



Observations for Climate: Shipboard Automated Meteorological and Oceanographic Systems on Research Vessels

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Introduction

Since 2005, the shipboard automated meteorological and oceanographic system (SAMOS) initiative has been collecting, quality evaluating, and preserving navigational, meteorological, and oceanographic observations from research vessels (RVs).

- The core mission of the SAMOS initiative supports a wide range of 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.
- In 2009, a new partnership with the Rolling Deck to Repository (R2R) project in the U.S. provided an opportunity to recruit ~15 additional RVs to the initiative.
- Similar national efforts outside the U.S. may be leveraged to expand access to SAMOS data.

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.
- 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).
- SAMOS sensors typically differ from, but are complementary to, those provided by National Meteorological Services (for the Voluntary Observing Ship Scheme).

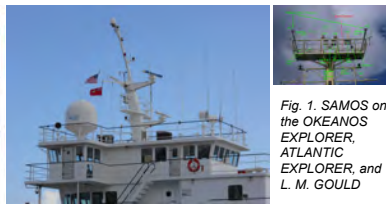


Fig. 1. SAMOS on the OKEANOS EXPLORER, ATLANTIC EXPLORER, and L. M. GOULD

Data Coverage

- RVs recruited to SAMOS provide observations from the High Arctic to the Southern Ocean.
- Many vessels routinely operate on the continental shelf of North America.
- A typical vessel reports ~20 parameters in each 1-minute report
 - Navigation – position, course, heading, and speed
 - Meteorology – wind, pressure, air temperature, humidity, rainfall, and radiation (SW, LW, PAR)
 - Oceanography – sea temperature, conductivity, salinity
- In CY2010, over 6.1 million individual 1-minute data reports were collected by SAMOS vessels (Fig. 3).

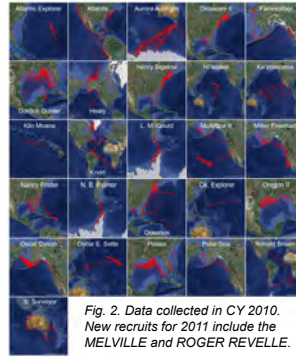


Fig. 2. Data collected in CY 2010. New recruits for 2011 include the MELVILLE and ROGER REVELLE.

Fig. 4. Data access page from SAMOS website.



SAMOS Data Flow

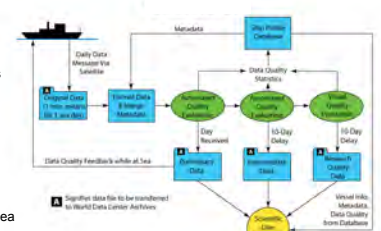


Fig. 3. SAMOS data flow.

Provision to Marine Climate Archives

US National Oceanographic Data Center

- All original, preliminary, intermediate, and research quality data are archived.
- Archive includes key metadata and documentation.
- Protocol provides for monthly input to archive.
- All files are cataloged and verified with MD5 checksums.

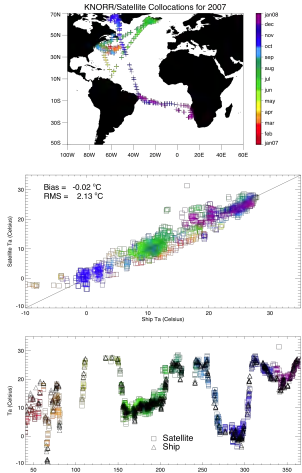
ICOADS

- One-minute SAMOS data will be reduced to hourly samples.
- Code developed for WOCE submission to ICOADS v2.5 will be modified to allow automated submission as part of NODC protocol.
- Implementation is expected for release 2.6.

Data Access

- <http://samos.coaps.fsu.edu/> (from data access tab, Fig. 4)
- <http://coaps.fsu.edu/thredds.php>
- ftp://www.coaps.fsu.edu/samos_pub/data

Satellite Retrieval Algorithm Development



- SAMOS observations from the RV KNORR were compared to dual sensor satellite air temperature (Ta) retrievals (Jackson et al., 2006) during 2007 and adjusted to the satellite Ta retrieval height of 10 m (Fig. 4).
- The map indicates 1627 locations where ship and satellite observations are collocated.
- The scatterplot shows unbiased agreement at nearly all temperatures with overall bias near zero.
- The time series also identifies good agreement except for regional biases in March over the Gulf Stream and in December near the west coast of Africa where satellite Ta predicts warmer temperatures.
- KNORR and other SAMOS datasets can be used to validate and correct bias in satellite retrievals of Ta and specific humidity, particularly in regions where seasonal effects on profiles (i.e., cold-air outbreaks, inversions in stratocumulus regions) can impact satellite retrievals.

Fig. 4. Comparison of SAMOS air temperature and humidity to satellite values (colored by date).

SAMOS Applications

Ocean Model Validation

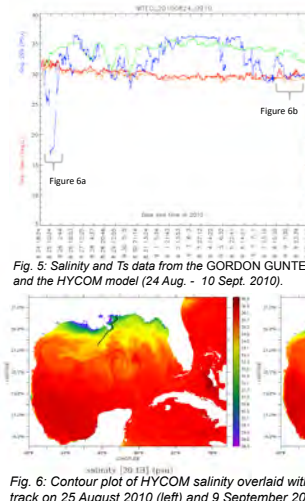


Fig. 5. Salinity and Ts data from the GORDON GUNTER and the HYCOM model (24 Aug. - 10 Sept. 2010).

Fig. 6. Contour plot of HYCOM salinity overlaid with GORDON GUNTER cruise track on 25 August 2010 (left) and 9 September 2010 (right).

- SAMOS sea temperature (Ts) and salinity (SSS) observations are used to examine ocean surface analyses from the 1/25° Hybrid Coordinate Ocean Model (HYCOM; Figs. 5 and 6).
- Comparisons are made between RV thermosalinograph and HYCOM Ts and SSS data along ship tracks in the Gulf of Mexico.
- Bilinear interpolation is used to map HYCOM data to RV cruise tracks.
- Overall, HYCOM underestimates freshwater input from rivers, as shown by higher salinity near the Gulf coast in the model as compared to the measured ship observations.

- SAMOS salinity (SSS) observations are available to support validation of Aquarius and SMOS missions.
- The DAC continues to encourage the deployment of SW (Fig. 7), LW, and PAR sensors to support the radiation and air-sea flux communities.
- SAMOS data provide sampling in the remote oceans and under extreme conditions, which is desired by a wide range of user communities.

Future Potential

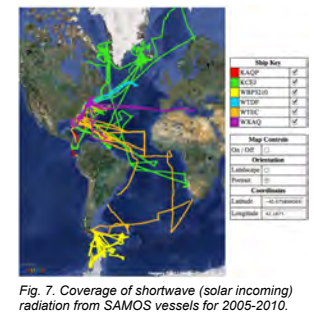


Fig. 7. Coverage of shortwave (solar incoming) radiation from SAMOS vessels for 2005-2010.

Acknowledgements

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