Contributing Real-Time MET and TSG Data to SAMOS

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Introduction

Since 2005, the shipboard automated meteorological and oceanographic system (SAMOS) initiative has been collecting, quality evaluating, and preserving navigational (NAV), meteorological (MET), and surface oceanographic (TSG) observations from research vessels (RVs). *In 2009, the SAMOS data center joined the NSF Rolling Deck to Repository (R2R) project to recruit additional university-operated vessels.*

- The SAMOS initiative supports marine research by
  - creating quality estimates of the air-sea heat, moisture, momentum, and radiation fluxes;
  - improving our understanding of the biases and uncertainties in meteorological parameters and fluxes;
  - benchmarking new satellite and model products; and
  - providing high-quality data to support modeling activities (e.g., reanalysis) and global climate programs.

What is a SAMOS?

- A SAMOS is a continuously recording, computerized data logger connected to navigational, meteorological, and near-surface ocean sensors.
- The desired interval between sequential observations is equal to or less than one minute and varies between the SAMOS 1.0 and 2.0 data protocols.
- The SAMOS initiative does not specify or provide sensors used to collect data.
- The initiative leverages existing science-quality instrumentation deployed by RV operators (Fig. 1).

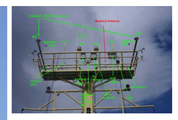


Fig. 1. SAMOS on the OKEANOS EXPLORER, ATLANTIC EXPLORER, and L. M. GOULD

SAMOS 1.0 Data Protocol

- The original SAMOS (1.0) protocol to transfer real-time MET and TSG data relies on vessel operators to complete the data reduction from the native instrument sampling rate to one-minute averages. This data reduction is typically done on the participating RV and then the data are attached to an email and sent to samos_data@coaps.fsu.edu.
- Once received by the data center, all data follow the data flow (Fig. 2) and are served to the user community. The processing includes:
- Combining received data with vessel and instrument metadata from a ship profile database
  - Daily monitoring for instrument or data flow errors
  - Automated (visual for some vessels) data quality control
  - Submission to National Oceanographic Data Center for long-term preservation

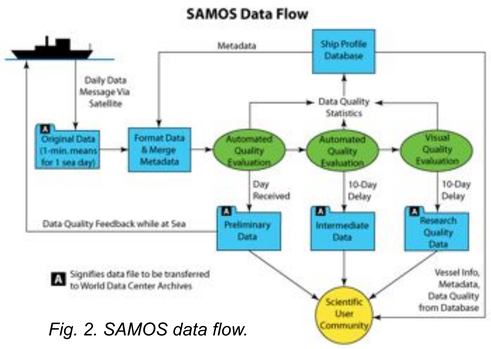


Fig. 2. SAMOS data flow.

1. Contact SAMOS data center: samos@coaps.fsu.edu
2. Download vessel and instrument metadata forms (Fig. 3), SAMOS 1.0 data format specification
3. Submit vessel and instrument metadata
   - Email forms
   - Use web-based metadata tool (URL)
4. Determine whether you need to develop scripts to develop SAMOS 1.0 format (examples below) or can use existing applications
   - NOAA SCS – contains application to develop SAMOS 1.0 files and data emails
5. Submit test file to data center (samos_data@coaps.fsu.edu)
   - Best done as a dockside test
6. Work out problems with our data quality analysts (Jeremy or Kristen)
7. Begin operational data flow

Example files

SAMOS 001 - Single time designator (Gould):
$SAMOS:001,CS:WCX7445,DT:20111108000030,LA:-64.77471,LO:-64.05515, AT:-0.94,BP:987.4,CR:182.0,FL:0.38,GY:275.4,RH:99.6,SST:2.37,SW:0.56,LW:301.13...

SAMOS 001 - Dual time designators (Atlantic Explorer):
$SAMOS:001, CS:WDC9417, YMD:20111108, HMS:000027, AT:23.05, BP:1015.17, CR: 200.4, DT:, FL:, GY:255.35, LA:32.37, LO:-64.7, PR:0, RH:71.35, TT1:22.8…

JGOFS (Palmer):
03/11/11 00:00:00 -53.7299 -62.1168 9.75 1.30 290.32 283.76 10.63
5.67 3.32 33.92 119 2.38 306.41 6.19 94.75
998.48 3.47 86.31 -8.57 257.03

Fig. 3: SAMOS Vessel (left) and Instrument (above) metadata forms.

SAMOS 2.0 Data Protocol

- The SAMOS 2.0 protocol provided the operator a mechanism to transmit real-time MET and TSG data collected at the native instrument sampling rate. Data reduction to one-minute averages is completed by the FSU data center. This system is still in development and undergoing testing with the R/V *Endeavor*.

- Differences between SAMOS 2.0 and SAMOS 1.0 include:

SAMOS 2.0	SAMOS 1.0
• Hourly data transmissions (pull)	• Daily data transmission (push)
• Multiple files per transmission NAV_file, MET_file, OCE_file	• 1 file
• Multiple formats (formats may differ between files) NMEA, xml, CSV	• 2 formats (SAMOS v001, JGOFS)
• Embedded metadata in each file	• Metadata stored in semi-static database
• High temporal resolution data (1 Hz)	• 1 minute temporal resolution
• Automated and visual QC with new NAV QC	• Automated and visual QC
• All instantaneous values	• All instantaneous values or 1-minute averages
• True wind calculations optional	• Provider calculates true winds

- Submission of data and metadata in SAMOS 2.0 format allows data center to
  - Continually update instrumental metadata (via extraction from XML files) as opposed to manual updates in SAMOS 1.0 (Fig. 4).
  - Calculate true winds and other derived quantities using controlled algorithms

- Upon data receipt and completion of data reduction at FSU (via flow show in Fig. 5), the data undergo the same data quality processing as for SAMOS 1.0 (Fig. 2).

- Note: SAMOS 2.0 does involve transmitting larger data files over satellite broadband. For some vessels this may not be possible, but tests with the Endeavor have not shown a significant impact on ship-to-shore bandwidth.

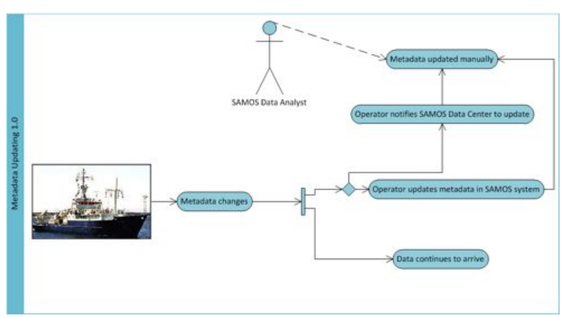
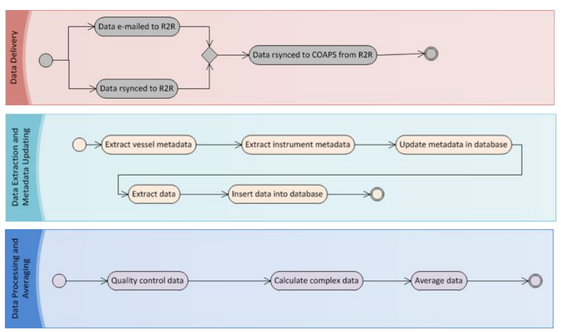


Fig. 4. Metadata modification flow in SAMOS 1.0.

Fig. 5. SAMOS 2.0 data flow.

1. Contact SAMOS data center to express interest in using SAMOS 2.0: samos@coaps.fsu.edu
2. Download vessel and instrument metadata form (URL)
   - Minimum metadata requirements are the same as with SAMOS 1.0
3. Submit vessel and instrument metadata
   - Email forms
   - Use web-based metadata tool (URL)
4. Develop scripts to create SAMOS 2.0 XML exchange format
5. Submit test file to data center (samos_data@coaps.fsu.edu)
   - Best done as a dockside test
6. Work out problems with our data quality analysts (Jeremy or Kristen)
7. Begin operational data flow



Final Thoughts

- The success of the SAMOS data center and its contributions to the NSF R2R would not be possible without the dedication of the individual operators and RV technicians.
- Although active new vessel recruitment in 2013 will be limited, we encourage all university operators to "self recruit".
- We will work closely with each operator to ensure that their NAV, MET, and TSG data are received and quality processed in a timely manner.

Acknowledgments

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