A Comparison of SAMOS and Bridge Observations on Research Vessels

Shawn R. Smith

Center for Ocean-Atmospheric Prediction Studies
The Florida State University, Tallahassee, FL 32306-2840 USA
smith@coaps.fsu.edu

Introduction

A comparison is made between two sources of marine meteorological observations collected by research vessels (RVs). The sources are permanently deployed shipboard automated meteorological and oceanographic systems (SAMOS) and the routine bridge observations transmitted to support weather forecasting.

To the authors’ knowledge, the SAMOS on RVs are rarely, if ever, used to create bridge reports. This makes these observations types independent.

Comparison data come from 13 R/Vs that collected one-minute sampling interval data during the World Ocean Circulation Experiment (WOCE). The comparison reveals large differences in temporal coverage provided by the bridge and SAMOS on RVs.

Using standard statistical techniques the authors examine differences in atmospheric pressure, sea and air temperatures, humidity, wind direction and speed. Where necessary metadata are available, observations are adjusted for instrument height and turbulent fluxes (latent and sensible heat; wind stress) are calculated. In some cases, large differences exist between bridge and SAMOS observations on individual vessels.

Data and Methods

Routine bridge observations are extracted from the International Comprehensive Ocean-Atmospheric Data Set (ICOADS version 2.1; Worley et al. 2005) in IMMA format (Woodruff 2000).

Original quality-evaluated meteorological observations from SAMOS are sampled at one-minute intervals.

Ten-minute averages of the SAMOS observations are constructed at the top of each hour to match the sampling practices of standard bridge observations.

The procedure for creating these hourly sub-samples and their subsequent reformattting in IMMA has been documented (Smith et al. 2005).

The IMMA version of the hourly RV SAMOS observations will soon be released as an auxiliary data set from ICOADS.

For the original 15 vessels, nearly 60,000 hourly SAMOS reports are created.

In terms of total hours of observation for the combined R/V cruises, reporting is much more complete from SAMOS systems versus bridge observations (Fig. 1).

• Lower bridge reporting frequency

• Failure to provide routine bridge observations in a manner that the ICOADS

Temporal matching of the hourly SAMOS to ICOADS reports results in ~12,000 matches from 13 RVs (Fig. 2).

Importance of Metadata

To understand the differences between the ICOADS and SAMOS observations, a minimum set of metadata is required.

The heights of individual instruments and their exposure are essential.

• For ICOADS, heights are extracted from the WMO publication No. 47

• For SAMOS, heights are available for some instruments from documentation provided to FSU

• Digital imagery (Fig. 3) is also helpful, but generally is unavailable for the RVs in this study

For the ICOADS, it is necessary to consider the varying sources of individual marine reports.

Table 1 lists the various ICOADS deck numbers for reports that match to SAMOS observations.

The majority of the data are from decks 888, 892, and 926, with 926 (the IBM data) comprising 76% of the total.

Through communication with the ICOADS group the author hopes to learn about the relative quality of these different decks.

Scatter plots will help determine whether the outliers in the individual RV comparisons are from a specific deck. If so, these decks can be removed from the comparison.

Future Plans

Clearly large differences can exist between bridge observations in ICOADS and the scientific (e.g., SAMOS) observations on individual RVs.

Establishing the cause of the differences will require:

1. obtaining additional metadata (e.g., digital photos, instrument exposures, heights not in Pub 47) for RVs that are still commissioned

2. adjusting pressures parameters for differences in observation heights (when available)

3. separation of matches by ICOADS deck to determine relative quality of original ICOADS data source

This exercise has again shown the importance of complete metadata documentation. During WOCE every effort was made to secure necessary metadata, but some key elements were not collected.

The SAMOS Initiative has established a detailed metadata specification that, when combined with continuing improvements to the WMO Pub 47, should allow more detailed comparisons to be completed.

Acknowledgements

The research vessel data center at COAPS is funded by the NOAA Office of Climate Observation. Funding for the development of the RV IMMA files was secured through NOAA ESMD.

References

The detailed comparisons to be completed.

Table 1: Occurrences of different ICOADS deck numbers for ICOADS versus SAMOS matches for 13 RVs (listed by name). Deck definitions are reproduced from ICOADS 2.1 documentation.

<table>
<thead>
<tr>
<th>Deck</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>926</td>
<td>892</td>
<td>888</td>
<td>826</td>
<td>780</td>
<td>764</td>
<td>713</td>
<td>691</td>
<td>676</td>
<td>667</td>
<td>655</td>
<td>623</td>
<td>617</td>
<td>603</td>
<td>551</td>
<td>378</td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>20</td>
<td>50</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Oltres</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>1.4hPa</td>
<td>3.5hPa</td>
<td>2.1hPa</td>
<td>3.0hPa</td>
<td>2.9hPa</td>
<td>2.8hPa</td>
<td>2.7hPa</td>
<td>2.6hPa</td>
<td>2.5hPa</td>
<td>2.4hPa</td>
<td>2.3hPa</td>
<td>2.2hPa</td>
<td>2.1hPa</td>
<td>2.0hPa</td>
<td>1.9hPa</td>
<td>1.8hPa</td>
<td>1.7hPa</td>
<td>1.6hPa</td>
</tr>
</tbody>
</table>

Fig. 3. Deck photo of the R/V Albatross. Note that the scientific instrument consists of a combination of one and expanded sensor cover. Several additional wind sensors are located on the main mast and the wind sensor located at the dock. One or more of these likely used for bridge reports. Bridge temperature sensors cannot be determined from this photo. (courtesy Woods Hole Oceanographic Institution)