2012 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 2012 by research vessels participating in the Shipboard Automated Meteorological and Oceanographic System (SAMOS) initiative. The SAMOS initiative focuses on improving the quality of, and access to, surface marine meteorological and oceanographic data collected *in-situ* by automated instrumentation on research vessels (RVs). A SAMOS is typically a computerized data logging system that continuously records navigational (ship position, course, speed, and heading), meteorological (winds, air temperature, pressure, moisture, rainfall, and radiation), and near-surface oceanographic (sea temperature, conductivity, and salinity) parameters while the RV is underway. Measurements are recorded at high-temporal sampling rates (typically 1 minute or less). A SAMOS comprises scientific instrumentation deployed by the RV operator and typically differs from instruments provided by national meteorological services for routine marine weather reports. The instruments are not provided by the SAMOS initiative.

Data management at the SAMOS data assembly center (DAC) provides a ship-to-shore-to-user data pathway (Figure 1). SAMOS version 1.0 relies on daily packages of one-minute interval SAMOS data being sent to the DAC at the Florida State University via e-mail attachment. Broadband satellite communication facilitates this transfer as near as possible to 0000 UTC daily. A new ship-to-shore protocol, known as SAMOS 2.0, allows operators to email full temporal resolution (up to 1Hz interval) data on schedules up to once per hour. SAMOS 2.0 was developmental in 2012 and only used by the *Endeavor*. For SAMOS 1.0, a preliminary version of the SAMOS data is made available via web services within five minutes of receipt while SAMOS 2.0 data are also processed once per day near 0000 UTC. 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 participating in the SAMOS initiative, 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 2012, out of 34 active recruits, a total of 29 research vessels routinely provided SAMOS observations to the DAC (Table 1). SAMOS data providers included the National Oceanographic and Atmospheric Administration (NOAA, 13 vessels), the Woods Hole Oceanographic Institution (WHOI, 2 vessels), the United States Coast Guard (USCG, 1 vessel), National Science Foundation Office of Polar Programs (OPP, 2 vessels), University of Hawaii (UH, 1 vessel), University of Rhode Island (URI, 1 vessel), University of Washington (UW, 1 vessel), Scripps Institution of Oceanography (SIO, 4 vessels), Bermuda Institute of Ocean Sciences (BIOS, 1 vessel), and the

Australian Integrated Marine Observing System (IMOS, 3 vessels). Three additional NOAA vessels – the *Fairweather*, the *McArthur II*, and the *Rainier* – one additional USCG vessel – the *Polar Sea* – and one additional vessel formerly with WHOI and transferred to Oregon State University in March 2012 – *Oceanus* – were active in the SAMOS system but for reasons beyond the control of the SAMOS DAC (e.g., caretaker status, changes to shipboard acquisition systems, etc.) were unable to contribute data in 2012.

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

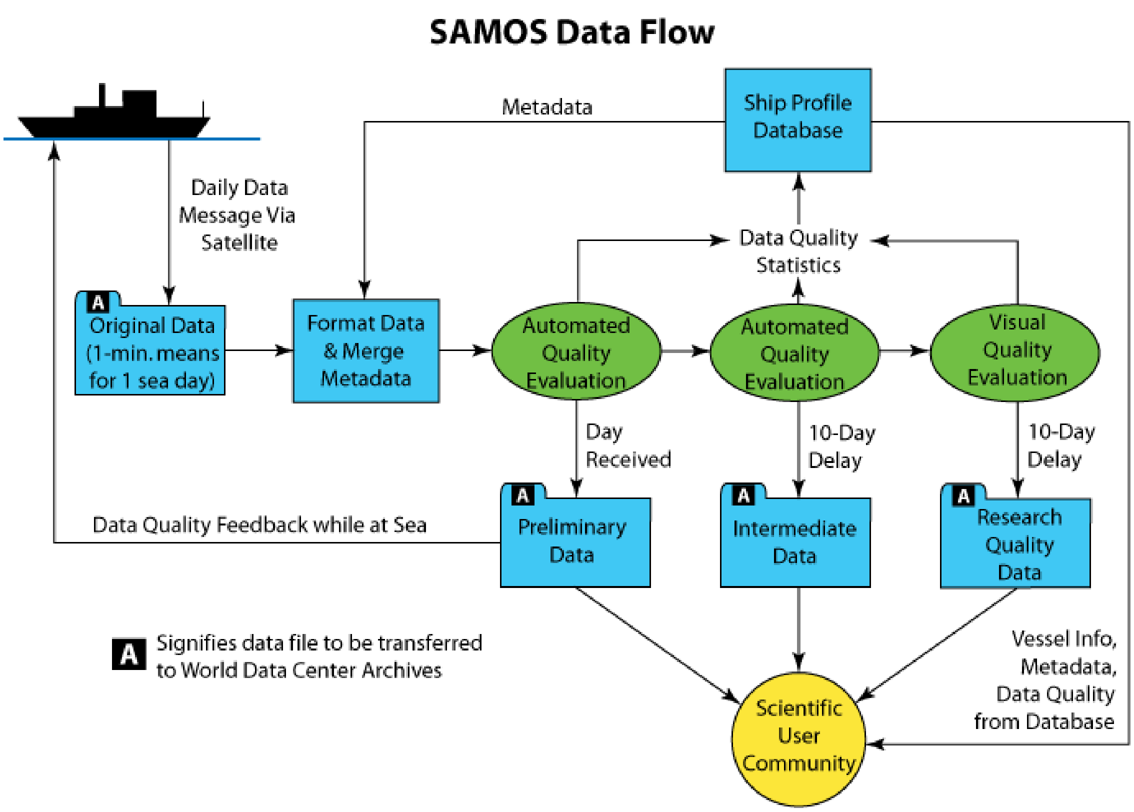


Figure 1: Diagram of operational data flow for the SAMOS initiative in 2012.

The quality results presented herein are from the research quality products, with the exception of data from the *Southern Surveyor, Aurora Australis, Tangaroa, Endeavor, Kilo Moana, Atlantic Explorer, Roger Revelle, Melville, New Horizon*, and the *Robert Gordon Sproul*. In the case of the *Southern Surveyor, Aurora Australis,* and *Tangaroa*, the IMOS project conducts their visual QC (only automated QC for these vessels occurs at the SAMOS DAC). For the *Endeavor, Kilo Moana, Roger Revelle, Melville, Robert*

Gordon Sproul, and *Atlantic Explorer,* current funding does not extend to cover visual QC of their data. Additionally, as of January 1, 2013 visual QC for the following vessels was discontinued, until such time as funding is extended to cover them: *Atlantis*, *Knorr*, *Oceanus*, *Nathaniel B. Palmer*, *Laurence M. Gould*, *Healy*, and *Polar Sea*. During 2012, 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 that remained problematic for extended periods (namely, the air temperature sensor onboard the *Roger Revelle*, one of the anemometers onboard the *Healy*, and the photosynthetically active radiation sensor onboard the *Gould*), and a z drive failure onboard the *Thomas G Thompson* that resulted in ceased data transmission for the rest of 2012 after only about a month of contribution. On a positive note, the long-standing issue with the atmospheric pressure sensor onboard the *Okeanos Explorer* was finally fixed on 03 July.

This report begins with an overview of the vessels contributing SAMOS observations to the DAC in 2012 (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 2013. Annexes include web interface instructions for accessing SAMOS observations (Annex A, part 1) and metadata submission by vessel operators (Annex A, part2), and complete snapshots of all vessels' metadata status (those that participated in 2012), as of each vessel's final month of data submission in 2012 (Annex B).

2. System review

In 2012, a total of 34 research vessels were under active recruitment to the SAMOS initiative; 29 of those vessels routinely provided SAMOS observations to the DAC (Table 1). The lack of any data in 2012 from the *Polar Sea* was the result of her not being deployed in 2012. In March 2012 stewardship of the *Oceanus* was transferred from WHOI to OSU and she underwent a major refit. The, *Oceanus* plans to return to SAMOS using the 2.0 data protocol, but this transition was not complete, hence the lack of any data in 2012. The *McArthur II* was not in operation in 2012 (C. Daniels, personal communication, 2013). The reasons for our not receiving data in 2012 from the *Rainier* and *Fairweather* were unknown at the time of writing this report.

In total, 4,942 ship days were received by the DAC for the January 1 to December 31 2012 period, resulting in 6,607,856 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 6,607,856 records received in 2012, a total of 139,825,167 distinct measurements were logged. Of those, 8,363,297 were assigned A-Y quality control flags – around 6 percent, a marginal improvement over 2011's approximate 6.4 percent – by the SAMOS DAC (see section 3a for descriptions of the QC flags). Measurements deemed "good data," through both automated and visual QC inspection, are assigned Z flags. The authors wish to note that the percentages of assigned A-Y quality control flags was roughly static (at around 6 percent) across 2010, 2011, and 2012. This consistency in percentages, when combined with the fact that the SAMOS data analyst has amassed four years of resident experience, now appears to clearly point to the data analyst's quality control methods having essentially stabilized. Additionally, recall that ten of the SAMOS vessels (the *Southern Surveyor, Aurora Australis, Tangaroa, Endeavor*, *Kilo Moana*, *Atlantic Explorer, Roger Revelle, Melville, New Horizon*, and the *Robert Gordon Sproul*) only underwent automated QC. (This is an increase over 2011's seven SAMOS vessels that only underwent automated QC.) None of these vessels' data was assigned any additional flags, nor were any automatically assigned flags removed via visual QC, which may also contribute to the balance.

SHIP NAME	CALL SIGN	# of Days	# of Vars	# of Records	# of A-Y Flags	# of All Flags
TOTAL	-	4,942	610	6,607,856	8,363,297	139,825,167
ROGER REVELLE	KAOU	353	25	493,891	450,822	11,395,097
ATLANTIS	KAQP	246	33	335,108	735,489	10,118,661
KNORR	KCEJ	292	31	414,344	1,407,720	11,877,801
T.G. THOMPSON	KTDQ	36	19	49,741	19,597	936,439
HEALY	NEPP	123	27	159,187	489,304	3,881,006
POLAR SEA	NRUO	0	22	-	-	-
SOUTHERN SURVEYOR	VLHJ	188	29	240,046	230,084	6,941,251
AURORA AUSTRALIS	VNAA	223	28	311,004	216,078	8,634,724
NATHANIEL B. PALMER	WBP3210	339	23	477,873	943,645	10,523,847
LAURENCE M. GOULD	WCX7445	247	23	354,846	835,110	8,157,138
ENDEAVOR	WCE5063	*3	26	*3,795	*18	*98,670
KILO MOANA	WDA7827	123	22	154,544	29,800	3,369,408
ATLANTIC EXPLORER	WDC9417	178	21	201,733	118,837	4,226,589
MELVILLE	WECB	323	22	434,785	179,382	8,651,074
NEW HORIZON	WKWB	147	27	196,000	126,087	5,210,038
ROBERT GORDON SPROUL	WSQ2674	76	18	53,019	22,410	927,592
HENRY B. BIGELOW	WTDF	154	18	193,518	166,906	3,124,934
OKEANOS EXPLORER	WTDH	134	16	175,927	256,393	2,809,957
PISCES	WTDL	174	15	236,063	432,768	3,531,537
OREGON II	WTDO	159	14	203,447	92,545	2,848,258
THOMAS JEFFERSON	WTEA	25	16	27,589	20,600	435,772
FAIRWEATHER	WTEB	0	14	-	-	-
RONALD H. BROWN	WTEC	69	16	91,762	63,133	1,462,684
BELL M. SHIMADA	WTED	148	24	190,501	291,714	4,125,179
OSCAR ELTON SETTE	WTEE	155	16	207,189	53,782	3,308,913
RAINIER	WTEF	0	14	-	-	-
MCARTHUR II	WTEJ	0	15	-	-	-
GORDON GUNTER	WTEO	184	16	250,825	200,223	4,013,200
OSCAR DYSON	WTEP	200	16	264,438	200,805	4,194,273
NANCY FOSTER	WTER	130	17	171,035	221,628	2,821,789
KA'IMIMOANA	WTEU	123	19	165,729	22,520	3,129,990
HI'IALAKAI	WTEY	153	16	209,386	239,546	3,302,656
OCEANUS	WXAQ	0	32	-	-	-
TANGAROA	ZMFR	237	17	340,531	316,969	5,766,690

Table 1: CY2012 summary table showing (column three) number of vessel days received by the DAC, (column four) number of variables reported per vessel, (column five) number of records received by DAC per vessel, (column six) total incidences of A-Y flags per vessel, (column seven) total incidences of A-Z flags per vessel. A "–" denotes information not available. *Note: counts for *Endeavor* are incomplete; vessel is the first to report in SAMOS 2.0 format, and 2.0 processing is not yet optimized.

a. Temporal coverage

As demonstrated in Figure 2, the files received by the DAC from each vessel are not often equally matched to the scheduled days reported by each institution. (*Note that complete CY2012 schedule information was not obtainable for the USCGC *Healy* and *Polar Sea*, nor 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.

In Figure 2, we directly compare the data we've received (green and blue) to final 2012 ship schedules provided by each vessel's institution. (*Note again that the schedules were not obtained for the *Tangaroa,* or the USCGC *Healy* and *Polar Sea*.) A "blue" day denotes that the data file was received well past the 10 day delayed-mode window (or otherwise entered the SAMOS processing system well past the window) and thus missed timely processing and visual quality control, although processing (and visual QC where applicable) were eventually applied. (It must be noted, though, that "late" data always incurs the risk of not being visually quality controlled, based on any time or funding constraints.) Days identified on the vessel institutions schedule for which no data was received by the DAC are shown in grey. Within the grey boxes, an italicized "*S*" indicates a day reportedly "at sea." It should be noted that the *Endeavor* (WCE5063) is the first vessel to participate in SAMOS2.0 and was undergoing SAMOS2.0 formatting for the bulk of 2012. *Endeavor* also was not able to be made active in the SAMOS processing system until early 2013. As such, a minimal number of data files were received for 2012 and were not actually processed until 2013. It should also be noted that *New Horizon* and *Robert Gordon Sproul* were not recruited and made active in the SAMOS system until mid April 2012, and likewise the *T.G. Thompson* in early June 2012 and the *Thomas Jefferson* in late July 2012, such that any preceding "at sea" days would not be anticipated to be in the SAMOS data system. Regarding the *Jefferson*, SAMOS programming issues also prohibited any 2012 data from being ingested until early 2013. All data received for 2012, with the exception of the *Tangaroa*, *Southern Surveyor,* and the *Aurora Australis*, has been archived at the NODC. Through agreement with IMOS, we receive data for the *Tangaroa*, *Southern Surveyor*, and the *Aurora Australis* and for these vessels perform automated QC only. IMOS data is visually evaluated in Australia and archived within the IMOS DAC-eMarine Information Infrastructure (eMII).

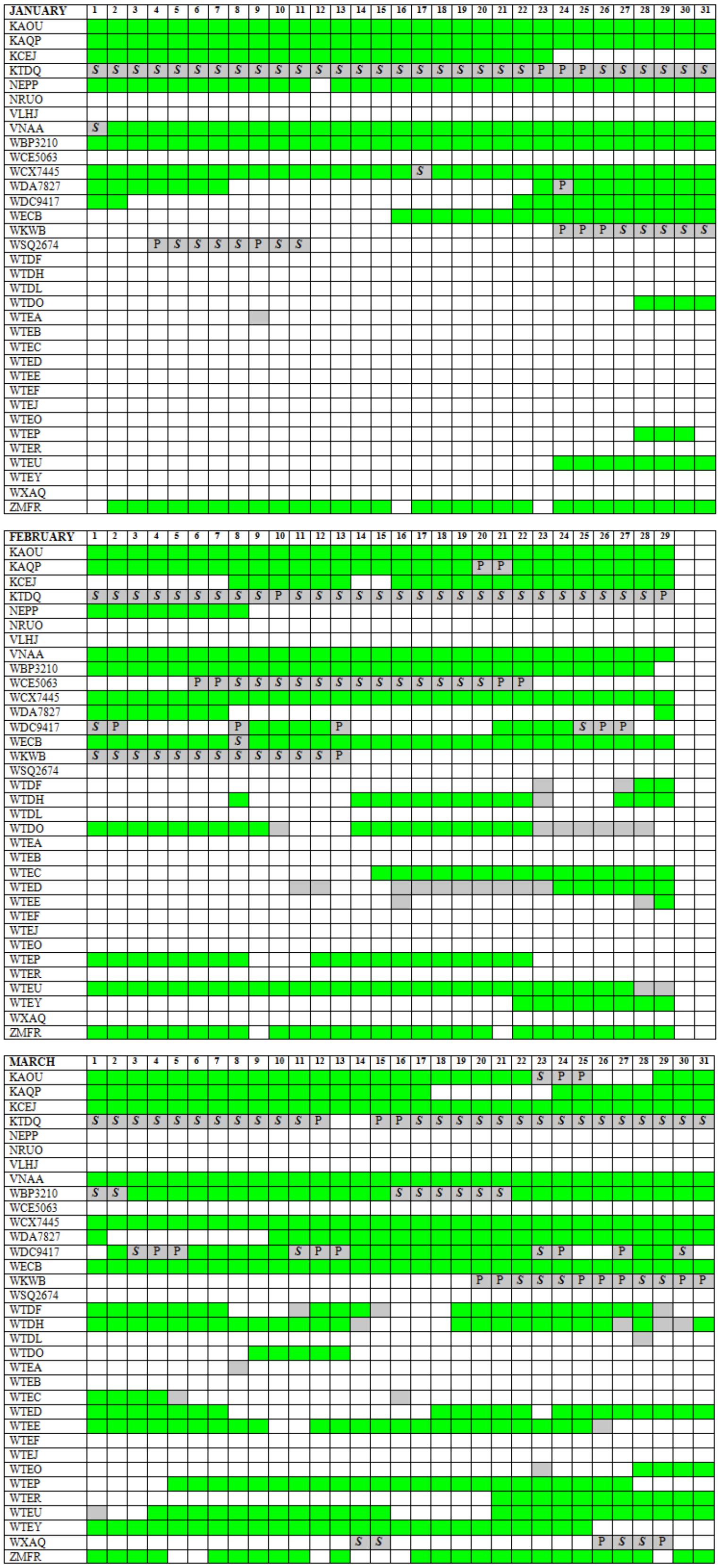
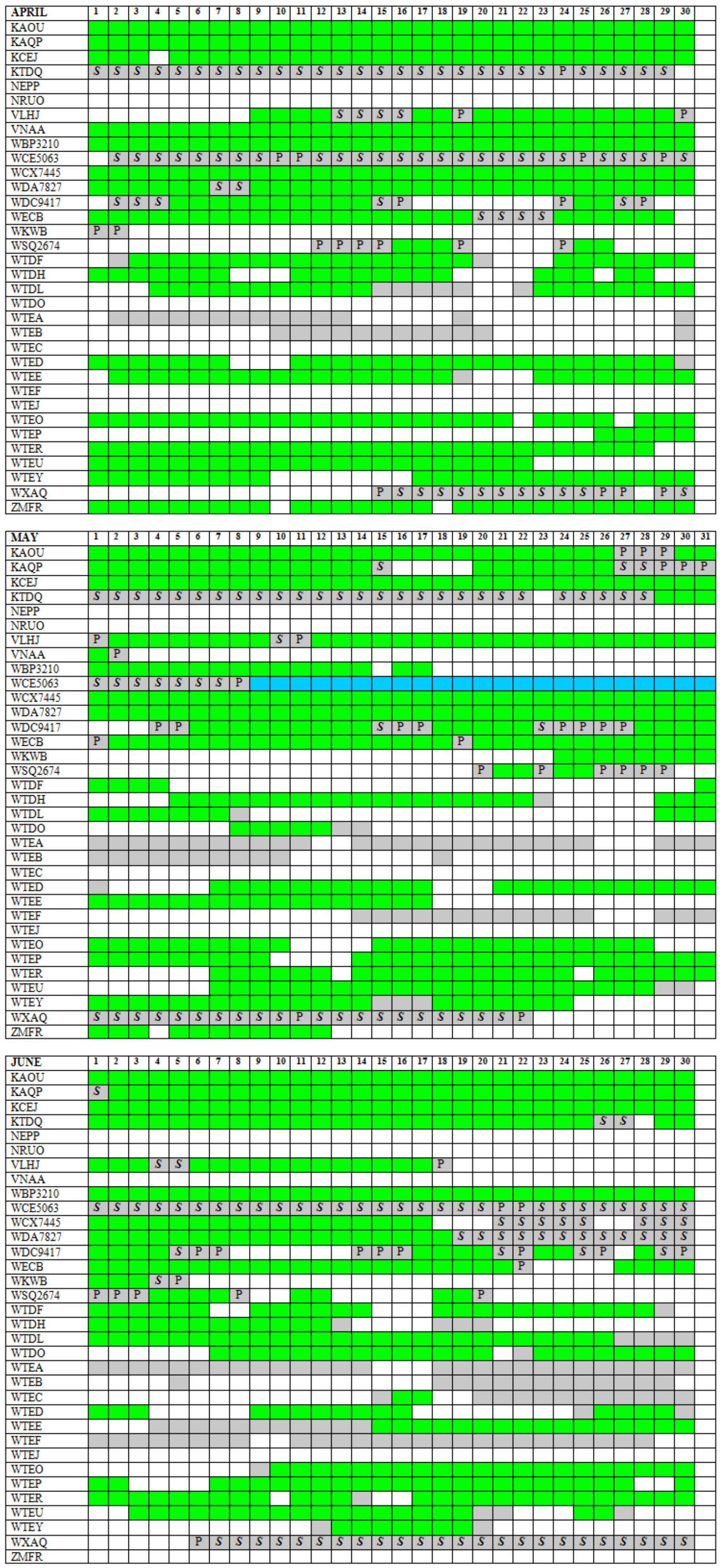


Figure 2: 2012 calendar showing (green and blue) ship days received by DAC and (grey) additional days reported afloat by vessels; "*S*" denotes vessel reportedly at sea, "P" denotes vessel reportedly at port. Vessels are listed by call sign (see Table 1).



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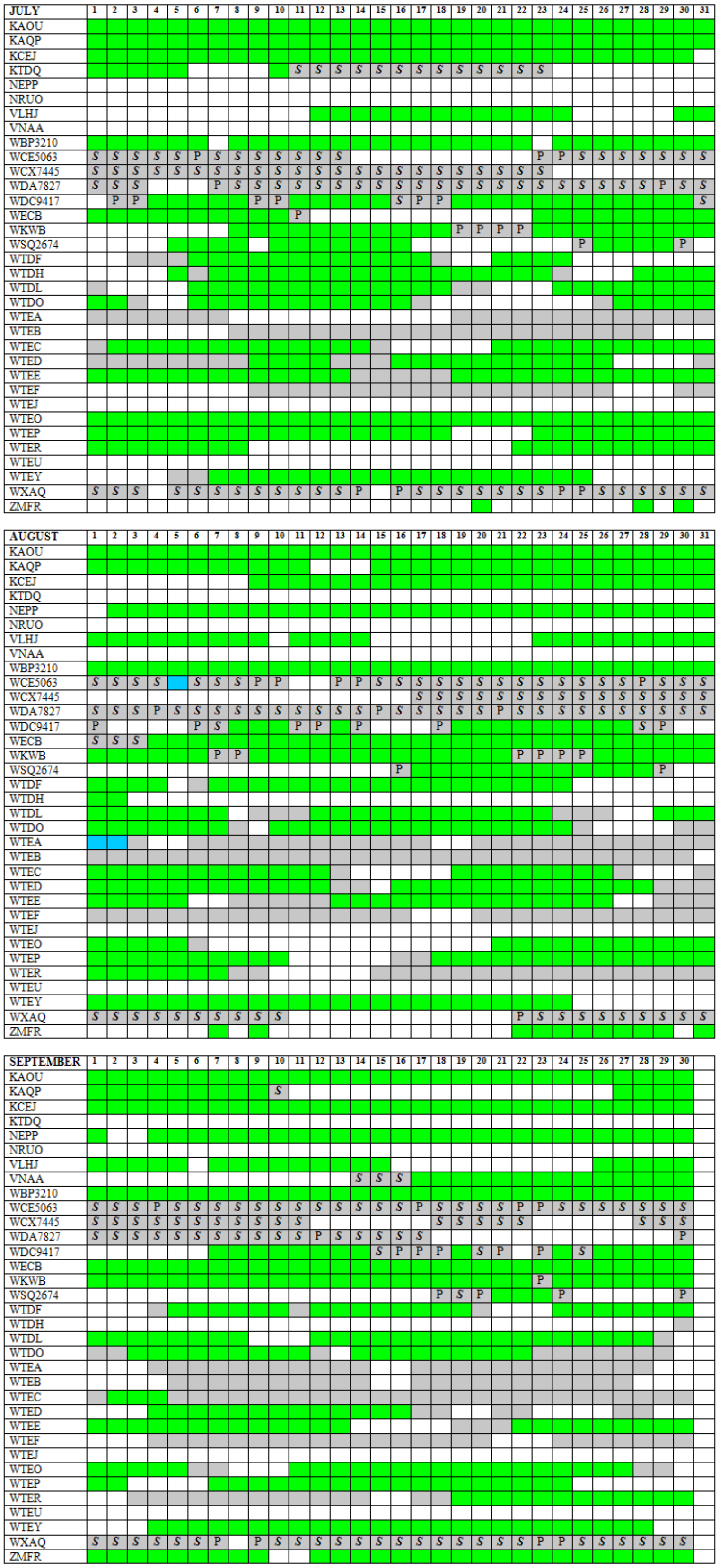

(Figure 2: cont'd)

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	S	P	P	S																											
KAQP																						S	S	S	S	S					
KCEJ																															
KTDQ																															
NEPP																															
NRUO																															
VLHJ																															
VNAA																															
WBP3210																															
WCE5063						S	S	S	S	S	P	S	S	S	S							P	P	S	S	S	S	S	S	S	S
WCX7445	S	S	S	S						S	S	S				S															
WDA7827	S	S	S	S	P	S	S	S	S	S	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
WDC9417													P		S	S	P					S	P							P	S
WECB																															
WKWB																															
WSQ2674	P											P																			
WTDF																															
WTDH																															
WTDL																															
WTDO																															
WTEA																															
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WTEJ																															
WTEO																															
WTEP																															
WTER																															
WTEU																															
WTEY																															
WXAQ	S	S	P	P	S	S	S	S	S	S	S	S	S	S	S	S	P	P	S	S	S	S	P		S	S	S	S	S	S	S
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																															
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KCEJ																															
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NEPP																															
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VLHJ																															
VNAA																P	P														
WBP3210																															
WCE5063	S	S	S	P			P	P	S	S	S	S	S	S	S	S	S	S	S	S	P	P					P	S	S	S	
WCX7445																															
WDA7827	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
WDC9417	S	P					S	P				P	S	S	S	S	S	S	P	P	P									S	
WECB																															
WKWB																															
WSQ2674		P											P			S											S		P		
WTDF																															
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WTDO																															
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WTER																															
WTEU																															
WTEY																															
WXAQ	S	S	S	P																											
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																															
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WBP3210																															
WCE5063	S	S	S	S	S	S	P																								
WCX7445																															
WDA7827	P	S	S	S	S	S	P	S	S	S	S	S	P	S	S	S	S	S													
WDC9417	P						P	P	P						S	P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
WECB															S																
WKWB																															
WSQ2674																			P												
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WXAQ																															
ZMFR																															

(Figure 2: cont'd)

b. Spatial coverage

Geographically, SAMOS data for 2012 is fairly comprehensive. Cruise coverage for the January 1, 2012 to December 31, 2012 period (Figure 3) includes occurrences poleward of both the Arctic (*Healy*) and Antarctic (*Aurora Australis, Palmer,* and *Gould*) circles, additional exposure in Alaskan waters (*Oscar Dyson*), occurrences at Cape Horn, Africa and a transit along the western Latin American coastline (*Melville*), samples along the northern Caribbean island coastlines, from Cuba to Puerto Rico (*Nancy Foster* and *Pisces*), and the Indian Ocean (*Roger Revelle*), and a sizable area in the South Pacific (*Southern Surveyor*, *Tangaroa*). The *Atlantis* provided data from the northeast coastline of South America, and the *Knorr* provided data from the north Atlantic between Greenland and Iceland. Natively, the western coastal United States is covered by the *Bell M. Shimada* and the *New Horizon*, and the eastern coastal United States is heavily covered by the *Henry Bigelow*, *Okeanos Explorer*, and *Ron Brown*, 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 *Kilo Moana*, as well as the *Ka'imimoana* and *Hi'ialakai,* both of which routinely cruise to the Hawai'ian waters from their home port in Seattle. Naturally, Bermuda is well-covered by the *Atlantic Explorer*.

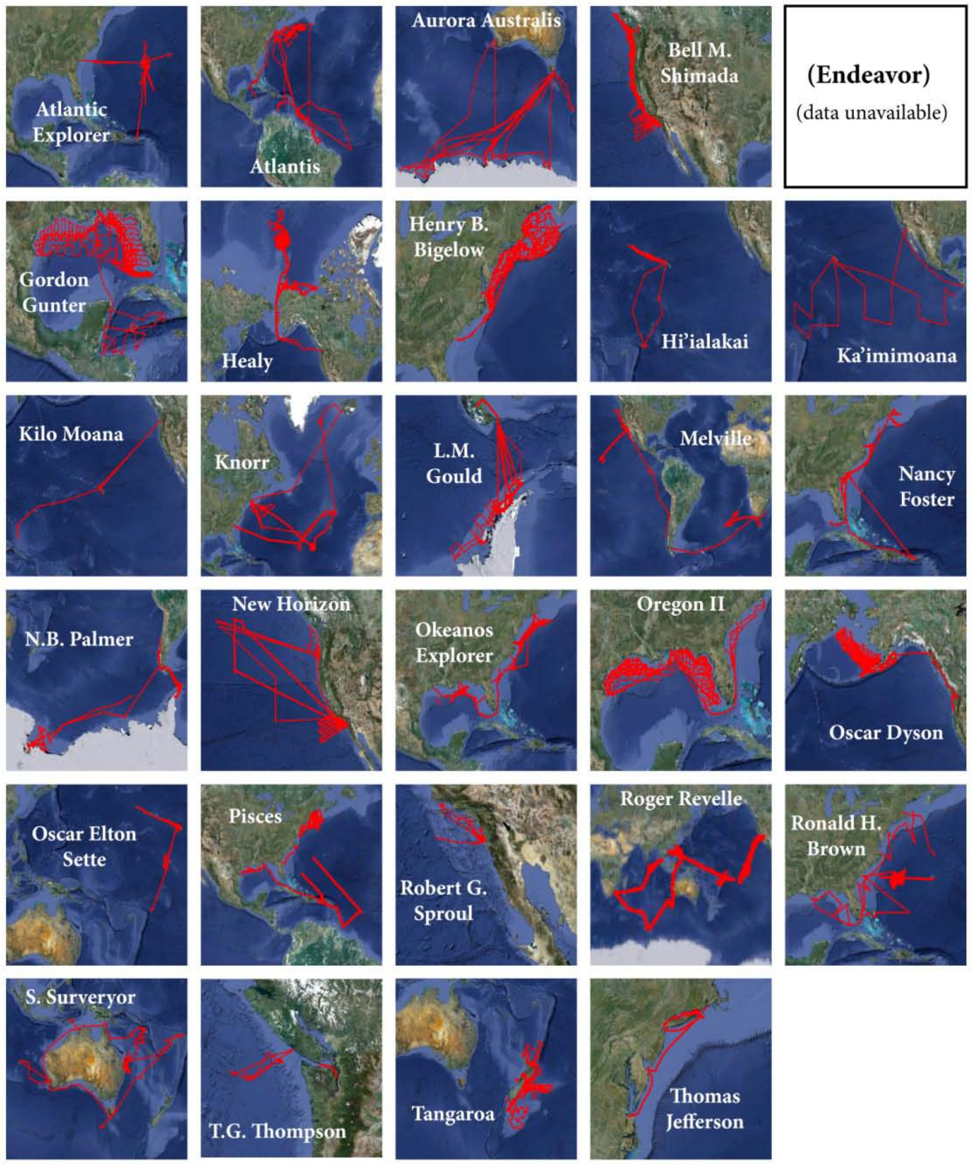


Figure 3: Cruise maps plotted for each vessel in 2012.

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, in 2012 processing of dew point temperature was enabled by the DAC and dew point data were provided by two vessels (*Healy* and *Roger Revelle*). A quick glance at Table 3 (located in Section 4) shows which parameters are reported by each vessel: those boxes in columns 6 through 26 with an entry indicate a parameter was reported and processed in 2012. (Further detail on Table 3 is discussed in Section 4.) Some vessels furnish redundant sensors, which can be extremely helpful for visually assessing data quality. Again referring to Table 3, those boxes in columns 6 through 26 with multiple entries indicate the number of redundant sensors reported and processed in 2012; boxes with a single entry indicate the existence of a single sensor.

3. Data quality

a. SAMOS quality control

Definitions of A-Z SAMOS quality control flags are listed in Table 2. It should be noted that no secondary automated QC was active in 2012 (SASSI), so quality control flags U-Y were not in use. If a coded variable does not contain an integer pointer to the flag attribute it is assigned a "special value" (set equal to -8888). A special value may also be set for any overflow value that does not fit the memory space allocated by the internal SAMOS format (e.g., character data value received when numeric value was expected). A "missing value" (set equal to -9999) is assigned for any missing data across all variables except time, latitude, and longitude, which must always be present. In general, visual QC will only involve the application of quality control flags H, I, J, K, M, N and S. Quality control flags J, K, and S are the most commonly applied by visual inspection, with K being the catchall for the various issues common to most vessels, such as (among others) steps in data due to platform speed changes or obstructed platform relative wind directions, data from sensors affected by stack exhaust contamination, or data that appears out of range for the vessel's region of operation. M flags are primarily assigned when there has been communication with vessel personnel in which they have dictated or confirmed there was an actual sensor malfunction. Port (N) flags are reserved for the latitude and longitude parameters and don't necessarily imply a problem. The port flag is applied to indicate the vessel is in port and may be combined with flags on other parameters to note questionable data that are likely attributable to dockside structural interference or, as in the case of sea temperature, the fact that some apparatus are habitually turned off while a vessel is in port. SAMOS data analysts may also apply Z flags to data, in effect removing flags that were applied by automated QC. For example, B flagging is dependent on latitude and occasionally a realistic value is assigned a B flag simply because it occurred very close to a latitude boundary. This happens with sea temperature from time to time in the extreme northern Gulf of Mexico – TS values of 32˚C or 33ºC are not unusual there in the summer, but portions of the coastline are north of 30 degrees latitude and thus fall into a region where such high temperature are coded as "out of bounds." In this case the B flags would be removed by the data analyst and replaced with good data (Z) flags.

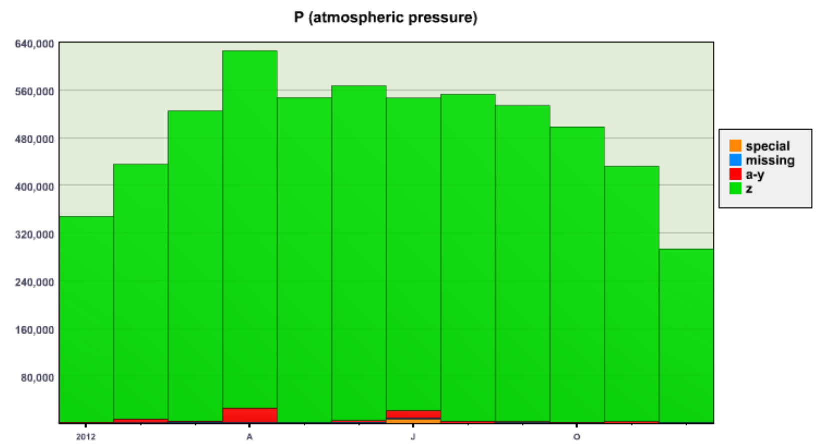
Flag	Description
A	Original data had unknown units. The units shown were determined using a climatology or some other method.
B	Original data were out of a physically realistic range bounds outlined.
C	Time data are not sequential or date/time not valid.
D	Data failed the T>=Tw>=Td test. In the free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

Table 2: Definitions of SAMOS quality control flags

b. 2012 quality across-system

This section presents the overall quality from the system of ships providing observations to the SAMOS data center in 2012. 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. 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. One vessel in particular, *Okeanos Explorer*, received a large quantity of K and J flags through July 2012 due to readings that were consistently a few millibars off (documented; see individual vessel description in section 3c for details).



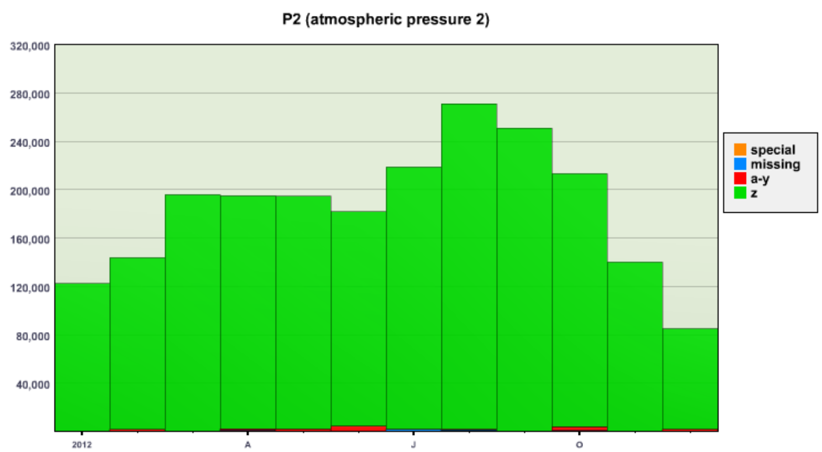
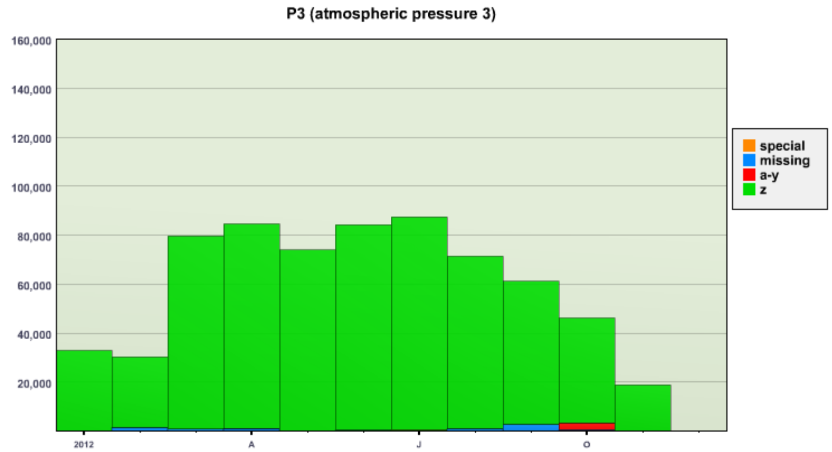


Figure 4: Total number of (top) atmospheric pressure – P – (bottom) atmospheric pressure 2 – P2 – and (next page) atmospheric pressure 3 – P3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS 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). An increase of flagging of T in March is likely due a T sensor failure onboard the *Revelle* that lasted the better part of the month (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.

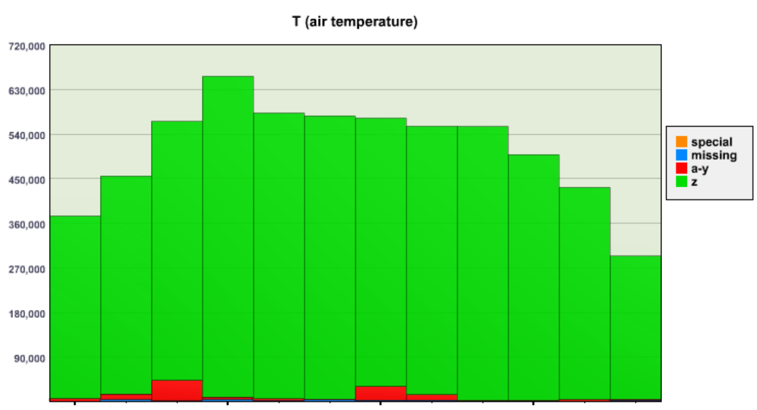
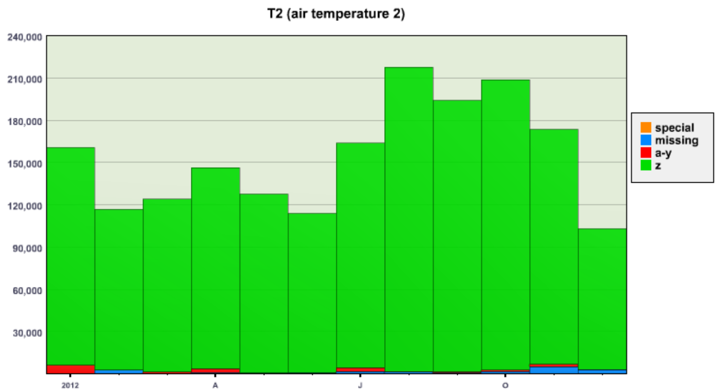
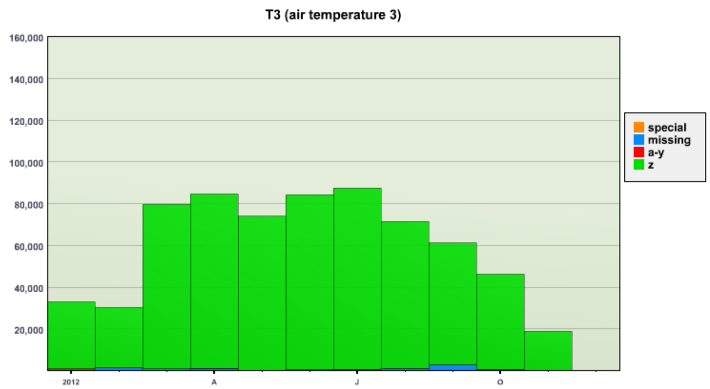


Figure 5: Total number of (this page) air temperature – T – (next page, top) air temperature 2 – T2 – and (next page, bottom) air temperature 3 – T3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of 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).

Dew point temperature is only available from a few vessels; namely, the *Healy*, the *Melville*, the *Thomas Jefferson*, and the *Roger Revelle*. It's important to note that the large increase in flagging of TD in March is actually due to the *Revelle's* air temperature data being of poor quality for that month. If the *Revelle* had been a vessel that receives visual quality control, the flags on TD likely would have been removed (again, see individual vessel description in section 3c for details).

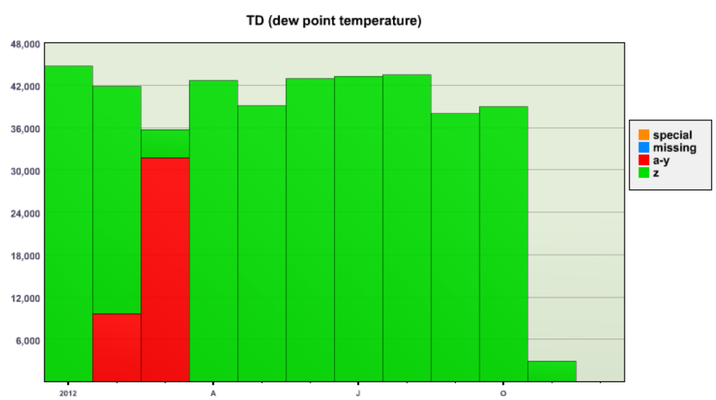
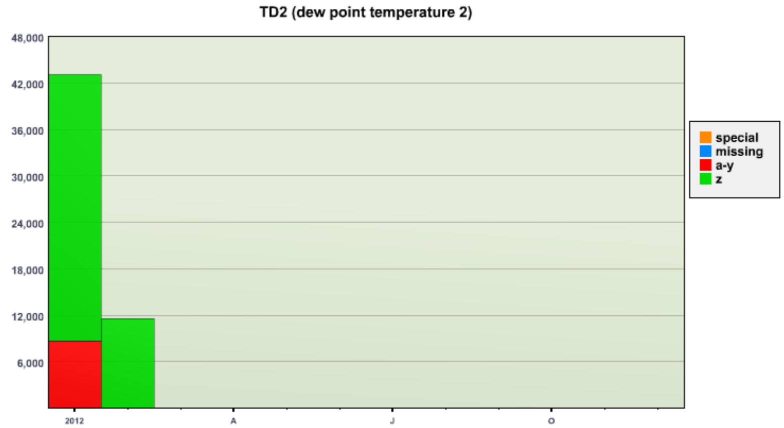


Figure 6: Total number of (this page) dew point temperature – TD – and (next page) dew point temperature 2 – TD2 –observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



(Figure 6: Cont'd)

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 7. Another point to consider is that, because RH sensors tend to be prone to more problems at sea (e.g. salt build up, supersaturation of sensor, sea spray, etc.), month to month flagging of RH data tends to experience greater variability than with other sensors.

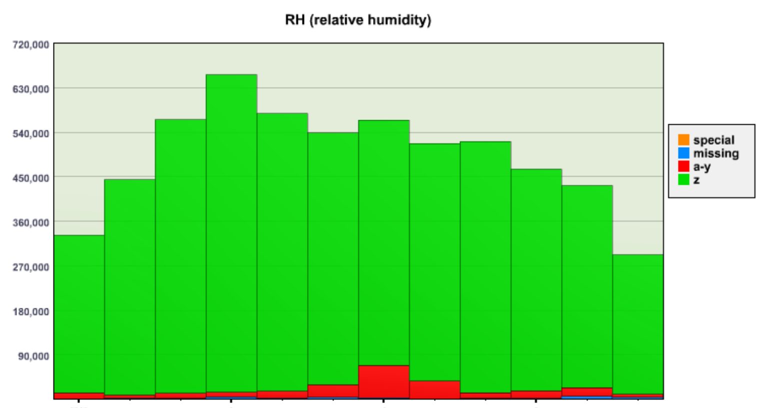
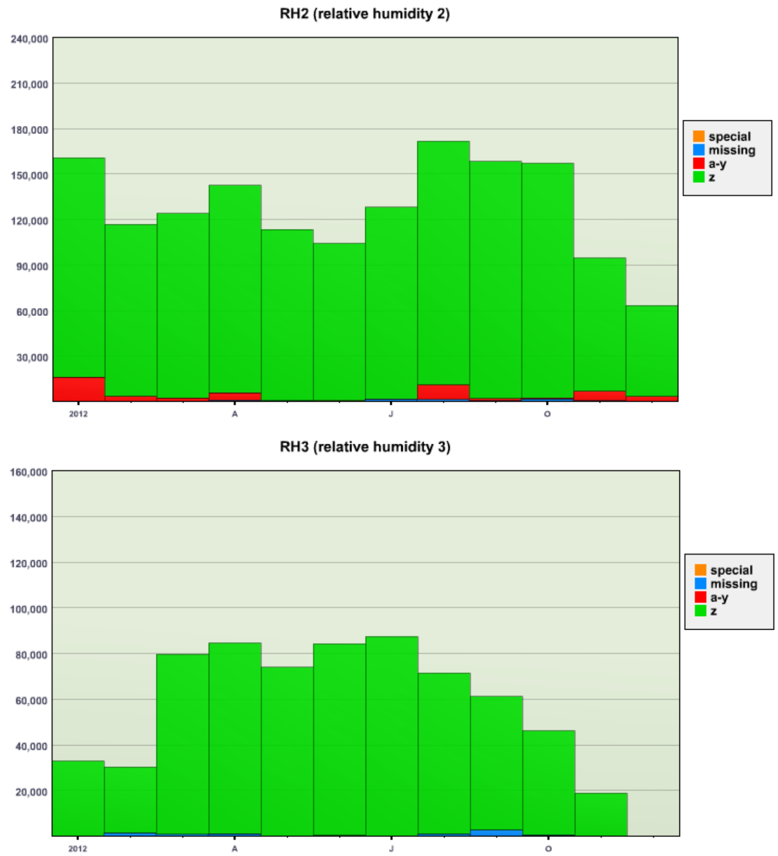


Figure 7: Total number of (this page) relative humidity – RH – (next page, top) relative humidity 2 – RH2 – and (next page, bottom) relative humidity 3 – RH3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed 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 7: Cont'd)

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 the most common problems across SAMOS vessels in 2012.

The overall quality of the 2012 SAMOS wind data was nonetheless good, as shown in Figures 8 (earth relative wind direction) and 9 (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.

The other major problem with earth relative wind data is errors caused by changes in platform speed. Figure 95 in the next section shows the spikes and steps that can occur in SPD and the spikes that can occur in DIR when the platform speed changes. Occasionally, a wind direction sensor is also suspected of being "off" by a number of degrees. Historically, SAMOS data analysts had access to global gridded wind data from the space-based QuikSCAT scatterometer with which to compare true wind speed and direction measurements. However, the QuikSCAT product terminated in late 2009 when the satellite failed in orbit. In general, if a technician suspects a wind direction bias it is critical they communicate that suspicion to SAMOS personnel, as otherwise the data analysts often will have no reliable means of discovering the problem themselves. Suspected wind direction biases are typically flagged with K flags, or J flags if the case is extreme and/or verifiable.

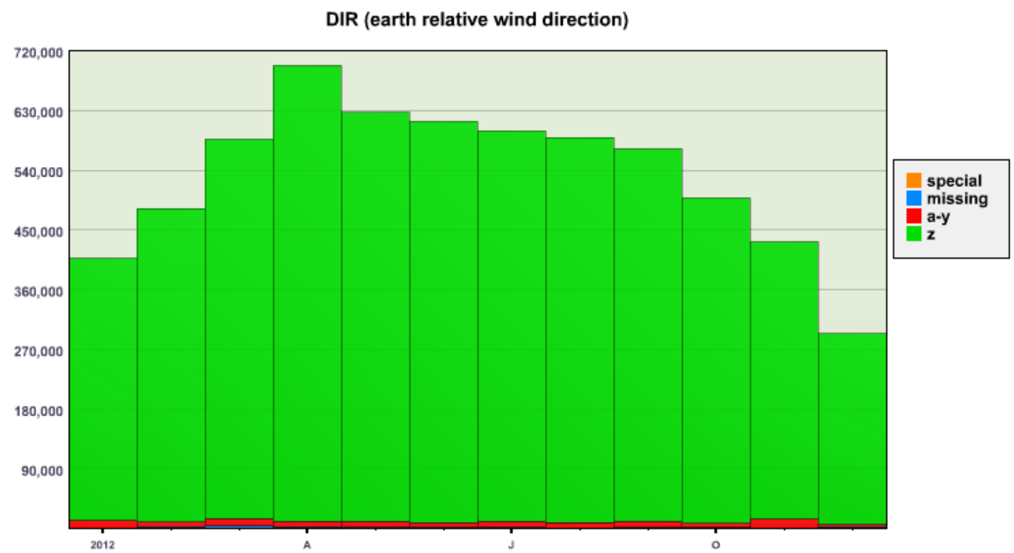
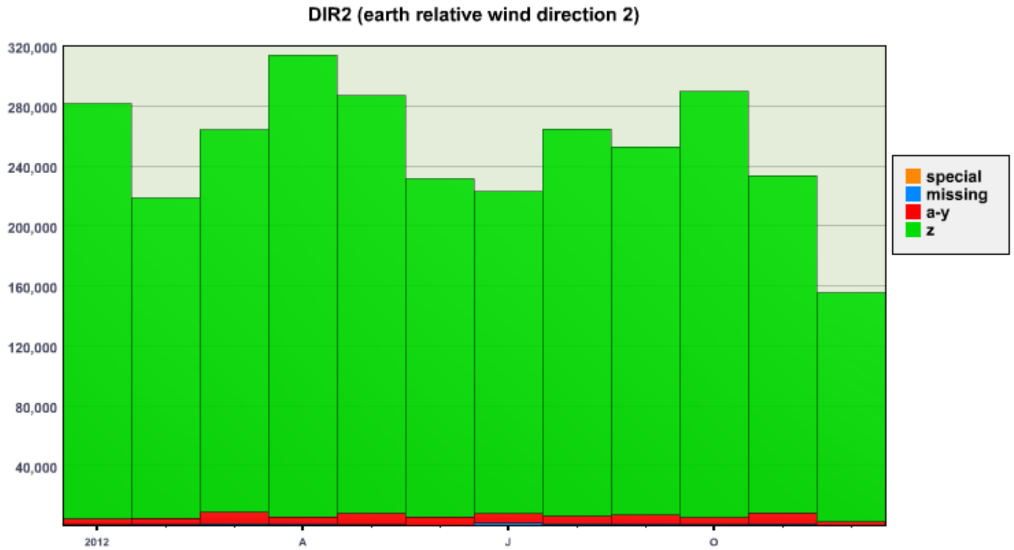
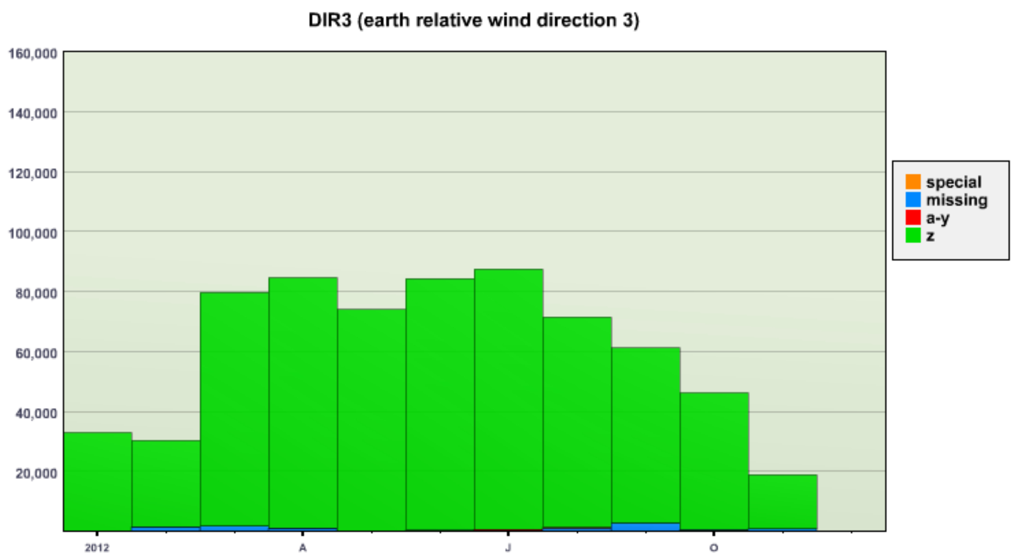


Figure 8: Total number of (this page) earth relative wind direction – DIR – (next page, top) earth relative wind direction 2 – DIR2 – and (next page, bottom) earth relative wind direction 3 – DIR3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) 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 8: Cont'd)

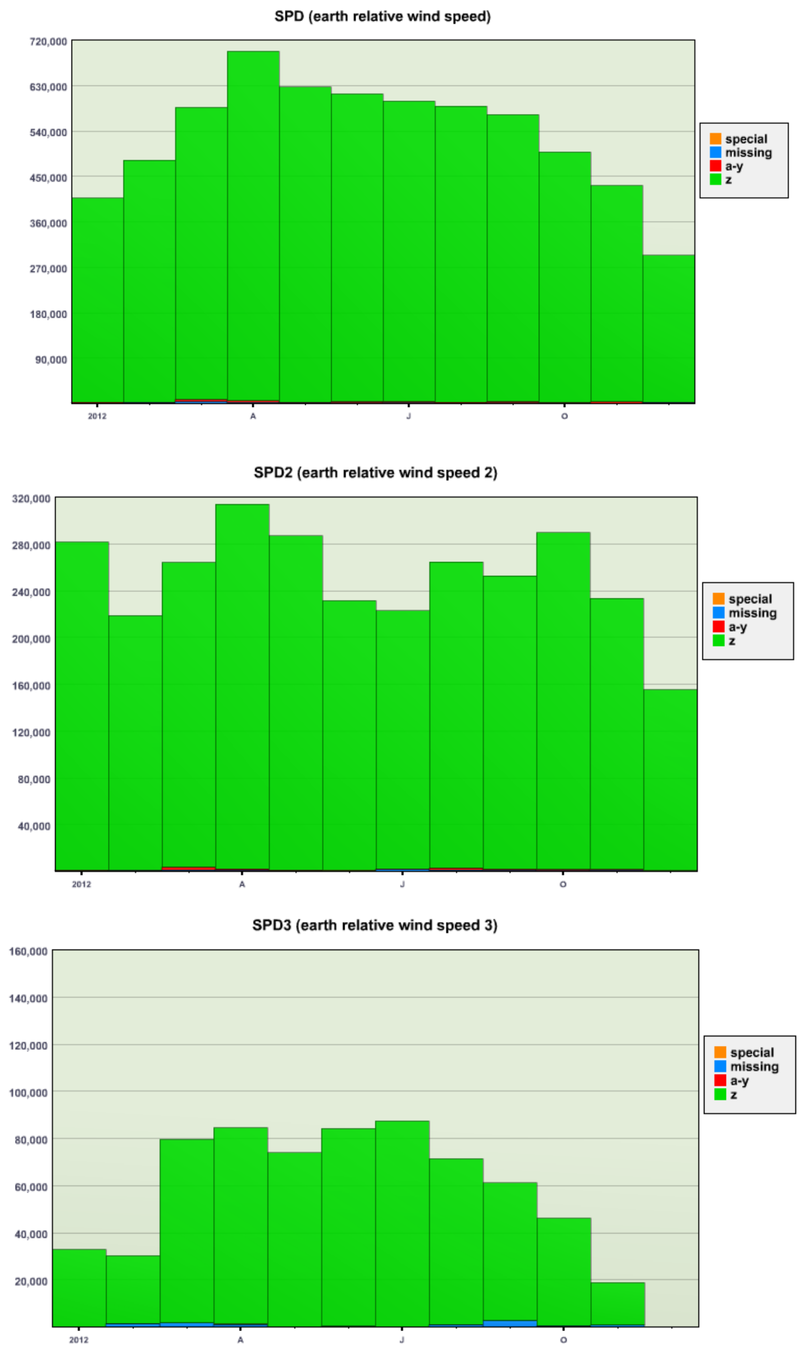
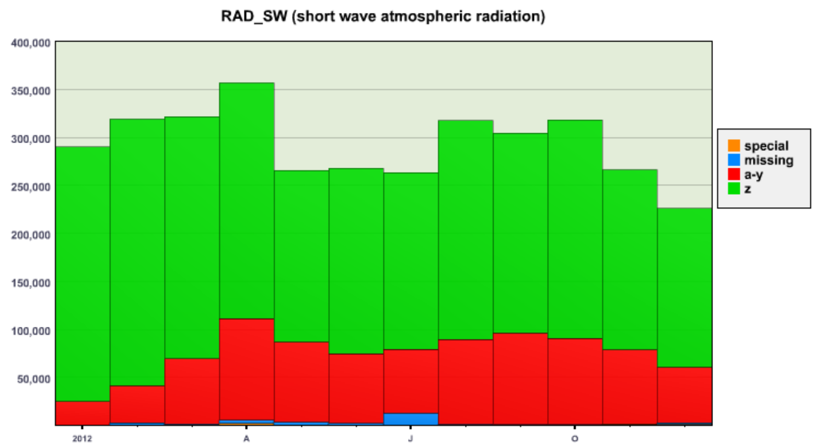


Figure 9: Total number of (top) earth relative wind speed – SPD – (middle) earth relative wind speed 2 – SPD2 – and (bottom) earth relative wind speed 3 – SPD3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed 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 10). 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 11). Overall quality for photosynthetically active atmospheric radiation and net atmospheric radiation also appears quite good (Figures 12, and 13, respectively), aside from a sizable number of B flags applied specifically to the *Laurence M. Gould's* RAD_PAR throughout most of 2012 (see next section for details).



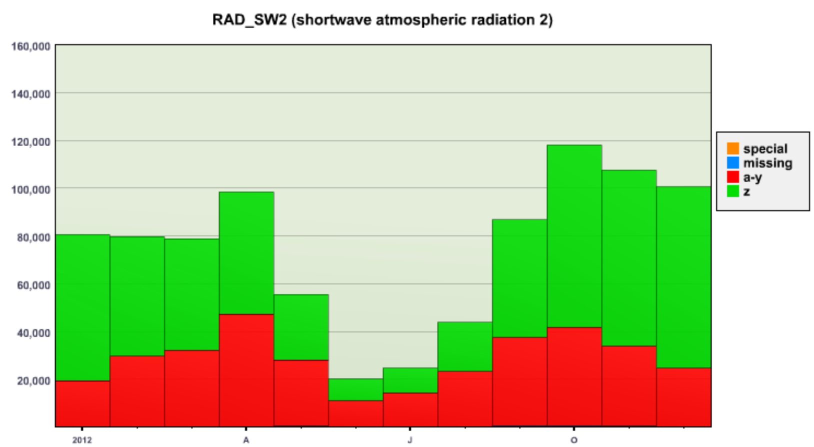
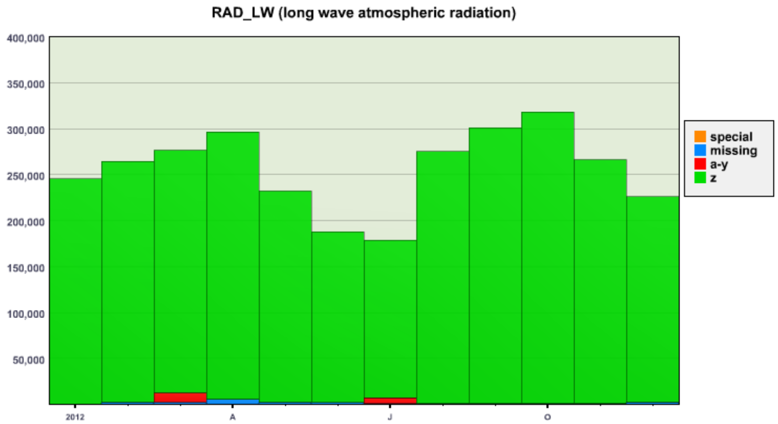


Figure 10: Total number of (top) shortwave atmospheric radiation – RAD_SW – and (bottom) shortwave atmospheric radiation 2 – RAD_SW2 –observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



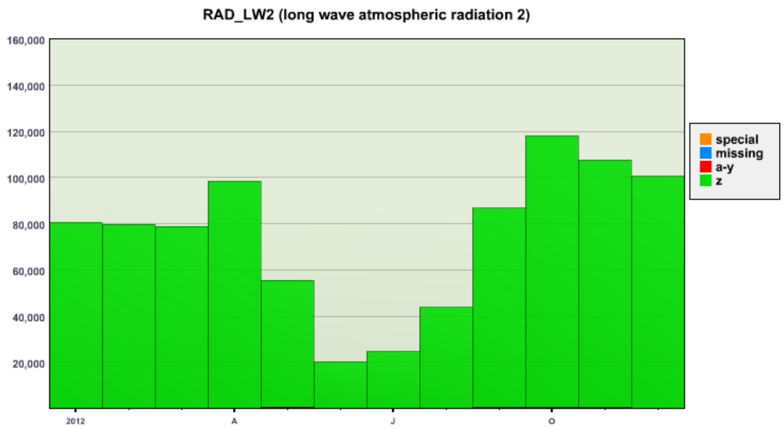


Figure 11: Total number of (top) long wave atmospheric radiation – RAD_LW – and (bottom) long wave atmospheric radiation 2 – RAD_LW2 –observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

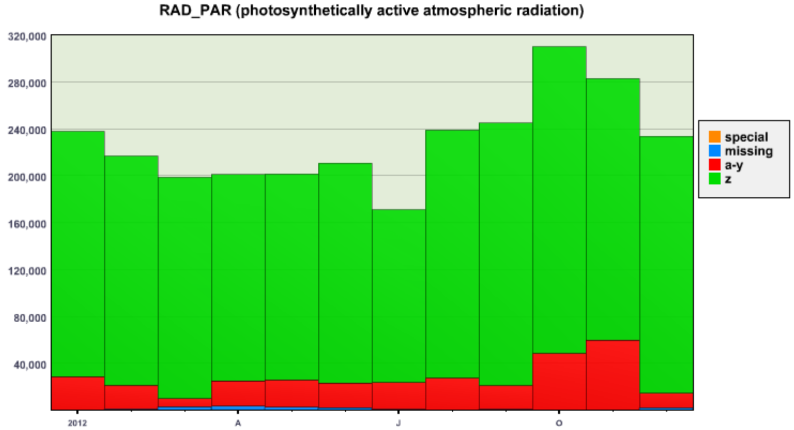
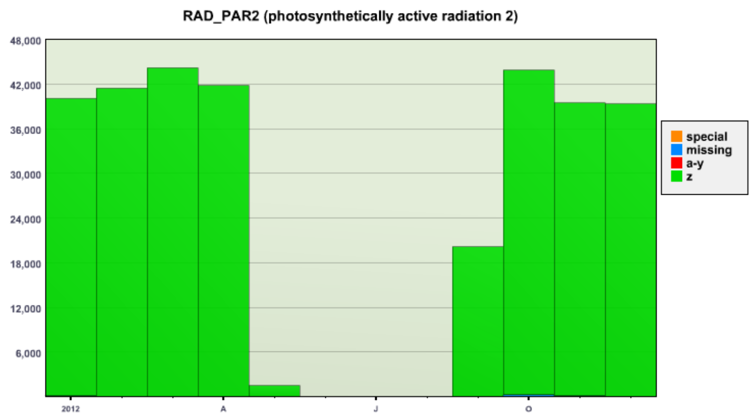


Figure 12: Total number of (this page) photosynthetically active atmospheric radiation – RAD_PAR – and (next page) photosynthetically active atmospheric radiation 2 – RAD_PAR2 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the 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: cont'd)

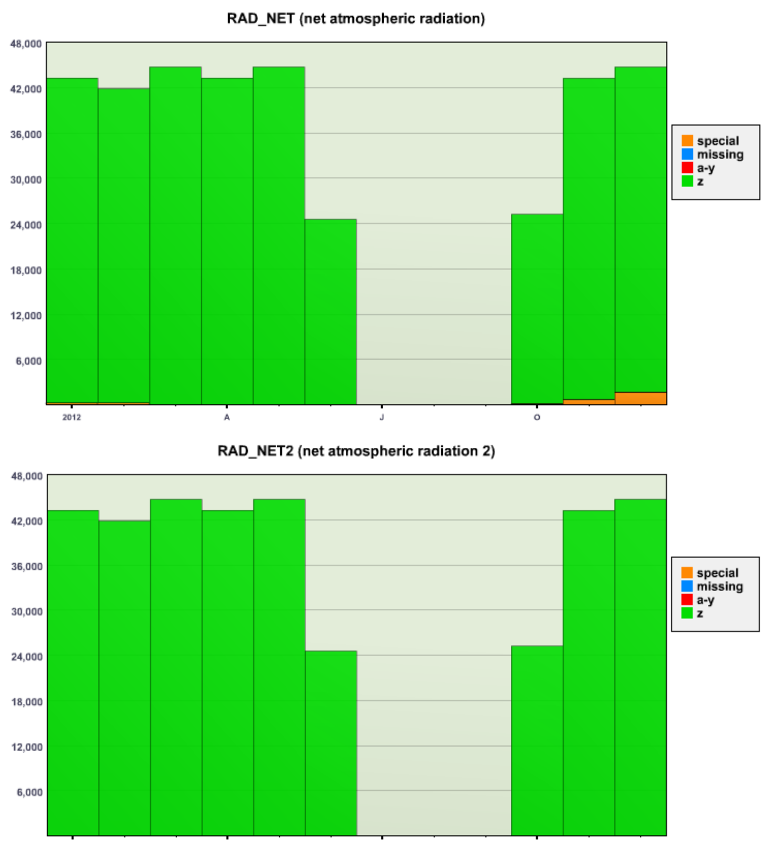


Figure 13: Total number of (top) net atmospheric radiation – RAD_NET – and (bottom) net atmospheric radiation 2 – RAD_NET2 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). 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 14) or precipitation accumulation (Figure 15) parameters. It should also be noted that some accumulation sensors will occasionally exhibit slow leaks and/or evaporation. These data are not typically flagged; nevertheless, frequent emptying of precipitation accumulation sensors is always advisable.

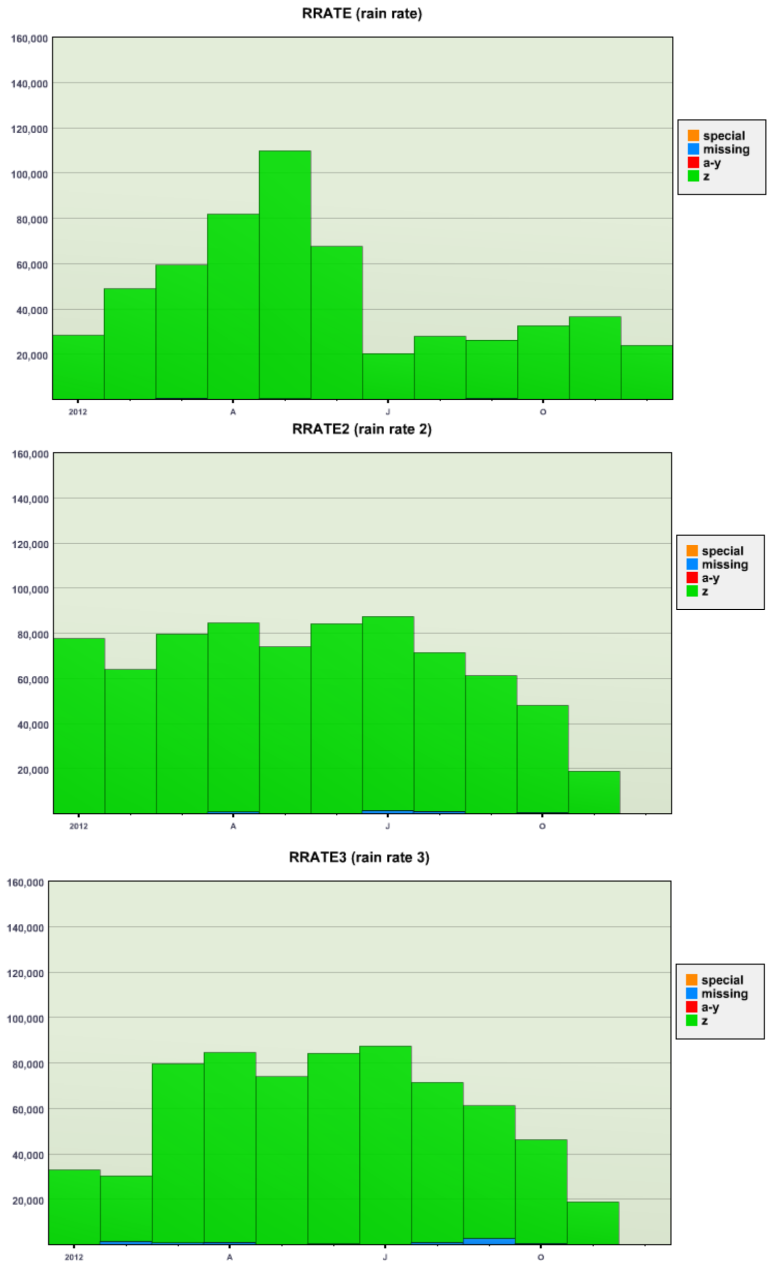


Figure 14: Total number of (top) rain rate – RRATE – (middle) rain rate 2 – RRATE2 – and (bottom) rain rate 3 – RRATE3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

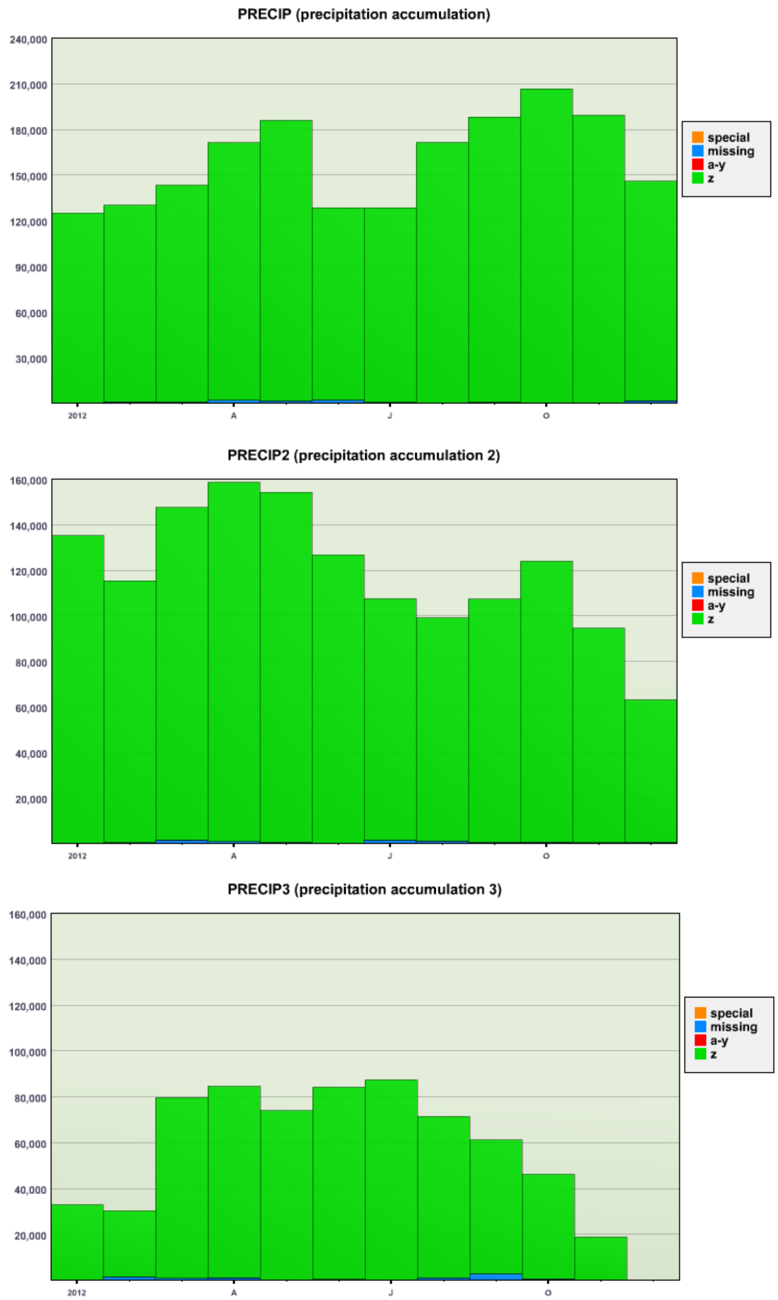


Figure 15: Total number of (top) precipitation accumulation – PRECIP – (middle) precipitation accumulation 2 – PRECIP2 – and (bottom) precipitation accumulation 3 – PRECIP3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values 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 16) 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. This fact probably also partially explains the increases in flagging of TS2 in January, October, and December, as the Woods Hole vessels *Knorr* and *Atlantis* were mostly laid up in those months and typically transmit their port data (including sea parameters while the flow water system is not running).

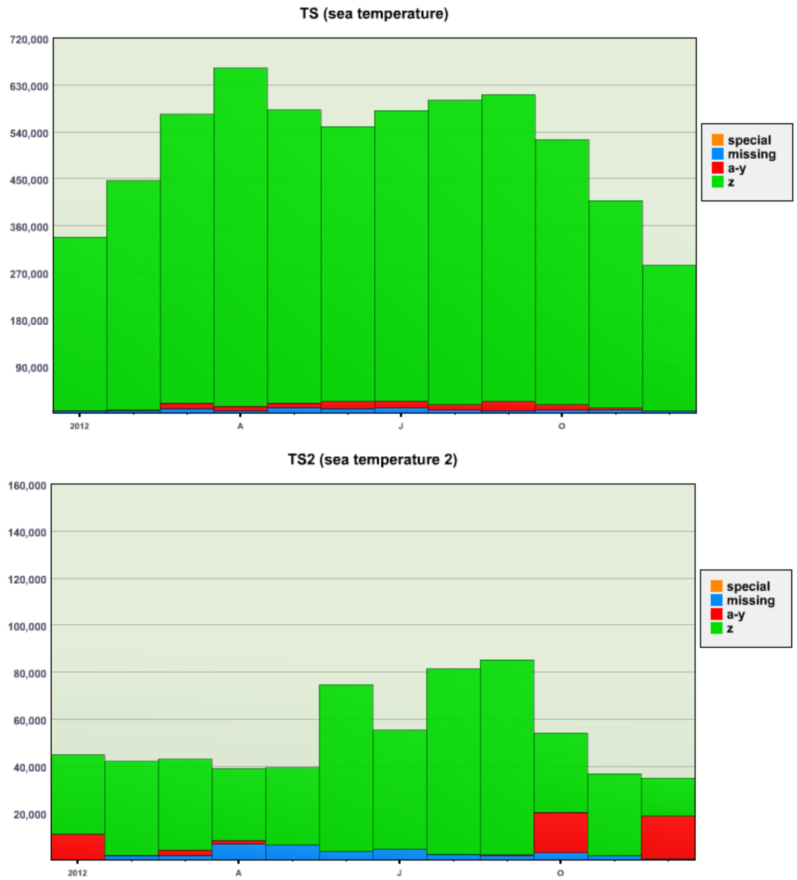
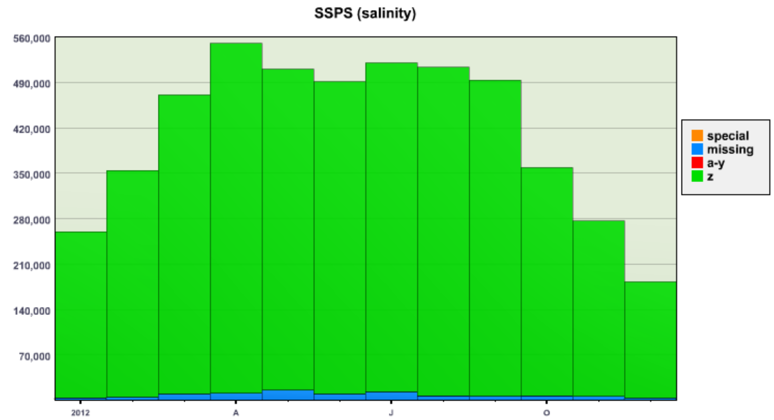


Figure 16: Total number of (top) sea temperature – TS – and (bottom) sea temperature 2 – TS2 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Salinity and conductivity (Figures 17 and 18, respectively) experienced the same major issue as sea temperature; namely, when a vessel was in port or ice the flow water system that feeds the probes was usually shut off, resulting in either inappropriate or static values. In spite of this issue, though, salinity and conductivity data 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.



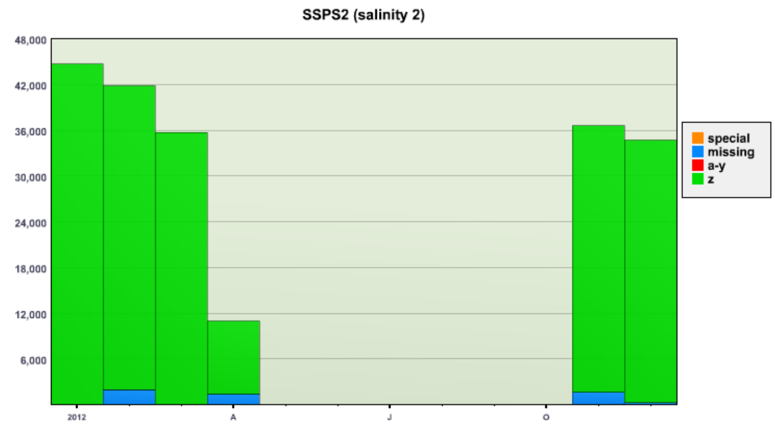


Figure 17: Total number of (top) salinity – SSPS – and (bottom) salinity 2 – SSPS2 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

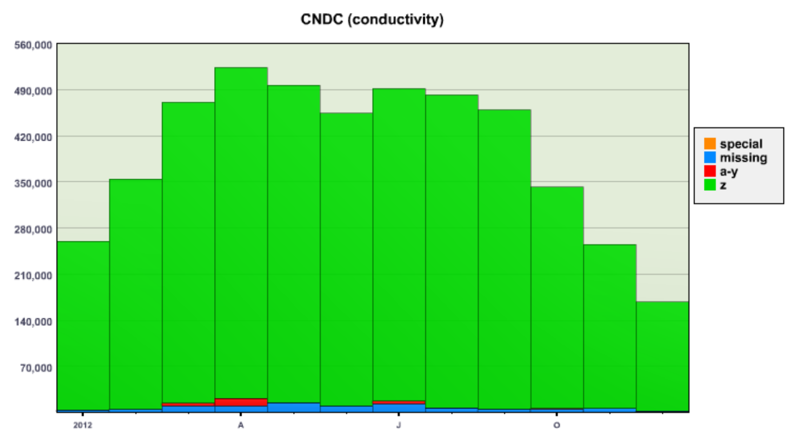
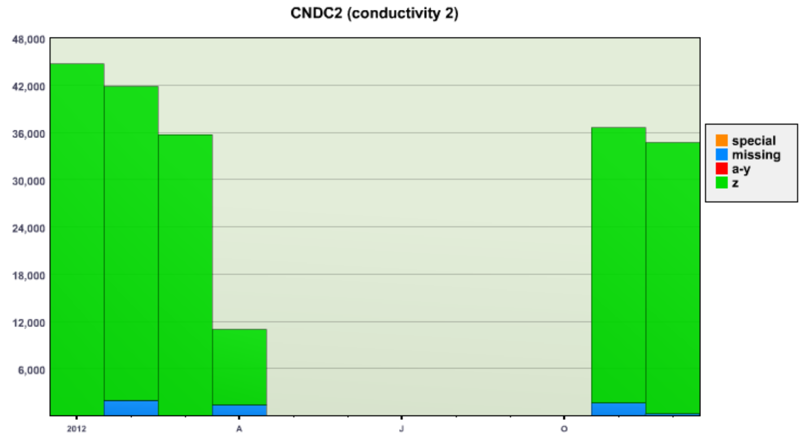


Figure 18: Total number of (this page) conductivity – CNDC – and (next page) conductivity 2 – CNDC2 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



(Figure 18: cont'd)

Latitude and longitude (Figure 19) 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 2012 was a two-minute grid.

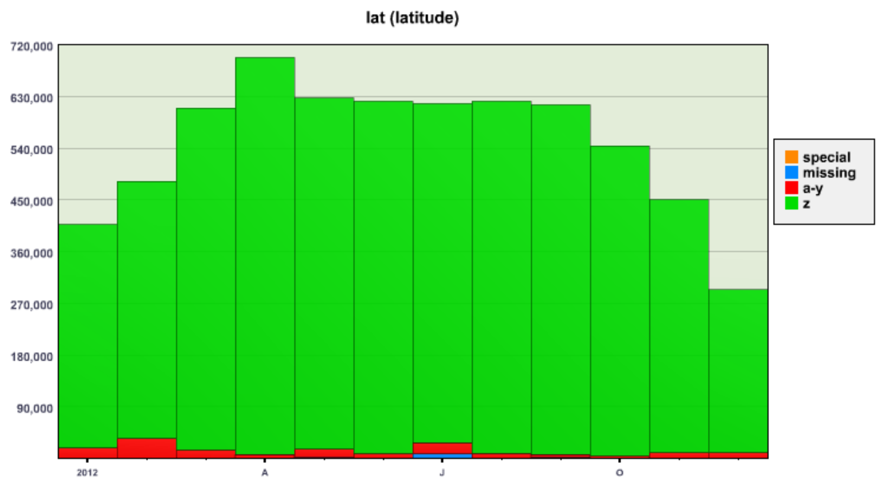
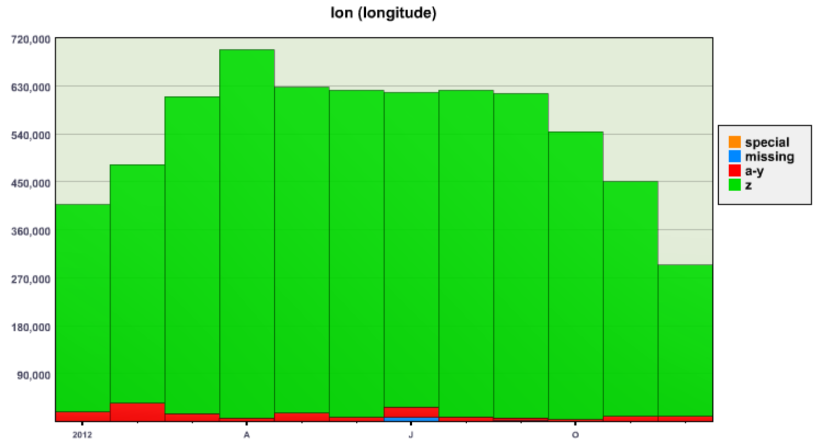


Figure 19: Total number of (this page) latitude – LAT – and (next page) longitude – LON – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.



(Figure 19: cont'd)

The remainder of the navigational parameters exhibited no problems of note. They are nevertheless included for completeness: platform heading (Figure 20), platform course (Figure 21), platform speed over ground (Figure 22), and platform speed over water (Figure 23).

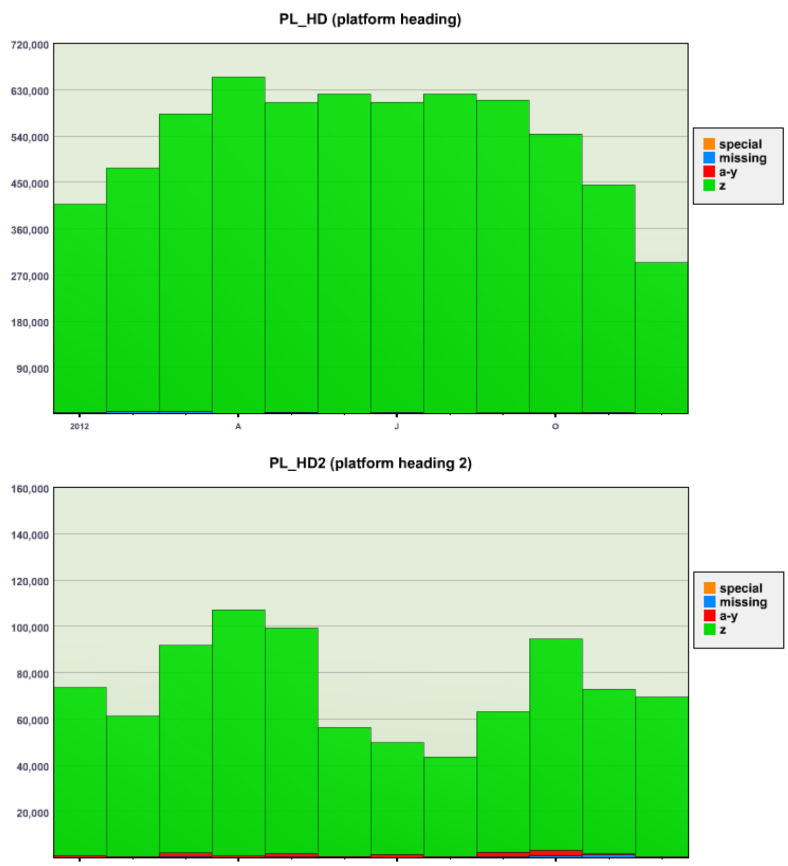


Figure 20: Same as Figure 19, except for (top) platform heading – PL_HD – and (bottom) platform heading 2 – PL_HD2.

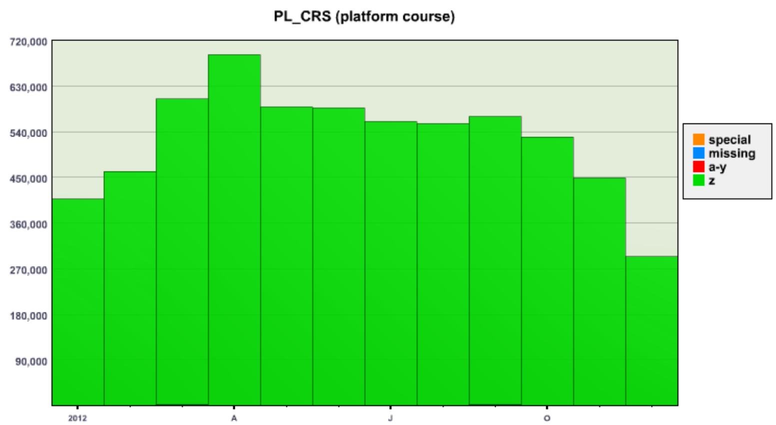


Figure 21: Total number of platform course – PL_CRS –observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

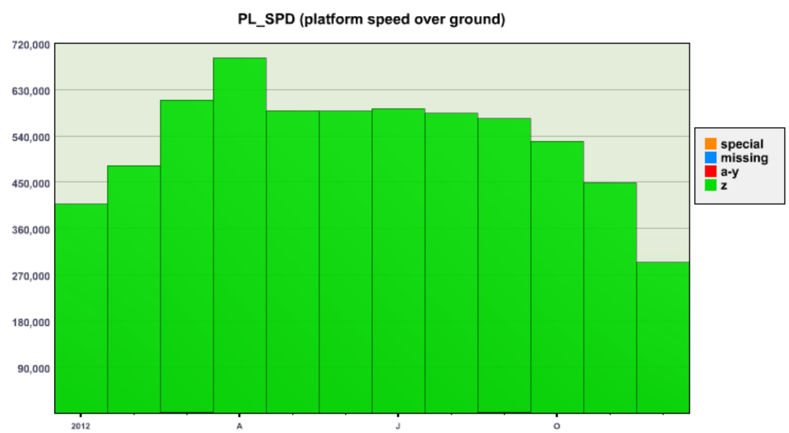


Figure 22: Total number of platform speed over ground – PL_SPD –observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

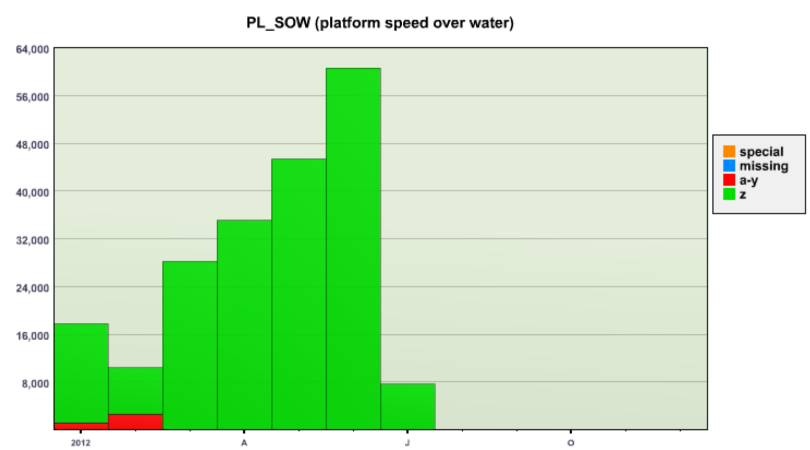
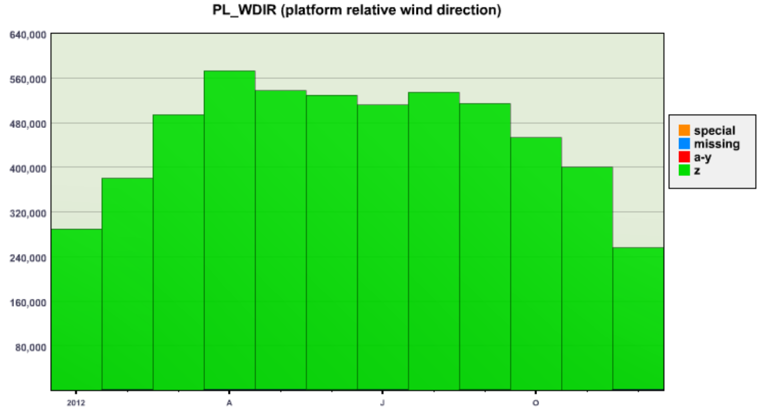
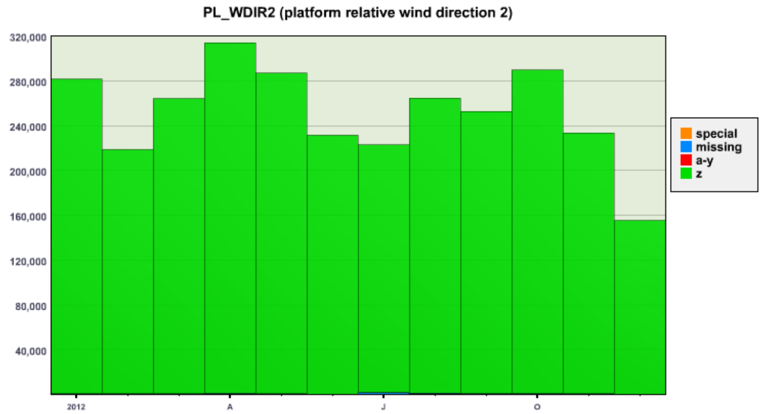


Figure 23: Same as Figures 22 and 23, except for platform speed over water – PL_SOW.

The platform relative wind parameters, both direction (Figure 24) and speed (Figure 25), 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.





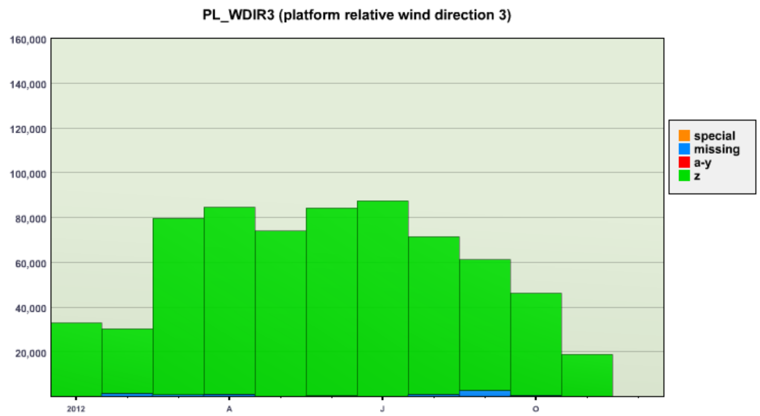


Figure 24: Total number of (top) platform relative wind direction – PL_WDIR –(middle) platform relative wind direction 2 – PL_WDIR2 – and (bottom) platform relative wind direction 3 – PL_WDIR3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) 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.

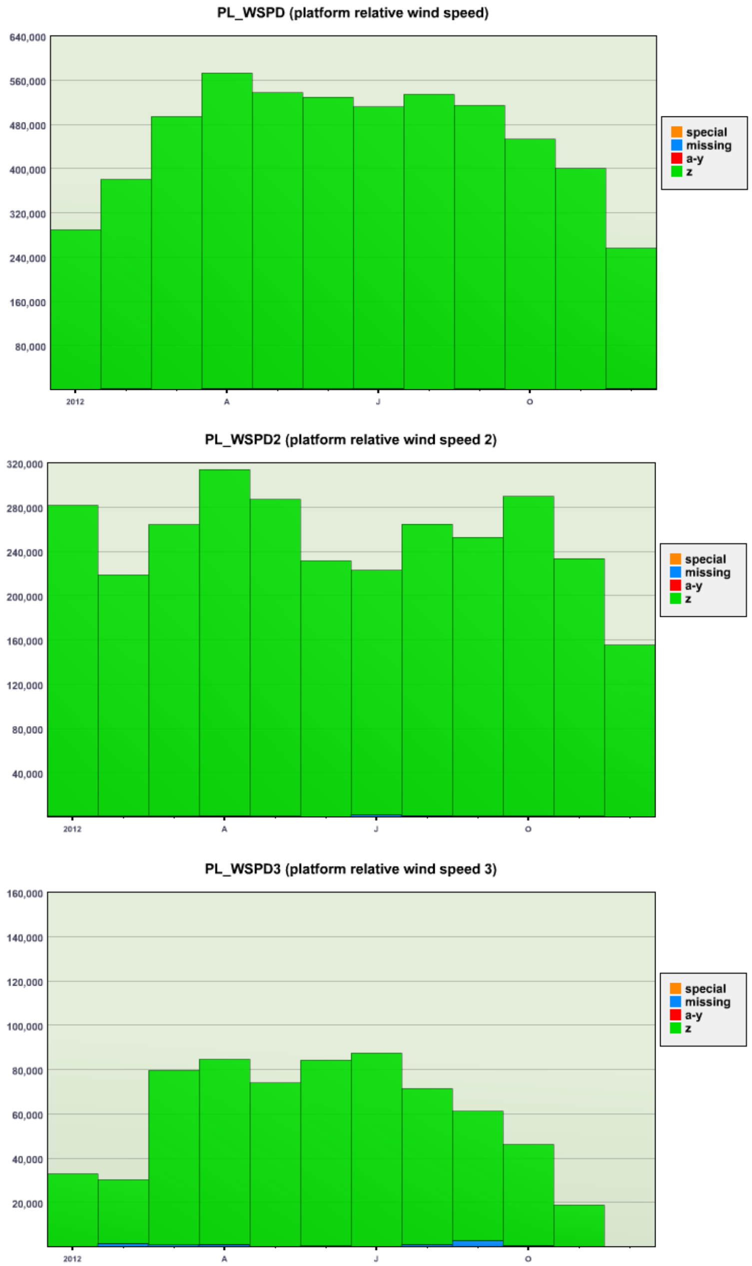


Figure 25: Total number of (top) platform relative wind speed – PL_WSPD – (middle) platform relative wind speed 2 – PL_WSPD2 – and (bottom) platform relative wind speed 3 – PL_WSPD3 – observations provided by all ships for each month in 2012. The colors represent the number of good (green) values versus 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. 2012 quality by ship

Atlantic Explorer

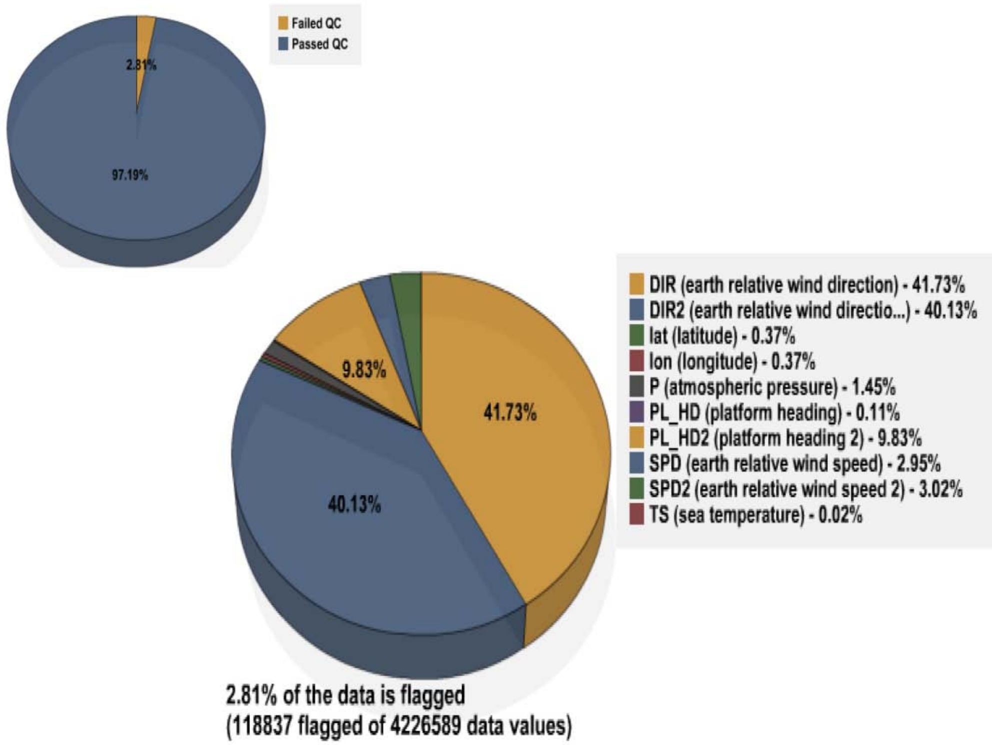
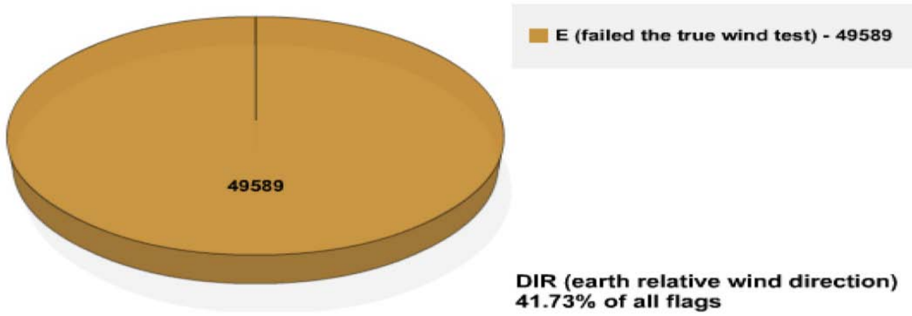


Figure 26: For the *Atlantic Explorer* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Atlantic Explorer* provided SAMOS data for 178 ship days, resulting in 4,226,589 distinct data values. After automated QC, 2.81% of the data was flagged using A-Y flags (Figure 26). This is a notably low percentage of flagged values, but it is important to note that the *Atlantic Explorer* does not receive visual QC (due to a lack of funding), which is when the bulk of flags are usually applied. Perhaps more telling of the *Atlantic Explorer's* actual data quality is the fact that the majority of the flags (over 80%, combined) were again applied to the two earth relative wind direction parameters (DIR and DIR2). The flags applied were exclusively failing the true wind test (E) flags (Figure 27), again as they were in 2011. This is possibly due to a combination of less than ideal sensor location (i.e. flow distortion) and possible true wind averaging problems; however, these unfortunately are not issues we are currently funded to sort out.

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



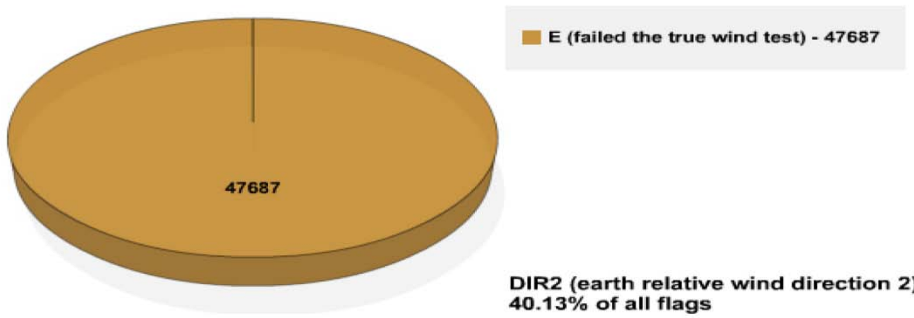


Figure 27: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – and (bottom) earth relative wind direction 2 – DIR2 –for the *Atlantic Explorer* in 2012.

Aurora Australis

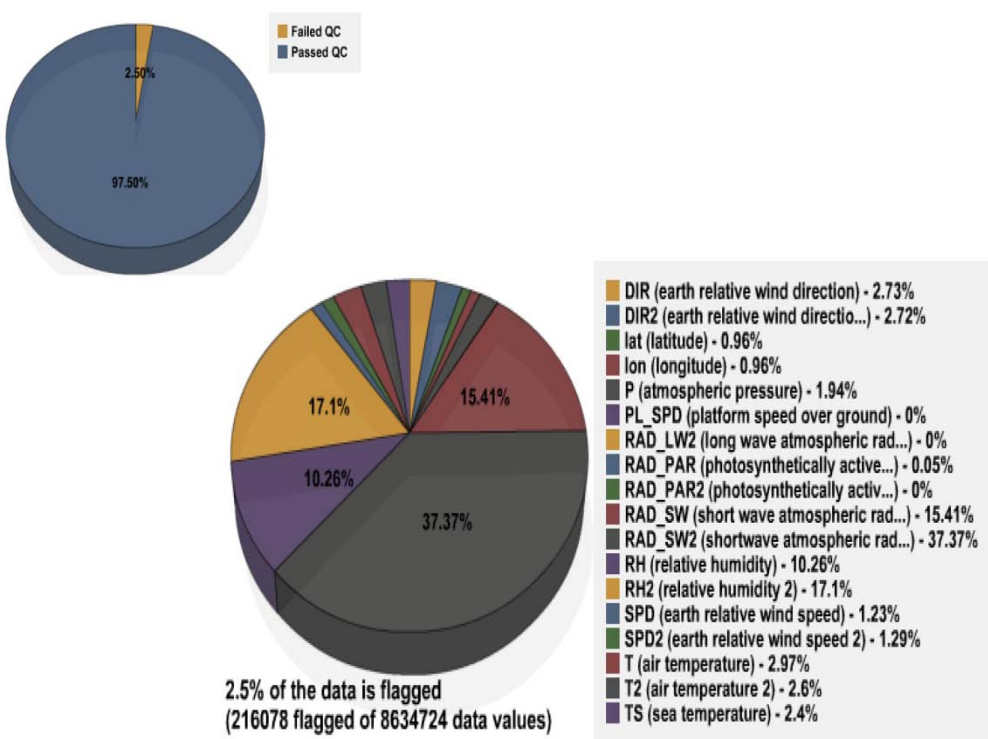


Figure 28: For the *Aurora Australis* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Aurora Australis* provided SAMOS data for 223 ship days, resulting in 8,634,724 distinct data values. After automated QC, 2.5% of the data was flagged using A-Y flags (Figure 28). This is a notably low percentage of flagged values; however, note that the *Aurora Australis* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Aurora Australis*).

Roughly 50% of the flags applied belong to the two short wave radiation parameters (RAD_SW and RAD_SW2), and those are overwhelmingly of the out of bounds (B) variety (Figure 29, top two figures). Upon inspection, it is apparent the short wave radiation B flags were applied to short wave radiation values slightly below zero. This is a common situation wherein the sensors are tuned for greater accuracy at much higher readings (see section 3b). A further roughly 25% of the flags were applied to the two relative humidity parameters (RH and RH2). These are, again, overwhelmingly out of bounds flags. Inspection reveals the similar tuning case with relative humidity sensors whereby the sensor is less accurate at or near saturation conditions (see 3b). NOTE: The IMOS group at the Australian Bureau of Meteorology does conduct visual quality control and makes research quality data files for the *Aurora Australis*.

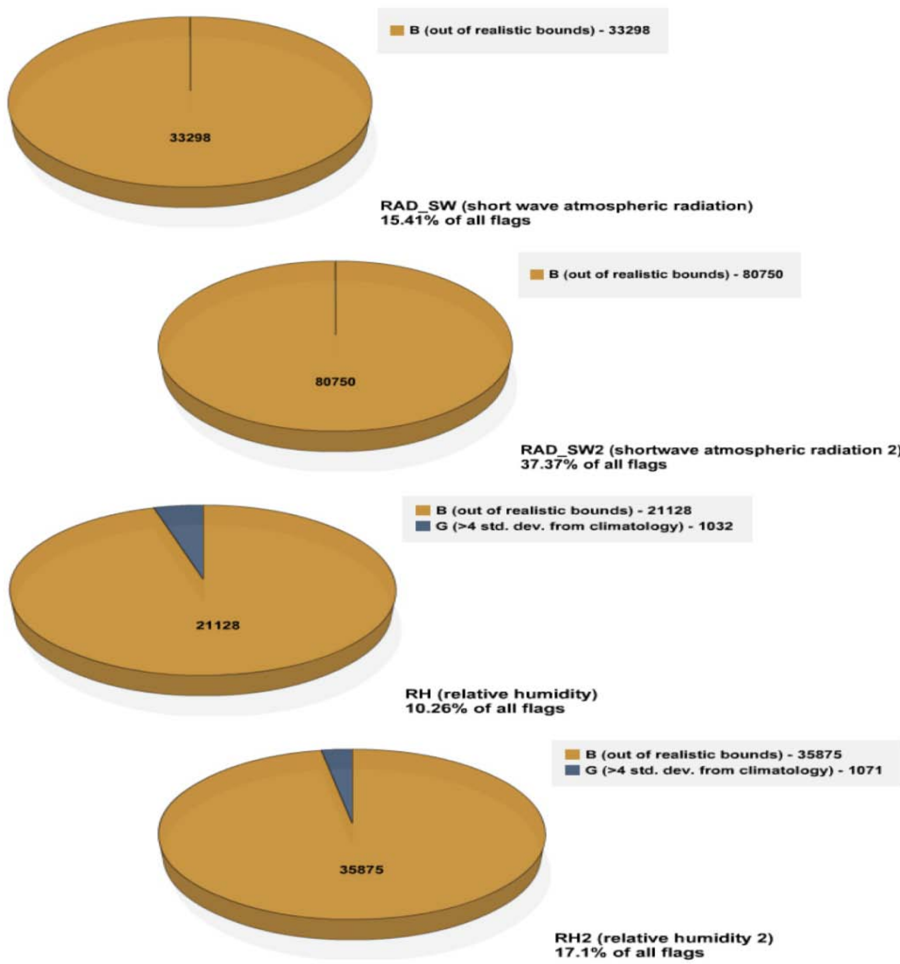


Figure 29: Distribution of SAMOS quality control flags for (top) shortwave atmospheric radiation – RAD_SW – (second) shortwave atmospheric radiation 2 – RAD_SW2 – (third) relative humidity – RH – and (bottom) relative humidity 2 – RH2 – for the *Aurora Australis* in 2012.

Southern Surveyor

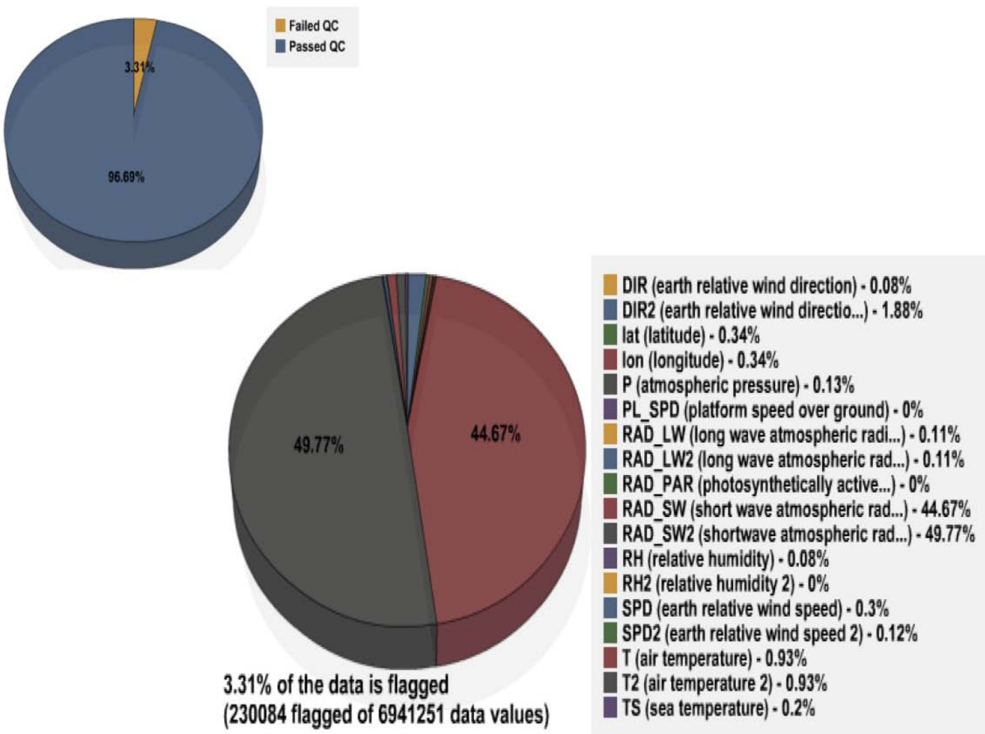
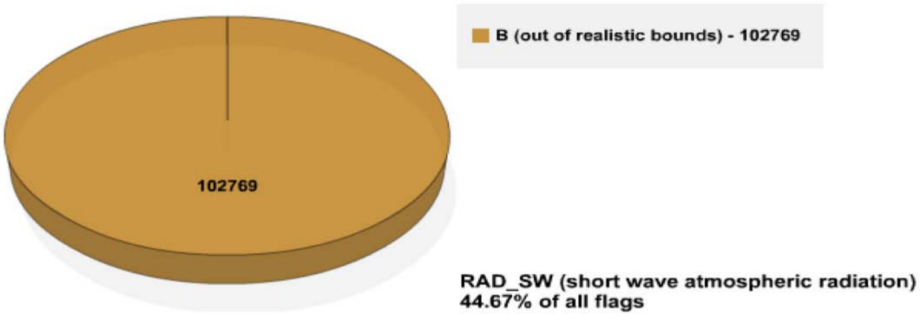


Figure 30: For the *Southern Surveyor* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Southern Surveyor* provided SAMOS data for 188 ship days, resulting in 6,941,251 distinct data values. After automated QC, 3.31% of the data was flagged using A-Y flags (Figure 30). This is a notably low percentage of flagged values; however, note that the *Southern Surveyor*, like the *Aurora Australis*, does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Southern Surveyor*).

Nearly 95% of the flags applied belong to the two short wave radiation parameters, and those are entirely of the out of bounds (B) variety (Figure 31). Upon inspection it is apparent the B flags were once again applied to short wave radiation values slightly below zero. This is a common situation wherein the sensors are tuned for greater accuracy at much higher readings (see section 3b), and as such it is not surprising that the flag situation has remained static for the *Surveyor* from 2009 through 2012. NOTE: The IMOS group at the Australian Bureau of Meteorology does conduct visual quality control and makes research quality data files for the *Southern Surveyor*.



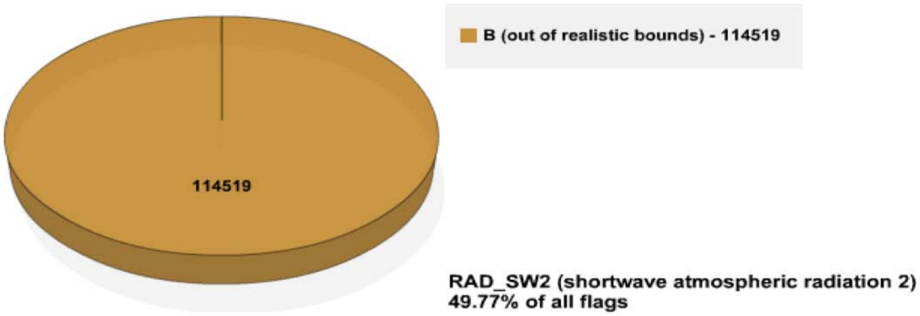


Figure 31: Distribution of SAMOS quality control flags for (top) shortwave atmospheric radiation – RAD_SW – and (bottom) short wave atmospheric radiation 2 – RAD_SW2 for the *R/V Southern Surveyor* in 2012.

Tangaroa

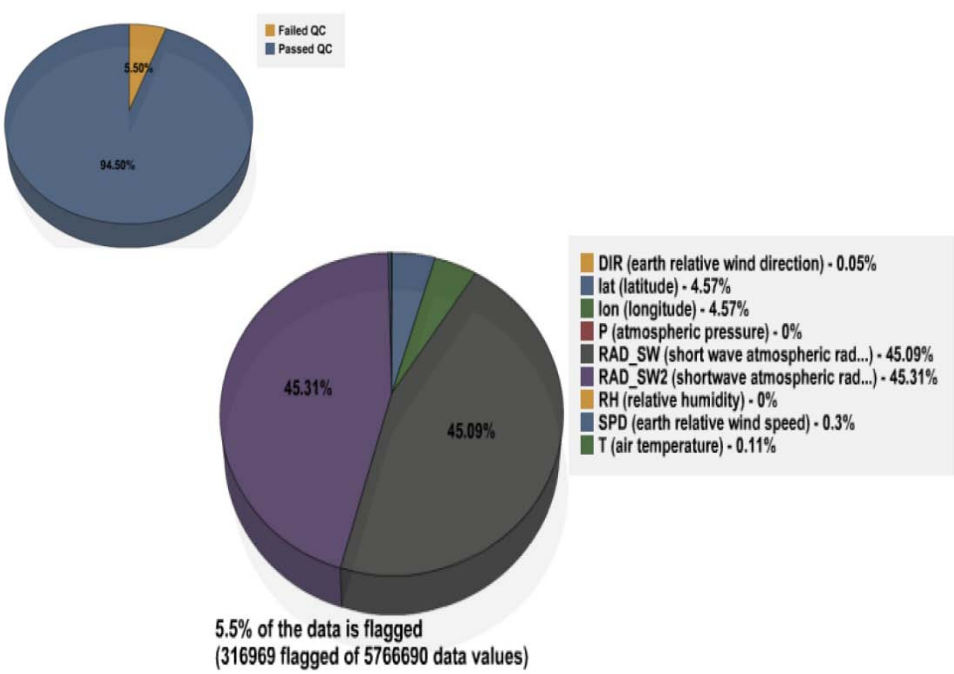


Figure 32: For the *Tangaroa* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Tangaroa* provided SAMOS data for 237 ship days, resulting in 5,766,690 distinct data values. After automated QC, 5.5% of the data was flagged using A-Y flags (Figure 32). NOTE: the *Tangaroa* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Tangaroa*). The IMOS group at the Australian Bureau of Meteorology does conduct visual quality control and makes research quality data files for the *Tangaroa*.

The two short wave radiation parameters (RAD_SW and RAD_SW2) garnered fully 90% of the total flags. The flags applied to the parameters were out of bounds (B) flags, exclusively (Figure 33). However, it appears the issue is merely the common occurrence of radiation readings slightly below zero in nighttime conditions, owing to sensor tuning (see Section 3b for details).

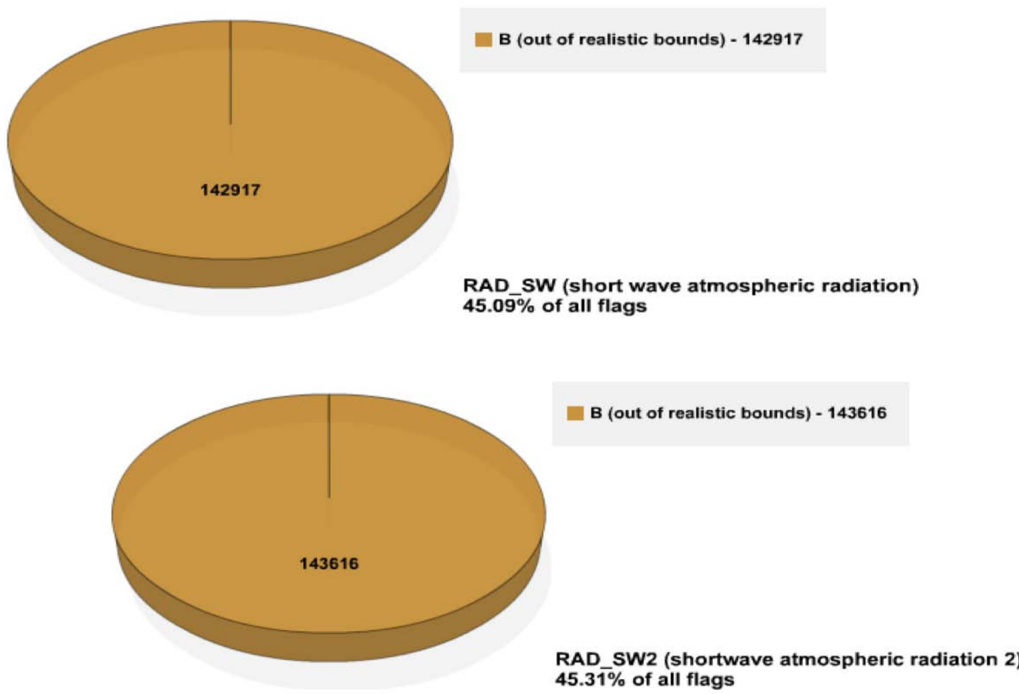


Figure 33: Distribution of SAMOS quality control flags for (top) short wave atmospheric radiation – RAD_SW – and (bottom) short wave atmospheric radiation 2 – RAD_SW2 – for the *Tangaroa* in 2012.

Bell M. Shimada

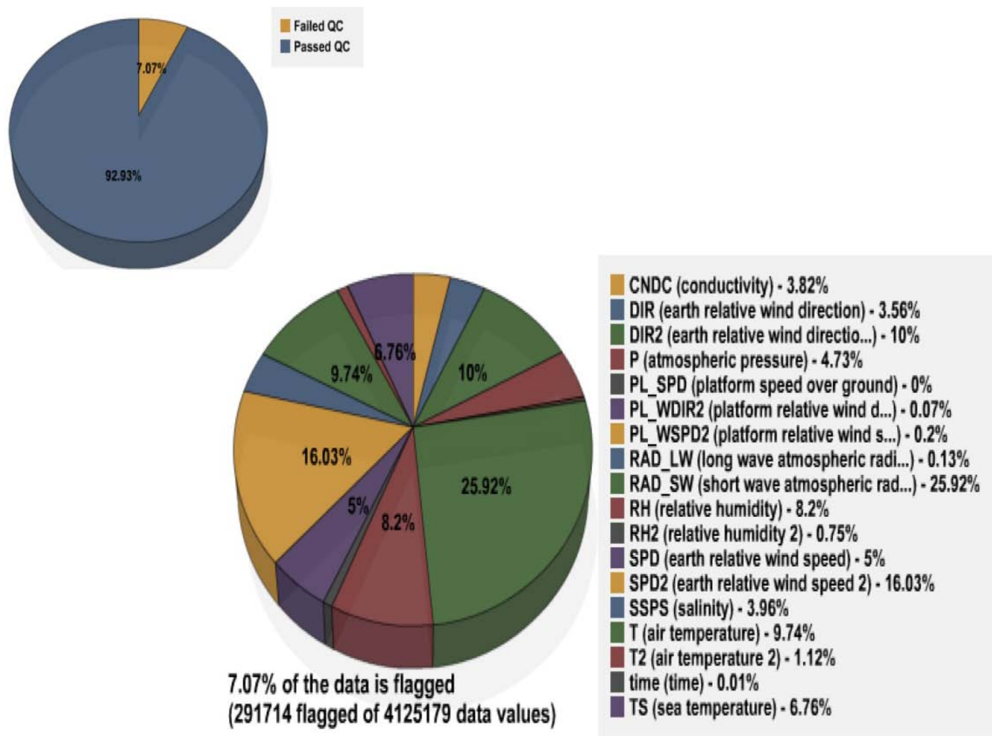


Figure 34: For the *Bell M. Shimada* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Bell M. Shimada*, after being recruited to SAMOS in late February 2012, provided SAMOS data for 148 ship days, resulting in 4,125,179 distinct data values. After both automated and visual QC, 7.07% of the data was flagged using A-Y flags (Figure 34).

At first glance the biggest issue with the *Shimada* data would appear to be short wave atmospheric radiation, making up over 25% of the flags. However, these are almost exclusively out of bounds (B) flags (Figure 36), applied by automated QC to values slightly below zero in the absence of solar radiation. This is, again, a very common occurrence, and details about radiation sensor tuning can be found in Section 3b.

There are several more significant flagging issues for the *Shimada*: First, the redundant wind sensors DIR2 and SPD2 (Figure 36), located amidships, often deviate from the forward mast wind sensors DIR and SPD (not shown), depending upon the platform relative wind direction. Digital imagery and/or a detailed flow analysis do not exist for this vessel, but flow obstruction is clearly indicated in Figure 35. *Shimada* also had some issues with the air temperature (T) and relative humidity (RH) sensors, which contributed to a combined further ~18% of all flags (Figure 36). Both T and RH frequently read much higher than the redundant sensors T2 and RH2 (and higher than was indicated by any nearby buoys or land stations), particularly under saturated conditions, resulting in K-flagging of T and K- and B-flagging of RH. *Shimada* technician Anna Priester was actively investigating the cause of the problem throughout 2012 and kept SAMOS personnel in the loop via email. At the end of the cruising season it was determined that sensor location was to blame, and as of 2013 the sensors are in a new location with better results.

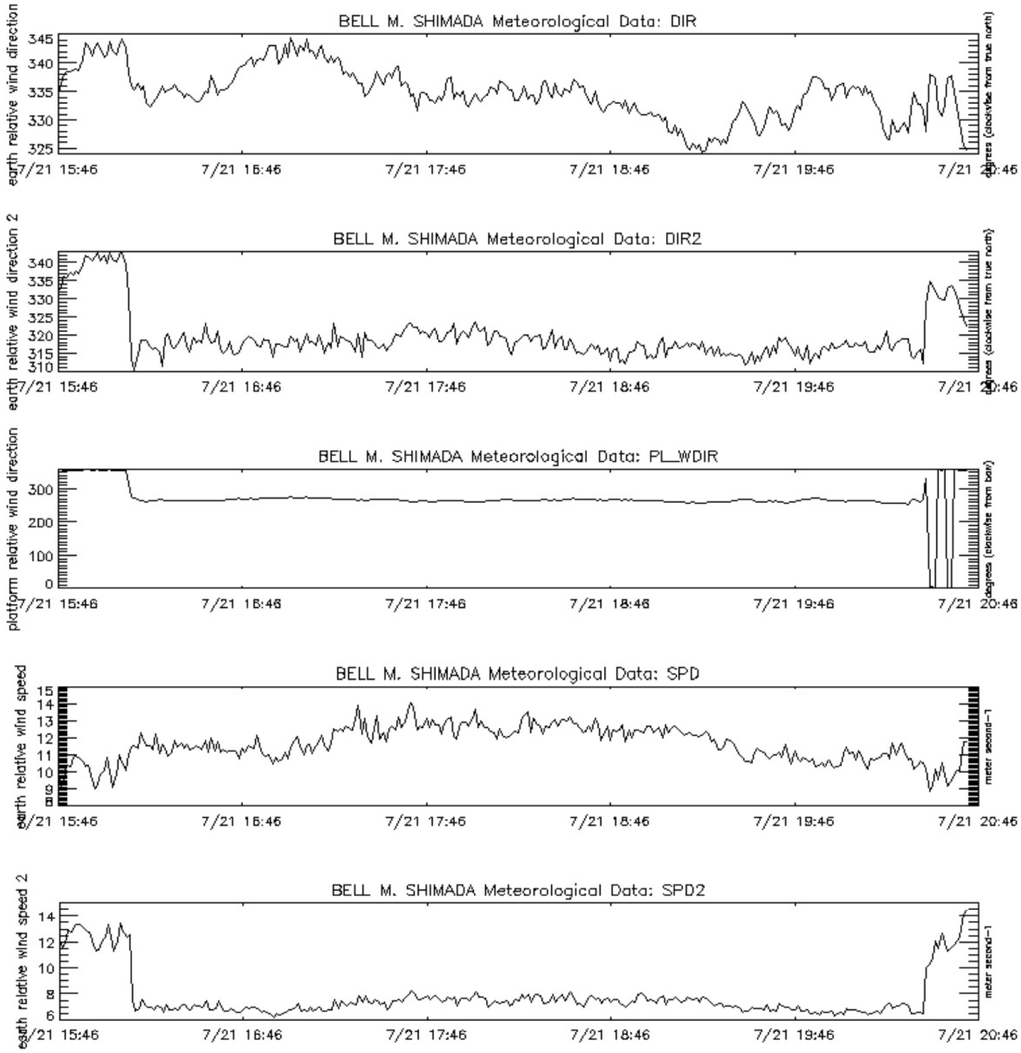


Figure 35: *Bell M. Shimada* SAMOS data for 21 July 2012: (first) earth relative wind direction – DIR – (second) earth relative wind direction 2 – DIR2 – (third) platform relative wind direction – PL_WDIR – (fourth) earth relative wind speed – SPD – and (last) earth relative wind speed 2 – SPD2. Note the ~20° step down in DIR2 (absent in DIR) and ~6 m/s step down in SPD2 (absent in SPD) when PL_WDIR changes to ~270°. This behavior resulted in K flagging of DIR2 and SPD2.

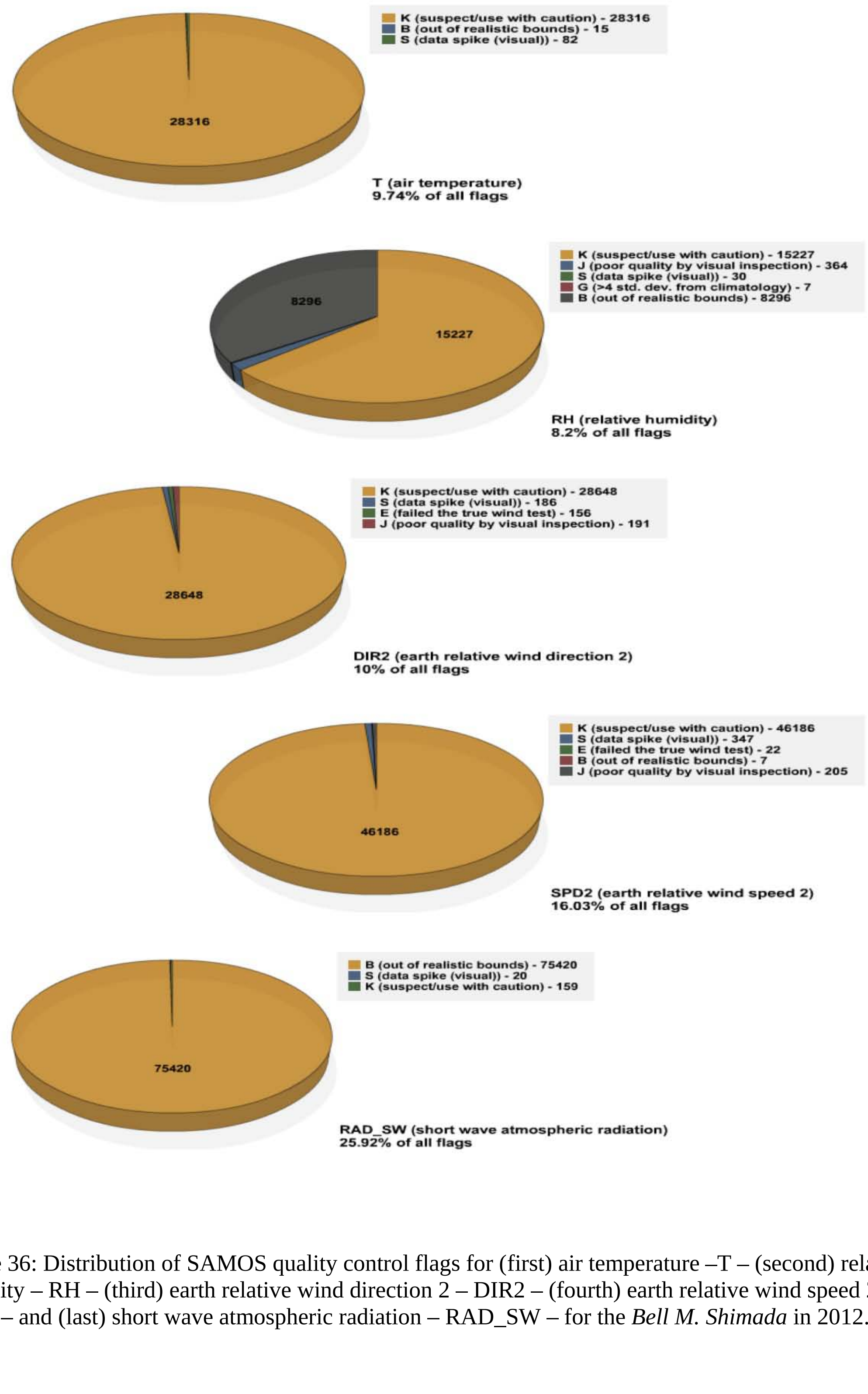
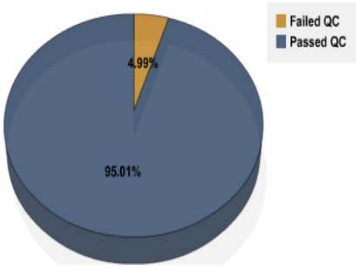


Figure 36: Distribution of SAMOS quality control flags for (first) air temperature –T – (second) relative humidity – RH – (third) earth relative wind direction 2 – DIR2 – (fourth) earth relative wind speed 2 – SPD2 – and (last) short wave atmospheric radiation – RAD_SW – for the *Bell M. Shimada* in 2012.

Gordon Gunter



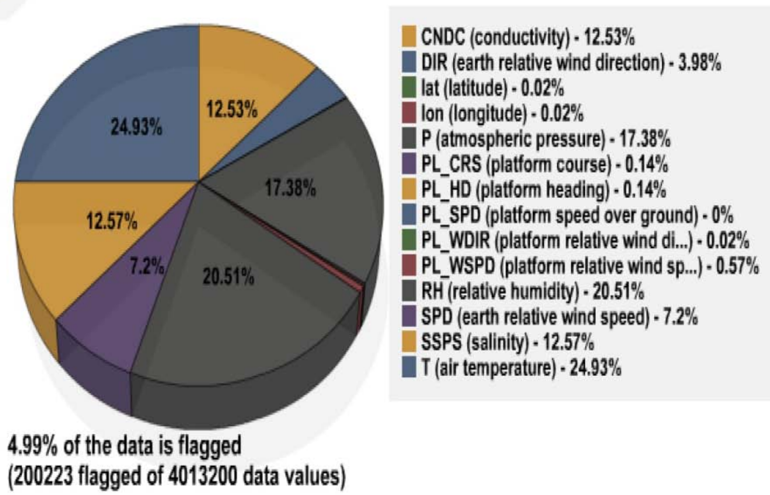


Figure 37: For the *Gordon Gunter* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Gordon Gunter* provided SAMOS data for 184 ship days, resulting in 4,013,200 distinct data values. After both automated and visual QC, 4.99% of the data was flagged using A-Y flags (Figure 38). So once again for 2012 *Gunter* flies just under the radar and keeps within the coveted < 5% flagged bracket.

The biggest issue with the *Gunter* data for 2012 was the problematic location of the air temperature (T)/relative humidity (RH) and pressure (P) sensors (see Figure 38). At this location, the sensors are in a wind shadow whenever the winds are from the starboard side, or astern. In 2012, this resulted in a good deal of caution/suspect (K) flagging of all three variables, for a combined total of over 60% of the total flags (Figure 39).

Figure 38: Location of air temperature/relative humidity and atmospheric pressure sensors onboard the *R/V Gordon Gunter* in 2012 (image looking forward).

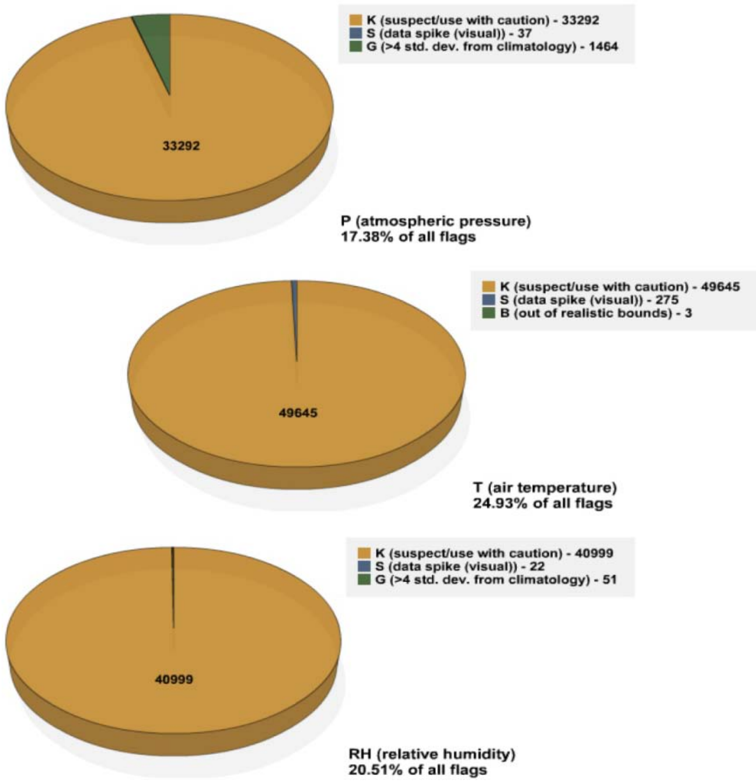


Figure 39: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (middle) air temperature – T – and (bottom) relative humidity – RH – for the *R/V Gordon Gunter* in 2012.

Henry B. Bigelow

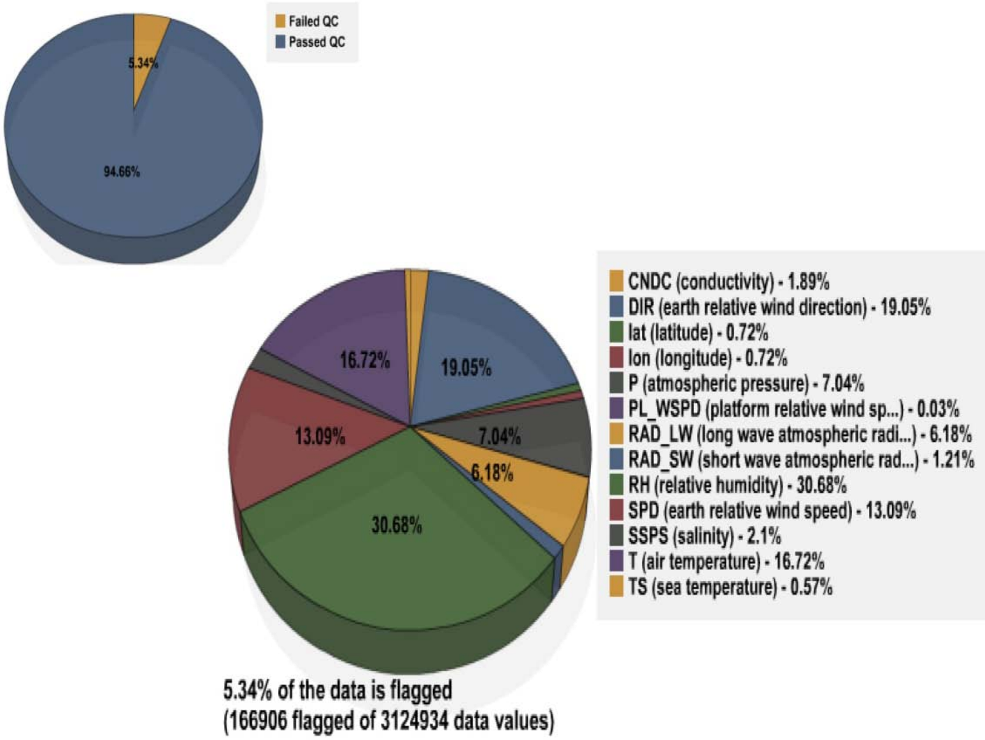


Figure 40: For the *Henry B. Bigelow* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Henry Bigelow* provided SAMOS data for 154 ship days, resulting in 3,124,934 distinct data values. After both automated and visual QC, 5.34% of the data was flagged using A-Y flags (Figure 40). This is an improvement of nearly 2% from 2011 (7.07% flagged) and brings the *Bigelow* very close to the desirable <5% flagged bracket. To this end, particular efforts were made in 2012 by Chief Survey Tech Jim Burkitt to update metadata for the *Bigelow* and address data issues from the 2011 report.

Earth relative wind direction (DIR) and speed (SPD), air temperature (T), and relative humidity (RH) showed signs of a fair amount of airflow obstruction. In all four cases this resulted in a number of caution/suspect (K) flags (Figure 41). Metadata and digital imagery are still insufficient to properly diagnose the specific cause. The winds also experienced some failed true wind test (E) flagging, which may be due to the specific algorithm used by the *Bigelow* to calculate true winds. Additionally, RH encountered the common occurrence of near-saturation values actually being reported as >100%, due to sensor tuning (see 3b for details), which resulted in some out of bounds (B) flags. There was also an issue with the long wave radiation sensor (LW – not shown) early in the sailing season whereby the sensor was reporting well in excess of realistic values. SAMOS personnel notified those onboard the *Bigelow* in short order, and a response was received immediately. Technician Henry J. informed the SAMOS DAC that the issue would be investigated ASAP. Several days later, SAMOS transmission of LW data ceased and remained off for the rest of 2012.

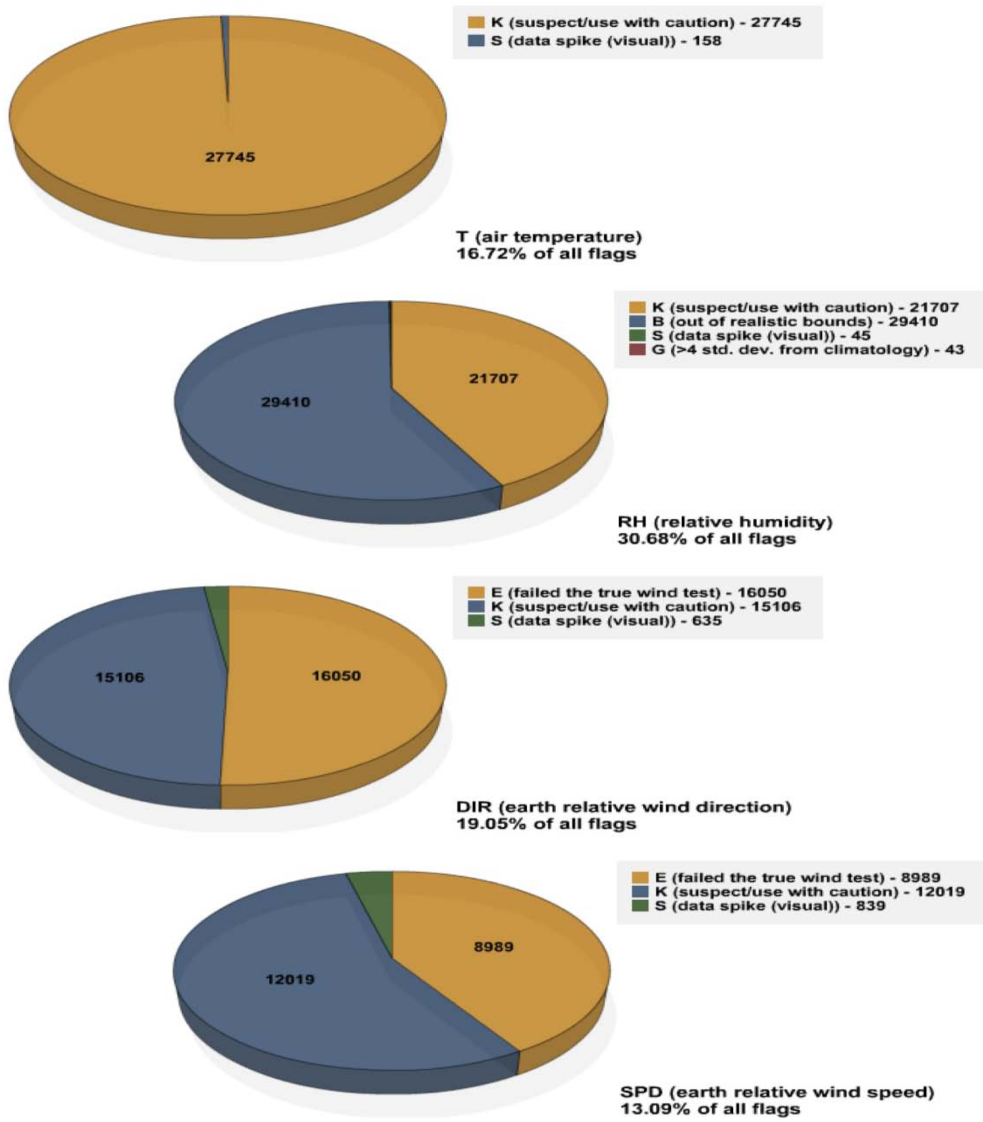


Figure 41: Distribution of SAMOS quality control flags for (first) air temperature – T – (second) relative humidity – RH – (third) earth relative wind direction – DIR – and (last) earth relative wind speed – SPD – for the *Henry B. Bigelow* in 2012.

Hi'ialakai

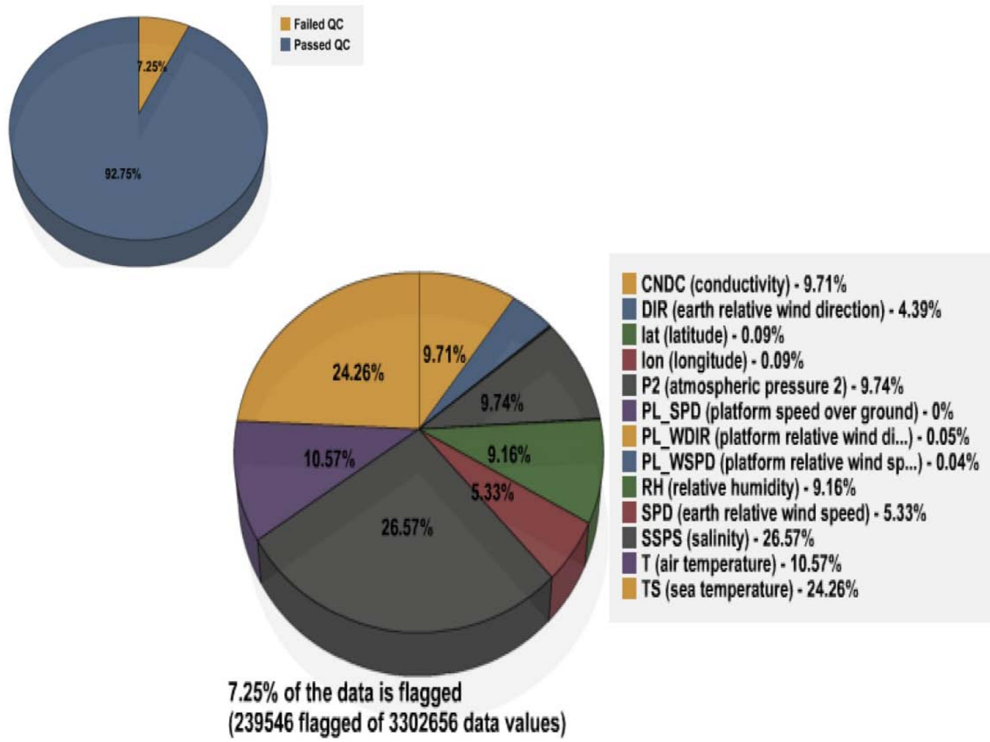


Figure 42: For the *Hi'ialakai* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Hi'ialakai* provided SAMOS data for 153 ship days, resulting in 3,302,656 distinct data values. After both automated and visual QC, 7.25% of the data was flagged using A-Y flags (Figure 42). This is a substantial improvement over 2011's 10.92% flagged – an improvement that was, notably, anticipated by SAMOS personnel, owing to the deactivation of *Hi'ialakai's* problematic pressure sensor in the SAMOS system (by agreement with *Hi'ialakai* technical crew) in favor of a newly installed pressure sensor in late 2011.

The main issues with *Hi'ialakai's* SAMOS data in 2012 were sea temperatures (TS) reading too low during the summer months, as compared to near buoy passes and gridded SST fields (on average, about 2°C colder), and, by extension, salinities (SSPS) that were also suspected of being low. As a consequence of these low readings, TS and SSPS were frequently flagged with caution/suspect (K) flags, to the tune of over 50% of the total number of flags (Figure 43). (As shown in Figure 43, there were also some poor quality (J) flags applied to each of these variables; however, those were in large part applied merely to readings when the TSG pump was off. It should be noted that HA personnel typically notified SAMOS personnel when the pump was off.) *Hi'ialakai* staff were notified of the suspected low TS/SSPS and were prompt in their reply; however, a concurrent personnel shakeup likely contributed to the issue not being resolved until after August 2012. It is nevertheless worth mentioning again for 2012 that, despite some major staff rotation, the *Hi'ialakai* continues to be a model of mutually beneficial communication between ship techs and SAMOS personnel.

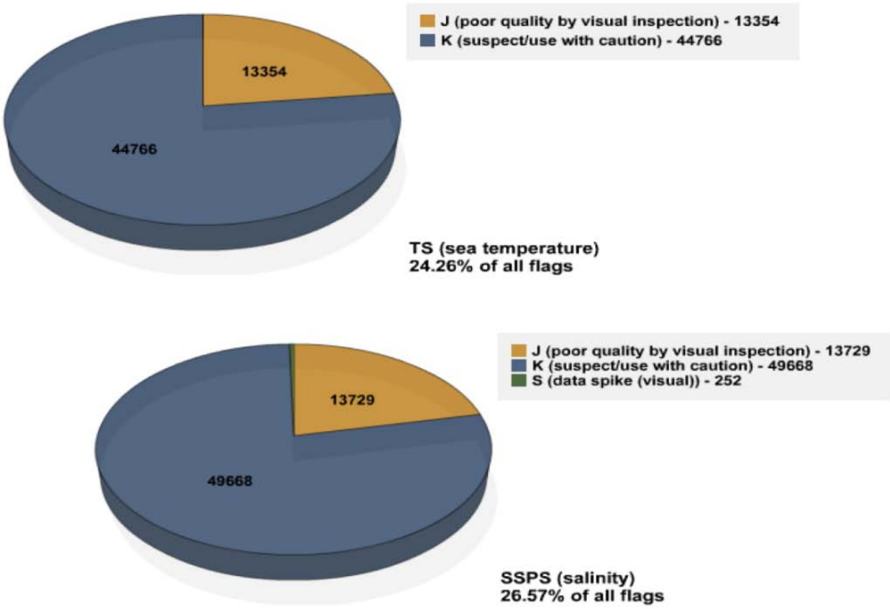


Figure 43: Distribution of SAMOS quality control flags for (top) sea temperature – TS – and (bottom) salinity – SSPS –for the *R/V Hi'ialakai* in 2012.

Ka'imimoana

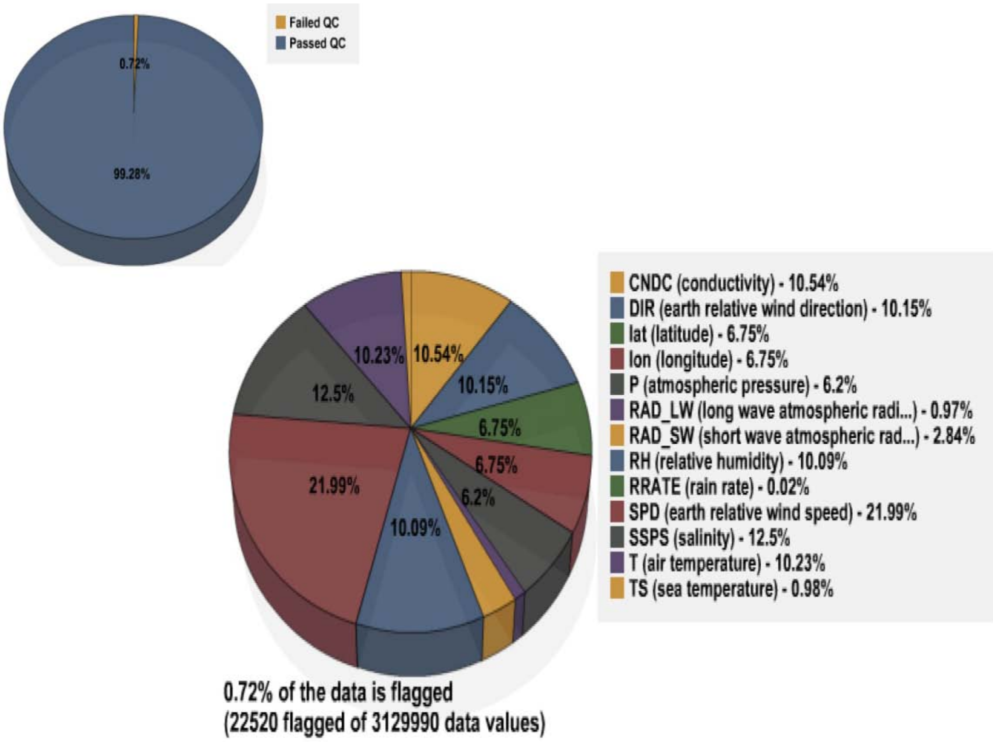


Figure 44: For the *Ka'imimoana* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Ka'imimoana* provided SAMOS data for 123 ship days, resulting in 3,129,990 distinct data values. After both automated and visual QC, 0.72% of the data was flagged using A-Y flags (Figure 44). This is an astoundingly low percentage, denoting "excellent" data overall.

With such excellent data, it is unfortunate that *Ka'imimoana* was taken off line in mid-2012. (It is also unnecessary to investigate any of the *Ka'imi's* QC flags, as there obviously were no major problems in 2012.) The technicians for *Ka'imi* were among the most responsive when it came to SAMOS communication and data issue resolution; fortunately, the silver lining was the relocation of wonderful SST Tonya Watson over to the *Hi'ialakai* (a vessel whose tech group lost the ambitious and always pleasant Lauren Fuqua to another job in 2012).

Nancy Foster

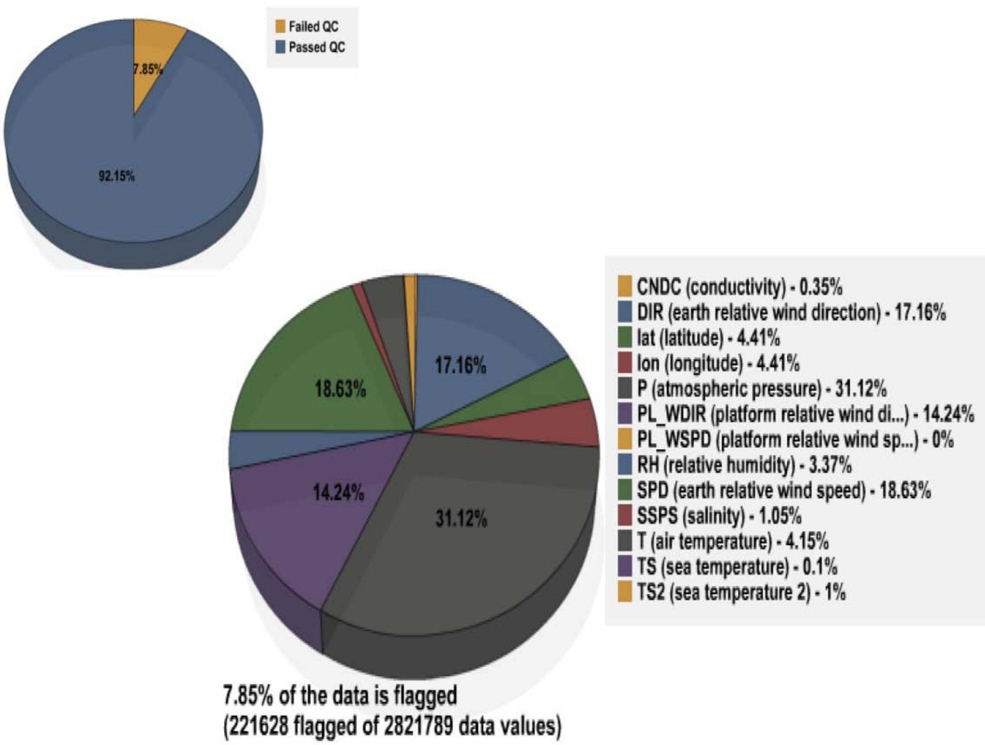


Figure 45: For the *Nancy Foster* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nancy Foster* provided SAMOS data for 130 ship days, resulting in 2,821,789 distinct data values. After both automated and visual QC, 7.85% of the data was flagged using A-Y flags (Figure 45). While this is only a modest improvement over 2011's percentage (8.99%), it is extremely noteworthy that the *Foster's* long-standing relative humidity problem was finally resolved as of their first transmission in 2012, after 3+ years of an unremitting need for flagging.

There were a few major data issues in 2012 that instigated most of the *Foster's* flags: First, there were erroneous coefficients in the translator affecting both the platform relative wind direction (PL_WDIR) and atmospheric pressure (P) data. In the case of PL_WDIR, values always ranged between 0 and about 30 degrees (Figure 46), while in the case of P values were always around 12.5 mb too low (confirmed by *Foster* technical personnel). These problems persisted from the advent of *Foster's* 2012 data (21 March) until they were addressed 15 April, after productive emails and a telephone conversation with Chief ET Keith Martin. Prior to the fix, all PL_WDIR – and, by extension, earth relative wind direction (DIR, Figure 46) – and atmospheric pressure data were assigned poor quality (J) flags (Figure 47). Earth relative wind speed (SPD) was also flagged with caution/suspect (K) flags during this period, since PL_WDIR is one of the components of the true wind speed calculation (Figure 47). Second, there was often what appeared to be a false signal evident in the *Foster's* P data (Figure 46). This anomalous oscillation did not appear in conjunction with any particular platform relative wind direction or platform speed changes that SAMOS data analysts could detect. It was conjectured by SAMOS personnel and suggested to *Foster* personnel that this might be electrical interference of some sort, such as from an air conditioning system cycling on and off. The issue persisted at least through July 2012, however, and resulted in much additional K-flagging of the P data.

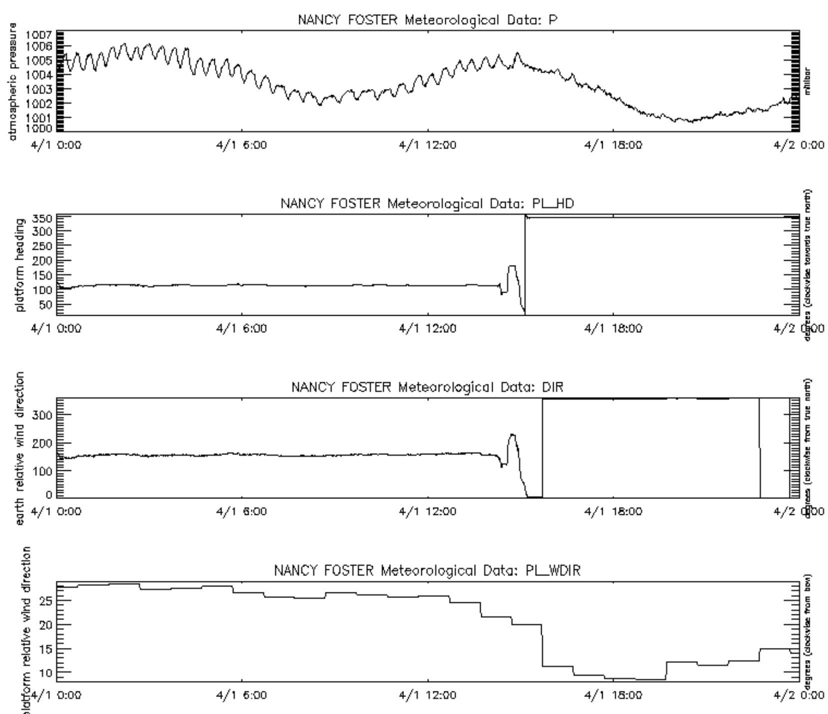


Figure 46: *Nancy Foster* SAMOS data for 01 April 2012: (first) atmospheric pressure – P – (second) platform heading – PL_HD – (third) earth relative wind direction –DIR – and (last) platform relative wind direction – PL_WDIR. Note confined ~30° range of PL_WDIR and resultant mirroring effect between PL_HD and DIR. Also note semi-regular high-frequency oscillation evident in P data.

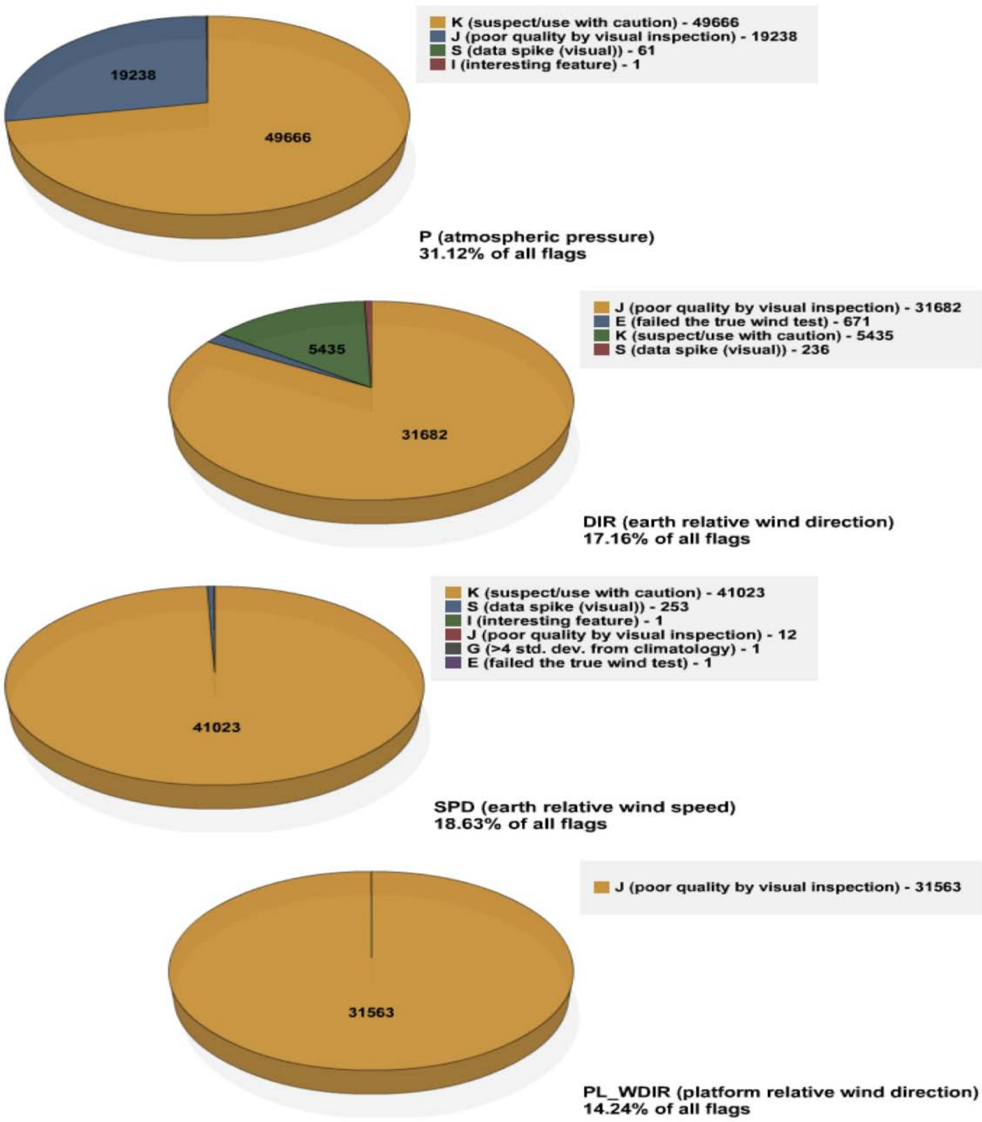


Figure 47: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (second) earth relative wind direction – DIR – (third) earth relative wind speed – SPD – and (bottom) platform relative wind direction – PL_WDIR – for the *R/V Nancy Foster* in 2012.

Okeanos Explorer

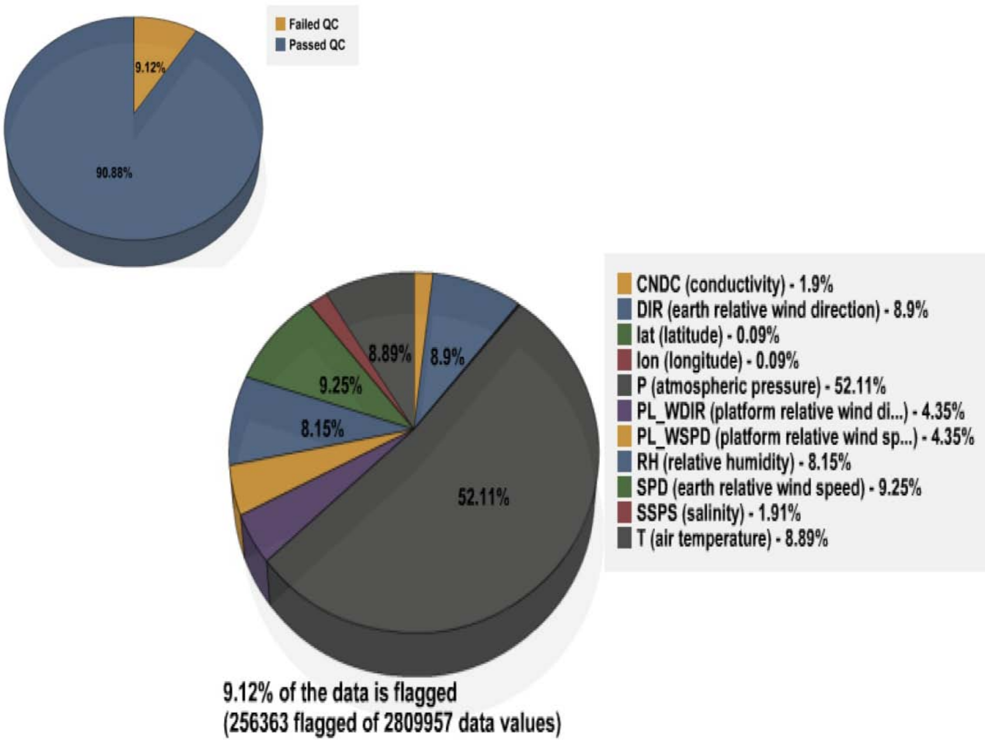


Figure 48: For the *Okeanos Explorer* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Okeanos Explorer* provided SAMOS data for 134 ship days, resulting in 2,809,957 distinct data values. After both automated and visual QC, 9.12% of the data was flagged using A-Y flags (Figure 48).

Overwhelmingly, the *Explorer's* largest data quality problem occurred with the atmospheric pressure (P), holding over 50% of the total flags (Figure 49). In a continuation from 2011, P values were still offset by a few millibars throughout much of 2012. However, by July the issue was finally resolved, and as of then the *Explorer's* pressure data has been exemplary. There was a fair amount of email communication between SAMOS and *Explorer* throughout the first half of the year regarding the pressure data: In March 2012, Chief ET Richard Conway first advised SAMOS personnel that the *Explorer's* barometer had been replaced as a result of failing calibration, but that the data were still off by about 4 mb. He stressed that the vessel was in a period when there was no one in the survey department, so the vessel was dependent on augmenters and things were likely to fall behind. Then on 03 July, Richard informed SAMOS that the barometer coefficient had finally been corrected to match up with the voltage output of the sensor. It is expected that the flag percentage will be much improved for the *Explorer* in 2013 as a result.

Aside from the P issue, there was also a Zenomet translator malfunction from 05 to 14 July that resulted in malfunction (M) flagging of all atmospheric variables – winds (both platform relative and earth relative: PL_WDIR, PL_WSPD, DIR, SPD), pressure (P), air temperature (T), and relative humidity (RH) – making up much of the remaining flags for 2012 (not shown). It should be noted that this malfunction was clearly communicated to the SAMOS DAC, thus flagging was anticipated.

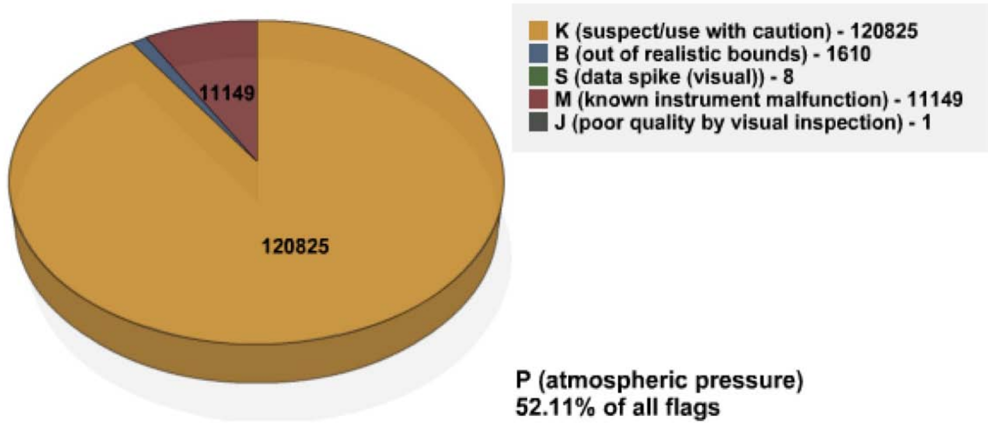
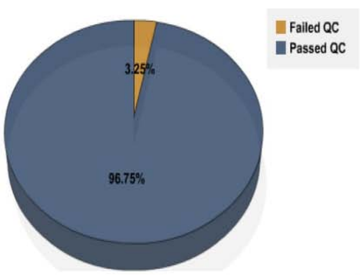


Figure 49: Distribution of SAMOS quality control flags for atmospheric pressure – P for the *R/V Okeanos Explorer* in 2012.

Oregon II



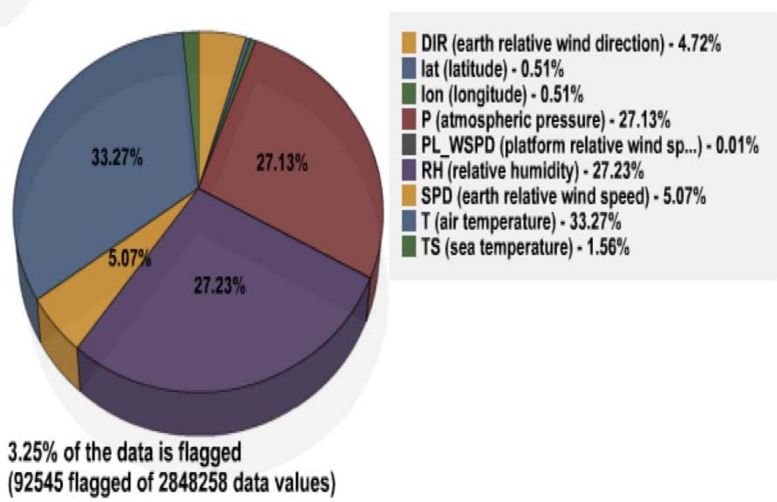


Figure 50: For the *Oregon II* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oregon II* provided SAMOS data for 159 ship days, resulting in 2,848,258 distinct data values. After both automated and visual QC, 3.25% of the data was flagged using A-Y flags (Figure 50). This percentage keeps *Oregon II* within the desirable < 5% flagged bracket regarded by SAMOS to represent "very good" data.

The bulk of the (limited) flagging was applied to the atmospheric pressure (P), air temperature (T), and relative humidity (RH) parameters, overwhelmingly suspect/caution (K) flags in all three cases (Figure 52). Upon inspection, these cases appear to be largely due to flow obstruction; namely, all three sensors would seem to be in a wind shadow whenever winds are from starboard or astern, particularly during daytime (Figure 51). However, no digital imagery exists in the SAMOS database for the *Oregon II* and location metadata for all meteorological parameters is unavailable. As such, any suspicions about problematic sensor placement cannot be confirmed.

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

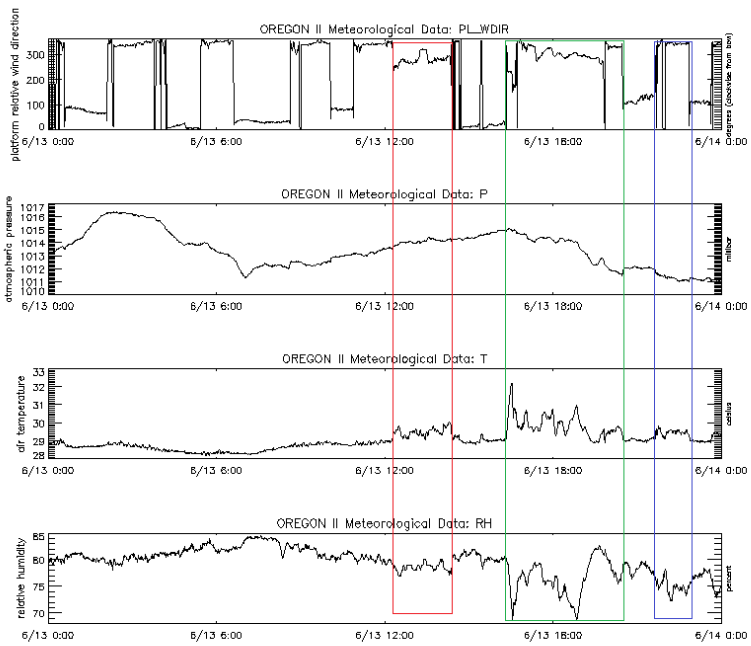


Figure 51: *Oregon II* SAMOS data for 13 June 2012: (first) platform relative wind direction – PL_WDIR – (second) atmospheric pressure – P – (third) air temperature –T – and (last) relative humidity – RH. Note daytime response in atmospheric data (within red, green, and blue rectangles) whenever winds are from port or astern.

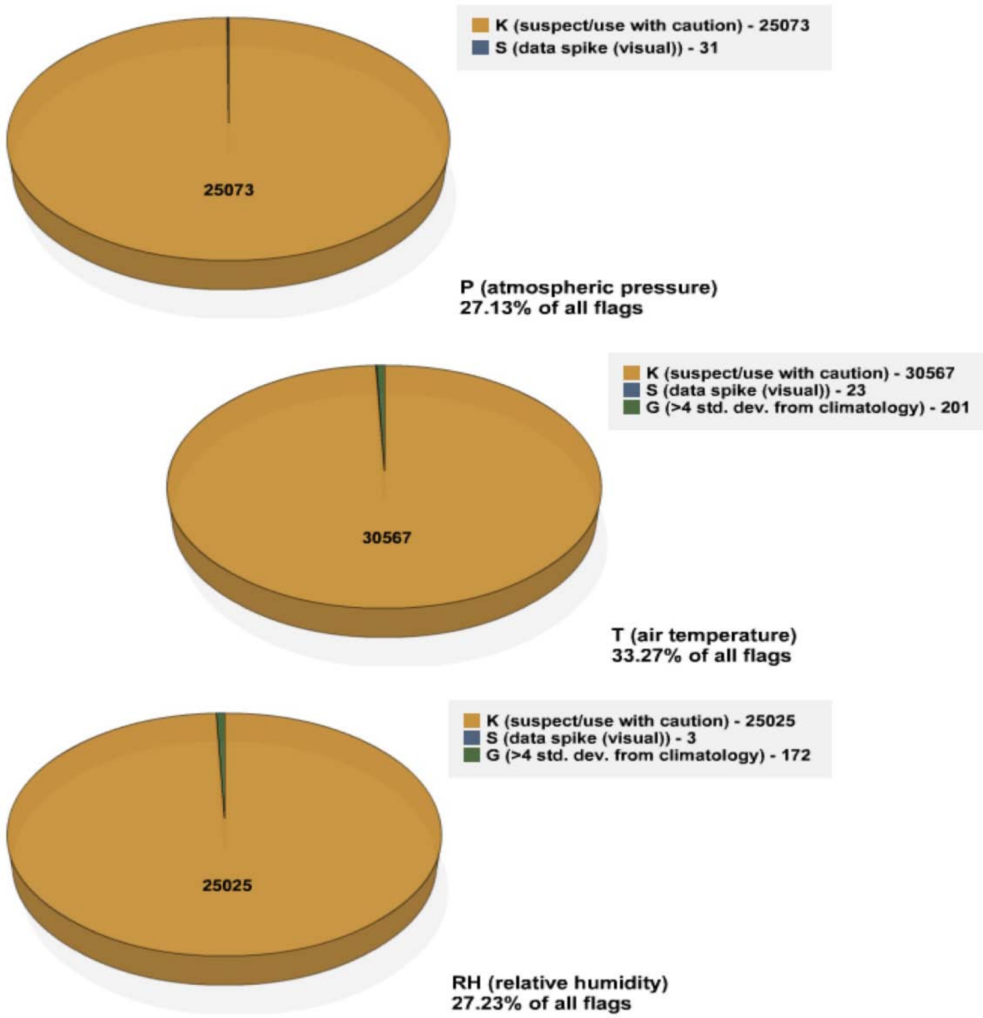


Figure 52: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (middle) air temperature – T – (bottom) relative humidity – RH –for the *R/V Oregon II* in 2012.

Oscar Dyson

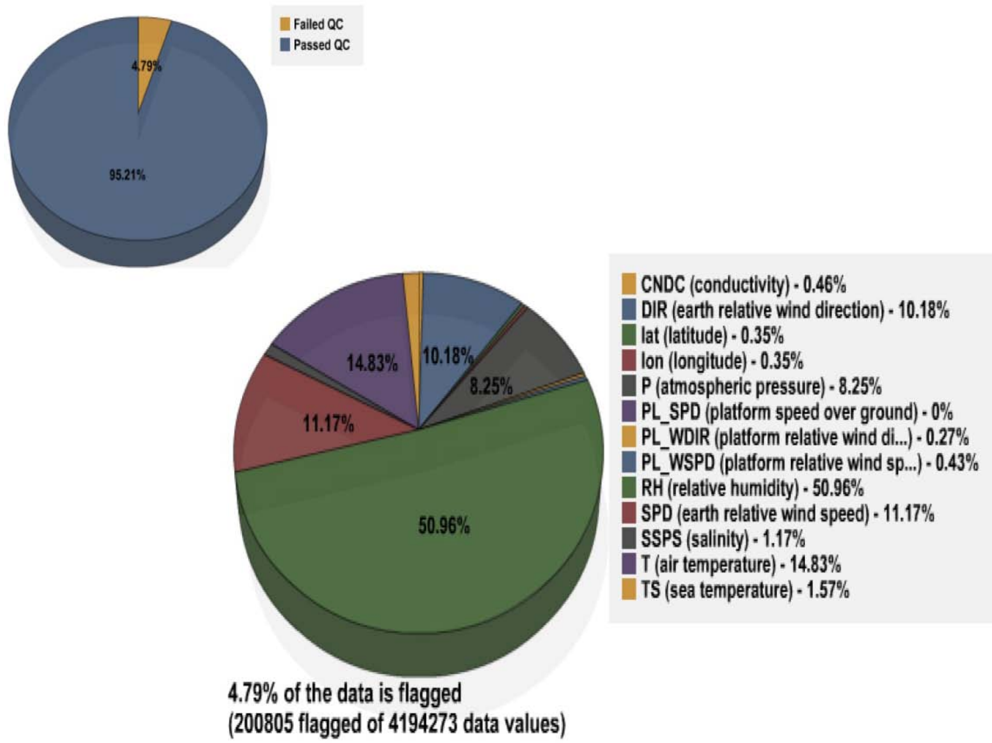


Figure 53: For the *Oscar Dyson* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Dyson* provided SAMOS data for 200 ship days, resulting in 4,194,273 distinct data values. After both automated and visual QC, 4.79% of the data was flagged using A-Y flags (Figure 53). *Dyson* therefore remains within the <5% flagged bracket for "very good" data in 2012.

Relative humidity incurred some out of bounds (B) flagging in near-saturation conditions that actually read as slightly over 100% (see section 3b for detail). Saturation conditions aren't uncommon in locations where the sea temperature is actually several degrees warmer than the air temperature (Figure 54), a situation the *Dyson* encounters with enough frequency to contribute to 50% of the total flags being assigned to RH alone (Figure 55).

The logic behind the flagging of the remaining MET parameters remains essentially unchanged from past analyses: With some vessels, the *Dyson* among them, SAMOS data analysts can attempt to compile a list of platform-relative wind direction bands that routinely produce compromised readings from the various MET sensors, suggesting the airflow to the sensors is obstructed. It is worth mentioning that the *Dyson* spends a lot of time in fjord regions and rounding the many mountainous island of Alaska, with the result that the vessel often travels through erratic winds. But while this complicates the data analysts attempts to identify obstructed platform relative wind directions, several bands of platform relative wind directions have nevertheless been identified with a fair amount of confidence. The vessel's cruise activity commonly requires repeated turns, passing the various MET sensors back and forth through these wind bands. This effect is compounded in the wind sensors, which typically have both a directional “dead zone” near 360° and a standard “error” (but still realistic) value that is output whenever the winds are highly erratic. The result of these issues is frequent caution/suspect (K) flags on atmospheric pressure, air temperature, relative humidity, and both earth relative wind parameters (Figure 55).

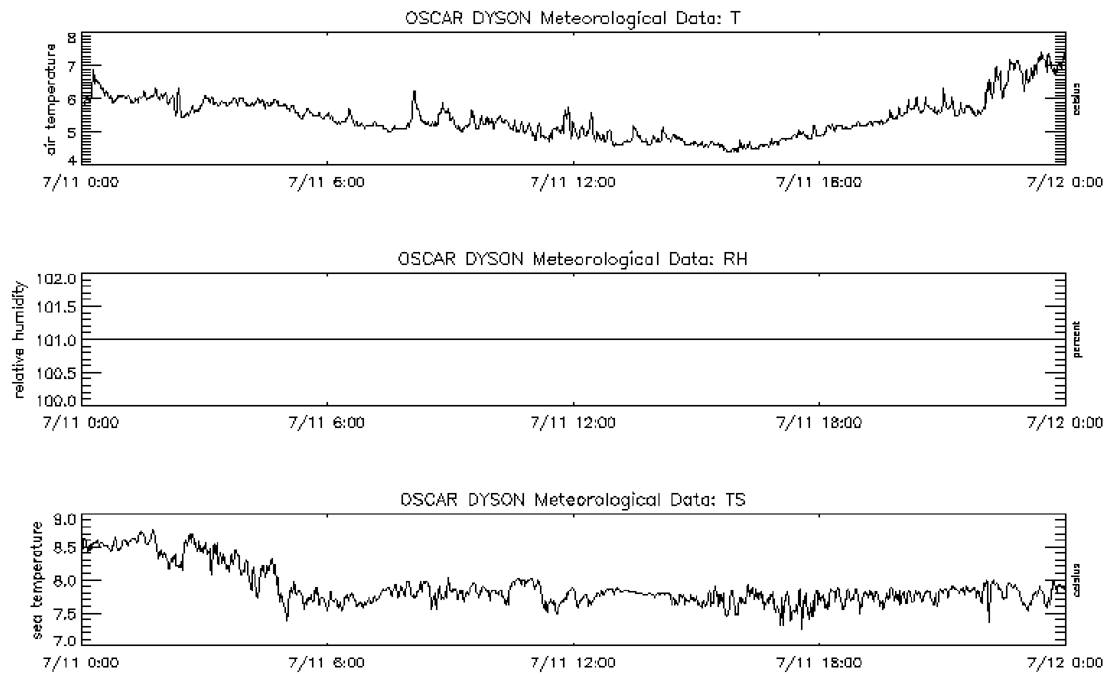


Figure 54: *Oscar Dyson* SAMOS data for 11 July 2012: (top) air temperature –T – (middle) relative humidity – RH – and (bottom) sea temperature – TS. Note sea temperatures in excess of air temperatures, resulting in saturated conditions reading slightly over 100%, due to sensor tuning.

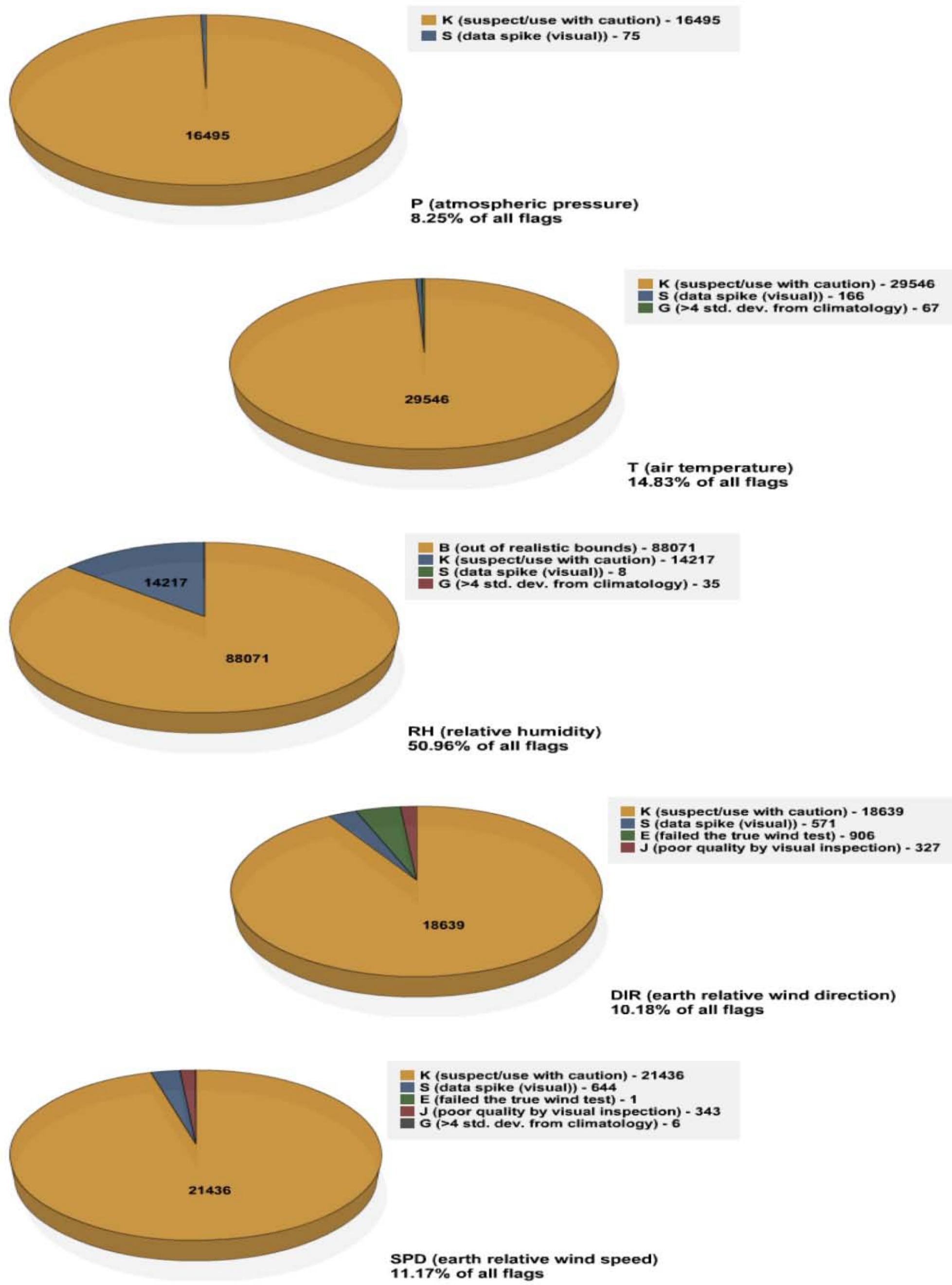


Figure 55: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) air temperature – T – (third) relative humidity – RH – (fourth) earth relative wind direction – DIR – and (last) earth relative wind speed – SPD – for the *R/V Oscar Dyson* in 2012.

Oscar Elton Sette

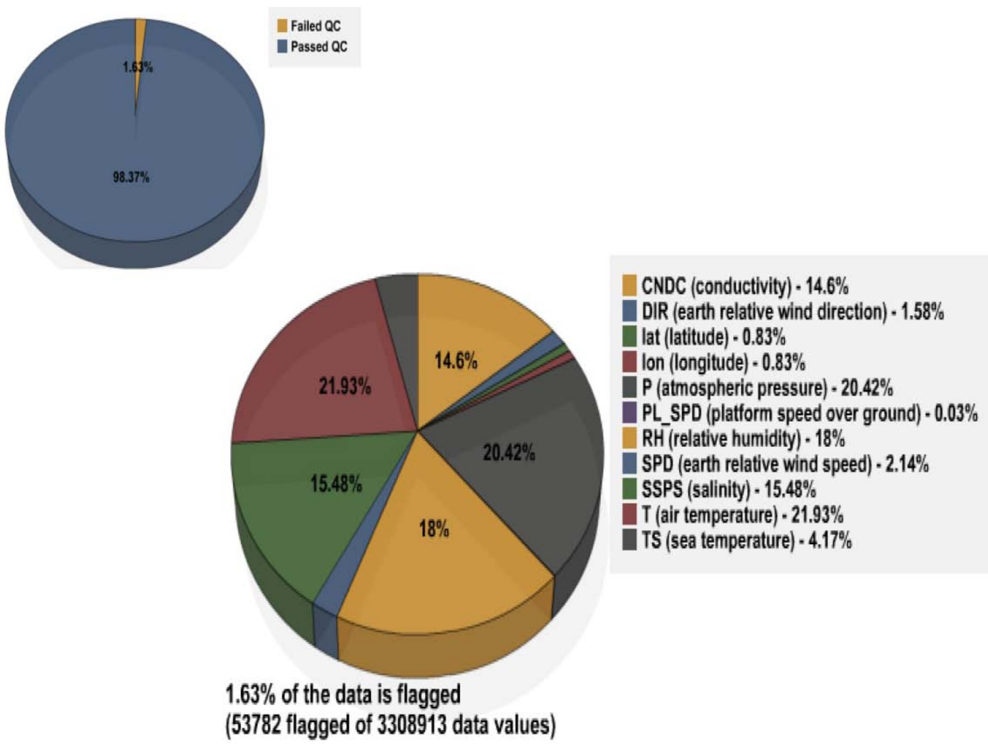


Figure 56: For the *Oscar Elton Sette* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Elton Sette* provided SAMOS data for 155 ship days, resulting in 3,308,913 distinct data values. After both automated and visual QC, 1.63% of the data was flagged using A-Y flags (Figure 56). This is once again well inside of the <5% flagged bracket, denoting “very good” data.

There were notably no major issues with data from the *Sette* in 2012, a conclusion that is supported and strengthened by the very low flag percentage and the fairly even distribution of the total flags among the various MET and TSG parameters provided by the *Sette*. What is particularly notable about the *Oscar Elton Sette* is the excellent line of communication to various personnel; their technicians at all levels are always very quick to respond to questions from the SAMOS staff, and they are usually proactive about improving all aspects of the *Sette’s* SAMOS data submission. They set a fine example for other SAMOS participants in their commitment to providing quality data.

Pisces

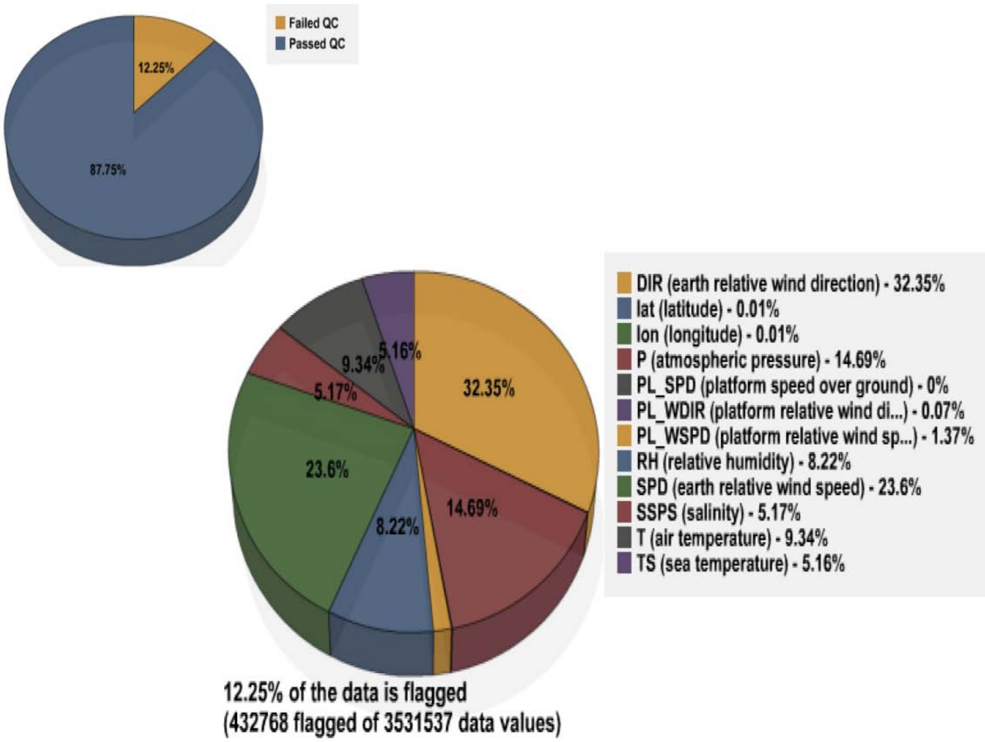


Figure 57: For the *Pisces* from 1/1/21 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Pisces* provided SAMOS data for 174 ship days, resulting in 3,531,537 distinct data values. After both automated and visual QC, 12.25% of the data was flagged using A-Y flags (Figure 57). This number is essentially static from year to year, and the flag distribution and reasoning remain the same as well.

Pisces wind data was among the least reliable of vessels reporting to SAMOS. Indeed, earth relative wind speed and direction received the highest percentage of flags for the *Pisces*, totaling a combined ~55% of all flags. Most of the flags applied to earth relative wind data were caution/suspect (K) flags (Figure 59). Upon inspection, the most notable cause appeared to be airflow obstruction occurring for multiple platform relative wind directions. However, without adequate metadata or digital imagery of the vessel, it continues to be difficult to adequately diagnose any of these problems.

Atmospheric pressure (P) also received a substantial portion of the total flags, mostly of the K variety (Figure 59). Upon inspection, once cause appears to be that the atmospheric pressure sensor also suffers from airflow obstruction, although again more detailed metadata are needed to accurately diagnose the condition. However, a more serious issue exists whereby the pressure data exhibit mysterious downward “steps” that appear unrelated to either platform relative wind direction or platform speed (see Figure 58). Attempts to contact and confer with *Pisces* personnel have been unsuccessful, and SAMOS personnel are at somewhat of a loss to even form a conjecture about the cause.

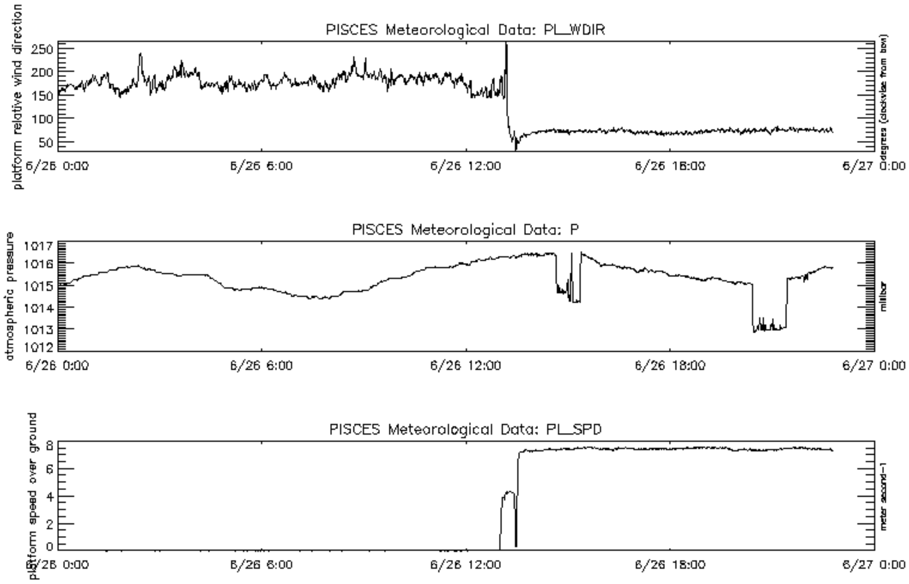


Figure 58: *Pisces* SAMOS data for 26 June 2012: (top) platform relative wind direction –PL_WDIR – (middle) atmospheric pressure – P – and (bottom) platform speed – PL_SPD. Note two "steps" in P after 12:00, with no explanatory behavior visible in either PL_WDIR or PL_SPD.

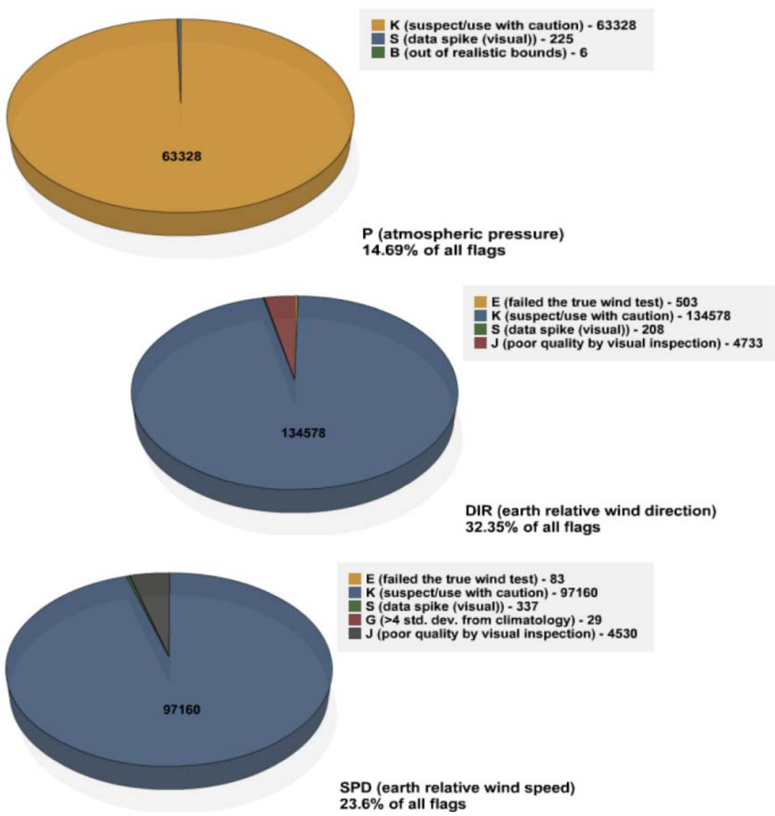


Figure 59: Distribution of SAMOS quality control flags for (top) atmospheric pressure – P – (middle) earth relative wind direction – DIR – and (bottom) earth relative wind speed – SPD – for the *Pisces* in 2012.

Ronald H. Brown

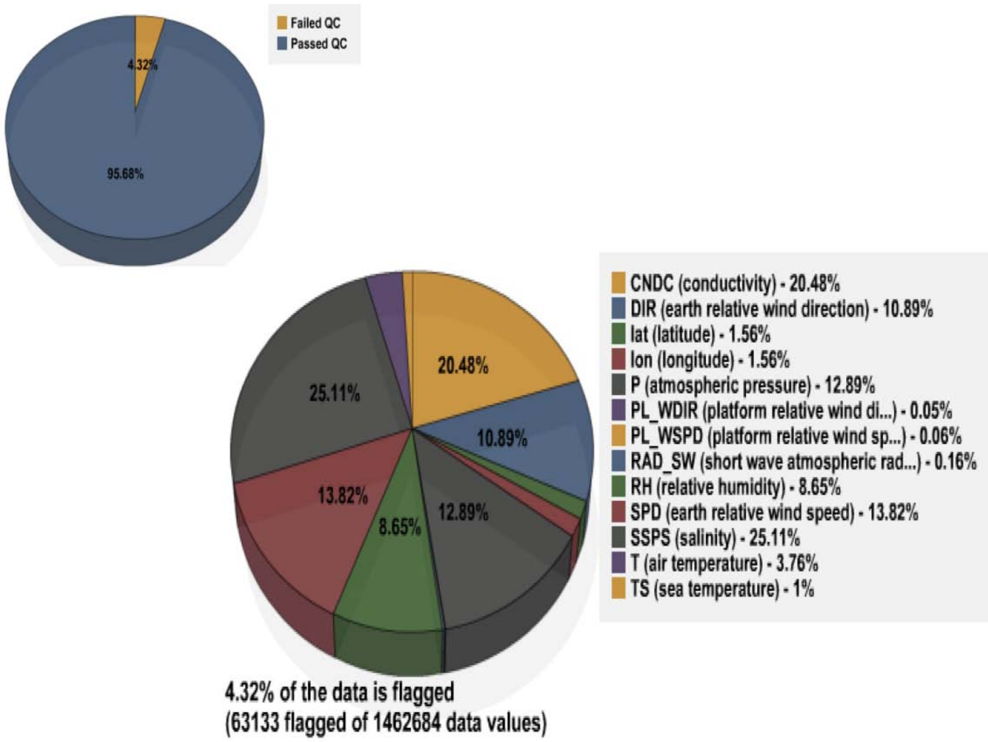


Figure 60: For the *Ronald H. Brown* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Ronald H. Brown* provided SAMOS data for 69 ship days, resulting in 1.462,684 distinct data values. After both automated and visual QC, 4.32% of the data was flagged using A-Y flags (Figure 56). This is a bit of an increase over 2011's 2.08% total flagged, but nevertheless once again below the 5% flagged threshold, denoting "very good" data.

The main issue with *Ron Brown's* data in 2012, and the likely cause of the slight increase in total flag percentage, concerned the sea parameters salinity (SSPS) and conductivity (CNDC). Approximately 45% of the total flags were applied to these two parameters, mainly caution/suspect (K) and poor quality (J) flags (Figure 63). Sometimes the issue was relatively benign – occasional spikes in the data that were likely the result of the intake sucking in air in rough seas, or sudden "sliding steps" in the data that were likely the result of intermittently shutting off the intake pump (see Figure 61 for examples of each). But sometimes there appeared to be a more serious issue at hand; namely, erratic, unexplained behavior of the two parameters that didn't follow the pattern of either of the previous two fairly common occurrences (see Figure 62). Our best guess at the DAC would be a sensor that needed some electrical or mechanical attention.

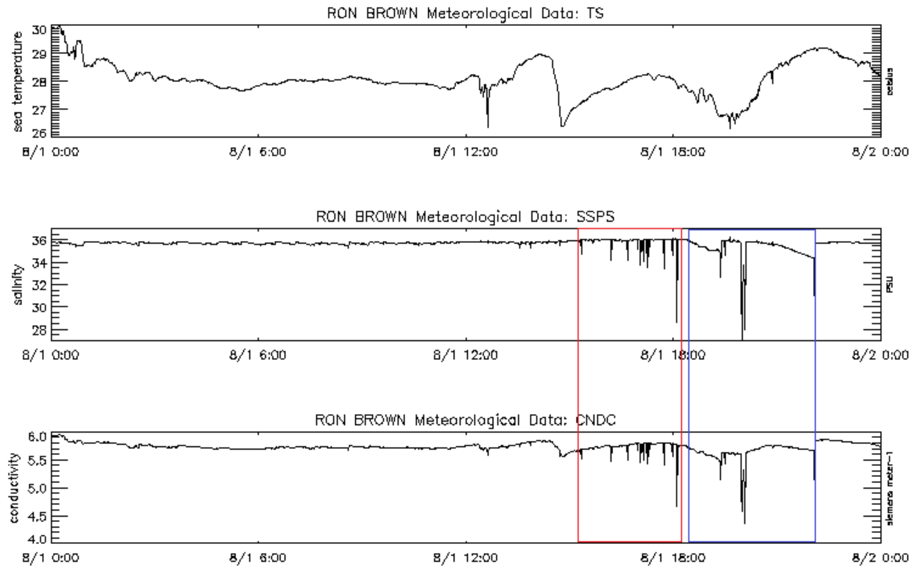


Figure 61: *Ron Brown* SAMOS data for 01 August 2012: (top) sea temperature – TS – (middle) salinity – SSPS – and (bottom) conductivity – CNDC. Note spikes in SSPS and CNDC in the red box (likely air intake) and "sliding steps" ending in discontinuous jump in the blue box (likely turning intake pump off and then back on).

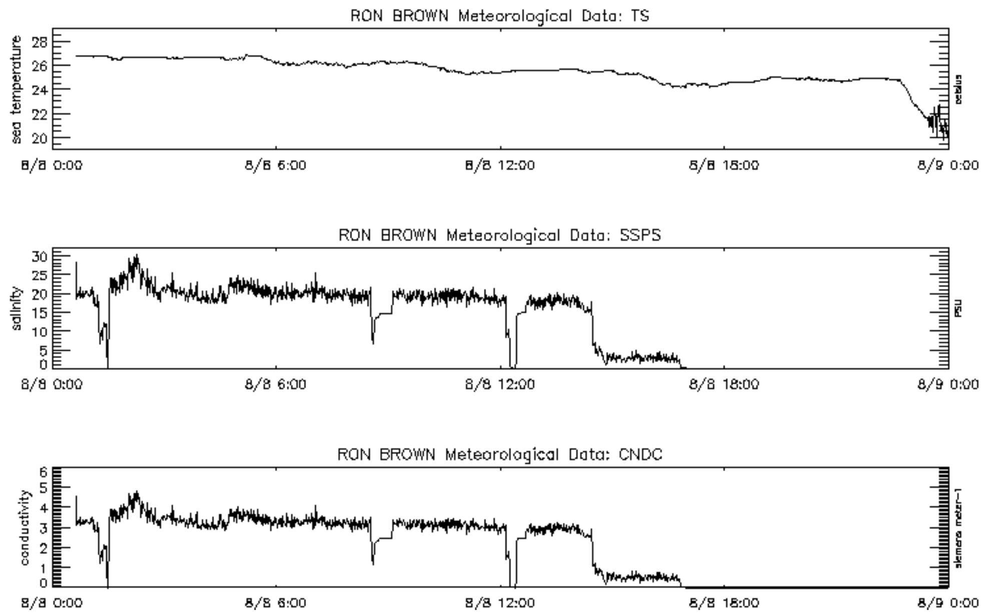


Figure 62: *Ron Brown* SAMOS data for 08 August 2012: (top) sea temperature – TS – (middle) salinity – SSPS – and (bottom) conductivity – CNDC. Note erratic behavior of SSPS/CNDC.

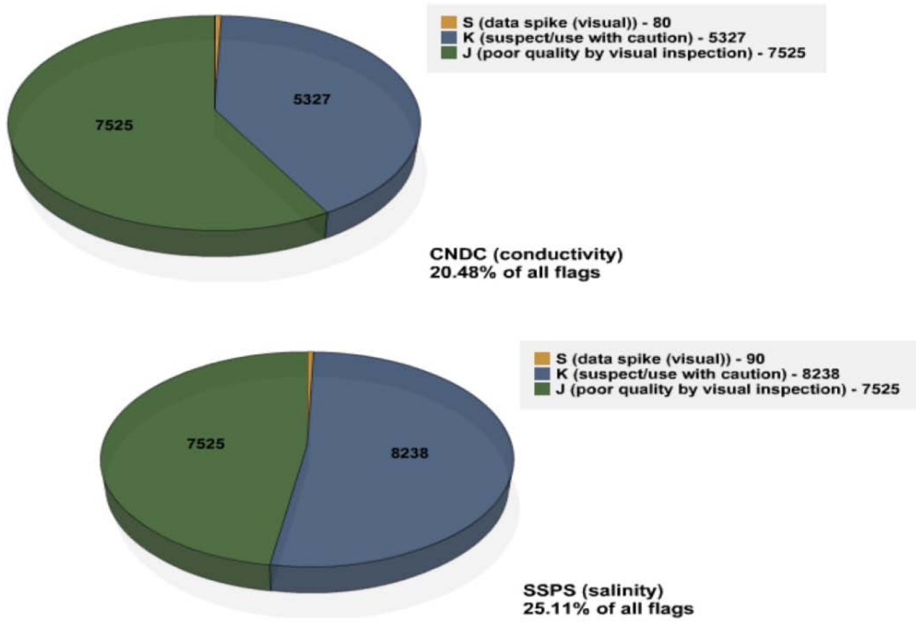


Figure 63: Distribution of SAMOS quality control flags for (top) conductivity – CNDC – and (bottom) salinity – SSPS for the *R/V Ronald H. Brown* in 2012.

Thomas Jefferson

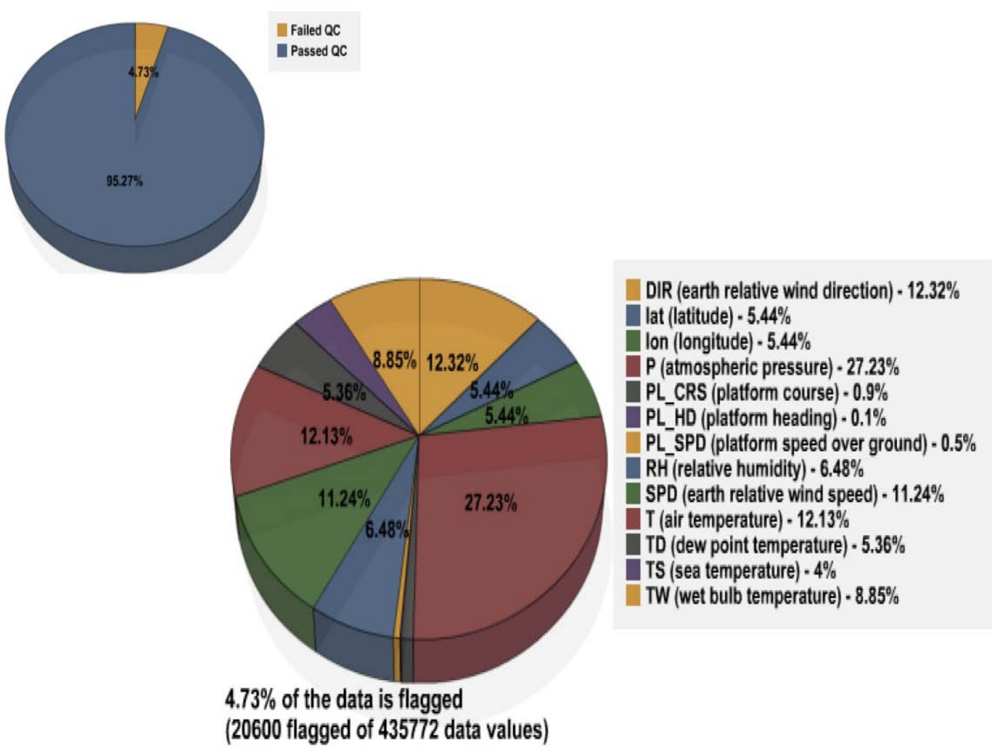


Figure 64: For the *Thomas Jefferson* from 1/1/21 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Thomas Jefferson* provided SAMOS data for 25 ship days, resulting in 435,772 distinct data values. (2012 marks the first year of SAMOS data transmission for the *Jefferson*, hence the low number of ship days.) After both automated and visual QC, 4.73% of the data was flagged using A-Y flags, starting the *Jefferson* off in the coveted <5% flagged bracket, denoting "good data" overall (Figure 64).

The only real issue evident in the *Jefferson's* limited amount of data appeared to be the sensitivity of nearly all of the MET parameters to platform relative wind direction, and none more so than atmospheric pressure (P), with over 27% of the total flags being assigned to that variable (Figure 66). There were a lot of steps in the data (see Figure 65 for an example), resulting in a need for a good amount of suspect/caution (K) flagging. It was anticipated that this would be the case with the *Jefferson*, as it's understood to be a hydrographic survey vessel that is not equipped with research-quality meteorological sensors.

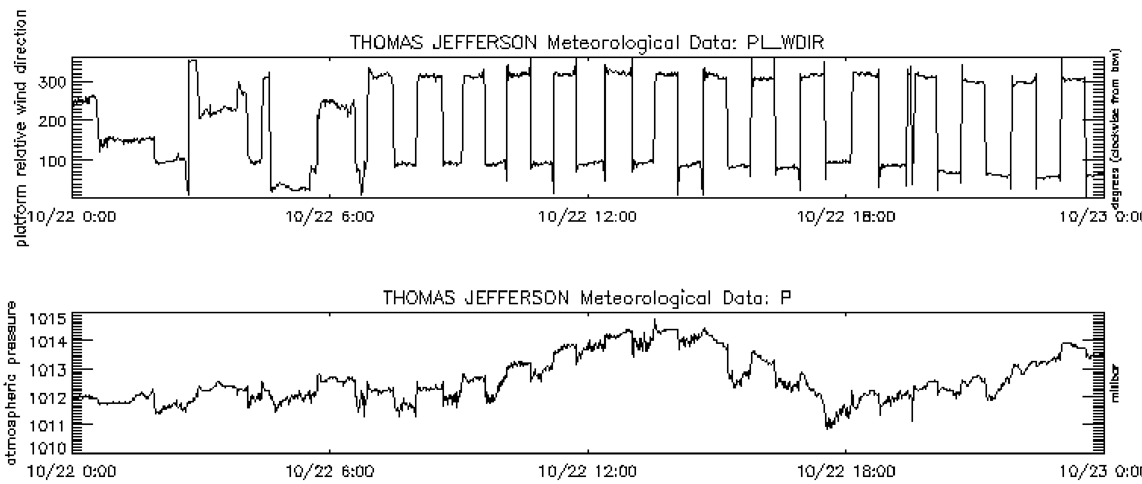


Figure 65: *Thomas Jefferson* SAMOS data for 22 October 2012: (top) platform relative wind direction –PL_WDIR – and (bottom) atmospheric pressure – P. Note frequent steps in P whenever PL_WDIR changes.

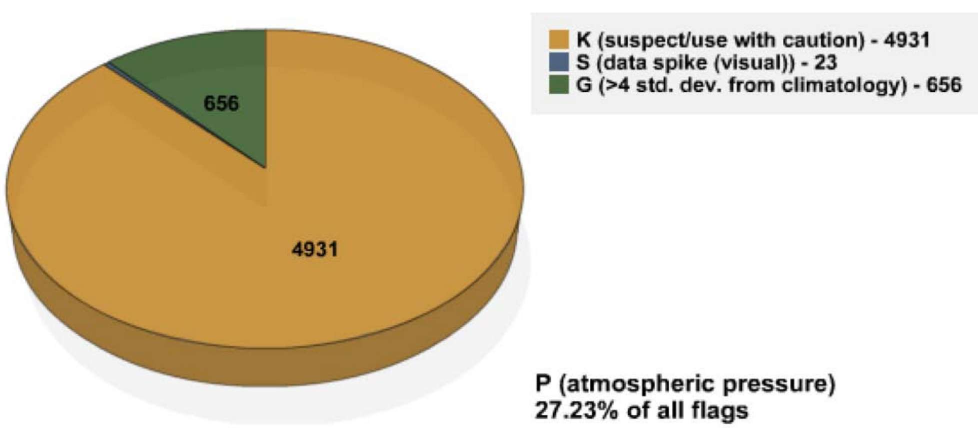


Figure 66: Distribution of SAMOS quality control flags for atmospheric pressure – P –for the *Thomas Jefferson* in 2012.

Laurence M. Gould

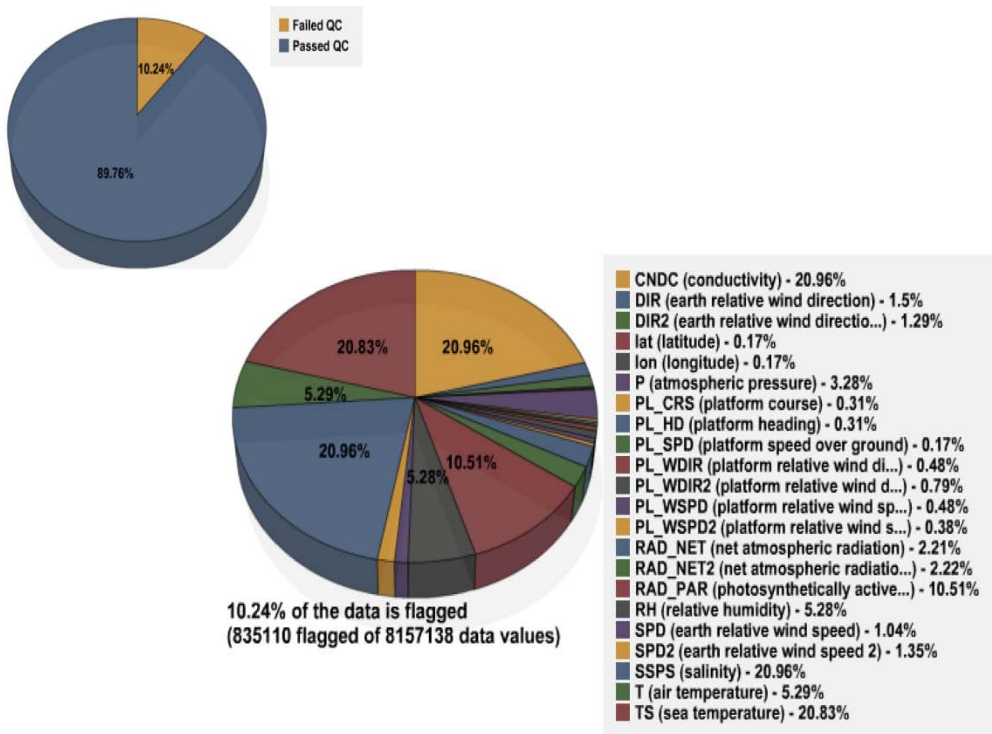


Figure 67: For the *Laurence M. Gould* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Laurence M. Gould* provided SAMOS data for 247 ship days, resulting in 8,157,138 distinct data values. After both automated and visual QC, 10.24% of the data was flagged using A-Y flags (Figure 67). As always, it is important to note that the location and exposure of the instruments on the *Gould* contribute to problems with the atmospheric observations. The T/RH sensor is located low on the mid-ship instrument mast, which is located aft of the vessel stack and main superstructure. In addition to being poorly exposed to the free atmosphere when the winds are from the forward portion of the vessel, some ship relative wind angles will contaminate the T/RH sensor with the ship's exhaust (typically resulting in increased T and RH values).Winds are also easily contaminated by flow distortion, again owing to the massive superstructure and block construction resident on the *Gould*.

The largest portion of flags, however, belongs to the sea parameters of sea temperature (TS), conductivity (CNDC), and salinity (SSPS) (Figure 69). In the case of the sea parameters, poor quality (J) flags were applied almost exclusively when the sea water pumps were turned off due to vessel either being in ice or in port. The bigger issue, despite the smaller flag percentage, involved the photosynthetically active radiation parameter (RAD_PAR). Regarding RAD_PAR, applied flags are primarily out of bounds (B) flags and caution/suspect (K) flags (Figure 69). The K flags were applied mainly in the early part of the year, when RAD_PAR values were mysteriously offset by about +100 microeinsteins meter^{-2} second^{-1} (Figure 68, top). At the occurrence, SAMOS personnel conferred with *Gould* personnel and at the conclusion of the cruise the questionable sensor was sent out for repair while another one was swapped in. Later in the year, the swapped-in RAD_PAR sensor was also sent out for repair. While there was no sensor connected to the data logging system, extreme negative values were "recorded" for the RAD_PAR parameter and reported to SAMOS (Figure 68, bottom). These data were all automatically assigned B flags. In late November, a new RAD_PAR sensor was installed and all of the previous conditions that result in flags were resolved for the remainder of the year.

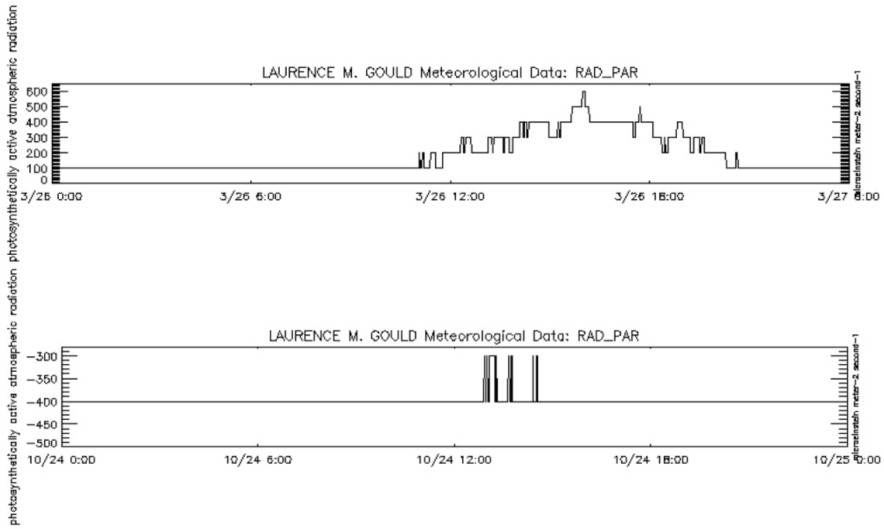


Figure 68: *Laurence M. Gould*: SAMOS data for (top) 26 March and (bottom) 24 October 2012: photosynthetically active radiation – RAD_PAR. Note the erroneous (top) +100 microeinsteins meter^{-2} second^{-1} offset and (bottom) approximate -400 microeinsteins meter^{-2} second^{-1} offset.

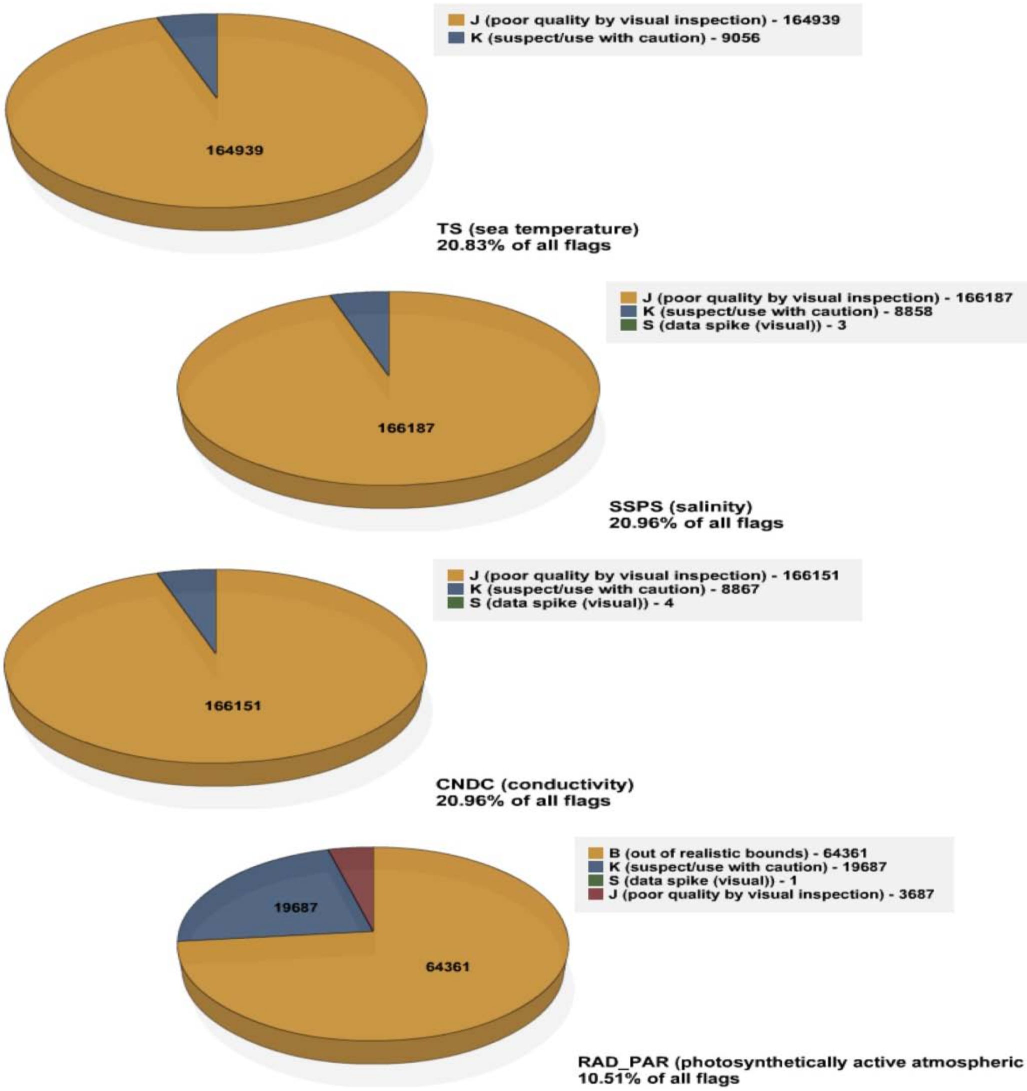


Figure 69: Distribution of SAMOS quality control flags for (first) sea temperature – TS – (second) salinity – SSPS – (third) conductivity – CNDC – and (last) photosynthetically active radiation – RAD_PAR –for the *R/V Lawrence M. Gould* in 2012.

Nathaniel B. Palmer

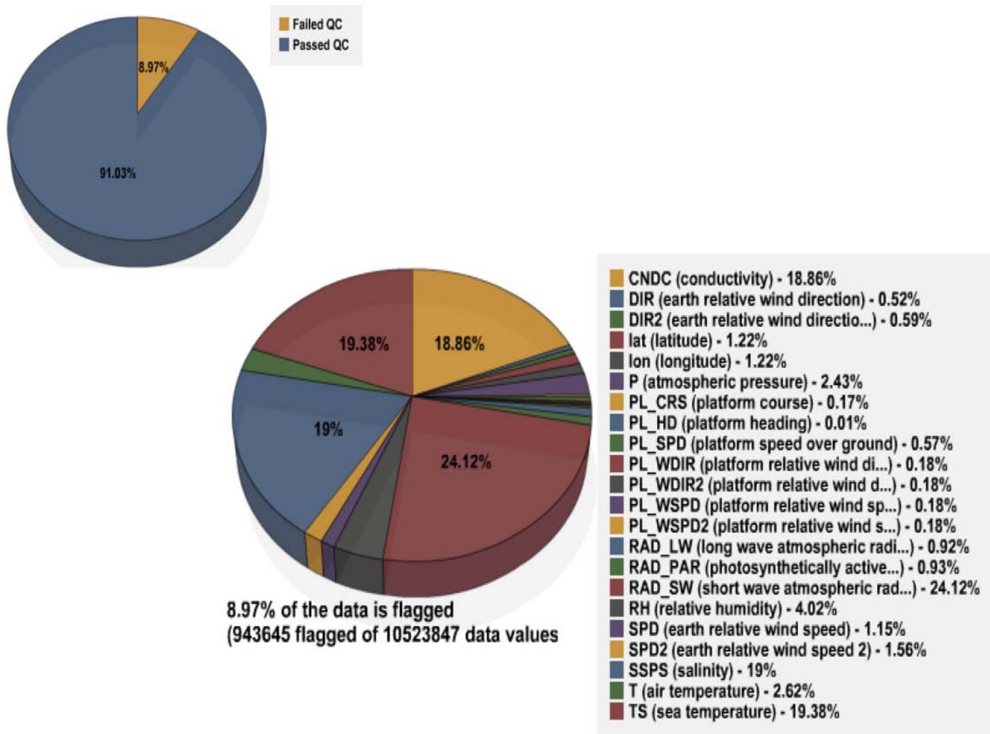


Figure 70: For the *Nathaniel B. Palmer* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nathaniel Palmer* provided SAMOS data for 339 ship days, resulting in 10,523,847 distinct data values. After both automated and visual QC, 8.97% of the data was flagged using A-Y flags (Figure 70).

The largest portion of flags applied (~24%) were once again to short wave radiation (RAD_SW) (Figure 71). The issue has been the same since 2009 – namely, out of bounds (B) flagging of short wave radiation values slightly below zero. This is a common consequence of tuning radiation sensors for better accuracy at much higher values (see Section 3b).

A further combined ~57% of the flags were applied to sea temperature (TS), conductivity (CNDC), and salinity (SSPS) (Figure 71). This is very similar to what we saw with the *Gould*; namely, that poor quality (J) flags were applied almost exclusively when the sea water pumps were turned off due to vessel either being in ice or in port.

It should be noted that airflow obstruction always gains the *Palmer* a fair amount of caution/suspect (K) flags applied to the various MET instruments as well (not shown), as the *Palmer* is an ice-capable research vessel that houses a large superstructure with the primary instrument mast located amidships. Indeed, photographic metadata for the *Palmer* clearly shows that the T/RH sensors are mounted down on a rail near the middle of the vessel where flow distortion and stack exhaust will be an issue.

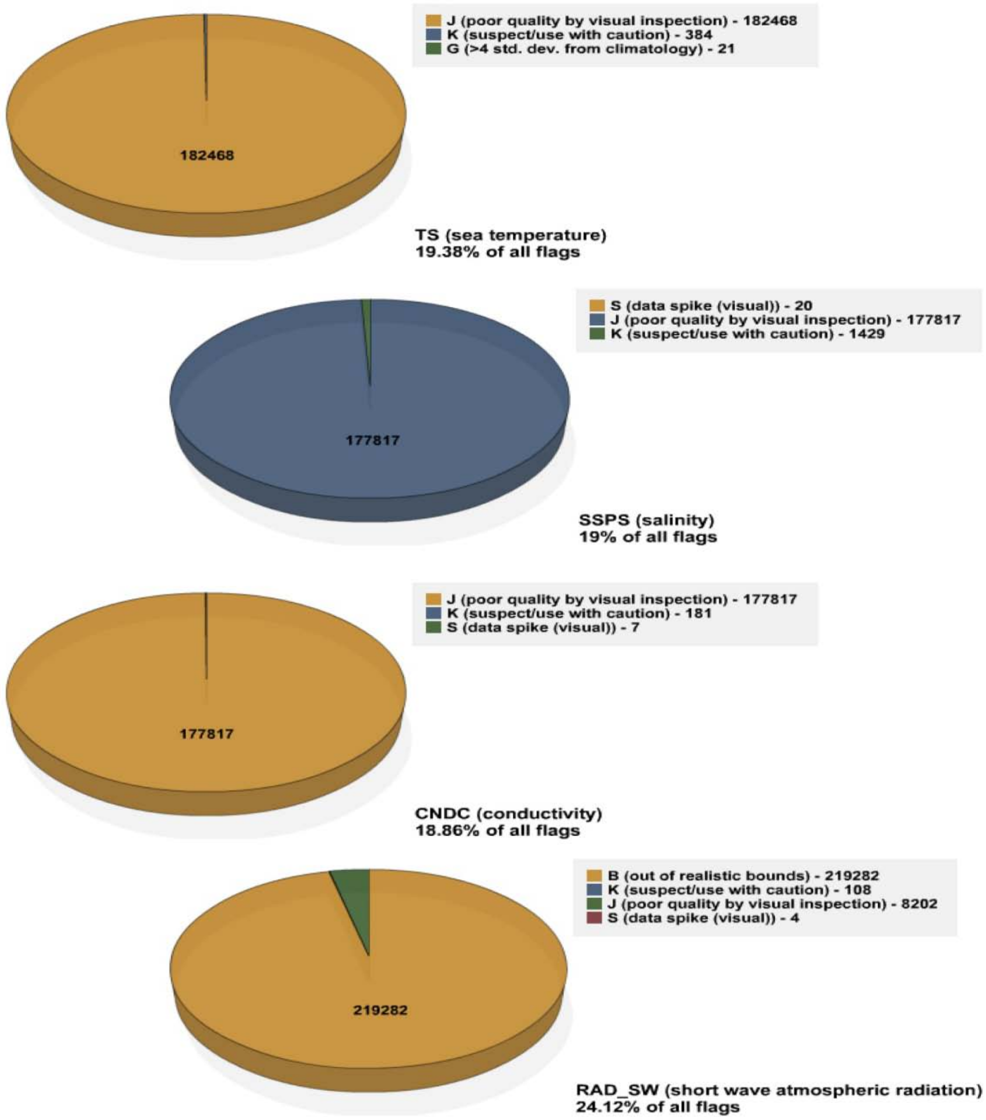


Figure 71: Distribution of SAMOS quality control flags for (first) sea temperature – TS –(second) salinity – SSPS – (third) conductivity – CNDC – and (last) short wave atmospheric radiation – RAD_SW for the *R/V Nathaniel B. Palmer* in 2012.

Melville

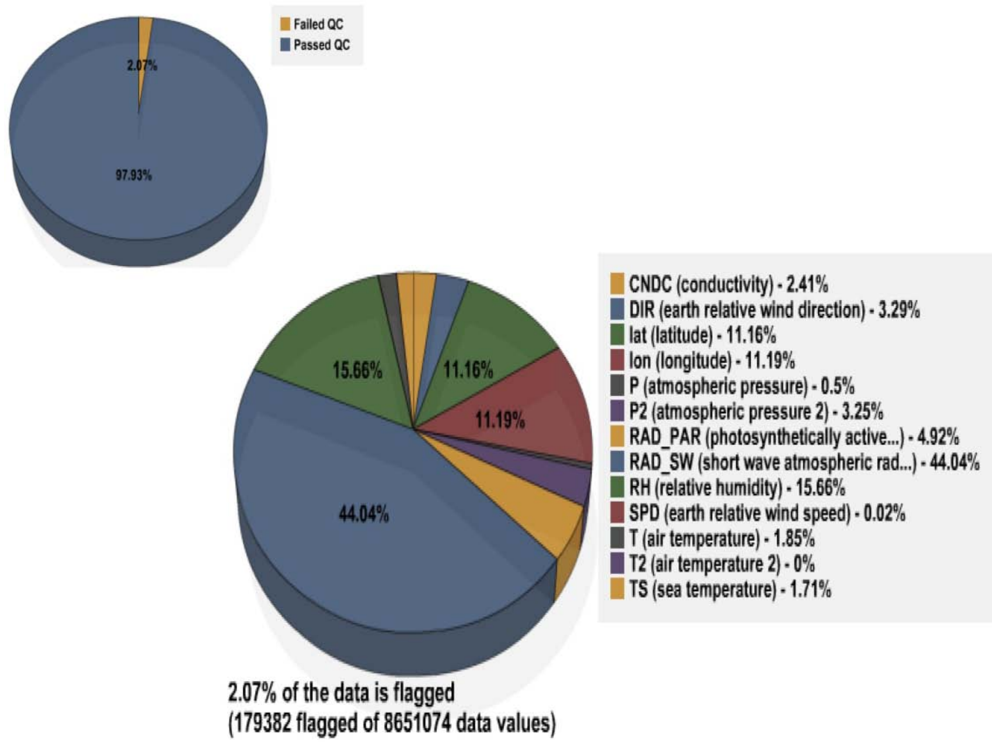


Figure 72: For the *Melville* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Melville* provided SAMOS data for 323 ship days, resulting in 8,651,074 distinct data values. After automated QC, 2.07% of the data was flagged using A-Y flags (Figure 72). NOTE: the *Melville* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Melville*).

The highest percentage of flags (~44%) was applied to shortwave atmospheric radiation (RAD_SW). All of those flags were out of bounds (B) flags (Figure 74). It is likely these were due mostly to the common occurrence of radiation readings slightly below zero in nighttime conditions, owing to sensor tuning (see Section 3b for details).

Relative humidity (RH) received another, smaller portion of the total flags (~15%), split between B flags and greater than 4 standard deviations (G) flags (Figure 74). Upon inspection, the RH sensor appears to have periods of behavior that is potentially unrepresentative of true atmospheric conditions, including dipping into negative values (which are definitely unrepresentative), resulting in "G" flags where above zero and “B” flags where below zero (see Figure 73). The authors recall that there were some issues with RH sensor integrity in 2011, so perhaps 2012 experienced a continuation of those difficulties; unfortunately, we are not funded to decipher problems that are only identified in visual inspection.

Another portion of flags was applied to the navigational parameters latitude (LAT) and longitude (LON) ; these were mainly land error (L) flags that, upon inspection, likely would have been removed during visual quality control as they appear to be applied in locations where *Melville* was actually either very close to shore or traversing narrow waterways (Figure 74).

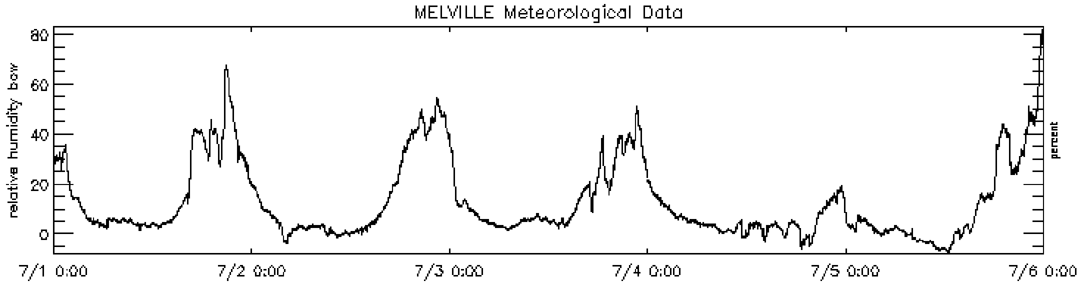


Figure 73: SAMOS relative humidity data from the *Melville* for 01 – 05 July, 2012. Vessel was located just off the California coast, near San Diego, where average relative humidities were around 70% for the period. Note the several drops below zero as well, particularly on 04 and 05 July.

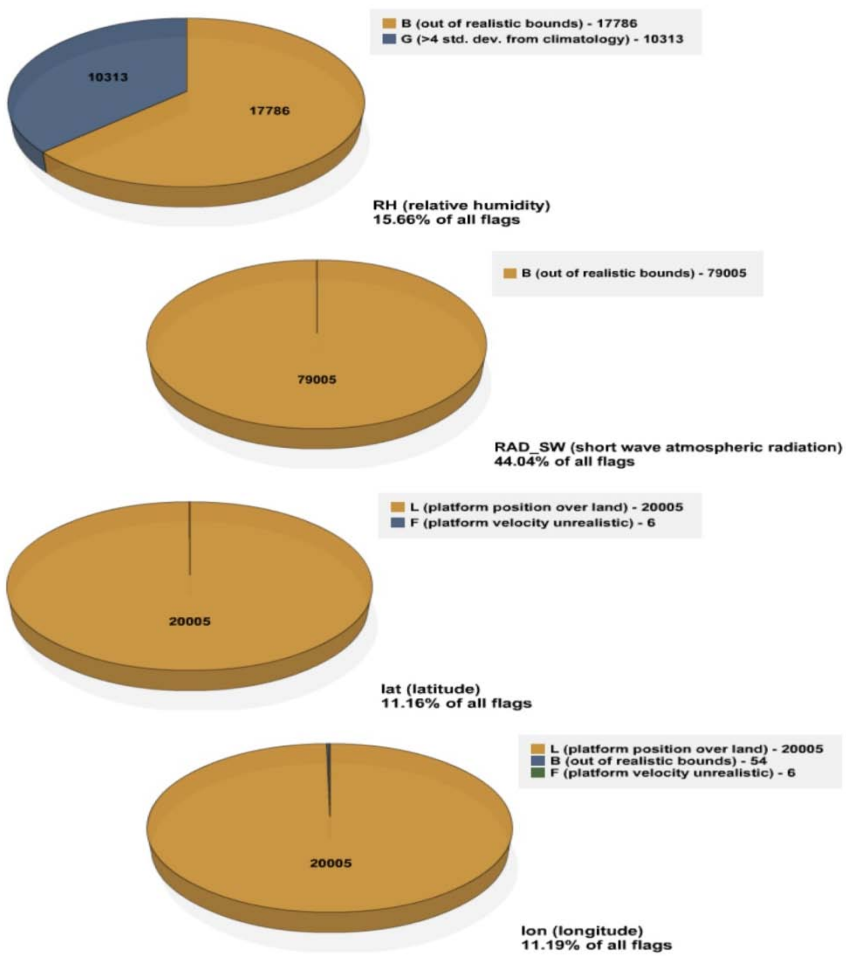


Figure 74: Distribution of SAMOS quality control flags for (top) relative humidity – RH – (middle) short wave atmospheric radiation – RAD_SW – and (bottom) photosynthetically active atmospheric radiation – RAD_PAR – for the *Melville* in 2011.

New Horizon

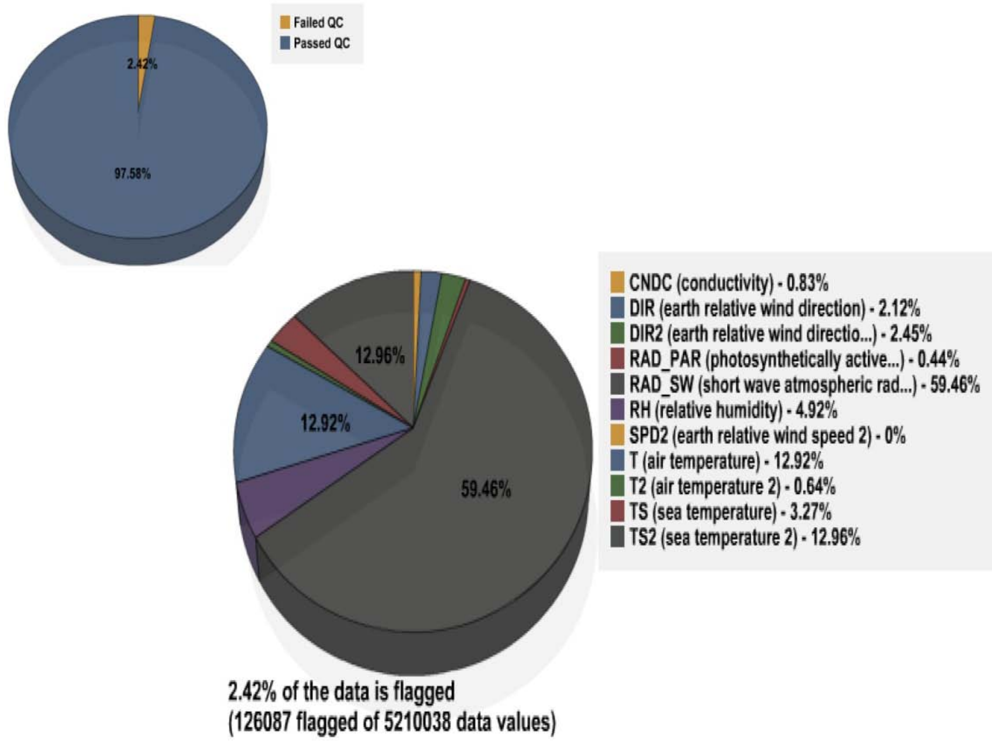


Figure 75: For the *New Horizon* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *New Horizon* provided SAMOS data for 147 ship days, resulting in 5,210,038 distinct data values. After automated QC, 2.42% of the data was flagged using A-Y flags (Figure 75). 2012 is the first year in which SAMOS received data from the *New Horizon*. 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 (nearly 60%) was applied to shortwave atmospheric radiation (RAD_SW). All of those flags were out of bounds (B) flags (Figure 78). It is likely these were due mostly to the common occurrence of radiation readings slightly below zero in nighttime conditions, owing to sensor tuning (see Section 3b for details).

The air temperature (T) parameter also received a fair amount of flags, mostly B and greater than 4 standard deviations (G) flags (Figure 78). Upon inspection, it appears there must have been an issue with that sensor; values were exceptionally high and in some cases unrealistic, especially when compared to the redundant air temperature sensor, T2 (see Figure 76). If visual quality control had been applied, all of the G flags would likely have been changed to caution/suspect (K) or poor quality (J) flags, so as to avoid any confusion on the part of the end user.

Additionally, the second sea temperature parameter (TS2) received a fair portion of flags, again mostly B and G (Figure 78). Again, inspection reveals there must have been an issue with the sensor; values traversed over an unrealistic range, especially when compared with the primary sea temperature sensor, TS (see Figure 77). This position is strengthened by the fact that after about two weeks of this behavior transmission of data from this particular sensor ceased and did not resume for the remainder of 2012. Once again, it should be noted that visual quality control would likely have changed any G flags to K or J flags to avoid any confusion on the part of the end user.

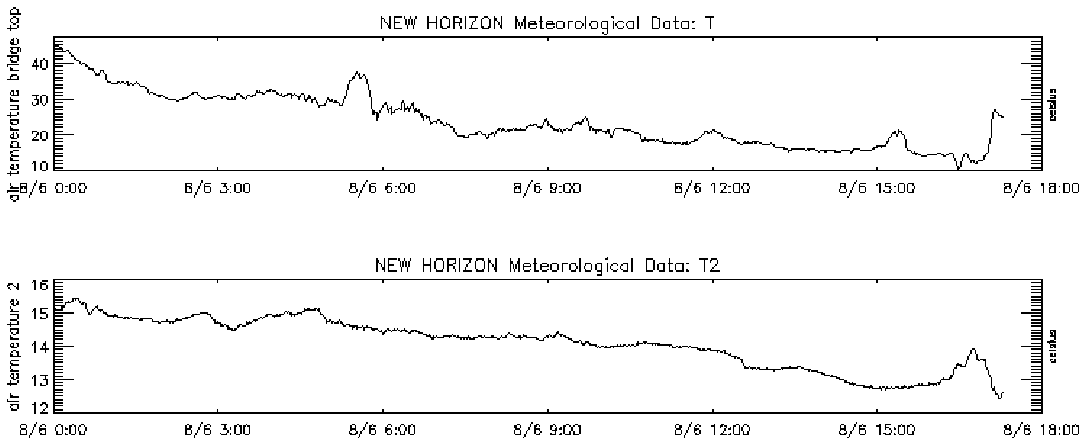


Figure 76: SAMOS air temperature data from the *New Horizon* for 06 August, 2012. Note the great discrepancy between T and T2.

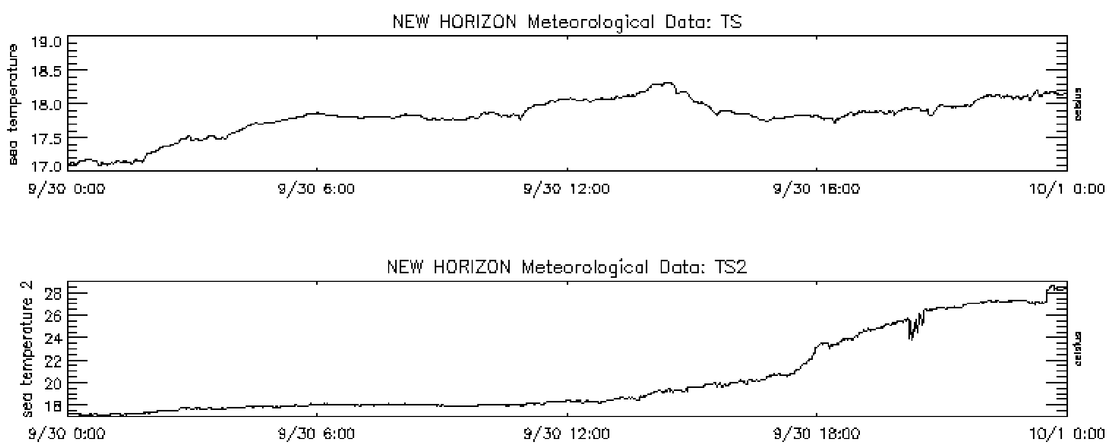
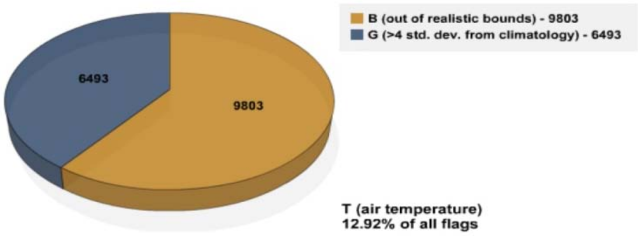
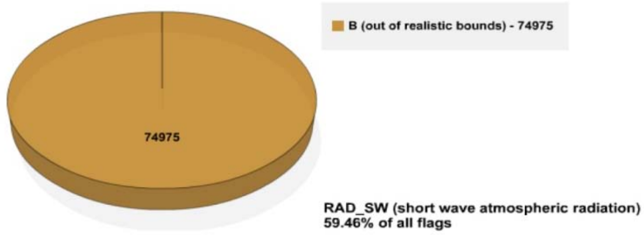


Figure 77: SAMOS sea temperature data from the *New Horizon* for 30 September, 2012. Note the great discrepancy between TS and TS2.





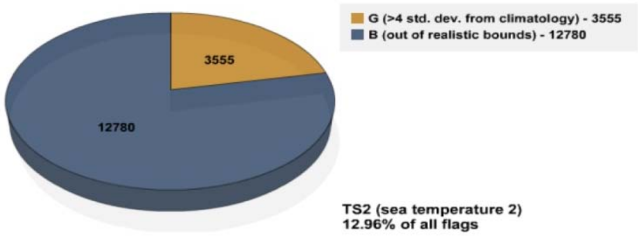


Figure 78: Distribution of SAMOS quality control flags for (top) air temperature – T – (middle) short wave atmospheric radiation – RAD_SW – and (bottom) sea temperature 2 – TS2 – for the *New Horizon* in 2012.

Roger Revelle

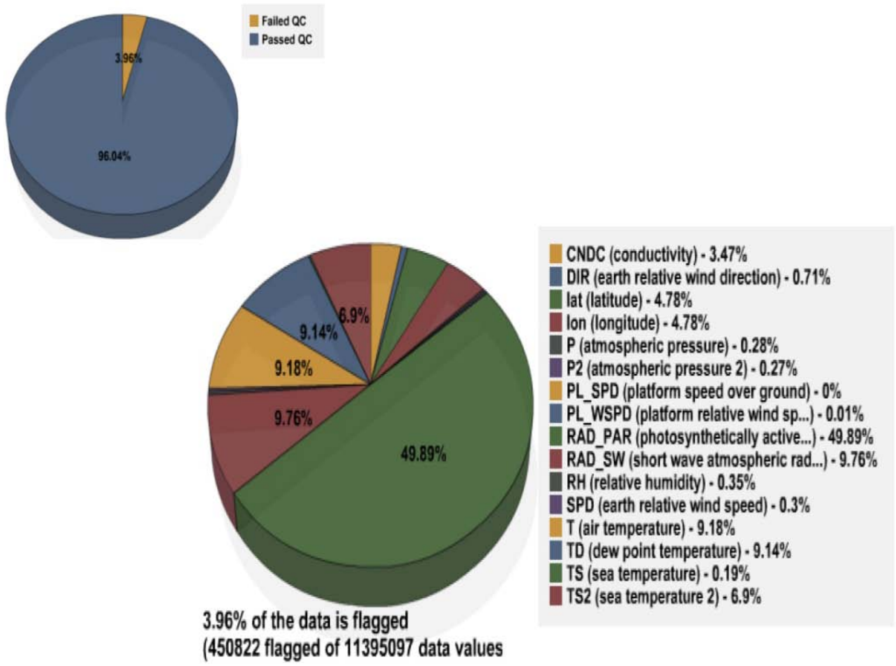


Figure 79: For the *Roger Revelle* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Roger Revelle* provided SAMOS data for 353 ship days, resulting in 11,395,097 distinct data values. After automated QC, 3.96% of the data was flagged using A-Y flags (Figure 79). 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 was applied to photosynthetically active radiation (RAD_PAR). All of those flags were out of bounds (B) flags (Figure 81). These were due mostly to the common occurrence of radiation readings slightly below zero in nighttime conditions, owing to sensor tuning (see Section 3b for details), as well as slightly out of bounds at the upper limit, another common occurrence. Short wave atmospheric radiation (RAD_SW) also received a fair amount of B flags, most likely with the same reasoning as RAD_PAR (Figure 81).

Air temperature (T) and dew point temperature (TD) each received about 9% of the total flags, as well, almost exclusively failed the T>=Tw>=Td test (D) flags (Figure 81). Upon inspection, it appears there was a major issue with T whereby it read a constant, unrealistic value for about a month in early Spring 2012 (see Figure 80). This would cause both the T and the associated TD parameter to incur the D flags. If the *Roger Revelle* received visual quality control, at the least the flags applied to TD would likely have been removed.

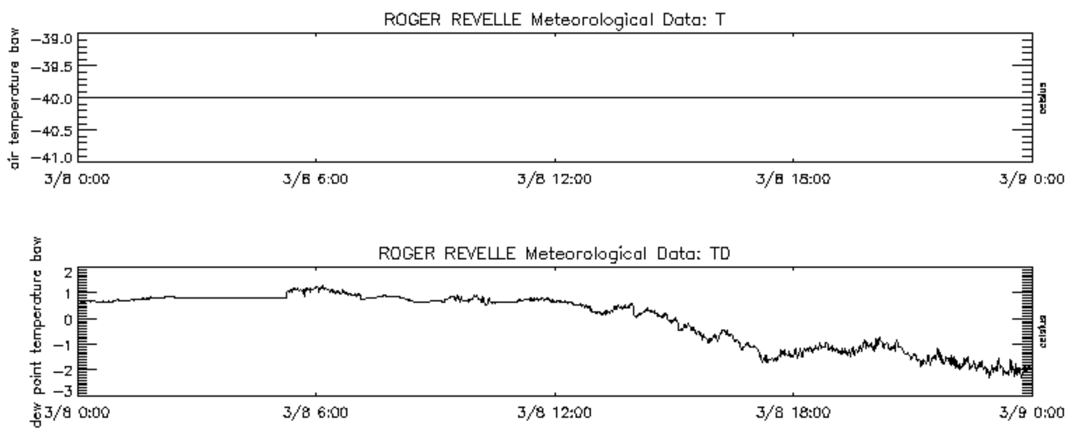


Figure 80: SAMOS data from the *New Horizon* for 30 September, 2012: (top) air temperature –T – and (bottom) dew point temperature – TD.

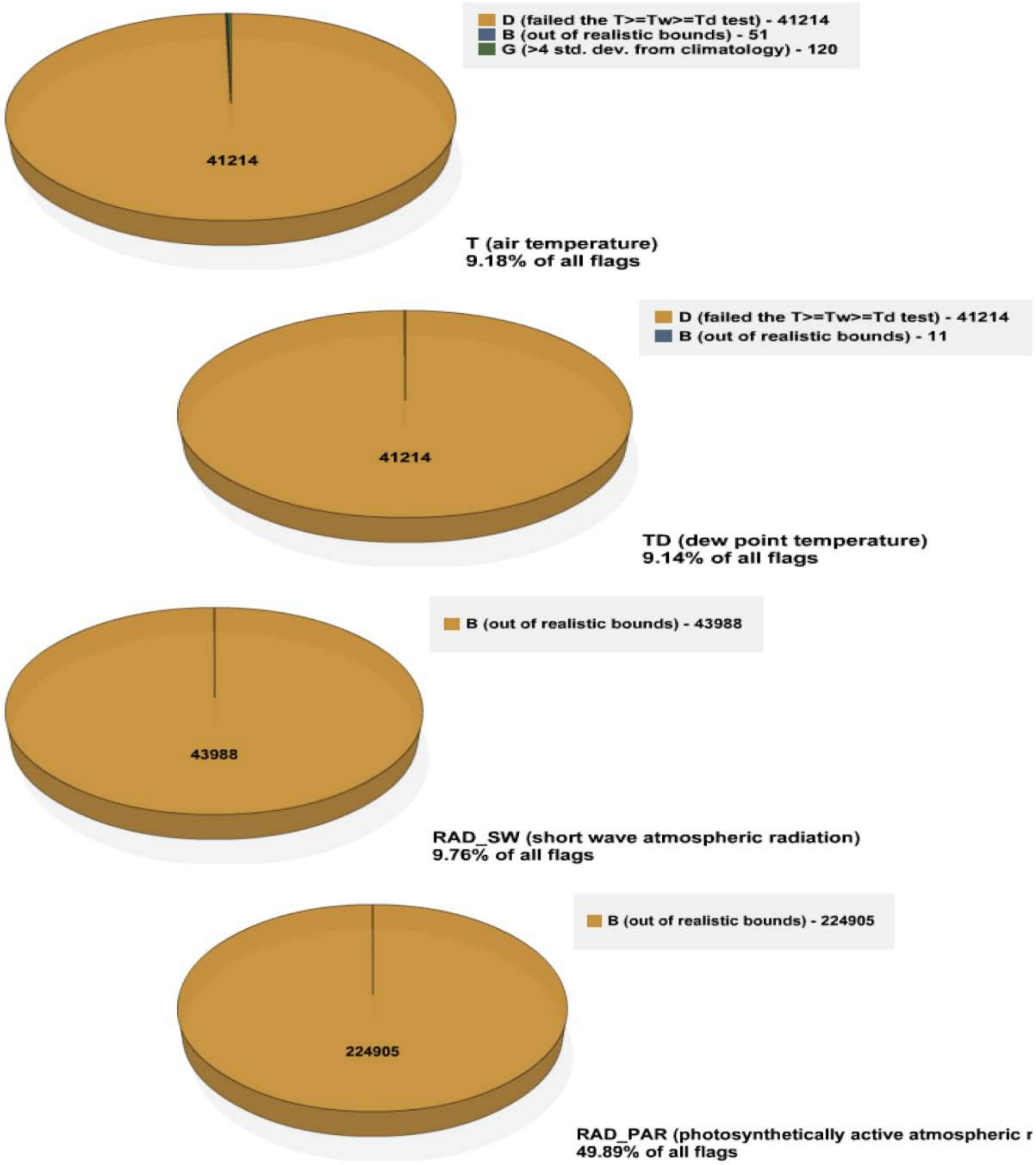


Figure 81: Distribution of SAMOS quality control flags for (first) air temperature – T – (second) dew point temperature – TD – (third) short wave atmospheric radiation – RAD_SW – and (last) photosynthetically active atmospheric radiation – RAD_PAR – for the *Roger Revelle* in 2012.

Robert Gordon Sproul

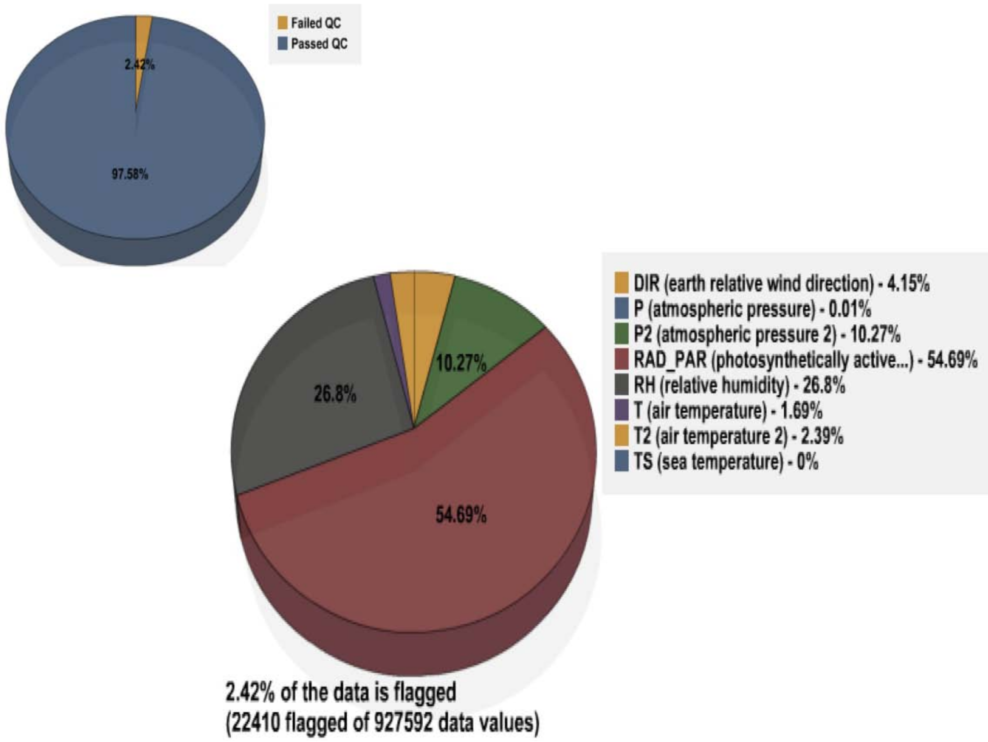


Figure 82: For the *Robert Gordon Sproul* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Robert Gordon Sproul* provided SAMOS data for 76 ship days, resulting in 927,592 distinct data values. After automated QC, 2.42% of the data was flagged using A-Y flags (Figure 82). 2012 is the first year in which SAMOS received data from the *Sproul*. 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 highest percentage of flags (nearly 55%) was applied to photosynthetically active atmospheric radiation (RAD_PAR). All of those flags were out of bounds (B) flags (Figure 84). It is likely these were due mostly to the common occurrence of radiation readings slightly below zero in nighttime conditions, owing to sensor tuning (see Section 3b for details).

The relative humidity (RH) parameter also received a fair amount of flags, strictly B and greater than 4 standard deviations (G) flags (Figure 84). RH values would occasionally reach well over 100% and “flatline” there (see Figure 83). When this behavior was discovered, SAMOS personnel contacted the *Sproul* and provided examples of the odd behavior. *Sproul* personnel replied, suggesting that sea spray may be the culprit.

There was also an issue with the second atmospheric pressure parameter (P2), whereby the data read a constant 800 mb or so for several days in a row in June. This resulted in a bit of B flagging (Figure 84).

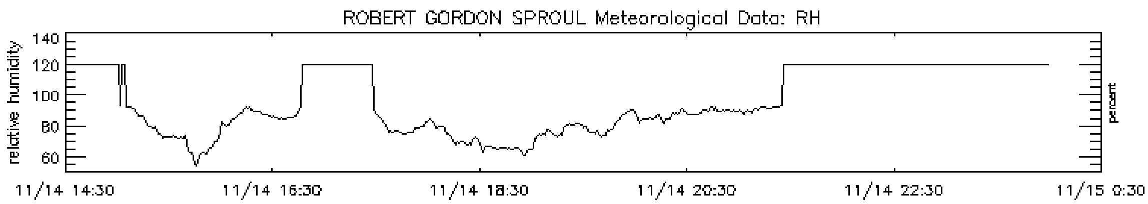


Figure 83: SAMOS relative humidity data from the *Robert Gordon Sproul* for 14 November, 2012.

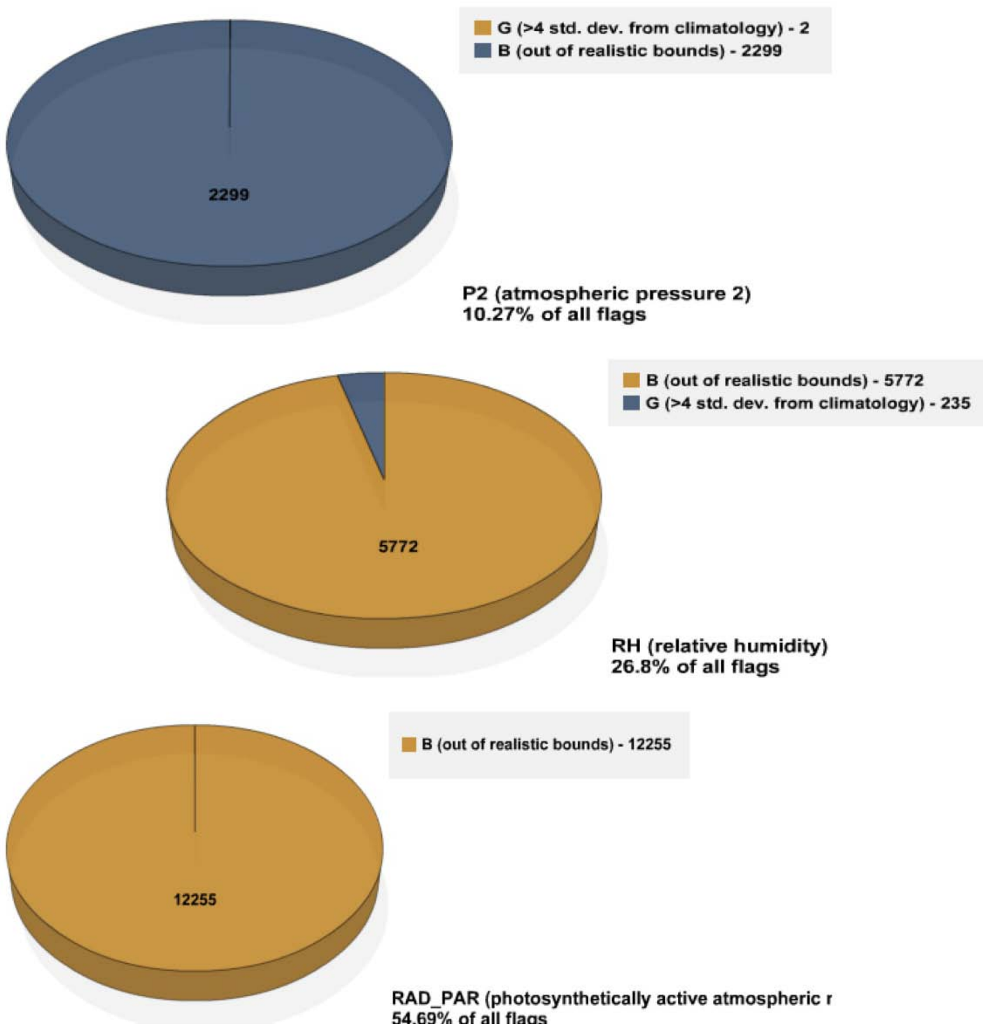


Figure 84: Distribution of SAMOS quality control flags for (top) atmospheric pressure 2 – P2 – (middle) relative humidity – RH – and (bottom) photosynthetically active atmospheric radiation – RAD_PAR – for the *Robert Gordon Sproul* in 2012.

Kilo Moana

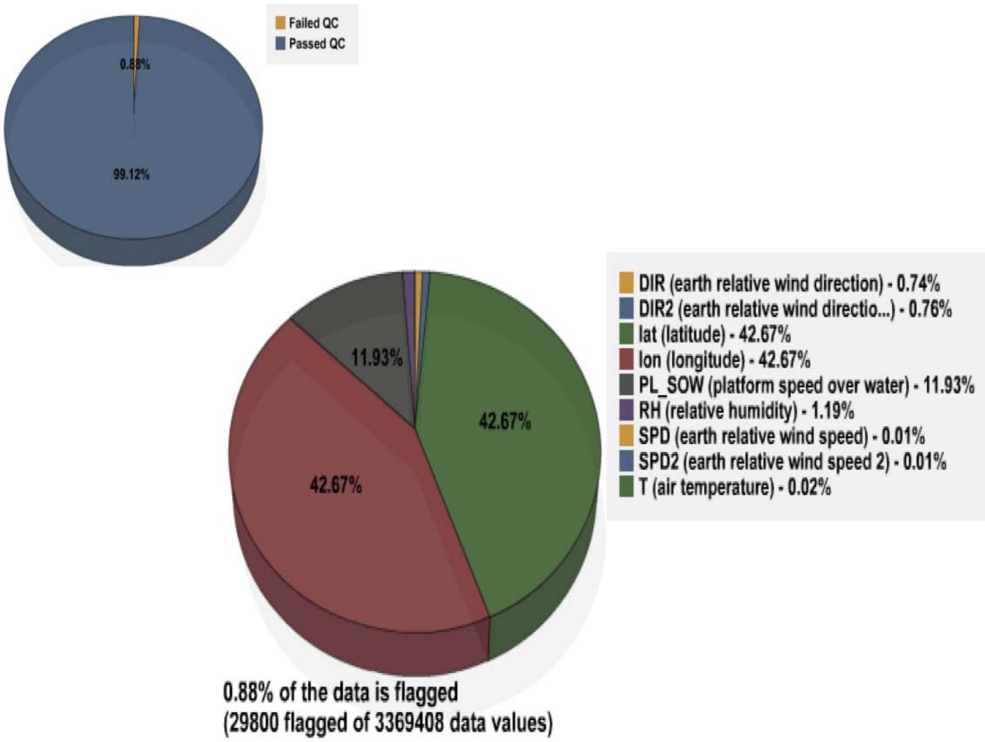
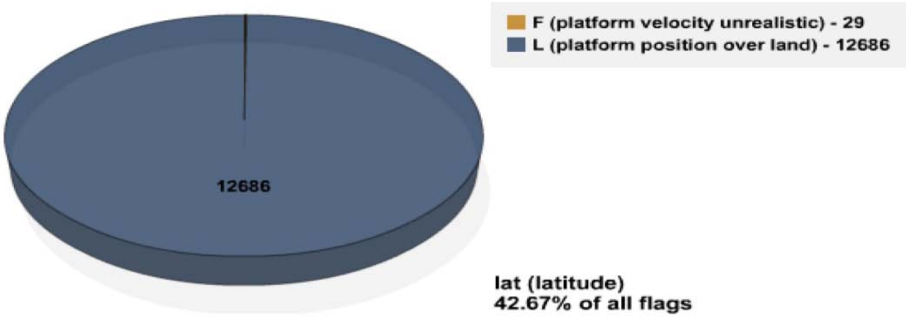


Figure 85: For the *Kilo Moana* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Kilo Moana* provided SAMOS data for 123 ship days, resulting in 3,369,408 distinct data values. After automated QC, 0.88% of the data was flagged using A-Y flags (Figure 85), by all accounts an extremely low flag percentage. 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. As such, the authors cannot determine the cause of limited number (29,800) of flagged data values, or even determine how representative of quality is the 0.88%. It bears mentioning, at least, that most of the flags were applied to the navigational parameters latitude (LAT) and longitude (LON), and those flags were mostly land error (L) flags that would likely have been removed by visual QC (Figure 86). (They were most likely applied to positions that were very close to shore or in narrow waterways.) Hopefully resources can be secured in the future for visual QC.



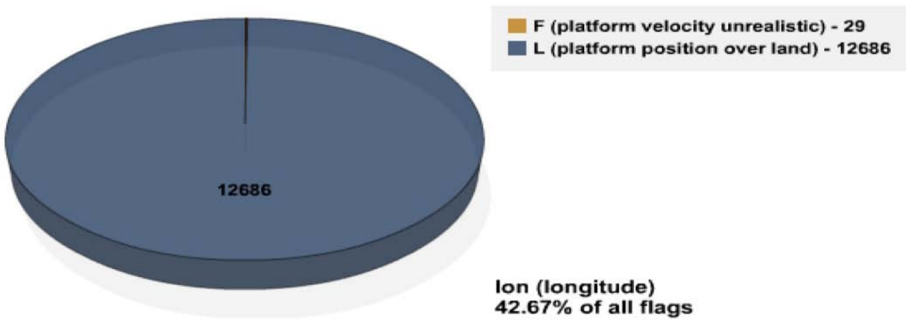


Figure 86: Distribution of SAMOS quality control flags for (top) latitude – LAT – and (bottom) longitude – LON – for the *Kilo Moana* in 2012.

Endeavor

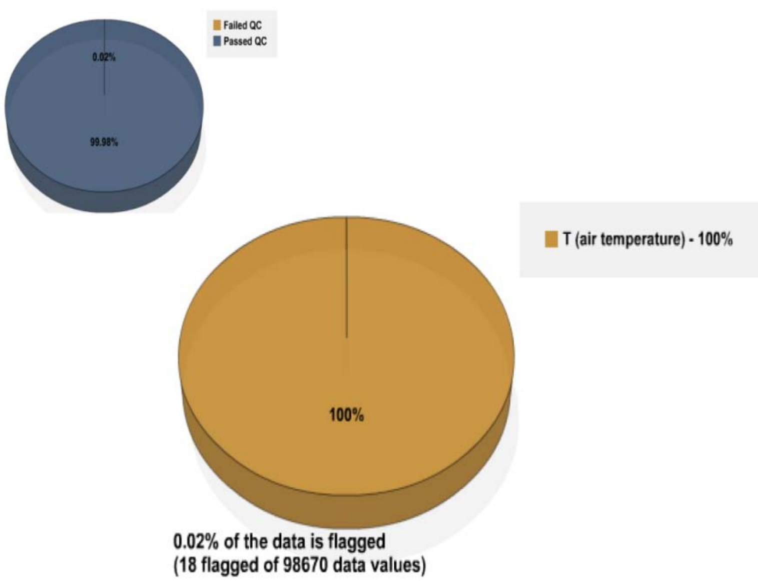


Figure 87: For the *Endeavor* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Endeavor* has so far submitted SAMOS data for some 60+ ship days for 2012; however, because *Endeavor* is the first vessel to submit in SAMOS 2.0 format and file processing is still in the testing phase, only 3 of those files have been fully processed. As such, the resulting 0.02% total flagging should in no way suggest anything about data quality for the *Endeavor* (Figure 87). Naturally, it makes no sense to investigate the 18 flagged air temperature (T) values for any "major problem" potential. It is anticipated that progress will be made in 2013 to fully process the *Endeavor* data, for 2012 through present.

Thomas G Thompson

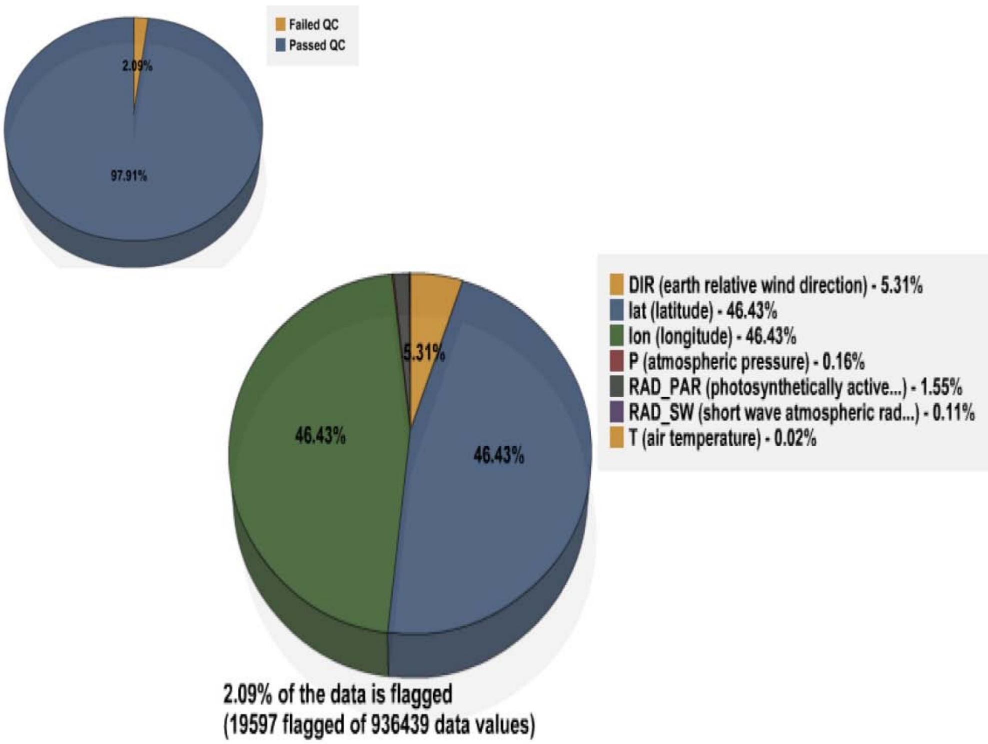


Figure 88: For the *Thomas G Thompson* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *T.G. Thompson* provided SAMOS data for 36 ship days, resulting in 3,369,408 distinct data values. After automated QC, 2.09% of the data was flagged using A-Y flags (Figure 88). 2012 is the first year in which SAMOS received data from the *Thompson*. NOTE: the *T.G. Thompson* does not receive visual quality control by the SAMOS DAC, so all of the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Thomas G Thompson*).

The *Thompson* was recruited to the SAMOS project on 06 June, 2012. However, a starboard z-drive failure onboard the *Thompson* prohibited them from sending any more data after that date in 2012. The bulk of the flags applied in the short period of data received by the SAMOS DAC were land error (L) flags, applied to the navigational parameters latitude (LAT) and longitude (LON) (Figure 89). It is likely that most or all of these flags would have been removed by visual QC, as they were probably applied to locations very close to shore or in narrow waterways. Other than this, no determination of overall data quality can really be made at this point for the *Thompson*. It is the understanding at SAMOS that there is a major MET system upgrade ongoing on the *Thompson*, as well as an ongoing upgrade to the data acquisition system. As such, the SAMOS group looks forward to the resumption of data transmission from the *Thompson* sometime in 2013.

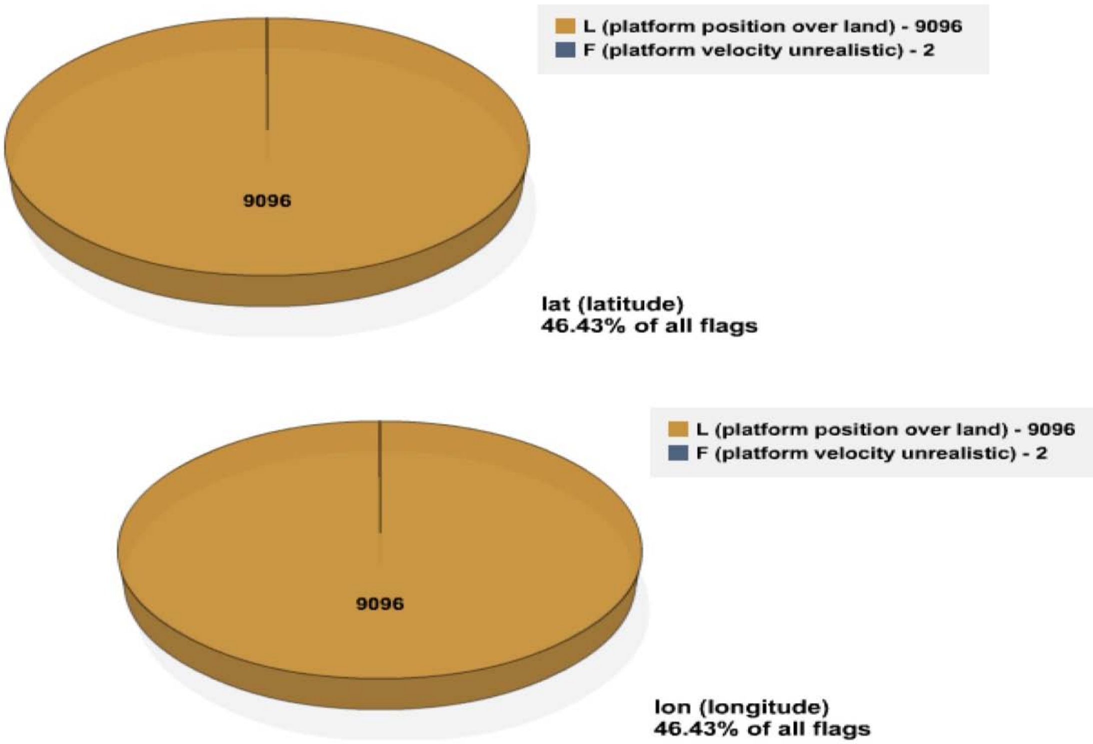


Figure 89: Distribution of SAMOS quality control flags for (top) atmospheric pressure 2 – P2 – (middle) relative humidity – RH – and (bottom) photosynthetically active atmospheric radiation – RAD_PAR – for the *Robert Gordon Sproul* in 2012.

Healy

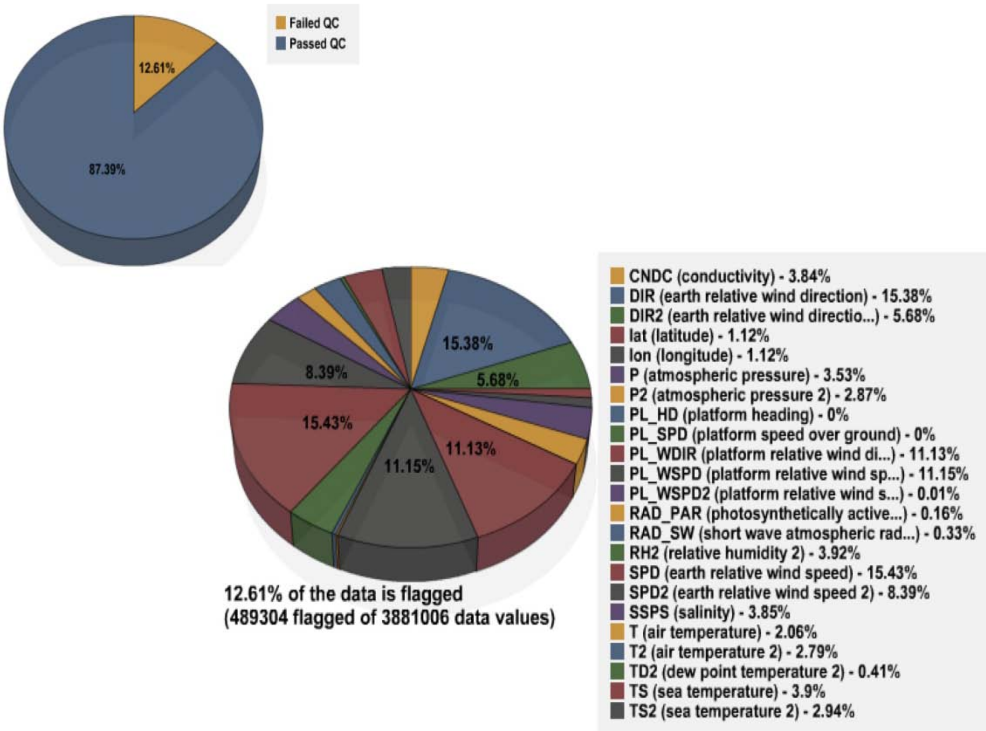


Figure 90: For the *Healy* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Healy* provided SAMOS data for 123 ship days, resulting in 3,881,006 distinct data values. After both automated and visual QC, 12.61% of the data was flagged using A-Y flags (Figure 90). This is a bit of a decline (+3.88%) over 2011's 8.73% flagged.

The authors stress, as they did in previous reports, that the block-house shape of the superstructure on the *Healy* makes flow obstruction nearly unavoidable and provides few good locations for meteorological sensors. As such, the majority of the flagging in most of the MET parameters was likely due to airflow obstruction. Once again, the many redundant sensors on board the *Healy* are clear evidence of that fact, as redundant sensors commonly differed from each other appreciably. However, as stated in previous reports, no definitive statement can be made regarding airflow obstruction without detailed airflow modeling of the *Healy*.

In addition to the flow obstruction issue, there was a period of several weeks in the early part of 2012 when the *Healy's* primary anemometer was either frozen or otherwise out of commission and reported constant values for the entire duration. This resulted in a good amount of poor quality (J) flagging of platform relative wind direction (PL_WDIR), platform relative wind speed (PL_WSPD), earth relative wind direction (DIR), and earth relative wind speed (SPD) (Figure 91).

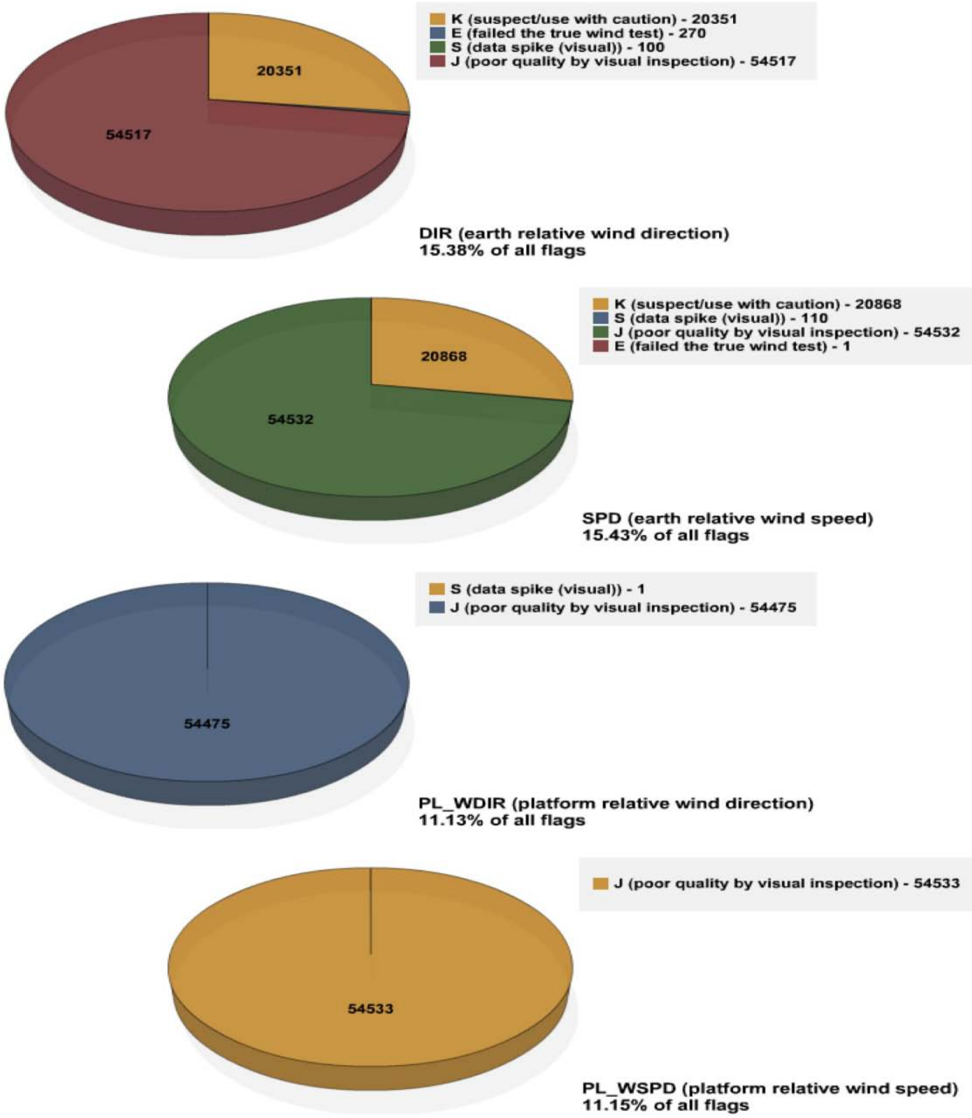


Figure 91: Distribution of SAMOS quality control flags for (first) relative earth relative wind direction – DIR – (second) earth relative wind speed – SPD – (third) platform relative wind direction – PL_WDIR – and (last) platform relative wind speed – PL_WSPD – for the *R/V Healy* in 2012.

R/V Atlantis

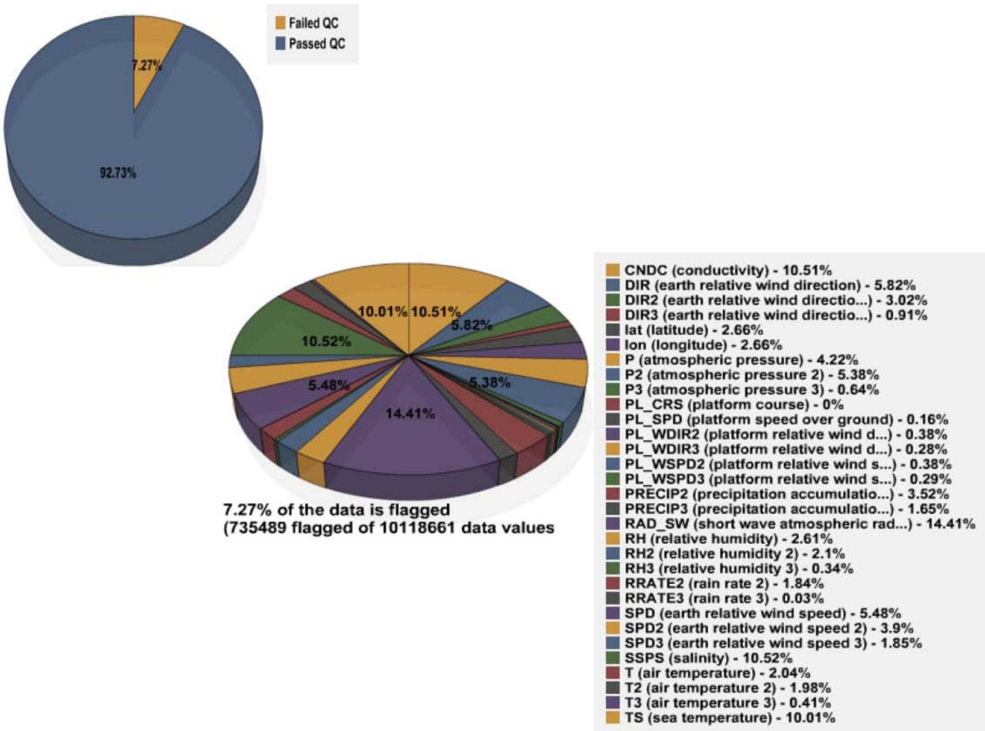


Figure 92: For the *R/V Atlantis* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Atlantis* provided SAMOS data for 246 ship days, resulting in 10,118,661 distinct data values. After both automated and visual QC, 7.27% of the data was flagged using A-Y flags (Figure 92).

Flags were spread pretty evenly amongst most of the variables, with the exception of the short wave radiation (RAD_SW) and the three sea parameters of sea temperature (TS), conductivity (CNDC), and salinity (SSPS). Each of the sea parameters received about 10% of the total flags, with the majority of flags being caution/suspect (K) and poor quality (J) flags (Figure 93). In most cases, the application of these flags was the result of the sea surface system being temporarily turned off, for such things as canal transits and port stops. Short wave radiation received about 14% of the total flags, with the majority of them being out of bounds (B) flags (Figure 93) applied to values slightly below zero at night, due to sensor tuning (see 3b for details). The authors wish to stress that neither of these flag situations is particularly troubling, and in fact they are common to many of the SAMOS vessels.

There were a few other situations onboard the *Atlantis* in 2012 that are difficult to see in the flag percentages: First, the MET mast was occasionally lowered while *Atlantis* was in port and data transmission continued throughout. In these instances, most or all of the MET variables were caution/suspect (K) or poor quality (J) flagged while the mast was down. It should be noted that *Atlantis* personnel often advised the SAMOS group when the mast was down, which was helpful as it wasn’t always easy to pick up visually.

Second, for most of January and the beginning of February, MET sensor 3 was non-functional, so a whole host of parameters were not reported (air temperature , relative humidity, atmospheric pressure, all associated wind parameters, and all associated precipitation parameters). Fortunately, the *Atlantis* houses redundant sensors for all of those parameters, so there was still MET data being sent to SAMOS.

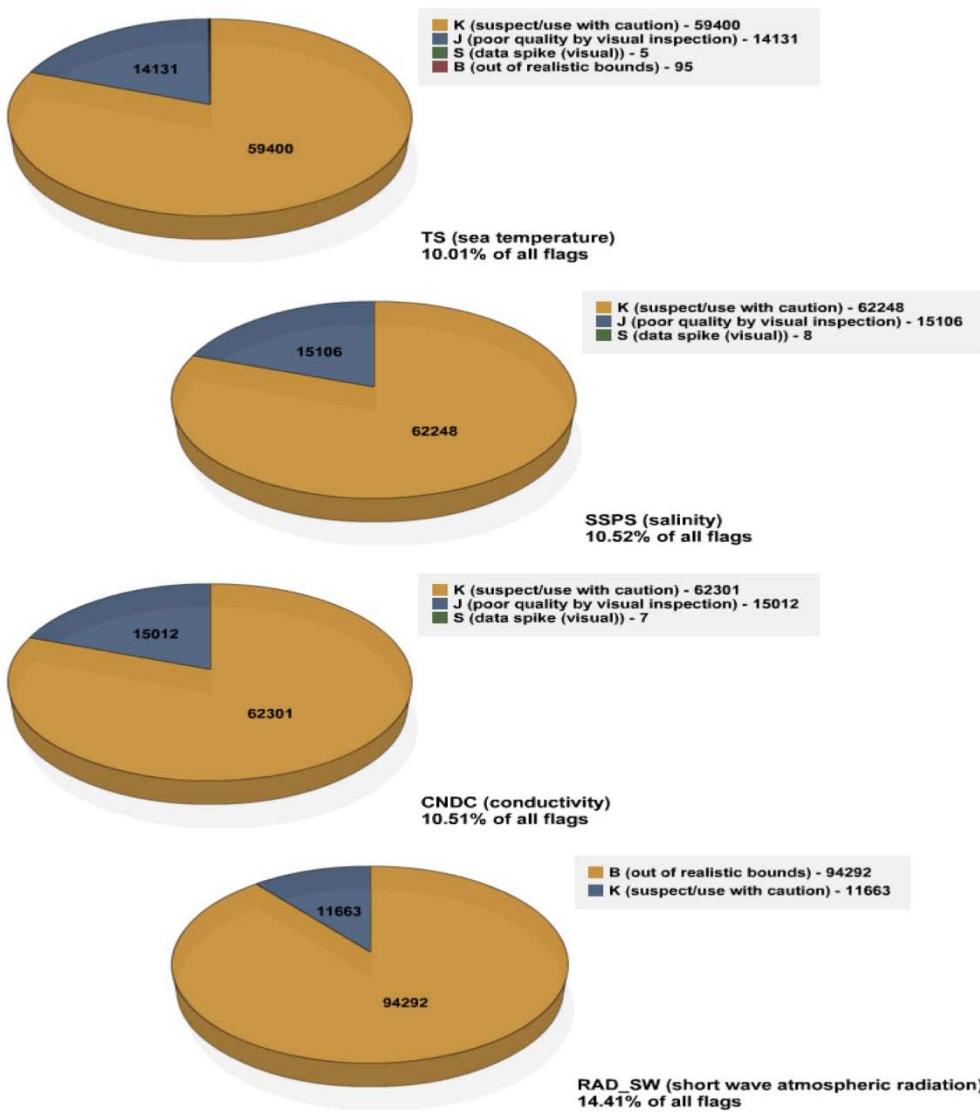


Figure 93: Distribution of SAMOS quality control flags for (first) sea temperature – TS – (second) salinity – SSPS – (third) conductivity – CNDC – and (last) short wave atmospheric radiation – RAD_SW – for the *R/V Atlantis* in 2012.

R/V Knorr

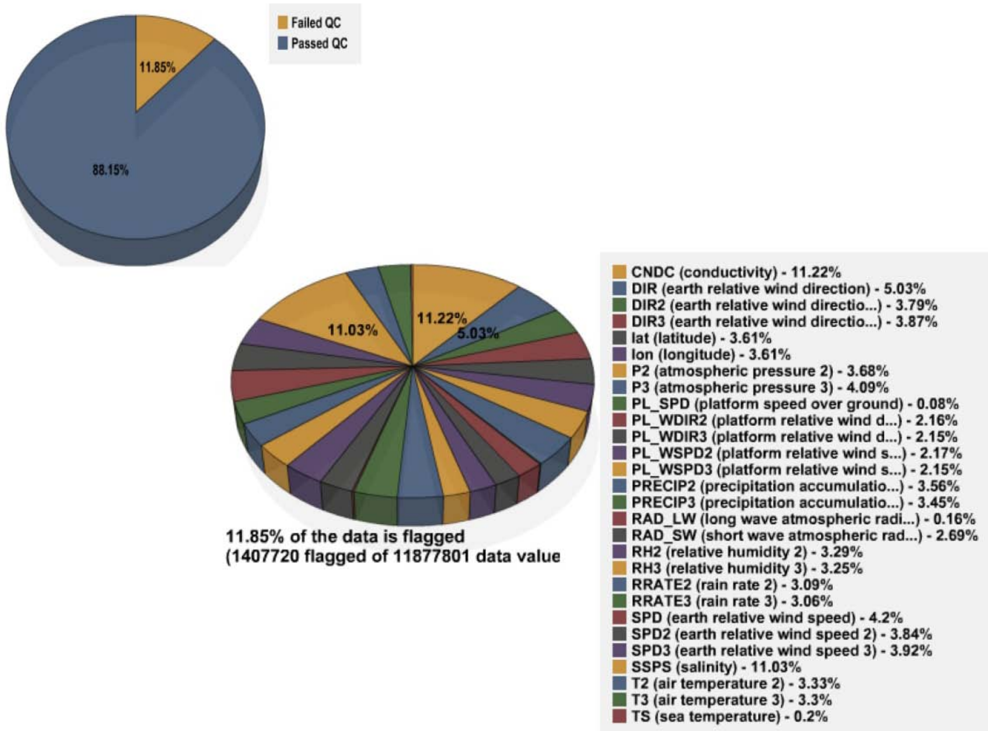


Figure 94: For the *R/V Knorr* from 1/1/12 through 12/31/12, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Knorr* provided SAMOS data for 292 ship days, resulting in 11,877,801 distinct data values. After both automated and visual QC, 11.85% of the data was flagged using A-Y flags (Figure 94). This is a change of +7.05% from 2011 (4.8% flagged). It's important to note that the *Knorr*, like the *Atlantis*, often continues to transmit data while in port. So while this may influence the total flag percentage in a seemingly negative way, since many parameters often get flagged while in port (due to lowered masts, flow water systems not being run, etc.), the SAMOS project still welcomes this port data. It can be useful for comparing to land stations, and may have applications in the science community, as well.

The sea parameters conductivity (CNDC) and salinity (SSPS) received the highest percentage of flags, with each receiving around 11%. The flags for these two parameters were split between caution/suspect (K) and poor quality (J) flags (Figure 96). Again, these flag applications usually occurred whenever it appeared the flow water system that supplied sea water to the sensors was shut off, usually while the vessel was in port. SAMOS personnel were often advised by *Knorr* personnel when the flow water system was shut off or was about to be shut off, which was always appreciated.

Two other items of note: First, the *Knorr* wind parameters are particularly vulnerable to acceleration spikes/steps (see Figure 95), with the R.M. Young C202 performing a little worse than the two Vaisala WXTs. And second, the *Knorr* added long wave atmospheric radiation to their suite of SAMOS parameters in 2012, a very welcome addition.

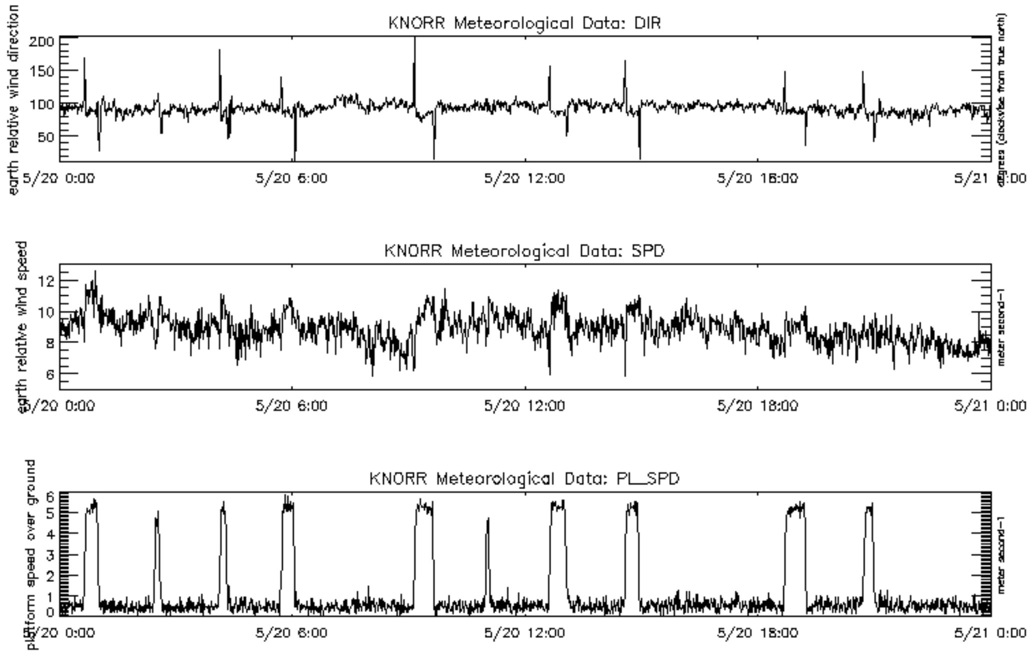


Figure 95: *R/V Knorr* SAMOS data for 20 May 2012: (top) earth relative wind direction – DIR – (middle) earth relative wind speed – SPD – and (bottom) platform speed over ground – PL_SPD. Note spikes and steps in wind data in relation to platform speed changes.

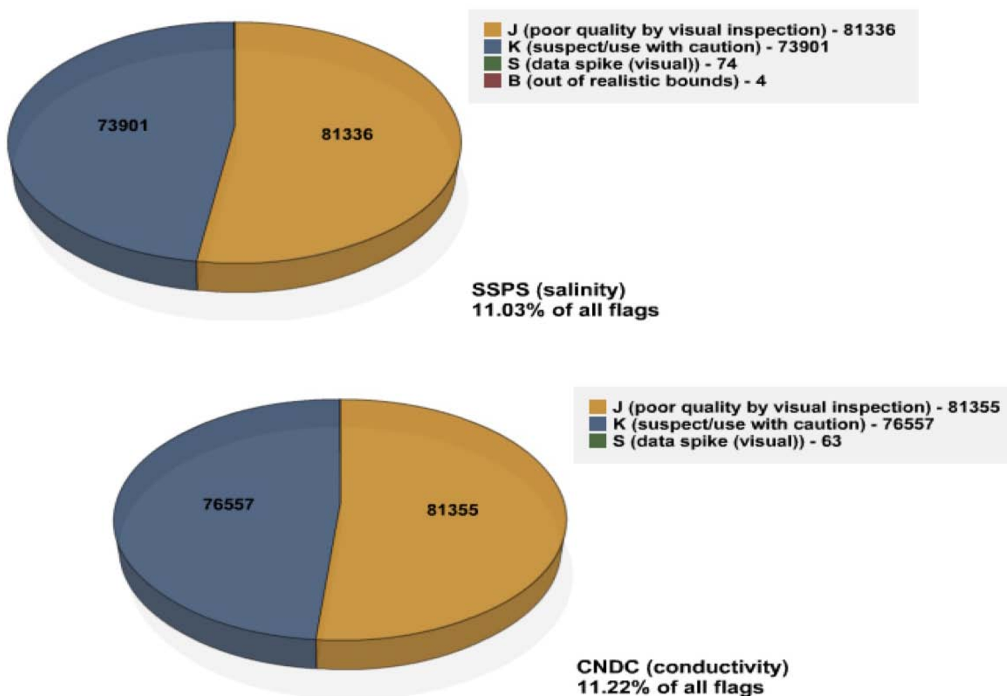


Figure 96: Distribution of SAMOS quality control flags for (top) salinity – SSPS – and (bottom) conductivity – CNDC – for the *R/V Knorr* in 2012.

4. Metadata summary

Adequate metadata is the backbone of good visual QC. As such, vessel operators are strongly advised to keep vessel and parameter metadata complete and up to date. Annex A, Part Two walks SAMOS operators through editing metadata online, step by step, while Part One offers instructions for monitoring metadata and data performance. For vessel metadata, the following are the minimum required items in consideration for completeness: Vessel information requires vessel name, call sign, IMO number, vessel type, operating country, home port, date of recruitment to the SAMOS initiative, and data reporting interval. Vessel layout requires length, breadth, freeboard, and draught measurements. Vessel contact information requires the name and address of the home institution, a named contact person and either a corresponding email address or phone number, and at least one onboard technician email address. A technician name, while helpful, is not vital. Note that for the IMOS ships *Aurora Australis* and *Southern Surveyor*, while Vessel contact information is considered "incomplete" in Table 3, there is intentionally no onboard contact information, at the discretion of the Australian Bureau of Meteorology. Vessel metadata should also include vessel imagery (highly desirable, see Figure 97 for examples) and a web address for a vessel's home page.

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 98. (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 98 b.), as is frequently the case, the only missing field is the date of the last instrument calibration. Calibration dates may be overlooked as important metadata, but there are several situations where knowing the last calibration date is helpful. For example, if a bias or trending is suspected in the data, knowing that a sensor was last calibrated several years prior may strongly support that suspicion. Alternatively, if multiple sensors give different readings, the sensor with a more recent last calibration date may be favored over one whose last calibration occurred years ago. The authors wish to point out that the field "Data Reporting Interval" erroneously appears in several of the parameters. This field is actually only applicable to the time parameter and the Vessel information metadata. The erroneous field needs to be removed and was not considered for completeness of any parameter in Table 3. Through our new online self-service Subscription and Report services (found at https://samos.coaps.fsu.edu/html/subscription/index.php), metadata summary tables for each ship can be viewed/downloaded at any time. To request login credentials for the subscription and report service, please send an email to samos@coaps.fsu.edu. The most recent 2012 version of these for each ship that participated in 2012 is included in Annex B.

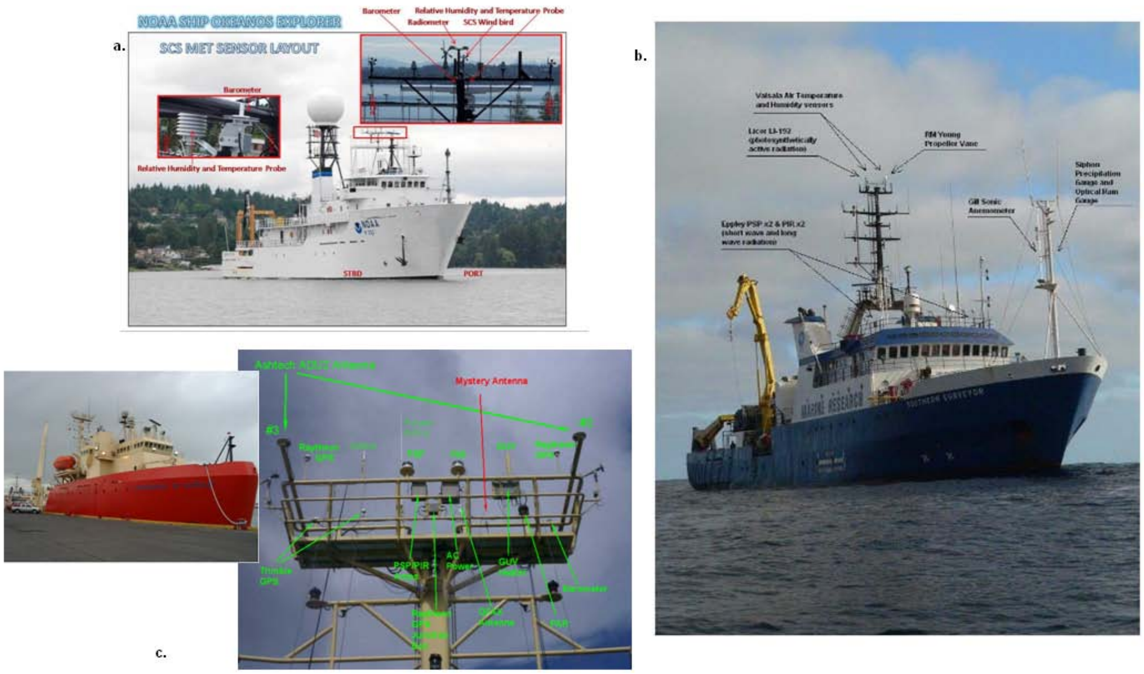


Figure 97: Examples of detailed vessel instrument imagery from (a) *Okeanos Explorer*, (b) *Southern Surveyor*, and (c) *Laurence M. Gould*

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

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

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

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

5. Plans for 2013

2013 marks the 10th anniversary of the workshop that led to the development of the SAMOS initiative (http://coaps.fsu.edu/RVSMDC/marine_workshop/Workshop.html). As chairman of the SAMOS Initiative, Shawn Smith 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, and the Australian IMOS project 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 2012, the university-operated vessels contributing to the SAMOS DAC were those operated by URI, WHOI, SIO, UH, and BIOS. The focus of the R2R is capturing all these data at the end of each planned cruise; however, the SAMOS DAC is using SAMOS1.0 and SAMOS2.0 real-time protocols to transfer a subset of meteorological and surface-oceanographic data from ship to shore. For SAMOS 2.0, the data will be transferred at the full observational resolution for the specified sensor (in some cases up to 1Hz samples) on an hourly to daily schedule, depending on the operator. The transfer protocol will take full advantage of the evolving broadband satellite communication technology. In early 2012, a prototype was completed and tested using an extensible mark-up language (XML) format that was developed in consultation with Oregon State University and the University of Rhode Island. The *Endeavor* became operational in early 2013 and we seek to restart transmissions from the *Oceanus* in 2013 using this new, SAMOS 2.0 data protocol.

In addition to new data transfer and processing protocols related to the R2R, we anticipate focusing some resources to expand and improve our automated quality control procedures in 2013. The experience from past visual QC will allow us to develop new procedures that will streamline the QC process and reduce visual analyst time spent on individual data streams. This change is necessary in the face of reducing budgets and an increased number of vessels contributing to SAMOS.

Finally, in an effort to improve communication with our data providers, vessel operators, and shipboard technicians, a subscription service for routine data reports developed in 2012 will be fully operational in 2013. We may also consider expanding a JSON web service developed for NOAA for other vessels. Available reports include monitoring the “date since last receipt” for data flowing to the SAMOS data center along with access to monthly quality control flag and metadata summaries. We are open to suggestions and ask operators and technicians to feel free to contact us at samos@coaps.fsu.edu.

6. References

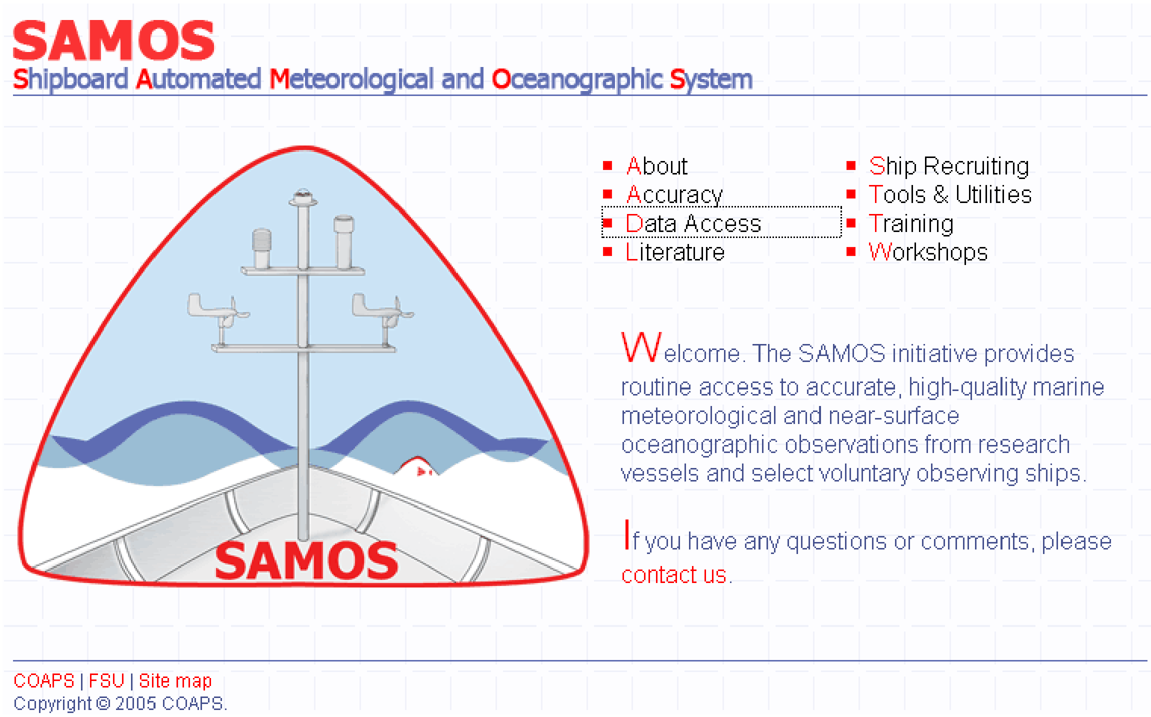
The Australian Integrated Marine Observing System, 2008: *J. Ocean Technology* **3**(3), 80-81.

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

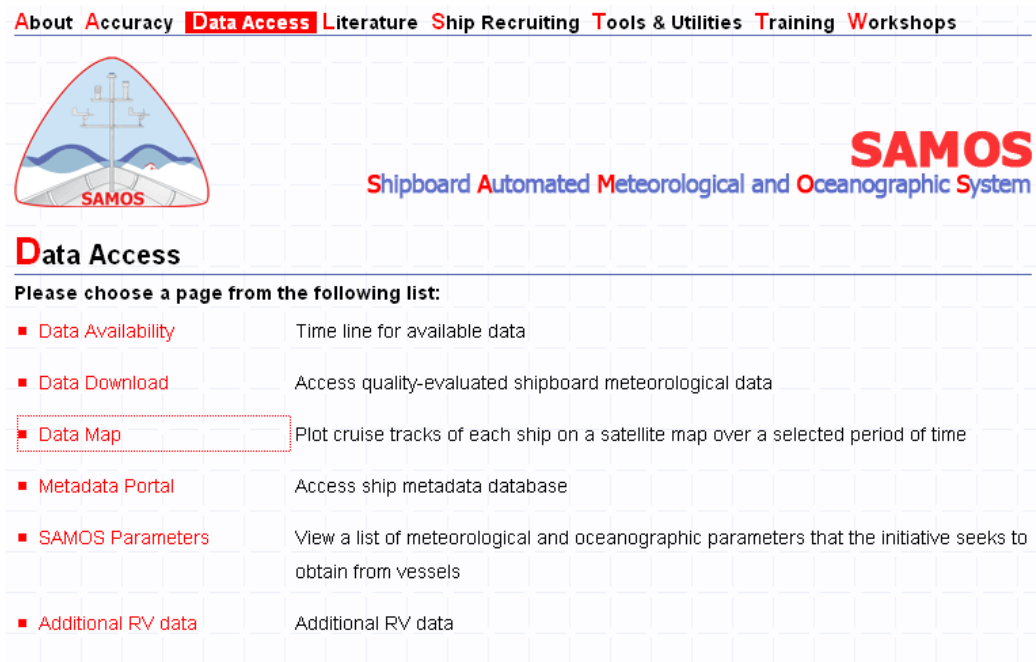
Annex A: SAMOS Online Metadata System Walk-through Tutorial

PART 1: the end user

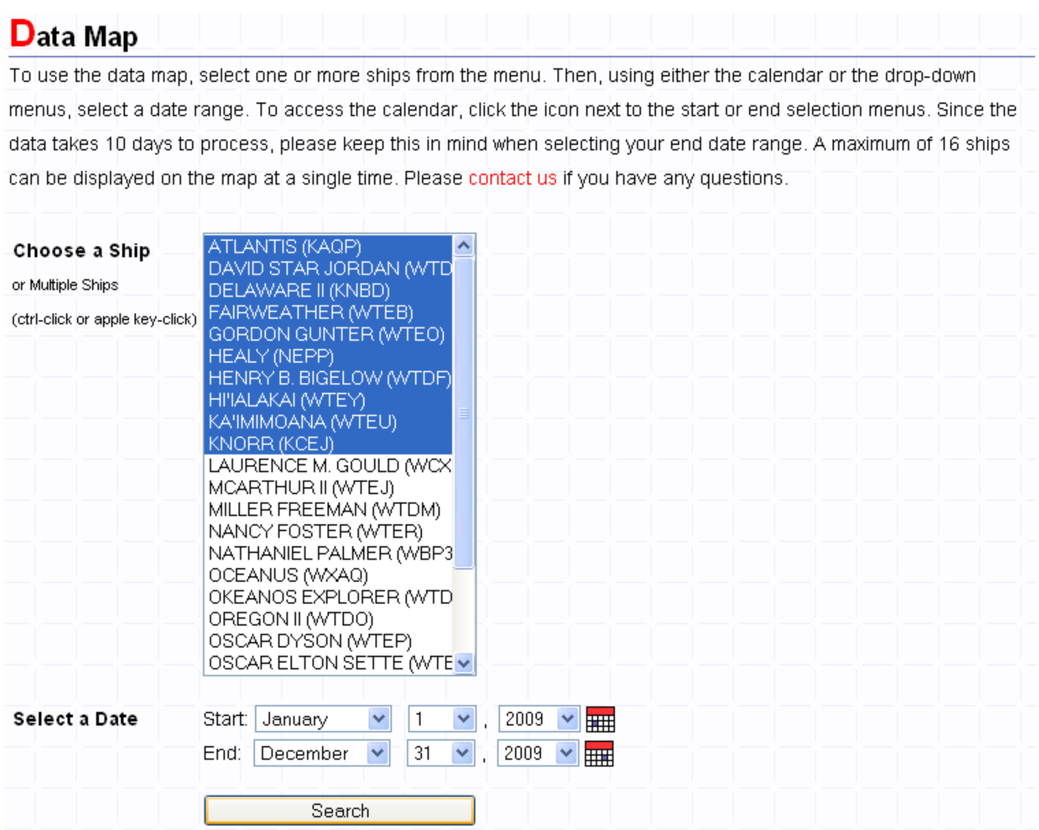
The SAMOS public website can be entered via the main page at
http://samos.coaps.fsu.edu/html/



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



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

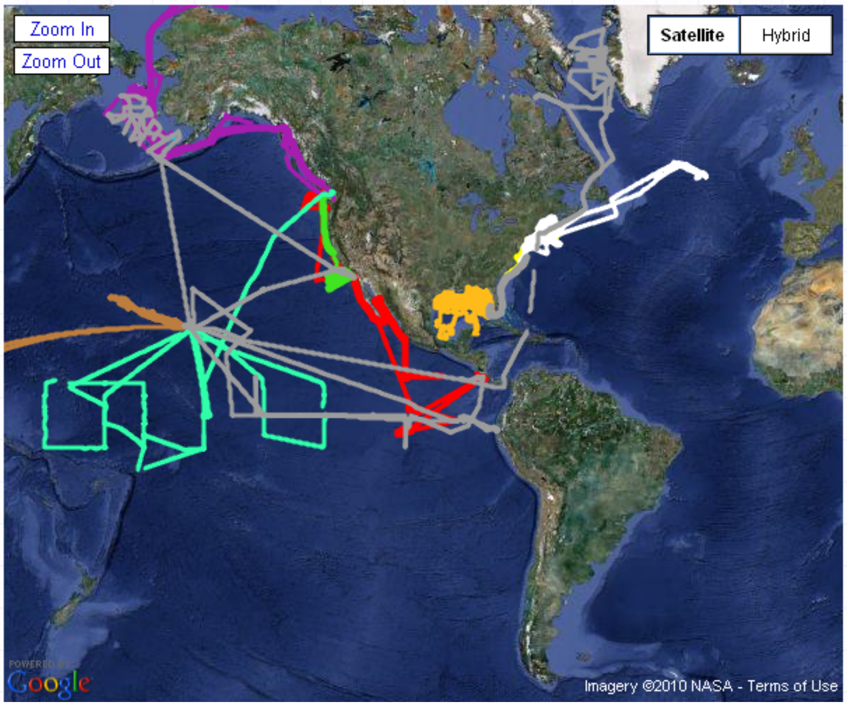


By entering a date range of January 1, 2009 to December 31, 2009 and clicking "search," a map is displayed showing all of the selected ship's tracks for the year 2009:

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	☑

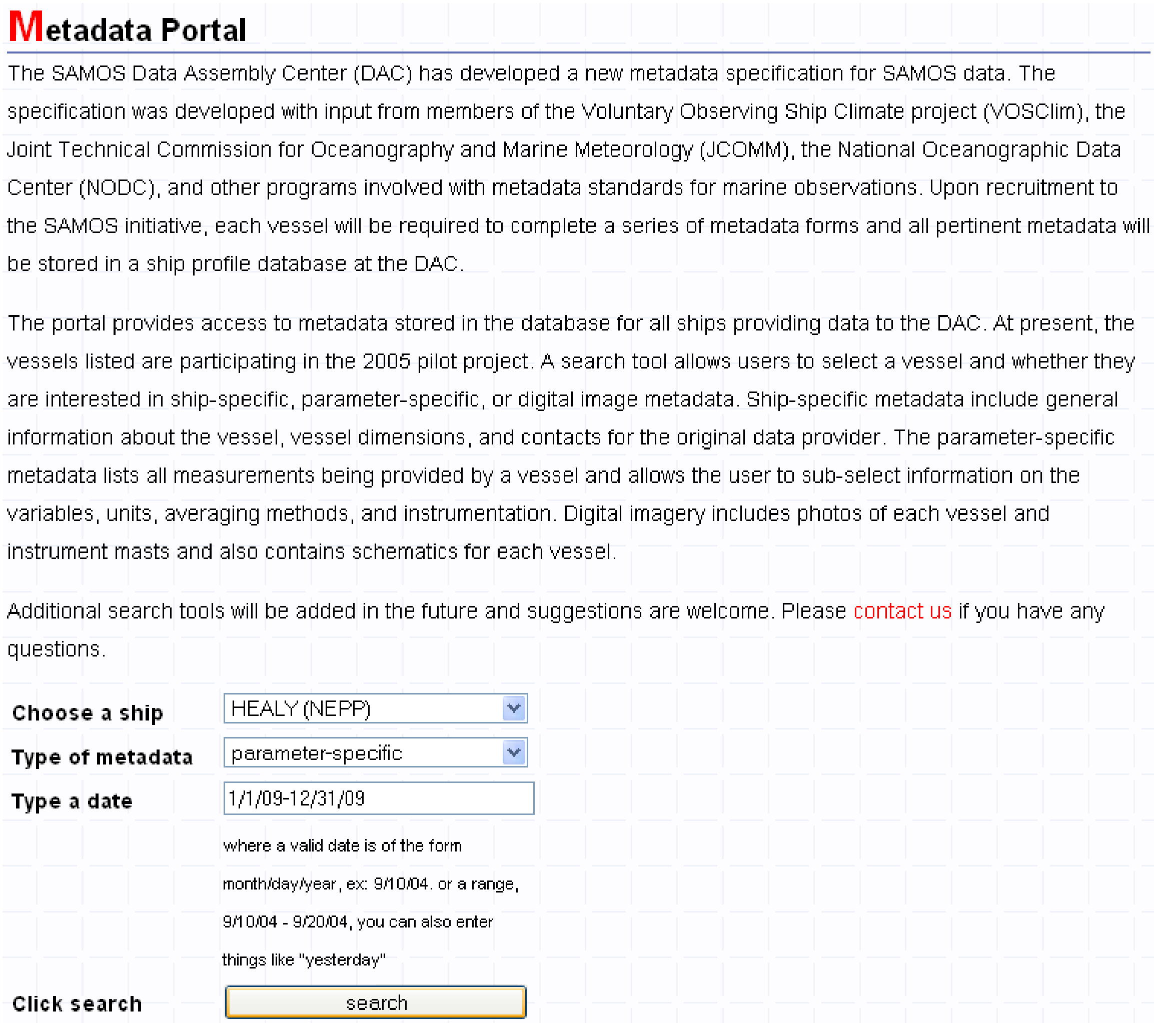
Now the user can see that both the *Healy* and the *Knorr* cruised in the north-polar region in 2009. The next step might be to see what parameters are available on each ship. Returning to the Data Access page, the user this time selects the Metadata Portal:

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

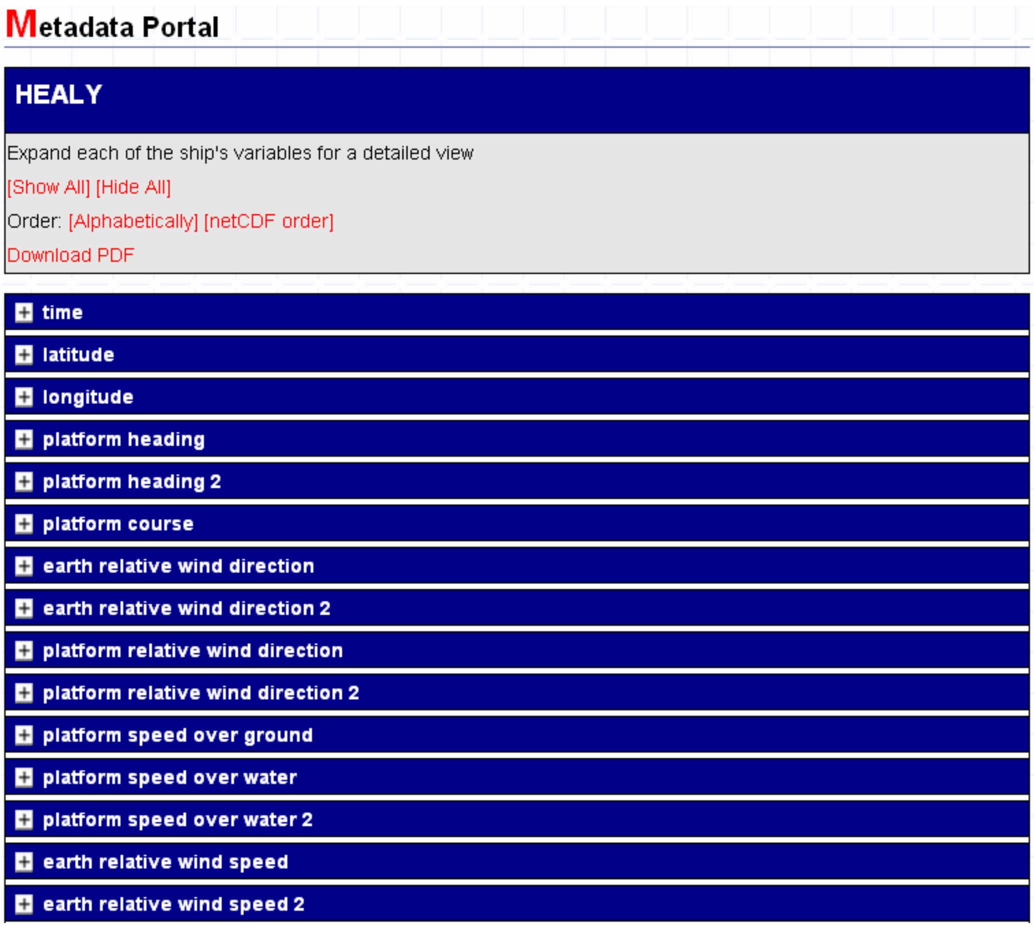
The SAMOS Data Assembly Center (DAC) has developed a new metadata specification for SAMOS data. The specification was developed with input from members of the Voluntary Observing Ship Climate project (VOSClim), the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), the National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

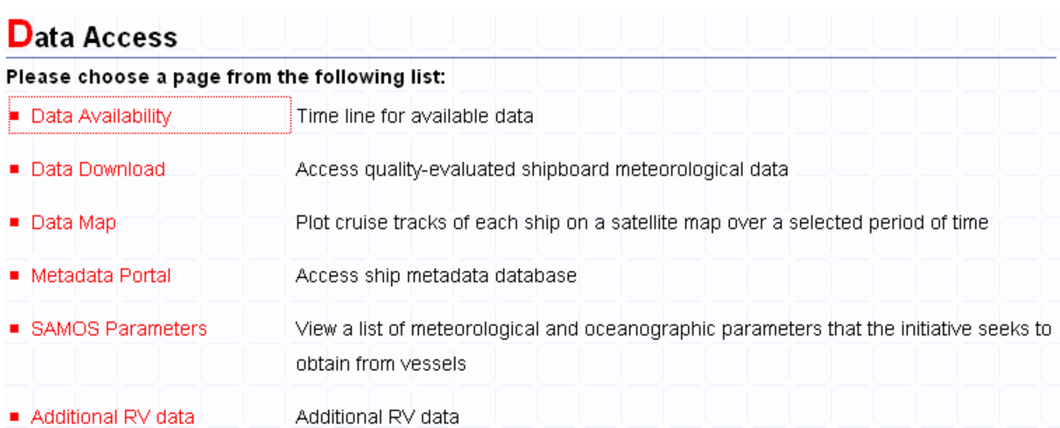
Additional search tools will be added in the future and suggestions are welcome. Please contact us if you have any questions.

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

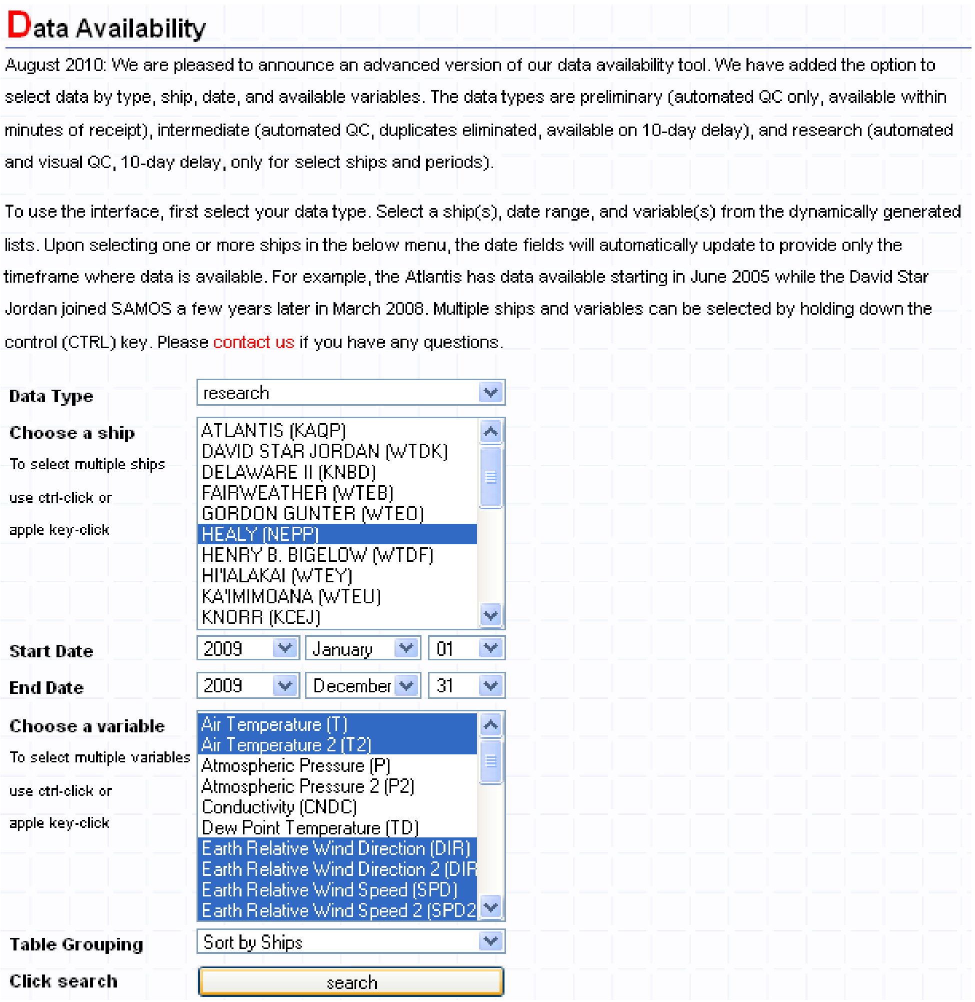
The result, once "search" is clicked, is an exhaustive list of all parameters available from the *Healy* in 2009:



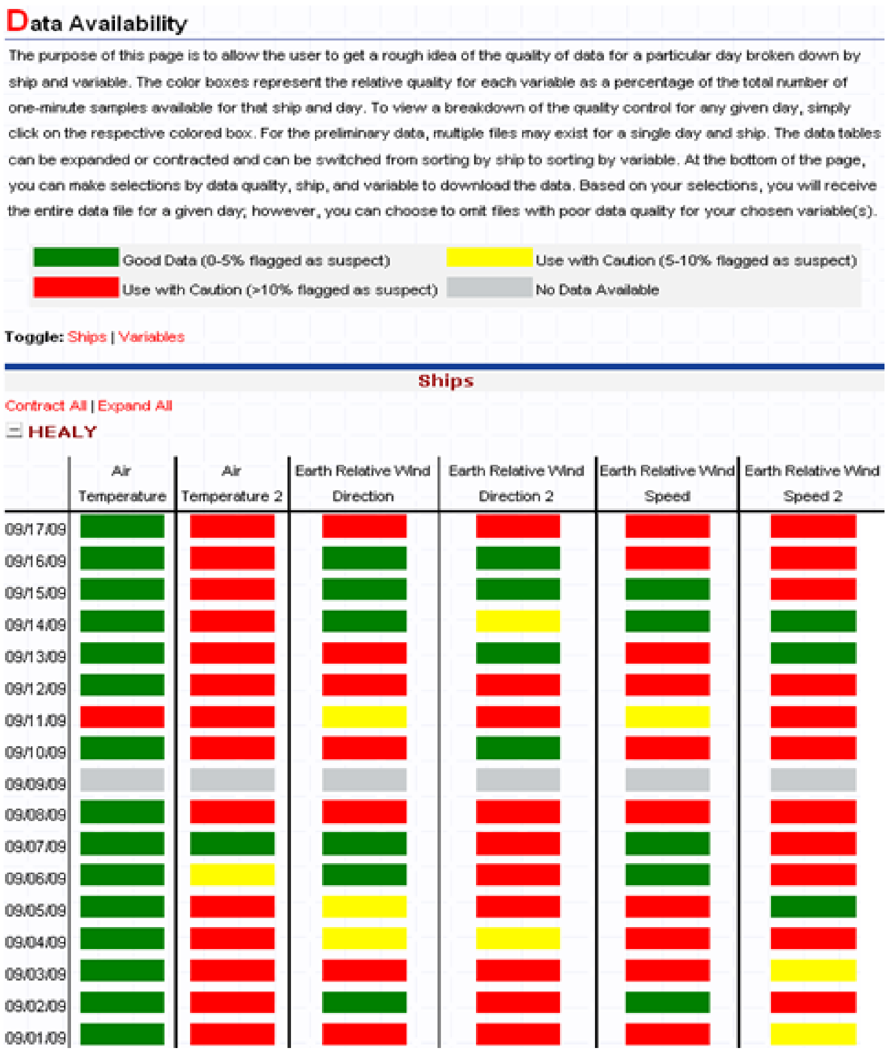
A thorough investigation of the list (note: image is truncated) tells the user the *Healy* did in fact provide both wind and temperature data in 2009. (Throughout the online SAMOS system, clicking on a "+" will yield further information; in this case the result would be metadata for the individual parameters.)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

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.

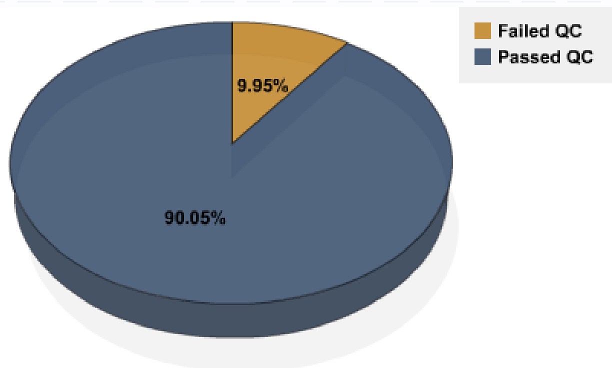
09-07-2009

HEALY

☐ select all

☐ File download | view file

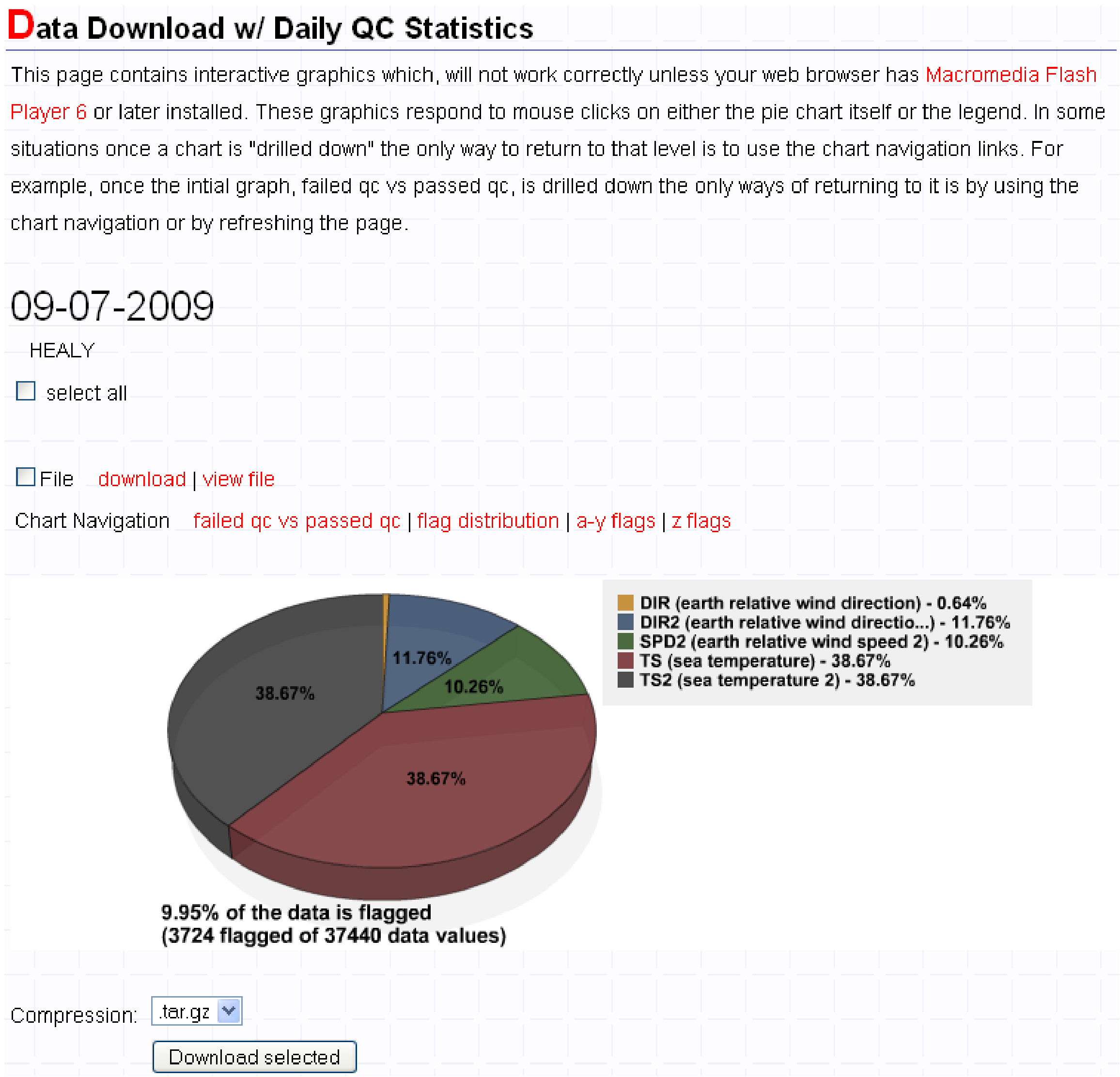
Chart Navigation failed qc vs passed qc | flag distribution | a-y flags | z flags



Compression: .tar.gz

Download selected

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.

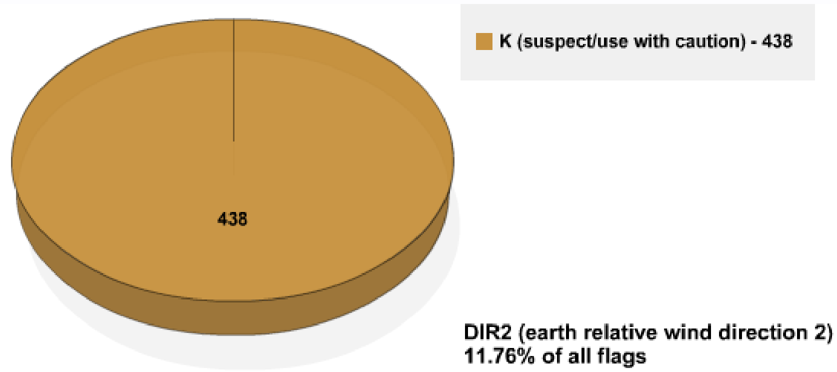
09-07-2009

HEALY

☐ select all

☑ File download | view file

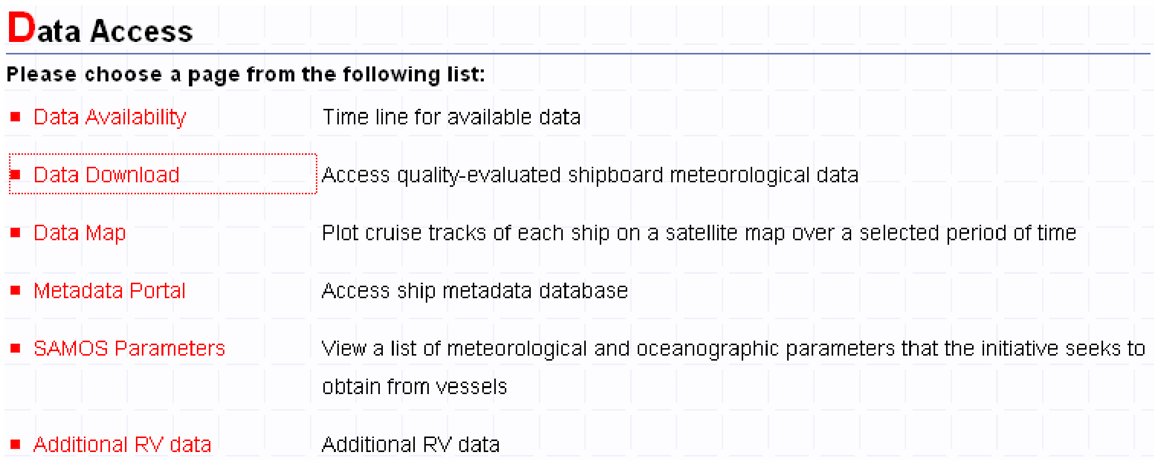
Chart Navigation failed qc vs passed qc | flag distribution | a-y flags | z flags



Compression: .zip

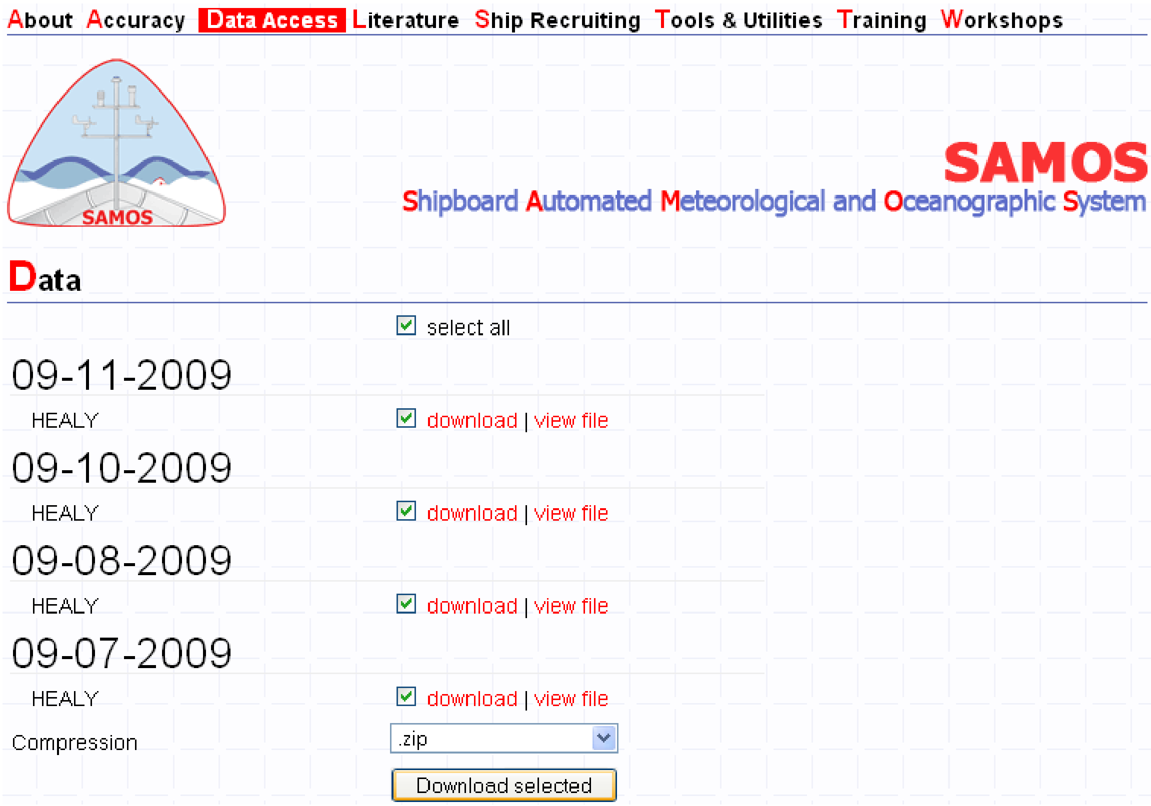
Download selected

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:



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:



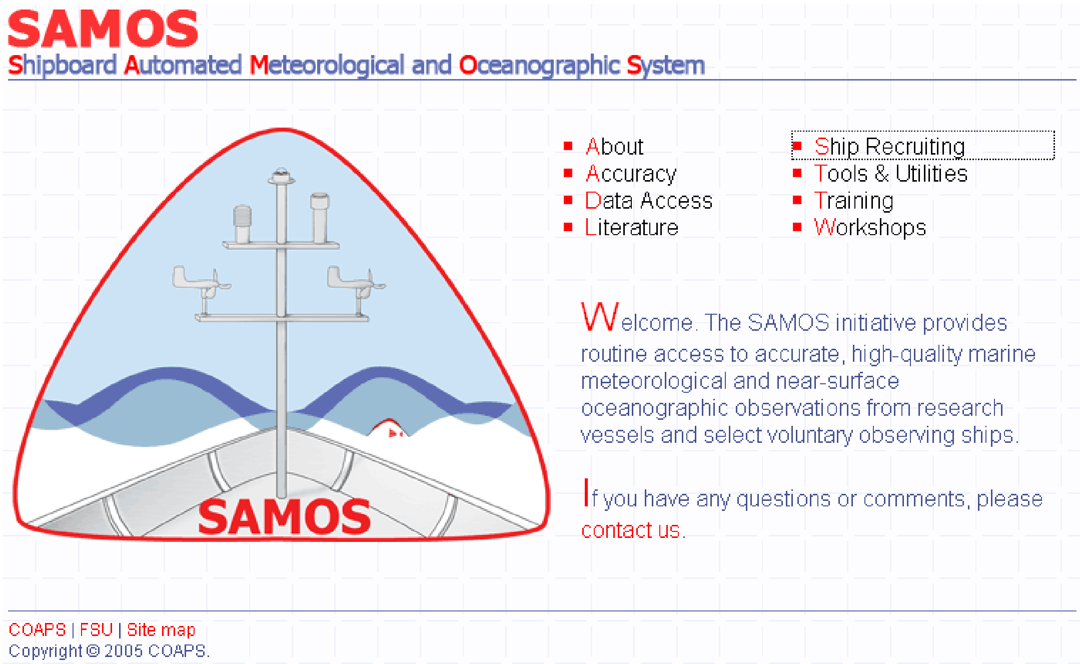
PART 2: the SAMOS operator

(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)

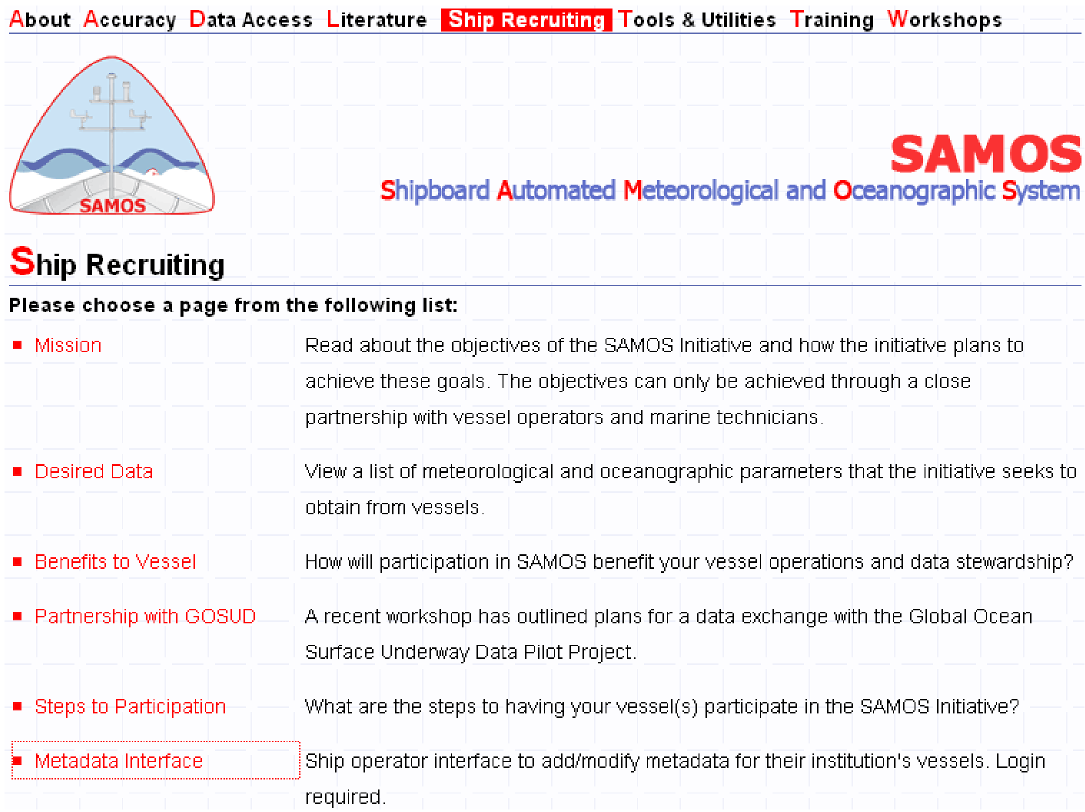
A SAMOS operator might choose to follow the steps outlined in part one as a simple way to keep tabs on the performance of his instruments. When problems are observed, vessel and instrument metadata are important tools for diagnosing a problem and finding a solution. For this reason we strongly emphasize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

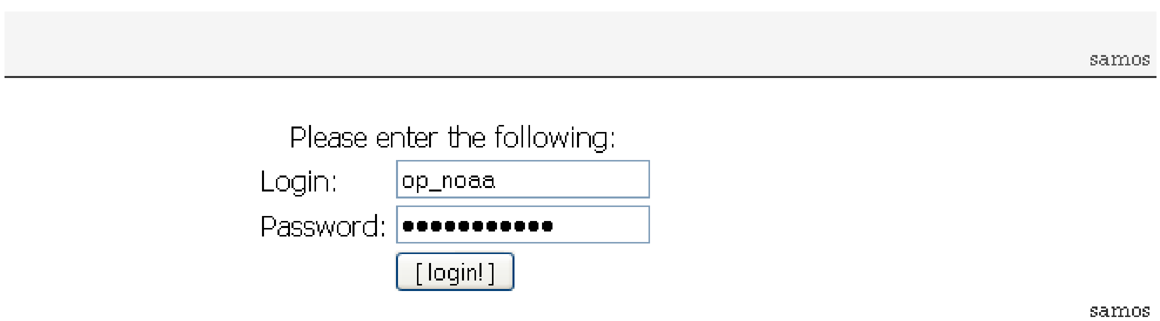
The database can be accessed by visiting the main page and choosing Ship Recruiting:



(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

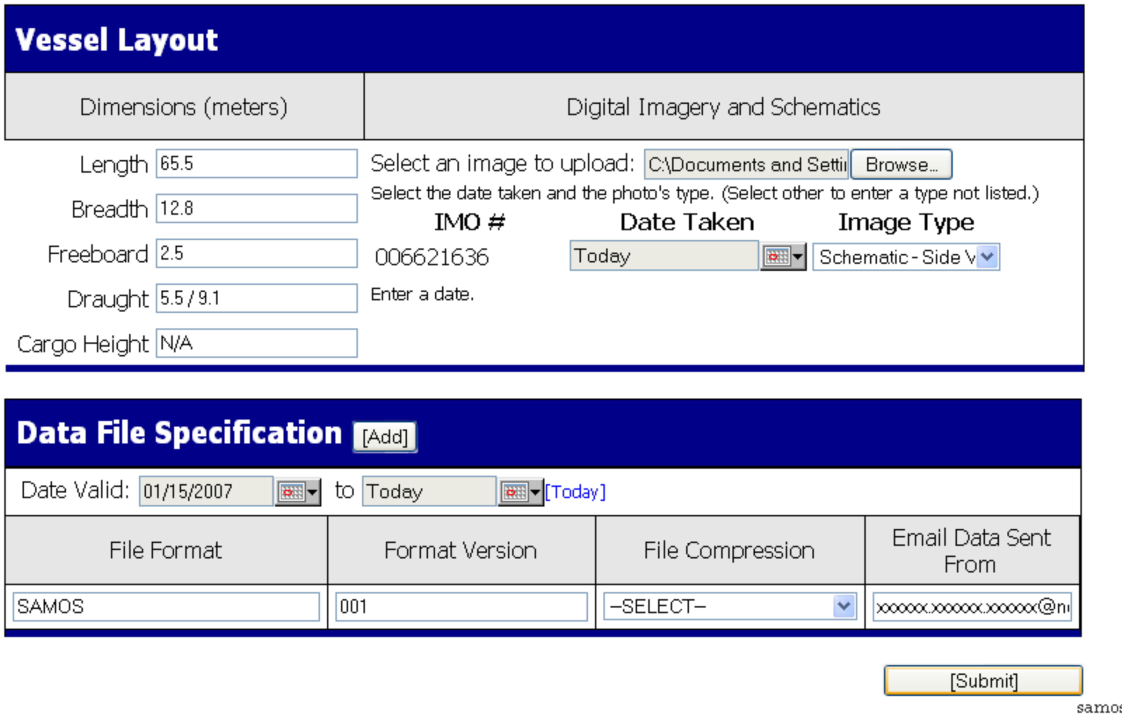
Edit Metadata

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

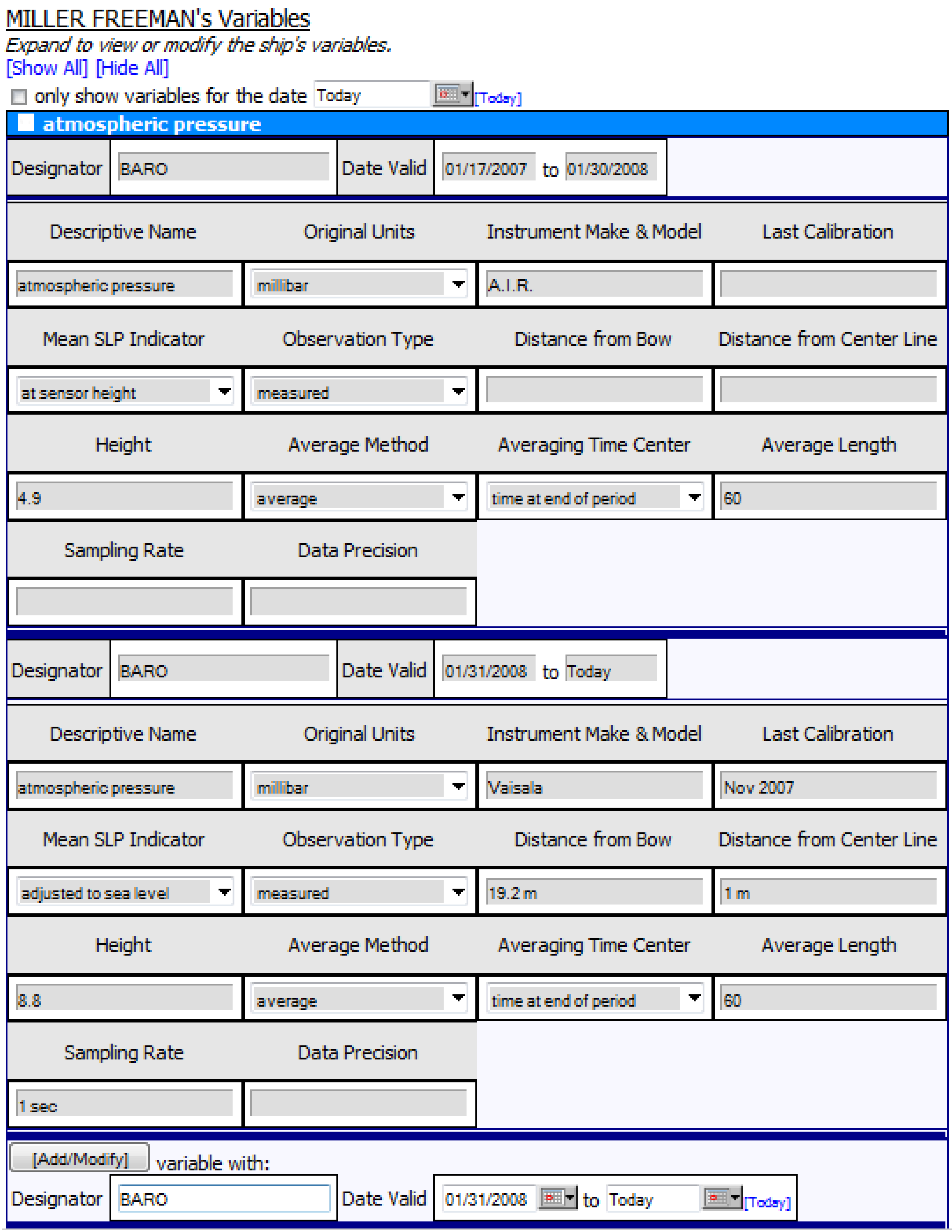
Ships for user op_noaa:

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**		

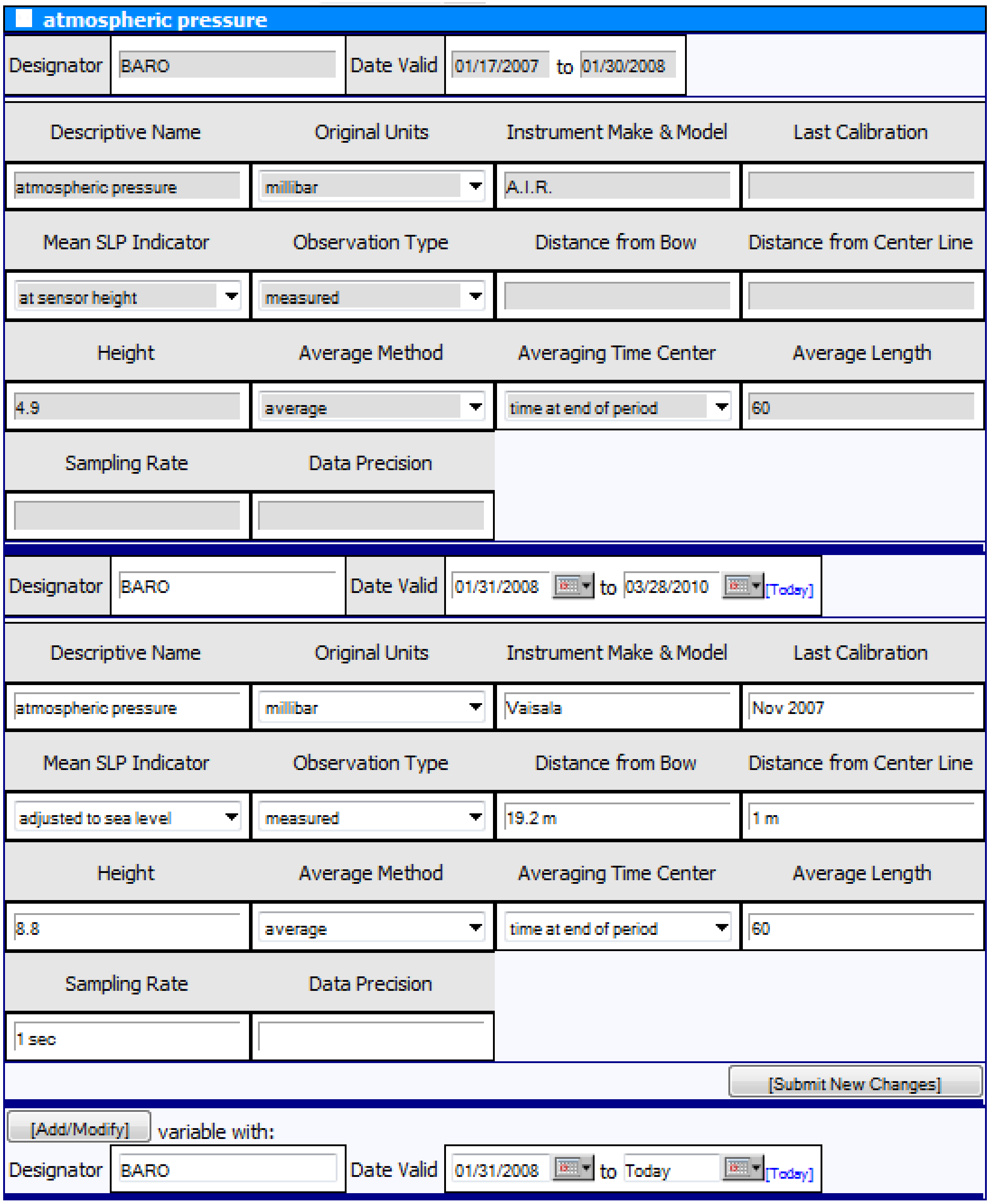
Designator	BARO	Date Valid	01/31/2008 to Today

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			

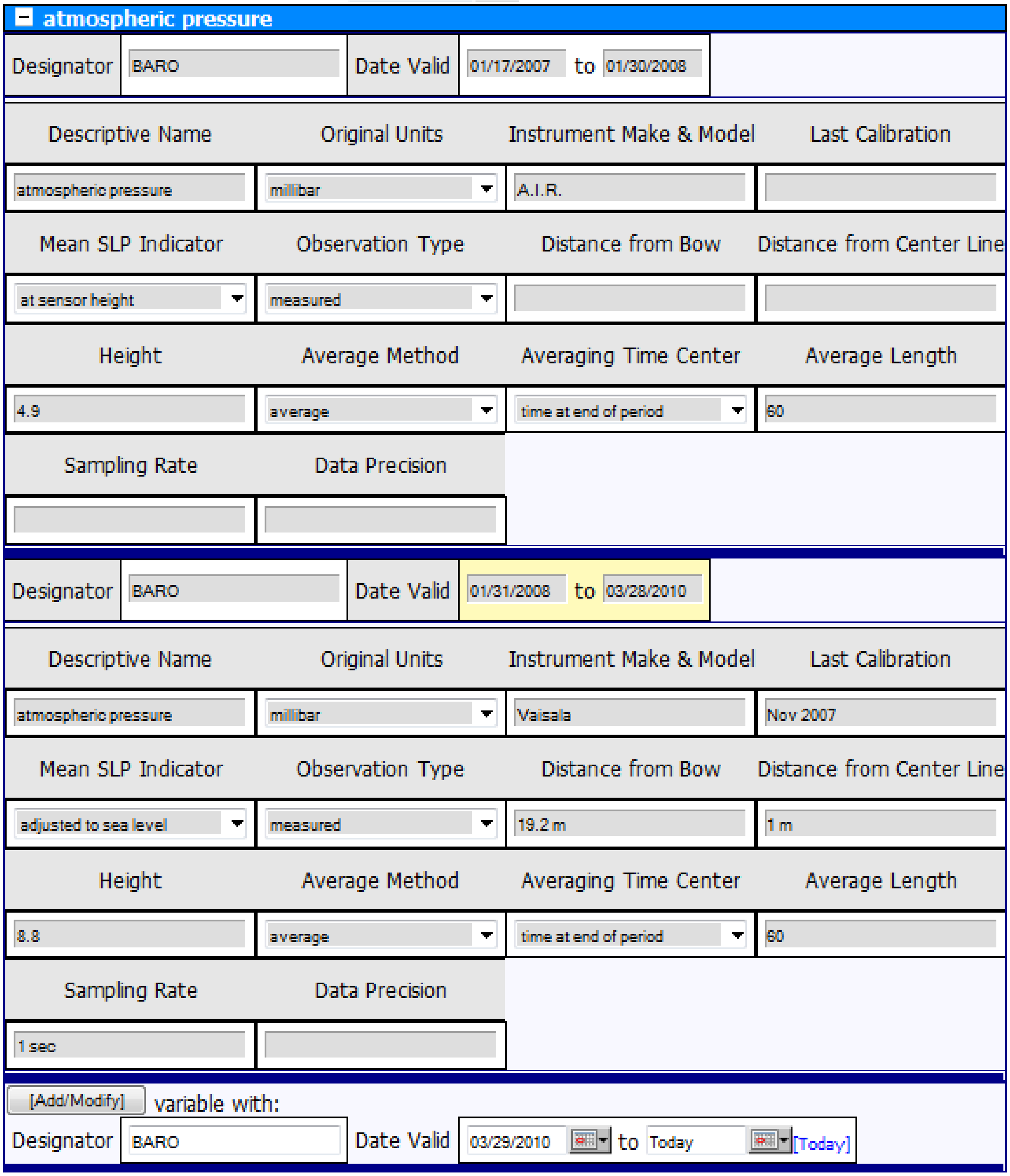
[Add/Modify] variable with:

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**		

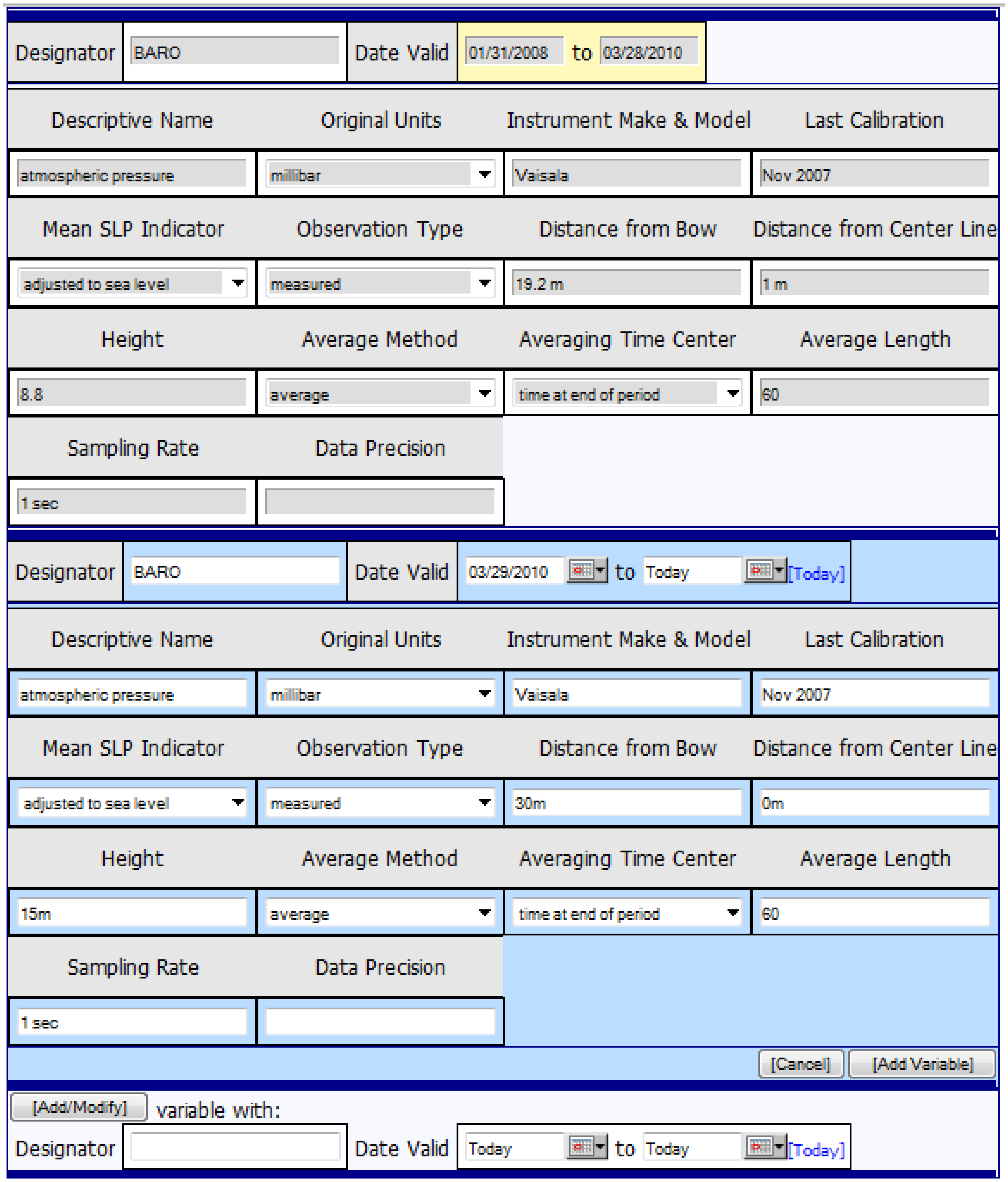
Designator	BARO	Date Valid	01/31/2008 to 03/28/2010
Descriptive Name	**Original Units**	**Instrument Make & Model**	**Last Calibration**
atmospheric pressure	millibar	Vaisala	Nov 2007
Mean SLP Indicator	**Observation Type**	**Distance from Bow**	**Distance from Center Line**
adjusted to sea level	measured	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:

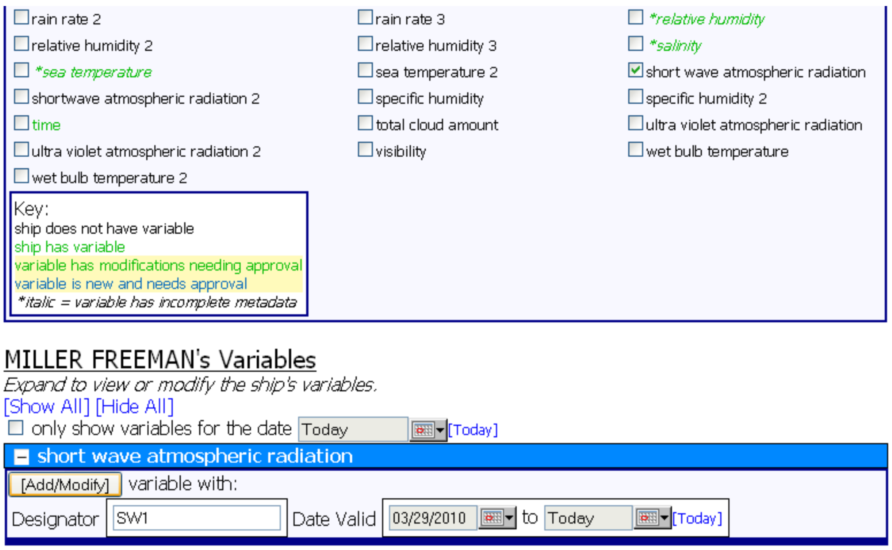
Designator BARO Date Valid 03/29/2010 to Today [Today]

*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":

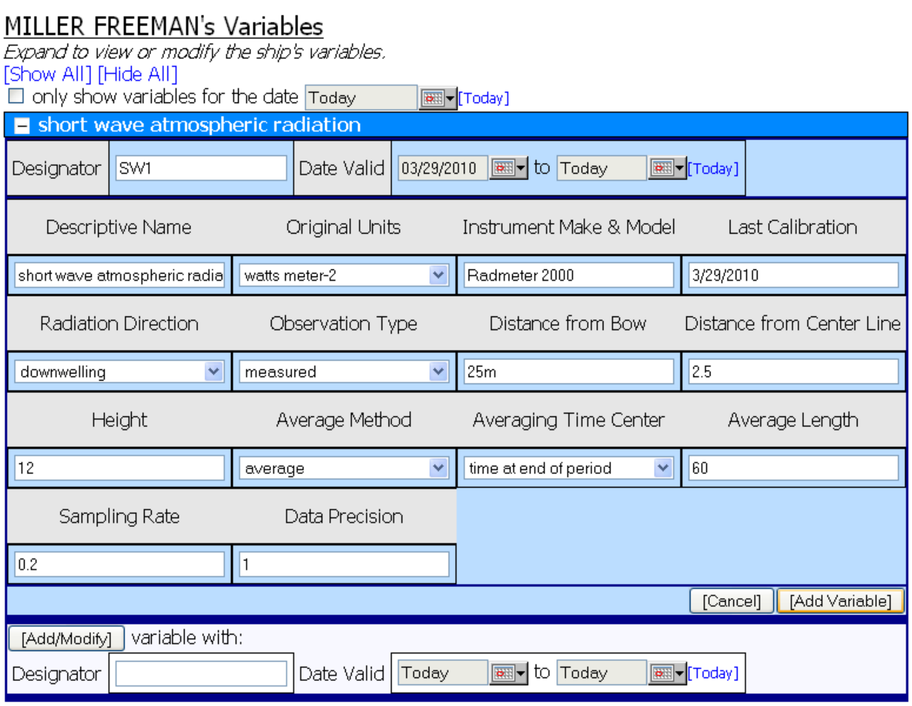


Adding an entirely new parameter follows only the latter part of these instructions: by simply choosing a parameter (for example short wave atmospheric radiation), clicking the "+" on the expansion bar, and entering either a new or not currently in use Designator and any Date Valid window:



samos

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



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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.

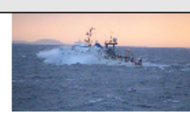
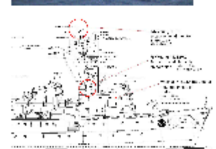
The portal provides access to metadata stored in the database for all ships providing data to the DAC. At present, the vessels listed are participating in the 2005 pilot project. A search tool allows users to select a vessel and whether they are interested in ship-specific, parameter-specific, or digital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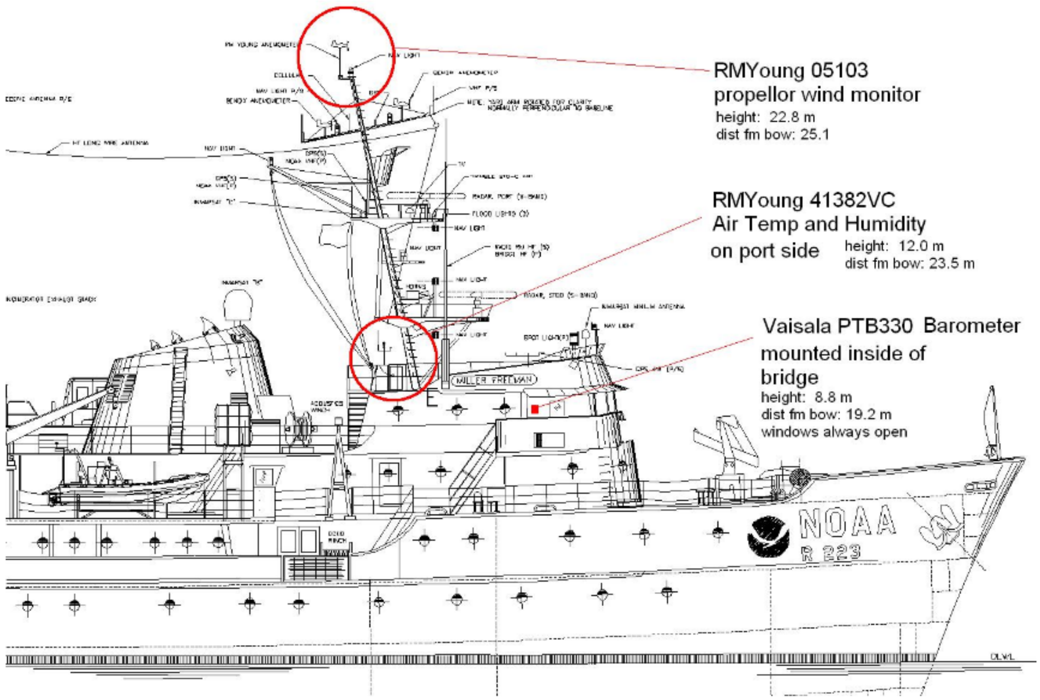
Clicking on the image itself would give us an enlarged view. In this case, the photo provides details about the locations of three MET sensors:

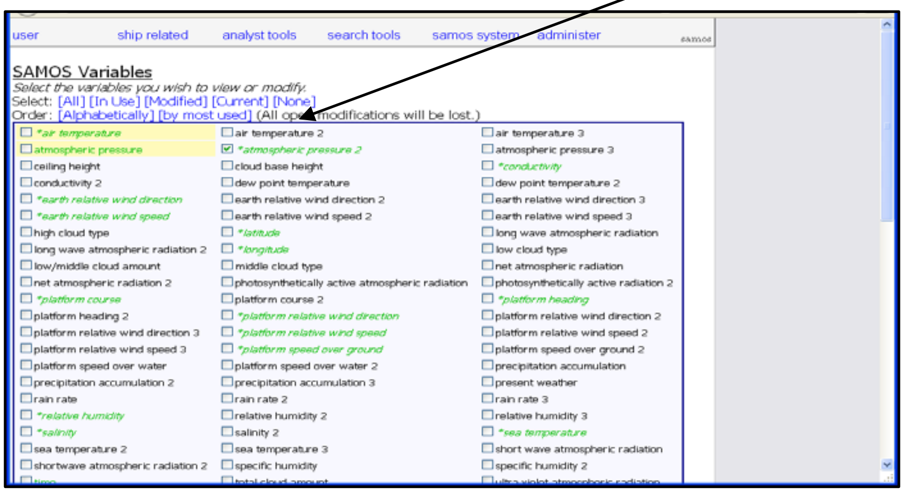


As a SAMOS user becomes familiar with following the metadata modification steps outlined in this section, chores such as adding duplicate sensors, logging sensor relocations, and keeping calibrations up-to-date become straightforward tasks. Naturally, complete and accurate metadata make for better scientific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

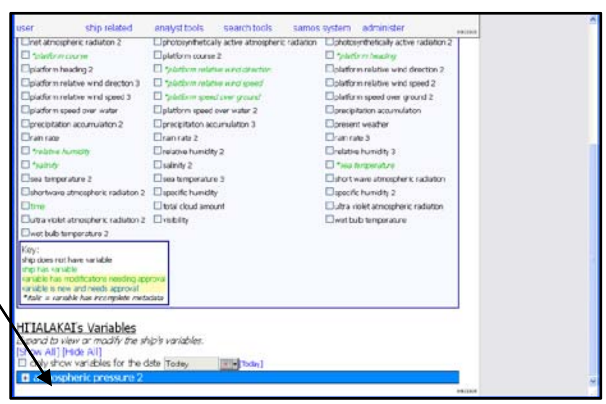
<u>UPDATING SAMOS METADATA: STEP BY STEP EXAMPLE</u>

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

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

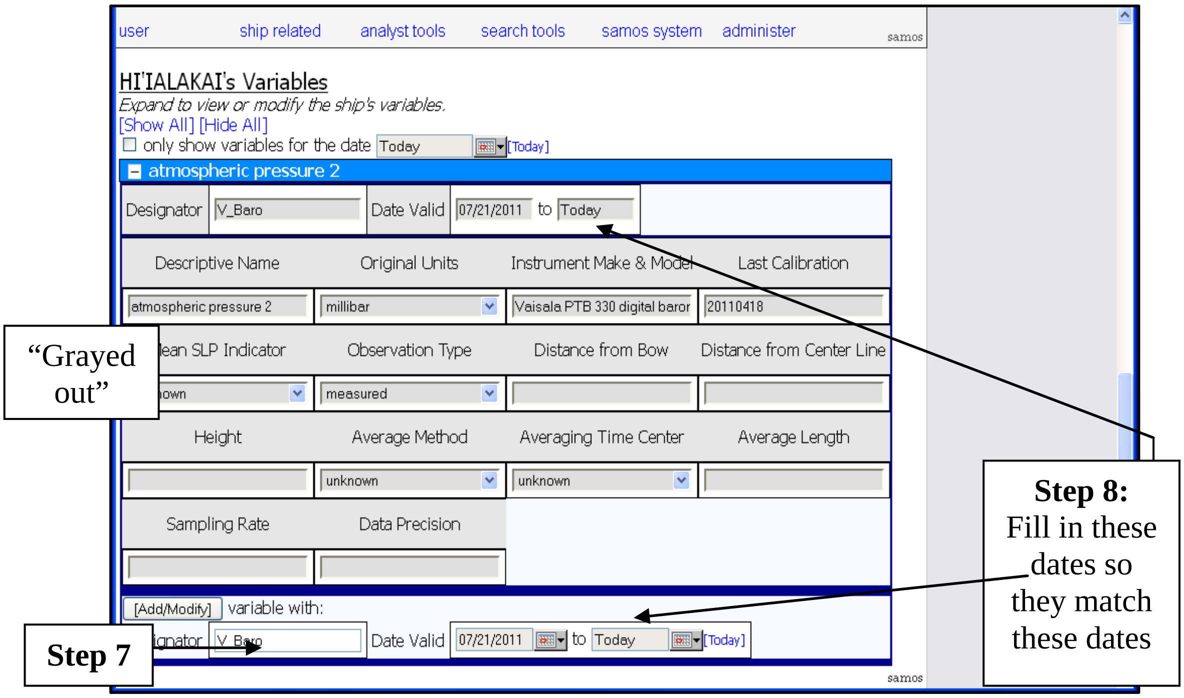


5. You will now see that sensor below, highlighted in Blue; click the plus sign to the left to expand the info about that sensor



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

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



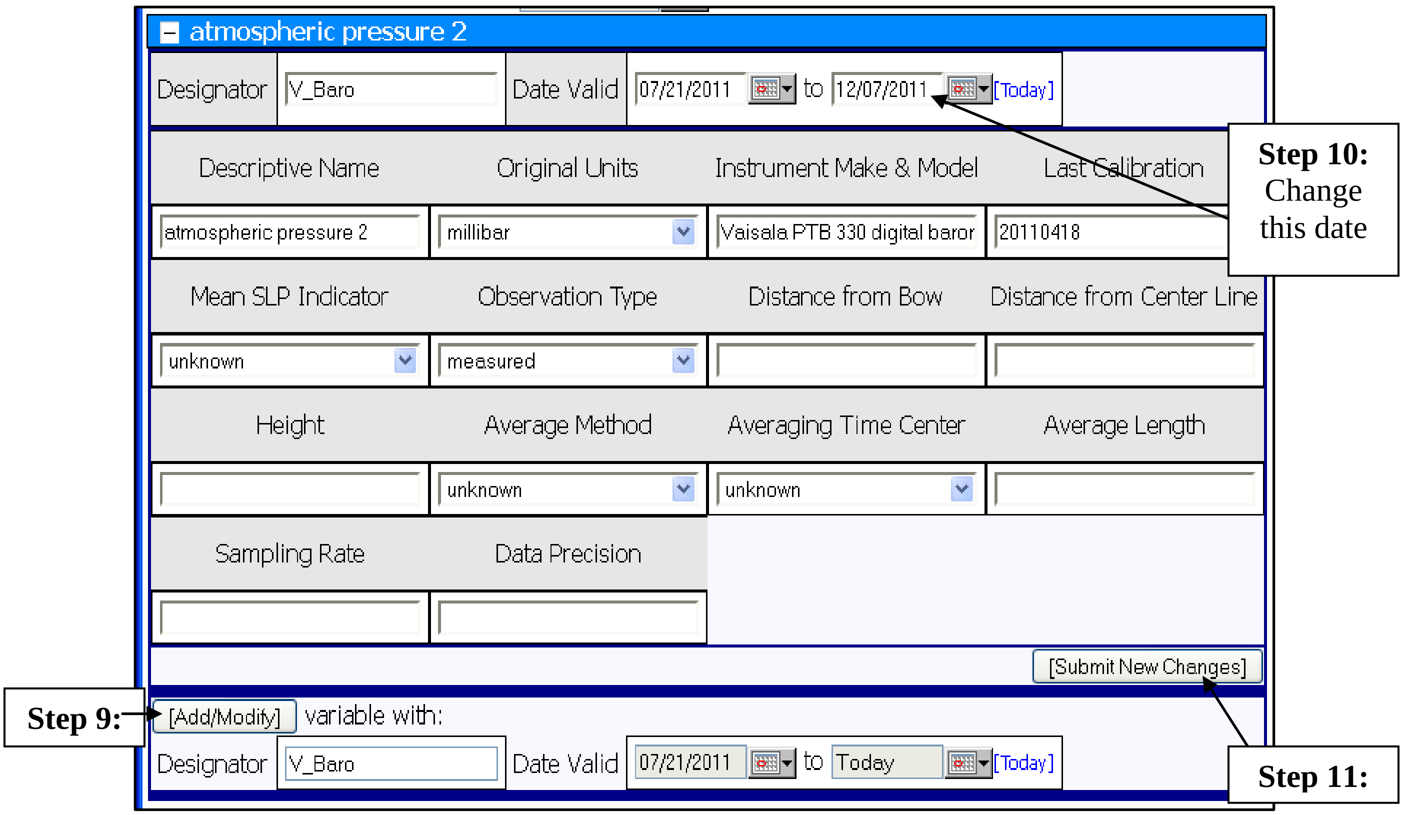
7. You first need to let the system know for which sensor you want to change information. In the box that appears at the very bottom (see image above), enter the name of the designator just at it appears in the box next to 'Designator' in the grayed out area.
    a. For the example above you would enter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

* Note that before an updated version of sensor information can be entered, you must first "close out" the existing version. This is accomplished via steps 8 through 11. (The updated information will be entered in steps 12 through 15.)

8. In the bottom "Date Valid" boxes, make the dates match what you see above for the "Date Valid" dates in the grayed out area
    a. For the example above you would enter 02/01/2011 in the left box and you would click the blue [Today] button to make the right box read Today
    b. The right box will probably say 'TODAY' by default, and that is likely what you want.
        i. **NOTE:** The word 'Today' in any "Date Valid" entry is a floating date that implies the sensor is currently valid, no matter what day it is. The actual calendar dates mean the sensor starts & stops on the actual dates shown.

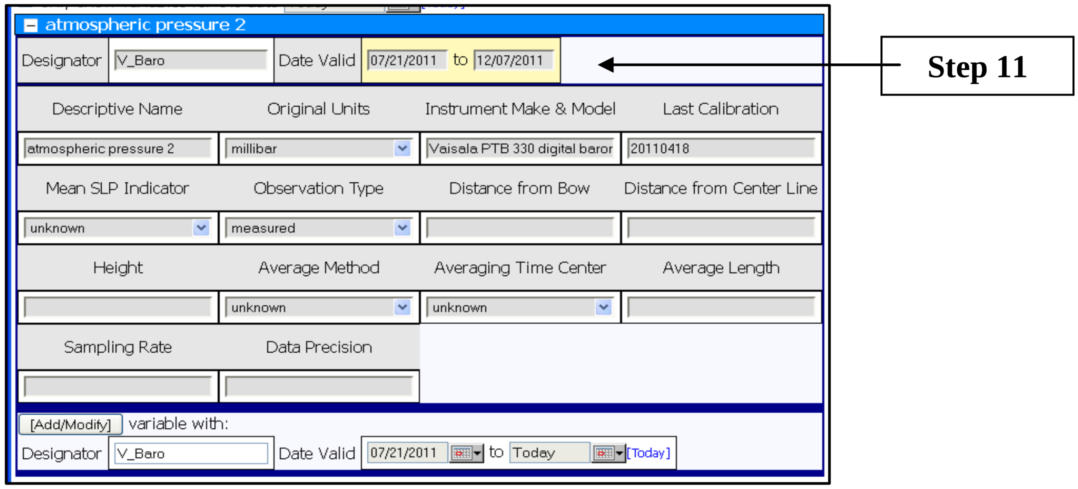
c. Months are changed using the arrows
d. Year is changed by clicking on the year (it will now be highlighted) and then typing in the year you want.

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

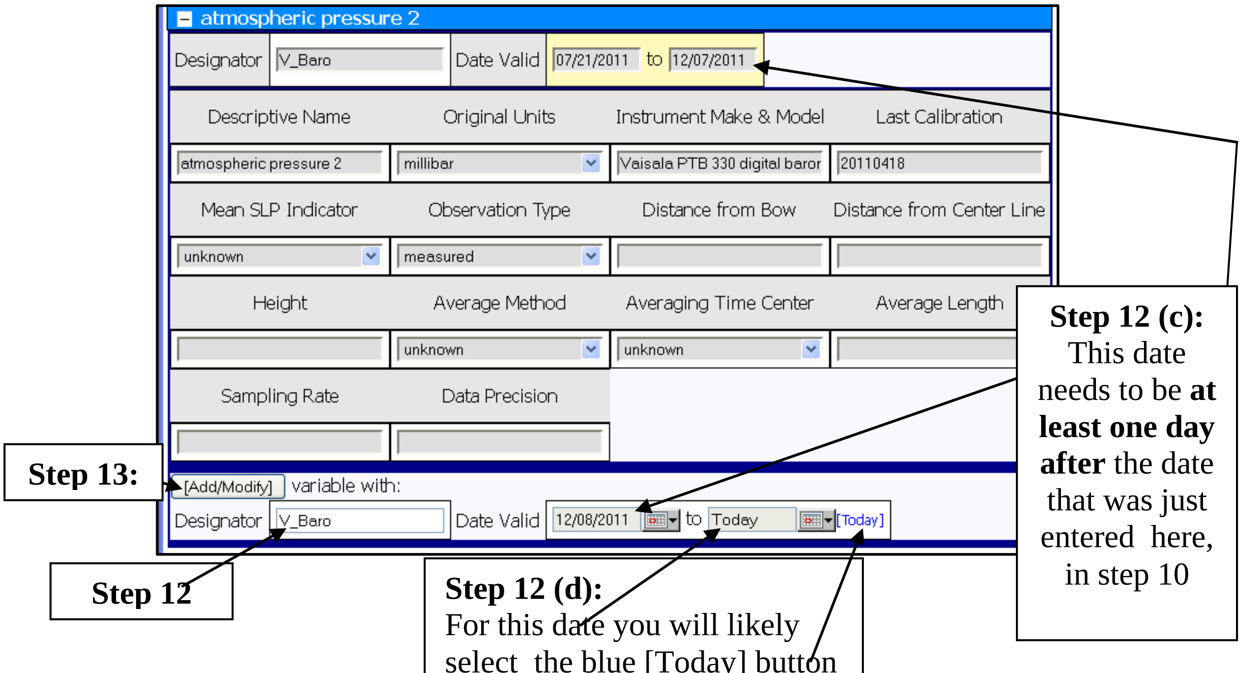


10. You now want to change the "Date Valid" info in this data box. The "Date Valid" start date (on the left) in this now edit-able area will likely stay the same unless you want to correct a previously entered erroneous start date. More than likely you will only be changing the end date, on the right.
   a. This step simply closes out the current data; letting the system know the start and end dates for which the data on the screen about that sensor are valid. You will probably not change any data here; only the end date.
   b. You will most likely be entering a calendar date in the right hand "Date Valid" box to close out the existing data for the sensor.

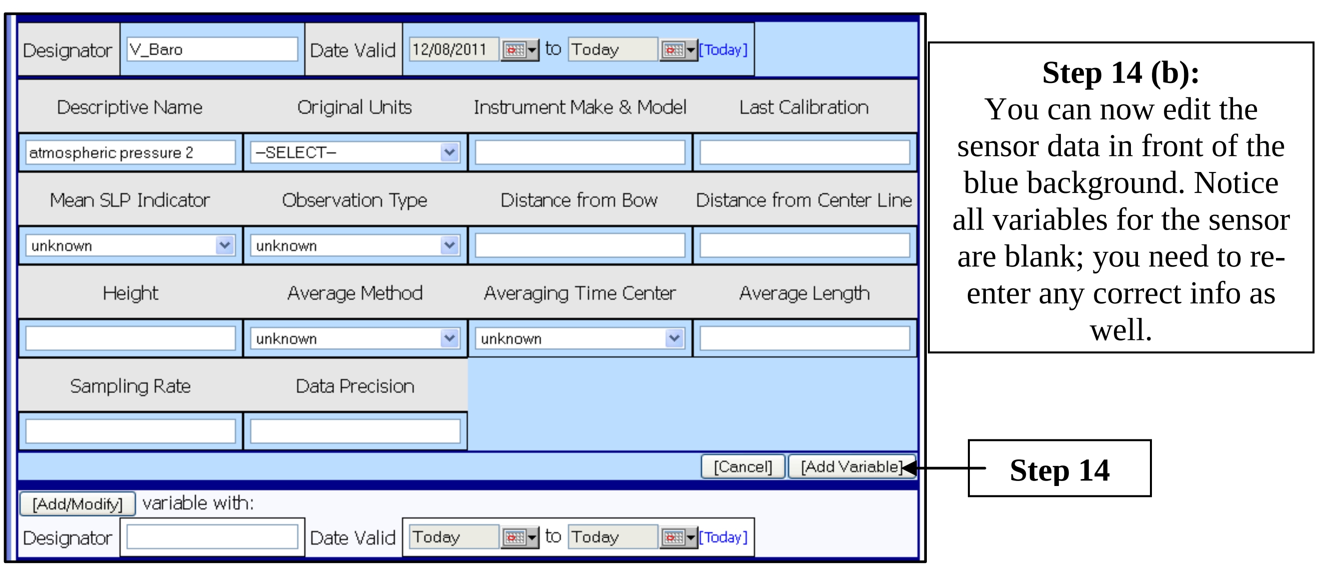
11. Click "Submit New Changes" on the bottom right of the data box (see image above)
   a. The text boxes in the data entry area should be grayed out again. The background of the dates that you just edited will be yellow (see image below).



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

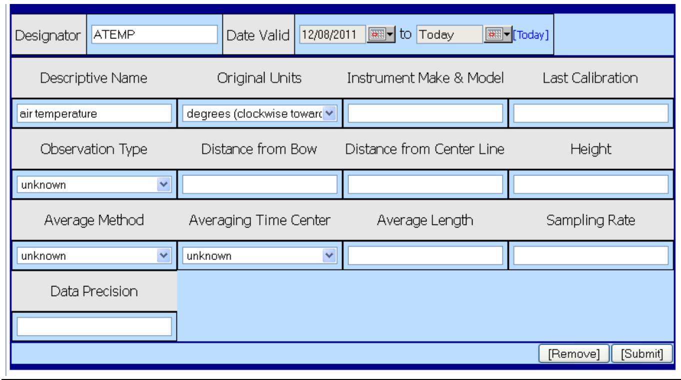


13. Click the [Add/Modify] button again (see image above)
14. You will now see a new, editable data box at the bottom of the screen that has blue around the sensor info instead of gray.
    a. Leave the Date Valid area the same
    b. You can now change the sensor data to reflect updates and add new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



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

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



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

Annex B: Final 2012 Metadata Status Snapshots

(*for all participating vessels in 2012, as of last month of participation)

Atlantic Explorer

Atlantis

Aurora Australis

Bell M. Shimada

Gordon Gunter

Healy

Henry B. Bigelow

Hi'ialakai

Ka'imimoana

Kilo Moana

Knorr

Laurence M. Gould

Melville

Nancy Foster

Nathaniel B. Palmer

New Horizon

Okeanos Explorer

Oregon II

Oscar Dyson

Oscar Elton Sette

Pisces

Robert Gordon Sproul

Roger Revelle

Ronald H. Brown

Southern Surveyor

Tangaroa

Thomas G. Thompson

*NOTE: due to a programming glitch, *Endeavor* and *Thomas Jefferson* could not be included here

WDC9417 2012-12 Metadata Status

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

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

KAQP 2012-10 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	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	🟢	🟢	🟢	–	–	–	🟢	🔴	🔴	🔴	🔴	🟢	🔴
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	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Relative Wind Speed 2	WPRS	🟢	🟢	🟢	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴

🟢 : <=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 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 2012-09 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	● green	● green	● green	● green	● green	● green	● green	● red	● red	● green	● green	● green	● red
Air Temperature 2	ATEMP2	● green	● green	● green	● green	● green	● green	● green	● green	● red	● green	● red	● green	● green
Atmospheric Pressure	BARO	● green	● green	● green	● green	● green	● green	● green	● red	● red	● green	● green	● green	● green
Conductivity	TSGC	● green	● green	● green	● red	● red	● red	● green	● red	● red	● green	● green	● green	● green
Earth Relative Wind Direction	TWDIR	● green	● green	● green	● green	● green	● green	● green	● green	● red	● green	● green	● green	–
Earth Relative Wind Direction 2	UTWDIR	● green	● green	● green	● green	● green	● green	● green	● green	● red	● green	● green	● green	● green
Earth Relative Wind Speed	TWSPD	● green	● green	● green	● green	● green	● green	● green	● green	● red	● green	● green	● green	–
Earth Relative Wind Speed 2	UTWSPD	● green	● green	● green	● green	● green	● green	● green	● red	● red	● green	● green	● green	● green
Latitude	LAT	● green	● green	● green	–	–	–	● green	● red	● red	● green	● green	● green	● red
Long Wave Atmospheric Radiation	RADLW	● green	● green	● green	● green	● green	● green	● red	● red	● red	● green	● green	● green	● green
Longitude	LON	● green	● green	● green	–	–	–	● green	● red	● red	● green	● green	● green	● red
Platform Course	COG	● green	● green	● green	–	–	–	● red	● red	● red	● green	● green	● red	● red
Platform Heading	GYRO	● green	● green	● green	–	–	–	● red	● red	● red	● green	● green	● green	● red
Platform Relative Wind Direction	RWDIR	● green	● green	● green	● green	● green	● green	● green	● green	● red	● green	● green	● green	● green
Platform Relative Wind Direction 2	URWDIR	● green	● green	● green	● green	● green	● green	● green	● red	● red	● green	● green	● green	● green
Platform Relative Wind Speed	RWSPD	● green	● green	● green	● green	● green	● green	● green	● green	● red	● green	● green	● green	● green
Platform Relative Wind Speed 2	URWSPD	● green	● green	● green	● green	● green	● green	● green	● red	● red	● green	● green	● green	● red
Platform Speed Over Ground	SOG	● green	● green	● green	–	–	–	● red	● red	● red	● green	● green	● green	● red
Relative Humidity	RELH	● green	● green	● green	● green	● green	● green	● green	● red	● red	● green	● green	● green	● red
Relative Humidity 2	RELH2	● green	● green	● green	● green	● green	● green	● green	● green	● red	● green	● green	● red	● green
Salinity	TSGS	● green	● green	● green	● red	● red	● red	● green	● red	● red	● green	● green	● green	● green
Sea Temperature	TSGWT	● green	● green	● green	● red	● red	● red	● green	● green	● red	● green	● green	● green	● green

● green : <=6 months old | ● yellow : >6 months old | ● red : 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

WTEO 2012-11 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

NEPP 2012-10 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	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡
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	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡
Platform Relative Wind Speed	WS	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡

🟢 : <=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	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 2012-11 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 2012-09 Metadata Status

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

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

WTEU 2012-06 Metadata Status

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

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

WDA7827 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	TWDP	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	–
Earth Relative Wind Direction 2	TWDS	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🔴
Earth Relative Wind Speed	TWSP	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	–
Earth Relative Wind Speed 2	TWSS	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🔴
Latitude	LA	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Long Wave Atmospheric Radiation	PIR	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Longitude	LO	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Course	CG	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Heading	HG	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Heading 2	GY	🔴	🔴	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🔴
Platform Relative Wind Direction	RWDP	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Relative Wind Direction 2	RWDS	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Relative Wind Speed	RWSP	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Relative Wind Speed 2	RWSS	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Speed Over Ground	SG	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Platform Speed Over Water	SL	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🔴
Precipitation Accumulation	PAO	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Precipitation Accumulation 2	PAY	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Rain Rate	PRO	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🟢
Relative Humidity	RH	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢

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

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

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

KCEJ 2012-11 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	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Air Temperature 2	WSAT	🔴	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Air Temperature 3	WPAT	🔴	🔴	🟢	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Atmospheric Pressure	BP	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Atmospheric Pressure 2	WSBP	🔴	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Atmospheric Pressure 3	WPBP	🔴	🔴	🟢	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Conductivity	SSC	🟢	🟢	🟢	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Earth Relative Wind Direction	TIP	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	–
Earth Relative Wind Direction 2	WSTD	🔴	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Earth Relative Wind Direction 3	WPTD	🔴	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Earth Relative Wind Speed	TWP	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	–
Earth Relative Wind Speed 2	WSTS	🔴	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Earth Relative Wind Speed 3	WPTS	🔴	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	–
Latitude	LA	🟢	🟢	🟢	–	–	–	🟢	🔴	🔴	🔴	🔴	🟢	🔴
Long Wave Atmospheric Radiation	LWR	🔴	🔴	🟢	🔴	🟢	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Longitude	LO	🟢	🟢	🟢	–	–	–	🟢	🔴	🔴	🔴	🔴	🟢	🔴
Platform Course	COG	🟢	🟢	🟢	–	–	–	🟢	🔴	🔴	🔴	🔴	🟢	🔴
Platform Heading	GY	🟢	🟢	🟢	–	–	–	🟢	🔴	🔴	🔴	🔴	🟢	🔴
Platform Relative Wind Direction	Imet_wndd	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Relative Wind Direction 2	WSRD	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Relative Wind Direction 3	WPRD	🟢	🟢	🟢	🔴	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴
Platform Relative Wind Speed	Imet_wnds	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢

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

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

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

WCX7445 2012-12 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	green	green	green	green	green	green	green	green	red	green	green	red	green
Atmospheric Pressure	BP	green	green	green	green	green	green	green	green	red	green	green	red	green
Conductivity	TC	red	red	green	red	red	red	red	red	red	red	red	red	red
Earth Relative Wind Direction	TWDP	green	green	green	green	green	green	green	green	red	green	green	red	–
Earth Relative Wind Direction 2	TWDS	green	green	green	green	green	green	green	green	red	green	green	red	red
Earth Relative Wind Speed	TWSP	green	green	green	green	green	green	green	green	red	green	green	red	–
Earth Relative Wind Speed 2	TWSS	green	green	green	green	green	green	green	green	red	green	green	red	red
Latitude	LA	green	green	green	–	–	–	green	green	red	green	green	red	red
Longitude	LO	green	green	green	–	–	–	green	green	red	green	green	red	red
Net Atmospheric Radiation	SW	green	green	green	green	green	green	green	green	red	green	green	red	green
Net Atmospheric Radiation 2	LW	green	green	green	green	green	green	green	green	red	green	green	red	green
Photosynthetically Active Atmospheric Radiation	PA	green	green	green	green	green	green	green	green	red	green	green	red	red
Platform Course	CR	green	green	green	–	–	–	green	green	red	green	green	red	red
Platform Heading	GY	green	green	green	–	–	–	green	green	red	green	green	red	red
Platform Relative Wind Direction	WDP	green	green	green	green	green	green	green	green	red	green	green	red	green
Platform Relative Wind Direction 2	WDS	green	green	green	green	green	green	green	green	red	green	green	red	red
Platform Relative Wind Speed	WSP	green	green	green	green	green	green	green	green	red	green	green	red	green
Platform Relative Wind Speed 2	WSS	green	green	green	green	green	green	green	green	red	green	green	red	red
Platform Speed Over Ground	SOG	green	green	green	–	–	–	green	green	red	green	green	green	red
Relative Humidity	RH	green	green	green	green	green	green	green	green	red	green	green	red	green
Salinity	SA	green	green	green	red	red	red	green	green	red	green	green	red	green
Sea Temperature	SST	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

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

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

WECB 2012-12 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	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Air Temperature 2	RTB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Atmospheric Pressure	BPB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Atmospheric Pressure 2	BSB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Conductivity	TCO	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Dew Point Temperature	DPB	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🟡	🟡	🟡	🟡	🟡	🟡
Earth Relative Wind Direction	TIB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	–
Earth Relative Wind Speed	TWB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	–
Latitude	LAR	🟡	🟡	🟡	–	–	–	🟡	🟡	🟡	🟡	🟡	🟡	🔴
Long Wave Atmospheric Radiation	LWB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Longitude	LOL	🟢	🟢	🟢	–	–	–	🔴	🔴	🔴	🔴	🔴	🔴	🔴
Photosynthetically Active Atmospheric Radiation	PAB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Course	CRL	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Platform Heading	GYL	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Platform Relative Wind Direction	WDB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Relative Wind Speed	WSB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Platform Speed Over Ground	SPL	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Precipitation Accumulation	PRB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Relative Humidity	RHB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Salinity	SAO	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Sea Temperature	TTO	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Short Wave Atmospheric Radiation	SWB	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢

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

WTER 2012-10 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	WTEMP	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🔴	🔴
Sea Temperature 2	TSGWT	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🟢	🟢	🟢	🔴	🔴

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

WBP3210 2012-12 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 2012-11 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	ATT	green	green	green	green	green	green	green	green	green	green	green	green	green
Air Temperature 2	RTT	green	green	green	green	green	green	green	green	green	green	green	green	green
Atmospheric Pressure	BPT	green	green	green	green	green	green	green	green	green	green	green	green	green
Atmospheric Pressure 2	BST	green	green	green	green	green	green	green	green	green	green	green	green	green
Conductivity	TCW	green	green	green	red	red	red	green	green	green	green	green	green	green
Earth Relative Wind Direction	TIP	green	green	green	green	green	green	green	green	green	green	green	green	–
Earth Relative Wind Direction 2	TIS	green	green	green	green	green	green	green	green	green	green	green	green	red
Earth Relative Wind Speed	TWP	green	green	green	green	green	green	green	green	green	green	green	green	–
Earth Relative Wind Speed 2	TWS	green	green	green	green	green	green	green	green	green	green	green	green	red
Latitude	LAR	green	green	green	–	–	–	green	green	green	green	green	green	red
Long Wave Atmospheric Radiation	LWT	green	green	green	green	green	green	green	green	green	green	green	green	green
Longitude	LOR	green	green	green	–	–	–	green	green	green	green	green	green	red
Photosynthetically Active Atmospheric Radiation	PAT	green	green	green	green	green	green	green	green	green	green	green	green	green
Platform Course	CRR	green	green	green	–	–	–	green	green	green	green	green	green	red
Platform Heading	GYR	green	green	green	–	–	–	green	green	green	green	green	green	red
Platform Relative Wind Direction	WDP	green	green	green	green	green	green	green	green	green	green	green	green	red
Platform Relative Wind Direction 2	WDS	green	green	green	green	green	green	green	green	green	green	green	green	red
Platform Relative Wind Speed	WSP	green	green	green	green	green	green	green	green	green	green	green	green	red
Platform Relative Wind Speed 2	WSS	green	green	green	green	green	green	green	green	green	green	green	green	red
Platform Speed Over Ground	SPR	green	green	green	–	–	–	green	green	green	green	green	green	red
Precipitation Accumulation	PRT	green	green	green	green	green	green	green	green	green	green	green	green	green
Relative Humidity	RHT	green	green	green	green	green	green	green	green	green	green	green	green	green

green : <=6 months old | yellow : >6 months old | red : 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 2012-11 Metadata Status

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

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

WTDO 2012-11 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	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴
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	SST	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🔴

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

WTEP 2012-11 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 2012-10 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	HDG	🟢	🟢	🟢	–	–	–	🟢	🟢	🔴	🟢	🔴	🔴	🟢
Platform Relative Wind Direction	RWDIR	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🔴	🟢	🔴	🔴	🟢
Platform Relative Wind Speed	RWSPD	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🔴	🟢	🔴	🔴	🟢
Platform Speed Over Ground	SOG	🟢	🟢	🟢	–	–	–	🟢	🟢	🔴	🟢	🔴	🔴	🔴
Relative Humidity	RELH	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🔴	🟢	🔴	🔴	🔴
Salinity	TSGS	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🔴	🟢	🔴	🔴	🟢
Sea Temperature	TSGT	🟢	🟢	🟢	🔴	🔴	🔴	🟢	🟢	🔴	🟢	🔴	🔴	🟢

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

WTDL 2012-12 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	🔴	🔴	🟢	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🔴
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

WSQ2674 2012-12 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 2012-12 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 2012-09 Metadata Status

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

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

VLHJ 2012-06 Metadata Status

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

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

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

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

ZMFR 2012-06 Metadata Status

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

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

KTDQ 2012-07 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	AT	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Atmospheric Pressure	BP	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴
Conductivity	TC	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
Earth Relative Wind Direction	TWD	🟢	🟢	🟢	🟢	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢	–
Earth Relative Wind Speed	TWS	🟢	🟢	🟢	🟢	🔴	🟢	🟢	🟢	🟢	🟢	🟢	🟢	–
Latitude	LA	🟢	🟢	🟢	–	–	–	🟢	🟢	🟢	🟢	🟢	🔴	🔴
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