2013 SAMOS Data Quality Report

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Base funding for the SAMOS data center at COAPS is provided by the NOAA Climate Program Office, Climate Observation Division through the Northern Gulf Cooperative Institute administered by the Mississippi State University. Support for participation by university-operated vessels within SAMOS is provided by the National Science Foundation (NSF), Oceanographic Instrumentation and Technical Services Program under grant #0917685. In 2013, the Schmidt Ocean Institute (SOI) provided contract funding to recruit the *RV Falkor* to the SAMOS initiative. Any opinions, findings, and conclusions/recommendations expressed in this report are those of the authors and do not necessarily reflect the views of NOAA, NSF, or SOI.

The authors wish to thank the technicians working onboard participating research vessels. You are the backbone to the data system which makes the SAMOS Initiative possible and successful. We also thank the operators, captains, and crews of these vessels.

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1. Introduction

This report describes the quantity and quality of observations collected in 2013 by research vessels participating in the Shipboard Automated Meteorological and Oceanographic System (SAMOS) initiative. The SAMOS initiative focuses on improving the quality of, and access to, surface marine meteorological and oceanographic data collected *in-situ* by automated instrumentation on research vessels (RVs). A SAMOS is typically a computerized data logging system that continuously records navigational (ship position, course, speed, and heading), meteorological (winds, air temperature, pressure, moisture, rainfall, and radiation), and near-surface oceanographic (sea temperature, conductivity, and salinity) parameters while the RV is underway. Measurements are recorded at high-temporal sampling rates (typically 1 minute or less). A SAMOS comprises scientific instrumentation deployed by the RV operator and typically differs from instruments provided by national meteorological services for routine marine weather reports. The instruments are not provided by the SAMOS initiative.

Data management at the SAMOS data assembly center (DAC) provides a ship-to-shore-to-user data pathway (Figure 1). SAMOS version 1.0 relies on daily packages of one-minute interval SAMOS data being sent to the DAC at the Florida State University via e-mail attachment. Broadband satellite communication facilitates this transfer as near as possible to 0000 UTC daily. A new ship-to-shore protocol, known as SAMOS 2.0, allows operators to email full temporal resolution (up to 1Hz interval) data on schedules up to once per hour. SAMOS 2.0 continued as a developmental project in 2013, with the *Endeavor* being the only vessel testing this protocol. Challenges with satellite communications have limited the viability of SAMOS 2.0 and only a limited set of data were received from the *Endeavor* in 2013. These data were delivered in delayed-mode to support further SAMOS 2.0 testing and are not included in this report. For SAMOS 1.0, a preliminary version of the SAMOS data is made available via web services within five minutes of receipt. All preliminary data undergo common formatting, metadata enhancement, and automated quality control (QC). A data quality analyst examines each preliminary file to identify any major problems (e.g., sensor failures). When necessary, the analyst will notify the responsible shipboard technician via email while the vessel is at sea. On a 10-day delay, all preliminary data received for each ship and calendar day are merged to create daily intermediate files. The merge considers and removes temporal duplicates. For all NOAA vessels and the *Falkor* visual QC is conducted on the intermediate files by a qualified marine meteorologist, resulting in research-quality SAMOS products that are nominally distributed with a 10-day delay from the original data collection date. All data and metadata are version controlled and tracked using a structured query language (SQL) database. All data are distributed free of charge and proprietary holds through the web (http://samos.coaps.fsu.edu/html/) under “Data Access” and long-term archiving occurs at the US National Oceanographic Data Center (NODC).

In 2013, out of 35 active recruits, a total of 30 research vessels routinely provided SAMOS observations to the DAC (Table 1). SAMOS data providers included the National Oceanographic and Atmospheric Administration (NOAA, 14 vessels), the Woods Hole Oceanographic Institution (WHOI, 2 vessels), the United States Coast Guard (USCG, 1 vessel), National Science Foundation Office of Polar Programs (OPP, 2

vessels), University of Hawaii (UH, 1 vessel), University of Washington (UW, 1 vessel), Scripps Institution of Oceanography (SIO, 4 vessels), Bermuda Institute of Ocean Sciences (BIOS, 1 vessel), Schmidt Ocean Institute (SOI, 1 vessel), and the Australian Integrated Marine Observing System (IMOS, 3 vessels). Two additional NOAA vessels – the *McArthur II* and the *Ka'imimoana* – one additional USCG vessel – the *Polar Sea* – the University of Rhode Island (URI) vessel – the *Endeavor* – and one additional vessel formerly with WHOI and transferred to Oregon State University in March 2012 – *Oceanus* – were active in the SAMOS system but for reasons beyond the control of the SAMOS DAC (e.g., caretaker status, changes to shipboard acquisition systems, satellite communication problems, etc.) were unable to contribute data in 2013.

IMOS is an initiative to observe the oceans around Australia (see 2008 reference). One component of the system, the "IMOS underway ship flux project" (hereafter referred to as IMOS), is modelled on SAMOS and obtains routine meteorological and surface-ocean observations from one New Zealand (*Tangaroa*) and two Australian (*Aurora Australis* and *Southern Surveyor*) RVs. In addition to running a parallel system to SAMOS in Australia, IMOS is the only international data contributor to SAMOS.

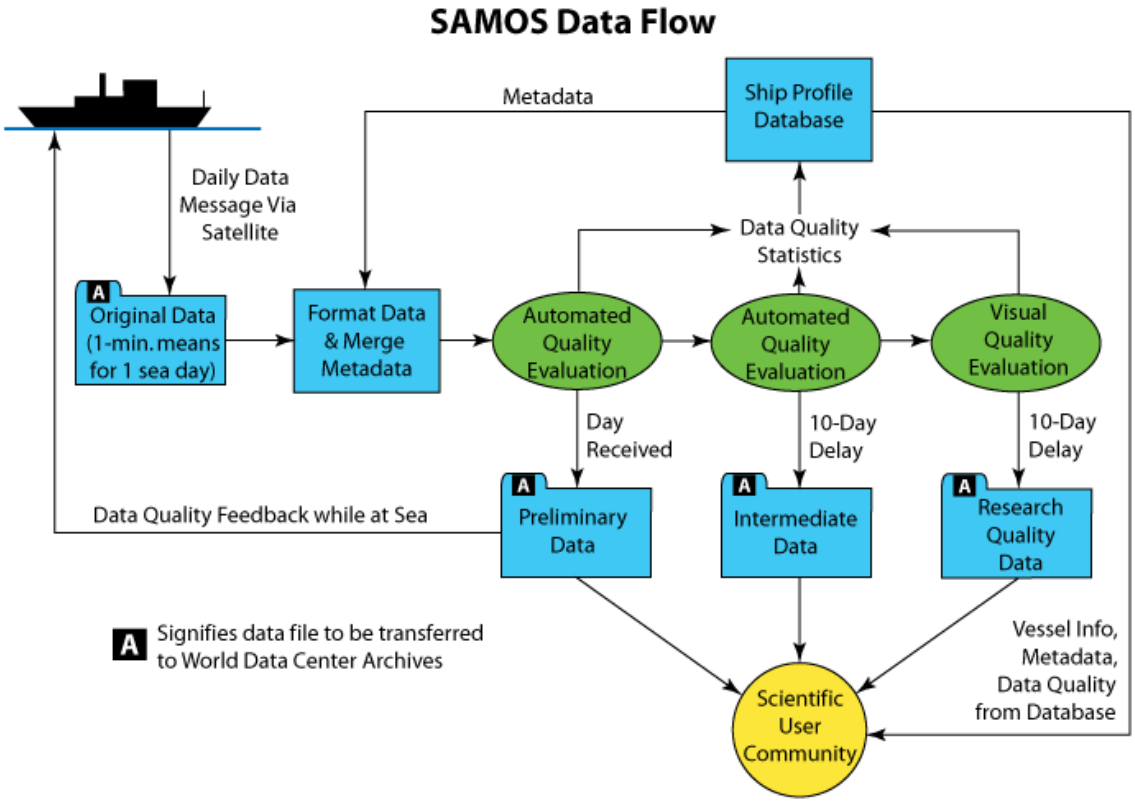

Figure 1: Diagram of operational data flow for the SAMOS initiative in 2013.

Beginning in 2013, funding did not allow for visual quality control procedures for any non-NOAA vessels except the *Falkor*, which is separately funded. As such, visual QC for all remaining vessels was discontinued, until such time as funding is extended to cover them. It should be noted that in the case of the *Southern Surveyor*, *Aurora Australis*, and *Tangaroa*, the IMOS project conducted their own visual QC up until a

personnel change there in June 2013 (only automated QC for these vessels occurs at the SAMOS DAC). The quality results presented herein are from the research quality products for all NOAA vessels and the *Falkor*, and automated-only quality control-level (intermediate) products for all remaining vessels. During 2013, the overall quality of data received varied widely between different vessels and the individual sensors on the vessels. Major problems included poor sensor placement that enhanced flow distortion (nearly all vessels experience some degree of flow distortion), sensors or equipment that remained problematic for extended periods (namely, the atmospheric pressure sensor onboard the *Hi'ialakai*, a relative humidity and an air temperature sensors onboard the *Sproul*, and the leaky TSG pump onboard the *Rainier*), data logger systems that were left running during maintenance (*Revelle* and *Knorr*), and a data buffer issue that led to inaccurate true winds from the *Knorr* for a significant period of time. Additionally, many or all of the NOAA vessels experienced some SCS-related glitches early in the season after a fleet wide SCS upgrade.

This report begins with an overview of the vessels contributing SAMOS observations to the DAC in 2013 (section 2). The overview treats the individual vessels as part of a surface ocean observing system, considering the parameters measured by each vessel and the completeness of data and metadata received by the DAC. Section 3 discusses the quality of the SAMOS observations. Statistics are provided for each vessel and major problems are discussed. An overview status of vessel and instrumental metadata for each vessel is provided in section 4. Recommendations for improving metadata records are discussed. The report is concluded with the plans for the SAMOS project in 2014. Annexes include web interface instructions for accessing SAMOS observations (Annex A, part 1) and metadata submission by vessel operators (Annex A, part2), and complete snapshots of all active vessels' current metadata status, as of the writing of this report (Annex B).

2. System review

In 2013, a total of 35 research vessels were under active recruitment to the SAMOS initiative; 30 of those vessels routinely provided SAMOS observations to the DAC (Table 1). The *Polar Sea* did not sail in 2013 (nor is she likely to in 2014), so naturally there was no data from her. In March 2012 stewardship of the *Oceanus* was transferred from WHOI to OSU and she underwent a major refit. *Oceanus* plans to return to SAMOS using the 2.0 data protocol, but this transition was not complete, hence the lack of any data in 2013. The *McArthur II* and the *Ka'imimoana* were both officially "inactive" in 2013, neither sailing nor collecting data (M. Van Waes, personal communication, 2014). Real-time data were not received in 2013 from the *Endeavor* because unexpected problems with satellite communications limited the Endeavor's ability to transmit SAMOS 2.0 formatted data files. Only a limited set of data were received from the *Endeavor* in 2013 in delayed-mode to support further SAMOS 2.0 testing and are not included in this report.

In total, 5,219 ship days were received by the DAC for the January 1 to December 31 2013 period, resulting in 6,994,884 records. Each record represents a single (one minute) collection of measurements. Records often will not contain the same quantity of information from vessel to vessel, as each vessel hosts its own suite of instrumentation. Even within the same vessel system, the quantity of information can vary from record to record because of occasional missing or otherwise unusable data. From the 6,994,884 records received in 2013, a total of 142,091,928 distinct measurements were logged. Of those, 4,917,716 were assigned A-Y quality control flags – about 3.5 percent – by the SAMOS DAC (see section 3a for descriptions of the QC flags). Measurements deemed "good data," through both automated and visual QC inspection, are assigned Z flags. At first glance there would appear to be a sizable improvement over 2012's approximate 6 percent A-Y flags; however, it is crucial to note that beginning in 2013 visual quality control procedures were halted for any but the NOAA vessels and the *Falkor,* owing to funding constraints, such that these flag percentages likely indicate missed opportunity for data quality enhancement. In total, fifteen of the SAMOS vessels (the *Southern Surveyor, Aurora Australis, Tangaroa, Atlantis, Knorr, Healy, Laurence M. Gould, Nathaniel B. Palmer, T.G. Thompson, Kilo Moana, Atlantic Explorer, Roger Revelle, Melville, New Horizon*, and the *Robert Gordon Sproul*) only underwent automated QC. This is an increase over 2012's ten SAMOS vessels that only underwent automated QC. None of these vessels' data was assigned any additional flags, nor were any automatically assigned flags removed via visual QC.

SHIP NAME	CALL SIGN	# of Days	# of Vars	# of Records	# of A-Y Flags	# of All Flags
TOTAL	-	5,219	612	6,994,884	4,917,716	142,091,928
ROGER REVELLE	KAOU	309	24	423,665	357,309	8,483,888
ATLANTIS	KAQP	258	34	353,635	208,757	9,863,399
KNORR	KCEJ	268	29	371,880	96,275	10,737,550
T.G. THOMPSON	KTDQ	61	21	86,652	55,050	1,816,894
HEALY	NEPP	91	27	125,690	48,099	2,781,350
SOUTHERN SURVEYOR	VLHJ	157	29	205,103	264,843	5,946,081
AURORA AUSTRALIS	VNAA	68	28	92,478	60,422	2,572,042
NATHANIEL B. PALMER	WBP3210	348	23	500,980	319,441	11,488,046
LAURENCE M. GOULD	WCX7445	258	23	368,995	101,567	7,971,033
KILO MOANA	WDA7827	124	22	170,477	36,235	3,750,494
ATLANTIC EXPLORER	WDC9417	153	21	177,394	107,466	3,723,537
MELVILLE	WECB	276	22	362,842	188,873	7,695,816
NEW HORIZON	WKWB	352	26	463,576	252,818	11,189,986
ROBERT GORDON SPROUL	WSQ2674	176	18	221,379	171,752	3,941,183
HENRY B. BIGELOW	WTDF	168	16	207,560	232,967	3,306,715
OKEANOS EXPLORER	WTDH	113	16	147,686	81,002	2,343,942
PISCES	WTDL	174	16	232,416	403,285	3,649,611
OREGON II	WTDO	175	16	227,559	142,186	3,536,638
THOMAS JEFFERSON	WTEA	164	16	219,510	105,676	3,512,160
FAIRWEATHER	WTEB	38	13	50,093	32,291	651,209
RONALD H. BROWN	WTEC	184	17	248,041	175,160	4,046,865
BELL M. SHIMADA	WTED	177	22	231,374	286,845	4,993,636
OSCAR ELTON SETTE	WTEE	127	16	170,805	73,410	2,732,880
RAINIER	WTEF	124	16	167,114	215,005	2,353,703
GORDON GUNTER	WTEO	143	16	188,360	155,552	2,982,178
OSCAR DYSON	WTEP	216	16	275,508	79,568	4,358,704
NANCY FOSTER	WTER	147	17	192,377	83,687	3,067,142
HI'IALAKAI	WTEY	77	16	101,413	168,991	1,601,149
FALKOR	ZCYL5	30	19	33,201	37,465	615,847
TANGAROA	ZMFR	263	17	377,121	386,708	6,378,250

Table 1: CY2013 summary table showing (column three) number of vessel days received by the DAC, (column four) number of variables reported per vessel, (column five) number of records received by DAC per vessel, (column six) total incidences of A-Y flags per vessel, (column seven) total incidences of A-Z flags per vessel.

a. Temporal coverage

As demonstrated in Figure 2, the files received by the DAC from each vessel are not often equally matched to the scheduled days reported by each institution. (*Note that complete CY2013 schedule information was not obtainable for the USCGC *Healy* and *Polar Sea* or the *Tangaroa* prior to this report distribution.) Scheduled days sometimes include days spent at port (denoted with a "P" in Figure 2, when possible), which are assumedly of less interest to the scientific community than those spent at sea. We are therefore not intensely concerned when we do not receive data during port stays, although if a vessel chooses to transmit port data we are pleased to apply automated and visual QC and archive it. However, when a vessel is reportedly "at sea" (denoted with an "*S*" in Figure 2, when possible) and we have not received underway data, we endeavor to reclaim any available data, usually via email communication with vessel technicians and/or lead contact personnel. For this reason we perform visual QC on a 10 day delay. SAMOS data analysts strive to follow each vessel's time at sea by focusing on continuity between daily files and utilizing online resources (when available), but as ship scheduling is subject to change and in some cases is unavailable in real time, we may be unaware a vessel is at sea until well after the 10 day delay period. An automated reporting service went live in early 2013 that, among other things, provides interested parties with a summary of ship days received by the DAC for each vessel. This product is available in both PDF and comma-separated values formats and can be emailed out automatically at

the end of every month, the intent being that files that were "missed" can be identified and manually sent to the DAC. (Reports are accessed at https://samos.coaps.fsu.edu/html/subscription/index.php with a login ID and password; see Section 4 for additional details.) It should be noted, however, that current funding for the SAMOS initiative would not permit the visual quality control of a large number of "late" files, so it is important that vessel operators and SAMOS data analysts do their best to ensure files are received within the 10 day delayed-mode window. As of the writing of this report, there is also a tool available to the DAC that can alert analysts, via email reporting, when a vessel has not submitted data for a chosen amount of days, providing one additional step towards ensuring no "missed/late" data.

In Figure 2, we directly compare the data we've received (green and blue) to final 2013 ship schedules provided by each vessel's institution. (*Note again that the schedules were not obtained for the *Tangaroa,* the USCGC *Healy*, or the USCGC *Polar Sea*.) A "blue" day denotes that the data file was received well past the 10 day delayed-mode window (or otherwise entered the SAMOS processing system well past the window) and thus missed timely processing and visual quality control, although processing (and visual QC where applicable) were eventually applied. (It must be noted, though, that "late" data always incurs the risk of not being visually quality controlled, based on any time or funding constraints.) Days identified on the vessel institution's schedule for which no data was received by the DAC are shown in grey. Within the grey boxes, an italicized "*S*" indicates a day reportedly "at sea." It should be noted that our contract with the *Falkor* was established in early August 2013, so no data would have been made available to us before then. There were, however, some problems with final delivery of some *Falkor* data (noted in gray in Figure 2). It should also be noted that there was a government furlough period for about two weeks in October. Many of the scheduled NOAA cruise days (again, shown in gray) during that period probably did not actually take place at the times for which they were scheduled. As such, it's not surprising that we at the DAC received only limited October data from the NOAA vessels. Also, the *T. G. Thompson* technicians finally were able to resolve problems with their data acquisition system in October 2013 and data began flowing again to SAMOS. Prior to October, no data was available from the *T. G. Thompson* for any of their cruises (again noted in gray in Figure 2). An oversight at the DAC after a personnel change at IMOS resulted in our not receiving any IMOS data after late June 2013 (persistent through the end of the year). Fortunately, once the oversight was identified by SAMOS personnel, IMOS personnel were able to send the missing data in bulk (noted in blue in Figure 2, *Tangaroa* and *Southern Surveyor*) and the data were processed as usual. All data received for 2013, with the exception of the *Tangaroa, Southern Surveyor,* and the *Aurora Australis,* has been archived at the NODC. Through agreement with IMOS, we receive data for the *Tangaroa, Southern Surveyor,* and the *Aurora Australis* and for these vessels perform automated QC only. IMOS data is archived within the IMOS DAC-eMarine Information Infrastructure (eMII).

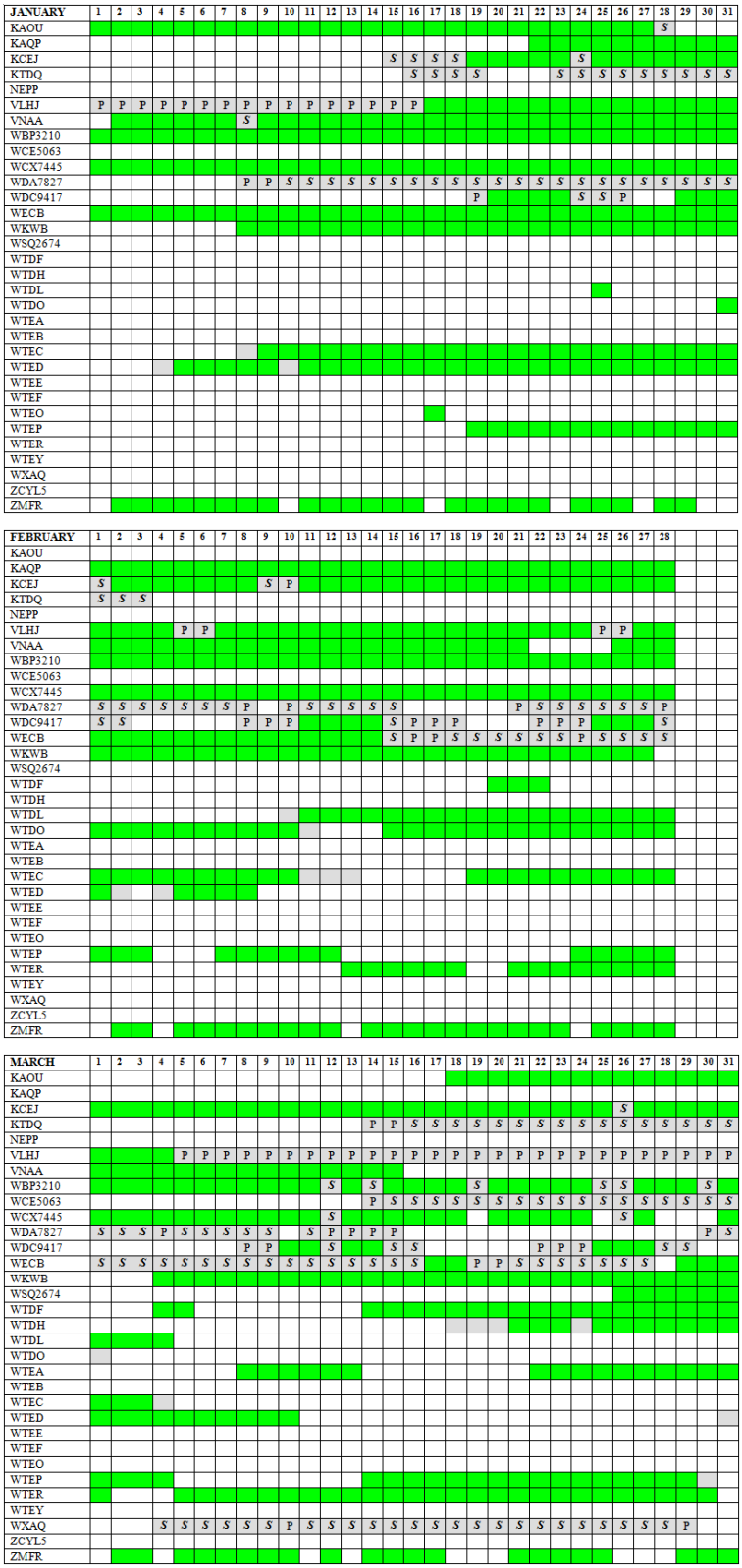

Figure 2: 2013 calendar showing (green and blue) ship days received by DAC and (grey) additional days reported afloat by vessels; "*S*" denotes vessel reportedly at sea, "P" denotes vessel reportedly at port. Vessels are listed by call sign (see Table 1).

APRIL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
KAOU																														
KAQP																														
KCEJ																														
KTDQ	S	P	P	S	S	S	S	S	P	S	S	S	S	S	S	S	S	S				S	S	S	S					
NEPP																														
VLHJ	P																					S	P	P	P	P				
VNAA																														
WBP3210	S			S	S						S					S	S		S			S								
WCE5063	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P						P	P	S	S	S	S	S	S	S
WCX7445				S			S									S	S					S								
WDA7827	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
WDC9417												P	P	P					S	P		P								
WECB					S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
WKWB																														
WSQ2674																														
WTDF																														
WTDH																														
WTDL																														
WTDO																														
WTEA																														
WTEB																														
WTEC																														
WTED																														
WTEE																														
WTEF																														
WTEO																														
WTEP																														
WTER																														
WTEY																														
WXAQ		P	S	S	S	S	S	S	S	S	S	S	S	S	S	P	S	S	S	S	S	S	S	P	P	S	S	S	S	S
ZCYL5																														
ZMFR																														

MAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
KAOU																															
KAQP																									S						
KCEJ																															
KTDQ																								S	S	S	S	S	S	S	S
NEPP																															
VLHJ										S	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
VNAA																															
WBP3210																															
WCE5063	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P	S	P	S	S	S	S	P		P	S	S	S	S	S	S
WCX7445																															
WDA7827	S	S	S	S	S	S	S	S	S	S	S	S	S	P	P	S	S	S	S	S	P	S	S	S	S	S	S				
WDC9417													S					S	P	P									S	P	P
WECB	S	S	S	S	S			S	S	S											S	S	S	S	S	S	S	S	S	S	S
WKWB																															
WSQ2674																															
WTDF																															
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WXAQ	S	S	P															P	S	S	S	S	S	S	S	S	S	S	S	S	S
ZCYL5																															
ZMFR																															

JUNE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
KAOU																														
KAQP																														
KCEJ																					P									
KTDQ	S	S	S	S	S	S	S		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S				
NEPP																														
VLHJ	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P													S	P
VNAA																														
WBP3210																														
WCE5063	S	S	S	P						S	S	S	S	S	S	S	S	P	S	S	S	S	S	S	S	S	S	S	S	S
WCX7445																														
WDA7827	S	S	S	S	S					P	S	S	S	S	S	S	S	S	S	S	S		P	S	S	S	S	S		P
WDC9417							S		P	S							S		P			P	P		S					
WECB							S																							
WKWB																														
WSQ2674														P	P	P	S	P												
WTDF																														
WTDH																														
WTDL																														
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WTEA																														
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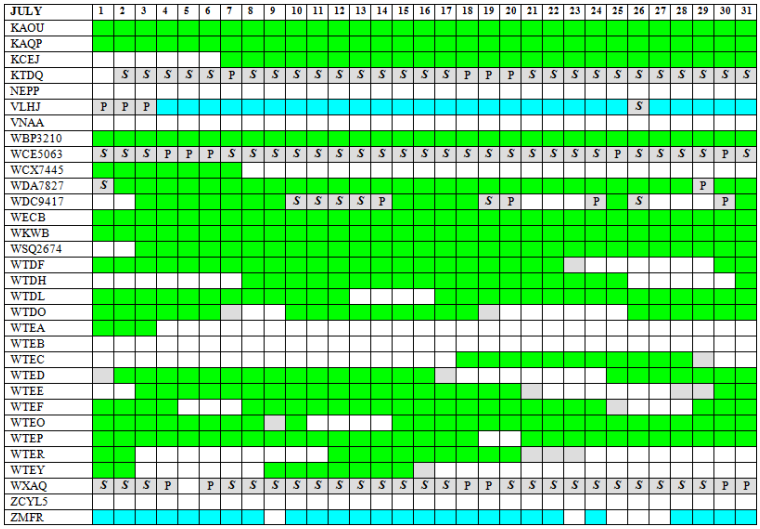
WTEO																														
WTEP																														
WTER																														
WTEY																														
WXAQ	P	P	S	S	S	S	S	S	S	S	S	S	S	S	P	P	S	S	S	S	S	S	P		P	S	S	S	S	S
ZCYL5																														
ZMFR																														

(Figure 2: cont'd)



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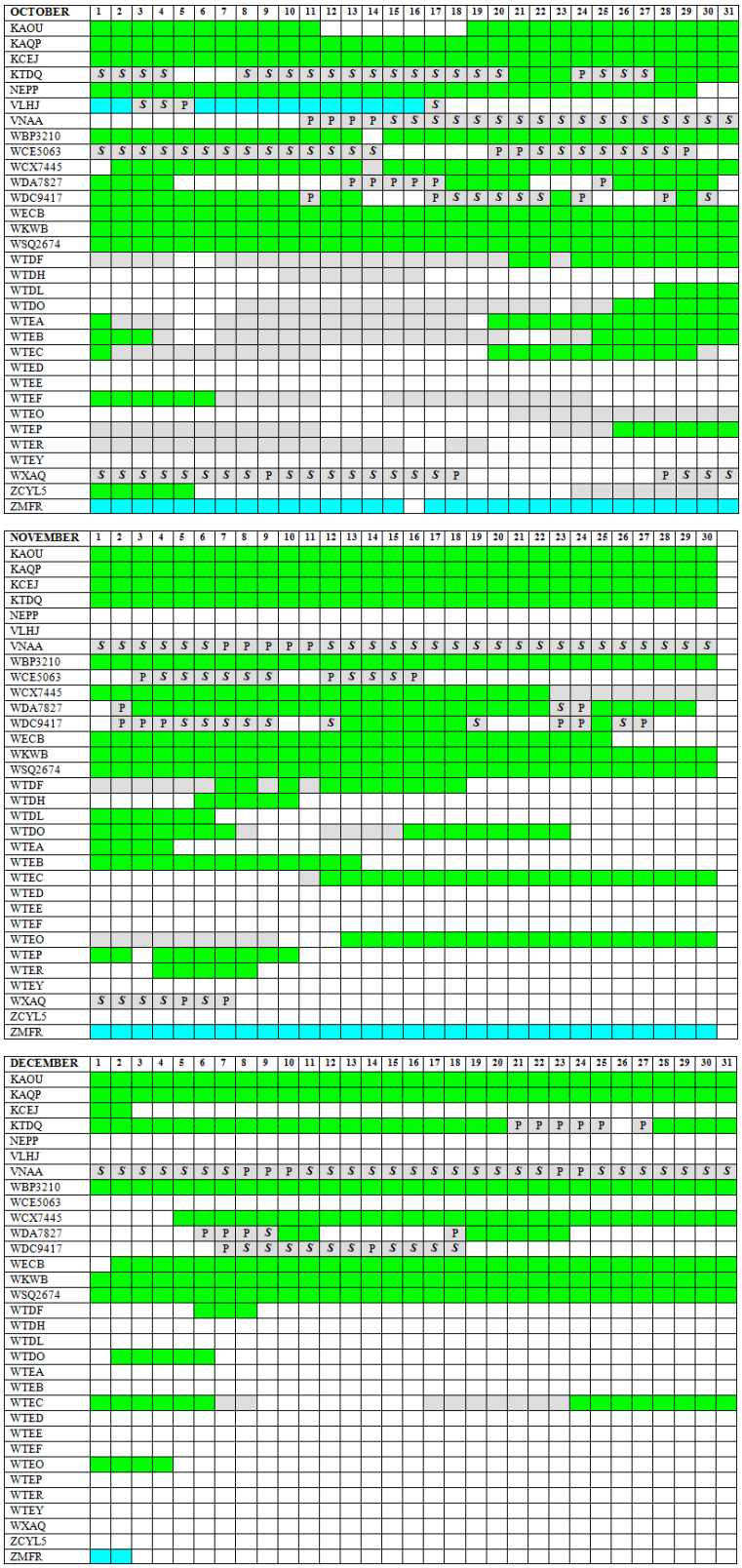


(Figure 2: cont'd)

b. Spatial coverage

Geographically, SAMOS data coverage continues to be fairly comprehensive in 2013. Cruise coverage for the January 1, 2013 to December 31, 2013 period (Figure 3) again includes occurrences poleward of both the Arctic (*Healy*) and Antarctic (*Aurora Australis, Palmer,* and *Gould*) circles, additional exposure in Alaskan waters (*Oscar Dyson* and *Rainier*), and samples along the northern Caribbean island coastlines, from Cuba to Puerto Rico (*Nancy Foster*). An impressive resume from the *Knorr* includes occurrences at Cape Horn, Africa, much of the western South American coastline, and heavy sampling west of Greenland. The Indian Ocean was again sampled by the *Roger Revelle*, and the waters south of Australia and New Zealand are covered by the *Southern Surveyor* and the *Tangaroa*. The *Ron Brown* provides a broad sample of the Atlantic, while the *Melville, Kilo Moana*, *Revelle* and *Thompson* together do the same for the Pacific. Natively, the western coastal United States is covered by, among others, the *Bell M. Shimada* and the *New Horizon*; additionally, the *Atlantis* provides data all the way up the western coastline between Latin America and the state of Washington. The eastern coastal United States is heavily covered by the *Henry Bigelow*, *Okeanos Explorer*, and *Gordon Gunter*, among others. The northern Gulf of Mexico is virtually covered by the *Oregon II* and *Pisces*. Hawai'ian waters are well-sampled by the *Oscar Elton Sette* and the *Hi'ialakai*. Naturally, Bermuda is again well-covered by the *Atlantic Explorer*.

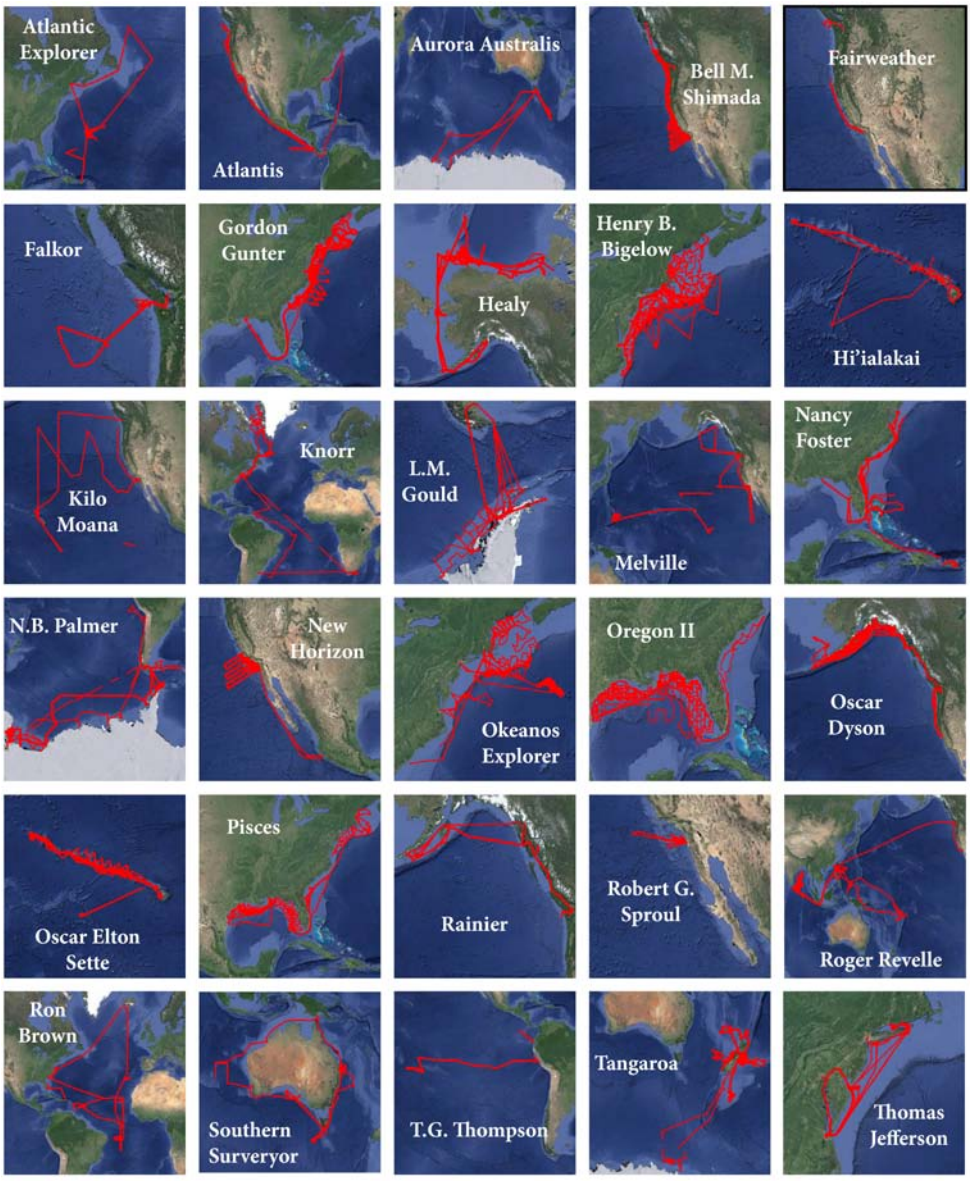


Figure 3: Cruise maps plotted for each vessel in 2013.

c. Available parameter coverage

The core meteorological parameters – earth relative wind speed and direction, atmospheric pressure, and air temperature and relative humidity – and the oceanographic parameter sea temperature are reported by all ships. Many SAMOS vessels also report precipitation accumulation, rain rate, longwave, shortwave, net, and photosynthetically active radiations, along with sea water conductivity and salinity. Additionally, the *Healy*, *Roger Revelle*, *Melville*, and *Thomas Jefferson* are all capable of providing dew point temperature, although only the *Thomas Jefferson* did so in 2013. The *Jefferson* is also the only vessel set up to provide wet bulb temperature, and did so in 2013. A quick glance at Table 3 (located in Section 4) shows which parameters are reported by each vessel: those boxes in columns 6 through 26 with an entry indicate a parameter was enabled for reporting and processing in 2013. (Further detail on Table 3 is discussed in

Section 4.) Some vessels furnish redundant sensors, which can be extremely helpful for visually assessing data quality. Again referring to Table 3, those boxes in columns 6 through 26 with multiple entries indicate the number of redundant sensors available for reporting and processing in 2013; boxes with a single entry indicate the existence of a single sensor.

3. Data quality

a. SAMOS quality control

Definitions of A-Z SAMOS quality control flags are listed in Table 2. It should be noted that no secondary automated QC was active in 2013 (SASSI), so quality control flags U-Y were not in use. If a coded variable does not contain an integer pointer to the flag attribute it is assigned a "special value" (set equal to -8888). A special value may also be set for any overflow value that does not fit the memory space allocated by the internal SAMOS format (e.g., character data value received when numeric value was expected). A "missing value" (set equal to -9999) is assigned for any missing data across all variables except time, latitude, and longitude, which must always be present. In general, visual QC will only involve the application of quality control flags H, I, J, K, M, N and S. Quality control flags J, K, and S are the most commonly applied by visual inspection, with K being the catchall for the various issues common to most vessels, such as (among others) steps in data due to platform speed changes or obstructed platform relative wind directions, data from sensors affected by stack exhaust contamination, or data that appears out of range for the vessel's region of operation. M flags are primarily assigned when there has been communication with vessel personnel in which they have dictated or confirmed there was an actual sensor malfunction. Port (N) flags are reserved for the latitude and longitude parameters and don't necessarily imply a problem. The port flag is applied to indicate the vessel is in port and may be combined with flags on other parameters to note questionable data that are likely attributable to dockside structural interference or, as in the case of sea temperature, the fact that some apparatus are habitually turned off while a vessel is in port. SAMOS data analysts may also apply Z flags to data, in effect removing flags that were applied by automated QC. For example, B flagging is dependent on latitude and occasionally a realistic value is assigned a B flag simply because it occurred very close to a latitude boundary. This happens with sea temperature from time to time in the extreme northern Gulf of Mexico – TS values of 32˚C or 33ºC are not unusual there in the summer, but portions of the coastline are north of 30 degrees latitude and thus fall into a region where such high temperature are coded as "out of bounds." In this case the B flags would be removed by the data analyst and replaced with good data (Z) flags.

Flag	Description
A	Original data had unknown units. The units shown were determined using a climatology or some other method.
B	Original data were out of a physically realistic range bounds outlined.
C	Time data are not sequential or date/time not valid.
D	Data failed the T>=Tw>=Td test. In the free atmosphere, the value of the temperature is always greater than or equal to the wet-bulb temperature, which in turn is always greater than or equal to the dew point temperature.
E	Data failed the resultant wind re-computation check. When the data set includes the platform's heading, course, and speed along with platform relative wind speed and direction, a program re-computes the earth relative wind speed and direction. A failed test occurs when the wind direction difference is >20 or the wind speed difference is >2.5 m/s.
F	Platform velocity unrealistic. Determined by analyzing latitude and longitude positions as well as reported platform speed data.
G	Data are greater than 4 standard deviations from the ICOADS climatological means (da Silva et al. 1994). The test is only applied to pressure, temperature, sea temperature, relative humidity, and wind speed data.
H	Discontinuity found in the data.
I	Interesting feature found in the data. More specific information on the feature is contained in the data reports. Examples include: hurricanes passing stations, sharp seawater temperature gradients, strong convective events, etc.
J	Data are of poor quality by visual inspection, DO NOT USE.
K	Data suspect/use with caution – this flag applies when the data look to have obvious errors, but no specific reason for the error can be determined.
L	Oceanographic platform passes over land or fixed platform moves dramatically.
M	Known instrument malfunction.
N	Signifies that the data were collected while the vessel was in port. Typically these data, though realistic, are significantly different from open ocean conditions.
O	Original units differ from those listed in the *original_units* variable attribute. See quality control report for details.
P	Position of platform or its movement is uncertain. Data should be used with caution.
Q	Questionable – data arrived at DAC already flagged as questionable/uncertain.
R	Replaced with an interpolated value. Done prior to arrival at the DAC. Flag is used to note condition. Method of interpolation is often poorly documented.
S	Spike in the data. Usually one or two sequential data values (sometimes up to 4 values) that are drastically out of the current data trend. Spikes for many reasons including power surges, typos, data logging problems, lightning strikes, etc.
T	Time duplicate.
U	Data failed statistical threshold test in comparison to temporal neighbors. This flag is output by automated Spike and Stair-step Indicator (SASSI) procedure developed by the DAC.
V	Data spike as determined by SASSI.
X	Step/discontinuity in data as determined by SASSI.
Y	Suspect values between X-flagged data (from SASSI).
Z	Data passed evaluation.

Table 2: Definitions of SAMOS quality control flags

b. 2013 quality across-system

This section presents the overall quality from the system of ships providing observations to the SAMOS data center in 2013. The results are presented for each variable type for which we receive data and are broken down by month. The number of

individual 1 minute observations varies by parameter and month due to changes in the number of vessels at sea and transmitting data.

The quality of SAMOS atmospheric pressure data is good, overall (Figure 4). The most common problems with the pressure sensors are flow obstruction and barometer response to changes in platform speed. Figure 65 does a good job of demonstrating these issues. Unwanted pressure response to vessel motion can be avoided by ensuring good exposure of the pressure port to the atmosphere (not in a lab, bridge, or under an overhanging deck) and by using a Gill-type pressure port. The increased flagging of the P2 parameter in the second half of 2013 (Figure 4) appears to have come mainly from the *Revelle* and the *New Horizon*. Neither of these vessels receives visual quality control, so it's not entirely clear what the issues were, but it is noted that a lightning strike within 20m of *Revelle* in mid-July did cause some data upsets on that vessel (documented; see individual vessel description in section 3c for details).

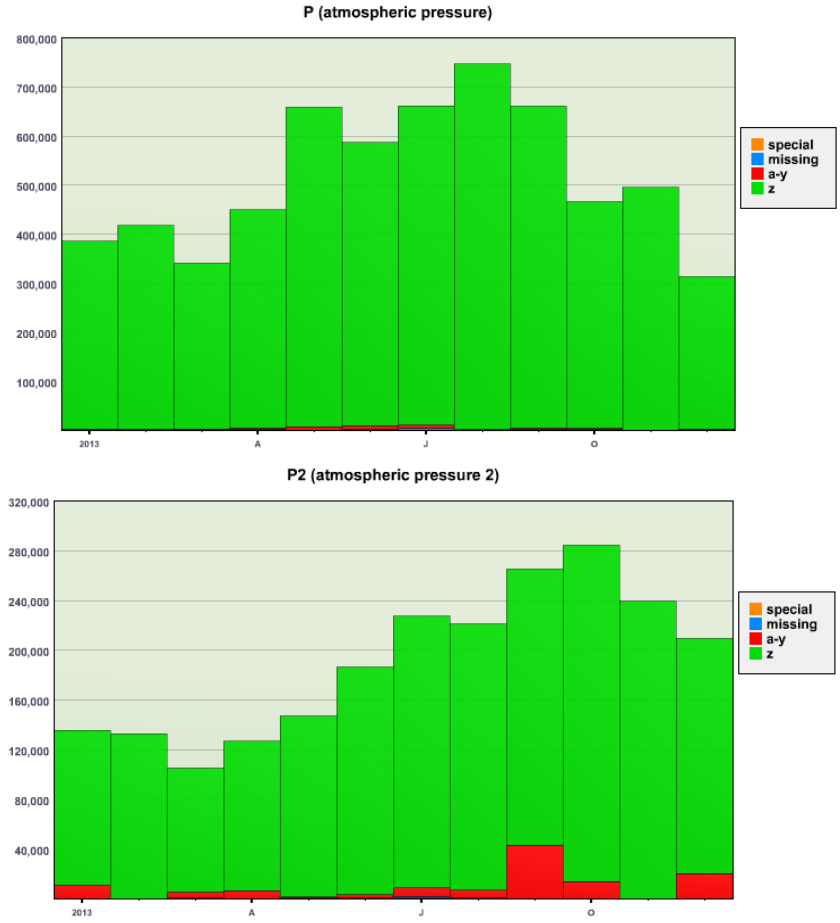
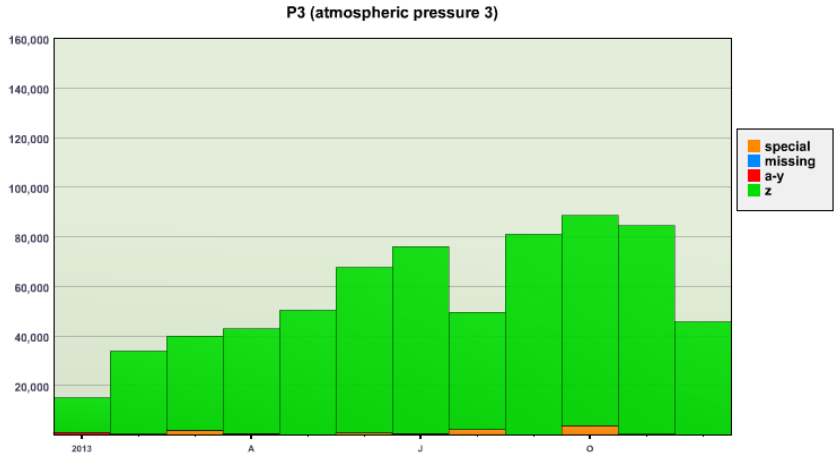


Figure 4: Total number of (top) atmospheric pressure – P – (bottom) atmospheric pressure 2 – P2 – and (next page) atmospheric pressure 3 – P3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



(Figure 4: cont'd)

Air temperature was also of decent quality (Figure 5). The *Robert Gordon Sproul* is the likely culprit of the increase of flagging of T2 in November/December, as their T2 sensor was out to lunch throughout that period (documented; see individual vessel description in section 3c for details). But for the most part, flagging occurred across multiple vessels in any given month for typical reasons. With the air temperature sensors, again flow obstruction was a primary problem. In this case, when the platform relative wind direction is such that regular flow to the sensor is blocked, unnatural heating of the sensor location can occur. Figure 52 does a good job of demonstrating this phenomenon. Deck heating can also occur simply when winds are light and the sensor is mounted on or near a large structure that easily retains heat (usually metal). Contamination from stack exhaust was also a common problem. Each of these incidences will result in the application of either caution/suspect (K) or poor quality (J) flags. In the case of stack exhaust, the authors wish to stress that adequate digital imagery, when used in combination with platform relative wind data, can facilitate the identification of exhaust contamination and subsequent recommendations to operators to change the exposure of their thermometer.

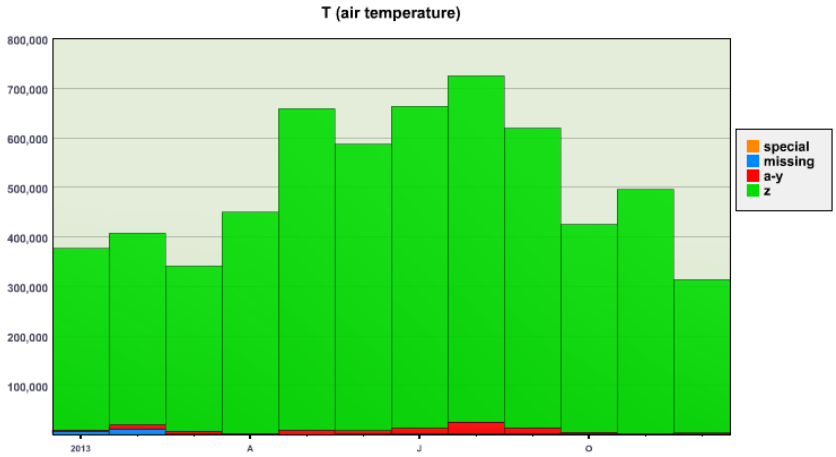
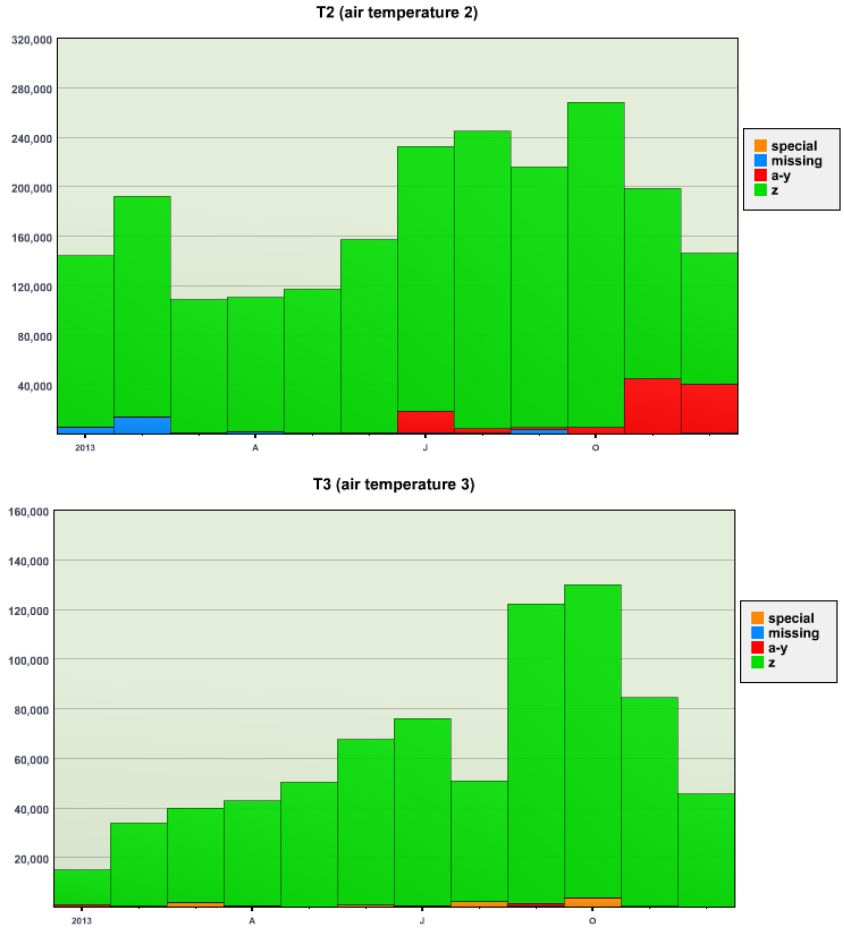


Figure 5: Total number of (this page) air temperature – T – (next page, top) air temperature 2 – T2 – and (next page, bottom) air temperature 3 – T3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



(Figure 5: cont'd)

Wet bulb temperature (Figure 6) was reported by only one vessel in 2013; namely, the *Thomas Jefferson*, which is also the only vessel currently set up to report wet bulb. No significant issues appear to exist with the parameter.

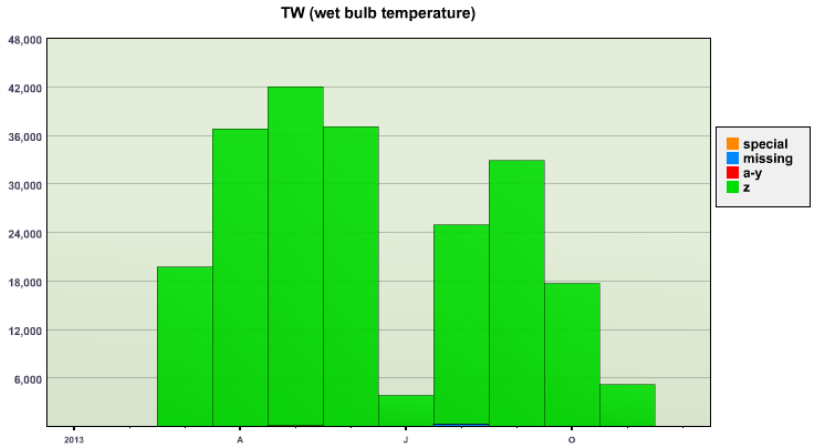


Figure 6: Total number of wet bulb temperature – TW – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Dew point temperature (Figure 7) also was only reported by one vessel in 2013; again, the *Thomas Jefferson*, although three other vessels are currently set up to report dew point if they wish. Again, no significant issues appear to exist with the parameter.

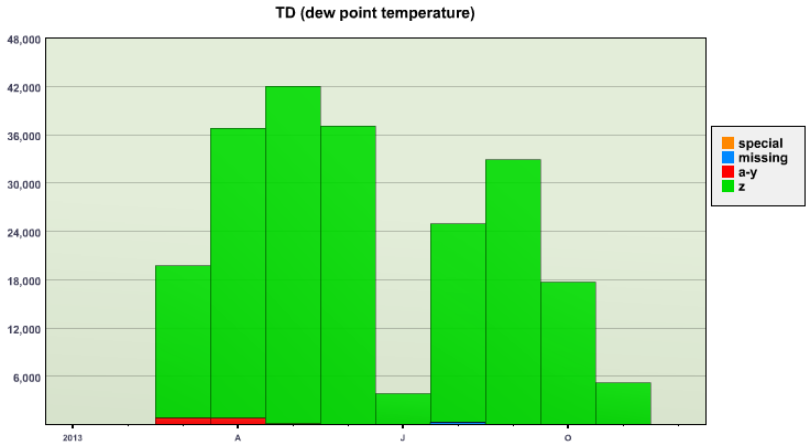


Figure 7: Total number of dew point temperature – TD – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

With relative humidity, the most common issue is readings slightly greater than 100%. If these measurements were sound they would imply supersaturated conditions, but in fact that scenario is quite rare near the surface of the ocean. When it comes to relative humidity, the mechanics of most types of sensors is such that it is easier to obtain high accuracy over a narrow range than over a broader range, say from 10% to 100% (Wiederhold, 2010). It is often desirable to tune these sensors for the greatest accuracy within ranges much less than 100%. The offshoot of such tuning, of course, is that when conditions are at or near saturation (e.g. rainy or foggy conditions) the sensor performs with less accuracy and readings over 100% commonly occur. While these readings are not really in grave error, they are nonetheless physically implausible and should not be used. Thus, they are B flagged by the automated QC flagger. These B flags likely account for a large portion of the A-Y flagged portions depicted in Figure 8. The slightly higher amount of flags accorded to RH in November/December are probably due again to the *Sproul*, as that sensor along with T2 was also out to lunch during that period (documented; see individual vessel description in section 3c for details). The increased flagging of RH2 during the August-October period looks to come mostly from the *Healy*, of indeterminate origin (documented; see individual vessel description in section 3c for details).

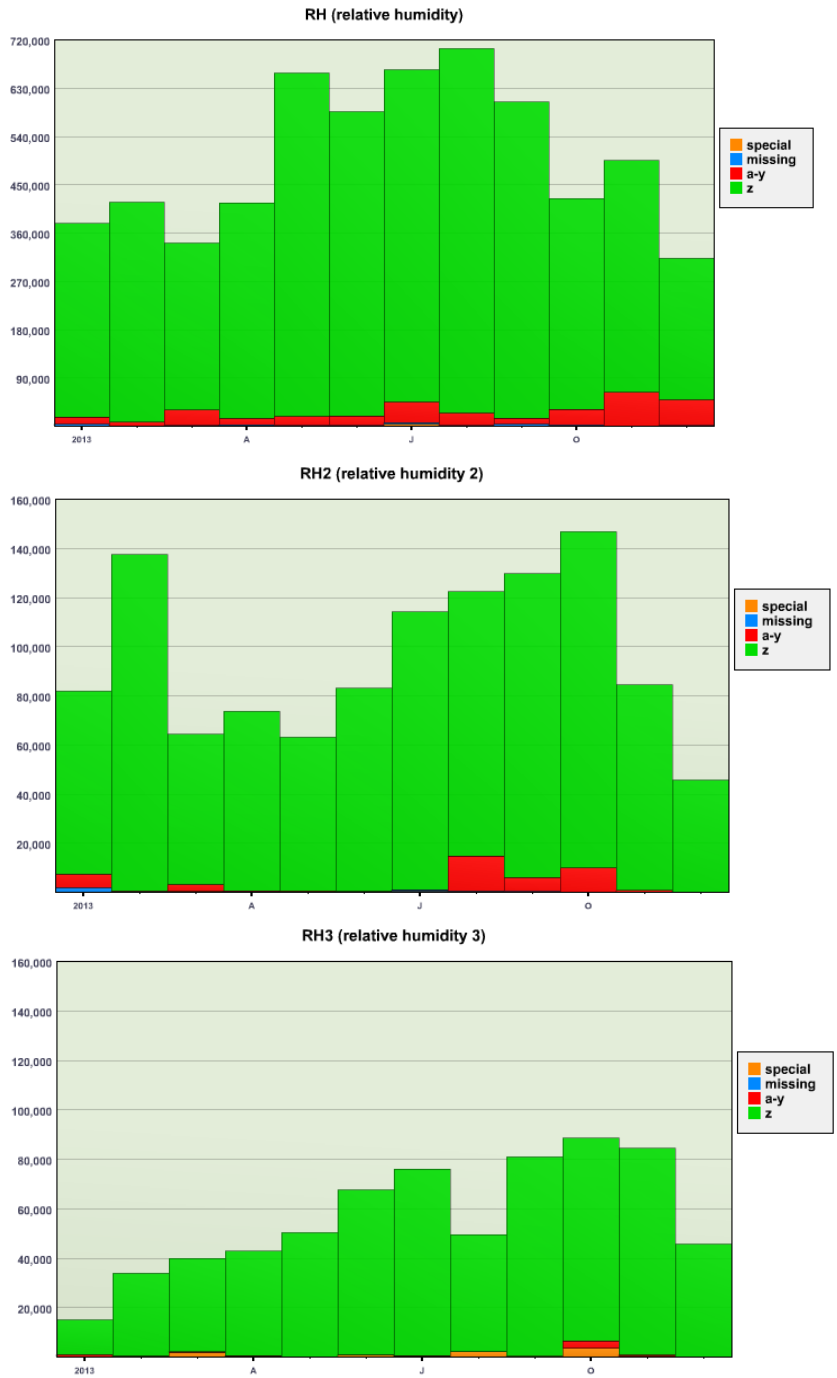


Figure 8: Total number of (top) relative humidity – RH – (middle) relative humidity 2 – RH2 – and (bottom) relative humidity 3 – RH3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Wind sensors, both direction and speed, are arguably the instruments most affected by flow obstruction and changes in platform speed. Because research vessels traditionally carry bulky scientific equipment and typically have multi-level superstructures, it is a challenge to find locations on a research vessel where the sensors will capture the free-

atmospheric circulation. Unlike other met sensors such as air temperature and relative humidity that are designed to function more or less independent of the micro scale nuances in airflow surrounding them, nuances in flow are the very thing that wind sensors are intended to measure. This is why obstructed flow is readily incorporated into wind measurements. These flow-obstructed and platform speed-affected wind data were a common problem across SAMOS vessels in 2013.

The overall quality of the 2013 SAMOS wind data was nonetheless good, as shown in Figures 9 (earth relative wind direction) and 10 (earth relative wind speed). The only standout is an increase in flagging in December regarding SPD2. This looks to have come from the Gould but it appears to be mainly “failed the true wind test” (E) flags applied to noisy, yet still potentially realistic, winds. In SAMOS visual quality control, compromised wind data is addressed with caution/suspect (K), visual spike (S), and sometimes poor quality (J) flags. Where comprehensive metadata and digital imagery exist, flow obstructed platform relative wind bands can often be diagnosed based on the structural configuration of the vessel and recommendations can be made to the vessel operator to improve sensor locations. Another diagnostic tool available to SAMOS data analysts is a polar plotting routine, which can look at a single variable and identify the ratio of flagged observations to total observations in one degree (platform relative wind direction) bins. In this way, platform relative wind bands that interfere with sensor readings may be identified. Currently the polar plot program is configured to accept air temperature, humidity, and true wind speed and direction data with corresponding platform relative wind data. The polar plotting program is not currently in regular use by SAMOS data analysts because it is a time consuming process and the routines need more tuning, but its attributes could be improved and its benefits further explored in the future. Figures 38, 41, 58, and 62 in the next section do a good job of showing the spikes and steps that can occur in DIR and SPD when flow obstruction or distortion occurs.

The other major problem with earth relative wind data is errors caused by changes in platform speed. Occasionally, a wind direction sensor is also suspected of being "off" by a number of degrees. Satellite wind products can sometimes clue data analysts in to such a bias, particularly if the bias is very large. But in general, if a technician suspects a wind direction bias it is critical they communicate that suspicion to SAMOS personnel, as otherwise the data analysts often will have no reliable means of discovering the problem themselves. Suspected wind direction biases are typically flagged with K flags, or J flags if the case is extreme and/or verifiable.

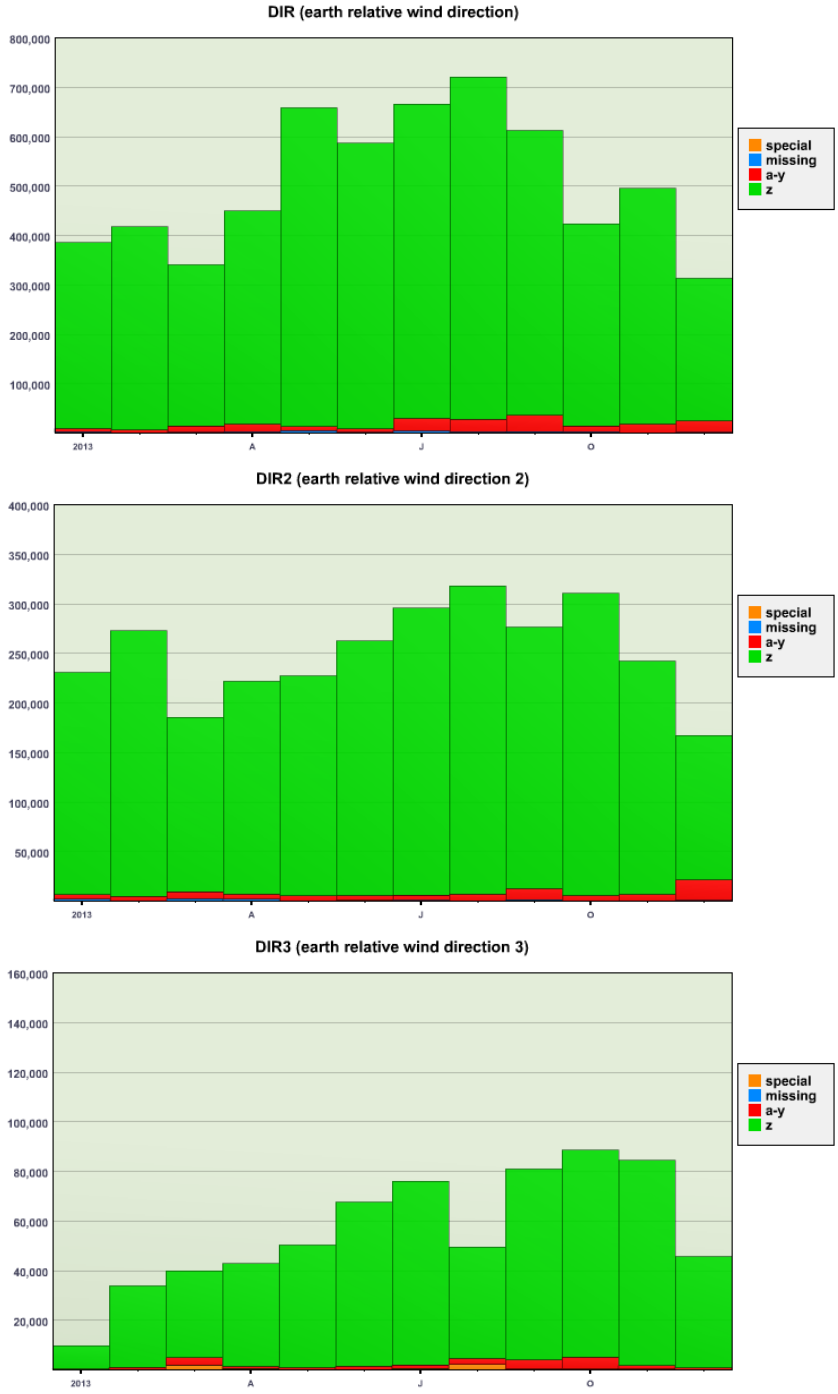


Figure 9: Total number of (top) earth relative wind direction – DIR – (middle) earth relative wind direction 2 – DIR2 – and (bottom) earth relative wind direction 3 – DIR3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

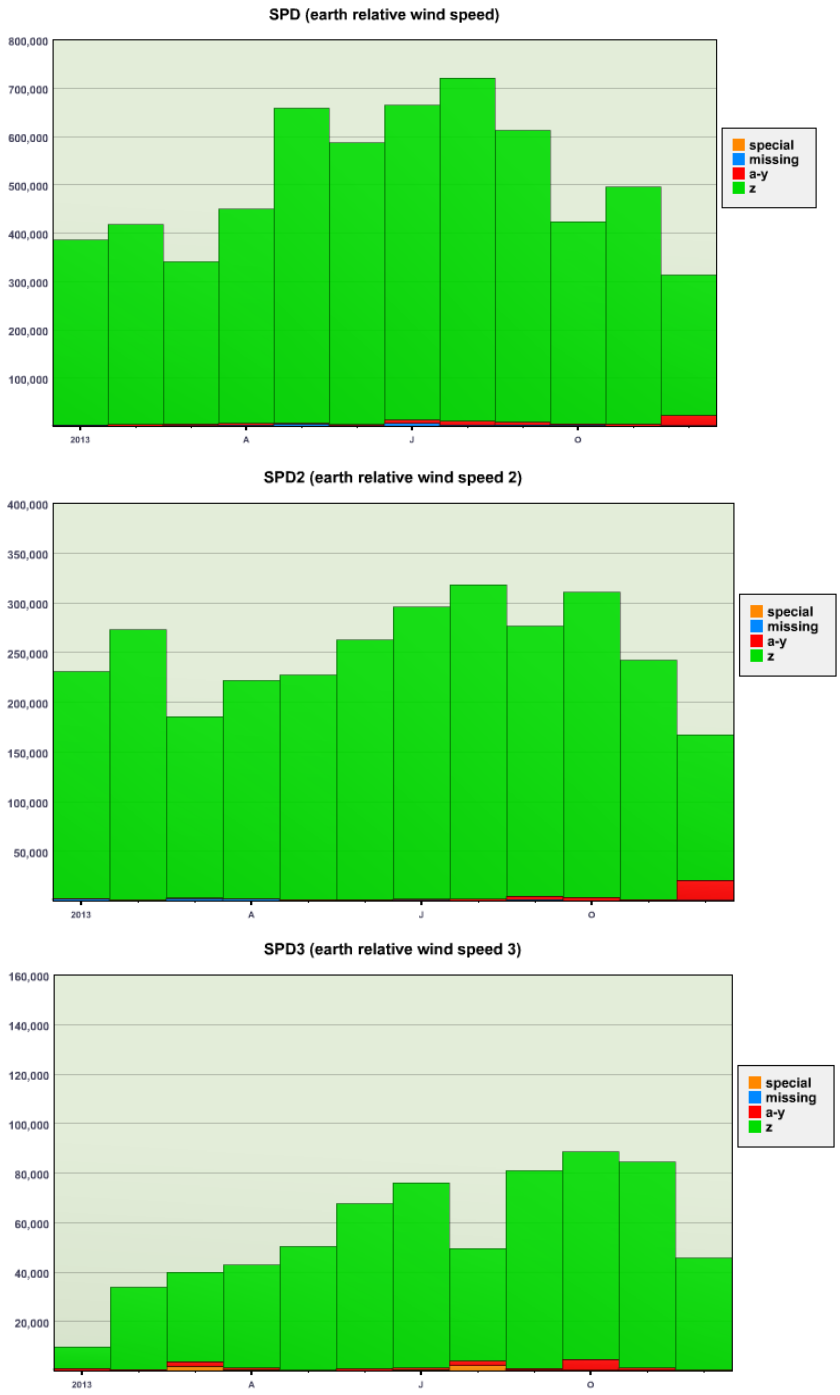


Figure 10: Total number of (top) earth relative wind speed – SPD – (middle) earth relative wind speed 2 – SPD2 – and (bottom) earth relative wind speed 3 – SPD3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Most of the flags applied to the radiation parameters were assigned by the autoflagger, primarily to short wave radiation (Figure 11). Short wave radiation tends to have the largest percentage of data flagged for parameters submitted to SAMOS. Out of bounds

(B) flags dominate in this case. Like the relative humidity sensors, this is again a situation where a high degree of accuracy is impossible over a large range of values. As such, shortwave sensors are typically tuned to permit greater accuracy at large radiation values. Consequently, shortwave radiation values near zero (i.e., measured at night) often read slightly below zero. Once again, while these values are not a significant error, they are nonetheless invalid and unsuitable for use as is and should be set to zero by any user of these data. Long wave atmospheric radiation, on the other hand, has perhaps the smallest percentage of data flagged for parameters submitted to SAMOS (Figure 12). Overall quality for photosynthetically active atmospheric radiation and net atmospheric radiation also appears reasonably good (Figures 13, and 14, respectively).

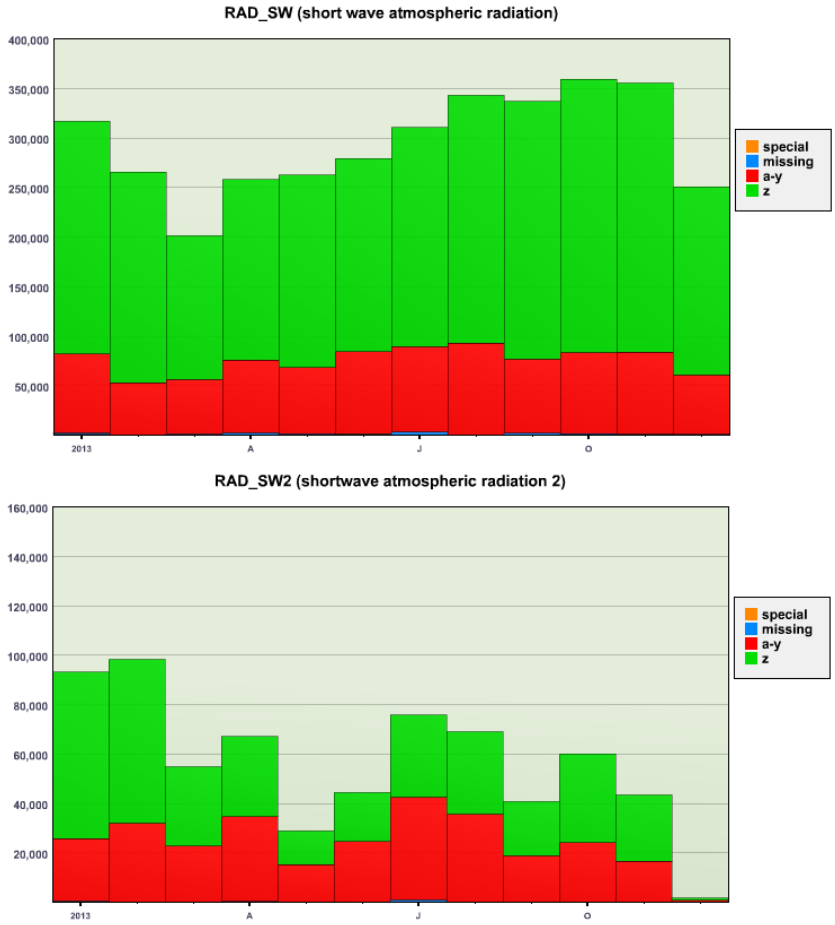


Figure 11: Total number of (top) shortwave atmospheric radiation – RAD_SW – and (bottom) shortwave atmospheric radiation 2 – RAD_SW2 –observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

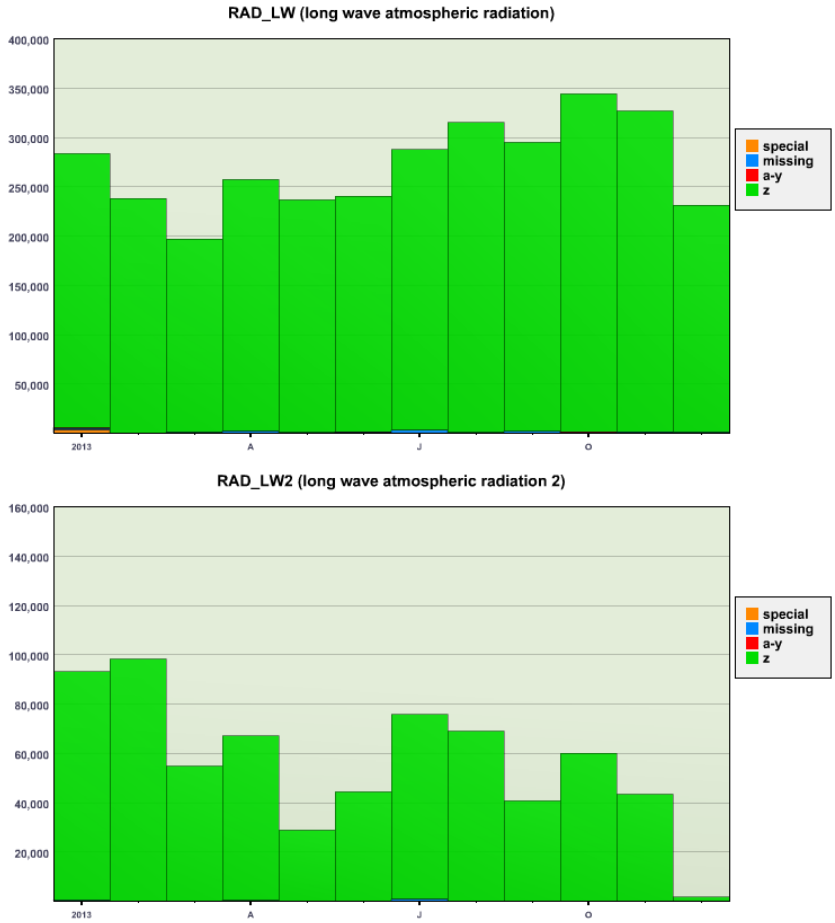


Figure 12: Total number of (top) long wave atmospheric radiation – RAD_LW – and (bottom) long wave atmospheric radiation 2 – RAD_LW2 –observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

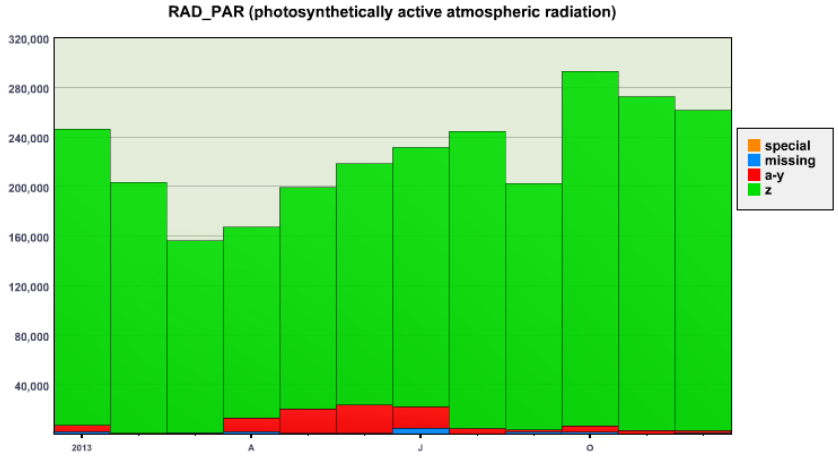
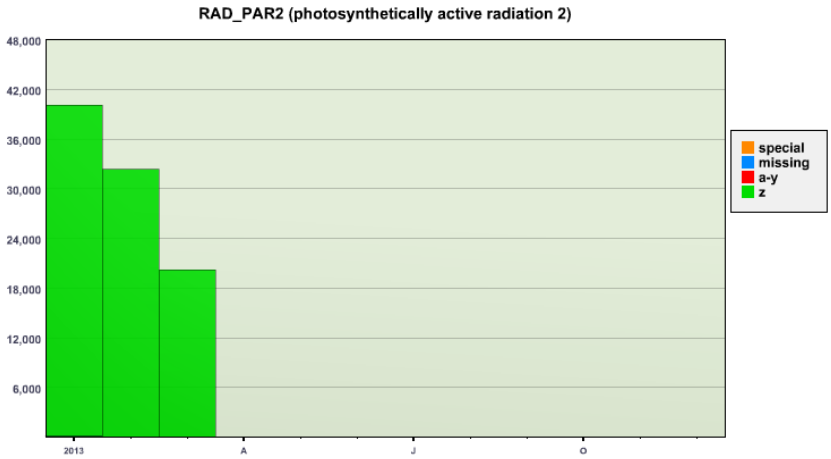


Figure 13: Total number of (this page) photosynthetically active atmospheric radiation – RAD_PAR – and (next page) photosynthetically active atmospheric radiation 2 – RAD_PAR2 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



(Figure 13: cont'd)

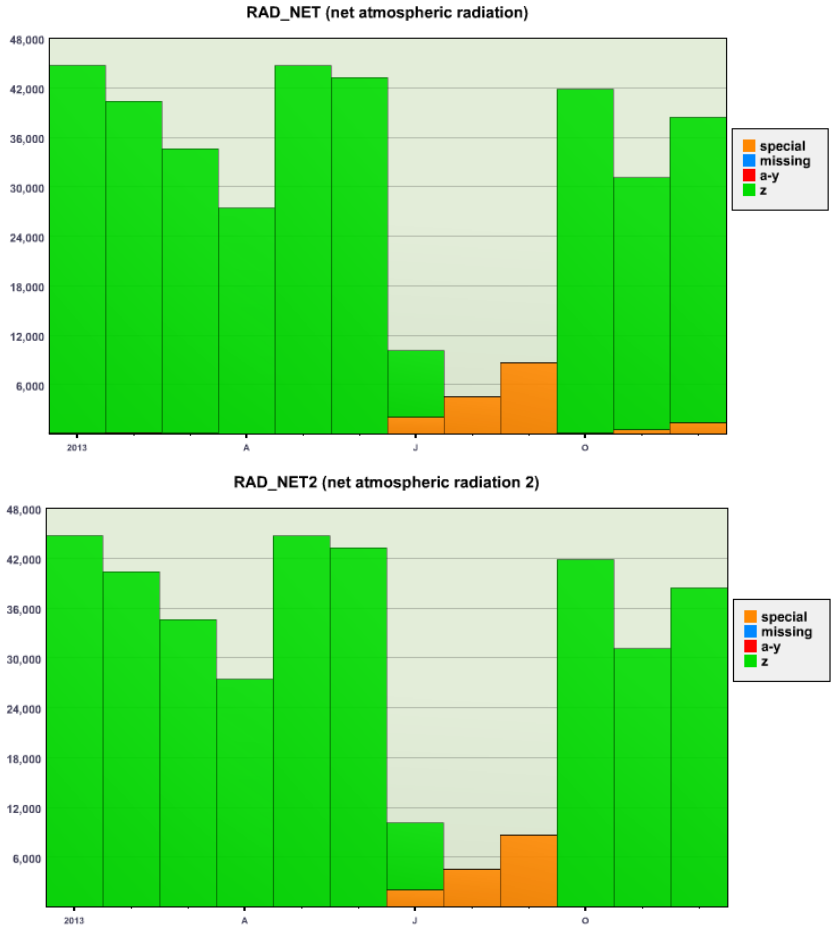


Figure 14: Total number of (top) net atmospheric radiation – RAD_NET – and (bottom) net atmospheric radiation 2 – RAD_NET2 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

There were no major problems of note with either the rain rate (Figure 15) or precipitation accumulation (Figure 16) parameters. It should also be noted that some accumulation sensors will occasionally exhibit slow leaks and/or evaporation. These data are not typically flagged; nevertheless, frequent emptying of precipitation accumulation sensors is always advisable.

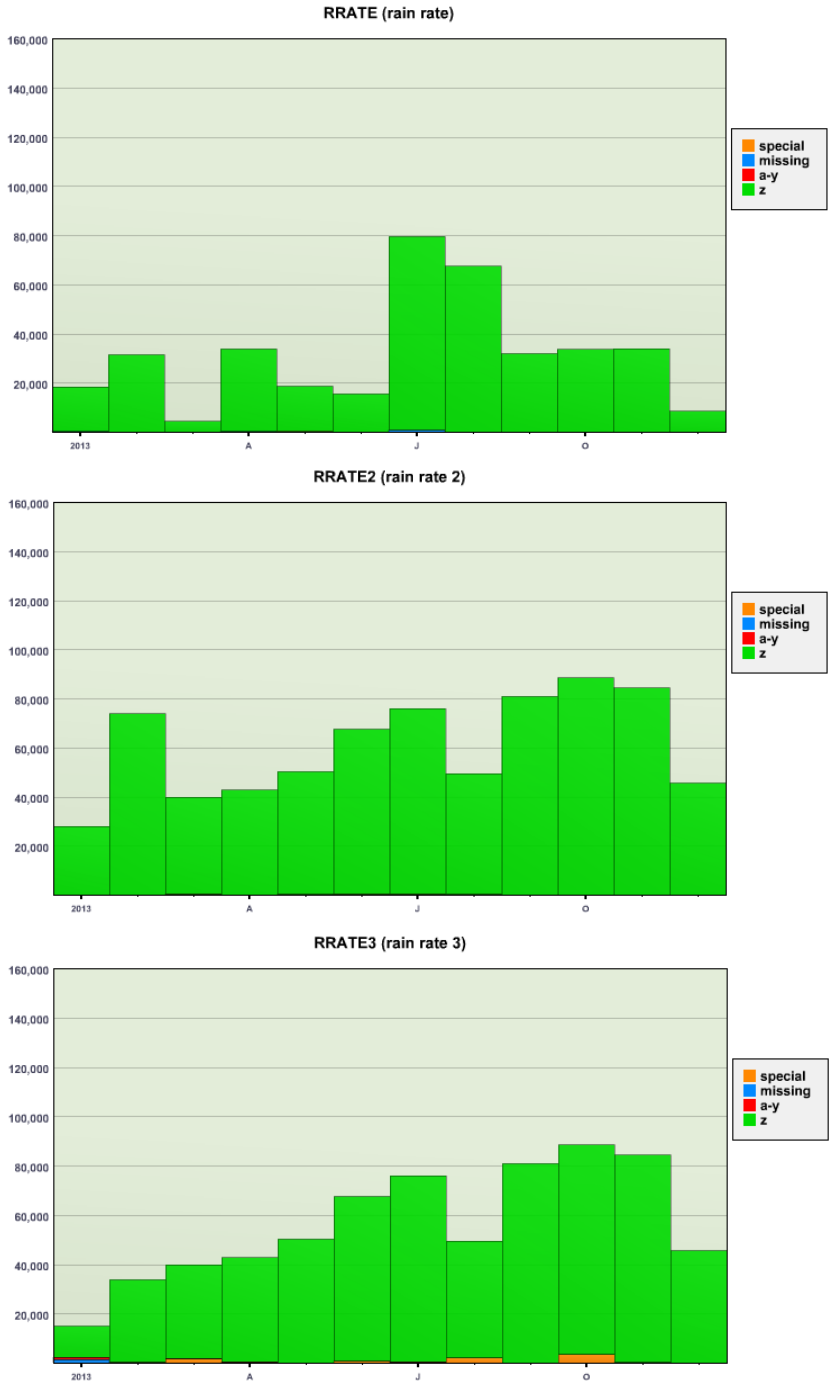


Figure 15: Total number of (top) rain rate – RRATE – (middle) rain rate 2 – RRATE2 – and (bottom) rain rate 3 – RRATE3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

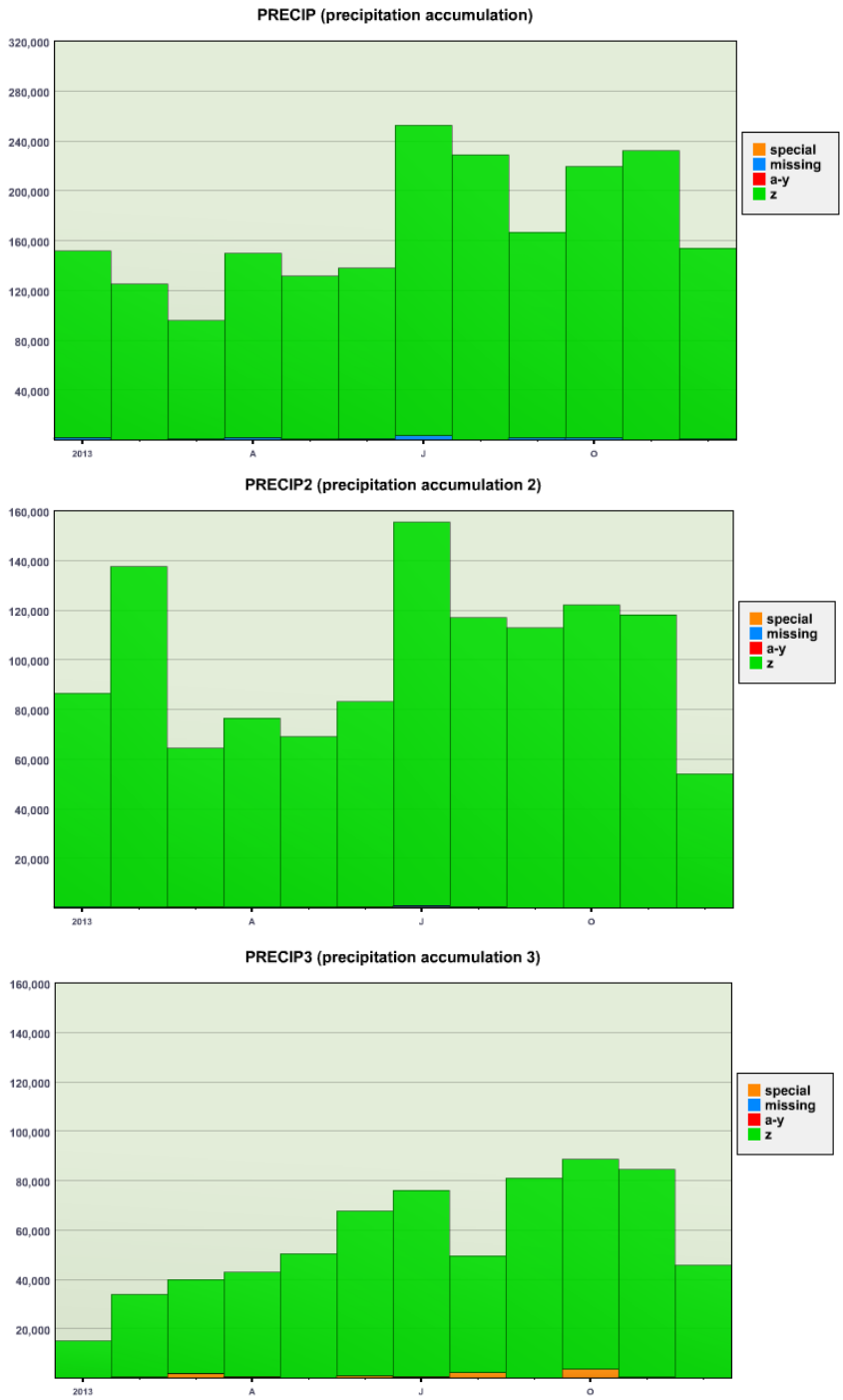


Figure 16: Total number of (top) precipitation accumulation – PRECIP – (middle) precipitation accumulation 2 – PRECIP2 – and (bottom) precipitation accumulation 3 – PRECIP3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

The main problem identified with the sea temperature parameter (Figure 17) occurred when the sensor was denied a continuous supply of seawater. In these situations, either the resultant sea temperature values were deemed inappropriate for the region of

operation (using gridded SST fields as a guide), in which case they were flagged with suspect/caution (K) flags or occasionally poor quality (J) flags if the readings were extraordinarily high or low, or else the sensor reported a constant value for an extended period of time, in which case they were unanimously J-flagged. The authors note that this often occurred while a vessel was in port, which is rather anticipated as the normal ship operation practice by SAMOS data analysts. The increase in flagging of TS in July and August is explained via the *Southern Surveyor*, as the parameter read a constant approximate -1.0 °C between 6 July and 10 August (documented; see individual vessel description in section 3c for details). This resulted in out of bounds (B) flags for the duration of the event. Some of the flag increases in TS2 appear to have come from the *Revelle*, who transmitted a fair amount of data while the vessel was undergoing maintenance earlier in the year and who also suffered a lightning strike and subsequent electrical difficulties later in the year (also documented; see individual vessel description in section 3c for details). These occurrences may go a long way towards explaining the flag increases.

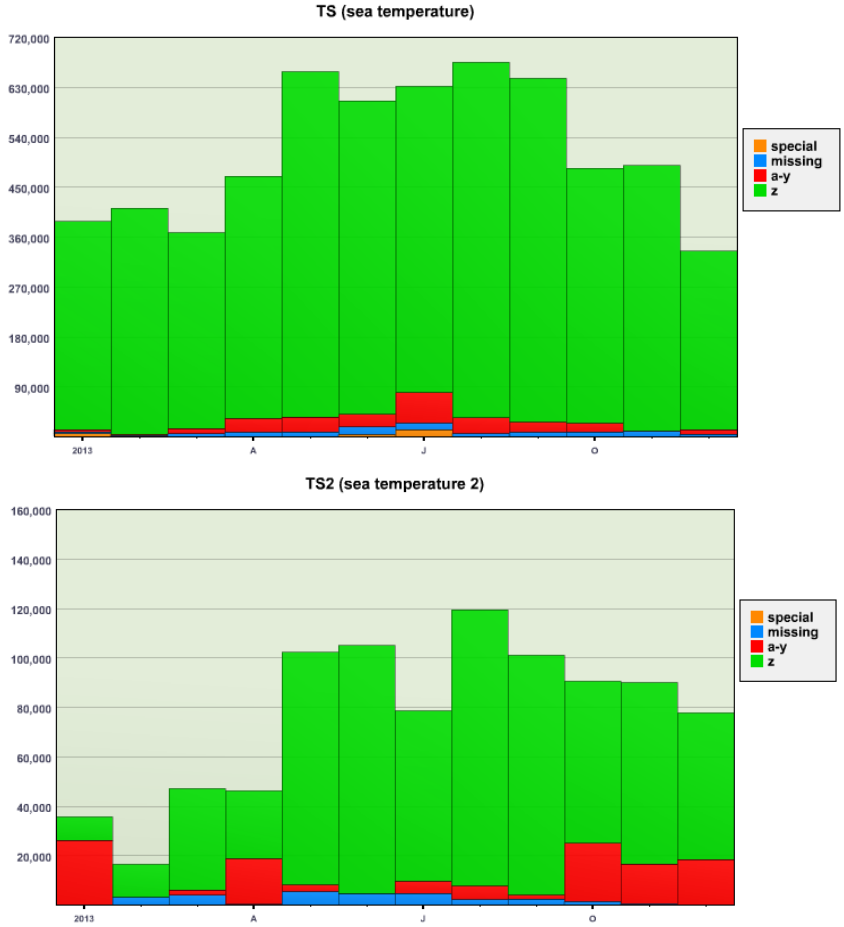


Figure 17: Total number of (top) sea temperature – TS – and (bottom) sea temperature 2 – TS2 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Salinity and conductivity (Figures 18 and 19, respectively) experienced the same major issue as sea temperature; namely, when a vessel was in port or ice the flow water system that feeds the probes was usually shut off, resulting in either inappropriate or static values. Another fairly common issue with salinity and conductivity, though, is that on some vessels the intake port is a little shallower than is desirable, such that in heavy seas the intake cyclically rises above the waterline and air gets into the sample. When this occurs, the data can be fraught with spikes. Data such as this is typically flagged with either spike (S), suspicious quality (K), or occasionally even poor quality (J) flags. In spite of these issues, though, salinity and conductivity data in 2013 was still rather good. The flag increases in CNDC2 again appear to come mostly from the *Revelle*, possibly for the reasons discussed above with sea temperature. The authors do note that all the salinity values are relative and no effort was made to benchmark the values to water calibration samples. Calibration of salinity data is presently beyond the scope of SAMOS.

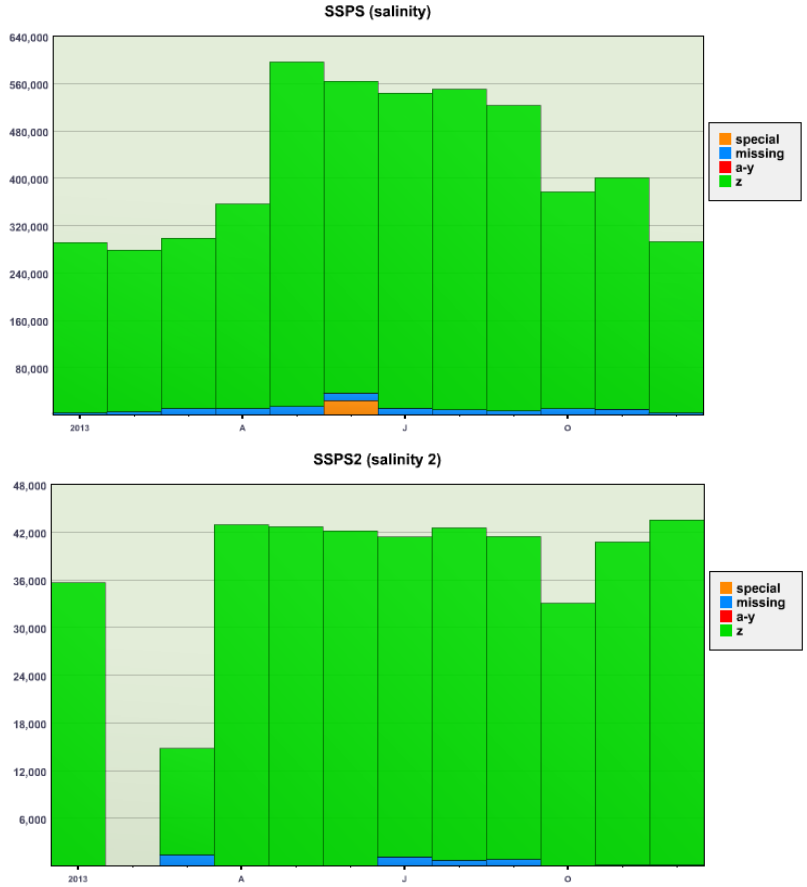


Figure 18: Total number of (top) salinity – SSPS – and (bottom) salinity 2 – SSPS2 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Figure 19: Total number of (top) conductivity – CNDC – and (bottom) conductivity 2 – CNDC2 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Latitude and longitude (Figure 20) primarily only receive flags via the autoflagger, although occasionally the data analyst will apply port (N) flags as prescribed in the preceding section 3a, and in the rare cases of system-wide failure they can each be assigned malfunction (M) flags by the data analyst. Other than these few cases, LAT and LON each primarily receive land error flags, which are often removed by the data analyst when it is determined that the vessel was simply very close to land, but still over water (although in non-visual QC ships this step is not taken). The geographic land/water mask in use for determining land positions in 2013 was a two-minute grid. It should be noted that in 2013 several vessels, including the WHOI vessels *Knorr* and *Atlantis* were removed from the visual QC roster, due to budget cuts. The WHOI vessels in particular transmit a good deal of port data and since they no longer receive visual QC, an increase in erroneous L (position over land) autoflagging would be expected for 2013.

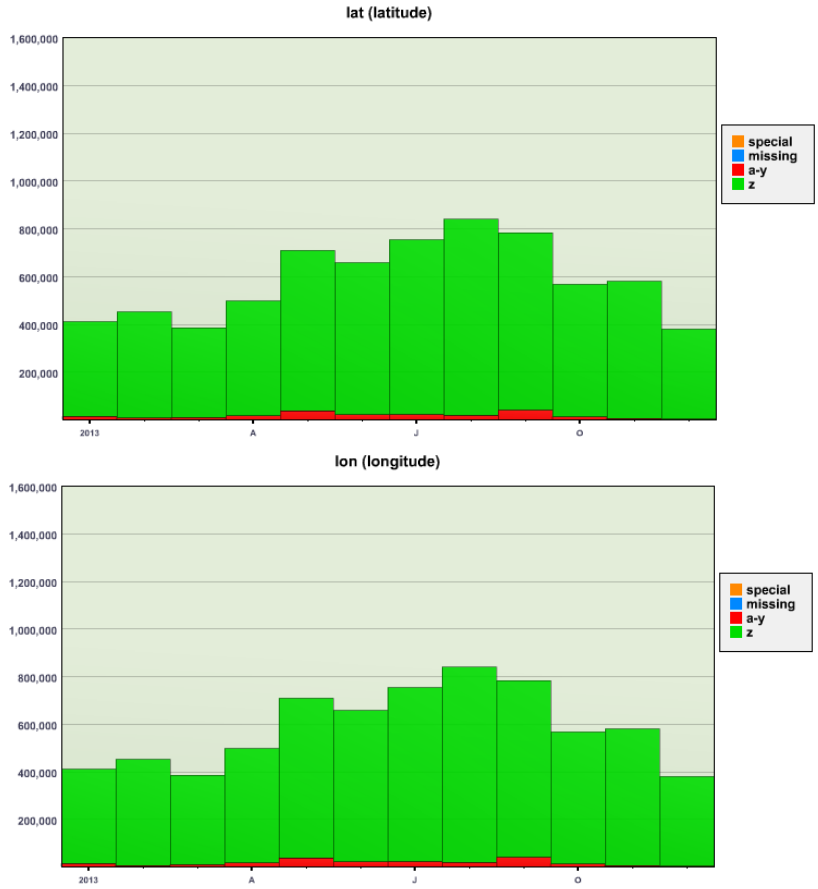


Figure 20: Total number of (this page) latitude – LAT – and (next page) longitude – LON – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

The remainder of the navigational parameters exhibited no problems of note. They are nevertheless included for completeness: platform heading (Figure 21), platform course (Figure 22), platform speed over ground (Figure 23), and platform speed over water (Figure 24).

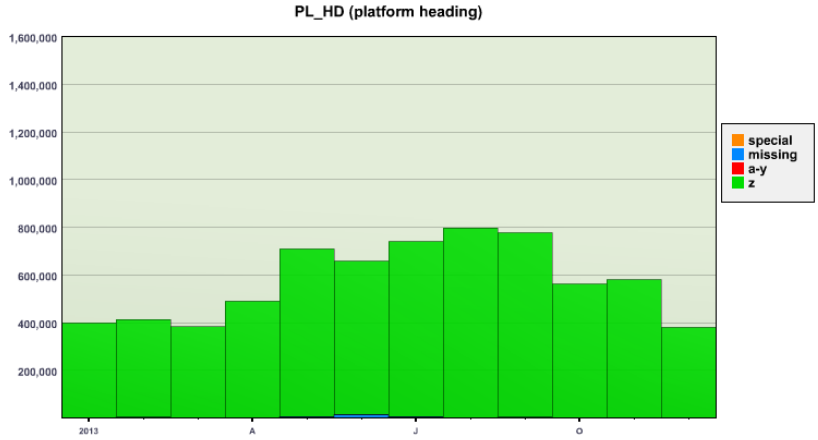
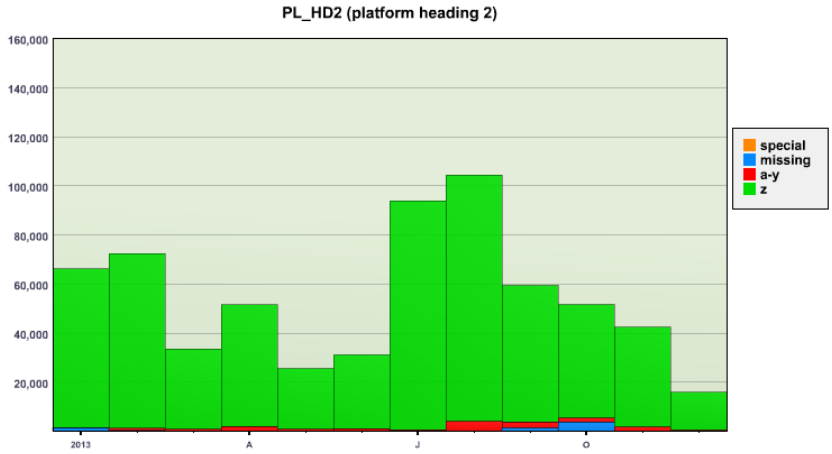


Figure 21: Same as Figure 20, except for (this page) platform heading – PL_HD – and (next page) platform heading 2 – PL_HD2.



(Figure 21: cont'd)

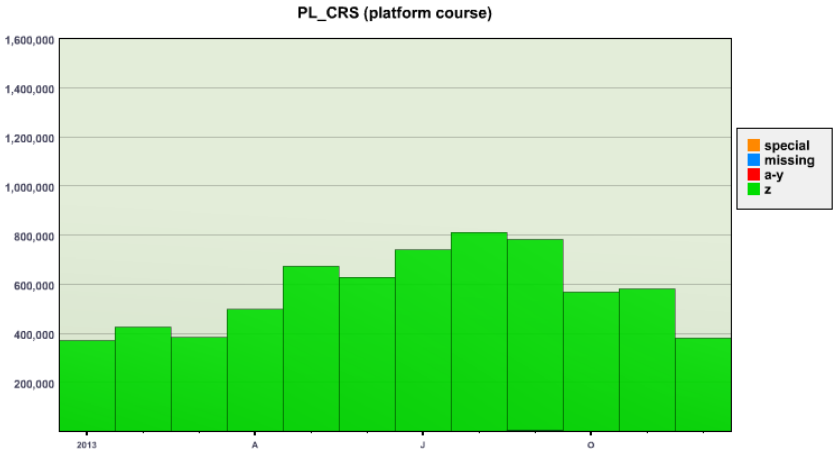


Figure 22: Total number of platform course – PL_CRS –observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

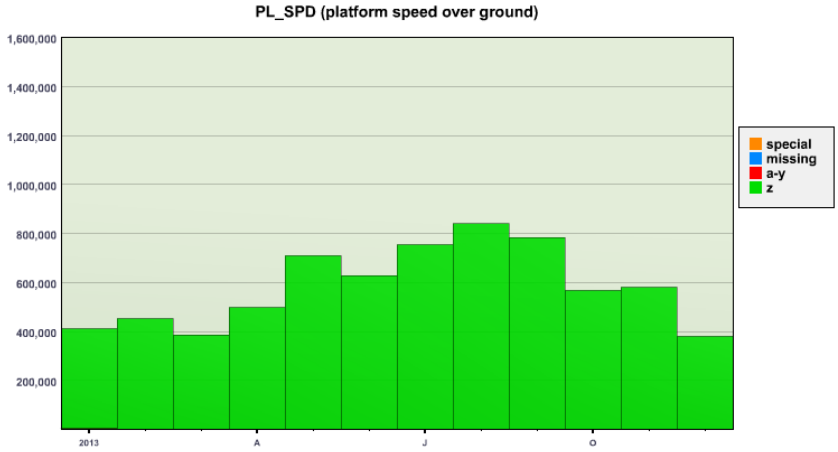


Figure 23: Total number of platform speed over ground – PL_SPD –observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

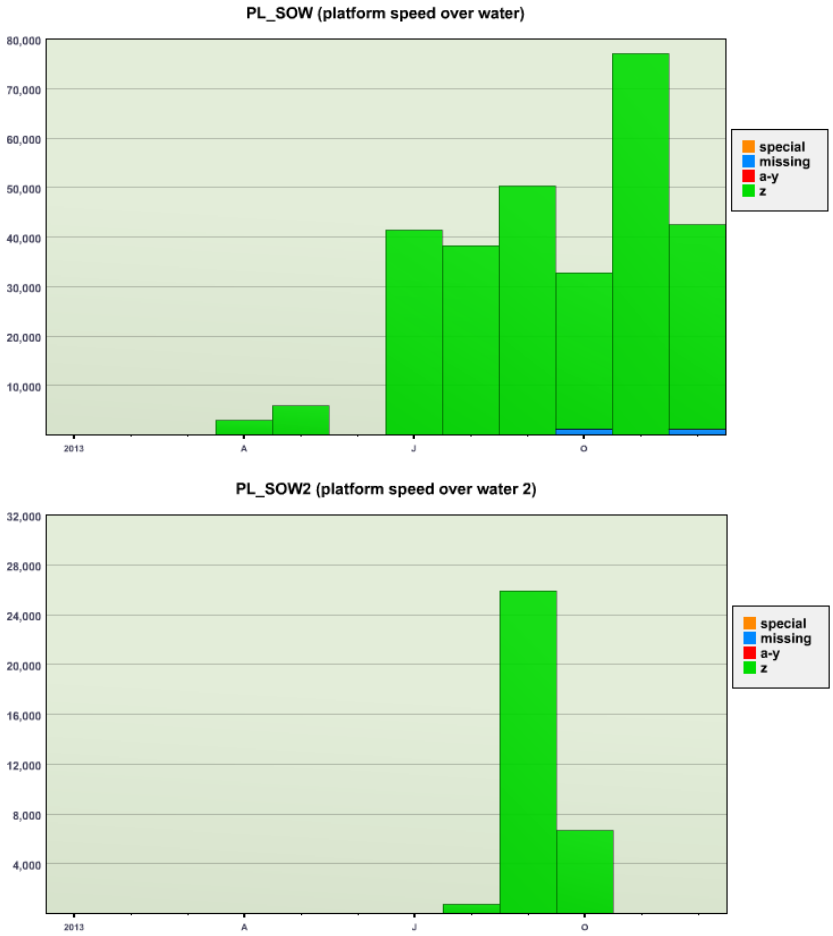


Figure 24: Total number of (top) platform speed over water – PL_SOW – and (bottom) platform speed over water 2 – PL_SOW2 observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

The platform relative wind parameters, both direction (Figure 25) and speed (Figure 26), also exhibited no problems of note, save that a few rare sensor and/or connectivity failures occurred. These sparse cases were treated with J and M flags in those vessels that receive visual quality control, but left alone (and more than likely unflagged by the autoflagger) for the remaining vessels.

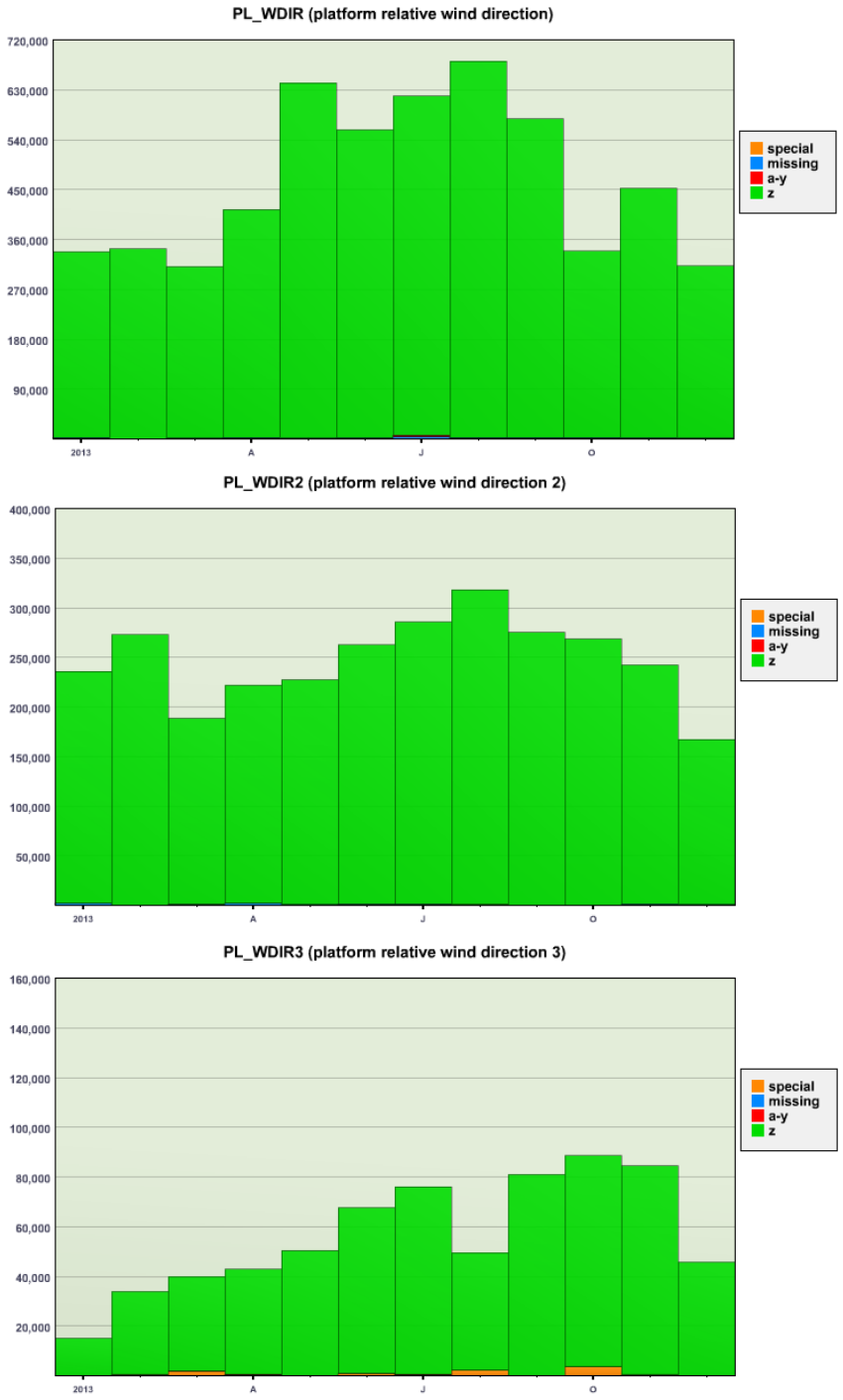


Figure 25: Total number of (top) platform relative wind direction – PL_WDIR –(middle) platform relative wind direction 2 – PL_WDIR2 – and (bottom) platform relative wind direction 3 – PL_WDIR3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

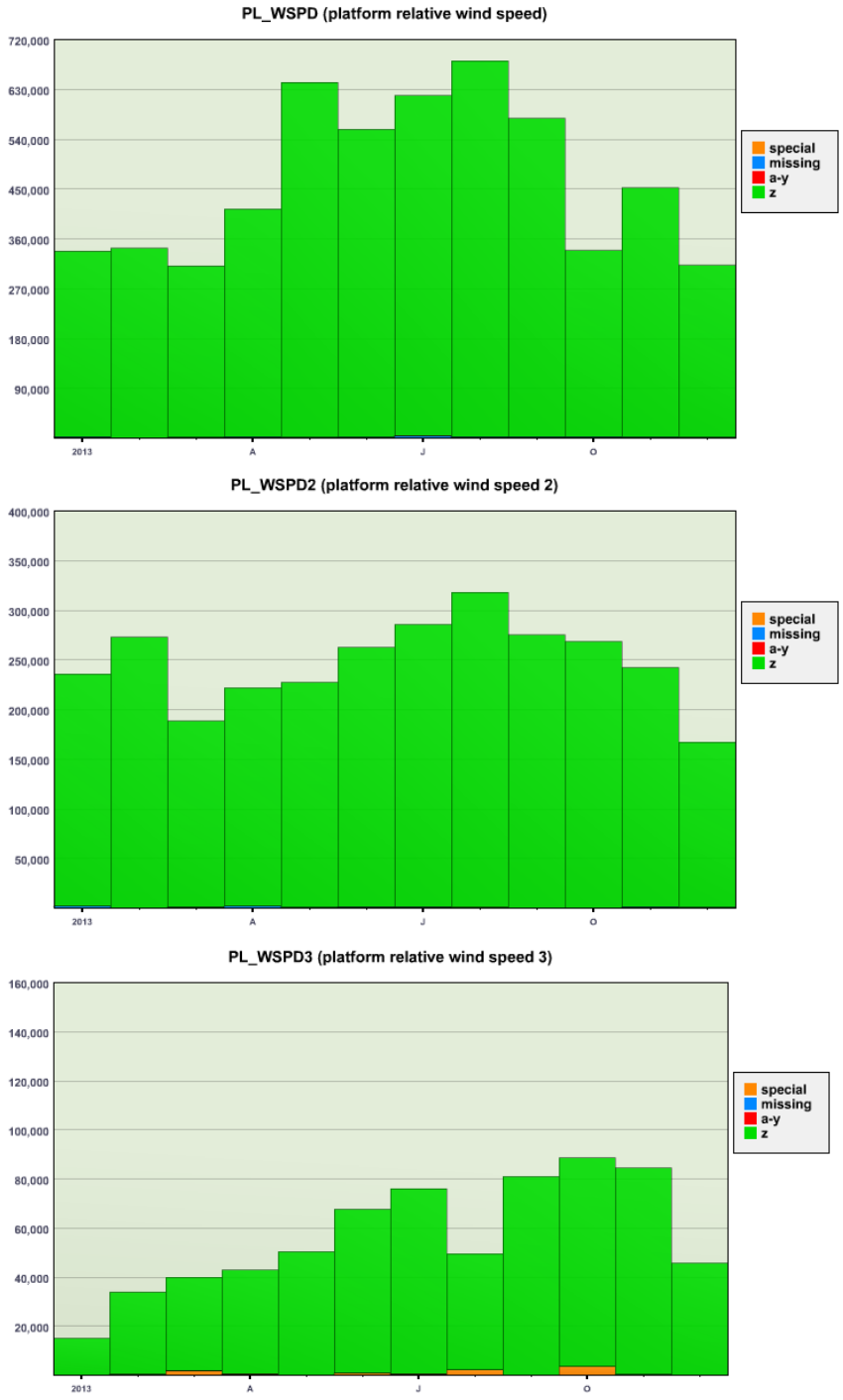


Figure 26: Total number of (top) platform relative wind speed – PL_WSPD – (middle) platform relative wind speed 2 – PL_WSPD2 – and (bottom) platform relative wind speed 3 – PL_WSPD3 – observations provided by all ships for each month in 2013. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

c. 2013 quality by ship

Atlantic Explorer

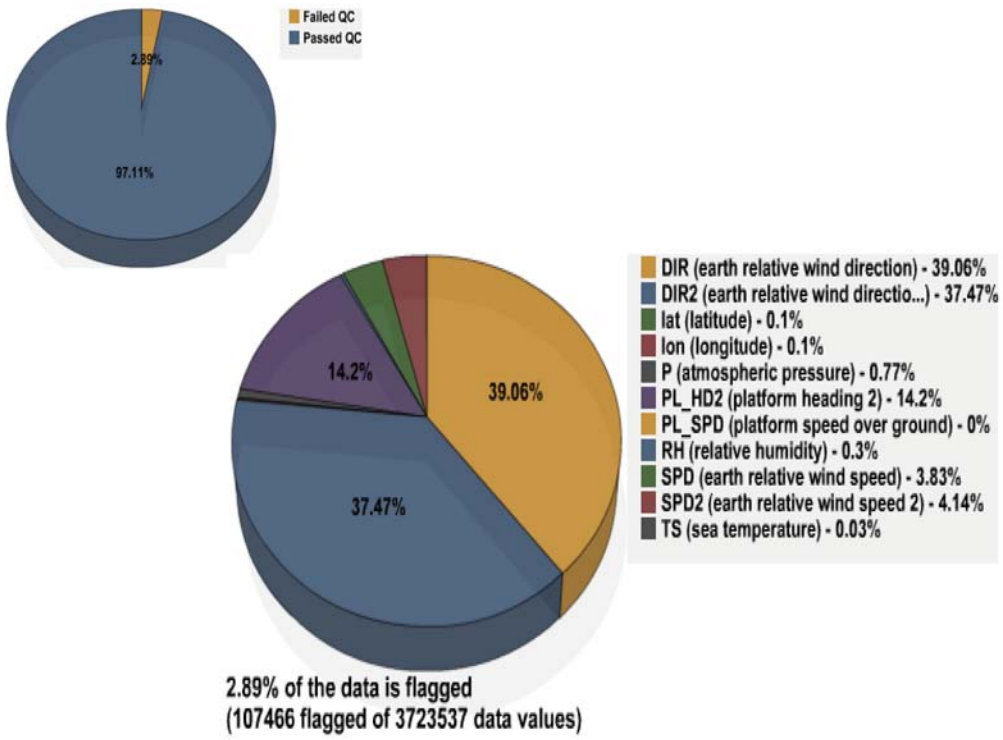


Figure 27: For the *Atlantic Explorer* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Atlantic Explorer* provided SAMOS data for 153 ship days, resulting in 3,723,537 distinct data values. After automated QC, 2.89% of the data was flagged using A-Y flags (Figure 27). This is a notably low percentage of flagged values, but it is important to note that the *Atlantic Explorer* does not receive visual QC (due to a lack of funding), which is when the bulk of flags are usually applied.

Perhaps more telling of the *Atlantic Explorer's* actual data quality is the fact that the majority of the flags (over 80%, combined) were again applied to the two earth relative wind direction parameters (DIR and DIR2). The flags applied were exclusively failing the true wind test (E) flags (Figure 28), again as they were in both 2011 and 2012. This is possibly due to a combination of less than ideal sensor location (i.e. flow distortion) and possible true wind averaging problems; however, these unfortunately are not issues we are currently funded to sort out.

An additional problem continues to exist with platform heading 2 (PL_HD2) whereby missing values get into the averaging, resulting in a good deal of out of bounds (B) flags being applied during automated quality control. During conversation, *Explorer* personnel have expressed their belief that this problem cannot be resolved.

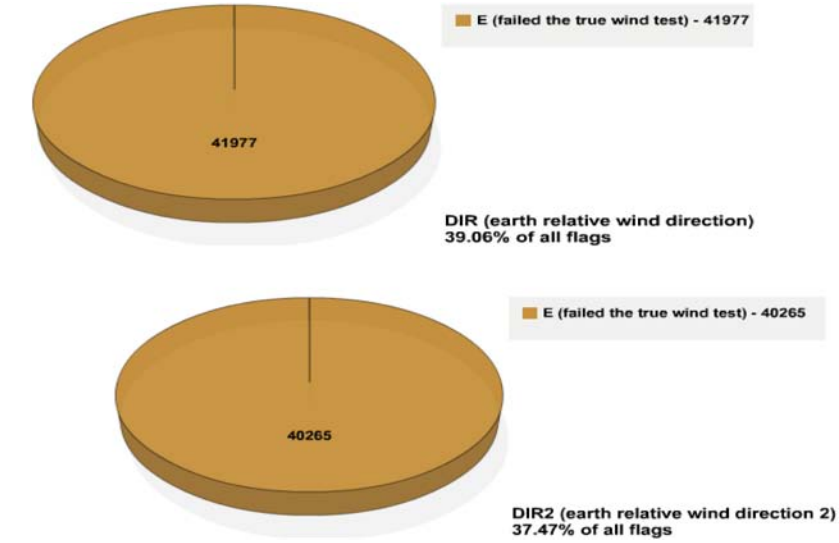


Figure 28: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – and (bottom) earth relative wind direction 2 – DIR2 –for the *Atlantic Explorer* in 2013.

Aurora Australis

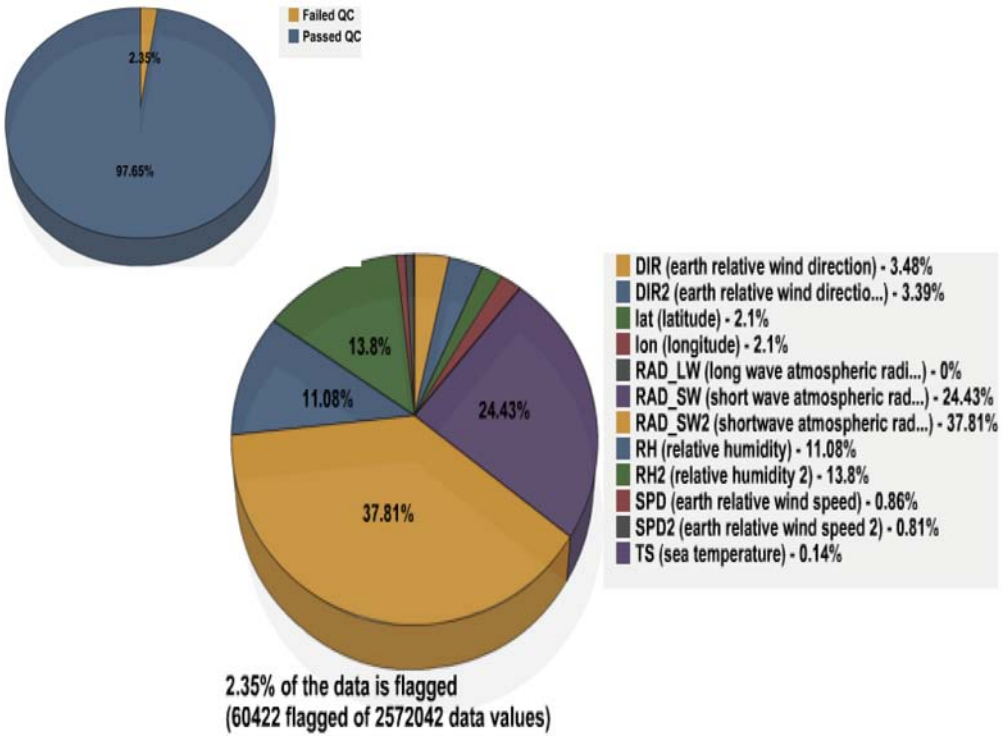


Figure 29: For the *Aurora Australis* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Aurora Australis* provided SAMOS data for 68 ship days, resulting in 2,572,042 distinct data values. After automated QC, 2.35% of the data was flagged using A-Y flags (Figure 29). This is a notably low percentage of flagged values; however, note that the *Aurora Australis* does not receive visual quality control by the SAMOS DAC, so all of

the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Aurora Australis*).

Over half of the flags applied belong to the two short wave radiation parameters (RAD_SW and RAD_SW2), and those are overwhelmingly of the out of bounds (B) variety (Figure 30, top two panels). Upon inspection, it is apparent the short wave radiation B flags were applied to short wave radiation values slightly below zero. This is a common situation wherein the sensors are tuned for greater accuracy at much higher readings (see section 3b). A further roughly 25% of the flags were applied to the two relative humidity parameters (RH and RH2). These are, again, overwhelmingly out of bounds flags. Inspection reveals the similar tuning case with relative humidity sensors whereby the sensor is less accurate at or near saturation conditions (see 3b). NOTE: The IMOS group at the Australian Bureau of Meteorology did conduct visual quality control and made research quality data files for the *Aurora Australis* until a personnel change in June 2013. Since that change, no visual quality control was or is applied for the *Australis*, either at SAMOS or at IMOS.

As an interesting note nowhere reflected in the 2013 data quality for the *Australis*, it was discovered in early April 2013 by our (former) IMOS data liaison that the long wave radiation data for *Australis* for the entire 2012-2013 season up to that point was incorrect, due to a wiring mistake. Fortunately our liaison was able to restore the correct data and resend all of the affected files – quite a long list – and we were able to reprocess everything at the DAC.

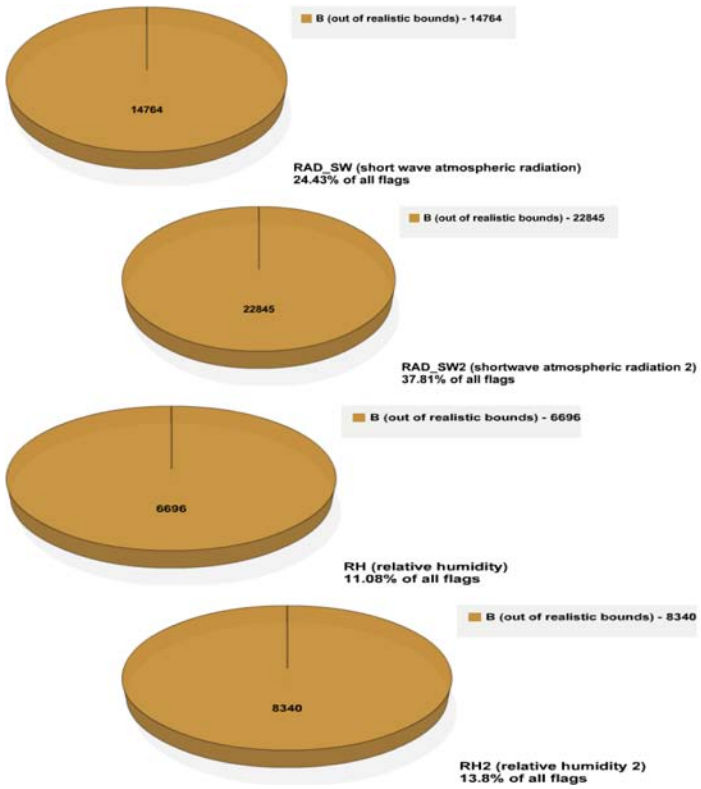


Figure 30: Distribution of SAMOS quality control flags for (first) shortwave atmospheric radiation – RAD_SW – (second) shortwave atmospheric radiation 2 – RAD_SW2 – (third) relative humidity – RH – and (last) relative humidity 2 – RH2 – for the *Aurora Australis* in 2013.

Southern Surveyor

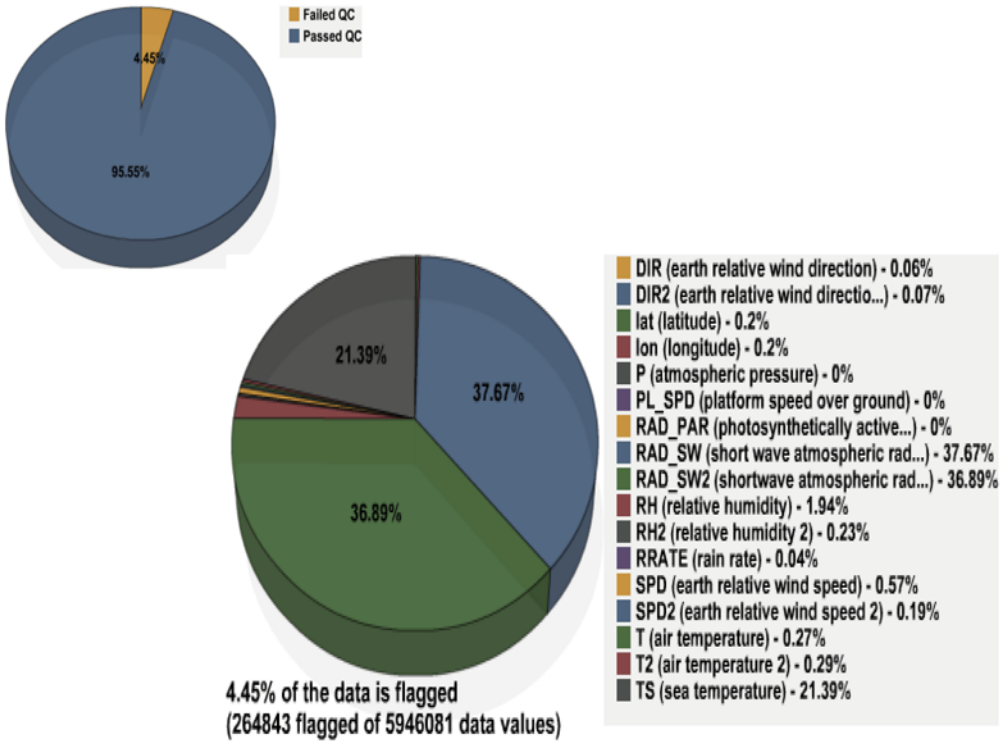


Figure 31: For the *Southern Surveyor* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Southern Surveyor* provided SAMOS data for 157 ship days, resulting in 5,946,081 distinct data values. After automated QC, 4.45% of the data was flagged using A-Y flags (Figure 31). This is a notably low percentage of flagged values; however, note that the *Southern Surveyor*, like the *Aurora Australis*, does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Southern Surveyor*). This marks the final year of SAMOS data transmission from the *Surveyor*, as she had her last voyage in late 2013.

A little over 70% of the flags applied belong to the two short wave radiation parameters, and those are entirely of the out of bounds (B) variety (Figure 32). Upon inspection it is apparent the B flags were once again applied to short wave radiation values slightly below zero. This is a common situation wherein the sensors are tuned for greater accuracy at much higher readings (see section 3b), and as such it is not surprising that these two parameters have garnered the bulk of the flags for the *Surveyor* from 2009 through 2013. In 2013, however, a sizable portion of the flags (~21%, Figure 31) also went to the sea temperature (TS) parameter. Over three quarters of those flags were B flags (Figure 32, top). Upon inspection, there was an approximate one-month period between 6 July and 10 August when TS reported a constant value of about -1.0 °C – obviously way out of range for the Indian Ocean just west of Australia, where the ship was cruising at the time. The sea temperature parameter was therefore flagged “out of

bounds" (B) for the duration of the event. Unfortunately, due to an oversight at the DAC, this particular period of data was not received and processed until early 2014. After contacting IMOS, and in cooperation with the Commonwealth Science and Industrial Research Organisation (CSIRO) Marine and Atmospheric Research division (CMAR), data analysts learned there had been a hardware incompatibility onboard the *Surveyor* that rendered the sea surface temperature inaccessible during the period of note. (It isn't immediately clear what the outputted TS value represents, but it was in any case definitely out of bounds and appropriately B flagged by the autoflagger.) NOTE: The IMOS group at the Australian Bureau of Meteorology did conduct visual quality control and made research quality data files for the *Southern Surveyor* until a personnel change in June 2013. Since that change, no visual quality control was or is applied for the *Surveyor*, either at SAMOS or at IMOS.

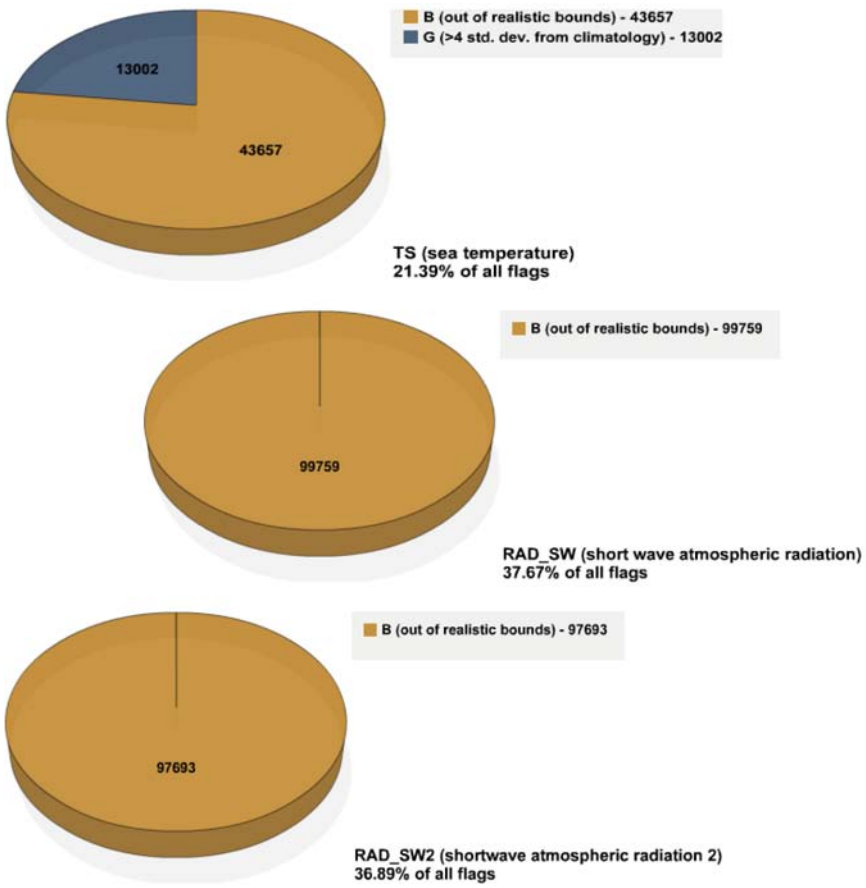


Figure 32: Distribution of SAMOS quality control flags for (top) shortwave atmospheric radiation – RAD_SW – and (bottom) short wave atmospheric radiation 2 – RAD_SW2 for the *R/V Southern Surveyor* in 2013.

Tangaroa

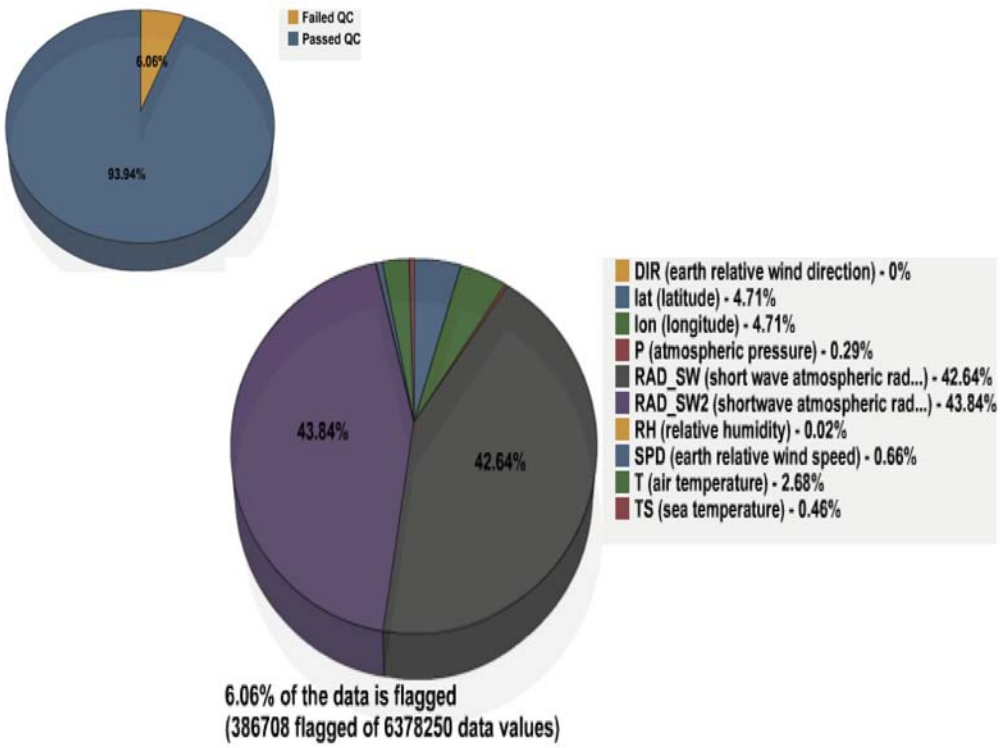


Figure 33: For the *Tangaroa* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Tangaroa* provided SAMOS data for 263 ship days, resulting in 6,378,250 distinct data values. After automated QC, 6.06% of the data was flagged using A-Y flags (Figure 33). NOTE: the *Tangaroa* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Tangaroa*).

The two short wave radiation parameters (RAD_SW and RAD_SW2) garnered over 85% of the total flags. The flags applied to the parameters were out of bounds (B) flags, exclusively (Figure 34, top two). However, it appears the issue is merely the common occurrence of radiation readings slightly below zero in nighttime conditions, owing to sensor tuning (see Section 3b for details). It is interesting to note that a further ~10% of the flags were applied to the latitude and longitude parameters. These were solely land error (L) flags (figure 34, bottom two). Upon inspection, these flags appear to have been applied while the vessel was docked deep within Wellington Harbor, NZ. At the DAC, the geographic land/water mask in use for determining land positions in 2013 was a two-minute grid. As such, positions that are very close to land are occasionally erroneously L-flagged by the autoflagger, such as in this case. Upon visual quality control these types of L flags are removed by the visual data analyst, but as Tangaroa does not receive visual quality control through the SAMOS initiative the flags remain in place. NOTE: The IMOS group at the Australian Bureau of Meteorology did conduct visual quality control and made research quality data files for the *Tangaroa* until a personnel change in June

2013. Since that change, no visual quality control was or is applied for the *Tangaroa*, either at SAMOS or at IMOS.

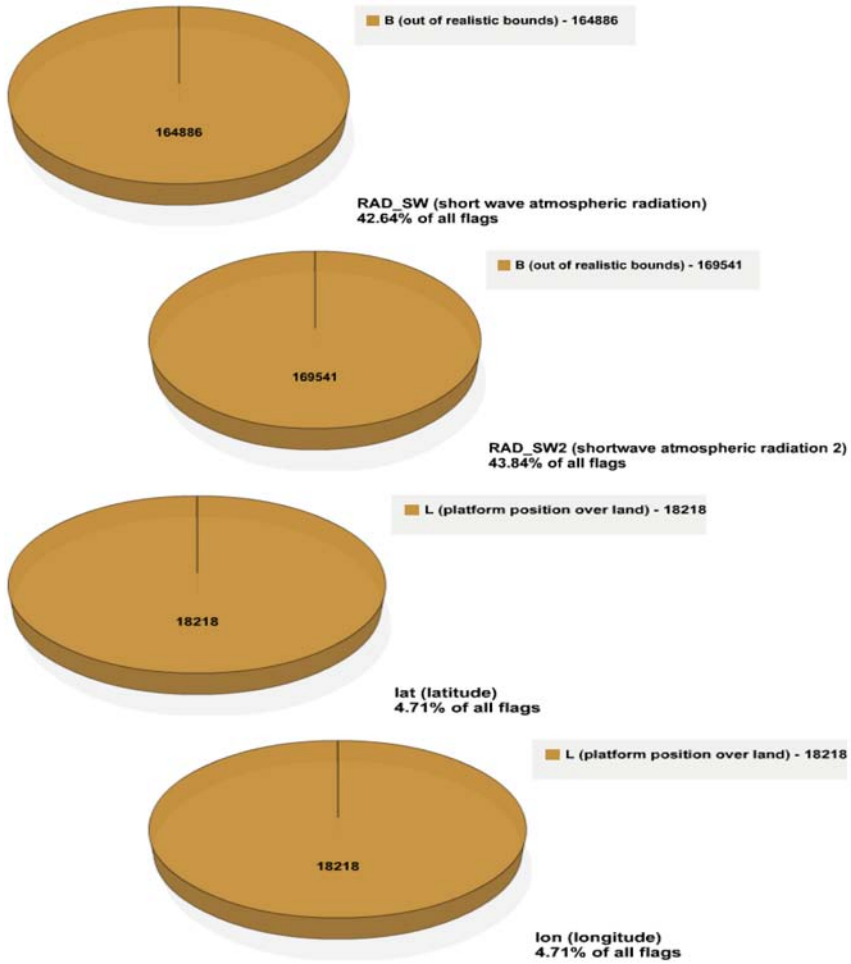


Figure 34: Distribution of SAMOS quality control flags for (first) short wave atmospheric radiation – RAD_SW – (second) short wave atmospheric radiation 2 – RAD_SW2 – (third) latitude – lat – and (last) longitude – lon – for the *Tangaroa* in 2013.

Bell M. Shimada

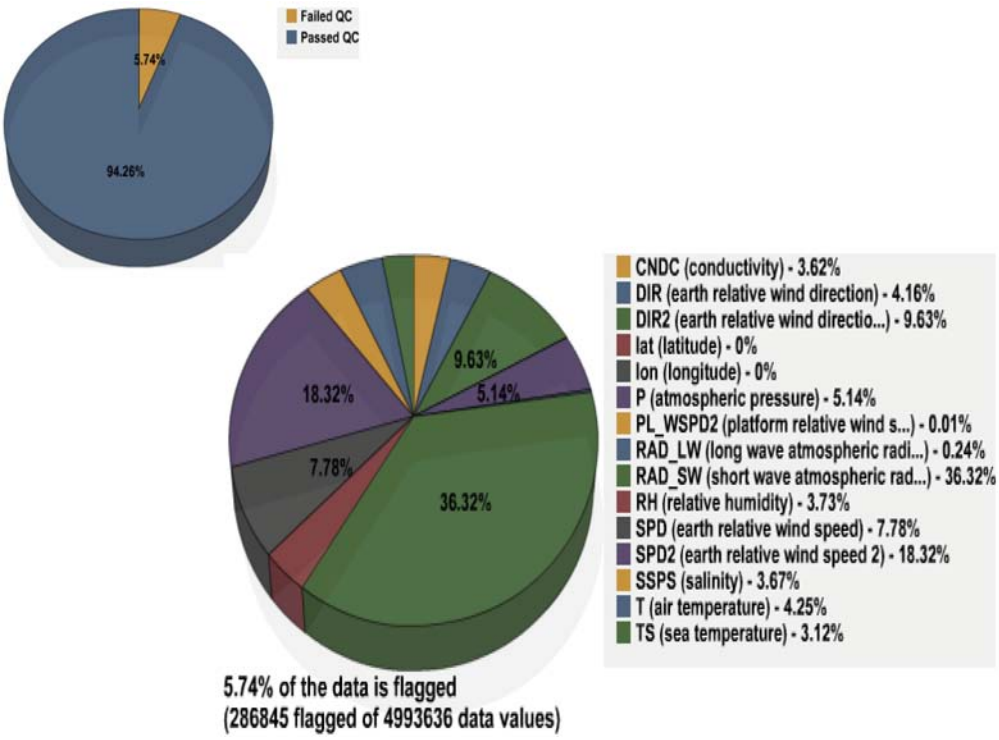


Figure 35: For the *Bell M. Shimada* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Bell M. Shimada* provided SAMOS data for 177 ship days, resulting in 4,993,636 distinct data values. After both automated and visual QC, 5.74% of the data was flagged using A-Y flags (Figure 35). This is about a 1.25% improvement over *Shimada's* first-year performance (in 2012) of 7.07% total flagged.

At first glance the biggest issue with the *Shimada* data would again appear to be short wave atmospheric radiation, making up over 36% of the flags. However, just as in 2012, these are almost exclusively out of bounds (B) flags (Figure 36, bottom), applied by automated QC to values slightly below zero in the absence of solar radiation. This is, again, a very common occurrence, and details about radiation sensor tuning can be found in Section 3b.

There are several more significant flagging issues for the *Shimada*; they are, notably, the same as for 2012: First, the redundant wind sensors DIR2 and SPD2, located amidships, often deviate from the forward mast wind sensors DIR and SPD, depending upon the platform relative wind direction, resulting in quite a bit of suspect/caution (K) flagging (Figure 36). Digital imagery and/or a detailed flow analysis do not exist for this vessel, but flow distortion is clearly indicated in the data and noted both by SAMOS data analysts and *Shimada* technical personnel, alike. In particular, the forward mast sensors (DIR and SPD) suffer when the wind is from the stern, while the sensors amidships (DIR2 and SPD2) experience flow obstruction when the wind is on the port beam. In most cases, though, the redundant sensors act as a sanity check each for the other, making

clear the value of duplicate sensors, particularly on a vessel where an ideal sensor location is difficult to find. In early 2014 *Shimada* Chief Survey Tech Phil White advised SAMOS personnel that a new ultrasonic wind sensor was installed on the port mast (making it a second redundant sensor); we are eagerly awaiting its inclusion in the SAMOS data from the *Shimada*. It could be noted here, as well, that since assuming the Chief Survey Tech position, Phil White has consistently showed an exceptionally dedicated concern for the quality of data onboard the *Shimada*.

The *Shimada* also encountered a very brief period of both mixed-up (wind direction being reported as temperature) and missing (redundant wind sensor) data, among other minor mishaps, as a result of a fleet wide SCS upgrade that took place early in the year. These bugs contributed a small amount to the total flag percentage, but were ironed out quickly by *Shimada* technical personnel.

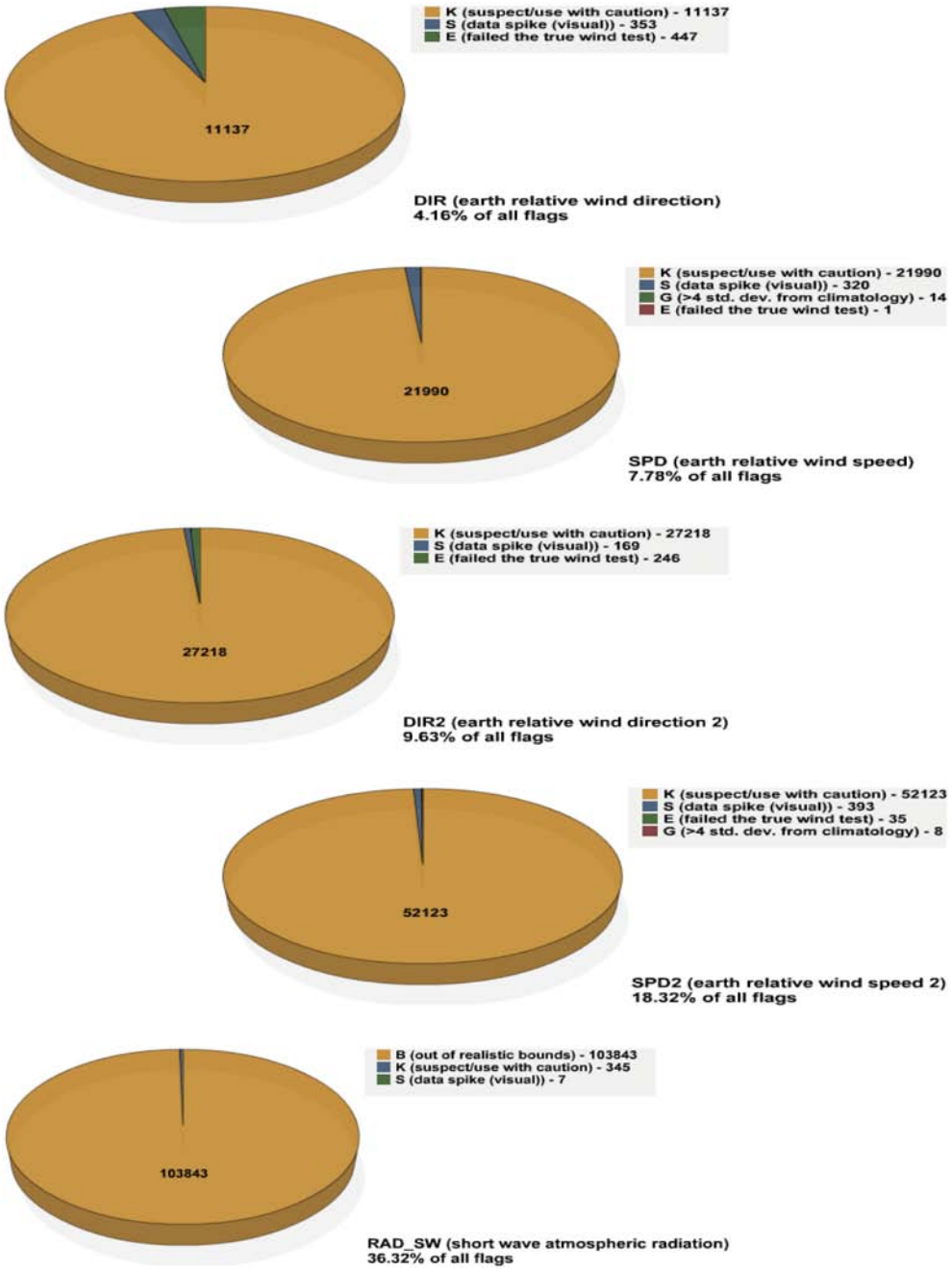


Figure 36: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) earth relative wind speed – SPD – (third) earth relative wind direction 2 – DIR2 – (fourth) earth relative wind speed 2 – SPD2 – and (last) short wave atmospheric radiation – RAD_SW – for the *Bell M. Shimada* in 2013.

Fairweather

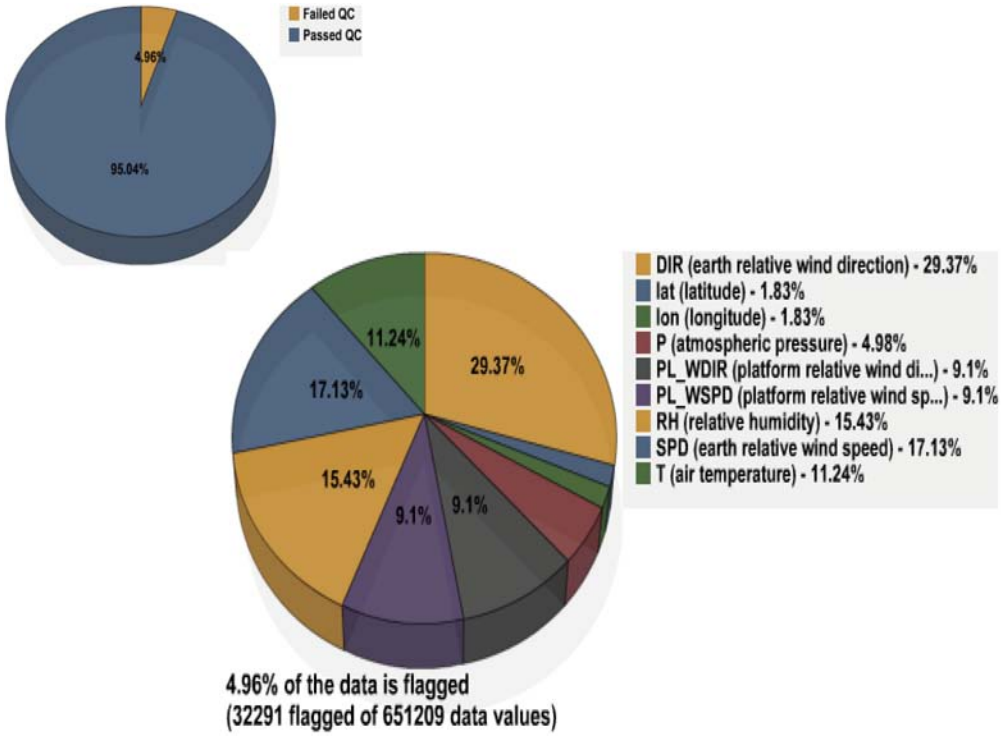


Figure 37: For the *Fairweather* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Fairweather* provided SAMOS data for 38 ship days, resulting in 651,209 distinct data values. After both automated and visual QC, 4.96% of the data was flagged using A-Y flags (Figure 37). This places *Fairweather* just inside the coveted < 5% total flagged bracket regarded by SAMOS to represent "very good" data, although it should be kept in mind that the sample size (38 days) is on the small side.

The biggest issue with the *Fairweather* data is likely problematic sensor location, although neither adequate metadata, nor digital imagery or a detailed flow analysis exists for this vessel so it is impossible to confirm. However, as Figure 38 shows, changes in platform wind direction correspond with aberrant behavior in the true wind parameters, as well as in temperature, relative humidity, and pressure (not shown in Figure 38). The data shown in Figure 38 was recorded while the ship was moored just off the California coast so the vessel was not actually moving, aside from cyclical reorientation (i.e. heading), likely due to wave behavior. This type of noisy data leads to suspect/caution (K) flags, as shown in Figure 39. It's worth noting that, with such a promising total flag percentage, a thorough metadata portfolio would go a long way towards precisely diagnosing *Fairweather's* shortcomings and perhaps improving her data to the point of being one of the top SAMOS performers, data-wise.

The wind parameters incurred some additional poor quality (J) flagging (Figure 39) due to a brief period of the platform relative wind direction reading at a constant value, which negatively affects the true wind calculations. This occurred at the onset of

Fairweather's 2013 data submission, and the issue was resolved within a few days so it was likely just a typical startup glitch.

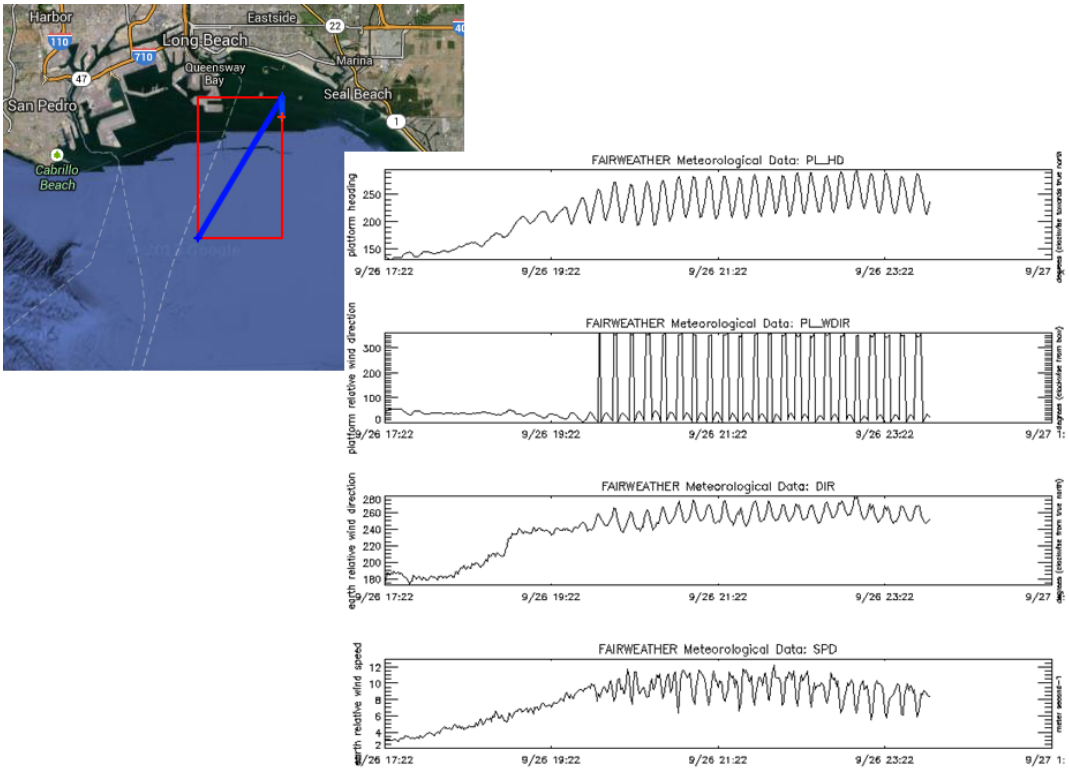


Figure 38: *Fairweather* SAMOS data for 26 September 2013: (first) platform heading – PL_HD – (second) platform relative wind direction – PL_WDIR – (third) earth relative wind direction –DIR – and (last) earth relative wind speed – SPD, and (inset) *Fairweather's* location at the time of the data (at the small red cross, top right of red box). Note the noisy, step-like behavior in both DIR and SPD in tandem with the noisy PL_HD behavior. There likely exists a platform relative wind direction issue (interfering with the DIR/SPD sensors) when the wind comes from somewhere over the bow. As the behavior is seen in other parameters as well, it is likely not merely related to the anemometer's directional "dead zone."

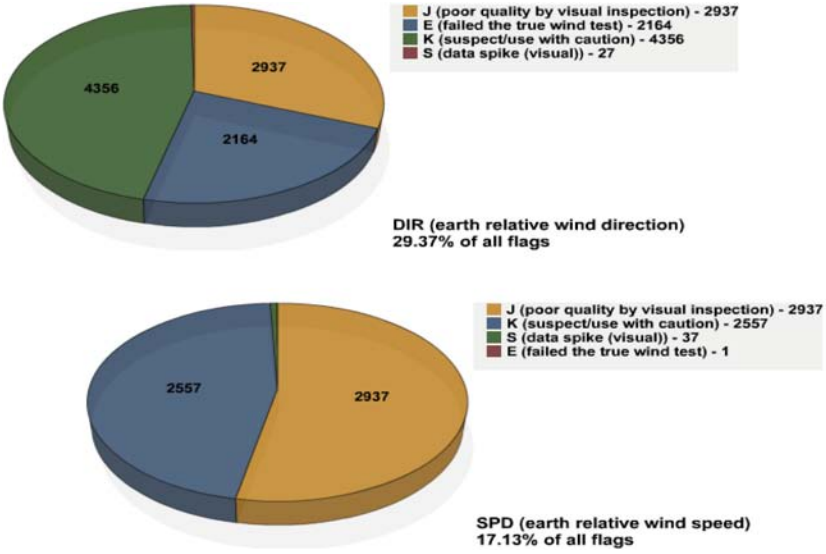


Figure 39: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD – for the *Fairweather* in 2013.

Gordon Gunter

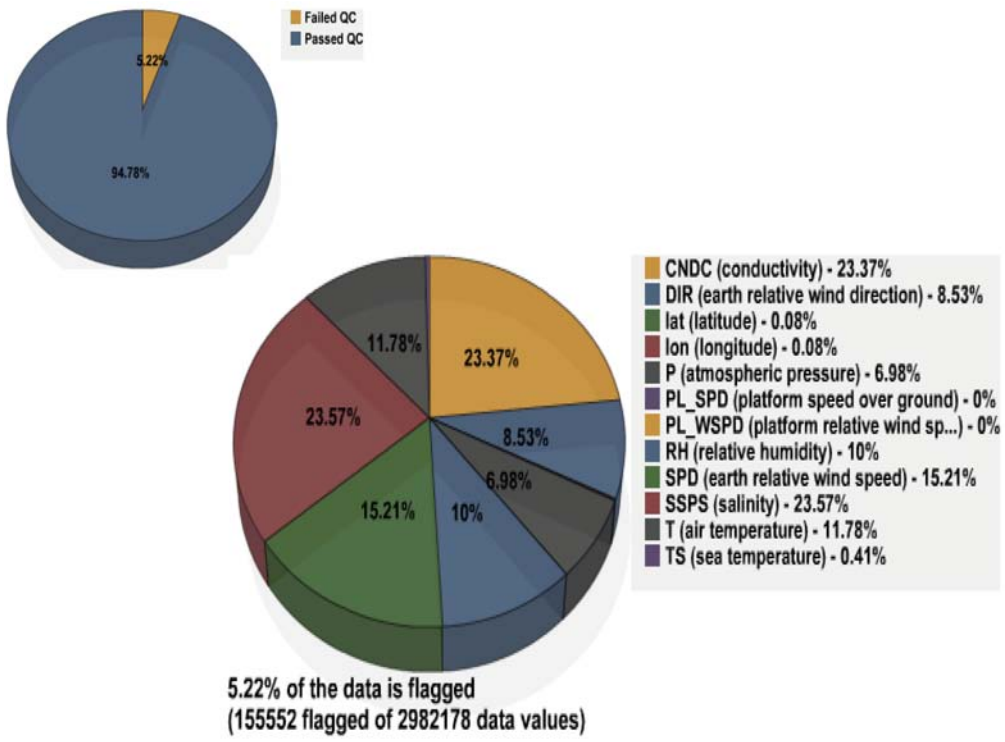


Figure 40: For the *Gordon Gunter* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Gordon Gunter* provided SAMOS data for 175 ship days, resulting in 3,536,638 distinct data values. After both automated and visual QC, 5.22% of the data was flagged using A-Y flags (Figure 40).

While the minuscule increase in total flags over 2012's 4.99% does bump the *Gunter* outside of the coveted < 5% flagged bracket, what is far more interesting is the fact that *Gunter's* long-standing issues with air temperature, relative, humidity, and pressure were greatly improved in 2013. For several years the sensors were installed in very problematic locations that always led to the bulk of flags being applied to those three parameters. Sometime prior to the 2013 sailing season, the temp/RH unit was relocated a railing on the flying bridge and a Gill port and tubing were added to the pressure unit to attenuate wind effects. The result of these changes was that the air temp/RH/pressure flag percentages dropped from 24.93% / 20.51% / 17.38% of total flags in 2012 to 11.78% / 10% / 6.98% in 2013, respectively (Figure 40). Instead, in 2013 the bigger issues were with salinity and conductivity – around 50% of the flags, together – and earth relative wind speed, with a further ~15% (Figure 42). In the case of salinity and conductivity, the bulk of the suspect/caution (K) and poor quality (J) flags were applied merely when the intake that feeds the TSG was switched off, generally when the vessel was in port. This is a very common practice among many vessels, and the resultant flagging does not really signify a problem. The K flags applied to earth relative wind speed (and direction), on the other hand, appear mainly due to flow distortion, as

demonstrated in Figure 41. Digital imagery for the *Gunter's* wind sensor may indicate why: the ship structure may be in direct line with the sensor location on the bow jackstaff whenever there are platform relative winds from anywhere astern.

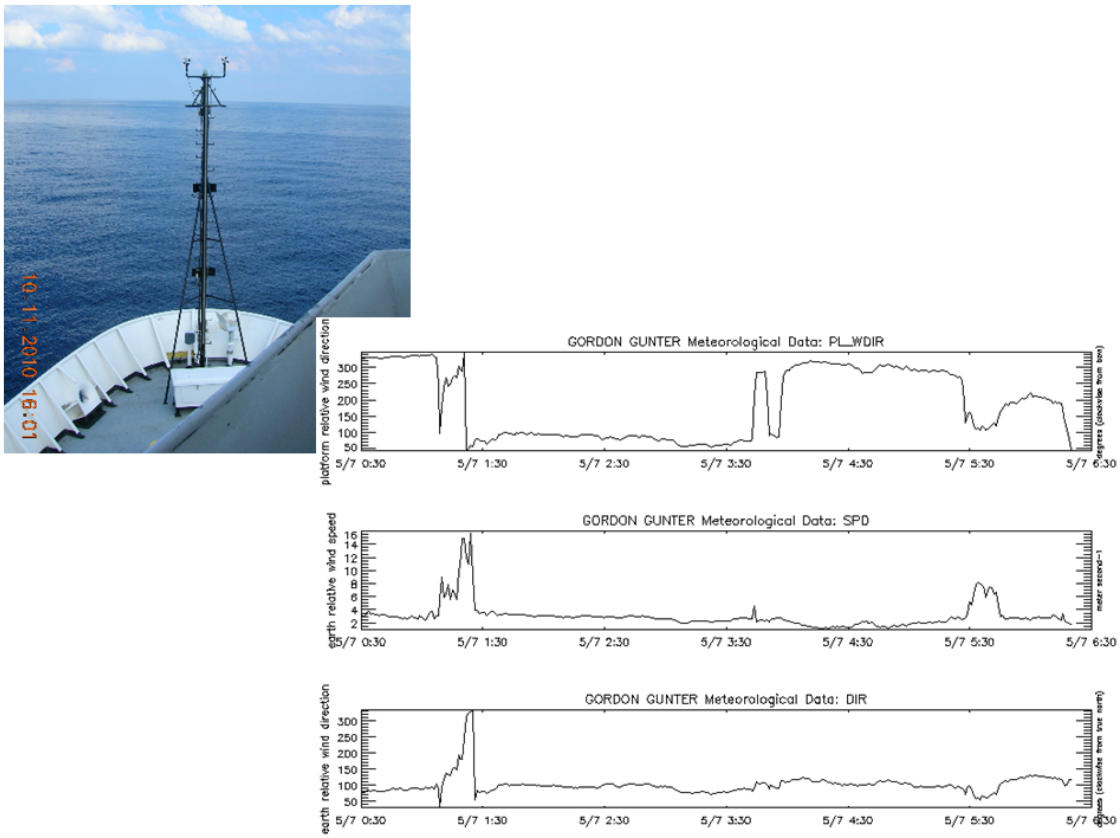


Figure 41: *Gordon Gunter* SAMOS data for 7 May 2013: (top) platform relative wind direction – PL_WDIR – (middle) earth relative wind speed – SPD – and (bottom) earth relative wind direction – DIR, and (inset) *Gunter's* presumed wind sensor location. Note the steps and spikes in both DIR and SPD when platform relative winds are more astern.

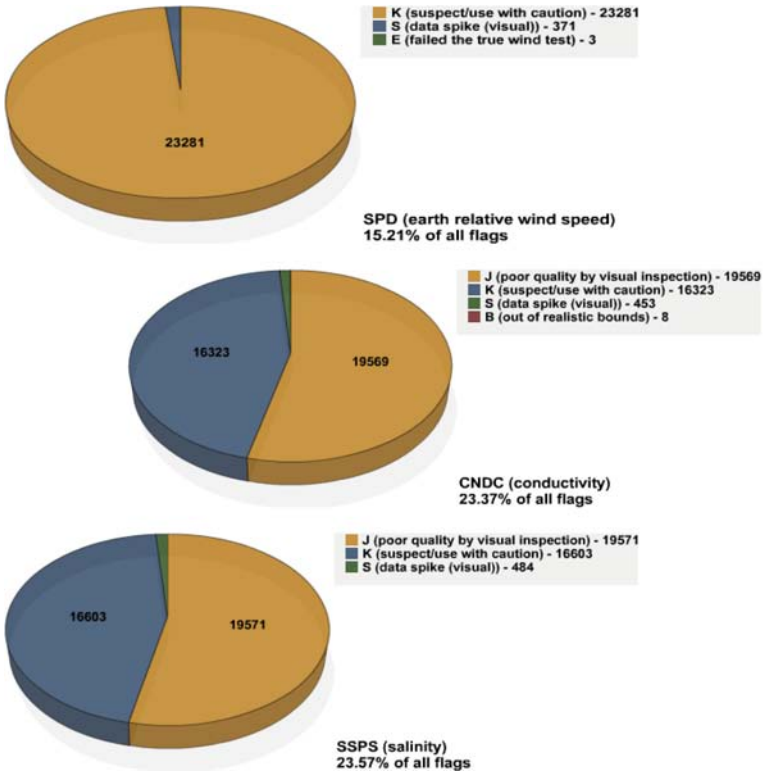


Figure 42: Distribution of SAMOS quality control flags for (top) earth relative wind speed – SPD – (middle) conductivity – CNDC – and (bottom) salinity – SSPS – for the *Gordon Gunter* in 2013.

Henry B. Bigelow

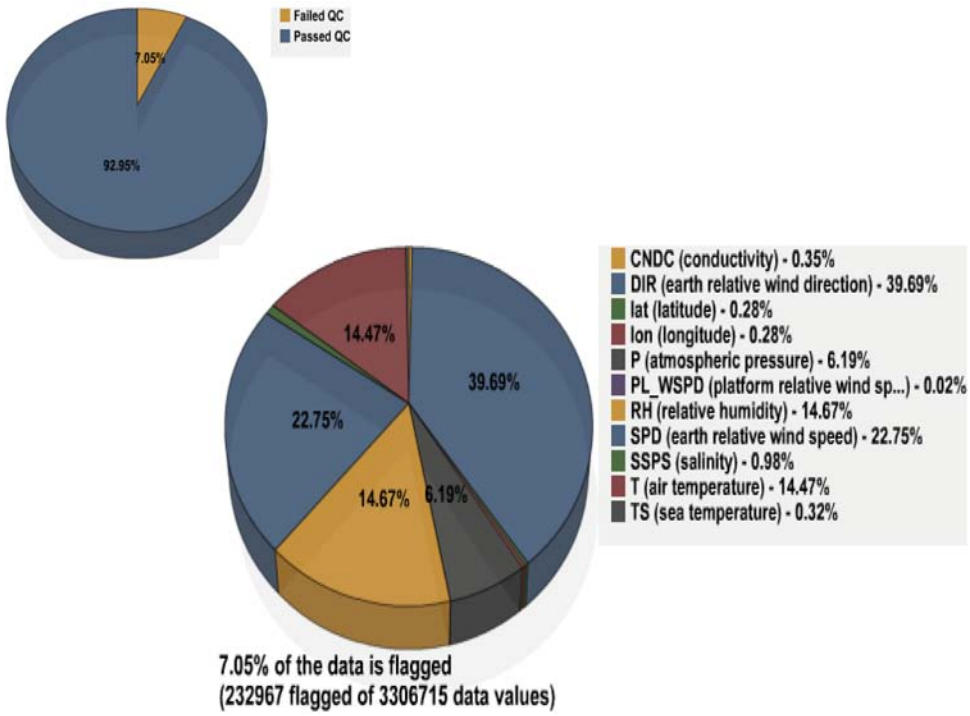


Figure 43: For the *Henry B. Bigelow* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Henry Bigelow* provided SAMOS data for 168 ship days, resulting in 3,306,715 distinct data values. After both automated and visual QC, 7.05% of the data was flagged using A-Y flags (Figure 43).

The biggest issues with *Bigelow's* data in 2013 were earth relative wind speed (SPD) and direction (DIR), comprising over 60% of all flags. For a good portion of the year, and always at or around the same time of day, both DIR and SPD would often suddenly exhibit questionable behavior that roughly followed (or responded to) the shape of the platform speed parameter, as demonstrated in Figure 44. After a few hours the behavior of SPD and DIR would just as abruptly return to normal. This analyst has no record of an explanation for this anomalous behavior, but as of 9 October the behavior stopped occurring. Up until that time, though, there was a fair amount of suspect/caution (K) flagging of both parameters (Figure 45). Possible explanations might be some sort of periodic interference with the true wind calculation, or perhaps some sort of electrical interference with the wind sensor itself. The issue did not, however, appear to have any sort of relationship with platform relative wind direction. Additionally, both DIR and SPD incur a fair amount of "failed the true wind test" (E) flags from the autoflagger.

Another issue of note, the relative humidity parameter (not shown) exhibited some strange behavior in early 2013 wherein the sensor would occasionally read over 140%, obviously well out of the realistic range. After some communication between the DAC and *Bigelow* technicians, and some tech investigation onboard the *Bigelow*, the sensor was replaced on 1 April. After the switch the problem did not return.

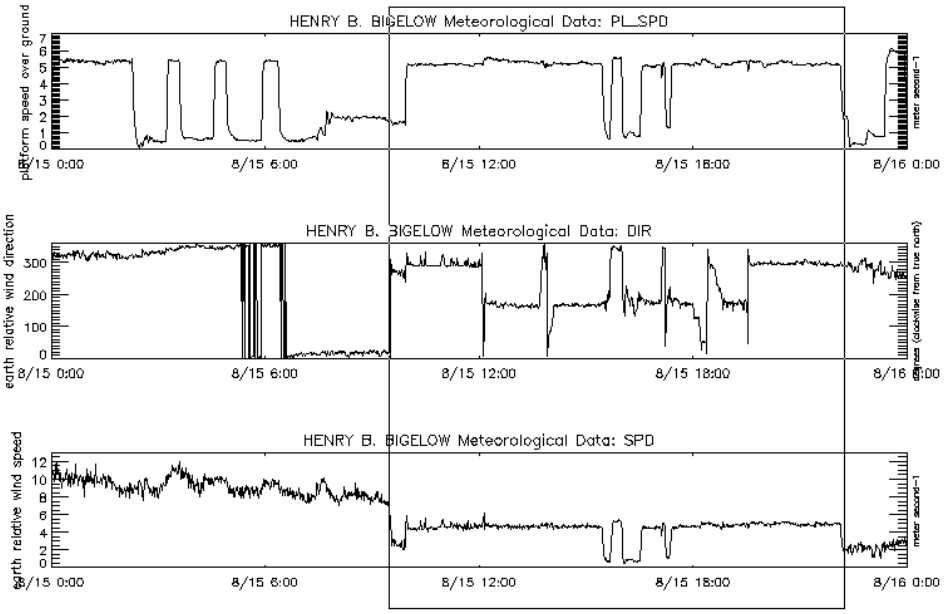


Figure 44: *Henry Bigelow* SAMOS data for 15 August 2013: (top) platform speed over ground – PL_SPD – (middle) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD. Note the sudden changes to both DIR and SPD inside the boxed area; the character of each changes and appears to become somehow linked to PL_SPD.

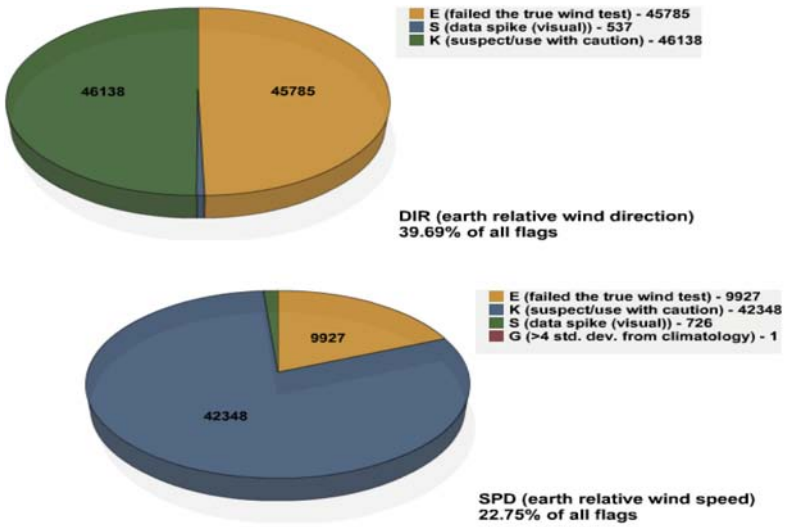


Figure 45: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD – for the *Henry B. Bigelow* in 2013.

Hi'ialakai

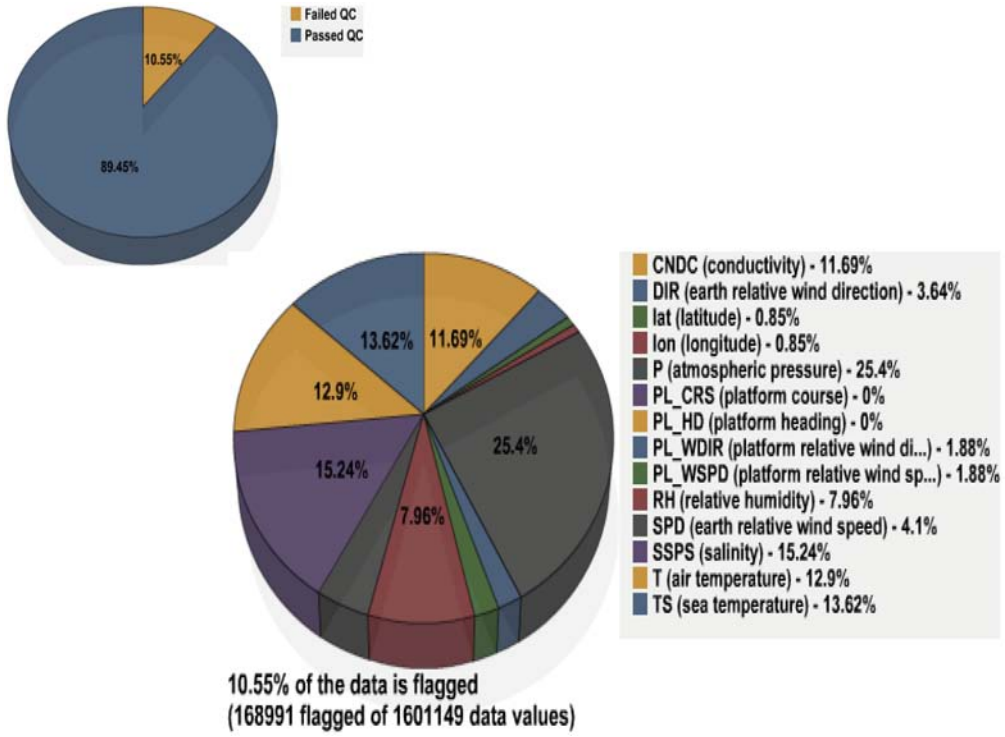


Figure 46: For the *Hi'ialakai* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Hi'ialakai* provided SAMOS data for 77 ship days, resulting in 1,601,149 distinct data values. After both automated and visual QC, 10.55% of the data was flagged using A-Y flags (Figure 46). This is over 3% higher than 2012's 7.25% flagged.

Hi'ialakai experienced a number of data issues over the course of the year, but it is well worth mentioning that the *Hi'ialakai* technical crew is among the most responsive when it comes to trying to locate and rectify data issues. It would also probably be fair to say that, in the case of *Hi'ialakai,* confusion regarding SCS (and likely in conjunction with the fleet wide SCS upgrade) was partly to blame for the extent and/or persistence of some of the problems in 2013. Troubleshooting a problematic SAMOS data reading isn't so simple when it's not entirely clear from which sensor the reading is coming in the first place. (It should be noted that there were also some major personnel changes onboard the *Hi'ialakai* late in the 2012 season, so the SCS confusion isn't all that surprising.) The most notable of these cases in 2013: the barometer that fed into the SAMOS data file pretty consistently read several mb too low, for much of the *Hi'ialakai* cruising season. The faulty sensor was eventually identified and the data stream from the sensor was disabled in early July. Pressure data transmission resumed a few days later however, and although the readings were more on target, there were still some apparent exposure issues (also present before the sensor disable), as evidenced by occasional "steps" in the data. There were no changes to the metadata for the sensor so it is still a bit unclear to us at the DAC from where the data is coming. It's possible a bias correction was applied, rather than a sensor swap or the like. In any case, the pressure parameter took on about 25% of the total flags (Figure 47). The three sea water parameters – sea surface temperature, conductivity, and salinity – also picked up a fair amount of suspect (K) and poor quality (J) flagging (Figure 47). Together they made up a further 40% of the total flags, but most of it was applied as a result of the intake pump being off (usually while the vessel was in port but occasionally while underway), which isn't really a serious issue. Incidentally, there was a fair bit of investigation on and off throughout much of 2013 concerning the sea temperature reading received at SAMOS – again the source was unclear. It seems in the end that tech Tonya Watson was able to isolate the correct sensor, and, as we understand it at the DAC, additional sea temp sensors are planned to be added to the SAMOS data file. We eagerly anticipate this development in 2014.

Air temperature and relative humidity data also received a fair amount of K flagging, but *Hi'ialakai* personnel made mention in an email that the sensor providing this data had not been calibrated in a while and was installed in a less than ideal location.

As a special point of note, early in 2014 it came to our attention (via the *Hi'ialakai's* SAMOS operator) that there may be a 1°C bias in the *Hi'ialakai* air temperature data, as noted by a WHOI science team during a cruise with separate instrumentation.

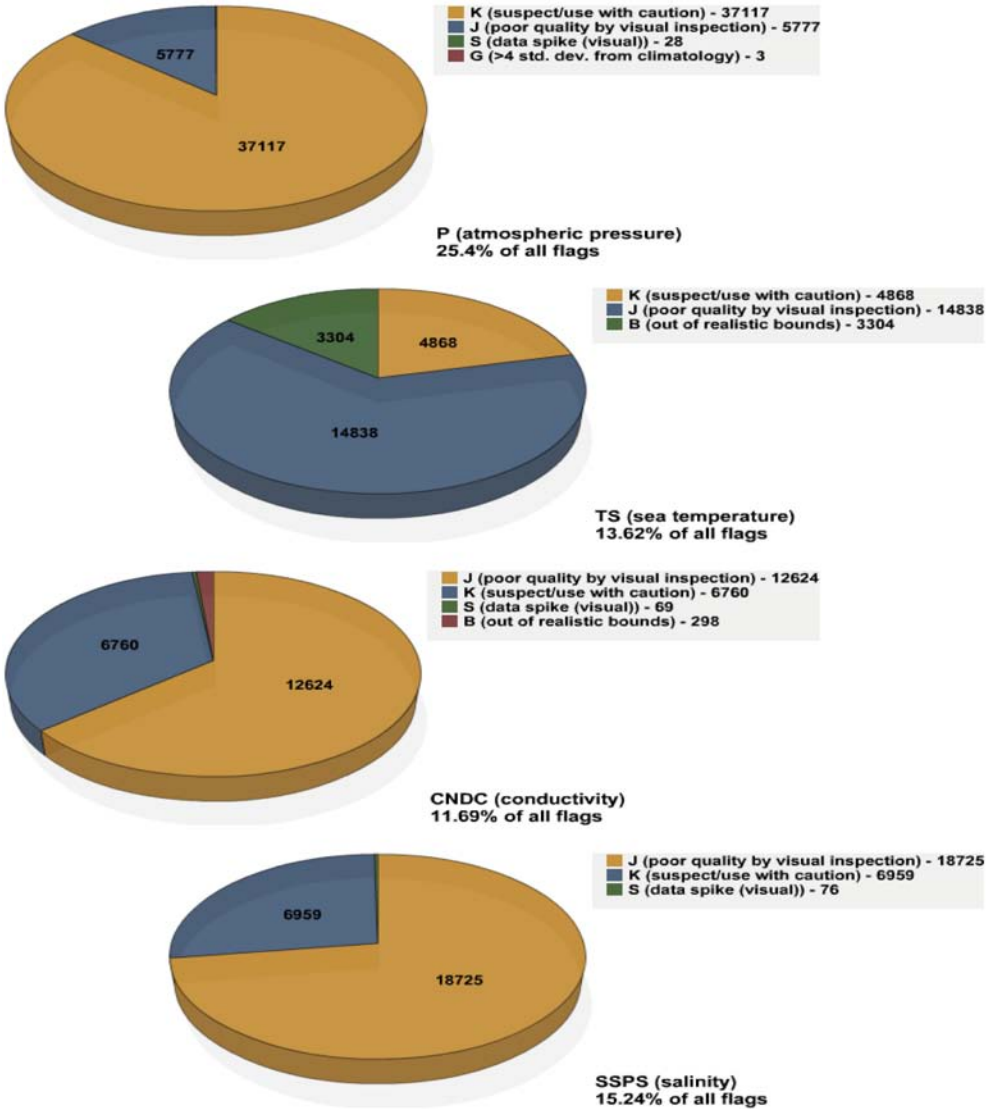


Figure 47: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) sea temperature – TS – (third) conductivity – CNDC – and (last) salinity – SSPS –for the *Hi'ialakai* in 2013.

Nancy Foster

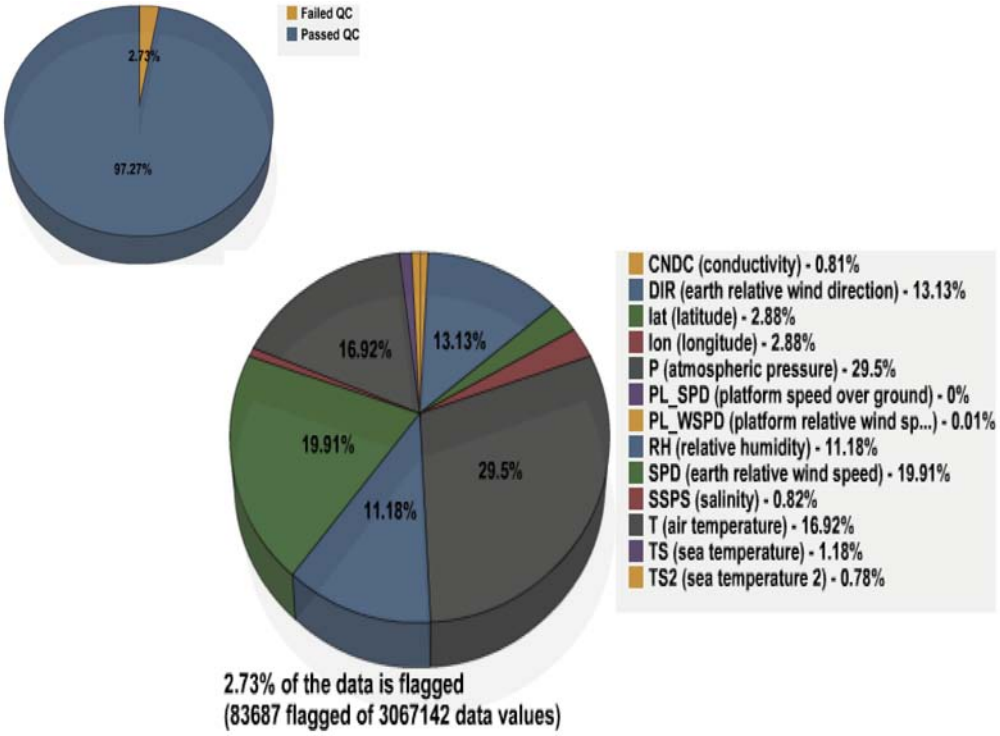


Figure 48: For the *Nancy Foster* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nancy Foster* provided SAMOS data for 147 ship days, resulting in 3,067,142 distinct data values. After both automated and visual QC, just 2.73% of the data was flagged using A-Y flags (Figure 45). This is a substantial improvement over 2012's 7.85% and at long last places *Nancy Foster* well inside the < 5% flagged bracket regarded by SAMOS to represent "very good" data.

After several years of effort by *Foster* personnel to identify and fix her numerous data issues (both persistent and transient), *Nancy Foster* really has become a bit of a success story in 2013. There were no major issues with the *Foster* data, as there had been in the years leading up to 2013. She does exhibit a moderate amount of flow distortion in each of the meteorological parameters, as evidenced by occasional spikes and steps in the data. However, this is true of virtually all vessels and is nearly impossible to completely eliminate, and in any case current metadata for the *Foster's* instrumentation is inadequate for us to be able to properly diagnose any problematic platform relative wind directions. With such a low total flag percentage and a fairly even spread of those flags (Figure 48), there really isn't much cause for serious concern anyway. Perhaps at 29.5% of the total flags, the atmospheric pressure sensor would be the most conspicuous sensor worthy of investigation, but again with a total percentage of just 2.73% this is not a critical issue. It may be that the simple addition of a Gill pressure port would improve the pressure quality, but again we are unable to make any definitive suggestions without better metadata. No location information is given for the sensor, and although we have some

digital imagery on file it is unclear where the pressure sensor is actually located. (Previous attempts at clarification were unsuccessful.)

Okeanos Explorer

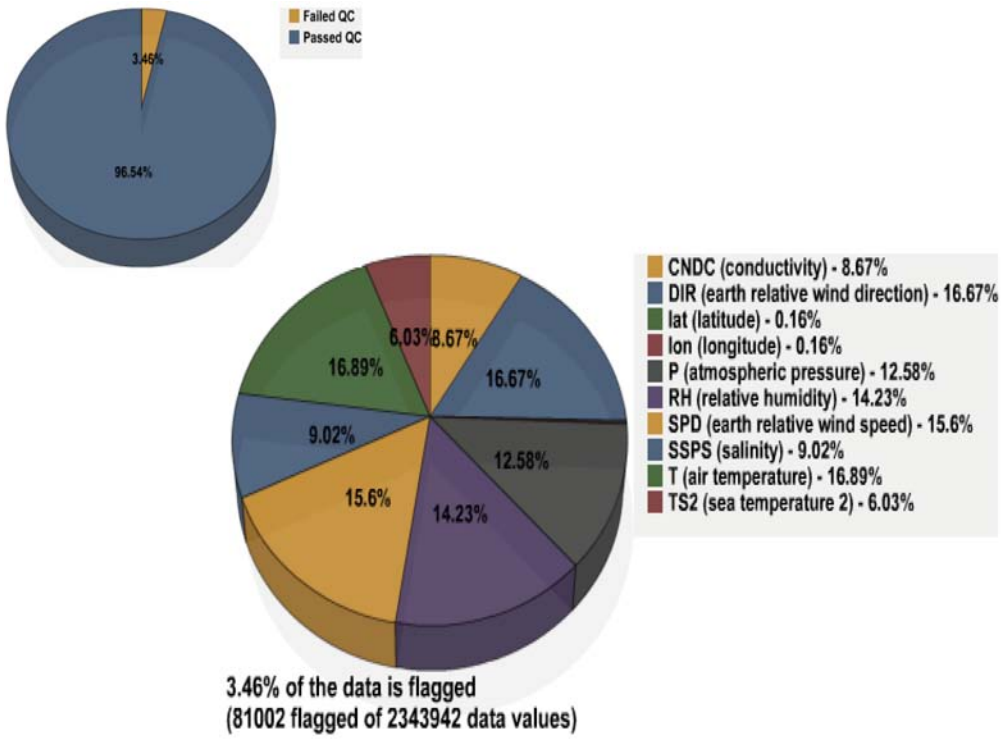


Figure 49: For the *Okeanos Explorer* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Okeanos Explorer* provided SAMOS data for 113 ship days, resulting in 2,343,942 distinct data values. After both automated and visual QC, 3.46% of the data was flagged using A-Y flags (Figure 49). This is a substantial improvement over 2012's 9.12% flagged and brings the *Explorer* comfortably inside the < 5% flagged bracket regarded by SAMOS to represent "very good" data.

The improvement in flag percentage was highly anticipated by SAMOS personnel, as a very long-standing issue with pressure readings from the *Explorer* was finally resolved in July 2012. The remarkably even spread of A-Y flags across the meteorological parameters (Figure 49) points heavily towards there being no major issues remaining with the *Explorer*. There was a very short-lived data issue when a sudden erroneous bias appeared in the pressure data (see Figure 50), but it was spotted immediately by SAMOS data analysts and communicated to the vessel technicians. Putting two heads together, the Chief ET onboard *Explorer* and SAMOS personnel were quickly able to resolve the issue (an offset intended for VOS pressure data that did not in fact need to be applied to SAMOS pressure data) and the data was restored to normal in short order, keeping any accumulation of flags low. This is a perfect example of an efficient feedback loop

between the SAMOS DAC and vessel technicians, acting to resolve data problems quickly and maintain good quality data.

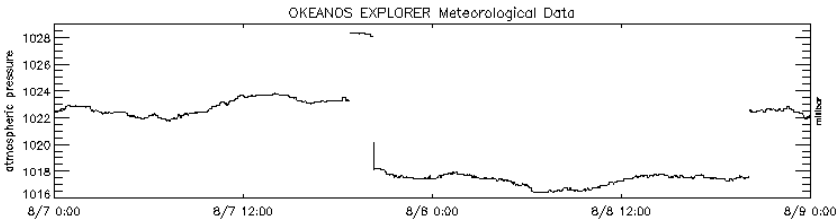


Figure 50: *Okeanos Explorer* atmospheric pressure – P – SAMOS data for 7-8 August 2013. Note the discontinuous behavior when the bias was introduced late in the day 7 Aug and then removed again late in the day 8 Aug.

Oregon II

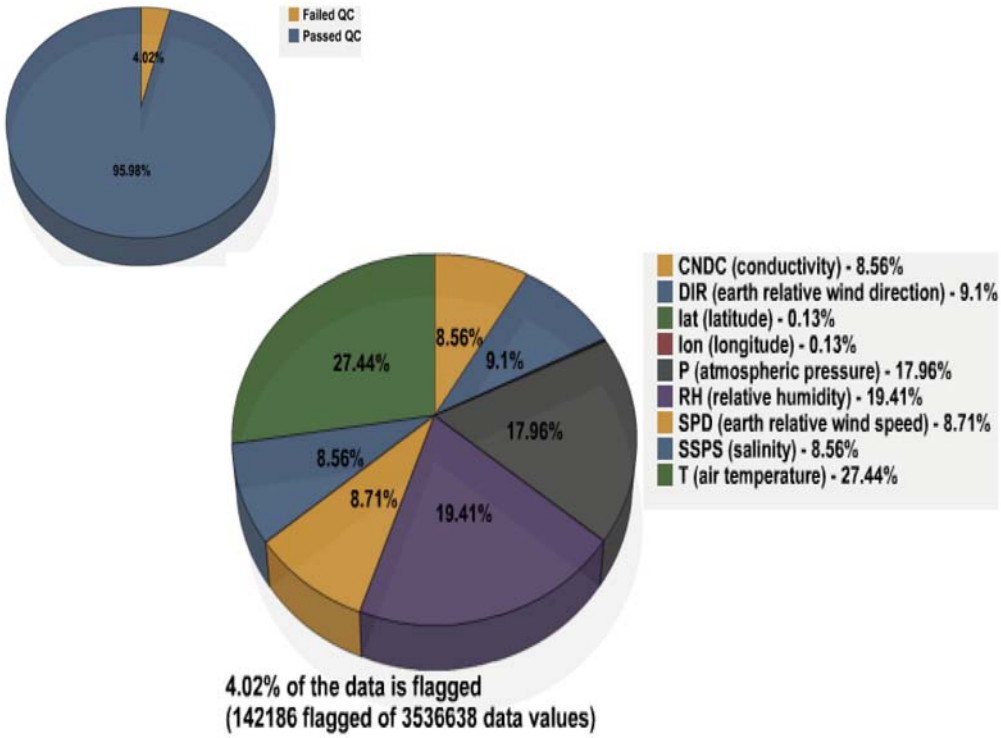


Figure 51: For the *Oregon II* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oregon II* provided SAMOS data for 175 ship days, resulting in 3,536,638 distinct data values. After both automated and visual QC, 4.02% of the data was flagged using A-Y flags (Figure 51). This percentage keeps *Oregon II* within the desirable < 5% flagged bracket regarded by SAMOS to represent "very good" data.

The bulk of the (limited) flagging was once again, as in 2012, applied to the atmospheric pressure (P), air temperature (T), and relative humidity (RH) parameters, overwhelmingly suspect/caution (K) flags in all three cases (Figure 53). These cases continue to appear to be largely due to flow distortion or obstruction; namely, all three sensors would seem to be in a wind shadow whenever winds are from starboard or astern,

particularly during daytime (Figure 52). Metadata for all three sensors was updated in early 2013, so we can now tell at least that both the atmospheric pressure and relative humidity sensors are located about 20m back from the bow at heights less than 10m from the waterline. Neither digital imagery nor ship measurements (length, breadth, freeboard, and draft) exist in the SAMOS database for the *Oregon II* so nothing can be confirmed, but considering the relatively low heights of these two sensors and probable location amidships, it is suspected that they are installed somewhere on a level with the wheelhouse on the starboard side and thus in a severe wind shadow when the winds come in from the port. The air temperature sensor, reported to be at a height of about 16 meters, is a little less easy to make a conjecture about, but it would seem at least that it is located close to some ship structure prone to heating up from insolation when cut off from the platform relative winds (again, from the port).

Additionally, the latitude (LAT) and longitude (LON) parameters incur a fair amount of unreal movement (F) flags (not shown). These flags are automatically applied when the platform speed calculated using two positions is greater than the expected top speed of an RV. In the *Oregon II's* case, though, it is most likely that the F-flagging would be remedied simply by increasing the resolution of the LAT/LON data, as it is currently reported only to the hundredths.

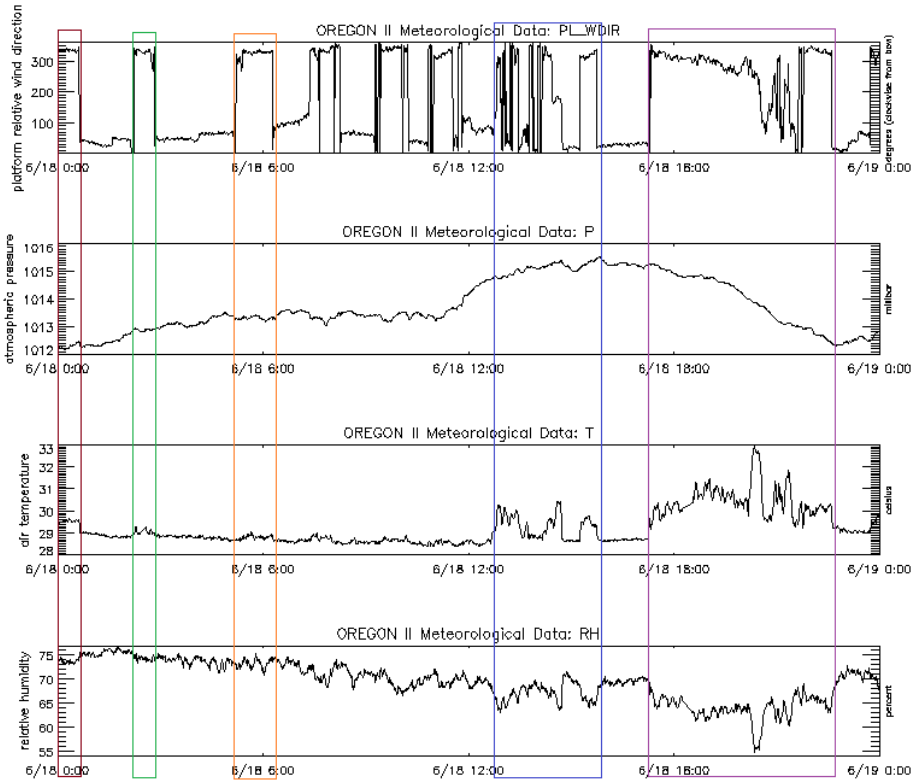


Figure 52: *Oregon II* SAMOS data for 18 June 2013: (first) platform relative wind direction – PL_WDIR – (second) atmospheric pressure – P – (third) air temperature –T – and (last) relative humidity – RH. Note the responses in the atmospheric data (particularly within the colored rectangles) whenever winds are from port or astern. Note also that the issue is much more pronounced in both T and RH during daytime hours.

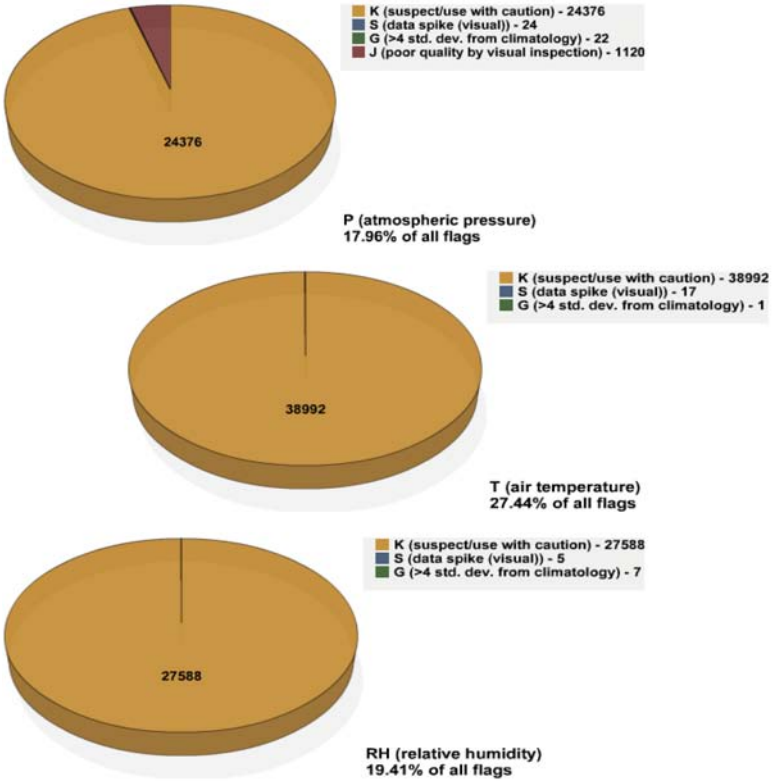


Figure 53: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (middle) air temperature – T – (bottom) relative humidity – RH –for the *Oregon II* in 2013.

Oscar Dyson

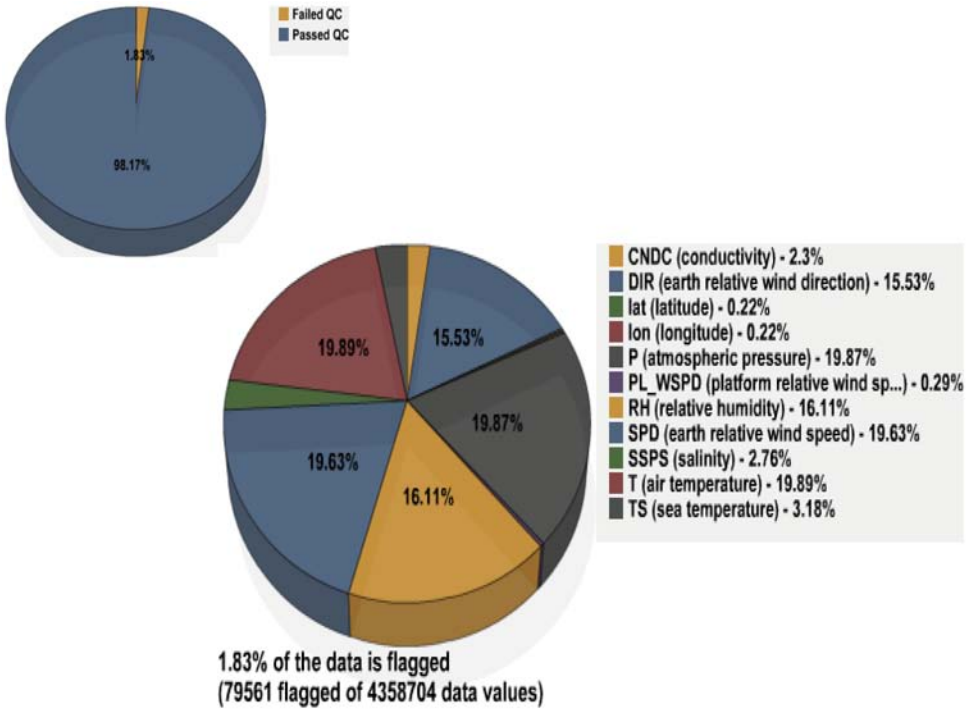


Figure 54: For the *Oscar Dyson* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Dyson* provided SAMOS data for 216 ship days, resulting in 4,358,704 distinct data values. After both automated and visual QC, 1.83% of the data was flagged using A-Y flags (Figure 54). *Dyson* not only remains within the < 5% flagged bracket for "very good" data in 2013; she also wins for lowest total flag percentage among those vessels receiving visual quality control. Bravo, *Dyson*.

The *Dyson* does suffer mildly from a bit of flow distortion affecting her various atmospheric sensors, as do virtually all vessels. However, with such an exceptionally low total flag percentage and a remarkably even spread of flag percentages among the atmospheric sensors, it is clear there were no major problems onboard the *Dyson* in 2013.

Oscar Elton Sette

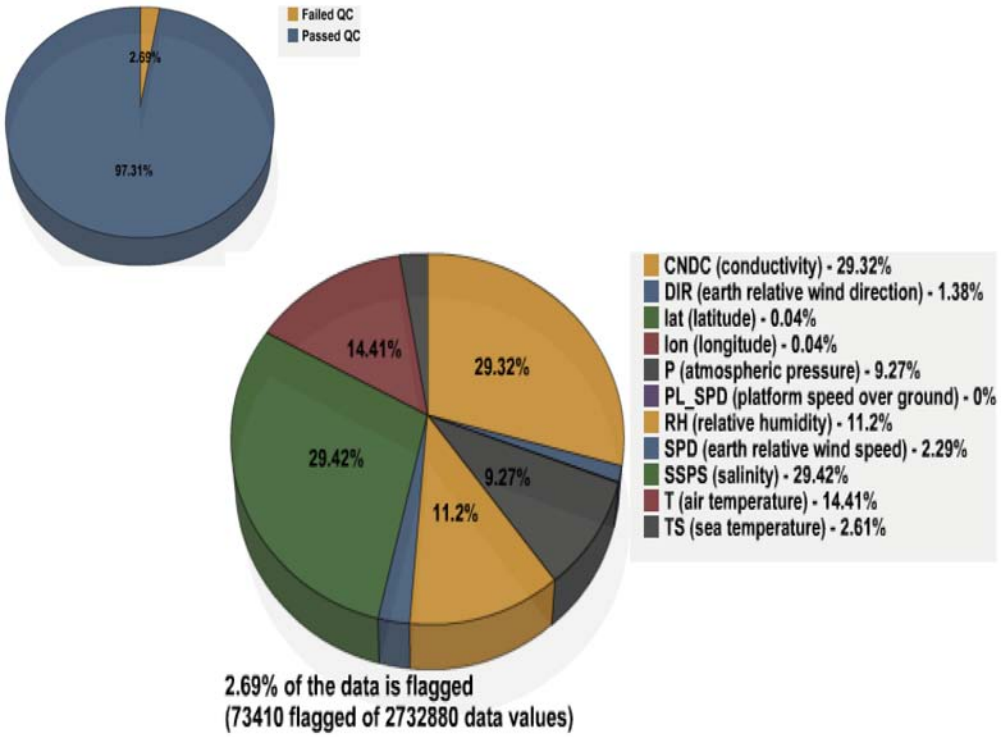


Figure 55: For the *Oscar Elton Sette* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Elton Sette* provided SAMOS data for 127 ship days, resulting in 2,732,880 distinct data values. After both automated and visual QC, 2.69% of the data was flagged using A-Y flags (Figure 55). This is once again well inside of the < 5% flagged bracket, denoting "very good" data, and the *Sette* remains one of the vessels with the lowest flag percentages.

There was a startup glitch at the advent of the *Sette's* sailing season, likely related to the fleet wide SCS upgrade, whereby the longitude data was not getting into the SAMOS files. This unfortunately prevented any data we received from the *Sette* in March 2013 from being processed/quality controlled and archived. By the next cruise in mid-April, though, the issue was resolved. Communication between the DAC and *Sette* personnel

was fluid and thorough while the problem persisted, very characteristic of the *Sette* technicians. After that point, there were notably no major issues with data from the *Sette* in 2013, a conclusion that is supported by the low flag percentage. While the conductivity and salinity parameters may have taken the bulk of the flagging in 2013, upon inspection these mainly suspect/caution (K) flags were applied in cases when the intake apparatus was turned off, usually while in port (Figure 56). This is not considered a major issue by the DAC.

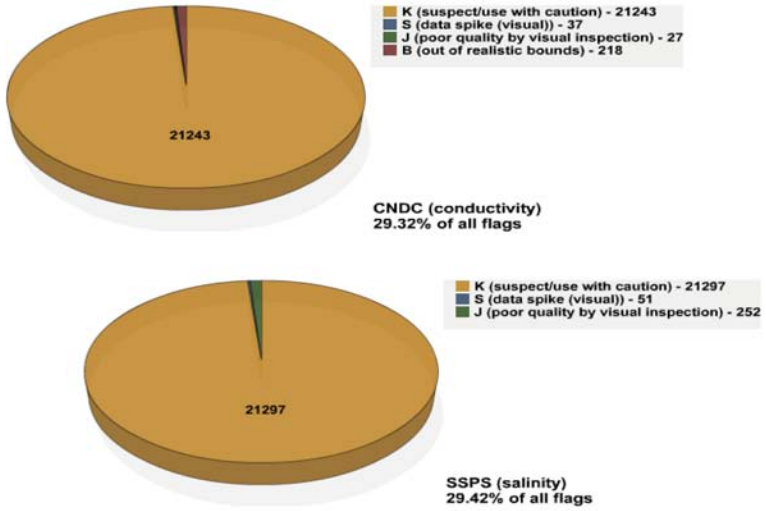


Figure 56: Distribution of SAMOS quality control flags for (top) conductivity –CNDC – and (bottom) salinity – SSPS –for the *Oscar Elton Sette* in 2013.

Pisces

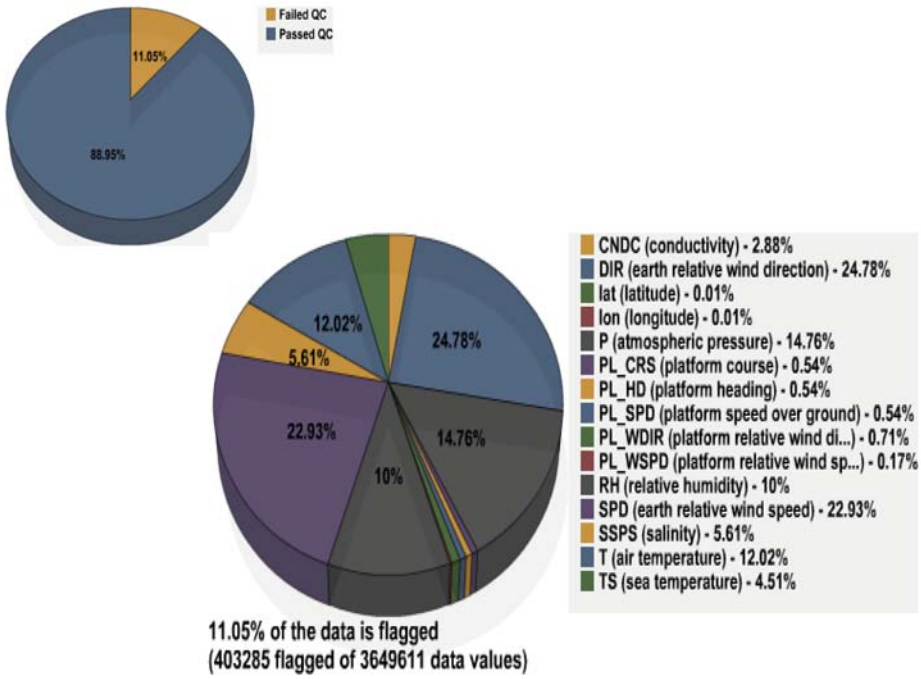


Figure 57: For the *Pisces* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Pisces* provided SAMOS data for 174 ship days, resulting in 3,649,611 distinct data values. After both automated and visual QC, 11.05% of the data was flagged using A-Y flags (Figure 57). This number is essentially static from year to year, and the flag distribution and reasoning remain the same as well.

Pisces wind data was among the least reliable of vessels reporting to SAMOS. Indeed, earth relative wind speed (SPD) and direction (DIR) again received the highest percentage of flags for the *Pisces* in 2013, together carrying almost 50% of all flags. Most of the flags applied to earth relative wind data were caution/suspect (K) flags (Figure 60). This continually appears to be airflow distortion/obstruction issue, occurring for multiple platform relative wind directions (Figure 58). Air temperature (T) and relative humidity (RH) exhibit similar flow distortion behavior to DIR and SPD and picked up a further 20% of the total flags (not shown). In August 2013 several digital images of *Pisces* sensors were provided to the DAC. It appears as though the T, RH, and atmospheric pressure (P) sensors, at least, are located in a potentially problematic location, not far from the exhaust stack structure. This could certainly be a culprit of flow distortion where those three sensors are concerned; stack exhaust could also potentially interfere with those sensors' readings. It is not entirely clear in the images, however, from which wind sensor SAMOS receives its data (the *Pisces* has several wind sensors). Without knowing this for a certainty, definitively diagnosing the issue with the wind data will be impossible.

Atmospheric pressure (P) also received a substantial portion of the total flags, mostly of the K variety (Figure 60). Upon inspection, the problem is unchanged from 2012: namely, one cause appears to be that the atmospheric pressure sensor also suffers from airflow distortion, probably that which is mentioned above. The more serious issue that persists is that the pressure data exhibit mysterious downward "steps" that appear unrelated to either platform relative wind direction or platform speed (see Figure 59). SAMOS personnel will again attempt to contact and confer with *Pisces* personnel if the issue persists when *Pisces* data transmission resumes in 2014.

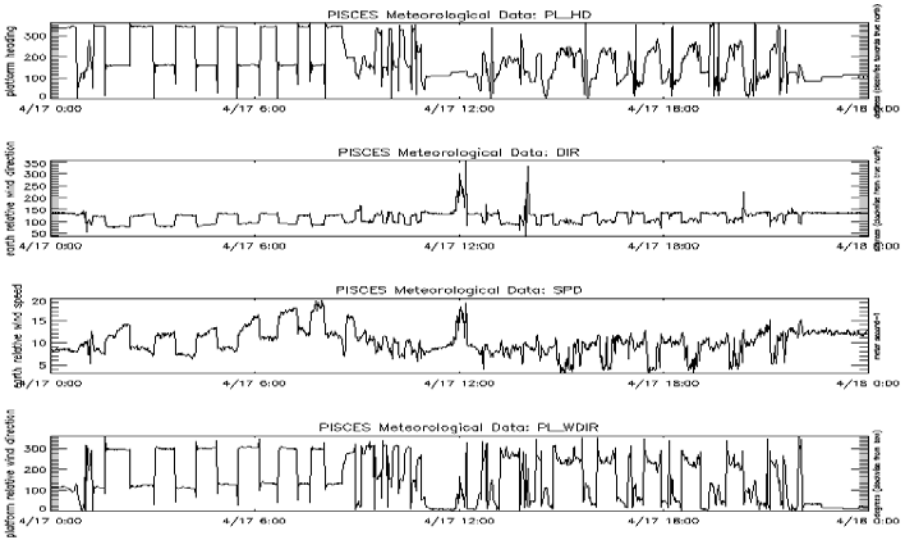


Figure 58: *Pisces* SAMOS data for 17 April 2013: (first) platform heading –PL_HD – (second) earth relative wind direction – DIR – (third) earth relative wind speed – SPD – and (last) platform relative wind direction – PL_WDIR. Note all the steps in DIR and SPD, seemingly in response to PL_WDIR.

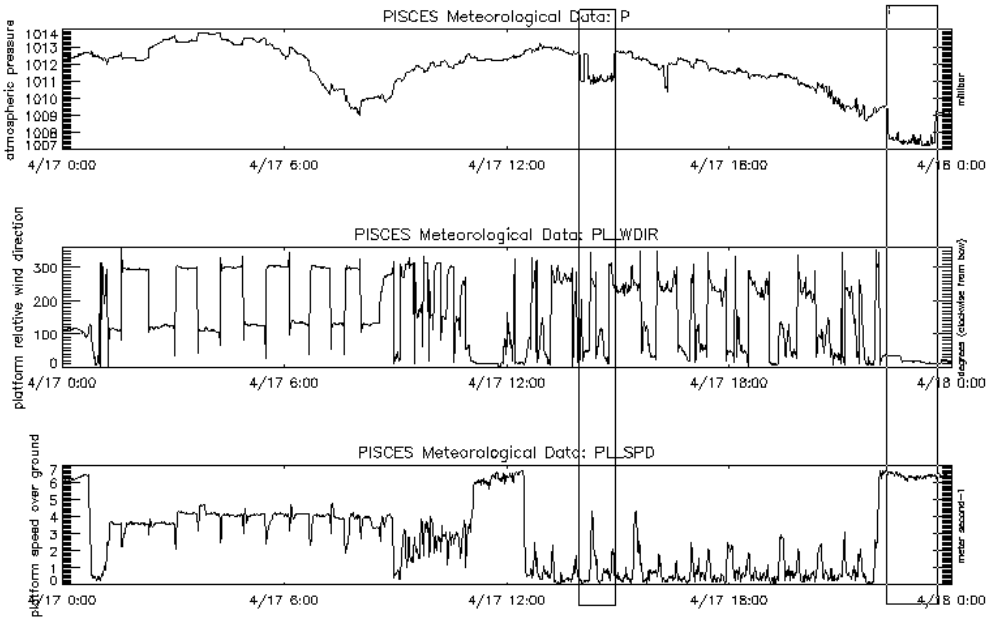


Figure 59: *Pisces* SAMOS data for 17 April 2013: (top) atmospheric pressure – P – (middle) platform relative wind direction – PL_WDIR – and (bottom) platform speed – PL_SPD. Note two overt "steps" in P after 12:00 (enclosed in rectangles), with no explanatory behavior visible in either PL_WDIR or PL_SPD. Note also the different "steppy" behavior evident in P prior to 12:00; this was likely due to flow distortion, as it matches well with PL_WDIR.

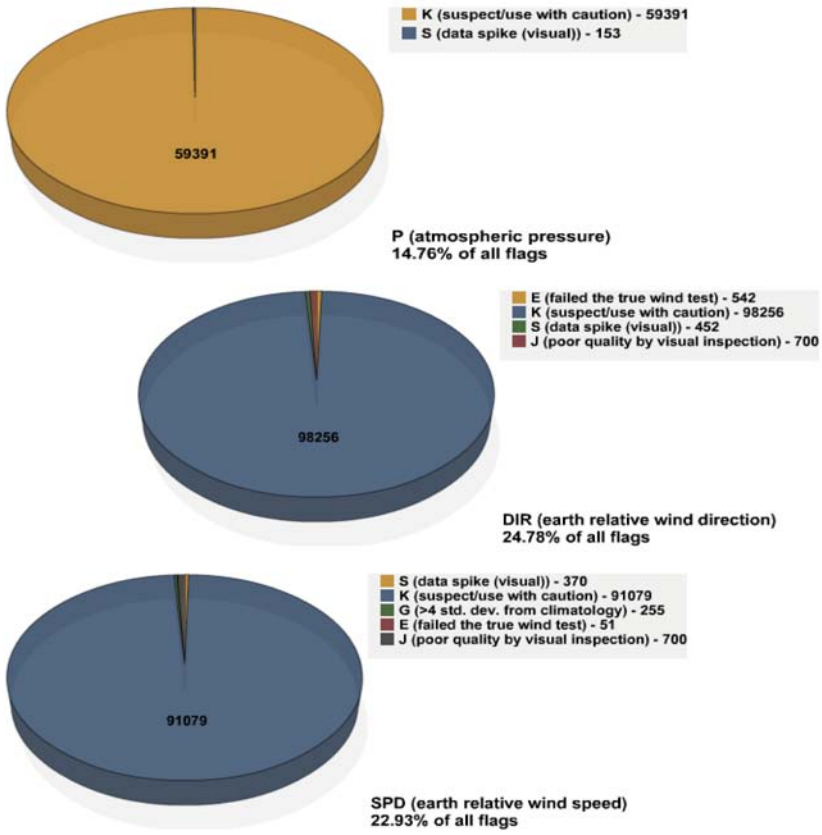


Figure 60: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (middle) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD – for the *Pisces* in 2013.

Rainier

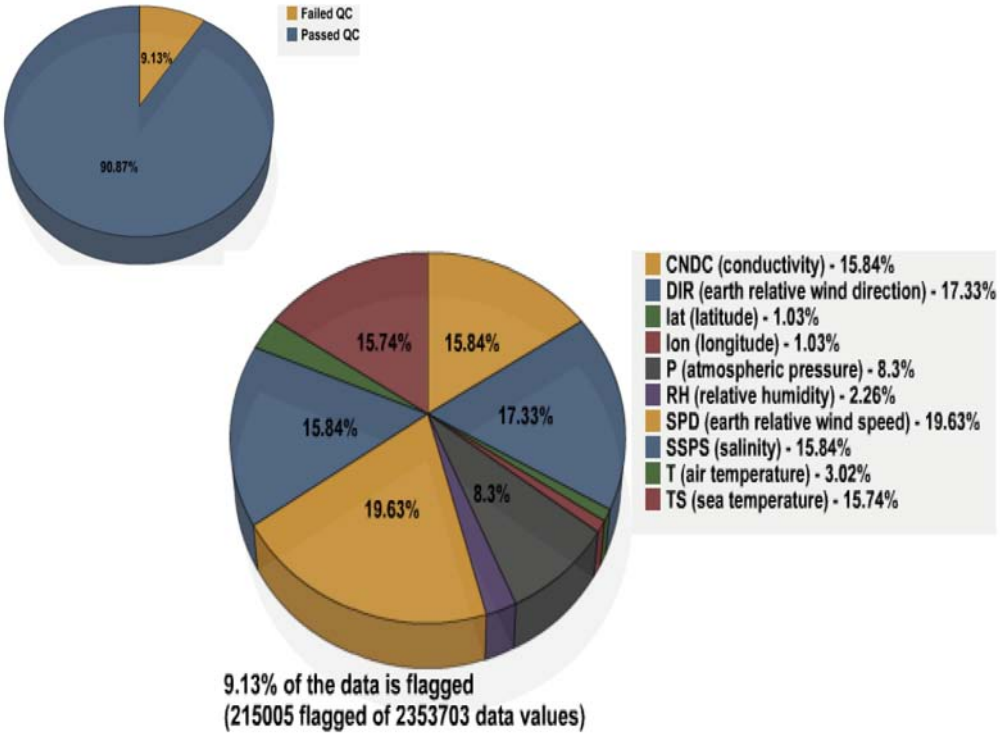


Figure 61: For the *Rainier* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Rainier* provided SAMOS data for 124 ship days, resulting in 2,353,703 distinct data values. After both automated and visual QC, 9.13% of the data was flagged using A-Y flags (Figure 61).

We at SAMOS were pleased to welcome the *Rainier* back into the fold in 2013, after several years without receiving data from her. As somewhat of a "freshman" year of data submission, a total flag percentage of 9.13% isn't too terrible. Of course anything < 5% is ideal, so we hope this "first" year quality wrap up aids in bringing the flag total closer to 5% in 2014.

The first issue with *Rainier's* data is the earth relative wind direction (DIR) and speed (SPD) parameters. Together they hold almost 40% of the total flags in 2013, mostly of the suspect (K) variety (Figure 63). Upon inspection, the issue is obvious: *Rainier* suffers, like so many other vessels, from a flow distortion problem. It is rather pronounced in the *Rainier's* case, in fact (see Figure 62). Unfortunately *Rainier's* sensor metadata is insufficient for us to be able to pinpoint the problem; we do not have any clue about where the sensors are located, and there is no digital imagery to show what structures might be interfering with the flow over the ship.

The next big issue concerned the sea parameters: sea temperature (TS), conductivity (CNDC), and salinity (SSPS). The problem was actually with the TSG pump, as communicated by vessel technicians. There was a pump casualty in the very beginning

of the sailing season and the pump was consequently turned off, though the TSG continued to record data. As a result, and on the advice from the techs that the data was probably invalid, all three of TS, CNDC, and SSPS were flagged with caution/suspect (K) and poor quality (J) flags through most of the month of May, likely making up the bulk of the combined 45% of total flags they received (Figure 63). In the meantime *Rainier* engineers repaired the pump, and when it was finally back in service on 27 May the data appeared more or less normal. The TSG data continued until early July, when the techs again disabled the pump and advised SAMOS personnel that they had a difficult time keeping the pump online without leaking and needed to find a long-term solution. At that point TSG SAMOS data transmission was discontinued and it remained out of the data stream for the remainder of the season.

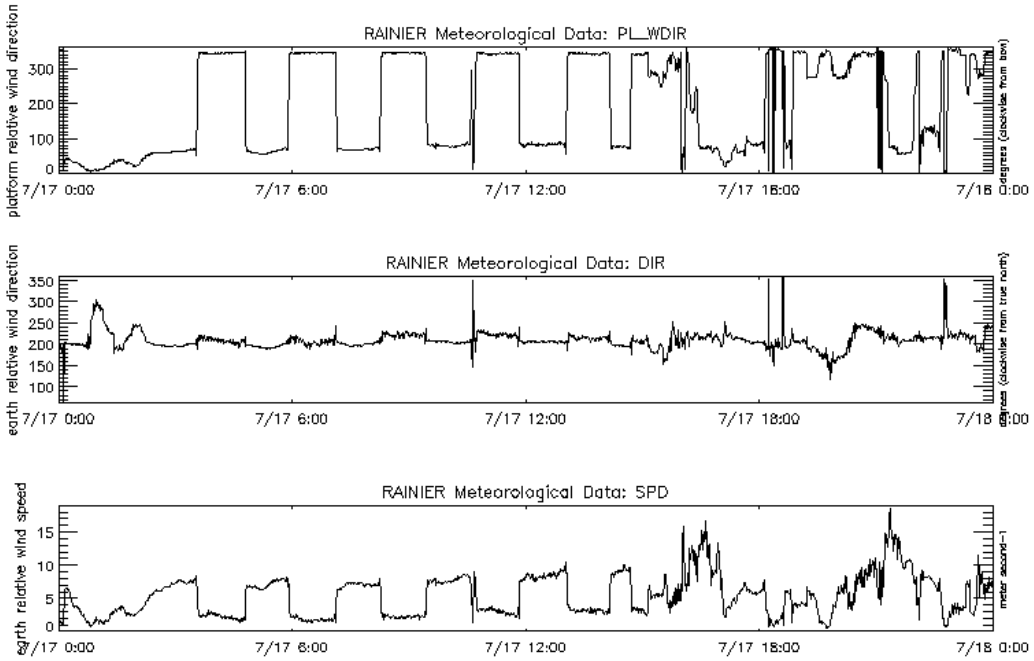


Figure 62: *Rainier* SAMOS data for 17 July 2012: (top) platform relative wind direction – PL_WDIR – (middle) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD. Note the obvious step behavior prior to 18:00 in DIR and SPD in lockstep with PL_WDIR behavior.

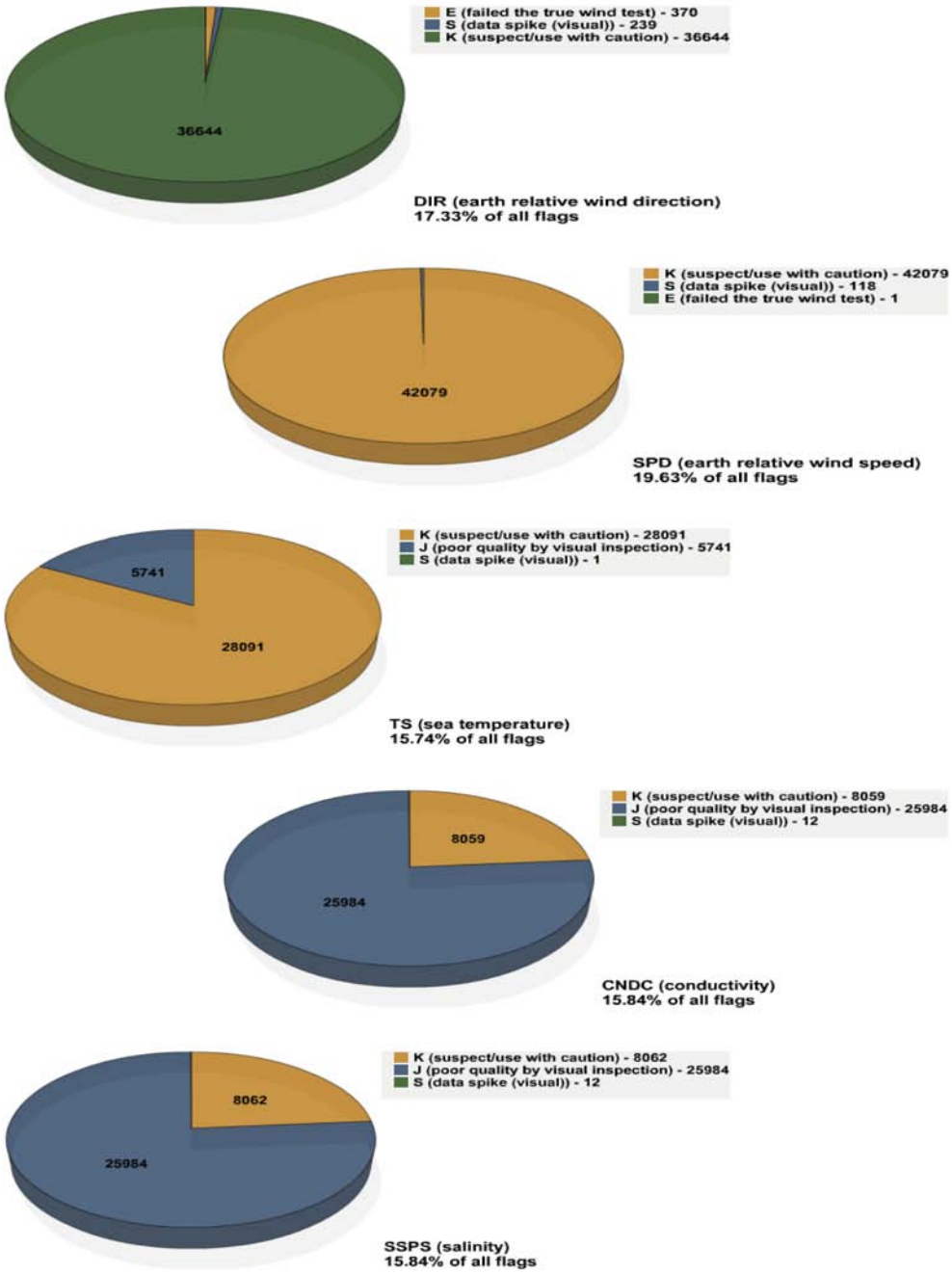


Figure 63: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) earth relative wind speed – SPD – (third) sea temperature – TS – (fourth) conductivity – CNDC – and (last) salinity – SSPS for the *Rainier* in 2013.

Ronald H. Brown

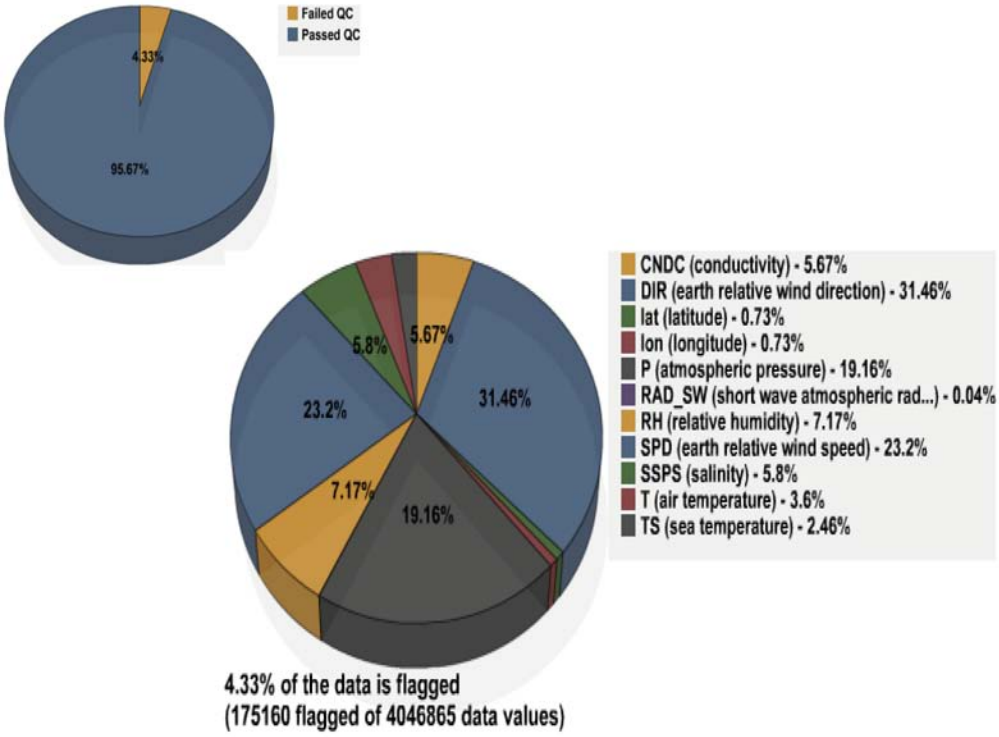


Figure 64: For the *Ronald H. Brown* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Ronald H. Brown* provided SAMOS data for 184 ship days, resulting in 4,046,865 distinct data values. After both automated and visual QC, 4.33% of the data was flagged using A-Y flags (Figure 64). This keeps the *Ron Brown* below the 5% flagged threshold, denoting "very good" data.

The main issue with *Ron Brown's* data in 2013 concerned the true wind measurements, both direction (DIR) and speed (SPD). Together they populated over half of the total flags, mostly of the suspect/caution (K) variety, although DIR does receive a bit of "failed true wind test" (E) flags, as well (Figure 67). Upon inspection, it appears as though there may be flow distortion when the winds are coming from somewhere in the port bow vicinity. Metadata for the *Brown* is insufficient for a proper diagnosis of this issue; there is no sensor location information available and no digital imagery showing the ship and her sensors, either. Atmospheric pressure (P) also shows signs of being compromised by either flow distortion or perhaps ship speed (see Figure 65), with the result being a further ~19% of the total flags, again mostly K flags (Figure 67). Once again, adequate metadata would help in diagnosing the issue.

A third issue, though not immediately evident in the flag percentages, concerns the sea parameters (temperature, conductivity, and salinity) and is a carry-over issue from at least 2012. Readings in CNDC/SSPS and sometimes in all three parameters will occasionally slide upwards or downwards and then suddenly jump back to the prevailing values (see Figure 66). It may be that the TSG pump is not functioning properly and needs to be

serviced or replaced. Whether or not TS is affected as well in any particular case perhaps depends upon the ambient temperature in the ship as compared to the water temperature. Or it may be that some of the cases are actually due to ship personnel manually and intentionally turning the pump off, although the short durations and random vessel locations when they occur make this scenario a little difficult to imagine.

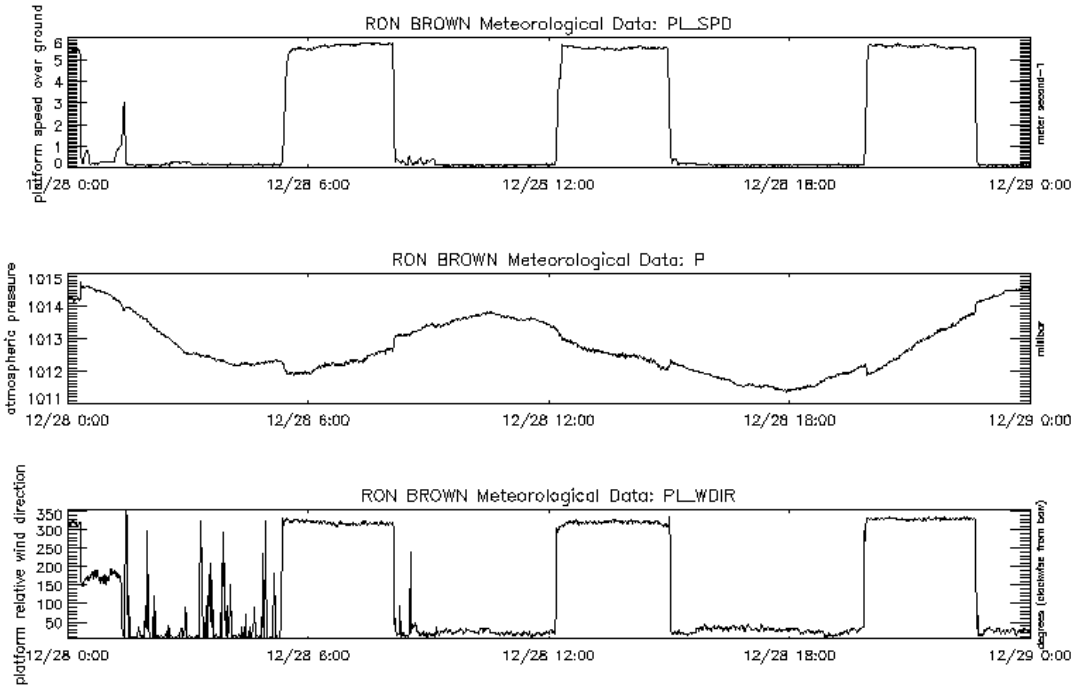


Figure 65: *Ron Brown* SAMOS data for 28 December 2013: (top) platform speed over ground – PL_SPD – (middle) atmospheric pressure – P – and (bottom) platform relative wind direction – PL_WDIR. Note the negative "steps" in P whenever the vessel is moving and/or PL_WDIR is around 300°.

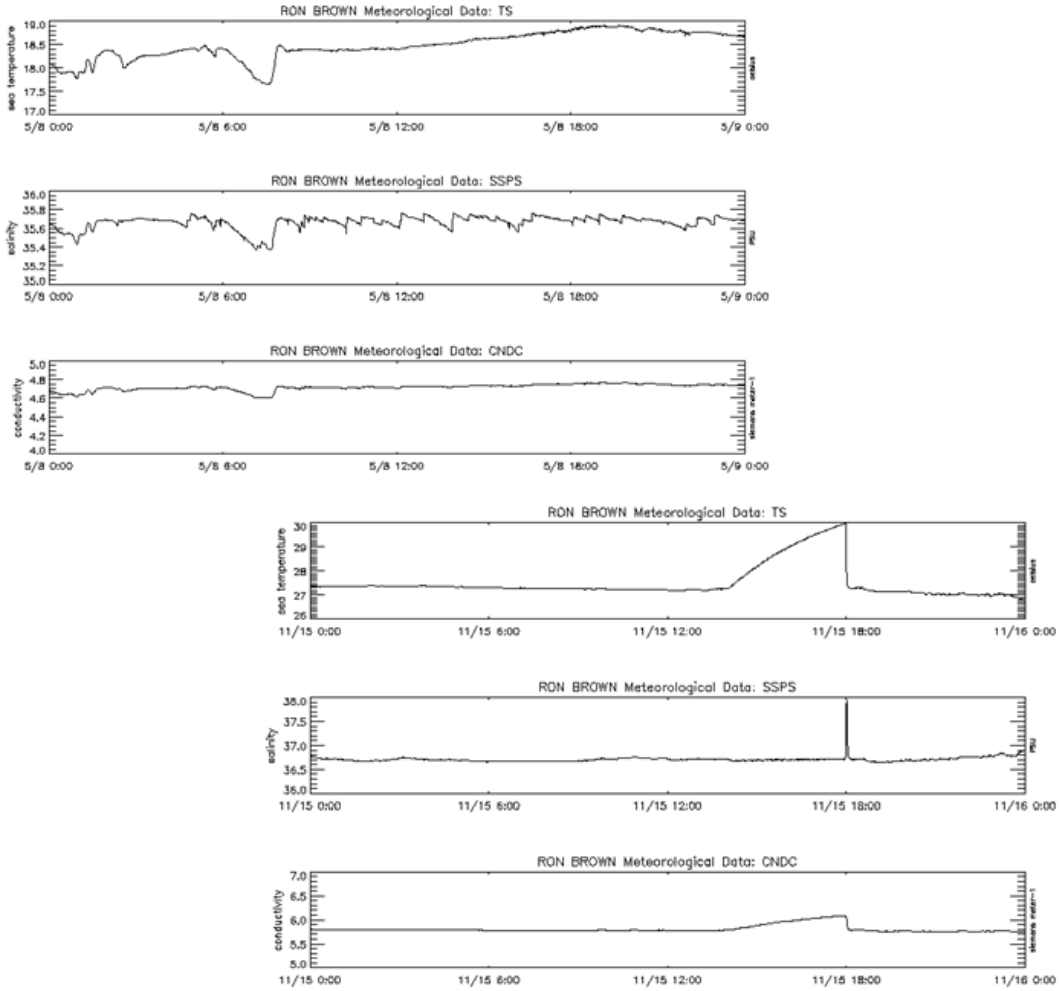


Figure 66: Two examples of *Ron Brown* SAMOS data for (top left) 8 May 2013 and (bottom right) 15 November 2013: (top) sea temperature – TS – (middle) salinity – SSPS – and (bottom) conductivity – CNDC. Note the "sliding steps" ending in discontinuous jumps in both SSPS and (difficult to see due to scaling) CNDC in the 8 May data, and again in all three parameters in the 15 November data.

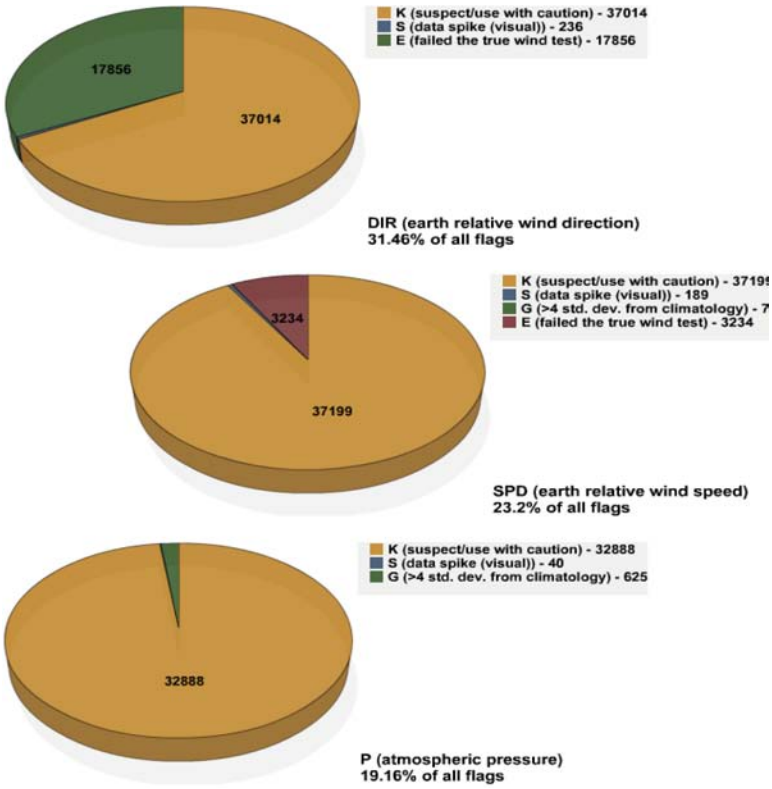


Figure 67: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – (middle) earth relative wind speed – SPD – and (bottom) atmospheric pressure –P – for the *Ronald H. Brown* in 2013

Thomas Jefferson

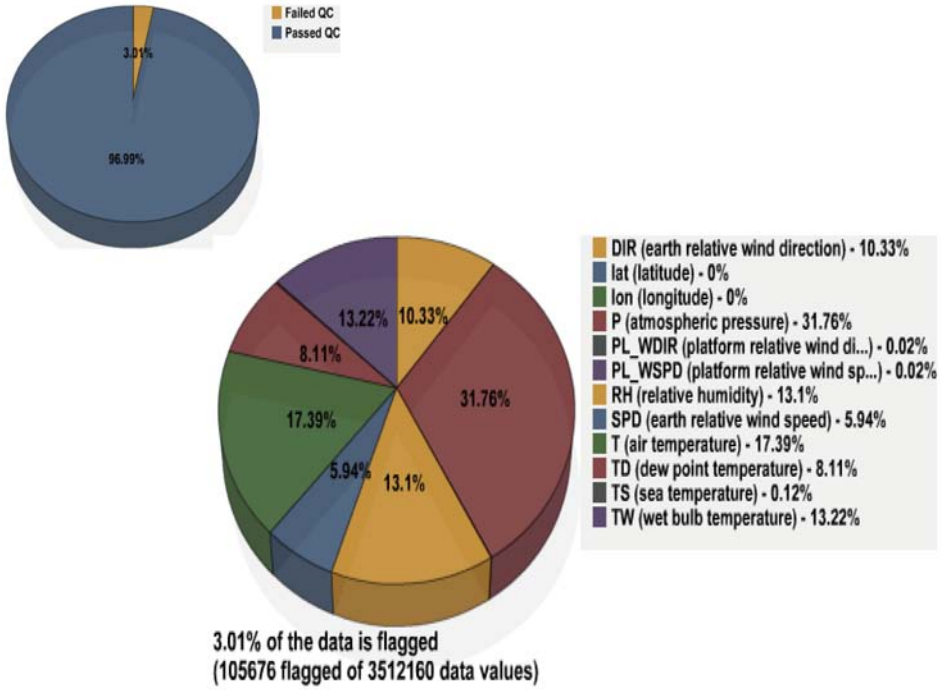


Figure 68: For the *Thomas Jefferson* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Thomas Jefferson* provided SAMOS data for 164 ship days, resulting in 3,512,160 distinct data values. After both automated and visual QC, 3.01% of the data was flagged using A-Y flags (Figure 68). This is well within the coveted <5% flagged bracket, denoting "good data" overall

The only issue evident in the *Jefferson's* data appears once again to be the sensitivity of nearly all of the MET parameters to platform relative wind direction, and, as in 2012, none more so than atmospheric pressure (P), with over 31% of the total flags being assigned to that variable in 2013. There were a lot of steps in the data (see Figure 69), resulting in a need for a good amount of suspect/caution (K) flagging (Figure 70). It was anticipated that this would be the case with the *Jefferson*, as it's understood to be a hydrographic survey vessel that is not equipped with research-quality meteorological sensors.

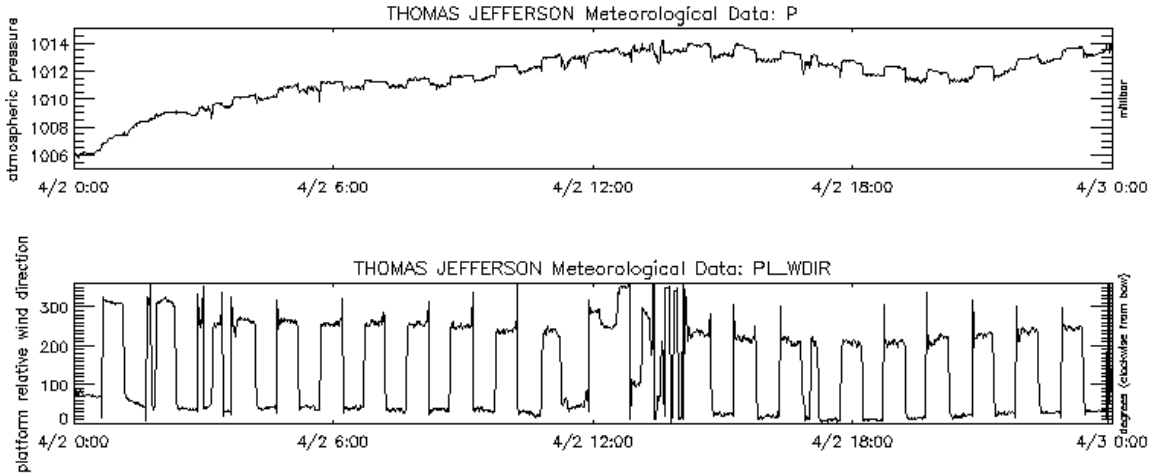


Figure 69: *Thomas Jefferson* SAMOS data for 2 April 2013: (top) platform relative wind direction –PL_WDIR – and (bottom) atmospheric pressure – P. Note frequent steps in P whenever PL_WDIR changes.

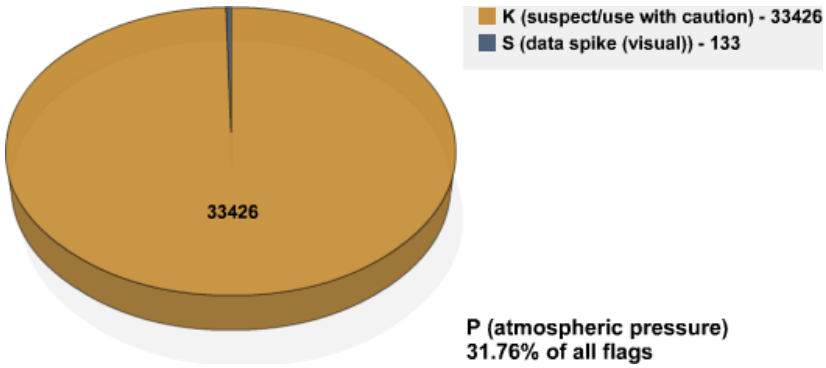


Figure 70: Distribution of SAMOS quality control flags for atmospheric pressure – P –for the *Thomas Jefferson* in 2013.

Laurence M. Gould

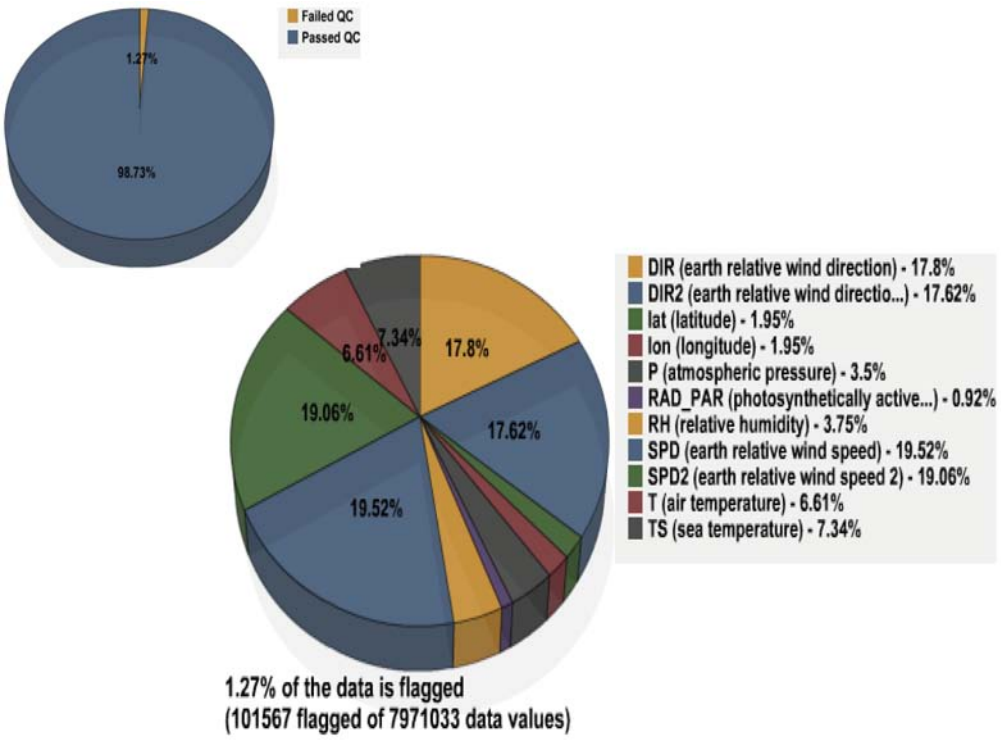


Figure 71: For the *Laurence M. Gould* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Laurence M. Gould* provided SAMOS data for 258 ship days, resulting in 7,971,033 distinct data values. After automated QC, 1.27% of the data was flagged using A-Y flags (Figure 71), which is a huge change from 2012's 10.24% flagged. However, due to funding constraints, the *Gould* did not receive visual QC in 2013 (and will not until such time as funding is extended to cover it). So rather than this greatly reduced percentage of flags signifying greatly improved data, it probably actually, paradoxically, highlights a slight *decrease* in the quality of data available to the public from the *Gould*. (*Gould's* data no longer reaches the "research quality" stage that results from visual quality control being applied.) Visual quality control is generally when the bulk of quality control flags are applied and the *Gould* had a history of multiple data issues prior to 2013, owing in large part to the massive superstructure resident on the vessel. As it stands, with such a low total flag percentage (again, flagging from automated QC only), the authors cannot really conclude anything specific regarding data quality in 2013.

What can be noted are a few issues that were brought to light by the quick visual inspection that occurs when data files are first received. These issues were immediately communicated to *Gould* technicians by SAMOS personnel, and *Gould* staff were then able to isolate the problems on their end, but that is now the limit of our capabilities at the DAC, unfortunately. In early March there was a data logger issue connected with the relative humidity readings that evidently resulted in RH values of -25%, persisting for several days. Fortunately this value would have been flagged by the autoflagger, but it's

interesting to note that if the constant value had been a positive number between 0 and 100% instead, automated QC would not have caught it. Also, in May, one of the anemometers malfunctioned and as soon as it was replaced (about a month later), the other anemometer failed. This likely resulted in a lot of erroneous true wind data but if the erroneous data was still within a reasonable range it would not have been flagged by the autoflagger. Judging from the low total flag percentage the *Gould* received, this was probably the case. The best we could do in this situation was to suggest to the *Gould* that they turn off the suspect data feed until it could be repaired.

Nathaniel B. Palmer

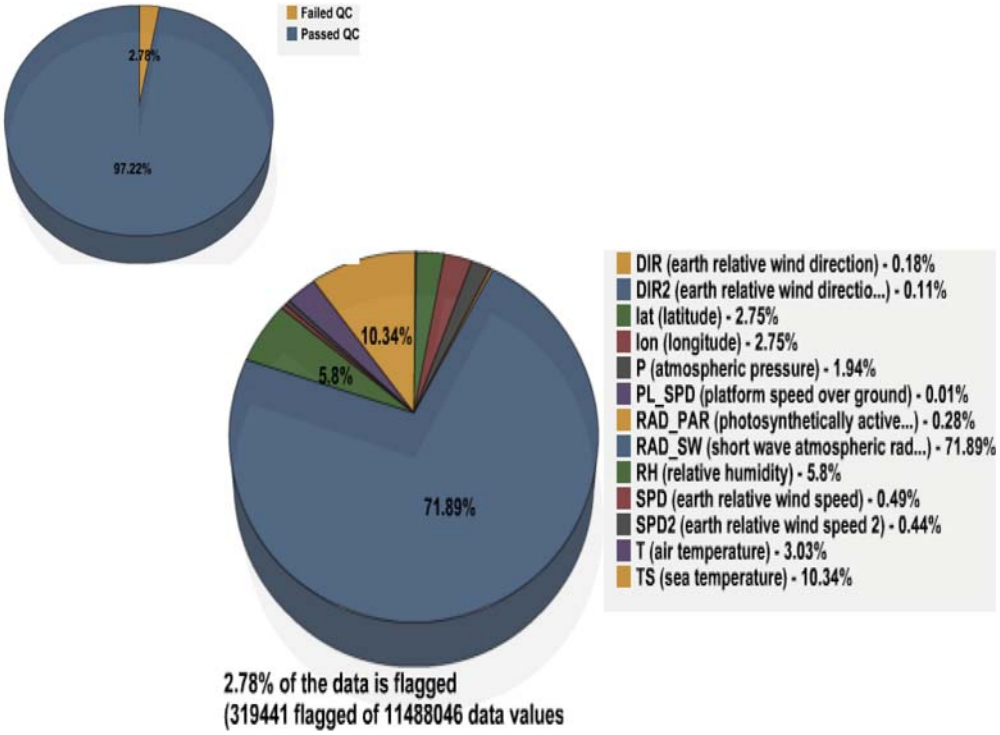


Figure 72: For the *Nathaniel B. Palmer* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nathaniel Palmer* provided SAMOS data for 348 ship days, resulting in 11,488,046 distinct data values. After automated QC, 2.78% 8.97% of the data was flagged using A-Y flags (Figure 72). This is a large change from 2012's 8.97%. However, like the *Gould*, due to funding constraints the *Palmer* did not receive visual QC in 2013 (and will not until such time as funding is extended to cover it). So again in the *Palmer's* case, rather than this reduced percentage of flags signifying greatly improved data, it probably only paradoxically highlights a slight *decrease* in the quality of data available to the public from the *Palmer*. (*Palmer's* data no longer reaches the "research quality" stage that results from visual quality control being applied.) Visual quality control is generally when the bulk of quality control flags are applied, and the *Palmer* and *Gould* alike had a history of multiple data issues prior to 2013, owing in large part to the massive superstructures resident on each vessel.

The one standout parameter appears to be short wave atmospheric radiation, comprising over 70% of the total flags. However, these are exclusively out of bounds (B) flags (Figure 73) and a cursory inspection of the data reveals the issue is likely just sensor tuning, whereby the sensor reads slightly negative values at night (details in Section 3b). This is a common occurrence, and one that really can't be remedied without risking the precision of the large positive values expected during daytime.

It is worth noting that the quick visual inspection that occurs when data files first arrive at the DAC revealed a bad anemometer for several days in late November. But as the problem appeared to resolve after a few days, *Palmer* personnel were not notified. (This is a customary practice at the DAC; we often give the data a few days to see if the issue resolves, as often it does, indeed.) The downside of this episode is that the true wind calculations may well have still produced direction and speed values that were within a reasonable range, so they would not have been flagged by the autoflagger, although they would nevertheless be erroneous.

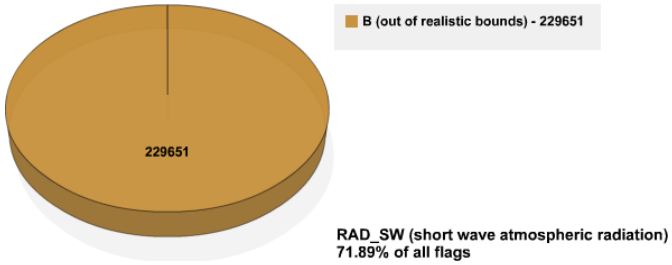


Figure 73: Distribution of SAMOS quality control flags for short wave atmospheric radiation – RAD_SW – for the *Nathaniel B. Palmer* in 2013.

Melville

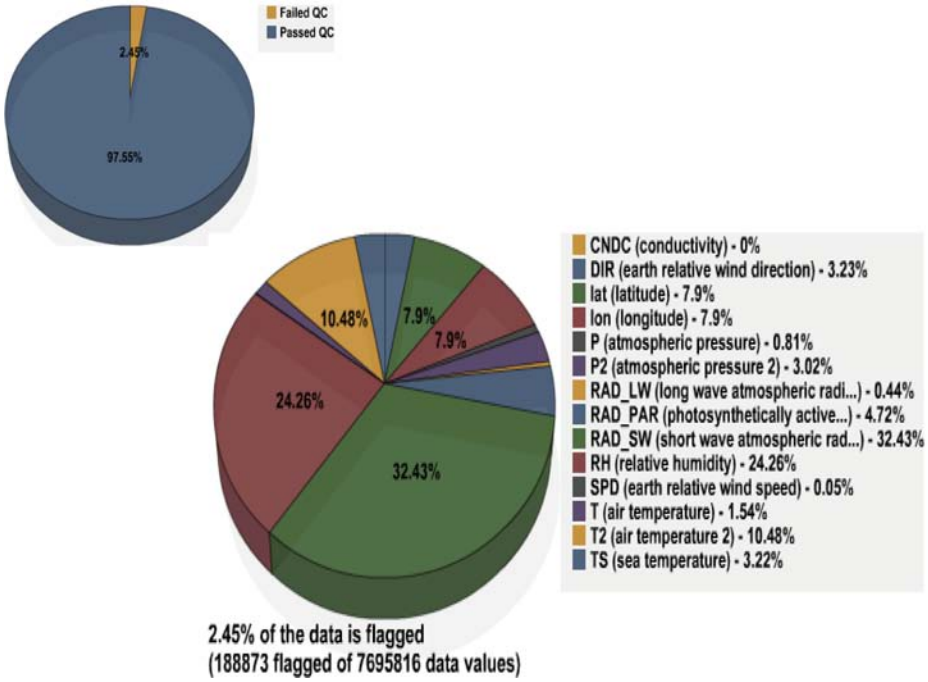


Figure 74: For the *Melville* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Melville* provided SAMOS data for 276 ship days, resulting in 7,695,816 distinct data values. After automated QC, 2.45% of the data was flagged using A-Y flags (Figure 74). NOTE: the *Melville* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Melville*).

The highest percentage of flags (~32%) was applied to shortwave atmospheric radiation (RAD_SW). All of those flags were out of bounds (B) flags (Figure 75). It is likely these were due mostly to the common occurrence of radiation readings slightly below zero in nighttime conditions, owing to sensor tuning (see Section 3b for details).

Relative humidity (RH) received another, slightly smaller portion of the total flags (~24%), split between B flags and greater than 4 standard deviations (G) flags (Figure 75). A cursory inspection reveals that at least some of the B flags were applied to readings slightly over 100%, which can be a combination of sensor tuning and saturated conditions (see section 3b) and a lot of the G flags were applied to very low RH values, which may or may not have been realistic. But the authors also recall that in both 2011 and 2012 the sensor performed about the same in terms of flag percentage and flag type and distribution. In both of those cases the RH sensor appeared to have periods of behavior that was potentially unrepresentative of true atmospheric conditions, including dipping into negative values (which are definitely unrepresentative), resulting in "G" flags where above zero and “B” flags where below zero. So it is possible 2013 saw a continuation of that difficulty; unfortunately, we are not funded to investigate in depth or to decipher problems that are only identified in visual inspection.

A few other items of note in 2013: First, there was about a three-week period in Feb/March when position data (lat/lon) was excluded from the *Melville’s* data files. After this was communicated to *Melville* personnel via email, it was discovered that there’d been some inadvertent changes to the MET setup file on the vessel. The issue was corrected, but unfortunately the missing navigation data prevented the affected files from being processed at the DAC. Then in May *Melville* technicians advised SAMOS personnel that they’d discovered water in both the pressure sensor tubing leading to the static pressure head and in the air temperature sensor circuitry. This had led to a slight bias in the pressure data and erratic behavior in the air temp data, lasting from sometime in March until 5 May when the water was removed and both sensors were replaced. It’s unlikely that the autoflagger caught either of these cases, so it is noted here for anyone using Melville data for this period.

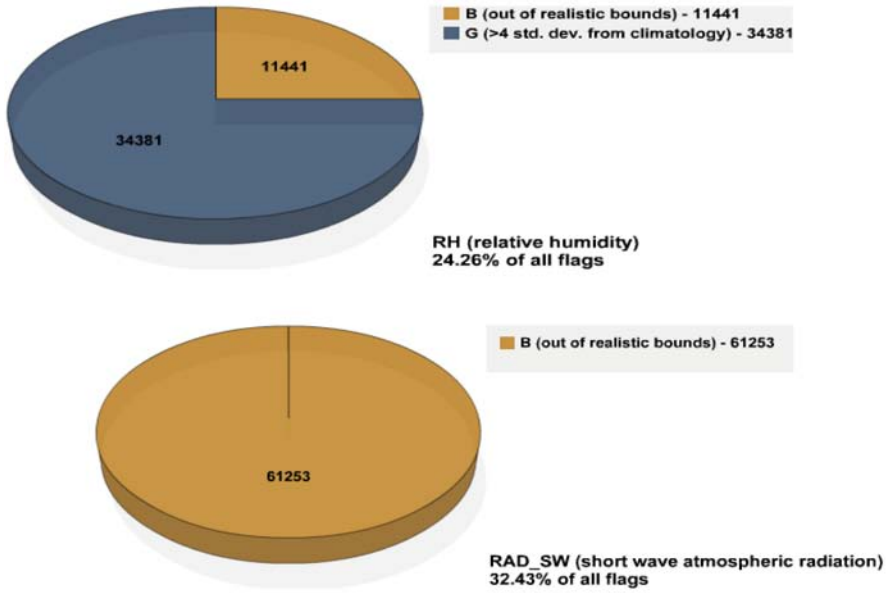


Figure 75: Distribution of SAMOS quality control flags for (top) relative humidity – RH – and (bottom) short wave atmospheric radiation – RAD_SW – for the *Melville* in 2013.

New Horizon

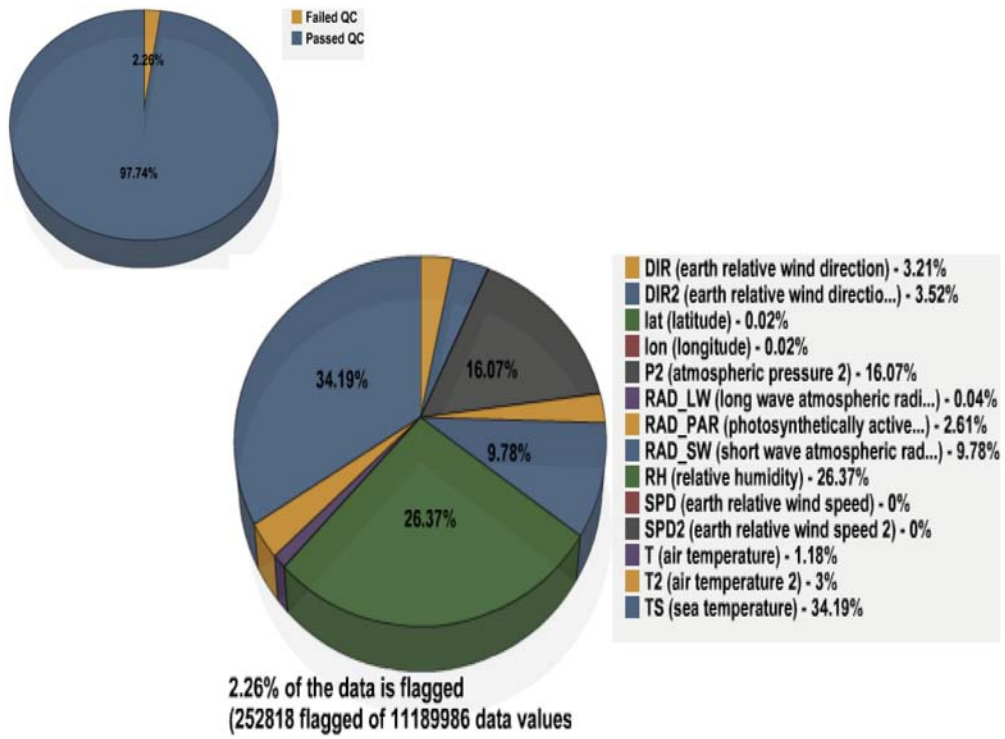


Figure 76: For the *New Horizon* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *New Horizon* provided SAMOS data for 352 ship days, resulting in 11,189,986 distinct data values. After automated QC, 2.26% of the data was flagged using A-Y flags

(Figure 76). NOTE: the *New Horizon* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *New Horizon*).

The highest percentage of flags (about 34%) was applied to sea temperature (TS). Most of those flags were "greater than 4 standard deviations from climatology" (G) flags (Figure 77). These values may or may not have been realistic; we are not currently funded to investigate cases like this for the *New Horizon*. It could be noted here that if *New Horizon* did receive visual quality control and had the flagged values been discovered to be unrealistic they likely would have been changed to suspect/caution (K) or poor quality (J) flags during visual QC to avoid confusion on the part of the end-user.

The relative humidity (RH) parameter also received a fair amount of flags, mostly out of bounds (B) flags (Figure 77). In late March, in response to an email inquiry, it was communicated to SAMOS personnel by *New Horizon* technical staff that the RH sensor appeared to have a broken element and was slated for repair upon the *Horizon's* return to home port on 1 April. RH readings did indeed return to normal on 1 April, but the data between 21 March and 1 April were less than 0% (obviously well out of bounds). This episode surely accounted for a sizable portion of the B flags allotted to RH.

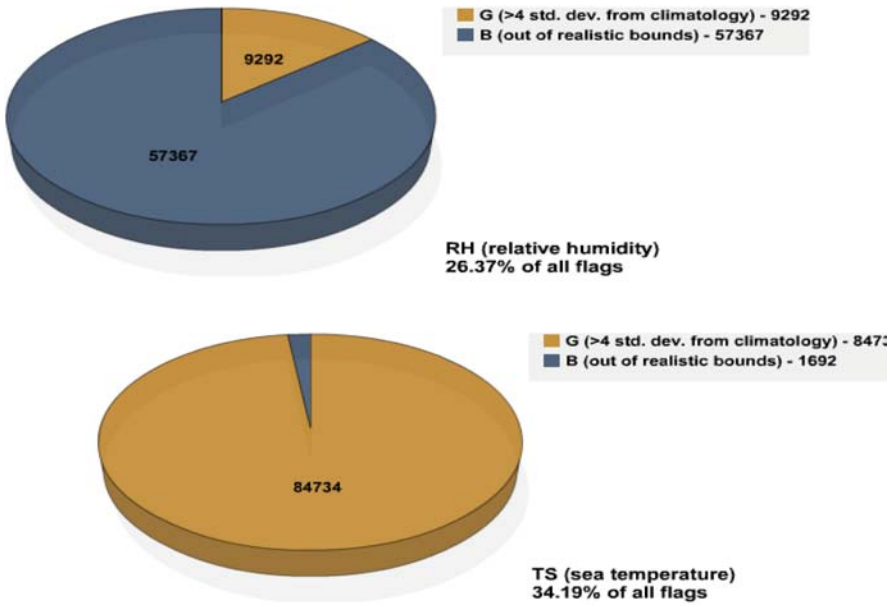


Figure 77: Distribution of SAMOS quality control flags for (top) relative humidity – RH – and (bottom) sea temperature – TS – for the *New Horizon* in 2013.

Roger Revelle

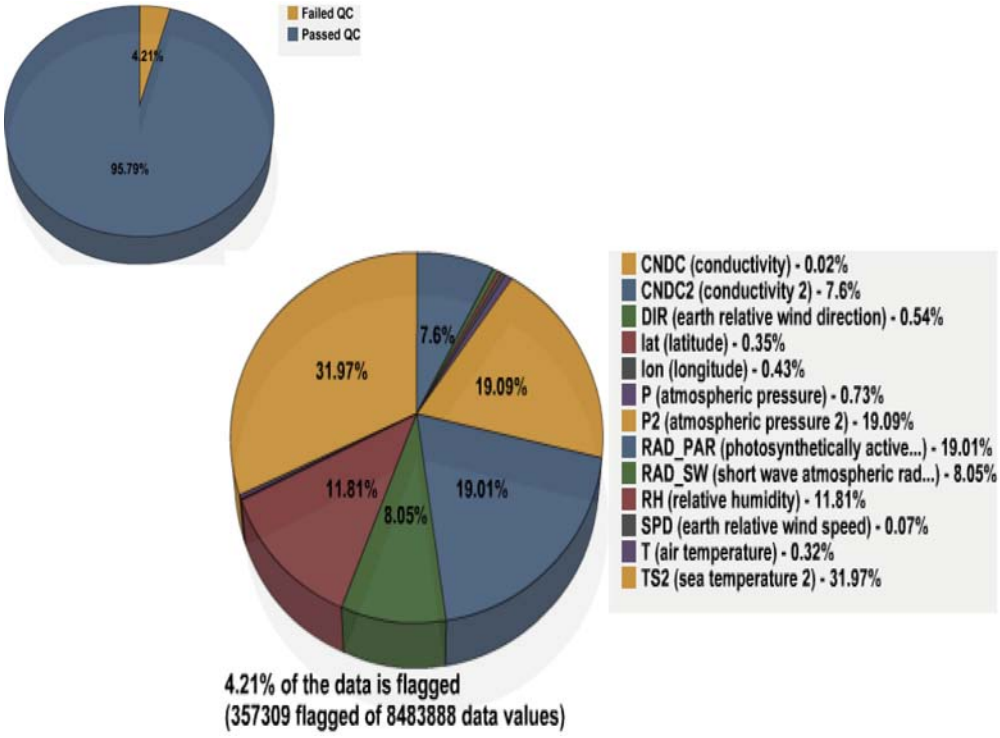


Figure 78: For the *Roger Revelle* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Roger Revelle* provided SAMOS data for 309 ship days, resulting in 8,483,888 distinct data values. After automated QC, 4.21% of the data was flagged using A-Y flags (Figure 78). NOTE: the *Roger Revelle* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Roger Revelle*).

The highest percentage of flags (about 32%) was applied to sea temperature 2 (TS2). Very similarly to *New Horizon*, most of those flags were "greater than 4 standard deviations from climatology" (G) flags (Figure 79). Just as with *New Horizon*, these values may or may not have been realistic; we are not currently funded to investigate cases like this for the *Revelle*. It could be noted here as well that if *Revelle* did receive visual quality control and had the flagged values been discovered to be unrealistic they likely would have been changed to suspect/caution (K) or poor quality (J) flags during visual QC to avoid confusion on the part of the end-user.

Much of the rest of the significant flagging was probably influenced by two rather significant events that occurred on the *Revelle*: The first of these was that between December, 2012 and at least late March, 2013 the vessel had been undergoing maintenance and the MET system had been left running the entire time. This likely resulted in some erroneous data that was caught by the autoflagger. The second event that occurred was a lightning strike within 20m of the vessel on 20 July, which reportedly knocked out many electronic devices on the *Revelle* and also destroyed a critical portion

of the MET system onboard. While technicians were able to cobble together a temporary solution with whatever analogous components they had onboard at the time, most of the meteorological and oceanographic sensors that are typically reported to SAMOS were not included. Further, it is possible that whatever met parameters *were* restored may have had reduced functionality and thus may have been flagged. Nevertheless, quite an interesting event! (Thankfully, no one was reported to have been hurt.)

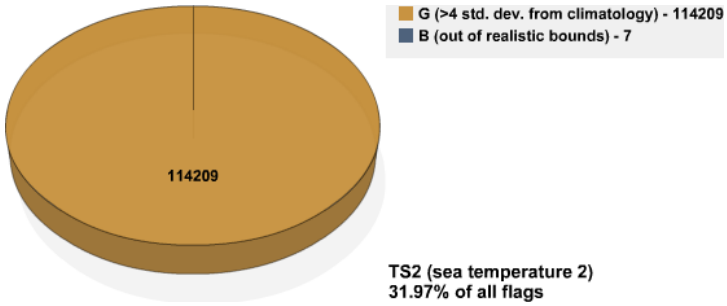


Figure 79: Distribution of SAMOS quality control flags for sea temperature 2 – TS2 – for the *Roger Revelle* in 2013.

Robert Gordon Sproul

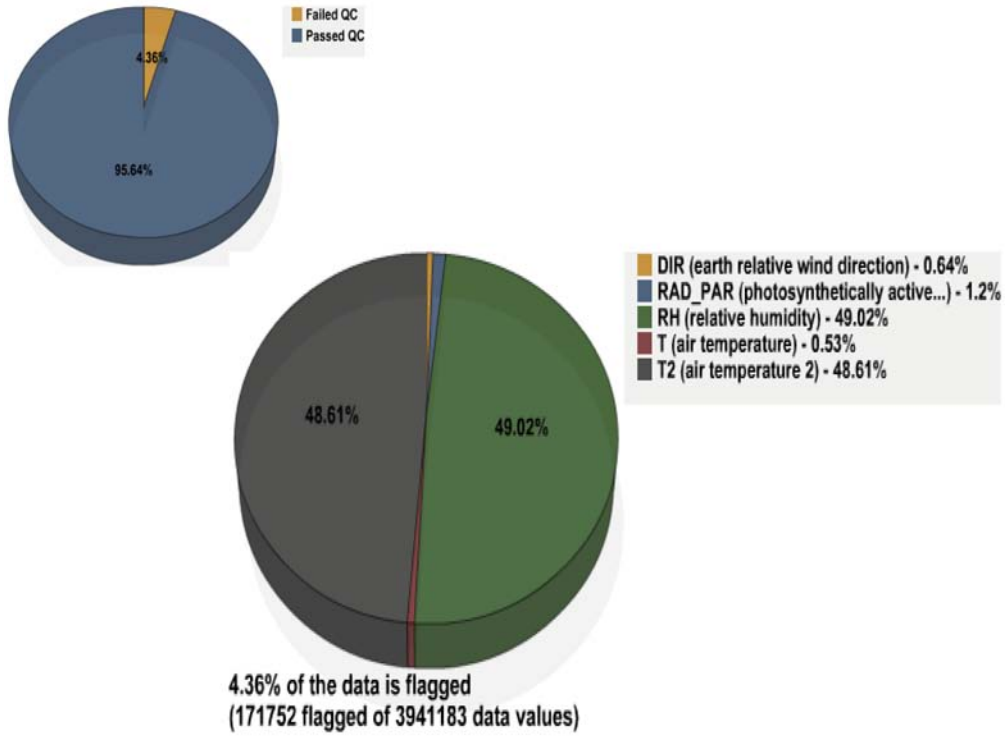


Figure 80: For the *Robert Gordon Sproul* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Robert Gordon Sproul* provided SAMOS data for 176 ship days, resulting in 3,941,183 distinct data values. After automated QC, 4.36% of the data was flagged using A-Y flags (Figure 80). NOTE: the *Robert Gordon Sproul* does not receive visual quality

control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Robert Gordon Sproul*).

The *Sproul's* flags were split virtually down the middle between the relative humidity (RH) and air temperature 2 (T2) parameters (Figure 80). RH incurred mostly "greater than 4 standard deviations from climatology" (G) flags, with a few out of bounds (B) flags thrown in, and T2 was almost exclusively B flags (Figure 82). The bulk of these flags appeared to have been incurred after 27 October, persistent through the end of the year, and upon a cursory inspection the two sensors were clearly "out to lunch" (Figure 81). SAMOS personnel have contacted *Sproul* technicians regarding these two sensors on multiple occasions. Reports are inconclusive, but it's suspected that there is a wiring issue.

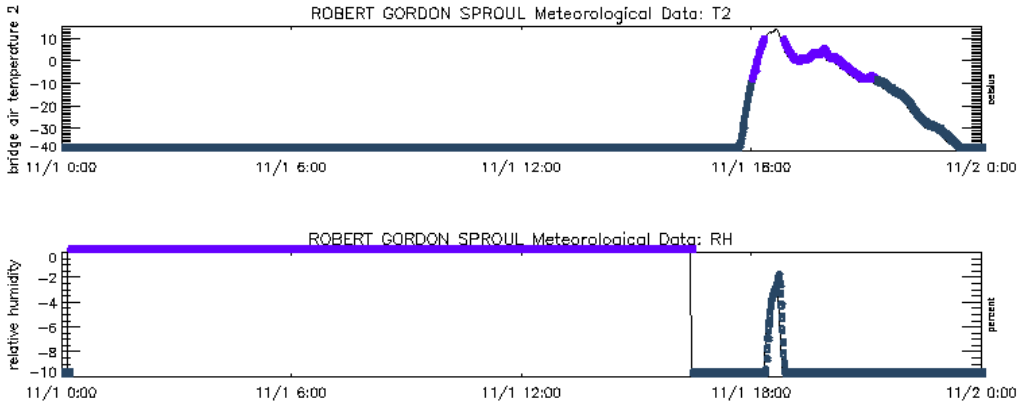


Figure 81: *Robert Gordon Sproul* SAMOS data for 1 November 2013: (top) bridge air temperature 2 – T2 – and (bottom) relative humidity – RH. Note the G flags (in purple) when either parameter is very close to 0 but still within realistic bounds (though obviously not realistic) and B flags (in grey) when either parameter was obviously outside of those bounds.

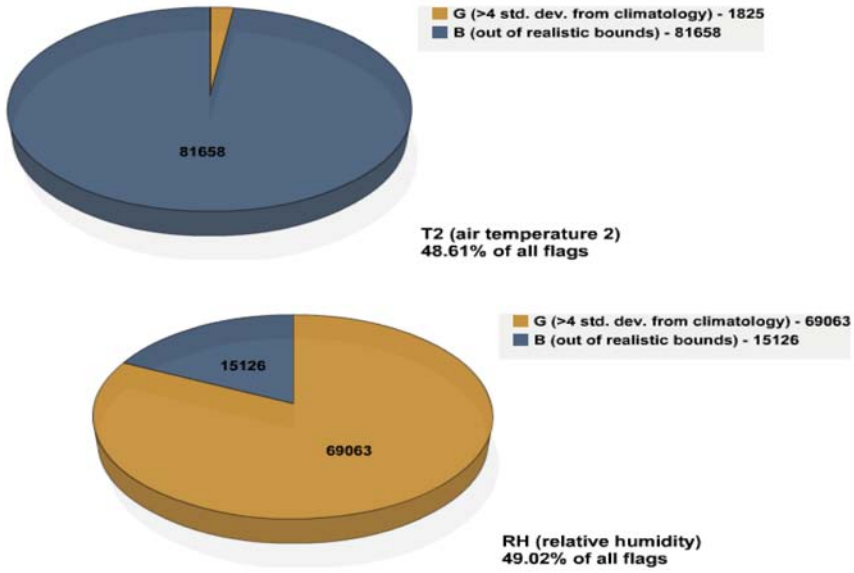


Figure 82: Distribution of SAMOS quality control flags for (top) air temperature 2 – T2 – and (bottom) relative humidity – RH – for the *Robert Gordon Sproul* in 2013.

Falkor

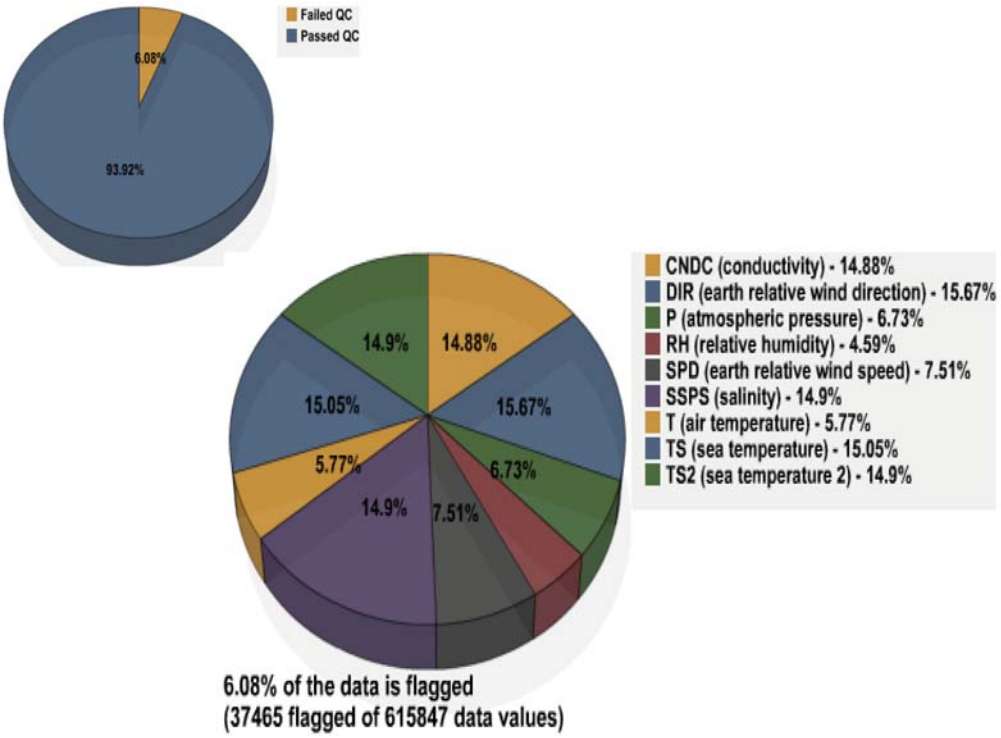


Figure 83: For the *Falkor* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Falkor* provided SAMOS data for 30 ship days, resulting in 615,847 distinct data values. After both automated and visual QC, 6.08% of the data was flagged using A-Y flags (Figure 83). 2013 marks the first year of SAMOS participation for the *Falkor*, and she seems off to a pretty good start; at roughly 6% total flagged, her data is not far off from the coveted < 5% total flagged bracket regarded by SAMOS to represent "very good" data, although it might be noted that so far the sample size is on the small side.

About 60% of the total flags belonged to the four sea water parameters (sea temperature – TS – sea temperature 2 – TS2 – conductivity – CNDC – and salinity – SSPS), and across all four it was almost entirely either caution/suspect (K) or poor quality (J) flagging, depending upon the parameter (Figure 84). Upon inspection, all of these flags, across all four parameters, were incurred almost exclusively when the vessel was in port or the intake pump was otherwise turned off. This is quite a common occurrence, exhibited frequently by many of the other SAMOS vessels, and does not really indicate a problem with the *Falkor* data.

This analyst had made a note over the course of the *Falkor's* 2013 data submission that there does seem to be a fairly minor issue with "steps" in the air temperature, relative humidity, and, occasionally, pressure data. This would occur occasionally when the wind was from the stern, and looking at digital imagery of the vessel that would seem logical, since the exhaust stack appears to be in a more or less direct line behind (and probably a bit lower than) the instrument tower. Nevertheless, this did not result in a lot of flagging.

Taking that into consideration, and taking a look at the whole vessel, this analyst felt she should have to conclude that the *Falkor* instruments are actually quite well-placed.

The only other issue that might be worth a mention is a fair amount of automated "failed the true wind test" (E) flagging of the true wind data, particularly earth relative wind direction (Figure 84, top). This seemed to have occurred more often when the vessel was either in port or just stationary, and as with some other vessels the gyro data could tend to be noisier at those times. Switching to a different GPS to calculate true winds may help alleviate the issue, but it is a relatively minor issue to begin with.

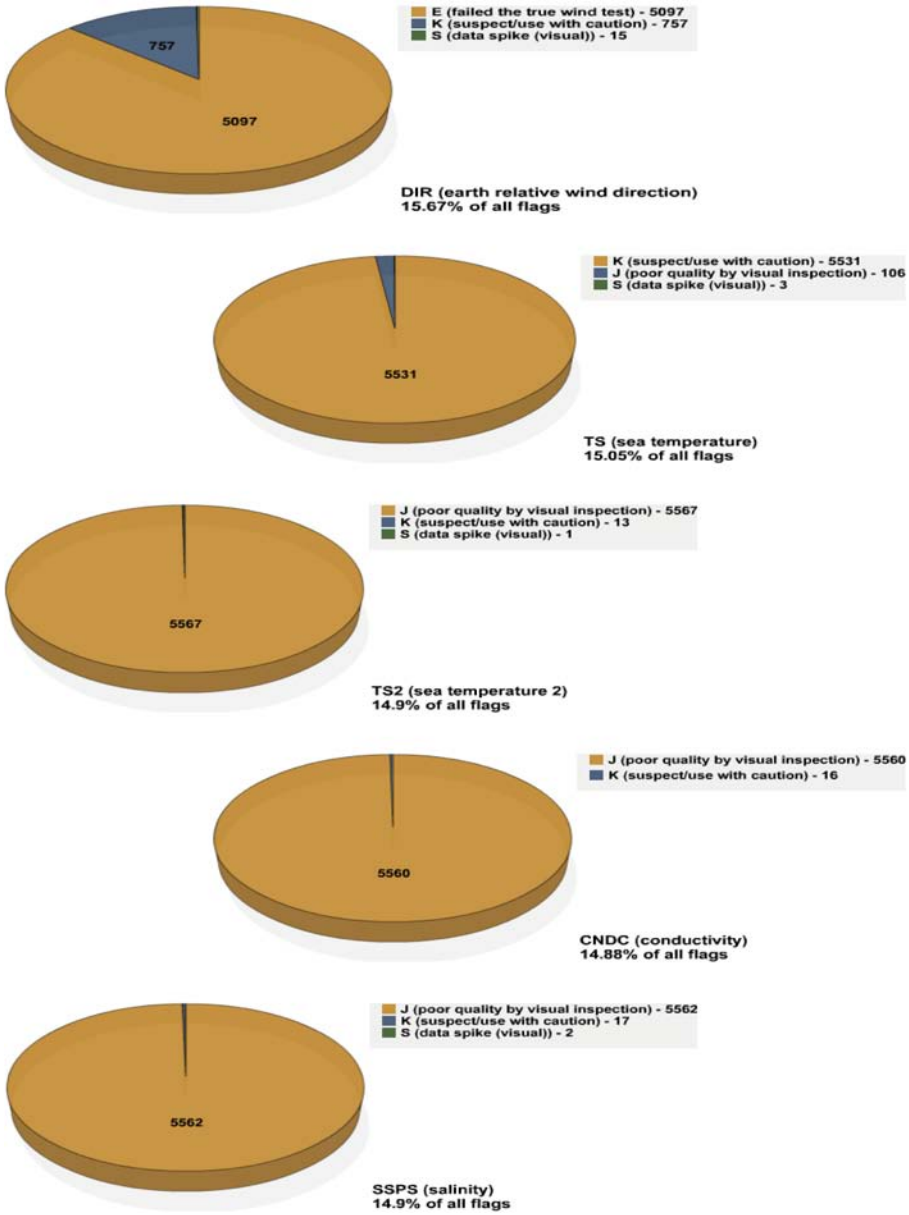


Figure 84: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) sea temperature – TS – (third) sea temperature 2 – TS2 – (fourth) conductivity – CNDC – and (last) salinity – SSPS – for the *Falkor* in 2013.

Kilo Moana

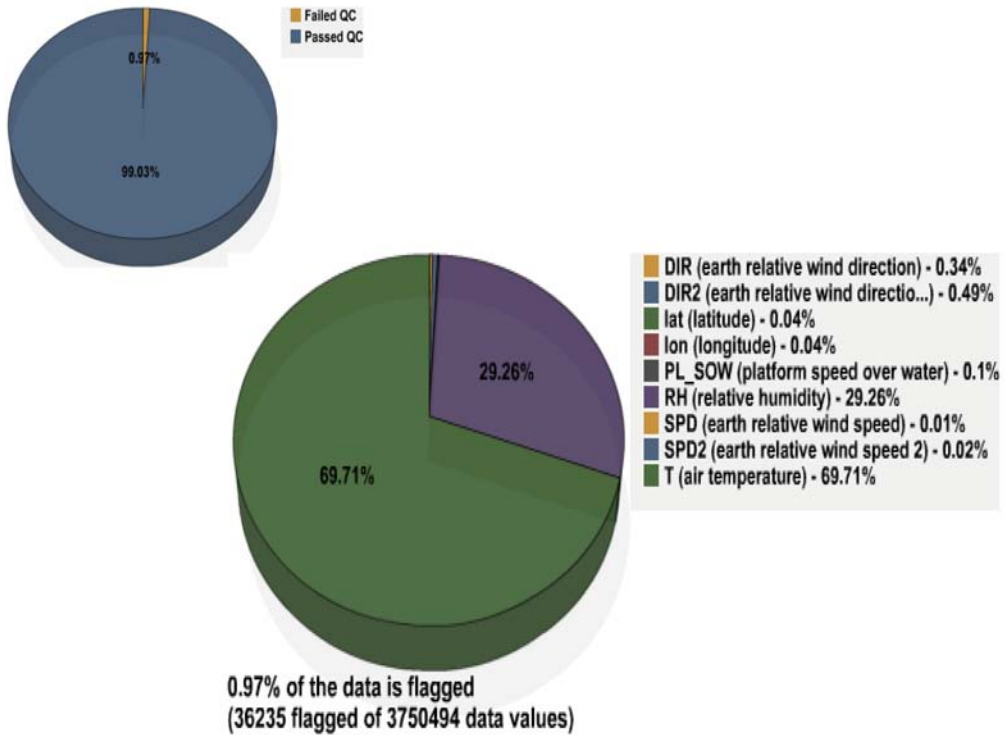


Figure 85: For the *Kilo Moana* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Kilo Moana* provided SAMOS data for 123 ship days, resulting in 3,369,408 distinct data values. After automated QC, 0.97% of the data was flagged using A-Y flags (Figure 85). This is both an extremely low flag percentage and essentially unchanged from 2012. However, due to funding constraints, the *Kilo Moana* does not receive visual QC, which is when the bulk of quality control flags are usually applied. Hopefully resources can be secured in the future for visual QC, as it's entirely within the realm of possibility that *Kilo Moana* would actually represent one of the best research quality data sets at SAMOS, if it were to reach that level.

About 70% of the, again, extremely low number of flags were applied to the air temperature (T), and the approximate remaining 30% were applied to relative humidity (RH), as shown in Figure 85. In the case of RH the flags were entirely out of bounds (B) flags (Figure 86, bottom). These are most likely almost entirely explained by suspected faulty wiring associated with the sensor that lasted about a week. The suspected faulty wiring was discovered after SAMOS personnel alerted the *Kilo* techs that their RH readings were well over 150% for several days in a row in July, all of which was B flagged by the autoflagger. The RH sensor was subsequently swapped out and data returned to normal. Regarding T, the flags are mainly "greater than 4 standard deviations from climatology" (G) flags (Figure 86, top). Because the DAC is not funded to conduct the in-depth investigation for *Kilo Moana* that normally occurs during visual QC, it could not be determined whether these G flags were realistic or whether they represented a

problem with the sensor. It is worth noting that if visual QC had revealed a problem, the flags would likely have been changed to either suspect/caution (K) or poor quality (J) flags so as to avoid any confusion.

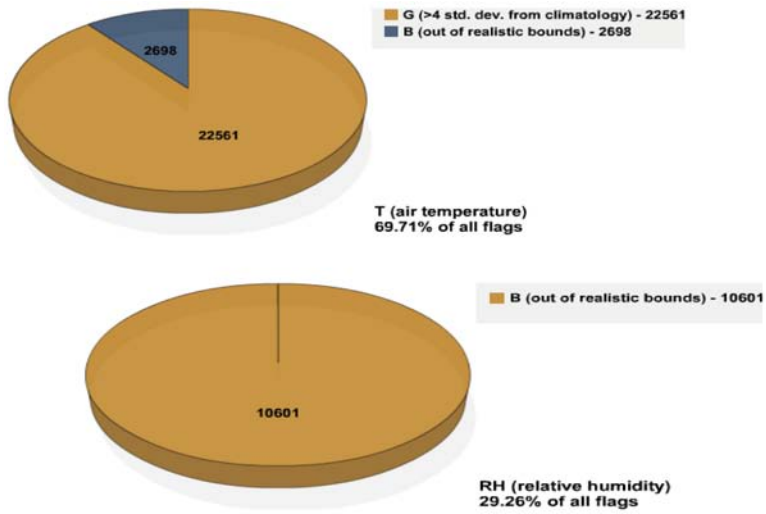


Figure 86: Distribution of SAMOS quality control flags for (top) air temperature – T – and (bottom) relative humidity – RH – for the *Kilo Moana* in 2013.

Thomas G Thompson

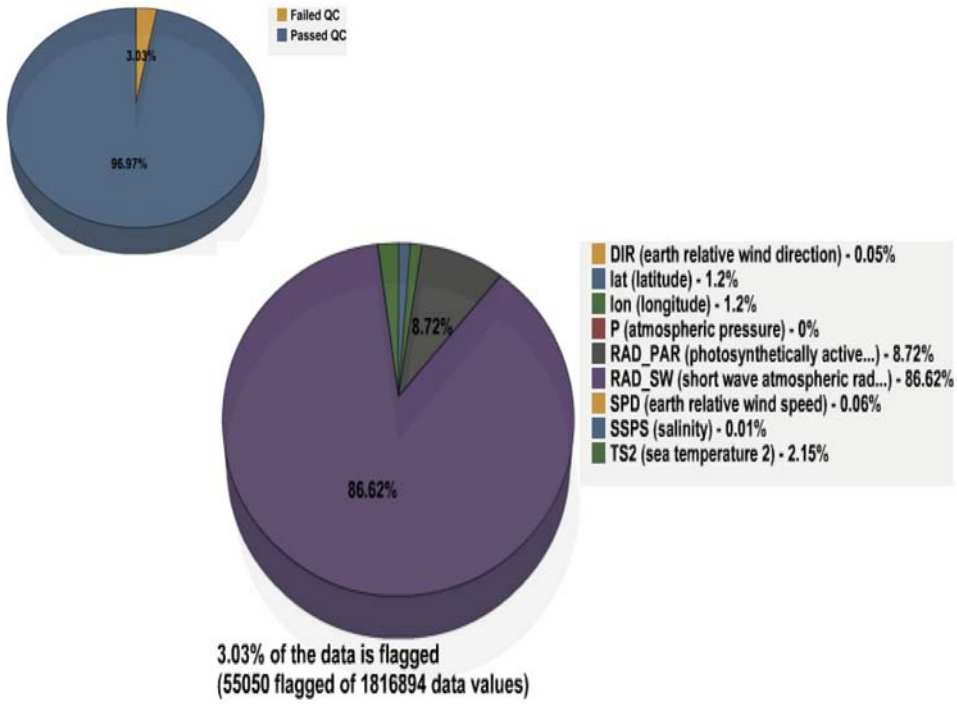


Figure 87: For the *Thomas G Thompson* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

After resolving a long-standing problem with their data acquisition software in October 2013, the *T.G. Thompson* provided SAMOS data for 61 ship days, resulting in 1,816,894 distinct data values. After automated QC, 3.03% of the data was flagged using

A-Y flags (Figure 87). NOTE: the *T.G. Thompson* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Thomas G Thompson*).

The overwhelming majority of the flags applied to the *Thompson* data were applied to short wave atmospheric radiation (Figure 87). These were entirely out of bounds (B) flags (Figure 88), and were entirely anticipated, as *Thompson* personnel advised the DAC via email that they were having issues with the sensor. No other major issues were recorded for the *Thompson* in 2013.

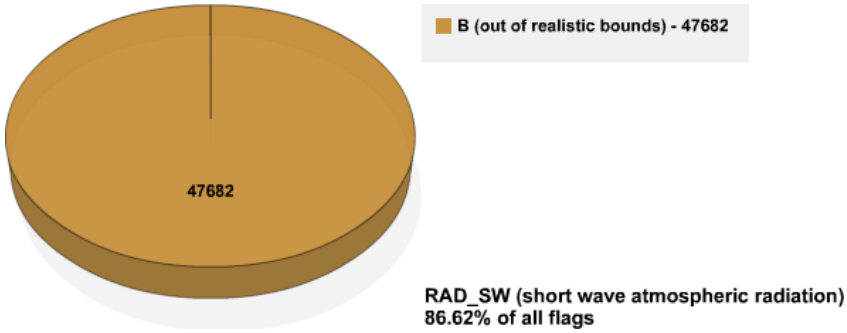


Figure 88: Distribution of SAMOS quality control flags for short wave active atmospheric radiation – RAD_SW – for the *Thomas G. Thompson* in 2013.

Healy

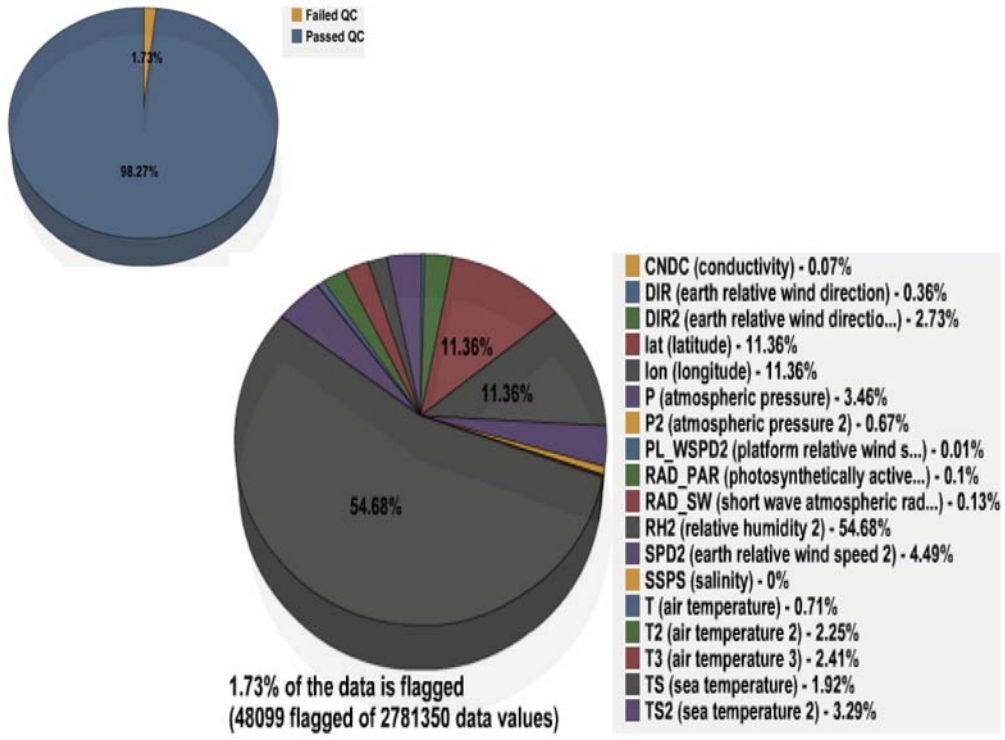


Figure 89: For the *Healy* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Healy* provided SAMOS data for 91 ship days, resulting in 2,781,350 distinct data values. After automated QC, 1.73% of the data was flagged using A-Y flags (Figure 89), which is a huge change from 2012's 12.61% flagged. However, due to funding constraints, the *Healy* did not receive visual QC in 2013 (and will not until such time as funding is extended to cover it). So rather than this greatly reduced percentage of flags signifying greatly improved data, it probably actually, paradoxically, highlights a slight *decrease* in the quality of data available to the public from the *Healy*. (*Healy's* data no longer reaches the "research quality" stage that results from visual quality control being applied.) Visual quality control is generally when the bulk of quality control flags are applied and the *Healy* had a history of multiple data issues prior to 2013, owing in large part to the massive superstructure resident on the vessel. As it stands, with such a low total flag percentage (again, flagging from automated QC only), the authors cannot really conclude anything specific regarding overall data quality in 2013.

Data analysts recall from previous years' visual QC that *Healy's* many sets of redundant sensors often disagreed with each other. This disagreement usually led to caution/suspect (K) flagging in whichever sensor appeared to be compromised and occasionally even poor quality (J) flagging if a sensor appeared obviously handicapped. It's important to note, though, that the flagged data were nevertheless usually still in realistic ranges. With that in mind, it is not too surprising that the total flag percentage is so low for the *Healy* in 2013. These sensor discrepancies and handicaps almost certainly still exist but they are not being caught by the autoflagger. The one standout appears to be the relative humidity 2 parameter (RH2), which holds over half of all the flags applied by the autoflagger in 2013 (Figure 89). The flags applied here are overwhelmingly out of bounds (B) flags (Figure 91). Upon a cursory inspection the flags appear to be applied mainly to readings within a few degrees over 100%; however, it is difficult to discern whether this is a simple instrument tuning issue (a benign situation, see section 3b) or whether the sensor is showing signs of being compromised (see example, Figure 90).

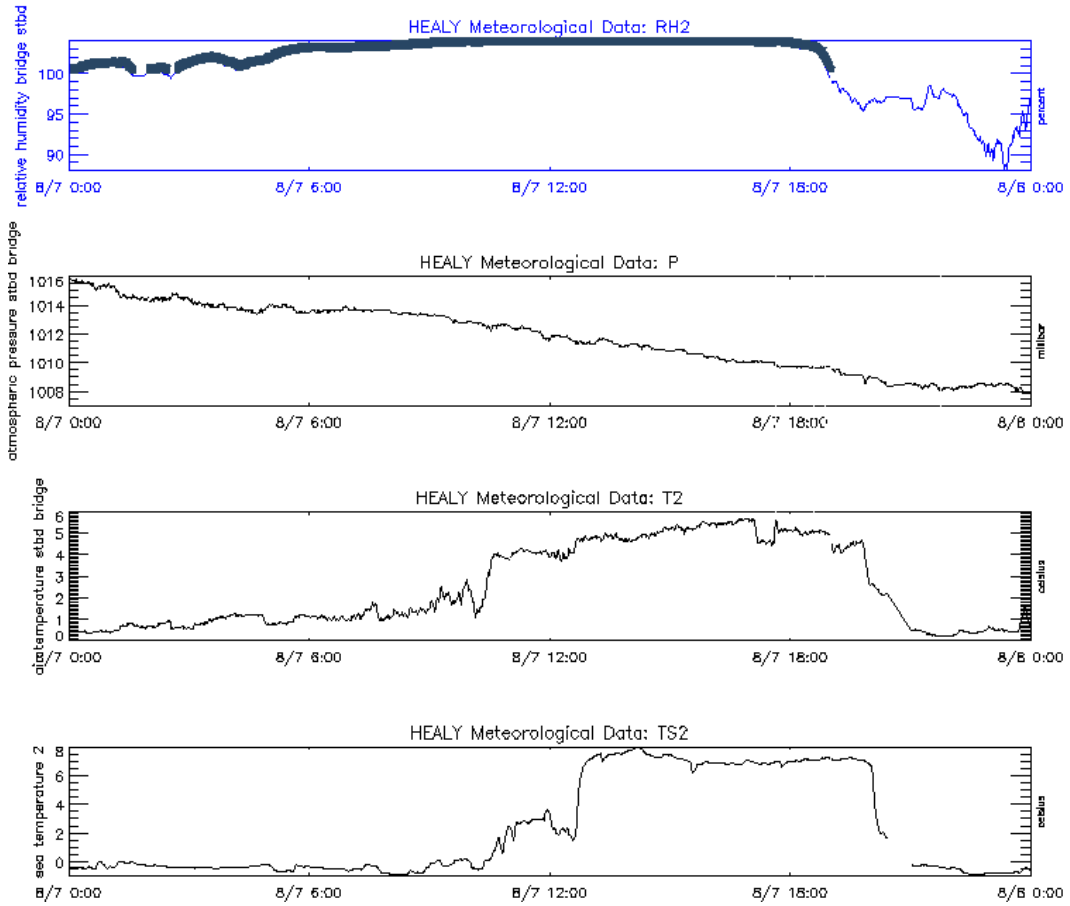


Figure 90: *Healy* SAMOS data for 1 November 2013: (first) relative humidity stbd bridge – RH2 – (second) atmospheric pressure stbd bridge – P – (third) air temperature stbd bridge – T2 – and (last) sea temperature 2 – TS2. Note the B flags applied to RH2 when values are greater than 100%, up to about 105%. Most valid RH sensors that read slightly over 100% in saturation conditions in fact read only *very* slightly over 100%; 105% is higher than we normally see, so it may represent a combination of looser tuning and saturation conditions (note TS2 very close to, if not slightly higher than, T2, as well as falling pressure: these may indicate saturation), OR it may signal a fault with the sensor.

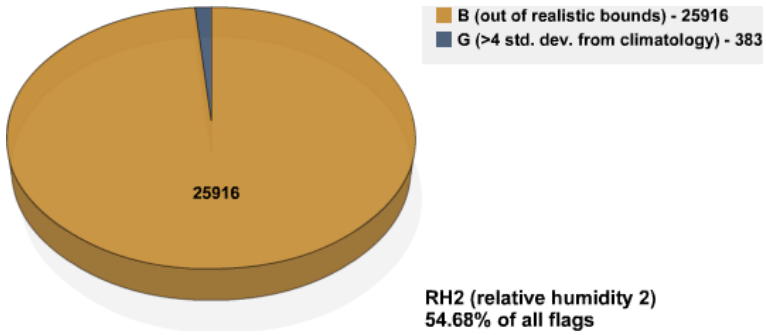


Figure 91: Distribution of SAMOS quality control flags for relative humidity 2 – RH2 – for the *Healy* in 2013.

R/V Atlantis

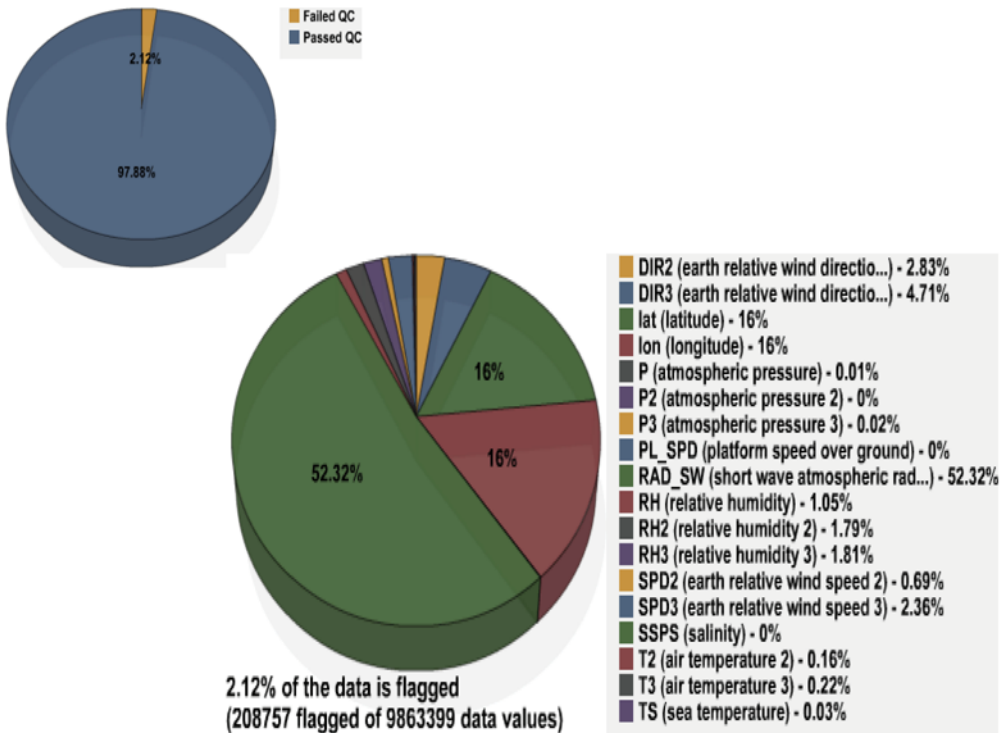


Figure 92: For the *R/V Atlantis* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Atlantis* provided SAMOS data for 258 ship days, resulting in 9,863,399 distinct data values. After automated QC, 2.12% of the data was flagged using A-Y flags (Figure 92). This is a notable decrease from 2012's 7.27% flagged, but it is also important to note that, due to funding constraints, the *Atlantis* did not receive visual QC in 2013 (and will not until such time as funding is extended to cover it). Visual QC is when the bulk of flags are usually applied.

Over 50% of the total flags were applied to the short wave atmospheric radiation parameter (RAD_SW). These were entirely comprised of out of bounds (B) flags (Figure 93), and upon inspection it appears they were overwhelmingly applied simply to data that read slightly below zero at night, a common radiation sensor tuning occurrence (see section 3b). This is no cause for concern. Most of the remainder of the flags were applied to latitude and longitude; these were almost entirely "platform over land" (L) flags (Figure 93). *Atlantis* often transmits port data and these flags are likely a result of that practice. The SAMOS geographic land/water mask in use for determining land positions in 2013 was a two-minute grid. As such, positions that are very close to land are occasionally erroneously L-flagged by the autoflagger. It is interesting to note that these flags likely would have been removed by visual QC.

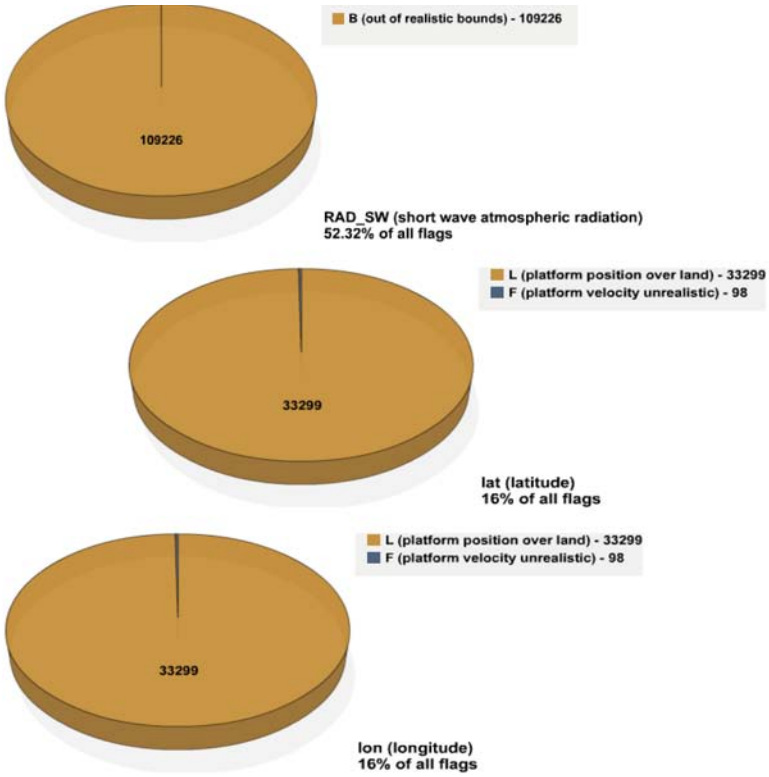


Figure 93: Distribution of SAMOS quality control flags for (top) short wave atmospheric radiation – RAD_SW – (middle) latitude – lat – and (bottom) longitude – lon – for the *R/V Atlantis* in 2013.

R/V Knorr

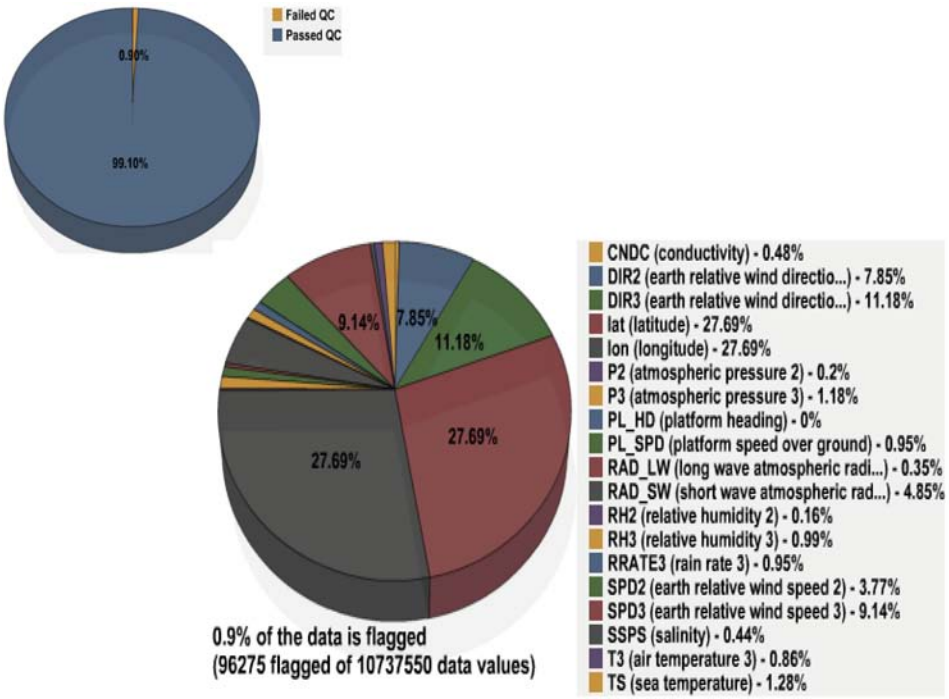


Figure 94: For the *R/V Knorr* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Knorr* provided SAMOS data for 268 ship days, resulting in 10,737,550 distinct data values. After automated QC, 0.9% of the data was flagged using A-Y flags (Figure 94). This is a huge decrease from 2012's 11.85% flagged, but it is important to note that like the *Atlantis*, due to funding constraints, the *Knorr* did not receive visual QC in 2013 (and will not until such time as funding is extended to cover it). Visual QC is when the bulk of flags are usually applied.

With such a minuscule total flag percentage, it would be unwise to base any judgment of 2013 *Knorr* data quality solely on the autoflagger-applied flags. Indeed, the total flag percentage belies some known data issues in 2013 that came to light via email correspondence between SAMOS staff and *Knorr* technical personnel. The first of these was that the MET tower was occasionally down for maintenance while the data logger was kept running. This has always been a fairly common practice for the WHOI vessels, and almost always results in some unreliable, though still within realistic bounds, data. In the past this data would have been flagged by the visual qc analyst (the autoflagger is highly unlikely to have caught anything in this type of situation), but as is fairly obvious from the 0.9% total flagged percentage much or all of this data was left untouched by flags in 2013. A second known issue involved a buffering issue that affected the *Knorr's* GYRO feed, in turn affecting the true wind calculations. This issue wasn't discovered until at least a month after it began, meaning there was a significant period of time during which the true winds being reported to SAMOS were technically inaccurate, though likely still within realistic bounds and thus unlikely to have been caught and flagged by the autoflagger. Visual QC procedures could have addressed the issue but again, unfortunately, visual QC of the *Knorr's* data was a casualty of budget cuts in 2013.

Ironically, the two standouts of the very small flag total flag percentage – latitude and longitude, together holding over 50% of the flags (Figure 94) – actually likely would have had their flags *removed* by visual qc. They are almost exclusively land error (L) flags (Figure 95), and much like the *Atlantis* the flags were likely a result of the practice of transmitting port data. The SAMOS geographic land/water mask in use for determining land positions in 2013 was a two-minute grid and it is not uncommon for positions very close to land to be erroneously L flagged by the autoflagger.

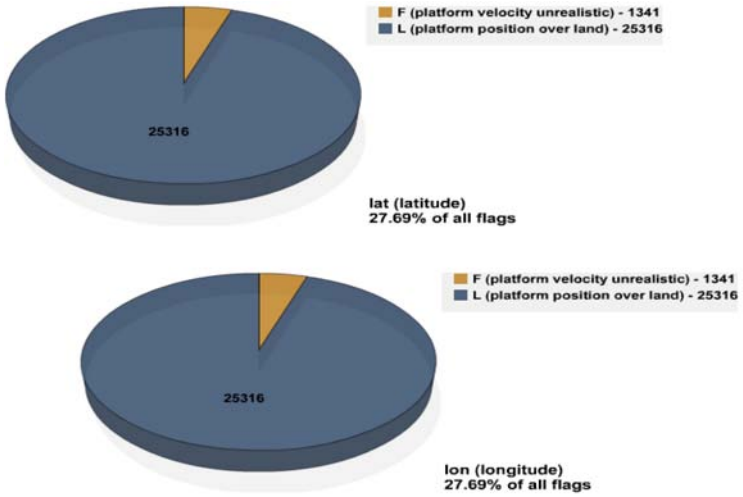


Figure 95: Distribution of SAMOS quality control flags for (top) latitude – lat – and (bottom) longitude – lon – for the *R/V Knorr* in 2013.

4. Metadata summary

Adequate metadata is the backbone of good visual QC. As such, vessel operators are strongly advised to keep vessel and parameter metadata complete and up to date. Annex A, Part Two walks SAMOS operators through editing metadata online, step by step, while Part One offers instructions for monitoring metadata and data performance. For vessel metadata, the following are the minimum required items in consideration for completeness: Vessel information requires vessel name, call sign, IMO number, vessel type, operating country, home port, date of recruitment to the SAMOS initiative, and data reporting interval. Vessel layout requires length, breadth, freeboard, and draught measurements. Vessel contact information requires the name and address of the home institution, a named contact person and either a corresponding email address or phone number, and at least one onboard technician email address. A technician name, while helpful, is not vital. Note that for the IMOS ships *Aurora Australis* and *Southern Surveyor*, while Vessel contact information is considered "incomplete" in Table 3, there is intentionally no onboard contact information, at the discretion of the Australian Bureau of Meteorology. Vessel metadata should also include vessel imagery (highly desirable, see Figure 96 for examples) and a web address for a vessel's home page, if available.

Parameter metadata requirements for completeness vary among the different parameters, but in all cases "completeness" is founded on filling in all available fields in the SAMOS metadata form for that parameter, as demonstrated in Figure 97. (Any questions regarding the various fields should be directed to samos@coaps.fsu.edu. Helpful information may also be found at http://samos.coaps.fsu.edu/html/docs/samos_metadata_tutorial_p2.pdf, which is the metadata instruction document located on the SAMOS web site.) In this example (Figure 97 b.), as is frequently the case, the only missing field is the date of the last instrument calibration. Calibration dates may be overlooked as important metadata, but there are several situations where knowing the last calibration date is helpful. For example, if a bias or trending is suspected in the data, knowing that a sensor was last calibrated several years prior may strongly support that suspicion. Alternatively, if multiple sensors give different readings, the sensor with a more recent last calibration date may be favored over one whose last calibration occurred years ago. The authors wish to point out that the field "Data Reporting Interval" erroneously appears in several of the parameters. This field is actually only applicable to the time parameter and the Vessel information metadata. The erroneous field needs to be removed and was not considered for completeness of any parameter in Table 3. Through our new online self-service Subscription and Report services (found at https://samos.coaps.fsu.edu/html/subscription/index.php), metadata summary tables for each ship can be viewed/downloaded at any time. To request login credentials for the subscription and report service, please send an email to samos@coaps.fsu.edu. The most recent version of these for all active ships is included in Annex B.

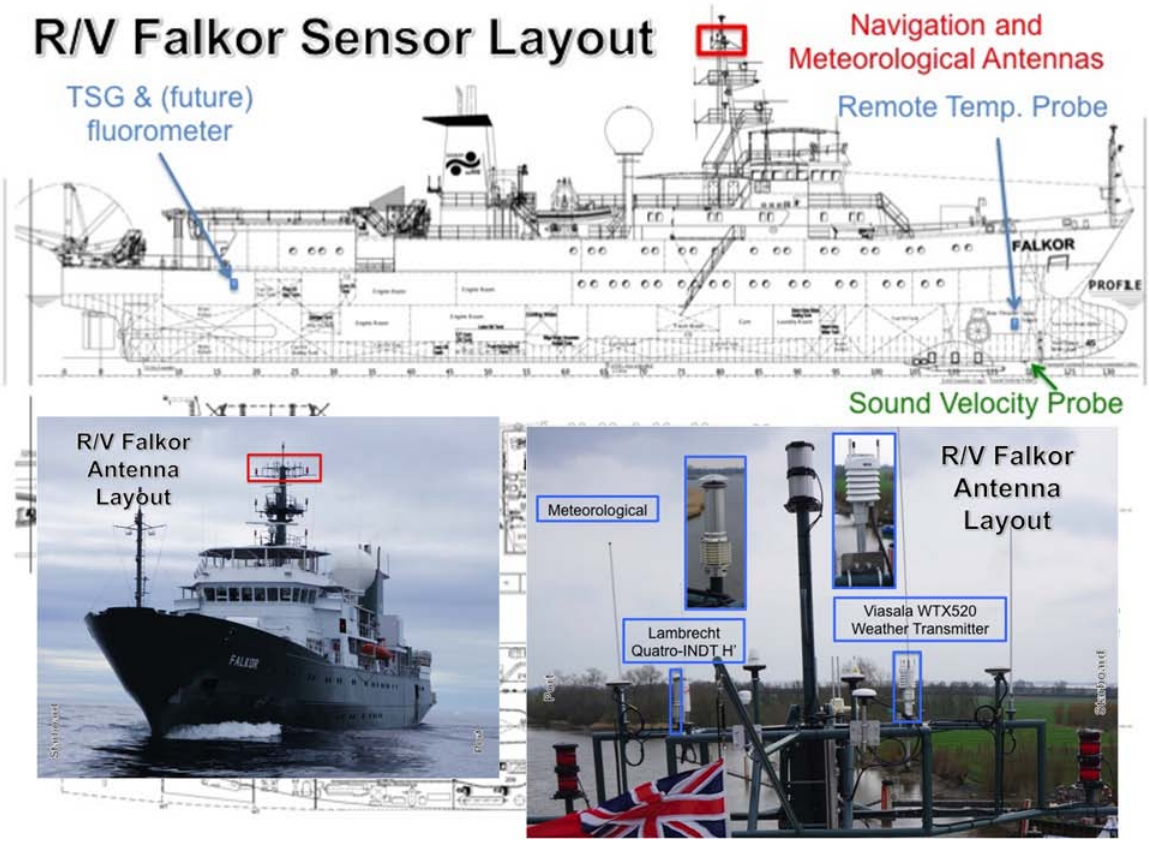


Figure 96: Examples of detailed vessel instrument imagery from the *R/V Falkor*.

a.

sea temperature

Designator		Date Valid	
SST		06/01/2005 to Today	
Descriptive Name	Original Units	Instrument Make & Model	Last Calibration
sea temperature	celsius	Falmouth Science Inc. OTM-S-212 (OTM1378)	August 2004
TS Sensor Category	Observation Type	Distance from Bow	Distance from Center Line
12	measured	0	0
Height	Average Method	Averaging Time Center	Average Length
-5.4	average	time at end of period	1
Sampling Rate	Data Precision		
4	0.01		

b.

sea temperature

Designator		Date Valid	
SST		05/09/2005 to Today	
Descriptive Name	Original Units	Instrument Make & Model	Last Calibration
sea temperature	celsius	Sea-bird SBE48 Hull Sensor	
TS Sensor Category	Observation Type	Distance from Bow	Distance from Center Line
hull contact sensor	measured	0	0
Height	Average Method	Averaging Time Center	Average Length
-5	average	time at end of period	1
Sampling Rate	Data Precision		
4	0.01		

Figure 97: Example showing parameter metadata completeness (a.) vs. incompleteness (b.). Note missing information in the "Last Calibration" field in (b.)

Following the above guidelines for completeness, Table 3 summarizes the current state of all SAMOS vessel and parameter metadata:

	Vessel Info	Contact Info	Vessel Layout	Digital Imagery	LAT	LON	HD	CRS	PL SPD	PL WSPD	PL WDIR	SPD	DIR	T	Td	Tw	P	RH	PRECIP	R RATE	LW	SW	NET RAD	PAR	TS	CON	SAL
KAOU	C	C	I	No	I	I	I	I	I	I	I	I	I	I	I		LI	I	I		I	I		I	LI,I	LI	LI
KAQP	C	C	C	Yes	I	I	I	I	I	C,I,I	C,I,I	C,I,I	C,I,I	C,I,I			C,I,I	C,I,I	C,I,I	I,I,I	I	C			C	I	C
KCEJ	C	C	C	Yes	I	I	I	I	I	C,I,I	C,I,I	C,I,I	C,I,I	C,I,I			C,I,I	C,I,I	LI	C,I,I	I	I			I	I	I
KTDQ	C	C	C	No	I	I	I	I	I,C	I	I	I	I	I			C	C			C	C		I	C,C	C	C
NEPP	C	C	I	Yes	I	I	LI	I	LI,I	C,C	C,C	C,C	C,C	C,C,C	C,C		C,C	C,C	C		C,C	C		C	C,C	C	C
NRUO	I	I	I	No	I	I	I	LI	LI	LI	LI	LI	LI	I			I	I							LI		I
VLHJ	C	I	I	Yes	I	I	LI	I	I	C,C	C,C	LI	LI	C,C			I	C,C	C,C	C	C,C	C,C		C	I		
VNAA	C	I	C	No	I	I	LI	I	I	LI	LI	LI	LI	LI			I	LI	LI	I	LI	LI		LI	I		
WBP3210	C	I	I	Yes	I	I	I	I	I	LI	LI	LI	LI	I			I	I			I	I		I	I	I	I
WCE5063	I	I	I	No	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
WCX7445	C	C	C	Yes	I	I	I	I	I	LI	LI	LI	LI	I			I	I					LI	I	LI	I	I
WDA7827	C	C	C	No	I	I	LI	I	I	LI	LI	LI	LI	I			I	I	LI	I	I				I		I
WDC9417	C	C	C	Yes	I	I	LI	I	I	LI	LI	LI	LI	I			I	I							LI	I	I
WECB	C	C	I	No	I	I	I	I	I	I	I	I	I	LI	I		LI	I	I		I	I		I	I	I	I
WKWB	I	I	I	No	I	I	I	I	I	LI	LI	C,I	C,I	C,C			C,C	C	C		C	C		C	LI	I	I
WSQ2674	I	I	I	No	I	I	I	I	I	I	I	I	I	LI			LI	I	I					I	I		
WTDF	C	C	C	No	I	I	I	I	LI,I	I	I	I	I	I			I	I			I	I			I	I	I
WTDH	C	C	I	Yes	I	I	I	I	I	I	I	I	I	I			C	I							LI	I	I
WTDL	I	I	I	Yes	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTDO	I	I	I	No	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEA	C	C	C	No	I	I	I	I	I	I	I	I	I	I	I	I	I	I							I		
WTEB	I	I	I	No	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEC	C	C	I	No	I	I	I	I	I	I	I	I	I	I			I	I				I			I	I	I
WTED	C	C	C	No	I	I	I	I	I	LI	LI	LI	LI	LI			I	LI			I	I			I	I	I
WTEE	C	C	C	No	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEF	I	I	I	No	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEJ	I	I	I	No	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEO	C	I	I	Yes	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEP	C	C	I	Yes	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTER	C	C	I	Yes	I	I	I	I	I	I	I	I	I	I			I	I							LI	I	I
WTEY	C	C	I	Yes	I	I	I	I	I	I	I	I	I	I			LI	I							I	I	I
ZCYL5	C	C	C	Yes	I	I	I	I	LI,I	C	C	C	C	C			C	C							C,C	C	C
ZMFR	I	I	I	No	I	I	I	I	I			C	C	C			I	C	I		LI	LI			I		

Table 3: Vessel and parameter metadata overview. "C" indicates complete metadata; "I" indicates incomplete metadata. Under "Digital Imagery," "Yes" indicates the existence of vessel/instrument imagery in the SAMOS database, "No" indicates non-existence. Empty boxes indicate non-existence of a parameter; multiple entries in any box indicate multiple sensors for that parameter and vessel.

5. Plans for 2014

As the SAMOS initiative moves into its second decade following the workshop where the concept was born (http://coaps.fsu.edu/RVSMDC/marine_workshop/Workshop.html), the SAMOS chairman would like to personally thank all of the technicians, operators, captains, and crew of the SAMOS research vessels for their dedication to the project. The data center team would also like to thank personnel within our funding agencies, NOAA OMAO, NOAA NODC, NOAA ESRL, Australian IMOS project, and the Schmidt Ocean Institute (our newest collaborator) for their support of the SAMOS initiative.

The SAMOS DAC also recognizes an ongoing partnership with the Rolling deck To Repository (R2R; http://www.rvdata.us/overview) project. Funded by the National Science Foundation, R2R is developing a protocol for transferring all underway data (navigation, meteorology, oceanographic, seismic, bathymetry, etc) collected on U. S. University-National Oceanographic Laboratory System (UNOLS) research vessels to a central onshore repository. During 2013, the university-operated vessels contributing to the SAMOS DAC were those operated by URI, WHOI, SIO, UH, UW, and BIOS. The focus of the R2R is capturing all these data at the end of each planned cruise; however, the SAMOS DAC is using SAMOS1.0 and developing the SAMOS2.0 real-time protocols to transfer a subset of meteorological and surface-oceanographic data from ship to shore. The SAMOS2.0 prototype was completed and tested in 2012 using an extensible mark-up language (XML) format that was developed in consultation with Oregon State University and the University of Rhode Island; however, challenges with satellite communications on the *Endeavor* revealed flaws in the SAMOS2.0 design. More testing will be needed before this protocol can become fully operational.

In 2014 we hope once again to expand and improve our automated quality control procedures in 2013. The experience from past visual QC will allow us to develop new procedures that will streamline the QC process and reduce visual analyst time spent on individual data streams. Implementing a new land check routine with a one-minute resolution land mask and creating a constant value check will be priorities. This change is necessary in the face of reducing budgets and an increased number of vessels contributing to SAMOS. The chairman does wish to note that failure to conduct full visual quality control does degrade the quality of the data being provided to our users. Automated QC will never be able to replace a set of experienced “eyes on the data”.

Finally, in an effort to improve communication with our data providers, vessel operators, and shipboard technicians, we plan to build a JSON web service to provide the content from our data subscription service. This was requested by several operators who prefer a machine-harvestable interface as opposed to an email subscription. Available reports include monitoring the “date since last receipt” for data flowing to the SAMOS data center along with access to monthly quality control flag and metadata summaries. We are open to suggestions and ask operators and technicians to feel free to contact us at samos@coaps.fsu.edu.

6. References

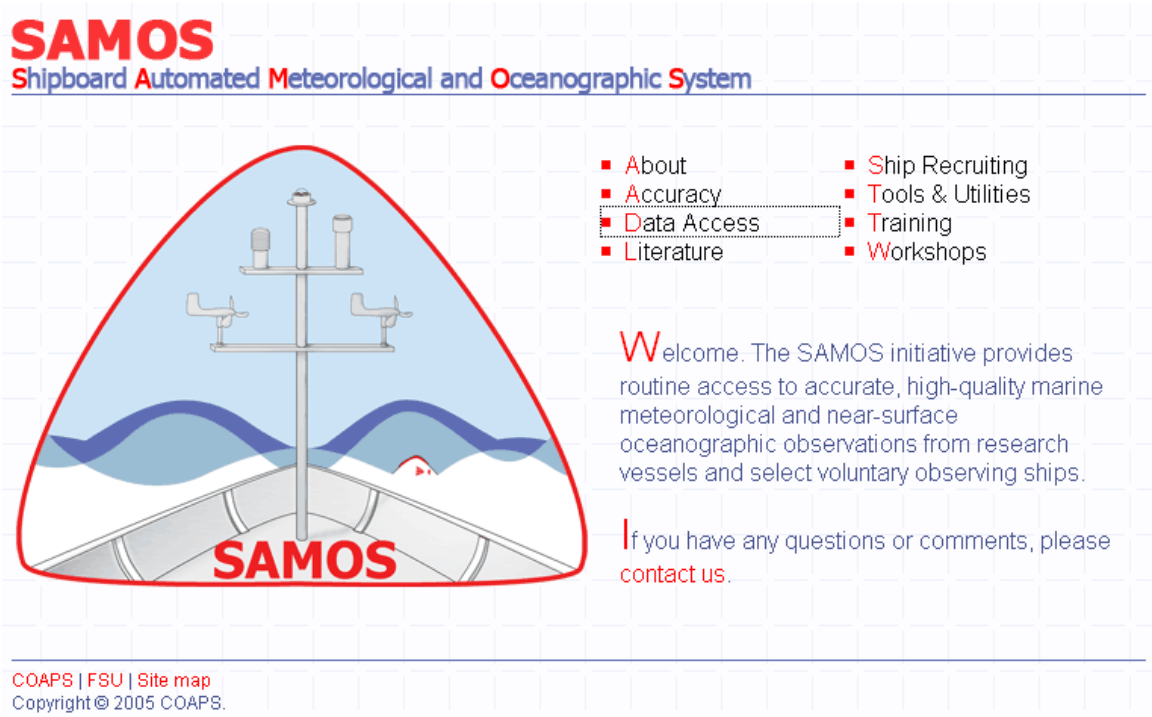
The Australian Integrated Marine Observing System, 2008: *J. Ocean Technology* **3**(3), 80-81.

Pieter R. Wiederhold, cited 2010: True Accuracy of Humidity Measurement. [Available online at http://archives.sensorsmag.com/articles/0997/humidity/index.htm.]

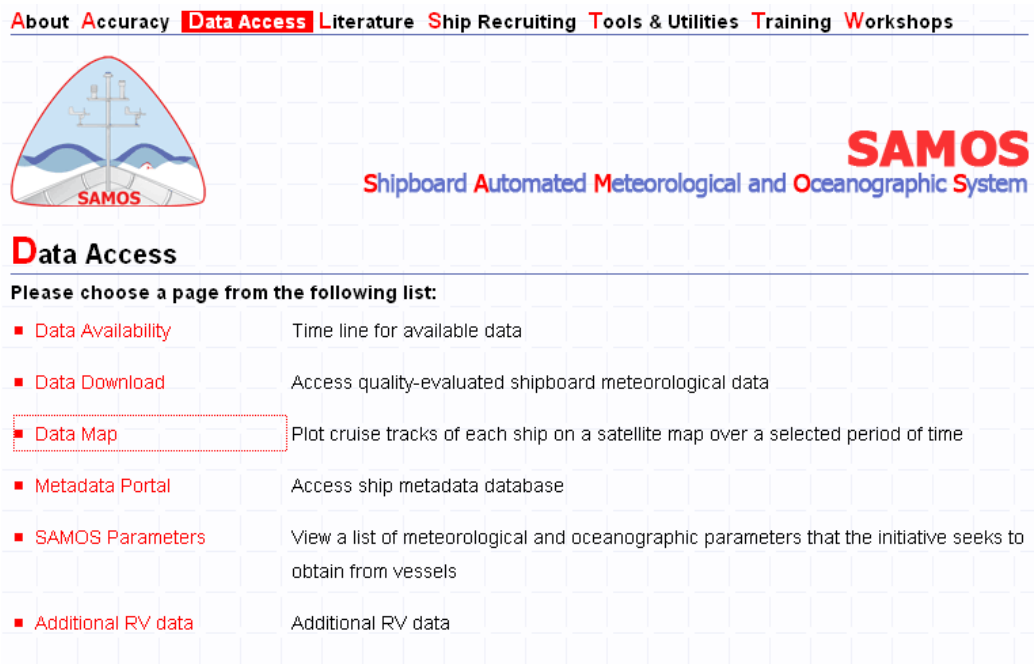
Annex A: SAMOS Online Metadata System Walk-through Tutorial

PART 1: the end user

The SAMOS public website can be entered via the main page at
http://samos.coaps.fsu.edu/html/

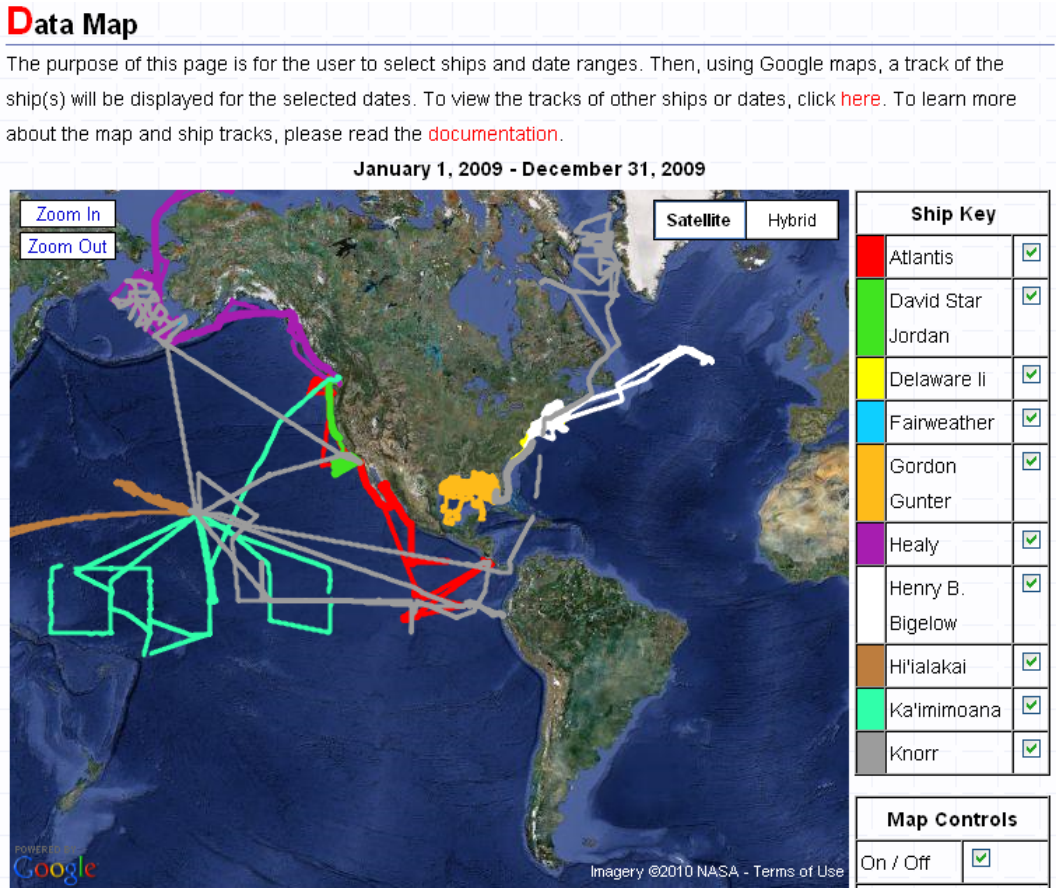


By choosing the Data Access link (boxed area), the user can access preliminary, intermediate, and research-quality data along with graphical representations of data availability and quality. As an example, consider the user who wants to find 2009 in situ wind and temperature data for the north-polar region. The first step would be to identify which ships frequented this area in 2009. To do so, choose Data Map on the Data Access page:

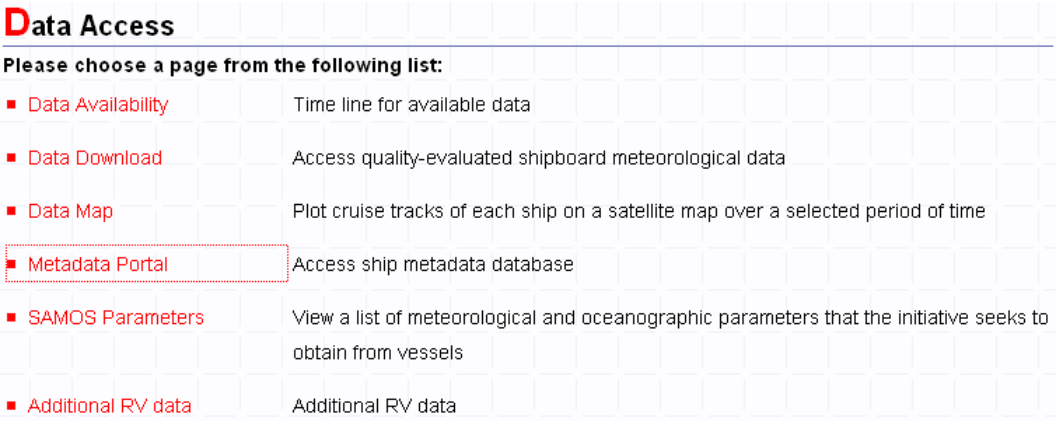


The user highlights a set of ships from the available list (10 ships may be chosen at a time):

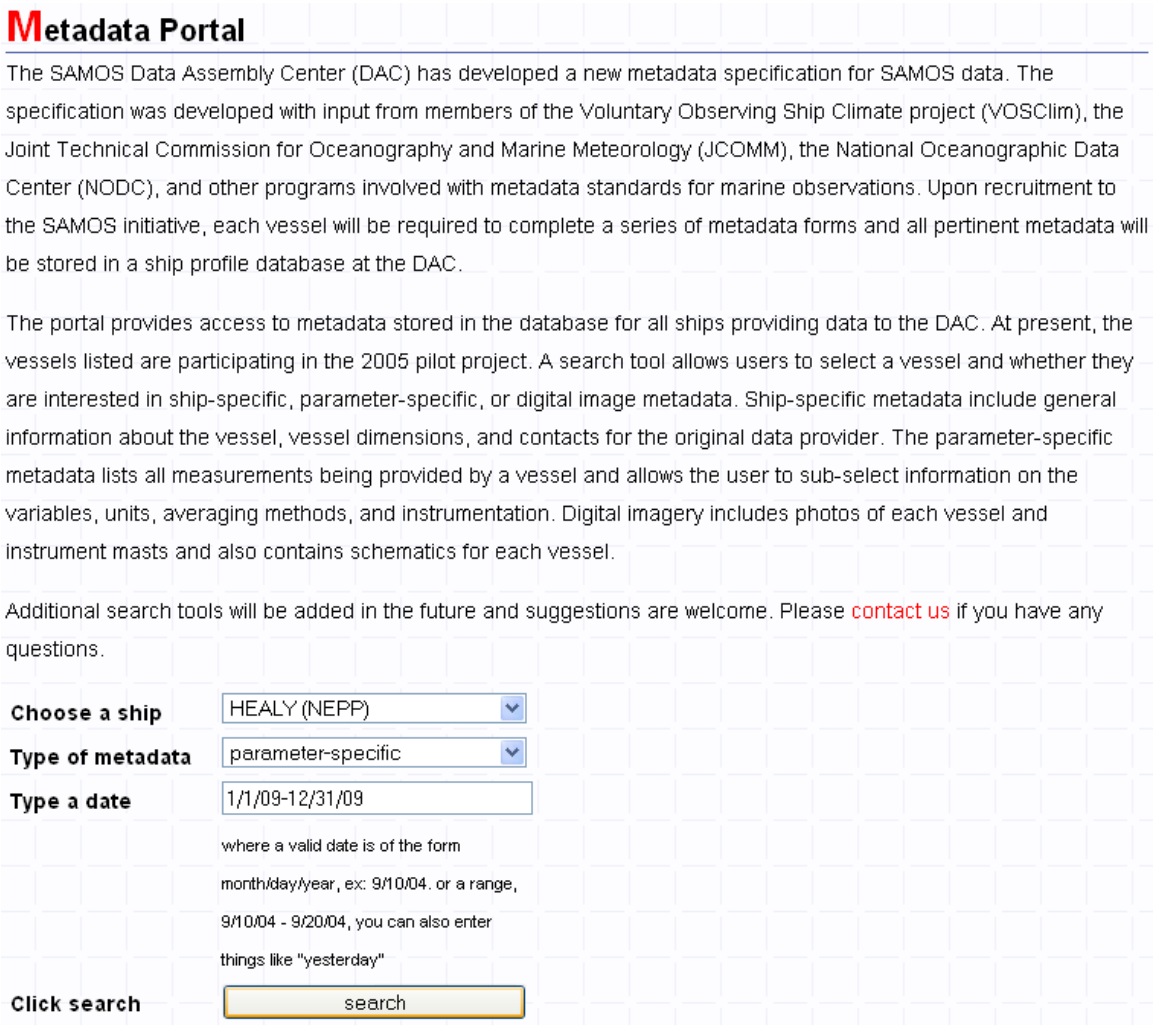
By entering a date range of January 1, 2009 to December 31, 2009 and clicking "search," a map is displayed showing all of the selected ship's tracks for the year 2009:



Now the user can see that both the *Healy* and the *Knorr* cruised in the north-polar region in 2009. The next step might be to see what parameters are available on each ship. Returning to the Data Access page, the user this time selects the Metadata Portal:



and first inputs the proper information for the *Healy*:



Metadata Portal

The SAMOS Data Assembly Center (DAC) has developed a new metadata specification for SAMOS data. The specification was developed with input from members of the Voluntary Observing Ship Climate project (VOSClim), the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), the National Oceanographic Data Center (NODC), and other programs involved with metadata standards for marine observations. Upon recruitment to the SAMOS initiative, each vessel will be required to complete a series of metadata forms and all pertinent metadata will be stored in a ship profile database at the DAC.

The portal provides access to metadata stored in the database for all ships providing data to the DAC. At present, the vessels listed are participating in the 2005 pilot project. A search tool allows users to select a vessel and whether they are interested in ship-specific, parameter-specific, or digital image metadata. Ship-specific metadata include general information about the vessel, vessel dimensions, and contacts for the original data provider. The parameter-specific metadata lists all measurements being provided by a vessel and allows the user to sub-select information on the variables, units, averaging methods, and instrumentation. Digital imagery includes photos of each vessel and instrument masts and also contains schematics for each vessel.

Additional search tools will be added in the future and suggestions are welcome. Please contact us if you have any questions.

Choose a ship HEALY (NEPP)

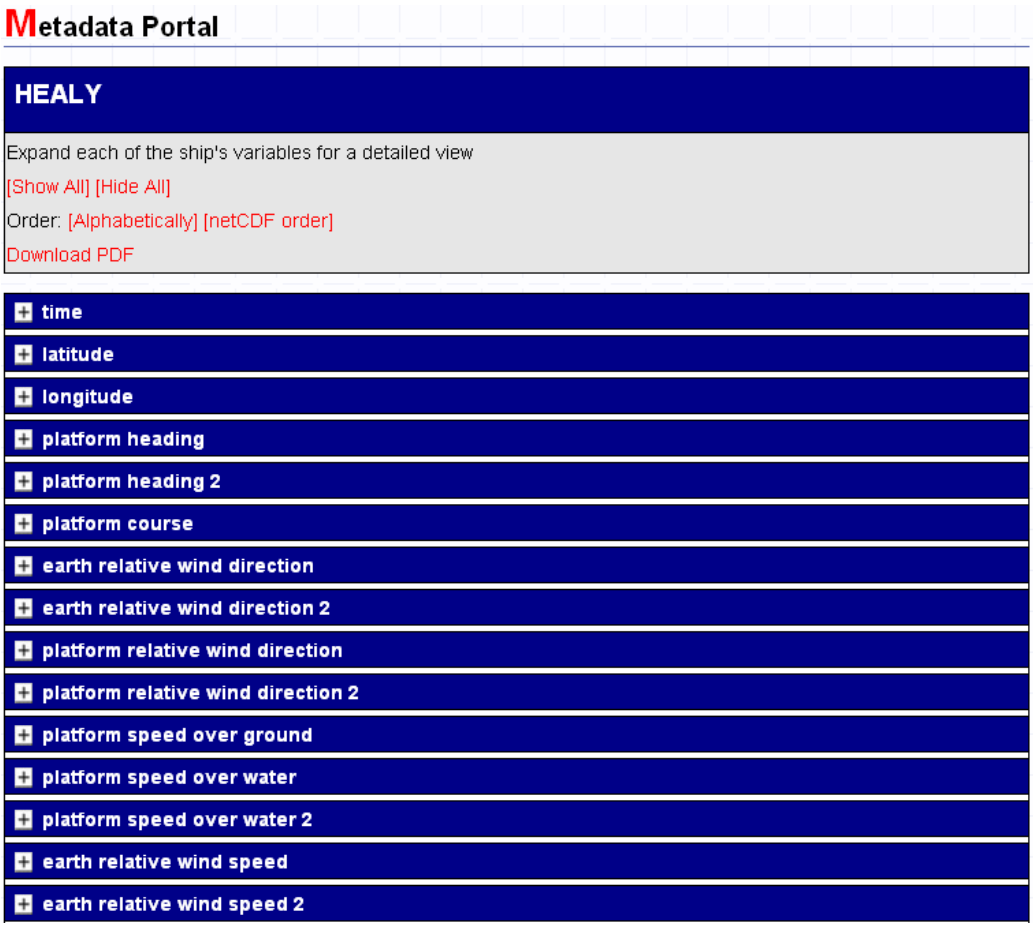
Type of metadata parameter-specific

Type a date 1/1/09-12/31/09

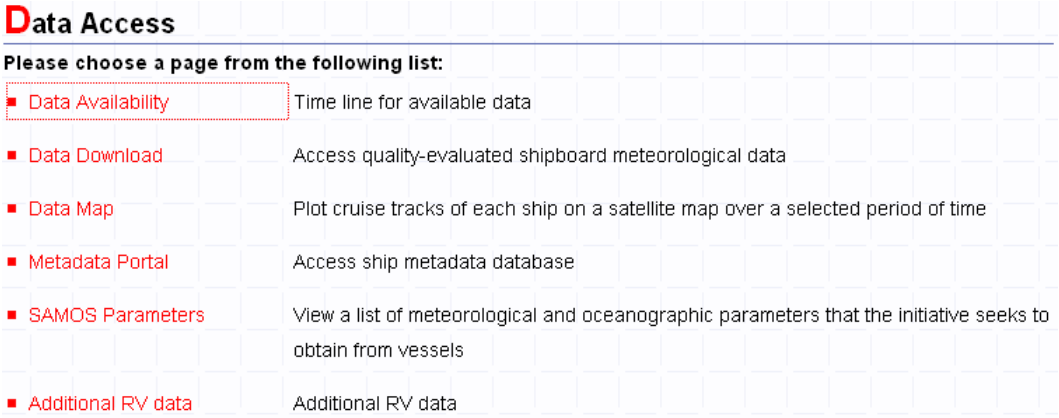
where a valid date is of the form month/day/year, ex: 9/10/04. or a range, 9/10/04 - 9/20/04, you can also enter things like "yesterday"

Click search search

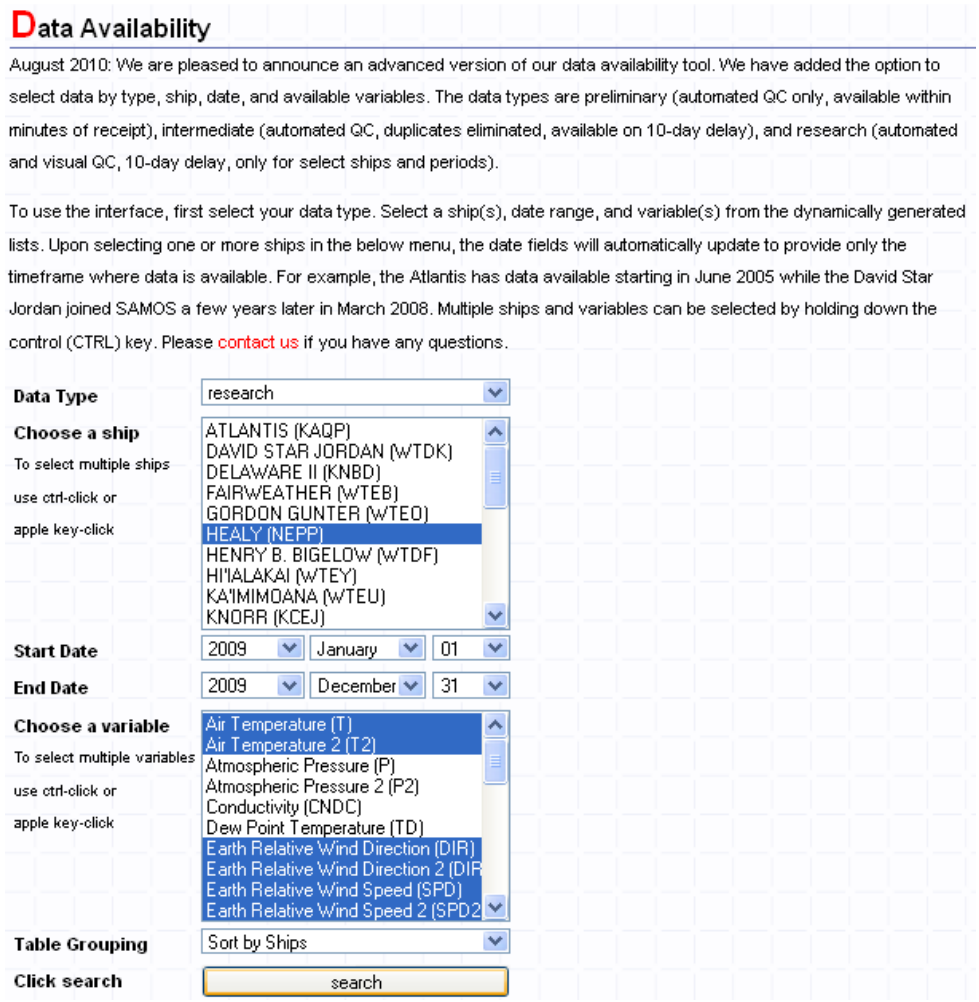
The result, once "search" is clicked, is an exhaustive list of all parameters available from the *Healy* in 2009:



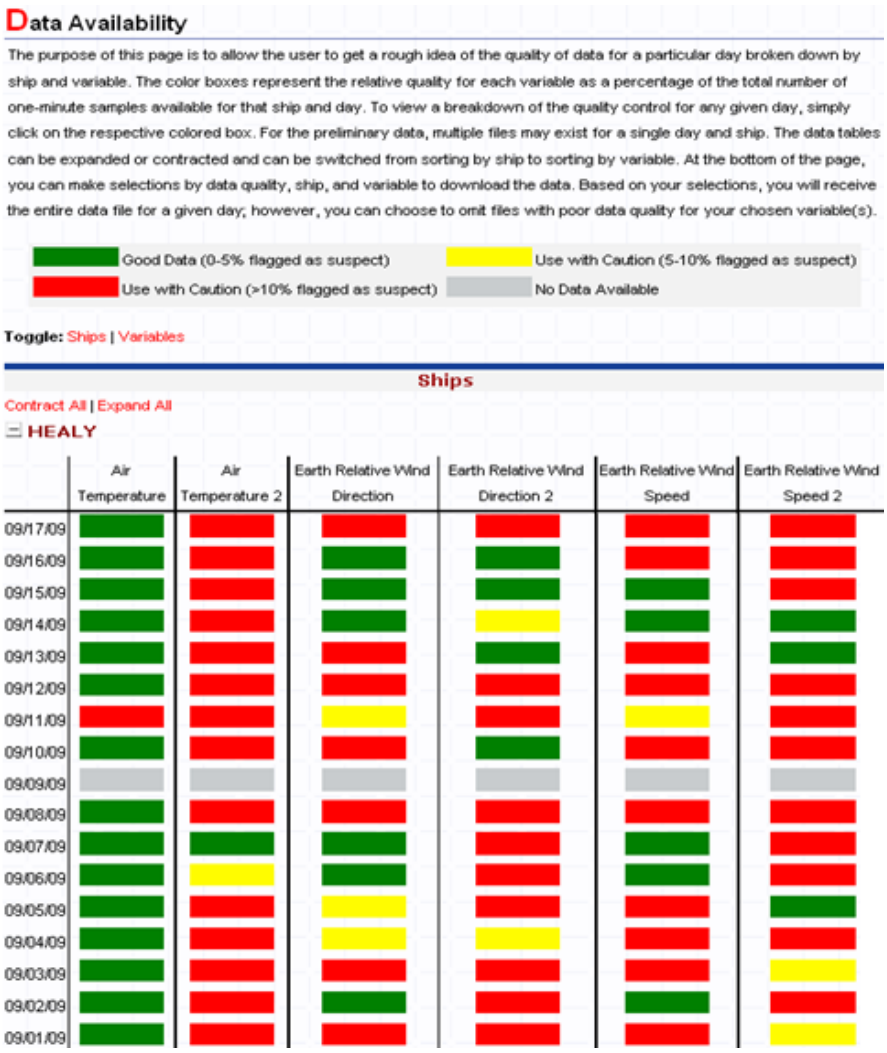
A thorough investigation of the list (note: image is truncated) tells the user the *Healy* did in fact provide both wind and temperature data in 2009. (Throughout the online SAMOS system, clicking on a "+" will yield further information; in this case the result would be metadata for the individual parameters.) Now the user will want to know the quality of the wind and temperature data. To find that, he returns once again to the Data Access page and this time chooses Data Availability:



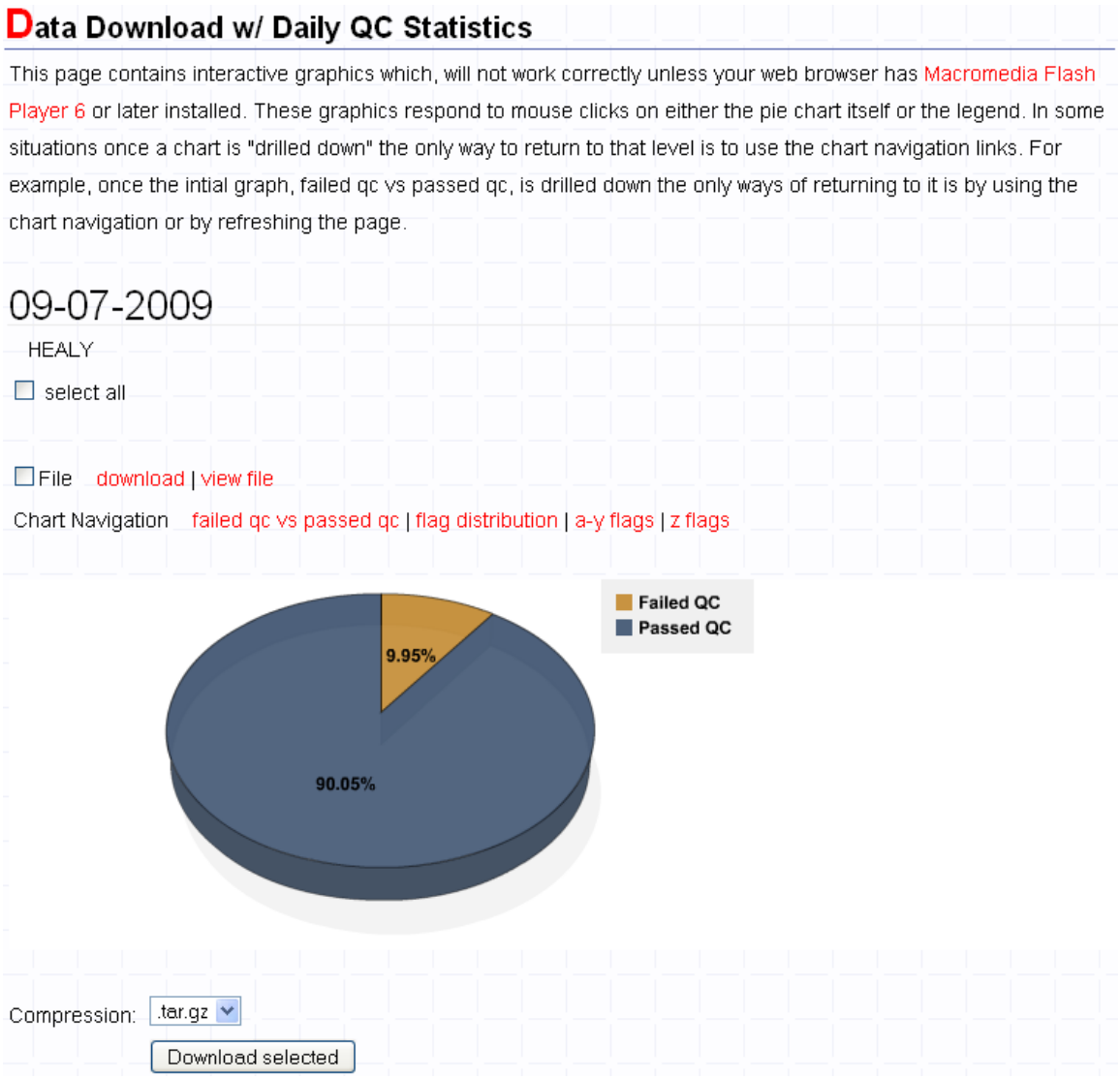
After selecting the *Healy* along with the desired parameter(s), date range, and data version (preliminary, intermediate, or research), noting that the default date range and available parameters will change once a vessel and data version are selected, and then clicking "search":



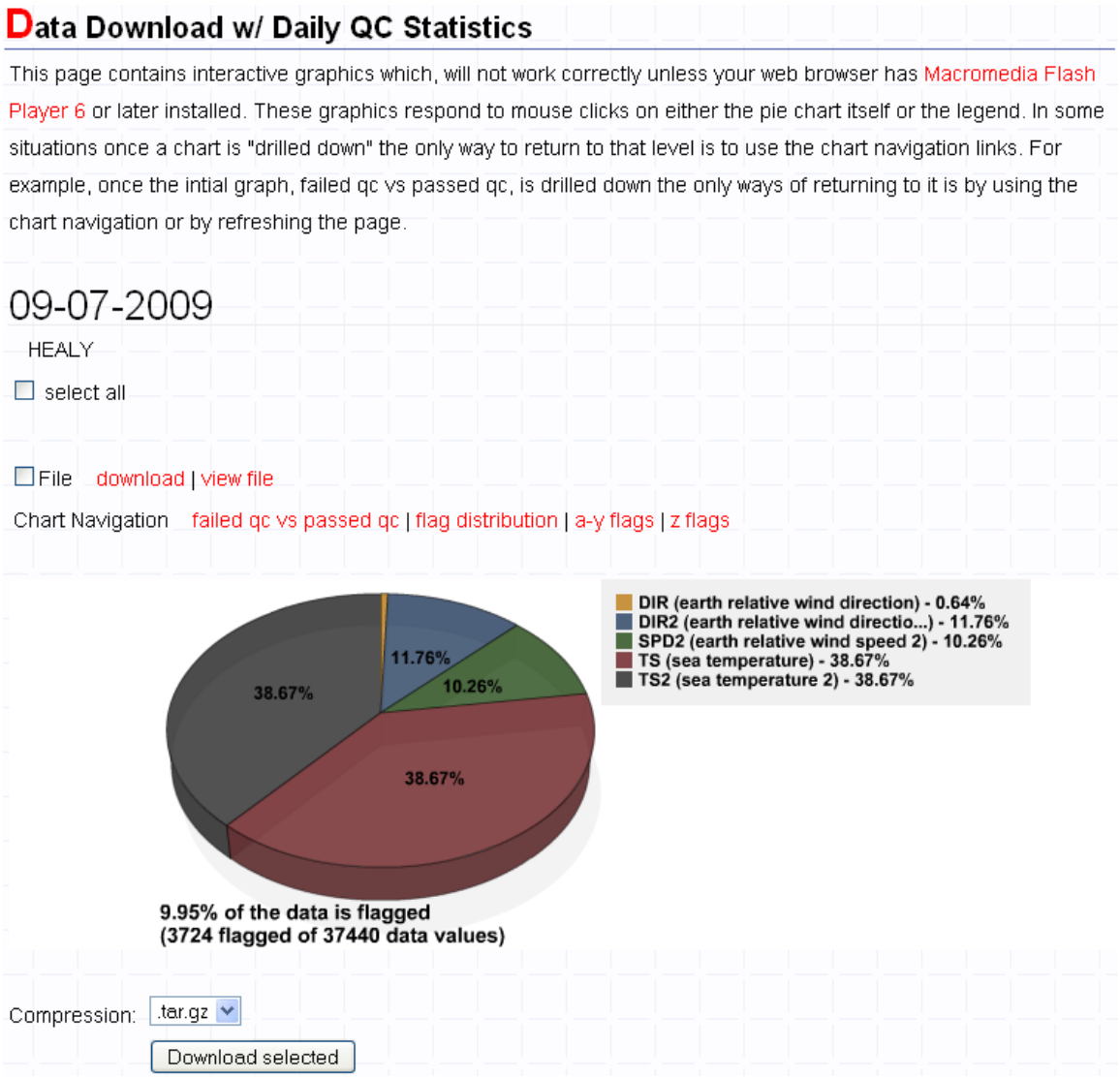
the user arrives at a timeline showing on which days in 2009 the Healy provided data for the chosen parameter(s), as well as the quality of that data for each calendar day (note: image has been customized):



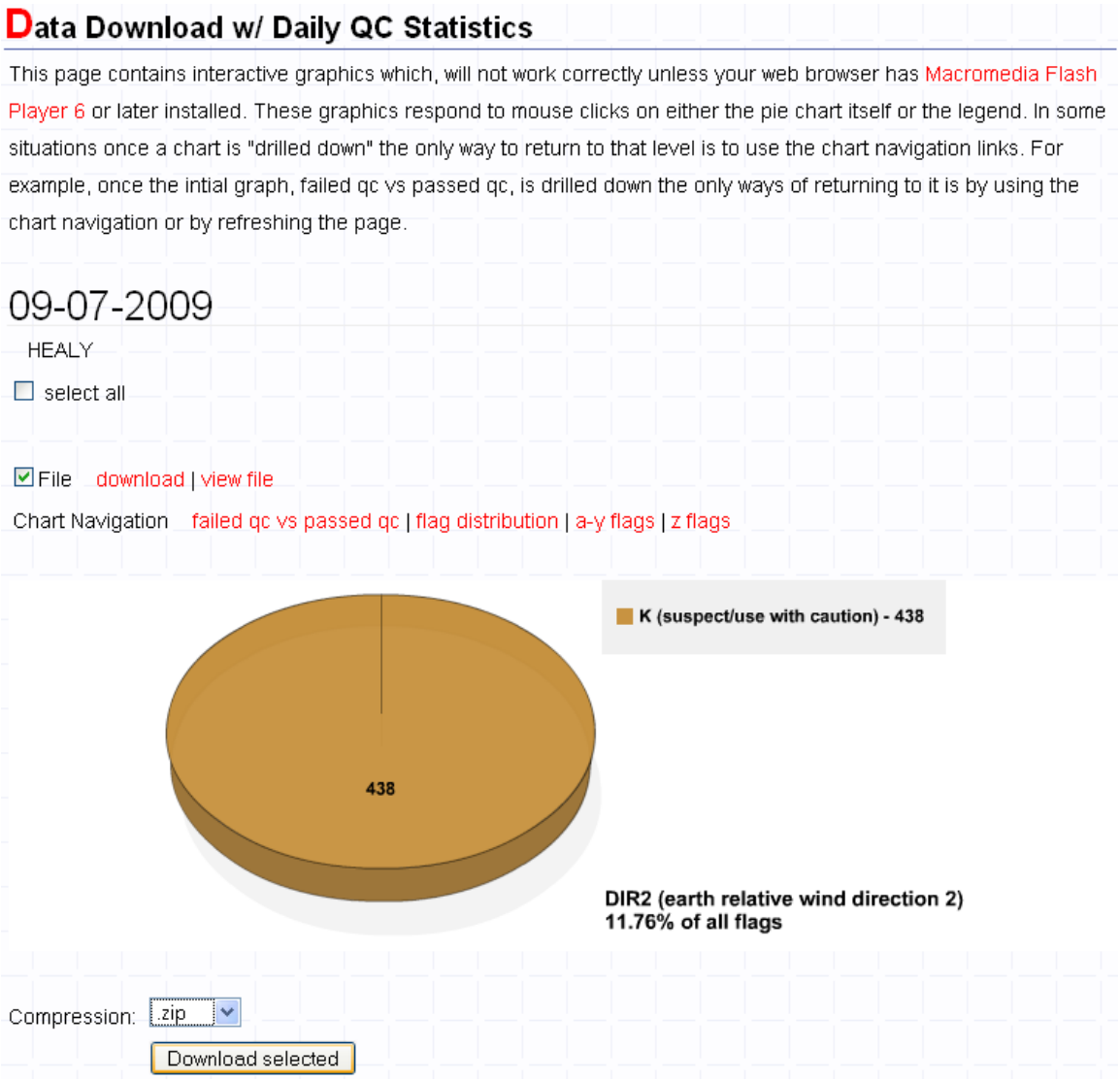
Color-coding alerts the user to the perceived quality of the data. As explained in the key at the top of the page, green indicates "Good Data" (with 0-5% flagged as suspect), yellow indicates "Use with Caution" (with 5-10% flagged as suspect), and red indicates a more emphatic "Use with Caution" (with >10% flagged as suspect). A grey box indicates that no data exists for that day and variable. In this case, the user can automatically see that on 09/07/09 all of the *Healy's* temperature data and the winds from the first wind sensor are considered "Good Data." More detailed flag information, as well as information pertaining to all other available parameters, can be found by simply clicking on any colored box. As an example, by clicking over the red bar for DIR2 on the date 09/07/09 a user can find out more specific information about data quality to determine whether the wind data might also be useful. When the red bar is clicked, the user is first directed to a pie chart showing overall quality:



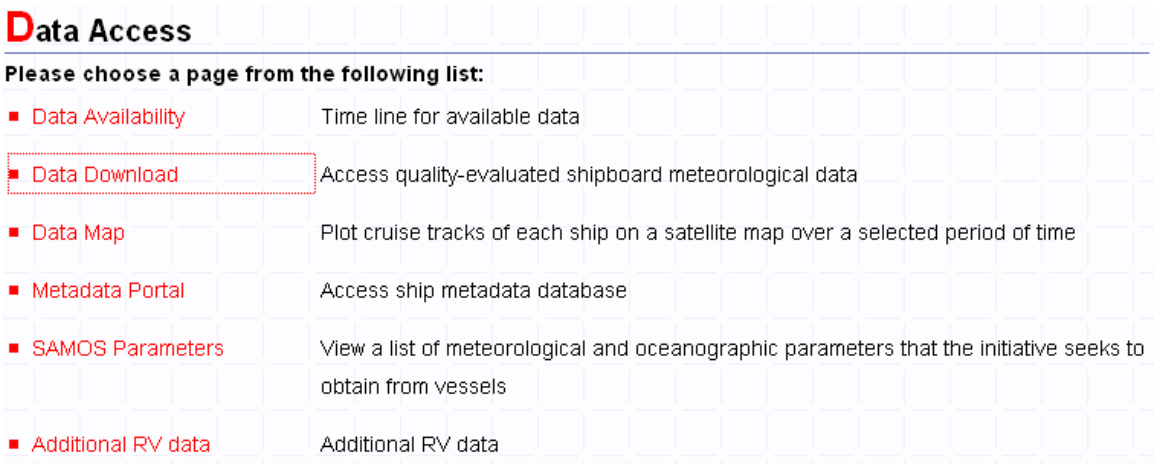
Clicking over the yellow pie slice showing the percentage of data that failed quality control yields a more in-depth look:



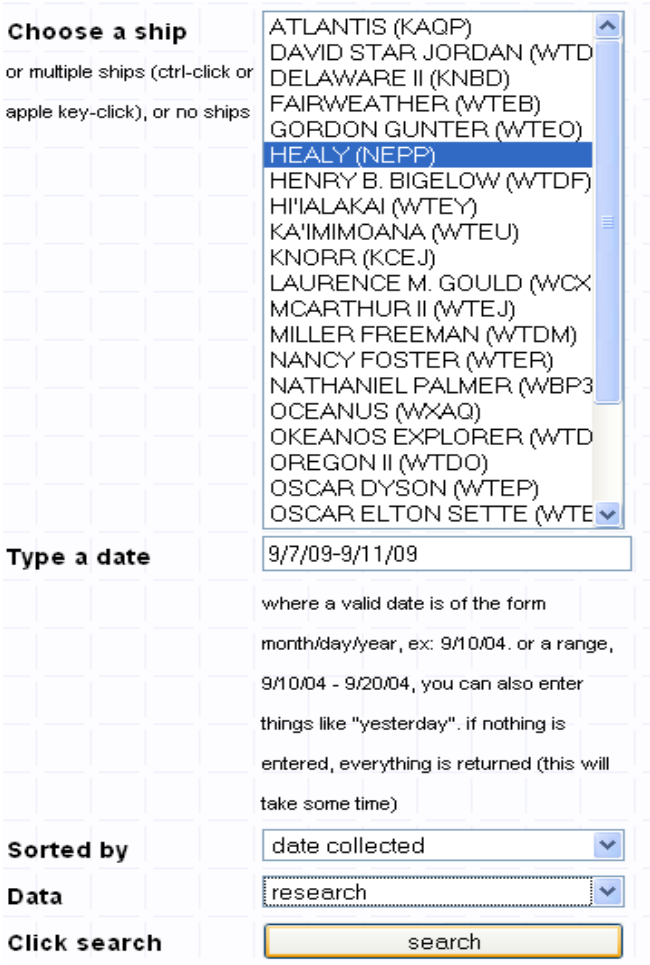
The user can now check to see precisely what types of flags were applied to the second wind sensor data, as only a portion of the data were flagged and they may still be usable. By clicking on either the blue pie slice for "DIR2" or the "DIR2" line in the grey box, he determines that "caution" flags were applied to a portion of the data:



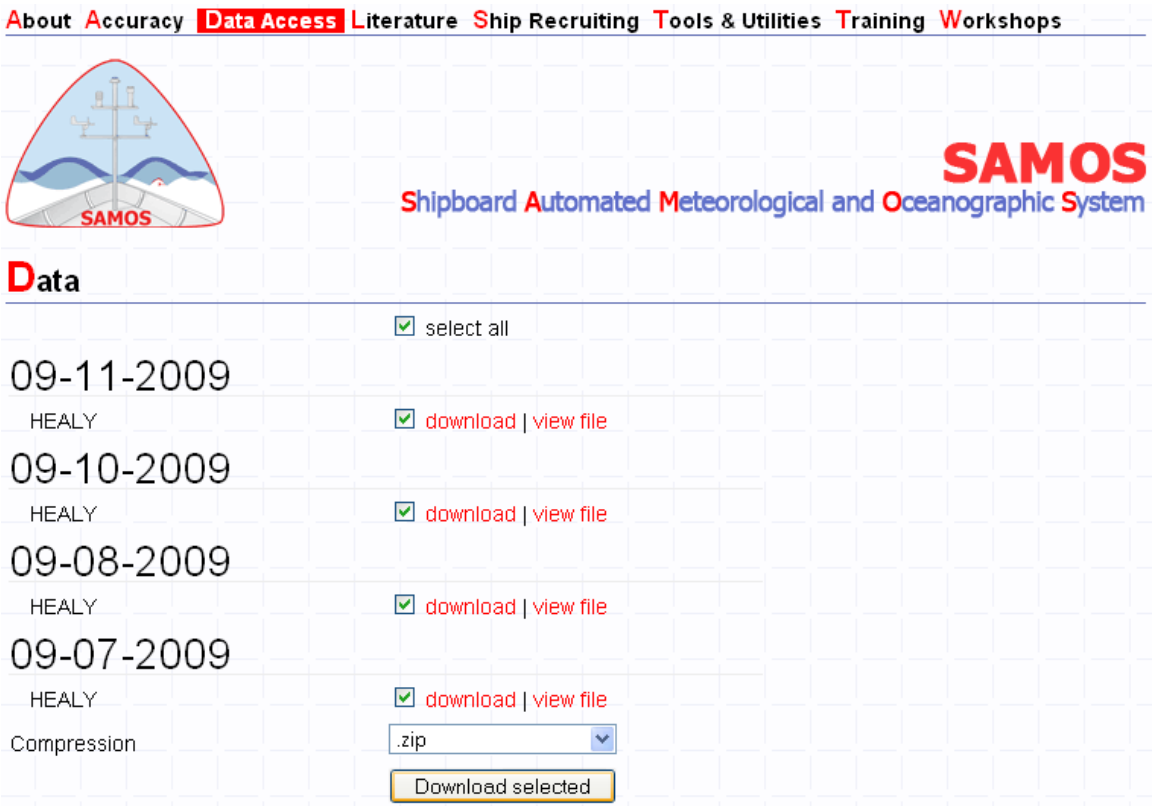
In this example, the user might repeat these steps to evaluate the quality of "SPD2" for 09/07/09. In the end, perhaps he decides the second wind sensor data will also be useful to him and now he would like to download the data. There are a couple of ways to accomplish this: By toggling a check mark in the "File" box (as shown above) and choosing the preferred file compression format (".zip" in this case) on this or any of the pie chart pages, the 09/07/09 file containing all available parameters for that date is downloaded once "Download selected" is clicked. (Note that the entire file must be downloaded; individual parameters are not available for singular download at this time.) Alternatively, the user can return to the Data Access page and choose Data Download, where he will have an opportunity to download multiple files at one time:



Let us assume that, after careful consideration of the quality of wind and temperature data from the *Healy* for the period from 09/07/09 to 09/11/09, the user decides he would like to download all available data from that period. By filling in the proper information on the Data Download page:



the user can choose "select all," along with a file compression format, and click "Download selected" to begin the download:



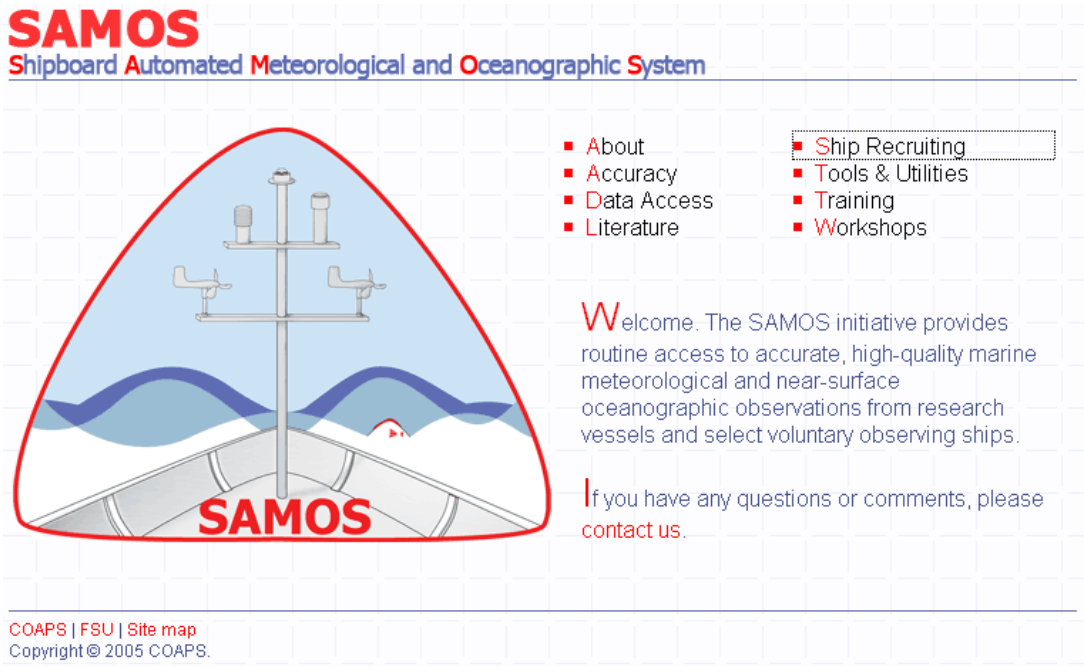
PART 2: the SAMOS operator

(NOTE: a step-by-step example created by a shipboard technician, suitable for saving and generalizing to any SAMOS instrument metadata change, follows this summary)

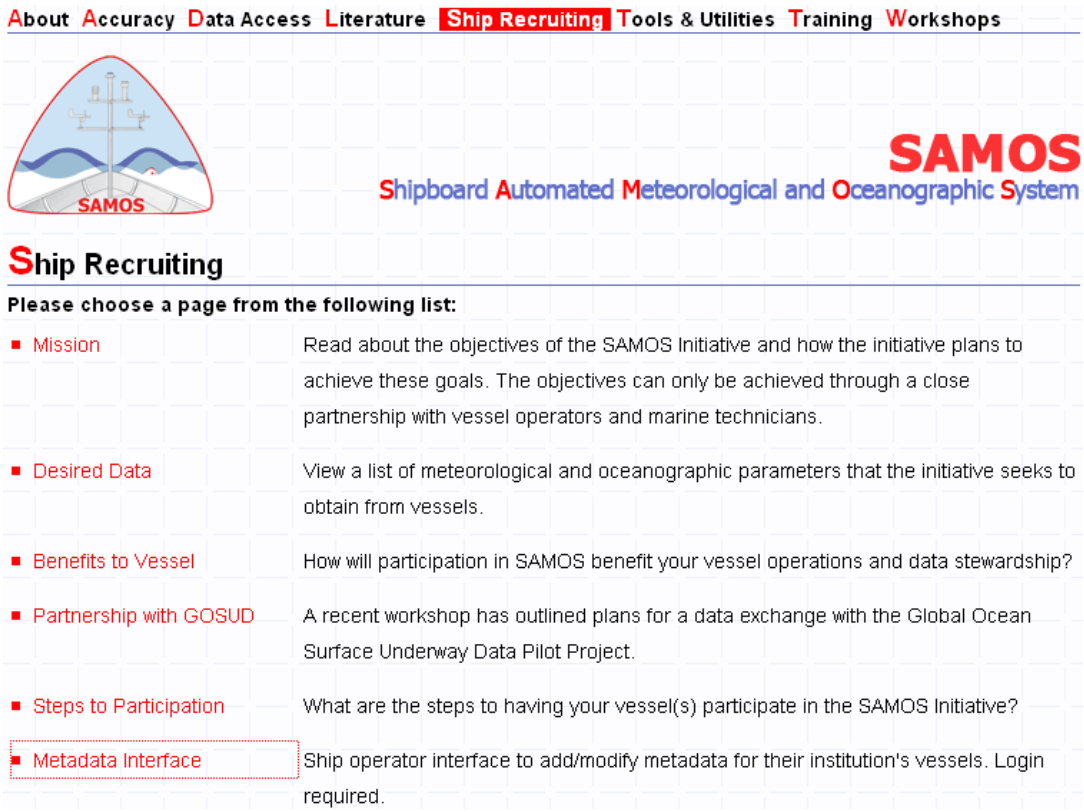
A SAMOS operator might choose to follow the steps outlined in part one as a simple way to keep tabs on the performance of his instruments. When problems are observed, vessel and instrument metadata are important tools for diagnosing a problem and finding a solution. For this reason we strongly emphasize the need for complete, accurate, up-to-date information about the instruments in use. Digital imagery of the ship itself and of the locations of instruments on the ship is also highly desirable, as it is often beneficial in diagnosing flow obstruction issues. As a SAMOS operator, it is important to note that metadata (vessel and/or instrument) should be updated whenever new instruments are added or changes are made to existing instruments (for example moving an instrument or performing a calibration). Inputting and modifying both vessel and instrument metadata are easy tasks that the SAMOS operator can perform via the internet at any time, provided the ship exists in the database and has been assigned "original time units" by a

SAMOS associate at COAPS. In order to use the online system, the SAMOS operator will need to be assigned a unique login and password for his ship, which is obtained by contacting samos@coaps.fsu.edu. With a login and password in hand, the following steps outline the methods for inputting and updating metadata.

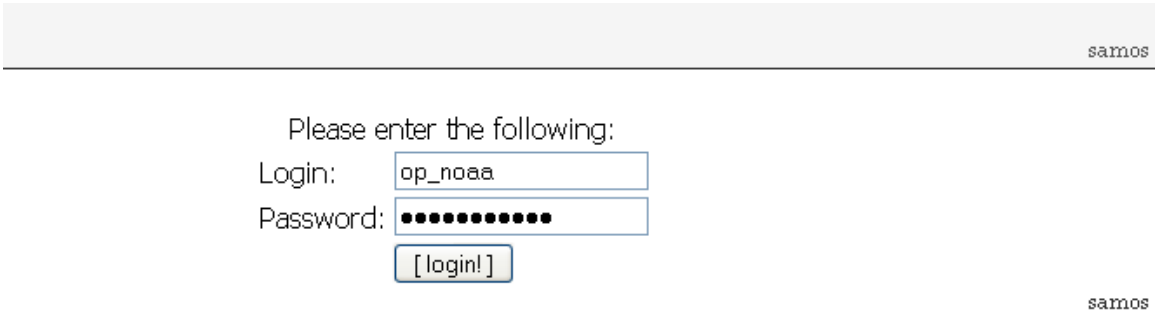
The database can be accessed by visiting the main page and choosing Ship Recruiting:



(or by navigating directly to the Ship Recruiting page, located at http://samos.coaps.fsu.edu/html/nav.php?s=4), and then choosing Metadata Interface:

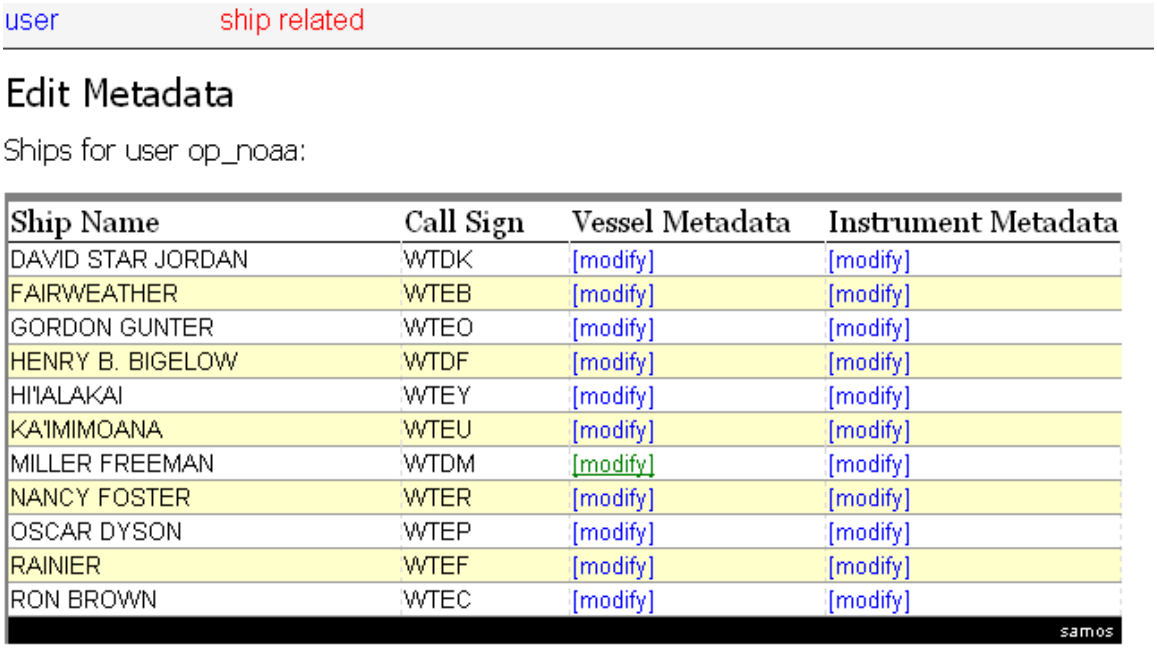


The user will then be directed to log in, using their group's username and password (please contact samos@coaps.fsu.edu to obtain a username or for misplaced passwords):

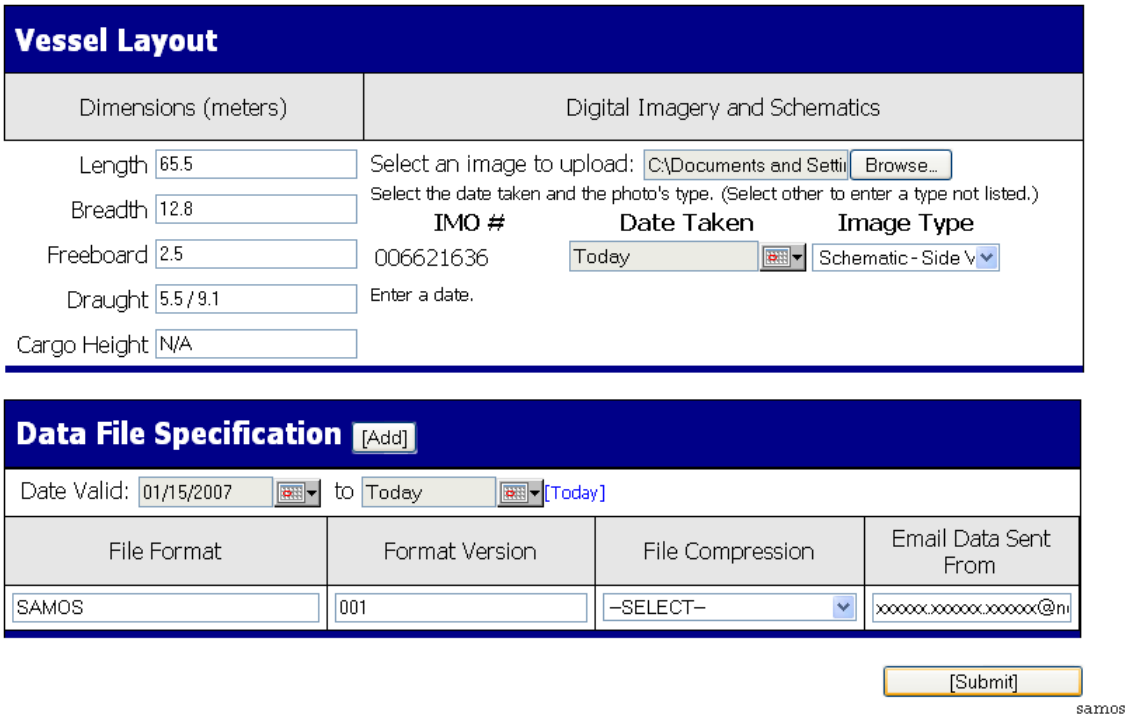


Once logged in, the SAMOS operator chooses to modify either Vessel or Instrument Metadata..

a. Select Vessel Metadata



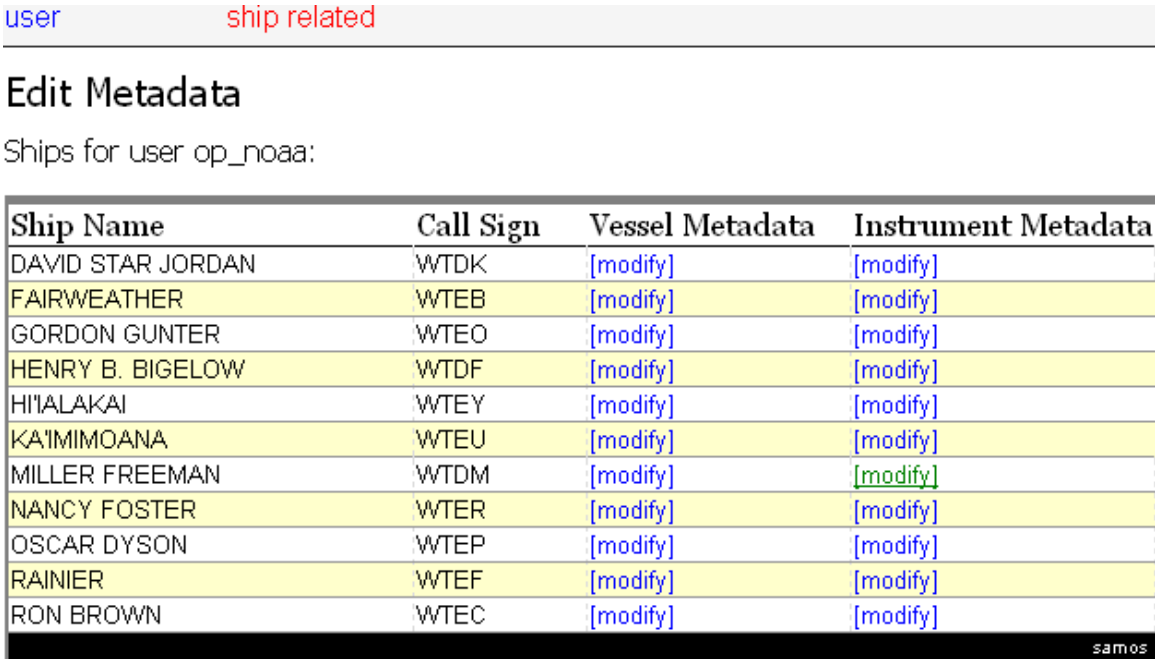
This metadata form provides Vessel Information (such as call sign and home port location), Contact Information for the home institution and shipboard technicians (as well as any other important persons), Vessel Layout, which details ship dimensions and allows for the uploading of digital imagery, and Data File Specification, which refers to the file format and file compression associated with SAMOS data transmission. On this page, all an operator would need to do is fill in the appropriate information and click "submit." For example, let us assume operator op_noaa desires to add a digital image to his vessel's metadata. Assuming the desired image is located on his native computer, he would merely need to click "Browse" to find the image he wants, fill in a Date Taken (if known) and choose an Image Type from the dropdown list, and then click "Submit" at the bottom of the page:



When editing Vessel Metadata, it is important to remember that submitting any new information will overwrite any existing information. The user should therefore take special care not to accidentally overwrite a valid field, for example the vessel Draught field. However, adding an image, as previously demonstrated, will not overwrite any existing images. This is true even if a duplicate Image Type is selected. The only way to remove an image is to contact SAMOS database personnel at COAPS. In any case, other than the addition of photos, Vessel Metadata does not often change. Additionally, except in the incidental case of Data File Specification (shown in image), changes are not date-tracked. Regarding the Date Valid field in the Data File Specification section, this date window maps to the File Format, Version, and Compression properties; it is not intended to capture the date Vessel Metadata changes were made by the SAMOS operator.

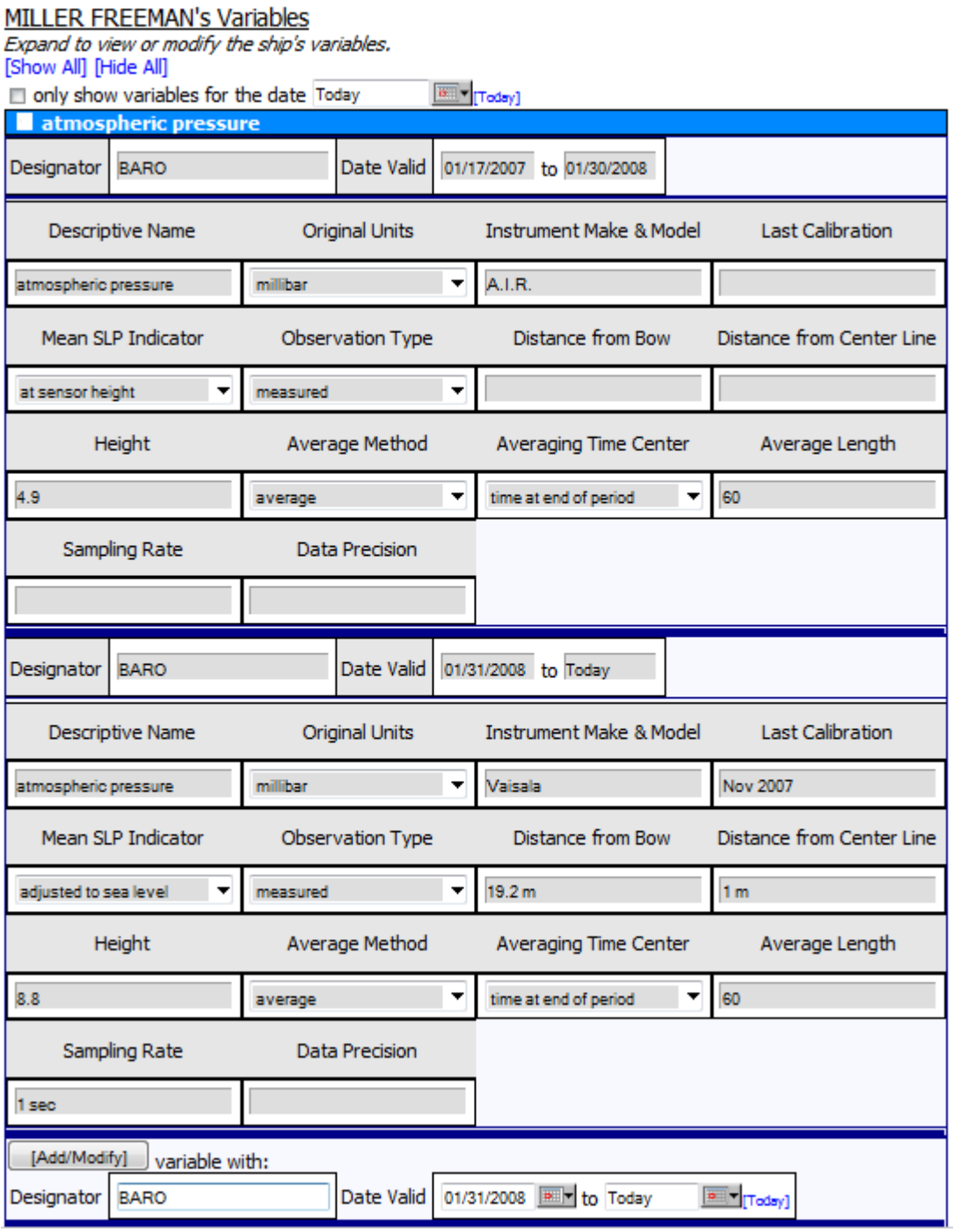
b. Select Instrument Metadata

(NOTE: a step-by-step example created by a shipboard technician, suitable for saving and generalizing to any SAMOS instrument metadata change, follows this summary)



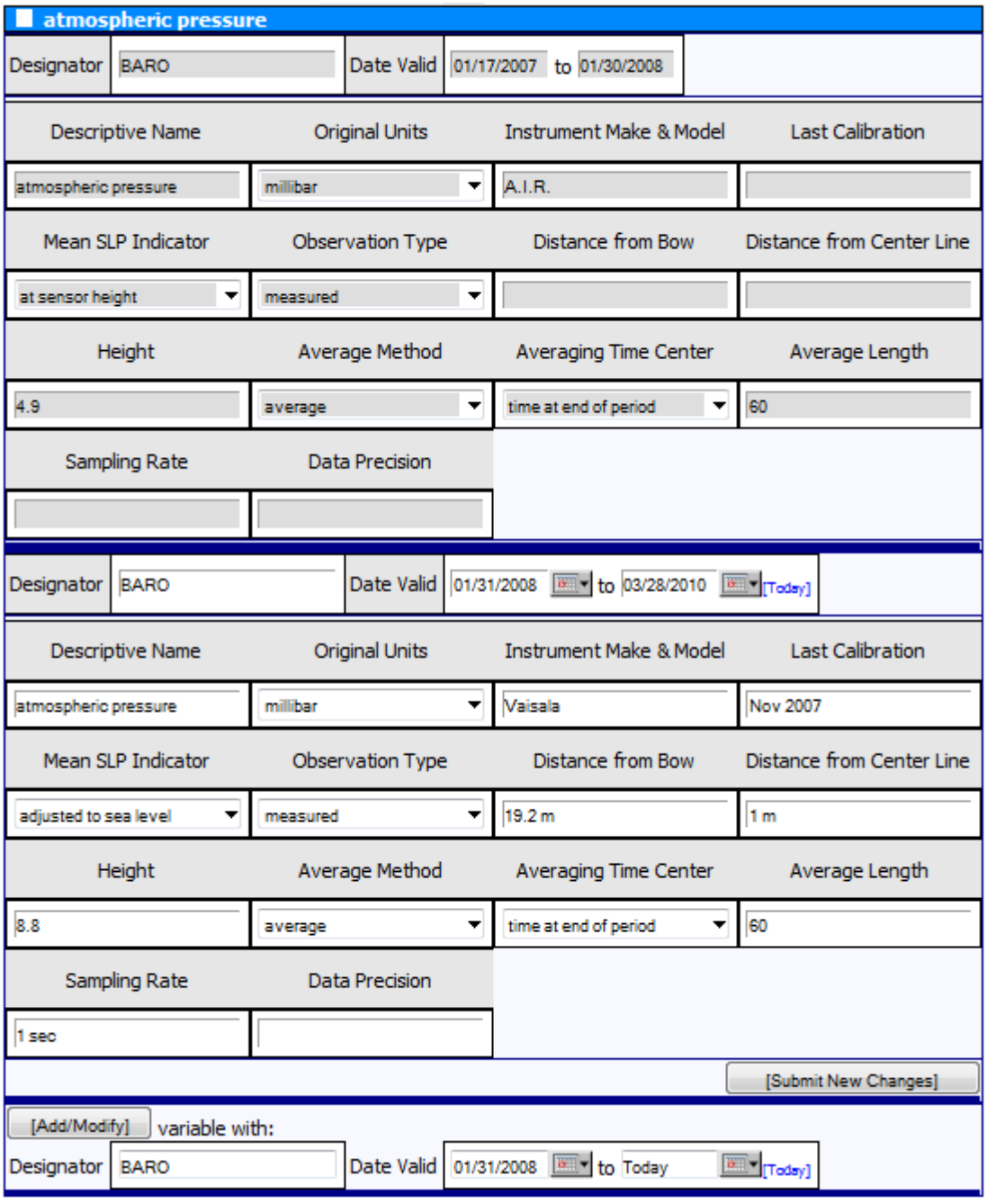
Adding and editing instrument (or parameter) metadata follow a slightly different procedure. The first step for the SAMOS operator is to identify which parameter he wishes to add or modify. Let us first consider the case of modifying a parameter already in use. Let us assume that a pressure sensor has been moved and user op_noaa wants to update the metadata for that parameter to reflect the new location. He would toggle a check in the box for *atmospheric pressure*, resulting in an expansion bar at the bottom of the screen:

Clicking over the "+" for atmospheric pressure opens the list of metadata fields associated with that parameter. The first step is to identify to the system which version (i.e. range of dates for which the listed metadata values are valid for the instrument) of the parameter metadata is being modified. (In most cases that will be the current version; however, it should be noted that occasionally there are multiple versions listed, as in this case, and a previous version needs to be edited retrospectively. For clarity, though, we will only be modifying the most recent in this example.) This identification is accomplished by filling in the sequestered set of Designator and Date Valid fields (located at the bottom below the metadata name, e.g., atmospheric pressure in the example below.) to exactly match those of the desired version metadata and then clicking "Add/Modify." Note that because we are modifying the most recent version, we choose our dates to match 01/31/2008 to today, instead of 01/17/2007 to 01/30/2008:



If the identification procedure is successful, there will be a "Submit New Changes" button visible in the desired version metadata area. User op_noaa must first close out the current metadata version (so the previous data is still associated with the correct information) and then initiate a new version. To close out the current version, the user would change the Date Valid field in the metadata area to reflect the last date the

metadata displayed for an instrument was associated with at the old location and then click "Submit New Changes." (Note the first version, i.e. with Dates Valid 01/17/2007 to 01/30/2008, is left untouched):

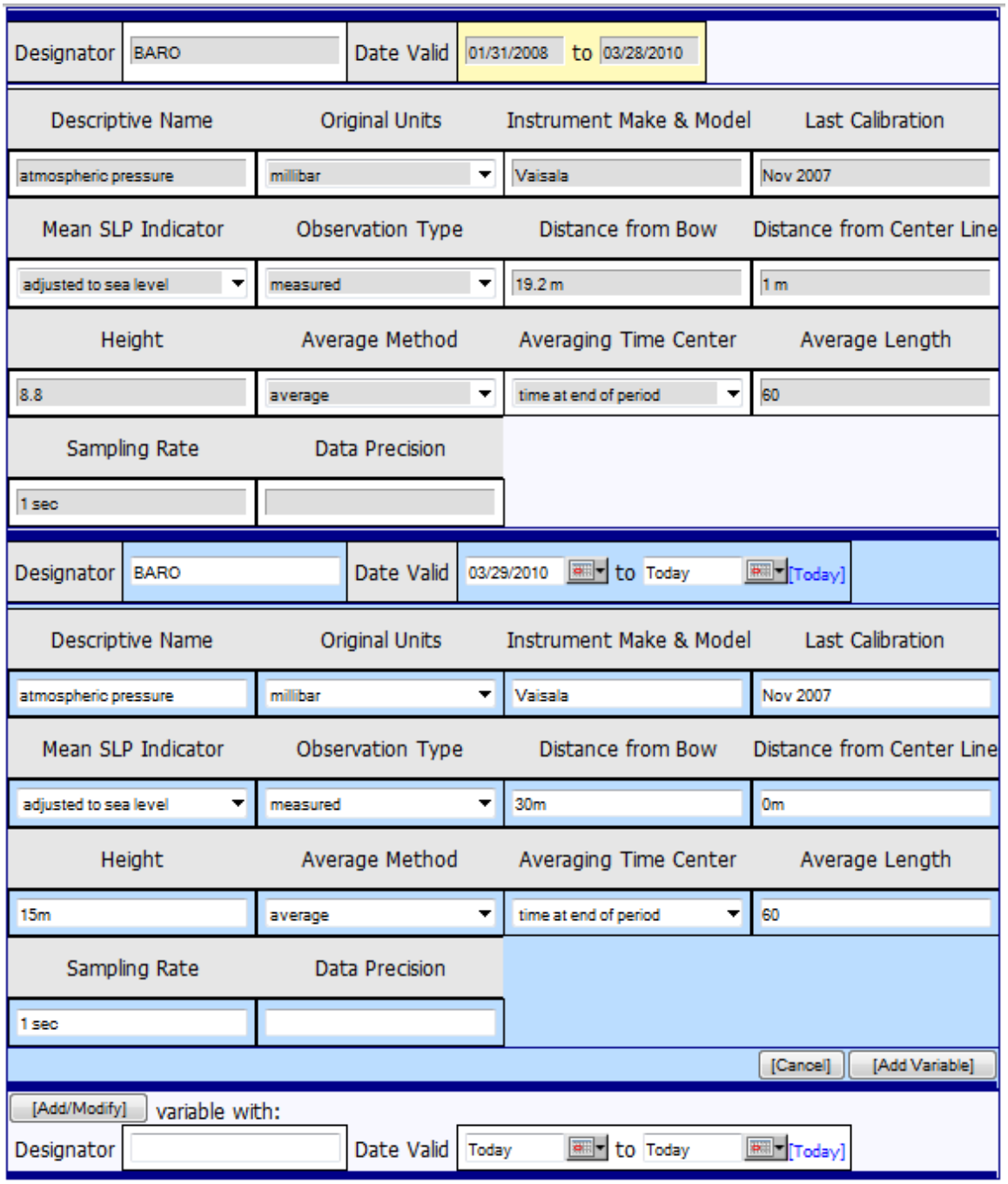


The user then initiates a new version by filling in the sequestered set of Designator and Date Valid fields to reflect the new period for the new or altered metadata, beginning at the date the instrument was relocated, and once again clicking "Add/Modify":

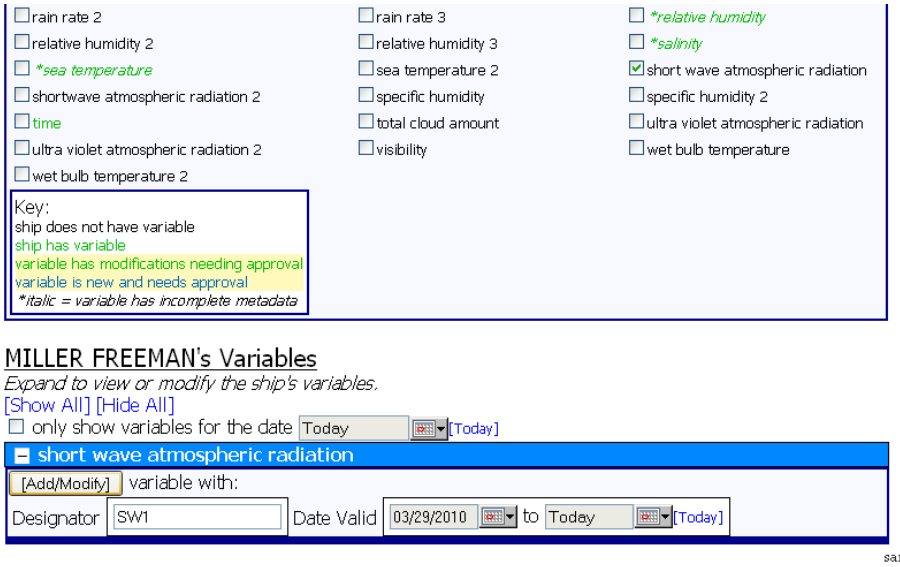
*It is crucial to note that Valid Dates cannot overlap for a single Designator, so if an instrument is moved in the middle of the day (and the Designator is not to be changed), the SAMOS user must decide which day is to be considered the "last" day at the old location, i.e. the day of the change or the day before the change. If the day of the change is considered the last day, then the new version must be made effective as of the day after the change. Likewise, if the day before the change is considered the last day, then the new version becomes effective as of

the day of change. Let us assume the technician moved the instrument on 03/28/2010 and user op_noaa chose to consider that the last valid date for the old information, as demonstrated in the preceding figure.

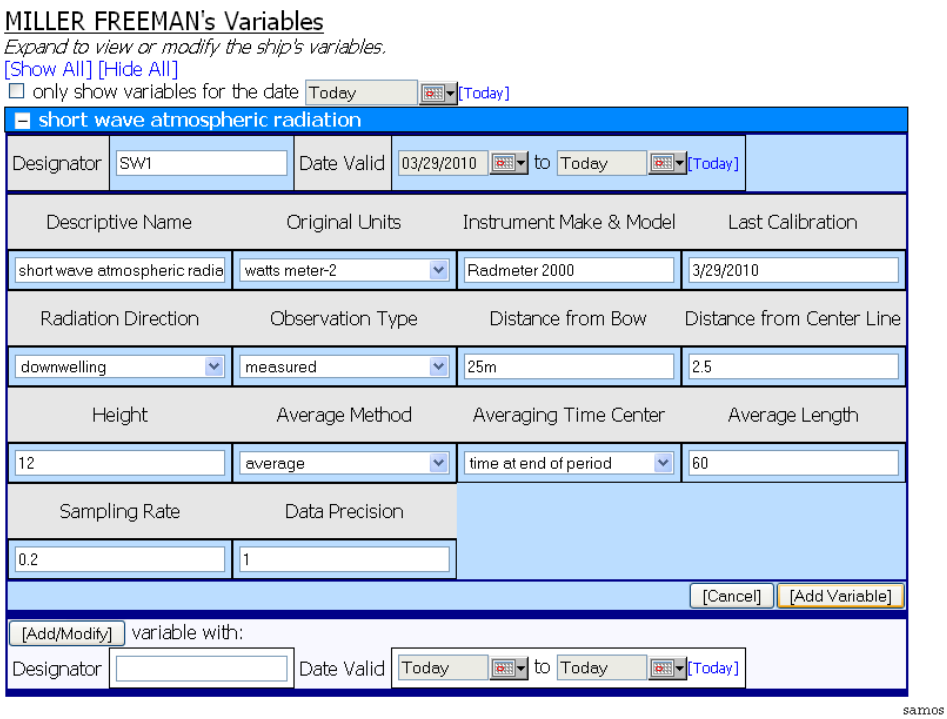
Once "Add/Modify" is clicked, a new set of fields opens up for the BARO parameter. All op_noaa need do at this point is recreate the parameter metadata entry, of course taking care to fill in the new location information, and click "Add Variable":



Adding an entirely new parameter follows only the latter part of these instructions: by simply choosing a parameter (for example short wave atmospheric radiation), clicking the "+" on the expansion bar, and entering either a new or not currently in use Designator and any Date Valid window:

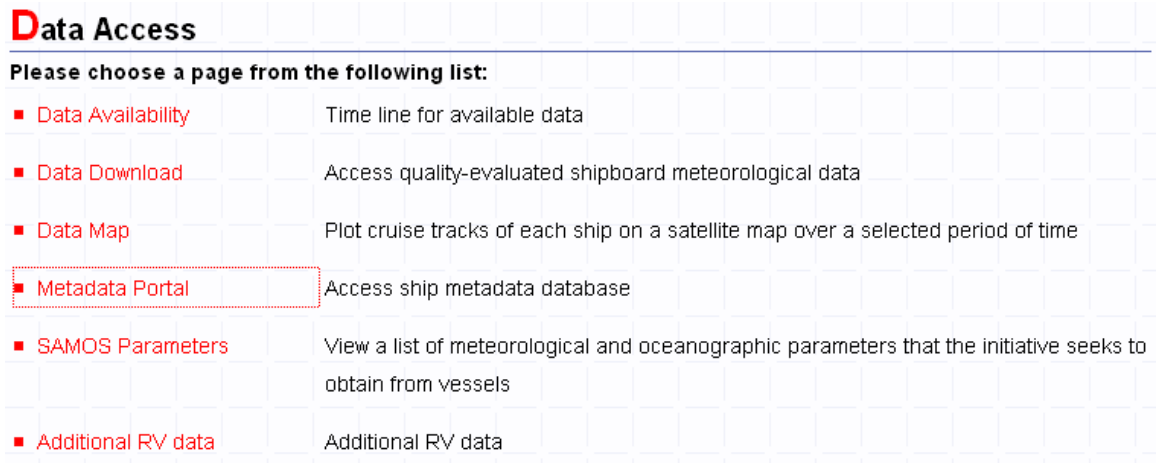


the user is immediately given the new set of fields, to be filled in as desired:



Once an addition or modification to metadata has been submitted, a SAMOS associate at COAPS is automatically notified that approval is needed. Once approved, the new

information will be visible to the public, via the Metadata Portal, accessed from the Data Access page as outlined in part one:



For example, let's say we'd like to see the photo added by op_noaa for the *Miller Freeman*. We would simply choose the correct vessel from the dropdown list, choose "ship-specific" for the Type of metadata, and type in a date. (We choose "today" because we want the most up-to-date information.) Once we click "search,"

Metadata Portal

The SAMOS Data Assembly Center (DAC) has developed a new metadata specification for SAMOS data. The specification was developed with input from members of the Voluntary Observing Ship Climate project (VOSClim), the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), the National Oceanographic Data Center (NODC), and other programs involved with metadata standards for marine observations. Upon recruitment to the SAMOS initiative, each vessel will be required to complete a series of metadata forms and all pertinent metadata will be stored in a ship profile database at the DAC.

The portal provides access to metadata stored in the database for all ships providing data to the DAC. At present, the vessels listed are participating in the 2005 pilot project. A search tool allows users to select a vessel and whether they are interested in ship-specific, parameter-specific, or digital image metadata. Ship-specific metadata include general information about the vessel, vessel dimensions, and contacts for the original data provider. The parameter-specific metadata lists all measurements being provided by a vessel and allows the user to sub-select information on the variables, units, averaging methods, and instrumentation. Digital imagery includes photos of each vessel and instrument masts and also contains schematics for each vessel.

Additional search tools will be added in the future and suggestions are welcome. Please contact us if you have any questions.

Choose a ship MILLER FREEMAN (WTDM)

Type of metadata ship-specific

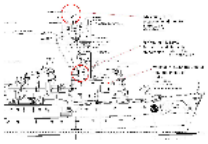
Type a date today

where a valid date is of the form month/day/year, ex: 9/10/04. or a range, 9/10/04 - 9/20/04, you can also enter things like "yesterday"

Click search search

we are directed to a listing of all valid ship-specific information. At the bottom of the page we find the Vessel Layout items, including the newly added photo at the bottom of the Digital Imagery and Schematics scroll list:

Vessel Layout

Dimensions (meters)	Digital Imagery and Schematics
Length: 65.5 Breadth: 12.8 Freeboard: 2.5 Draught: 5.5 / 9.1 Cargo Height: N/A	 Schematic - Side View 

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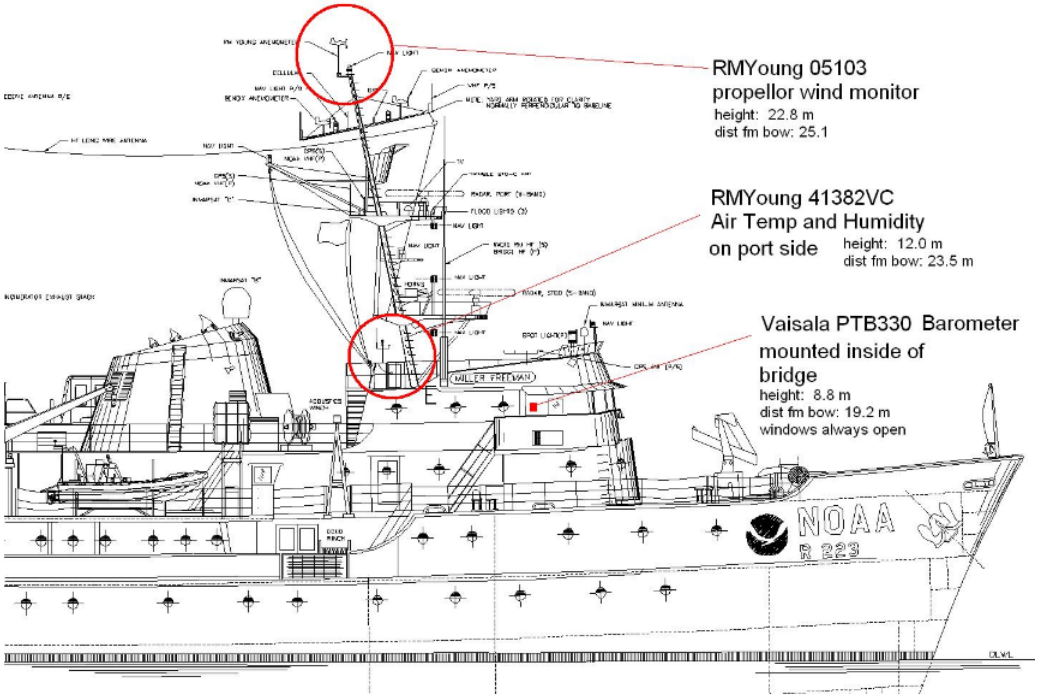
Clicking on the image itself would give us an enlarged view. In this case, the photo provides details about the locations of three MET sensors:

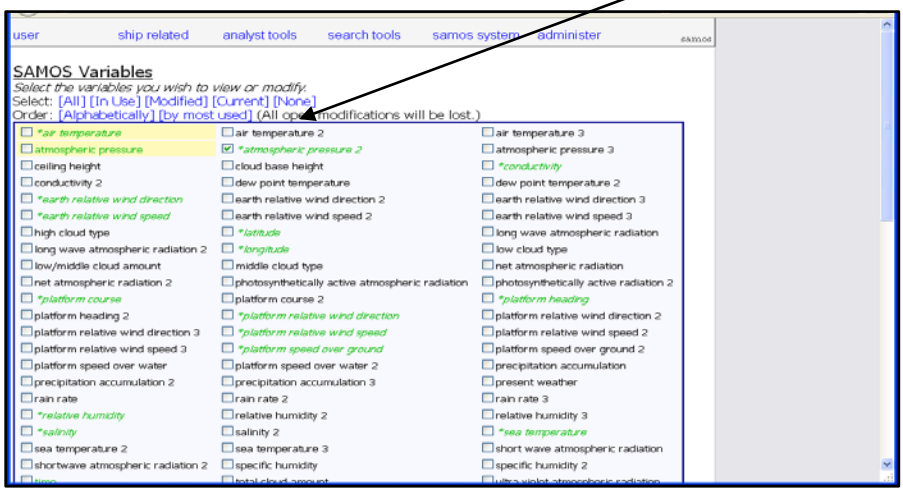


As a SAMOS user becomes familiar with following the metadata modification steps outlined in this section, chores such as adding duplicate sensors, logging sensor relocations, and keeping calibrations up-to-date become straightforward tasks. Naturally, complete and accurate metadata make for better scientific data. (and thus, happier end users!)

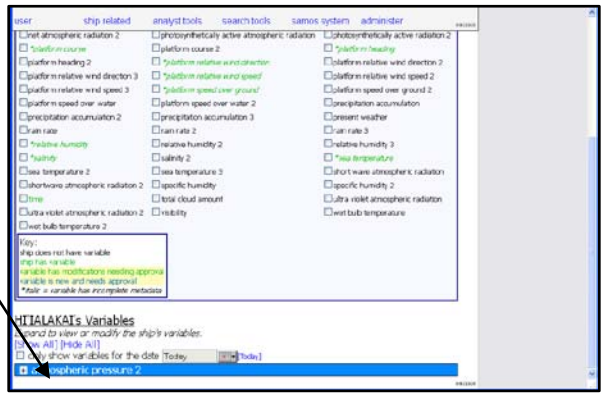
UPDATING SAMOS METADATA: STEP BY STEP EXAMPLE

(credit: Lauren Fuqua, chief technician for *Hi'ialakai*)

1. Go to: http://samos.coaps.fsu.edu/html/
    a. Click "Ship Recruiting"
    b. Click "Metadata Interface"
2. Enter login ID and password (case sensitive)
3. You can choose to modify Vessel or Instrument Metadata; you will likely choose Instrument. Vessel Metadata does not often change, other than the addition of photos.
4. Once "Instrument Metadata" is clicked, a box of sensors will appear. You will usually only be dealing with the Green ones (will look different if entering a new sensor).
    a. Select the sensor you want to Modify by clicking the box to the left of it

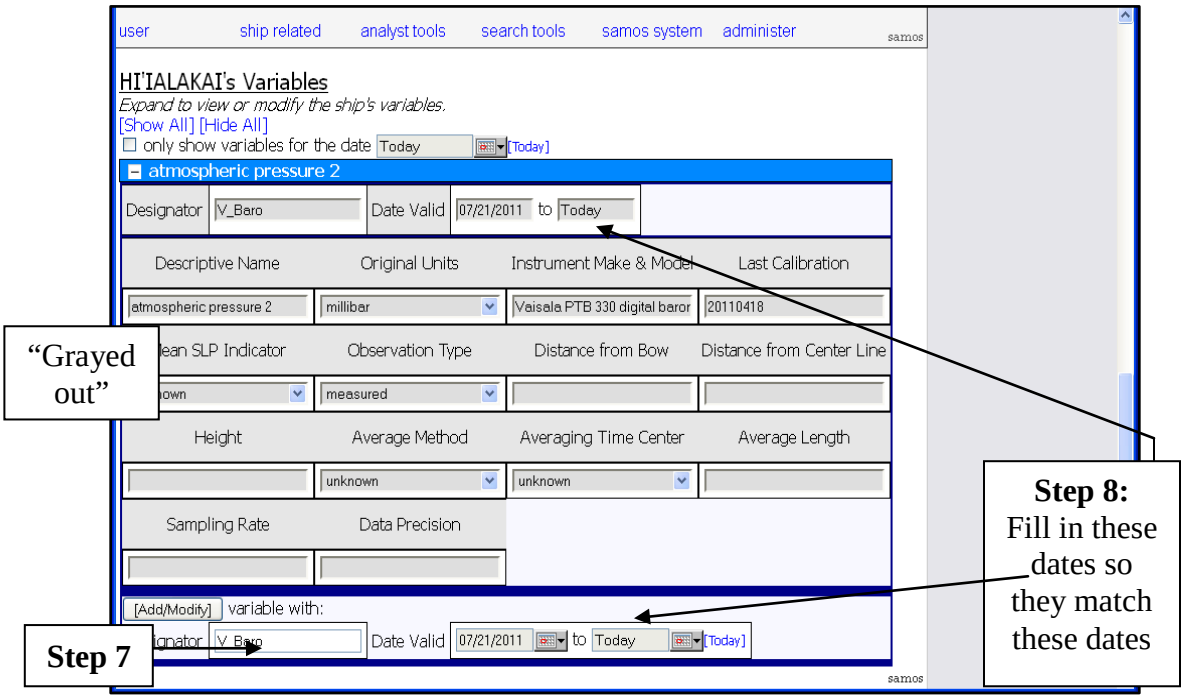


5. You will now see that sensor below, highlighted in Blue; click the plus sign to the left to expand the info about that sensor



6. You will now see the current data for that sensor, grayed out at the top (see image below). You are unable to make changes at this point in the grayed out sensor info area.

a. If this is a brand new sensor you will only see Designator and Date Valid.
b. If changes have already been made to this sensor you will see several sets of data boxes; scroll to the bottom one.

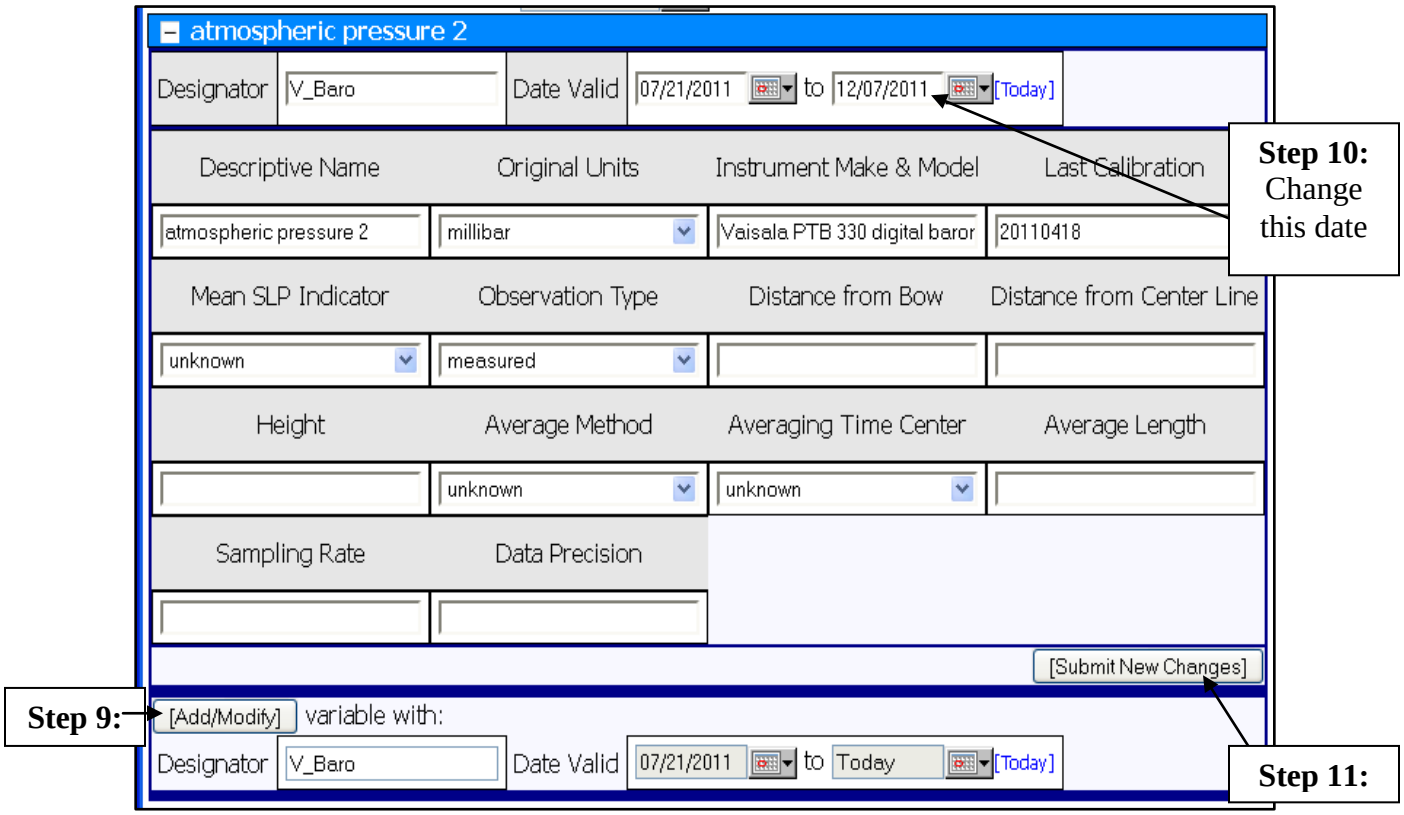


7. You first need to let the system know for which sensor you want to change information. In the box that appears at the very bottom (see image above), enter the name of the designator just at it appears in the box next to 'Designator' in the grayed out area.
    a. For the example above you would enter 'V_Baro' for atmospheric pressure 2

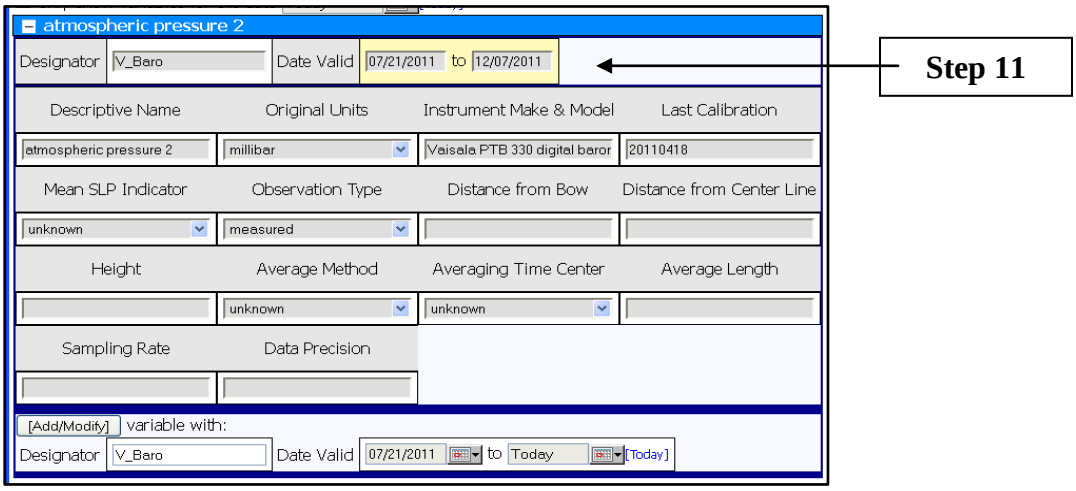
    * Note that before an updated version of sensor information can be entered, you must first "close out" the existing version. This is accomplished via steps 8 through 11. (The updated information will be entered in steps 12 through 15.)
8. In the bottom "Date Valid" boxes, make the dates match what you see above for the "Date Valid" dates in the grayed out area
    a. For the example above you would enter 02/01/2011 in the left box and you would click the blue [Today] button to make the right box read Today
    b. The right box will probably say 'TODAY' by default, and that is likely what you want.
        i. **NOTE:** The word 'Today' in any "Date Valid" entry is a floating date that implies the sensor is currently valid, no matter what day it is. The actual calendar dates mean the sensor starts & stops on the actual dates shown.

c. Months are changed using the arrows
d. Year is changed by clicking on the year (it will now be highlighted) and then typing in the year you want.

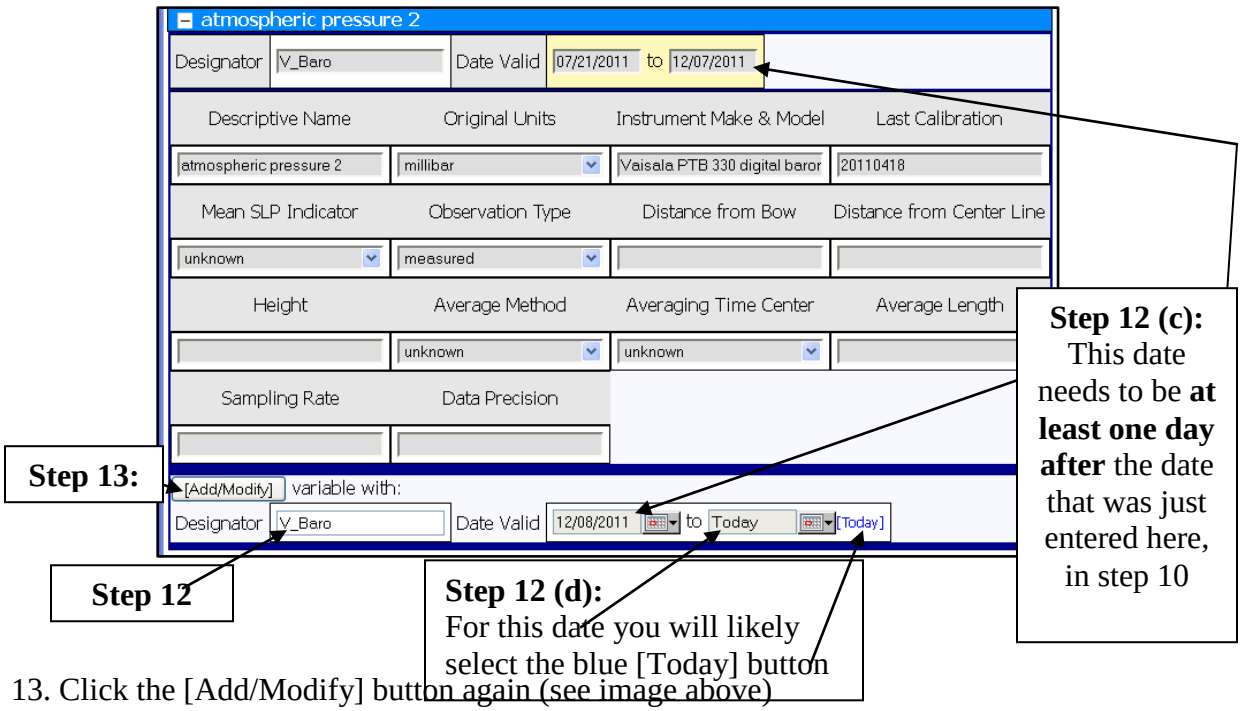
9. Click the [Add/Modify] button (see image below); this should change the text boxes in the data area from gray to white (as in the image below), so that you can now put your cursor in there. If you are unable to make changes in the data area, then the date valid dates and/or designator you entered are incorrect.



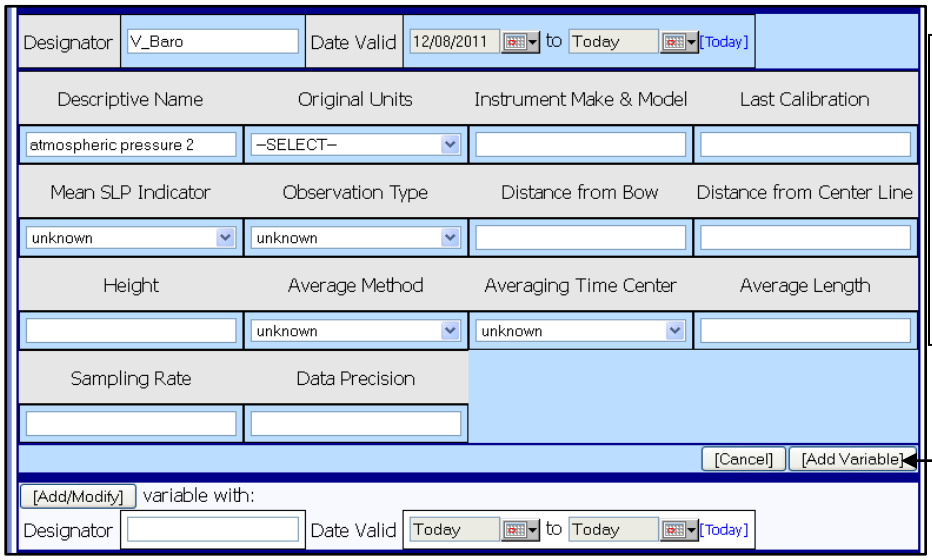
10. You now want to change the "Date Valid" info in this data box. The "Date Valid" start date (on the left) in this now edit-able area will likely stay the same unless you want to correct a previously entered erroneous start date. More than likely you will only be changing the end date, on the right.
    a. This step simply closes out the current data; letting the system know the start and end dates for which the data on the screen about that sensor are valid. You will probably not change any data here; only the end date.
    b. You will most likely be entering a calendar date in the right hand "Date Valid" box to close out the existing data for the sensor.
11. Click "Submit New Changes" on the bottom right of the data box (see image above)
    a. The text boxes in the data entry area should be grayed out again. The background of the dates that you just edited will be yellow (see image below).



12. Now you need to choose new "Date Valid" info in the bottom window (see image below). *Note again that steps 12 through 15 should NOT be performed until the previous set of instrument metadata has been "closed out" for that instrument, via steps 8 through 11.
    a. This step lets the system know the new valid dates for the new information about this sensor (you will enter the new information in Step 14).
    b. Make sure the same designator name is in the 'Designator' box
    c. The left box in the Date Valid area will indicate the start date for which the new sensor info is valid. **That start date needs to be at least one day after the end date that was just entered above in Step 10; the valid dates cannot overlap.**
    d. The right "Date Valid" date will most likely be Today (again, do this by clicking the blue [Today] button to the right of the box; not by putting in today's date on the calendar).
    e. Note: If you are seeing X's over the calendar date you want to select on the left hand "Date Valid" box, change the right hand box to Today first, and you will now be able to change the left box to the date you want.

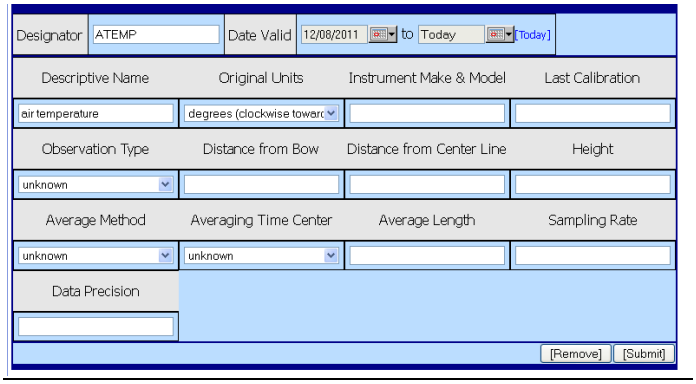


13. Click the [Add/Modify] button again (see image above)
14. You will now see a new, editable data box at the bottom of the screen that has blue around the sensor info instead of gray.
    a. Leave the Date Valid area the same
    b. You can now change the sensor data to reflect updates and add new information. Note that you need to re-enter any existing, correct info about the sensor.
    c. When finished entering data, select [Add Variable]



15. You do not need to click [Submit] on the new window that appears (see image below) unless you make any additional changes or corrections immediately after finishing step 11, for example if you realize you've entered incorrect info or

you've accidentally left something out. Otherwise, your new data are now waiting for approval from the SAMOS staff. To prevent anything being changed mistakenly from this point on, you should now close out that sensor window by going to the top window that has all of the sensors listed and un-checking the sensor you just edited. You can now either exit the website or select a new sensor



Step 15: If all info entered is correct, **DO NOT** select the [Submit] button. Simply close out of SAMOS

Annex B: Current Metadata Status Snapshots

(all active vessels*)

Atlantic Explorer
Atlantis
Aurora Australis
Bell M. Shimada
Fairweather
Falkor
Gordon Gunter
Healy
Henry B. Bigelow
Hi'ialakai
Ka'imimoana
Kilo Moana
Knorr
Laurence M. Gould
McArthur II
Melville
Nancy Foster
Nathaniel B. Palmer
New Horizon
Okeanos Explorer
Oregon II
Oscar Dyson
Oscar Elton Sette
Pisces
Polar Sea
Rainier
Robert Gordon Sproul
Roger Revelle
Ronald H. Brown
Southern Surveyor
Tangaroa
Thomas G. Thompson
Thomas Jefferson

*NOTE: Instrument metadata for the *Endeavor* and the *Oceanus* via SAMOS 2.0 are not yet available

WDC9417 2013-12 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIS	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TIP	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TKS	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TKP	●	●	●	●	●	●	●	●	●	●	●	●	●
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	CR	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GY	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading 2	SH	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	WDS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WDP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	WSS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 2	WSP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SP	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SA	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TT1	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	WT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

KAQP 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	WPAT	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 3	WSAT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	WPBP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 3	WSBP	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	SSC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	WPTD	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction 3	WSTD	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TWP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	WPTS	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed 3	WSTS	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LWR	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GY	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	Imet_wndd	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WPRD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 3	WSRD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	Imet_wnds	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Platform Relative Wind Speed 2	WPRS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 3	WSRS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation	PRC	●	●	●	●	●	●	●	●	●	●	●	●	●
Precipitation Accumulation 2	WPRC	●	●	●	●	●	●	●	●	●	●	●	●	●
Precipitation Accumulation 3	WSRC	●	●	●	●	●	●	●	●	●	●	●	●	●
Rain Rate	PRC	●	●	●	●	●	●	●	●	●	●	●	●	●
Rain Rate 2	WPRI	●	●	●	●	●	●	●	●	●	●	●	●	●
Rain Rate 3	WSRI	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	HRH	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 2	WPRH	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 3	WSRH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SAL	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	SST	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SWR	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

VNAA 2012-06 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATP	●	●	●	●	●	●	●	●	●	●	●	●	■
Air Temperature 2	ATS	●	●	●	●	●	●	●	●	●	●	●	●	■
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	●	●	●	●	■
Earth Relative Wind Direction	TIP	■	■	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TIS	■	■	●	●	●	●	●	●	●	●	●	●	■
Earth Relative Wind Speed	TKP	■	■	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TKS	■	■	●	●	●	●	●	●	●	●	●	●	■
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	■
Long Wave Atmospheric Radiation	LWP	●	●	●	●	●	●	●	●	●	●	●	●	■
Long Wave Atmospheric Radiation 2	LWS	●	●	●	●	●	●	●	●	●	●	●	●	■
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	■
Photosynthetically Active Atmospheric Radiation	PAR1P	●	●	●	●	●	●	●	●	●	●	●	●	■
Photosynthetically Active Radiation 2	PAR1S	●	●	●	●	●	●	●	●	●	●	●	●	■
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Heading	HD	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Heading 2	GY	■	■	●	–	–	–	●	●	●	●	●	●	■
Platform Relative Wind Direction	WDP	●	●	●	●	●	●	●	●	●	●	●	●	■
Platform Relative Wind Direction 2	WDS	●	●	●	●	●	●	●	●	●	●	●	●	■
Platform Relative Wind Speed	WSP	●	●	●	●	●	●	●	●	●	●	●	●	■
Platform Relative Wind Speed 2	WSS	●	●	●	●	●	●	●	●	●	●	●	●	■
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	■
Precipitation Accumulation	PR2	●	●	●	●	●	●	●	●	■	●	■	■	■

: <=6 months old | : >6 months old | : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Precipitation Accumulation 2	PR	●	●	●	●	●	●	●	●	●	●	●	●	■
Rain Rate	PT	●	●	●	●	●	●	●	●	●	●	●	●	■
Relative Humidity	RHP	●	●	●	●	●	●	●	●	●	●	●	●	■
Relative Humidity 2	RHS	●	●	●	●	●	●	●	●	●	●	●	●	■
Sea Temperature	ST	●	●	●	■	■	●	●	●	●	●	●	●	■
Short Wave Atmospheric Radiation	SWP	●	●	●	●	●	●	●	●	●	●	●	●	■
Shortwave Atmospheric Radiation 2	SWS	●	●	●	●	●	●	●	●	●	●	●	●	■

● : <6 months old | ▲ : >6 months old | ■ : no metadata reported

WTED 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	ATEMP2	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	UTWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	UTWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	RADLW	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	URWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 2	URWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 2	RELH2	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Short Wave Atmospheric Radiation	RADSW	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEB 2013-11 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGCOND	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELHUM	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGSAL	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGTEMP	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

ZCYL5 2013-10 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR2	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD2	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water	LWS	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water 2	TWS	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGEXT	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	TSGINT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEO 2013-12 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	SST	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

NEPP 2013-10 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	AT1	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 3	RTT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	BST	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TC	●	●	●	●	●	●	●	●	●	●	●	●	●
Dew Point Temperature	DP	●	●	●	●	●	●	●	●	●	●	●	●	●
Dew Point Temperature 2	DPT	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TI	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TIS	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TS	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TWM	●	●	●	●	●	●	●	●	●	●	●	●	●
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LWH	●	●	●	●	●	●	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation 2	LD	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Photosynthetically Active Atmospheric Radiation	PAH	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GY	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading 2	POSHDT	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	WDPR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WDSR	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Platform Relative Wind Speed	WS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 2	WSSR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water	SL	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water 2	SPPS	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation	PR	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	RH	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 2	RHT	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SAW	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	ST	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	STI	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SW	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTDF 2013-12 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LWAVE	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water	FAWTRSPD	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water 2	PSWTRSPD	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGWTEX	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SWAVE	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEY 2013-09 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	V_Baro	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEU 2012-06 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	■	■	●	■	■	■	■	●	●	●	■	■	■
Atmospheric Pressure	BARO	●	●	●	■	■	■	■	■	■	■	■	■	●
Conductivity	TSGC	■	■	●	■	■	■	■	●	■	●	■	■	■
Earth Relative Wind Direction	TWDIR	■	■	●	■	■	■	●	●	●	●	■	■	–
Earth Relative Wind Speed	TWSPD	■	■	●	■	■	■	●	●	●	●	■	■	–
Latitude	LAT	■	■	●	–	–	–	■	●	●	●	●	■	■
Long Wave Atmospheric Radiation	RAD_LW	●	●	●	■	■	■	●	■	■	■	■	■	■
Longitude	LON	■	■	●	–	–	–	■	●	●	●	●	■	■
Platform Course	COG	■	■	●	–	–	–	■	●	●	●	●	■	■
Platform Heading	GYRO	■	■	●	–	–	–	■	●	●	●	●	■	■
Platform Relative Wind Direction	RWDIR	■	■	●	■	■	■	■	●	●	●	■	■	■
Platform Relative Wind Speed	RWSPD	■	■	●	■	■	■	■	●	●	●	■	■	■
Platform Speed Over Ground	SOG	■	■	●	–	–	–	■	●	●	●	●	■	■
Rain Rate	PRECIP	■	■	●	■	■	■	■	■	■	■	■	■	■
Relative Humidity	RELH	■	■	●	■	■	■	■	●	●	●	■	■	■
Salinity	TSGS	■	■	●	■	■	■	●	●	●	●	■	■	■
Sea Temperature	TSGWT	■	■	●	■	■	■	■	●	●	●	■	■	■
Short Wave Atmospheric Radiation	RAD_SW	●	●	●	■	■	■	■	■	■	■	■	■	■

● : <6 months old | ▲ : >6 months old | ■ : no metadata reported

WDA7827 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TWDS	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TWSP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TWSS	●	●	●	●	●	●	●	●	●	●	●	●	●
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	PIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	CG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	HG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading 2	GY	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	RWDS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 2	RWSS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water	SL	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation	PAO	●	●	●	●	●	●	●	●	●	●	●	●	●
Precipitation Accumulation 2	PAY	●	●	●	●	●	●	●	●	●	●	●	●	●
Rain Rate	PRO	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	RH	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Salinity	S45S	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	SST	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

KCEJ 2013-12 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	WSAT	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 3	WPAT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	WSBP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 3	WPBP	●	●	●	●	●	●	●	●	●	–	–	–	●
Conductivity	SSC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	WSTD	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction 3	WPTD	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TWP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	WSTS	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed 3	WPTS	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LWR	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GY	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	Imet_wndd	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WSRD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 3	WPRD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	Imet_wnds	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Platform Relative Wind Speed 2	WSRS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 3	WPRS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation 2	WSRC	●	●	●	●	●	●	●	●	●	●	●	●	●
Precipitation Accumulation 3	WPRC	●	●	●	●	●	●	●	●	●	●	●	●	●
Rain Rate	PRC	●	●	●	●	●	●	●	●	●	●	●	●	●
Rain Rate 2	WSRI	●	●	●	●	●	●	●	●	●	●	●	●	●
Rain Rate 3	WPRI	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	HRH	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 2	WSRH	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 3	WPRH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SAL	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	SST	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SWR	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WCX7445 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TWDS	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TWSP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TWSS	●	●	●	●	●	●	●	●	●	●	●	●	●
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	●
Net Atmospheric Radiation	SW	●	●	●	●	●	●	●	●	●	●	●	●	●
Net Atmospheric Radiation 2	LW	●	●	●	●	●	●	●	●	●	●	●	●	●
Photosynthetically Active Atmospheric Radiation	PA	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	CR	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GY	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	WDP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WDS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	WSP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 2	WSS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SA	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	SST	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Sea Temperature 2	SST2	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEJ 2012-06 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	■	■	●	■	■	■	●	■	■	■	■	■	■
Atmospheric Pressure	BARO	■	■	●	■	■	■	●	■	■	■	■	■	■
Conductivity	TSGC	■	■	●	■	■	■	●	■	■	■	■	■	■
Earth Relative Wind Direction	TWDIR	■	■	●	■	■	■	●	■	■	■	■	■	–
Earth Relative Wind Speed	TWSPD	■	■	●	■	■	■	●	■	■	■	■	■	–
Latitude	LAT	■	■	●	–	–	–	■	■	■	■	■	■	■
Longitude	LON	■	■	●	–	–	–	■	■	■	■	■	■	■
Platform Course	COG	■	■	●	–	–	–	■	■	■	■	■	■	■
Platform Heading	GYRO	■	■	●	–	–	–	■	■	■	■	■	■	■
Platform Relative Wind Direction	RWDIR	■	■	●	■	■	■	■	■	■	■	■	■	■
Platform Relative Wind Speed	RWSPD	■	■	●	■	■	■	■	■	■	■	■	■	■
Platform Speed Over Ground	SOG	■	■	●	–	–	–	■	■	■	■	■	■	■
Relative Humidity	RELH	■	■	●	■	■	■	■	■	■	■	■	■	■
Salinity	TSGS	■	■	●	■	■	■	■	■	■	■	■	■	■
Sea Temperature	TSGWT	■	■	●	■	■	■	■	■	■	■	■	■	■

● : <6 months old | ▲ : >6 months old | ■ : no metadata reported

WECB 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATB	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	RTB	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BPB	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	BSB	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TCO	●	●	●	●	●	●	●	●	●	●	●	●	●
Dew Point Temperature	DPB	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIB	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWB	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAR	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LWT	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LOL	●	●	●	–	–	–	●	●	●	●	●	●	●
Photosynthetically Active Atmospheric Radiation	PAB	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	CRL	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYL	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	WDB	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	WSB	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SPL	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation	PRB	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	RHB	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SAO	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TTO	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTER 2013-11 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	WTEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	TSGWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WBP3210 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	16	🔴	🔴	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Atmospheric Pressure	BP	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Conductivity	TC	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Earth Relative Wind Direction	15	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	–
Earth Relative Wind Direction 2	TWDS	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Earth Relative Wind Speed	14	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	–
Earth Relative Wind Speed 2	TWSS	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Latitude	LA	🔴	🔴	🟢	–	–	–	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Long Wave Atmospheric Radiation	22	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Longitude	04	🔴	🔴	🟡	–	–	–	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Photosynthetically Active Atmospheric Radiation	PA	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Course	08	🟡	🟡	🟡	–	–	–	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Platform Heading	GY	🟢	🟢	🟢	–	–	–	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Relative Wind Direction	WDP	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Relative Wind Direction 2	WDS	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Relative Wind Speed	WSP	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Relative Wind Speed 2	WSS	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Speed Over Ground	05	🟡	🟡	🟡	–	–	–	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Relative Humidity	17	🔴	🔴	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Salinity	12	🔴	🔴	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Sea Temperature	SST	🔴	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Short Wave Atmospheric Radiation	21	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴

🟢 : <6 months old | 🟡 : >6 months old | 🔴 : no metadata reported

WKWB 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATT	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	RTT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BPT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	BST	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TCW	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TIS	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Speed	TWP	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TWS	●	●	●	●	●	●	●	●	●	●	●	●	●
Latitude	LAR	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LWT	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LOR	●	●	●	–	–	–	●	●	●	●	●	●	●
Photosynthetically Active Atmospheric Radiation	PAT	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	CRR	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYR	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	WDP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WDS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	WSP	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 2	WSS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SPR	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation	PRT	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	RHT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Salinity	SAW	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TTW	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	STE	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTDH 2013-11 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	EXTWT	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	TSGWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTDO 2013-12 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	SST	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEP 2013-11 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEE 2013-09 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	HDG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTDL 2013-11 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGWT	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

NRUO 2012-06 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	■	■	■	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	■	■	■	●	●	●	●	●	●	●
Earth Relative Wind Direction	TI	●	●	●	■	■	■	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TI1	■	■	●	■	■	■	●	●	●	●	●	●	■
Earth Relative Wind Speed	TS	●	●	●	■	■	■	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TS1	■	■	●	■	■	■	●	●	●	●	●	●	■
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	■
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Course	CR	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Course 2	CR1	●	●	●	–	–	–	–	●	●	●	●	●	■
Platform Heading	GY	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Relative Wind Direction	WD	●	●	●	■	■	■	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WD1	■	■	●	■	■	■	●	●	●	●	●	●	■
Platform Relative Wind Speed	WS	●	●	●	■	■	■	●	●	●	●	●	●	■
Platform Relative Wind Speed 2	WS1	■	■	●	■	■	■	●	●	●	●	●	●	■
Platform Speed Over Ground	SP	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Speed Over Ground 2	SP1	●	●	●	–	–	–	●	●	●	●	●	●	■
Relative Humidity	RH	●	●	●	■	■	■	●	●	●	●	●	●	●
Salinity	SA	●	●	●	■	■	■	●	●	●	●	●	●	●
Sea Temperature	TT	●	●	●	■	■	■	●	●	●	●	●	●	■
Sea Temperature 2	ST	●	●	●	■	■	■	●	●	●	●	●	●	●

● : <6 months old | ▲ : >6 months old | ■ : no metadata reported

WTEF 2013-10 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELHUM	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGTEMP	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WSQ2674 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATT	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	RTT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BPT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	BST	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIT	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWT	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAR	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LOR	●	●	●	–	–	–	●	●	●	●	●	●	●
Photosynthetically Active Atmospheric Radiation	PAT	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	CRR	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYR	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	WDT	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	WST	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SPR	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation	PRT	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	RHT	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	STE	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

KAOU 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATB	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BPB	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure 2	BSB	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TCU	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity 2	TCY	●	●	●	●	●	●	●	●	●	●	●	●	●
Dew Point Temperature	DPB	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIB	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWB	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LWB	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LOE	●	●	●	–	–	–	●	●	●	●	●	●	●
Photosynthetically Active Atmospheric Radiation	PAB	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	CRE	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GTE	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	WDB	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	WSB	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SPE	●	●	●	–	–	–	●	●	●	●	●	●	●
Precipitation Accumulation	PRB	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	RHB	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SAU	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity 2	SAY	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TTU	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <=6 months old | ● : >6 months old | ● : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Sea Temperature 2	TTY	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Sea Temperature 3	STU	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Short Wave Atmospheric Radiation	SWB	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢

🟢 : <6 months old | 🟡 : >6 months old | 🔴 : no metadata reported

WTEC 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TSGC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGWT	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SWR	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

VLHJ 2012-06 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATP	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Temperature 2	ATS	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	■	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TIM	■	■	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Direction 2	TIF	■	■	●	●	●	●	●	●	●	●	●	●	■
Earth Relative Wind Speed	TKM	■	■	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed 2	TKF	■	■	●	●	●	●	●	●	●	●	●	●	■
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	■
Long Wave Atmospheric Radiation	LWP	●	●	●	●	●	●	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation 2	SWS	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	■
Photosynthetically Active Atmospheric Radiation	PAR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Heading	HD	●	●	●	–	–	–	●	●	●	●	●	●	■
Platform Heading 2	GY	■	■	●	–	–	–	●	●	●	■	■	■	■
Platform Relative Wind Direction	WDM	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Direction 2	WDF	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	WSM	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed 2	WSF	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	■
Precipitation Accumulation	PR	●	●	●	●	●	●	●	●	●	●	●	●	●
Precipitation Accumulation 2	PR2	●	●	●	●	●	●	●	●	●	●	●	●	●

: <=6 months old | : >6 months old | : no metadata reported

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Rain Rate	PT	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity	RHP	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 2	RHS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	ST	●	●	●	●	■	●	●	●	●	●	●	●	■
Short Wave Atmospheric Radiation	LWP	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Shortwave Atmospheric Radiation 2	SWS	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ▲ : >6 months old | ■ : no metadata reported

ZMFR 2012-06 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	■	■	●	●	●
Earth Relative Wind Direction	TI	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TK	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LA	■	■	●	–	–	–	●	●	■	■	●	●	■
Long Wave Atmospheric Radiation	LWS	●	●	●	●	●	●	●	●	●	●	●	●	■
Long Wave Atmospheric Radiation 2	LWP	●	●	●	●	●	●	●	●	●	●	●	●	■
Longitude	LO	■	■	●	–	–	–	●	●	■	■	●	●	■
Platform Course	COG	■	■	●	–	–	–	●	●	■	■	●	●	■
Platform Heading	GY	●	●	●	–	–	–	●	●	■	■	●	●	■
Platform Speed Over Ground	SOG	■	■	●	–	–	–	●	●	■	■	●	●	■
Precipitation Accumulation	PR	●	●	●	●	●	●	●	●	■	■	●	●	■
Relative Humidity	RH	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	ST	●	●	●	■	■	●	●	●	■	■	●	●	■
Short Wave Atmospheric Radiation	SWS	●	●	●	●	●	●	●	●	●	●	●	●	■
Shortwave Atmospheric Radiation 2	SWP	●	●	●	●	●	●	●	●	●	●	●	●	■

● : <6 months old | ▲ : >6 months old | ■ : no metadata reported

KTDQ 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	AT	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BP	●	●	●	●	●	●	●	●	●	●	●	●	●
Conductivity	TC	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWD	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWS	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LA	●	●	●	–	–	–	●	●	●	●	●	●	●
Long Wave Atmospheric Radiation	LW	●	●	●	●	●	●	●	●	●	●	●	●	●
Longitude	LO	●	●	●	–	–	–	●	●	●	●	●	●	●
Photosynthetically Active Atmospheric Radiation	PR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Course	CG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GY	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWS	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Speed Over Water	SL	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RH	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	SA	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	WT	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	TT	●	●	●	●	●	●	●	●	●	●	●	●	●
Short Wave Atmospheric Radiation	SW	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported

WTEA 2014-01 Metadata Status

Parameter	Designator	Make	Model	Units	From bow	P/S from center line	Height / Depth	Measured / Calculated	Spot vs. Average Value	Value Time Center	Length (sec)	Sampling rate (Hz)	Data precision (decimal)	Date in/last calibration
Air Temperature	ATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Atmospheric Pressure	BARO	●	●	●	●	●	●	●	●	●	●	●	●	●
Dew Point Temperature	DEWP	●	●	●	●	●	●	●	●	●	●	●	●	●
Earth Relative Wind Direction	TWDIR	●	●	●	●	●	●	●	●	●	●	●	●	–
Earth Relative Wind Speed	TWSPD	●	●	●	●	●	●	●	●	●	●	●	●	–
Latitude	LAT	●	●	●	–	–	–	●	●	●	●	●	●	●
Longitude	LON	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Course	COG	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Heading	GYRO	●	●	●	–	–	–	●	●	●	●	●	●	●
Platform Relative Wind Direction	RWDIR	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Relative Wind Speed	RWSPD	●	●	●	●	●	●	●	●	●	●	●	●	●
Platform Speed Over Ground	SOG	●	●	●	–	–	–	●	●	●	●	●	●	●
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	SEATEMP	●	●	●	●	●	●	●	●	●	●	●	●	●
Wet Bulb Temperature	WETB	●	●	●	●	●	●	●	●	●	●	●	●	●

● : <6 months old | ● : >6 months old | ● : no metadata reported