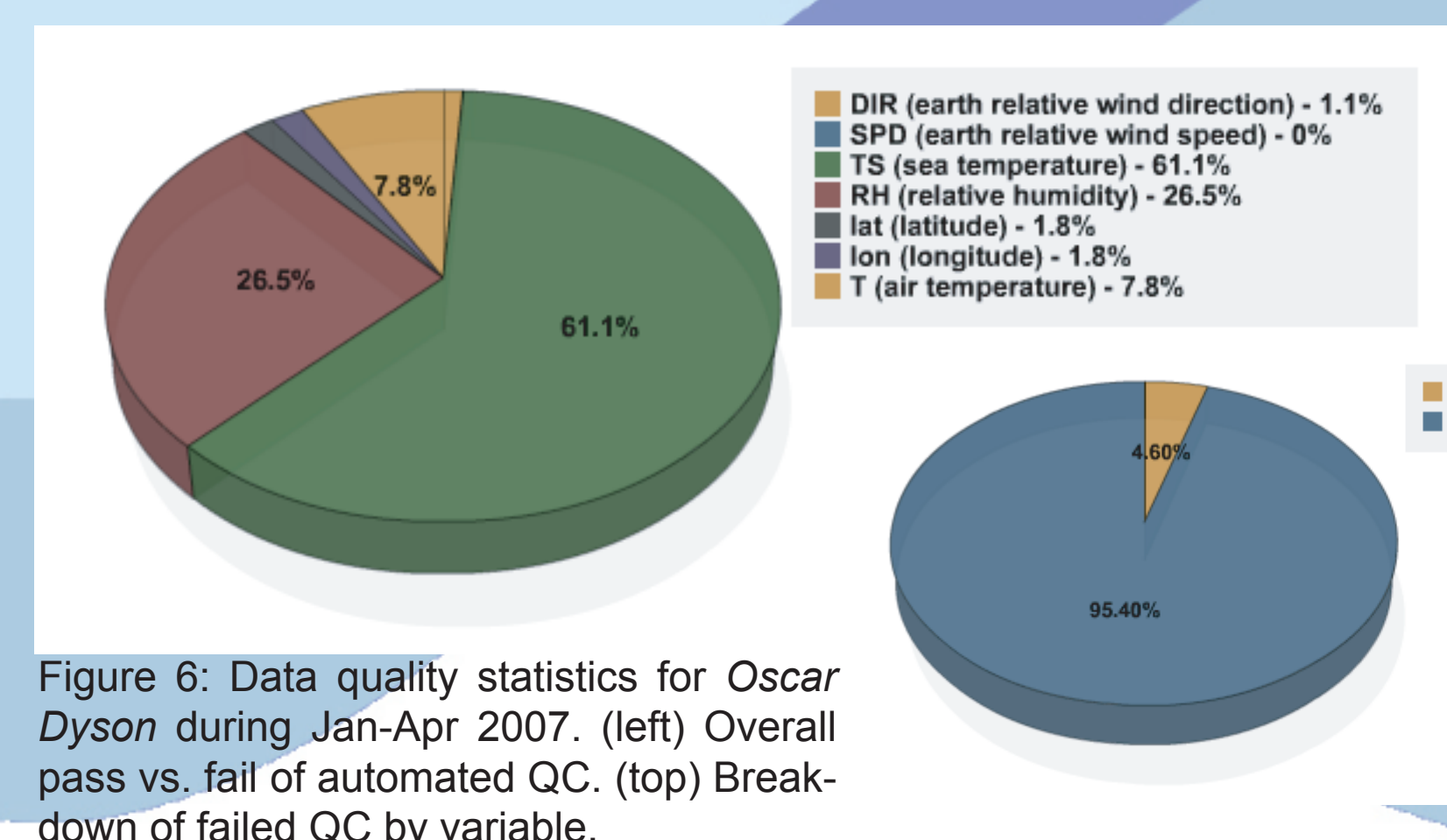


Figure 6: Data quality statistics for Oscar Dyson during Jan-Apr 2007. (left) Overall pass vs. fail of automated QC. (top) Breakdown of failed QC by variable.

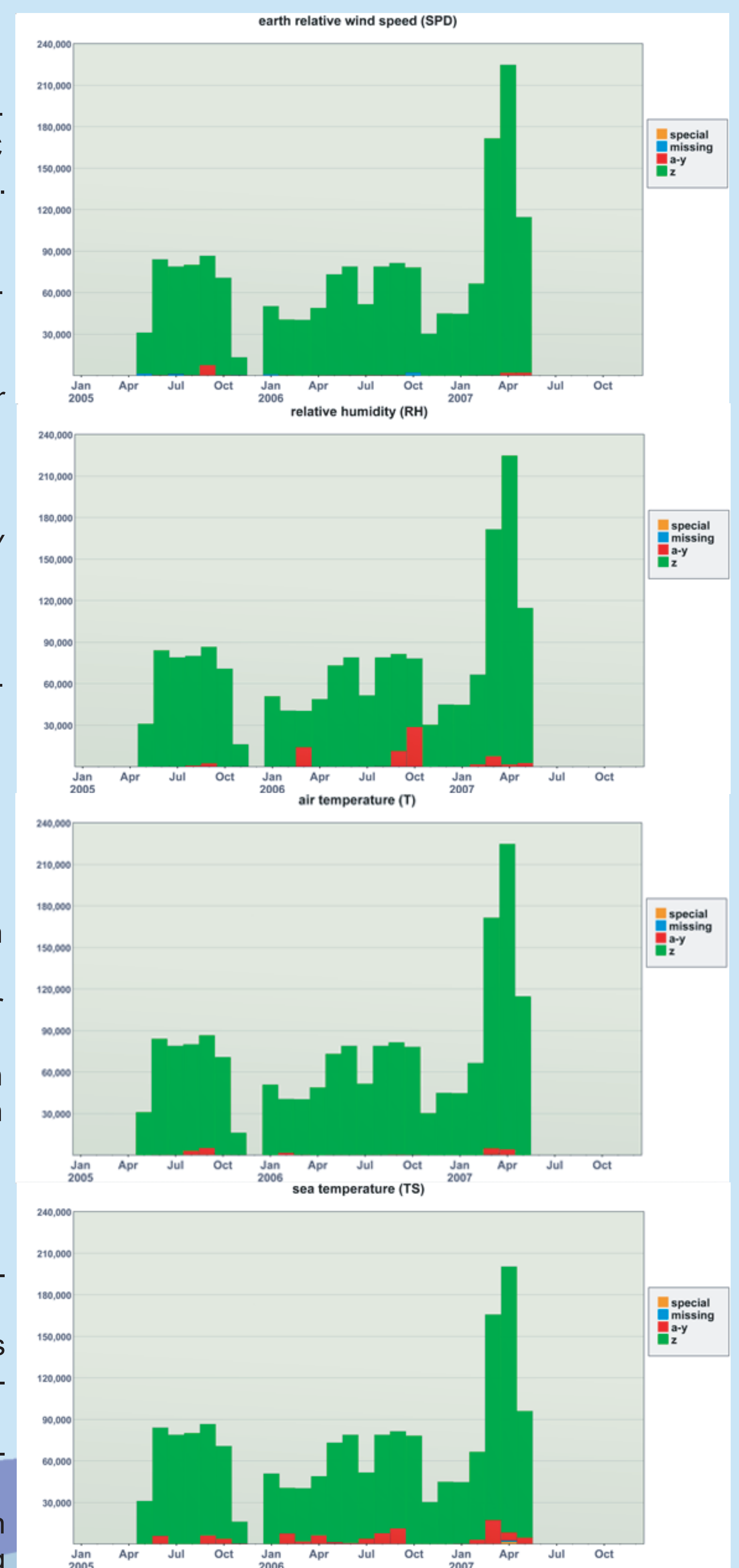


Figure 4: Monthly number of 1-min. observations of true wind speed, relative humidity, air and sea temperature from the inception of SAMOS in 2005. The large increase in 2007 results from adding vessels. Counts are color coded with green (red) representing good (suspect) values.

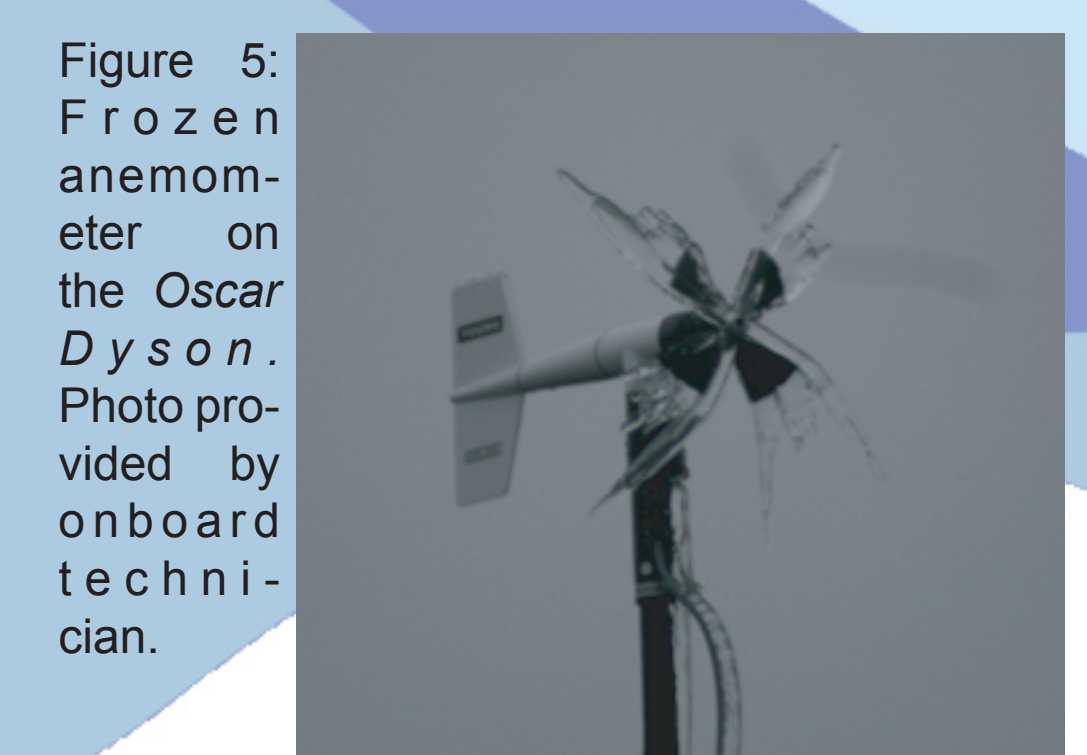


Figure 5: Frozen anemometer on the Oscar Dyson. Photo provided by onboard technician.

Plans for data distribution

The SAMOS DAC continues to develop new ways to distribute observations. In the near future we plan to

- ◆ Provide access to hourly observations via a Geographical Information System interface.
- ◆ Expand the search and access to full one-minute resolution data via an IOOS compliant THREADS server.

| "Ship Data based on Ship Track" | | | |
|---------------------------------|----------|----------------------|-----------|
| KCEJ | | | |
| Date (YYYYMMDD): | 20070418 | Time(HHMMSS): | 170000 |
| Ship Speed | 11.7700 | Latitude | 30.4439 |
| Air Temperature | 19.5700 | Sea Temperature | 19.5200 |
| Relative Humidity | 63.7000 | Wind Direction(Truc) | 278.9000 |
| | | Longitude | 161.2000 |
| | | Sea Level Pressure | 1001.3700 |
| | | Wind Speed (True) | 15.3100 |

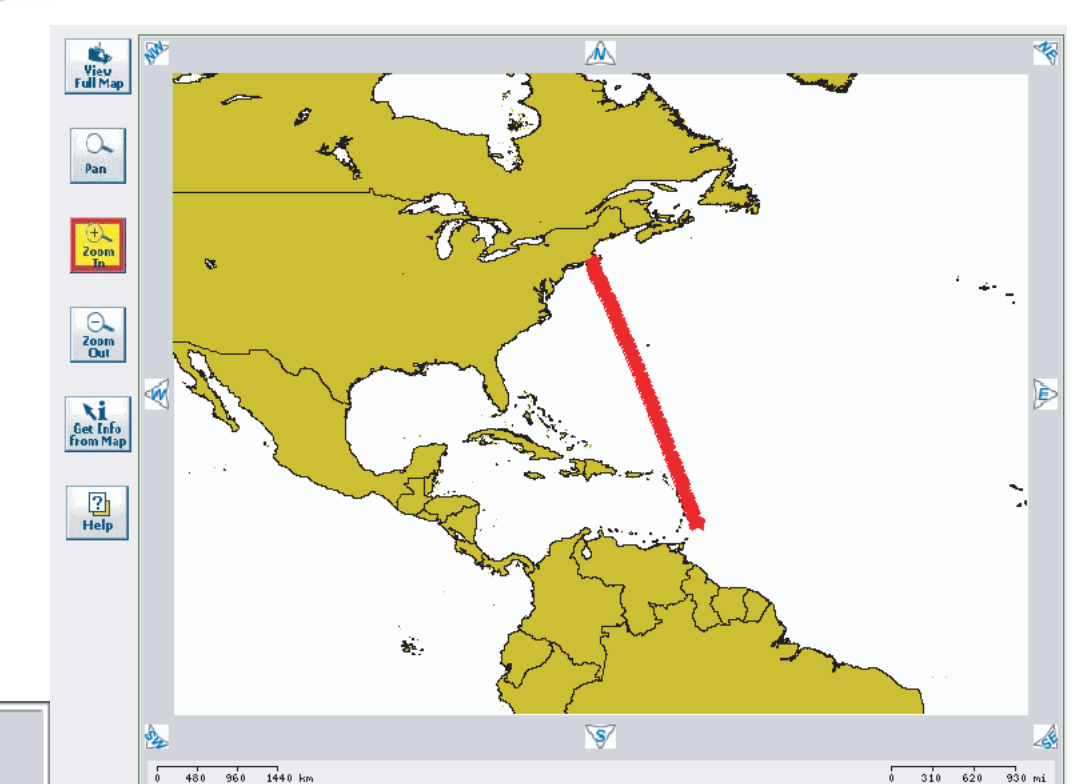


Figure 7: Preliminary design of GIS data interface being developed at the DAC. Users will be able to view ship tracks for selected regions and time periods (above), plot data by variable value, and extract spot samples of data (left).

Partnerships

Partnerships are essential to the success of the SAMOS initiative. The initiative thanks those who have already contributed and continues to seek new expertise and resources.

- ◆ **User Community:** Provides scientific input to establish sampling methods and accuracy targets. SAMOS will continue to engage a wide user community to develop products for both research and operations.
- ◆ **Ship Operators:** NOAA OMAO, RPS, and WHOI have gone to great lengths to develop shipboard software that transmits SAMOS formatted data. A new collaboration with the USCG is underway.
- ◆ **JCOMM SOT:** Opened a dialog in 2007 to improve connectivity between SAMOS and VOS/Automated VOS programs.
- ◆ **GOSUD:** A pilot data exchange with the Global Ocean Surface Underway Data (GOSUD) project is underway. The SAMOS DAC will provide DQE of meteorological data collected by GOSUD (starting with French R/Vs) while the GOSUD data center (at Coriolis) will evaluate the near-surface ocean data collected by SAMOS.
- ◆ **WCRP WGSF:** Led development of *A guide to making climate quality meteorological and flux measurements at sea*. First distributed at INMARTech 2006 at WHOI.
- ◆ **NOAA ESRL:** Ongoing collaboration with C. Fairall (and others) to improve data quality and accuracy via a portable seagoing air-sea flux standard, through training documents, and a proposed program of computational fluid dynamics modeling of airflow around R/Vs.

Acknowledgements

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