2014 SAMOS Data Quality Report

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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 2014 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; however, this protocol is still in development and has not been made operational. Experiments with the *Endeavor* revealed instabilities related to satellite communication of 1Hz observations. Additional development will be needed to bring SAMOS 2.0 to fruition and resources are not available at this time; thus, SAMOS 2.0 has been tabled. 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 2014, out of 35 active recruits, a total of 28 research vessels routinely provided SAMOS observations to the DAC (Table 1). SAMOS data providers included the National Oceanographic and Atmospheric Administration (NOAA, 15 vessels), the Woods Hole Oceanographic Institution (WHOI, 2 vessels), 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, 1 vessel). Two additional NOAA vessels – the *McArthur II* and the *Ka'imimoana* – one additional IMOS vessel – the *Aurora Australis* – two United States Coast Guard (USCG) vessels – the *Healy* and 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 or delivery systems, satellite communication problems, etc.) were unable to contribute data in 2014.

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. The *Southern Surveyor* was retired in 2013 and has been removed from the SAMOS initiative, while software problems at IMOS have resulted in the interruption of the data flow from the *Aurora Australis*. In addition to running a parallel system to SAMOS in Australia, IMOS is the only international data contributor to SAMOS.

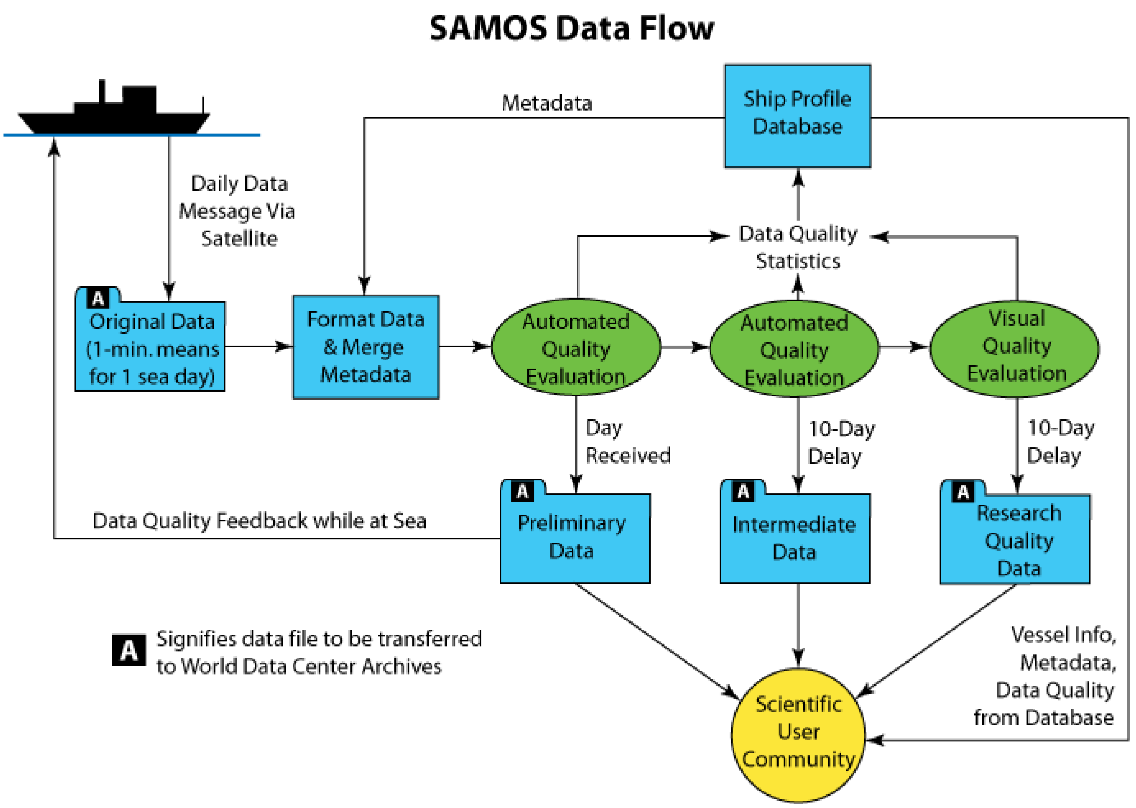


Figure 1: Diagram of operational data flow for the SAMOS initiative in 2013.

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 until a personnel change there in June 2013. Since, 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 2014, 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 *Pisces* and one of the atmospheric pressure sensors onboard the *Falkor*, a relative humidity and an air temperature sensors onboard the *Sproul*, a platform heading onboard the *Atlantic Explorer*, and the (suspected) sea temperature sensors onboard both the *New Horizon* and the *Revelle*), rotated wind sensors that led to inaccurate true winds from both the *New Horizon* and the *Okeanos Explorer* for a significant period of time, parameter designators that were changed without notice to the DAC (*Gunter* and *Hi'ialakai*), and data transmission oversights or issues that created a large volume of backlogged data (*Foster, Okeanos Explorer, Fairweather, Hassler, Falkor, Kilo Moana,* and *Revelle*). Additionally, a troubling 2-minute data averaging practice was brought to light by at least two NOAA vessels (*Hi'ialakai* and *Okeanos Explorer*) that could be expected to cause true wind recalculation problems.

This report begins with an overview of the vessels contributing SAMOS observations to the DAC in 2014 (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 2015. Annexes include a listing of vessel data identified as suspect but not flagged by quality control procedures (Annex A, a new addition), web interface instructions for accessing SAMOS observations (now Annex B, part 1) and metadata submission by vessel operators (now Annex B, part2), and complete snapshots of all active vessels' current metadata status, as of the writing of this report (now Annex C). We note that some new metadata updates continue to come into the DAC in 2015; these additions are not included in this report, and all references to metadata herein reflect what was available as of 31 December, 2014.

2. System review

In 2014, a total of 35 research vessels were under active recruitment to the SAMOS initiative; 28 of those vessels routinely provided SAMOS observations to the DAC (Table 1). The *Polar Sea* likely did not sail in 2014, so naturally there was no data from her. The *Healy*, however, did sail but data were not transmitted using the SAMOS 1.0 protocol in 2014. Several attempts have been made to restart the data flow with the operator and these efforts continue in 2015. The *Aurora Australis* also sailed in 2014 but the data processing/delivery systems in place for the IMOS vessels had some failures that have not yet been resolved (partially the result of IMOS funding challenges). In March 2012 stewardship of the *Oceanus* was transferred from WHOI to OSU and she underwent a major refit. *Oceanus* planned to return to SAMOS using the 2.0 data protocol, but this transition will not occur, hence the lack of any data in 2013. In 2015 we hope to restore the *Oceanus* using SAMOS 1.0. The *McArthur II* and the *Ka'imimoana* were both officially "inactive" in 2014, neither sailing nor collecting data (M. Van Waes, personal communication, 2014), and were officially retired as of 1 January 2015 from the SAMOS initiative. Real-time data were not received in 2014 from the *Endeavor* because problems with satellite communications limit the *Endeavor's* ability to transmit SAMOS 2.0 formatted data files. We hope to transition the *Endeavor* to SAMOS 1.0 in 2015.

In total, 5,031 ship days were received by the DAC for the January 1 to December 31 2014 period, resulting in 6,717,969 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 6,717,969 records received in 2014, a total of 134,841,635 distinct measurements were logged. Of those, 4,733,647 were assigned A-Y quality control flags – about 3.5 percent – by the SAMOS DAC (see section 3a for descriptions of the QC flags). This percentage is identical to that in 2013. Measurements deemed "good data," through both automated and visual QC inspection, are assigned Z flags. In total, twelve of the SAMOS vessels (the *Tangaroa, Atlantis, Knorr, 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. None of these vessels' data were 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	-	5,031	539	6,717,969	4,733,647	134,841,635
ROGER REVELLE	KAOU	240	24	324,063	109,362	7,768,872
ATLANTIS	KAQP	328	29	456,395	236,624	13,214,111
KNORR	KCEJ	236	29	326,459	118,611	9,467,311
T.G. THOMPSON	KTDQ	277	21	376,379	139,833	7,368,433
HEALY	NEPP	0	(27)	0	-	-
AURORA AUSTRALIS	VNAA	0	(28)	0	-	-
NATHANIEL B. PALMER	WBP3210	358	23	509,862	344,717	11,498,169
LAURENCE M. GOULD	WCX7445	361	23	512,722	252,891	11,056,360
KILO MOANA	WDA7827	246	22	321,837	27,263	6,862,022
ATLANTIC EXPLORER	WDC9417	103	21	119,050	76,229	2,474,643
MELVILLE	WECB	201	22	279,749	132,703	5,985,050
NEW HORIZON	WKWB	309	27	388,113	162,143	10,130,970
ROBERT GORDON SPROUL	WSQ2674	163	18	217,805	153,097	3,883,051
HENRY B. BIGELOW	WTDF	134	16	166,494	129,183	2,660,148
OKEANOS EXPLORER	WTDH	136	16	171,194	182,523	2,712,323
PISCES	WTDL	140	16	184,377	324,739	2,922,312
OREGON II	WTDO	151	16	201,028	190,383	3,188,526
THOMAS JEFFERSON	WTEA	117	16	149,949	102,938	2,399,184
FAIRWEATHER	WTEB	51	13	59,488	38,176	773,344
RONALD H. BROWN	WTEC	143	17	184,894	217,659	3,132,298
BELL M. SHIMADA	WTED	110	22	144,574	164,535	2,954,183
OSCAR ELTON SETTE	WTEE	158	16	209,012	60,436	3,243,974
RAINIER	WTEF	117	16	155,042	173,251	2,159,687
FERDINAND HASSLER	WTEK	89	11	115,692	12,238	1,046,230
GORDON GUNTER	WTEO	175	16	219,649	366,219	3,470,545
OSCAR DYSON	WTEP	201	16	270,711	171,340	4,315,052
NANCY FOSTER	WTER	126	14	165,310	246,231	2,305,700
HI'IALAKAI	WTEY	133	14	179,270	105,899	2,334,777
FALKOR	ZCYL5	134	28	174,599	320,496	3,248,253
TANGAROA	ZMFR	94	17	134,252	173,928	2,266,107

Table 1: CY2014 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. ( ) # of Vars denote the number of variables available from vessels that were active in the SAMOS system but that did not provide data in CY2014. These numbers are not included in the Total # of Vars.

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 CY2014 schedule information was not obtainable for 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. 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 2014 ship schedules provided by each vessel's institution. (*Note again that the schedule was not obtained for the *Tangaroa*.) A "blue" day denotes that the data file was received 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." As an added metric this year, Table 2 attempts to measure each vessel's actual submission performance by matching scheduled at-sea (or assumed at-sea) days to the availability of SAMOS data files for those days. All data received for 2014, with the exception of the *Tangaroa*, has been archived at the NODC. Through agreement with IMOS, we receive data for the *Tangaroa* and the *Aurora Australis* and for these vessels perform automated QC only. IMOS data is archived within the IMOS DAC-eMarine Information Infrastructure (eMII).

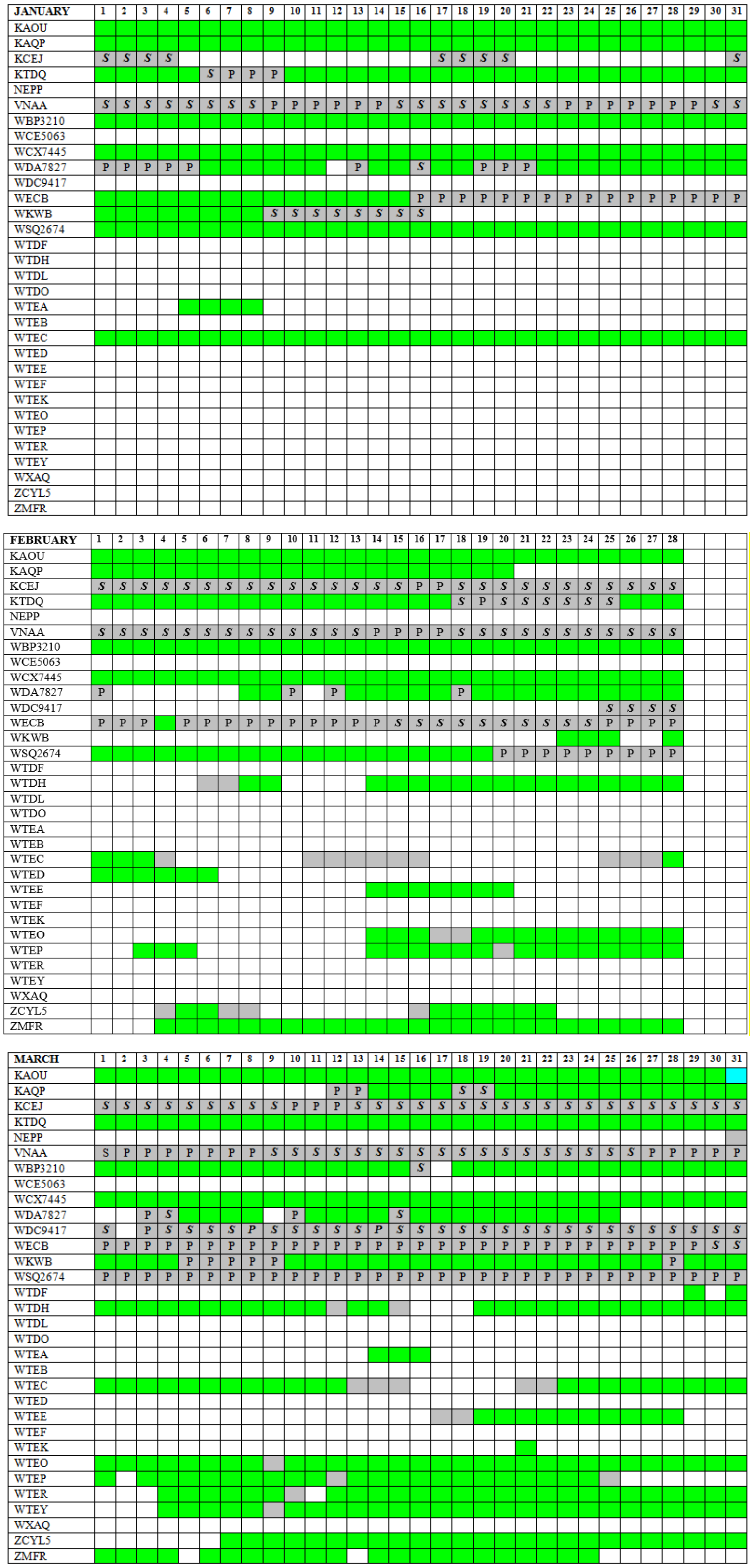
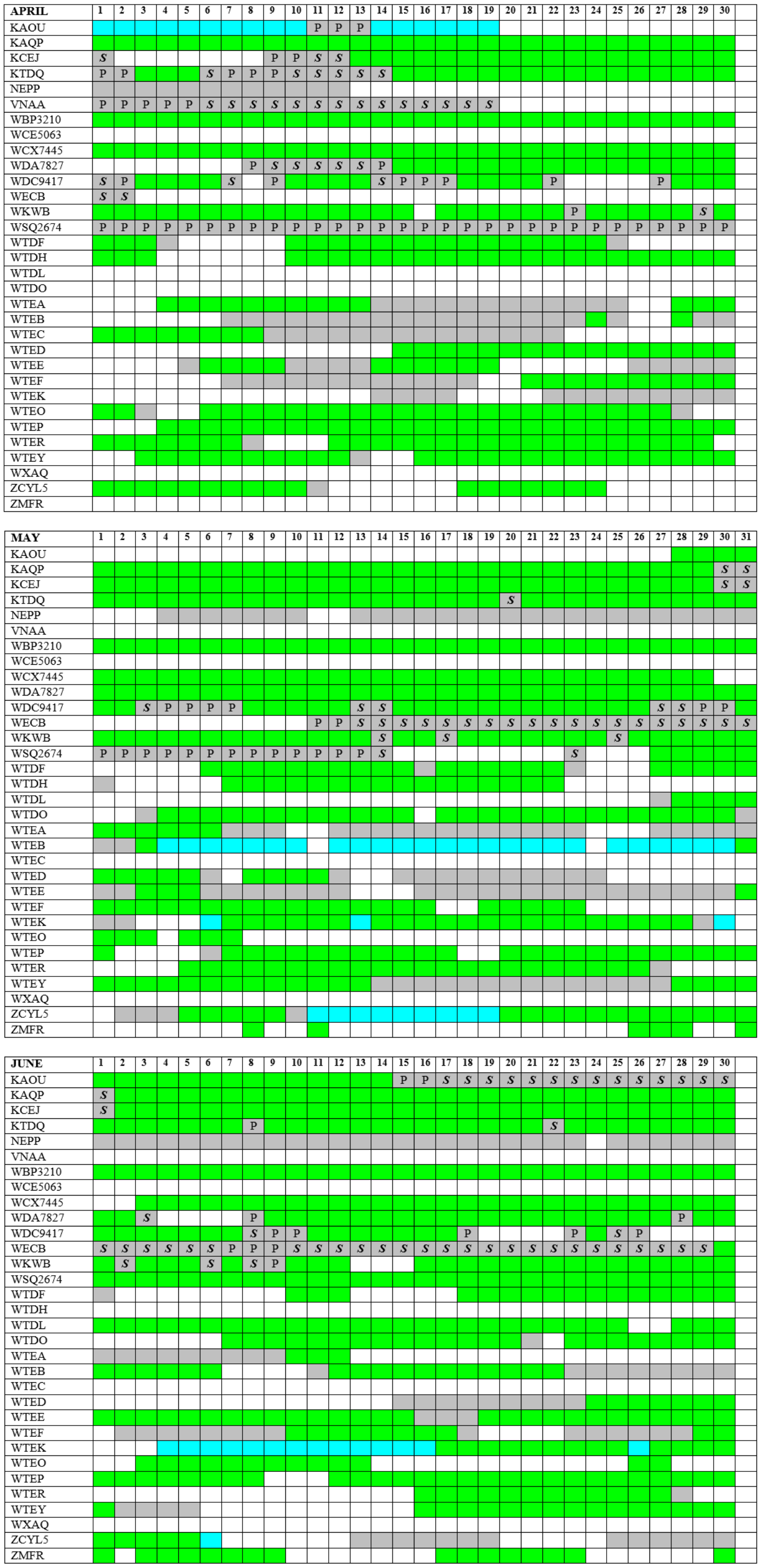
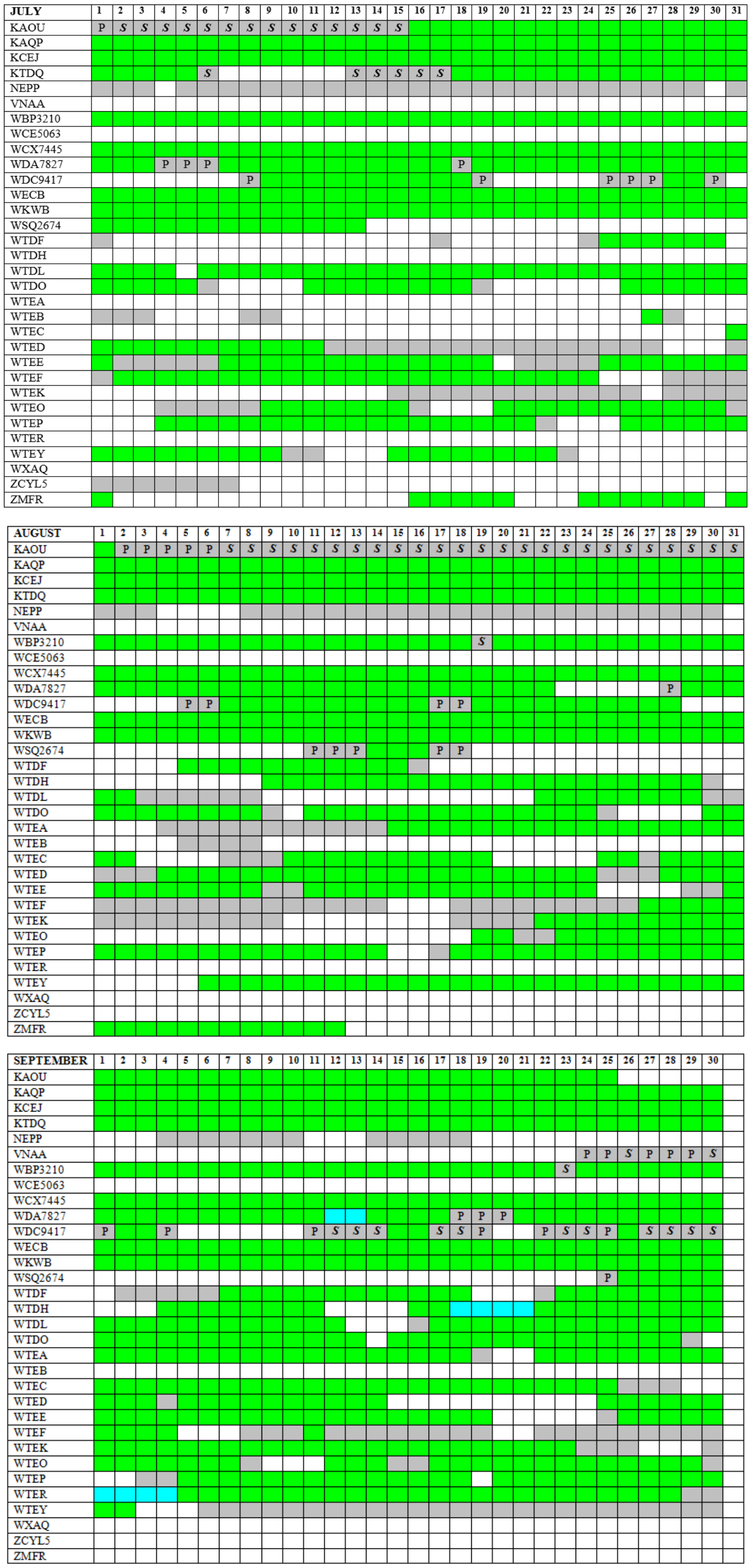


Figure 2: 2014 calendar showing (**green** and **blue**) ship days received by DAC and (**grey**) additional days reported afloat by vessels; "*S*" denotes vessel reportedly at sea, "P" denotes vessel reportedly at port. Vessels are listed by call sign (see Table 1).



(Figure 2: cont'd)



(Figure 2: cont'd)

OCTOBER	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	S	S	S	S	S	S	S	S	S	S							
KCEJ																						P	P	P							
KTDQ										S												S	S	S	S	S					
NEPP																															
VNAA	S												P	P	S	S			P	P	P	S	S	S	S	S	S	S	S	S	S
WBP3210																															
WCE5063																															
WCX7445																															
WDA7827				P	P	P	P	P	P		P						S	S	S	P	P									S	S
WDC9417	S	S	S	S	S	S	S	S	S	S	S	P	P		S				S	S	S	S	S	S	P						
WECB																															
WKWB																															
WSQ2674				P	P															P	P	S	P	P							
WTDF																															
WTDH																															
WTDL																															
WTDO																															
WTEA																															
WTEB																															
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WTEO																															
WTEP																															
WTER																															
WTEY																															
WXAQ																															
ZCYL5																															
ZMFR																															

NOVEMBER	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										P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
NEPP																															
VNAA	S	S	S	S	S	S	P	P	P	P	P	S	S	S	S	S	S	S	S	S	S	S	S	P	P	P	P	P	P	P	
WBP3210																														S	
WCE5063																															
WCX7445																															
WDA7827	S	S	S	P	P														P												
WDC9417	P								P			P							P	S	S	S	S	S	S	P					
WECB																															
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WSQ2674			P									P	P																		
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WTEP																															
WTER																															
WTEY																															
WXAQ																															
ZCYL5																															
ZMFR																															

DECEMBER	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																															
KCEJ																															
KTDQ	P	P	P	P	P	P	P	P	P		S																				
NEPP																															
VNAA	P	P	P	P	S	S	S	S	S	S	S	S	S	S	P	P	P	P	P	P	S	S	S	S	S	P	P	S	P	P	P
WBP3210	S	S																													
WCE5063																															
WCX7445																															
WDA7827		P	S	S	S	P	P							P	S	S															
WDC9417								P	S	S	S	S	S	P		S	S	S	S	P									P	P	S
WECB																															
WKWB																															
WSQ2674																															
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WTEY																															
WXAQ																															
ZCYL5																															
ZMFR																															

(Figure 2: cont'd)

NOAA								
Ship Name	Bell M. Shimada	Fairweather	Ferdinand Hassler	Gordon Gunter	Henry Bigelow	Hi'ialakai	Nancy Foster	Okeanos Explorer
Call Sign/ Ship Code	WTED/SH	WTEB/FA	WTEK/FH	WTEO/GU	WTDF/HB	WTEY/HI	WTER/NF	WTDH/EX
# SDAL scheduled days	131	83	154	169	144	169	121	138
# matching SAMOS days	86	42	65	134	122	121	115	123
→% received	66%	51%	42%	79%	85%	72%	95%	89%

NOAA (cont'd)							
Ship Name	Oregon II	Oscar Dyson	Oscar E. Sette	Pisces	Rainier	Ronald Brown	Thomas Jefferson
Call Sign/ Ship Code	WTDO/OT	WTEP/OD	WTEE/OS	WTDL/PI	WTEF/RA	WTEC/RB	WTEA/TJ
# SDAL scheduled days	167	196	183	147	189	188	151
# matching SAMOS days	148	187	130	125	104	134	93
→% received	89%	95%	71%	85%	55%	71%	62%

TOTAL SDAL scheduled days:	2330
TOTAL matching SAMOS days:	1729
OVERALL RATIO:	74%

OPP		
Ship Name	Laurence M. Gould	Nathaniel B. Palmer
Call Sign	WCX7445	WBP3210
# scheduled days	126	293
# matching SAMOS days	126	287
→% received	100%	98%

TOTAL scheduled days:	988
TOTAL matching SAMOS days:	852
OVERALL RATIO:	99%

SIO				
Ship Name	Melville	New Horizon	Robert G. Sproul	Roger Revelle
Call Sign	WECB	WKWB	WSQ2674	KAOU
# scheduled at-sea days	130	172	28	239
# matching SAMOS days	71	157	25	186
→% received	55%	91%	89%	78%

TOTAL scheduled at-sea days:	569
TOTAL matching SAMOS days:	439
OVERALL RATIO:	77%

Table 2: 2014 data submission performance metrics, listed by institution and ship. Note that where official schedules specified "at sea" days, only those days were counted. In all other cases "at sea" was assumed and scheduled days were counted as-is. Note also that while SAMOS days follow GMT, ship schedules may not. This leaves room for some small margin of error. Lastly, note that any transit through maritime exclusive economic zones (EEZs) may preclude data transmission. Public ship schedule resources are listed in the References, where possible.

WHOI		
Ship Name	R/V Atlantis	R/V Knorr
Call Sign	KAQP	KCEJ
# scheduled days	285	225
# matching SAMOS days	269	156
→% received	94%	69%
TOTAL scheduled days:	1410	
TOTAL matching SAMOS days:	1152	
OVERALL RATIO:	83%	

	BIOS	SOI	UHI	UW
Ship Name	Atlantic Explorer	Falkor	Kilo Moana	Thomas G. Thompson
Call Sign	WDC9417	ZCYL5	WDA7827	KTDQ
TOTAL scheduled at-sea days	181	166	272	281
TOTAL matching SAMOS days	94	136	245	252
OVERALL RATIO:	52%	82%	90%	90%

(Table 2: cont'd)

b. Spatial coverage

Geographically, SAMOS data coverage continues to be fairly comprehensive in 2014. Cruise coverage for the January 1, 2014 to December 31, 2014 period (Figure 3) again includes Antarctic exposure (*Palmer* and *Gould*), exposure in Alaskan waters (*Oscar Dyson*, *Rainier*, and *Fairweather*), the far Northern Atlantic (*Knorr)* and samples along the northern Caribbean island coastlines, from Cuba to Puerto Rico (*Nancy Foster*). The Indian Ocean was again sampled by the *Roger Revelle*, and the waters south of Australia and New Zealand are covered by the *Tangaroa*. The *Knorr* and *Atlantic Explorer* provide a broad sample of the Atlantic, while the *Ron Brown*, *Oscar Elton Sette*, *T. G. Thompson*, *New Horizon*, *Hi'ialakai*, and *Kilo Moana* together do the same for the Pacific, both the *Hi'ialakai* and *Oscar Elton Sette* particularly sampling around Guam and the Northern Mariana Islands. Natively, the western coastal United States is covered by, among others, the *Bell M. Shimada* and the *Melville*; additionally, the *Atlantis* provides data all the way up the western coastline between Peru and the state of Washington. The eastern coastal United States is heavily covered by the *Henry Bigelow*, *Okeanos Explorer*, and *Pisces*, among others. The northern Gulf of Mexico is virtually covered by the *Oregon II* and *Gordon Gunter*. Hawai'ian waters are well-sampled by the *Oscar Elton Sette* and the *Hi'ialakai*. Naturally, the oceans around Bermuda are again well-covered by the *Atlantic Explorer*.

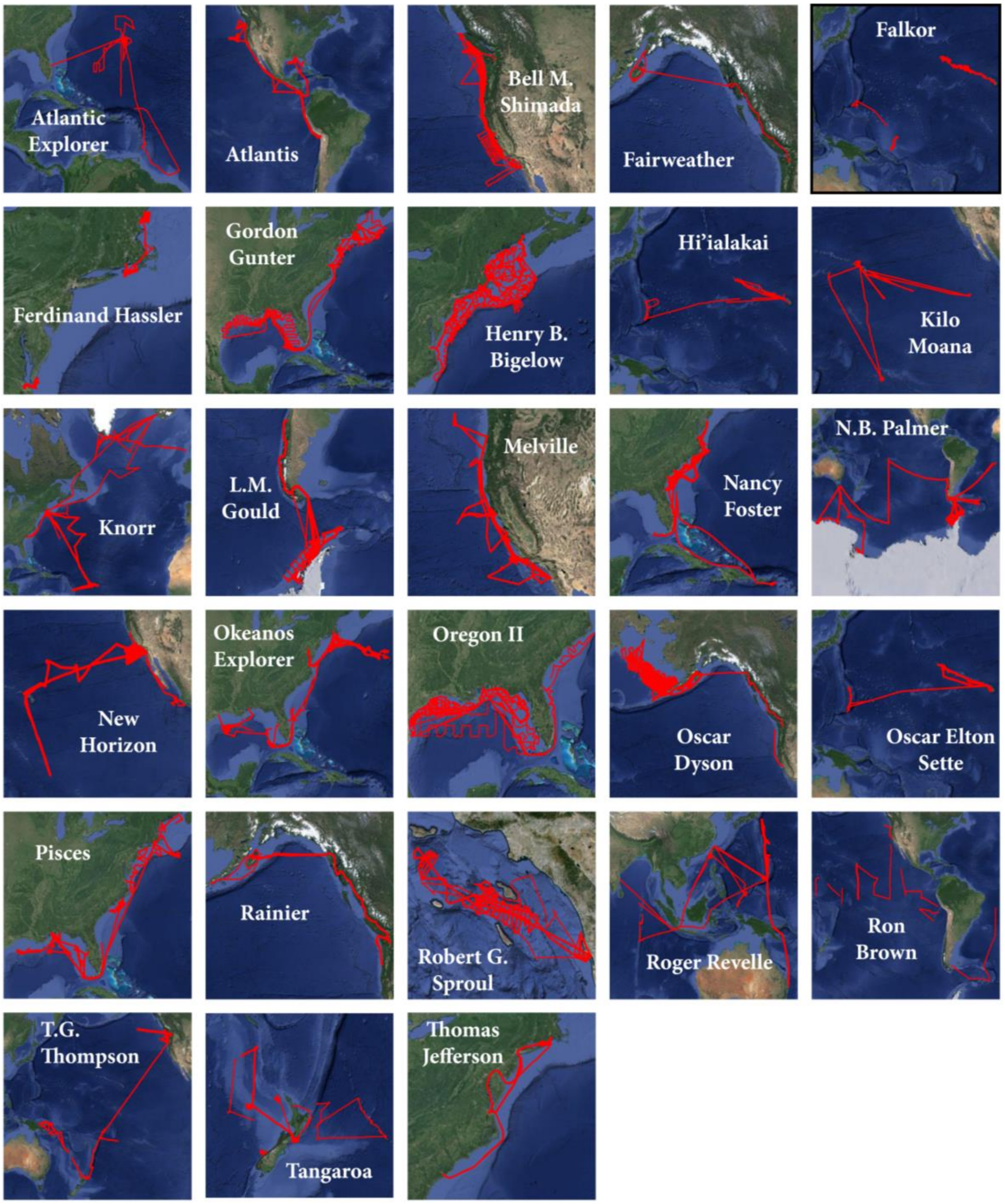


Figure 3: Cruise maps plotted for each vessel in 2014.

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 2014, just as in 2013. The *Jefferson* is also the only vessel set up to provide wet bulb temperature, and did so in 2014. A quick glance at Table 4 (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 2014. (Further detail on Table 4 is discussed in Section 4.) Some vessels furnish redundant sensors, which can be extremely helpful for visually assessing data quality. Again referring to Table 4, those boxes in columns 6 through 26 with multiple entries indicate the number of redundant sensors available for reporting and processing in 2014; 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 3. It should be noted that no secondary automated QC was active in 2014 (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 are rarely used, in an effort to minimize over-flagging. The primary application of the port flag occurs when a vessel is known to be in dry dock. The port flag may also be applied, often in conjunction with flags on other parameters, to indicate that the vessel is confirmed (visually or via operator) in port and any questionable data are likely attributable to dockside structural interference, although this practice is traditionally only used in extreme cases. 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 3: Definitions of SAMOS quality control flags

b. 2014 quality across-system

This section presents the overall quality from the system of ships providing observations to the SAMOS data center in 2014. 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. Figures 59 and 74 do 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 P evident in November and December is due in large part to the *Falkor's* P data being entirely J-flagged (poor quality) from 31 October to the end of the year (documented; see individual vessel description in section 3c for details). Aside from the *Falkor's* contribution, we note that the colder months (in the northern hemisphere, here January, and October through December) appear to have involved heavier flagging of P and P2. One possible explanation could be a lot of sampling of cold fronts and/or low pressure centers coming off the East Coast U.S. and in the Pacific, as well. These data are frequently G-flagged (greater than 4 standard deviations from climatological mean) during autoprocessing.

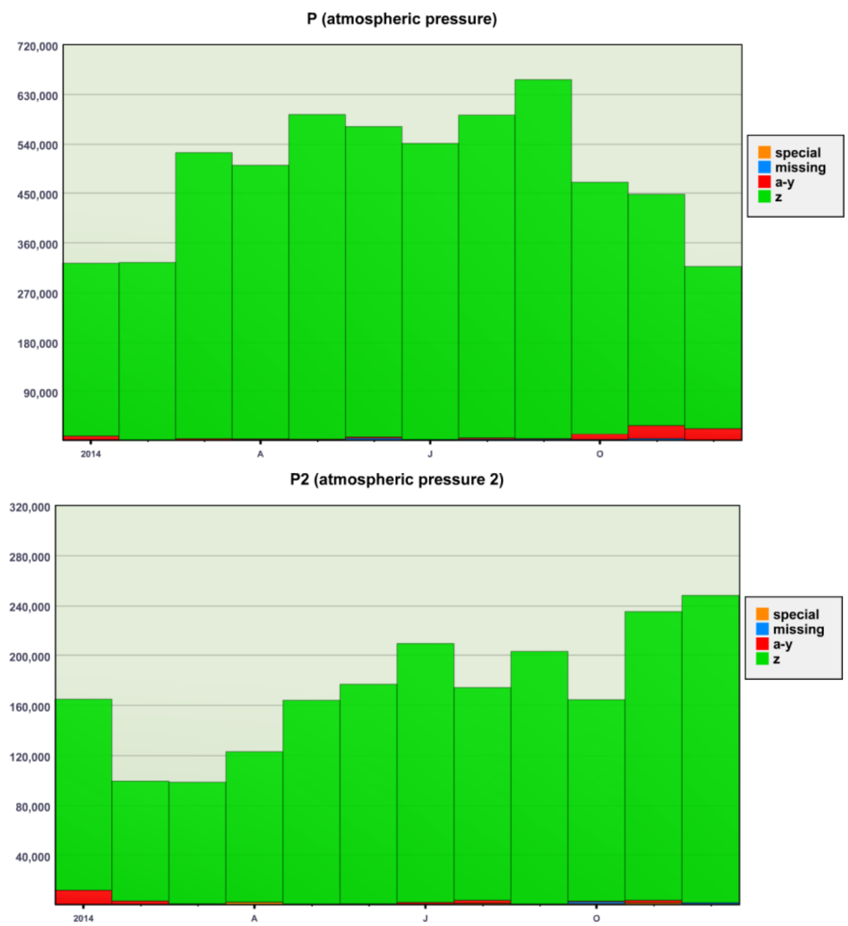
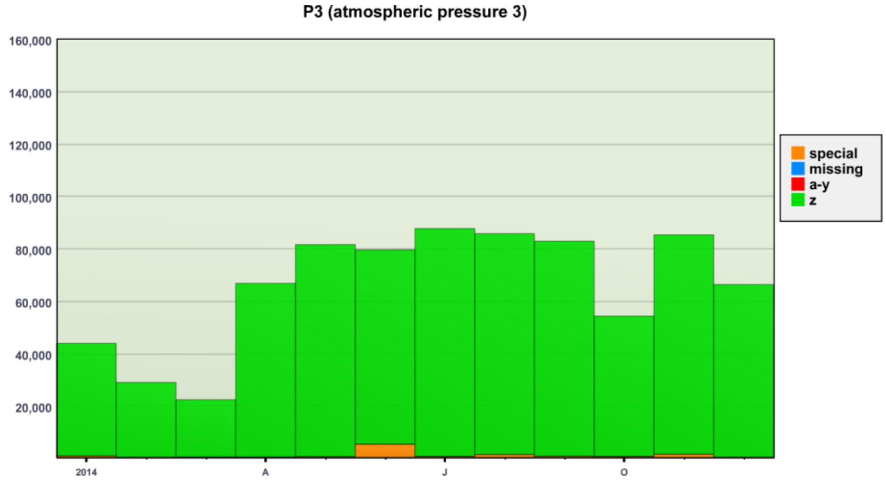


Figure 4: Total number of (top) atmospheric pressure – P – (bottom) atmospheric pressure 2 – P2 – and (next page) atmospheric pressure 3 – P3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS 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 January/February, 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. 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.

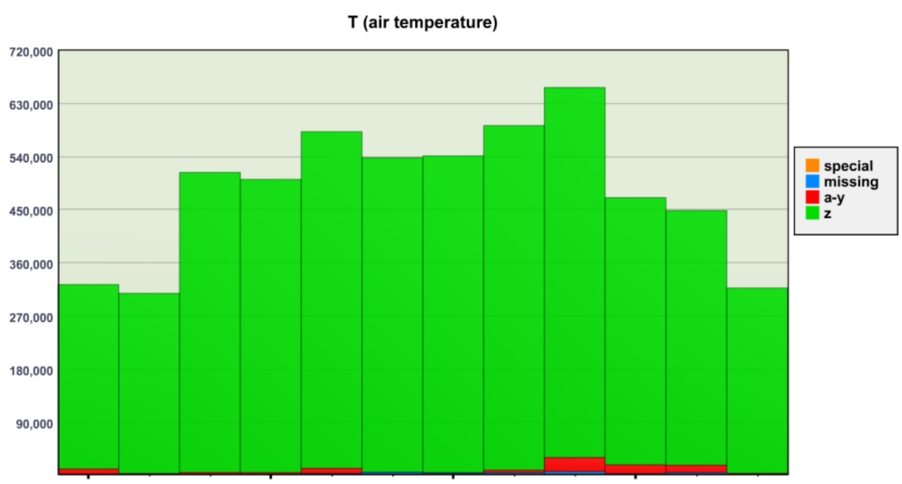
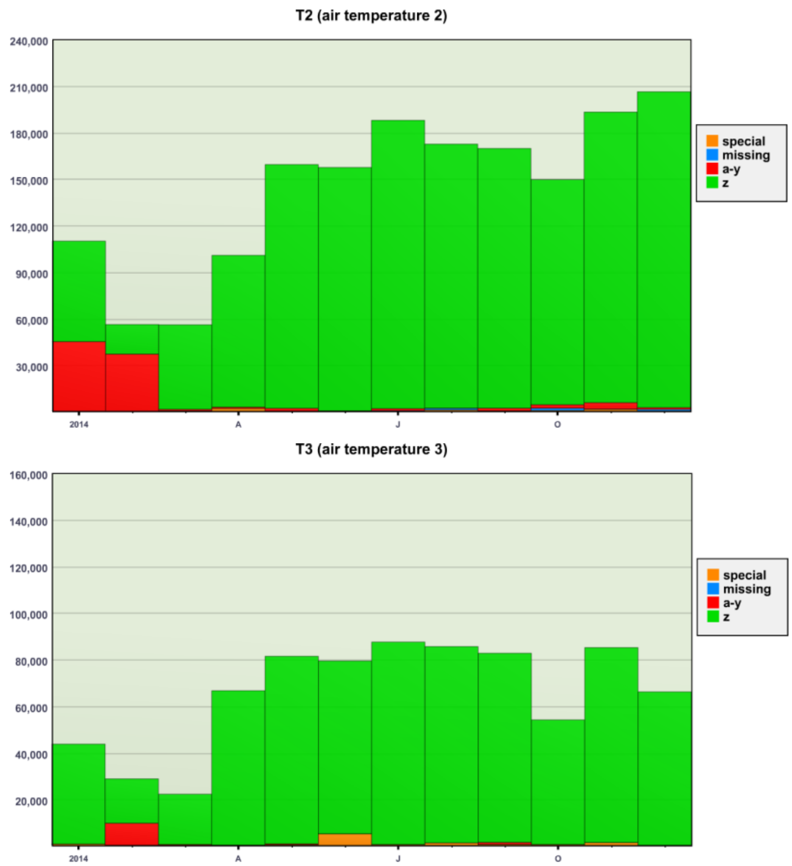


Figure 5: Total number of (this page) air temperature – T – (next page, top) air temperature 2 – T2 – and (next page, bottom) air temperature 3 – T3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of 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 2014; 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. The flagging evident in January was due to data being transmitted after the sensor had already been removed for calibration (documented; see individual vessel description in section 3c for details) and is therefore not representative of the sensor itself.

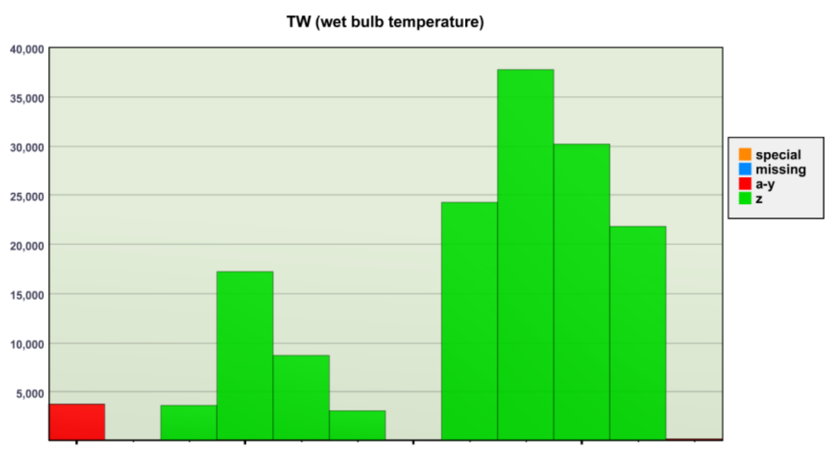


Figure 6: Total number of wet bulb temperature – TW – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Dew point temperature (Figure 7) also was only reported by one vessel in 2014; 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; the reasoning for the flags in January remains the same as above for wet bulb temperature.

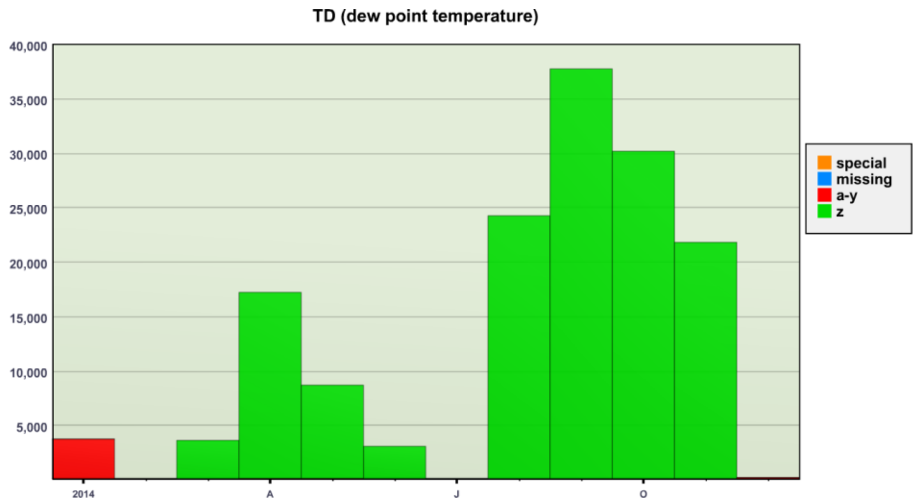


Figure 7: Total number of dew point temperature – TD – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are 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 January/February 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).

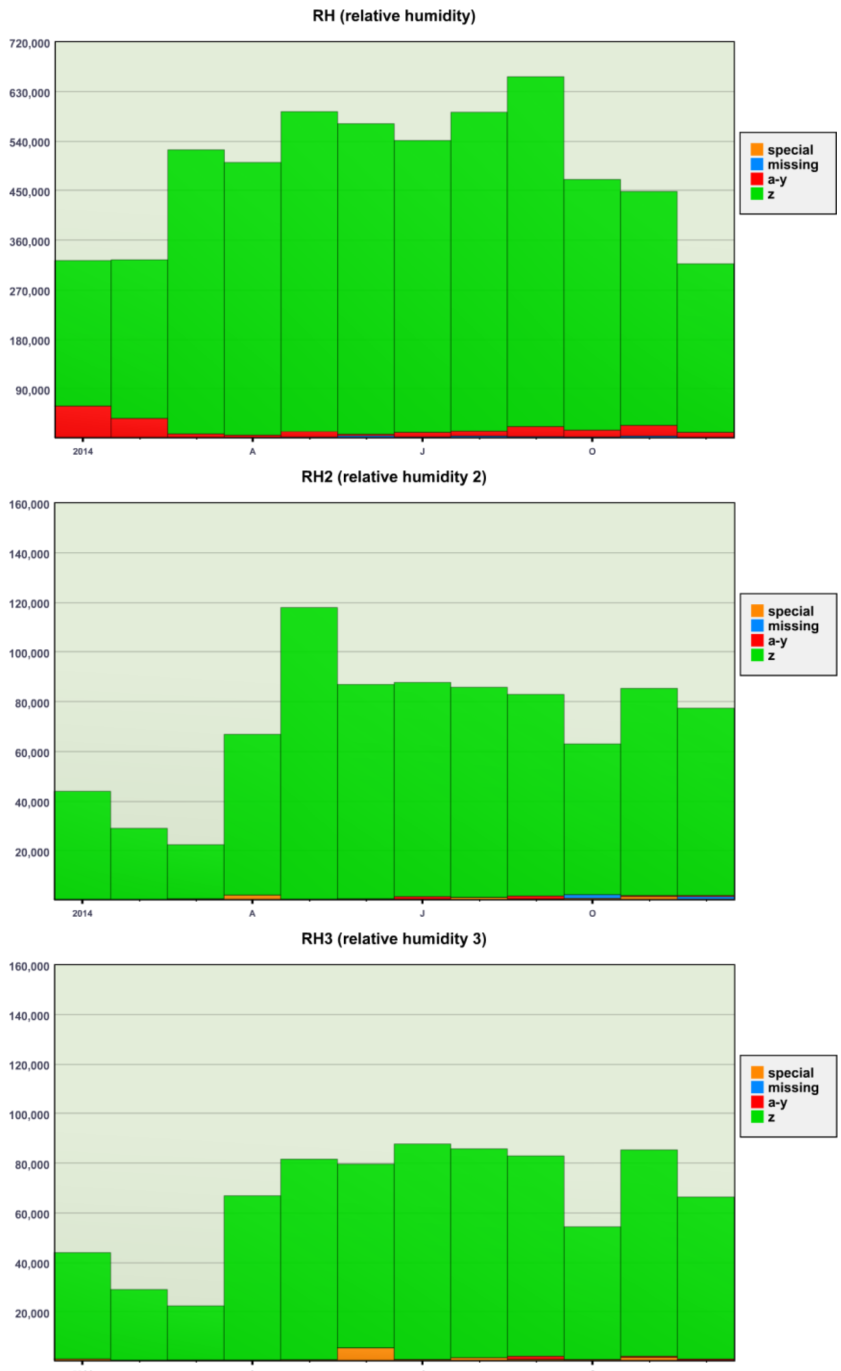


Figure 8: Total number of (top) relative humidity – RH – (middle) relative humidity 2 – RH2 – and (bottom) relative humidity 3 – RH3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (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 2014.

The overall quality of the 2014 SAMOS wind data was nonetheless good, as shown in Figures 9 (earth relative wind direction) and 10 (earth relative wind speed). 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. Figure 35 in the next section does a good job of showing the steps that can occur in DIR and/or SPD when flow obstruction or distortion occurs; spikes are pretty self-explanatory.

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 and in-situ data (buoys, pier-based stations, etc.) 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. Figure 52 depicts the type of in-depth analysis that goes into investigating a suspected wind direction bias. Suspected wind direction biases are typically flagged with K flags, or J flags if the case is extreme and/or verifiable.

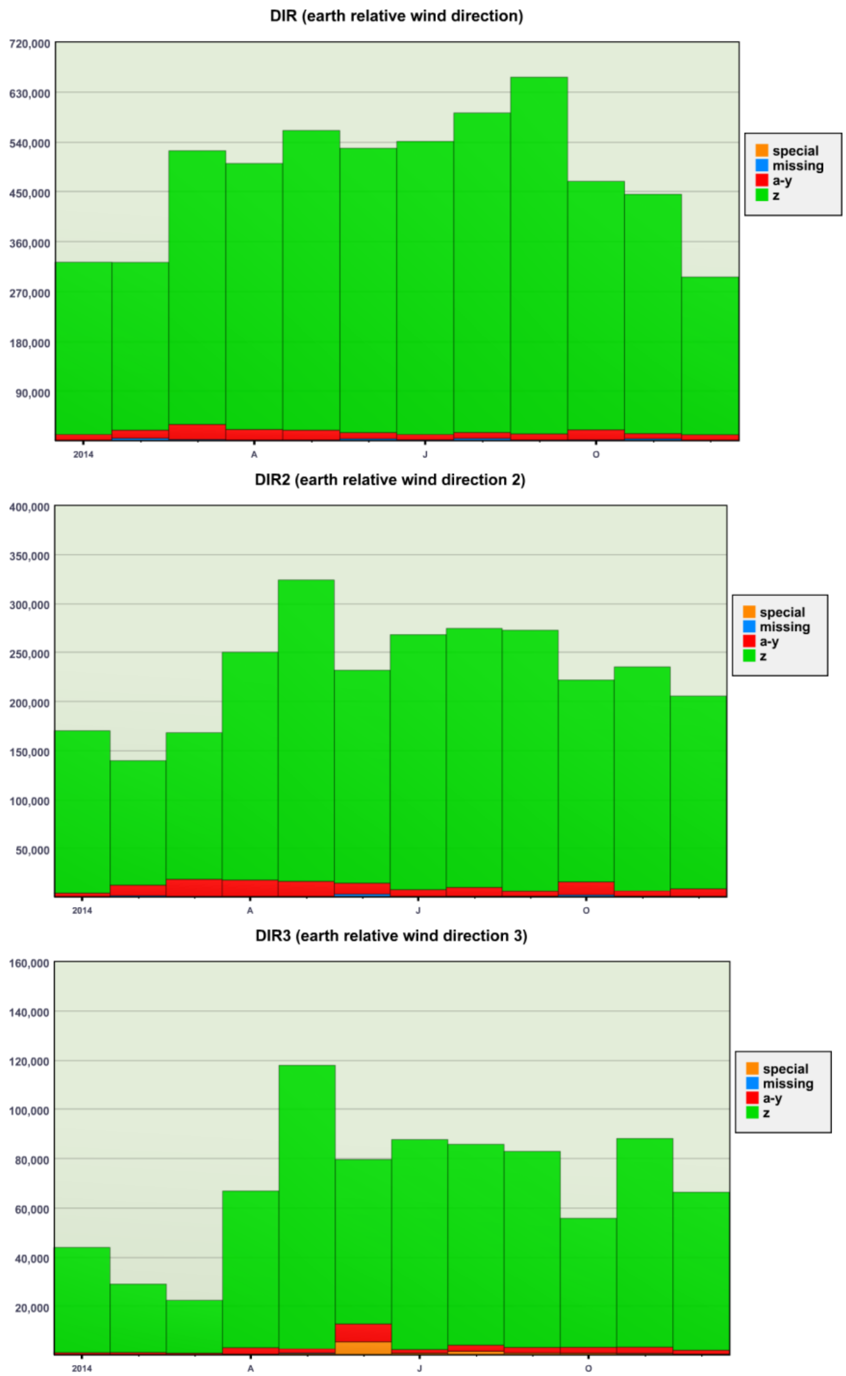


Figure 9: Total number of (top) earth relative wind direction – DIR – (middle) earth relative wind direction 2 – DIR2 – and (bottom) earth relative wind direction 3 – DIR3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values 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.

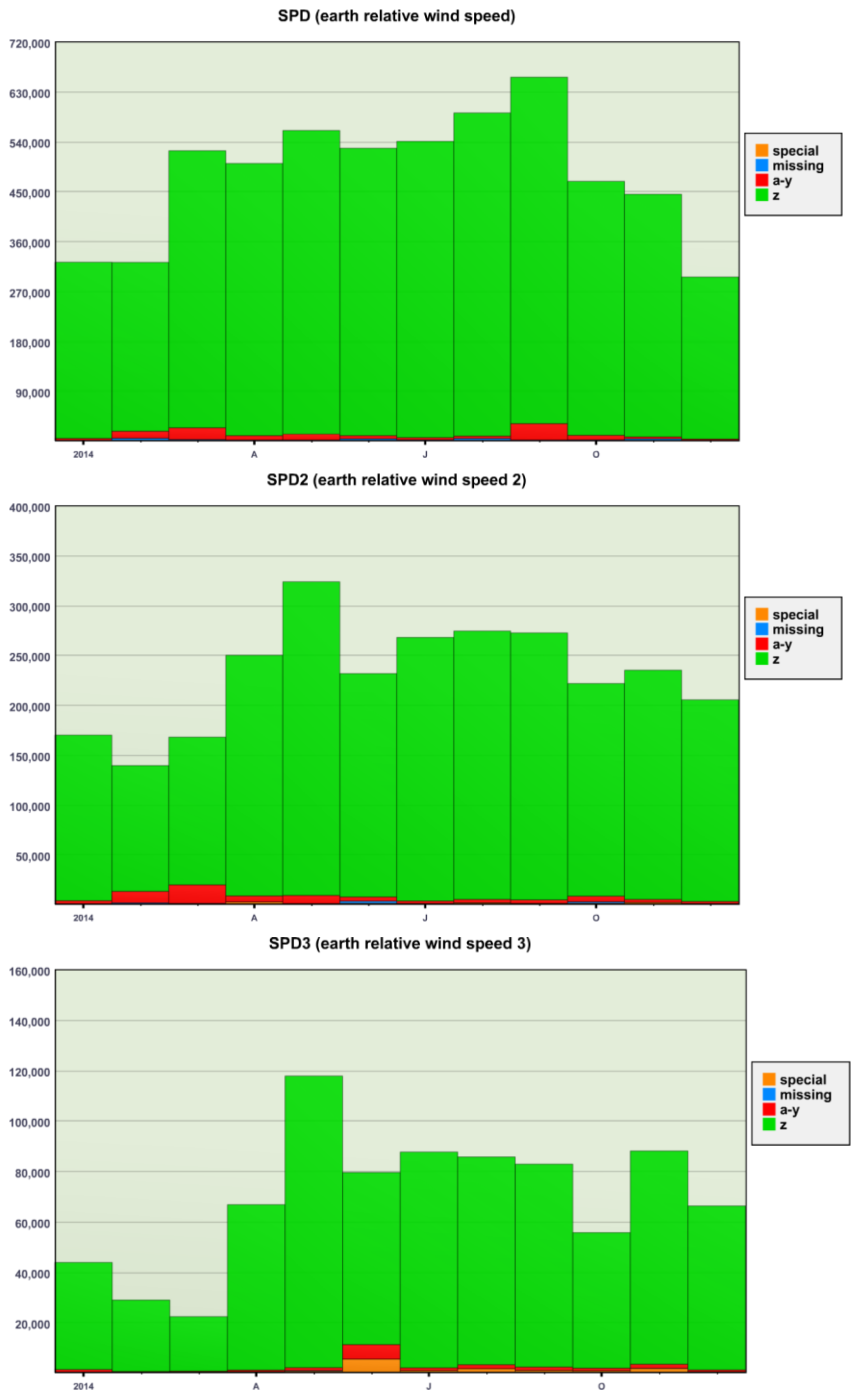
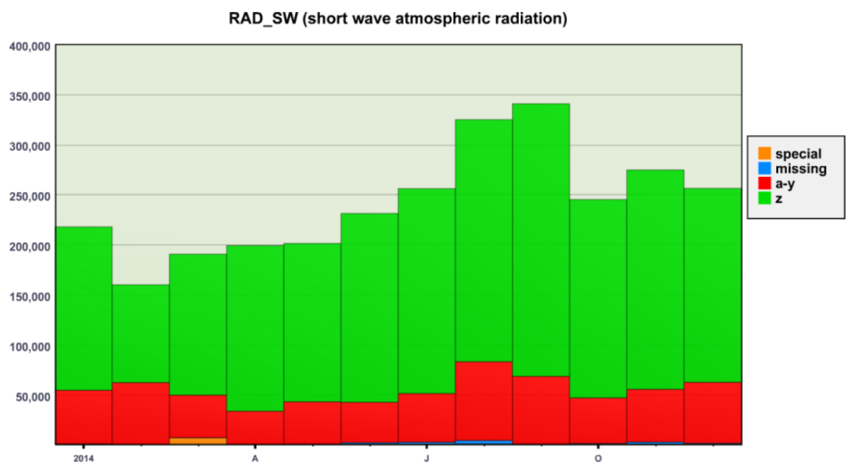


Figure 10: Total number of (top) earth relative wind speed – SPD – (middle) earth relative wind speed 2 – SPD2 – and (bottom) earth relative wind speed 3 – SPD3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed 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). There is one event evident in the radiation parameter statistics: from 17 June to 20 July the *Tangaroa's* two short wave sensors and two long wave sensors (*Tangaroa* is the only vessel that offer the duplicate sensors) all put out bad data and RAD_SW2, RAD_LW, and RAD_LW2 were J flagged for the duration of the event (documented; see individual vessel description in section 3c for details). Otherwise overall quality for the short wave and long wave parameters looks good, as does the overall quality for photosynthetically active atmospheric radiation and net atmospheric radiation (Figures 13, and 14, respectively).



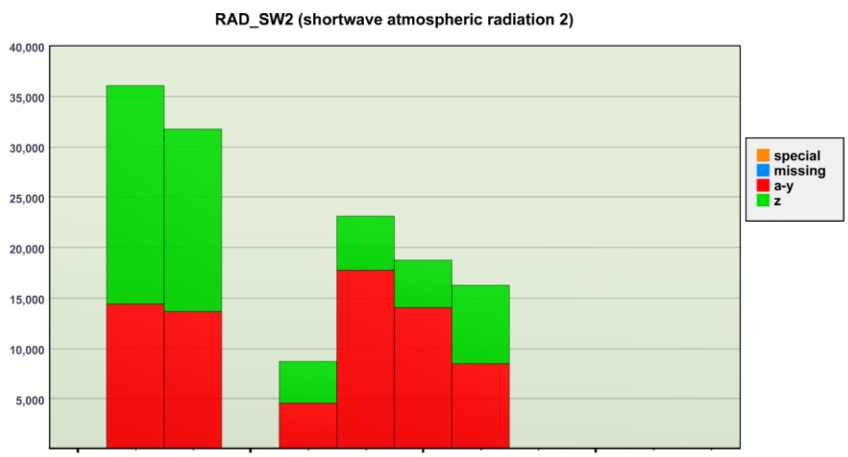


Figure 11: Total number of (top) shortwave atmospheric radiation – RAD_SW – and (bottom) shortwave atmospheric radiation 2 – RAD_SW2 –observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

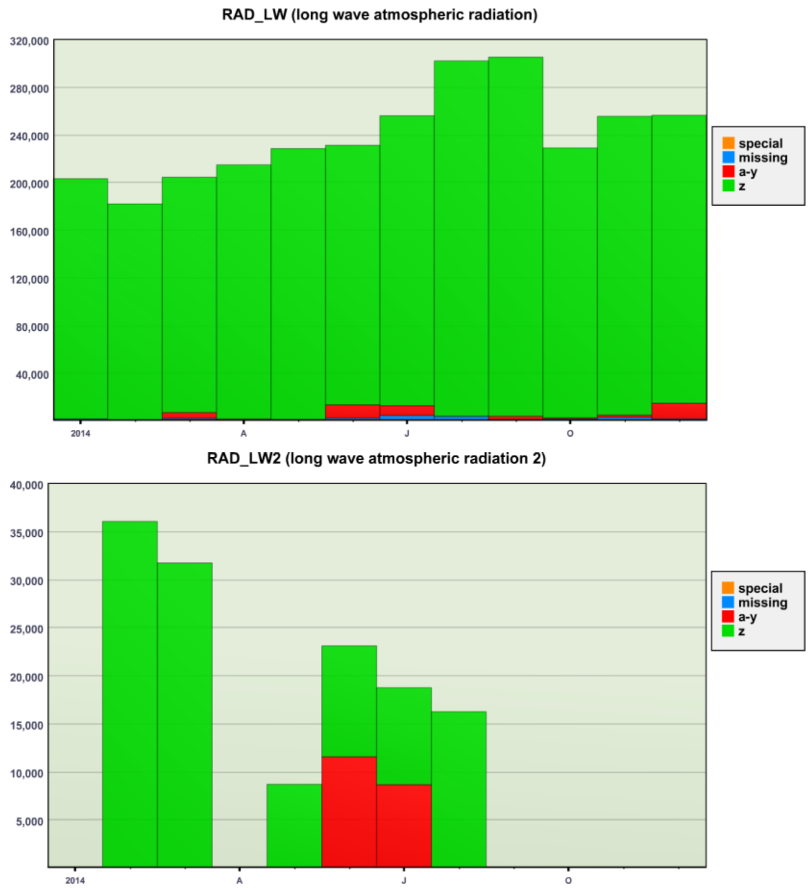


Figure 12: Total number of (top) long wave atmospheric radiation – RAD_LW – and (bottom) long wave atmospheric radiation 2 – RAD_LW2 –observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

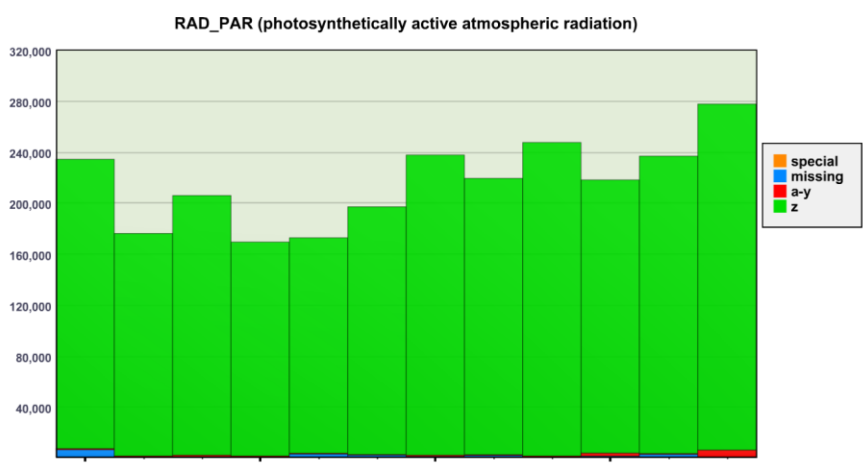


Figure 13: Total number of photosynthetically active atmospheric radiation – RAD_PAR – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

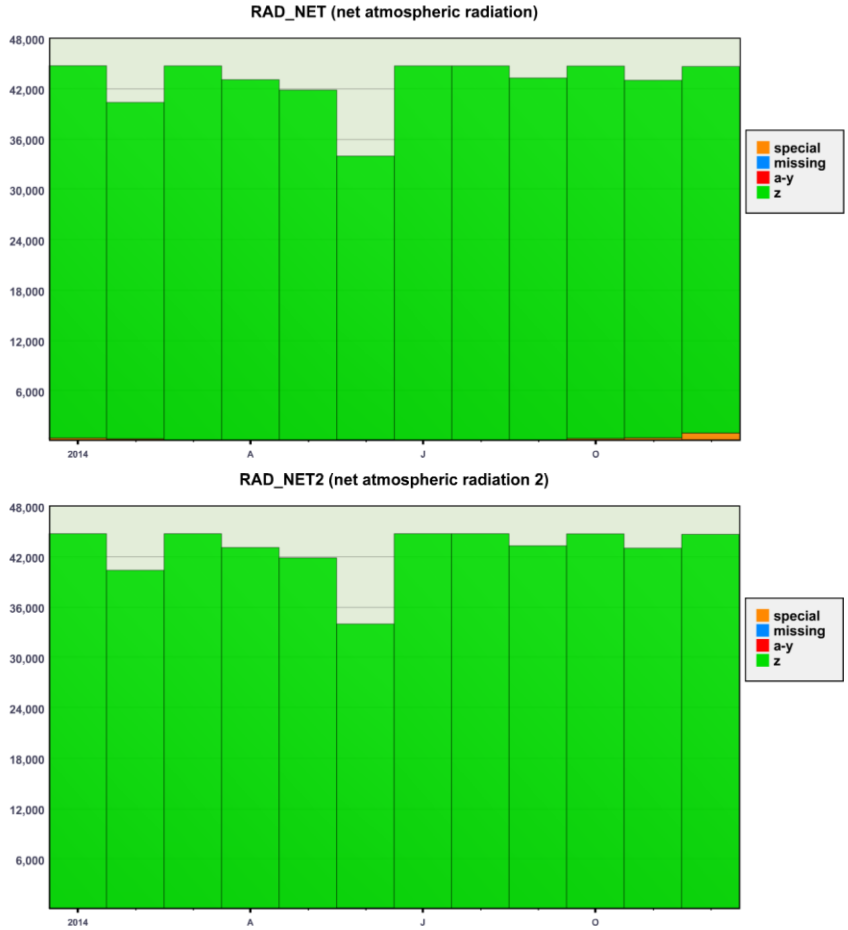


Figure 14: Total number of (top) net atmospheric radiation – RAD_NET – and (bottom) net atmospheric radiation 2 – RAD_NET2 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). 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 occasionally exhibit slow leaks and/or evaporation. These data are not typically flagged; nevertheless, frequent emptying of precipitation accumulation sensors is always advisable.

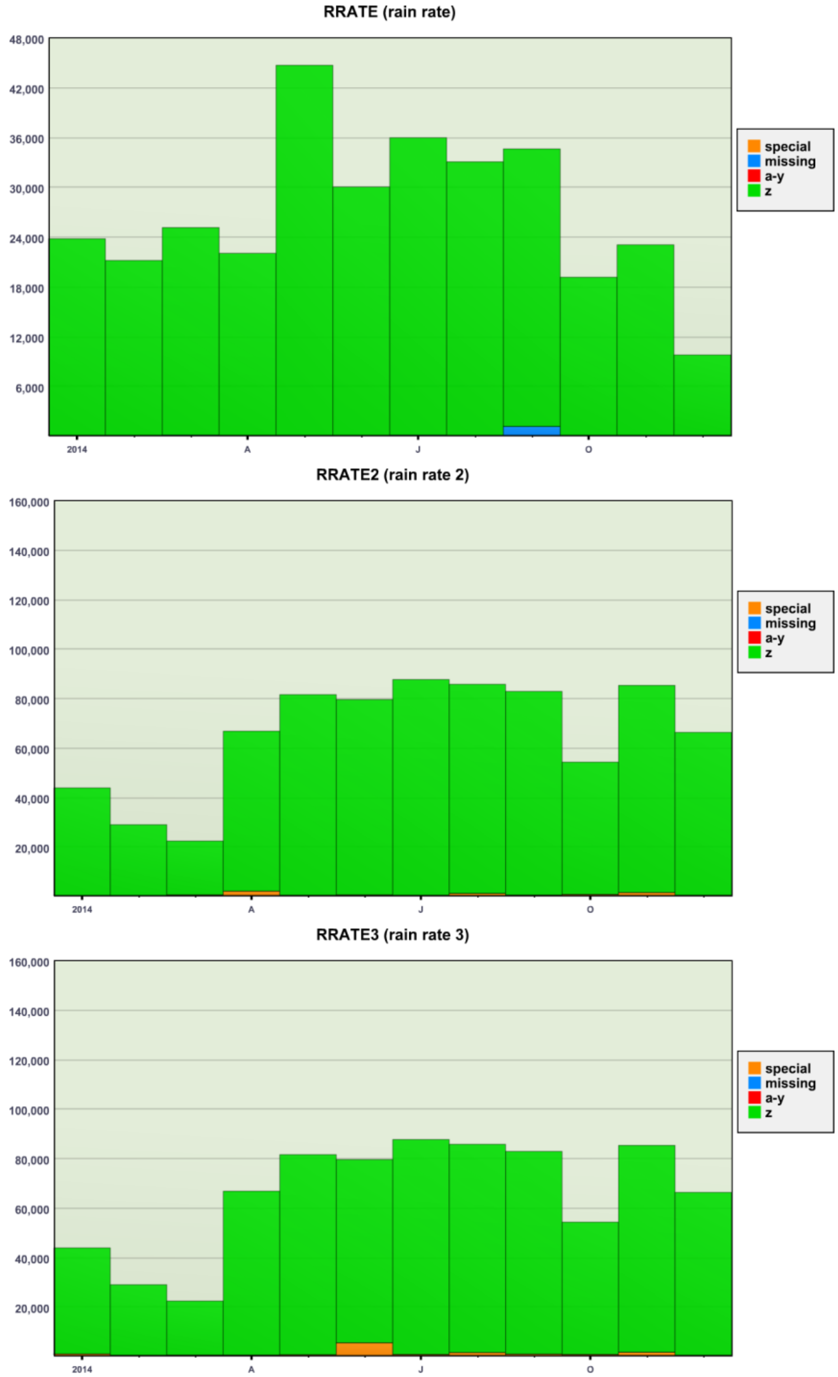


Figure 15: Total number of (top) rain rate – RRATE – (middle) rain rate 2 – RRATE2 – and (bottom) rain rate 3 – RRATE3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

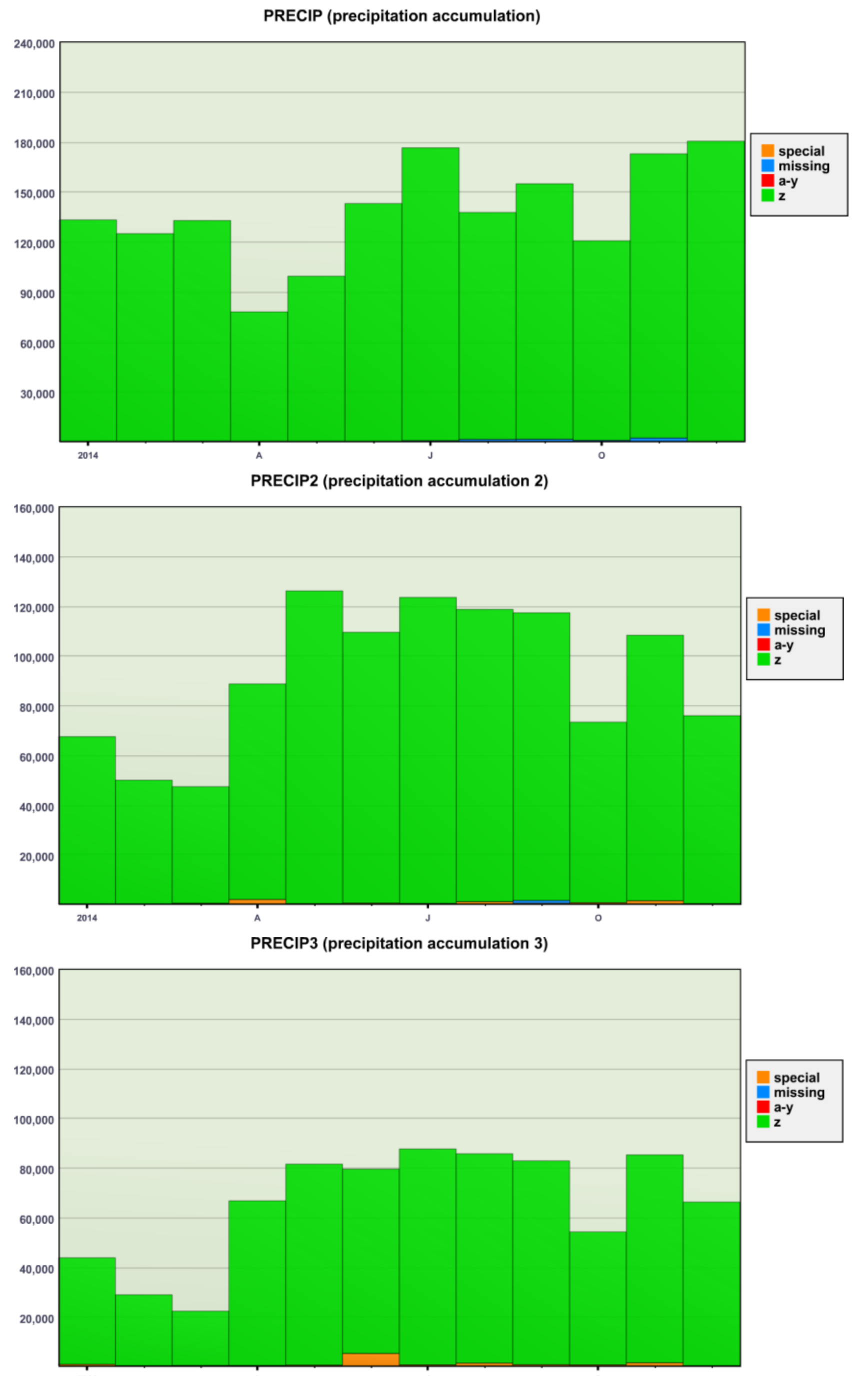
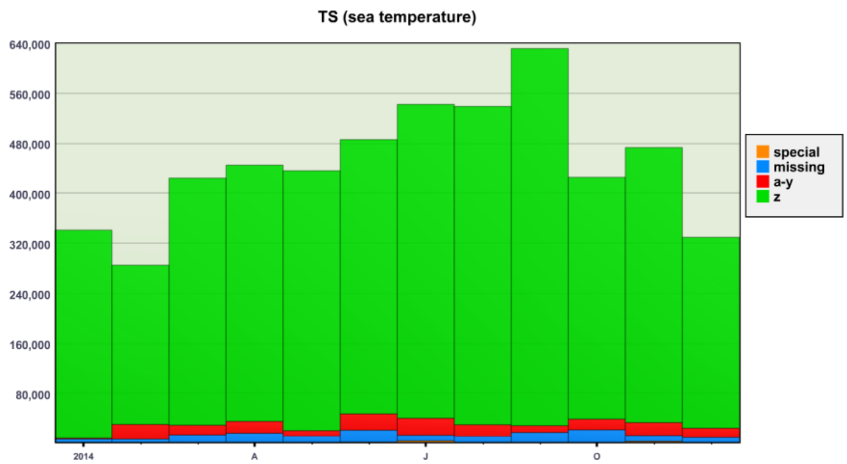


Figure 16: Total number of (top) precipitation accumulation – PRECIP – (middle) precipitation accumulation 2 – PRECIP2 – and (bottom) precipitation accumulation 3 – PRECIP3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values 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. It is unclear where the increase in TS2 in July originated, but we note the *Revelle* is one of a few vessels that provide a secondary sea temperature and her TS2 data routinely picks up a lot of B flags during automated quality control. It's suspected the sensor reads consistently too high (possibly because it is a hydro lab TSG temp, meaning the water likely travels a ways inside the vessel before it is sampled), and July would certainly be a prime month for that type of behavior to max out.



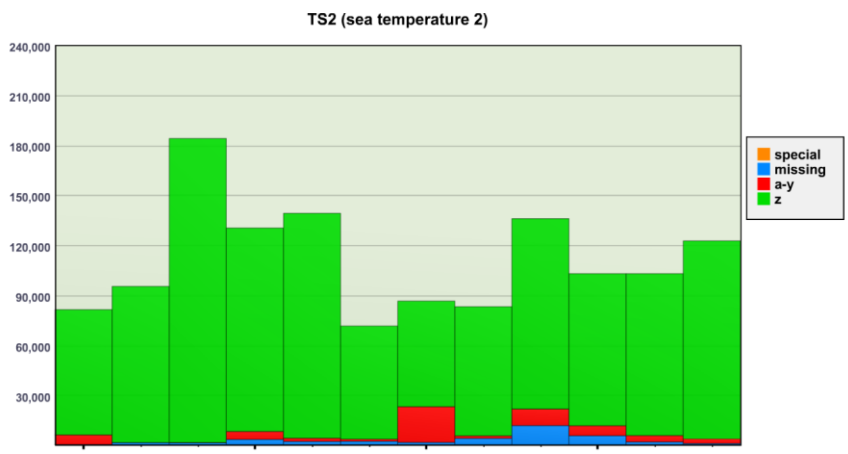
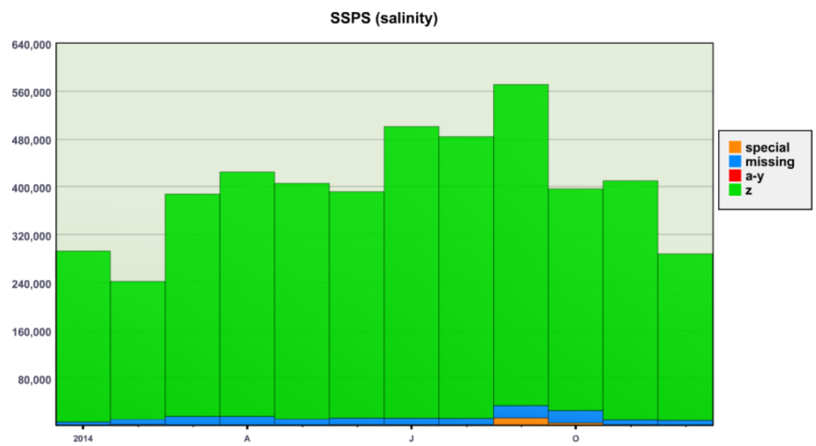


Figure 17: Total number of (top) sea temperature – TS – and (bottom) sea temperature 2 – TS2 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special 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 or rough seas 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 2014 was still rather good. 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.



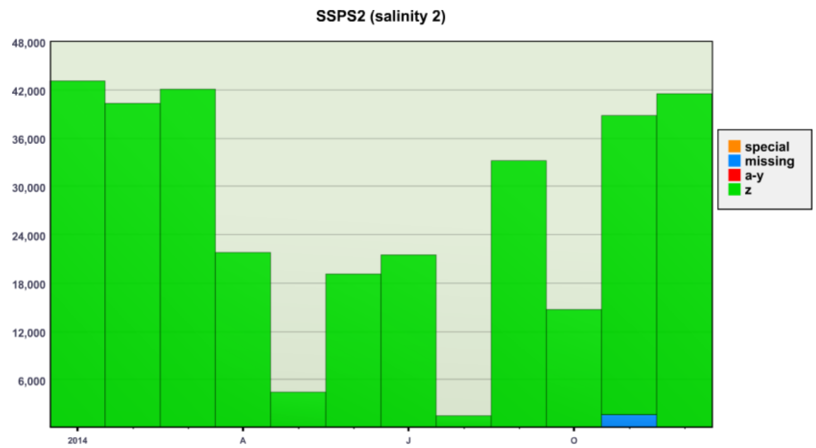


Figure 18: Total number of (top) salinity – SSPS – and (bottom) salinity 2 – SSPS2 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

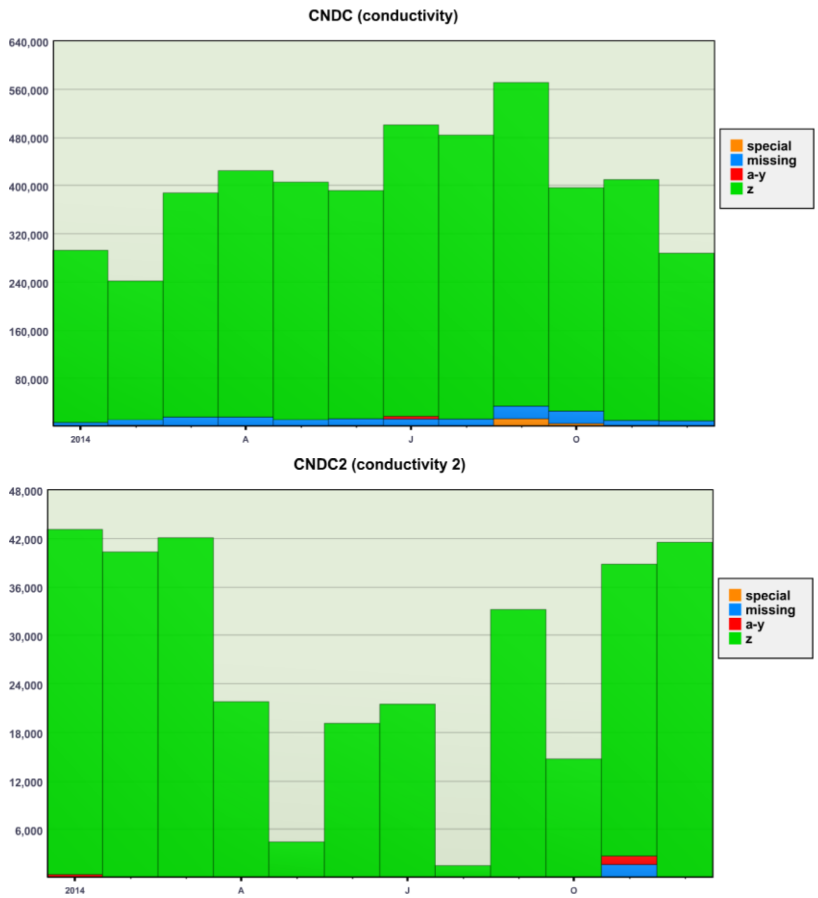
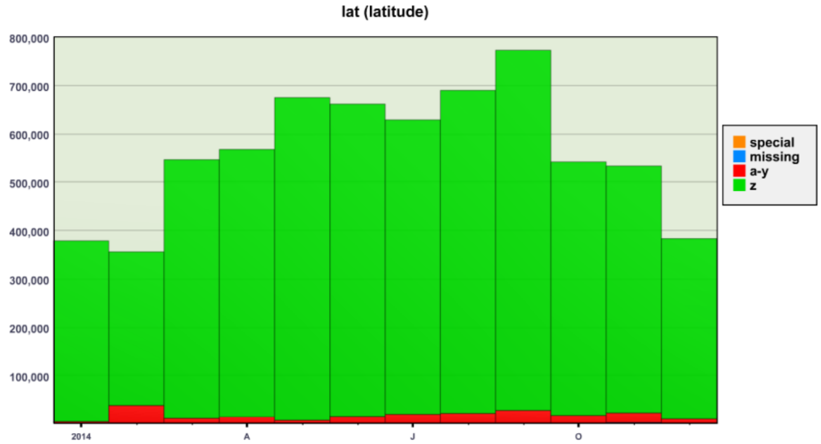


Figure 19: Total number of (top) conductivity – CNDC – and (bottom) conductivity 2 – CNDC2 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special 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 2014 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 2014. It should also be noted that a new one-minute land-sea mask is currently undergoing testing at the SAMOS DAC. It is expected that the overall application of L flags will decrease once the new land-sea mask is operational.



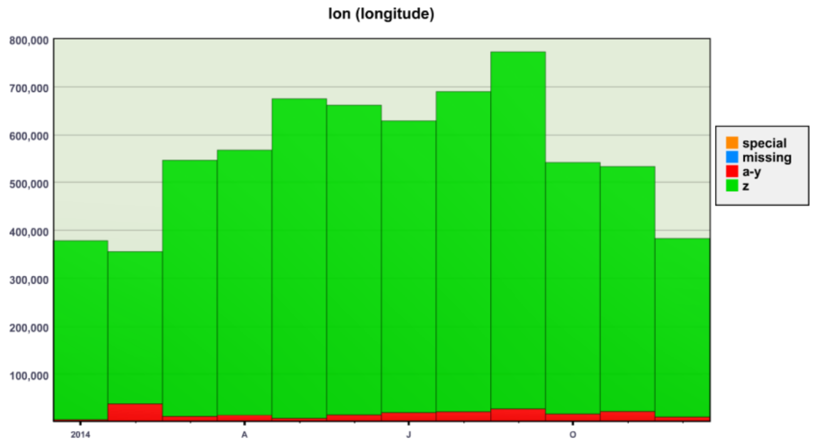


Figure 20: Total number of (this page) latitude – LAT – and (next page) longitude – LON – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special 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).

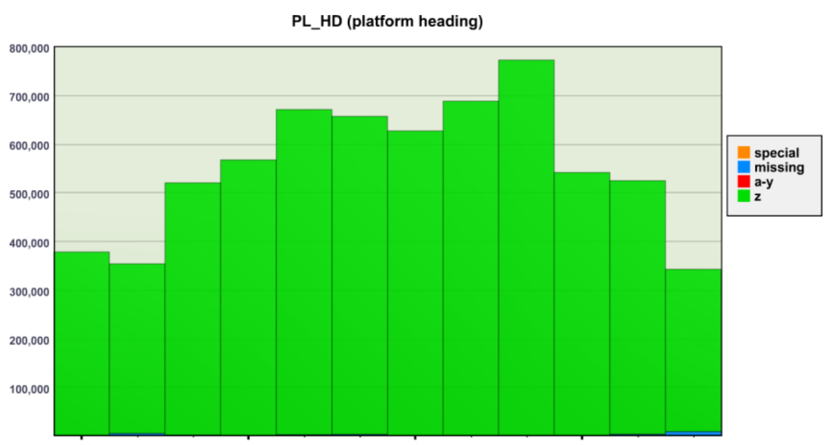
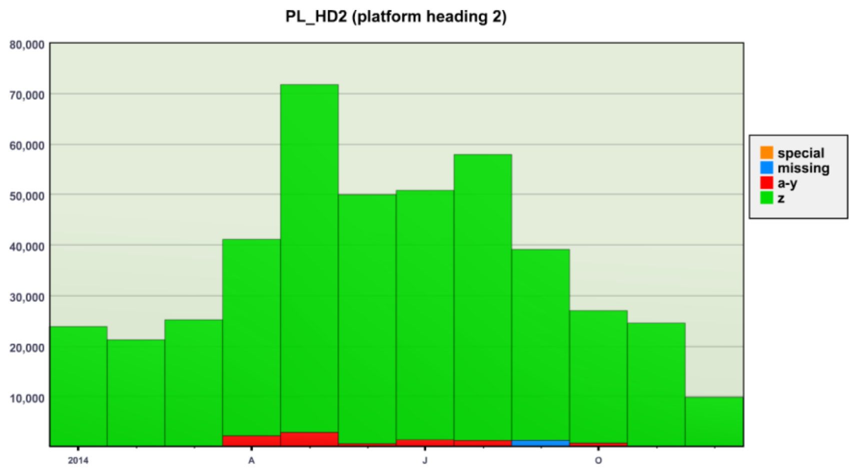


Figure 21: Same as Figure 20, except for (this page) platform heading – PL_HD – and (next page) platform heading 2 – PL_HD2.



(Figure 21: cont'd)

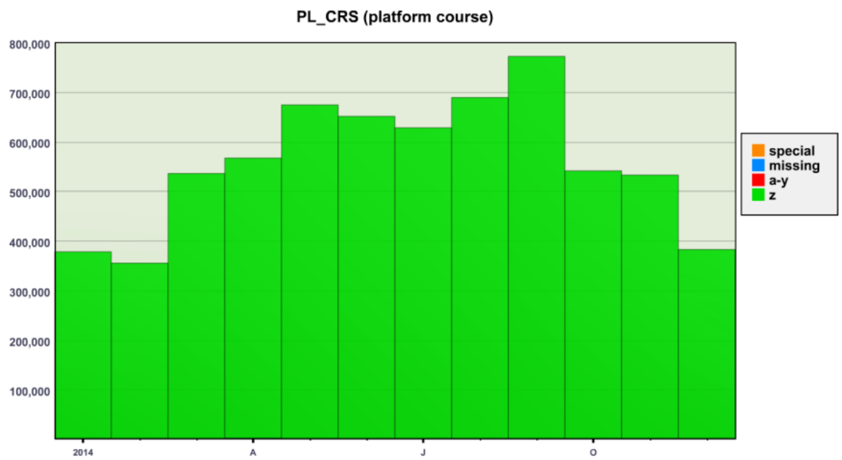


Figure 22: Total number of platform course – PL_CRS –observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

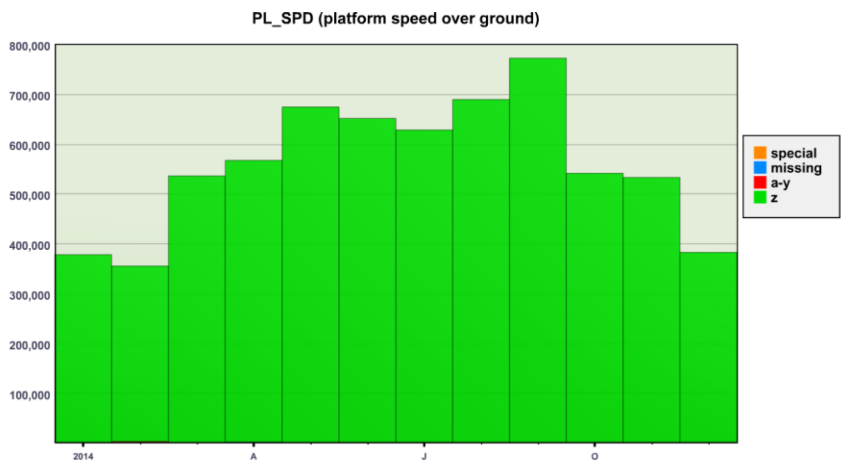
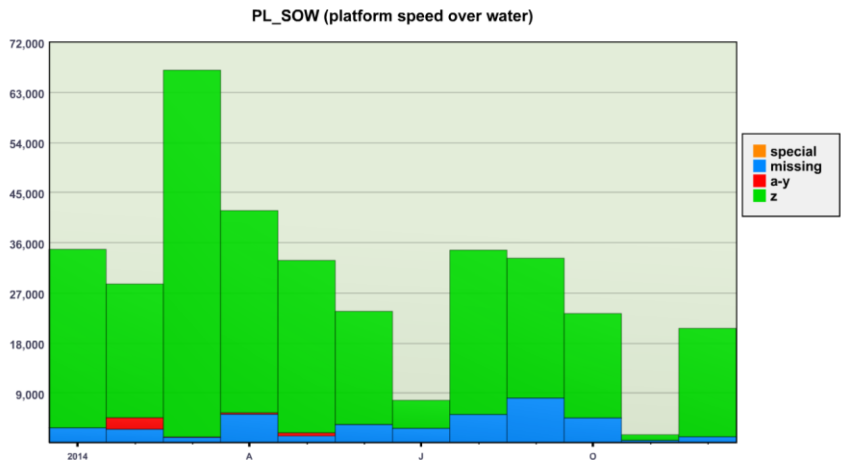


Figure 23: Total number of platform speed over ground – PL_SPD –observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



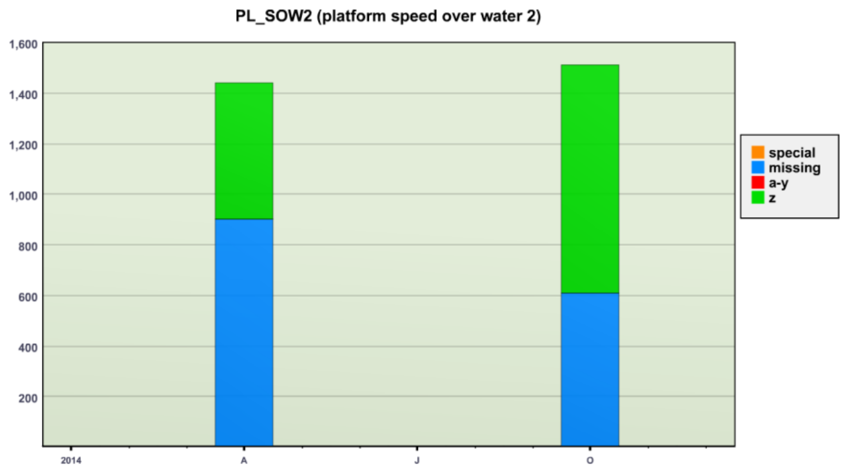


Figure 24: Total number of (top) platform speed over water – PL_SOW – and (bottom) platform speed over water 2 – PL_SOW2 observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values 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.

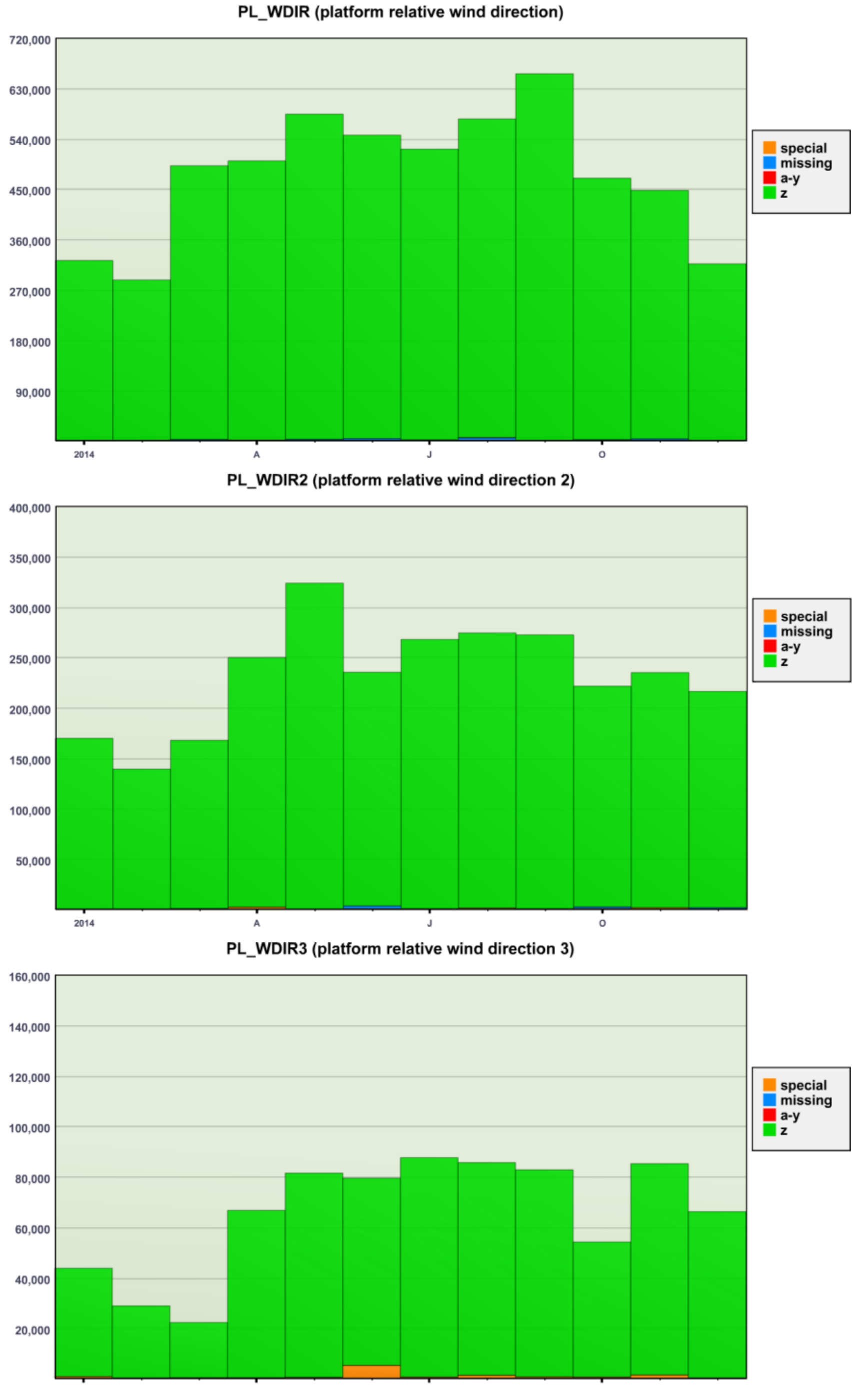


Figure 25: Total number of (top) platform relative wind direction – PL_WDIR –(middle) platform relative wind direction 2 – PL_WDIR2 – and (bottom) platform relative wind direction 3 – PL_WDIR3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) 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.

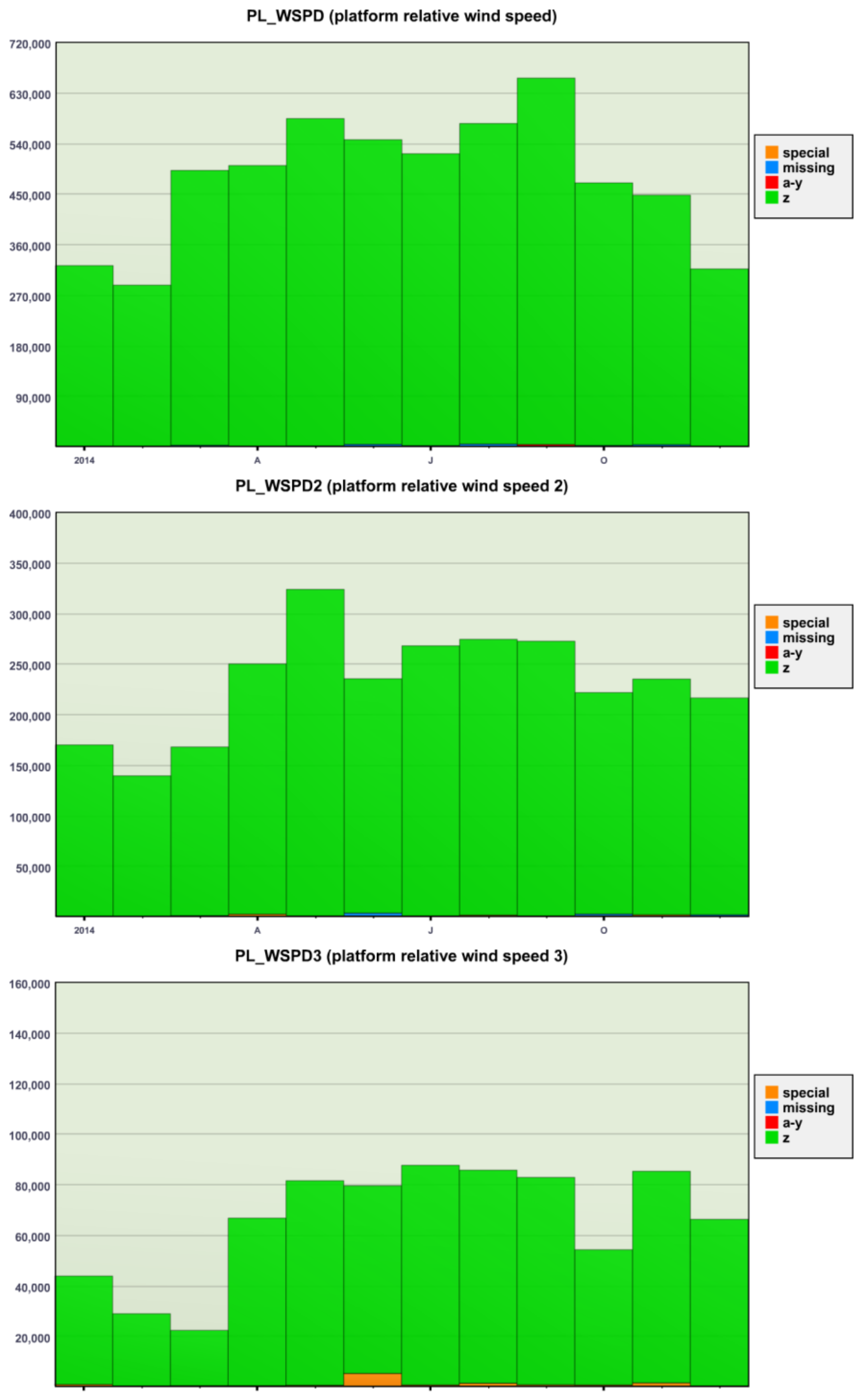


Figure 26: Total number of (top) platform relative wind speed – PL_WSPD – (middle) platform relative wind speed 2 – PL_WSPD2 – and (bottom) platform relative wind speed 3 – PL_WSPD3 – observations provided by all ships for each month in 2014. The colors represent the number of good (green) values versus 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. 2014 quality by ship

Atlantic Explorer

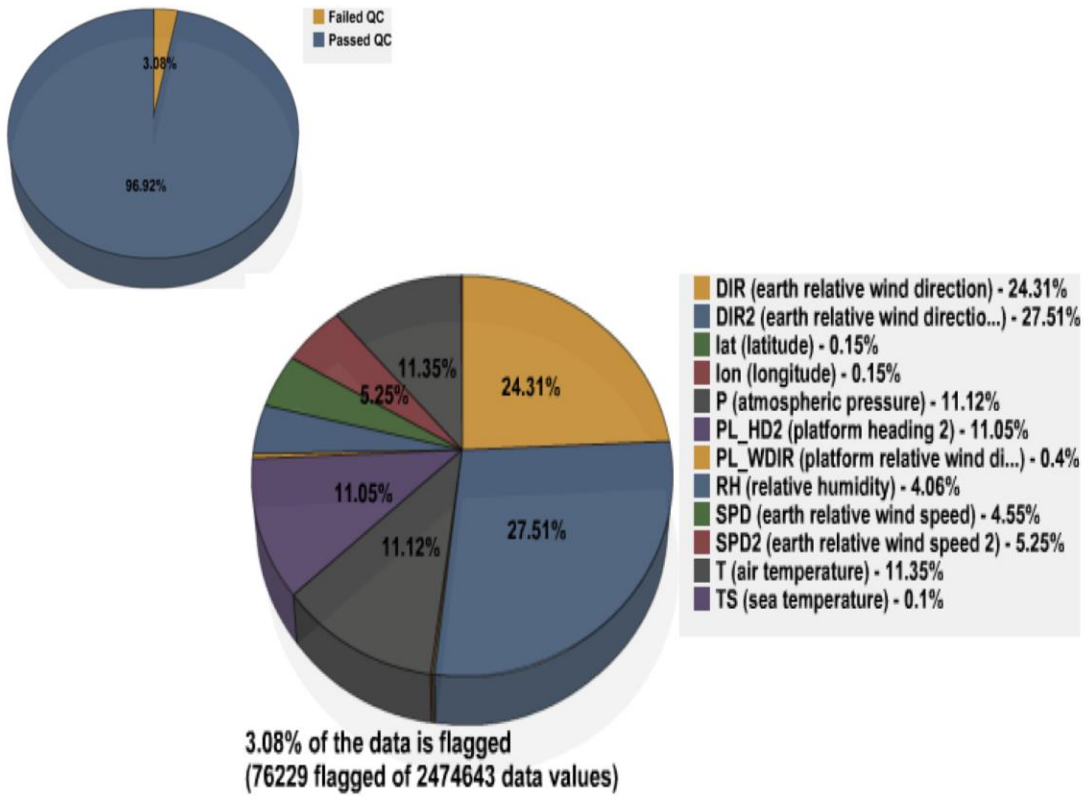


Figure 27: For the *Atlantic Explorer* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Atlantic Explorer* provided SAMOS data for 103 ship days, resulting in 2,474,643 distinct data values. After automated QC, 3.08% of the data were 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.

As with previous years, over half of all flags were 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 29), echoing previous years' performance. We continue to assert the possibility this is 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.

Atmospheric pressure (P) took on another ~11% of the total flags, all of them out of bounds (B) flags (Figure 29). These occurred primarily in October, when values read < 100mb for all P data in that month. *Explorer* personnel were notified of the problem on 6 November, during ongoing email communication regarding P and other suspect parameters, and by 10 November the issue appeared resolved. Another problem with *Explorer* pressure data, not evident in the flag percentages, existed early on in the year.

On 4 April, just as the vessel began transmitting data for the year, SAMOS analysts noted that the barometer behaved oddly – intermittently displaying in units of 1.0mb and then 0.1 or 0.01mb (Figure 28). This behavior was immediately reported to the *Explorer* via email. The response came back that after an SCS upgrade the SAMOS targets had to be rebuilt from scratch. There was reportedly some uncertainty surrounding how to obtain the desired unit output in the P parameter. This uncertainty may or may not have been related to the later October P issue, but at any rate by November the pressure data appeared fully uncompromised.

At roughly the same time the barometer was reading < 100mb, i.e. during October, the air temperature (T) was also malfunctioning, which was explicitly communicated to the DAC by *Explorer* staff. This malfunction tended to produce values above realistic expectation. The malfunction was fortunately largely caught by the auto flagging process, at which time T data were overwhelmingly given B and greater than 4 standard deviations (G) flags, to the tune of a further ~11% of all flags (Figure 29). In the case of ships that receive visual QC (in addition to automated), this would have been a situation where analysts simply apply the malfunction (M) flag to all of the faulty data immediately upon ship notification of the problem. Again, as the *Explorer* does not receive visual QC, it was fortunate the data were mainly out of the bounds set by the auto flagger – had the malfunction produced slightly lower values the data may well have entirely slipped the net and passed as "good data," though they were not.

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 (Figure 29). This totaled another ~11% of all flags. During conversation, *Explorer* personnel have expressed their belief that this problem cannot be resolved.

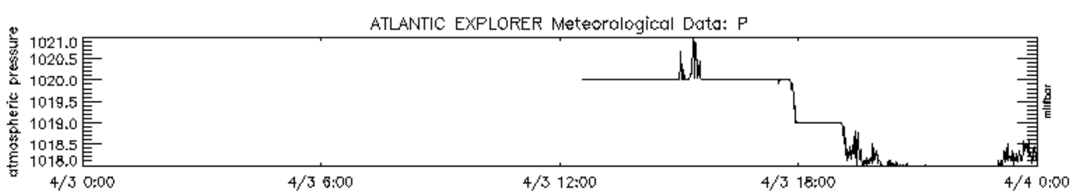


Figure 28: *Atlantic Explorer* SAMOS atmospheric pressure – P – data for 3 April 2014. Data alternately reported with different precision.

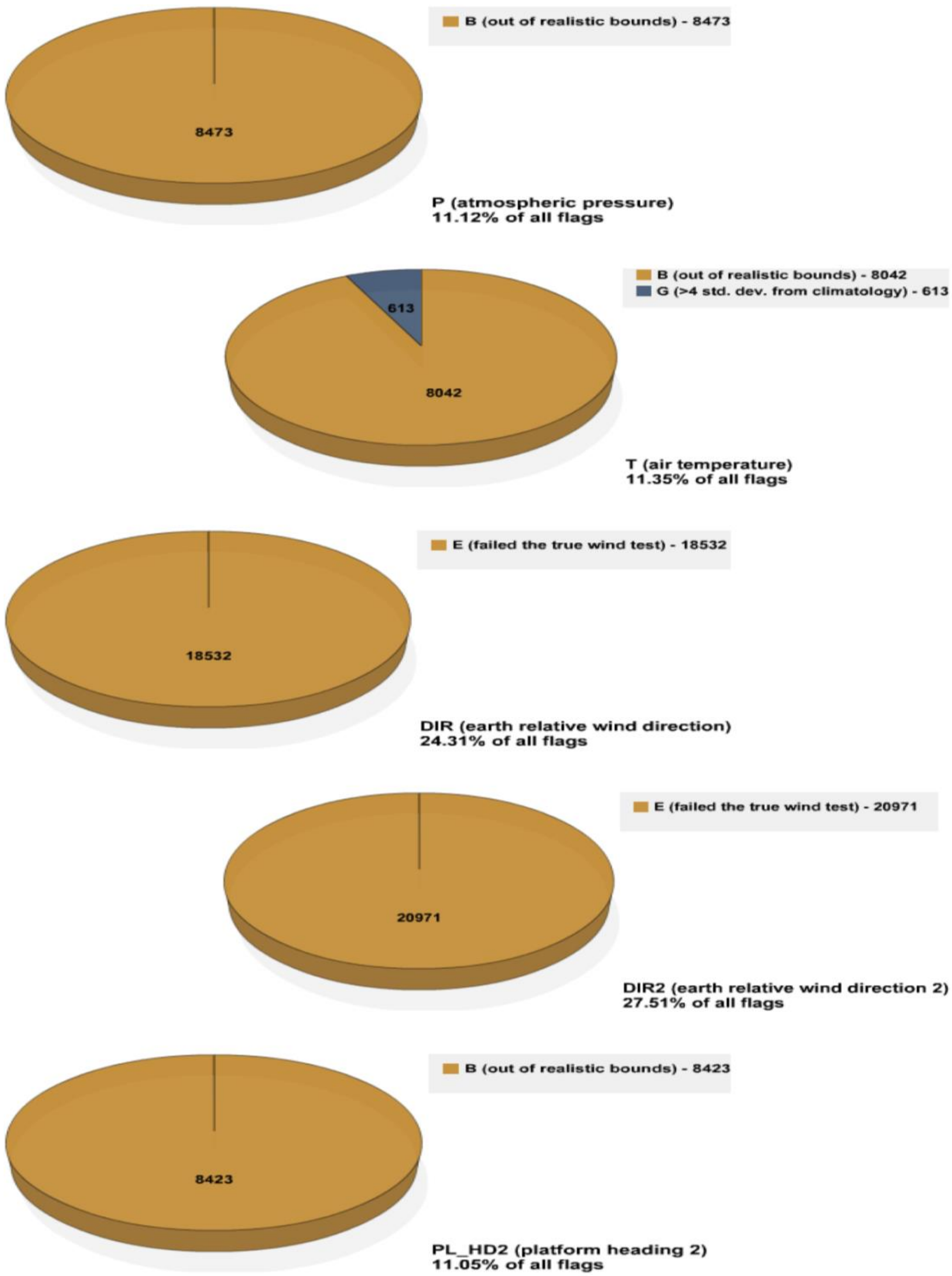
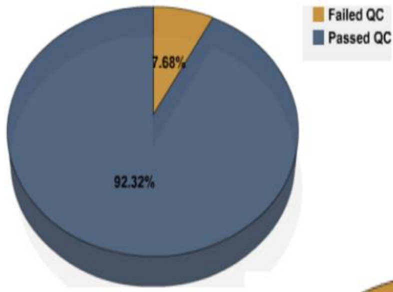


Figure 29: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) air temperature – T – (third) earth relative wind direction – DIR – (fourth) earth relative wind direction 2 – DIR2 – and (last) platform heading 2 – PL_HD2 – for the *Atlantic Explorer* in 2014.

Tangaroa



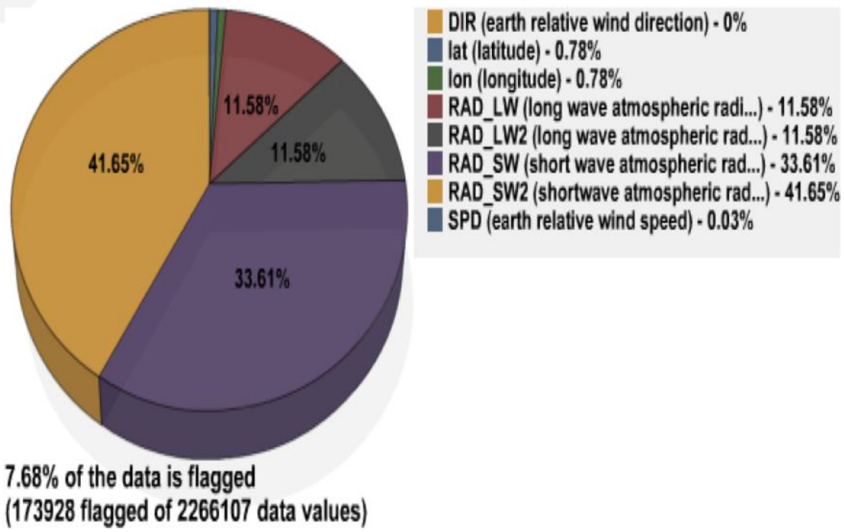


Figure 30: For the *Tangaroa* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Tangaroa* provided SAMOS data for 94 ship days, resulting in 2,266,107 distinct data values. After automated QC, 7.68% of the data were flagged using A-Y flags (Figure 30). 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*).

Tangaroa's four radiation parameters i.e. long wave atmospheric radiation (RAD_LW and RAD_LW2) and short wave atmospheric radiation (RAD_SW and RAD_SW2) made up ~98% of the total flags (Figure 30). All of these flags, for all four parameters, were out of bounds (B) flags (Figure 31). Upon inspection it appears most of the B flags applied to RAD_SW and RAD_SW2 were linked to short wave radiation values slightly less than zero. Although technically impossible, short wave radiation sensors commonly read slightly below zero at night, owing to sensor tuning (see 3b for discussion). However, the remainder of the B flags applied to RAD_SW and RAD_SW2 as well as all of the B flags applied to RAD_LW and RAD_LW2 appear to have signified an actual problem with the data. During the period 17 June to 20 July RAD_SW alternated between days-long readings of constant zero and readings of mostly physically impossible values (on the order of several thousand Wm^{-2}, both positive and negative). During this same period RAD_SW2 read at a constant -2846.16 Wm^{-2}, and RAD_LW and RAD_LW2 both read a constant 0 Wm^{-2}. All of these physically unrealistic values received B flags except, interestingly, the constant zero readings from RAD_SW. As short wave radiation values of zero are not actually out of bounds, that portion of the affected data passed the auto flagger's inspection. If the *Tangaroa* had been a vessel that receives visual quality control at the SAMOS DAC these values would have been manually assigned poor quality (J) flags, or perhaps malfunction (M) flags. We note that 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.

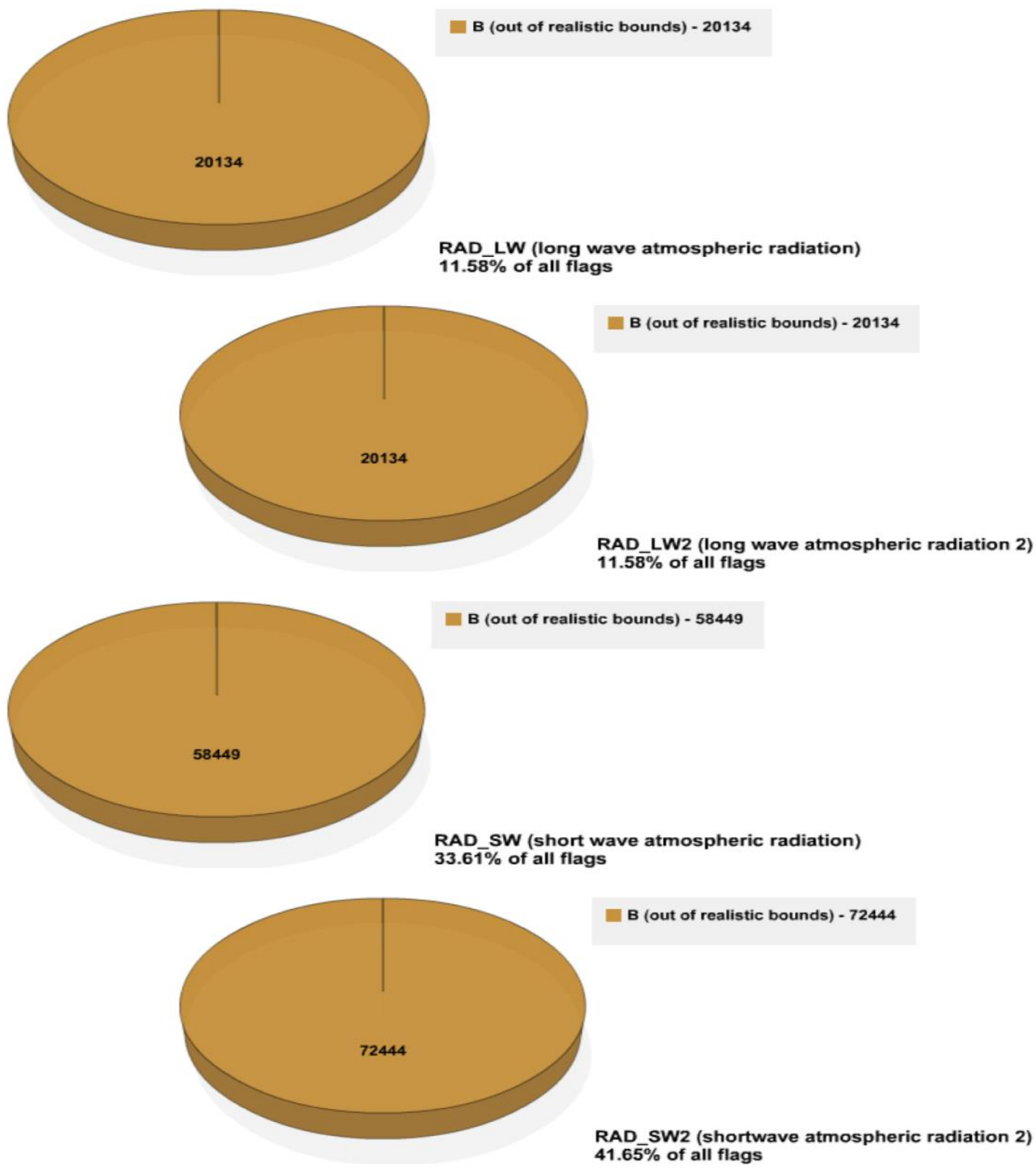
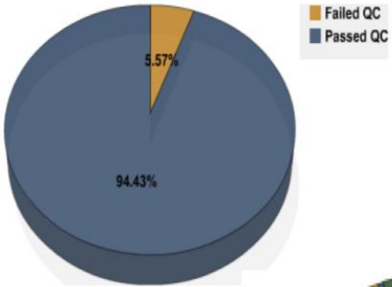


Figure 31: Distribution of SAMOS quality control flags for (first) long wave atmospheric radiation – RAD_LW – (second) long wave atmospheric radiation 2 – RAD_LW2 – (third) short wave atmospheric radiation – RAD_SW – and (last) short wave atmospheric radiation 2 – RAD_SW2 – for the *Tangaroa* in 2014.

Bell M. Shimada



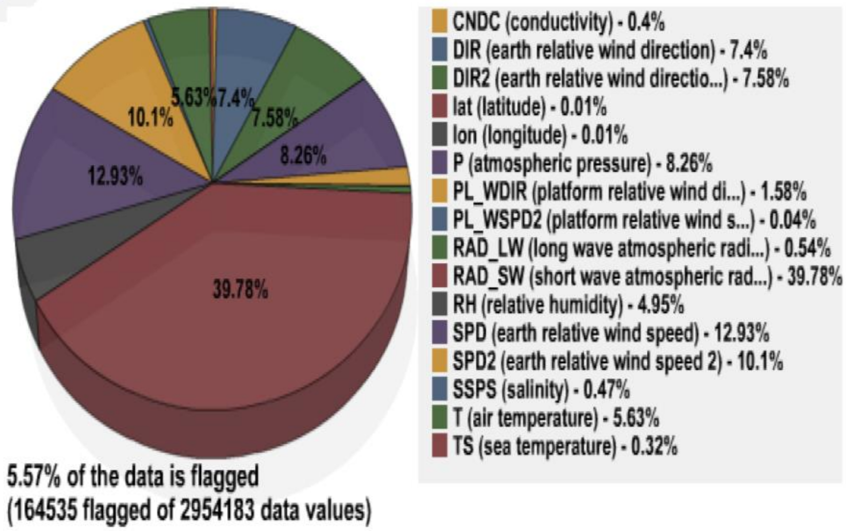


Figure 32: For the *Bell M. Shimada* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Bell M. Shimada* provided SAMOS data for 110 ship days, resulting in 2,954,183 distinct data values. After both automated and visual QC, 5.57% of the data were flagged using A-Y flags (Figure 32). This is nearly identical to *Shimada's* 2013 performance (5.74% total flagged).

At first glance the biggest issue with the *Shimada* data would again appear to be short wave atmospheric radiation, making up over 39% of the flags. However, just as in previous years, these are almost exclusively out of bounds (B) flags (not shown), 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.

The main issues with the *Shimada* data continue to be wind-related. First, the redundant wind measurements DIR2 and SPD2, from the anemometer located amidships, often deviate from the forward mast (jackstaff) wind measurements DIR and SPD, depending upon the platform relative wind direction, resulting in quite a bit of suspect/caution (K) flagging in either sensor (Figure 33). A detailed flow analysis does not exist for this vessel, but flow distortion is clearly indicated in digital imagery and in the data itself, as noted both by SAMOS data analysts and *Shimada* technical personnel. In particular, the jackstaff sensor (DIR and SPD) suffers when the wind is from the stern, while the starboard ultrasonic sensor amidships (DIR2 and SPD2) experiences flow obstruction when the apparent wind is roughly 20 degrees to either side of the port beam. In most cases, though, the redundant sensors do 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. We note that while an additional (port) ultrasonic was reportedly installed on the *Shimada* as of January 2014, metadata for this new sensor has not been provided nor is a third set of wind values extant in the *Shimada* data.

There were also a few occurrences of compromised wind data outside of these flow obstruction issues that contributed a small portion of the DIR/SPD flags. During 15-16 April, the jackstaff sensor was discovered to be sending a constant value for platform relative wind direction, which resulted in some poor quality (J) flagging of DIR/SPD (Figure 33). Then on 25 June *Shimada* personnel advised the DAC they'd had to apply a fix to the sensor that day, which resulted in K flagging of DIR/SPD 24-25 June (prior to the fix). Finally, during an in port late July/early August, the jackstaff wind monitor was replaced with an accidental 180 degree rotation. The data were quickly noticed by the ship's technician and were immediately rotated in the software until someone could get to the sensor itself and fix the issue, but DIR/SPD were nevertheless K flagged for most of 4 August. It's important to note here that any one of these issues could have resulted in a much longer duration of data flagging, but the continual diligence of the *Shimada* technicians both prevented that from happening and kept SAMOS personnel informed as to what was going on with the data.

Atmospheric pressure (P) also shared about 8% of the total flags (Figure 32). This was partly due to a hiccup when the *Shimada* got underway in January whereby the data read at a constant 2.5 mb. It is unclear what caused the constant reading, but once it was pointed out by the lead SAMOS analyst in an email conversation with *Shimada's* chief survey technician the issue was immediately fixed. Interestingly, the technician had noted automated out of bounds (B) flagging of the pressure data and asked the DAC about it, since the pressure data he was looking at onboard the vessel appeared reasonable. This activity underscores the value of monitoring one's own SAMOS data files, beginning with the preliminary-level files (automated error checking only) available within minutes of transmission. It is likely this was a minor translator or SCS issue that was easily fixed once it became clear what data the tech saw versus what the DAC was receiving. Note in this case the data flags, which were applied 19-21 January, were further changed from B to J by the visual quality control analyst (Figure 33). The rest of the K flagging of P was due mainly to flow obstruction. (Some quantity of such is nearly unavoidable on most vessels.)

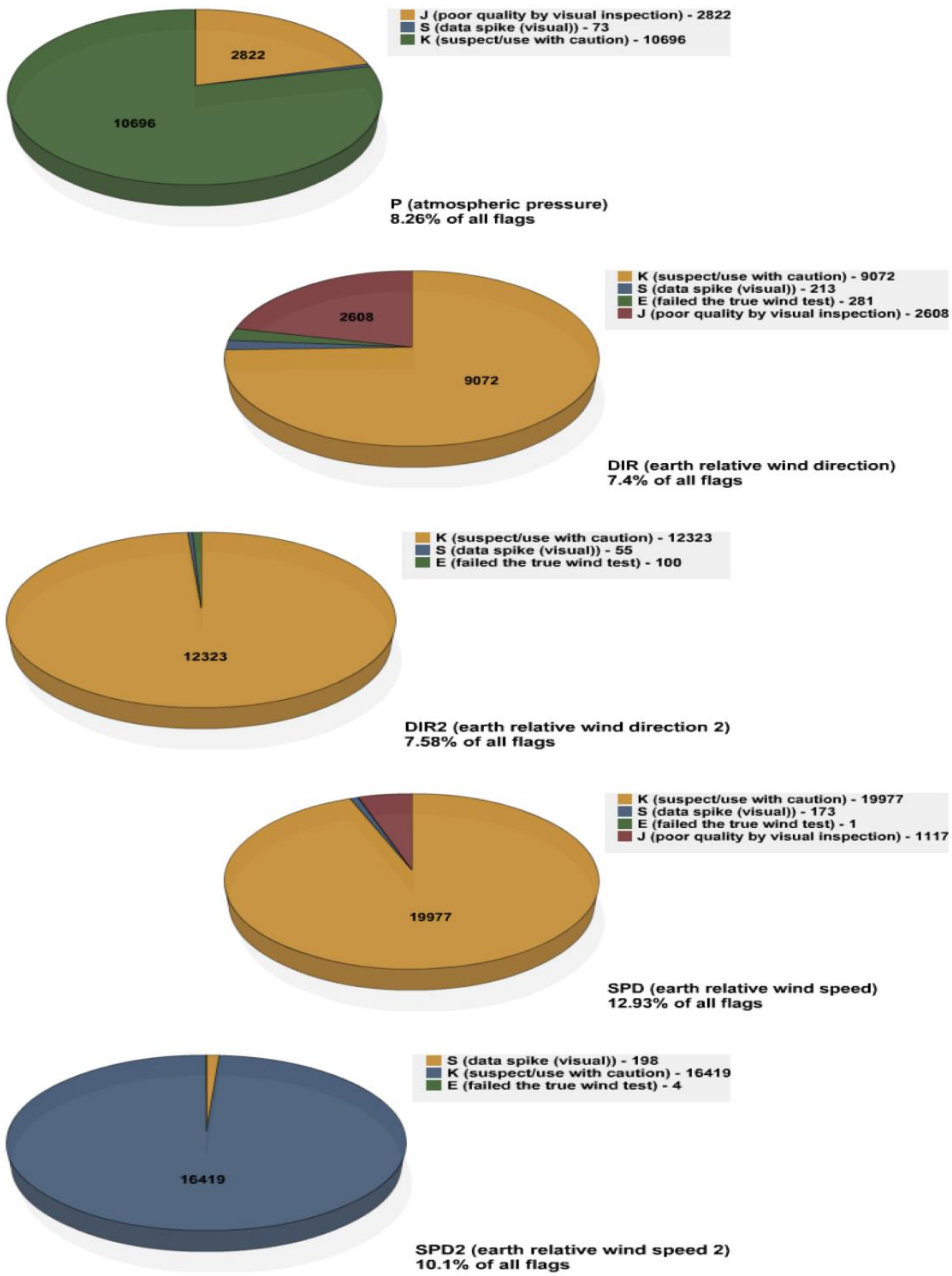


Figure 33: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) earth relative wind direction – DIR – (third) earth relative wind direction 2 – DIR2 – (fourth) earth relative wind speed – SPD – and (last) earth relative wind speed 2 – SPD2 – for the *Bell M. Shimada* in 2014.

Fairweather

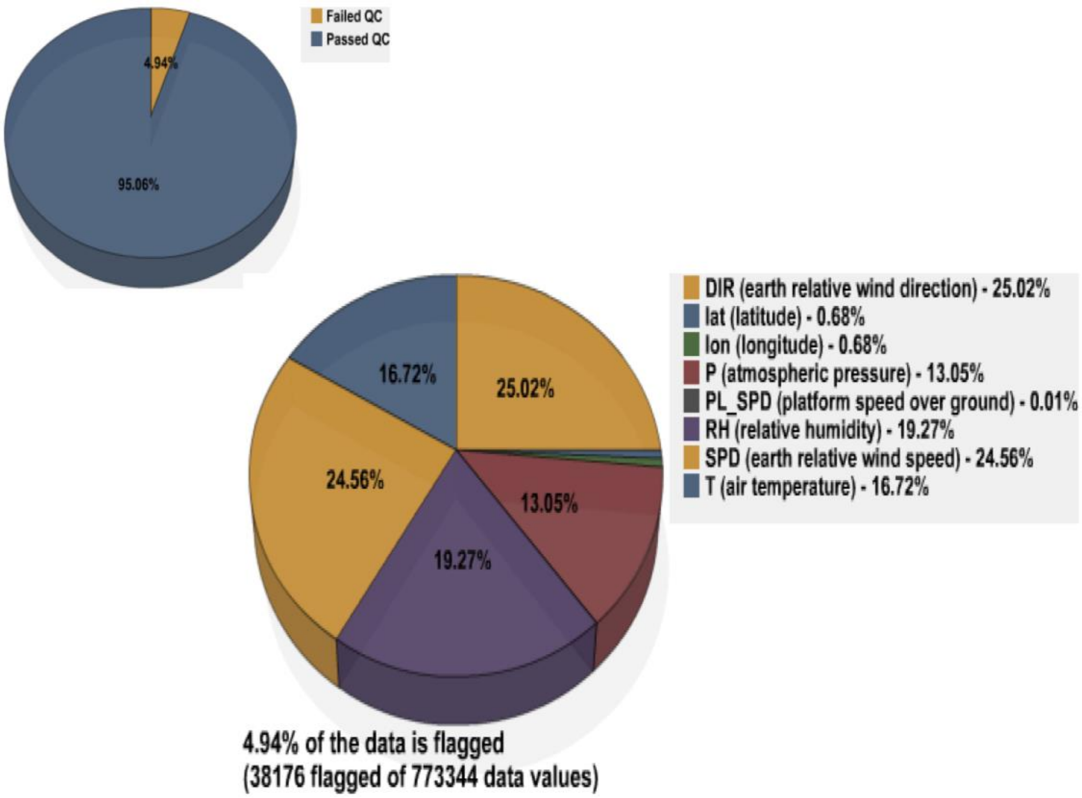


Figure 34: For the *Fairweather* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Fairweather* provided SAMOS data for 51 ship days, resulting in 773,344 distinct data values. After both automated and visual QC, 4.94% of the data were flagged using A-Y flags (Figure 34). This percentage is essentially unchanged from 2013 (4.96% total flagged) and once again places *Fairweather* just inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data. It should still be kept in mind, though, that *Fairweather's* sample size tends to be on the small side (38 days in 2013 and 51 days in 2014).

The relatively even distribution of flags across all meteorological parameters (Figure 34) combined with the low total flag percentage points toward there having been no outstanding occurrence of sensor failure or issue in 2014. Rather, the biggest issue with the *Fairweather* data likely continues to be problematic sensor location, although neither adequate metadata (refer to Table 4 or Annex C), nor digital imagery or a detailed flow analysis exists for this vessel preventing confirmation. Of the five meteorological parameters offered by *Fairweather*, the earth relative wind direction (DIR) and earth relative wind speed (SPD) fare the worst, with about 25% each of the total flags (Figure 34). These flags are mainly caution/suspect (K) flags and, especially in the case of DIR, some true wind test failed (E) flags (Figure 36). Echoing wind parameter performance from 2013, *Fairweather* wind data in 2014 were particularly noisy whenever the vessel was moored and cyclically reorienting, likely due to sea state, as shown in Figure 35.

It’s worth reiterating 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. It should also be mentioned that the *Fairweather* contributed one of the many backlogged batches of data in 2014, submitting data for the period 4-30 May well after the 10-day delayed mode window for visual quality control. While these files were eventually given visual QC (as time permitted) it’s important to note that there is no guarantee of undergoing visual QC analysis in the case of “late” files and every effort should therefore be made to ensure timely arrival of daily SAMOS data files.

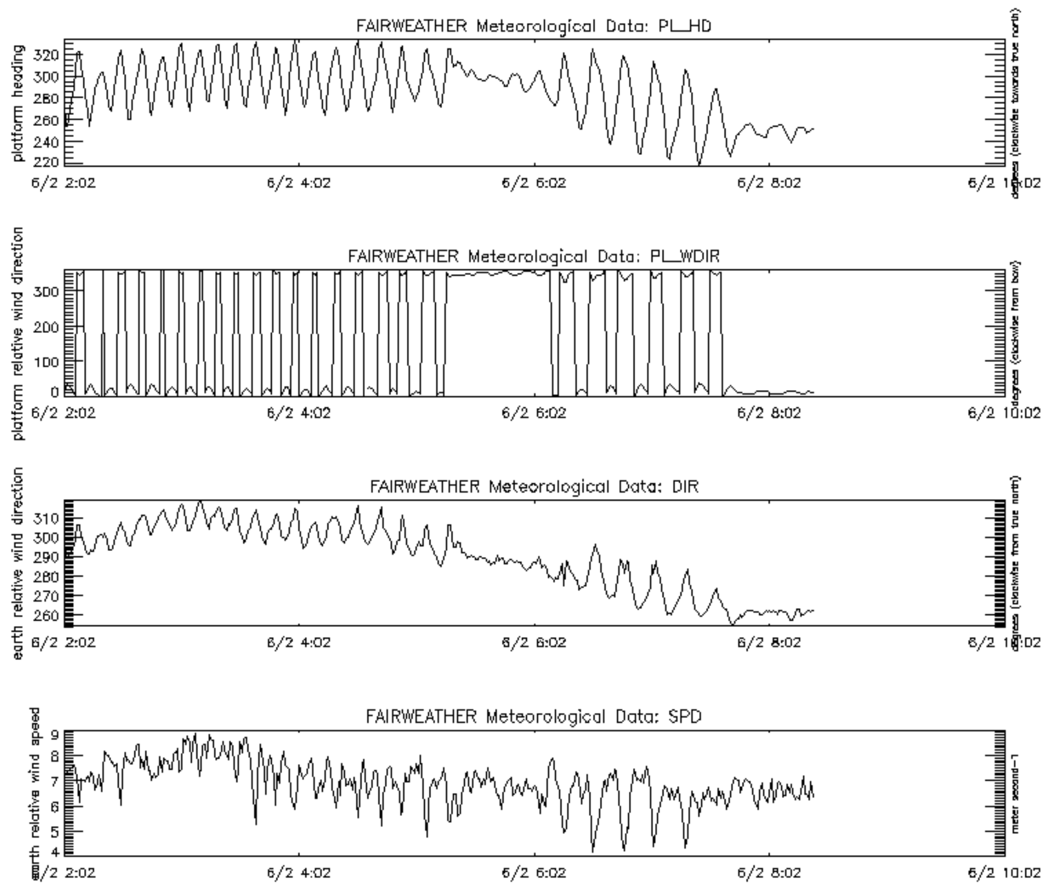
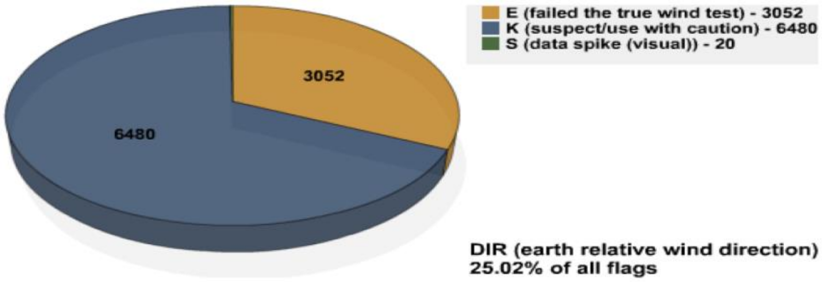


Figure 35: A portion of the *Fairweather* SAMOS data for 2 June 2014, while the vessel was moored off of Kodiak Island: (first) platform heading – PL_HD – (second) platform relative wind direction – PL_WDIR – (third) earth relative wind direction –DIR – and (last) earth relative wind speed – SPD. Note 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.”



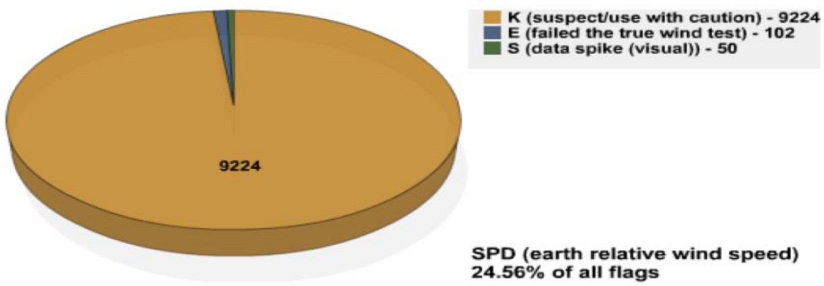
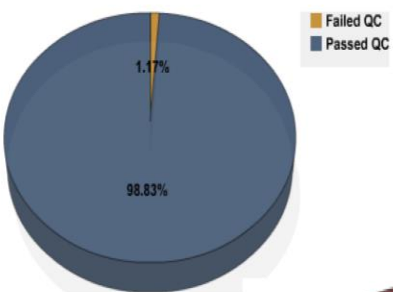


Figure 36: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD – for the *Fairweather* in 2014.

Ferdinand Hassler



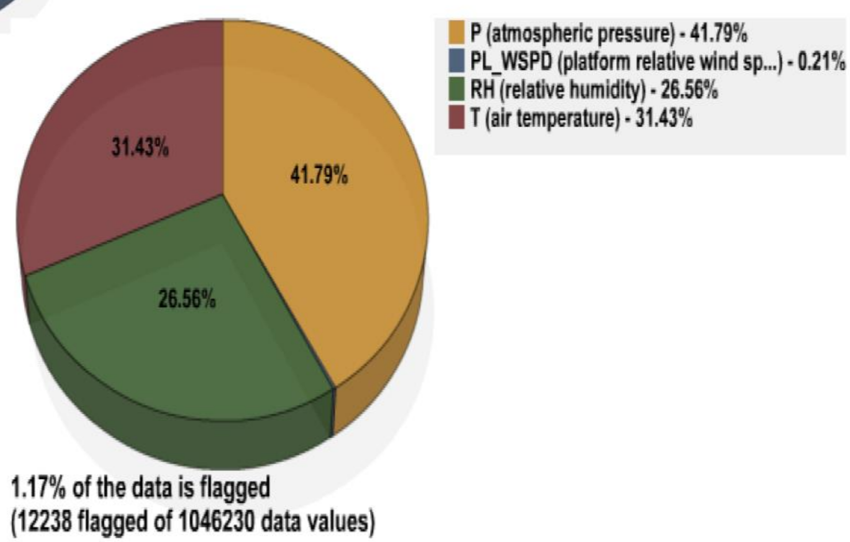


Figure 37: For the *Ferdinand Hassler* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

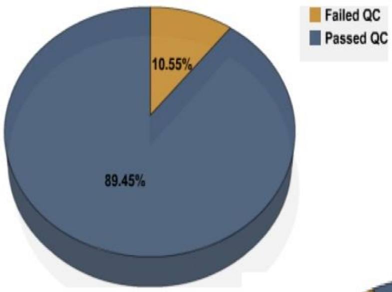
After much groundwork and discussion about transmission errors over the past few years, the *Ferdinand Hassler* was made active in the SAMOS system in early June 2014. At that time, data files dating back through 2012 were finally able to be processed and it was decided to begin visual quality control of the data effective 2014. (Data from 2013 and 2012 are both archived and publicly available in preliminary status, meaning they have undergone automated quality control only.) And although transmission difficulties persisted in 2014, resulting in more than one backlog of data beyond the initial one, the *Ferdinand Hassler* ultimately provided SAMOS data for 89 ship days, resulting in 1,046,230 distinct data values.

After both automated and visual QC, 1.17% of the data were flagged using A-Y flags (Figure 37). This is a remarkably low percentage, well inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data. However, we should here take note of both the modest sample size (89 days), and the fact that *Hassler* SAMOS data includes no earth relative winds, which are common culprits for data flagging.

There were also no thermosalinograph data processed by SAMOS in 2014, as we have never received any metadata for the TSG and were unaware of the existence of TSG data from the *Hassler* prior to early November. Unfortunately, adding TSG data into files that have already undergone visual quality control is beyond our capabilities at this point, and in any case metadata for the TSG still has not been received.

Again, with the very low percentage of total flags, there is little to say about those flags distributed across atmospheric pressure (P), air temperature (T), and relative humidity (RH), save that it is quite possible these three sensors benefit from unusually good exposure. However, adequate metadata and digital imagery are needed to confirm this suspicion, and the *Hassler* currently lacks both (see Table 4 and Annex C). It is hoped that earth relative winds and thermosalinograph data from the *Hassler* (and completed metadata for all parameters) can be added in 2015, especially as she may prove to be a model vessel with highly reliable data.

Gordon Gunter



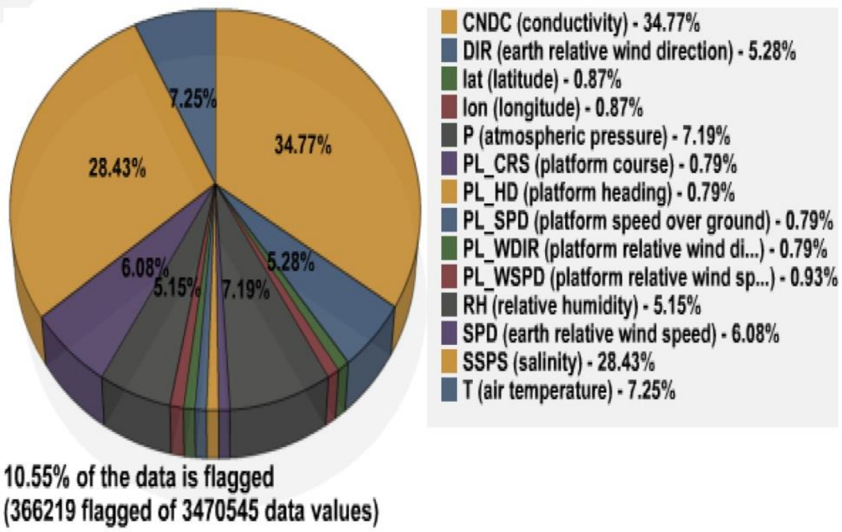


Figure 38: For the *Gordon Gunter* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Gordon Gunter* provided SAMOS data for 175 ship days, resulting in 3,470,545 distinct data values. After both automated and visual QC, 10.55% of the data were flagged using A-Y flags (Figure 38). This is a twofold increase over the 2013 total flag percentage (5.22%).

The *Gunter's* thermosalinograph was the comparative underperformer among her sensors in 2014, prompting 34.77% and 28.43% of the total flags to be applied to conductivity (CNDC) and salinity (SSPS), respectively (Figure 41). During the period 22 February through 7 March both CNDC and SSPS behaved erratically because of a clogged micro flow valve servicing the TSG (Figure 39), as stated by *Gunter* personnel in a 7 March email communication. On the *Gunter* technician's advice that the data were unreliable, both variables were assigned mainly poor quality (J) flags for the duration of the event. (We note that the vessel's sea temperature (SST) data comes from the Furuno hull contact sensor rather than the TSG, and as such the SST data were unaffected in this case.) Despite the technician clearing the TSG valve clog on 7 March, erratic behavior in SSPS and especially CNDC did resurface from time to time over the course of the year, and both parameters thus continued to amass both caution/suspect (K) and J flags. Email notification was sent on 25 August requesting that *Gunter* personnel observe the CNDC data, with no response on record. It is suspected that the flow valve continues to be problematic. A further portion of the CNDC/SSPS flags was applied simply to port or moored data, when the sensor was understandably turned off.

Winds, air temperature, relative humidity, and atmospheric pressure all showed signs of moderate flow distortion (common on most vessels), but a particular issue at the start of the sailing season was responsible for a portion of the position (latitude – LAT – and longitude – LON), platform speed (PL_SPD), and thereby earth relative wind (direction – DIR – and speed – SPD) parameters (not shown) to have flags applied. Over the winter in port new gyroscopes and other circuitry were installed on the *Gunter*. Technicians were still ironing out the bugs with this new system as the season got underway, and the result was profuse spikes in the navigational data that in turn created spikes in the platform speed data and, ultimately, the earth relative wind data (Figure 40). This behavior occurred during the period 14-19 February, and all of the data spikes were flagged as such.

One final occurrence not reflected in the flag percentages: On 7 March the *Gunter* was notified that air temperature (T) had been missing from its data files since the onset of the sailing season, and then on 10 March it was determined that the *Gunter's* designator for air temperature had changed without notice. Metadata for T was updated at the DAC at that point and the data were added back into the files from 10 March forward. But, unfortunately, T data could not be "added in" to prior files that had already received visual QC (capability does not currently exist) and thus a portion of T data is only available in the original SAMOS 1.0 ASCII files received from the ship (and archived at NODC).

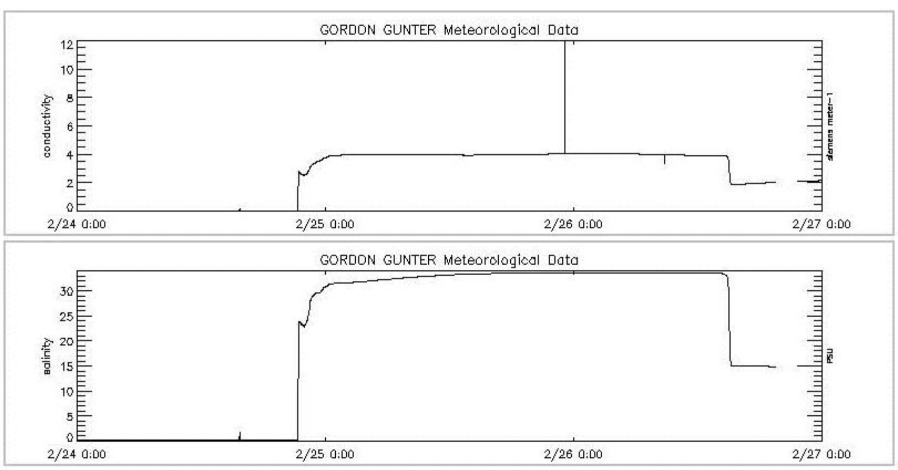


Figure 39: *Gordon Gunter* SAMOS data for 24-26 February 2014: (top) conductivity – CNDC –and (bottom) salinity– SSPS. Note erratic steps and unrealistic values at either end of the period.

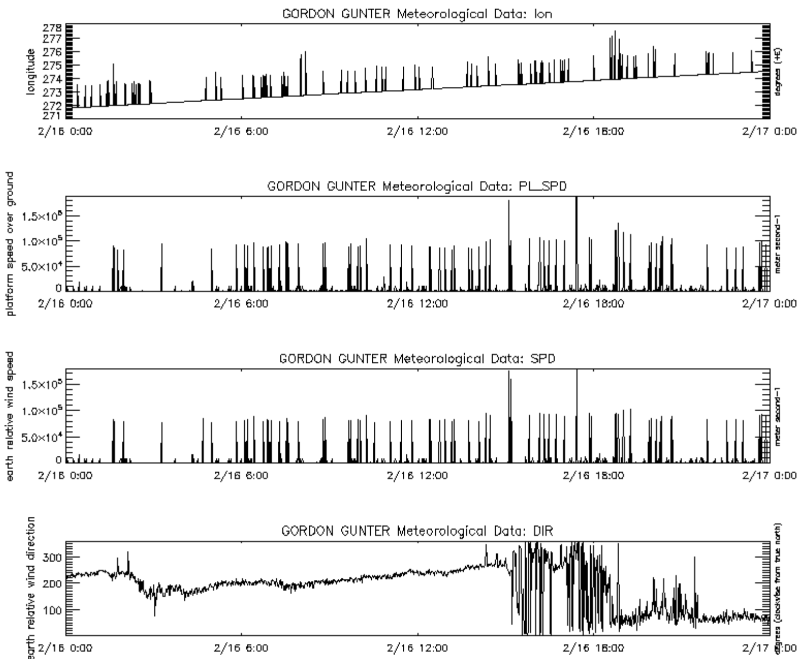


Figure 40: *Gordon Gunter* SAMOS data for 16 February 2014: (first) longitude – CNDC – (second) platform speed – PL_SPD – (third) earth relative wind speed – SPD – and (last) earth relative wind direction– DIR. Note spikes in position data and corresponding spikes in platform speed, leading to spikes in wind data.

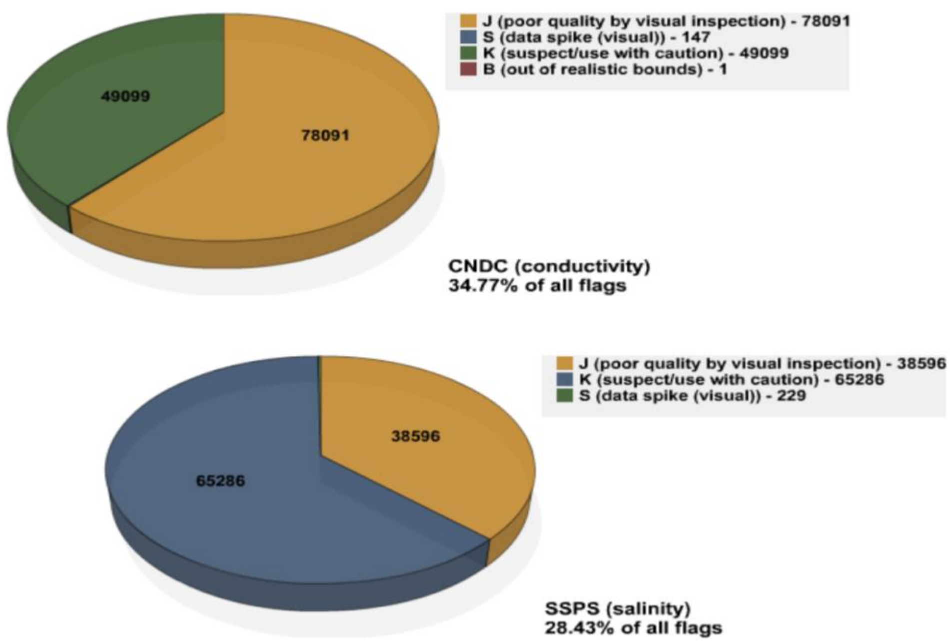


Figure 41: Distribution of SAMOS quality control flags for (top) conductivity – CNDC – and (bottom) salinity – SSPS – for the *Gordon Gunter* in 2014.

Henry B. Bigelow

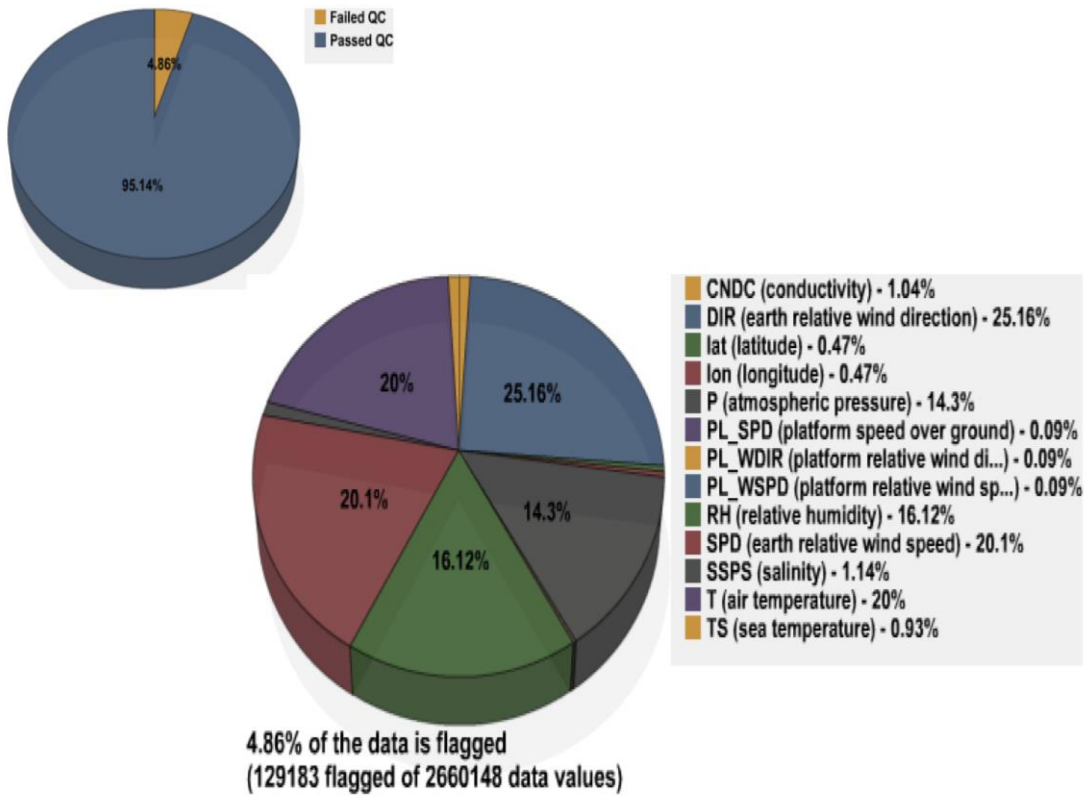


Figure 42: For the *Henry B. Bigelow* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Henry Bigelow* provided SAMOS data for 134 ship days, resulting in 2,660,148 distinct data values. After both automated and visual QC, 4.86% of the data were flagged using A-Y flags (Figure 42). This is a couple of percentage points improvement over 2013 (7.05% total flagged) and brings the *Bigelow* inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

Despite the overall improvement in total flag percentage, the biggest issues with *Bigelow's* data in 2014 continued to be earth relative wind speed (SPD) and direction (DIR), comprising ~45% of all flags. And for the same reason as in 2013: namely, throughout 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 43. After a few hours the behavior of SPD and DIR would just as abruptly return to normal. This analyst continues to retain no record of an explanation for this anomalous behavior. As a result of the aberrations there was a fair amount of suspect/caution (K) flagging of both parameters (Figure 44). 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.

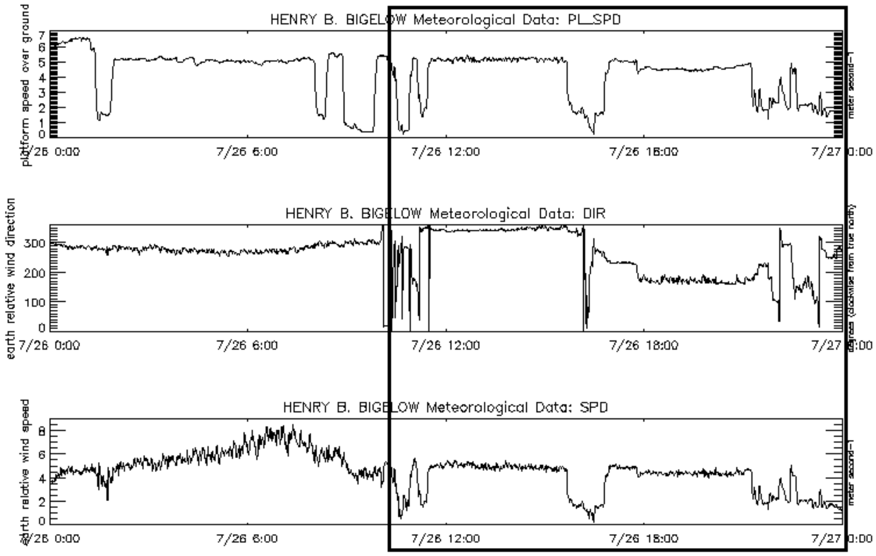


Figure 43: *Henry Bigelow* SAMOS data for 26 July 2014: (top) platform speed over ground – PL_SPD – (middle) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD. Note the sudden changes to both DIR and SPD inside the boxed area; the character of each changes and appears to become somehow linked to PL_SPD.

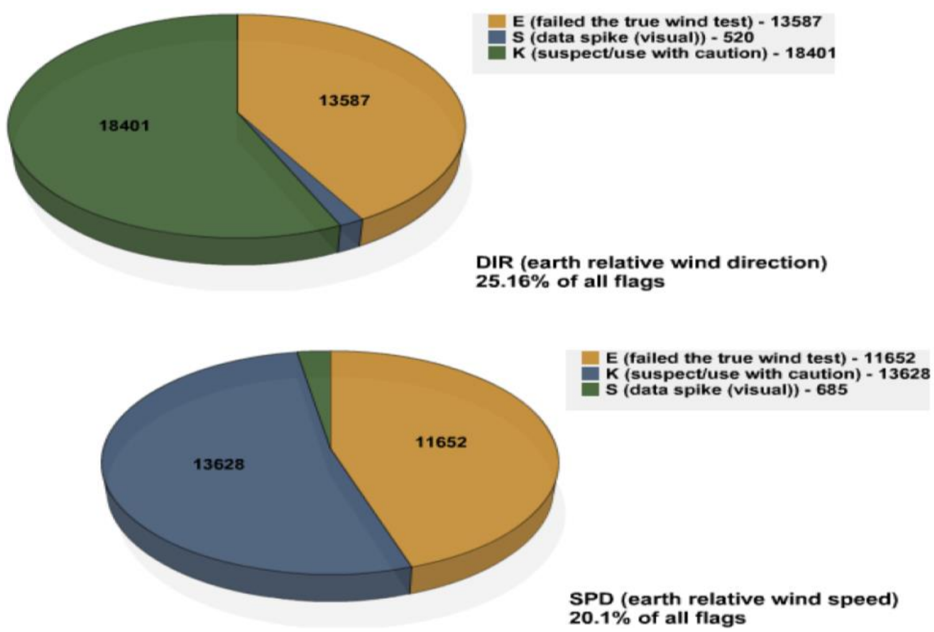


Figure 44: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD – for the *Henry B. Bigelow* in 2014.

Hi'ialakai

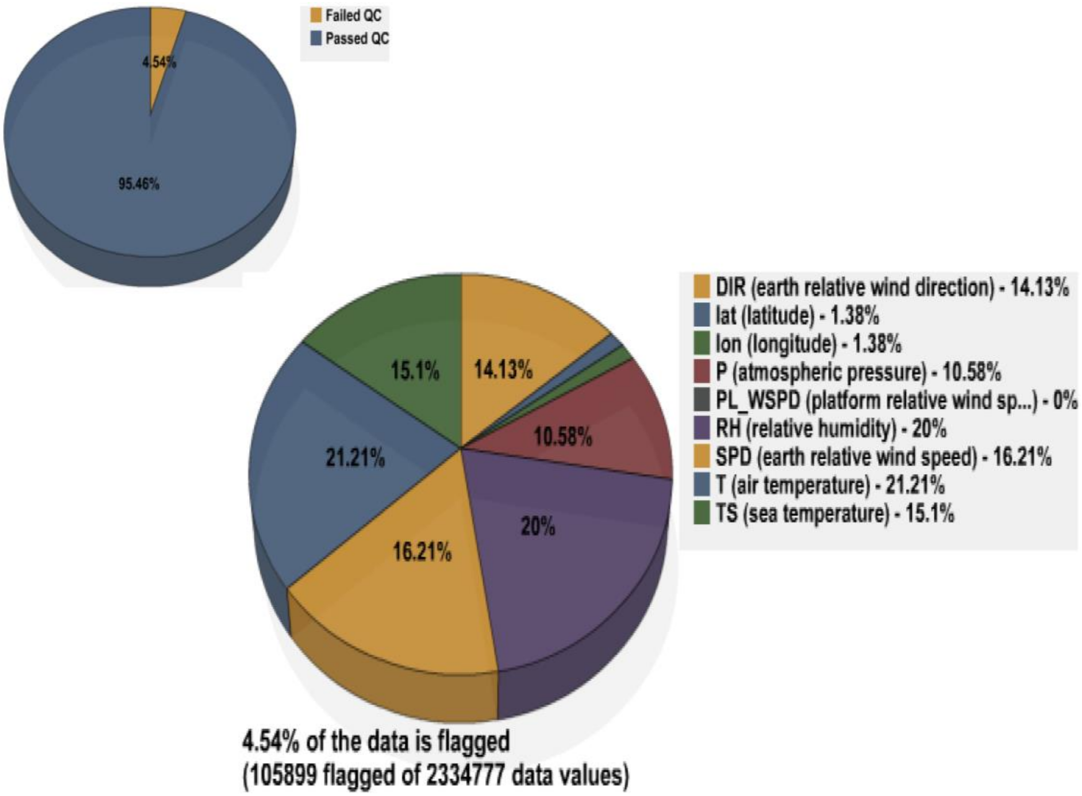
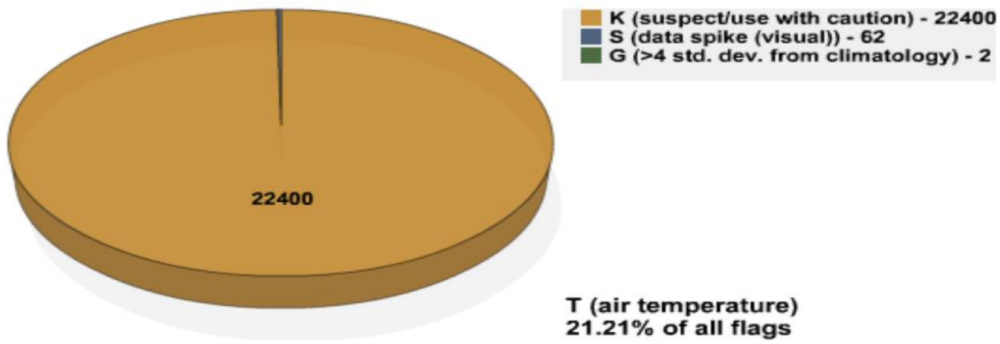


Figure 45: For the *Hi'ialakai* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Hi'ialakai* provided SAMOS data for 133 ship days, resulting in 2,334,777 distinct data values. After both automated and visual QC, 4.54% of the data were flagged using A-Y flags (Figure 45). This is an admirable improvement over 2013 (10.55% total flagged) and brings the *Hi'ialakai* inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

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 due to radiated heat off the bridge, as noted by a WHOI science team during a cruise with separate instrumentation. Discussions between *Hi'ialakai* and SAMOS first considered a bias correction, second an across-the-board flagging of T and relative humidity (RH, a capacitance-based value calculated using T in this case), but ultimately a decision was made to keep a close eye on the data for a while to determine the behavior of any bias. It was suspected there would be a diurnal signal in the heating, rather than a constant bias. Owing to the *Hi'ialakai's* usual region of operation in the tropical Pacific, direct comparisons to in-situ buoy or station data were hard to come by. But in the end the SAMOS QC analyst felt there was not enough evidence to support a constant bias. It was obvious, though, (as it had been in previous years) that both T and RH frequently experienced radiative heating. As such, both parameters received a heavy portion (~41% combined) of the total flag percentage (Figure 45), mostly in the form of caution/suspect (K) flags (Figure 46).

Another issue not reflected in the flag percentage involved missing thermosalinograph data for a good portion of 2014. At the start of *Hi'ialakai's* cruising season the lead technician onboard notified the SAMOS DAC that the TSG was not working, so sea temperature (T), conductivity (CNDC), and salinity (SSPS) data were not expected. However, in mid-July the TSG data were started again under unreported/unexpected designators. The DAC discovered the oversight several days later and after communication with *Hi'ialakai* the designators were changed back to their original values. While this action restored SST data to the SAMOS files, for reasons unknown CNDC and SSPS were still omitted. This omission was further communicated to vessel technicians on 24 July, but ultimately there were no CNDC/SSPS data received in 2014. Incidentally, the majority of the flags that were applied to SST – mainly caution/suspect (K) and some poor quality (J) flags (not shown) – were due to the TSG pumps being understandably off while the vessel was tied up in port, which was clearly communicated to the DAC by the *Hi'ialakai's* lead technician.



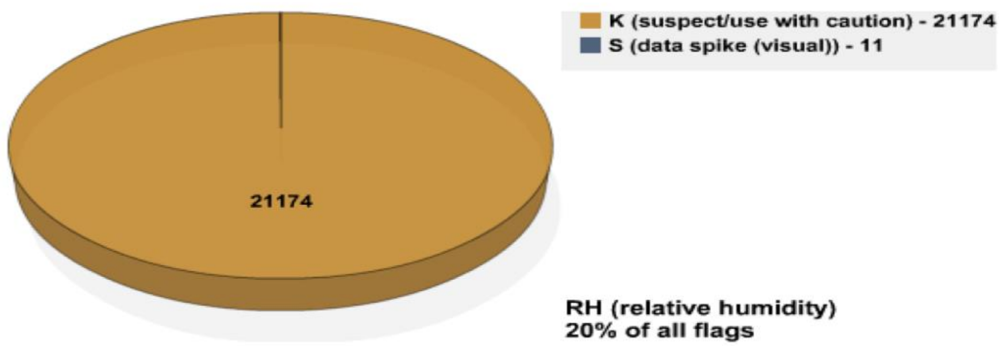


Figure 46: Distribution of SAMOS quality control flags for (top) air temperature – T – and (bottom) relative humidity – RH –for the *Hi'ialakai* in 2014.

Nancy Foster

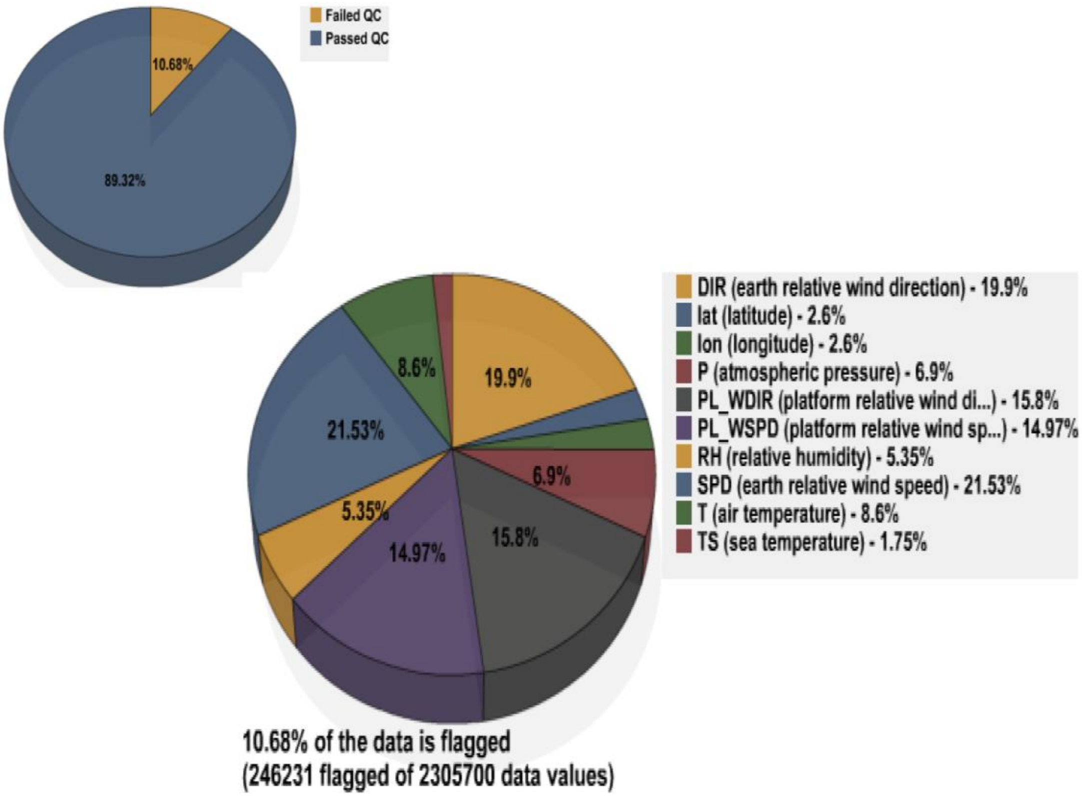


Figure 47: For the *Nancy Foster* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nancy Foster* provided SAMOS data for 126 ship days, resulting in 2,305,700 distinct data values. After both automated and visual QC, 10.68% of the data were flagged using A-Y flags (Figure 47). This is a sizeable departure from 2013 (2.73% total flagged), when the *Foster* held one of the lowest flag percentages.

The three atmospheric parameters air temperature (T), pressure (P), and relative humidity (RH) together comprised ~21% of the total flags (Figure 47). At the commencement of the *Foster's* sailing season it was noted that the P, T, and RH data routinely exhibited a large number of spikes (Figure 48). On 20 March this behavior was communicated to the *Foster* via email, and at the time the SAMOS analyst conjectured that the cause may have been related to the orientation of the vessel and steady Caribbean trade winds. However, no response was received and the issue persisted throughout much of the year. By the end of 2014 the three parameters had garnered a sizable volume of spike (S), poor quality (J), and suspect/caution (K) flags (Figure 50), in addition to the usual K flags applied to P/T/RH related to sensor exposure issues (common on most vessels).

A further combined ~41% of the total flags were assigned to the earth relative wind parameters (direction – DIR – and speed – SPD). The culprit here was a second data issue that arose in early September, whereby the platform wind speed (PL_WSPD) continuously exhibited highly suspicious magnitude and numerous steps and spikes. As a result, SPD also read suspiciously high, and both SPD and DIR mirrored the steps and spikes in PL_WSPD (Figure 49). This prompted the application of a volume J and K flags for both parameters (Figure 50) and for the platform relative wind parameters, as well (not shown). *Foster* personnel were advised of this activity via email on 22 September. No response was received, but the issue appeared to have been resolved on 27 September. A second email attempt was made by the SAMOS DAC to ascertain what the problem had been; again no response was received.

Finally, it should also be mentioned that the *Nancy Foster* contributed one of the many backlogged batches of data in 2014, albeit a small one, submitting data for the period 1-4 September after the 10-day delayed mode window for visual quality control. While these files were given visual QC as soon as it was possible, it's important to note that there is no guarantee of undergoing visual QC analysis in the case of "late" files and every effort should therefore be made to ensure timely arrival of daily SAMOS data files.

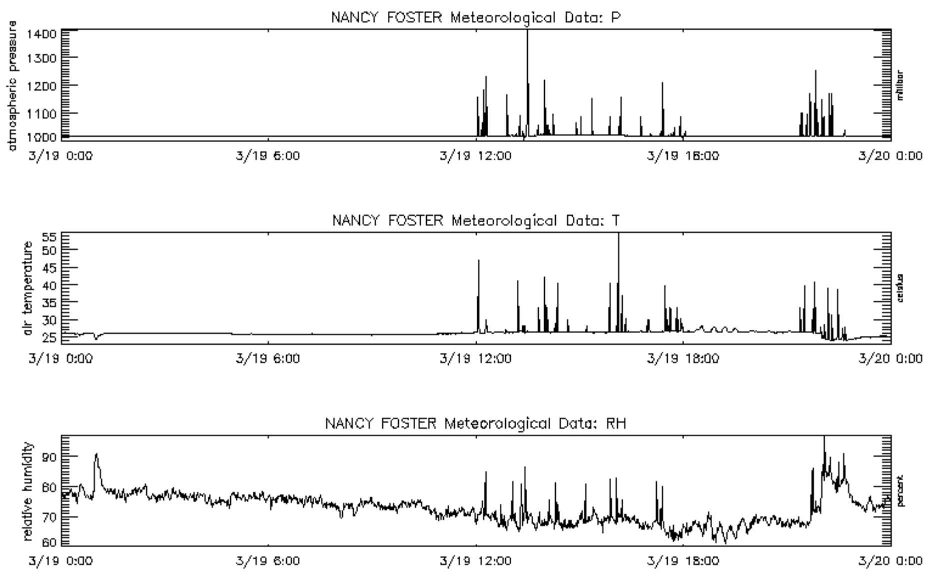


Figure 48: *Nancy Foster* SAMOS data for 19 March 2014: (top) atmospheric pressure – P – (middle) air temperature – T – and (bottom) relative humidity – T. Note anomalous spikes in each variable.

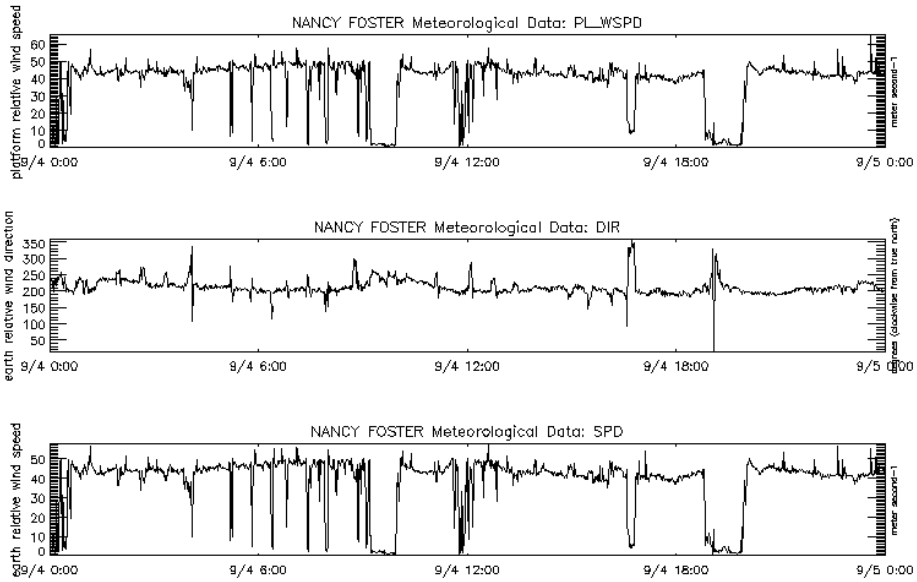


Figure 49: *Nancy Foster* SAMOS data for 4 September 2014: (top) platform relative wind speed – PL_WSPD – (middle) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD. Note highly suspect magnitude of PL_WSPD/SPD as well as numerous spikes/steps in all three variables.

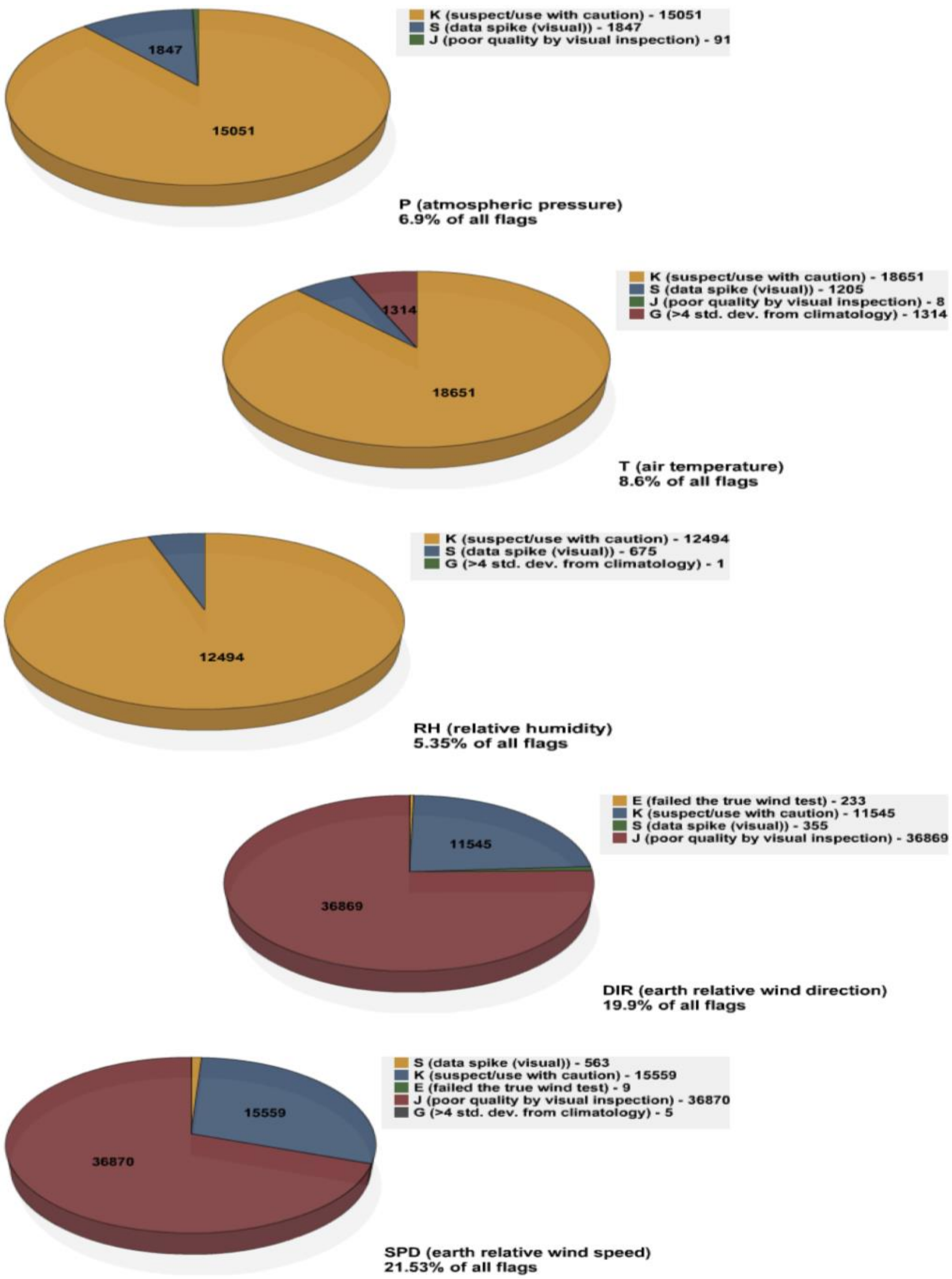


Figure 50: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) air temperature – T – (third) relative humidity – RH – (fourth) earth relative wind direction – DIR – and (last) earth relative wind speed – SPD – for the *Nancy Foster* in 2014.

Okeanos Explorer

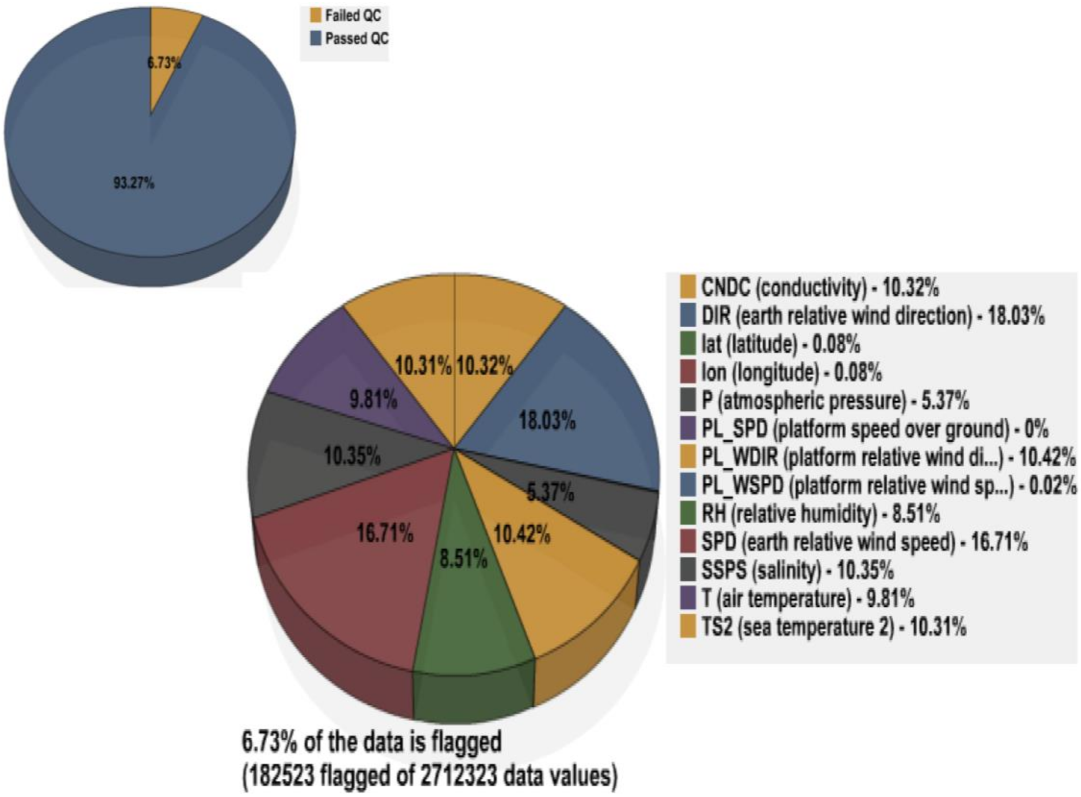


Figure 51: For the *Okeanos Explorer* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Okeanos Explorer* provided SAMOS data for 136 ship days, resulting in 2,712,323 distinct data values. After both automated and visual QC, 6.73% of the data were flagged using A-Y flags (Figure 51). This is about a 3% increase over 2013 (3.46% total flagged) and places the *Explorer* back outside the < 5% flagged bracket regarded by SAMOS to represent "very good" data.

The likely reason for the increase in total flagging in 2014 is evident in the flag percentages for earth relative wind speed (SPD), earth relative wind direction (DIR), and platform relative wind direction (PL_WDIR), each contributing ~17%, ~18%, and ~10%, respectively, to the total number of flags (Figure 51). From the onset of the *Explorer's* cruise season, the SAMOS visual quality control analyst began suspecting on the basis of nearby wind data that the vessel's wind data was off by about 100°. But as the vessel was in port the analyst decided to take a "wait and see" approach until the vessel was underway. Once the *Explorer* left port the analyst had the opportunity for some near-in situ comparison and her suspicions were strengthened. Consequently, on 7 March an email containing a detailed comparison (Figure 52) was sent to the technicians onboard the vessel to alert them to the potential issue. A response came back the following day confirming the issue and stating that *Explorer* personnel themselves had both discovered and fixed the problem about a week prior (SAMOS visual quality control occurs on a 10-day delay; as such the analyst had not yet seen the corrected data). At this point the visual quality control analyst went back through the affected data, which spanned 2-28 February, and applied poor quality (J) flags to both DIR and PL_WDIR and caution/suspect (K) flags to SPD, the calculation of which also depends on platform relative wind direction (Figure 53). When contacted by SAMOS again with a request for details of the event, one of the ship's technicians replied back that a loose pipe clamp used to secure the orientation ring below the anemometer had been discovered. The clamp was then replaced and the relative wind direction was brought back parallel with the center line of the ship.

A further combined ~31% of the total flagging was allotted to the three ocean parameters: sea temperature (SST), conductivity (CNDC), and salinity (SSPS). However, these were overwhelmingly K and J flags (not shown) applied to data while the vessel was in port with the sensor apparatus turned off. This is a very common occurrence and does not signify a problem with the sensor.

It should also be mentioned that the *Okeanos Explorer* contributed one of the many backlogged batches of data in 2014, albeit a small one, submitting data for the period 18-21 September after the 10-day delayed mode window for visual quality control. While these files were given visual QC as soon as it was possible, it's important to note that there is no guarantee of undergoing visual QC analysis in the case of "late" files and every effort should therefore be made to ensure timely arrival of daily SAMOS data files.

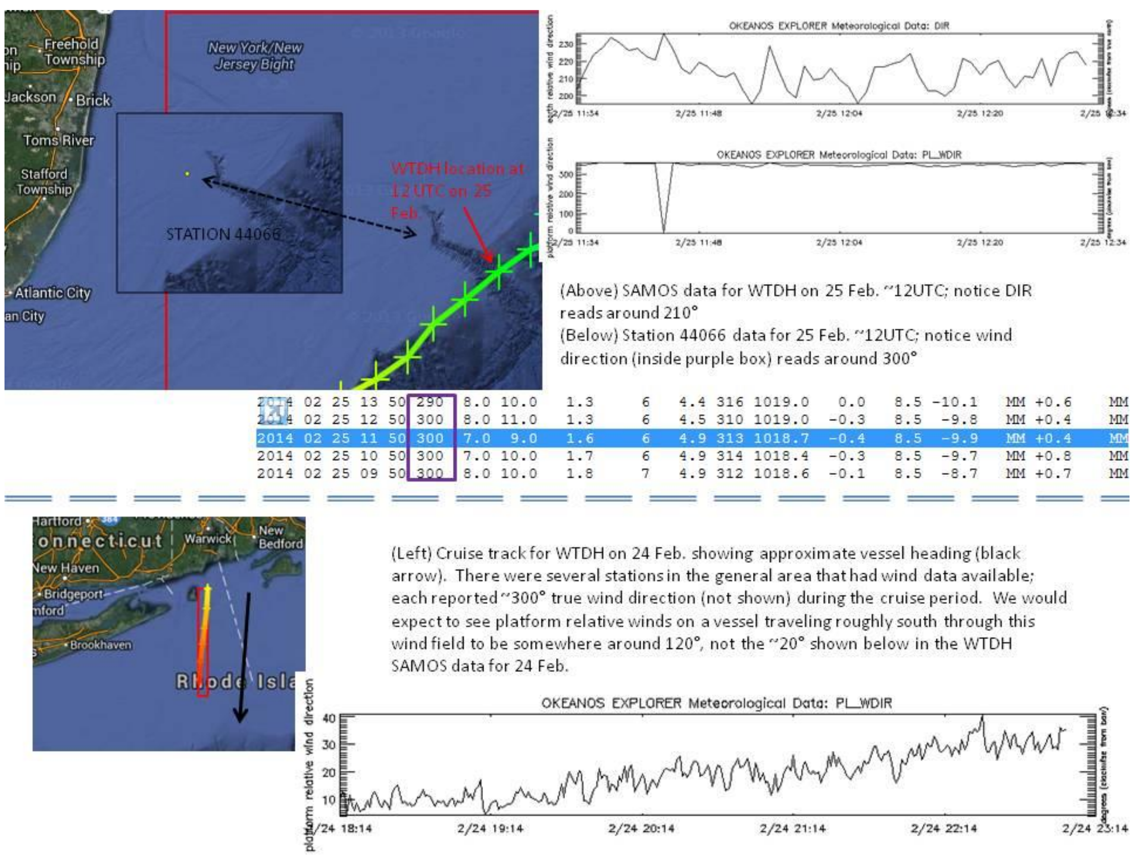


Figure 52: Composite graphic provided to vessel technicians detailing near-in situ analysis of *Okeanos Explorer* wind data.

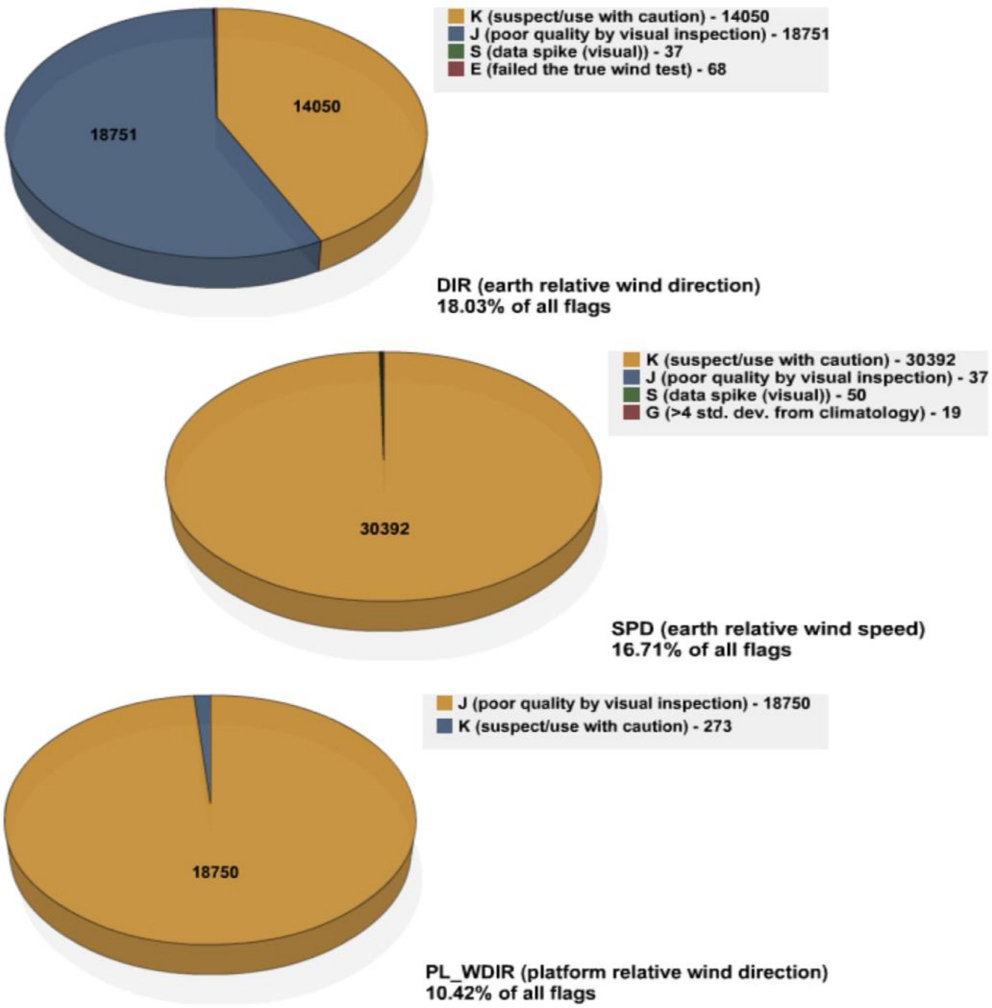


Figure 53: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – (middle) earth relative wind speed – SPD – and (bottom) platform relative wind direction – PL_WDIR – for the *Okeanos Explorer* in 2014.

Oregon II

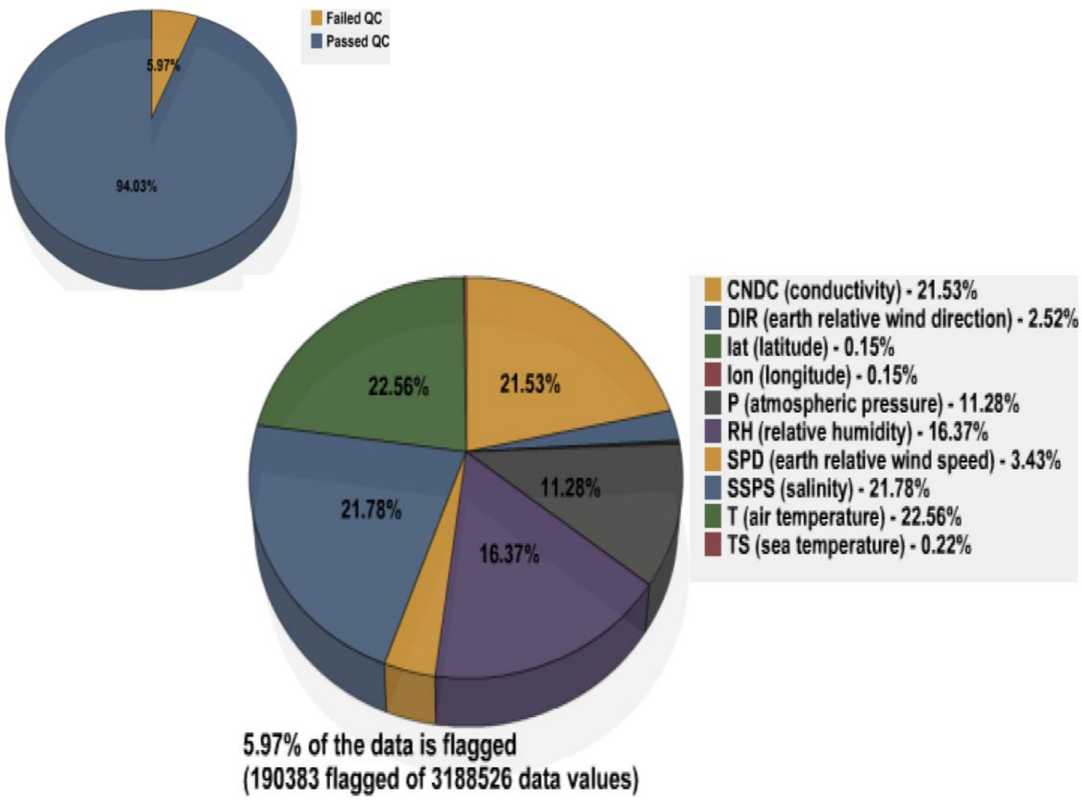


Figure 54: For the *Oregon II* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oregon II* provided SAMOS data for 151 ship days, resulting in 3,188,526 distinct data values. After both automated and visual QC, 5.97% of the data were flagged using A-Y flags (Figure 54). This is about 2% higher than 2013 (4.02% total flagged) and places *Oregon II* just outside the < 5% flagged bracket regarded by SAMOS to represent "very good" data.

In a virtual repeat of both 2012 and 2013, a sizeable portion of the flagging was once again applied to the atmospheric pressure (P), air temperature (T), and relative humidity (RH) parameters, overwhelmingly suspect/caution (K) flags in all three cases (Figure 56). 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 apparent winds are from the port side and/or astern, particularly during daytime (Figure 55). From the variable metadata we can at least tell 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. Digital imagery and ship measurements (length, breadth, freeboard, and draft) still do not 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). The suspected radiative heating appears strongest in the summer months, further supporting the conjecture. Further, the *Oregon II* is understood to have an atypical structure – she is an old and low vessel – and it is suspected that her data problems may also be related to stack exhaust.

Conductivity (CNDC) and salinity (SSPS) each incurred another ~21% of the total flags (Figure 54). However, these were overwhelmingly K and poor quality (J) flags (not shown) applied to data while the vessel was in port with the sensor apparatus turned off. This is a very common occurrence and does not signify a problem with the sensor. We note that the *Oregon's* sea temperature data comes from the Furuno hull contact as opposed to the TSG; hence it is not similarly affected when in port.

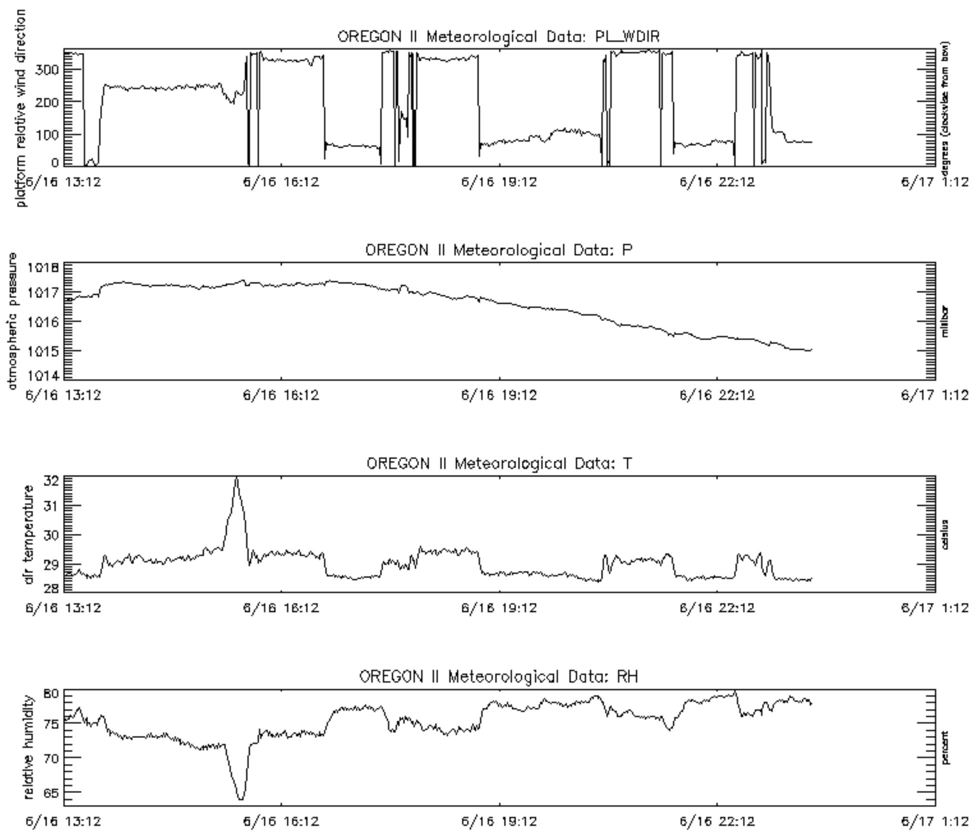


Figure 55: *Oregon II* SAMOS data for 16 June 2014: (first) platform relative wind direction – PL_WDIR – (second) atmospheric pressure – P – (third) air temperature –T – and (last) relative humidity – RH. Note the steps in the atmospheric data whenever winds are from portside and/or astern.

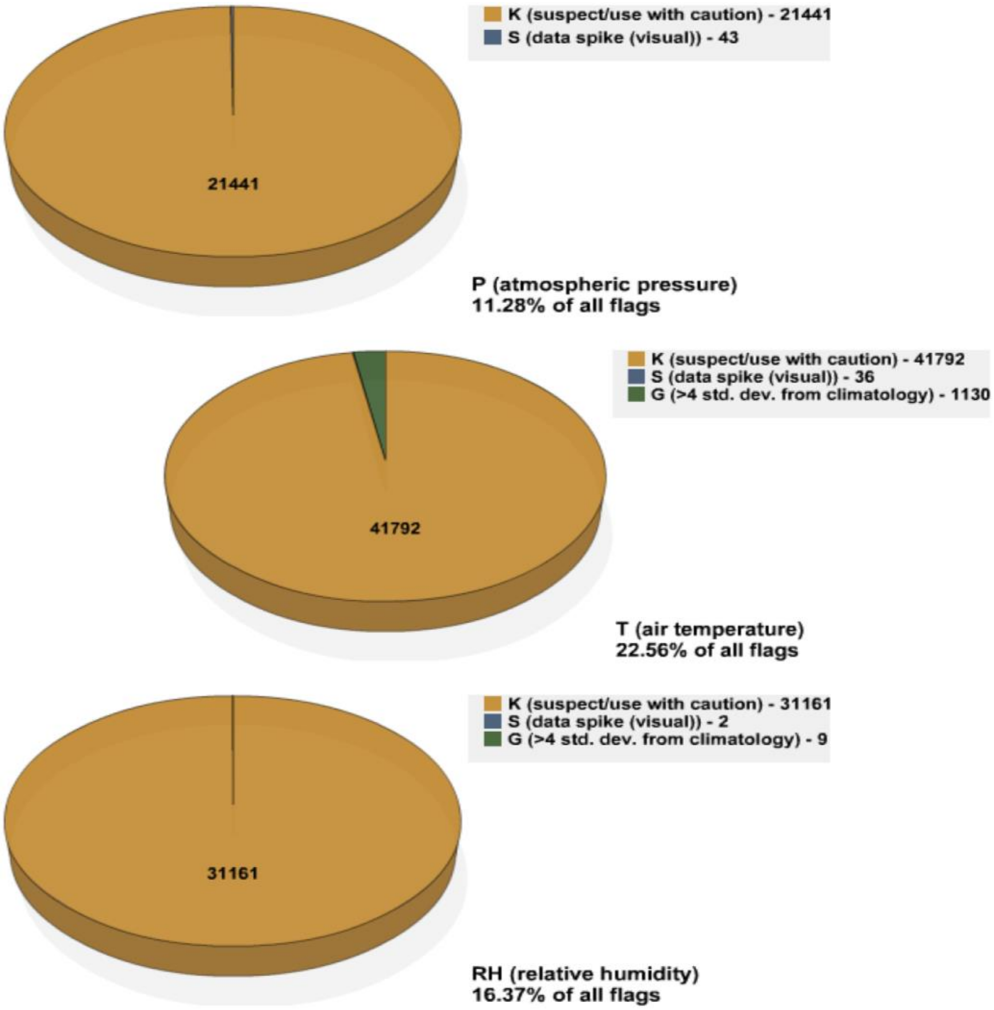


Figure 56: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (middle) air temperature – T – (bottom) relative humidity – RH –for the *Oregon II* in 2014.

Oscar Dyson

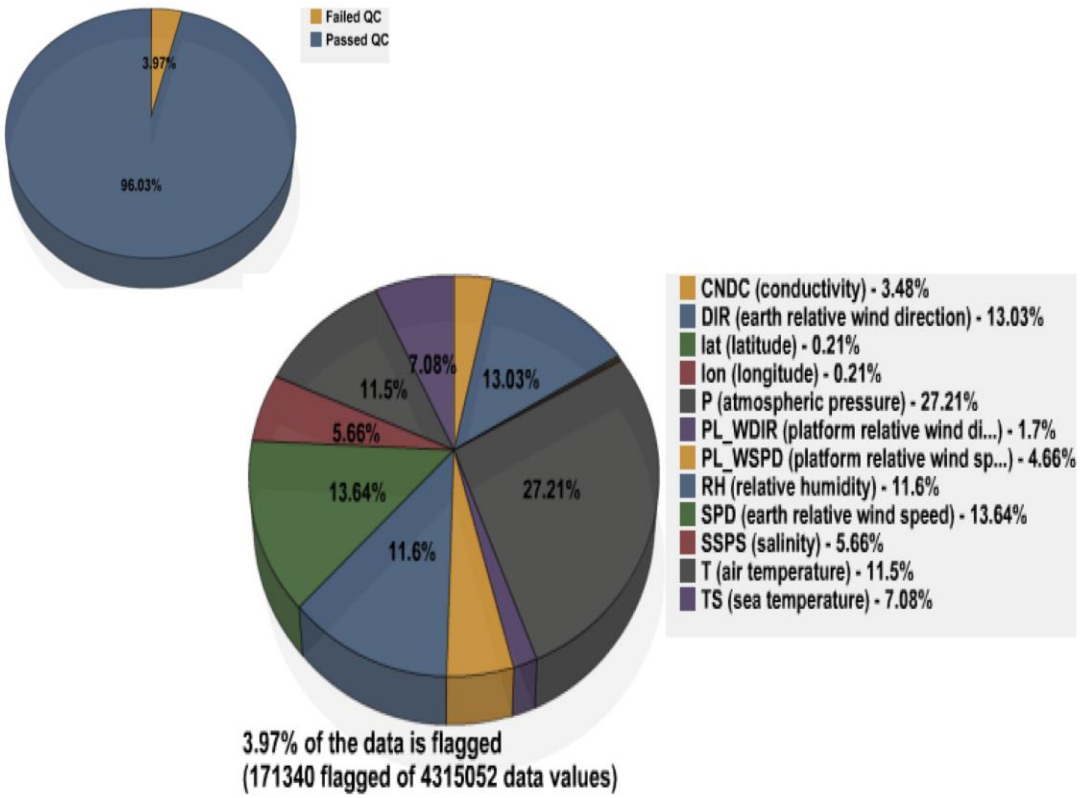


Figure 57: For the *Oscar Dyson* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Dyson* provided SAMOS data for 201 ship days, resulting in 4,315,052 distinct data values. After both automated and visual QC, 3.97% of the data were flagged using A-Y flags (Figure 57). This is about a 2% increase over 2013 (1.83% total flagged) and *Dyson* remains within the < 5% flagged bracket regarded by SAMOS to represent "very good" data.

The *Dyson* does suffer mildly from a bit of flow distortion and ship heating affecting her various atmospheric sensors, as do virtually all vessels. Digital imagery currently on file for the *Dyson* appears to show a potentially problematic location for the temperature (T) and relative humidity sensors in particular, low down on an instrument mast amidships and not far from the exhaust stack. As her metadata have never been updated, it's assumed that is still the location of her T/RH sensors, and in fact both sensors do incur a bit of caution/suspect (K) flagging (Figure 60). But again her total flagged percentage points toward minimal issue. It's possible that radiative heating is in this case less of a concern than we'd normally expect given the location of the sensors, simply by virtue of the *Dyson's* usual region of operations (generally sub-polar).

Additionally, earth relative winds (direction – DIR – and speed – SPD) experience a bit of flow distortion particularly when the winds are from the stern. Digital imagery points to an explanation here, too, as the anemometer is shown to be on the jackstaff, with the main structure of the ship behind it (a common and fairly ideal placement, all things considered). Aside from any K flagging that occurred as a result of flow distortion (Figure 60), there was a brief period of questionable wind data in mid-September while the vessel operated off a remote island in the Bering Sea. During this time the platform relative wind speed often read very close to zero and was particularly noisy. ASCAT data seemed to imply these readings were in error, so there was likely some temporary issue with the sensor. Additionally, the apparent wind (PL_WDIR) switched back and forth repeatedly over the vessel a good deal of the time, probably due to sea state. These two platform relative effects combined to create DIR and SPD data that closely mirrored PL_WDIR and platform speed (PL_SPD), as the example in Figure 58 shows. DIR and SPD incurred some additional K and J (poor quality) flagging during the event (Figure 60).

From Figure 57 above, clearly the most affected variable is atmospheric pressure (P), holding ~27% of the total flags. Digital imagery and variable metadata unfortunately do not specify where on the ship this sensor is located. Looking at the data, it isn't always clear whether the instrument is sensitive to a particular apparent wind direction, changes in ship speed, or both (see Figure 59, also Figure 58); all that is really certain is that the P data are in fact quite sensitive. It is likely either due to poor exposure or the need for a pressure port to attenuate any wind effects – perhaps both. In any case, P received K flags whenever the data appeared compromised (Figure 60).

But despite any of the issues mentioned herein, we shall reiterate that the *Dyson* maintains reasonably good data, overall.

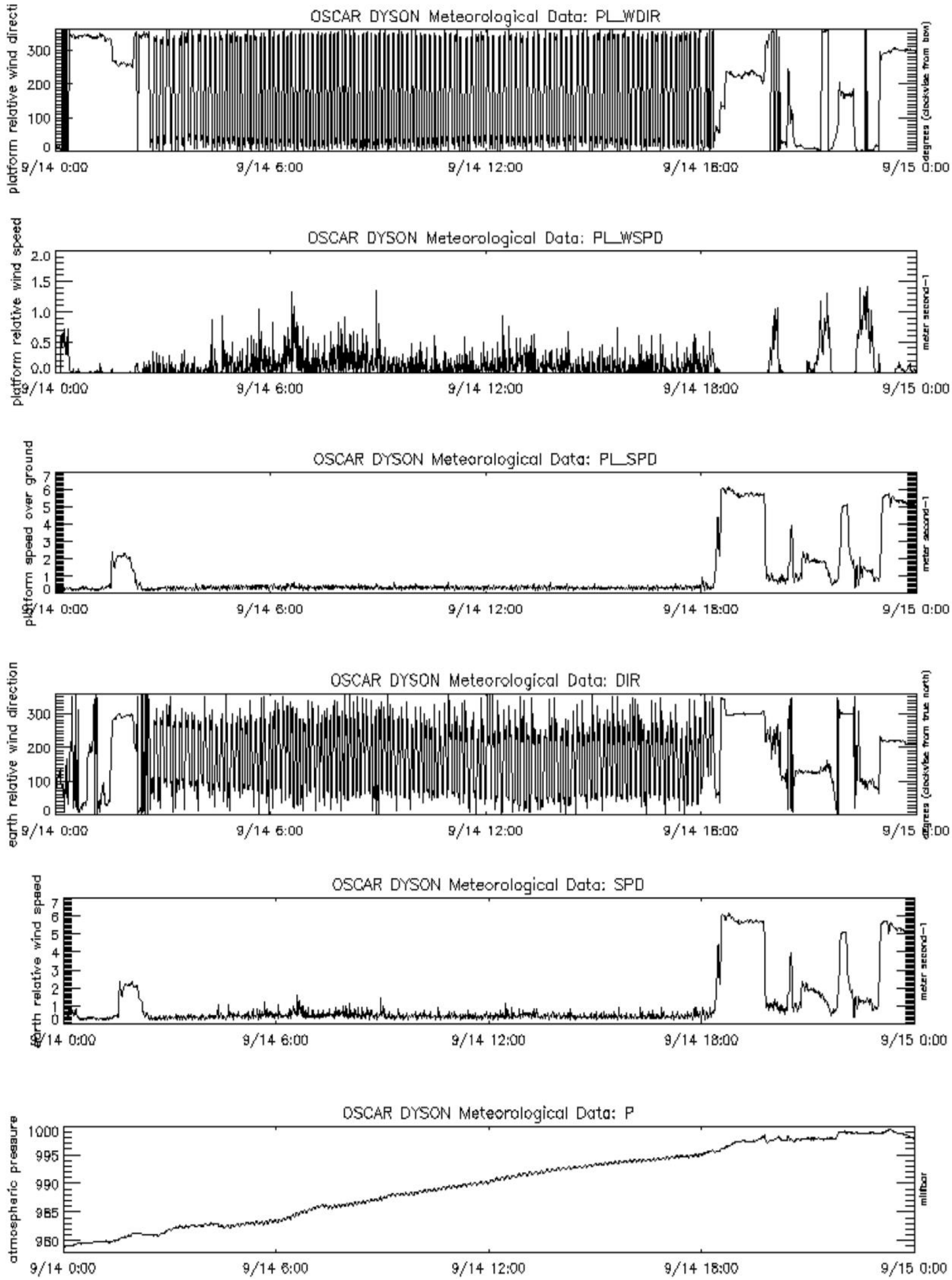


Figure 58: *Oscar Dyson* SAMOS data for 14 September 2014: (first) platform relative wind direction – PL_WDIR – (second) platform relative wind direction – PL_WSPD – (third) platform speed – PL_SPD – (fourth) earth relative wind direction – DIR – (fifth) earth relative wind speed – SPD – and (last) atmospheric pressure – P. Note DIR/SPD mirroring of PL_WDIR/PL_SPD in response to near-zero PL_WSPD. Also note saw tooth behavior in P, likely in response to PL_WDIR.

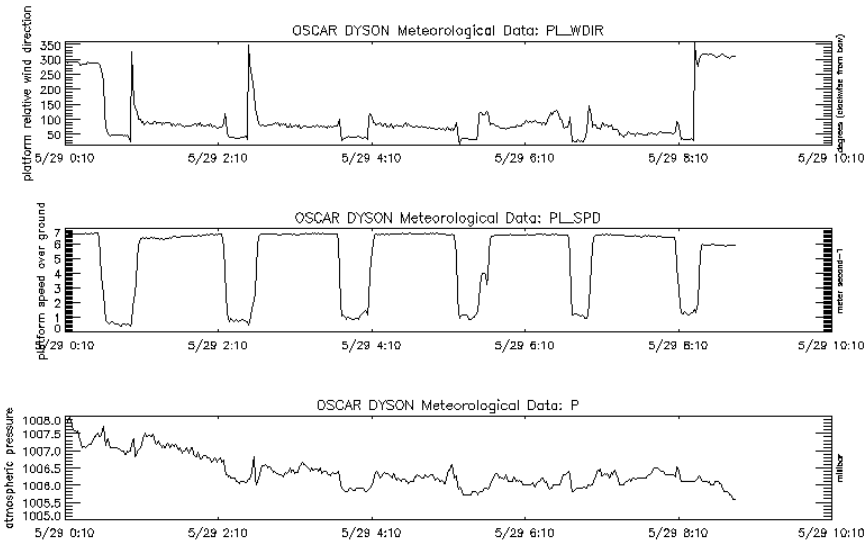


Figure 59: *Oscar Dyson* SAMOS data for 29 May 2014: (top) platform relative wind direction – PL_WDIR – (middle) platform speed – PL_SPD –and (bottom) atmospheric pressure – P. Note the steppy behavior in P in response to PL_WDIR and/or PL_SPD changes.

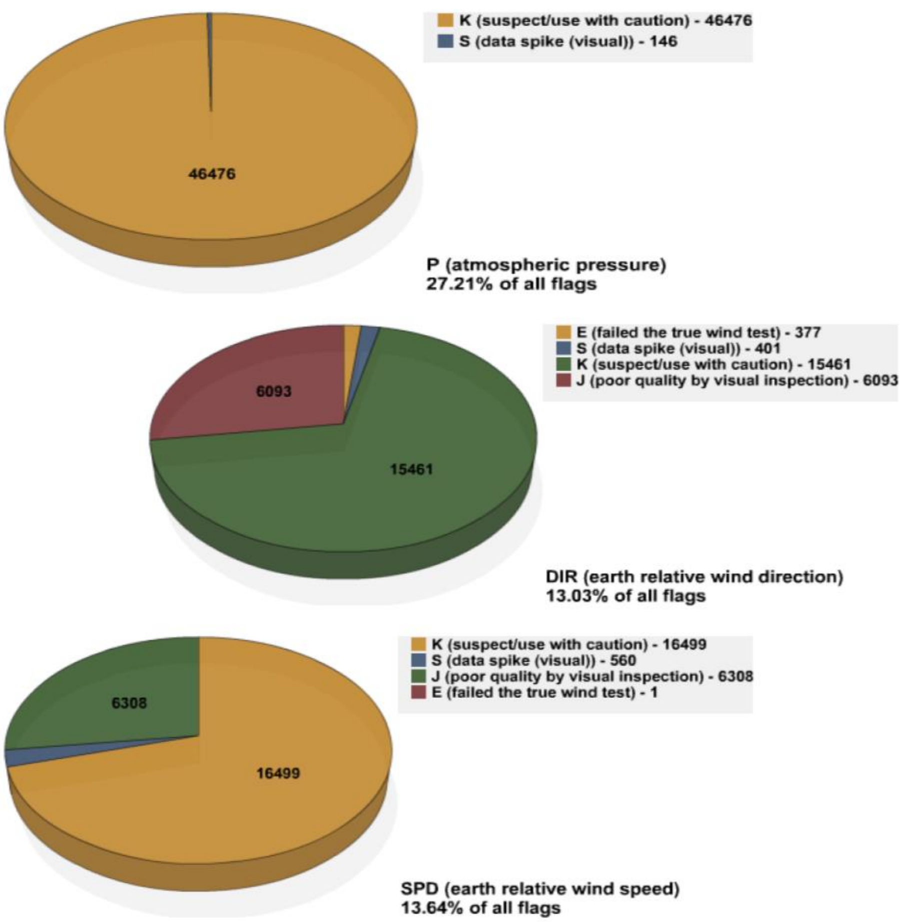
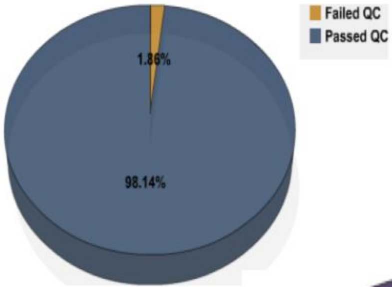


Figure 60: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (middle) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD –for the *Oscar Dyson* in 2014.

Oscar Elton Sette



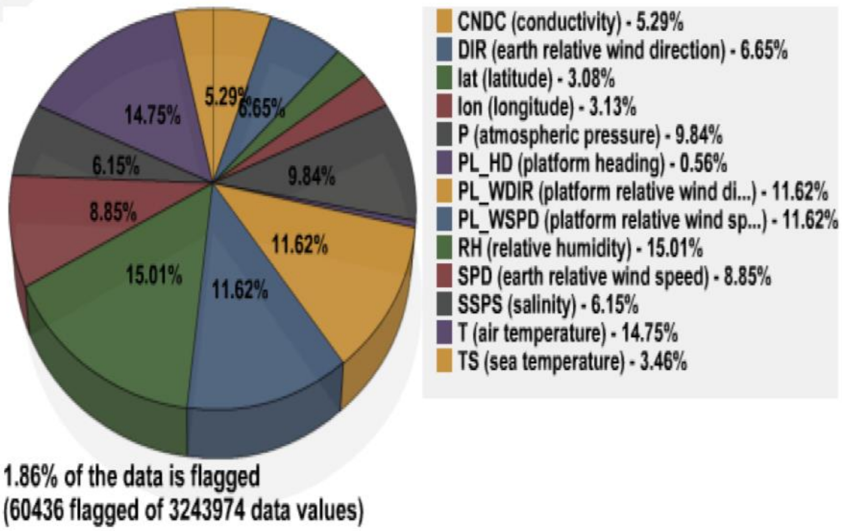


Figure 61: For the *Oscar Elton Sette* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Elton Sette* provided SAMOS data for 158 ship days, resulting in 3,243,974 distinct data values. After both automated and visual QC, 1.86% of the data were flagged using A-Y flags (Figure 61). This is even lower than 2013 (2.69% total flagged). This is once again well inside of the < 5% total flagged bracket, and it not only denotes "very good" data, it is truly outstanding, particularly for a vessel that receives visual QC.

With such an admirable flag percentage, there are only two items from the *Sette's* 2014 SAMOS data worth mentioning. The first (not shown) was a brief period from 14-20 February, when the vessel was in port at Pearl Harbor (and may or may not have been dry docked), wherein the platform relative winds (direction – PL_WDIR – and speed – PL_WSPD) were bad (PL_WDIR constant 0 and PL_WSPD near-constant ~53°). This demanded poor quality (J) flagging of all wind parameters, including earth relative wind direction (DIR) and earth relative wind speed (SPD). As to the second item, now and again the *Sette's* navigational data (latitude – LAT – and longitude – LON) exhibit spikes, as shown in Figure 62. It isn't clear what causes the spikes, and of course they incurred unrealistic movement (F) or poor quality (J) flags (not shown); but even though they presented throughout 2014 they contributed only a diminutive percentage to the already small total number of flags, and are thus of relatively minor concern to the SAMOS team. We note, though, that any faulty navigation data may affect true wind calculation.

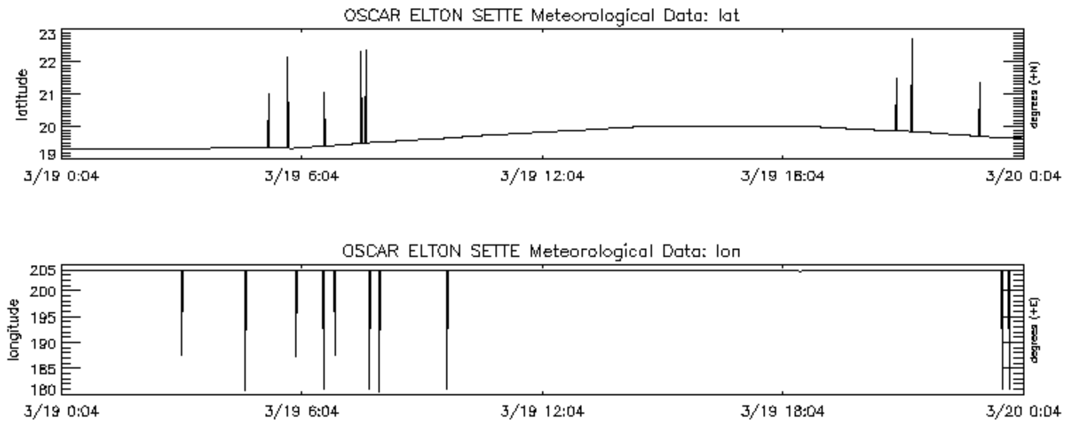


Figure 62: *Oscar Elton Sette* SAMOS data for 19 March 2014 showing unexplained spikes in (top) latitude – LAT – and (bottom) longitude – LON.

Pisces

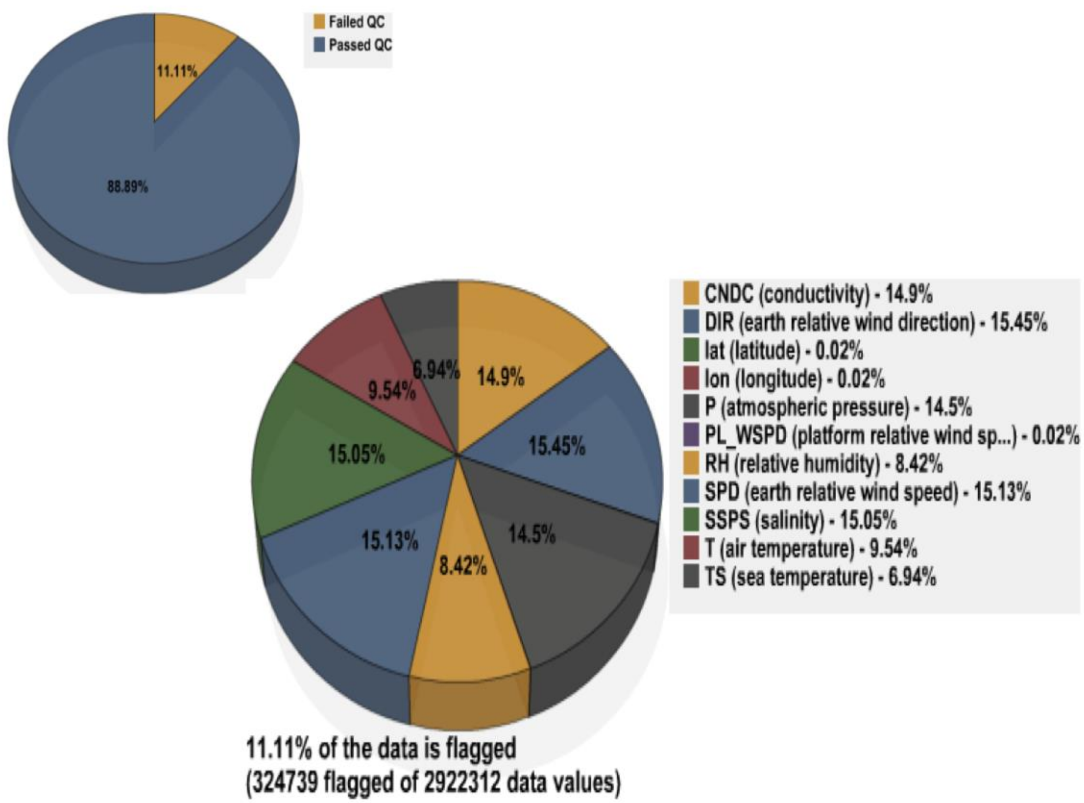


Figure 63: For the *Pisces* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Pisces* provided SAMOS data for 140 ship days, resulting in 2,922,312 distinct data values. After both automated and visual QC, 11.11% of the data were flagged using A-Y flags (Figure 63). 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 percentages of flags for the *Pisces* in 2014, at ~15% each (Figure 63). Most of the flags applied to earth relative wind data were caution/suspect (K) flags (Figure 66). This continually appears to be an airflow distortion/obstruction issue, originating at multiple platform relative wind directions. Several digital images of *Pisces* sensors do exist at SAMOS; however, it is not entirely clear in the images 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.

Air temperature (T), relative humidity (RH), and atmospheric pressure (P) exhibit similar flow distortion behavior to DIR and SPD (flag breakdown not shown) and picked up a further ~33% combined of the total flags in 2014 (Figure 63). It appears in the digital imagery as though the T, RH, and P sensors, at least, are in a potentially problematic location very close to 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. Additionally, the pressure data continue to exhibit mysterious downward "steps" that appear unrelated to either platform relative wind direction or platform speed (see Figure 64). Attempts will be made again in 2015 to contact *Pisces* personnel and get to the bottom of the issue, though previous attempts to determine the cause have gone unanswered.

Flag percentages for both conductivity (CNDC) and salinity (SSPS) were a bit higher than usual this year, at ~15% each (Figure 64). In mid-October the two parameters developed intermittent periods of noise, which quickly worsened (Figure 65). An email dated 10 November from the *Pisces* stated that, after sea conditions had calmed down, troubleshooting onboard revealed a fault with the TSG interface box, which affected CNDC and SSPS. The issue persisted for the remainder of the year, and resulted in a good amount of K and J (poor quality) flags (Figure 66). This was in addition to the K and J flags that occurred when the vessel was in port with the sensor turned off (a common and more or less excusable event).

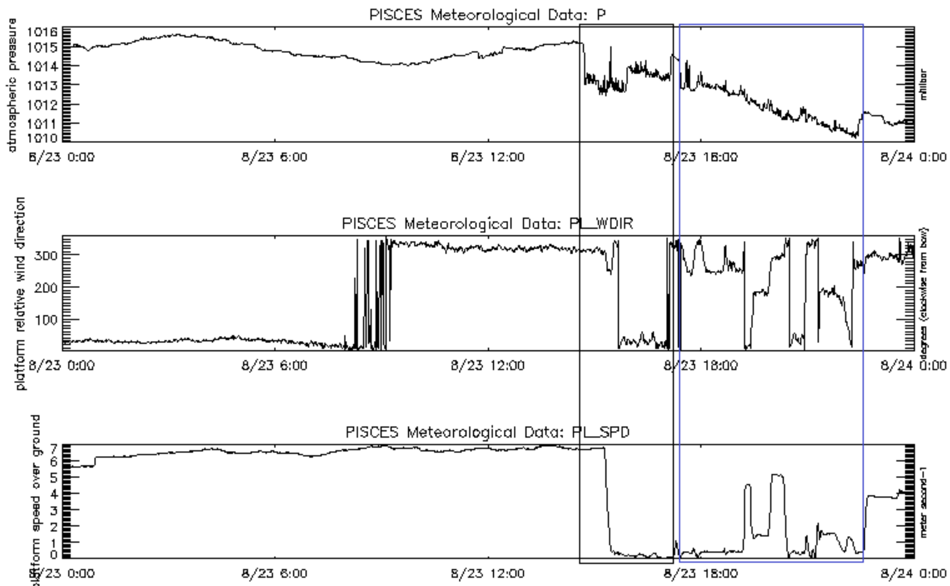


Figure 64: *Pisces* SAMOS data for 23 August 2014: (top) atmospheric pressure – P – (middle) platform relative wind direction – PL_WDIR – and (bottom) platform speed – PL_SPD. Note the unexplained behavior in P (inside the black and blue boxes), which seems to bear no correlation with either PL_WDIR or PL_SPD.

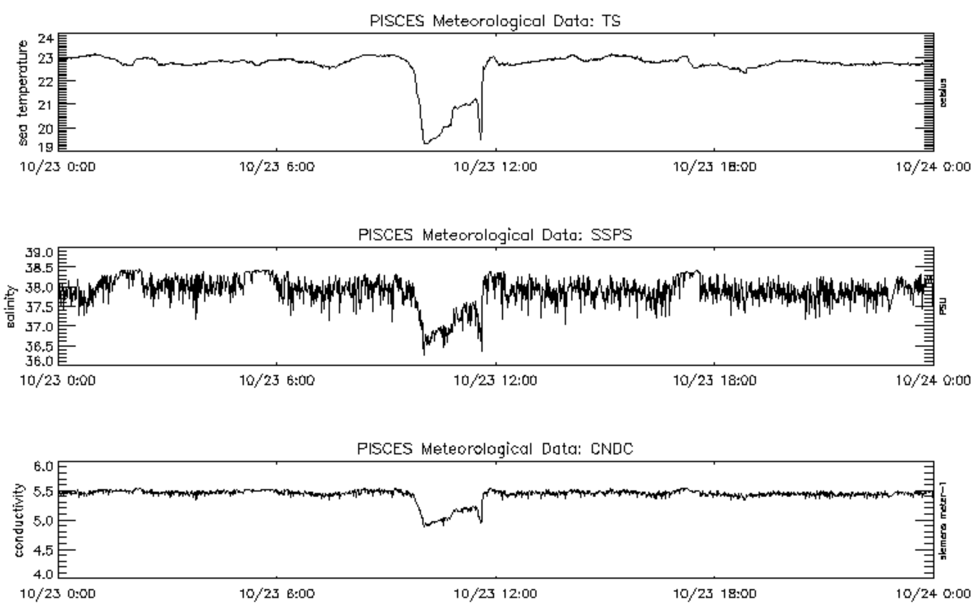


Figure 65: *Pisces* SAMOS data for 23 October 2014: (top) sea temperature – TS – (middle) salinity – SSPS – and (bottom) conductivity – CNDC. The noisy behavior in SSPS and CNDC were a result of a bad TSG interface component; TS was unaffected.

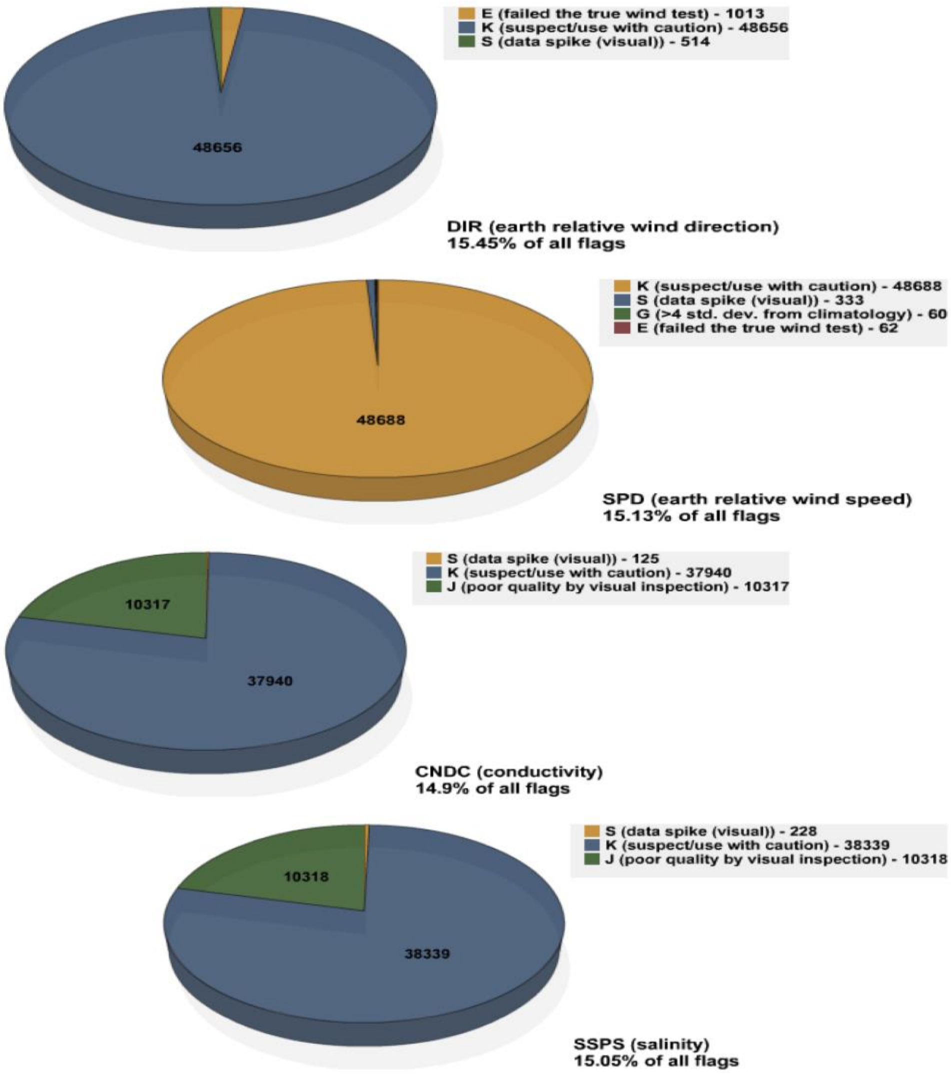


Figure 66: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) earth relative wind speed – SPD – (third) conductivity – CNDC – and (last) salinity – SSPS – for the *Pisces* in 2014.

Rainier

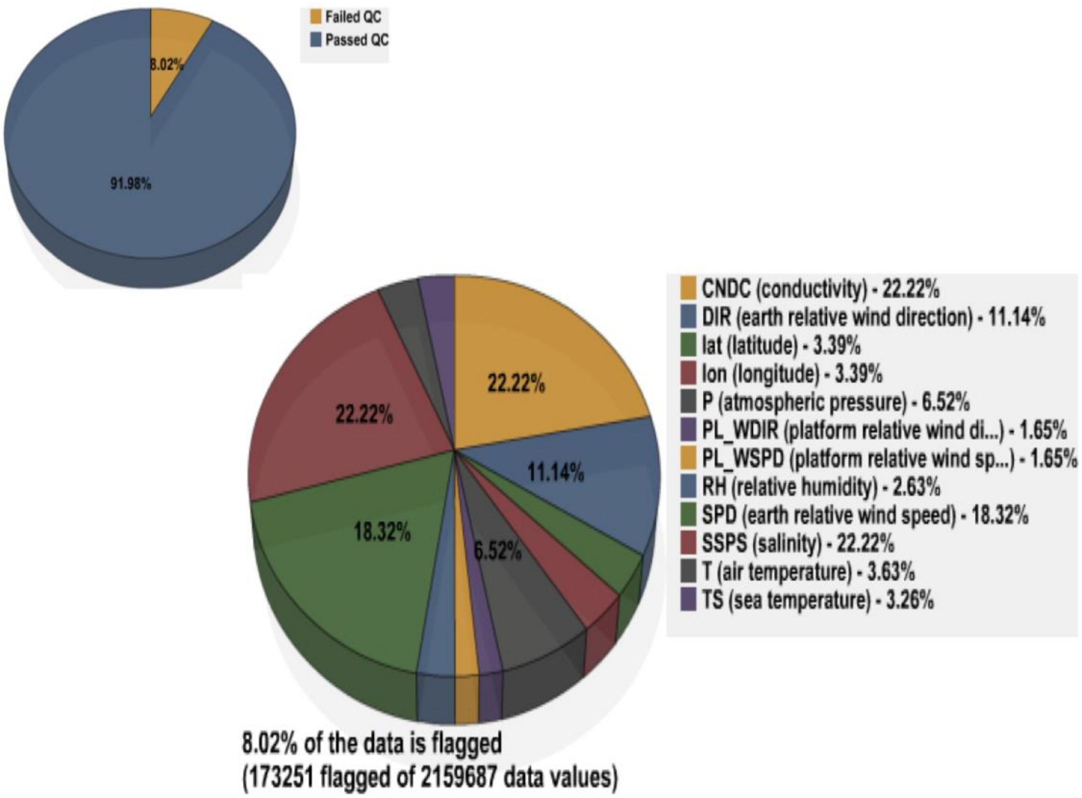


Figure 67: For the *Rainier* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Rainier* provided SAMOS data for 117 ship days, resulting in 2,159,687 distinct data values. After both automated and visual QC, 8.02% of the data were flagged using A-Y flags (Figure 67). This is about a one percent improvement over 2013 (9.13% total flagged).

A good portion of the total flags was assigned to conductivity (CNDC) and salinity (SSPS), about 22% each (Figure 67). These were primarily poor quality (J) flags (Figure 69), the bulk of which were applied during the period 2-24 July while the sensor was likely turned off. It should be noted that for most (though certainly not all) of this period the vessel was stationary. In such situations it is not uncommon for vessel technicians to turn the sensor off. It's merely unfortunate that the practice resulted in such a large quantity of flagging in this case. We do note that no issue is assumed with this sensor.

The other main issue with *Rainier's* data is the earth relative wind direction (DIR) and speed (SPD) parameters. In a continuation from last year, it is obvious the *Rainier* suffers from a rather pronounced flow distortion problem. Unfortunately *Rainier's* sensor metadata is still insufficient for us to be able to pinpoint the problem (see Annex C); we do not have any clue about where the sensors are located, and there is no adequate digital imagery available to show what structures might be interfering with the flow over the ship. In addition to the flow distortion issue, the DIR and SPD data also suffered a brief unexplained interlude of odd behavior (originating in the platform relative winds) that added a quantity of K flags to the pool of flow distortion-based K and J flags (Figure 69). On 13 June, platform relative wind direction (PL_WDIR) and speed (PL_WSPD) suddenly changed character and became generally much more constant, changing value only occasionally in steps or spikes. DIR and SPD followed suit (Figure 68). As of 16 June the data suddenly returned to normal. Again, it is not known what caused this event.

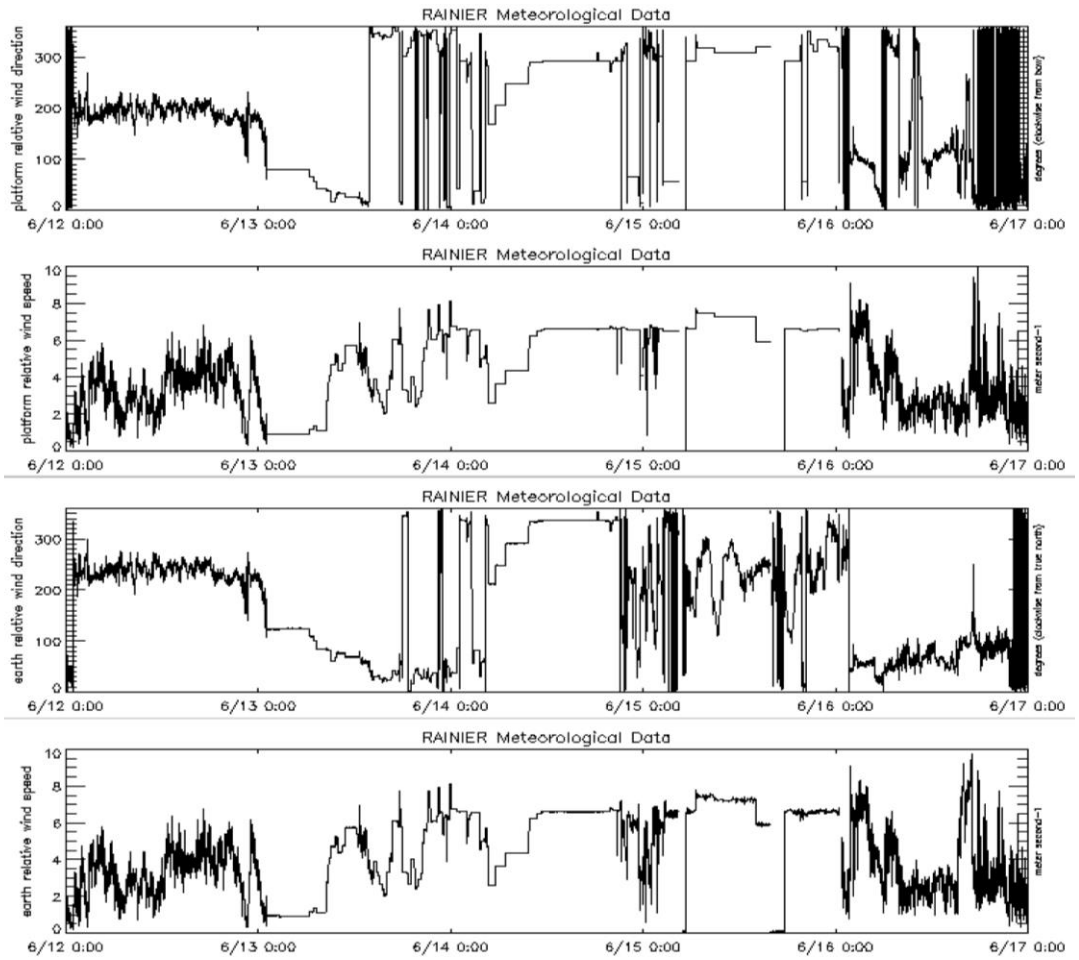


Figure 68: *Rainier* SAMOS data for 12-16 June 2014: (first) platform relative wind direction – PL_WDIR – (second) platform relative wind speed – PL_WSPD – (third) earth relative wind direction – DIR – and (last) earth relative wind speed – SPD. Note the unusual (and unreliable) behavior in all four parameters between 00Z 13 June and 00Z 16 June.

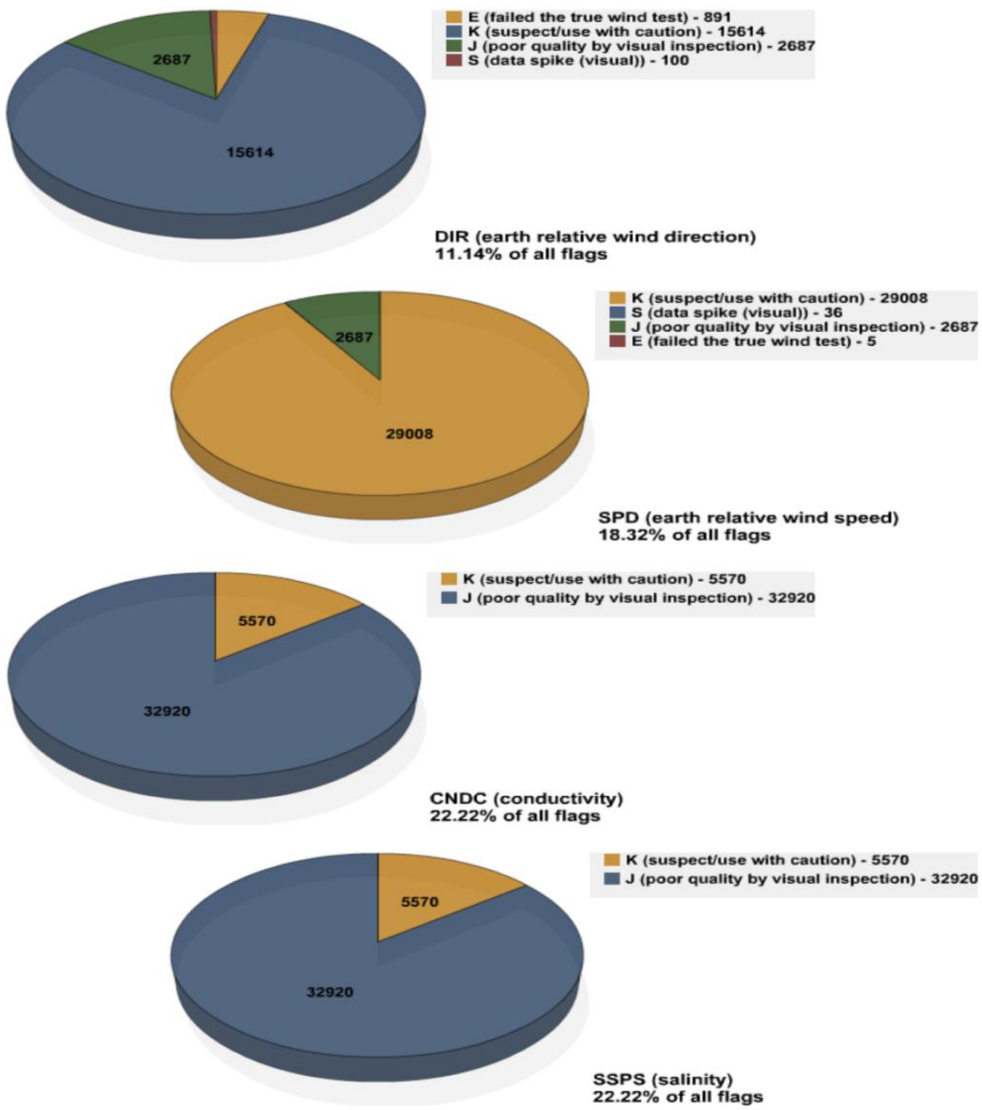
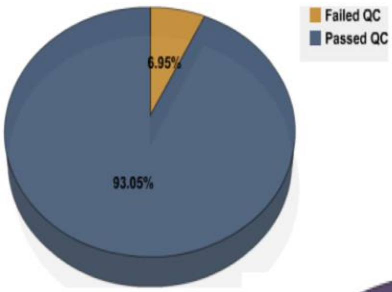


Figure 69: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) earth relative wind speed – SPD – (third) conductivity – CNDC – and (last) salinity – SSPS for the *Rainier* in 2014.

Ronald H. Brown



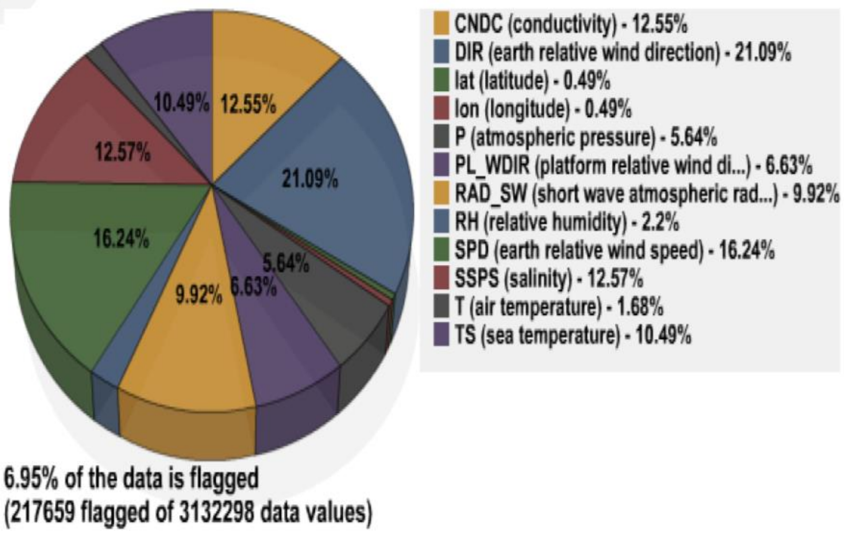


Figure 70: For the *Ronald H. Brown* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Ronald H. Brown* provided SAMOS data for 143 ship days, resulting in 3,132,298 distinct data values. After both automated and visual QC, 6.95% of the data were flagged using A-Y flags (Figure 70). This is about a 2.5% increase over 2013 (4.33% total flagged) and unfortunately knocks the *Ron Brown* outside the < 5% flagged threshold denoting "very good" data. It is important to note here, though, that communication from the *Brown* regarding her data in 2014 was exemplary. Any problems were thoroughly and promptly investigated, and troubleshooting, correcting, and even data comparison methods onboard the ship in several cases went above and beyond what we've come to expect from vessel technicians. Despite the middling flag percentage, the *Brown* should be considered a model SAMOS participant in 2014 for the concerted efforts her technicians put forth to improve her data.

The first major issue occurred when a 10-day batch of backlogged data arrived at the DAC in mid-August (fortunately just at the 10-day delayed mode window set for visual quality control). Upon quick inspection, the lead analyst noted that the platform relative wind direction (PL_WDIR) had recorded a constant 0 degrees for the entire period. This information was immediately relayed to the *Brown* via email, on 20 August. A response came back from the new chief survey technician on 26 August stating that he had been unaware of the problem until the previous day, when the vessel had finally left port. He outlined a plan to attempt to fix the jackstaff sensor, and if that failed all wind parameters would be switched to a different sensor. Later that day the chief tech emailed SAMOS again to say that the faulty sensor could not be fixed and all wind parameters were switched to the *Brown's* starboard ultrasonic anemometer. Wind parameter metadata were immediately updated, and the following day's wind data resumed normal patterns. There are both a positive and a negative to take from this entire transaction: On the one hand, quick response to problem notification and a thorough plan of action, followed through in short order, are highly desirable activities from any SAMOS operator. On the other hand, it highlights the problem with backlogged data – if these data files had been received on time, the problem would likely have been identified and perhaps addressed immediately. As it stood, the platform relative wind direction had to be assigned poor quality (J) flags for the entire period 10-19 August (not shown). Earth relative wind direction (DIR) also had to be assigned J flags for the period, and earth relative wind speed (SPD) data were assigned caution/suspect (K) flags, as they depend upon PL_WDIR in their calculation (Figure 72).

The second and third major issues both involved thermosalinograph variables (sea surface temperature, or TS, conductivity, or CNDC, and salinity, or SSPS), and both occurrences were actually pointed out to the DAC by the chief survey tech. In the first of the two cases, the effects were mild enough to have escaped the attention of the visual quality control analyst; had the issues not been highlighted by the technician, the unreliable data would have gone undetected in the research-quality files.

Notice of this first TSG issue came in early September, when the *Brown's* chief tech emailed to say he'd been doing comparisons between their TSG sea surface temp and the surface reading off their CTD casts. He'd noted about a 2 degree difference between the two, as well as a discrepancy in the conductivity readings from both instruments, and surmised that the TSG readings were likely the less reliable, as the instrument had not been calibrated since 2011. He outlined a plan to install new instrumentation at their next in port, and advised SAMOS analysts not to trust the TS and CNDC (and thus SSPS) readings from their current and, perhaps, previous cruise(s). As the visual quality control analyst could not determine when the issue actually began, it was decided to apply caution/suspect (K) flags to TS/CNDC/SSPS (Figure 72) from the current cruise only, and include a note to the user here in the annual report that suspicious TSG data may exist in the recent historical SAMOS data from the *Brown.* Several days later the chief tech emailed again to say the new TSG had been installed, and he included a spreadsheet analysis he'd compiled of the new TSG data, testing it once more against the CTD data. The results were unmistakable – the new TS data read within a hundredth of a degree of the surface data off the CTD, and the CNDC data were likewise within a few hundredths PSU of each other. SAMOS metadata was again updated to reflect the change in sensors, and TSG data regained credibility.

The second TSG issue came about a month later, when on 19 September the chief tech once again initiated email contact with the DAC. He stated that he'd suspected false readings in the TSG data for the past day or so, and this time he suspected a flow problem in their scientific seawater system. A second email from the tech later that same day supplied confirmation; he explained that their engineers had looked into the issue and had removed a plastic bag from the flow system and also shut a vent valve that may have been sucking air into the seawater system. After the fix the TSG data again returned to normal. In this case, it was obvious to the visual QC analyst as well precisely when the problem was in effect (see Figure 71), and TS/CNDC/SSPS thus incurred a few more days' worth of J flags (Figure 72).

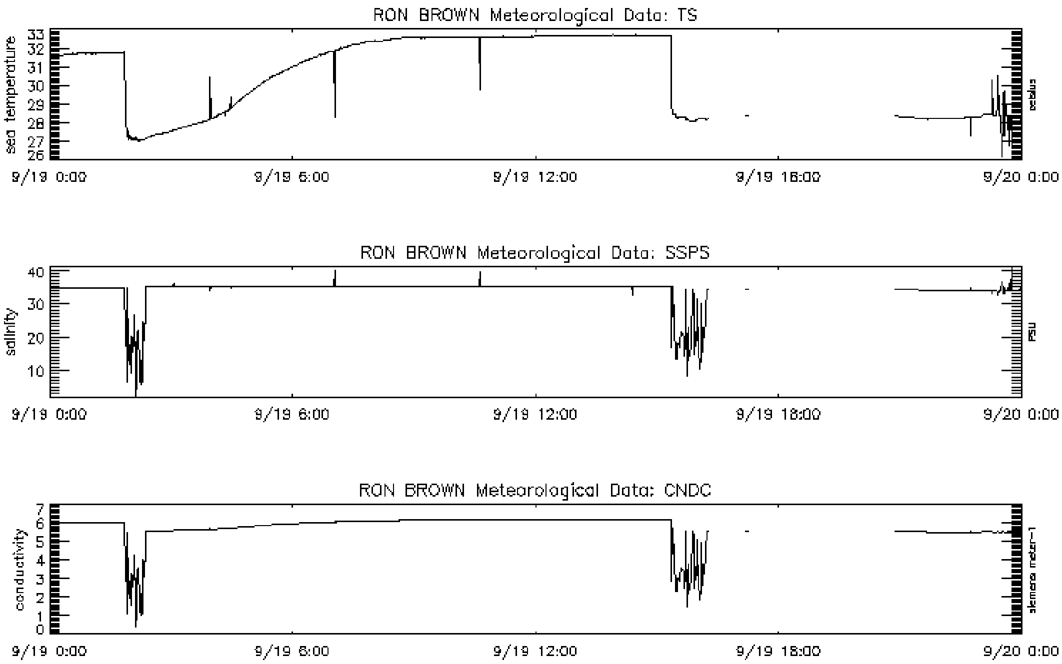


Figure 71: *Ron Brown* SAMOS data for 19 September 2014: (top) sea temperature – TS – (middle) salinity – SSPS – and (bottom) conductivity – CNDC. Note the repeated pattern of slow rise and abrupt fall particularly evident in TS and CNDC, as well as the sudden steps in SSPS/CNDC (likely air intake) and spikes in all three variables. Transmission of TSG data was stopped around 16GMT. The problems were addressed, and normal transmission resumed around 2130GMT.

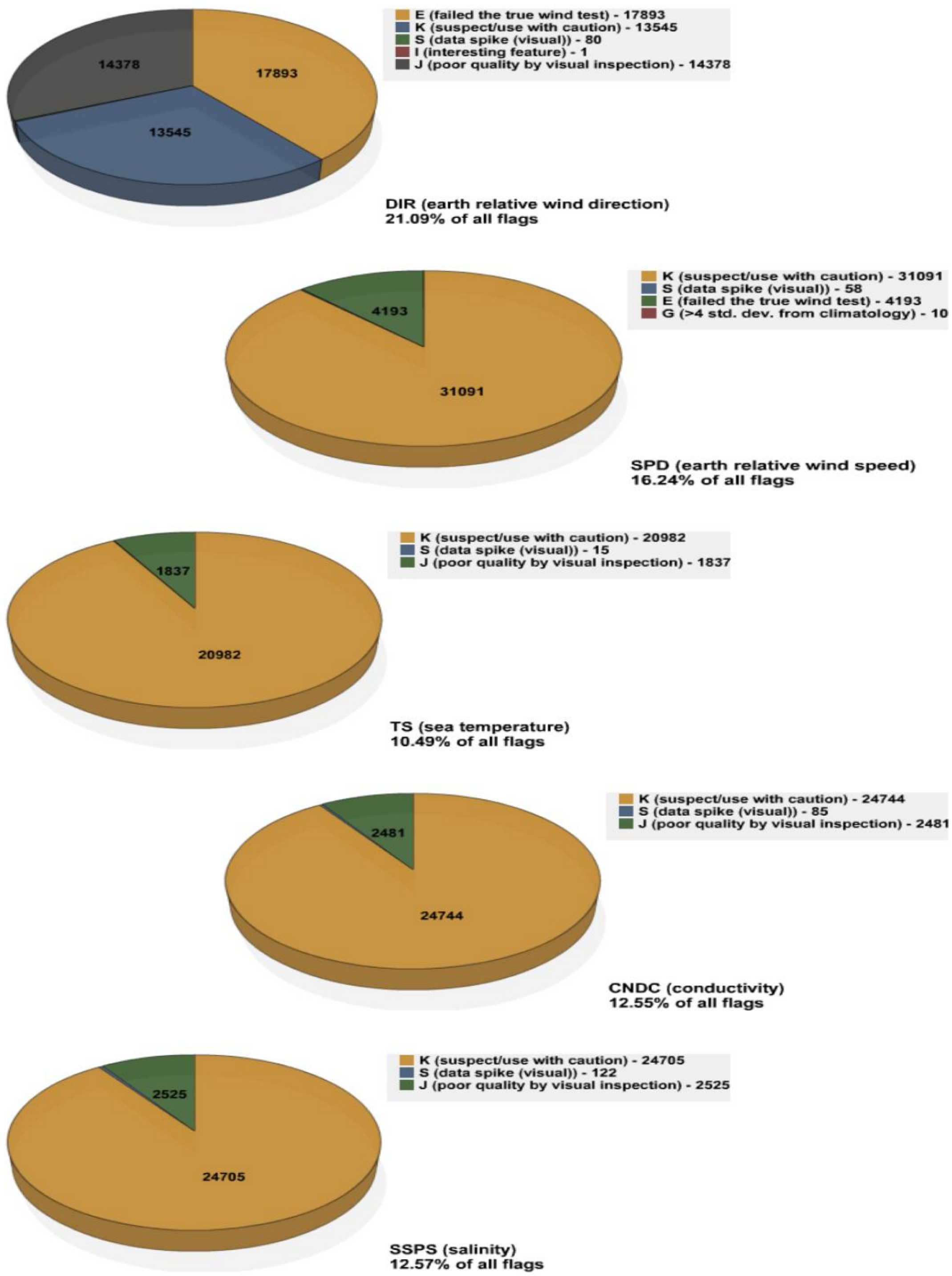


Figure 72: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) earth relative wind speed – SPD – (third) sea temperature – TS – (fourth) conductivity – CNDC – and (last) salinity – SSPS – for the *Ronald H. Brown* in 2014.

Thomas Jefferson

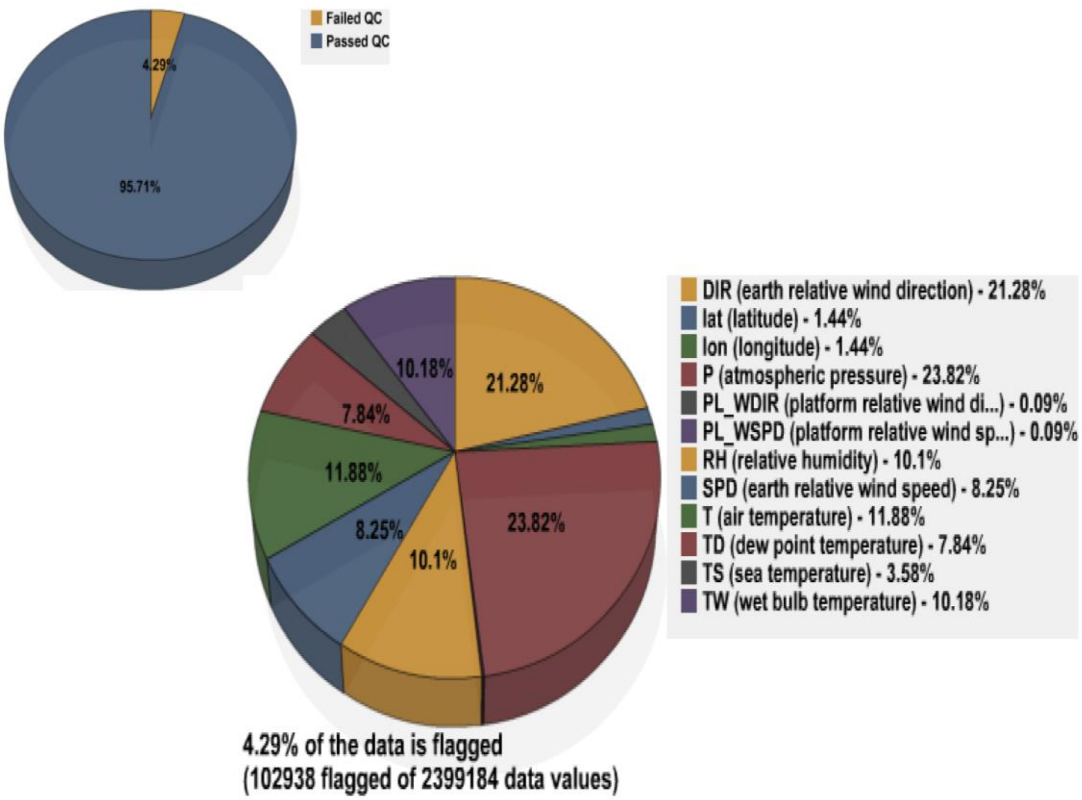


Figure 73: For the *Thomas Jefferson* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Thomas Jefferson* provided SAMOS data for 117 ship days, resulting in 3,512,160 distinct data values. After both automated and visual QC, 4.29% of the data were flagged using A-Y flags (Figure 73). This is a little more than a percentage point increase over 2013 (3.01% total flagged) but is still inside the < 5% flagged bracket regarded by SAMOS to represent "very good" data.

Echoing previous years, the main 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 still none more so than atmospheric pressure (P), with nearly a quarter of the total flags being assigned to that variable in 2014 (Figure 73). There were a lot of steps in the data (see Figure 74), resulting in a need for a good amount of suspect/caution (K) flagging (Figure 75). Earth relative wind direction DIR was also particularly sensitive to platform relative winds, behaving similarly to P with a lot of steps and spikes. The volume of K flags applied to DIR (Figure 75) fostered another ~21% of the total flags (Figure 73). It was again anticipated that these types of suspicious behavior 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.

A separate issue foisted a quantity of poor quality (J) flags upon most of the atmospheric parameters – namely, air temperature (T), wet bulb temperature (TW), dew point temperature (TD), relative humidity (RH), and atmospheric pressure (P) – for the entire period 5-8 January. When the data were received, SAMOS personnel noted the data were all well below any reasonable values and alerted *Jefferson* personnel to the occasion via email. A response quickly came back that all of the meteorological sensors except the anemometer had been removed for calibration, as the vessel was transiting to Charleston for a dry dock period. As such, when the time came for visual QC all affected data were J flagged (not shown).

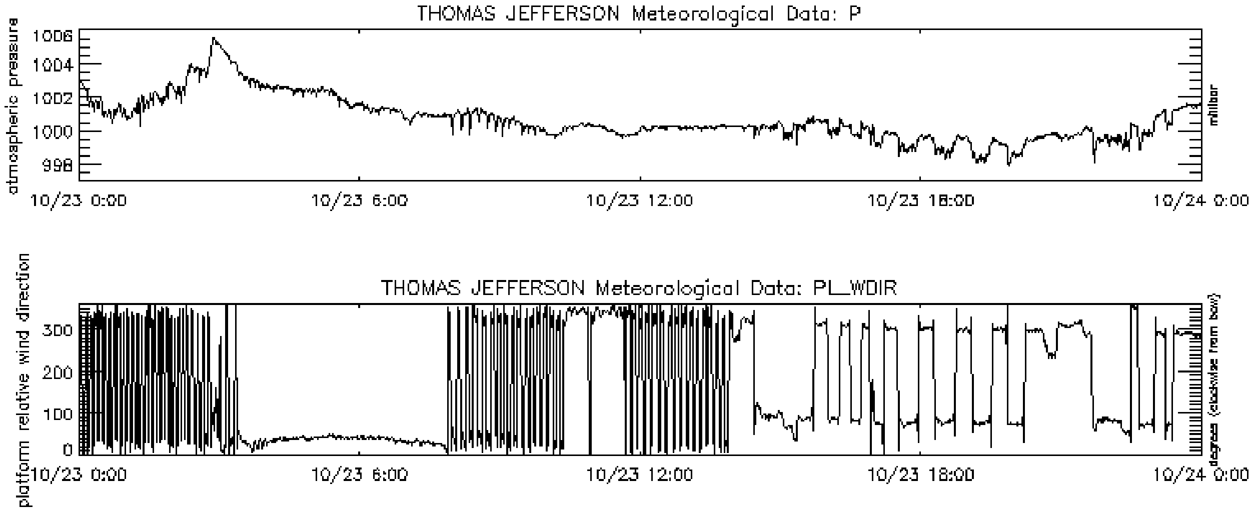


Figure 74: *Thomas Jefferson* SAMOS data for 23 October 2014: (top) platform relative wind direction –PL_WDIR – and (bottom) atmospheric pressure – P. Note frequent steps/spikes in P whenever PL_WDIR changes.

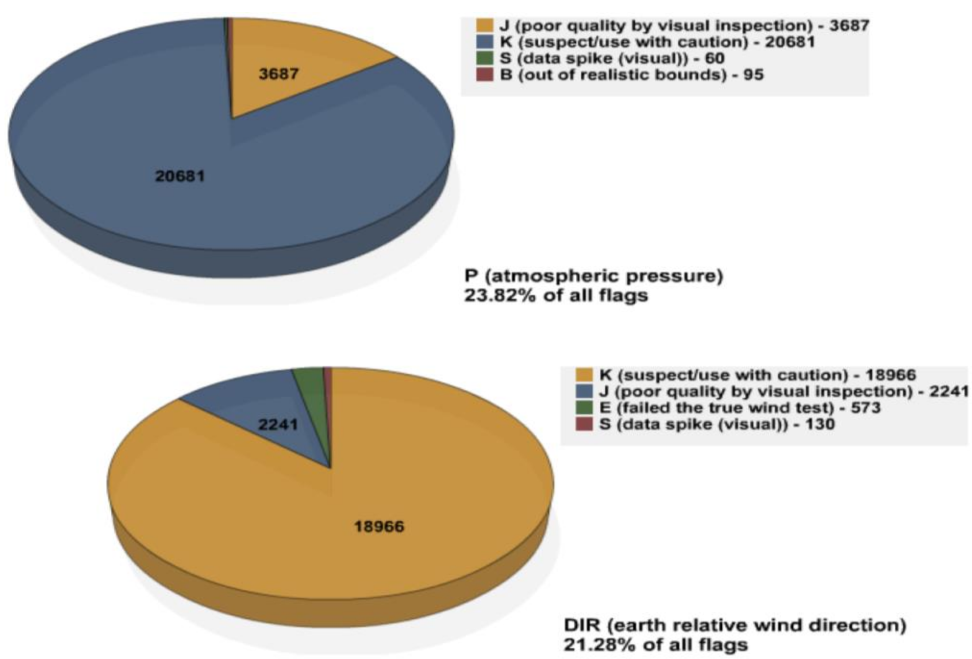


Figure 75: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – and (bottom) earth relative wind direction – DIR – for the *Thomas Jefferson* in 2014.

Laurence M. Gould

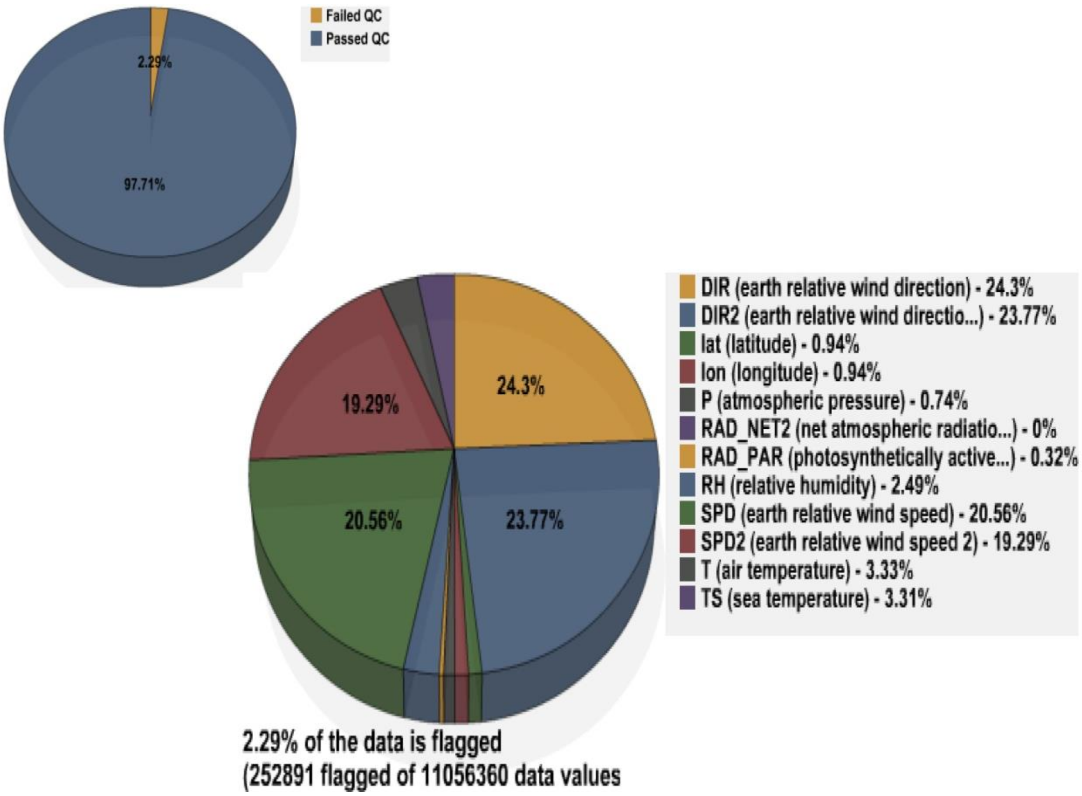


Figure 76: For the *Laurence M. Gould* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Laurence M. Gould* provided SAMOS data for 361 ship days, resulting in 11,056,360 distinct data values. After automated QC, 2.29% of the data were flagged using A-Y flags (Figure 76), which is one percent higher than 2013 (1.27% total flagged). However, as the *Gould* does not receive visual QC this percentage is likely misleading. Visual quality control is generally when the bulk of quality control flags are applied and the *Gould* historically maintains multiple data issues, owing in large part to the massive superstructure resident on the vessel. What can be noted here are a number of issues that were brought to light by the quick visual inspection that occurs when data files are first received.

First, in early March it was discovered that the platform course (PL_CRS) was reading at a constant value. When contacted by the lead SAMOS analyst via email, the *Gould* responded that there were issues with the GPS and thus they'd decided to swap it for one of their spares. As a side note to the user here, while updating the *Gould's* navigational parameter metadata after this GPS swap (meaning latitude, or LAT, longitude, or LON, course over ground, or PL_CRS, and speed over ground, or PL_SPD) we at SAMOS discovered there had been a previous GPS swap back in 2008 that was never reported to us. This means that the GPS instrument metadata we have on file for LAT, LON, PL_CRS, and PL_SPD will not match the actual instrument that was used for the period 2008 – 4 March 2014. We further note that, though they likely were not flagged by automated SAMOS processing, the earth relative winds must also be considered suspect during the period of constant value PL_CRS.

Once the PL_CRS issue was corrected, it was noted that PL_SPD was reading at a constant value. *Gould* was again notified via email (on 10 March) and the response came back that there had been a typo in the output string script and it had been addressed immediately upon discovery. The issue was thus assumed to have been corrected, however on 2 April the lead data analyst noted again that PL_SPD was still stuck at a constant value. Another email notification was sent to the *Gould* and this time they stated that the GPS parser that outputs the string used to acquire PL_SPD needed reconfiguring. At that point the *Gould* folks decided to switch PL_SPD to a different GPS until the problem could be corrected in about a week. And indeed by 9 April the issue was finally resolved. However, the earth relative winds prior to the correction should again be considered unreliable, though they likely were not flagged by automated processing.

On 21 May it was noted that the air temperature parameter (T) had flat lined. Notification was sent, and the response that came back did not identify the issue but noted that the *Gould* was headed into the shipyard and that they would temporarily disable the sensor. (Again, none of the faulty T data was likely caught by the auto flagger.) On 1 July the lead analyst noticed that the parameter was still missing from the SAMOS files and contacted the *Gould* again to inquire whether the instrument had been replaced during their dry dock period. *Gould* responded that it had indeed been replaced, and that someone must have overlooked turning it back on. They expressed their thanks for the notification and promptly restarted the T data flow.

One final noteworthy event occurred during the *Gould's* dry dock period. The *Nathaniel B. Palmer* was also at the same shipyard with *Gould* and the lead SAMOS analyst took the rare opportunity to do a side by side comparison of the data coming from the two vessels. He discovered about a 12-13 mb difference between the two atmospheric pressure parameters (P) and provided detailed graphics to the *Gould* demonstrating the discrepancy. This prompted the *Gould* technicians to do their own comparison; in the end they determined that the barometer onboard the *Palmer* read about 4 mb too high, while the barometer onboard the *Gould* read about 9 mb too low. They borrowed a spare barometer from the *Palmer* (as their own spare was out for repair) and compared readings again – this time they found that the two vessels' P data were within 1 mb of each other. A decision was made to keep the *Palmer* spare until their' own spare was reclaimed. To reiterate a final time, though the *Gould's* P data was likely unreliable for quite some time, it's almost certain the error was not discovered by the auto flagger.

All of these notification/resolution events underscore the importance of two-way communication between the SAMOS data analysts and the SAMOS vessel operators, especially in the case of ships that do not receive visual quality control (like the *Gould*). In many of these non-visQC cases there is nothing we can do to highlight suspicious or poor quality data, aside from making a formal note in these annual reports. But at least we can try to minimize the damage by pinpointing any issues early on and getting them resolved as quickly as possible with the help of the ships' technicians.

Nathaniel B. Palmer

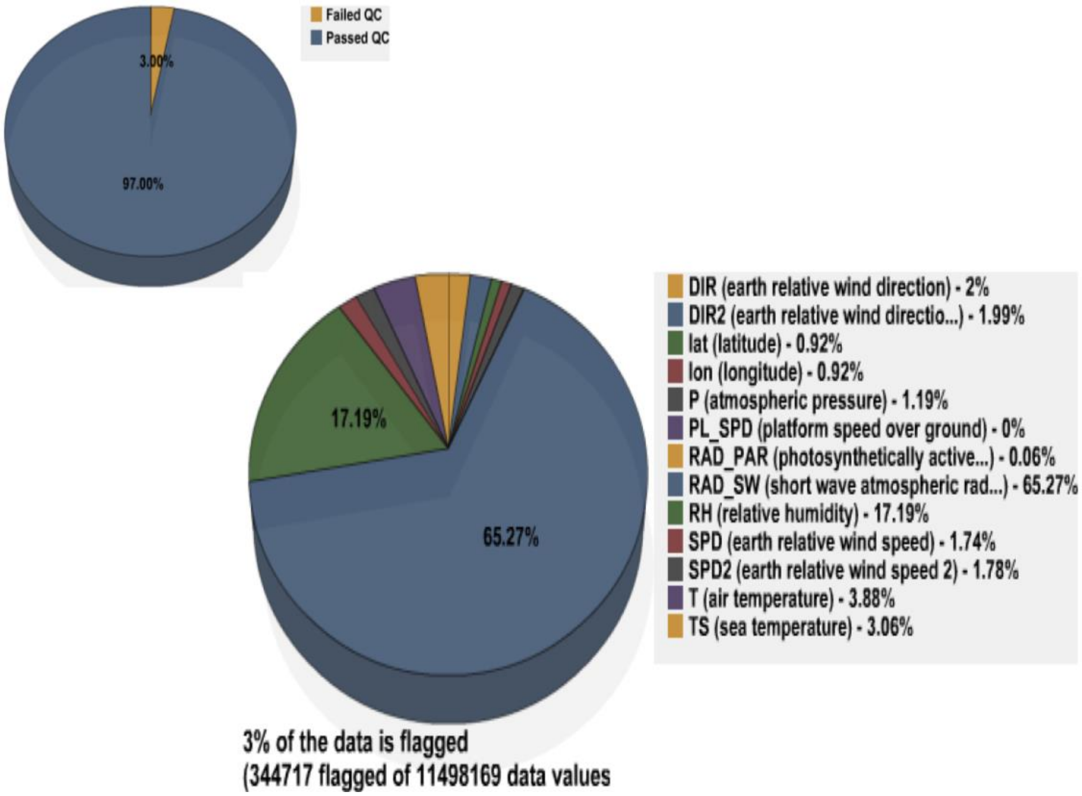


Figure 77: For the *Nathaniel B. Palmer* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nathaniel Palmer* provided SAMOS data for 358 ship days, resulting in 11,498,169 distinct data values. After automated QC, 3% of the data were flagged using A-Y flags (Figure 77). This is about the same as 2013 (2.78% total flagged) and resides inside the < 5% total flagged bracket typically denoting "good data." However, like the *Gould*, the *Palmer* does not receive visual QC so again this percentage is likely to be misleading. Visual quality control is generally when the bulk of quality control flags are applied, and the *Palmer* and *Gould* alike have a history of multiple data issues, owing in large part to the massive superstructures resident on each vessel.

Just as it was in 2013, the primary standout parameter appears to be short wave atmospheric radiation, comprising over 65% of the total flags (Figure 77). However, these continue to be exclusively out of bounds (B) flags (Figure 78) and a cursory inspection of the data reveals the issue is still 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.

Relative humidity (RH) also holds a disproportionate percentage of the total flags in 2014 (~17%, Figure 77). The flags are of both the B and G (greater than 4 standard deviations from climatology) variety, and in this case they do actually signify a temporary data issue. In mid-October the lead SAMOS data analyst noticed an apparent RH sensor failure and contacted the *Palmer* via email to verify. The senior marine ET onboard the *Palmer* sent back confirmation that it had indeed been a known failure, as the sensor had water in it. She noted that the sensor had been swapped, and that they'd only had to wait for good enough weather to get up the instrument mast to replace it. As demonstrated in Figure 78, this was fortunately one time when most of the faulty data were bad enough to be caught and flagged by automated processing; in many non-visQC situations this is not the case.

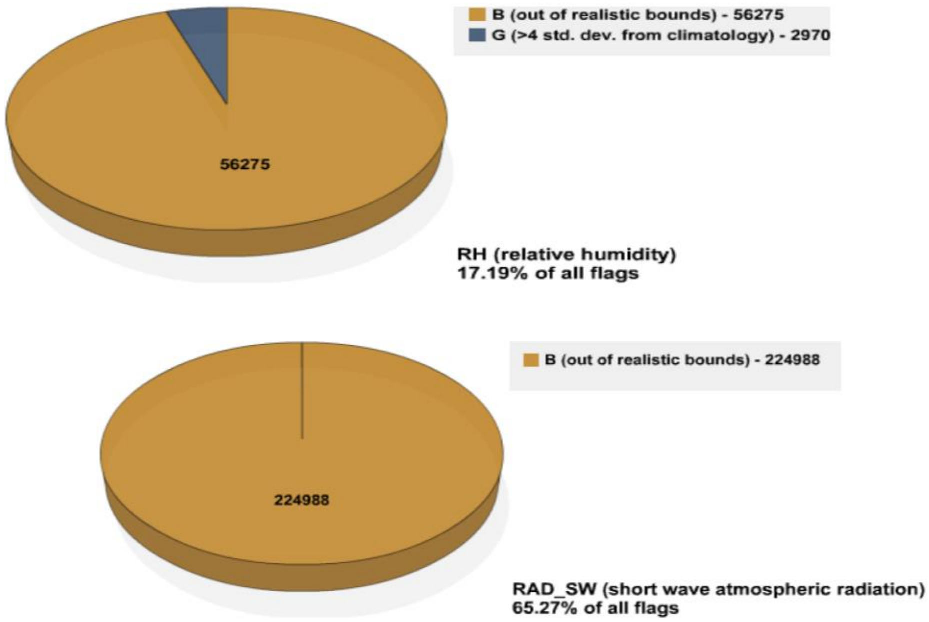


Figure 78: Distribution of SAMOS quality control flags for (top) relative humidity – RH – and (bottom) short wave atmospheric radiation – RAD_SW – for the *Nathaniel B. Palmer* in 2014.

Melville

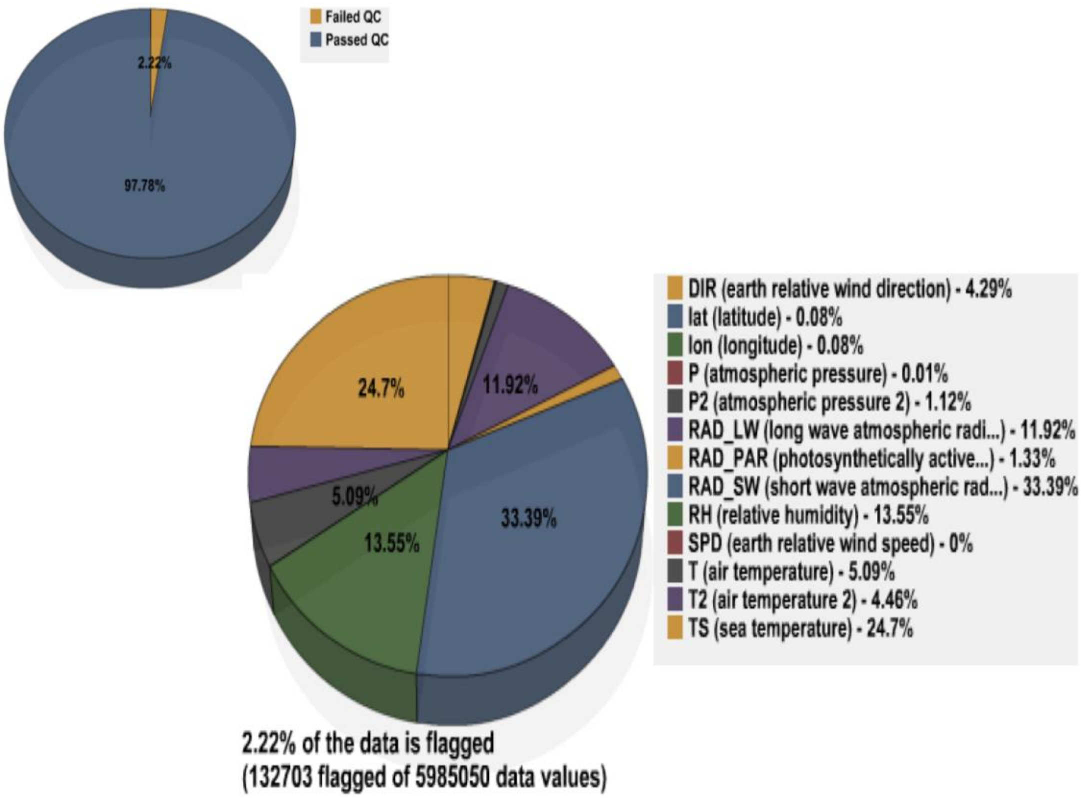


Figure 79: For the *Melville* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Melville* provided SAMOS data for 201 ship days, resulting in 5,985,050 distinct data values. After automated QC, 2.22% of the data were flagged using A-Y flags (Figure 79), about the same as 2013 (2.45% total flagged). NOTE: the *Melville* did not receive visual quality control by the SAMOS DAC in 2014, 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 (~33%) was applied to shortwave atmospheric radiation (RAD_SW). All of those flags were out of bounds (B) flags (Figure 80). While it's likely most of these flags were merely due to sensor tuning and the slightly negative values at night that occur thereof (see Section 3b for details), in this case at least a small portion of the B flags had a more noteworthy origin: On 22 September the quick visual inspection that occurs when data first arrive at the DAC revealed that *Melville's* RAD_SW had begun delivering suspect data (all values < 2 Wm^{-2}). An email request for problem identification, or details, if the issue was already known, was sent to the ship's technicians. There was no immediate reply, and a second email was sent on 7 October. In response to this second email, a dialogue between the DAC and vessel personnel was begun and eventually it was determined that there was either a problem with the sensor element or with the connection between the sensor and its interface. A plan was created to lower the mast at the earliest convenience and investigate the issue further. A cursory glance at year-end data does seem to suggest the problem was fixed, as data ranges appeared back within expected limits. We note that as not all of the faulty data were < 0 Wm^{-2}, not all of them would have been detected by the auto flagger, but those that fell below 0 certainly were assigned some of the B flags noted in Figure 80.

One other item of note in 2014: It was discovered during the course of addressing the RAD_SW issue that the gyro being used to calculate *Melville's* earth relative winds was not the same gyro that was reporting navigational data to SAMOS. This is not an ideal practice, as it does not maintain consistency and reproducibility of the earth relative wind data using the necessary parameters being reported to SAMOS. In the *Melville's* case the lead SAMOS data analyst had noted that true wind direction was behaving strangely even though the source parameters' data presumed used for the calculation looked fine. It turned out that the gyro used for wind calculation was acting up, while the gyro being reported to SAMOS was in working order. Once the gyro discrepancy was identified, *Melville* personnel switched their true wind calculation to use the gyro that was being reported to SAMOS and at that point the true wind direction resumed normal behavior.

Finally, we note that the *Melville* has been officially retired, and officially separated from the SAMOS initiative as of 1 January 2015. We would like to take this opportunity to thank the *Melville* and in particular her dedicated tech group for their participation and service these past four years.

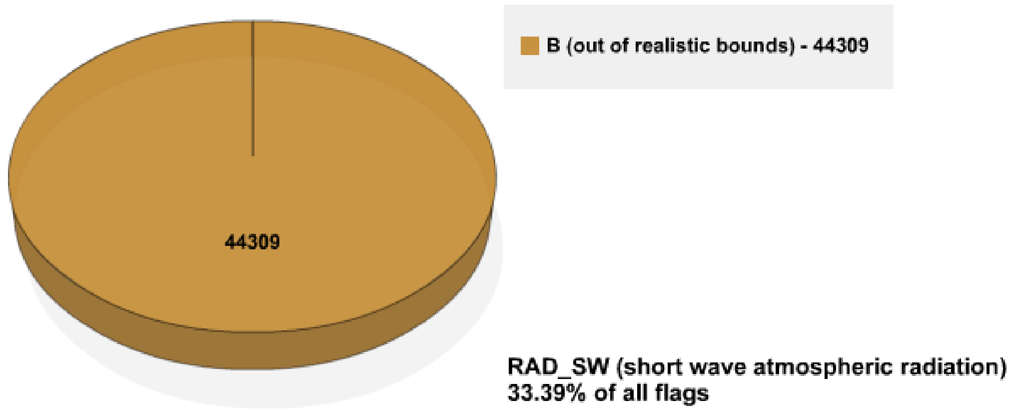


Figure 80: Distribution of SAMOS quality control flags for short wave atmospheric radiation – RAD_SW – for the *Melville* in 2014.

New Horizon

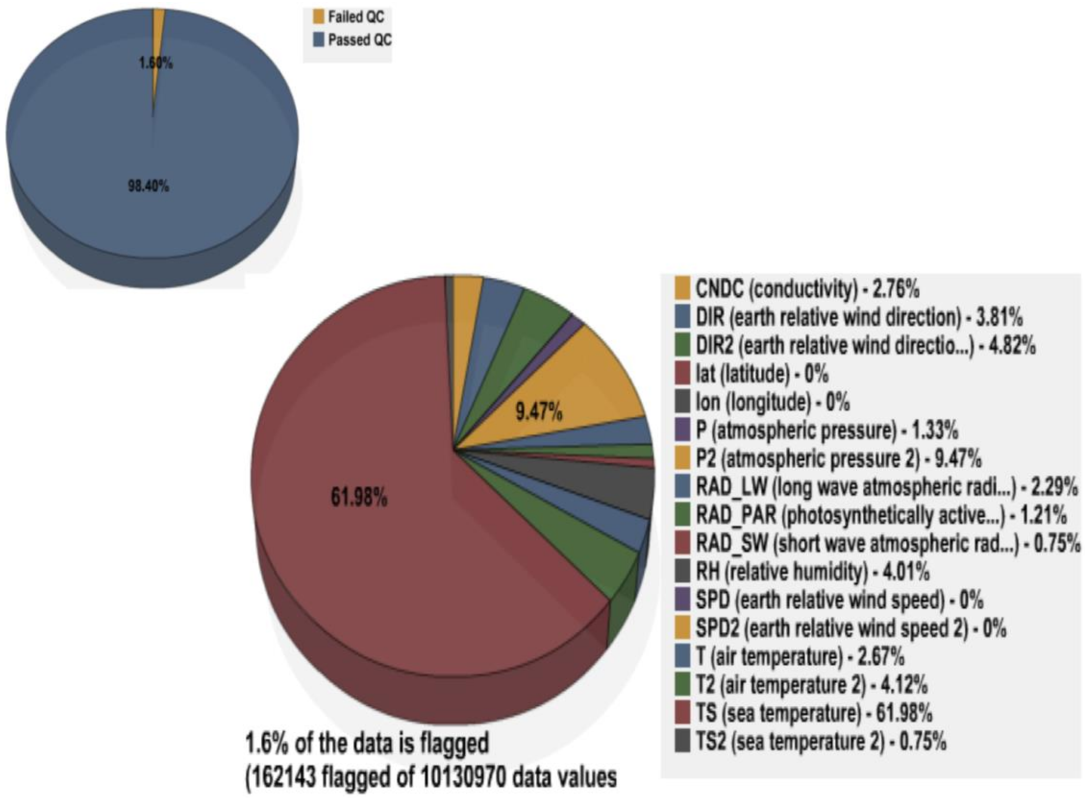


Figure 81: For the *New Horizon* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *New Horizon* provided SAMOS data for 309 ship days, resulting in 10,130,970 distinct data values. After automated QC, 1.6% of the data were flagged using A-Y flags (Figure 81), about a half percent lower than 2013 (2.26% flagged). 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 by far (~62%) was applied to sea temperature (TS). Most of those flags were “greater than 4 standard deviations from climatology” (G) flags (Figure 83). These values may or may not have been realistic; we are not currently funded to investigate cases like this for the *New Horizon*. But as this TS flag analysis is identical to that in 2013, the likelihood exists that the sensor does in fact exhibit a bias for some reason. 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.

Another issue with the *New Horizon* data that is not reflected in the flag totals was discovered during the quick visual inspection that occurs when vessel data first comes into the DAC. In late May the lead data analyst noted that the wind direction data from the *New Horizon's* redundant wind sensors did not agree. A sample of that data depicting the difference was provided to the ship technicians (Figure 82) and an email discussion between the vessel and the SAMOS group was begun. Eventually it was determined that a hose clamp securing the starboard wind sensor to the mast had come loose and the sensor base had rotated by about 60 degrees. At that point the issue was able to be resolved. While the auto flagger would not have applied any flags in response to this sensor rotation, is should be noted that the starboard wind data (both earth relative wind direction, or DIR2, and platform relative wind direction, or PL_WDIR2) between about 28 May – 10 June are unreliable. The starboard earth relative wind speed (SPD2) should also be considered suspect, as they rely on the PL_WDIR2 data for their calculation.

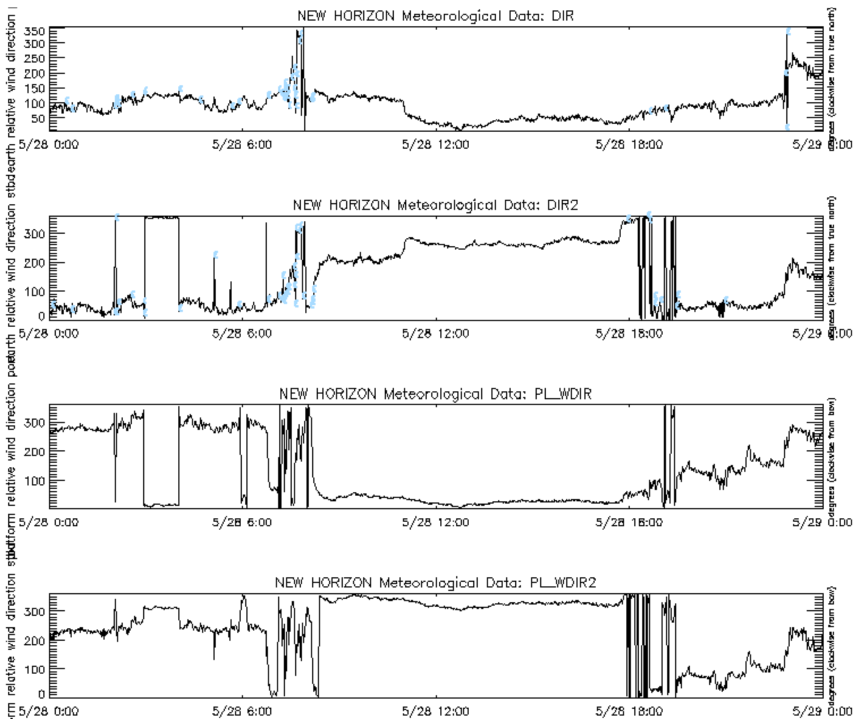


Figure 82: *New Horizon* SAMOS data for 28 May 2014: (first) port earth relative wind direction – DIR – (second) starboard earth relative wind direction – DIR2 – (third) port platform relative wind direction – PL_WDIR – and (last) starboard platform relative wind direction – PL_WDIR2. Note the apparent ~60 degree difference between redundant parameters.

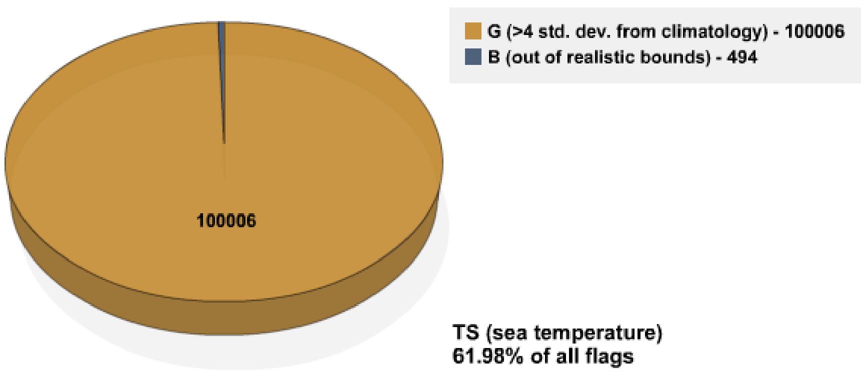
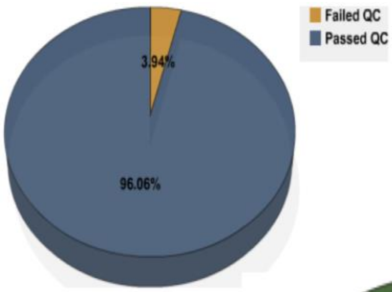


Figure 83: Distribution of SAMOS quality control flags for sea temperature – TS – for the *New Horizon* in 2014.

Robert Gordon Sproul



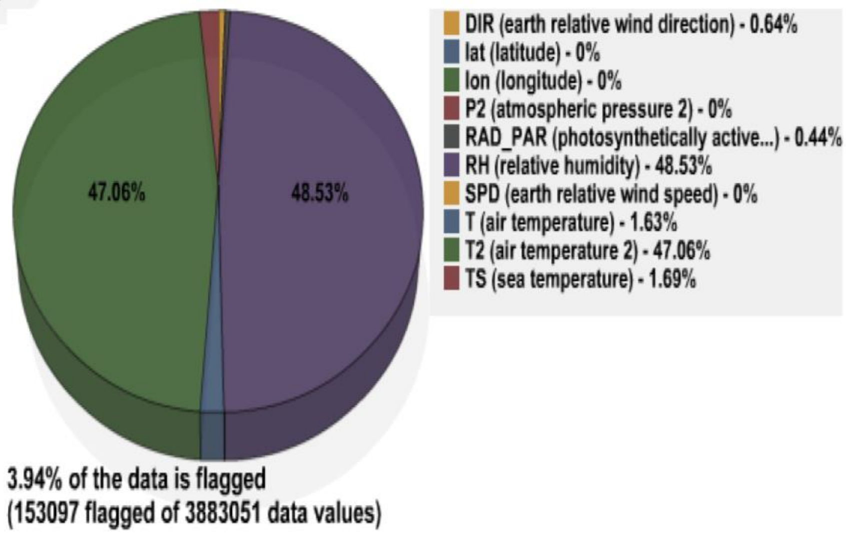


Figure 84: For the *Robert Gordon Sproul* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Robert Gordon Sproul* provided SAMOS data for 163 ship days, resulting in 3,883,051 distinct data values. After automated QC, 3.94% of the data were flagged using A-Y flags (Figure 84). This is essentially unchanged from 2013 (4.36% total flagged). 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 once again split virtually down the middle between the relative humidity (RH) and air temperature 2 (T2) parameters (Figure 84). 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 86). The bulk of these flags appeared to have been incurred between the period 1 January and 20 February, and upon a cursory inspection the two sensors were clearly still "out to lunch," just as they were in the latter portion of 2013 (Figure 85). SAMOS personnel had contacted *Sproul* technicians regarding these two sensors on multiple occasions. Reports were inconclusive, but it is suspected that there was a wiring issue. Regardless, it is good to see the issue seems to have been resolved.

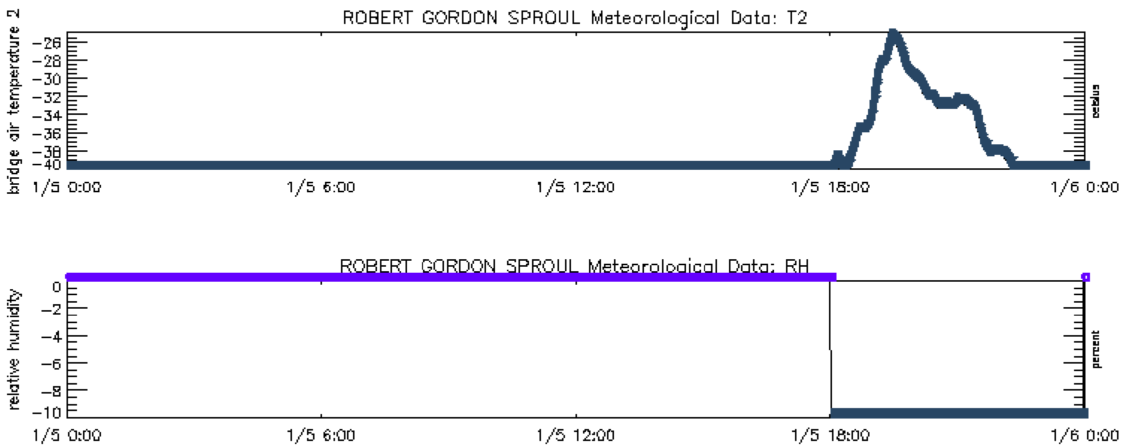


Figure 85: *Robert Gordon Sproul* SAMOS data for 5 January 2014: (top) bridge air temperature 2 – T2 – and (bottom) relative humidity – RH. Note the G flags (in purple) when either parameter is very close to 0 but still within realistic bounds (though obviously not realistic) and B flags (in grey) when either parameter was obviously outside of those bounds.

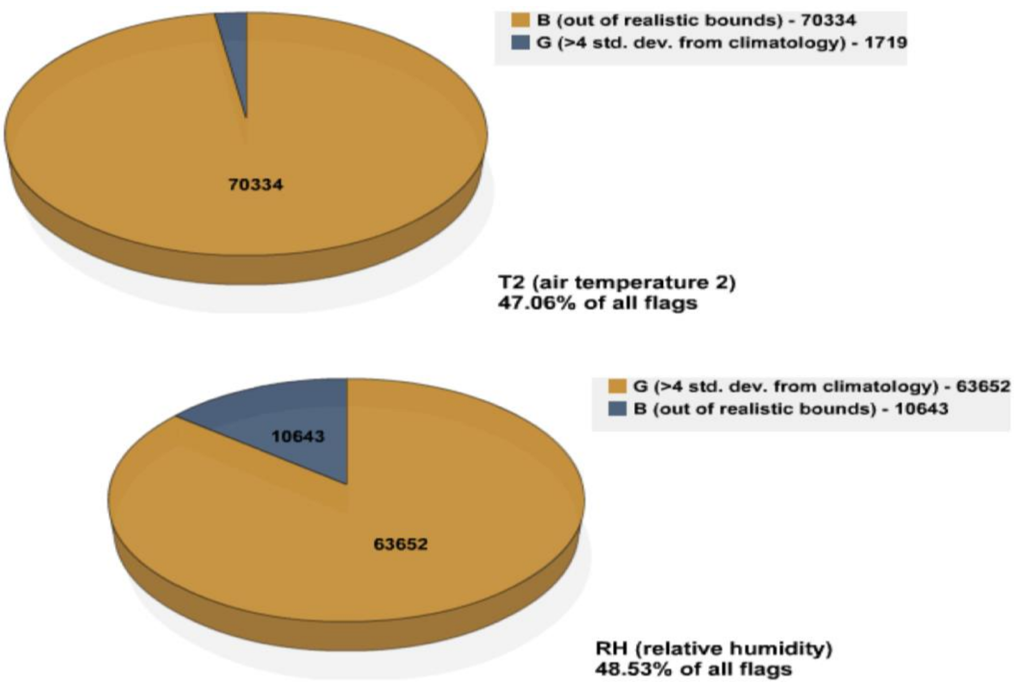


Figure 86: Distribution of SAMOS quality control flags for (top) air temperature 2 – T2 – and (bottom) relative humidity – RH – for the *Robert Gordon Sproul* in 2014.

Roger Revelle

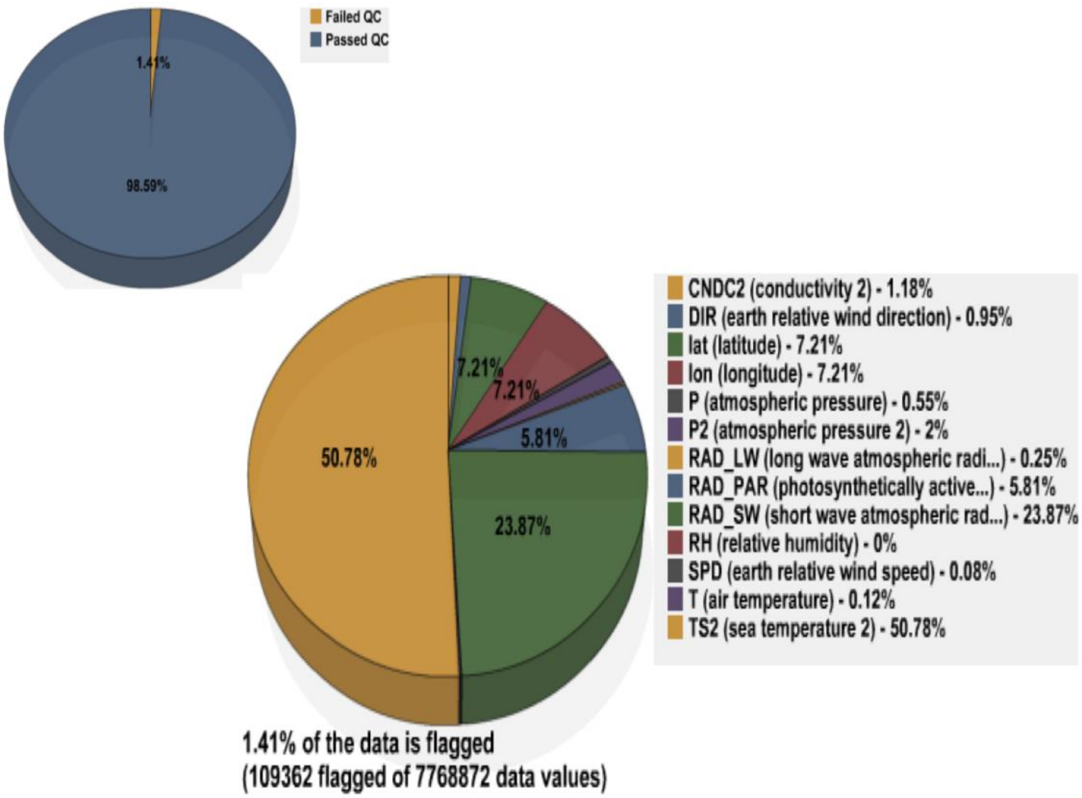


Figure 87: For the *Roger Revelle* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Roger Revelle* provided SAMOS data for 240 ship days, resulting in 7,768,872 distinct data values. After automated QC, 1.41% of the data were flagged using A-Y flags (Figure 87). This is about a 3% improvement over 2013 (4.21% total flagged). 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 by far (about 51%) 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 88). As was likewise stated for the *New Horizon*, these values may or may not have been realistic; we are not currently funded to investigate cases like this for the *Roger Revelle*. But as this TS2 flag analysis is identical to that in 2013, the likelihood exists that the sensor does in fact exhibit a bias for some reason. 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.

There were no other data items of note for the *Revelle*, except that she contributed two of the many batches of backlogged data that were received at the DAC in 2014. Data for the periods 31 March – 10 April and 14-19 April were all received in late August, for reasons unknown. This did not pose a problem for visual quality control, as the *Revelle* does not receive it. But it should be noted that if there were any problems in the backlogged data they would not have been discovered until it was already too late to notify the vessel technicians. Suspect data that might otherwise have been quickly identified and resolved might instead have been permitted to accumulate. For this reason it is important to ensure the timely arrival of SAMOS data.

On the other hand, when the science party aboard the *Revelle* during one summer cruise did not want data disseminated, the ship's technician was quick to email the DAC and alert them that no data would be forthcoming for that cruise. This type of notification activity is sincerely appreciated by the SAMOS group.

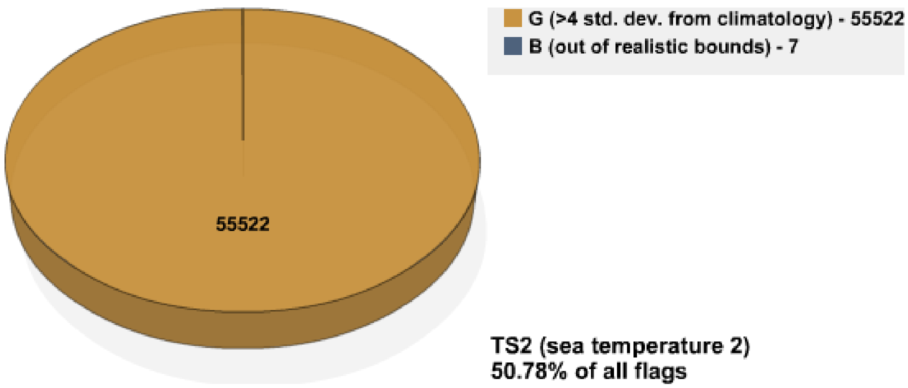


Figure 88: Distribution of SAMOS quality control flags for sea temperature 2 – TS2 – for the *Roger Revelle* in 2014.

Falkor

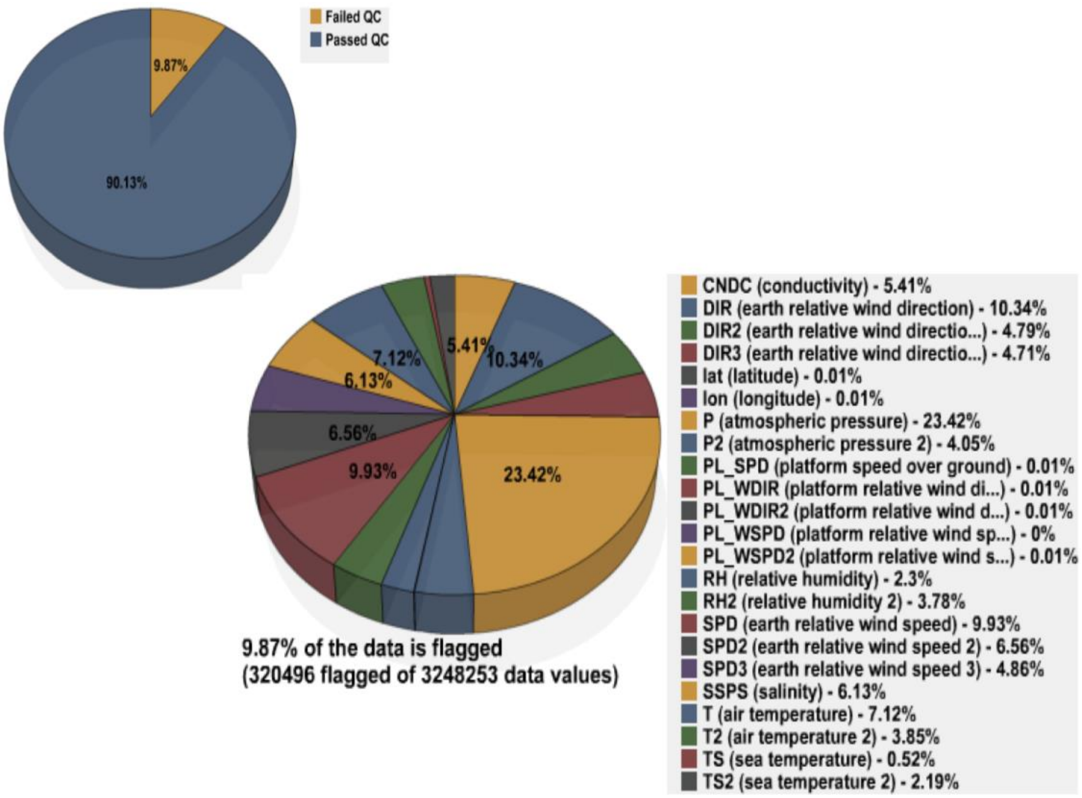


Figure 89: For the *Falkor* from 1/1/13 through 12/31/13, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Falkor* provided SAMOS data for 134 ship days, resulting in 3,248,253 distinct data values. After both automated and visual QC, 9.87% of the data were flagged using A-Y flags (Figure 89). This is more than a 3% increase over 2013 (6.08% total flagged).

Perhaps the most noteworthy *Falkor* issue in 2014 did not reference the data itself, but rather the act of transmitting that data. Several times over the course of the year sizable batches of data were received well after the 10-day delay window set for visual quality control. The first batch, covering data files from 11-19 May, was determined to be the result of a power failure onboard the vessel. While the power failure itself was promptly relayed to the DAC, initial efforts onboard the *Falkor* to get the SAMOS mailer restarted were unsuccessful. There was a fair amount of troubleshooting by the techs onboard and eventually the mailer was restarted, but any backlogged data did not find its way to the DAC until 10 June. The second batch, covering 16-26 November, was likely another mailer issue, with the technician most familiar with the mailer not onboard to deal with the problem. The final backlog batch, covering 16-22 December, did not arrive until about 12 January, 2015. It is not known why this batch came in late, but it was noted in an email from the *Falkor* dated 17 January 2015 that they had recently changed mail servers. There were also a few single dates that sporadically came in late (6 June, 29 October, 5 December).

As the *Falkor* SAMOS contract is always written for a set number of sea days, visual QC will always be performed on her data files, regardless of how late they come in. But it is important to note that the process of identifying any issues with the data, notifying the techs, and getting to a resolution progresses far more advantageously when files are received on time. Continuity of visual quality control application, too, can be of issue with backlogged data. It often takes time to reestablish familiarity with the data, particularly if there had been any ongoing data issues at the time the data stopped being received.

Regarding the data itself, the atmospheric pressure parameter (P) received roughly one quarter of the total flags, quite a bit higher than any of the remaining percentages (Figure 89). These are split between out of bounds (B), suspect/caution (K), and poor quality (J) flags (Figure 91). There are believed to be multiple factors in play, here: Firstly, it's known that the P sensor is considered "navigation grade" (as opposed to science) and it is not often calibrated, nor does it have a pressure port installed. For these reasons alone it is not surprising the data tend to behave in a suspect fashion. Secondly, though, from 31 October through the end of the year the P data hovered around 10 mb, sparking the majority of the B flags seen in Figure 91. It's unclear precisely what caused the low readings, but we note that *Falkor* personnel advised us on 27 October that they were trying to get the Vaisala met sensor carrying P reinstalled (it had been taken down sometime back in May in preparation for the removal of their helodeck) and documentation of the sensor was lacking, making cabling very challenging. Currently there is a plan onboard the *Falkor* to look into the issue, but so far technicians have not found the time to do so.

In late April the *Falkor* installed a new, scientific grade Gill met sensor, and redundant air temperature (T2), pressure (P2), relative humidity (RH2), and platform and earth relative winds (DIR, PL_WDIR, SPD, and PL_WSPD) were added to their SAMOS data. Comparison of the redundant sensors has revealed clear differences from the beginning: There is often up to about a 1 mb difference between the two pressure readings, the pressures also often behave in opposition to each other (one goes up while the other goes down), the two relative humidities usually differ by several percent, and the winds often differ by up to 10 degrees or so in direction and 2 or 3 ms^{-1} in speed. Considering one instrument (the Vaisala) is "nav grade" and the other (the Gill) is "science grade" it's not surprising the two often differ, though this doesn't always imply the Gill is the "correct" reading. Each instrument experiences some amount of flow distortion, as well, (as do most met sensors aboard vessels), and given that the two instruments are not located in the same part of the ship the character and quantity of that flow distortion is different for each. All of these factors can and do translate to some K flagging in all of the met variables (not shown). It's clear from the flag percentages, though, that the Vaisala ("nav grade") data (DIR, SPD, P, T, and RH) are the less reliable of the pack (Figure 89).

In late October the *Falkor* technicians suspected the humidity data from the Gill and thus removed the instrument until the filter for the humidity sensor could be replaced. (It was around this time that the Vaisala reinstall was attempted and the erroneous P readings began.) After the Gill was reinstalled in mid-December its temperature (T2) and relative humidity (RH2) data quickly went bad. T2, while still more or less in a reasonable range of values, became exceedingly noisy (Figure 90) and was summarily J-flagged (not shown). RH2, in stark contrast to the more reasonable RH data, steadily made its way up to 100% and just stayed put. These were also summarily J-flagged (not shown). Unfortunately this was one of the backlogged batches of data, not arriving at the DAC until mid-January 2015, so we were unable to highlight the issues at the time of the occurrence or isolate the cause(s). We note however that to date the RH2 problem persists, and technicians are aware of it and are planning investigative procedures when time permits.

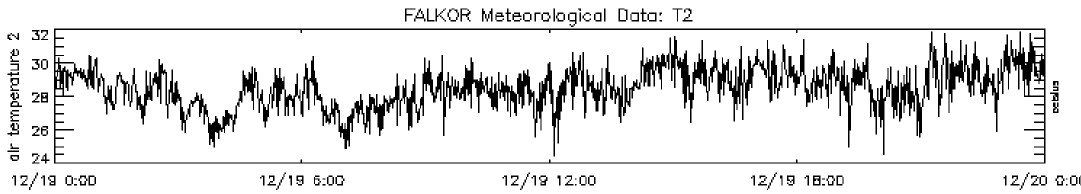


Figure 90: *Falkor* air temperature 2 – T2 – SAMOS data for 19 December 2014. Note noisiness of the data.

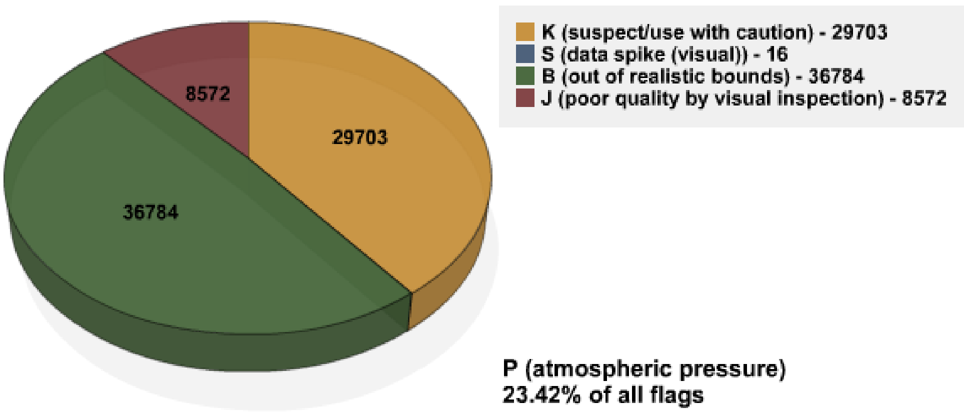


Figure 91: Distribution of SAMOS quality control flags for atmospheric pressure – P – for the *Falkor* in 2014.

Kilo Moana

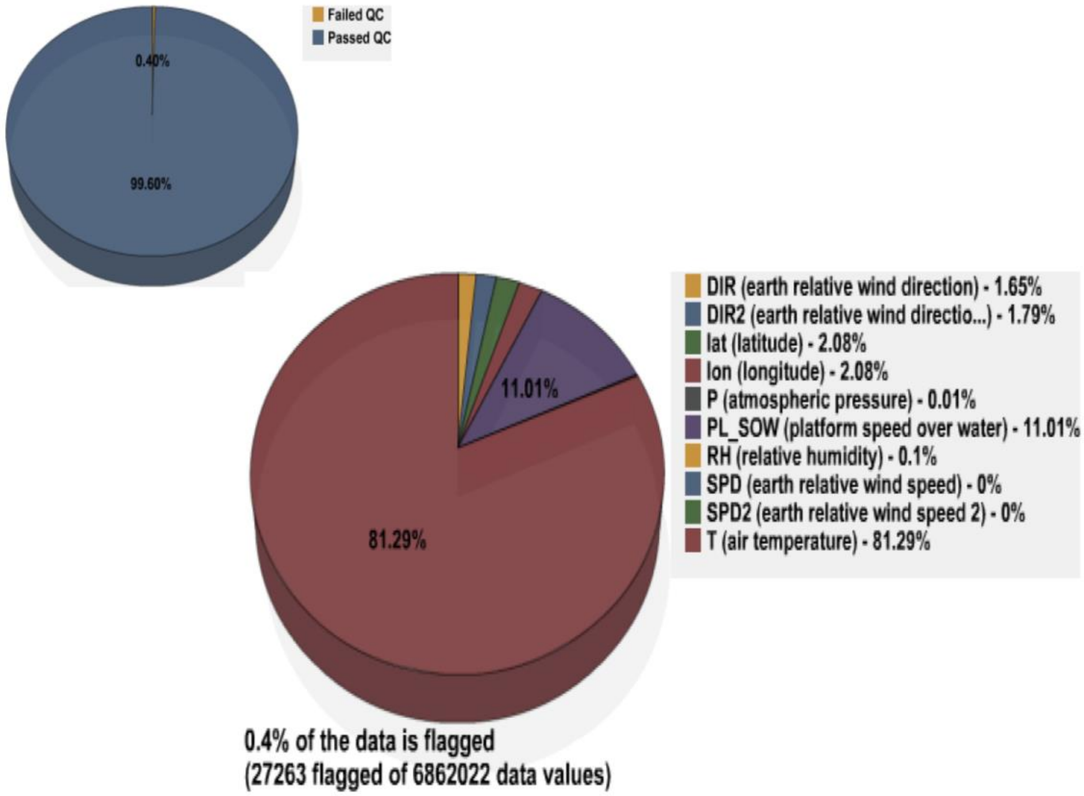


Figure 92: For the *Kilo Moana* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Kilo Moana* provided SAMOS data for 246 ship days, resulting in 6,862,022 distinct data values. After automated QC, 0.4% of the data were flagged using A-Y flags (Figure 92). This is both an extremely low flag percentage and essentially unchanged from previous years. 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.

Not surprisingly, the variable flagged percentage breakdown did capture the one parameter issue we have on record for the *Kilo Moana* in 2014 – namely, air temperature (T), which received ~81% of the total (minimal) flags. On 27 August the T sensor onboard the *Kilo* was replaced and about a week later the lead SAMOS data analyst notified *Kilo* techs that the sensor appeared to have been malfunctioning. Technician response was appreciative of the notification, as they had been unaware there was any issue. They promised to investigate as time allowed, and on 15 September alerted us they'd determined there was either an issue with the instrument's wiring into their data logger or an issue with the data logger itself. As of 21 September the wiring issue (as it turned out to be) was resolved. During the period 21-27 September, however, the T data were assigned out of bounds (B) flags by the auto flagger (Figure 93).

There was also a persistent data logging problem onboard the *Kilo* that unfortunately resulted in several backlogs: Data for the periods 12-13 September, 3-12 October, and 22-29 October all arrived late and in bulk. This is not really a problem for processing purposes, and the *Kilo* does not receive visual quality control so there's no issue there. Nevertheless we stress the importance of timely data transmission, as it enables the data analysts to promptly identify any data issues and make attempts to get those issues resolved as quickly as possible.

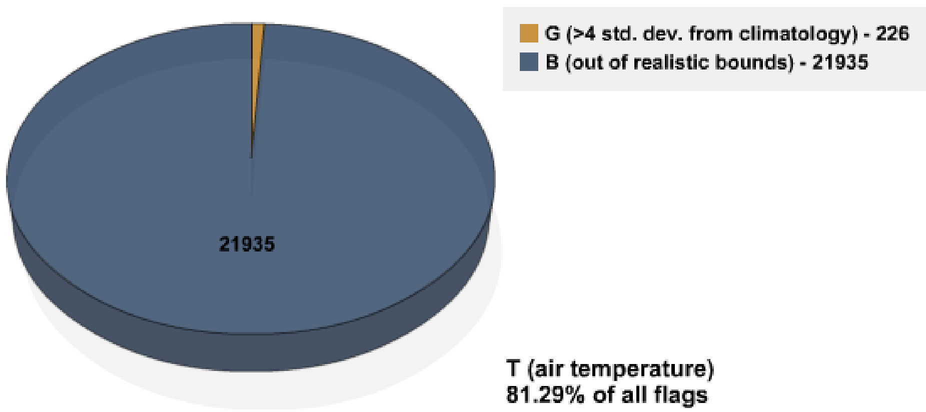


Figure 93: Distribution of SAMOS quality control flags for air temperature – T – for the *Kilo Moana* in 2014.

Thomas G Thompson

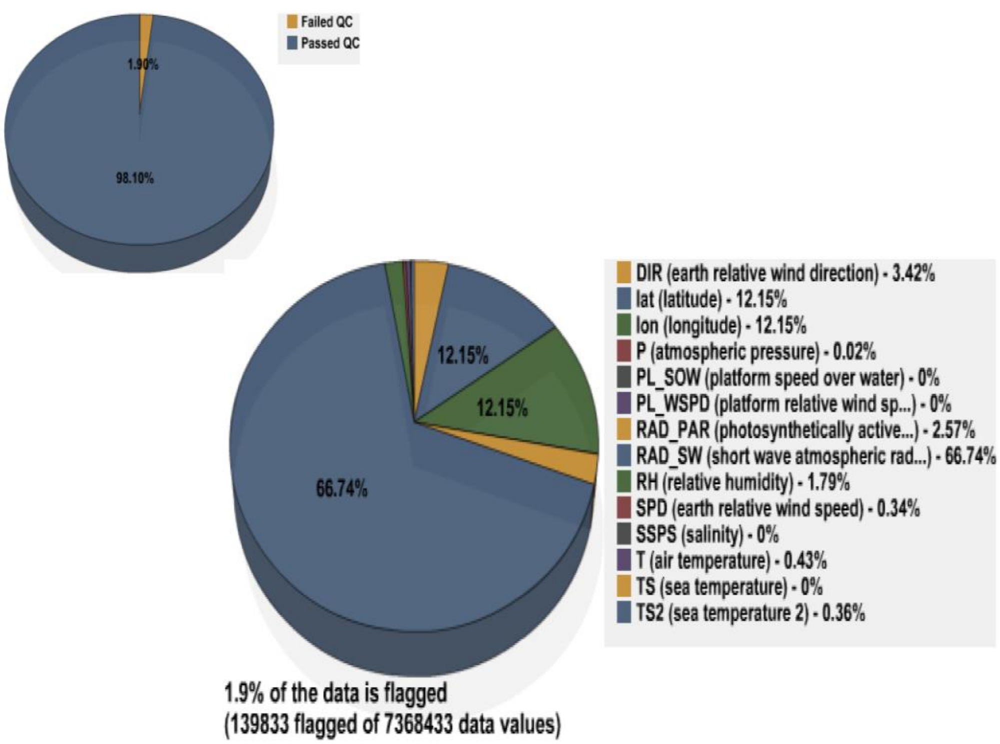


Figure 94: For the *Thomas G Thompson* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *T.G. Thompson* provided SAMOS data for 277 ship days, resulting in 7,268,433 distinct data values. After automated QC, 1.9% of the data were flagged using A-Y flags (Figure 94). This is about a 1% improvement over 2013 (3.03% total flagged). NOTE: the *T.G. Thompson* does not receive visual quality control by the SAMOS DAC where the majority of flags are applied, 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 again applied to short wave atmospheric radiation (Figure 94), as they were in 2013. These were entirely out of bounds (B) flags (Figure 95). Upon inspection, most of these were applied to the slightly negative values that commonly read out at night owing to sensor tuning (see 3b for details). A small portion, though, were likely due to bad data and – notably – were entirely anticipated, as *Thompson* personnel advised the DAC via email on 9 January that they were having issues with the sensor. They stated that they were thus removing the sensor, and several months later it was finally replaced without issue.

There were two other sensor issues that were promptly and thoroughly communicated to the SAMOS group that were not picked up by the auto flagger, so we will include them here for posterity: First, around 29 May the *Thompson* tech group notified us that most of their wind parameters (earth relative wind direction, or DIR, earth relative wind speed, or SPD, and platform relative wind speed, or PL_WSPD) were unreliable, though they may look reasonable, owing to a problem with the PL_WSPD reading. We were advised that it was not known when the issue started, and that time currently would not permit for troubleshooting. Second, the tech group notified us on 28 June that their sound velocity (SSV) sensor was showing very low (unrealistic) values. It was conjectured that the problem had been going on for a little while, but again an exact start date is not known. While SSV data are not processed to the SAMOS netCDF files (preliminary-level files, in the *Thompson's* case), they would still be available in the vessel's original files, which are included in the NODC's SAMOS archive packages.

It is well worth mentioning that the support group onboard the *Thompson* excels at keeping SAMOS personnel informed of their status – both regarding data issues and when data should or should not be expected. In fact, they are on record in 2014 as being one of the only active users of our subscription reporting service. On 6 November, in response to their SAMOS report subscription that alerted them they'd not submitted data in 3 days, someone from the tech group emailed us to let us know their next cruise wasn't until December and we should not expect any data from them until that time. Efforts like this are highly appreciated within the SAMOS group, it helps us to keep on top of data flow. We recommend other operators take advantage of the subscription and web services to monitor their data submission and quality. A special point of note here, the web service is a new feature and can be found at http://samos.coaps.fsu.edu/html/webservices.php

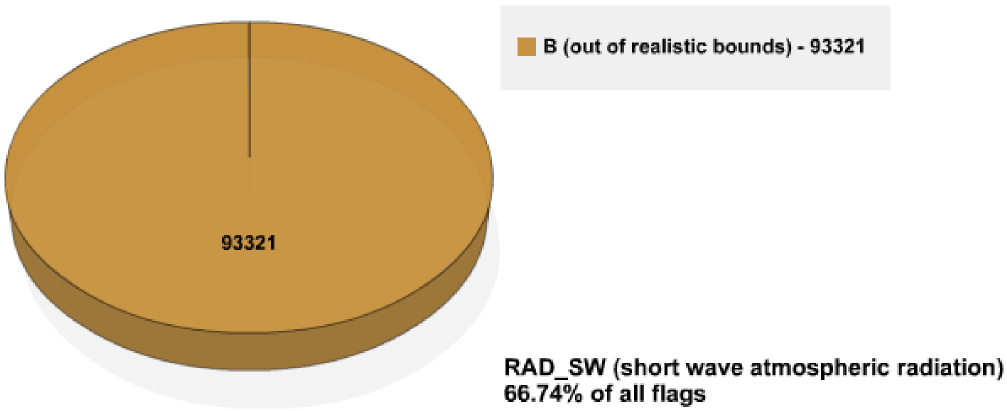


Figure 95: Distribution of SAMOS quality control flags for short wave active atmospheric radiation – RAD_SW – for the *Thomas G. Thompson* in 2014.

R/V Atlantis

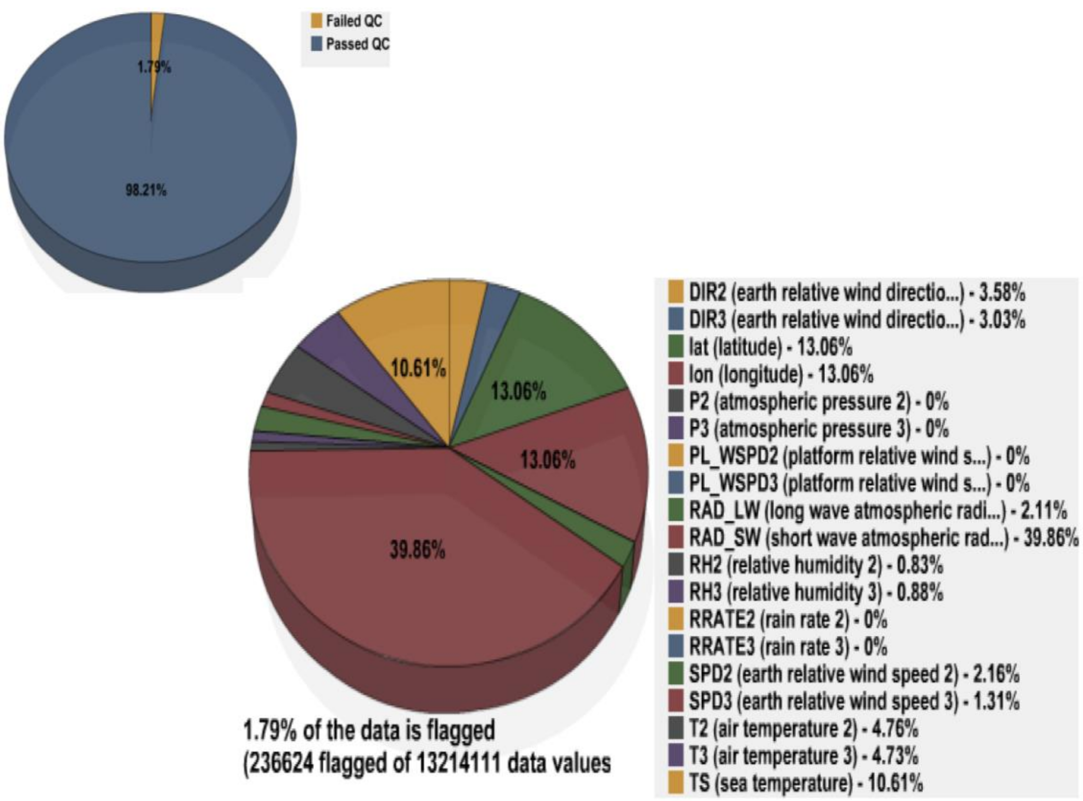


Figure 96: For the *R/V Atlantis* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Atlantis* provided SAMOS data for 328 ship days, resulting in 13,214,111 distinct data values. After automated QC, 1.79% of the data were flagged using A-Y flags (Figure 96). This is just a small decrease from 2013 (2.12% total flagged). NOTE: the *R/V Atlantis* 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 *R/V Atlantis* in 2014).

The only issue of note for *Atlantis* involved the radiometer (both short wave, or RAD_SW, and long wave, or RAD_LW). During a quick visual inspection, which typically occurs when SAMOS data files first arrive at the DAC, the lead data analyst noticed on 10 February that nighttime RAD_SW readings were falling well below 0. A few -Wm^{-2} at night is not unexpected, owing to sensor tuning, even though the negative values are technically physically impossible (see 3b for details) but in this case minimum values were much closer to -100 Wm^{-2}. The analyst promptly notified the *Atlantis* group, additionally wondering if their position upriver in New Orleans and near the city could have anything to do with the event. After they'd had a chance to investigate, *Atlantis* reported back that they'd determined neither RAD_SW nor RAD_LW was functioning properly and further advised that they likely wouldn't be able to address the issue until late March. And indeed, on 30 March, we were given notice that they'd finally been able to get new sensors onboard one day prior. The auto flagger did not single out the RAD_LW data during this event, but the negative RAD_SW values were tagged with out of bounds (B) flags (Figure 97). The problem seemingly resurfaced sometime in October, at least in the RAD_SW data, and B flags were again assigned to any negative values. (Interestingly, the vessel was once again in port.) *Atlantis* was notified of the data issue but it's not known what actions, if any, were taken by the group. A cursory glance at year-end data does suggest the issue has resolved, though. These two separate radiometer events likely contributed heavily to the ~40% flag percentage held by the RAD_SW parameter (Figure 90).

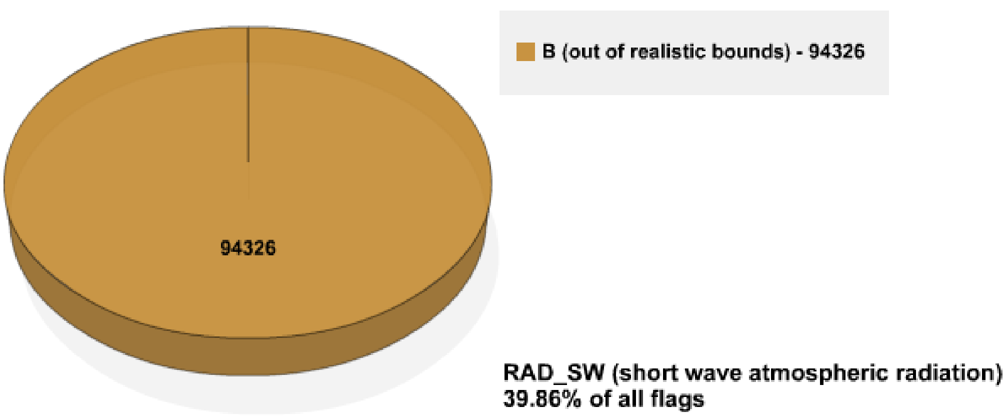


Figure 97: Distribution of SAMOS quality control flags for short wave atmospheric radiation – RAD_SW – for the *R/V Atlantis* in 2014.

R/V Knorr

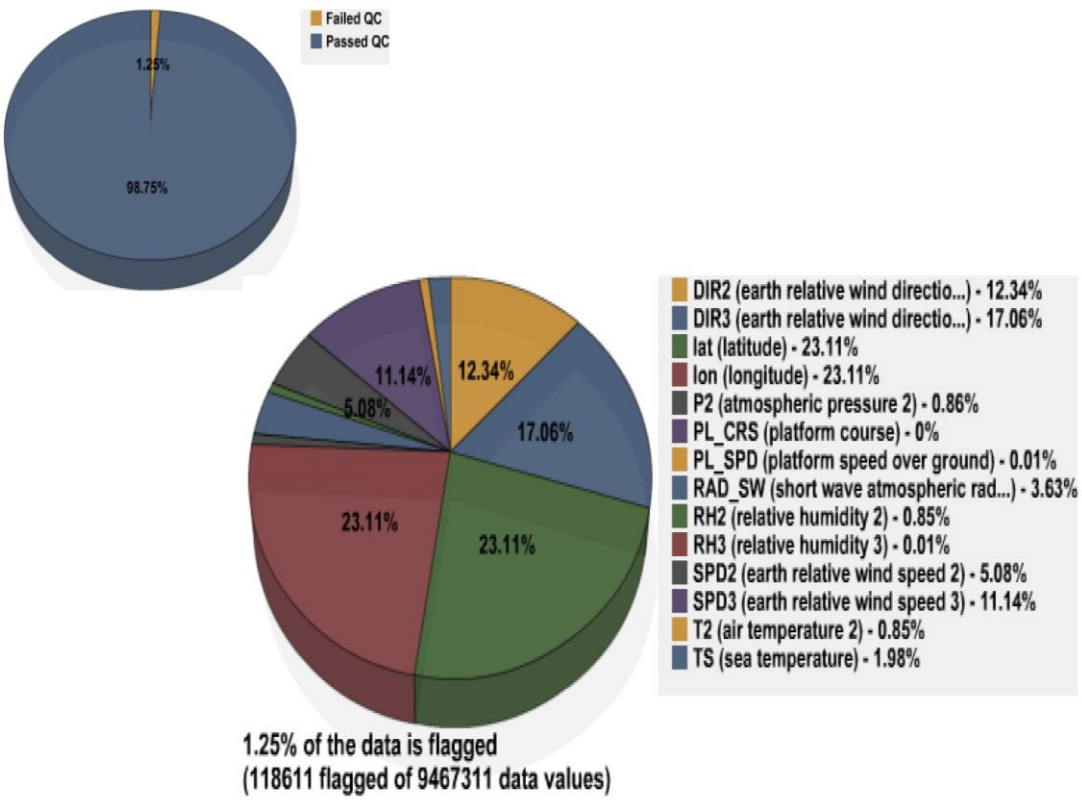


Figure 98: For the *R/V Knorr* from 1/1/14 through 12/31/14, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Knorr* provided SAMOS data for 236 ship days, resulting in 9,467,311 distinct data values. After automated QC, 1.25% of the data were flagged using A-Y flags (Figure 98). This is only a very small increase over 2013 (0.9% total flagged) NOTE: the *R/V Knorr* 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 *R/V Knorr* in 2014).

The first item on record for the *Knorr* involves an apparent failure of the starboard Vaisala WXT, which houses all of earth relative wind direction and speed 2 (DIR2, SPD2), atmospheric pressure 2 (P2), air temperature 2 (T2), and relative humidity 2 (RH2) on 7 July. The lead SAMOS data analyst, who handles the quick visual inspection of incoming SAMOS files, noticed that all of the above parameters began outputting unrealistic values. He immediately notified the *Knorr* group. Their response quickly came back, stating that they were aware of the problem and were attempting to troubleshoot. A day later they reported that while the problem had not specifically been identified, they had at least been able to get it to go away. The end result here, though, was that during the period of roughly 7-9 July some portion of all the above listed variables received various distributions of flags from the auto processor (Figure 99). The flags may vary, but certainly all data within that period should be considered suspect by the end user.

A second noteworthy event that is not reflected in the flag percentages began around 00:30 GMT 21 September. At that time (as related by *Knorr* personnel) the pump for the *Knorr's* flow through system was secured due to a leak. The result was that the thermosalinograph data became invalid, though they were not highlighted as such by the auto flagger. It is not known for how long this issue persisted.

Ironically, just as in 2013 the two standouts of the *Knorr's* very small flag total flag percentage – latitude and longitude, together holding about 46% of the flags (Figure 98) – actually likely would have had their flags *removed* by application of visual qc. They are almost exclusively land error (L) flags (not shown) and were likely a result of the practice of transmitting port data. The SAMOS geographic land/water mask in use for determining land positions in 2014 was a two-minute grid and it was not uncommon for positions very close to land to be erroneously L flagged by the autoflagger. We note that testing of a new one-minute land-sea grid is underway in 2015.

Finally, we note that the *Knorr* has been officially retired, and officially separated from the SAMOS system as of 1 January 2015. We would like to take this opportunity to thank the *Knorr* and in particular her dedicated tech group and the whole WHOI crew for their participation and service these past nine years.

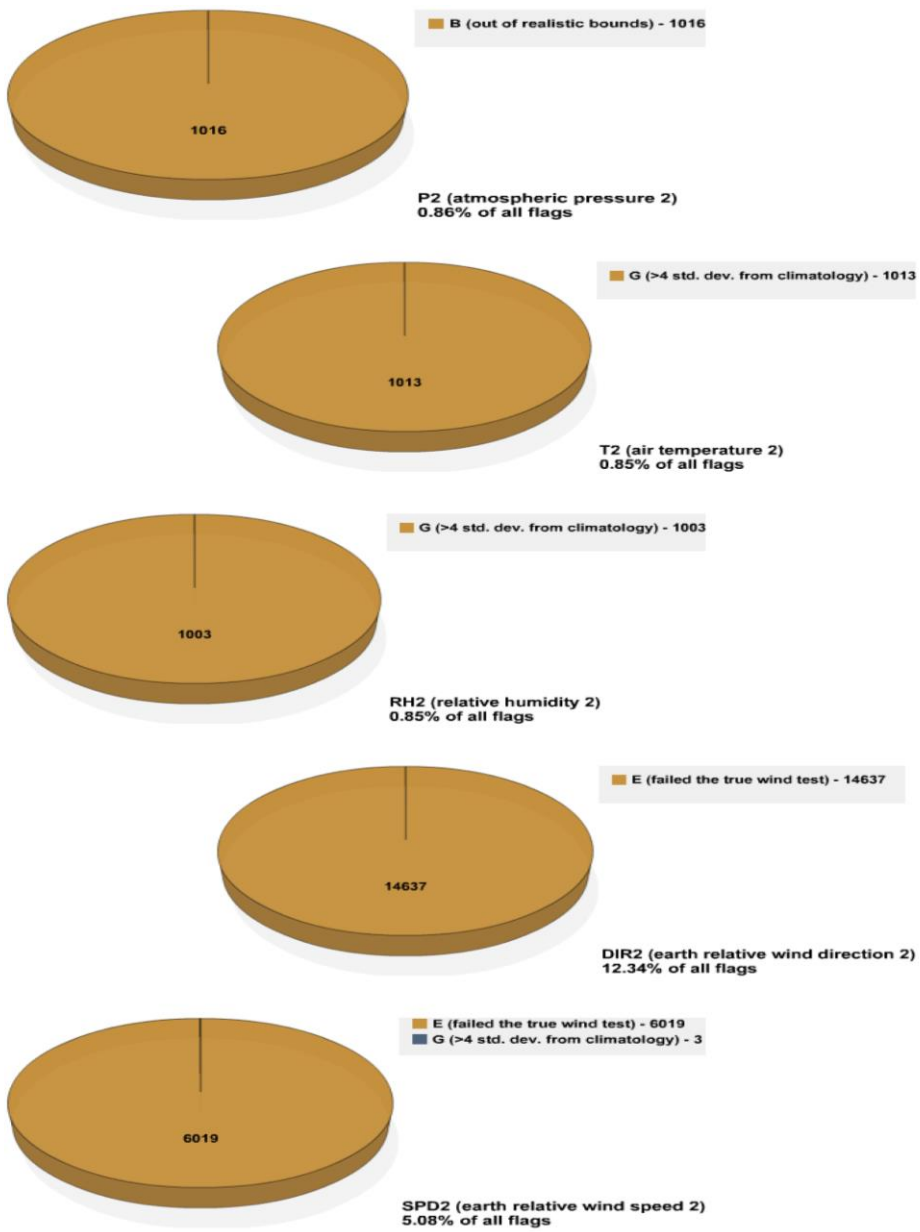


Figure 99: Distribution of SAMOS quality control flags for (first) atmospheric pressure 2 – P2 – (second) air temperature 2 – T2 – (third) relative humidity 2 – RH2 – (fourth) earth relative wind direction 2 – DIR2 – and (last) earth relative wind speed 2 – SPD2 – for the *R/V Knorr* in 2014.

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 B, 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. Vessel metadata should also include vessel imagery (highly desirable, see Figure 100 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 101. (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 101 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 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 C.

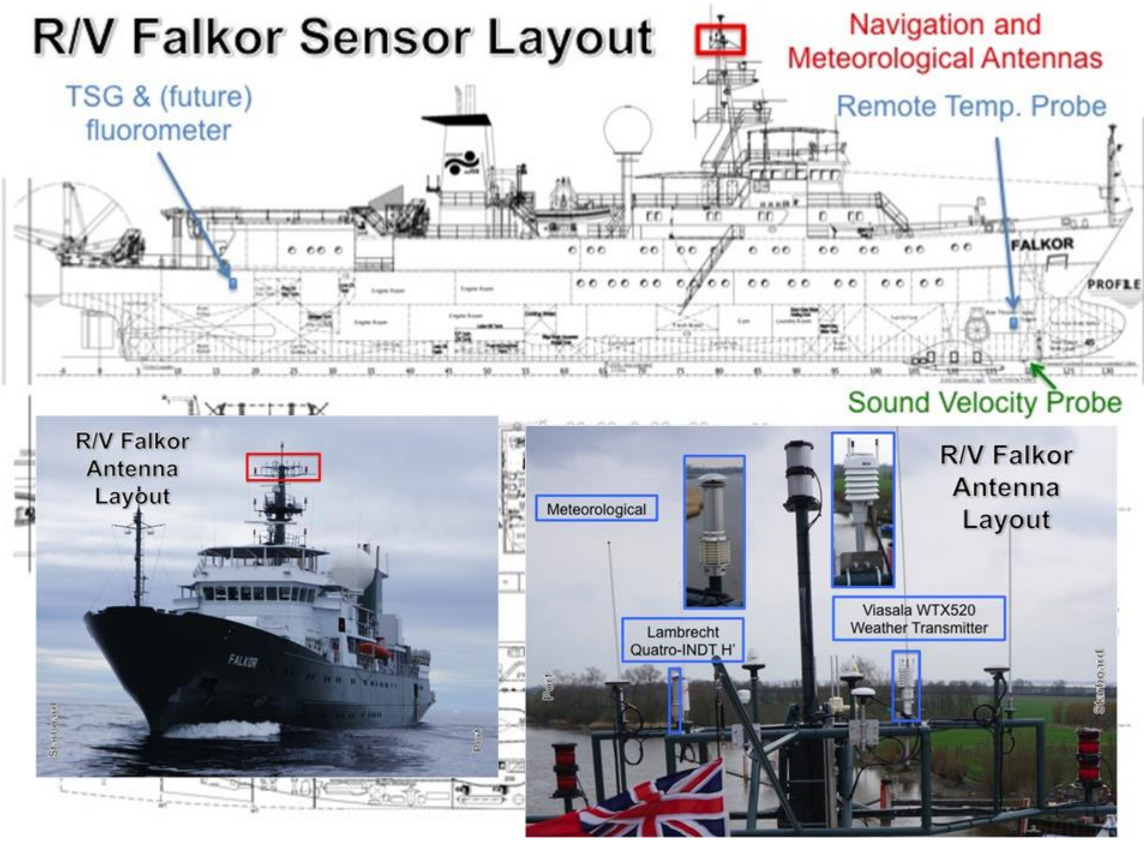


Figure 100: Examples of detailed vessel instrument imagery from the *R/V Falkor*.

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 101: 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 4 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	C	No	I	I	I	I	I	I	I	I	I	I	I		I,I	I	I		I	I		I	I,I,I	I,I	I,I
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	I			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	I,I	C,I,I	I	I			I	I	I
KTDQ	C	C	C	No	I	I	I	I	I,C	C	C	C	C	C			C	C			C	C		I	C,C	C	C
NEPP	C	C	C	Yes	I	I	I,I	I	I,I,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	I,I	I,I	I,I	I,I	I,I	I,I	I			I	I							I,I		I
VNAA	C	C	C	No	I	I	I,I	I	I	I,I	I,I	I,I	I,I	I,I			I	I,I	I,I	I	I,I	I,I		I,I	I		
WBP3210	C	I	C	Yes	I	I	I	I	I	I,I	I,I	I,I	I,I	I			I	I			I	I		I	I	I	I
WCX7445	C	C	C	Yes	I	I	I	I	I	I,I	I,I	I,I	I,I	C			I	I					I,I	I	I,I	I	I
WDA7827	C	C	C	No	I	I	I,I	I	I,I	I,I	I,I	I,I	I,I	I			I	I	I,I	I	I				I		I
WDC9417	C	C	C	Yes	I	I	I,I	I	I	I,I	I,I	I,I	I,I	I			I	I							I,I	I	I
WECB	C	C	C	No	I	I	I	I	I	I	I	I	I	I,I			I,I	I	I		I	I		I	I	I	I
WKWB	I	C	C	No	I	I	I	I	I	I,I	I,I	C,I	C,I	C,C			C,C	C	C		C	C		C	I,I	I	I
WSQ2674	I	I	I	No	I	I	I	I	I	I	I	I	I	I,I			I,I	I	I					I	I		
WTDF	C	C	C	No	I	I	I	I	I,I,I	I	I	I	I	I			I	I			I	I			I	I	I
WTDH	C	I	C	Yes	I	I	I	I	I	I	I	I	I	I			C	I							I,I	I	I
WTDL	I	I	C	Yes	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTDO	I	I	C	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	C	No	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEC	C	I	C	No	I	I	I	I	I	I	I	I	I	I			I	I				I			I	I	I
WTED	C	C	C	Yes	I	I	I	I	I	I,I	I,I	I,I	I,I	I,I			I	I,I			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	C	No	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEK	I	I	C	No	I	I	I	I	I	I	I			I			I	I									
WTEO	C	I	C	Yes	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTEP	C	I	C	Yes	I	I	I	I	I	I	I	I	I	I			I	I							I	I	I
WTER	C	I	I	Yes	I	I	I	I	I	I	I	I	I	I			I	I							I,I	I	I
WTEY	C	I	C	Yes	I	I	I	I	I	I	I	I	I	I			I,I	I							I	I	I
ZCYL5	C	C	C	Yes	I	I	I	I	I,I,I	C,C	C,C	C,C,C	C,C,C	C,C			C,C	C,C							C,C	C	C
ZMFR	I	I	C	No	I	I	I	I	I			C	C	C			I	C	I		I,I	I,I			I		

Table 4: 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 2015

As the SAMOS initiative begins 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 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 2014, the university-operated vessels contributing to the SAMOS DAC were those operated by 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 the SAMOS1.0 real-time protocol to transfer a subset of meteorological and surface-oceanographic data from ship to shore. In 2015 we plan to recruit three additional university-operated vessels into SAMOS while we bid a fond farewell to the *Knorr* and *Melville*, both of which were retired from the initiative at the end of 2014.

In 2015 we hope once again to expand and improve our automated quality control procedures. We are testing a new routine to use a one-minute grid land-ocean mask to verify a vessel's position as over water. This should reduce the number of "land" flags on the data, particularly for vessels that do not undergo the visual QC (whereby erroneously applied land flags can be removed). Additional priorities include creating a constant value check and developing support to allow total flagging of individual variables when they are deemed by the operator to be erroneous. Recent small increases in funding for SAMOS will allow some new automated procedures to finally be implemented. Although improved automation is helpful, 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".

Also planned for 2015 is the inclusion of an hourly subset of all available SAMOS data (2005-2014) in the upcoming release 3.0 of the International Comprehensive Ocean-Atmosphere DataSet (ICOADS; Woodruff et al. 2011). ICOADS offers surface marine data dating back to the 17th Century, with simple gridded monthly summary products for 2° latitude x 2° longitude boxes back to 1800 (and 1°x1° boxes since 1960)—these data and products are freely distributed worldwide. Inclusion of your data in ICOADS will expand the reach of the SAMOS observations to the wider marine climate and research communities.

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.]

Woodruff, S.D., S.J. Worley, S.J. Lubker, Z. Ji, J.E. Freeman, D.I. Berry, P. Brohan, E.C. Kent, R.W. Reynolds, S.R. Smith, and C. Wilkinson, 2011: ICOADS Release 2.5: Extensions and enhancements to the surface marine meteorological archive. *Int. J. Climatol.* (CLIMAR-III Special Issue), **31**, 951-967 (doi:10.1002/joc.2103).

Ship schedule references, publicly available only:

UNOLS vessels are found online at http://strs.unols.org/public/search/diu_all_schedules.aspx?ship_id=0&year=2010 (*Atlantic Explorer*, *Atlantis, Kilo Moana, Knorr, Laurence M. Gould, Melville, Nathaniel B. Palmer*, *New Horizon*, *Robert Gordon Sproul*, *Roger Revelle*, *Thomas G. Thompson*)

R2R vessels are found online at http://www.rvdata.us/catalog (All of the above, and *Falkor, Healy*)

Aurora Australis is found online at https://its-app3.aad.gov.au/public/schedules/index.cfm

Annex A: Data Subsets with Verified Issues, Unflagged (listed by vessel)

All of the following data subsets should be considered either suspect or unreliable, as noted, by the user. The vessels listed here do not receive visual quality control. As such, this compilation relies only on notifications sent to the DAC by vessel operators or email exchanges initiated by the DAC; in many cases the exact cause and/or the exact date range under impact are unknown.

Atlantic Explorer:

- On or around 27 October – 6 November or later: T data unreliable (sensor malfunction)
- 4 April – 31 October or earlier: P data suspect (inconsistent data resolution)

Atlantis:

- 10 February – 30 March: RAD_LW data unreliable

Knorr:

- 7 – 9 July: T2, RH2, DIR2, SPD2 data suspect
- 21 September – duration unknown: CNDC, SSPS data unreliable (TSG flow-through system secured due to a leak)

Laurence M. Gould:

- 17 February – 8 April: PL_CRS, PL_SPD data unreliable, DIR, DIR2, SPD, SPD2 data suspect (platform course and platform speed data constant-valued)
- 21 May: T data unreliable

Melville:

- 22 September – 7 October or later: RAD_SW data unreliable

New Horizon:

- 28 May – 10 June: DIR2, PL_WDIR2 data unreliable, SPD2 data suspect (rotated sensor)

Robert Gordon Sproul:

- 1 January – 20 February: T, RH data unreliable

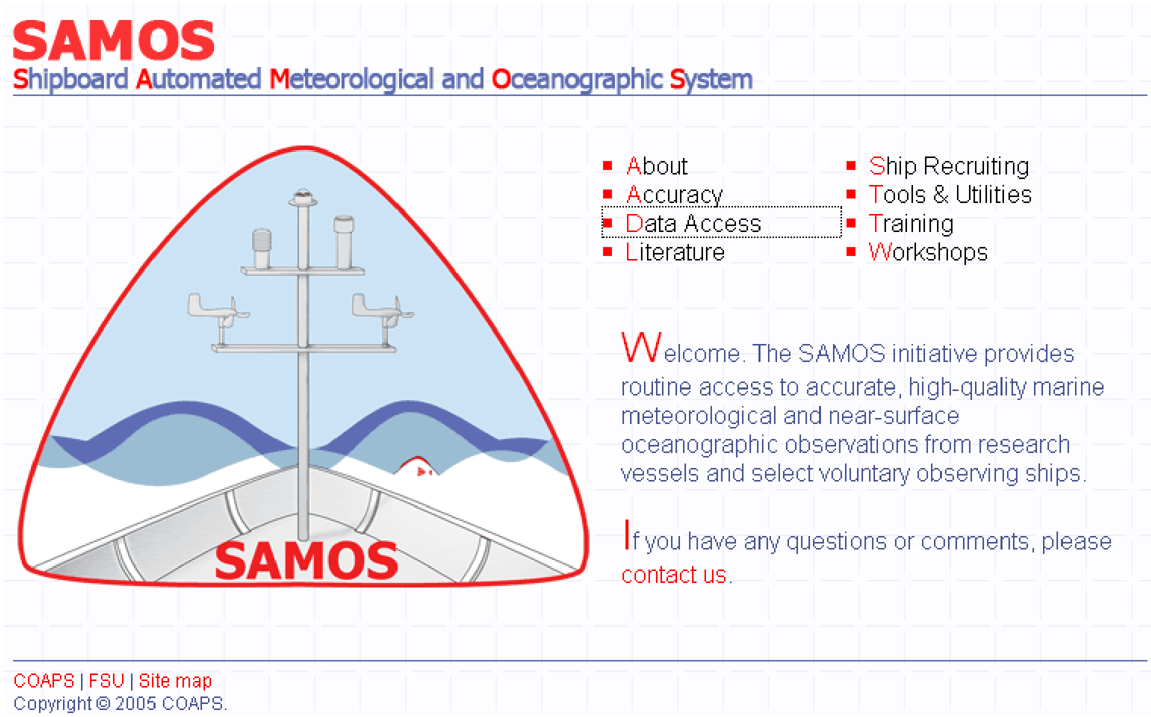
Thomas G. Thompson:

- Documented 29 May (date of origin unknown but possibly late April/early May, duration unknown but possibly addressed soon after 29 May): DIR, SPD, PL_WSPD data unreliable

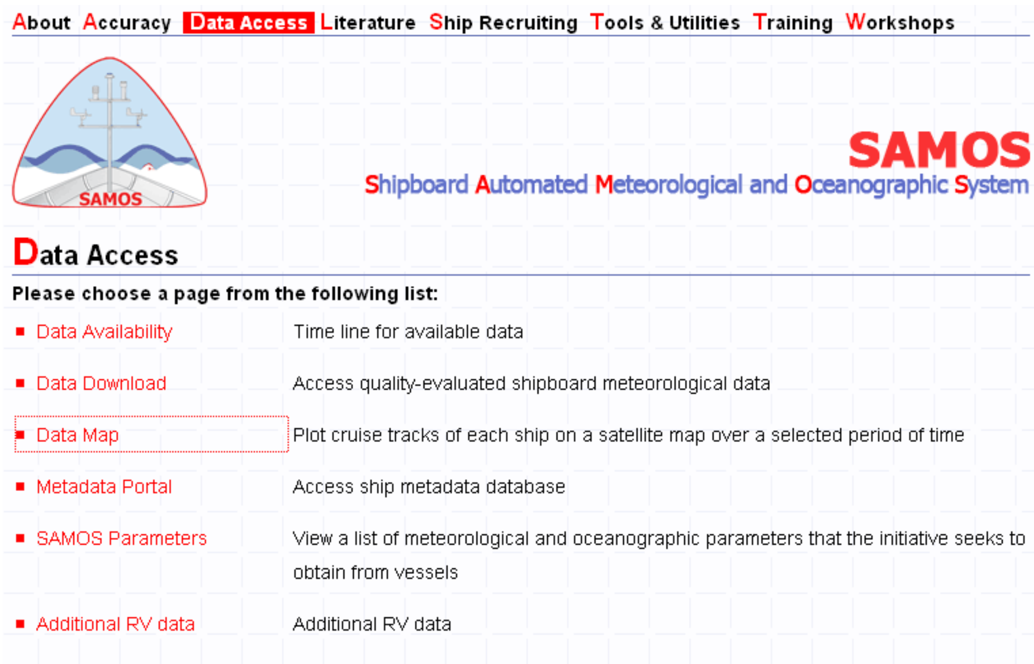
Annex B: SAMOS Online Metadata System Walk-through Tutorial

PART 1: the end user

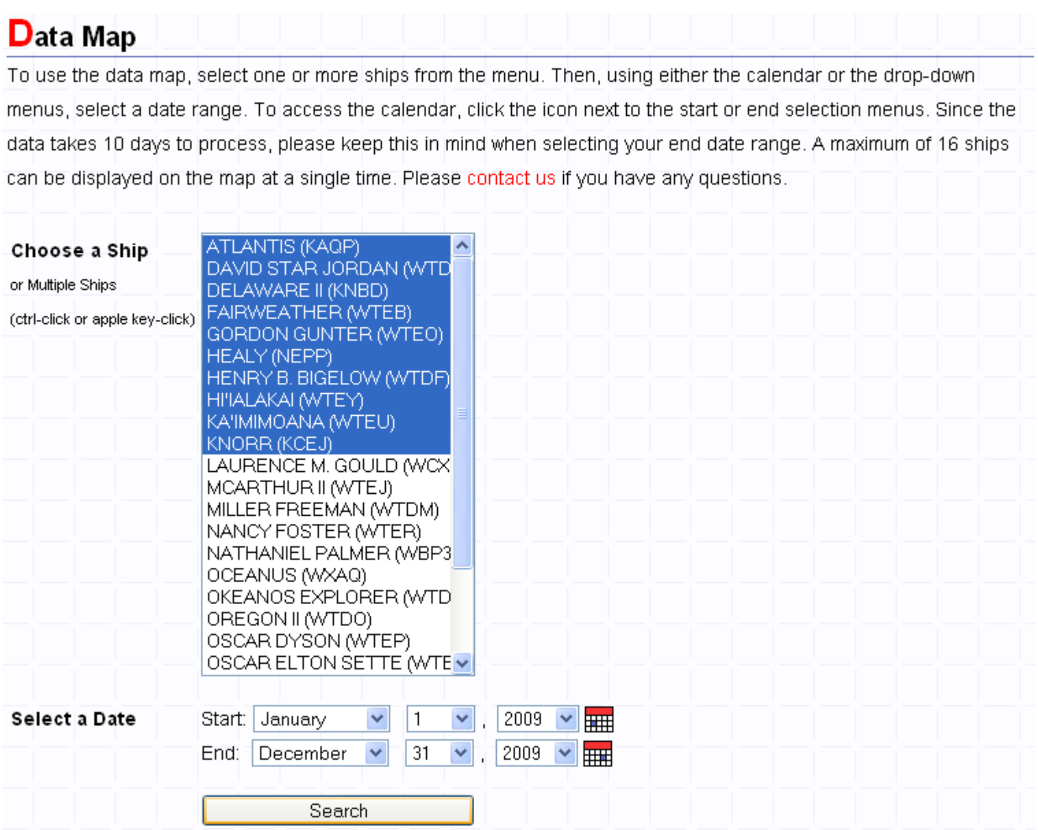
The SAMOS public website can be entered via the main page at http://samos.coaps.fsu.edu/html/



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):

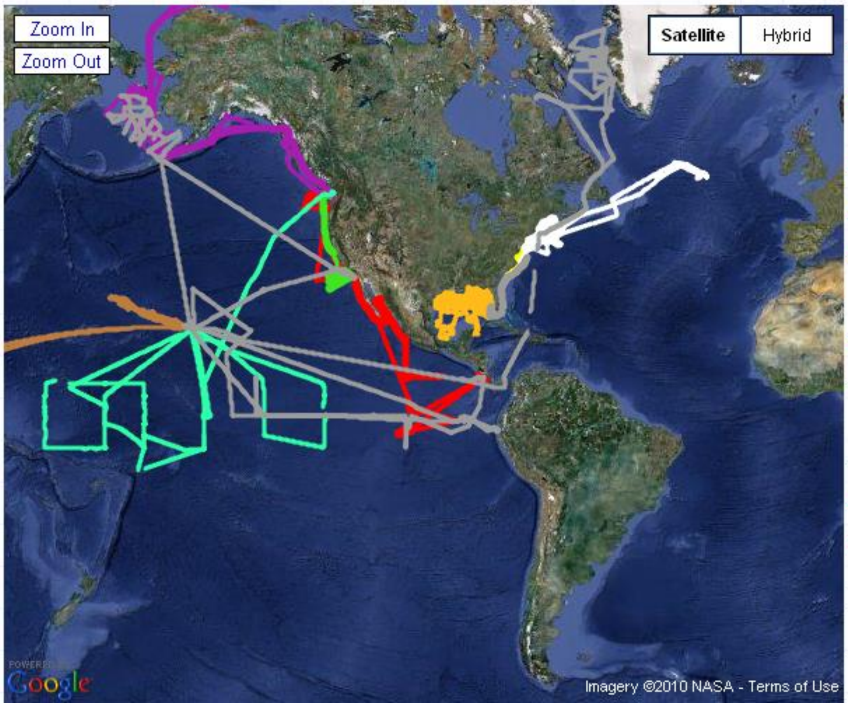


By entering a date range of January 1, 2009 to December 31, 2009 and clicking "search," a map is displayed showing all of the selected ship's tracks for the year 2009:

Data Map

The purpose of this page is for the user to select ships and date ranges. Then, using Google maps, a track of the ship(s) will be displayed for the selected dates. To view the tracks of other ships or dates, click here. To learn more about the map and ship tracks, please read the documentation.

January 1, 2009 - December 31, 2009



Ship Key	
Atlantis	☑
David Star Jordan	☑
Delaware Ii	☑
Fairweather	☑
Gordon Gunter	☑
Healy	☑
Henry B. Bigelow	☑
Hi'ialakai	☑
Ka'imimoana	☑
Knorr	☑

Map Controls	
On / Off	☑

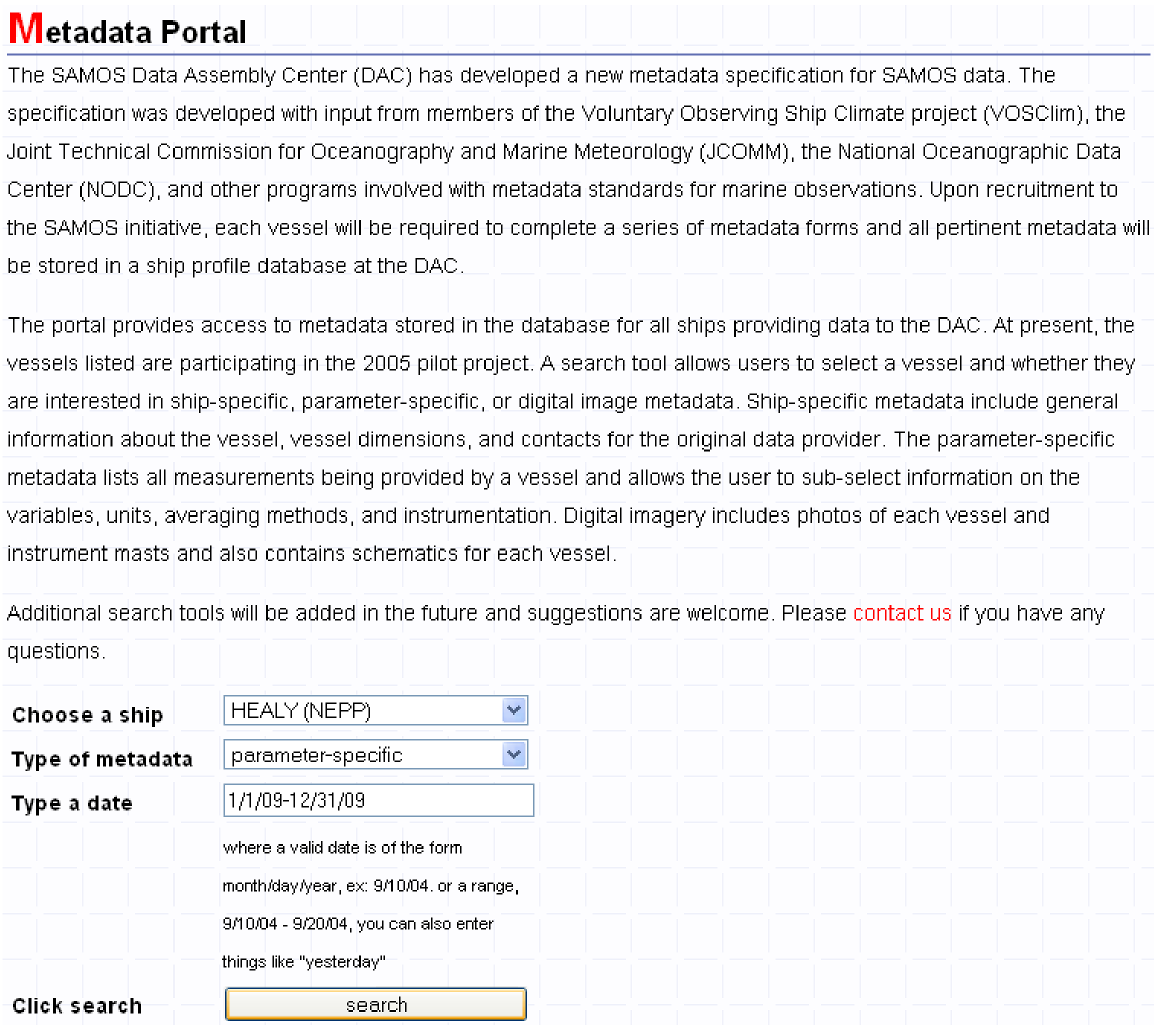
Now the user can see that both the *Healy* and the *Knorr* cruised in the north-polar region in 2009. The next step might be to see what parameters are available on each ship. Returning to the Data Access page, the user this time selects the Metadata Portal:

Data Access

Please choose a page from the following list:

▪ Data Availability	Time line for available data
▪ Data Download	Access quality-evaluated shipboard meteorological data
▪ Data Map	Plot cruise tracks of each ship on a satellite map over a selected period of time
▪ Metadata Portal	Access ship metadata database
▪ SAMOS Parameters	View a list of meteorological and oceanographic parameters that the initiative seeks to obtain from vessels
▪ Additional RV data	Additional RV data

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



Metadata Portal

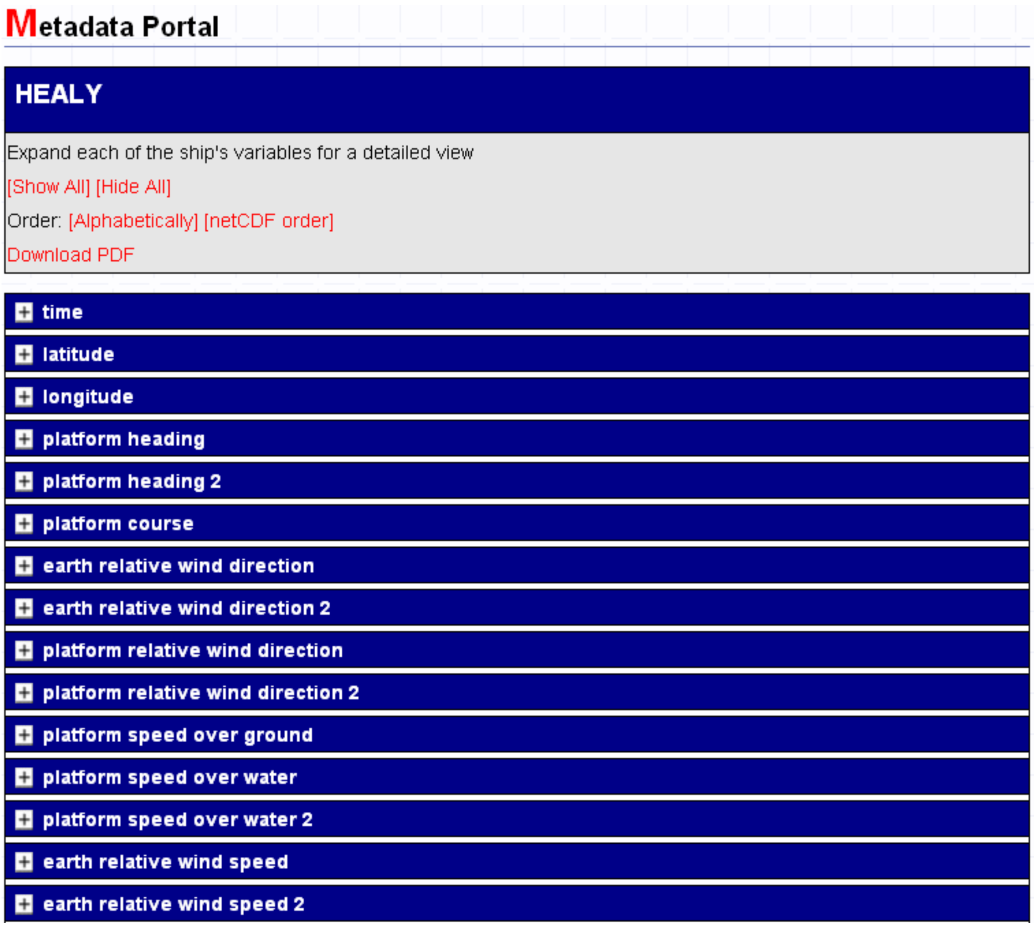
The SAMOS Data Assembly Center (DAC) has developed a new metadata specification for SAMOS data. The specification was developed with input from members of the Voluntary Observing Ship Climate project (VOSClim), the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), the National 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.

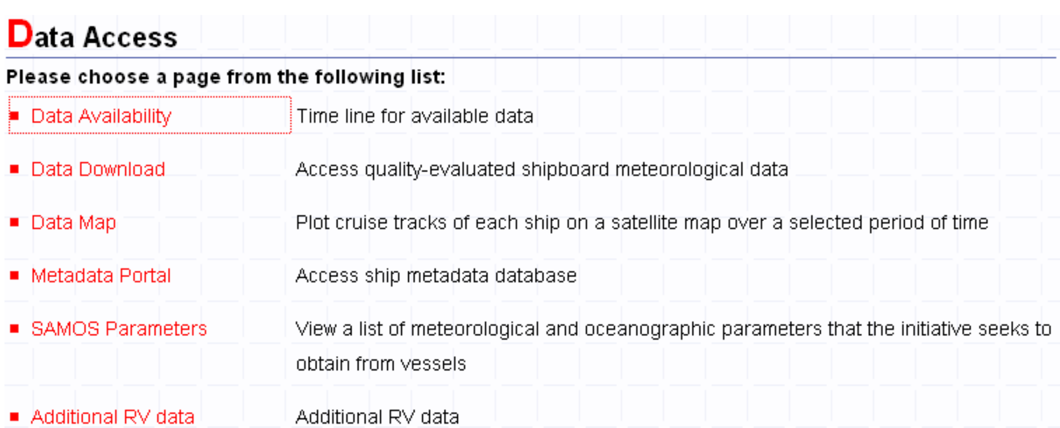
Additional search tools will be added in the future and suggestions are welcome. Please contact us if you have any questions.

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

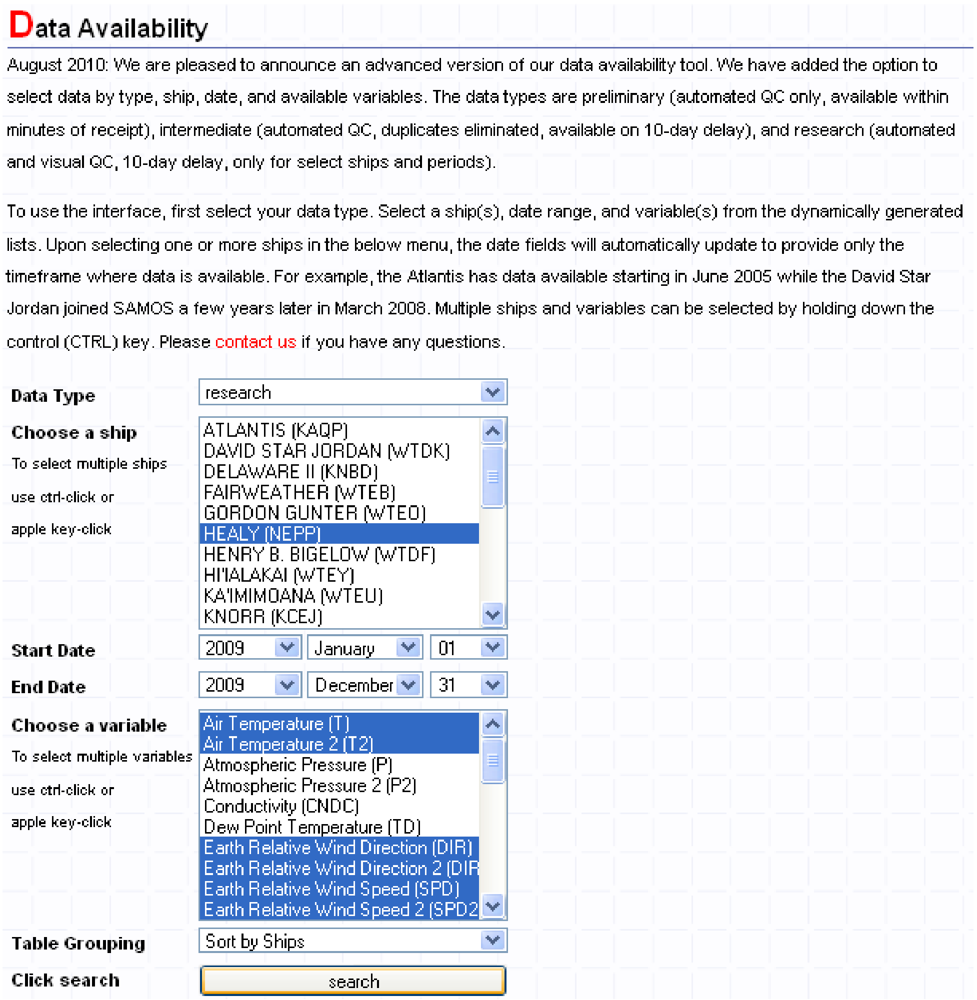
The result, once "search" is clicked, is an exhaustive list of all parameters available from the *Healy* in 2009:



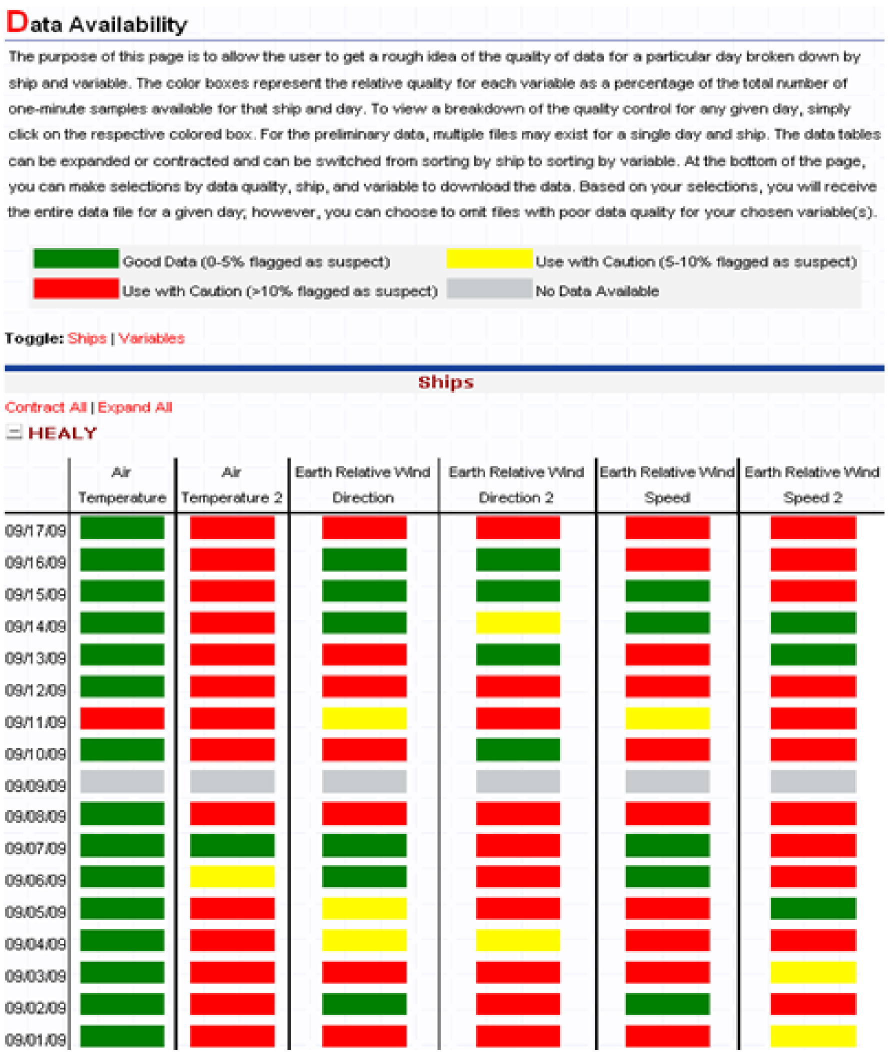
A thorough investigation of the list (note: image is truncated) tells the user the *Healy* did in fact provide both wind and temperature data in 2009. (Throughout the online SAMOS system, clicking on a "+" will yield further information; in this case the result would be metadata for the individual parameters.) 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:



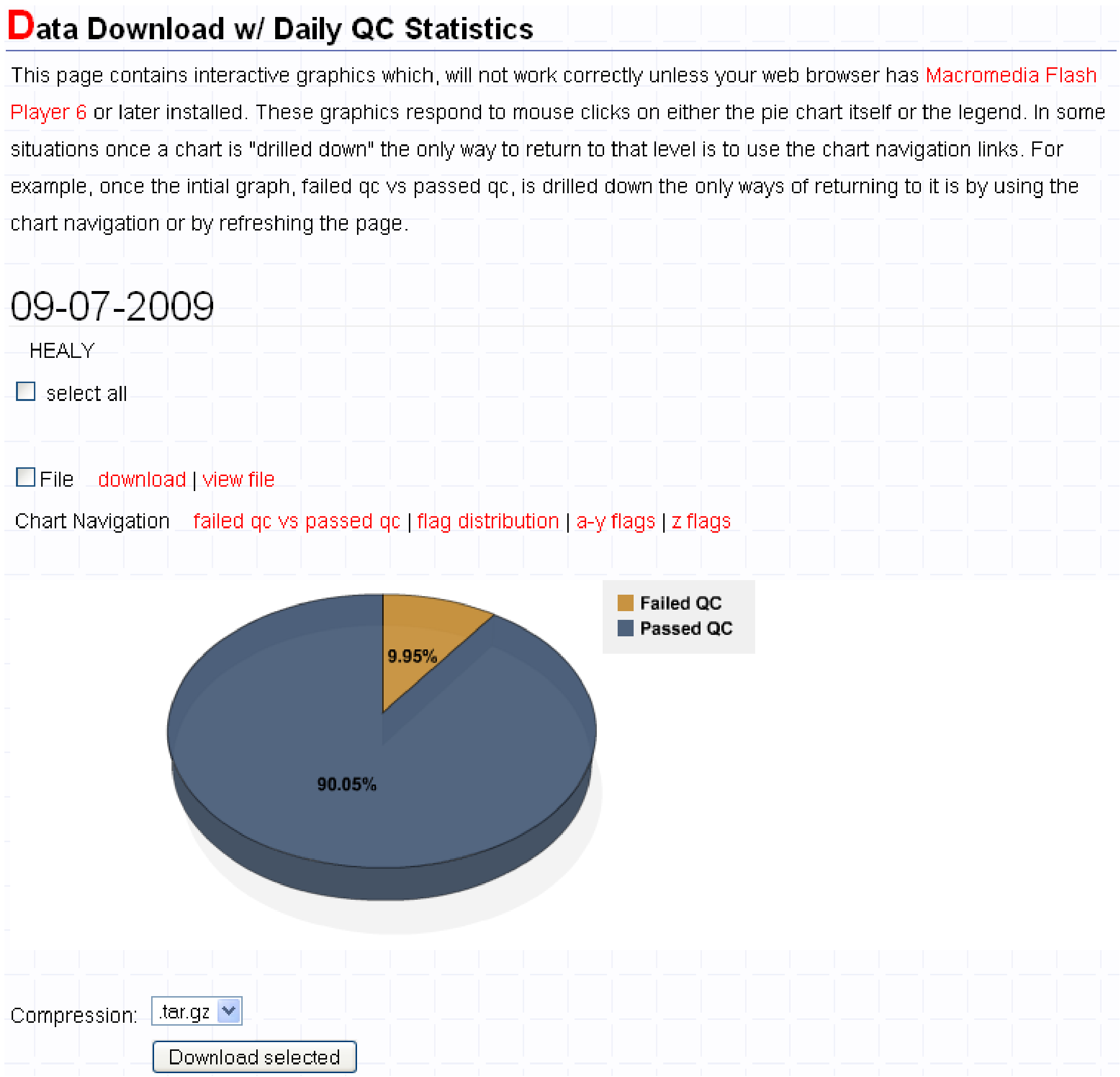
After selecting the *Healy* along with the desired parameter(s), date range, and data version (preliminary, intermediate, or research), noting that the default date range and available parameters will change once a vessel and data version are selected, and then clicking "search":



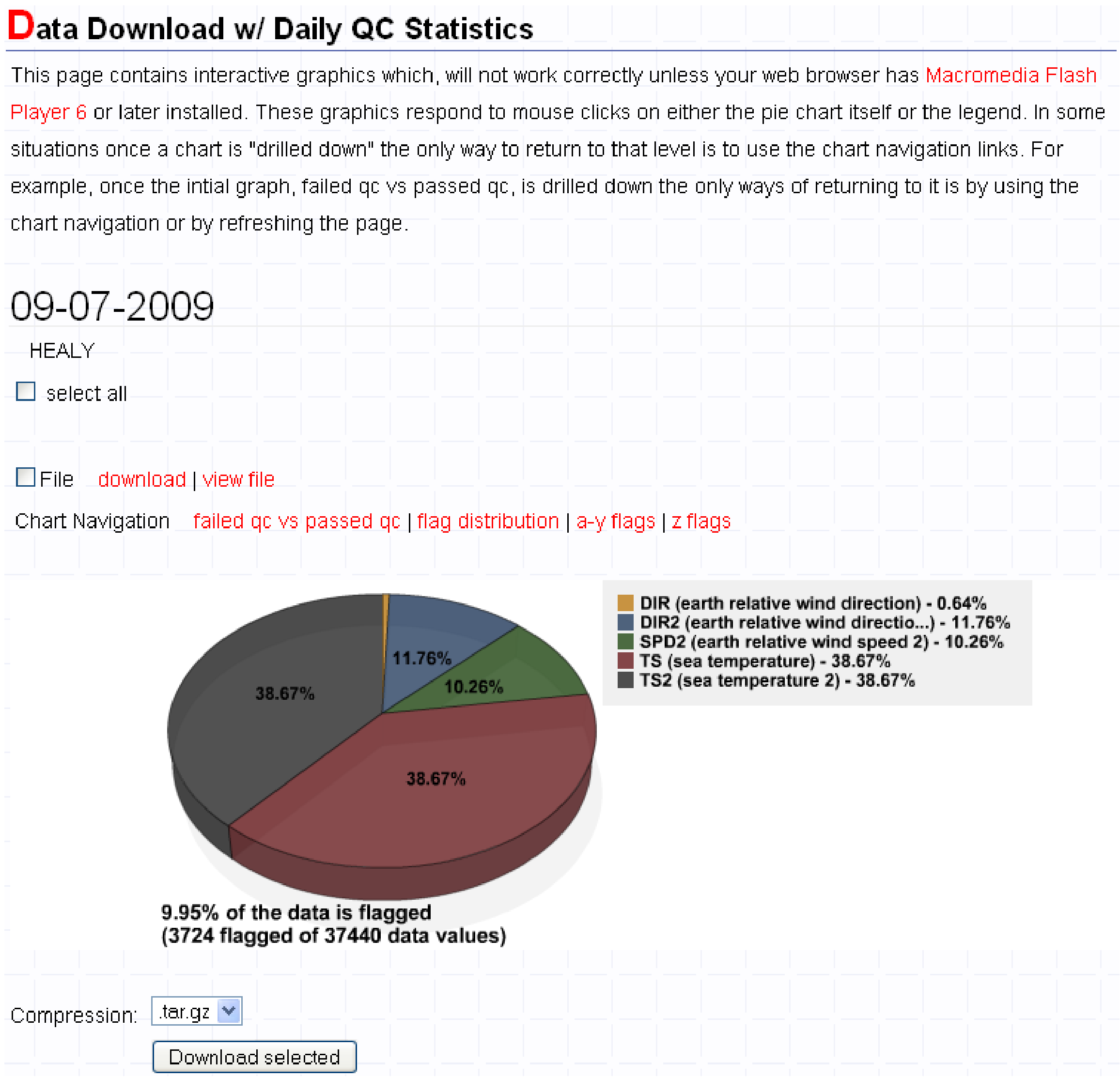
the user arrives at a timeline showing on which days in 2009 the Healy provided data for the chosen parameter(s), as well as the quality of that data for each calendar day (note: image has been customized):



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:

Data Download w/ Daily QC Statistics

This page contains interactive graphics which, will not work correctly unless your web browser has Macromedia Flash Player 6 or later installed. These graphics respond to mouse clicks on either the pie chart itself or the legend. In some situations once a chart is "drilled down" the only way to return to that level is to use the chart navigation links. For example, once the intial graph, failed qc vs passed qc, is drilled down the only ways of returning to it is by using the chart navigation or by refreshing the page.

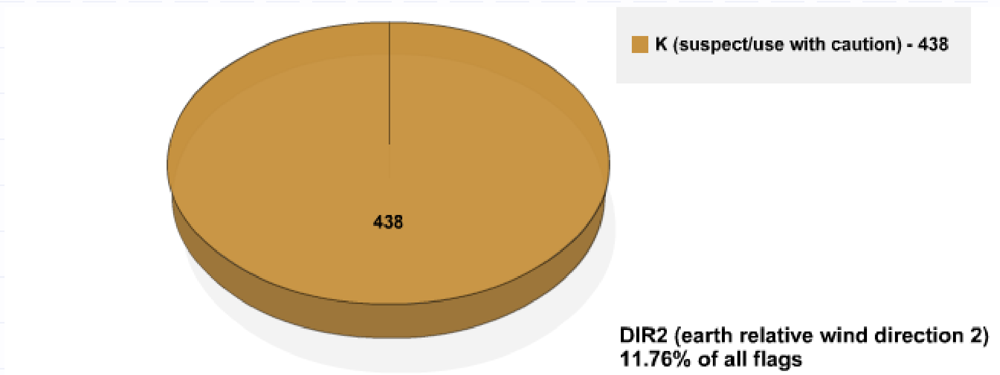
09-07-2009

HEALY

☐ select all

☑ File download | view file

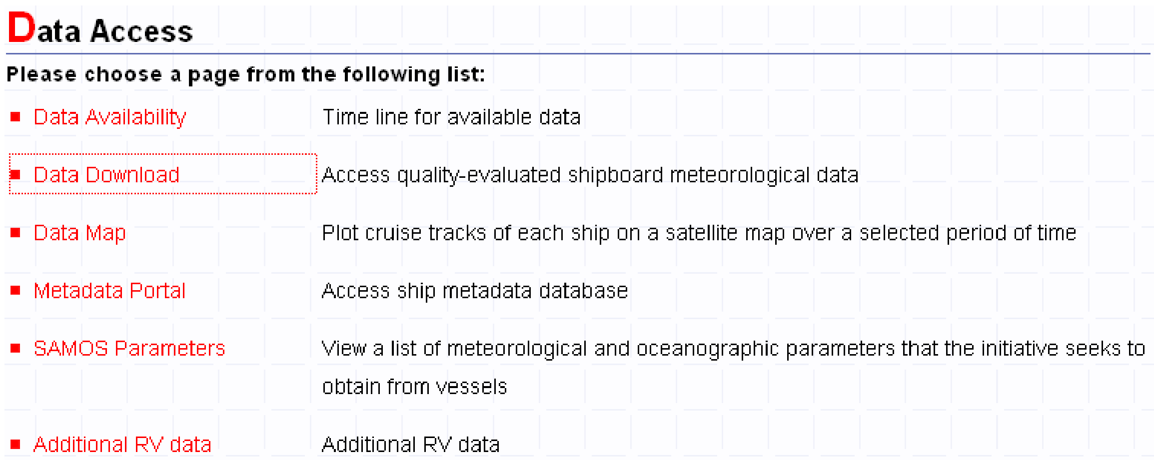
Chart Navigation failed qc vs passed qc | flag distribution | a-y flags | z flags



Compression: .zip

Download selected

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:



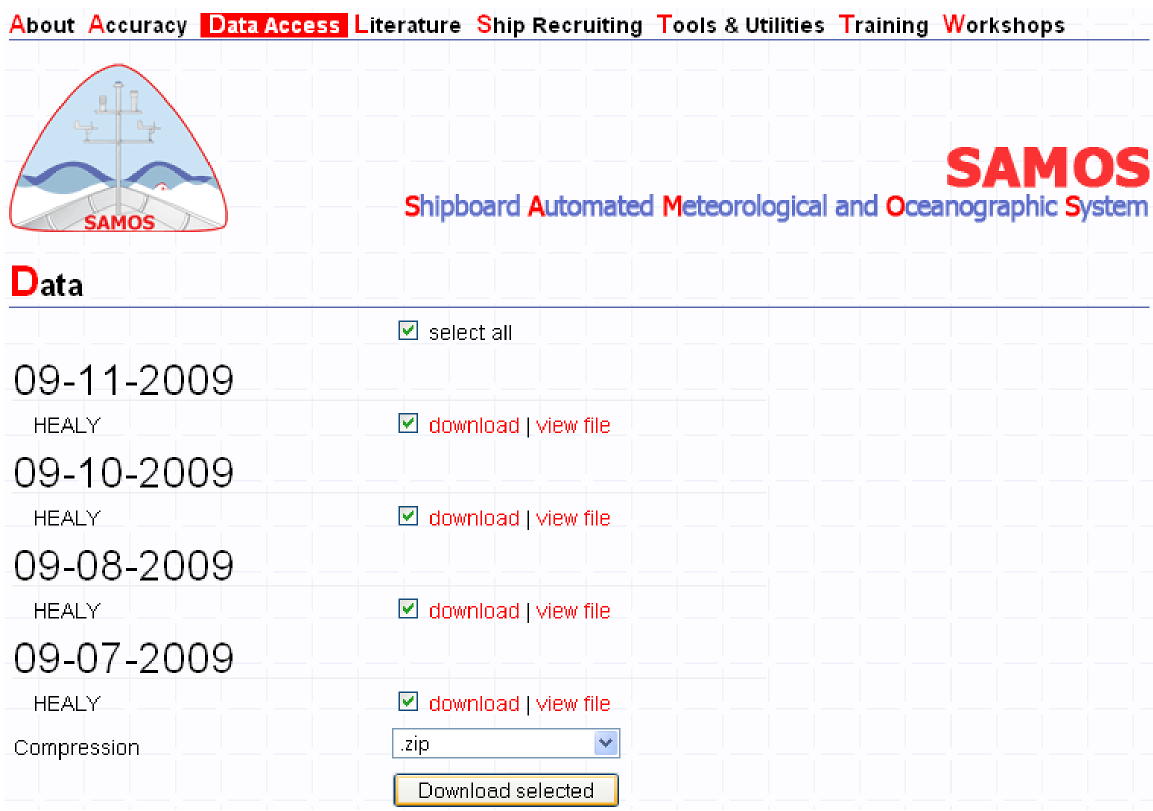
Data Access

Please choose a page from the following list:

Data Availability	Time line for available data
Data Download	Access quality-evaluated shipboard meteorological data
Data Map	Plot cruise tracks of each ship on a satellite map over a selected period of time
Metadata Portal	Access ship metadata database
SAMOS Parameters	View a list of meteorological and oceanographic parameters that the initiative seeks to obtain from vessels
Additional RV data	Additional RV data

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:



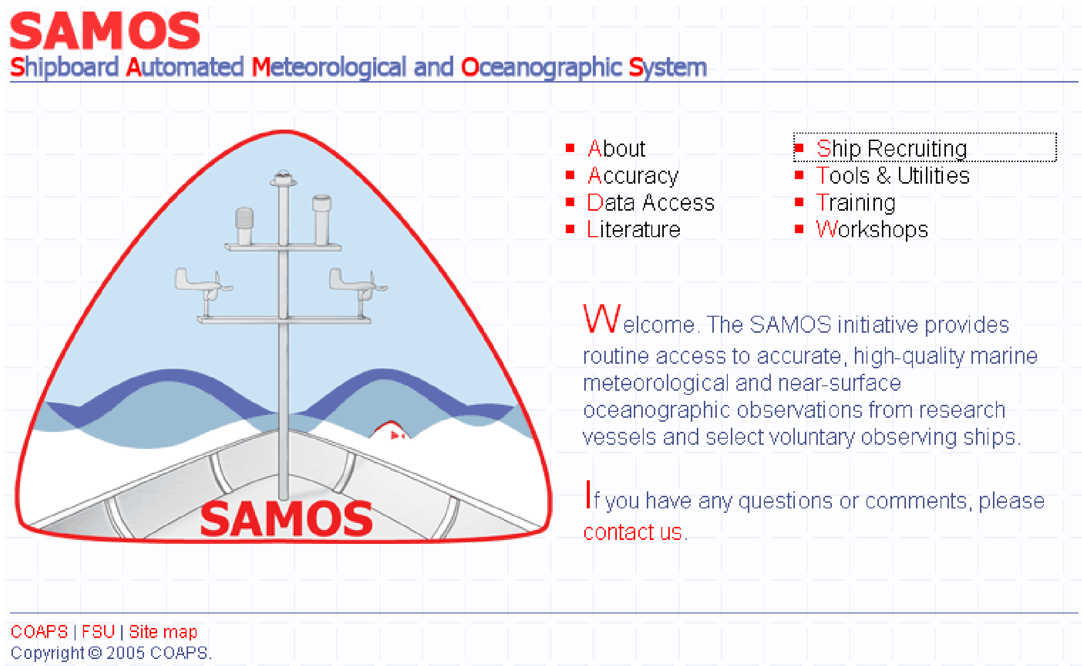
PART 2: the SAMOS operator

(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)

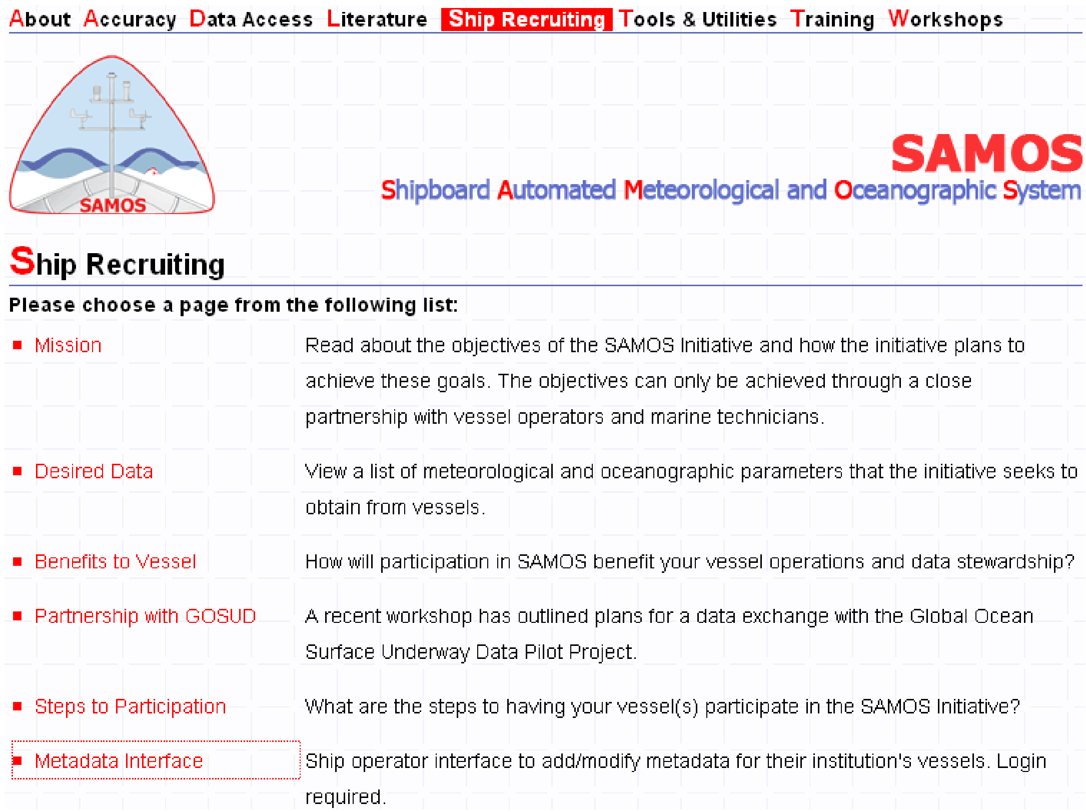
A SAMOS operator might choose to follow the steps outlined in part one as a simple way to keep tabs on the performance of his instruments. When problems are observed, vessel and instrument metadata are important tools for diagnosing a problem and finding a solution. For this reason we strongly emphasize 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.

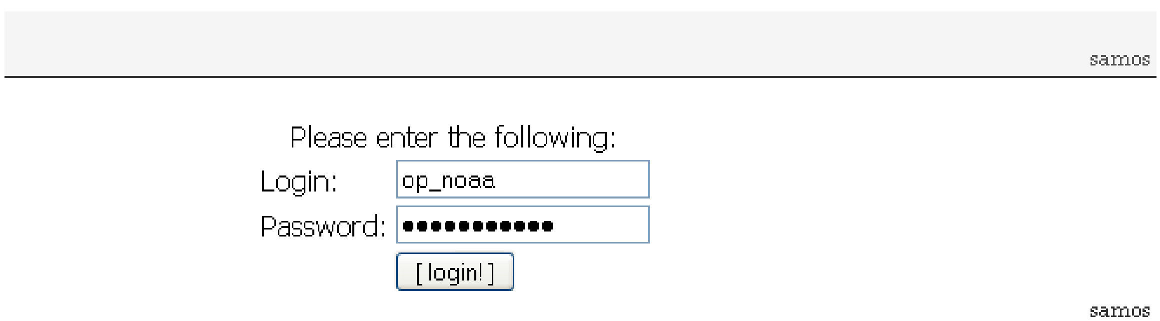
The database can be accessed by visiting the main page and choosing Ship Recruiting:



(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

user ship related

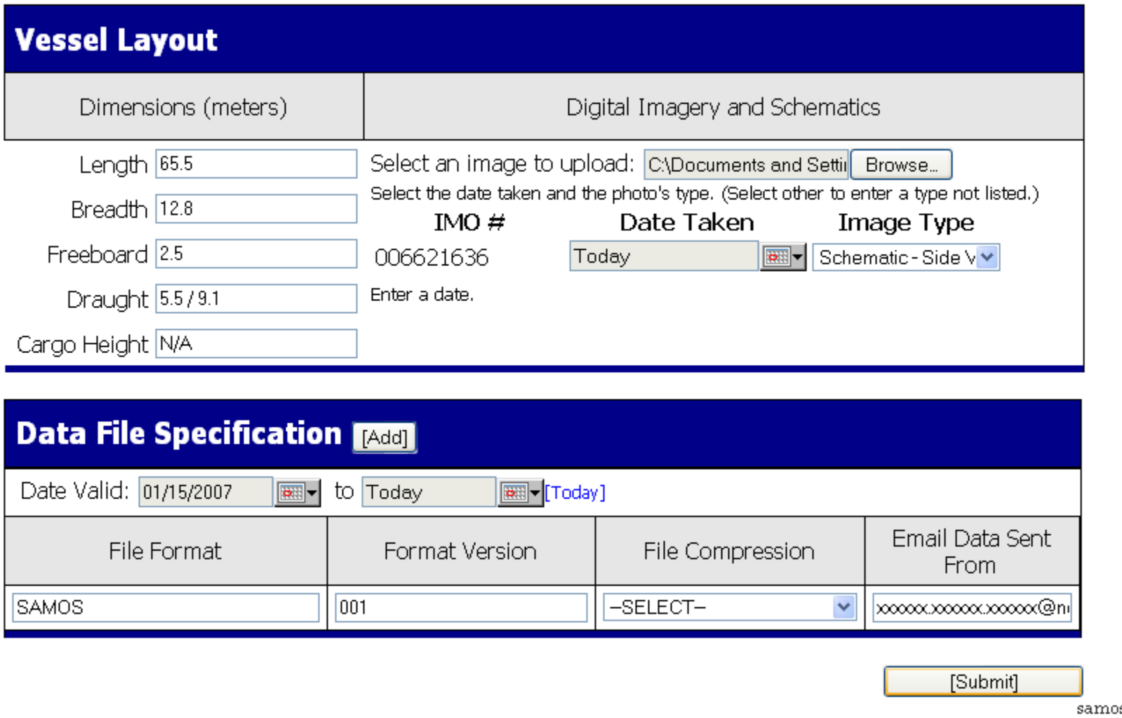
Edit Metadata

Ships for user op_noaa:

Ship Name	Call Sign	Vessel Metadata	Instrument Metadata
DAVID STAR JORDAN	WTDK	[modify]	[modify]
FAIRWEATHER	WTEB	[modify]	[modify]
GORDON GUNTER	WTEO	[modify]	[modify]
HENRY B. BIGELOW	WTDF	[modify]	[modify]
HI'IALAKAI	WTEY	[modify]	[modify]
KA'IMIMOANA	WTEU	[modify]	[modify]
MILLER FREEMAN	WTDM	[modify]	[modify]
NANCY FOSTER	WTER	[modify]	[modify]
OSCAR DYSON	WTEP	[modify]	[modify]
RAINIER	WTEF	[modify]	[modify]
RON BROWN	WTEC	[modify]	[modify]

samos

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)

user ship related

Edit Metadata

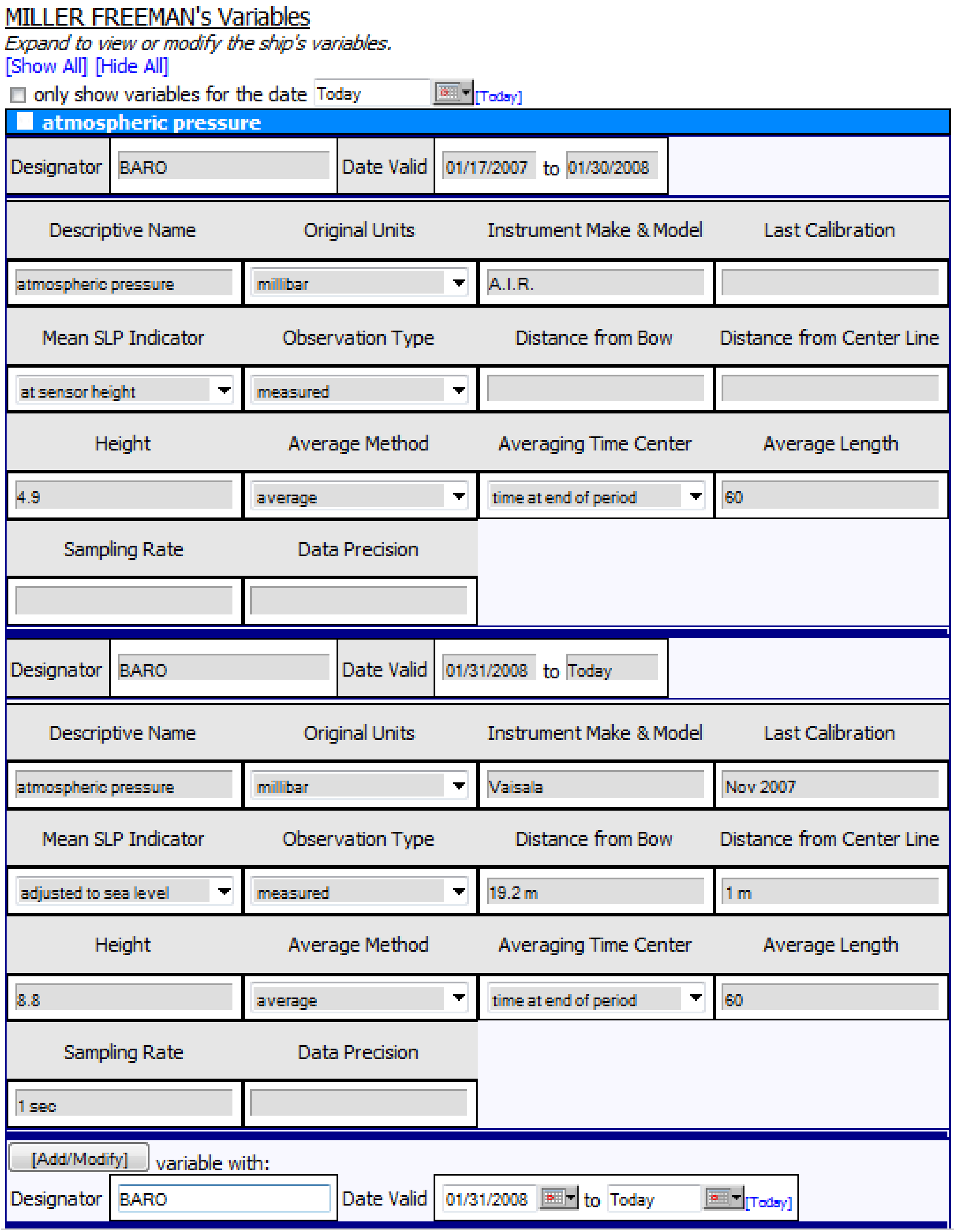
Ships for user op_noaa:

Ship Name	Call Sign	Vessel Metadata	Instrument Metadata
DAVID STAR JORDAN	WTDK	[modify]	[modify]
FAIRWEATHER	WTEB	[modify]	[modify]
GORDON GUNTER	WTEO	[modify]	[modify]
HENRY B. BIGELOW	WTDF	[modify]	[modify]
HI'IALAKAI	WTEY	[modify]	[modify]
KA'IMIMOANA	WTEU	[modify]	[modify]
MILLER FREEMAN	WTDM	[modify]	[modify]
NANCY FOSTER	WTER	[modify]	[modify]
OSCAR DYSON	WTEP	[modify]	[modify]
RAINIER	WTEF	[modify]	[modify]
RON BROWN	WTEC	[modify]	[modify]

samos

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:


MILLER FREEMAN's Variables

Expand to view or modify the ship's variables.

[Show All] [Hide All]

only show variables for the date Today [Today]

atmospheric pressure

Designator	BARO	Date Valid	01/17/2007 to 01/30/2008

Descriptive Name	Original Units	Instrument Make & Model	Last Calibration
atmospheric pressure	millibar	A.I.R.	
Mean SLP Indicator	**Observation Type**	**Distance from Bow**	**Distance from Center Line**
at sensor height	measured		
Height	**Average Method**	**Averaging Time Center**	**Average Length**
4.9	average	time at end of period	60
Sampling Rate	**Data Precision**		

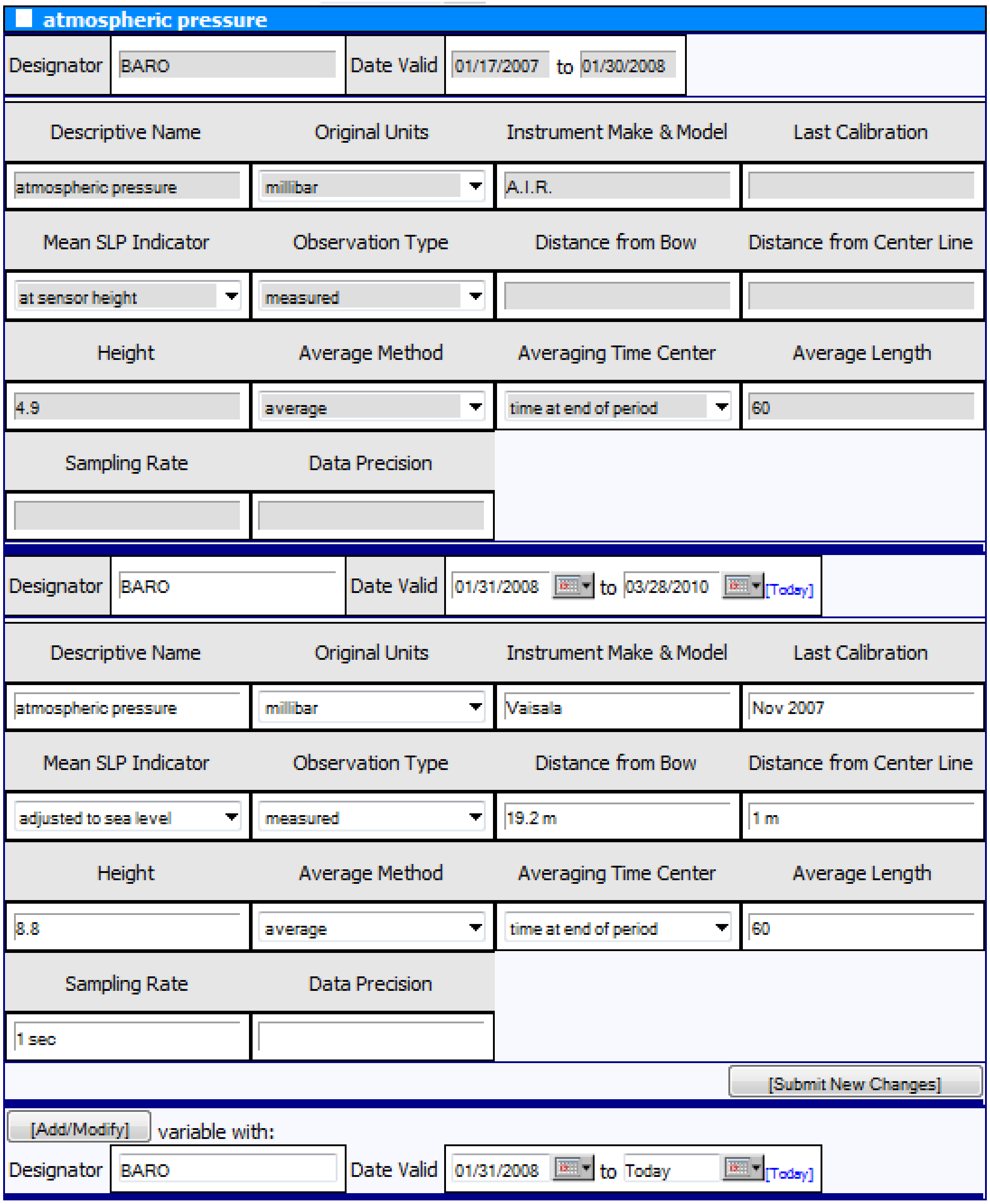
Designator	BARO	Date Valid	01/31/2008 to Today

Descriptive Name	Original Units	Instrument Make & Model	Last Calibration
atmospheric pressure	millibar	Vaisala	Nov 2007
Mean SLP Indicator	**Observation Type**	**Distance from Bow**	**Distance from Center Line**
adjusted to sea level	measured	19.2 m	1 m
Height	**Average Method**	**Averaging Time Center**	**Average Length**
8.8	average	time at end of period	60
Sampling Rate	**Data Precision**		
1 sec			

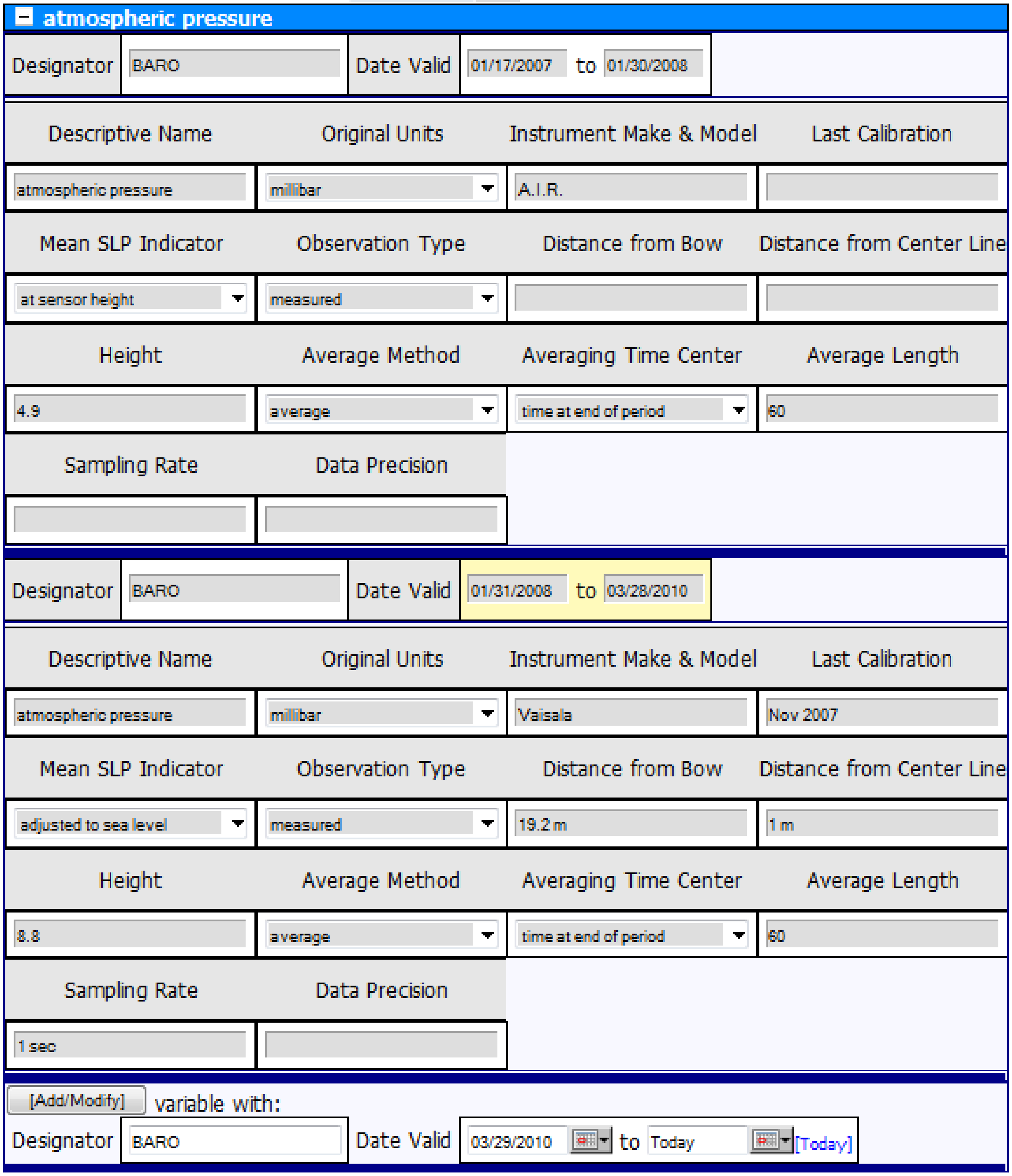
[Add/Modify] variable with:

Designator	BARO	Date Valid	01/31/2008 to Today [Today]

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":



atmospheric pressure

Designator	BARO	Date Valid	01/17/2007 to 01/30/2008

Descriptive Name	Original Units	Instrument Make & Model	Last Calibration
atmospheric pressure	millibar	A.I.R.	
Mean SLP Indicator	**Observation Type**	**Distance from Bow**	**Distance from Center Line**
at sensor height	measured		
Height	**Average Method**	**Averaging Time Center**	**Average Length**
4.9	average	time at end of period	60
Sampling Rate	**Data Precision**		

Designator	BARO	Date Valid	01/31/2008 to 03/28/2010

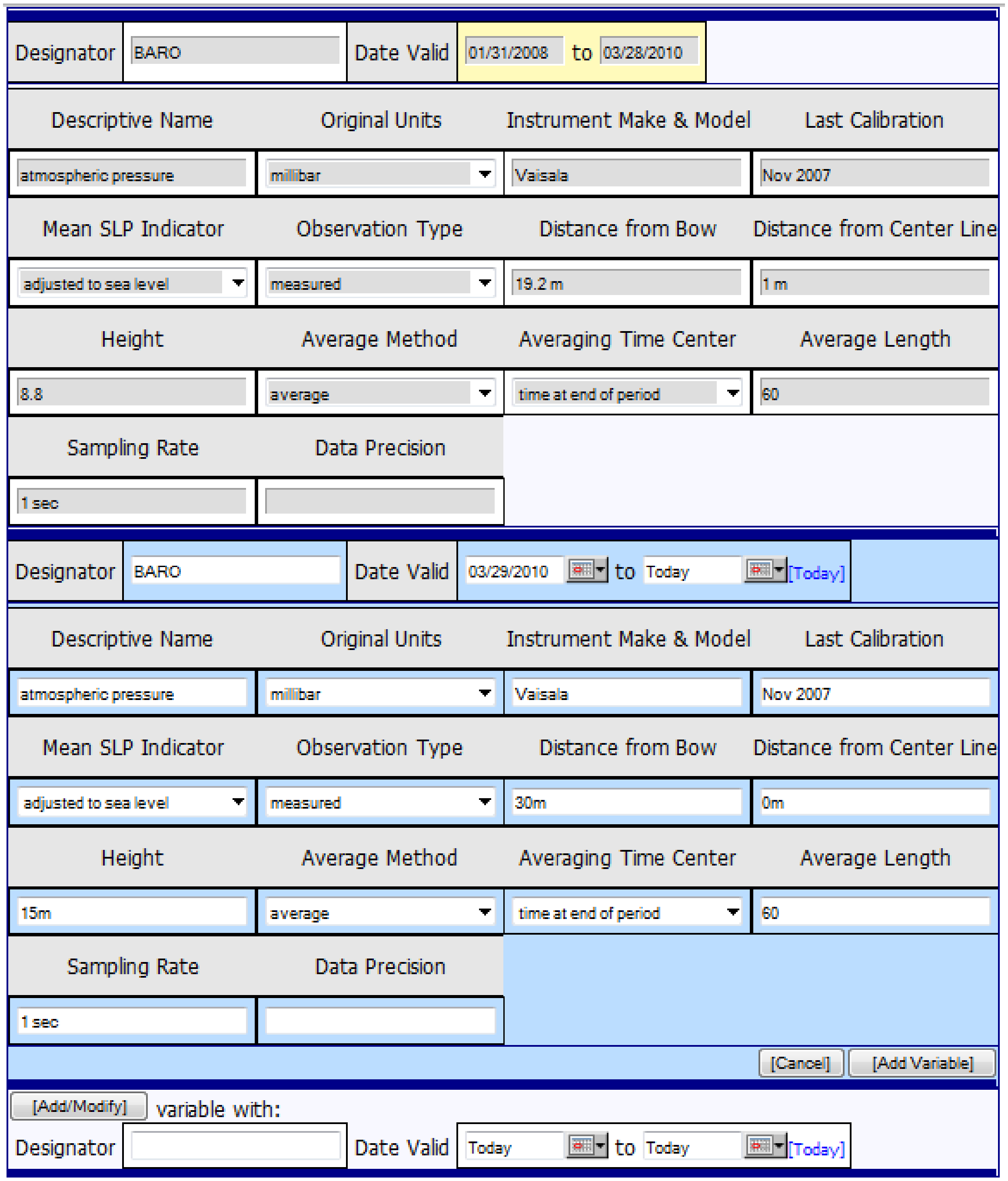
Descriptive Name	Original Units	Instrument Make & Model	Last Calibration
atmospheric pressure	millibar	Vaisala	Nov 2007
Mean SLP Indicator	**Observation Type**	**Distance from Bow**	**Distance from Center Line**
adjusted to sea level	measured	19.2 m	1 m
Height	**Average Method**	**Averaging Time Center**	**Average Length**
8.8	average	time at end of period	60
Sampling Rate	**Data Precision**		
1 sec			

[Add/Modify] variable with:

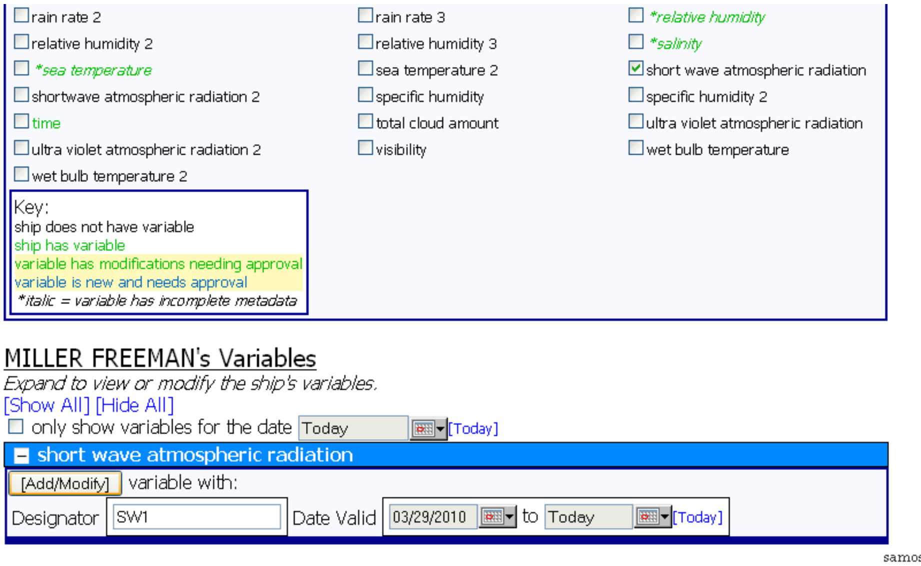
Designator	BARO	Date Valid	03/29/2010 to Today [Today]

*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.

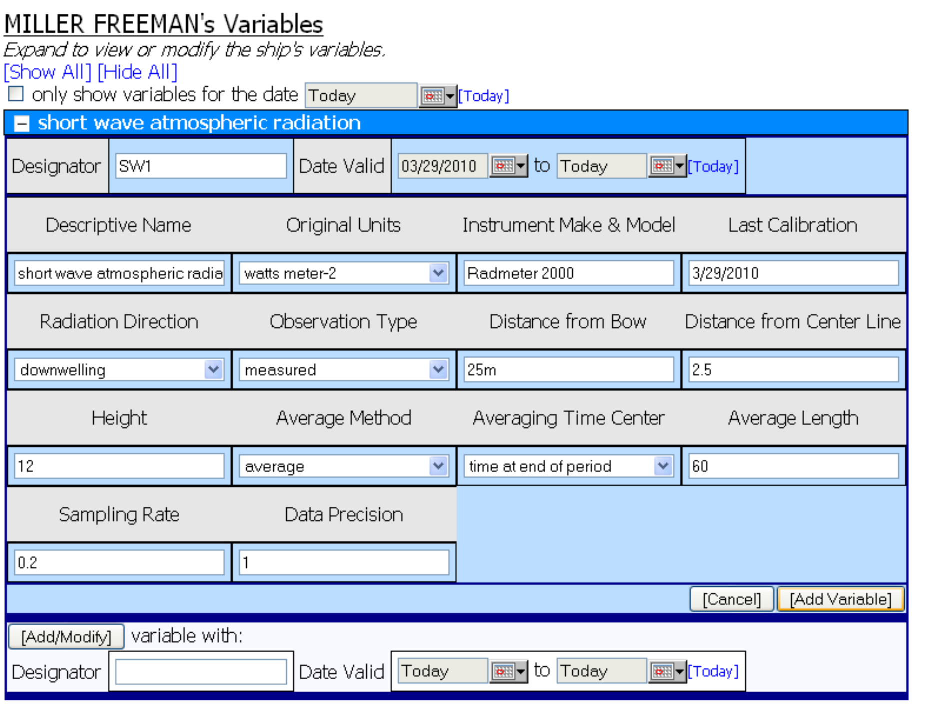
Once "Add/Modify" is clicked, a new set of fields opens up for the BARO parameter. All op_noaa need do at this point is recreate the parameter metadata entry, of course taking care to fill in the new location information, and click "Add Variable":



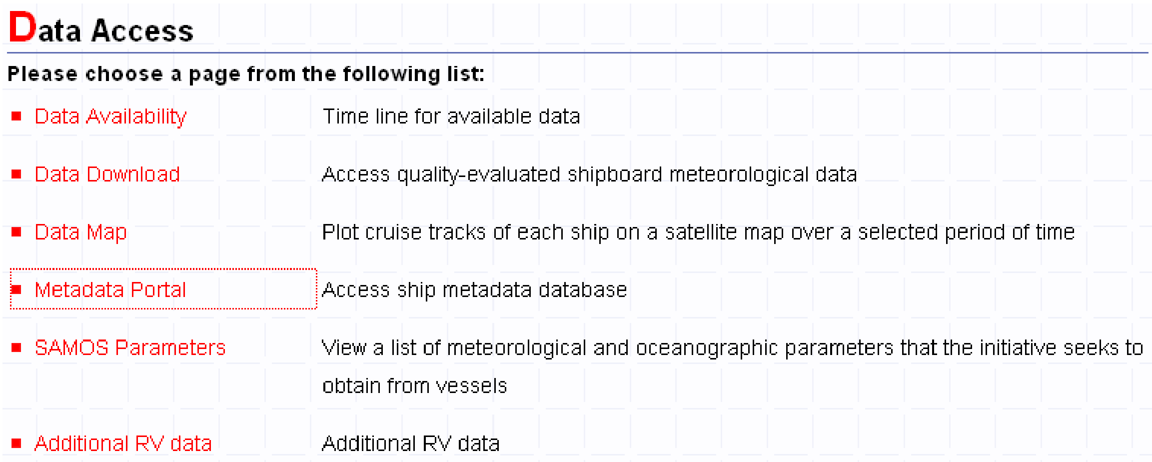
Adding an entirely new parameter follows only the latter part of these instructions: by simply choosing a parameter (for example short wave atmospheric radiation), clicking the "+" on the expansion bar, and entering either a new or not currently in use Designator and any Date Valid window:



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:



Data Access

Please choose a page from the following list:

Data Availability	Time line for available data
Data Download	Access quality-evaluated shipboard meteorological data
Data Map	Plot cruise tracks of each ship on a satellite map over a selected period of time
Metadata Portal	Access ship metadata database
SAMOS Parameters	View a list of meteorological and oceanographic parameters that the initiative seeks to obtain from vessels
Additional RV data	Additional RV data

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.

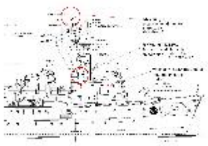
The portal provides access to metadata stored in the database for all ships providing data to the DAC. At present, the vessels listed are participating in the 2005 pilot project. A search tool allows users to select a vessel and whether they are interested in ship-specific, parameter-specific, or digital 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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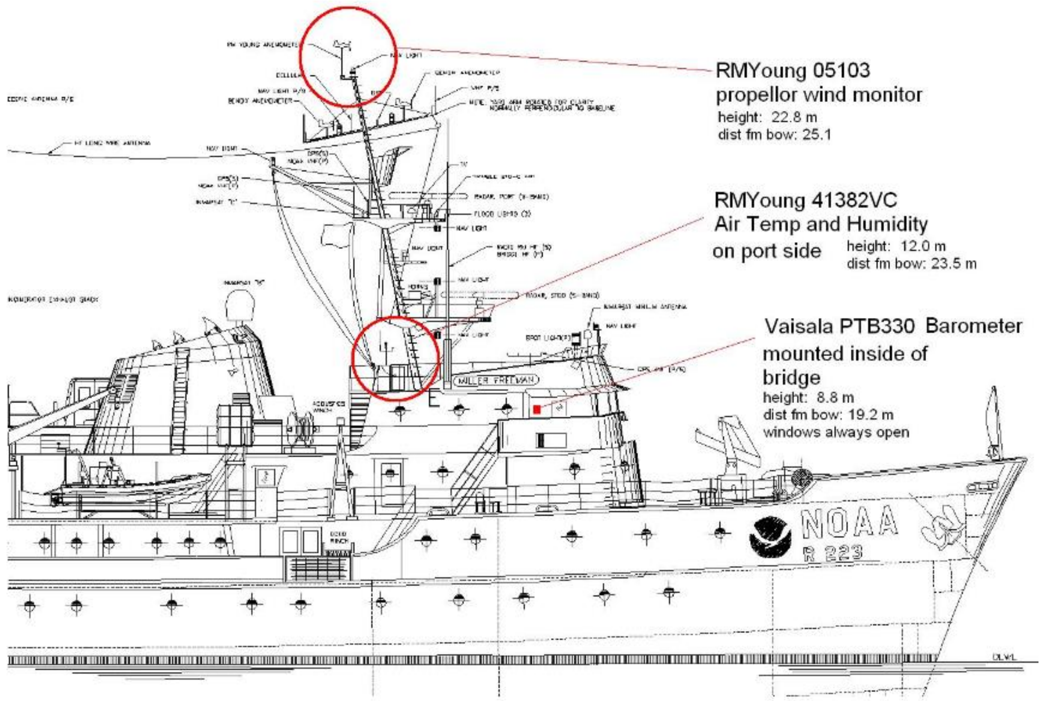
Clicking on the image itself would give us an enlarged view. In this case, the photo provides details about the locations of three MET sensors:

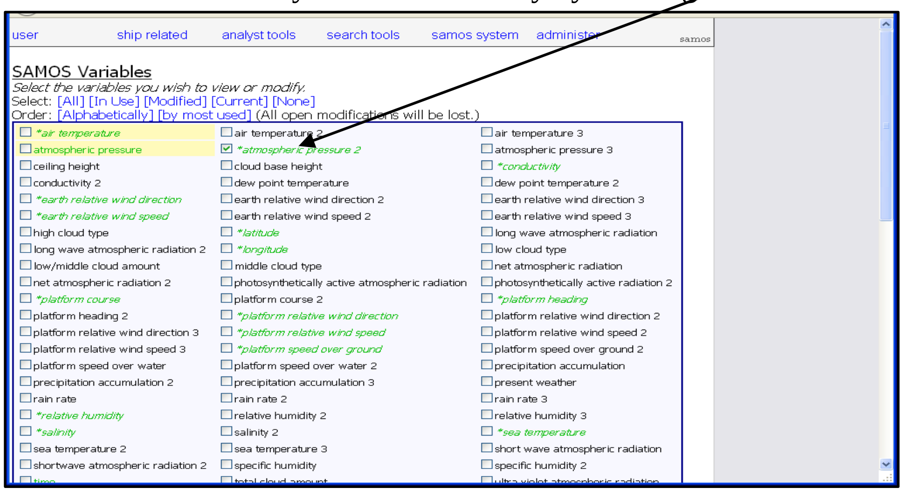


As a SAMOS user becomes familiar with following the metadata modification steps outlined in this section, chores such as adding duplicate sensors, logging sensor relocations, and keeping calibrations up-to-date become straightforward tasks. Naturally, complete and accurate metadata make for better scientific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

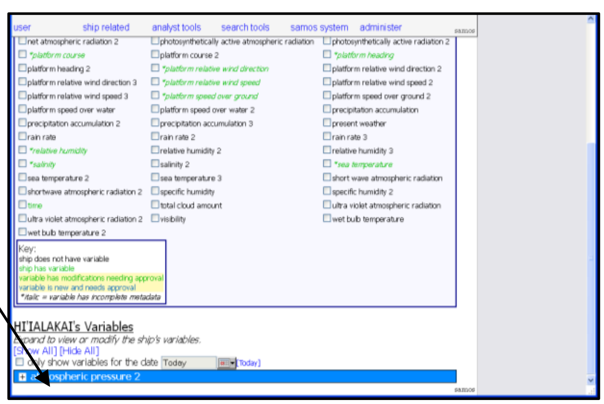
UPDATING SAMOS METADATA: STEP BY STEP EXAMPLE

(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

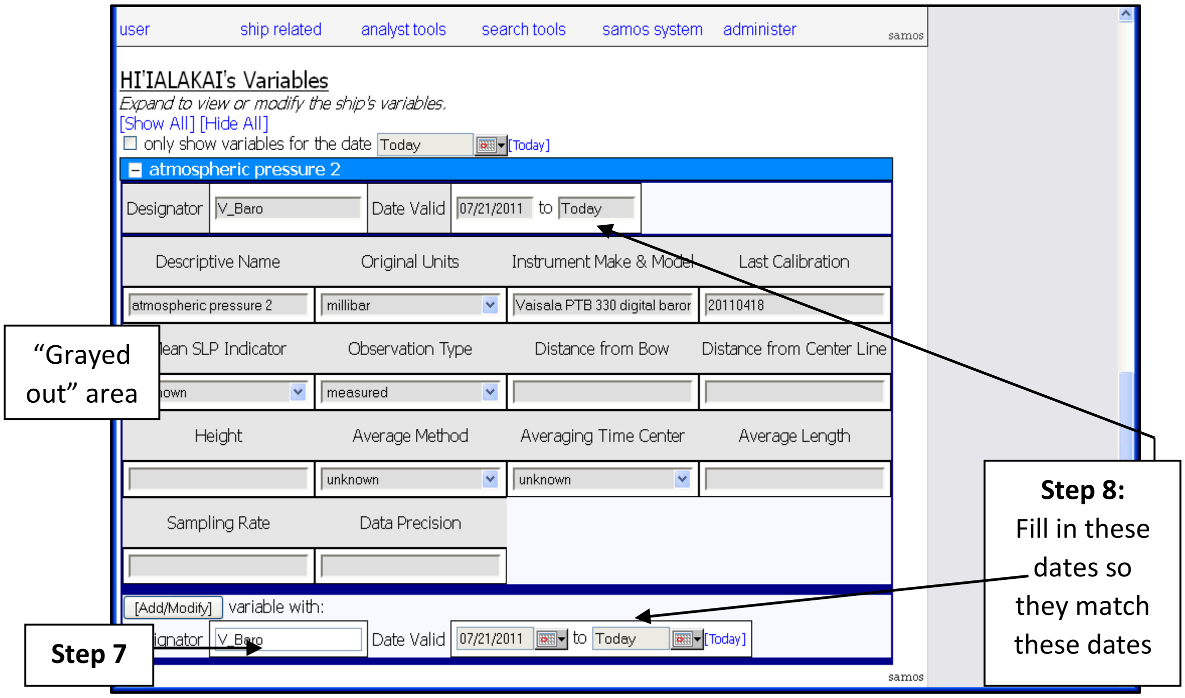


5. You will now see that sensor below, highlighted in Blue; click the plus sign to the left to expand the info about that sensor



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.



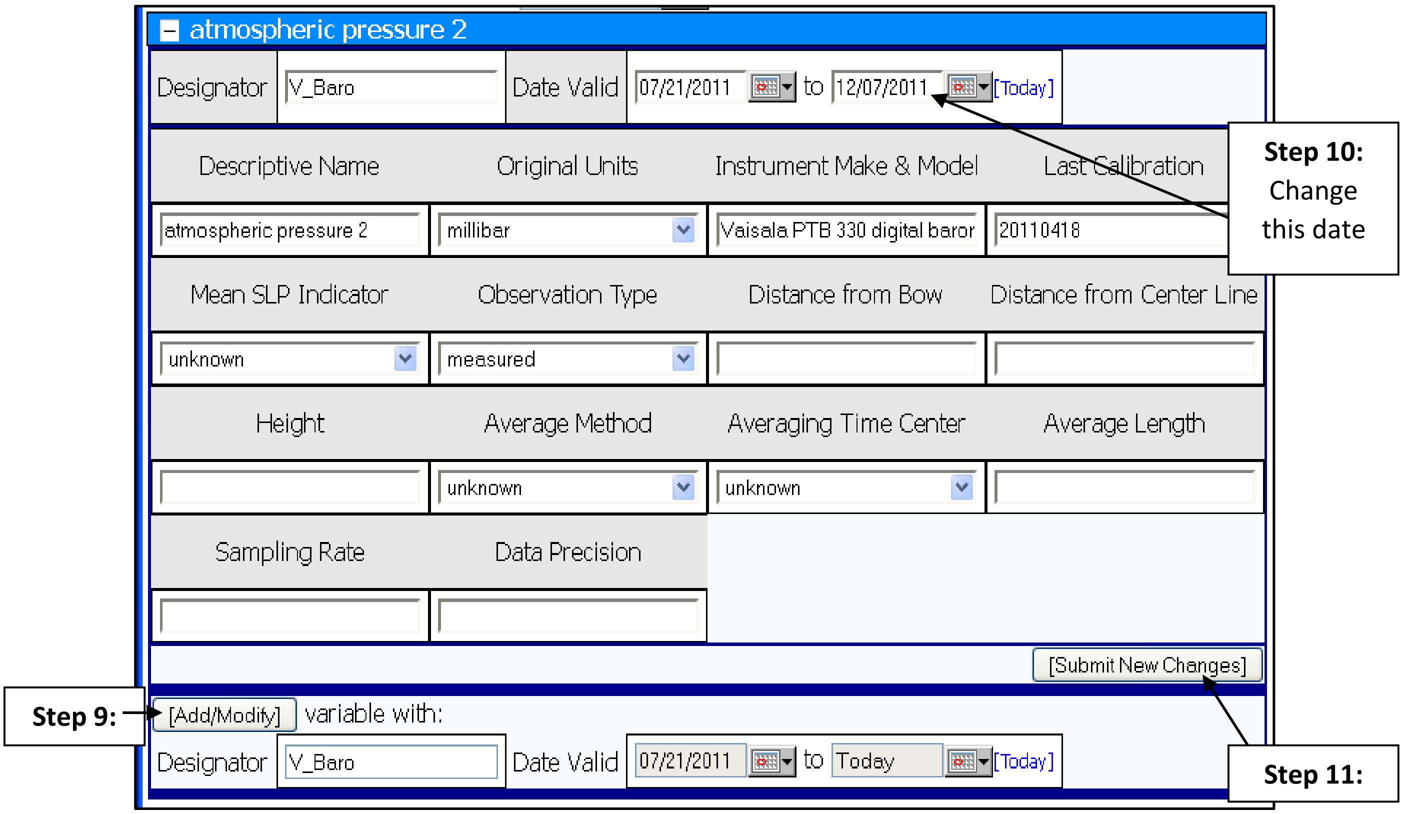
7. You first need to let the system know for which sensor you want to change information. In the box that appears at the very bottom (see image above), enter the name of the designator just at it appears in the box next to 'Designator' in the grayed out area.
   a. For the example above you would enter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



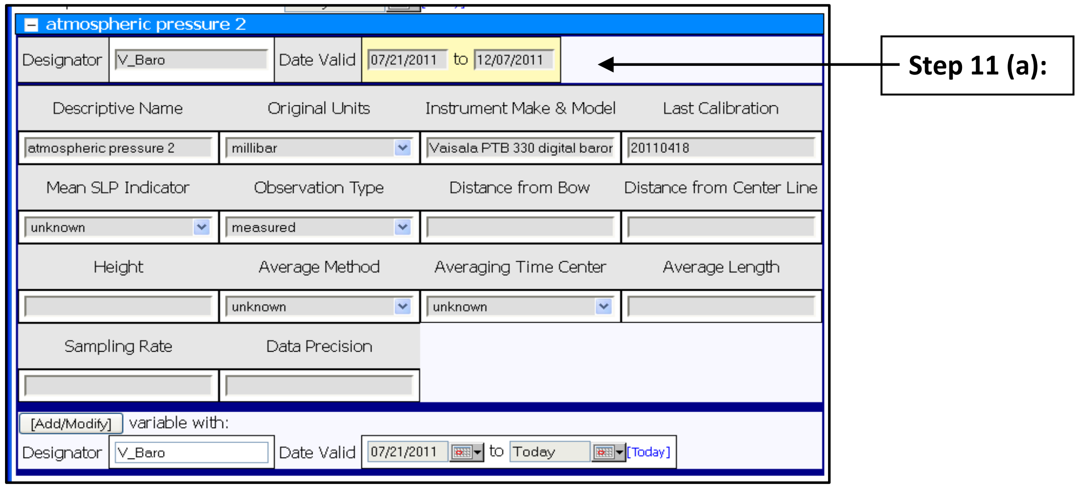
10. You now want to change the "Date Valid" info in this data box. The "Date Valid" start date (on the left) in this now edit-able area will likely stay the same unless you want to correct a previously entered erroneous start date. More than likely you will only be changing the end date, on the right.

   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.

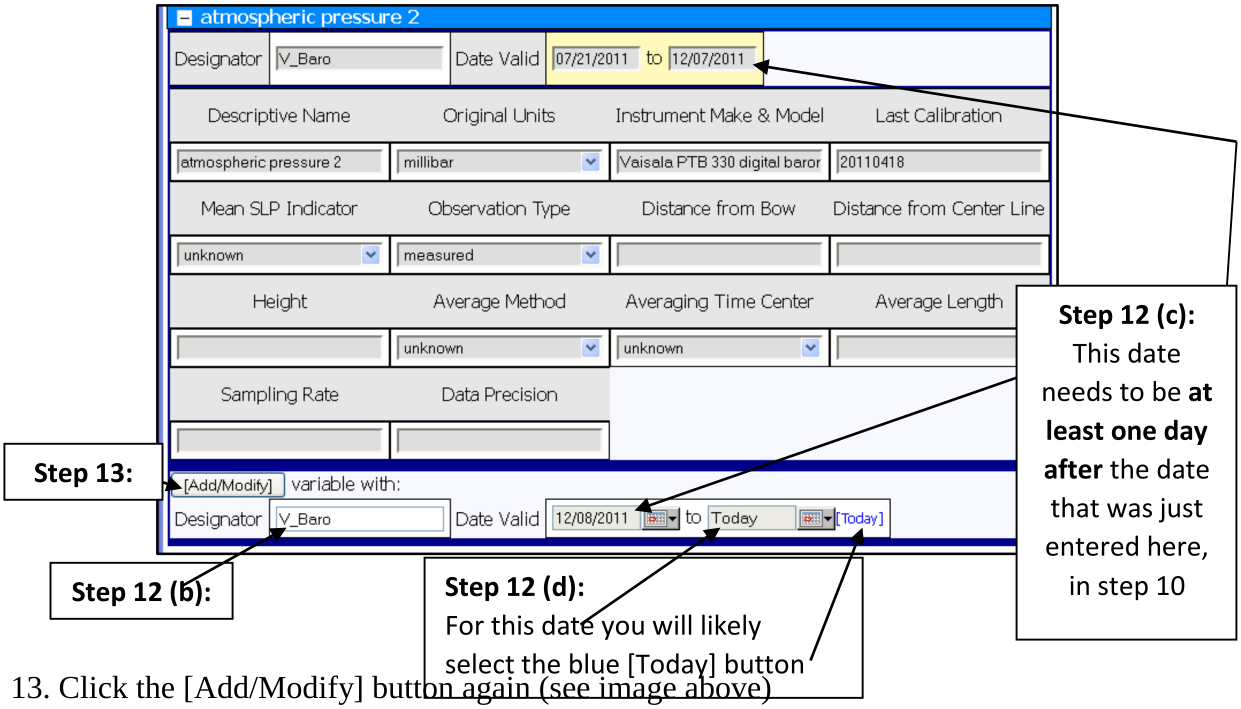
   b. You will most likely be entering a calendar date in the right hand "Date Valid" box to close out the existing data for the sensor.

11. Click "Submit New Changes" on the bottom right of the data box (see image above)

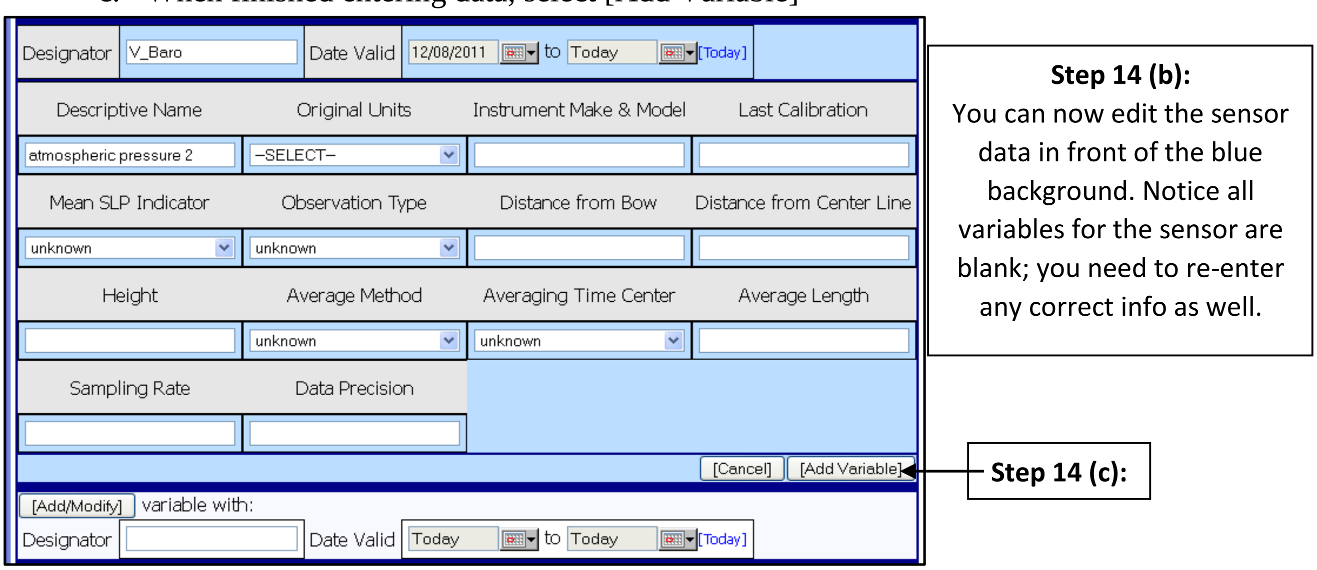
   a. The text boxes in the data entry area should be grayed out again. The background of the dates that you just edited will be yellow (see image below).



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.

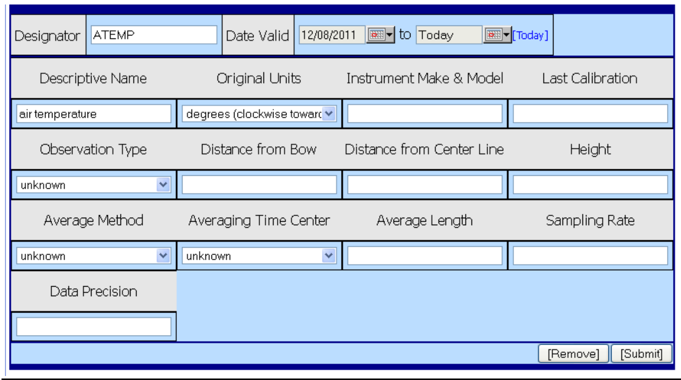


13. Click the [Add/Modify] button again (see image above)
14. You will now see a new, editable data box at the bottom of the screen that has blue around the sensor info instead of gray.
    a. Leave the Date Valid area the same
    b. You can now change the sensor data to reflect updates and add new 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 C: 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
Kilo Moana
Laurence M. Gould
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
Tangaroa
Thomas G. Thompson
Thomas Jefferson

WDC9417 2014-11 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	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 2014-12 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	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 2014-10 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	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢	🟢	🟢
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 2014-07 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 2014-12 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	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Air Temperature 2	ATEMP2	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Atmospheric Pressure	BARO	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Atmospheric Pressure 2	BARO2	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Conductivity	TSGC	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Earth Relative Wind Direction	TWDIR	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	–
Earth Relative Wind Direction 2	TWDIR3	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Earth Relative Wind Direction 3	TWDIR	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Earth Relative Wind Speed	TWSPD2	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	–
Earth Relative Wind Speed 2	TWSPD3	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Earth Relative Wind Speed 3	TWSPD	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	–
Latitude	LAT	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Longitude	LON	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Platform Course	COG	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Platform Heading	GYRO	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Platform Relative Wind Direction	RWDIR	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Relative Wind Direction 2	RWDIR2	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Relative Wind Speed	RWSPD	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Relative Wind Speed 2	RWSPD2	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Speed Over Ground	SOG	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Platform Speed Over Water	LWS	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Platform Speed Over Water 2	TWS	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴

🟢 : <=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
Relative Humidity	RELH	●	●	●	●	●	●	●	●	●	●	●	●	●
Relative Humidity 2	RELH2	●	●	●	●	●	●	●	●	●	●	●	●	●
Salinity	TSGS	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature	TSGEXT	●	●	●	●	●	●	●	●	●	●	●	●	●
Sea Temperature 2	TSGINT	●	●	●	●	●	●	●	●	●	●	●	●	●

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

WTEK 2014-12 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	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
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	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴

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

WTEO 2014-12 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	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 2014-11 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	🔴	🔴	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🔴
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 2014-09 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	POSMV-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

WDA7827 2014-12 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	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
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

WCX7445 2014-12 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	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	● (green)	● (green)	● (green)	● (red)	● (red)	● (red)	● (green)	● (green)	● (red)	● (green)	● (green)	● (red)	● (green)

● (green) : <6 months old | ● (yellow) : >6 months old | ● (red) : no metadata reported

WTER 2014-11 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 2014-12 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	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 2014-12 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	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 2014-10 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	RELH	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢
Salinity	TSGS	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢
Sea Temperature	EXTWT	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🔴	🟢	🟢
Sea Temperature 2	TSGWT	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢

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

WTDO 2014-11 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	SST	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🔴	🟢	🔴	🔴	🔴

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

WTEP 2014-11 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 2014-10 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	green	green	green	green	red	green	green	green	red	green	red	green	red
Atmospheric Pressure	BARO	green	green	green	red	red	red	green	green	red	green	red	red	red
Conductivity	TSGC	green	green	green	red	red	red	red	green	red	green	red	red	green
Earth Relative Wind Direction	TWDIR	green	green	green	red	red	red	green	green	red	green	red	red	–
Earth Relative Wind Speed	TWSPD	green	green	green	red	red	red	green	green	red	green	red	red	–
Latitude	LAT	green	green	green	–	–	–	green	green	red	green	red	green	red
Longitude	LON	green	green	green	–	–	–	green	green	red	green	red	red	red
Platform Course	COG	green	green	green	–	–	–	green	green	red	green	red	red	red
Platform Heading	HDG	green	green	green	–	–	–	green	green	red	green	red	red	green
Platform Relative Wind Direction	RWDIR	green	green	green	red	red	red	green	green	red	green	red	red	green
Platform Relative Wind Speed	RWSPD	green	green	green	red	red	red	green	green	red	green	red	red	green
Platform Speed Over Ground	SOG	green	green	green	–	–	–	green	green	red	green	red	red	red
Relative Humidity	RELH	green	green	green	red	red	red	green	green	red	green	red	red	red
Salinity	TSGS	green	green	green	red	red	red	green	green	red	green	red	red	green
Sea Temperature	TSGT	green	green	green	red	red	red	green	green	red	green	red	red	green

green : <6 months old | yellow : >6 months old | red : no metadata reported

WTDL 2014-12 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	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 2014-11 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	RELHUM	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴
Salinity	TSGS	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Sea Temperature	TSGTEMP	🔴	🔴	🟡	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴

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

WSQ2674 2014-12 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	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 2014-12 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	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 2014-11 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	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🔴	🔴
Short Wave Atmospheric Radiation	SWR	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🔴	🔴	🔴

🟢 : <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 2014-12 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	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 2014-12 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	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🔴	🟢	🟢
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