2024 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 for your dedication to marine meteorological and oceanographic data collection and research.

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1. Introduction

This report describes the quantity and quality of observations collected in 2024 by research vessels participating in the Shipboard Automated Meteorological and Oceanographic System (SAMOS) initiative (Smith et al. 2018). 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, precipitation, and radiation), and near-surface oceanographic (sea temperature, conductivity, and salinity) parameters while the RV is underway. Original measurements from installed instrumentation 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 DAC focuses on 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 or pulled from a shore-side data service hosted by the operating institution. Data reduction from original measurements down to 1-minute averages is completed onboard each ship using their respective data acquisition software. Broadband satellite communication facilitates transferal of SAMOS data to the DAC as near as possible to 0000 UTC daily. For SAMOS 1.0, a preliminary version of the SAMOS data is made available via web services within minutes of receipt. All preliminary data undergo common formatting, metadata conjoining, 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 and retains values with the "best" quality control flag when duplicates for a given parameter exist. For all NOAA vessels and the *Falkor (too)*, 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 (https://samos.coaps.fsu.edu/html/) under "Data Access" and long-term archiving occurs at the US National Centers for Environmental Information (NCEI). SAMOS data at NCEI are accessible in monthly packages sorted by ship and have been assigned a collection-level reference and digital object identifier (Smith et al. 2009) to facilitate referencing the SAMOS data in publications. Details of the SAMOS data center activities are documented in a data management plan published in 2025 (https://samos.coaps.fsu.edu/html/docs/SAMOS_DMP_for_NOAA_24Feb2025_v06.pdf).

In 2024, out of 32 active recruits, a total of 30 research vessels routinely provided SAMOS observations to the DAC (Table 1). SAMOS data providers included the National Oceanographic and Atmospheric Administration (NOAA, 14 vessels), the Schmidt Ocean Institute (SOI, 1 vessel), the Woods Hole Oceanographic Institution (WHOI, 2 vessels), the National Science Foundation Office of Polar Programs (OPP, 2 vessels), the United States Coast Guard (USCG, 1 vessel), the Bermuda Institute of Ocean Sciences (BIOS, 1 vessel), the University of Hawaii (UH, 1 vessel), the University of Washington (UW, 1 vessel), the University of Alaska (UA, 1 vessel), Scripps Institution of Oceanography (SIO, 3 vessels), and the Australian Integrated Marine Observing System (IMOS, 3 vessels). The Louisiana Universities Marine Consortium (LUMCON) vessel *Pelican* was active in the SAMOS system, but for reasons beyond the control of the SAMOS DAC (problems with their shipboard acquisition and data delivery systems) was unable to contribute data in 2024. Also, NOAA's *Ronald Brown* was undergoing mid-life refit and provided no observations in 2024. The newest vessel in the SAMOS initiative is the RSV *Nuyina*, recruited via IMOS and the Australian Antarctic Program.

IMOS is an initiative to observe the oceans around Australia (Hill et al. 2010). 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 vessel (*Tangaroa)* operated by New Zealand and two vessels (*Investigator, Nuyina*) operated by Australia. In 2015 code was developed at the SAMOS DAC (updated in 2018) which allows for harvesting *Tangaroa, Investigator,* and *Nuyina* SAMOS data directly from the IMOS THREDDS catalogue. In addition to running a parallel system to SAMOS in Australia, IMOS is the only international data contributor to SAMOS.

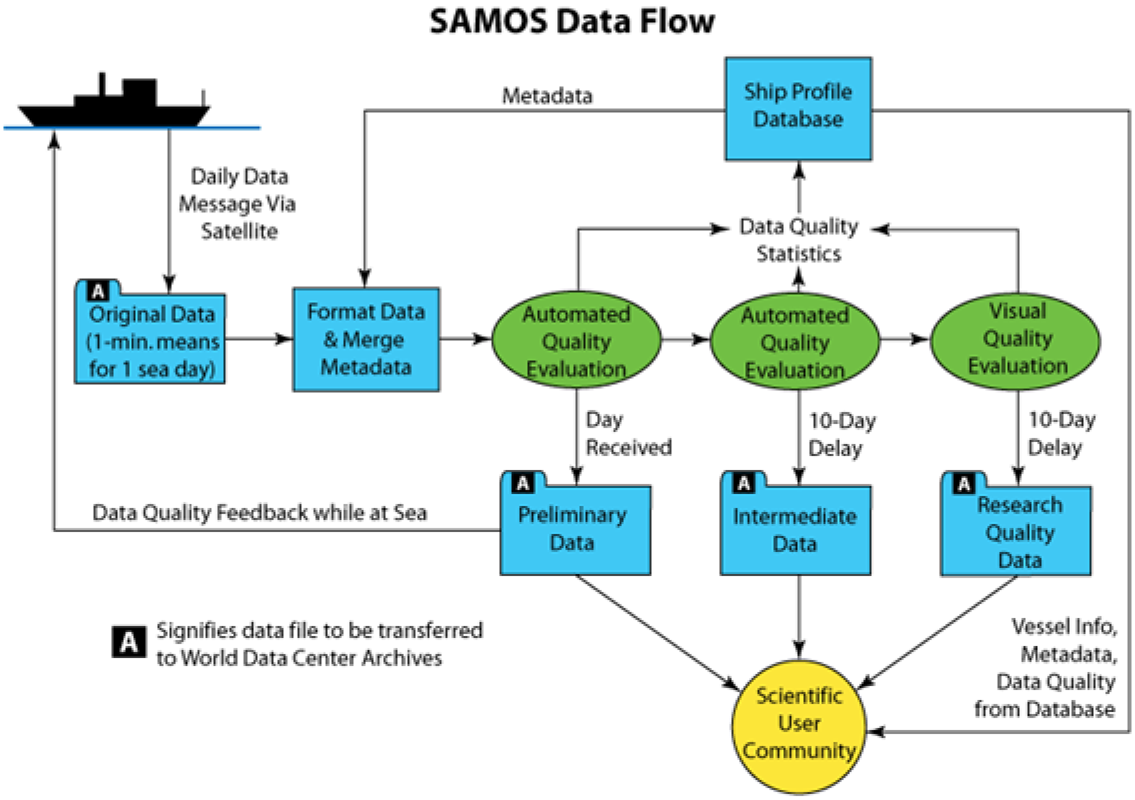

Figure 1: Diagram of operational data flow for the SAMOS initiative in 2024. Note that metadata for SCS5 ships is transmitted in daily XML files along with the data message. For other vessels, metadata is still received via separate emails or communication with the ship technicians.

Beginning in 2013, funding did not allow for visual quality control procedures for any non-NOAA vessels except the *Falkor* (2013-2021) and her successor the *Falkor (too)* (beginning 2023), the latter of which have been separately supported via a contract with SOI. As such, visual QC for all remaining vessels was discontinued, until such time as funding is extended to cover them. It should be noted that in the case of the *Tangaroa*, the IMOS project conducted their own visual QC until a personnel change there in June 2013. Only automated QC for the *Investigator, Nuyina,* and *Tangaroa* occurs at the SAMOS DAC. The quality results presented herein are from the research quality products for all NOAA vessels and automated-only quality control-level, daily-merged (intermediate) products for all remaining vessels.

During 2024, the overall quality of data received varied widely between different vessels and the individual sensors on the vessels. Major problems included non-ideal sensor placement that enhanced flow distortion (nearly all vessels experience some degree of flow distortion), potential non-ideal seawater intake location that makes taking a representative sea temperature difficult or impossible (*Hassler*), sensor damages or wiring problems caused in shipyard or by cruising science parties (*Dyson*, *Pisces*) or from extreme weather events (*Nuyina),* sensor failures/sensors or equipment that remained problematic or missing for extended periods (*Gordon Gunter*, *Kilo Moana, Falkor (too), Palmer,* others), sensor channels that continued to record a signal despite the sensor being removed (*Sproul*, *Oregon II*, others), incorrectly applied calibration coefficients/offset values (*Healy*), a lack of product support/issue resolution from Applanix, for their POS/MV system (*Okeanos Explorer*, potentially others), major engineering problems such as rudder issues (*Fairweather*) or critical systems power loss due to fire (*Rainier*) that limited ship operability, less severe engineering issues such as plumbing leaks (*Sette*), periodic bird roosting (especially in the tropics) affecting sonic anemometers, acoustic rain sensors, and radiometers (*Atlantis*, *Thompson*, *Revelle*, *Sally Ride*, *Falkor (too)*, potentially others), incorrect time stamps resulting from offsets between time serving components (*Dyson,* probably other SCSv5 ships*)*, major issues connecting sensors to data acquisition systems (*Pisces, Falkor (too),* others), and data transmission oversights or issues (many vessels).

This report begins with an overview of the vessels contributing SAMOS observations to the DAC in 2024 (section 2). The overview treats the individual vessels as part of a global 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. The 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 2025. Annexes include a listing of vessel notifications and vessel data identified as suspect but not flagged or only partially flagged by quality control procedures (Annex A), as well as web interface instructions for accessing SAMOS observations (Annex B, part 1).

2. System review

In 2024, a total of 32 research vessels were under active recruitment to the SAMOS initiative; 30 of those vessels routinely provided SAMOS observations to the DAC (Table 1). The *Pelican* sailed in 2024, but in her case proper configuration of the SAMOS SCS file template and mail server (for the purposes of transmitting SAMOS data) could not be established in 2024, despite several virtual meetings with their lead technician. We will continue efforts in 2025 to restart data flow from the *Pelican* as time permits.

In total, 6,694 ship days were received by the DAC from January 1 to December 31 2024, resulting in 9,266,436 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 9,266,436 records received in 2024, a total of 255,437,090 distinct measurements were logged. Of those, 11,371,295 were assigned A-Y quality control flags – about 4.5 percent – by the SAMOS DAC (see section 3a for descriptions of the QC flags). This is essentially the same as in 2023. Measurements deemed "good data," through both automated and visual QC inspection, are assigned Z flags. In total, fifteen of the SAMOS vessels (the *Tangaroa, Nuyina*, *Investigator, Atlantis, Neil Armstrong, Laurence M. Gould, Nathaniel B. Palmer, Healy*, *Atlantic Explorer*, *Kilo Moana, Thomas G. Thompson, Sikuliaq*, *Roger Revelle, Sally Ride*, and the *Robert Gordon Sproul*) only underwent automated QC. None of these vessels' data were assigned any additional flags, nor were any automatically assigned flags removed via visual QC.

SHIP NAME	CALL SIGN	# of Days	# of Vars	# of Records	# of A-Y Flags	# of All Flags	% Flagged
TOTAL	-	6,694	881	9,266,436	11,371,295	255,437,090	4.45
ROGER REVELLE	KAOU	319	28	449,342	140,450	12,122,480	1.16
ATLANTIS	KAQP	348	30	479,483	265,995	14,199,495	1.87
T.G. THOMPSON	KTDQ	242	28	328,760	225,692	8,372,100	2.70
HEALY	NEPP	173	40	233,994	151,921	8,221,830	1.85
INVESTIGATOR	VLMJ	246	34	343,344	373,547	11,213,696	3.33
NUYINA	VMIC	236	32	319,896	715,227	9,799,480	7.30
NEIL ARMSTRONG	WARL	277	32	388,870	379,047	12,128,771	3.13
NATHANIEL B. PALMER	WBP3210	347	23	496,831	750,825	10,692,363	7.02
LAURENCE M. GOULD	WCX7445	122	23	174,861	238,243	3,844,868	6.20
KILO MOANA	WDA7827	223	32	285,878	83,486	8,288,471	1.01
ATLANTIC EXPLORER	WDC9417	164	32	198,522	242,481	6,352,704	3.82
SIKULIAQ	WDN7246	310	35	446,018	466,136	14,919,080	3.12
SALLY RIDE	WSAF	269	29	373,956	180,537	10,488,600	1.72
ROBERT GORDON SPROUL	WSQ2674	249	23	345,408	271,757	7,915,584	3.43
HENRY B. BIGELOW	WTDF	185	35	244,086	378,454	6,545,647	5.78
OKEANOS EXPLORER	WTDH	177	25	248,322	164,836	5,582,286	2.95
PISCES	WTDL	262	34	372,157	948,914	11,423,232	8.31
OREGON II	WTDO	222	30	303,189	574,449	8,267,881	6.95
THOMAS JEFFERSON	WTEA	235	22	329,218	332,807	5,838,271	5.70
FAIRWEATHER	WTEB	105	22	147,158	26,180	2,160,266	1.21
BELL M. SHIMADA	WTED	175	40	238,975	447,068	9,002,908	4.97
OSCAR ELTON SETTE	WTEE	182	24	245,214	231,342	5,334,588	4.34
RAINIER	WTEF	45	15	63,735	94,025	943,083	9.97
REUBEN LASKER	WTEG	164	30	221,078	437,982	6,013,350	7.28
FERDINAND HASSLER	WTEK	149	20	211,100	276,410	2,986,389	9.26
GORDON GUNTER	WTEO	219	39	306,361	799,484	11,243,700	7.11
OSCAR DYSON	WTEP	197	32	253,312	612,746	7,669,238	7.99
NANCY FOSTER	WTER	243	36	348,903	272,264	11,690,175	2.33
FALKOR (TOO)	ZGOJ7	319	39	455,444	693,524	15,216,981	4.56
TANGAROA	ZMFR	290	17	413,021	595,466	6,959,573	8.56

Table 1: CY2024 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 one-minute 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, (column eight) percentage flagged A-Y.

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. Scheduled days may sometimes include days spent at port, 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. Occasionally vessel technicians may be under orders not to transmit data due to vessel location (e.g., within an exclusive economic zone, marine protected area, underwater cultural heritage site, etc., denoted with a "*" in Figure 2, when known). However, when a vessel is reportedly "at sea" (denoted with an "***S***" in Figure 2, when possible) and we have not received expected 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. The DAC provides JSON web services (https://samos.coaps.fsu.edu/html/webservices.php) to allow interested parties to track the date data was last received by the DAC for each vessel (Preliminary File), the results of the automated quality control on these files (Preliminary Quality), and to search for available SAMOS data by cruise identifier for those vessels cataloged by the Rolling Deck to Repository (R2R) project. This allows operators and the DAC to track the completeness of SAMOS data for each vessel and to identify when data are not received within the 10-day limit for visual quality control. When data are received after the 10-day limit, current funding for the SAMOS initiative does 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) to final 2024 ship schedules provided by each vessel's institution. Days identified on the vessel institution's schedule for which no data was received by the DAC are shown in grey. Within the grey boxes an italicized "***S***" indicates a day reportedly "at sea." As an added metric, Table 2 attempts to measure each vessel's actual submission performance by matching scheduled at-sea (or assumed at-sea) days to the availability of SAMOS data files for those days. All data received for 2024, with the exceptions of *Tangaroa, Nuyina,* and *Investigator,* has been archived at the NCEI. Through agreement with IMOS, we receive data for the *Tangaroa, Nuyina,* and the *Investigator* and for these vessels perform automated QC only. IMOS data is archived within the IMOS DAC-eMarine Information Infrastructure (eMII).

JANUARY	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
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Figure 2: 2024 calendar of ship days received by DAC (**green**) and (**grey**) additional days reported afloat by vessels; "**S**" denotes vessel reportedly at sea, "P" denotes vessel in port, "*" denotes a known "restricted data" situation (e.g., a maritime EEZ, underwater cultural heritage 'UCH' protocol, etc.) with no expectation of data. Vessels are listed by call sign (see Table 1).

MARCH	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
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WTDH																			S												
WTDL																															
WTDO																				S											
WTEA																															
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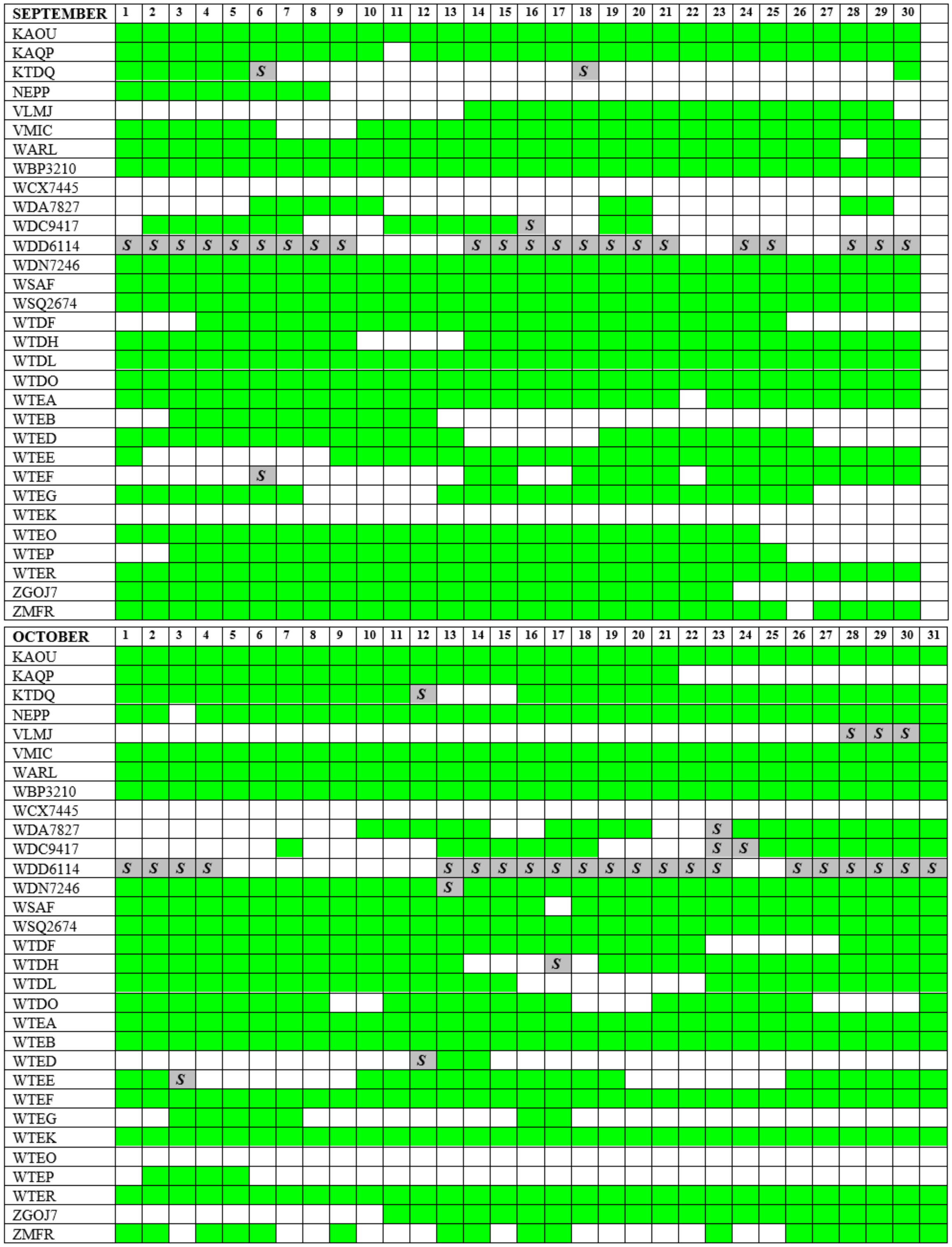
ZGOJ7																	S														
ZMFR																															

(Figure 2: cont'd)



(Figure 2: cont'd)

NOVEMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
KAOU																															
KAQP																															
KTDQ								S																							
NEPP																															
VLMJ																S	S														
VMIC																															
WARL																													S		
WBP3210									S	S																					
WCX7445																															
WDA7827																			S												
WDC9417																														S	
WDD6114	S	S	S	S	S	S	S	S	S	S	S	S																			
WDN7246																															
WSAF																															
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WTER																															
ZGOJ7																															
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																															
KTDQ								S																							
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VMIC											S																				
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ZMFR																															

(Figure 2: cont'd)

NOAA								
Ship Name	**Bell M. Shimada**	**Fairweather**	**Ferdinand Hassler**	**Gordon Gunter**	**Henry Bigelow**	**Nancy Foster**	**Okeanos Explorer**	**Oregon II**
Call Sign/ Ship Code	**WTED/SH**	**WTEB/FA**	**WTEK/FH**	**WTEO/GU**	**WTDF/HB**	**WTER/NF**	**WTDH/EX**	**WTDO/OT**
# scheduled at-sea days	140	15	76	152	179	153	168	149
# matching SAMOS days	134	4	72	142	176	153	165	141
→% received	96%	27%	95%	93%	98%	100%	98%	95%

NOAA (cont'd)						
Ship Name	**Oscar Dyson**	**Oscar E. Sette**	**Pisces**	**Rainier**	**Reuben Lasker**	**Thomas Jefferson**
Call Sign/ Ship Code	**WTEP/OD**	**WTEE/OS**	**WTDL/PI**	**WTEF/RA**	**WTEG/RL**	**WTEA/TJ**
# scheduled at-sea days	167	191	167	1	156	150
# matching SAMOS days	162	178	155	0	152	144
→% received	97%	93%	93%	0%	97%	96%
TOTAL scheduled at-sea days:	1864					
TOTAL matching SAMOS days:	1778					
OVERALL RATIO:	95%					

Table 2: 2024 data submission performance metrics listed by institution and ship. Note where official schedules specify "at sea" days only those days are counted. In all other cases "at sea" is assumed and scheduled days are counted as-is. Note also while SAMOS days follow GMT, ship schedules may not. This leaves room for some small margin of error. Lastly, note any transit through an exclusive economic zone, marine protected area, etc. may preclude data transmission. All public schedule resources are listed in the References.

IMOS			
Ship Name	Investigator	Nuyina	Tangaroa
Call Sign	VLMJ	ZMFR	ZMFR
# scheduled at-sea days	208	135	287
# matching SAMOS days	189	133	287
→% received	91%	99%	100%
TOTAL scheduled at-sea days:	630		
TOTAL matching SAMOS days:	609		
OVERALL RATIO:	97%		

OPP		
Ship Name	Laurence M. Gould	Nathaniel B. Palmer
Call Sign	WCX7445	WBP3210
# scheduled at-sea days	41	173
# matching SAMOS days	41	171
→% received	100%	99%
TOTAL scheduled days:	214	
TOTAL matching SAMOS days:	212	
OVERALL RATIO:	99%	

SIO			
Ship Name	Robert G. Sproul	Roger Revelle	Sally Ride
Call Sign	WSQ2674	KAOU	WSAF
# scheduled at-sea days	69	235	191
# matching SAMOS days	69	235	188
→% received	100%	100%	98%
TOTAL scheduled at-sea days:	495		
TOTAL matching SAMOS days:	492		
OVERALL RATIO:	99%		

WHOI		
Ship Name	R/V Atlantis	R/V Neil Armstrong
Call Sign	KAQP	WARL
# scheduled at-sea days	256	222
# matching SAMOS days	256	218
→% received	100%	98%
TOTAL scheduled at-sea days:	478	
TOTAL matching SAMOS days:	474	
OVERALL RATIO:	99%	

	BIOS	LUMCON	SOI	UAF	UHI	USCG	UW
Ship Name	Atlantic Explorer	Pelican	Falkor (too)	Sikuliaq	Kilo Moana	Healy	Thomas G. Thompson
Call Sign	WDC9417	WDD6114	ZGOJ7	WDG7520	WDA7827	NEPP	KTDQ
TOTAL scheduled at-sea days	173	151	259	259	221	59	211
TOTAL matching SAMOS days	159	0	252	251	214	59	178
OVERALL RATIO:	92%	0%	97%	97%	97%	100%	84%

(Table 2: cont'd)

b. Spatial coverage

Geographically, SAMOS data coverage maintains its tradition of noteworthiness in 2024, with both the typical exposures and a few trips outside traditional mapping/shipping lanes. Cruise coverage for 1 January to 31 December 2024 is shown in Figure 3. As usual, there were numerous cruises in the Southern Ocean, from Punta Arenas, Chile to and along the Antarctic shelf, furnished by the *Falkor (too), Thomas G. Thompson,* and the two OPP vessels *Nathaniel B. Palmer* and *Laurence M. Gould*, as well as forays near the other side of Antarctica completed by the Australian and Kiwi vessels *Investigator* and *Nuyina*. The well-traveled *Revelle* also spanned both the Pacific and the Atlantic Oceans. Meanwhile, broad exposure in the North Atlantic was afforded by the *Atlantic Explorer* and *Gordon Gunter* (among others). The WHOI vessel *Neil Armstrong* extended the northern range up into the Labrador Sea, even pushing into Baffin Bay in the Arctic Circle. Much more of the Arctic Ocean was visited by the *Sikuliaq* and the *Healy*. The Gulf of Alaska and the Bering Sea saw heavy coverage between the *Fairweather*, *Atlantis*, *Oscar Dyson*, and *Sikuliaq* (among others). Moving out again into the open ocean, several broad swaths of the North Pacific were provided by the *Atlantis*, *Kilo Moana*, and *Thomas G. Thompson* (among others). The south Pacific had it's visitors, too, in the forms of the *Thompson*, the WHOI vessel *Atlantis* (east Pacific), and the *Falkor (too)* (much of her time spent along the western side of South America). The *Roger Revelle* made a transit through the Panama Canal. The waters around Australia were explored by the *Thompson, Nuyina*, and *Investigator*, and the waters east of New Zealand received heavy coverage from the *Tangaroa*. The *Atlantic Explorer* naturally spent a lot of time cruising around Bermuda, but also pinged in San Juan, PR. Natively, the entire East coast was sampled by the *Ferdinand Hassler*, *Gordon Gunter*, *Henry Bigelow*, *Nancy Foster*, *Neil Armstrong*, *Pisces*, *Thomas Jefferson*, and others. Comparable coverage of British Columbia and the West coast was effected by, among others, the *Bell M. Shimada, Reuben Lasker*, *Sikuliaq*, the Scripps ships *Sally Ride* and *Robert Gordon Sproul*, and the *Atlantis*. The Hawai'ian archipelago was comprehensively explored by the *Kilo Moana*, *Oscar Elton Sette*, *Okeanos Explorer*, and the *Thompson*. There was also the typical full coverage in the northern Gulf of Mexico, as contributed by the *Gordon Gunter*, *Nancy Foster*, *Pisces*, *Oregon II*, and others.

Figure 3: Cruise maps plotted for each vessel in 2024.

c. Available parameter coverage

The core meteorological parameters – earth relative wind speed and direction, atmospheric pressure, and air temperature and relative humidity – are reported by all ships. Most ships also report the oceanographic parameter sea temperature. Many SAMOS vessels additionally report dew point and wet bulb temperatures; precipitation accumulation; rain rate; and longwave, shortwave, and photosynthetically active radiations; along with seawater conductivity and salinity. A quick glance at Table 4 (located in Section 4) shows which parameters are reported by each vessel: those boxes in columns 6 through 13 on the first page and columns 2 through 16 on the second page with an entry indicate a parameter was enabled for reporting and processing at the writing of this publication. (Further detail on Table 4 is discussed in Section 4.) Some vessels furnish redundant sensors, which can be extremely helpful for visually assessing data quality, and those boxes in columns 6 through 13 on the first page and columns 2 through 16 on the second page in Table 4 with multiple entries indicate the number of redundant sensors available for reporting and processing in 2024/2025; boxes with a single entry indicate the existence of a single sensor.

3. Data quality

a. SAMOS quality control

Definitions of A-Z SAMOS quality control flags are listed in Table 3 and detailed descriptions of the quality tests are provided in Smith et al. (2018). It should be noted that no secondary automated QC was active in 2024 (SASSI), so quality control flags U-Y were not in use. A “special value” (set equal to -8888) may exist in any variable when a value received 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, in an effort to minimize over-flagging, are rarely used. The primary application of the port flag occurs when a vessel is known to be in dry dock. The port flag may also be applied, often in conjunction with flags on other parameters, to indicate that the vessel is confirmed (visually or via operator) in port and any questionable data are likely attributable to dockside structural interference, although this practice is traditionally only used in extreme cases. (We note that, owing to a timeworn visual flagging platform, the H flag is not routinely used, to achieve expeditious flagging.) 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.
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 dewpoint temperature.
E	Data failed the resultant wind re-computation check. When the data set includes the platform's heading, course over the ground, and speed over the ground 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 difference between the reported and re-computed true wind direction is >20 degrees (or >2.5 m/s for true wind speed).
F	Platform velocity unrealistic. Determined by comparing distance travelled between sequential (3-minute interval) latitude and longitude positions. Flags applied to latitude and longitude (not the platform speed).
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 (step) found in the data. Flags assigned to the maximum and minimum points in the discontinuity.
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	Visual inspection shows the value to be erroneous/poor quality. The value should NOT be used.
K	Data suspect/use with caution - Applied when the data looks to have obvious errors, but no specific reason for the error can be determined. Some data may be useful, but uncertainty would be high and use is not recommended.
L	Oceanographic platform position over land when comparing reported latitude and longitude to ETOPO 1-arc-minute topography dataset.
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 are uncertain. Data should be used with caution.
Q	Questionable - observation reported as questionable/uncertain in consultation with vessel operator or data arrived at DAC already flagged as questionable/uncertain (use with caution).
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 5 values) that are drastically out of the current data trend. Spikes occur 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. (SASSI presently not in use).
V	Data spike as determined by SASSI. (SASSI presently not in use).
X	Step/discontinuity in data as determined by SASSI. (SASSI presently not in use).
Y	Suspect values between X-flagged data (from SASSI). (SASSI presently not in use).
Z	Data passed evaluation

Table 3: Definitions of SAMOS quality control flags

b. 2024 quality across-system

This section presents the overall quality from the system of ships providing observations to the SAMOS data center in 2024. 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.

Latitude and longitude (Figure 4) primarily only receive flags via the auto flagger, 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 either land error flags (L) or platform velocity unrealistic (F) flags. L flags are often removed by the data analyst when it is determined that the vessel was simply very close to land, but still over water and the flag is simply a result of using a 1 arc-minute land mask that cannot resolve the smaller near coastal waters (see Smith et al. 2018, land flag removal is not possible for non-visual QC ships). Otherwise, L and F flags are commonly assigned to spikes in LAT and LON data. It should be noted that *Atlantis*, *Neil Armstrong*, *Revelle*, *Sproul*, *Sally Ride, Sikuliaq*, *Palmer*, and *Gould* in particular are known to transmit a good deal of port data and since they do not receive visual QC, some amount of erroneous L (position over land) auto flagging would be expected for 2024. It might also be noted some visual QC ships that have been upgraded to the newest version of NOAA's Scientific Computing System (SCSv5) see an increase in L and F flags, particularly in port, which are not always able to be removed (mainly *Oscar Elton Sette* and *Thomas Jefferson*).

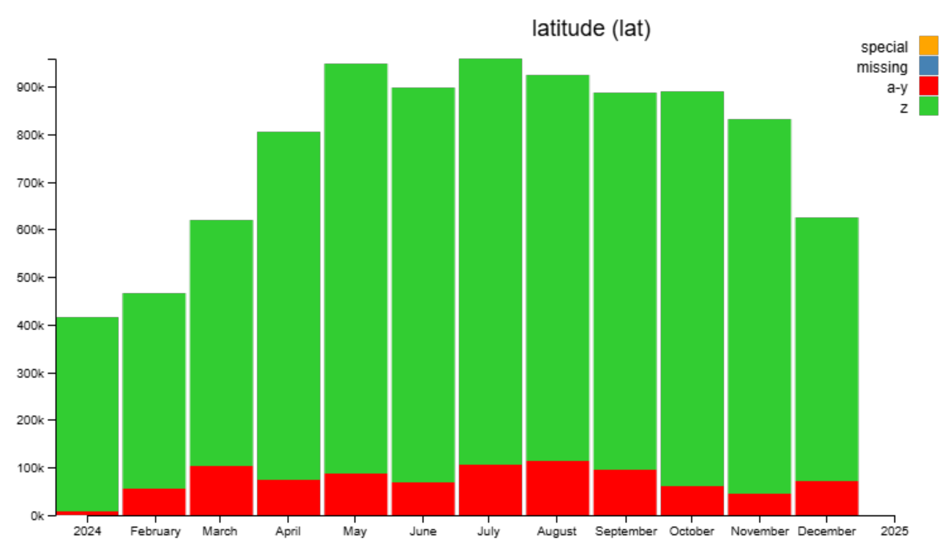


Figure 4: Total number of (this page) latitude – LAT – and (next page) longitude – LON – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

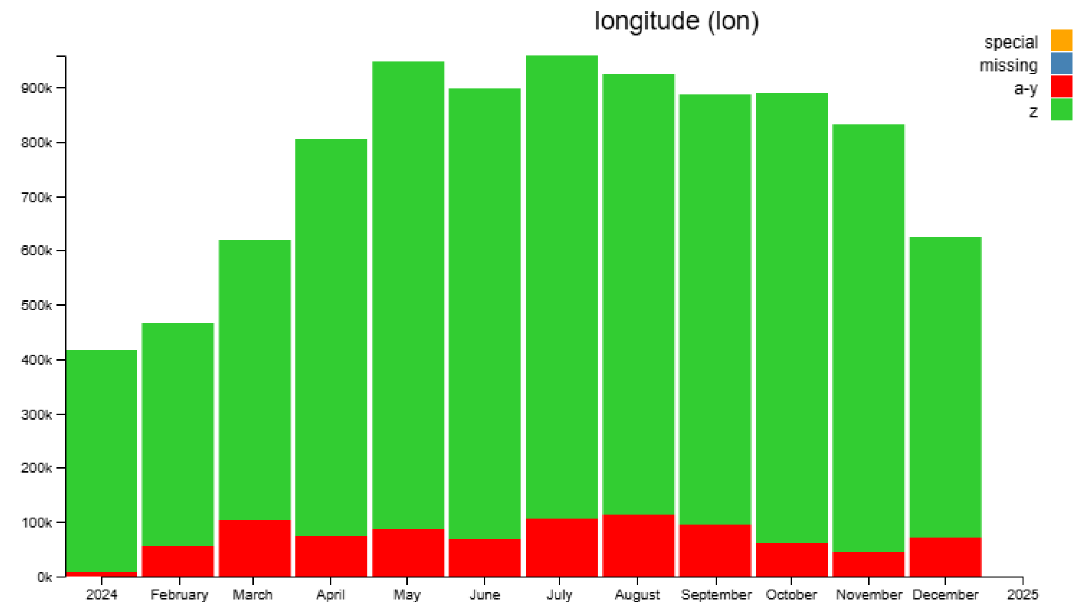
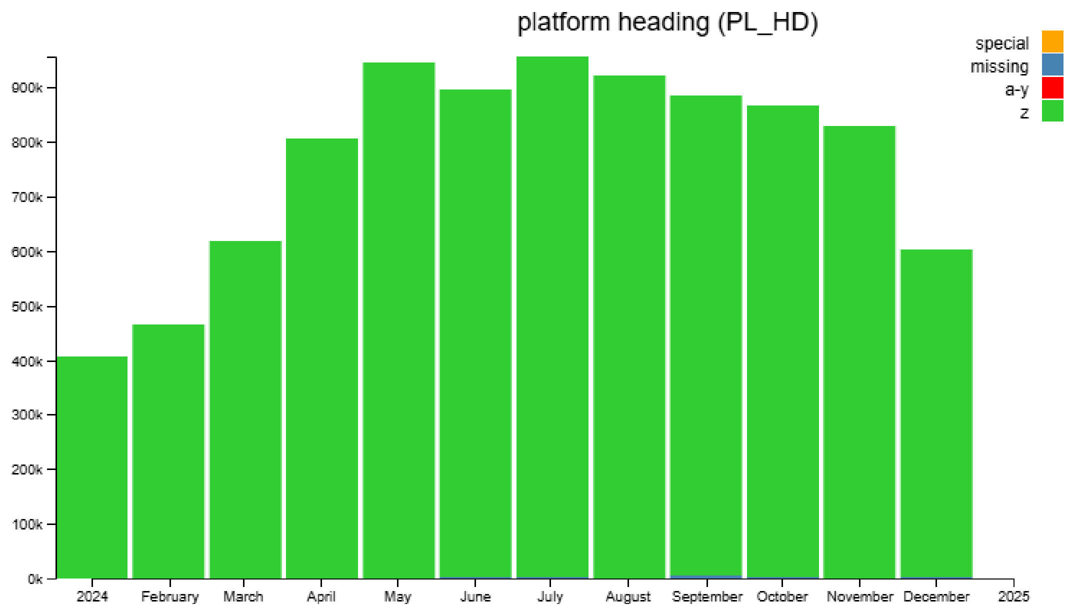


Figure 4: cont'd.

The remainder of the navigational parameters exhibited no major problems of note. They are nevertheless included for completeness: platform heading (Figure 5), platform course (Figure 6), platform speed over ground (Figure 7), and platform speed over water (Figure 8). We note, regarding PL_SOW, PL_SOW2, and PL_SOW3 it is common for these sensors only to transmit data when underway. As such, frequent missing values are the norm for those three. Looking at PL_CRS3 and PL_SPD3, we also note there are evidently some "missing" values from *Oregon II* in April and May. However, this may have simply been a case of an instrument that was not in use at the time but was still reporting empty values through SCSv5 (not unheard of for this logging software, and not of any real concern). A similar scenario likely explains the "special" values evident in PL_SOW2 and PL_SOW3, which in this case look to have mostly come from *Pisces*. In some situations (for reasons unknown) SCSv5 provides values of "?" instead of a null (empty) value when an instrument is not in use. These non-numeric values convert to "special" values in SAMOS processing. Again, there is no real cause for concern here.



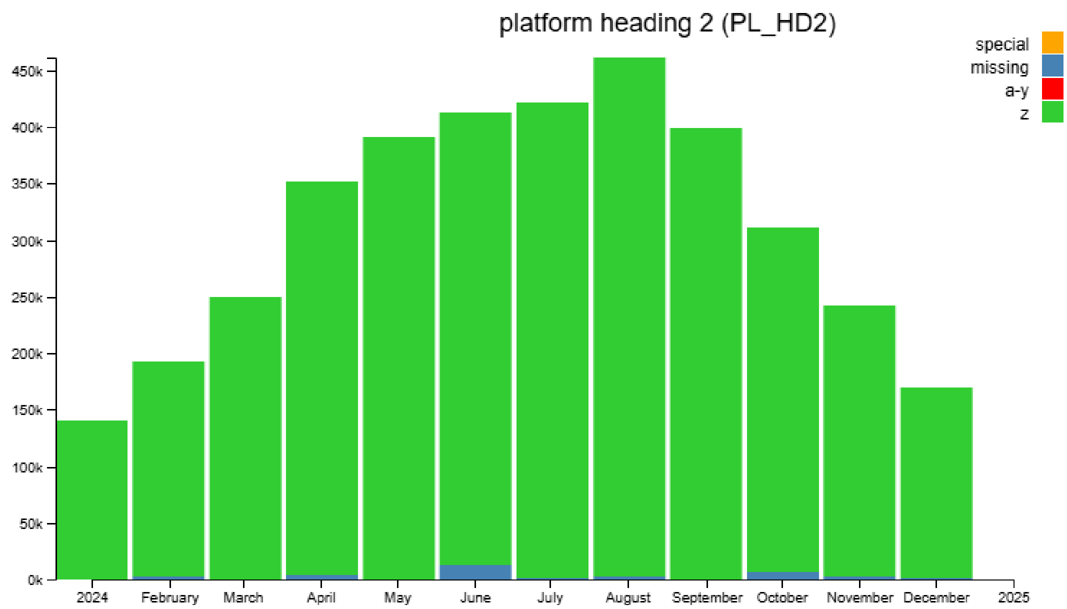


Figure 5: Total number of (this page, top) platform heading – PL_HD – (this page, bottom) platform heading 2 – PL_HD2 – and (next page) platform heading 3 – PL_HD3 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that 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.

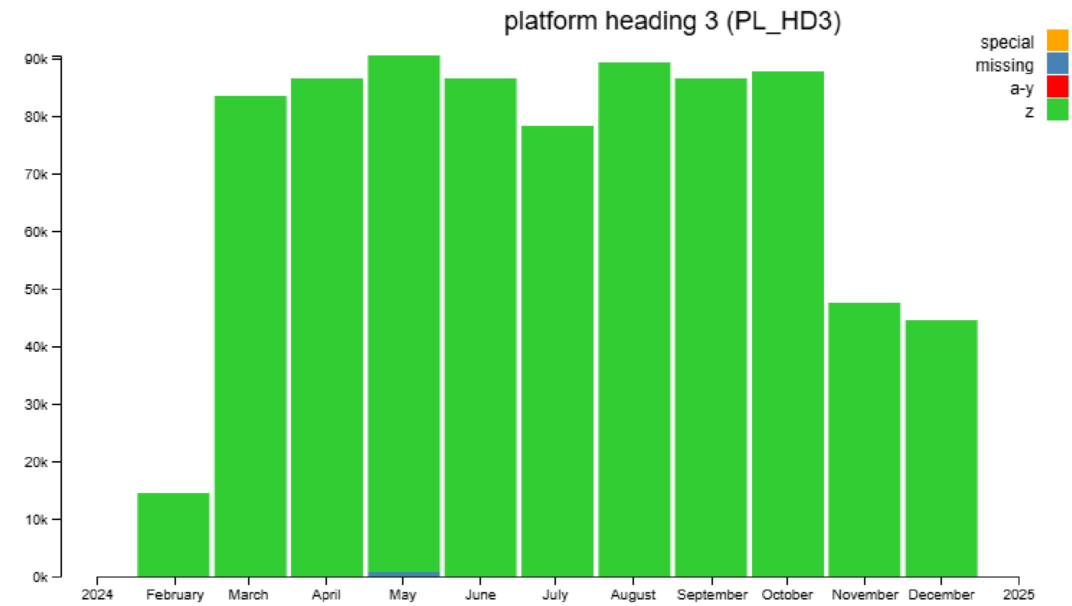


Figure 5: cont'd.

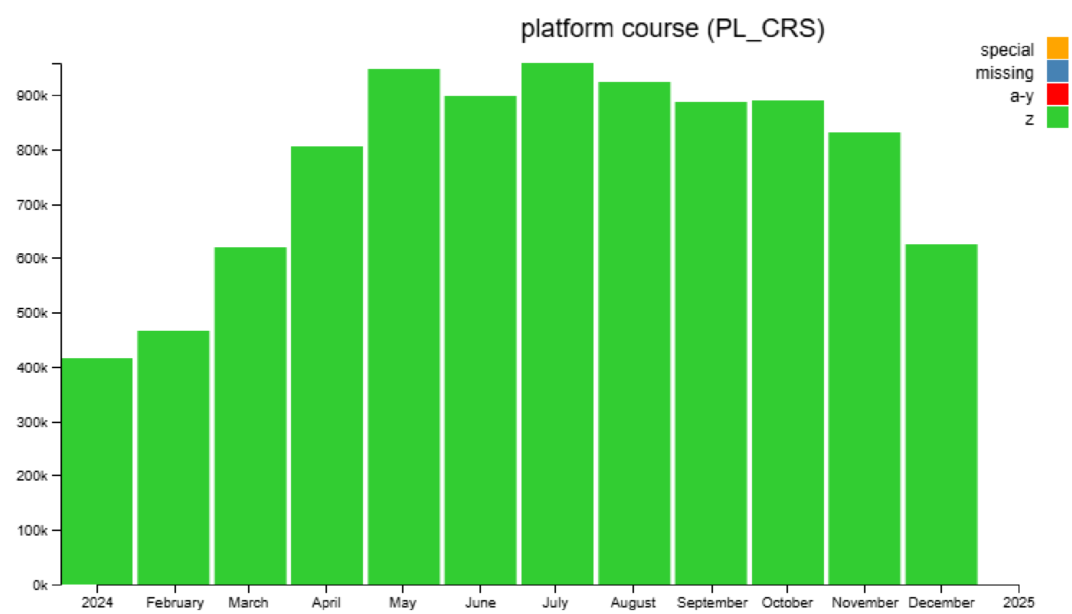
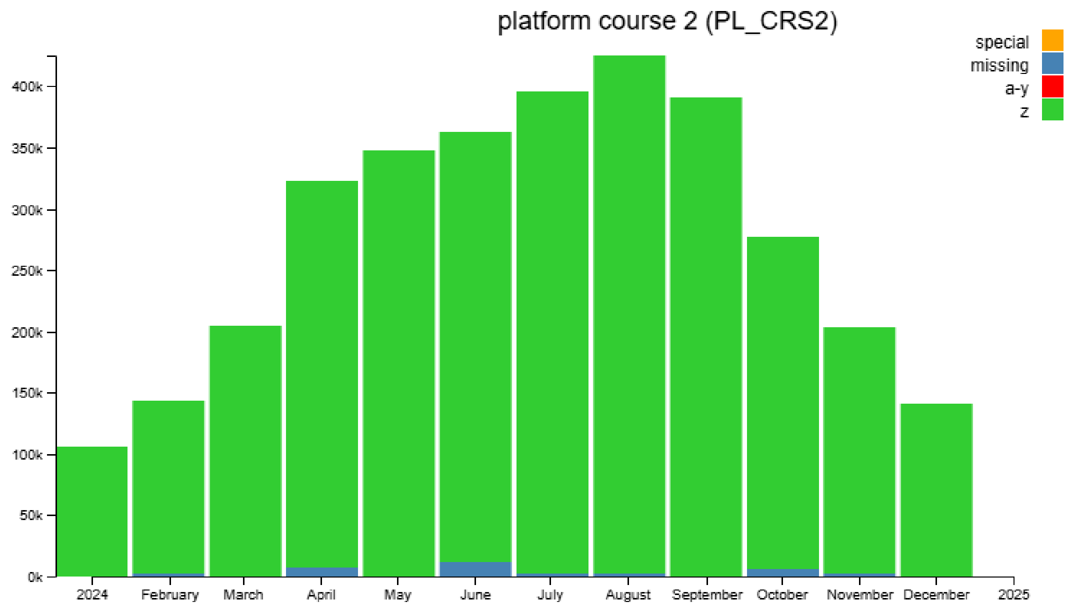


Figure 6: Total number of (this page) platform course – PL_CRS – (next page, top) platform course 2 – PL_CRS2 – and (next page, bottom) platform course 3 – PL_CRS3 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that 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.



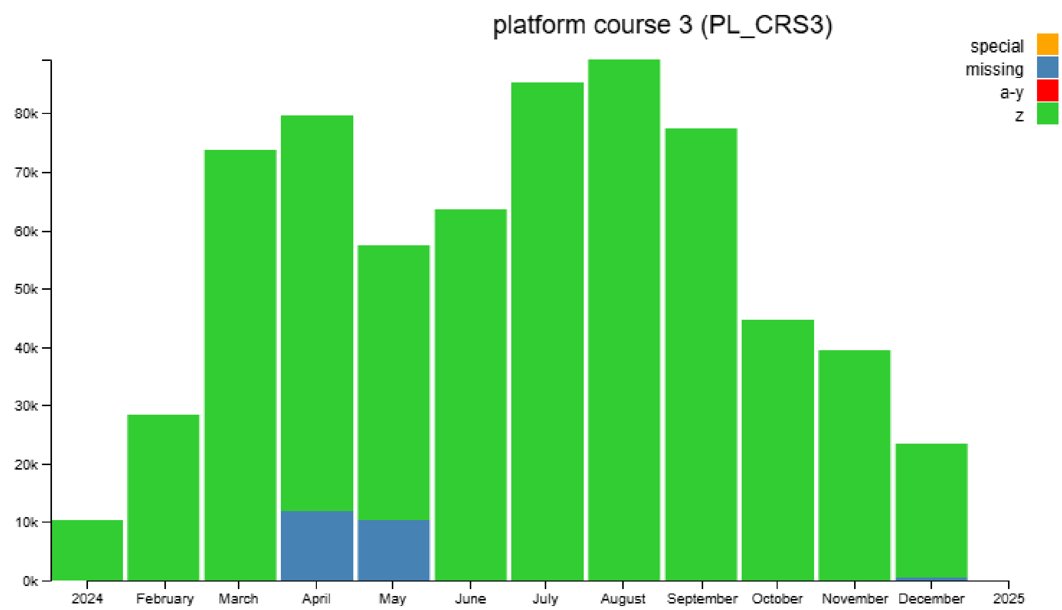
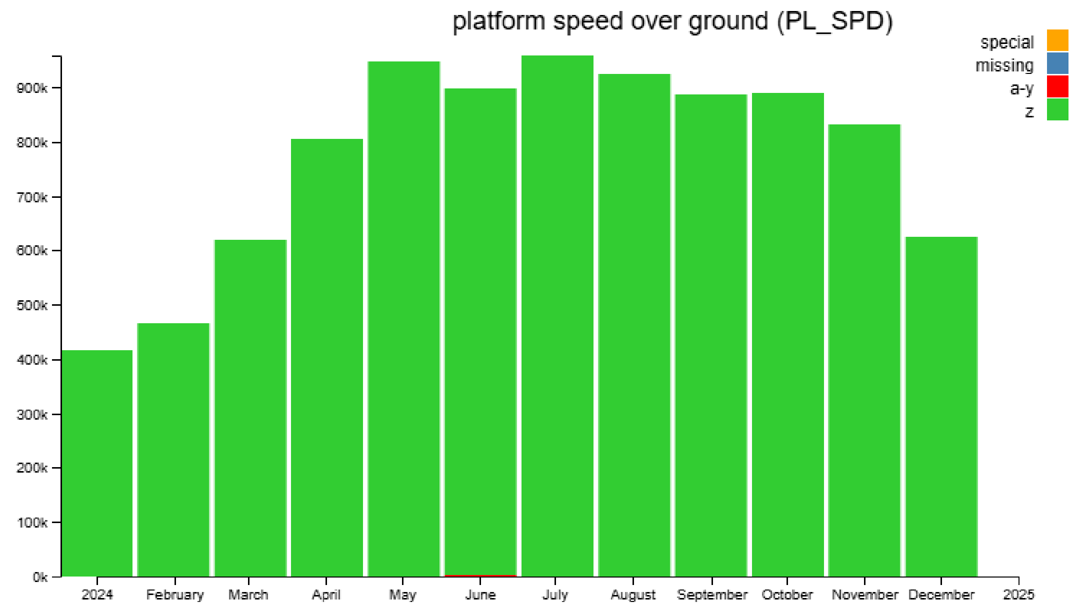


Figure 6: cont'd.



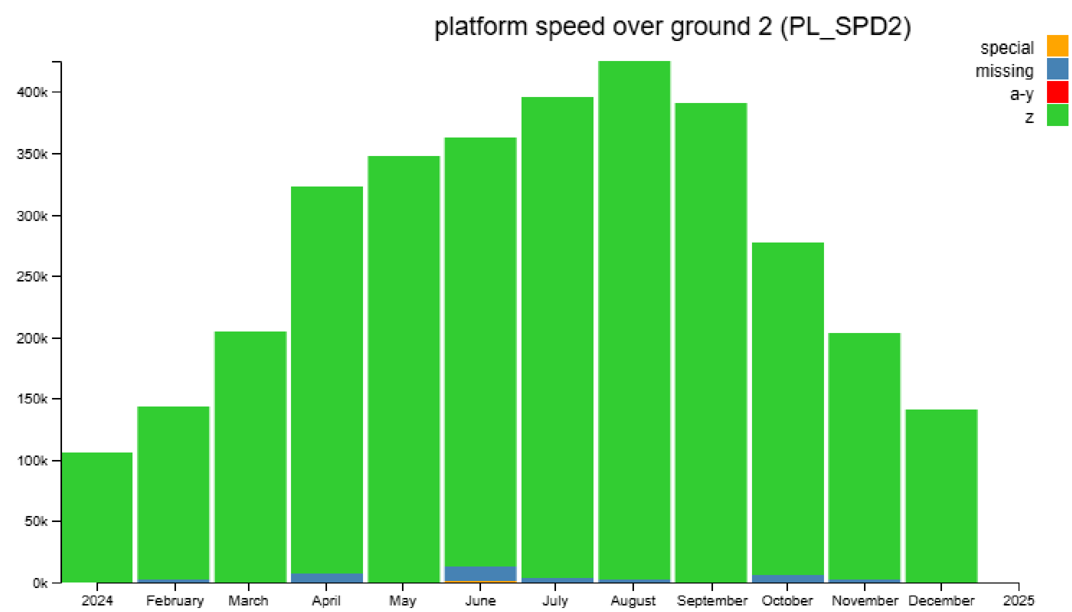


Figure 7: Total number of (this page, top) platform speed over ground – PL_SPD – (this page, bottom) platform speed over ground 2 – PL_SPD2 – and (next page) platform speed over ground 3 – PL_SPD3 — observations provided by all ships for each month in 2024. The colors represent the number of good (green) 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.

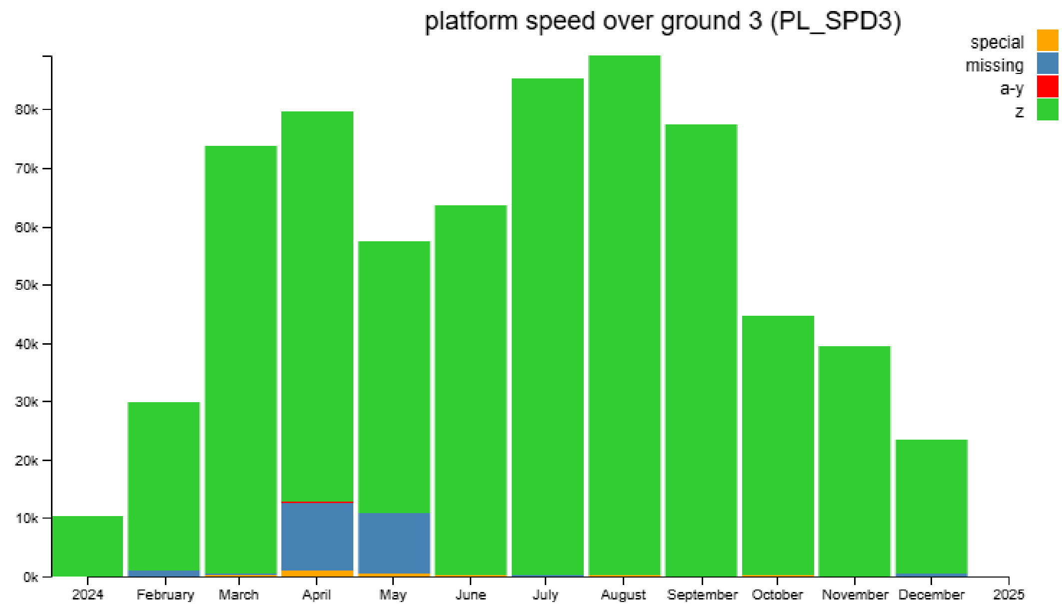


Figure 7: cont'd.

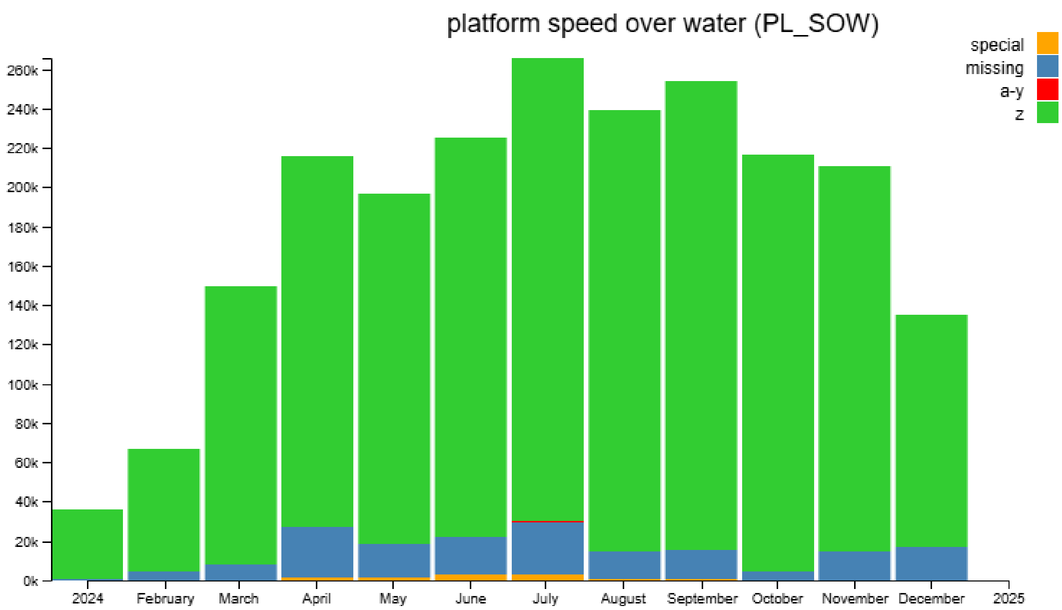
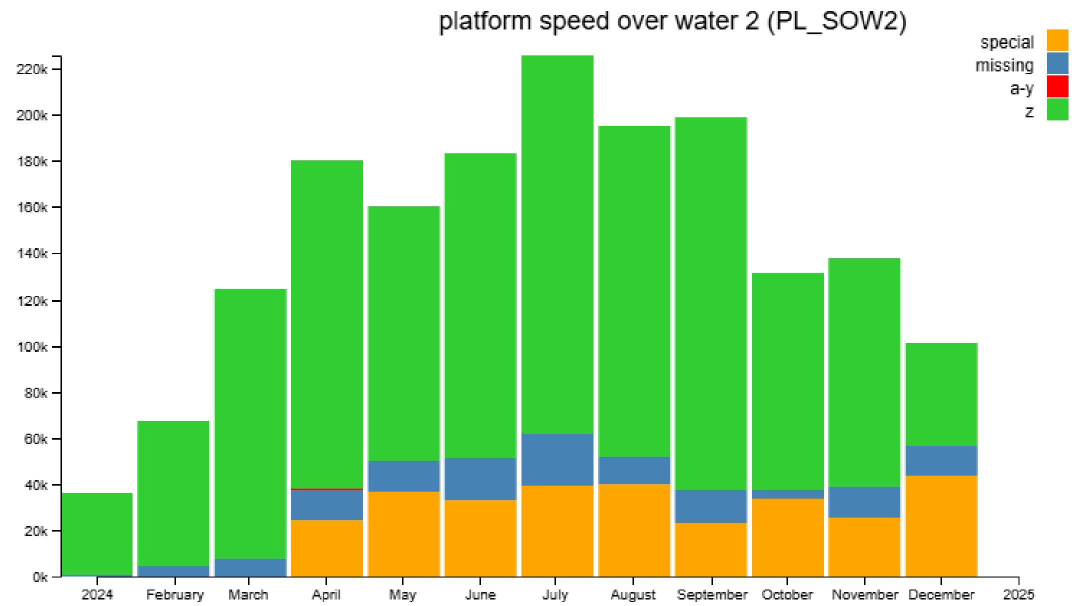


Figure 8: Total number of (this page) platform speed over water – PL_SOW – (next page, top) platform speed over water 2 – PL_SOW2 – and (next page, bottom) platform speed over water 3 – PL_SOW3 observations provided by all ships for each month in 2024. The colors represent the number of good (green) 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.



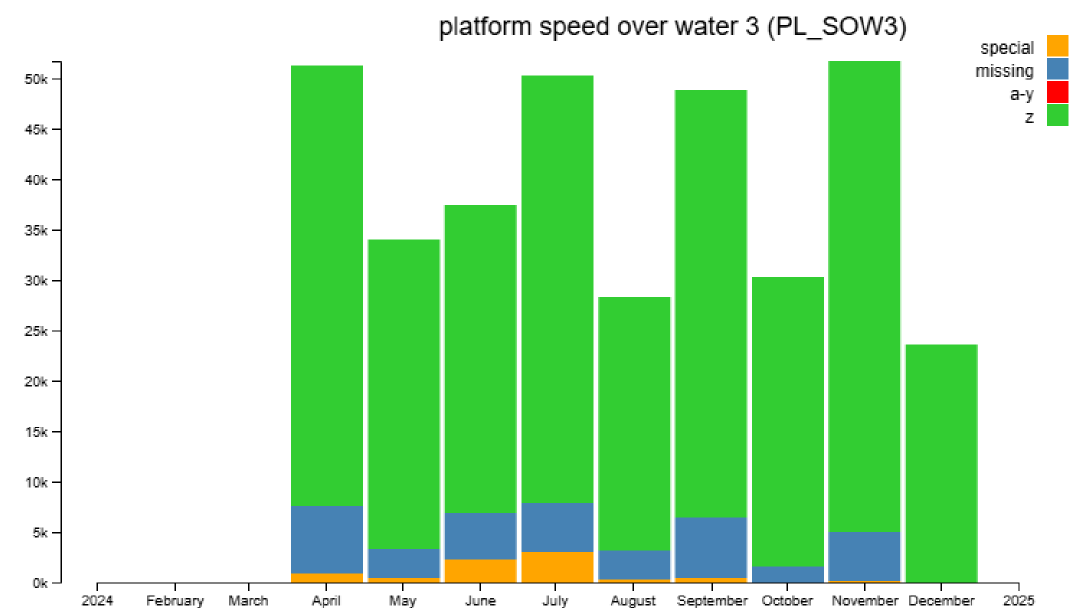
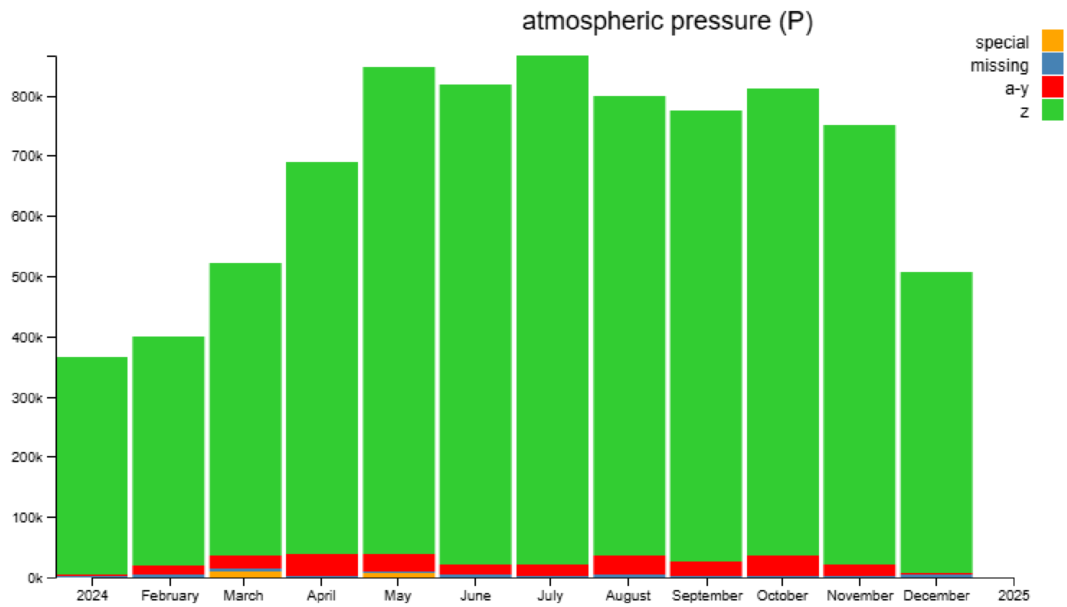


Figure 8: cont'd.

The quality of SAMOS atmospheric pressure data is generally good (Figure 9). 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. We note it is also fairly common to see water collection in cracked pressure port tubing, which affects the pressure data and can contribute to pressure flags during visual QC. We note the uptick in flagging in P2 seen in October and November may be down to an issue the *Falkor (too)* was experiencing with their MetPakPro sensor, an issue which was maximizing around this time of the year (see individual vessel description in section 3c for details).



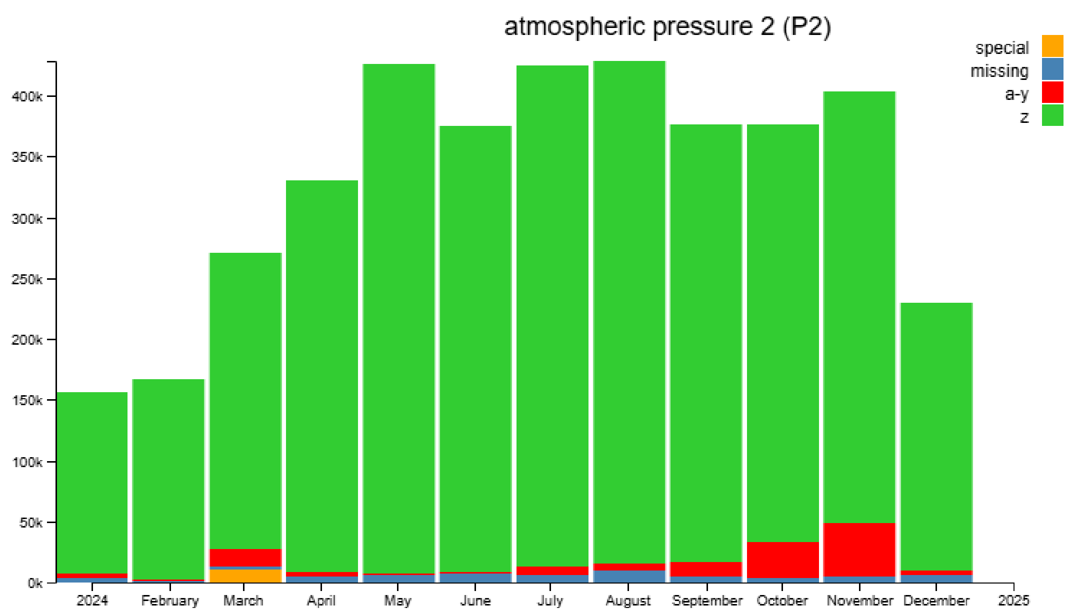
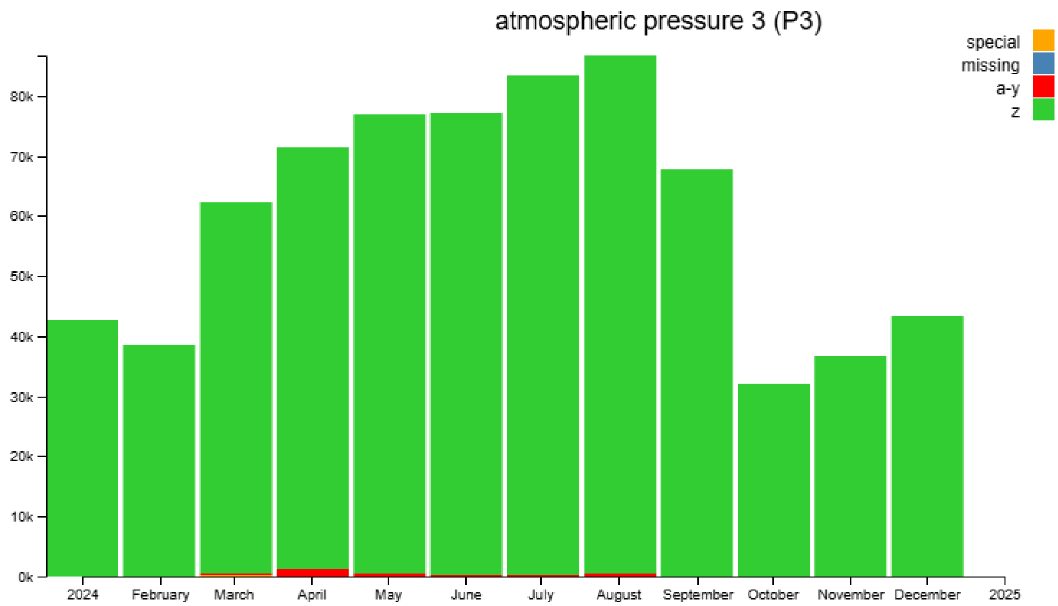


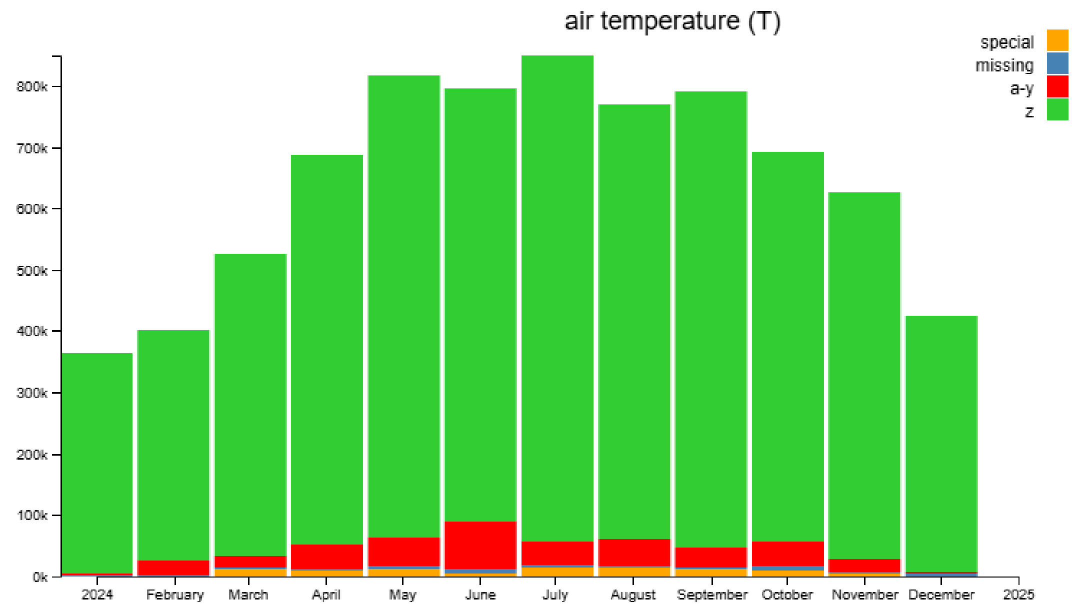
Figure 9: Total number of (this page, top) atmospheric pressure – P – (this page, bottom) atmospheric pressure 2 – P2 – and (next page) atmospheric pressure 3 – P3 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that 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 9: cont'd)

Air temperature was also of decent quality (Figure 10). With the air temperature sensors, again flow obstruction is 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. Thermal contamination 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. 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.

Several vessels experienced discrete issues with their primary air temperature and humidity sensor data in 2024. (Notably, *Oscar Dyson* in February, *Ferdinand Hassler* in June, and *Kilo Moana* periodically through the January – September period; all documented, see individual vessel descriptions in section 3c. for details.) This fact likely explains a lot of the flagging seen in T. Generally speaking, though, the origins of any upticks in flagging air temperature variables are often not clearly identified as belonging to any specific vessel(s) but tend to be due to several vessels simultaneously experiencing common sensor issues.



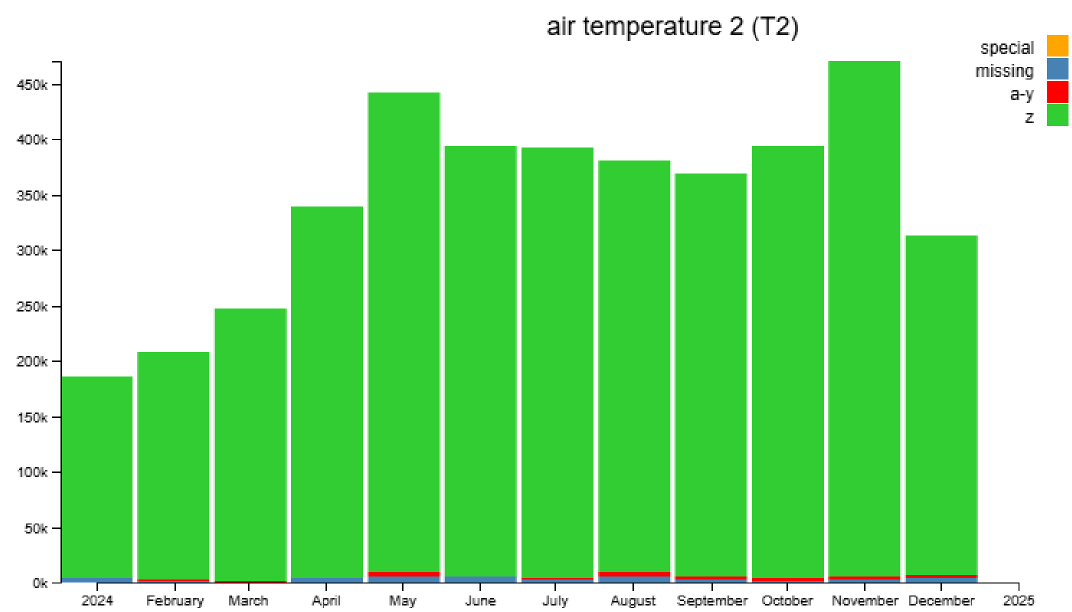
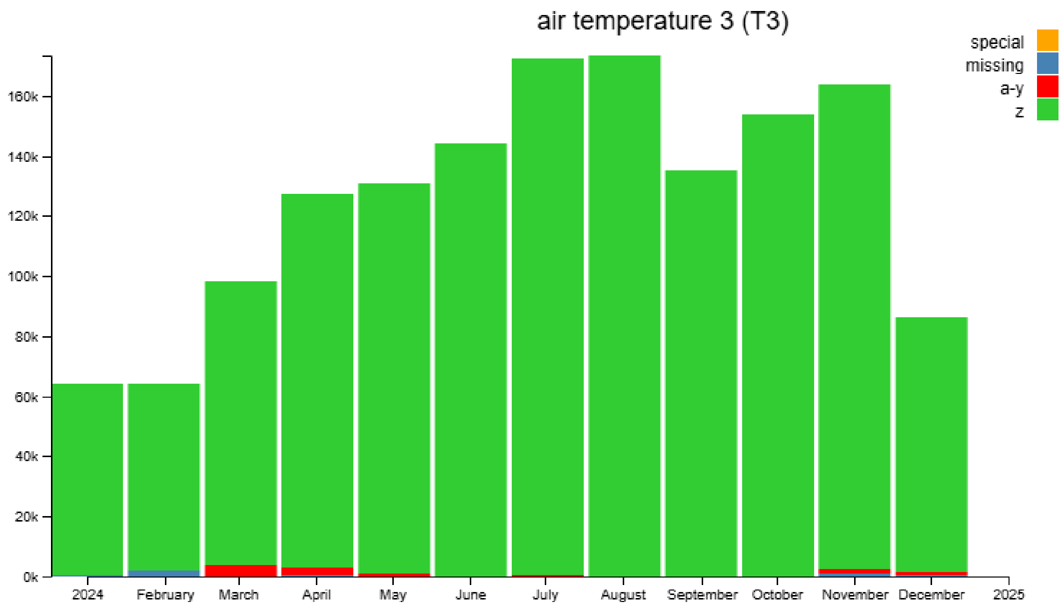
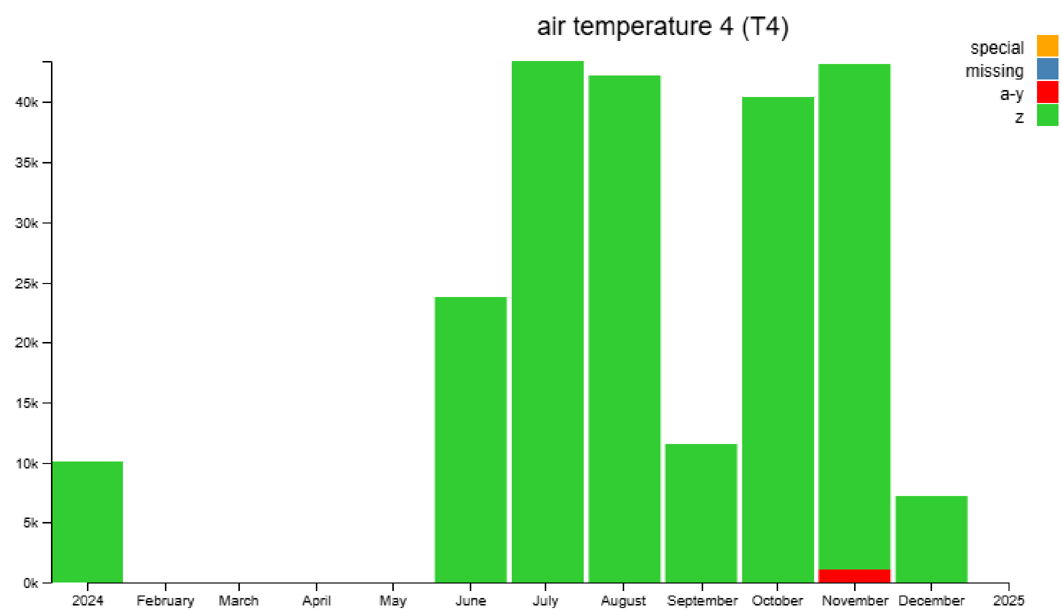


Figure 10: Total number of (this page, top) air temperature – T – (this page, bottom) air temperature 2 – T2 – (next page, top) air temperature 3 – T3 – and (next page, bottom) air temperature 4 – T4 observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.





(Figure 10: cont'd)

Wet bulb temperature (Figure 11) was reported by nine vessels in 2024: namely, *Bell M. Shimada*, *Fairweather*, *Nancy Foster*, *Gordon Gunter*, *Okeanos Explorer*, *Oregon II*, *Pisces*, *Rainier*, and *Thomas Jefferson*. We note TW from all vessels is a calculated value, rather than being directly measured. With several of these vessels, especially *Rainier* and *Jefferson*, because their relative humidity parameters can top out at just over 100% in saturation (common, see relative humidity topic below) the calculated TW (and TD, below) parameters are often unrealistic, meaning they receive "failed the T>=Tw>=Td test" (D) flags. Additionally, both *Rainier* (in October) and *Gunter* (all year) experienced discrete, flagged issues with their humidity sensors in 2024, meaning their calculated TW data were often flagged by association (see individual vessel description in section 3c for details). Other than these, most flags seen here were the result of flow obstruction and/or ship heating.

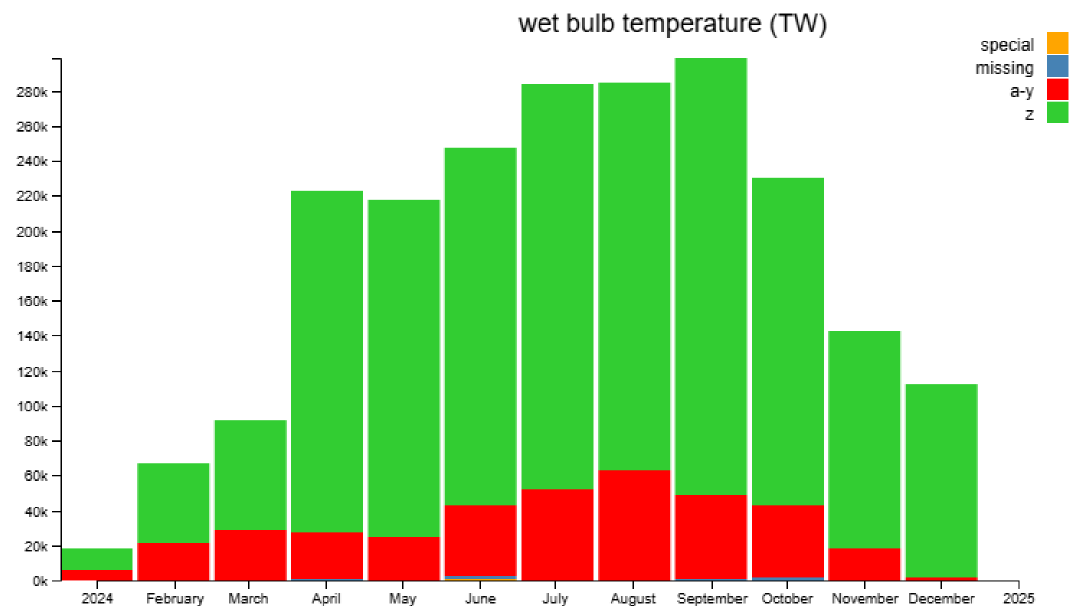
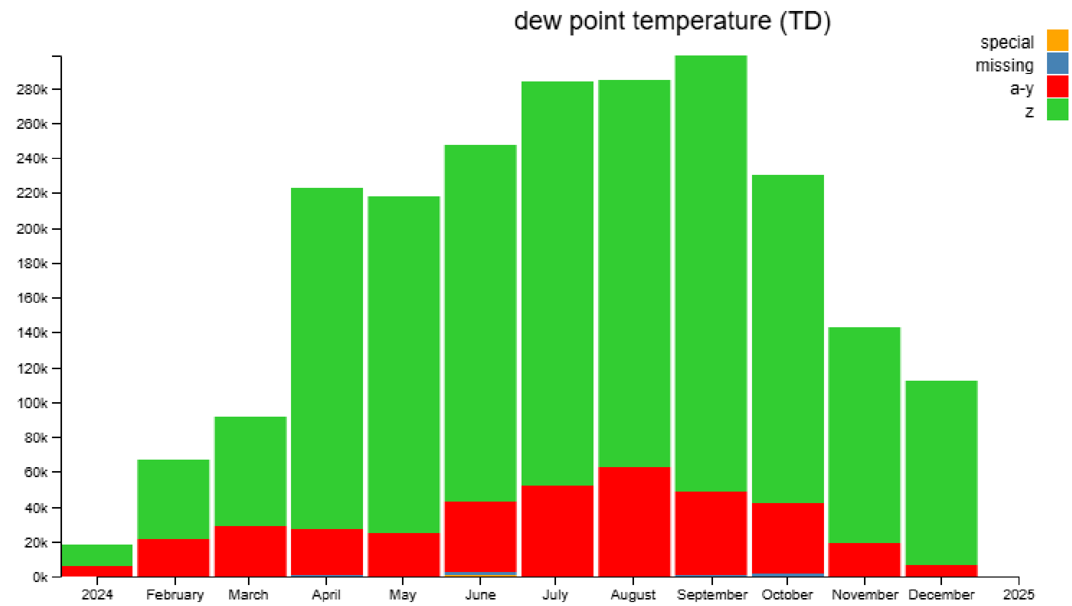


Figure 11: Total number of wet bulb temperature – TW – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

Dew point temperature (Figure 12) was also reported by these nine vessels in 2024 (again, *Bell M. Shimada*, *Fairweather*, *Gordon Gunter*, *Nancy Foster*, *Okeanos Explorer*, *Oregon II*, *Pisces*, *Rainier*, and *Thomas Jefferson*), plus the *Falkor (too)*, who comprised all of TD2. We reiterate, dew point temperature from all reporting vessels is a calculated value, rather than being directly measured. And again, in the case of at least *Rainier* and *Jefferson*, because their relative humidity parameters often top out at just over 100% in saturation (common, see relative humidity topic below) the calculated TD (and TW, above) parameters are often unrealistic, meaning they receive "failed the T>=Tw>=Td test" (D) flags (documented; see individual vessel description in section 3c for details). Also, the same note above about discrete issues with *Rainier's* (October) and *Gunter's* (all year) relative humidity sensors resulting in flagging of TW by association applies here, with TD, as well (see individual vessel description in section 3c for details). Other than these, most flags seen here were the result of flow obstruction and/or ship heating.



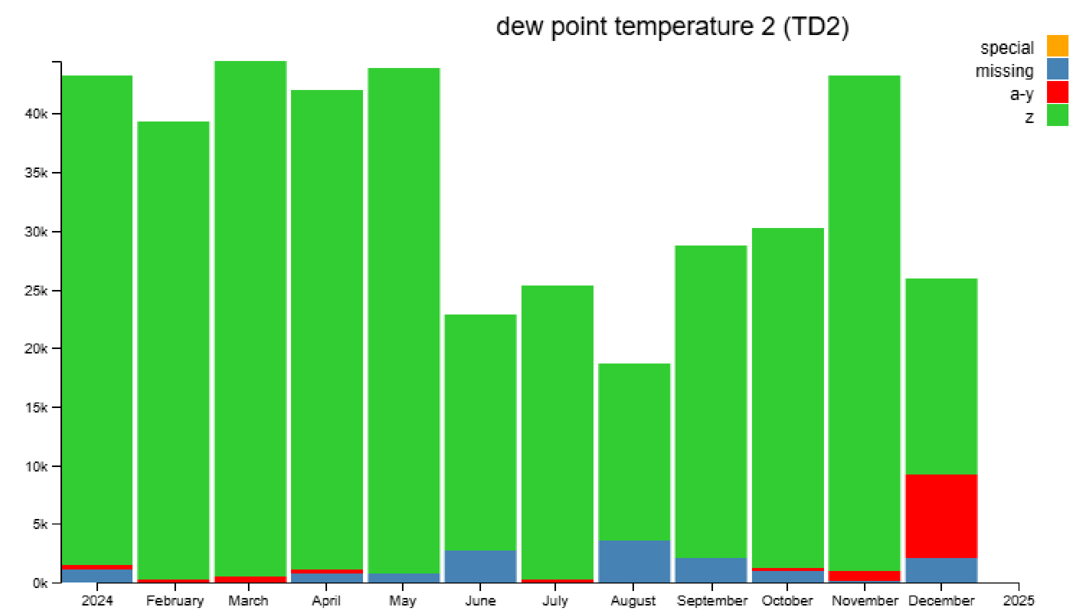
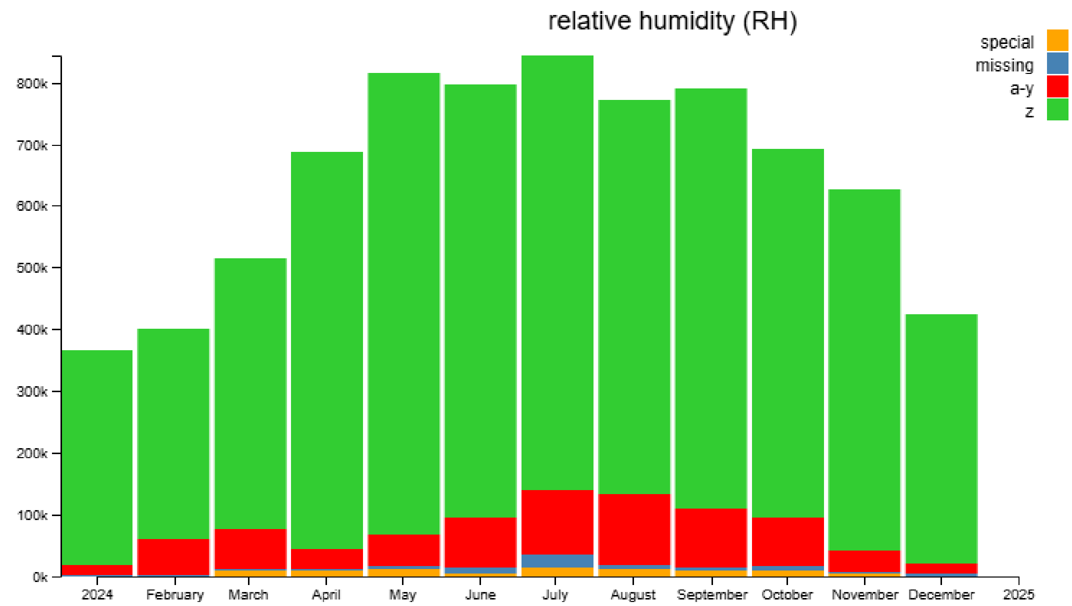


Figure 12: Total number of (top) dew point temperature – TD – and (bottom) dew point temperature 2 – TD2 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

With relative humidity, the most common issue is readings slightly greater than 100%. If these measurements were sound, they would imply supersaturated conditions, but in fact that scenario is quite rare near the surface of the ocean. When it comes to relative humidity, the mechanics of most types of sensors are 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 of 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, or, as desired by the user, simply set to a value of 100%. 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 13.

As with air temperature, several vessels experienced minor/short-lived issues with their relative humidity over the course of the year (see individual vessel descriptions in section 3c for details), which certainly would have contributed to any flagging seen here. There were also the more discrete cases of issues with the primary air temperature and humidity sensor mentioned above (most notably *Oscar Dyson* in February, *Ferdinand Hassler* in June, and *Kilo Moana* periodically throughout the January – September period; all documented, see individual vessel descriptions in section 3c. for details.); the same conclusion about this explaining much of the flagging seen in T applies here, with RH, as well. Regarding RH3, most of the “a-y” flagging and “missing” values noted here look to have come from the *Healy*; we note there was a documented data issue with their RH3 sensor in June (see individual vessel description in section 3c for details), although the reasoning for the rest of the upticks is not immediately clear. Generally speaking, though, the origins of any upticks in flagging in relative humidity are often not clearly identified as belonging to any specific vessel(s) but tend to be due to several vessels simultaneously experiencing common sensor issues.



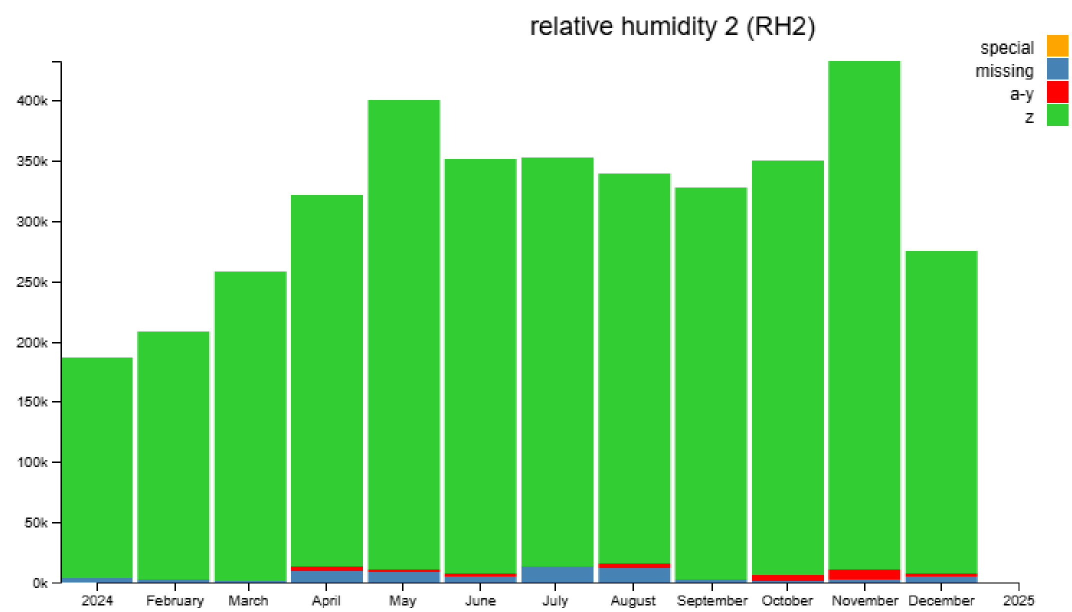
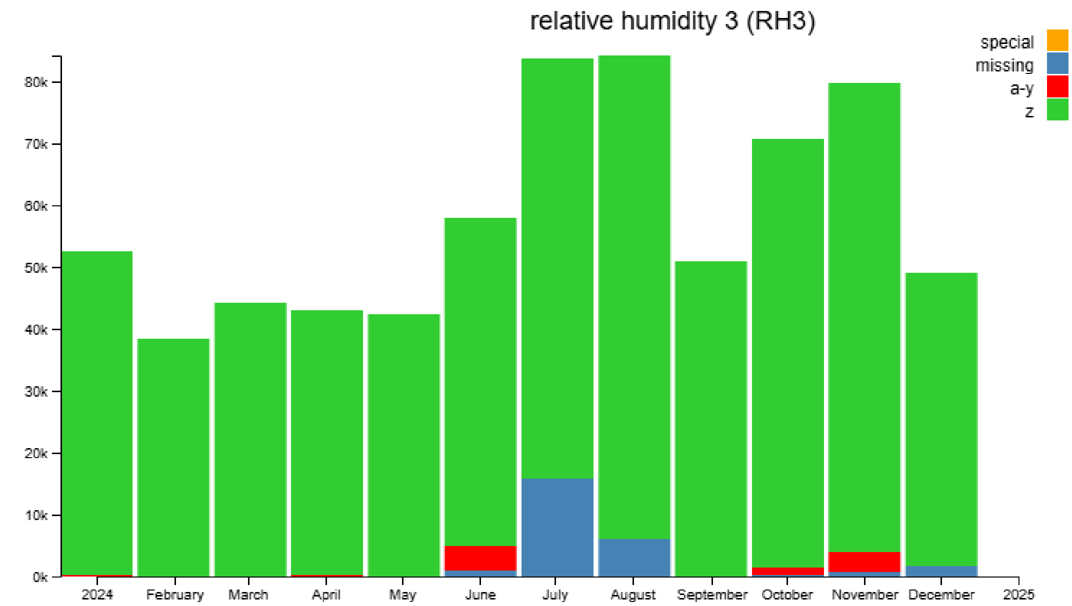


Figure 13: Total number of (this page, top) relative humidity – RH – (this page, bottom) relative humidity 2 – RH2 – and (next page) relative humidity 3 – RH3 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

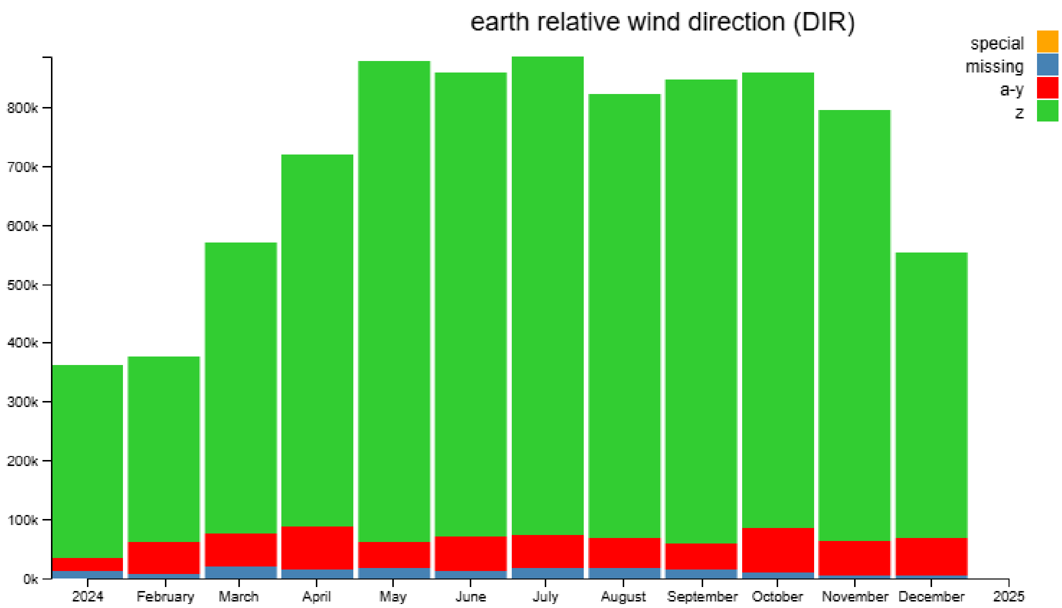


(Figure 13: cont'd)

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-circulating atmosphere. 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 so readily incorporated into wind measurements. These flow-obstructed and platform speed-affected wind data were a common problem across SAMOS vessels in 2024. 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.

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

Staggered across the whole year, there were a number of vessels that experienced issues with their wind sensor data (see individual vessel descriptions in section 3c. for details). To put a finer point on it, though, the remarkably even spread in flagging seen in all earth relative wind plots below can perhaps be taken as a testament to how these instruments are, as we stated earlier, arguably the most affected by ship movement (in all its forms).



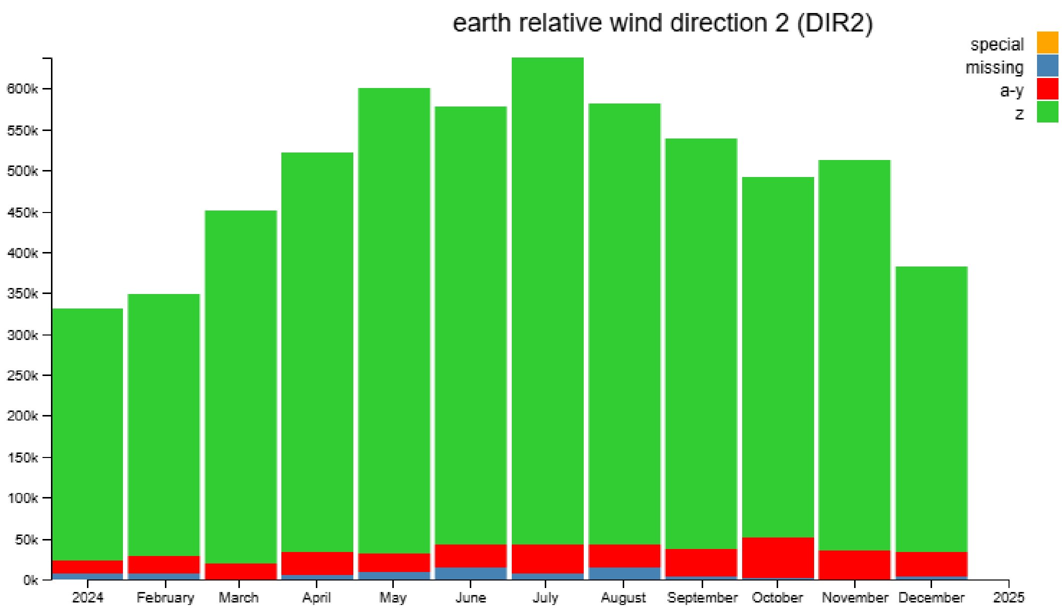
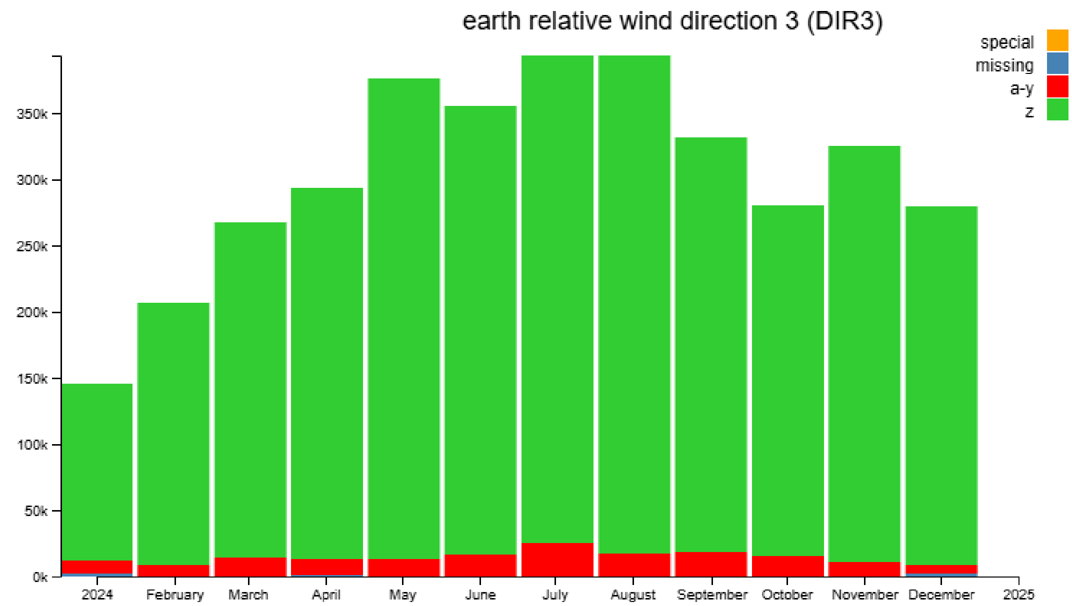
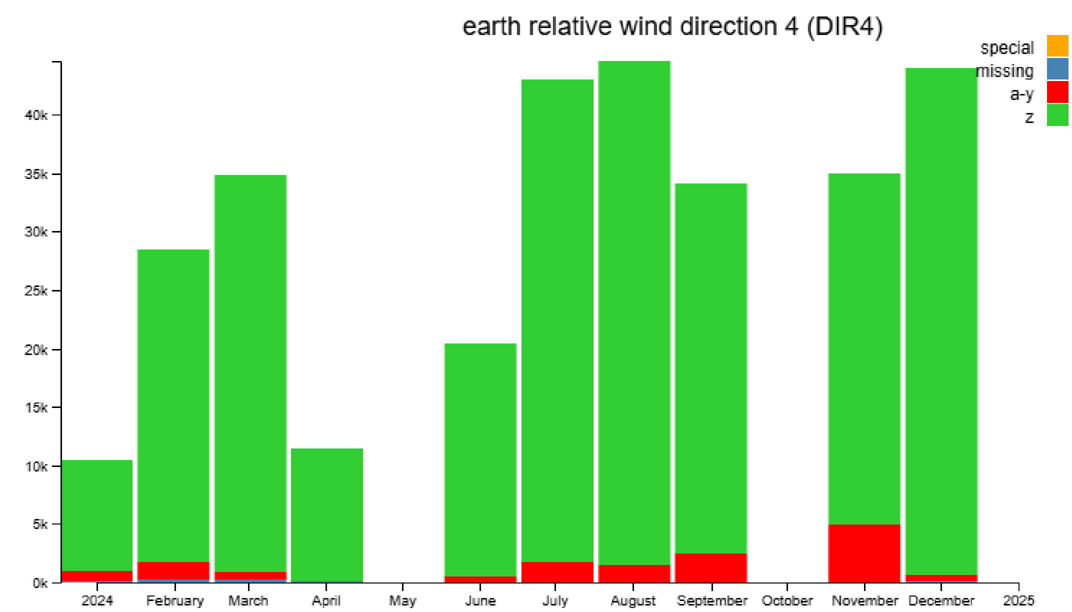
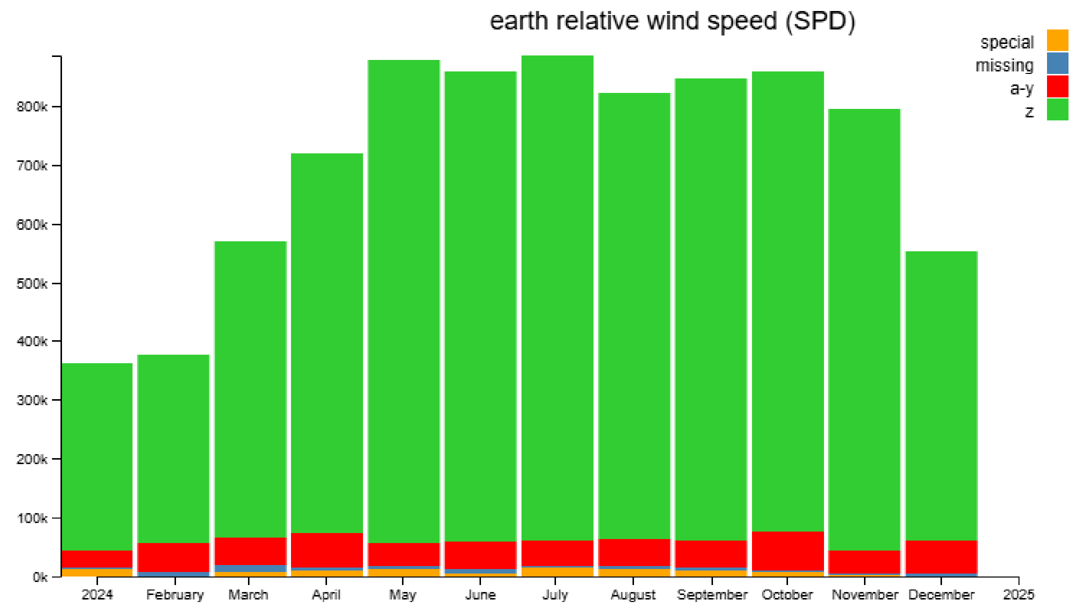


Figure 14: Total number of (this page, top) earth relative wind direction – DIR – (this page, bottom) earth relative wind direction 2 – DIR2 – (next page, top) earth relative wind direction 3 – DIR3 – and (next page, bottom) earth relative wind direction 4 – DIR4 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.





(Figure 14: cont'd)



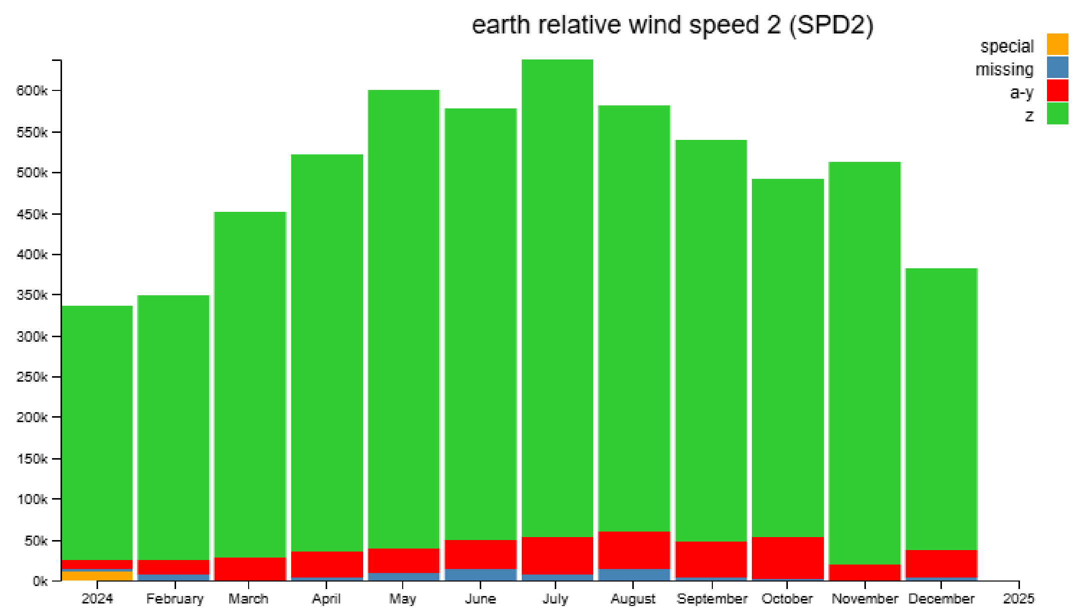
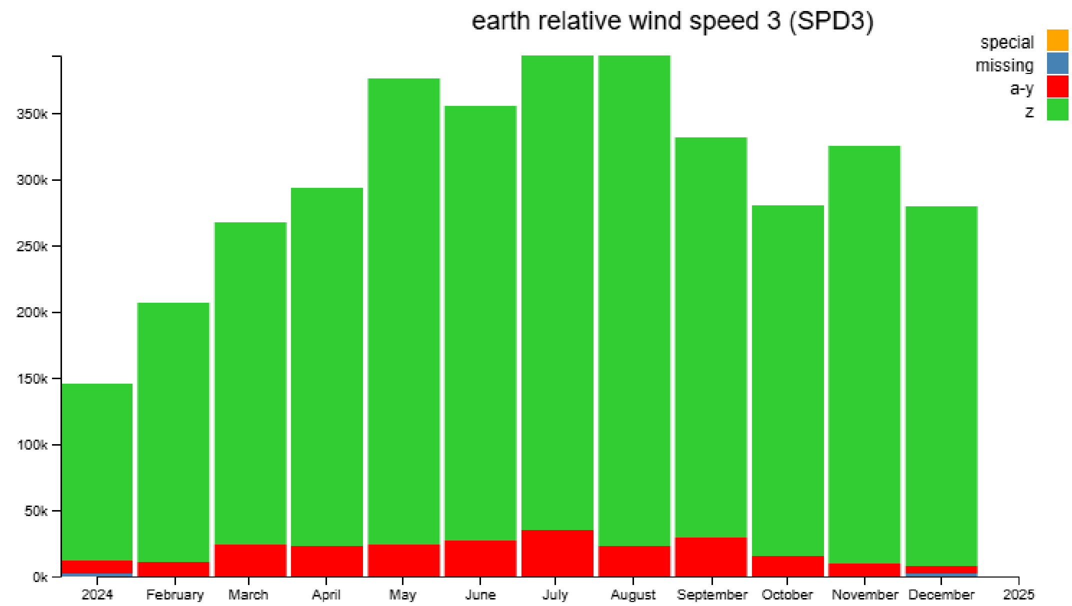
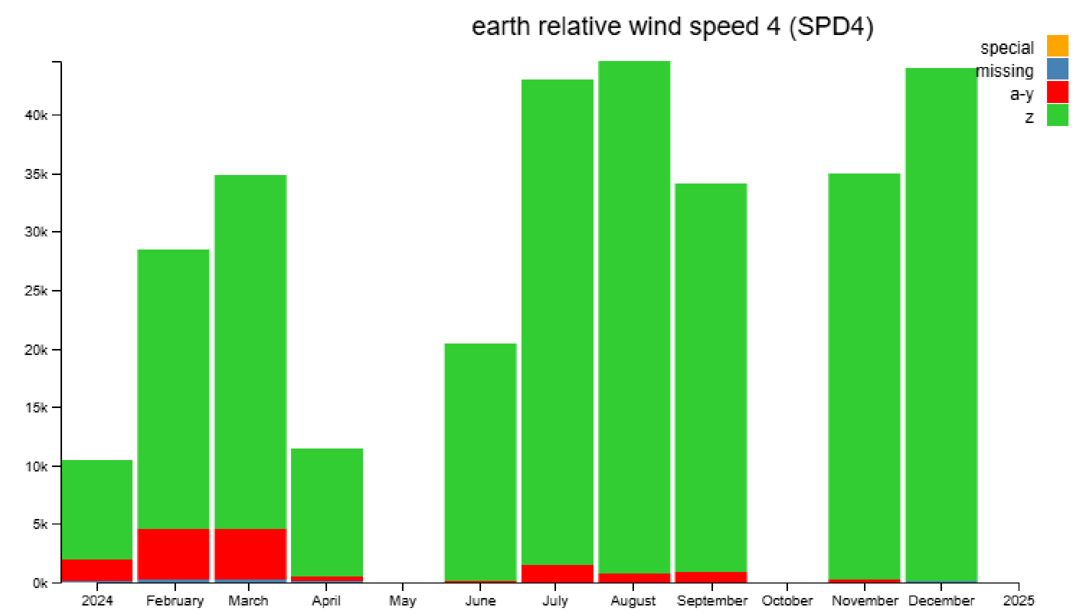


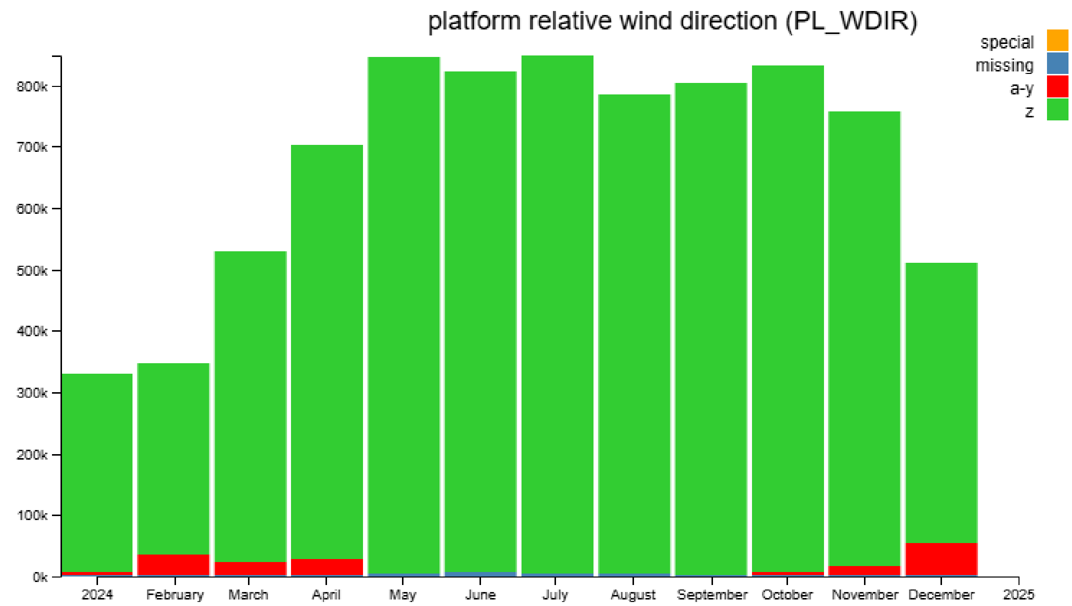
Figure 15: Total number of (this page, top) earth relative wind speed – SPD – (this page, bottom) earth relative wind speed 2 – SPD2 – (next page, top) earth relative wind speed 3 – SPD3 – and (next page, bottom) earth relative wind speed 4 – SPD4 – observations provided by all ships for each month in 2024. 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: cont'd)

The platform relative wind parameters, both direction (Figure 16) and speed (Figure 17), were of overall decent quality in 2024. Both *Dyson* and *Shimada* had issues with sensor wiring and/or configuration early in their field season that meant some flags on PL_WDIR, as noted in the January through March period for that variable. There is also some amount of flagging seen on PL_WDIR, PL_WDIR2, PL_WSPD, and PL_WSPD2 in the November to December period, but this is primarily from *Oregon II* continuing to report some residual signal even though the anemometers had been removed for the winter. (All documented; see individual vessel descriptions in section 3c for details.)



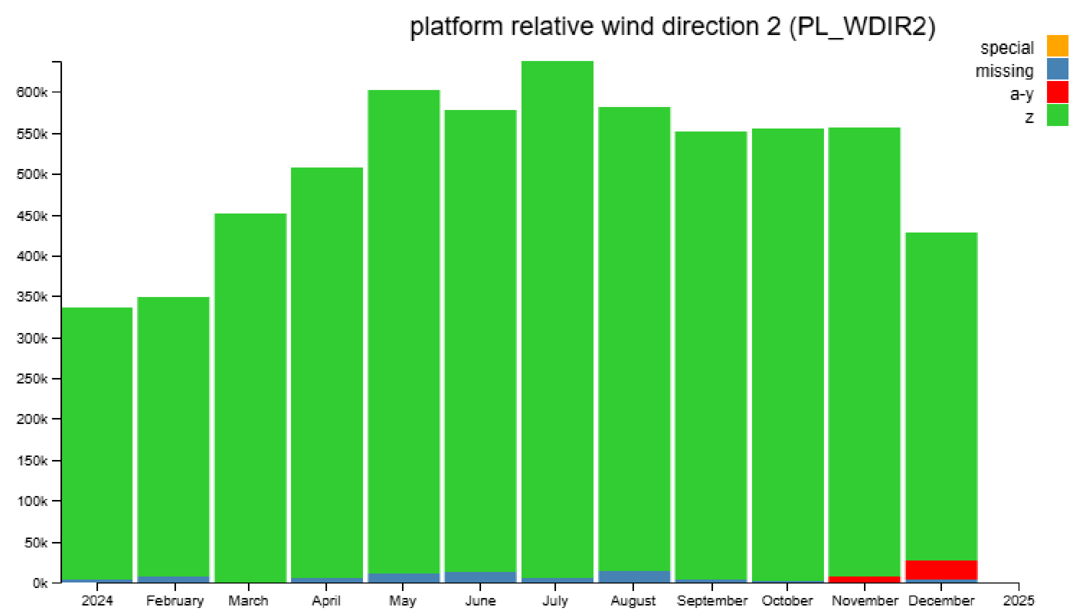
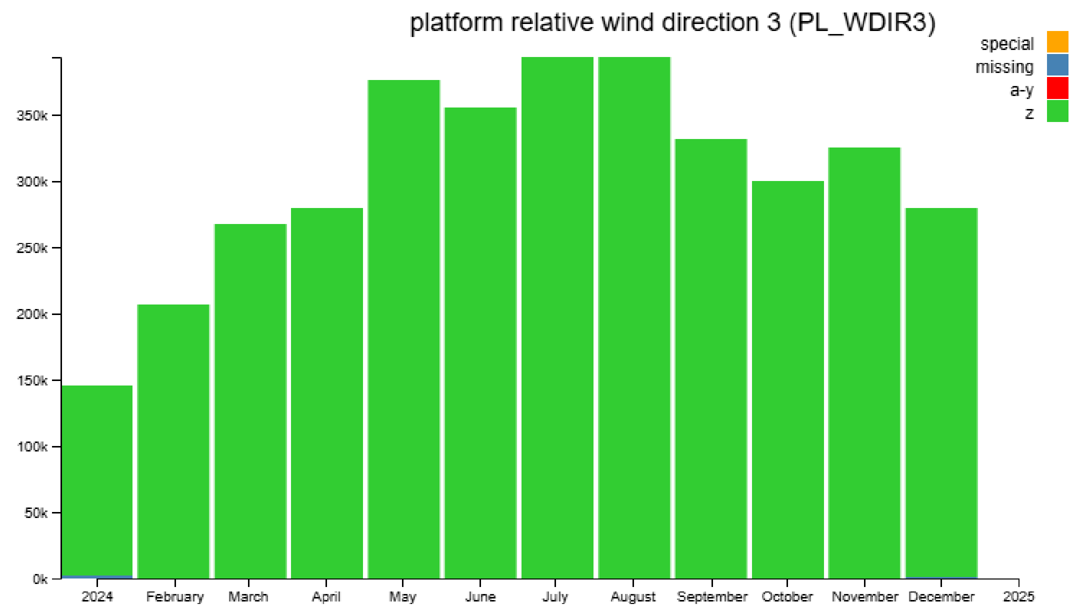
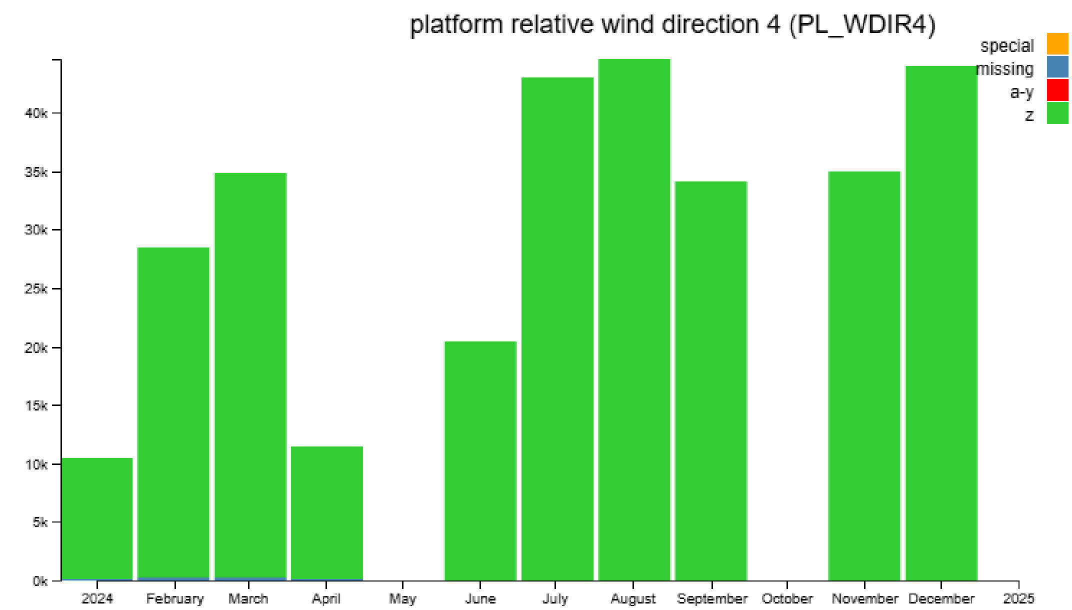
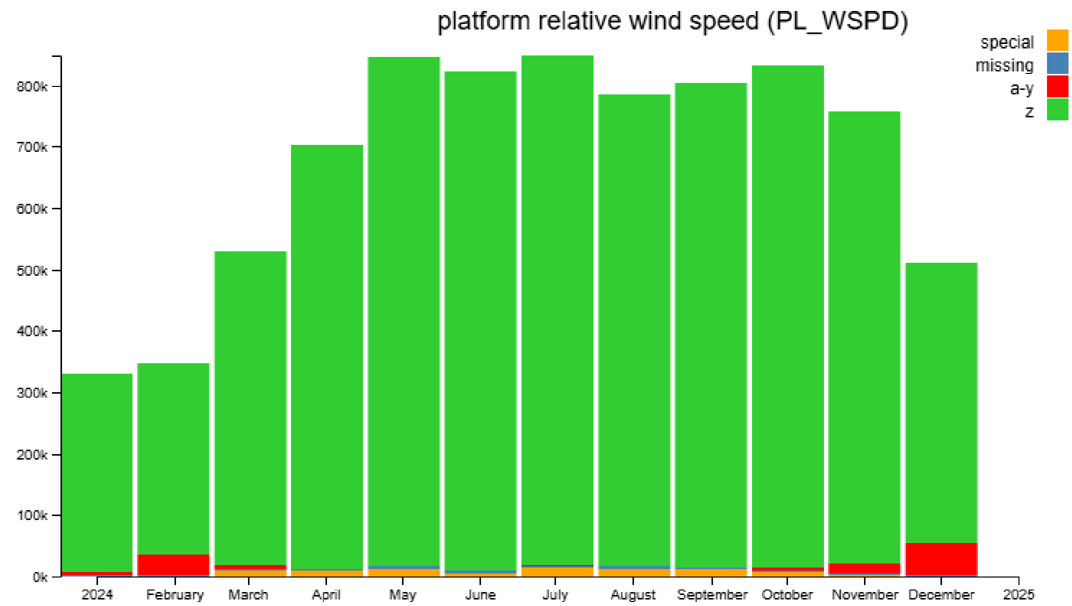


Figure 16: Total number of (this page, top) platform relative wind direction – PL_WDIR – (this page, bottom) platform relative wind direction 2 – PL_WDIR2 – (next page, top) platform relative wind direction 3 – PL_WDIR3 – and (next page, bottom) platform relative wind direction 4 – PL_WDIR4 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.





(Figure 16: cont'd)



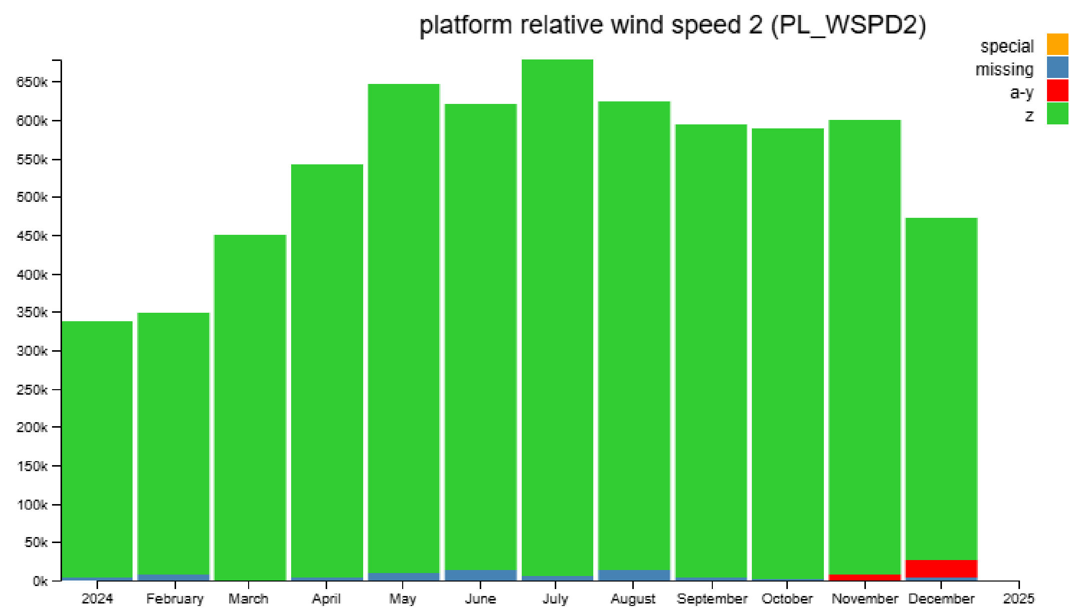
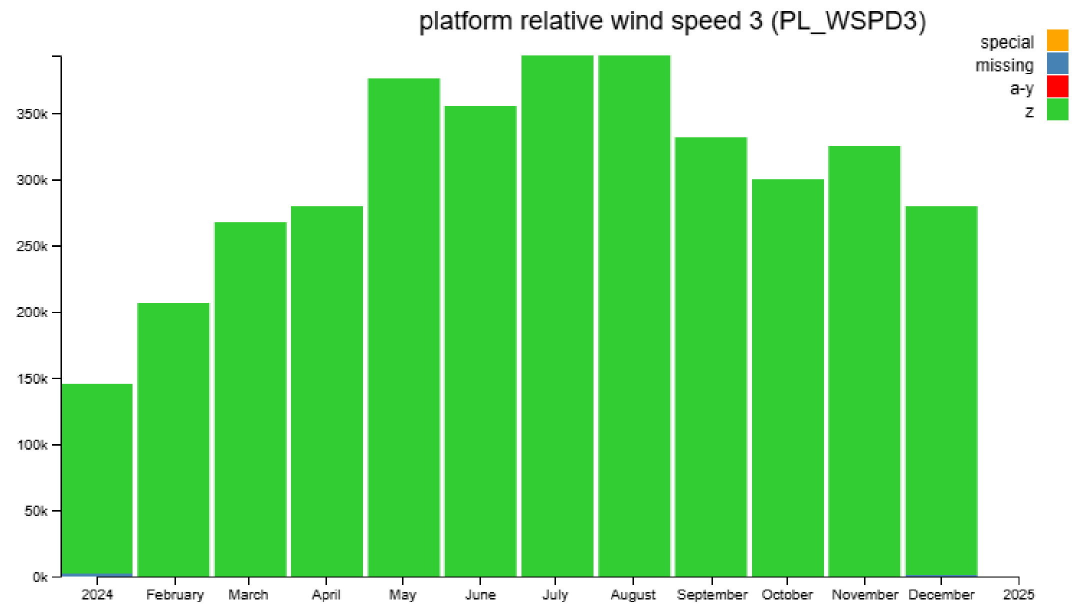
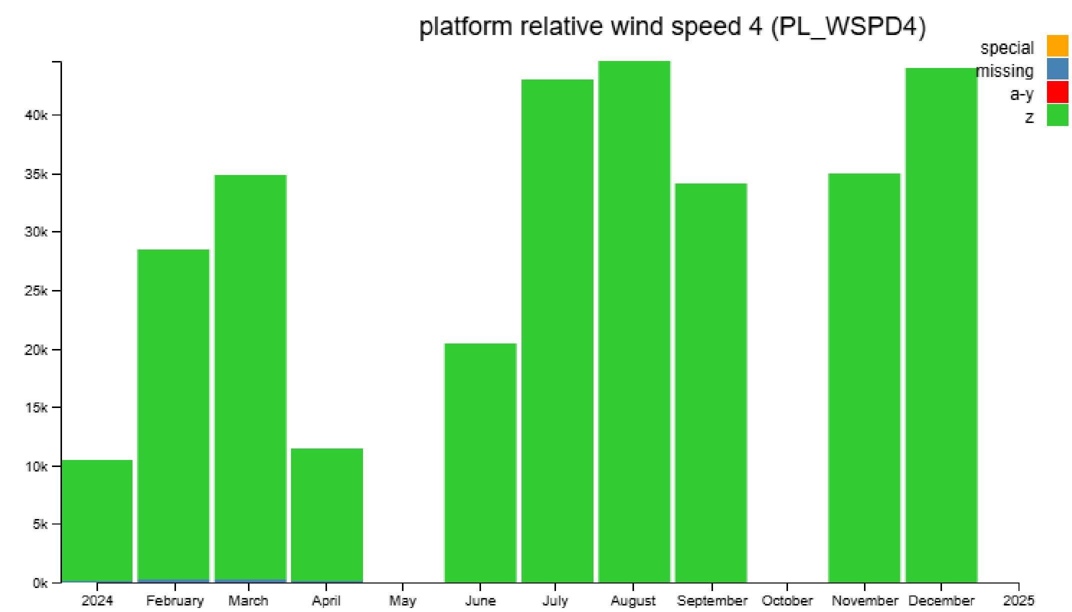


Figure 17: Total number of (this page, top) platform relative wind speed – PL_WSPD – (this page, bottom) platform relative wind speed 2 – PL_WSPD2 – (next page, top) platform relative wind speed 3 – PL_WSPD3 – and (next page, bottom) platform relative wind speed 4 – PL_WSPD4 – observations provided by all ships for each month in 2024. 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 17: cont'd)

Most of the flags applied to the radiation parameters were assigned by the auto flagger, primarily to short wave radiation (Figure 18) and photosynthetically active radiation (Figure 20). 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, short wave (and, similarly, photosynthetically active aka PAR) radiation sensors are typically tuned to permit greater accuracy at large radiation values. Consequently, short wave and photosynthetically active 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 (Figure 19), on the other hand, usually has the smallest percentage of data flagged among the radiation parameters submitted to SAMOS.

Much of the flagging seen in RAD_LW in January was due to both *Healy* and *Lasker* experiencing problems with sensor degradation/failure that month. *Pisces* similarly experienced RAD_LW sensor degradation in the July/August time frame. The *Nathaniel Palmer* also experienced several problems with their RAD_LW sensor both early in 2024 and in Nov/Dec and the *Thompson* had issues with their Eppley sensor before it was replaced in April, both of which likely account for some of the flag increase in Figure 19, (All documented; see individual vessel description in 3c for details).

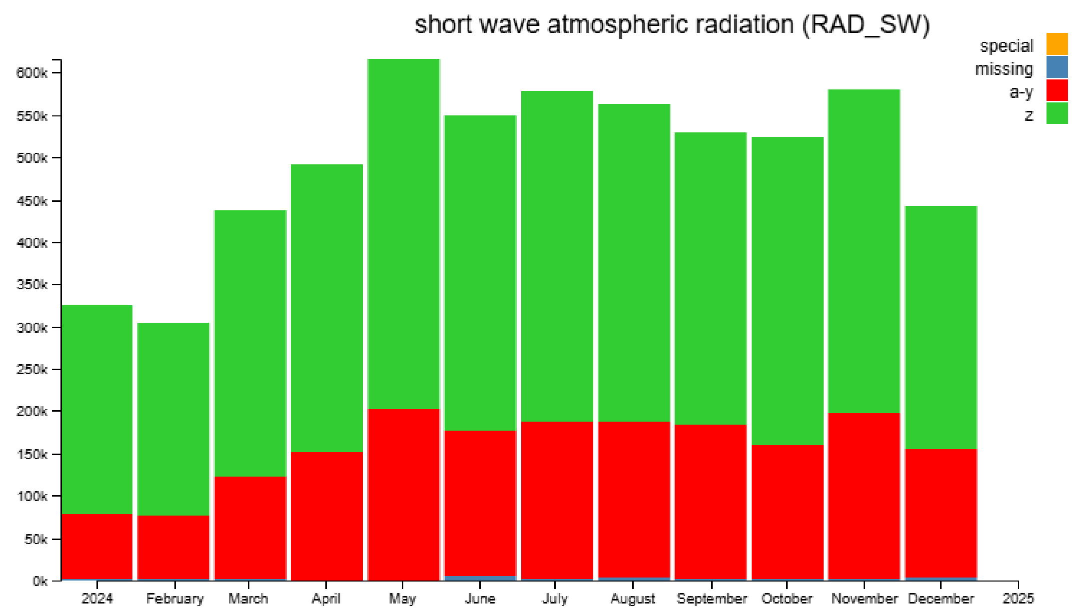
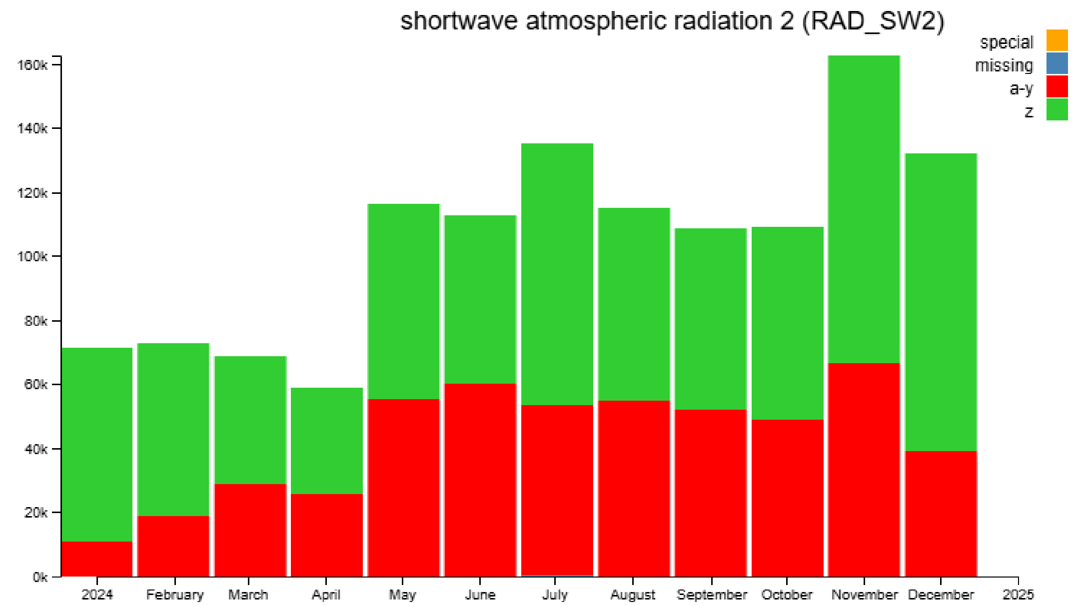


Figure 18: Total number of (this page) shortwave atmospheric radiation – RAD_SW – and (next page) shortwave atmospheric radiation 2 – RAD_SW2 –observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS 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)

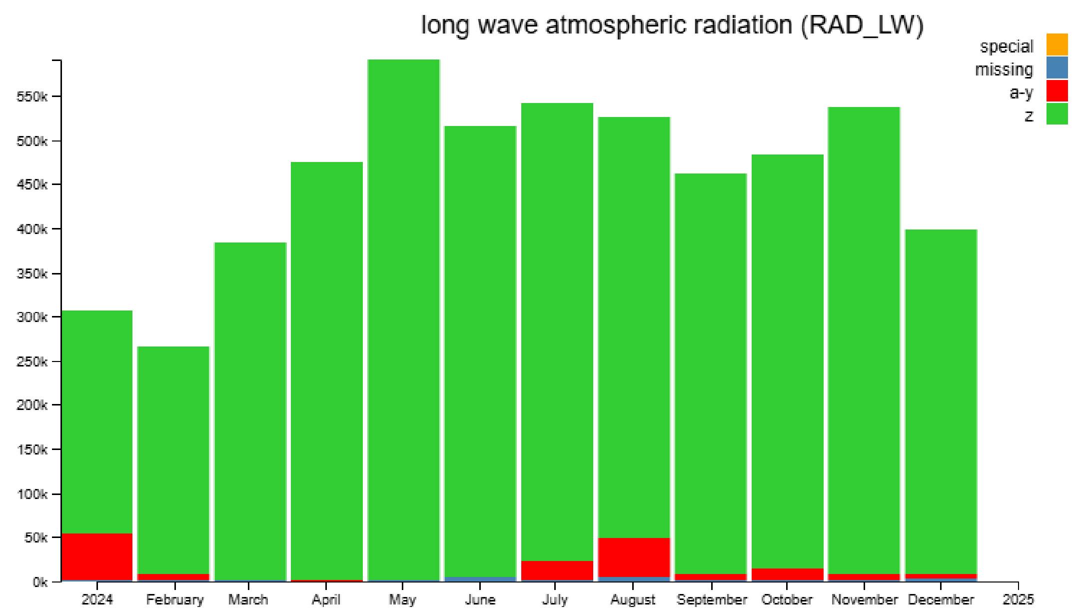
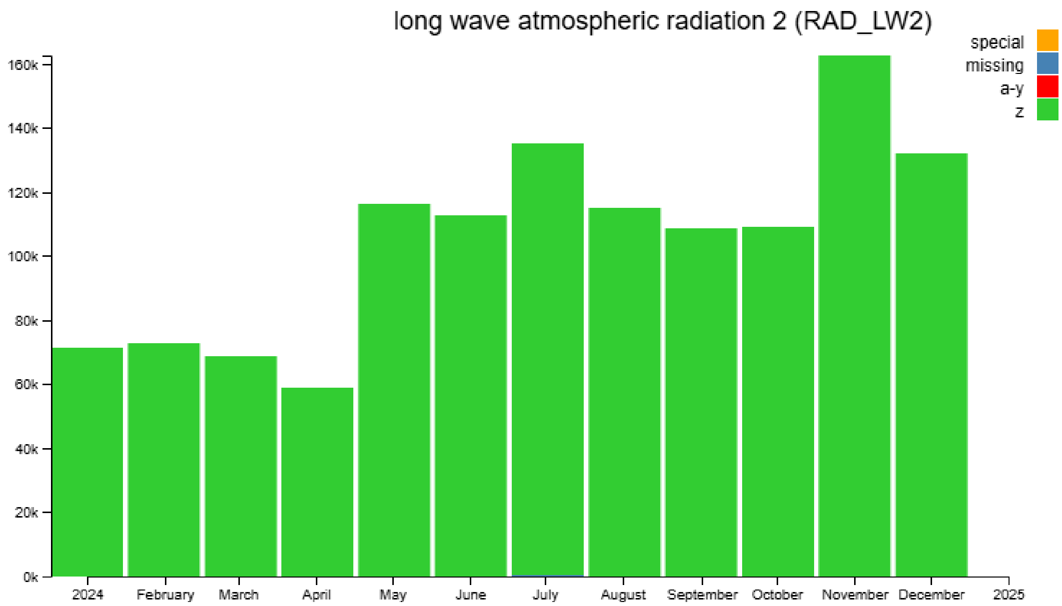


Figure 19: Total number of (this page) long wave atmospheric radiation – RAD_LW – and (next page) long wave atmospheric radiation 2 – RAD_LW2 –observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS 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)

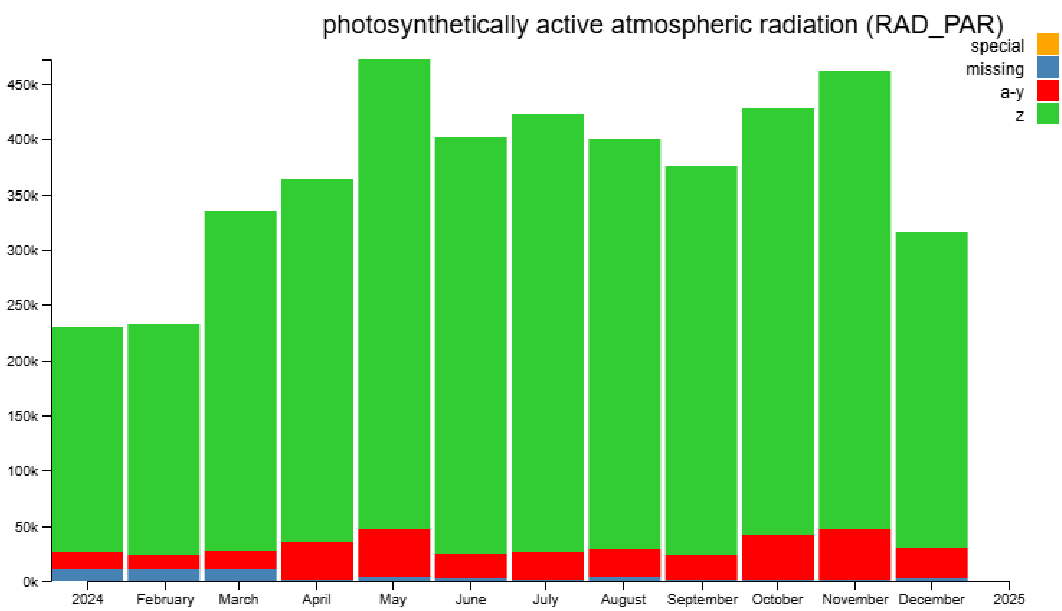
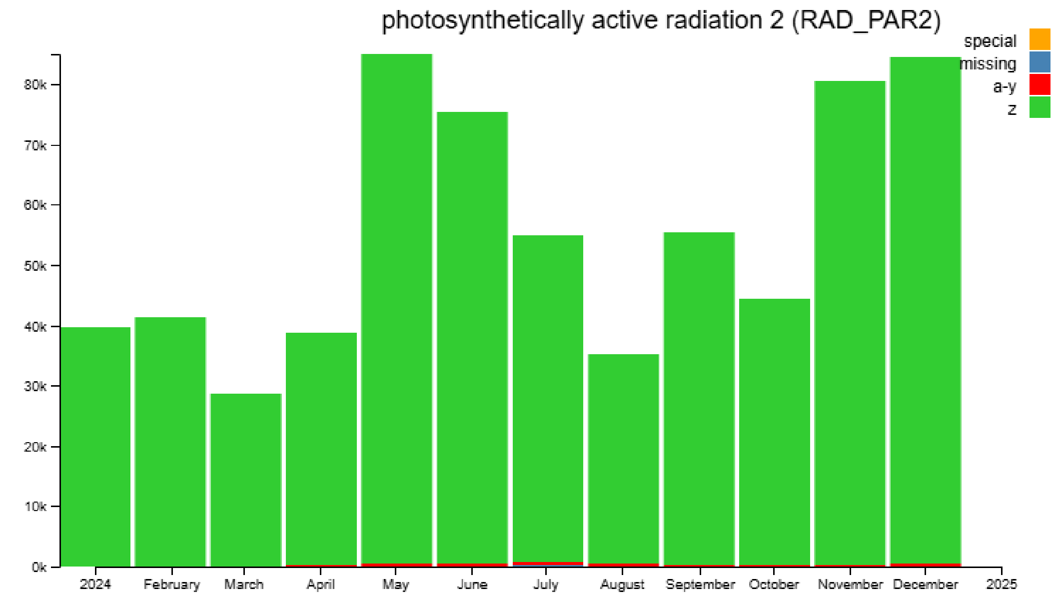


Figure 20: Total number of (this page) photosynthetically active atmospheric radiation – RAD_PAR – and (next page) photosynthetically active atmospheric radiation 2 – RAD_PAR2 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the 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 20: cont'd)

There were no major problems noted for either the rain rate (Figure 21) or precipitation accumulation (Figure 22) parameters. It should be mentioned that some accumulation sensors occasionally exhibit slow leaks and/or evaporation. These data are not typically flagged; nevertheless, frequent emptying of precipitation accumulation sensors is always advisable.

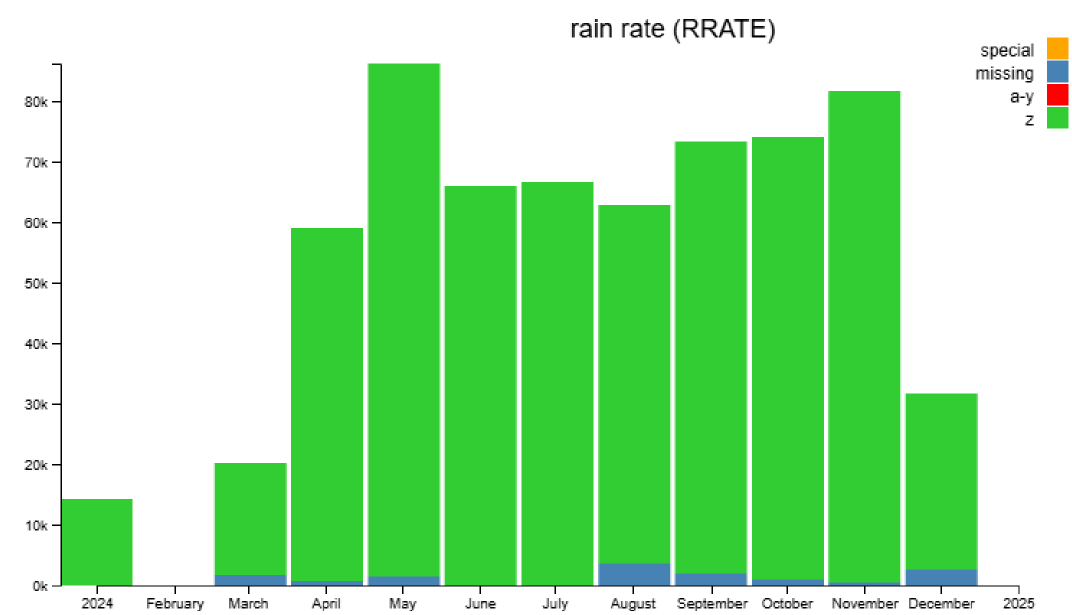
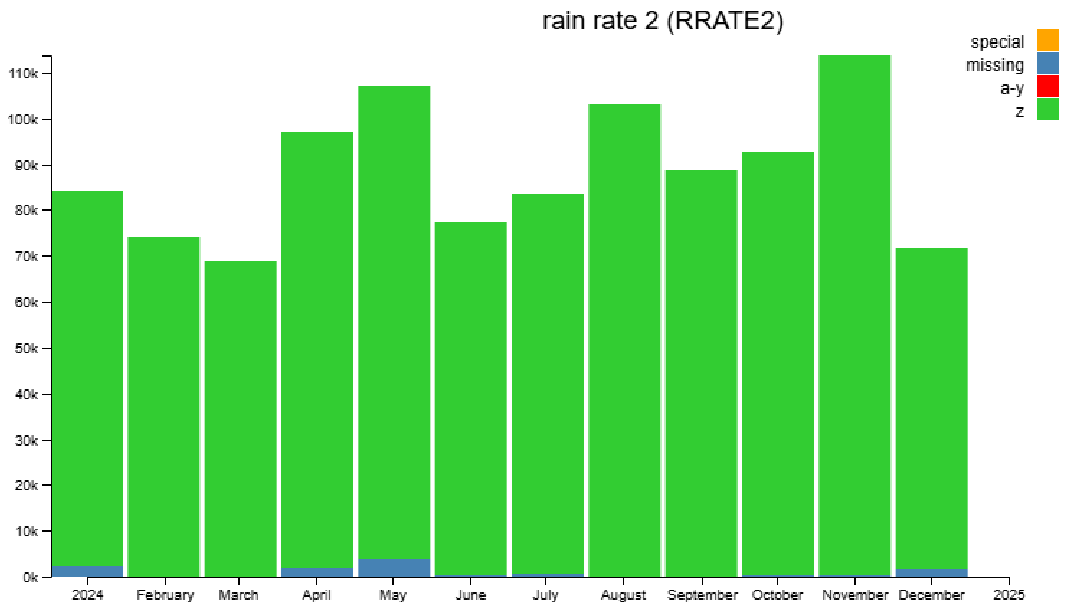
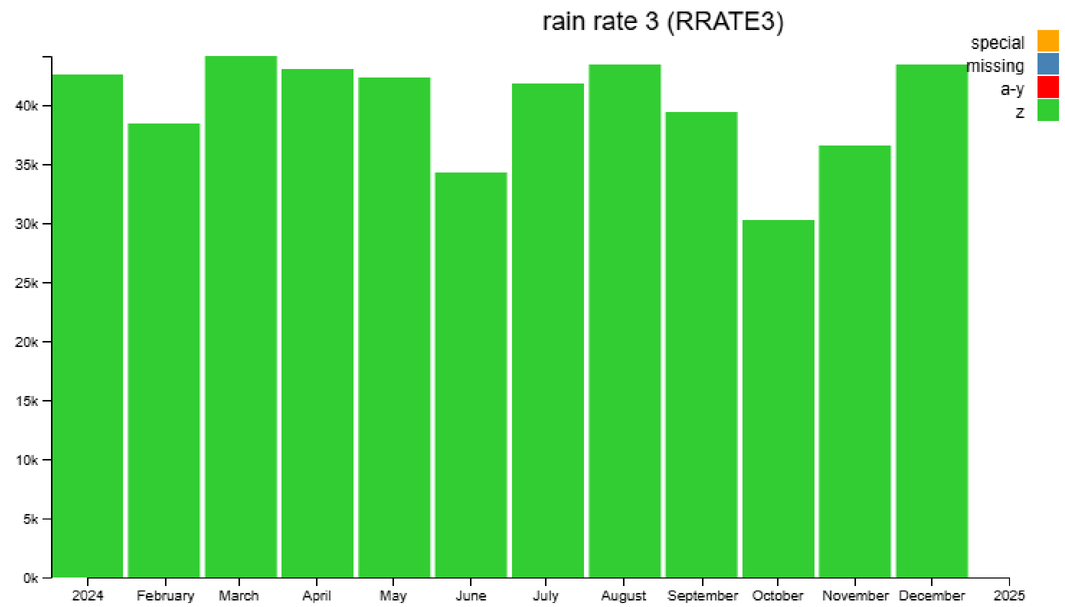
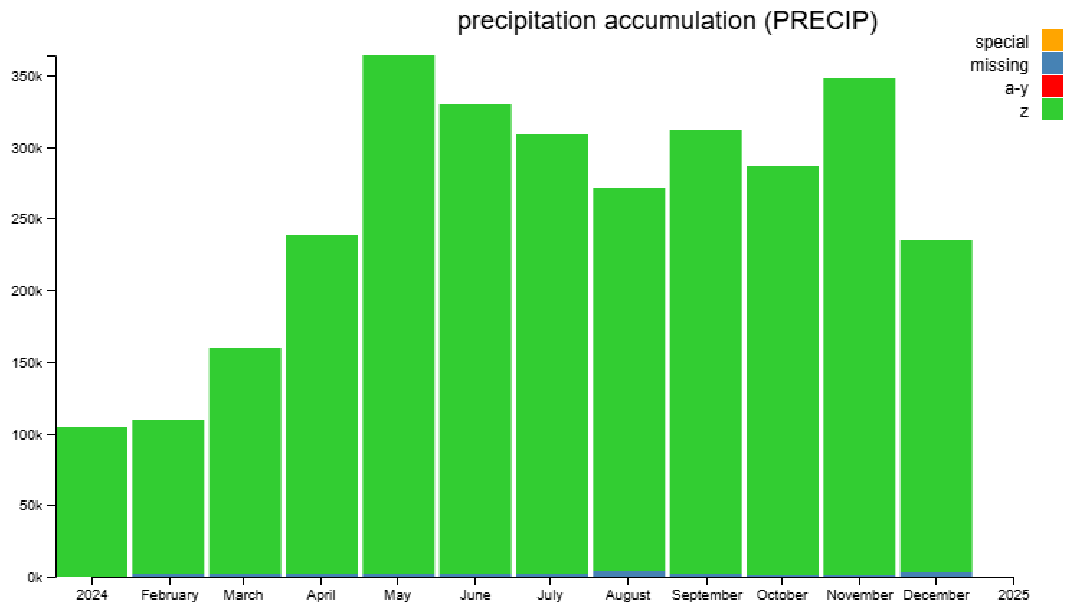


Figure 21: Total number of (this page) rain rate – RRATE – (next page, top) rain rate 2 – RRATE2 – and (next page, bottom) rain rate 3 – RRATE3 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.





(Figure 21: cont'd)



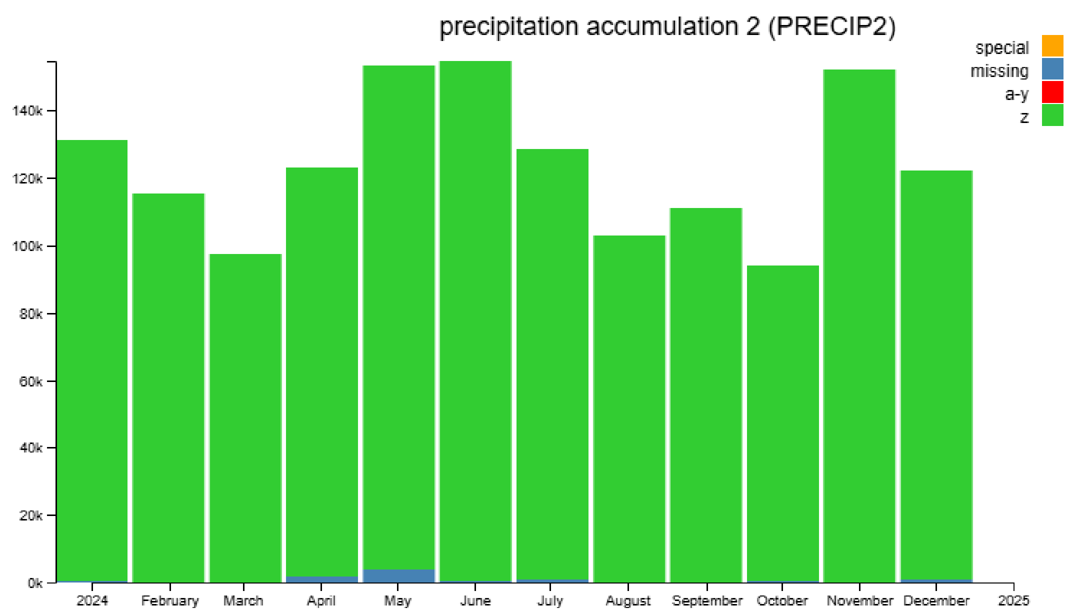
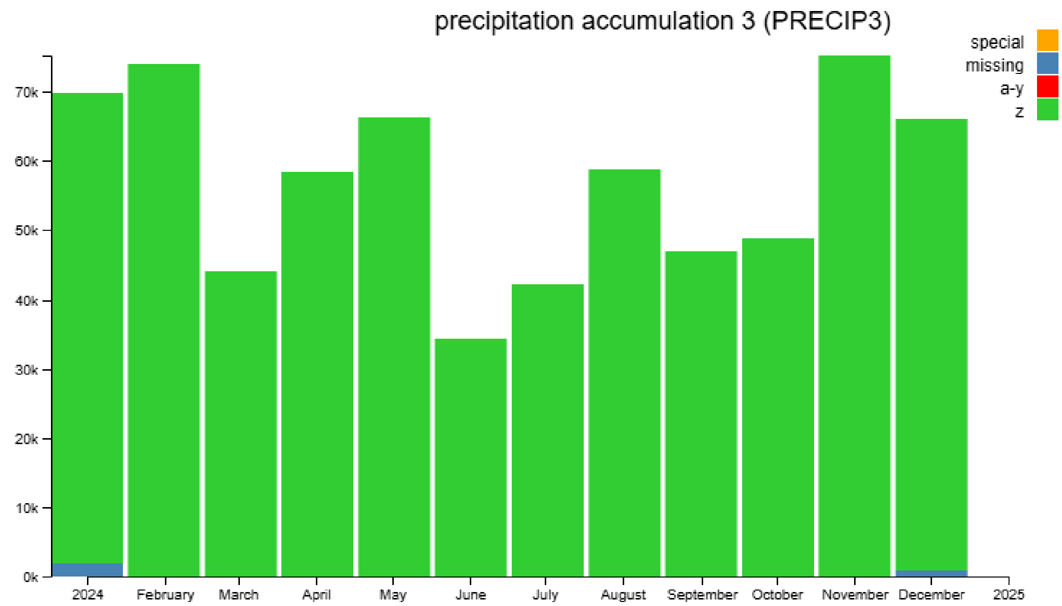


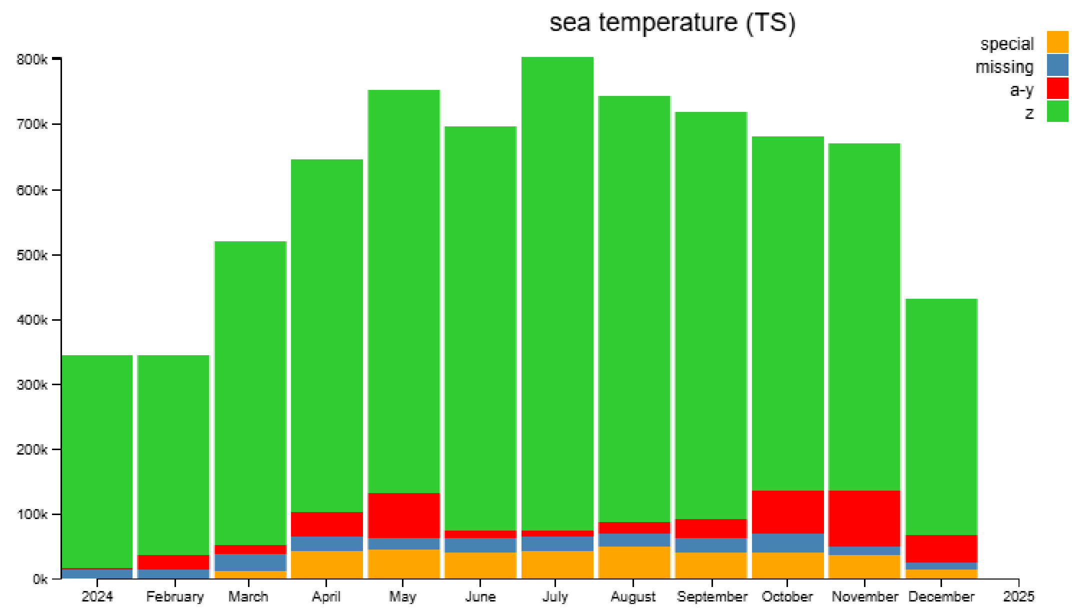
Figure 22: Total number of (this page, top) precipitation accumulation – PRECIP – (this page, bottom) precipitation accumulation 2 – PRECIP2 – and (next page) precipitation accumulation 3 – PRECIP3 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) 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: cont'd)

The main problem identified with the sea temperature parameter (Figure 23) occurs when the sensor is denied a continuous supply of seawater. In these situations (in the case of ships that receive visual QC), either the resultant sea temperature values are deemed inappropriate for the region of operation (using gridded SST fields as a guide), in which case they are flagged with suspect/caution (K) flags or occasionally poor quality (J) flags if the readings are extraordinarily high or low, or else the sensor reports a constant value for an extended period, in which case they are unanimously J-flagged. The events are also frequently extreme enough for the auto flagger to catch them and assign greater than four standard deviations from climatology (G) or out of bounds (B) flags. The authors note that this stagnant seawater scenario often occurs while a vessel is in port, which is anticipated as the normal ship operation practice by SAMOS data analysts. Further, NOAA ships running SCS5 tend to transmit from port more often than they did prior to their v5 transition. This means more stagnant seawater measurements and thus more flags during visual QC. Another issue these oceanographic sensors sometimes run into is air getting into the plumbing, usually under unique circumstances. For example, sailing in high seas that cause the intake to continuously be lifted above the water level, or traveling very slowly against the predominant swell, as with the *Revelle* (documented; see individual vessel description in 3c for details). Infrared sea temperature sensors are also prone to providing suspect or erroneous data if they are pointed elsewhere than the liquid sea surface (e.g., pack ice, or the dock). For vessels not receiving visual QC, many of these water flow issues are documented in Annex A.

Other than these examples, the TS data were generally good in 2024. The origins of any a-y flagging seen in the sea temperature and in fact all the sea water parameters are not clearly identified as belonging to any specific vessel(s). Rather, they were likely due to several vessels simultaneously experiencing the common sensor issues we have mentioned above. We also note it's common for sea water data transmission to cease when a vessel is nearing or in port (even while other types of data continue to be transmitted), meaning "missing," or perhaps "special" in the case of SCSv5 ships, values in these sea water parameters are not unexpected.



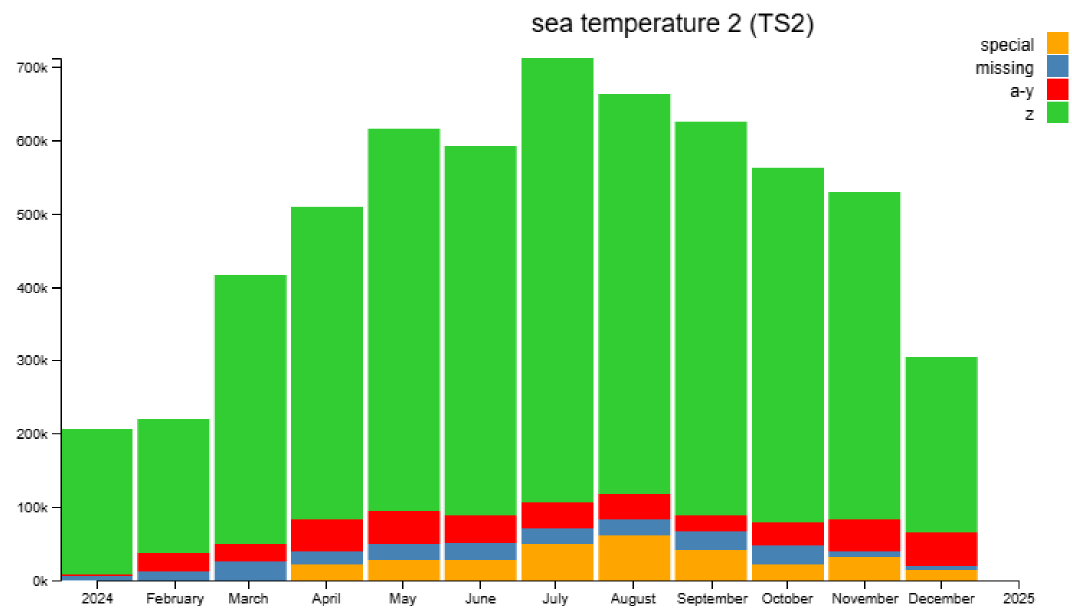
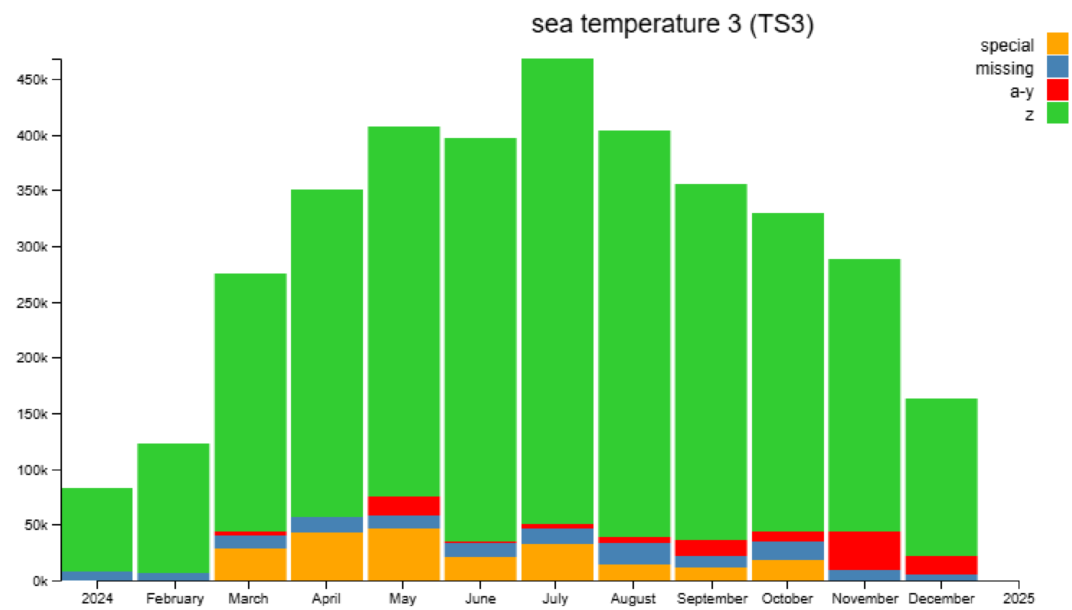
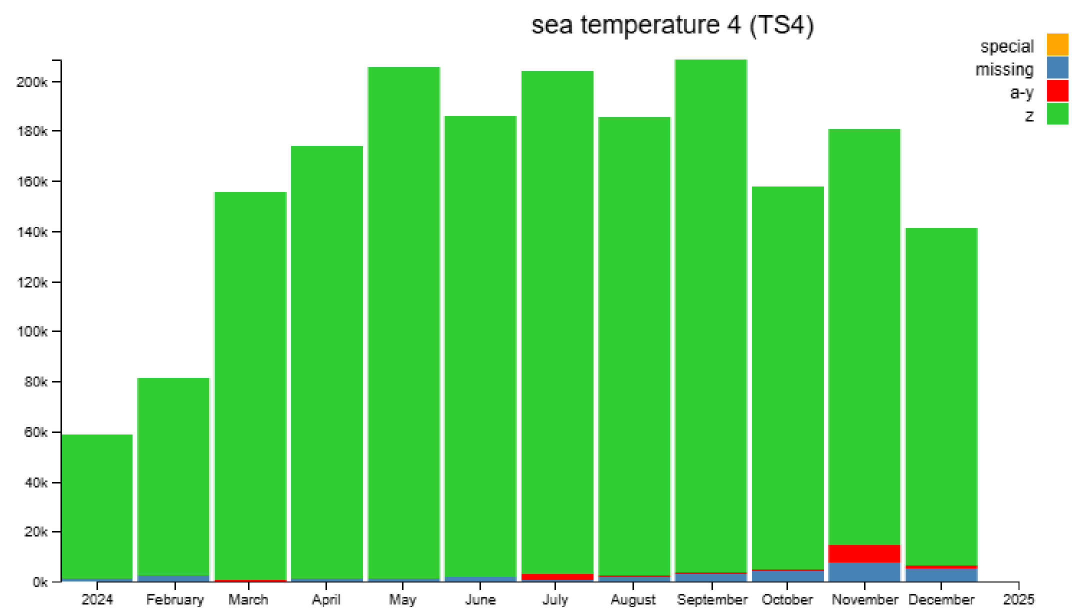
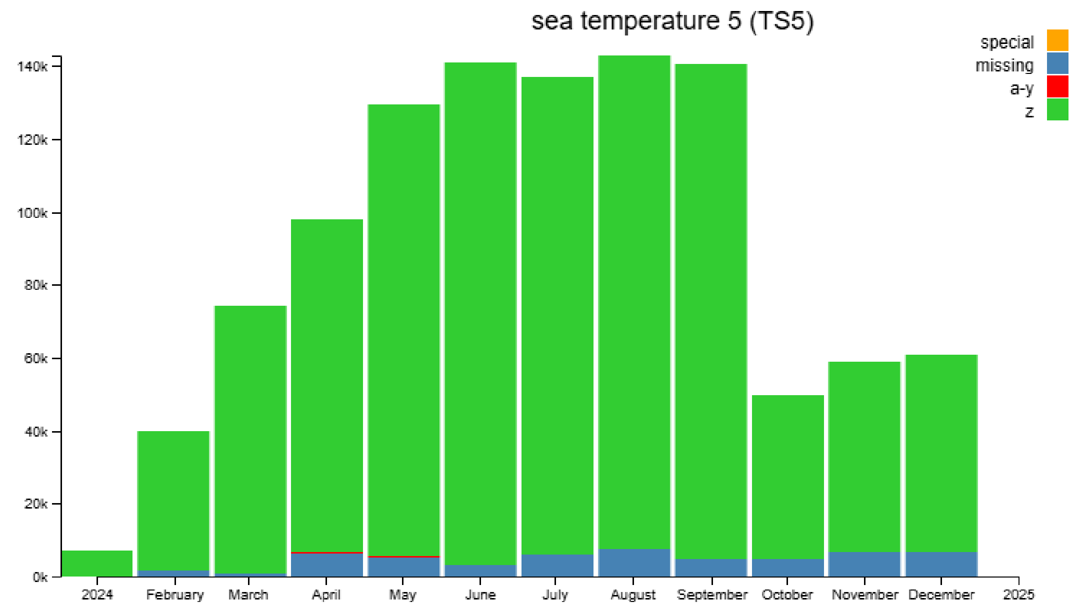


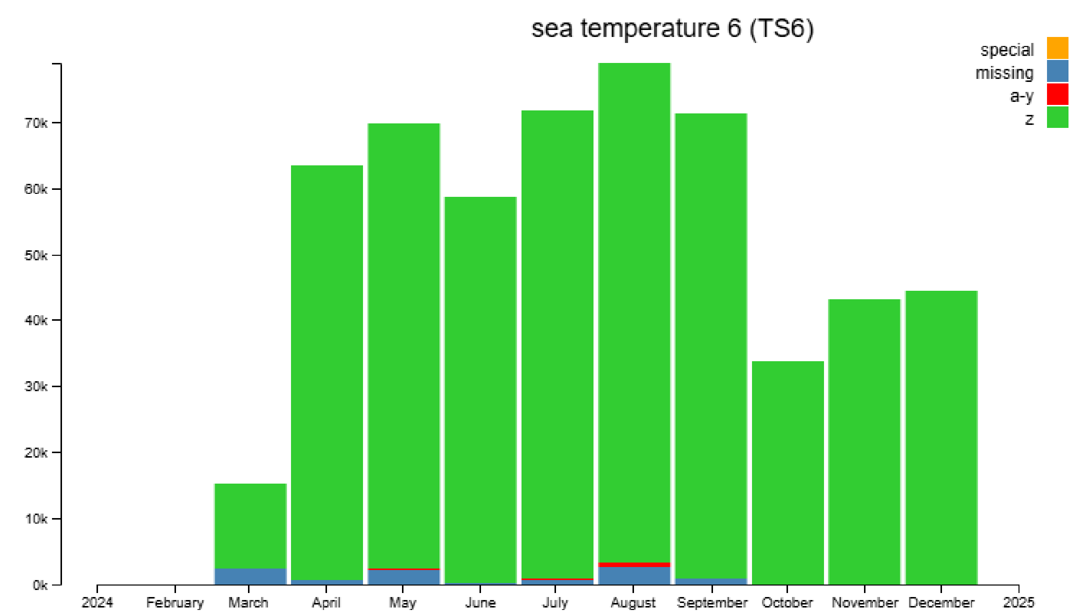
Figure 23: Total number of (this page, top) sea temperature – TS – (this page, bottom) sea temperature 2 – TS2 – (next page, top) sea temperature 3 – TS3 – (next page, bottom) sea temperature 4 – TS4 – (third page, top) sea temperature 5 – TS5 – and (third page, bottom) sea temperature 6 – TS6 – observations provided by all ships for each month in 2024. 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: cont'd.)





(Figure 23: cont'd.)

Salinity and conductivity (Figure 24 and Figure 25, respectively) experienced the same major issue as sea temperature; namely, when a vessel was in port or ice or rough seas the flow water system that feeds the probes was usually shut off, resulting in either inappropriate or static values. Like sea temperature, air intrusion is another fairly common issue with salinity and conductivity. When this occurs, the data can be fraught with spikes. Data such as this is typically flagged with either spike (S), suspicious quality (K), or occasionally even poor quality (J) flags during visual quality control, for those vessels that receive it. Despite these issues, though, the quality of salinity and conductivity data in 2024 was still well within reason.

The increased a-y flagging in SSPS2 and CNDC2 seen in October is likely from the *Sette*, on which ship there were simultaneously a plumbing leak and an unexplained thermosalinograph issue (or perhaps the two were connected). Other than this, though, once again the origins of any a-y flagging seen in all the sea water parameters (including conductivity and salinity) are not clearly identified as belonging to any specific vessel(s). Rather, they were likely due to several vessels simultaneously experiencing the common sensor issues we have mentioned above. We also reiterate it's common for sea water data transmission to cease when a vessel is nearing or in port (even while other types of data continue to be transmitted), meaning missing or special values in these sea water parameters are not unexpected.

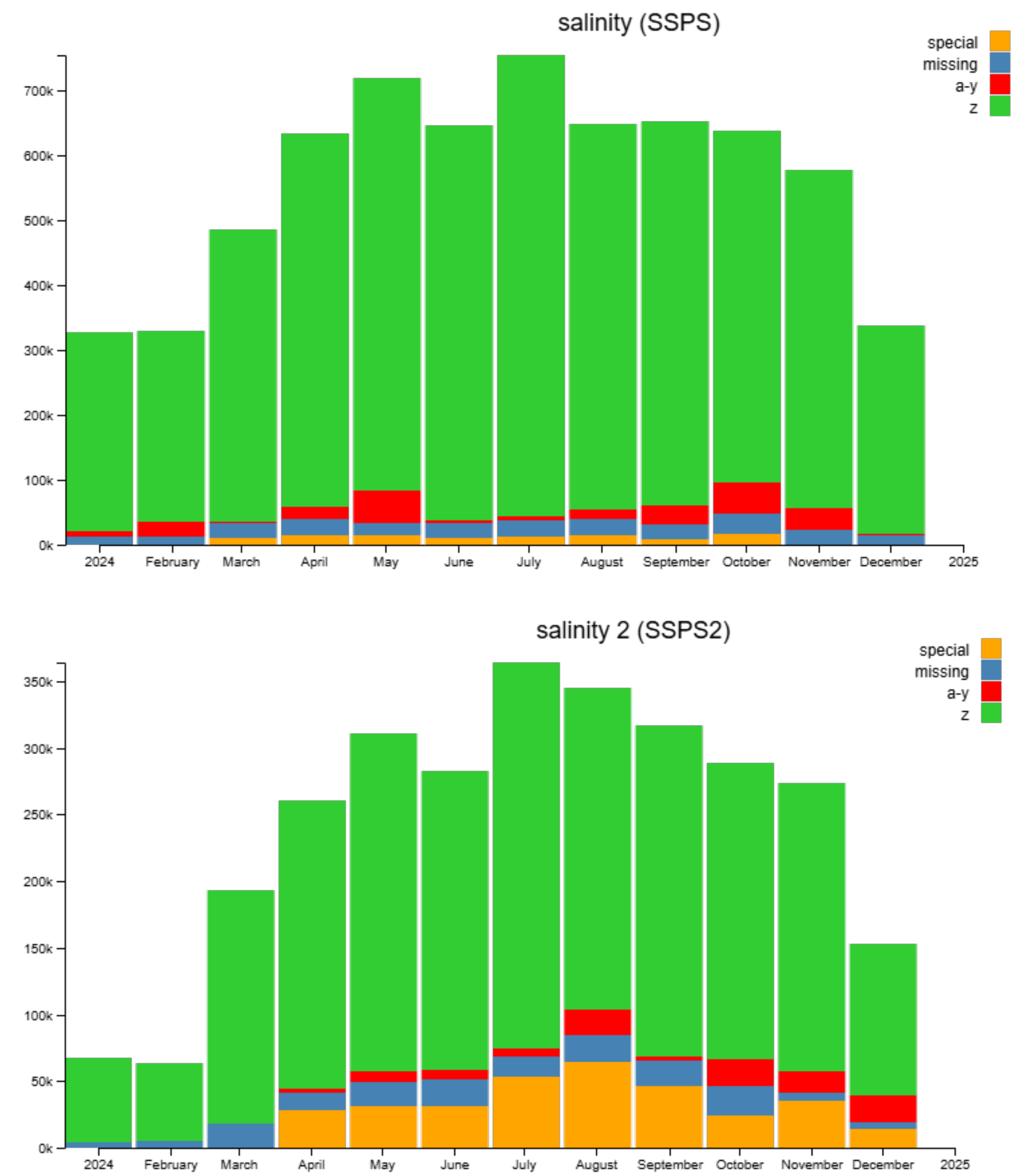


Figure 24: Total number of (top) salinity – SSPS – and (bottom) salinity 2 – SSPS2 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

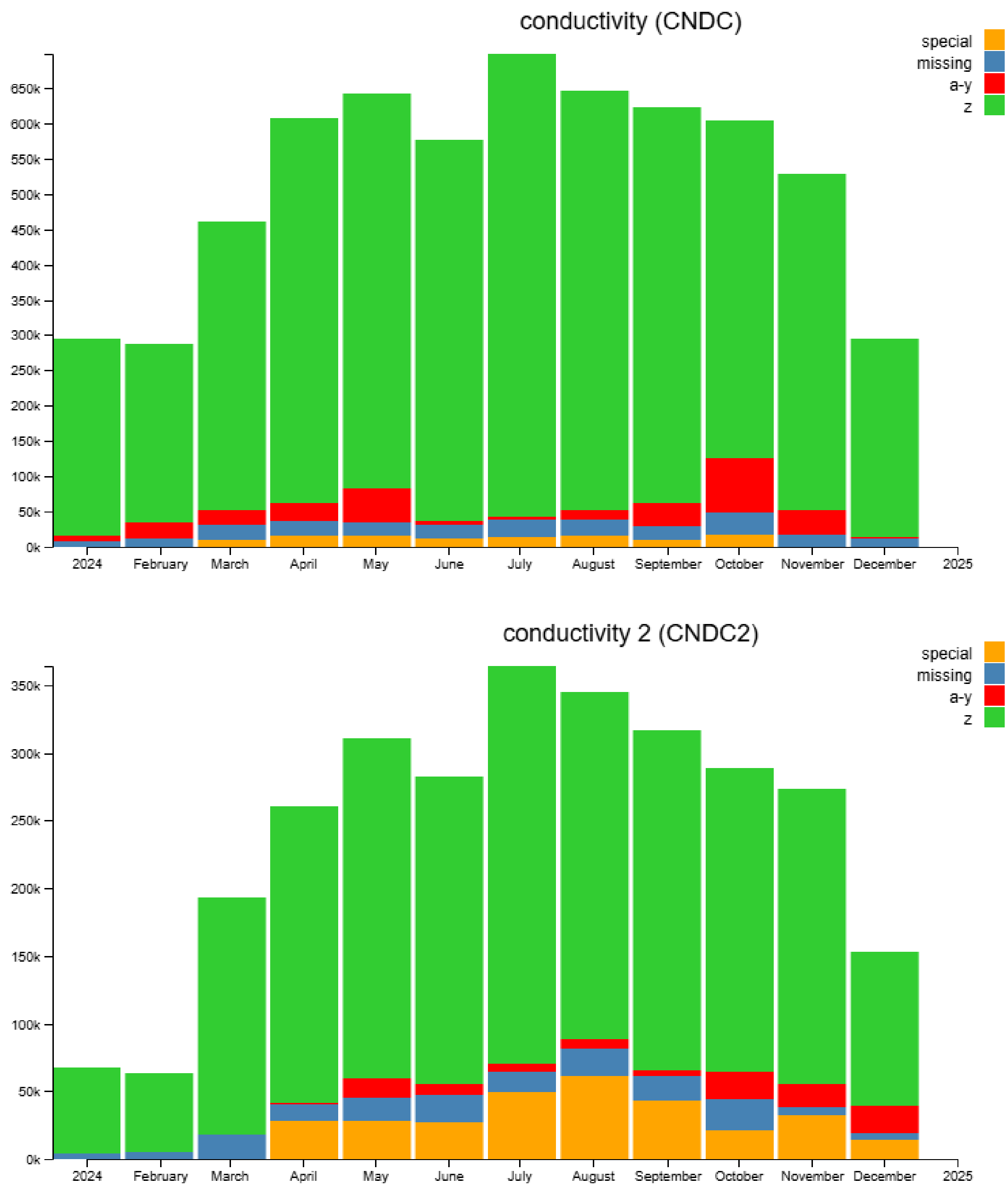


Figure 25: Total number of (top) conductivity – CNDC – and (bottom) conductivity 2 – CNDC2 – observations provided by all ships for each month in 2024. The colors represent the number of good (green) values versus the values that failed one of the SAMOS QC tests (red). Values noted as missing or special values by the SAMOS processing are also marked in blue and orange, respectively.

c. 2024 quality by ship

Atlantic Explorer

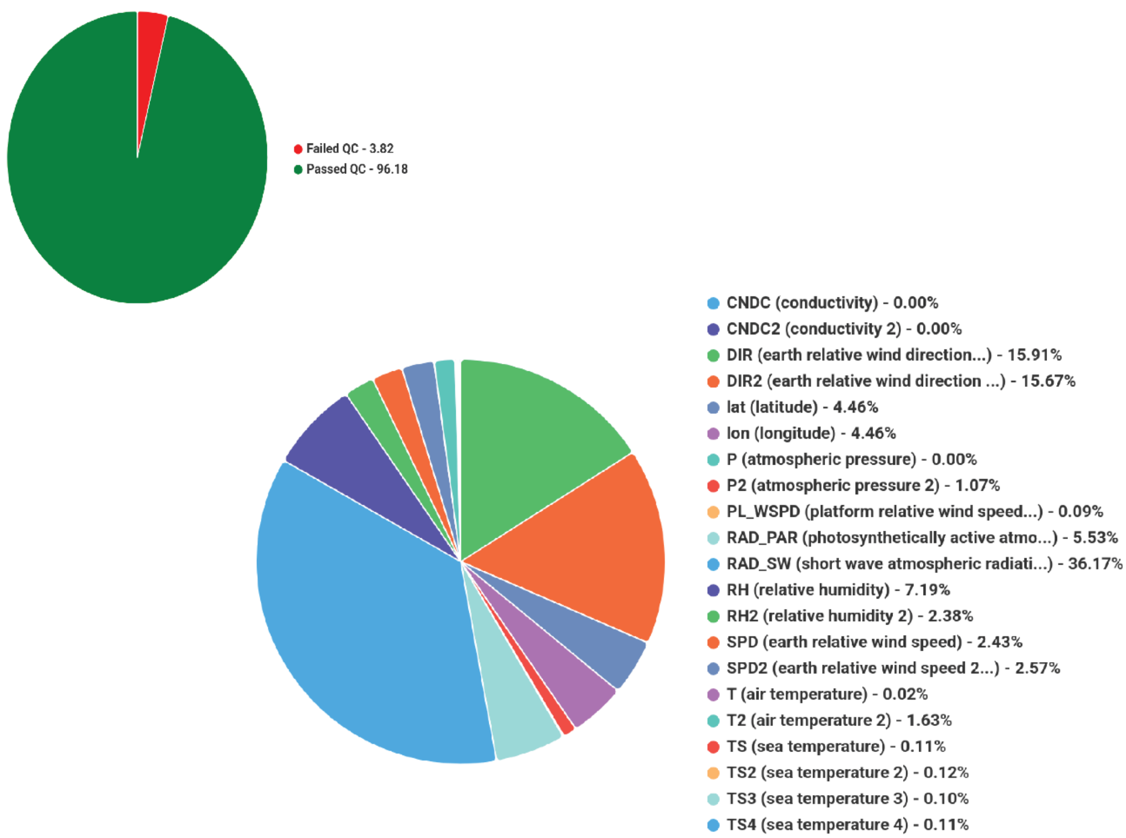


Figure 26: For the Atlantic Explorer from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Atlantic Explorer* provided SAMOS data for 164 ship days, resulting in 6,352,704 distinct data values. After automated QC, 3.82% of the data were flagged using A-Y flags (Figure 26). This is about the same as 2023 (3.95%) and is under the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. NOTE: The *Atlantic Explorer* does not receive visual quality control by the SAMOS DAC, so all the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Atlantic Explorer*).

Early in 2024, the temperature and humidity sensors on the vessel had periods when they differed significantly. The first from 3-5 May 2024 had the bow mast temperature (T2) running about 3˚C higher than the main mast temperature sensor (T). The bow mast sensor was swapped and the two temperatures subsequently agreed within 0.5˚C. From 24-31 May 2024, the two temperature sensors again drifted apart by upwards of 4˚C, delivering some "greater than four standard deviations from climatology" (G) flags to T2. No reason for the issue was identified, so the data should be used with caution. From 16-21 August 2024, both the bow mast temperature (T2) and relative humidity (RH2) were assigned numerous B (out of bounds) and G flags. T2 dropped to negative values and RH2 was over 40% lower than the main mast humidity (RH). The technicians confirmed that the sensor had been damaged by a hurricane that passed near Bermuda and the data in this period should not be used. The bow sensor was replaced by a temperature and humidity sensor on the 03 deck (the forward mast was inaccessible). But this location was affected by ship heating, so the data between 22 August and 8 September should be used with caution. The sensor was ultimately replaced on the bow mast on 8 September 2024. Overall, when both the bow and main mast temperature and humidity sensors are working well on the *Atlantic Explorer*, it is common for the temperatures to differ by about 1˚C. We believe this is simply the result of different exposures for the two sensors.

The *Atlantic Explorer* also experienced two problems with their radiometers in 2024. Their photosynthetic sensor (RAD_PAR) registered a lot of values at or below zero during the daylight hours from 9 May – 2 June 2024, which would be unusual, and some of these values received B flags (Figure 27). The techs confirmed the sensor had a faulty plug, so data in this period should be used with caution. A new PAR sensor was installed on the 03 deck bridge rail (as opposed to the bow mast) around 3 June 2024. The PAR was moved back to the main mast location on 16 July 2024. Also from 9 May – 26 July 2024 the longwave radiometer (RAD_LW) was reporting values at or above 500 W/m2, which is anomalously high for the vessel's operating region. The operator suspects they received a bad calibration on the radiometer and data for this period should be used with caution. On 26 July 2024, a newly calibrated LW radiometer was installed on the bridge rail and was reporting realistic values between 390-430 W/m2. We expect the LW sensor was moved back to the main mast at some point, but we do not have a date for the move.

There were no other major issues of note in 2024. Looking to the flag percentages in Figure 26, about 36% of the total flags were applied to the short-wave atmospheric radiation parameter (RAD_SW). Upon inspection the flags, which are unanimously B flags (Figure 27), appear to have been applied mainly to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.) Approximately 31% of the total flags were applied to the earth relative wind direction (DIR and DIR2) parameters, combined. These were entirely "failed the true wind recalculation" (E) flags (Figure 27), which may be indicative of the *Atlantic Explorer* mixing averaged values and spot values across the parameters used in true wind calculation (not confirmed to date). Finally, there were periods when the sea temperature (TS, TS2, TS3, TS4), conductivity (CNDC, CNDC2), and salinity (SSPS, SSPS2) data showed a smooth time series not representative of real ocean observations. This tends to occur when the pumps to the sea water system are shutdown, particularly when entering or leaving port. This sometimes results in B or G flags being applied to these variables (when the sea water in the pipes is not representative of the surrounding environment), but the autoQC does not flag all occurrences. When noted, the dates of these shutdowns are listed in Annex A.

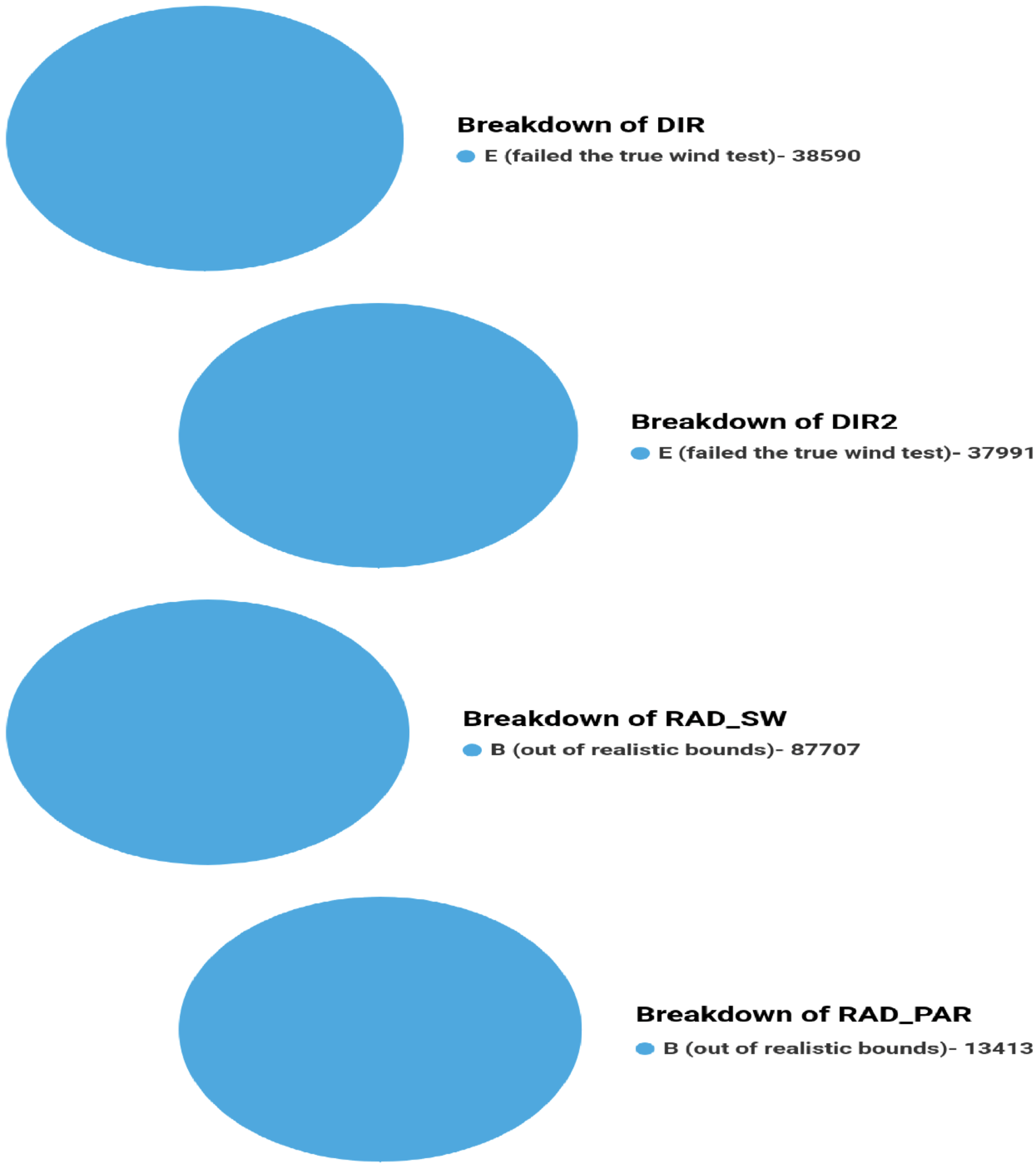
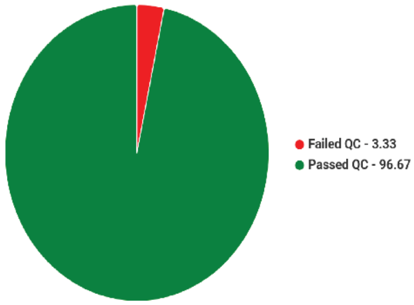


Figure 27: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) earth relative wind direction 2 – DIR2 –(third) short wave atmospheric radiation – RAD_SW – and (last) photosynthetically active atmospheric radiation – RAD_PAR – for the *Atlantic Explorer* in 2024.

Investigator



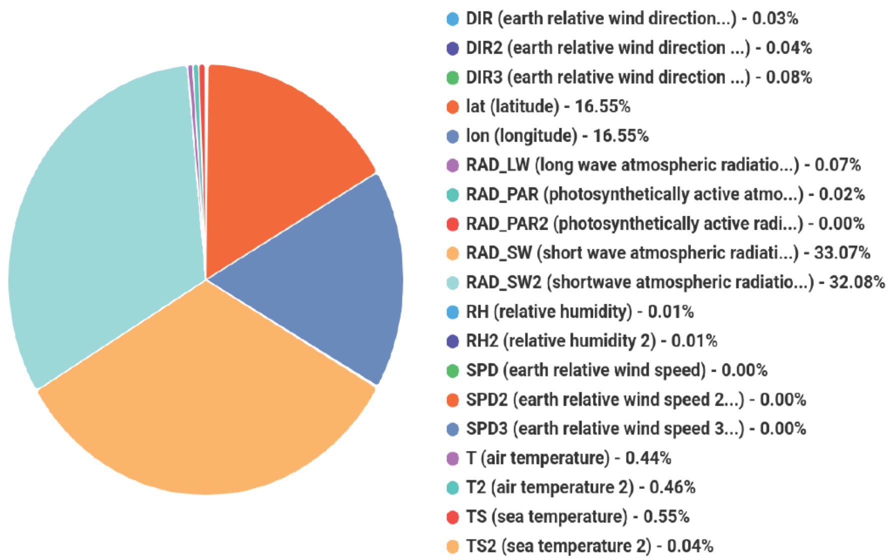


Figure 28: For the *Investigator* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Investigator* provided SAMOS data for 246 ship days, resulting in 11,213,696 distinct data values. After automated QC, 3.33% of the data were flagged using A-Y flags (Figure 28). This a bit less than 2023 (4.81%) and is still under the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. NOTE: The *Investigator* does not receive visual quality control by the SAMOS DAC, so all the flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Investigator*).

The main problem that occurred in 2024 was the failure of the port rain sensor (PRECIP2). The data flatlined at zero (no flags) for much of the year and was not repaired until 2025. PRECIP from the starboard sensor should be used to identify rain events.

Though rarely flagged by the autoQC, it is worth noting that the sea temperature (TS2) from the ISAR can differ from the intake sea temperature (TS) by 3˚C or more. The ISAR is designed to measure the skin sea temperature using a radiometer but can be prone to internal electronic noise that increases the sensor bias. The IMOS team conducts post cruise processing of the ISAR data and releases a research quality product that may be of interest to some users (Beggs et al. 2017, https://researchdata.edu.au/rv-investigator-isarsst-2014-onwards/794633). When the TS2 values vary from the TS by more than 1˚C, they should be used with caution. Also, the ISAR is not deployed on every cruise of the *Investigator* so TS2 will be missing in these cases.

As a general advisory, it's been noted all of *Investigator's* earth relative winds, meaning both directions and speeds (i.e., DIR, DIR2, DIR3, SPD, SPD2, SPD3), sometimes show steps in the data in association with changes in the ship speed or vessel orientation. Upon inspection and in consultation with the operator, flow distortion caused by the ship's superstructure obstructing the wind is prevalent for some (particularly for winds from abeam) or all (for winds from astern) wind sensors. In all cases, users should take care to choose the true winds from the best exposed anemometer based on the ship-relative wind direction.

Looking at the flag percentages in Figure 28, about 65% of the total flags were applied to the shortwave atmospheric radiation parameters (RAD_SW and RAD_SW2). Upon inspection the flags, which are unanimously "out of bounds" (B) flags (Figure 29), appear to have been applied mainly to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.) A further ~33% of the total flags were applied to latitude (LAT) and longitude (LON). Upon inspection these were entirely "platform position over land" (L) flags (Figure 29) that appear generally to have been applied when the vessel was in port (often reporting from the dock in Hobart, Tasmania) or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port.

For anyone interested in working with reprocessed, post-cruise data from the *Investigator*, you can access both flux and meteorological observations from the IMOS THREDDS server via http://thredds.aodn.org.au/thredds/catalog/IMOS/SOOP/SOOP-ASF/VLMJ_Investigator/catalog.html. For additional information see Beggs et al. (2017).

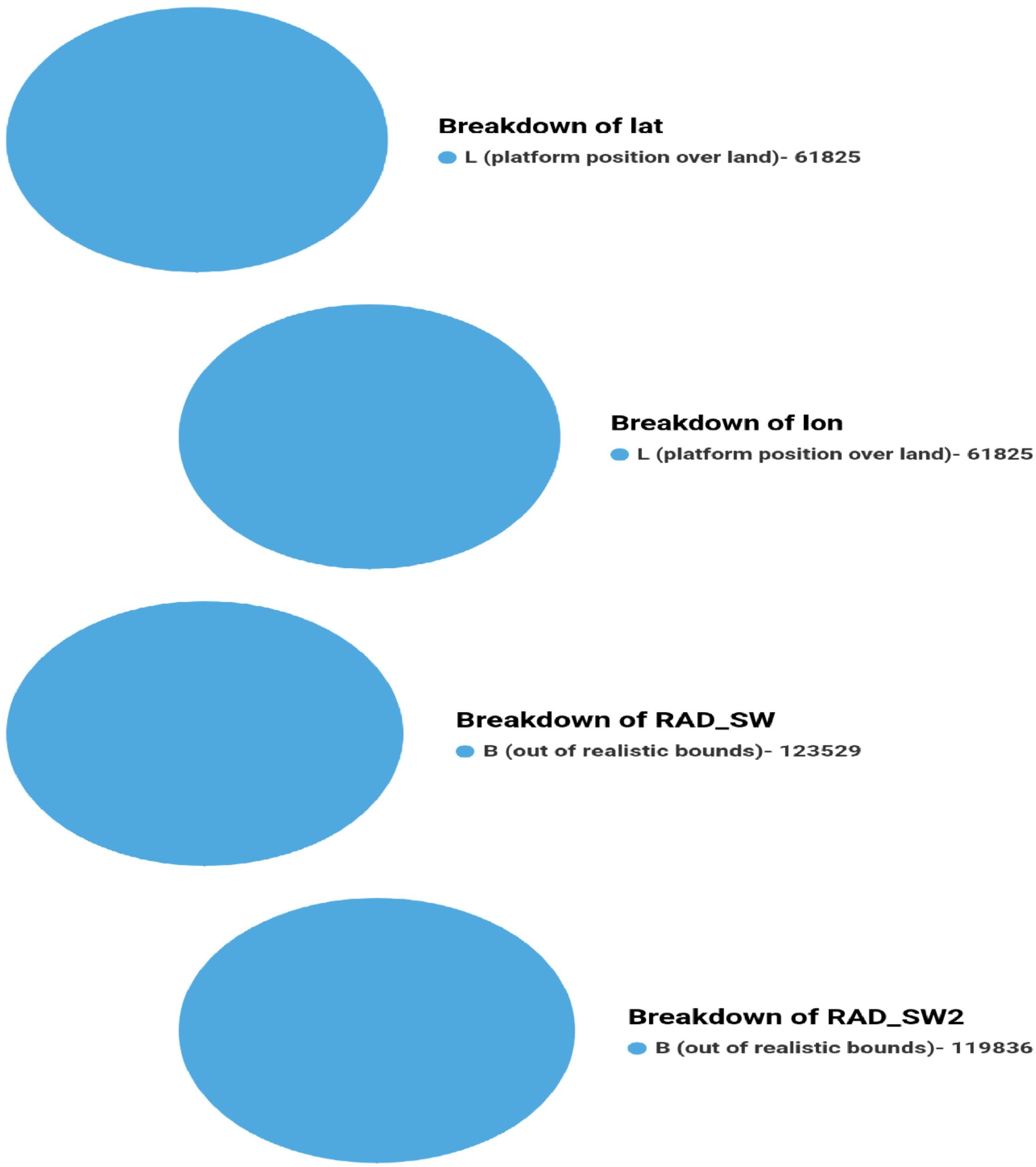


Figure 29: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) shortwave atmospheric radiation – RAD_SW – and (last) shortwave atmospheric radiation 2 – RAD_SW2 – for the *Investigator* in 2024.

Nuyina

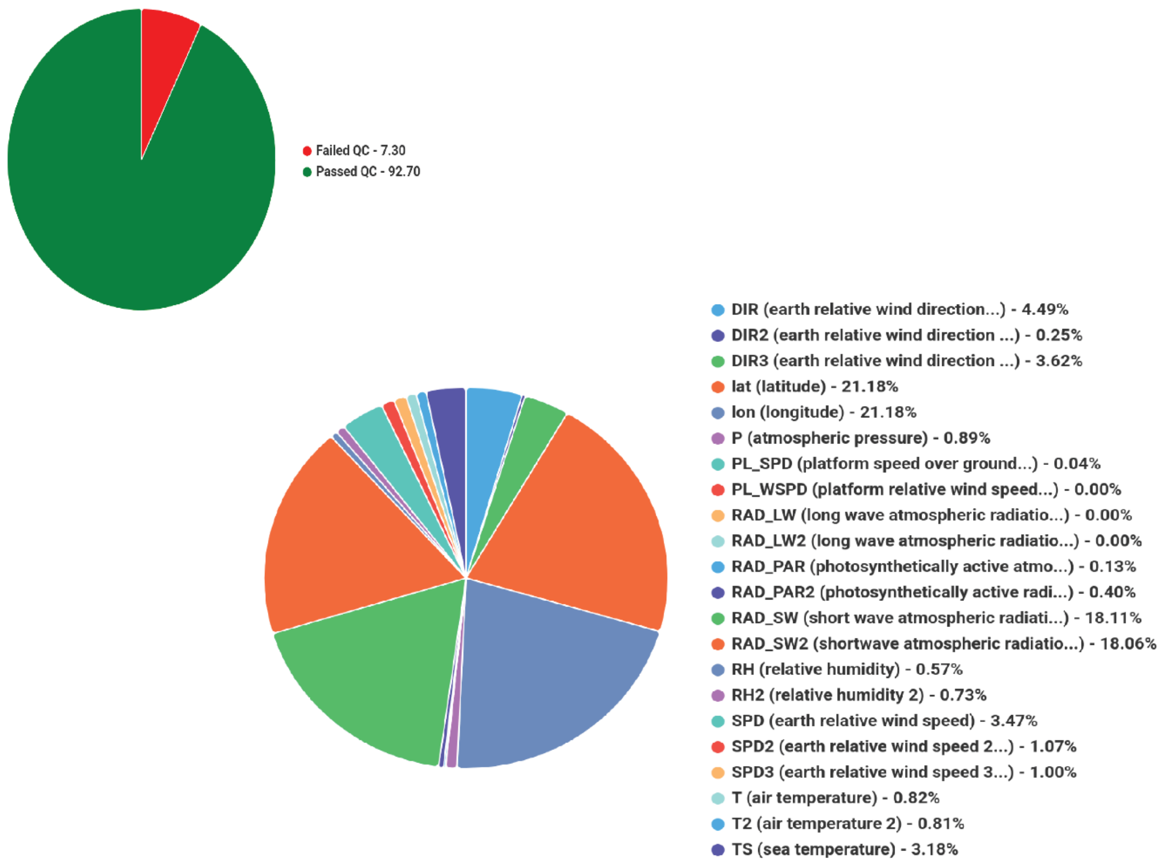


Figure 30: For the *Nuyina* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nuyina* provided SAMOS data for 236 ship days, resulting in 9,799,480 distinct data values. After automated QC, 7.3% of the data were flagged using A-Y flags (Figure 30). NOTE: the *Nuyina* does not receive visual quality control by the SAMOS DAC, so all flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Nuyina*).

Two notable events affected the data collection on the *Nuyina* in 2024: First, around 31 May 2024 the data officer confirmed that the port side foremast wind sensor was completely blown off the vessel. The data logger was still capturing a "signal" from this location, resulting in flatlined zero values for earth relative wind direction (DIR), earth relative wind speed (SPD), platform relative wind direction (PL_WDIR), and platform relative wind speed (PL_WSPD). The SAMOS team disabled processing of these variables on 7 July 2024 to keep the zero values out of the files. The damage was not repaired until 29 August 2024, when data processing for this sensor was restored. Second, from 18-22 November 2024, the long wave atmospheric radiation (RAD_LW) exhibited oscillations in the data with an amplitude of about 40 W/m2 and a period of an hour. This was the result of a sensor failure, which was promptly repaired. The RAD_LW in this period should not be used.

Looking at the flag percentages in Figure 30, about 38% of the total flags were applied to the shortwave atmospheric radiation parameters (RAD_SW and RAD_SW2). Upon inspection the flags, which are unanimously "out of bounds" (B) flags (Figure 31), appear to have been applied mainly to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.) A further ~43% of the total flags were applied to latitude (LAT) and longitude (LON). Upon inspection these were entirely "platform position over land" (L) flags (Figure 31) that appear generally to have been applied when the vessel was in port (often reporting from the dock in Hobart, Tasmania) or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port.

For anyone interested in working with reprocessed, post-cruise data from the *Investigator*, you can access both flux and meteorological observations from the IMOS THREDDS server via https://thredds.aodn.org.au/thredds/catalog/IMOS/SOOP/SOOP-ASF/VMIC_Nuyina/catalog.html

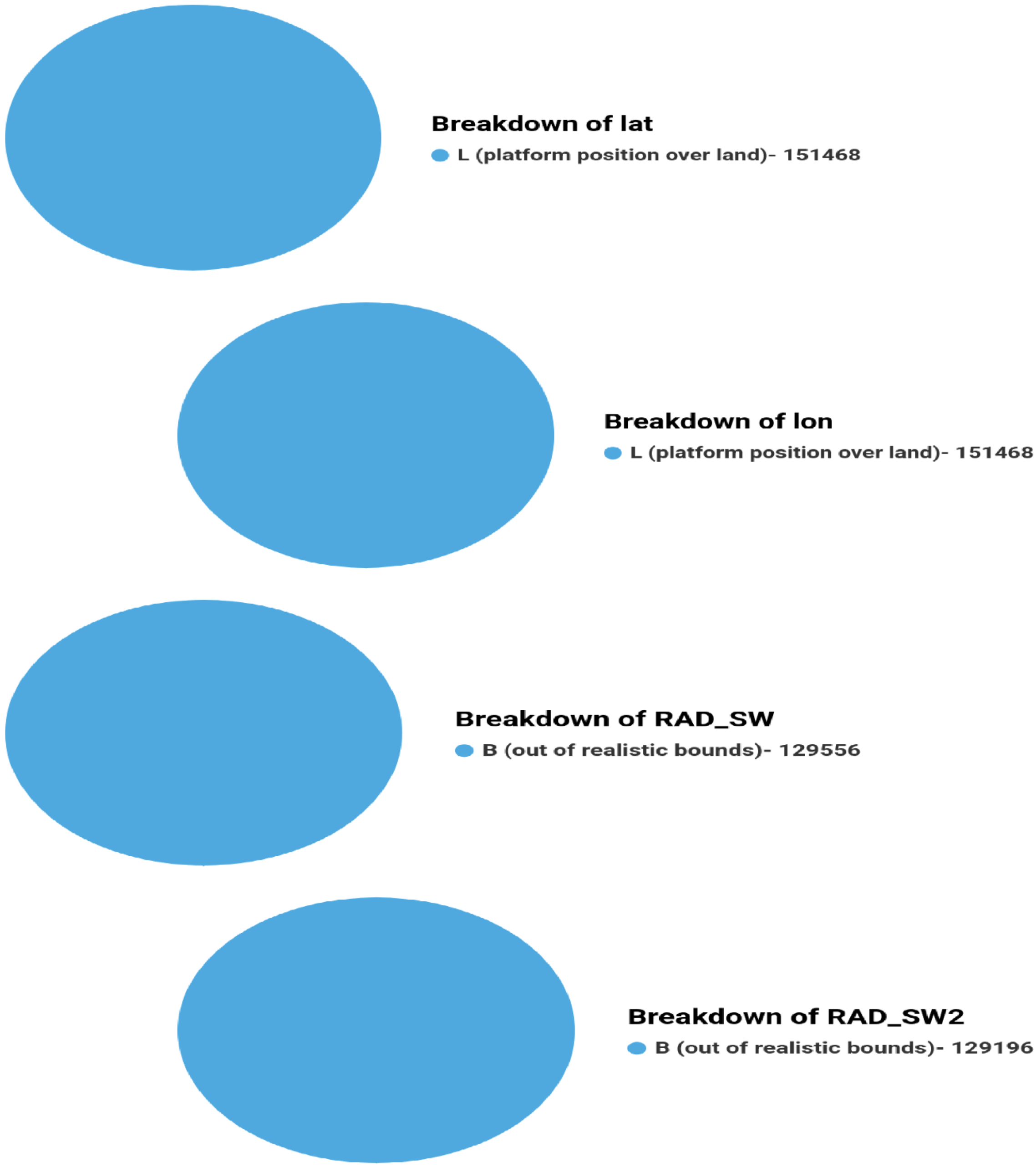


Figure 31: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) shortwave atmospheric radiation – RAD_SW – and (last) shortwave atmospheric radiation 2 – RAD_SW2 – for the *Nuyina* in 2024.

Tangaroa

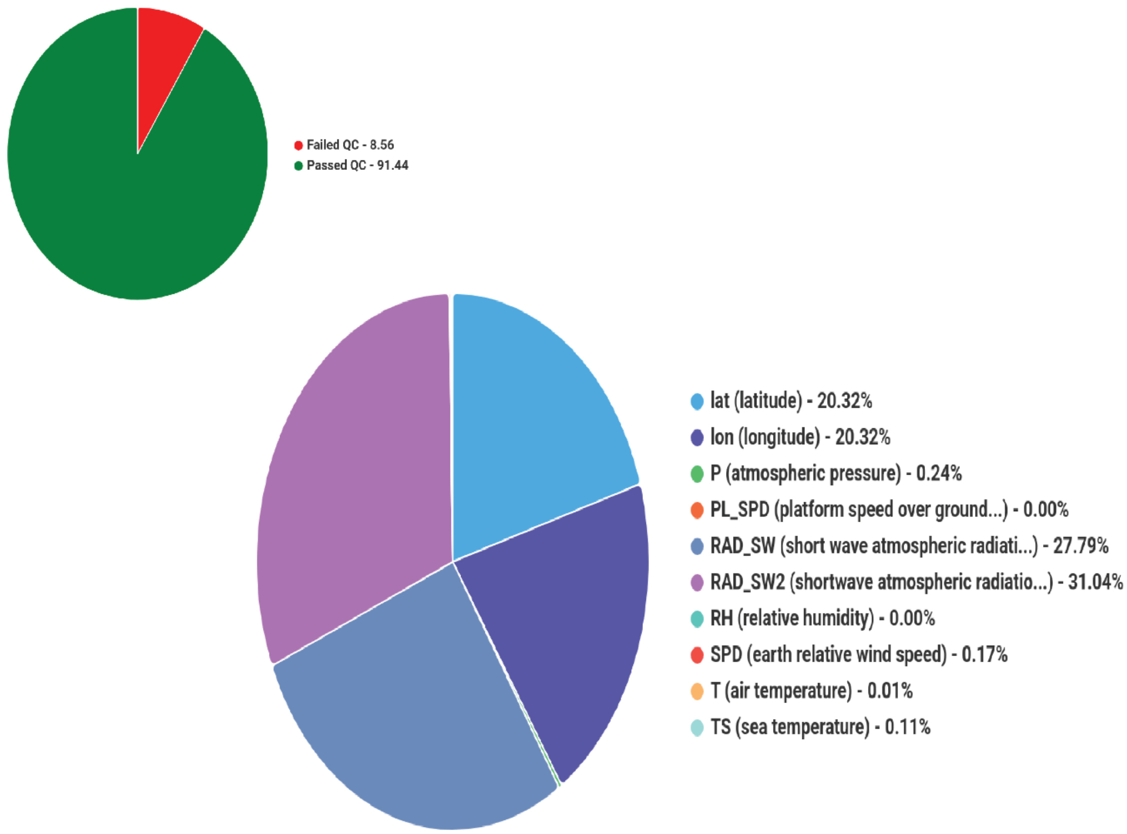


Figure 32: For the *Tangaroa* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Tangaroa* provided SAMOS data for 290 ship days, resulting in 6,959,573 distinct data values. After automated QC, 8.56% of the data were flagged using A-Y flags (Figure 32). This is slightly less than 2023 (9.11%). NOTE: the *Tangaroa* does not receive visual quality control by the SAMOS DAC, so all flags are the result of automated QC (no research-level files exist at the SAMOS DAC for the *Tangaroa*).

There were no specific data issues of record for *Tangaroa* in 2024, apart from multiple days when no SAMOS file was received from the vessel because of satellite communications issues and a period from 6-16 July 2024 when the air temperature (T), atmospheric pressure (P), and relative humidity (RH) data were missing because of a problem rebooting the AWS on the vessel. Sometimes these missing days were received and processed on a delayed basis, but others may not be included in the SAMOS data product for 2024. If a user is looking for a specific day of data not included in the SAMOS product, please refer to the IMOS THREDDS server (see below).

Looking to the flag percentages in Figure 32, about 59% of the total flags were applied to the shortwave atmospheric radiation parameters (RAD_SW and RAD_SW2). Upon inspection the flags, which are unanimously "out of bounds" (B) flags (Figure 33), appear to have been applied mainly to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.) A further ~41% of the total flags were applied to latitude (LAT) and longitude (LON). Upon inspection these were entirely "platform position over land" (L) flags (Figure 33) that appear generally to have been applied when the vessel was in port (often reporting from the dock in Wellington, NZ) or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port.

For anyone interested in working with reprocessed, post-cruise data from the *Tangaroa*, you can access both flux and meteorological observations from the IMOS THREDDS server via http://thredds.aodn.org.au/thredds/catalog/IMOS/SOOP/SOOP-ASF/ZMFR_Tangaroa/catalog.html.

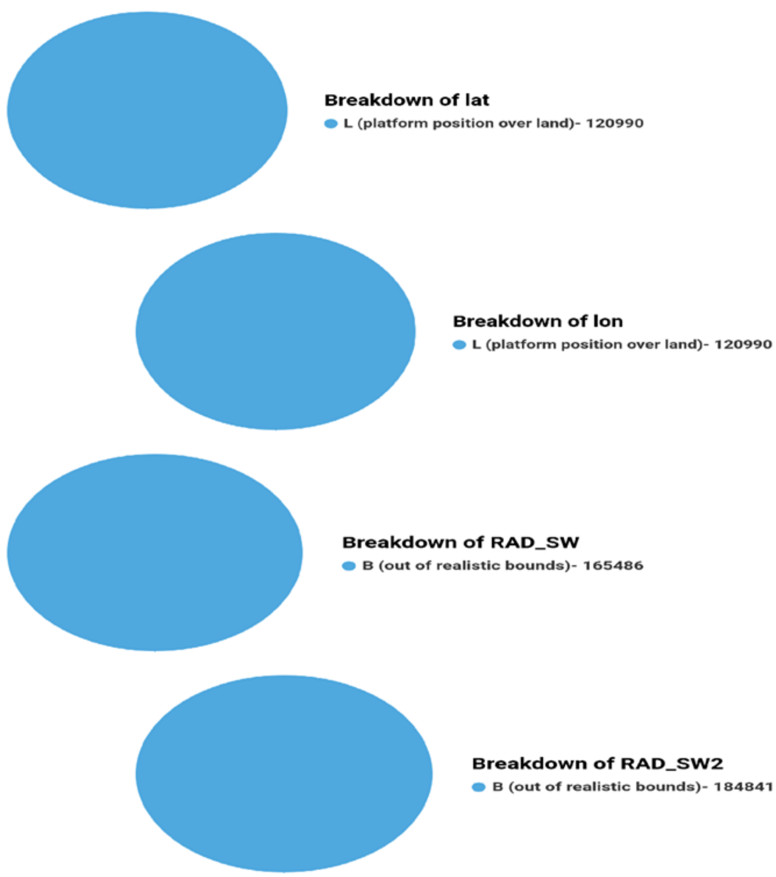
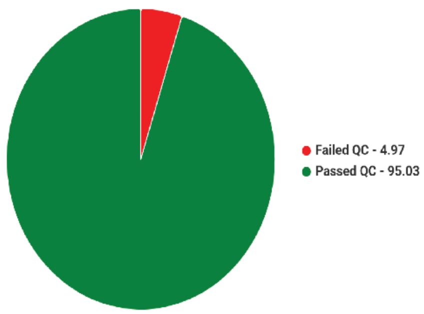


Figure 33: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) short wave radiation – RAD_SW – and (last) short wave radiation 2 – RAD_SW2 – for the *Tangaroa* in 2024.

Bell M. Shimada



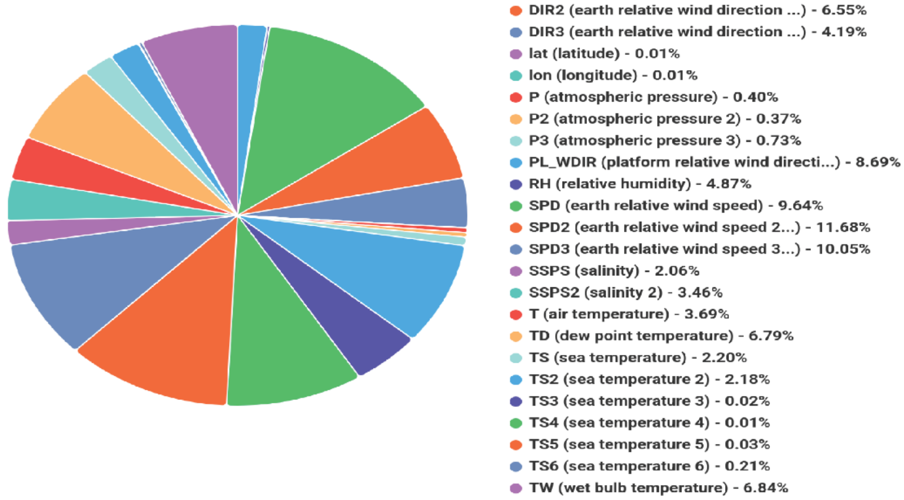


Figure 34: For the *Bell M. Shimada* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The Bell M. Shimada provided SAMOS data for 175 ship days, resulting in 9,002,908 distinct data values. After both automated and visual QC, 4.97% of the data were flagged using A-Y flags (Figure 34). This is about one and a half percentage points lower than in 2023 (6.6% total flagged) and brings Shimada just inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

At the onset of Shimada's 2024 field season, both the platform relative wind direction (PL_WDIR) and earth relative (i.e., calculated) wind direction (DIR) from the jack staff wind sensor appeared to show a constant ~180 degree offset as compared to the other two wind sensors, resulting in mainly "poor quality" (J) and "caution/suspect" (K) flags (Figure 36). We floated our suspicion the jack staff wind sensor had been reinstalled over the winter with the "zero" aka "north" mark facing backwards, i.e., towards the stern, although during extensive communications that ensued this stern-facing configuration was ultimately revealed to be the normal orientation for this sensor. At first, on or around 18 March, ship technicians attempted to address the issue by changing the jack staff wind sensor's "anemometer zero-line ref (deg)" metadata in their SCSv5 data logging system from "0" to "180," which would indicate a zero/north mark facing the stern. However, while this metadata change resulted in improved DIR data, the observed ~180 degree PL_WDIR offset was unaffected, and DIR additionally received a good amount of "failed the true wind recomputation" (E) flags (Figure 36). When transmission resumed in early May after a port period, PL_WDIR suddenly no longer appeared compromised but DIR was once again showing the ~180 degree offset. It was quickly determined a 180 degree offset had been programmed into the translator for the jack staff wind bird, and the "180" zero line ref still in SCSv5 metadata was now resulting in the true wind direction effectively being adjusted for orientation twice. At this point it became clear (in conjunction with another NOAA ship concurrently experiencing a very similar wind issue) that SCSv5 incorporates the zero line ref (deg) value in the true wind routine but does not use the value to adjust raw/relative wind direction. A day later, after sharing this revelation with the ship, the zero line ref for the jack staff sensor was updated again back to "0," and the issues with DIR and PL_WDIR were finally resolved. This episode highlights a bit of a conundrum, whereby SCSv5 can in some cases (like this one) force a choice between representative data values and accurate metadata.

In mid-August Shimada experienced an issue with the salinity data from their SBE 21 (SSPS2). As demonstrated in Figure 35, the salinity signal degraded to the point where, while values were still in roughly the right range, the overall trend resembled noise and did not capture the same variation (e.g., steps) seen in the SBE 21 conductivity, the SBE 45 conductivity/salinity, or all the sea various sea temperatures (all of which were in good agreement). This resulted in K flags on SSPS2 (Figure 35). When contacted about the issue, technicians first found and tightened a loose connection, although this did not immediately resolve the issue. The techs also voiced their suspicion that a recent computer system update may be at fault, as the update in question was known to have resulted in problems with data from their EK80. While the precise cause of the SSPS2 issue remains unclear, the signal returned to normal about a week later.

There were no other major issues noted for the Shimada in 2024. In general Shimada's various meteorological sensors are known (like most vessels) to exhibit some data distortion that is dependent on the vessel relative wind direction and, in the case of air temperature, likely ship heating. Where appropriate, these data are generally assigned K flags (not shown).

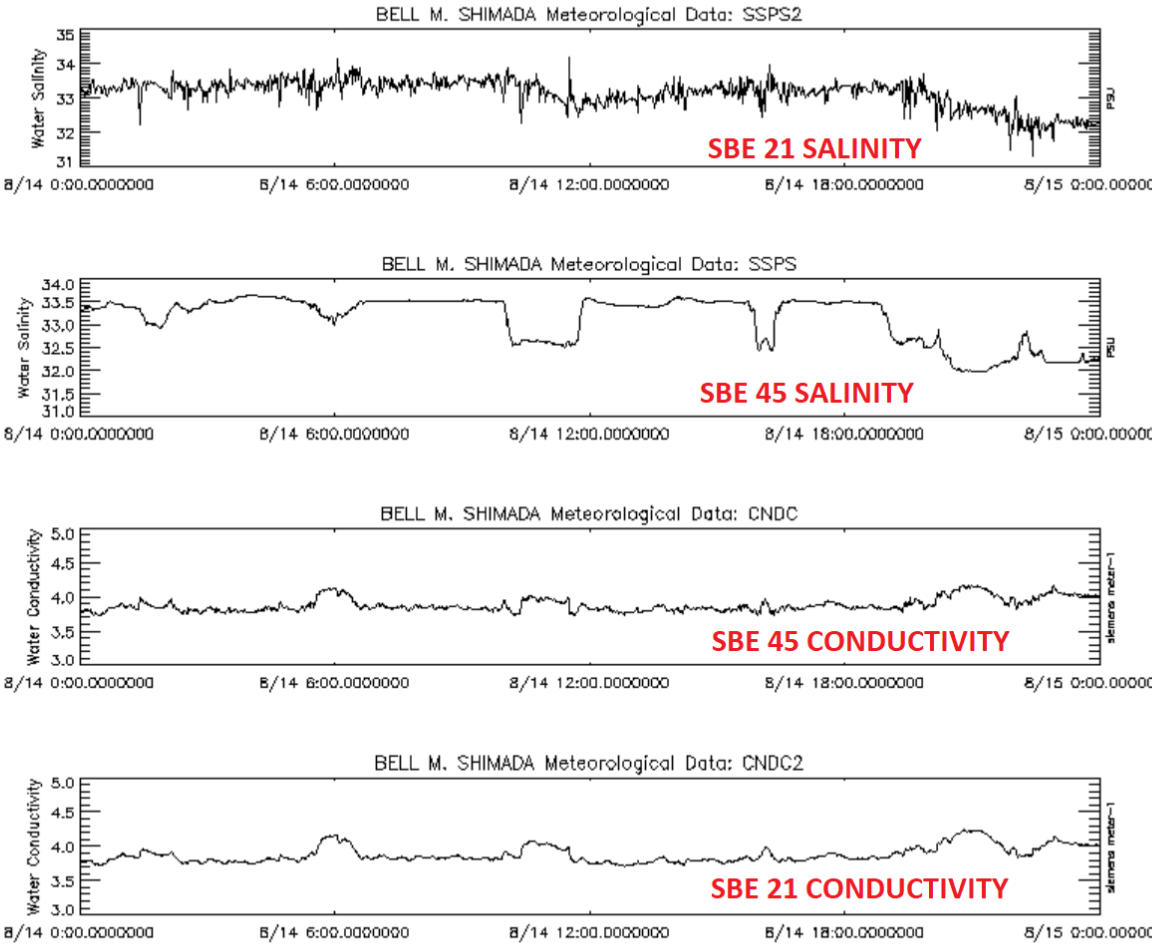


Figure 35: *Bell M. Shimada* SAMOS (first) salinity 2 – SSPS2 – (second) salinity – SSPS – (third) conductivity – CNDC – and (last) conductivity 2 – CNDC2 – data for 14 August 2024. Note poor agreement of SSP2 variability with the other salinity/conductivity variables.

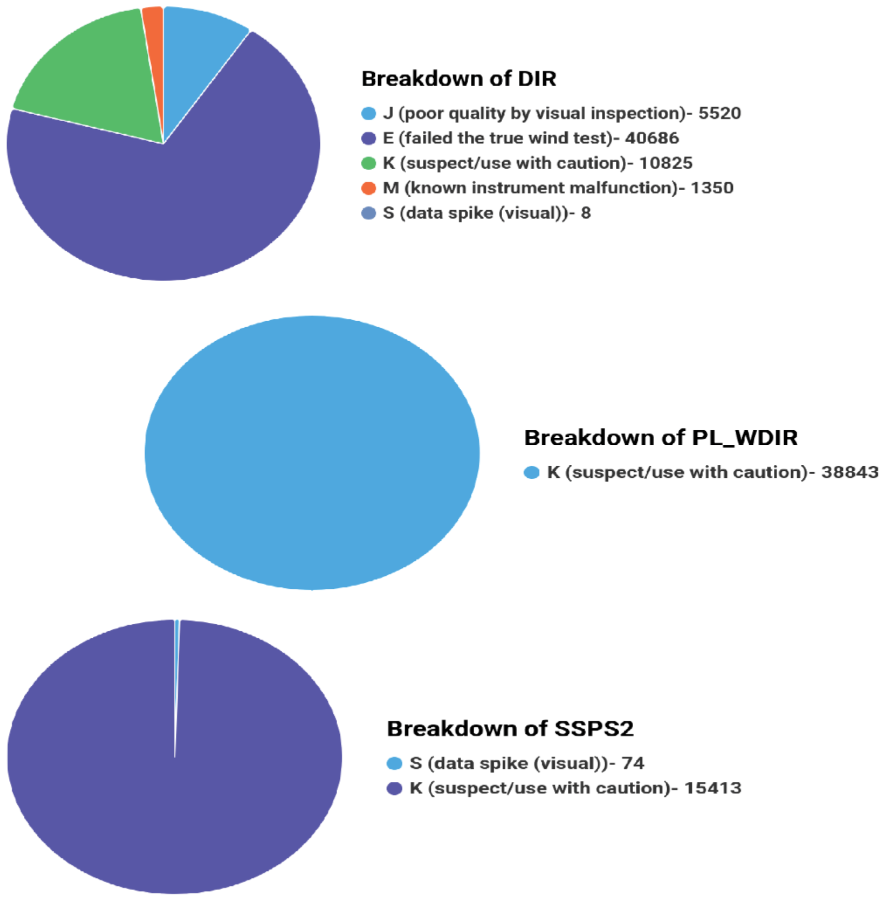
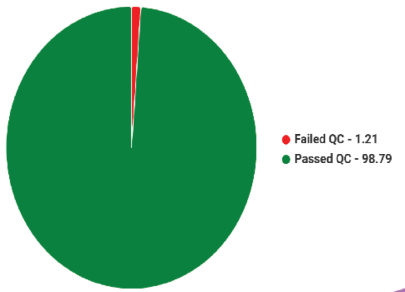


Figure 36: Distribution of SAMOS quality control flags for (top) earth relative wind direction – DIR – (middle) platform relative wind direction – PL_WDIR –and (bottom) salinity 2 – SSPS2 – for the *Bell M. Shimada* in 2024.

Fairweather



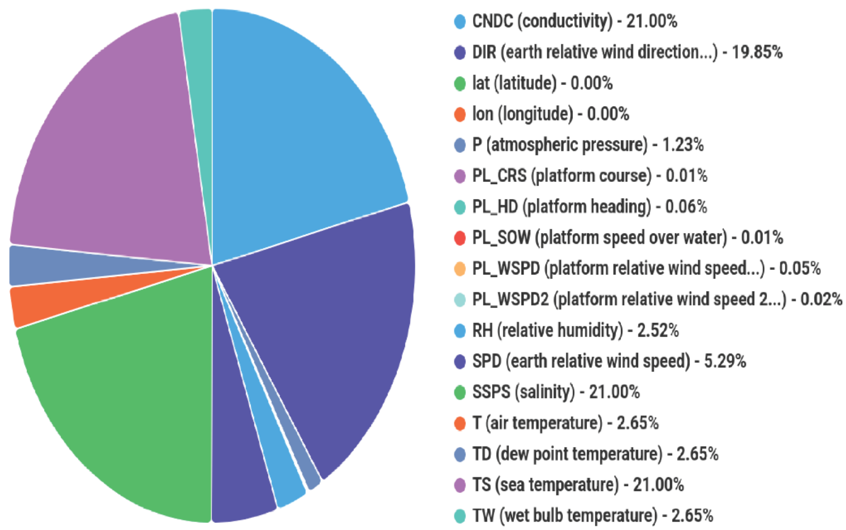


Figure 37: For the *Fairweather* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Fairweather* provided SAMOS data for 105 ship days, resulting in 2,160,266 distinct data values. After both automated and visual QC, 1.21% of the data were flagged using A-Y flags (Figure 37). This is a sizable departure from 2023, when the total flagged percentage was 9.61%, that brings *Fairweather* near the 1% total flagged cutoff regarded by SAMOS to represent "excellent" data.

Fairweather experienced a very curtailed 2024 field season, mainly due to a problem with the ship's rudder actuators that rendered the ship largely inoperable for much of the year, and in fact most of the data we received was transmitted late in the year while the vessel sat at the dock awaiting further repairs. The air temperature/humidity (T/RH) sensor was removed from service early in the transmitting period (in mid-August), meaning only limited T/RH and calculated wet bulb/dew point (TW/TD) data were received. Similarly, sea temperature (TS), salinity (SSPS), and conductivity (CNDC) saw only brief transmission in 2024, since the vessel was primarily in port. For the data we did receive in 2024, there were no issues noted, and with the low total flagged percentage there is not much use in analysing any variable flagged percentages shown in Figure 37.

Ferdinand Hassler

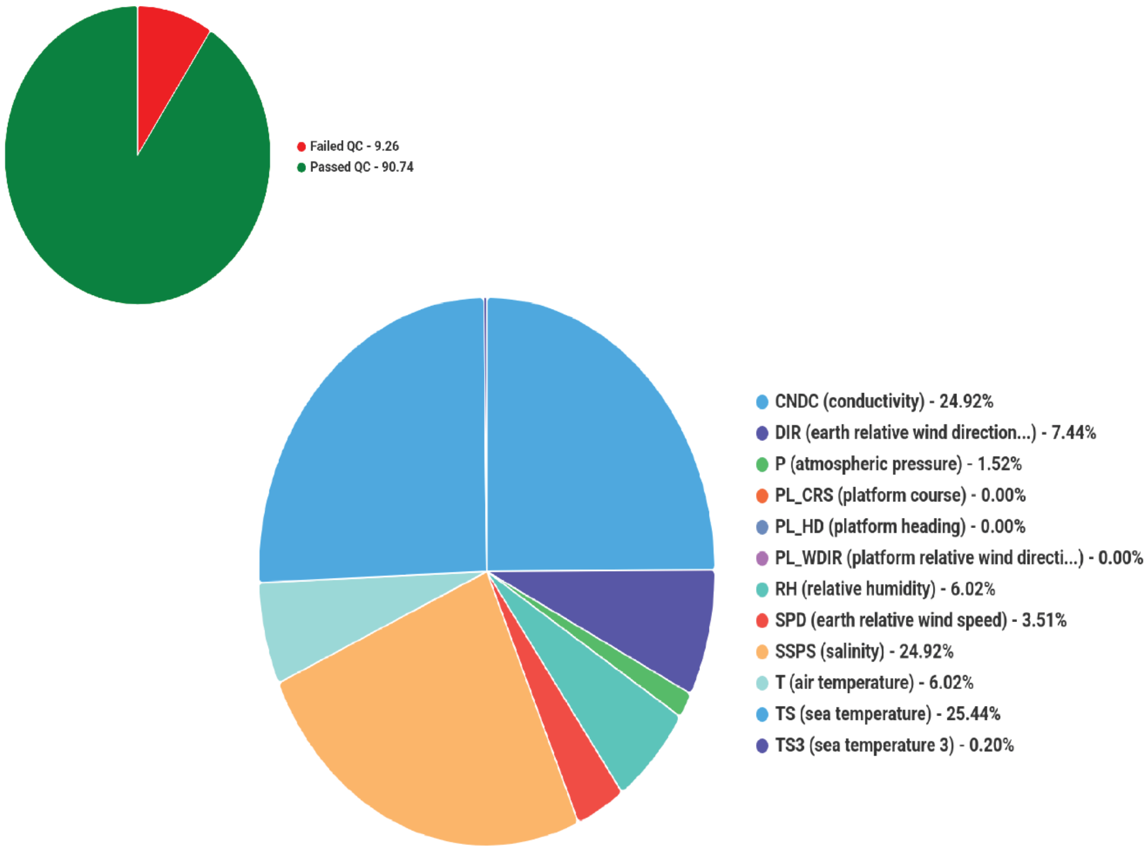


Figure 38: For the *Ferdinand Hassler* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Ferdinand Hassler* provided SAMOS data for 149 ship days, resulting in 2,986,389 distinct data values. After both automated and visual QC, 9.26% of the data were flagged using A-Y flags (Figure 38). This is several percentage points higher than in 2023 (3.45%) and pushes *Hassler* outside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

Back in 2022, for reasons unknown, *Hassler's* air temperature and relative humidity sensor (T and RH) continuously transmitted values that were well out of realistic bounds. This inconclusive issue continued in 2023 until 9 April of that year, when the raw feeds associated with T and RH were removed from *Hassler's* SCSv5 sensor configuration with a note about the sensors not sending the "correct data". On 11 June 2024, T and RH were re-enabled, but still with temperature values well out of range and relative humidity data that appeared suspicious, at best. We relayed this latest analysis to the ship technicians. They suspected the hookup and/or configuration of the sensor may be incorrect, and attempts were made to verify. However, these attempts did not appear to be successful, and with the sensor due to be replaced in 2025 (with a superior sensor, the Paroscientfic MET4A) T and RH were once again disabled from sending data, as of 24 June 2024. In the meantime, both T and RH received “malfunction” (M) flags (Figure 39).

Looking to the flag percentages in Figure 38, nearly three quarters of the total flags were assigned to the three sea parameters from *Hassler’s* thermosalinograph, meaning sea temperature (TS), salinity (SSPS), and conductivity (CNDC). In this case the flags were all “caution/suspect” (K) flags (Figure 39). While some of these would have been applied while the vessel was in port and flow to the sensors appeared restricted, many more were likely applied while the vessel was underway. We note *Hassler* had a longstanding history of not transmitting any oceanographic data to SAMOS, reportedly due to ongoing hardware issues. Beginning on 1 October 2024, TS, SSPS, and CNDC data transmission resumed after a yearslong hiatus. However, these data generally appear smoothed and frequently are unrepresentative of the environment. It was initially suspected it was common for the flow to the sensors to be restricted even while underway; however, the suspicion today is that the seawater intake for the thermosalinograph exists in the port canard space in between *Hassler’s* double hulls. This has yet to be confirmed, but, if true, it seems probable the underwater area between the two hulls experiences both heating from the ship directly above it and dynamic flow aberrations imposed by water channelling through the essentially walled-in space. Additionally, it is suspected the route the water takes from intake to thermosalinograph may be long and/or pass through significantly warmed areas of the ship (e.g., engine room). All of this would conceivably contribute to the odd/unrepresentative underway data routinely observed in TS/SSPS/CNDC.

In general, *Hassler’s* various meteorological sensors are known (like most vessels) to exhibit some data distortion that is dependent on the vessel relative wind direction. Where appropriate, these data are generally assigned K flags (not shown). This common issue is reflected in the flag percentages seen in Figure 38 for the earth relative wind speed and direction parameters (SPD and DIR) as well as the atmospheric pressure (P).

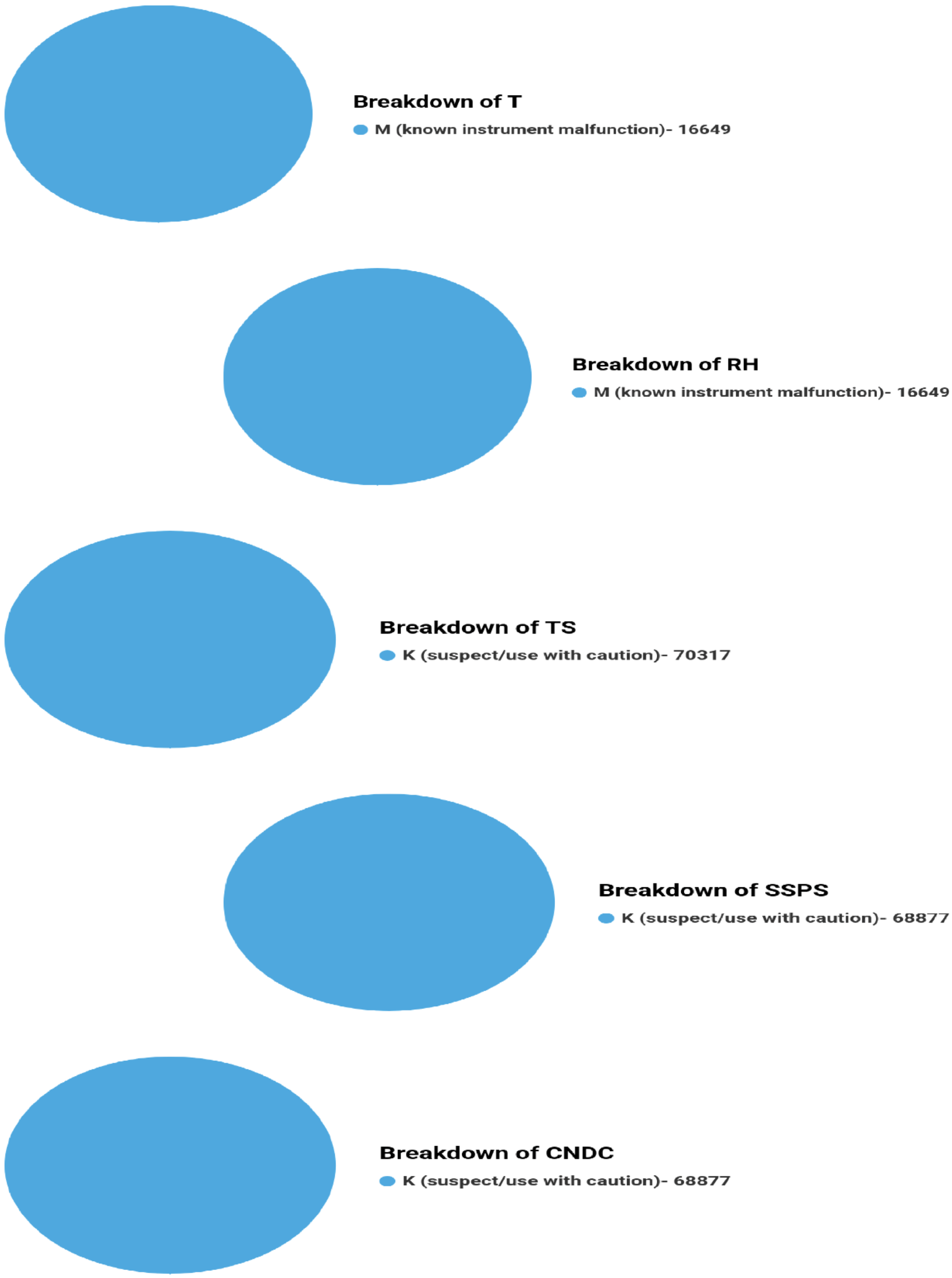


Figure 39: Distribution of SAMOS quality control flags for (first) air temperature – T – (second) relative humidity – RH – (third) sea temperature – TS – (fourth) salinity – SSPS – and (last) conductivity – CNDC – for the *Ferdinand Hassler* in 2024.

Gordon Gunter

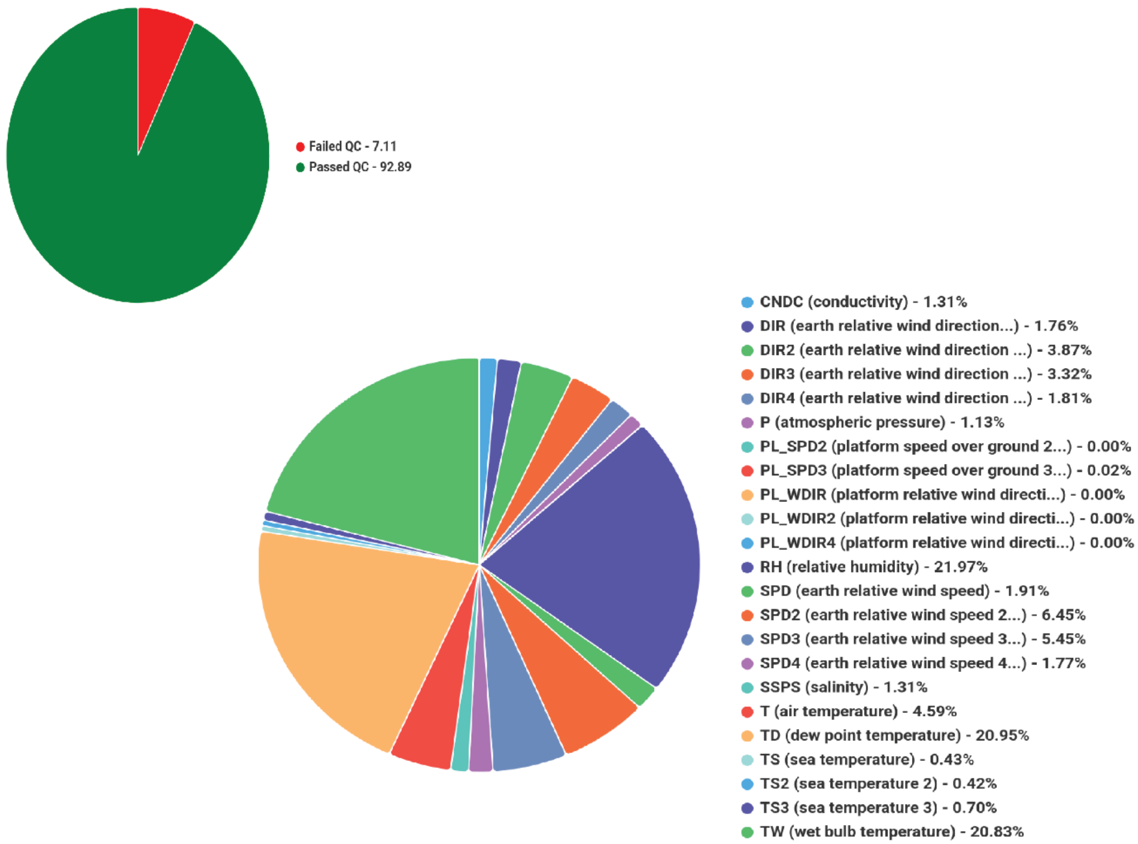


Figure 40: For the *Gordon Gunter* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Gordon Gunter* provided SAMOS data for 219 ship days, resulting in 11,243,700 distinct data values. After both automated and visual QC, 7.11% of the data were flagged using A-Y flags (Figure 40). This is only marginally higher than in 2023 (6.51%).

In a repeat of previous years, throughout the operating period *Gunter's* relative humidity data (RH) frequently displayed large, unrealistic swings (changes of 20-30% humidity over a few minutes) whenever the relative wind direction was from roughly starboard. Coincident response in the air temperature data (T) was generally muted or not observable. The ongoing suspicion has been that the RH disturbances are due to more than just localized heating (note, evident both day and night), although this has never been confirmed. Swings in RH and the calculated wet bulb and dew point temperatures (TW and TD) as well as any concurrent smaller bumps in T all received “caution/suspect” (K) flags (Figure 41, not all shown). We note this T/RH sensor is due to be supplanted by a Vaisala WXT536 all-in-one weather system and a (mechanically/dynamically superior) Paroscientific MET4A pressure/temp/humidity sensor in 2025. It is anticipated that the unrealistic swings observed in *Gunter's* relative humidity data will resolve once these new instruments are put into service.

Users should be advised that in 2023, at the request of the Voluntary Observing Ship Program (VOS), a +3 mb offset was added to the atmospheric pressure (P) parameter to provide a mean sea level pressure that would correlate well with model projections. We note that this type of model bias correction is an estimate at best. Further, such a provisional QC of the pressure can prove problematic down the road, e.g., a sensor is replaced, or sensor height is changed but the bias correction is not adjusted, a second correction is mistakenly added on top of the first, etc. Case in point, after a sensor replacement in June 2024, there is some indication the +3 mb offset value may no longer be appropriate. As a result, P is sometimes assigned K flags (Figure 41). Additionally, a brief sensor failure characterized by ~500 mb pressure readings preceded the June sensor replacement, and P received one day's worth of "out of bounds" (B) flags (Figure 41). When considering the needs of the scientific user community at large, we note it is generally more desirable to supply unadjusted pressure and confirm and record the height of the barometer. It is then the option of the data user to adjust the pressure to his or her preferred height and by his or her preferred adjustment method. However, we recognize and accept this pressure "offset" method as a VOS standard practice.

There are no other issues of note for *Gunter* in 2024. Looking to the flag percentages in Figure 40, a combined ~26% of the total flags was assigned to all eight true wind direction and speed parameters (DIR, SPD, DIR2, SPD2, DIR3, SPD3, DIR4, SPD4). All four of *Gunter's* wind sensors are known (like most vessels) to exhibit some data distortion that is dependent on the vessel relative wind direction. Where appropriate, these data are generally assigned K flags (Figure 41, not all shown).

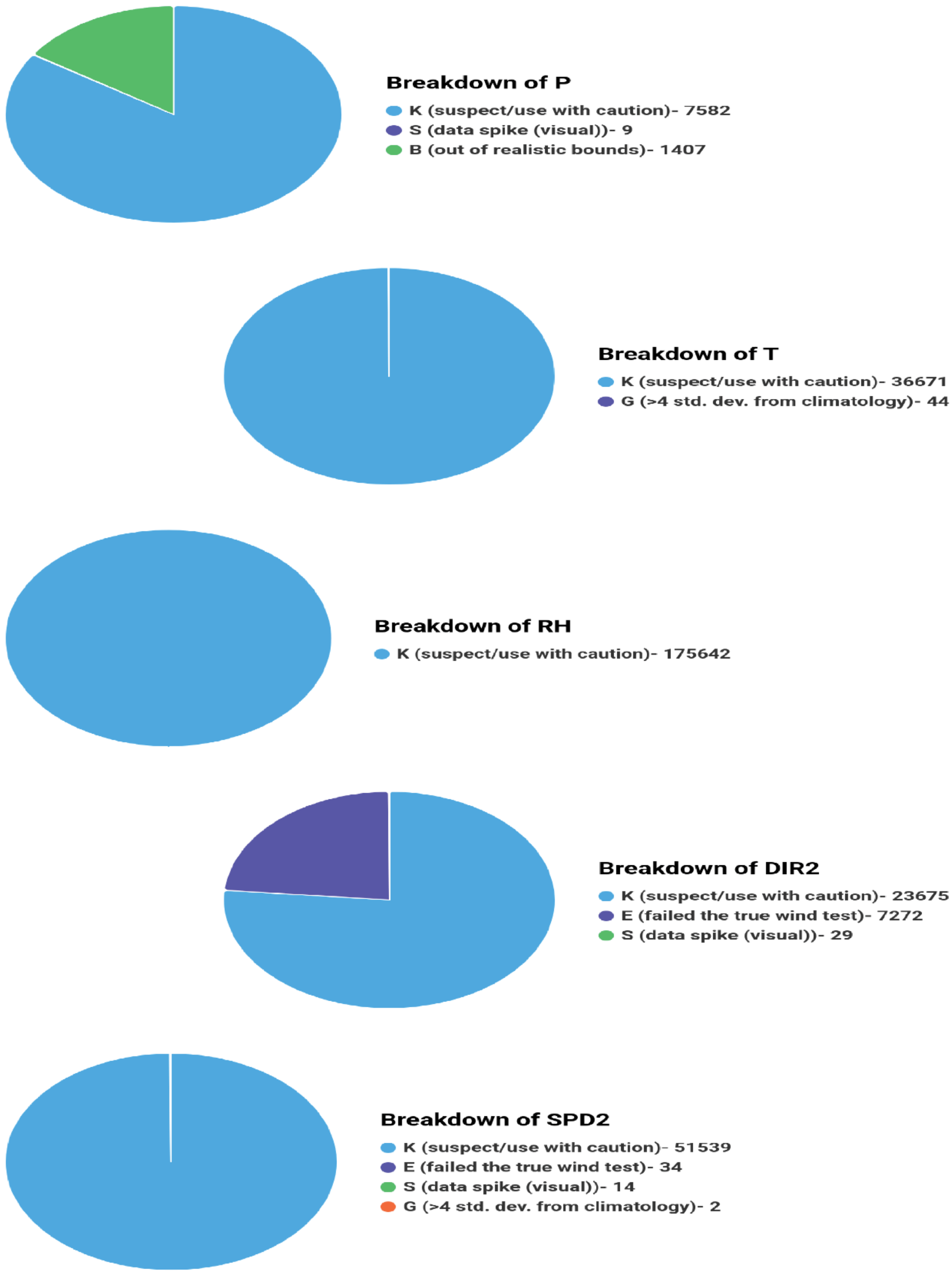


Figure 41: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) air temperature – T – (third) relative humidity – RH – (fourth) earth relative wind direction 2 – DIR2 – and (last) earth relative wind speed 2 – SPD2 – for the *Gordon Gunter* in 2024.

Henry B. Bigelow

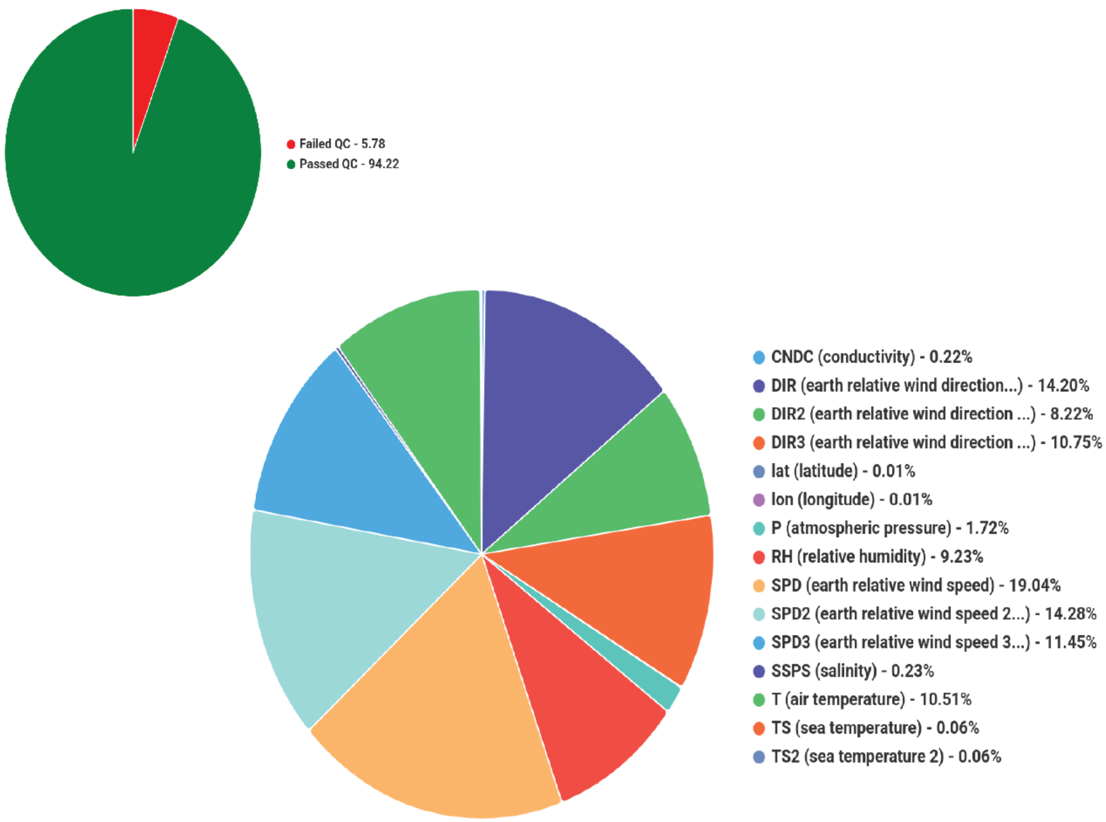


Figure 42: For the *Henry B. Bigelow* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Henry Bigelow* provided SAMOS data for 185 ship days, resulting in 6,545,647 distinct data values. After both automated and visual QC, 5.78% of the data were flagged using A-Y flags (Figure 42). This is about the same as in 2023 (5.12%) and keeps *Bigelow* very near the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

There were no issues of note for the *Bigelow* in 2024. In general *Bigelow's* various meteorological sensors, especially all three wind sensors, are known (like most vessels) to exhibit some data distortion that is dependent on the vessel relative wind direction and, in the case of air temperature and humidity (and by extension the calculated wet bulb and dew point temperatures), likely ship heating. Where the data appear affected, they are generally assigned “caution/suspect” K flags (Figure 43, not all shown). Like the other NOAA vessels, *Bigelow* is due to receive sensor upgrades in 2025/26, namely a Vaisala WXT536 all-in-one weather station and a Paroscientific MET4A pressure/temp/humidity sensor. It is guessed SAMOS will be invited to participate in the decision-making process about where to install these new sensors, and we hope some of the flow issues noted above will be able to be mitigated by securing new or modified locations on the ship (always a tough undertaking on a technologically busy vessel, though!) We note the most affected sensors, the standalone anemometers, are not expected to be upgraded until at least 2026.

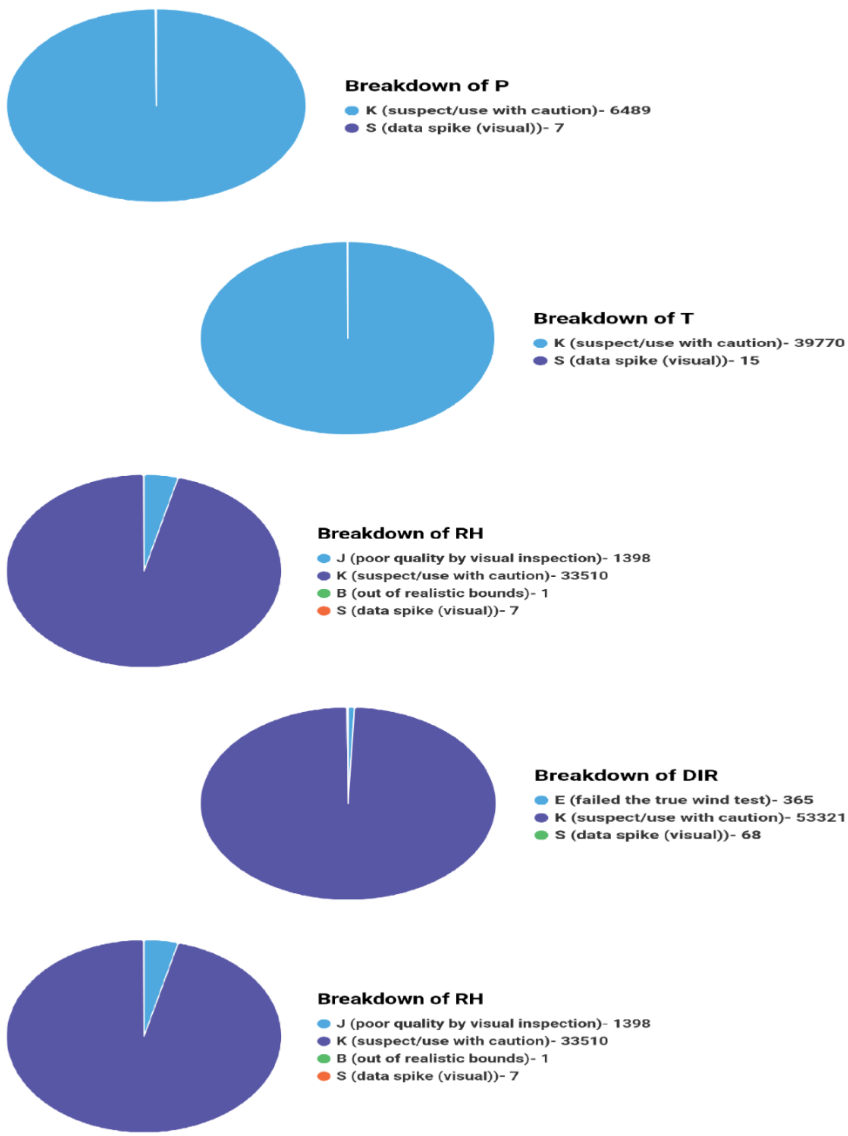
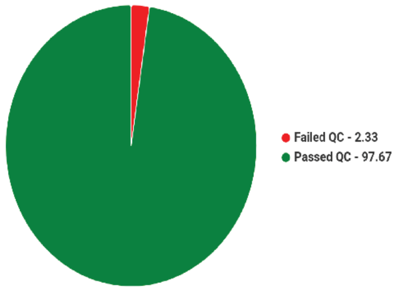


Figure 43: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) air temperature – T – (third) relative humidity – RH – (fourth) earth relative wind direction – DIR – and (last) earth relative wind speed –SPD – for the *Henry B. Bigelow* in 2024.

Nancy Foster



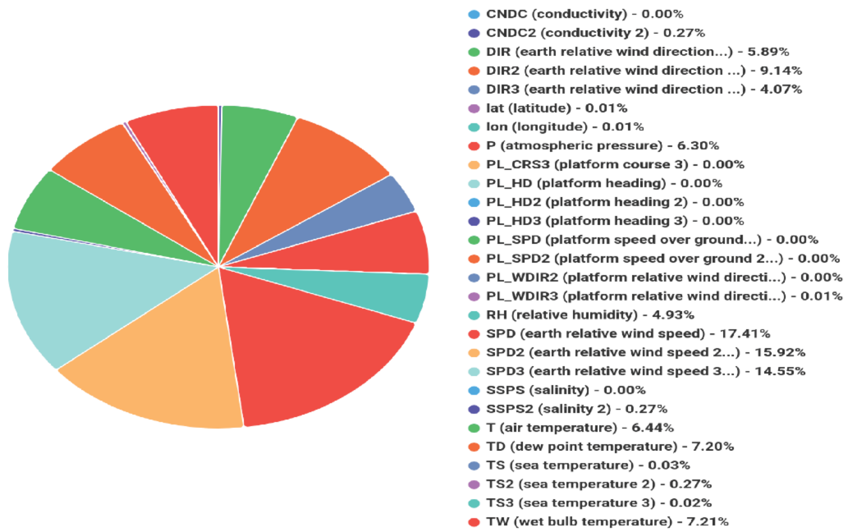
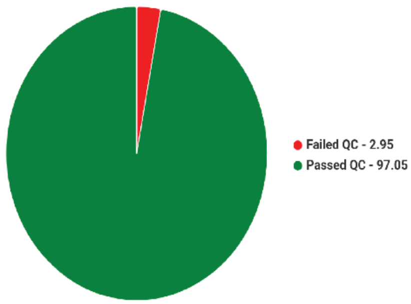


Figure 44: For the *Nancy Foster* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nancy Foster* provided SAMOS data for 243 ship days, resulting in 11,690,175 distinct data values. After both automated and visual QC, 2.33% of the data were flagged using A-Y flags (Figure 44). This is about a percentage point and a half higher than in 2023 (0.91%) but maintains *Foster's* standing well inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

There were no specific issues of note for the *Nancy Foster* in 2024. Like most vessels, the *Foster's* various meteorological sensors are sometimes subject to flow distortion that is dependent on the vessel relative wind direction, as well as possible heating imparted on the air temperature and humidity sensor (and by extension the calculated wet bulb and dew point temperatures) either from the stacks or from the ship itself when the relative flow at the sensor is near zero. These effects on the sensors are, however, notably smaller on the *Foster* than on many other vessels, suggesting their sensors' exposure to the free atmosphere is generally less obstructed than is common on research ships. Where appropriate, affected data are generally assigned "caution/suspect" (K) flags (not shown).

Okeanos Explorer



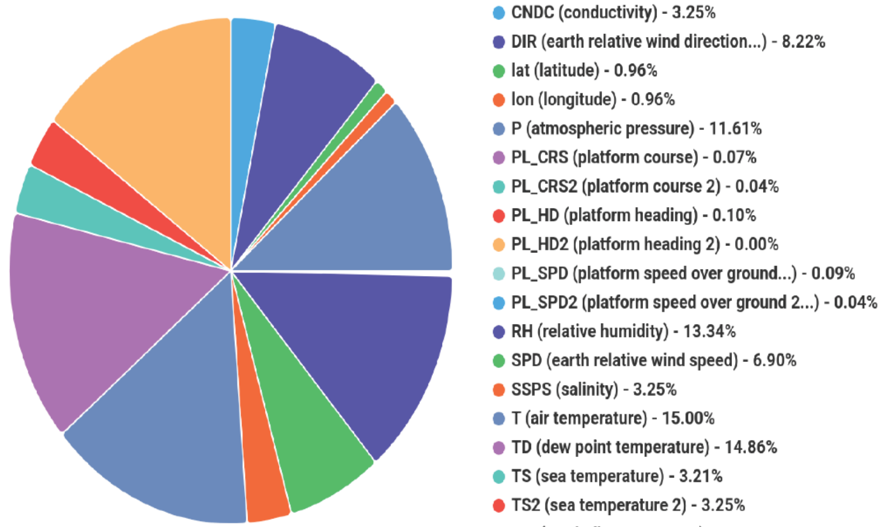


Figure 45: For the *Okeanos Explorer* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Okeanos Explorer* provided SAMOS data for 177 ship days, resulting in 5,582,286 distinct data values. After both automated and visual QC, 2.95% of the data were flagged using A-Y flags (Figure 45). This is about one and a quarter percentage points higher than in 2023 (0.69%) but maintains *Explorer's* standing well inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

In the second half of the year *Explorer* suffered several disruptive (yet relatively short-lived) events wherein their POS/MV system experienced a non-linear "position drift" (i.e., erroneous values) and/or data dropouts (see Figure 46). Much of this activity effectively washed out in the SAMOS averaging. But over the course of the roughly mid-August through early October period there was some associated, sporadic flagging of the POS/MV parameters as well as the true winds, the calculation of which tie back to the POS/MV. Specifically, affected latitude and longitude (LAT and LON) were variously assigned "platform velocity unrealistic" (F) and "platform position over land" (L) by autoQC and "position/movement uncertain" (P) during visualQC (based on communications with the ship), while affected platform heading (PL_HD), platform course (PL_CRS), platform speed over ground (PL_SPD) and the earth relative wind direction and speed (DIR and SPD) saw mainly "caution/suspect" (K), "poor quality" (J), and "spike" (S) flags applied during visual QC (Figure 47, not all shown). Ship technicians were in touch with Applanix (manufacturer of the POS/MV system) throughout, providing them with files, screen shots, conditions, and troubleshooting steps. Additionally, it came to light in October that several other NOAA vessels were experiencing similar disruptions in their POS/MV data, albeit none so disruptive as what was occurring on *Explorer*. No definitive diagnosis by Applanix is known to have been reached, however. We do know in early August an issue with time servers arose on several NOAA vessels as the result of a (non-SCS) software patch, which saw the SCS-A and SCS-B computers on affected vessels grow increasingly out of sync (on the order of a few minutes, at most). We are not aware that any connection was made to the POS/MV accuracy drifts/dropouts but given the timing of the time sync issues and the apparent onset of POS/MV issues, some connection seems at least remotely possible. (We note because of the way time stamps for SAMOS are transferred between the two servers, time sync issues did not ordinarily filter down into the SAMOS data records, unless the *Explorer's* POS/MV accuracy drifts/dropouts were in fact related.)

There were no other issues of note for the *Okeanos Explorer* in 2024. In general, like most vessels, the *Explorer's* various meteorological sensors are sometimes subject to flow distortion that is dependent on the vessel relative wind direction, as well as possible heating imparted on the air temperature and humidity (T and RH) sensor (and by extension the calculated wet bulb and dew point temperatures, TW and TD) either from the stacks or from the ship itself when the relative flow at the sensor is near zero. But these effects on the sensors are relatively minor, as evidenced by the low overall flagged percentage. Where appropriate, affected data are usually assigned "caution/suspect" (K) flags (not shown).

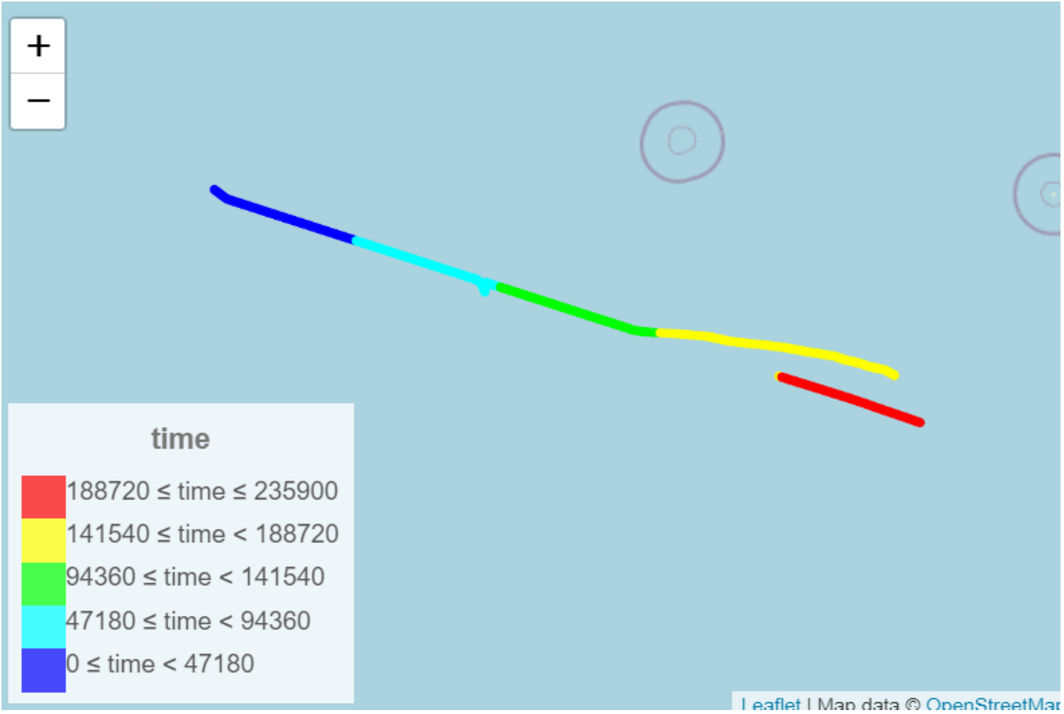


Figure 46: SAMOS latitude and longitude (ship track) data for *Okeanos Explorer* on 8 August, 2024 plotted on a map. Note large position drift observed in the yellow track segment (approximately 0943 through 1415 UTC), terminating in a discontinuous jump back to the actual track (leading into the red track segment).

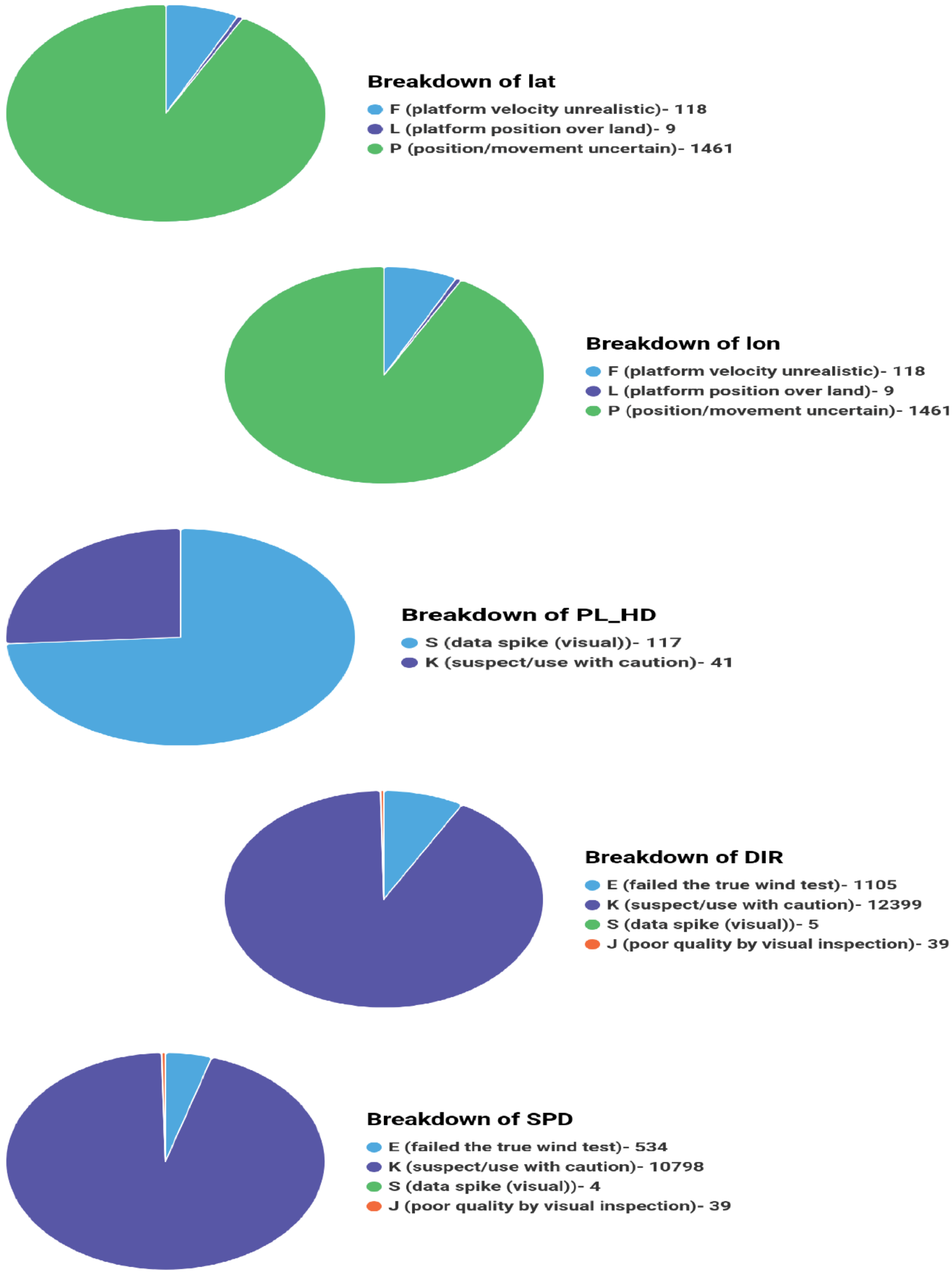


Figure 47: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) platform heading – PL_HD – (fourth) earth relative wind direction – DIR – and (last) earth relative wind speed –SPD – for the *Okeanos Explorer* in 2024.

Oregon II

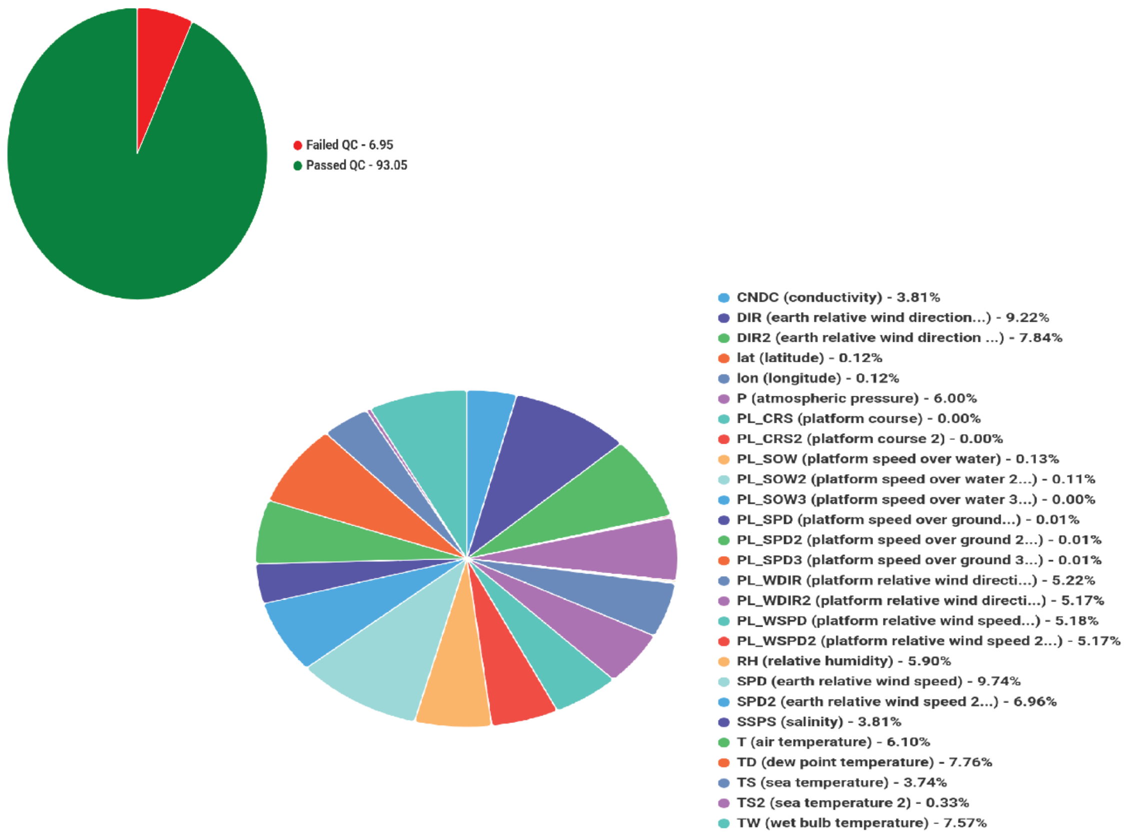


Figure 48: For the *Oregon II* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oregon II* provided SAMOS data for 222 ship days, resulting in 8,267,881 distinct data values. After both automated and visual QC, 6.95% of the data were flagged using A-Y flags (Figure 48). This is almost four percentage points higher than in 2023 (3.05%) and moves *Oregon II* outside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

Oregon II experienced a few brief data upsets in 2024. First, their relative humidity (RH) mysteriously dropped to near 0% for about a 24-hour period over 3-4 June, resulting in some “poor quality” (J) flags (Figure 49). By extension, calculated wet bulb and dew point temperatures (TW and TD) were also unrealistic during this period, resulting in mainly “failed the T>=Tw>=Td test” (D) flags (Figure 49, only TD shown). The sensor apparently self-resolved, although technicians were not initially aware it had resolved, and they attempted to swap out the sensor with their spare on 5 June. The spare sensor, ironically, was discovered to be bad and was very quickly removed from service. During the time RH was being serviced (from ~2000 - ~2100 UTC on 5 June), all sensors connected through *Oregon II's* metstation briefly reported unrealistic values, resulting in some additional J and "out of bounds" (B) flagging of RH, TW, and TD, as well as the air temperature (T), and atmospheric pressure (P) (Figure 49, not all shown).

The second issue involved the true wind direction and speed parameters from both the port and starboard anemometers (DIR, SPD, DIR2, SPD2). From about 2200 UTC on 22 October through about 1500 UTC on 25 October these true wind parameters suddenly exhibited unrealistic steps precisely mirroring changes in the platform speed and heading, which themselves did not look suspicious (nor did the relative winds associated with DIR/DIR2/SPD/SPD2). No cause for the aberrant true winds was apparent. When contacted, the electronics technician noted they had lost their UPS a couple hours before 2200 UTC on 22 October, and he wondered whether mostly "dirty" power could have caused the steps (more precisely, whether voltage interruptions might somehow cause "bad" true wind calculations in SCSv5). It's not known whether this is a viable theory. In any case, around the time of his reply the issue appeared to have self-resolved. DIR/DIR2/SPD/SPD2 data in the noted period were assigned K and/or J flags (Figure 49, not all shown).

Lastly, at the end of the field season (beginning around 1630 UTC 20241126), while *Oregon II* was tied up in her home port of Pascagoula, MS, the port and starboard DIR, SPD, DIR2, and SPD2, as well as the relative winds from these sensors (PL_WDIR, PL_WSPD, PL_WDIR2, PL_WSPD2) were essentially flat lined. We suspected the sensors had been removed for over winter servicing and the wired connection(s) may nevertheless have been continuing to report stray voltages. We raised this suspicion with the ship and suggested they terminate SAMOS transmission if they were wrapping for the season, and about three weeks later transmission ceased. During the noted period, all true and relative winds were assigned J flags (Figure 49, not all shown).

There were no other issues noted for the *Oregon II* in 2024. As a general note, air temperature (T), relative humidity (RH), calculated dew point and wet bulb temperatures (TD and TW, respectively), DIR/DIR2, SPD/SPD2, and atmospheric pressure (P) on the *Oregon* all occasionally suffer the myriad effects of less-than-ideal sensor placement (e.g., flow distortion, stack exhaust contamination, ship heating), which usually results in "caution/suspect" (K) flags for each of those parameters (Figure 49, not all shown). Assumed localized ship heating is particularly evident in T, TD, TW, and RH on sunny days when the relative wind is from broadly port to astern. All these effects are common among sea-faring vessels, where instrument siting can be tricky. As of 2025, with the addition of a new Vaisala WXT536 all-in-one weather station and a Paroscientific MET4A air temperature/humidity/pressure sensor, better exposures for these instruments on the vessel are being explored.

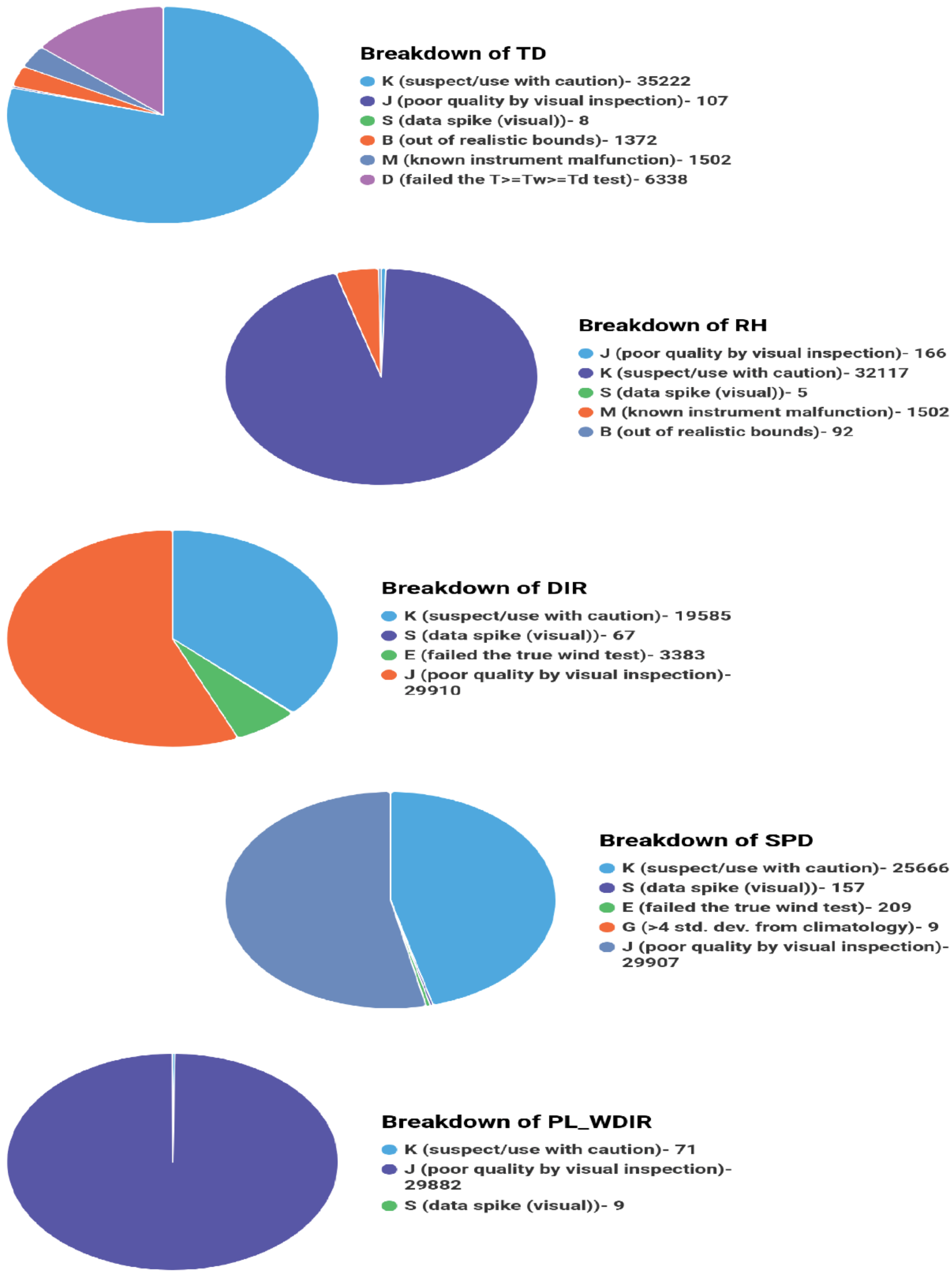
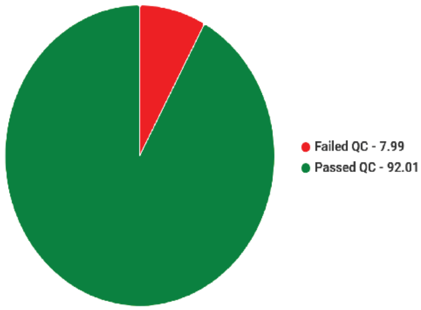


Figure 49: Distribution of SAMOS quality control flags for (first) dew point temperature –TD – (second) relative humidity – RH – (third) earth relative wind direction – DIR – (fourth) earth relative wind speed – SPD – and (last) platform relative wind direction – PL_WDIR – for the *Oregon II* in 2024.

Oscar Dyson



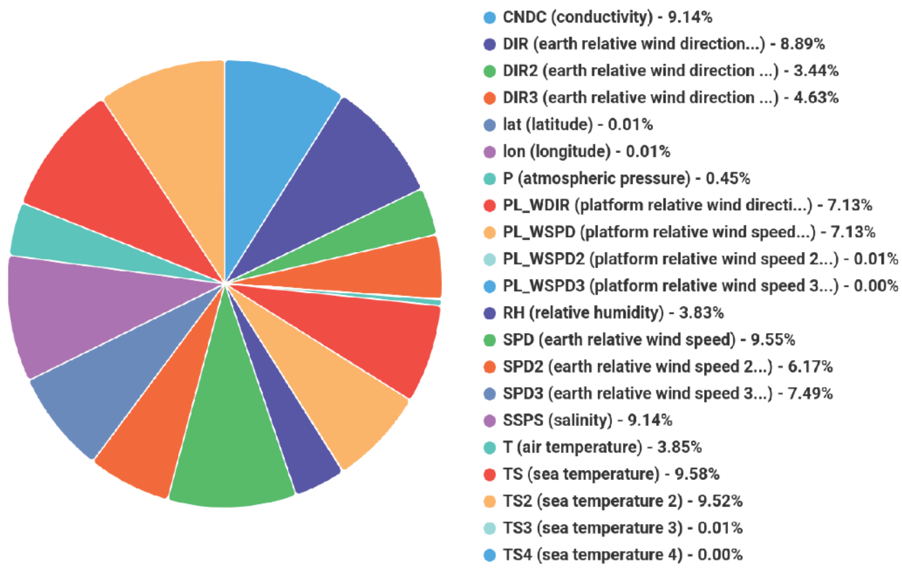


Figure 50: For the *Oscar Dyson* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Dyson* provided SAMOS data for 197 ship days, resulting in 7,669,238 distinct data values. After both automated and visual QC, 7.99% of the data were flagged using A-Y flags (Figure 50). This is about four percentage points higher than in 2023 (3.77%) and bumps *Dyson* outside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

Dyson's 2023/2024 overwinter period had some unfortunate impacts that meant a troubled start to her data collection capabilities when the 2024 field season began. In the first place, the ship had been upgraded to SCSv5, but the Chief Survey technician had not yet received any SCSv5 training, a significant shortcoming given how differently the SCSv4.9 and SCSv5 platforms operate. In the second place, many of *Dyson's* sensors came out of shipyard either losing their signals or failing completely, and some others were missing entirely. A freshly calibrated and reinstalled air temperature and humidity sensor was reporting in excess of 200 degrees Celsius, the POS/MV feed going into SCS was lost owing to a network issue, the RM Young 85004 ultrasonic wind sensors kept blowing a breaker, the analog wind bird on the forward mast was putting out bad data, and the ship was still awaiting delivery of two new barometers, meaning none was onboard. (Additionally, the shortwave atmospheric radiation sensor was irreparably damaged in the yard and would not be replaced in 2024.) With all these issues ongoing and the Chief Technician struggling to learn SCSv5 alongside troubleshooting sensors and connections (plus going in and out of port), the decision was made to delay operational SAMOS processing of *Dyson's* data for a couple of weeks to give them time to sort things out. SAMOS transmission was officially reestablished on 24 January, by which time the issues with the POS/MV (lat, lon, PL_HD, PL_CRS, PL_SPD) and the ultrasonic anemometers (DIR2, PL_WDIR2, SPD2, PL_WSPD2, DIR3, PL_WDIR3, SPD3, PL_WSPD3) had been largely ironed out, although the data from the forward anemometer (DIR, PL_WDIR, SPD, PL_WSPD) continued to struggle and were thus flagged with "malfunction" (M) flags (DIR, PL_WDIR, SPD) or "caution/suspect" (K) flags (PL_WSPD) (Figure 51, not all shown) for a few days until they were disabled on 28 January. Air temperature and humidity (T and RH) and pressure (P) were still missing, however, pending delivery and setup of a new translator box. On 3 February the T and RH feeds along with the forward wind feeds were reestablished, although the data values for all were still obviously bad/well out of range, and so M flagging ensued/continued for all of these (Figure 51, not all shown). P was also reestablished on this date, with good data flowing to SCS and SAMOS. Around 18 February T and RH began sending good data as well, but the wiring for the forward wind bird still needed work (thus flagging continued for this sensor only). Finally, around 11 March the forward wind feeds settled out, and technicians reported the issue had been incorrect wiring reassembly by the folks who had put the anemometer circuit back together in shipyard. Extra special thanks to the *Dyson* crew for all their recovery efforts during a particularly bumpy (and busy) 2024 field season start!

The only other issue of note for *Dyson* in 2024 was the discovery in early July that at sparse, odd intervals the port ultrasonic anemometer will inexplicably throw out several minutes of bad/garbled data lines, with the raw wind direction showing a value that does not agree at all with the two ultrasonics and the raw wind speed usually showing a value that looks more like a direction (e.g., 360). By 2025 the same or a very similar issue is known to be occurring in all three anemometers' data streams, as well as the three hull temperature sensors, although still very infrequently. It is not definitively known what causes the bad data lines – there is some suspicion it originates somehow with SCS, given the issue was never present before the upgrade to v5, but there is nothing specific pointing in that direction at this time (more of a gut feeling from the ship). As sporadic as the issue is, it is even more rare for the effects to trickle down to the SAMOS averaged data. But on these very isolated occasions, the affected SAMOS variables are generally flagged with "spike" (S) or potentially J flags (not shown).

Looking at the flag percentage in Figure 50, almost 40% of the total flags were assigned to the Sea-Bird SBE38 sea temperature (TS2) and the sea temperature, salinity, and conductivity from the Sea-Bird SBE45 (TS, SSPS, and CNDC). Upon inspection, these were mainly K flags (Figure 51, only TS shown) applied when flow to the sensors appeared to be restricted, such as occurs when the vessel is in port or in choppy/murky waters (a common practice on many vessels). In general, *Dyson's* two ultrasonic anemometers are known to occasionally experience discrete periods of unrealistic spikes or steps in the data, which typically results in application of S, J, or "out of bounds" (B) flags. Sometimes M flags are used if the episode is extreme and/or verbally confirmed by the survey technicians (not shown). It has long been suspected the cabling – which is hard to come by – is a distinct issue with these sensors. Additionally, *Dyson's* various meteorological sensors do occasionally exhibit data distortion that is dependent on the vessel relative wind direction and/or stack exhaust contamination and/or, in the case of air temperature (T) and relative humidity (RH), likely ship heating (all common to most vessels). Where any of the meteorological data appears affected by flow distortion, exhaust, or ship heating, they are typically assigned K flags (Figure 51, not all shown).

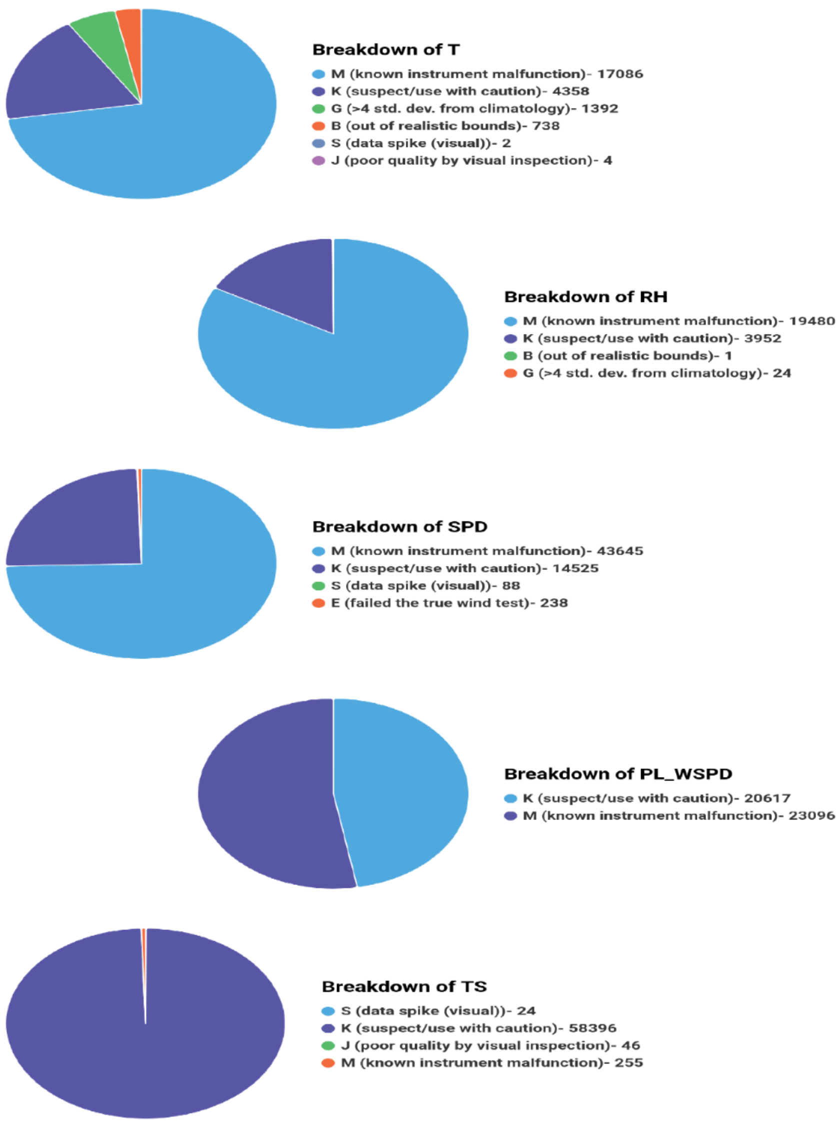
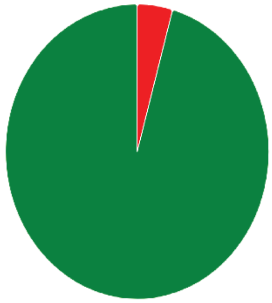


Figure 51: Distribution of SAMOS quality control flags for (first) air temperature – T – (second) relative humidity – RH – (third) earth relative wind speed – SPD – (fourth) platform relative wind speed – PL_WSPD – and (last) sea temperature – TS – for the *Oscar Dyson* in 2024.

Oscar Elton Sette



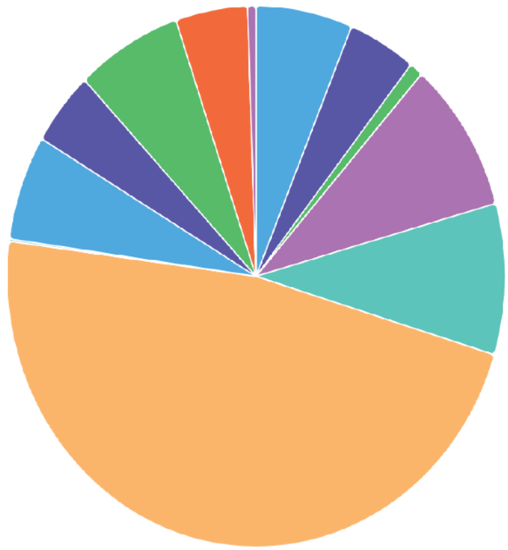


Figure 52: For the *Oscar Elton Sette* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Oscar Elton Sette* provided SAMOS data for 182 ship days, resulting in 5,334,588 distinct data values. After both automated and visual QC, 4.34% of the data were flagged using A-Y flags (Figure 52). This is about two and a half percentage points lower than in 2023 (6.81%) and brings *Sette* inside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

For much of the 2024 field season, *Sette's* relative humidity sensor data (RH) was stuck in an unrealistically narrow range (high 80s to low 90s %), leading to the majority of RH in 2024 receiving primarily “poor quality” (J) and some “caution/suspect” (K) flags (Figure 53). Interestingly, there were also a lot of missing/special values in RH as well as in the air temperature (T) and the true and relative wind directions and speeds (DIR, PL_WDIR, SPD, PL_WSPD), all which feed into SCS via the same translator box. There were multiple communications with the vessel about these issues over the year, but with no spare sensor onboard and no one with the necessary fall certification ever onboard anyway to access the sensor (no permanent tech onboard, even, until just before the season wrapped in October) the issues went unresolved in 2024. It was suspected the sensor had probably gone bad and was somehow additionally corrupting the rest of the feeds through the translator. However, in 2025 it was finally determined the RH serial connections had been wired incorrectly all along (now resolved). The missing/special values often seen in T, DIR, PL_WDIR, SPD, and PL_WSPD have also been resolved in 2025, although the jury is still out whether those traced back in some way to the miswired RH (seems likely, though).

Beginning around 24 August, frequent data gaps began appearing in the Sea-Bird SBE21 sea temperature (TS2), salinity (SSPS2), and conductivity (CNDC2). The ship was contacted about the issue but there was no response initially. When prompted again about a month later, technicians reported there had been a lot of recent troubleshooting of the thermosalinographs and that, separately, a leak in the scientific seawater system had been discovered on 30 September. Both thermosalinograph data streams were then briefly suspended, with the expectation everything should be fixed once logging resumed after the leak repair. Thermosalinograph logging restarted on 12 October, however SSPS2 and CNDC2 values were all suspected of being too high (by ~7 PSU and ~1 S/m, respectively). Both variables received mainly K flags (Figure 53) as a result. (TS2 was also suspected of possibly being a little high, but as the suspected bias was small, ~0.2° C, these data were mainly left unflagged.) The ship was contacted again, and technicians confirmed the issue, relaying that no cause had been found, but that the SBE21 was going in for calibrations shortly anyway. After 19 October all thermosalinograph data transmission ceased for the year, with the field season (and all SAMOS transmission) concluding about two weeks later.

There were no other major issues noted for the *Sette* in 2024. In general, *Sette's* air temperature (T) and the station pressure and associated surface-adjusted pressure (P and P2) do exhibit some data distortion that is dependent on the vessel relative wind direction and/or stack exhaust contamination (common to many vessels), particularly when the relative flow over the ship is from the stern. Where any of these data appear affected by flow distortion (P and P2) or exhaust (T) they are typically assigned K flags (Figure 53, not all shown).

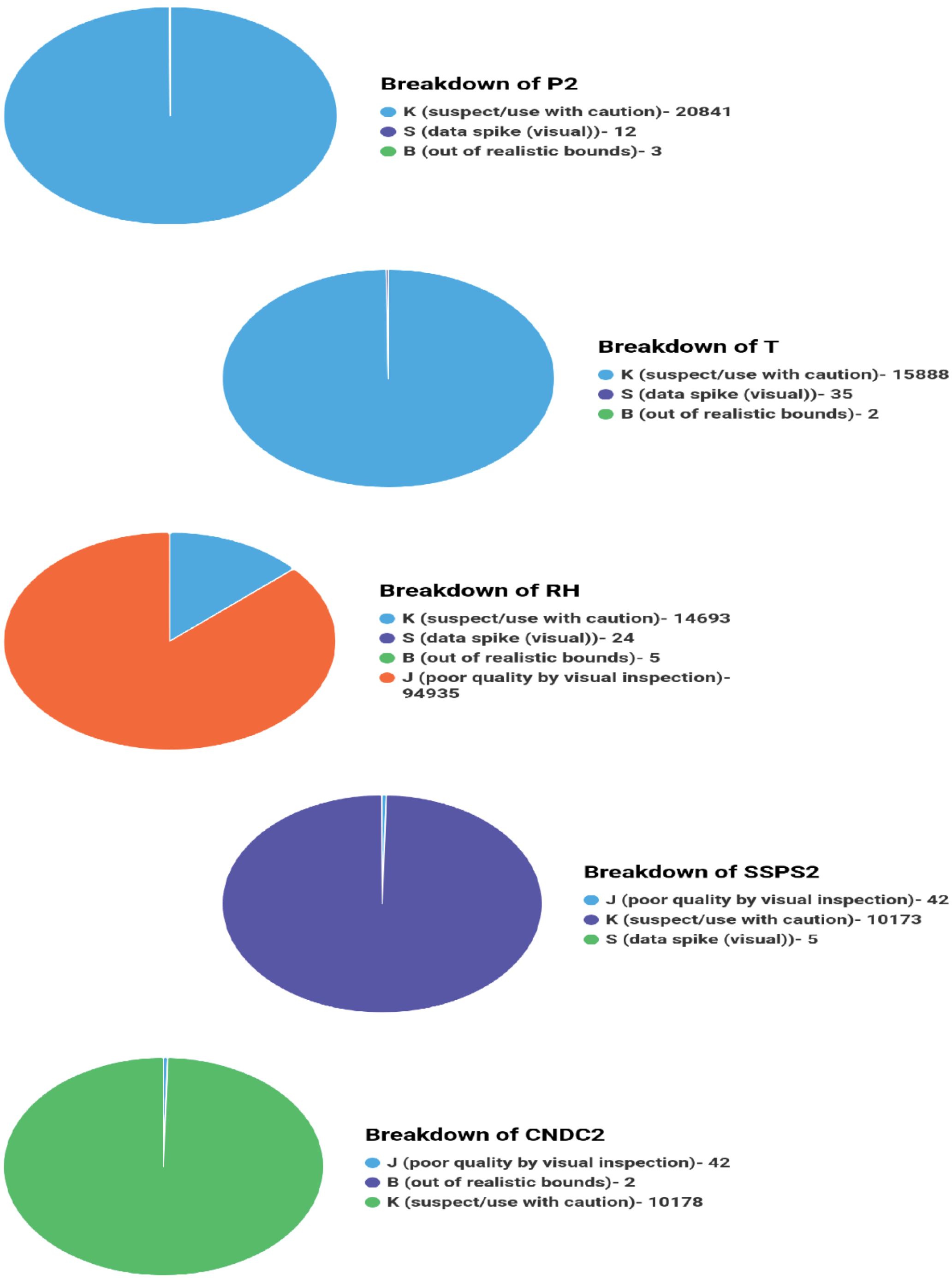
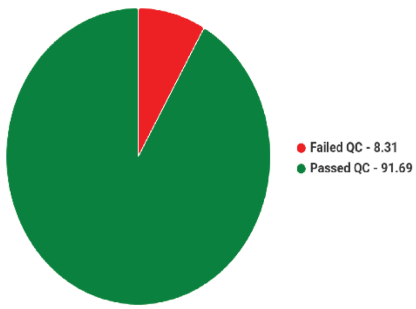


Figure 53: Distribution of SAMOS quality control flags for (first) atmospheric pressure – P – (second) air temperature – T – (third) relative humidity – RH – (fourth) salinity 2 – SSPS2 – and (last) conductivity 2 – CNDC2 – for the *Oscar Elton Sette* in 2024.

Pisces



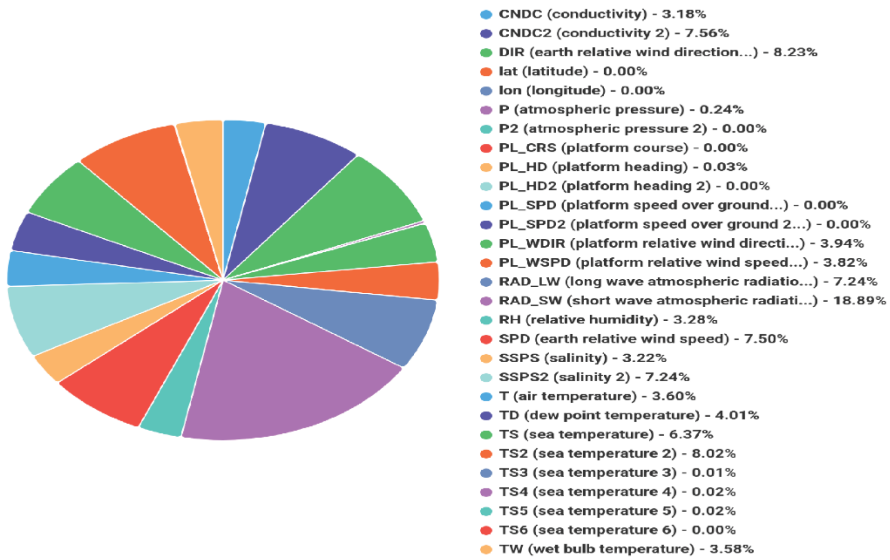


Figure 54: For the *Pisces* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Pisces* provided SAMOS data for 262 ship days, resulting in 11,423,232 distinct data values. After both automated and visual QC, 8.31% of the data were flagged using A-Y flags (Figure 54). This is roughly two percentage points higher than in 2023 (6.59%).

At the onset of *Pisces* 2024 field season SAMOS transmission, it was noted the true wind direction data (DIR) from the forward RM Young wind monitor, when compared with the ship's other anemometers as well as some satellite overpass data, appeared to be rotated by a static ~180 degrees. We did a little digging and found the forward sensor's "anemometer zero-line reference (deg)" metadata in their SCSv5 data logging system had been set to "180," which would normally indicate an anemometer installed with the "zero" aka "north" mark facing backwards, i.e., towards the stern. Oddly (at the time), the relative wind direction (PL_WDIR) from the forward sensor did not appear to be compromised, but nevertheless our first step was to contact the ship to verify the anemometer's orientation. Ship technicians quickly confirmed several things: First, the forward wind monitor's north mark had, in fact, been aligned with the bow of the ship, not the stern, as is standard for this ship (meaning the metadata was wrong). It was noted it's not actually possible to install their forward wind bird facing backwards, as there is a separate orientation ring for this wind bird model which locks down on the mounting pole permanently and contains a peg onto which a notch in the wind bird base fits precisely. This statement aside, technicians also noted there was a slight possibility the base of the sensor could have inadvertently come loose and swung ~180 degrees in recent high winds, considering the orientation ring peg had snapped off during shipyard. This was something they could not check for until at least their next port stop. But they stressed, all indicators on the bridge and in the Acoustics Lab for this wind bird aligned with the ship's four other installed anemometers. One last, telling wrinkle was mentioned, however – the data flow from the forward wind bird passes through several waypoints (including the indicators in the Acoustics Lab and on the bridge) before it finally arrives at SCS, and ship operators had also noticed an issue with the unaveraged (i.e., non-SAMOS) forward true wind through SCS while underway. Taken altogether, this information seemed to point to SCS being the source of the ~180 degree-rotated DIR values. This raised suspicion that the value entered into SCS's zero-line ref metadata may be used to adjust for orientation in the software's canned calculation for true winds. (We note this suspicion was subsequently confirmed, as another NOAA ship was experiencing similar wind issues around the same time.) Regardless, it was a fact that the zero line ref metadata value of "180" was wrong in this case, so we requested the technicians change the value to "0," with the expectation it might be likely to resolve the issue with DIR. Midday on 15 April this change was achieved, and the ~180-degree DIR offset did indeed resolve. Meanwhile, owing to the erroneous true wind calculation, both DIR and the forward earth relative wind speed (SPD) were assigned "malfunction" (M) flags (Figure 55) throughout the 1-15 April period. We wish to point out the technicians in this case were new on the job and relatively unfamiliar with the inner workings of SCSv5. Additionally, the "zero-line ref (deg)" metadata field had been recently relocated in the SCSv5 architecture and interface (per SAMOS request), and its full function in the software was not well understood by us nor, obviously, by the technicians. It was a metadata component in SCSv5 that to our knowledge had not, until this point, been utilized by anyone in the fleet. We thank the *Pisces* technicians for their dedication and hard work that went a long way towards gaining awareness of what this metadata field actually does. Interestingly, we now comprehend that SCSv5 can in some cases force a choice between representative data values and accurate metadata, since the zero line ref value is only used to adjust true winds, not relative.

A couple days later on 17 April, echoing a problem that originally arose in 2023 after *Pisces* was upgraded to SCS v5, the sea temperature (TS2), salinity (SSPS2), and conductivity (CNDC2) from *Pisces's* Sea-Bird SBE21 thermosalinograph as well as the sea temperature (TS) from the Sea-Bird SBE38 probe began reporting bad data across the board. In the case of TS, SSPS2, and CNDC2 this presented as non-numeric data values, which convert to "special" values (equals -8888) during SAMOS processing, and thus no data flagging was necessary. In the case of TS2, however, this meant values in an outrageous 1,000-10,000° C range, which were assigned "out of bounds" (B) flags by autoQC (Figure 55). When the ship was contacted, technicians confirmed the issue and noted they were stumped, as the sensors' junction boxes appeared to be outputting good data. They believed the problem originated in SCS, but they were unprepared to investigate that route and needed to wait for the resident Chief Survey tech to return from leave. Several days later TS2 also began reporting non-numeric data values, which converted to "special" values, thus no more B flags. By the end of the month, the issue appeared to have been mostly resolved (fix unknown) and all sensors were reporting good data again. However, we note the SBE21 and SBE38 data streams continue (to the present day) to routinely throw out isolated (i.e., single time step) but numerous non-numeric values amongst the good data, a scheme that has been noted in a couple other SCSv5 ships' SBE21/SBE38 SAMOS data streams. It seems suggestive there may be some complications with getting these sensors to communicate properly with SCS.

At very sporadic intervals in mid-June the long wave (RAD_LW) radiometer data exhibited a suspicious sawtooth pattern, which resulted in a bit of "caution/suspect" (K) flagging (Figure 55). About a month later RAD_LW values seemed to begin showing signs of a positive bias, at first reaching into the low to mid 500's W/m^2, resulting in more K flagging. We contacted the ship and suggested cleaning the sensor and checking it and the wiring for wear and/or damage, which the technicians ultimately did, but the RAD_LW climb continued. Eventually values were approaching 600 W/m^2, which were highly suspect (and still being K-flagged) for *Pisces's* region of operation, so the ship was contacted again. This time we suggested there was likely something mechanically wrong with the sensor. With this being an Eppley sensor, for which support and service options presumably no longer exist, and with the ship having no spare (and awaiting a new class of radiation sensors in 2025), the decision was made to terminate RAD_LW data transmission for the rest of the year, effective 5 September 2024.

Finally, on 24 November PL_WDIR data from the forward wind bird abruptly flat lined. The associated DIR appeared obviously bad in connection; however, the true wind speed (SPD) associated with the forward wind bird appeared curiously unaffected. When contacted, the Chief Survey technician informed us that the main translator for this wind bird seemed to be "affected" after wind farm project personnel had briefly lowered the forward mast and installed a large suite of radars and other sensors. He planned to continue problem solving as time permitted, and as of ~1700 UTC on 20 December the issue appeared resolved (fix unknown). DIR and PL_WDIR for the affected period were assigned M flags, while SPD and the forward wind bird relative wind speed (PL_WSPD) were assigned K flags, just as a precaution (Figure 55, not all shown).

There were no other issues noted for the *Pisces* in 2024. In general, *Pisces's* various meteorological sensors – DIR, SPD, air temperature (T), relative humidity (RH), calculated dew point and wet bulb temperatures (TD and TW), and, to a lesser extent, atmospheric pressure (P) – do exhibit some data distortion that is dependent on the vessel relative wind direction and, in the case of T/RH, ship heating (all common to most vessels). Where any of these data appear affected, they are generally flagged with K flags (Figure 55, only DIR and SPD shown). *Pisces* also occasionally transmits sea temperature and thermosalinograph (TS, TS2, TS5, SSPS, SSPS2, CNDC, and CNDC2) data while the flow-through sea water system appears to be secured, such as routinely occurs when a vessel is near/at port or in rough seas. Where this trend is apparent, variables receive either K or else "poor quality" (J) flags (Figure 55, only TS2 shown), depending on whether they are positive-valued or zero.

Looking to the flagged percentages in Figure 54, about 19% of the total flags were applied to the shortwave atmospheric radiation parameter (RAD_SW). However, these were primarily B flags (not shown) applied to slightly negative values such as occur frequently with these sensors at night (see 3b.).

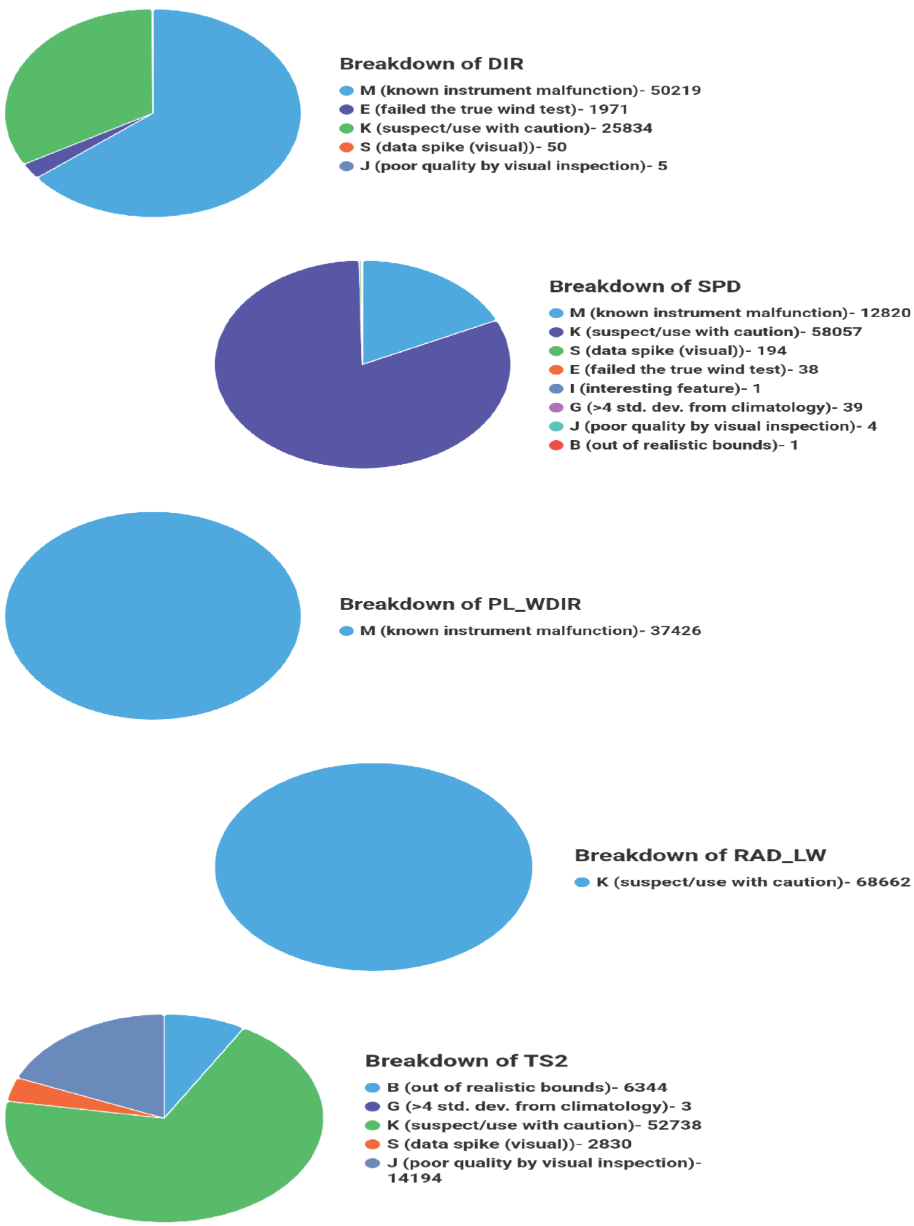


Figure 55: Distribution of SAMOS quality control flags for (first) earth relative wind direction – DIR – (second) earth relative wind speed – SPD – (third) platform relative wind direction – PL_WDIR – (fourth) long wave atmospheric radiation – RAD_LW – and (last) sea temperature 2 – TS2 – for the *Pisces* in 2024.

Rainier

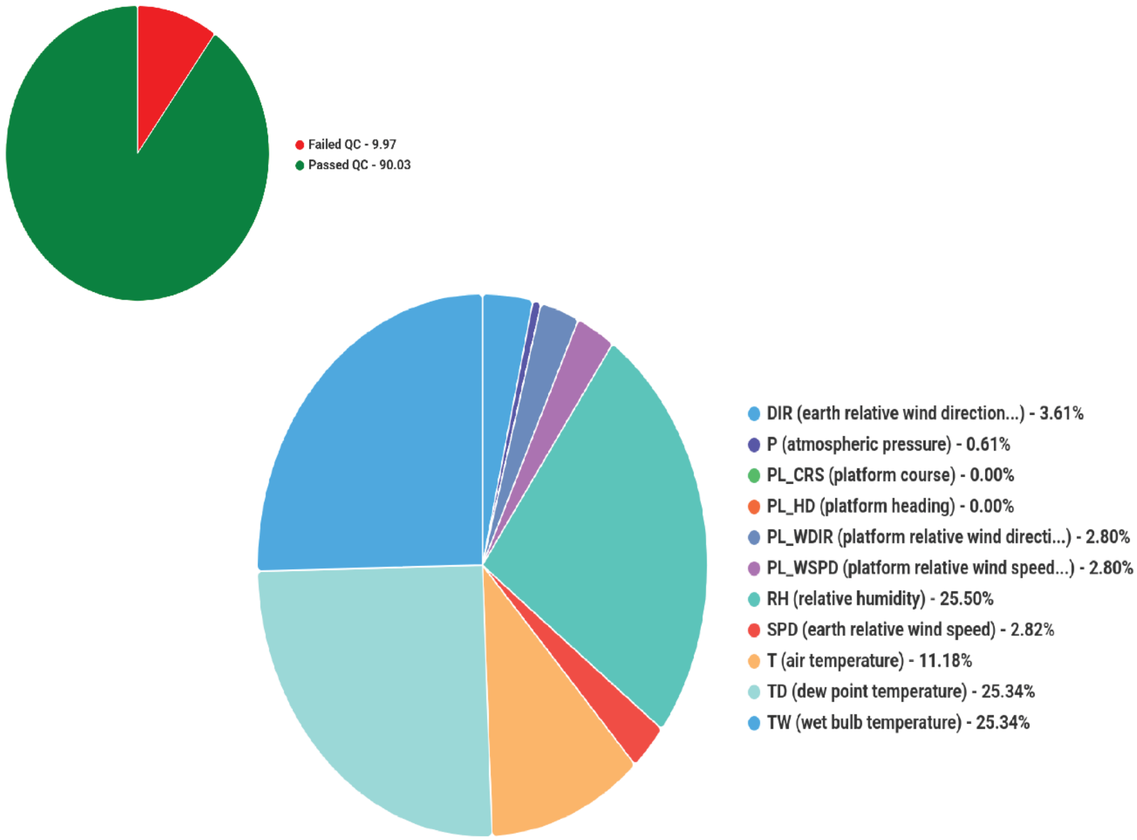


Figure 56: For the *Rainier* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Rainier* provided SAMOS data for 45 ship days, resulting in 943,083 distinct data values. After both automated and visual QC, 9.97% of the data were flagged using A-Y flags (Figure 56). This is about two percentage points higher than in 2023 (8.12%).

Rainier notably had suffered a critical systems power loss in late 2023, as the result of a ship fire, and she remained largely out of service throughout 2024. She did, however, transmit SAMOS data (from the dock) between 14 September and 31 October 2024. In mid-October, we began suspecting relative humidity (RH) data were "stuck" at ~101%, as reported conditions in the area did not seem to support sustained atmospheric saturation. These data were assigned "out of bounds" (B) flags by autoQC (Figure 57), since RH values > 100% are physically unrealistic, although we note it is not uncommon for RH sensors to report values slightly in excess of 100% in fully saturated conditions, owing to sensor tuning (see 3b). The associated calculated dew point and wet bulb temperatures (TD and TW) in this period were additionally assigned "failed the T>=Tw>=Td test" (D) flags by autoQC (Figure 57). On 21 October, after about a week of our suspicions, we contacted the vessel for confirmation of the issue and/or environmental conditions. A technician cleaned and reset both the sensor and the translator, and RH appeared to improve for a couple of days. But then on 24 October, at ~1730 UTC, all of RH, TD, TW, and air temperature (T) saw an abrupt and sustained shift into unrealistic ranges (~200% humidity and over 200° C for the temperatures). It was suspected the T/RH sensor may have been removed but the wiring was nevertheless still reporting some stray voltage. When contacted again, the technician confirmed the sensor had been pulled for calibration. In response, we suggested they either disable T, TD, TW, and RH from reporting to SAMOS (since the data were only getting B-flagged, Figure 57) or else shut down all SAMOS submission for the year, since the vessel was technically in a repair period anyway and would not be sailing before the end of the year. On 31 October all SAMOS transmission was suspended from the ship.

In general, in a carryover from previous years, at random times/days the *Rainier's* relative winds (PL_WDIR and PL_WSPD) will undergo a period of constant (aka flatlined) values, usually lasting no more than a few hours. These flatline periods do not have any apparent dependency on a particular relative wind direction or vessel speed, nor is the output value the same from one flatline occurrence to the next. A definitive cause has never been found. Whenever PL_WDIR and PL_WSPD flatline they are assigned "poor quality" (J) flags (not shown). The true winds (DIR and SPD), being calculated from PL_WDIR and PL_WSPD, clearly mirror changes in the platform heading and platform speed during these flatline occurrences. Thus, DIR and SPD are also J-flagged when the relative winds flatline (Figure 57, only DIR shown). Once PL_WDIR and PL_WSPD begin varying again DIR and SPD also resume typical wind patterns. Additionally, the installation location of *Rainier's* pressure (P)and T/RH sensors is known to have significant exposure issues, being low down on the instrument mast and quite close to the side of the mast structure. As a result, these three parameters are frequently flagged with "caution/suspect" (K) flags (not shown).

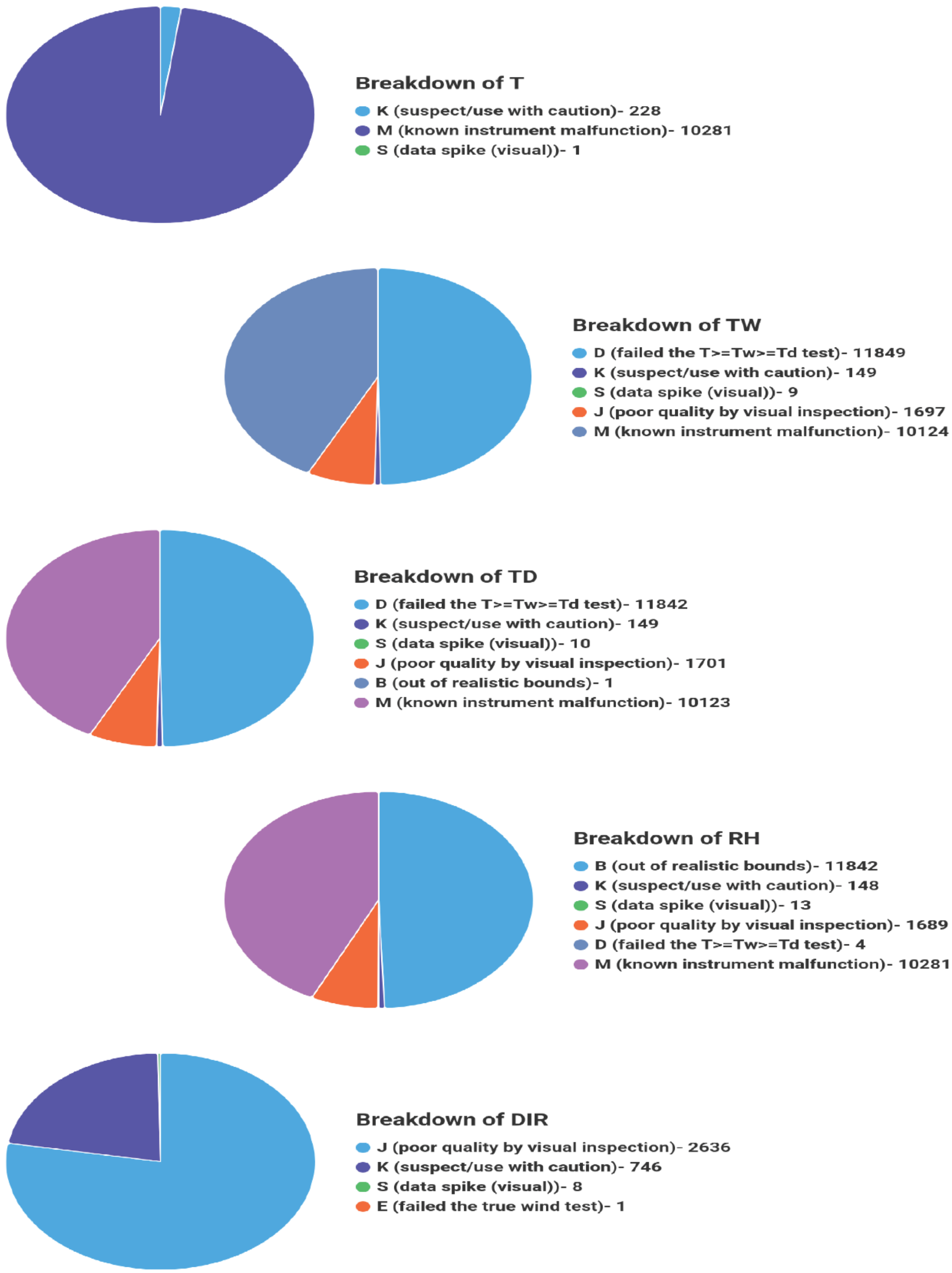


Figure 57: Distribution of SAMOS quality control flags for (first) air temperature – T – (second) wet bulb temperature – TW – (third) dew point temperature – TD – (fourth) relative humidity – RH – and (last) earth relative wind direction – DIR – for the *Rainier* in 2024.

Reuben Lasker

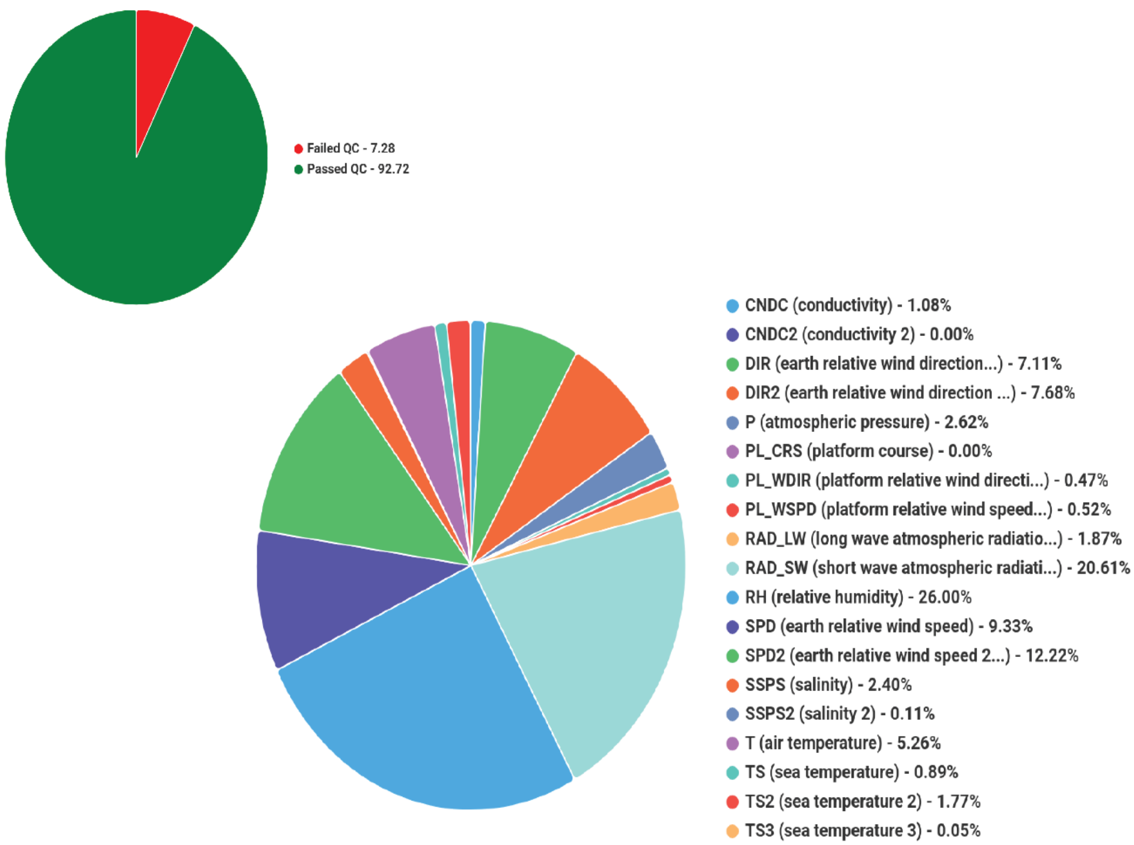


Figure 58: For the *Reuben Lasker* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Reuben Lasker* provided SAMOS data for 164 ship days, resulting in 6,013,350 distinct data values. After both automated and visual QC, 7.28% of the data were flagged using A-Y flags (Figure 58). This is about one and a half percentage points lower than in 2023 (8.74%).

In a continuation from late 2023, *Lasker's* long wave radiation (RAD_LW) data at the beginning of the 2024 field season were almost implausibly high often reaching 600-700 W/m^2, which resulted in application of "caution/suspect" (K) flags (Figure 60). With support and servicing options presumably no longer available for this Eppley radiometer and/or the RMRCo RAD signal converter box, and with deployment of a new class of radiometers expected for the NOAA fleet at large, the decision was made to disable RAD_LW from reporting to SAMOS beginning on 19 January and lasting through the end of the year.

Beginning sometime in June, or possibly earlier, the relative humidity (RH) often seemed stuck at or near 100%. Many times, it was hard to tell if the vessel may have been stuck in a persistent fog bank (not uncommon for this ship's typical region of operation off the southern California coastline), though the Chief Survey technician was able to confirm at least some fog early in this period. Eventually, as the periods of sustained 100% RH became increasingly longer, we recommended inspecting and cleaning the sensor. However, an opportunity to go aloft where the sensor is located did not immediately present itself. The situation with RH continued to degrade, and by late September RH values were routinely reaching 104% - 107%. At this point it was assumed the sensor had basically "gone bad," and we recommended swapping it out with a spare if one was available. There likely was none, however, and the bad data -- by this point being almost entirely flagged "out of bounds" (B) by autoQC (Figure 60) continued until the sensor was removed and shipped off to RM Young in mid-October, at the conclusion of the field season.

Lastly, in late August *Lasker's* Sea-Bird SBE45 salinity (SSPS) started exhibiting a lot of very small spikes as well as some little sawtooth disturbances (see Figure 59), which were assigned K flags and sometimes "spike" (S) flags (Figure 60). These effects appeared to be present in the SBE45 conductivity (CNDC) data, as well, although they were nearly microscopic in scale and were thus generally not flagged. The implication was not clear here, but we suggested to the ship technicians that the problem might be air bubbles or some kind of electrical noise. Although, the spikes and sawtooth steps were notably absent from the conductivity and salinity data (CNDC2 and SSPS2) from their other thermosalinograph (a Sea-Bird SBE21), pointing a bit more strongly towards an instrumentation problem rather than a flow/bubbles problem. At one point Katie Watkins-Brandt (Section Chief, Science Services for NOAA's Marine Operations – Engineering division) joined the conversation and offered that if the spikes/steps were not present in the sea temperature data (TS2) from the SBE45, it likely pointed to a dirty/fouled conductivity cell. We reconfirmed this was the case with TS2, so Katie may well have hit the nail on the head. In any event, the issue persisted into early 2025, until the sensor was removed for drydock. We wish to stress that the effects observed in SSPS and CNDC were very small in scale. The SSPS/CNDC data (partially flagged) in the noted period (approximately late August through 17 October) may still be perfectly usable to some in the user community, depending on the application.

There were no other issues noted for *Lasker* in 2024. In general, *Reuben Lasker's* earth relative wind parameters (SPD, SPD2, DIR, and DIR2) exhibit a fair amount of data distortion that is dependent on the vessel's relative wind direction. Where data appear affected, they are generally assigned K flags (Figure 60, only SPD2 shown). Additionally, *Lasker's* short wave radiation sensor (RAD_SW) is known to be located right next to the deck area from where they trawl. This area is routinely lit up very brightly during nighttime trawls. Positive (> 10-20 W/m^2) steps are frequently observed in RAD_SW at night, seemingly in response to the bright trawl lights. As such, nighttime RAD_SW are often flagged as either "caution/suspect" (K) or "poor quality" (J) at night (Figure 60). These flags are in addition to any "out of bounds" (B) flagging of slightly negative nighttime values that occur with RAD_SW sensors, owing to sensor tuning (see 3b. for details). We note there is often limited real estate for sensors on a ship, and sometimes sensor locations are a bit of a compromise. In this case, with nighttime values of RAD_SW essentially of no scientific interest anyway, the sacrifice made in favor of sensor accessibility is well chosen.

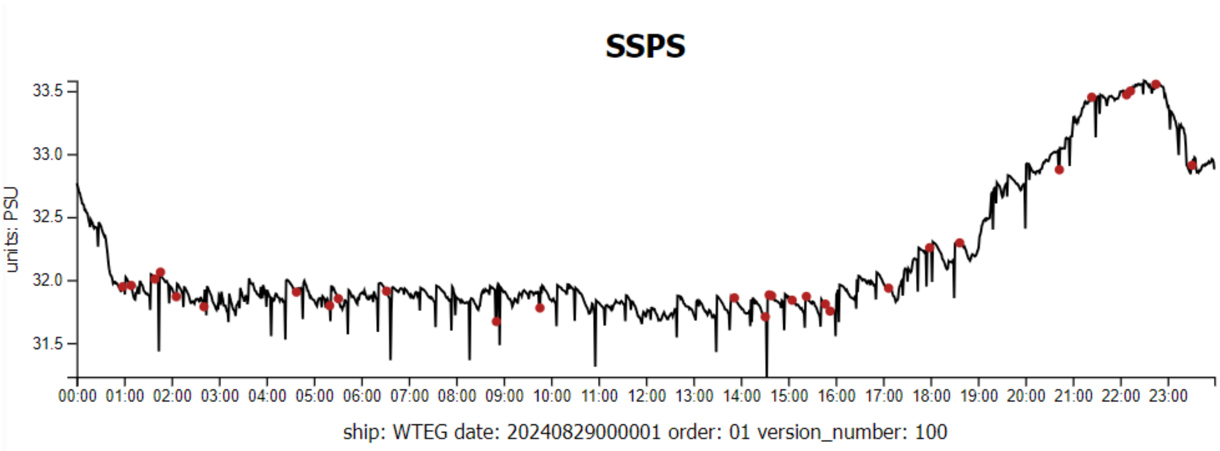


Figure 59: *Reuben Lasker* SAMOS salinity –SSPS – data for 29 August 2024. Note small-scale spikes and sawtooth steps.

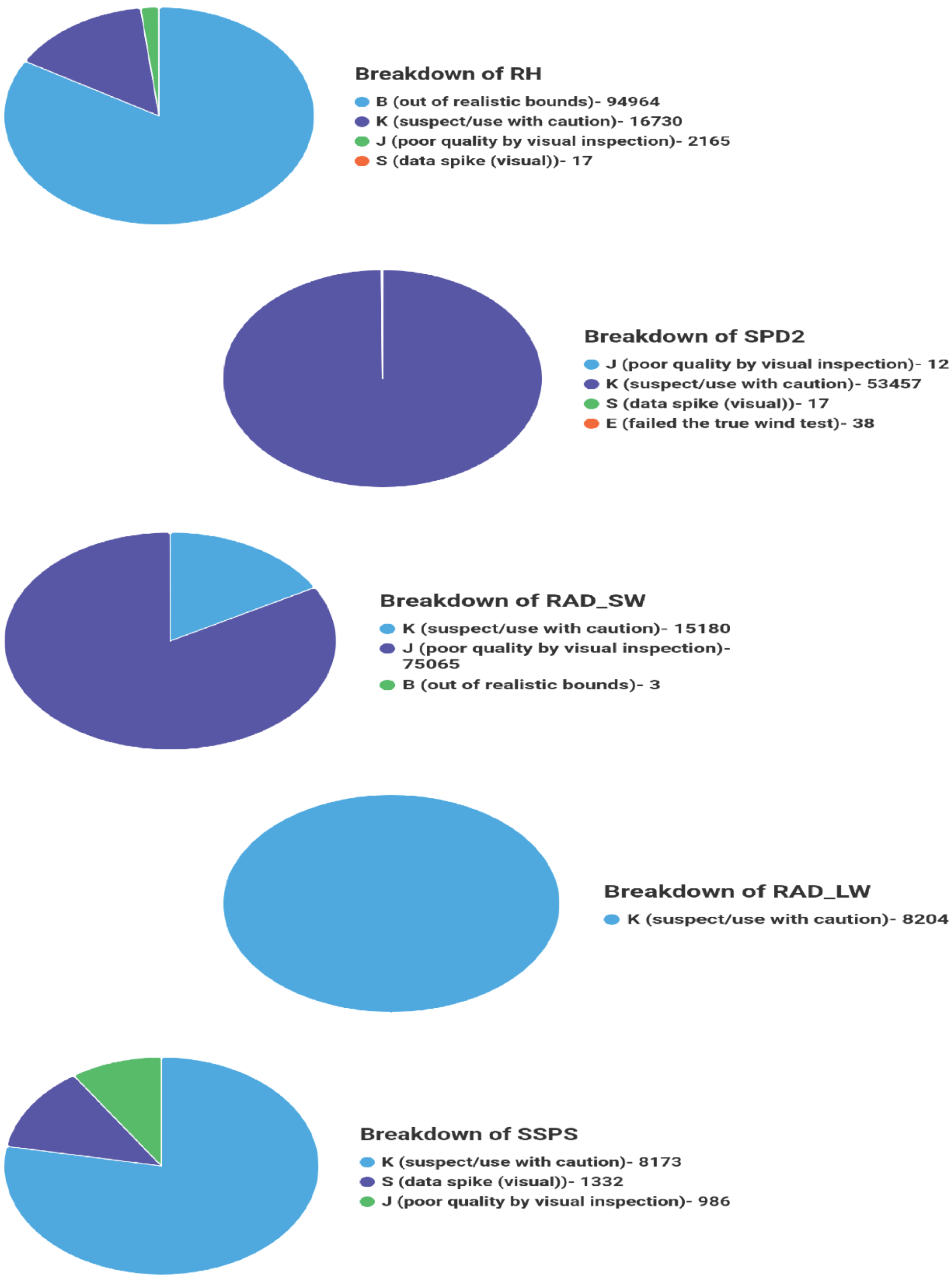


Figure 60: Distribution of SAMOS quality control flags for (first) relative humidity – RH – (second) earth relative wind speed 2 – SPD2 – (third) short wave atmospheric radiation – RAD_SW – (fourth) long wave atmospheric radiation – RAD_LW – and (last) salinity – SSPS – for the *Reuben Lasker* in 2024.

Thomas Jefferson

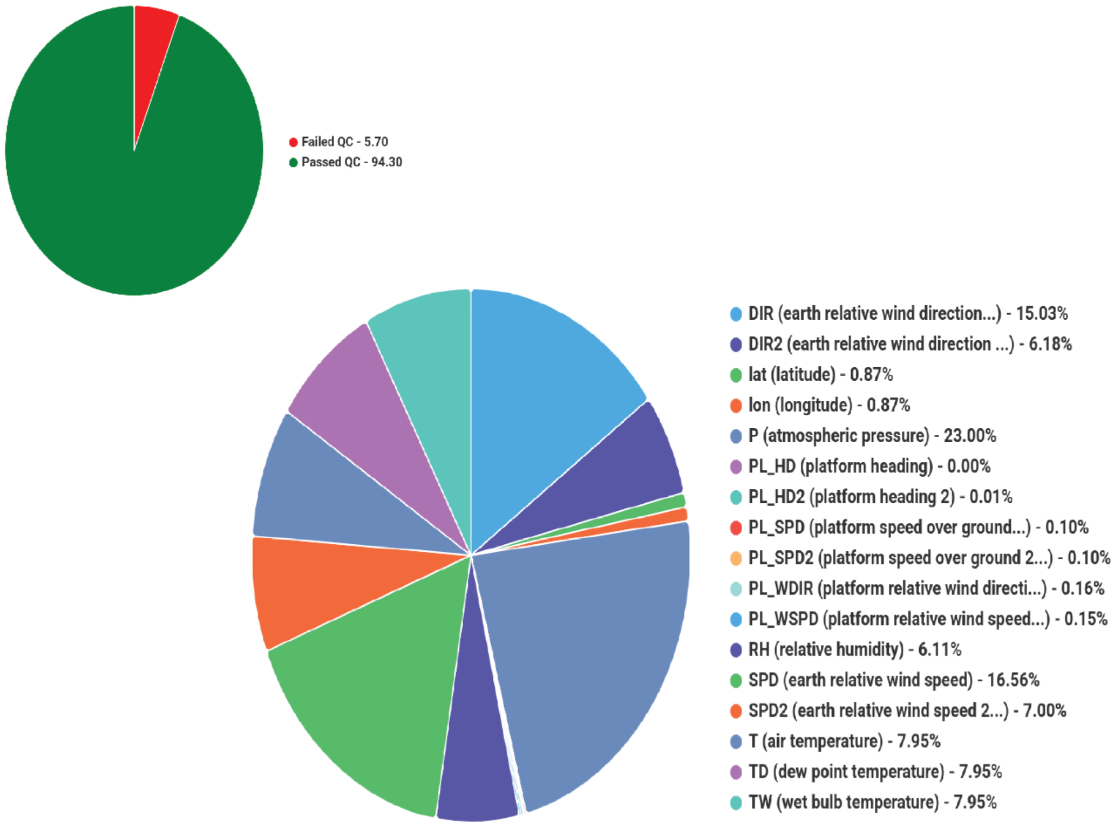


Figure 61: For the *Thomas Jefferson* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Thomas Jefferson* provided SAMOS data for 235 ship days, resulting in 5,838,271 distinct data values. After both automated and visual QC, 5.7% of the data were flagged using A-Y flags (Figure 61). This is a few percentage points higher than in 2023 (2.02%) and places *Thomas Jefferson* just outside the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

After a long hiatus (beginning 2022) stemming from translator and/or data message checksum issues, *Jefferson's* port wind bird data, meaning both true and relative speeds and directions (SPD, PL_WSPD, DIR, PL_WDIR), were finally able to be reestablished in the daily SAMOS data flow on 16 May 2024. The fix involved new ultrasonic wind sensors for the ship (to replace their aging wind birds) as well as extensive reprogramming of the RM Young translator, which had unfortunately been essentially "soft-bricked" by RMY technical support while troubleshooting.

Initially after the port wind fix, the starboard wind bird data (SPD2, PL_WSPD2, DIR2, PL_WDIR2), which had also been essentially missing since 2022, remained problematic/missing from SAMOS. But they were also reestablished in 2024, quite incidentally while resolving a separate problem involving *Jefferson's* GPSs (actually, both were resolved while resolving a third problem involving their ADCP). The issue with their GPS data – meaning in this case latitude (lat), longitude (lon), platform speed over ground (PL_SPD), and platform speed over ground 2 (PL_SPD2) – was first noted in mid-May, immediately after the port wind fix, though it could conceivably have existed for much longer. (A prior fleetwide issue tied to the SCSv5 software had a very similar presentation; looking back before the software fix, it would be difficult to discern the difference.) The issue in 2024 saw numerous large spikes appearing in GPS position and speed data, generally occurring in discrete, intermittent time chunks and resulting in some "out of bounds" (B) and "spike" (S) flags on PL_SPD and PL_SPD2 as well as "platform velocity unrealistic" (F) and "platform position over land" (L) flags on lat and lon (Figure 64, not all shown). There did not seem to be any obvious correlation with ship movement (e.g., turning) or orientation, or other ship-based activities, and we at first considered the chunks might be related to geographical location. However, the support for this conjecture turned out to be rather weak. We reached out to the vessel a few weeks later, guessing that maybe an antenna had gone bad, or perhaps there might be an electrical/wiring issue. A Chief Electronics technician confirmed he had been noticing the spikes sporadically, as well, and stated he would start by checking to see if they had any replacement antennas on board. Several days later he noted the connection for their port GPS had been found to be a little worse for wear, and he had subsequently both rebuilt this connection and changed out the port GPS antenna. It seemed at first like the spike issue may have been resolved, but a couple weeks after that, in early July, random patches of spikes began showing up in the GPS data again. This trend continued for a couple of months. Everything would be fine, then suddenly a few batches of spikes, then just as suddenly everything would return to normal. Finally in late September, while troubleshooting a whole other data issue indirectly involving their ADCP, the technician added an Actisense buffer/splitter prior to the inputs of SCS and the ADCP, for both the port and starboard GPS feeds. Among other things, he had suspected all the GPS issues were due to a cable that was "almost too long" being electronically loaded by the front-end RocketPort inputs, and so he had inserted a broadcast box to amplify those signals beyond the low switching threshold they were probably presenting (his words). Like magic, the spikes in the GPS data evaporated. Bonus points, while he was doing all of this, he also found a tiny coding error in their RMY translator. And once he figured out how to recode the translator's firmware, bingo was his name-o -- the starboard wind bird DIR2, SPD2, PL_WDIR2, and PL_WSPD2 data were flowing normally again. Problem(s) solved.

Jefferson also experienced a couple of brief upsets with their barometric pressure sensor (P) in 2024. The first episode began with a few small, negative drifts in the data on 8 February that amounted to a loss of about 4-5 millibars over a ~10-minute period and then a bigger, more obvious drop of about 10 mb on 14 February (see Figure 62). Comparison with nearby Charleston, SC station pressure data on 14 February revealed *Jefferson's* P was now reading about 15 mb too low. When contacted, one of the Chief Electronics technicians investigated the issue and discovered the sensor had fallen off its mounting bracket and there were additionally some loose wires in the sensor's terminal block. The culprit was believed to have been ship vibrations that occurred as the ship was getting underway, possibly first shaking the sensor loose, and then things progressed from there. Once the pressure sensor was reinstalled in its original position, P data went back to normal. P data for the affected period were assigned "malfunction" (M) flags (Figure 64). The second episode was characterized by discrete steps and spikes that appeared in the data first on 28 May and then again, a day later (see Figure 63). In this case the cause turned out to be water intrusion, first discovered in (and cleared from) the sensor housing on 28 May, and then discovered in the pressure tubing, which was ultimately replaced. Some of the affected P data received B flags during autoQC, as the steps were very large. Any affected data that were not flagged by autoQC were assigned M flags during visualQC (Figure 64).

There were no other major issues noted for *Thomas Jefferson* in 2024. As a general note, *Thomas Jefferson's* various meteorological sensors, especially the wind sensors, do exhibit a fair amount of data distortion that is dependent on the vessel relative wind direction and potentially, in the case of atmospheric pressure (P), the vessel speed. Ship/stack heating is also sometimes present in the temperature (T, TD, TW) and relative humidity (RH) parameters, again depending on the vessel's relative wind direction. (All common to most vessels.) Where the data appear affected, they are generally "caution/suspect" (K) flagged (Figure 64, not all shown). Additionally, when in the occasional saturated environment, *Jefferson's* RH can read just slightly over 100%, which results in autoQC application of B flags to those values (not shown). This is not an uncommon occurrence, as these sensors are often tuned for better accuracy at lower relative humidities (see 3b.) Interestingly, however, when RH exceeds 100% the calculated wet bulb (TW) and dew point (TD) temperatures exceed the reported air temperature (T) by a tiny bit and consequently acquire "failed the T>=Tw>=Td test" (D) flags (not shown).

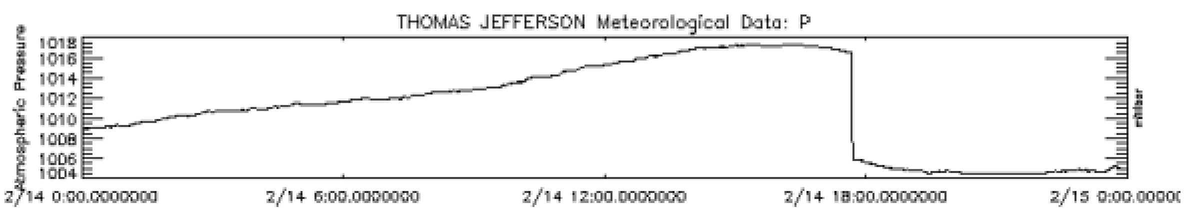


Figure 62: *Thomas Jefferson* SAMOS atmospheric pressure – P – data for 14 February 2024. Note discrete ~10 mb drop in pressure at ~1800 UTC.

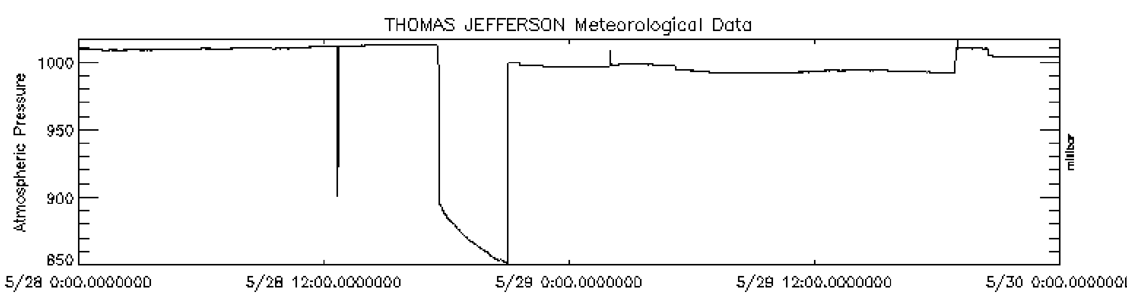


Figure 63: *Thomas Jefferson* SAMOS atmospheric pressure – P – data for 28-29 May 2024. Note spikes and steps caused by water in sensor housing and tubing.

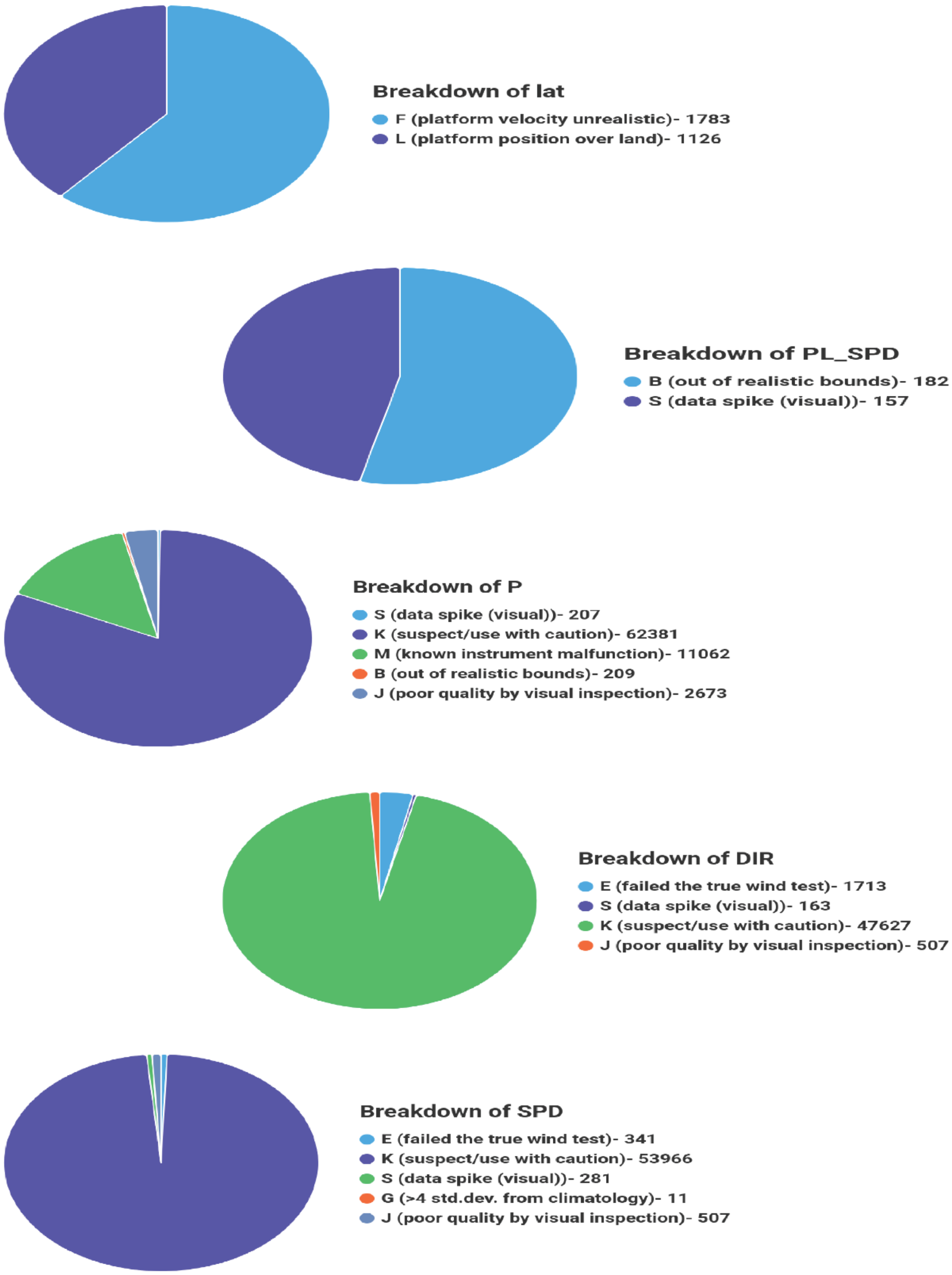
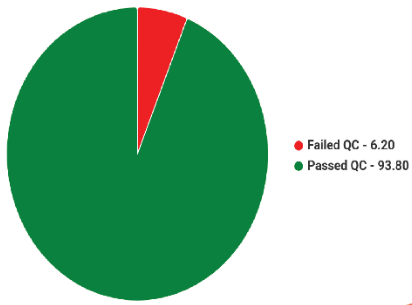


Figure 64: Distribution of SAMOS quality control flags for (first) latitude – lat – (second) platform speed over ground – PL_SPD – (third) atmospheric pressure – P – ((fourth) earth relative wind direction – DIR – and (last) earth relative wind speed – SPD – for the *Thomas Jefferson* in 2024.

Laurence M. Gould



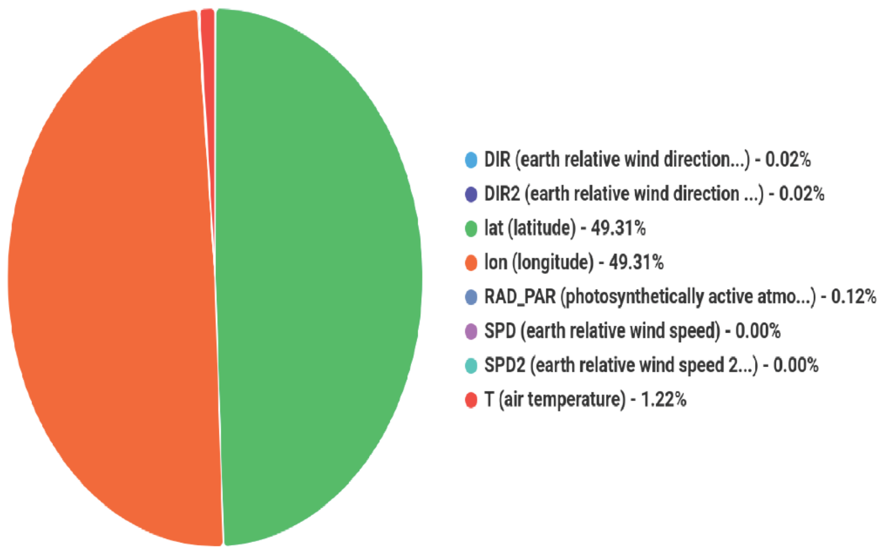


Figure 65: For the *Laurence M. Gould* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

Before retiring in May, the *Laurence M. Gould* provided SAMOS data for 122 ship days, resulting in 3,844,868 distinct data values. After automated QC, 6.20% of the data were flagged using A-Y flags (Figure 65). This is a few percentage points higher than in 2023 (4.73%) and pushes the *Gould* over the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. It should be noted the *Gould* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only. Also, the *Gould* frequently transmitted data while dockside in Chile, resulting in the large number of “platform position over land” (L) flags.

There were no major issues noted in 2024 for the *Gould*. Looking to the flag percentages in Figure 65, ~99% of the flags applied were assigned to latitude (LAT) and longitude (LON). These were almost exclusively L flags (Figure 66) that appear generally to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port. As a general note, it is known that Gould's sensors are frequently affected by airflow being deflected around the super structure, as well as stack exhaust contamination, although, being a vessel that does not receive visual QC, none of this is evident in the flag percentages seen in Figure 65.

We note with thanks that the LMG technicians frequently emailed the SAMOS team when they cleaned the T/RH sensor and radiometers. These occurrences are noted in Annex A, along with a number of shutdowns of their sea water system when they were in port. We also thank the technicians and crew of the *Gould* for their contributions to the SAMOS initiative over an 18-year period.

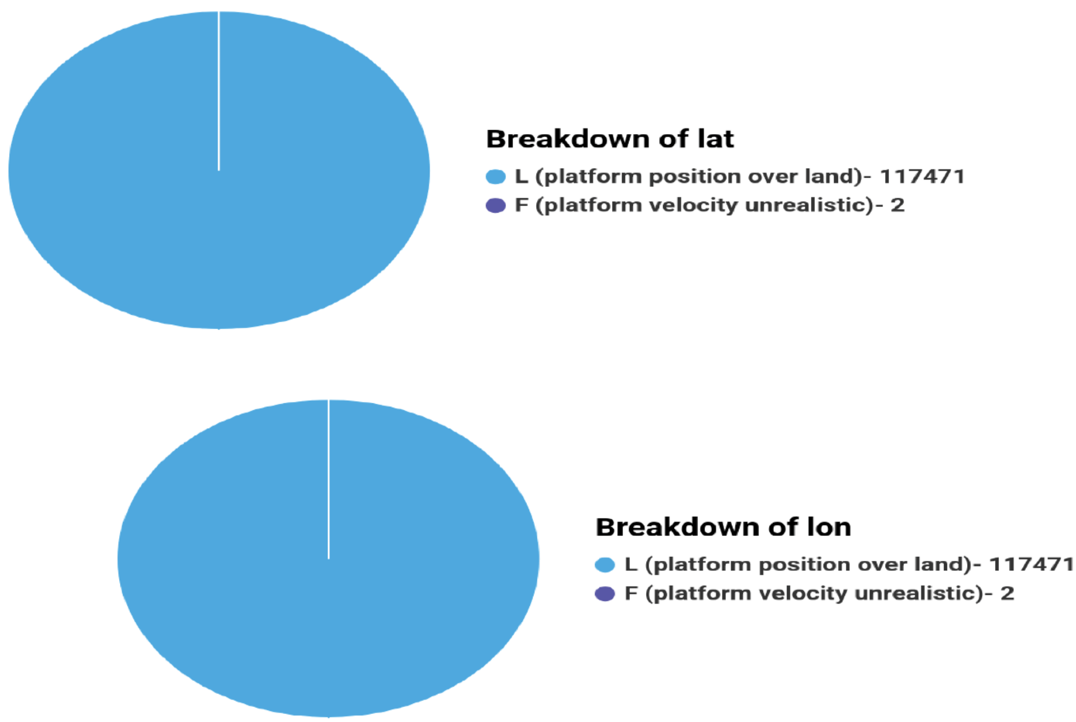


Figure 66: Distribution of SAMOS quality control flags for (top) latitude – LAT – and (bottom) longitude – LON – for the *Laurence M. Gould* in 2024.

Nathaniel B. Palmer

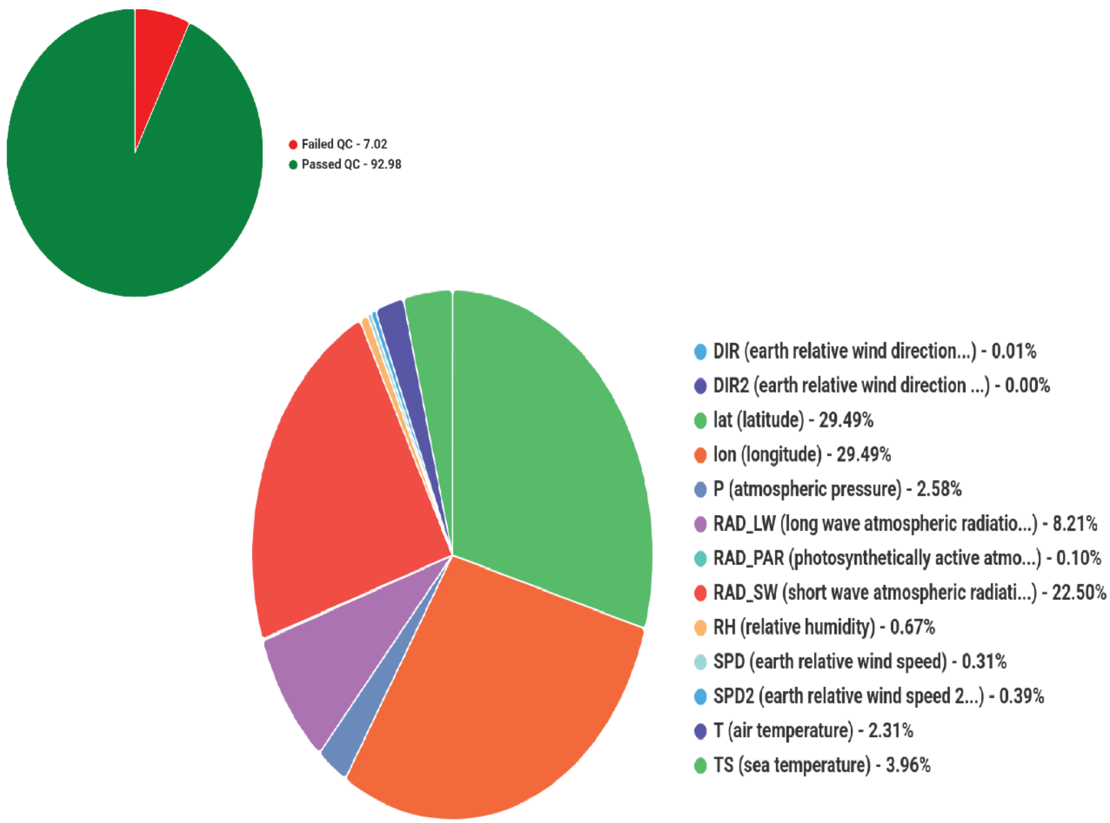


Figure 67: For the *Nathaniel B. Palmer* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Nathaniel Palmer* provided SAMOS data for 347 ship days, resulting in 10,692,363 distinct data values. After automated QC, 7.02% of the data were flagged using A-Y flags (Figure 67). This is several percentage points lower than in 2023 (10.32%). It should be noted that the *Palmer* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only. Also, the *Nathaniel Palmer* frequently transmitted data while dockside in Chile, resulting in the large number of "platform position over land" (L) flags.

The major issue in 2024 was repeated failures of the longwave radiometer (RAD_LW). The first occurrence started on 1 December 2023 and ran through 9 April 2024. Many large negative spikes occurred in the RAD_LW data resulting in "out of bounds" (B) flags (Figure 68). Although the techs confirmed this radiometer had failed late in 2023, the repair was not effected until April 2024 because of a busy sea schedule for the vessel. The problem recurred in November 2024 and seemed to be associated with sub-freezing air temperatures. No changes were made to the sensor and the problem seems to have been resolved by 13 December 2024. RAD_LW data should be used with caution for much of the year.

Only a few other minor issues occurred in 2024, primarily when the vessel was in port for the austral winter. From 8-23 June 2024, all variable values were stuck at a constant value as a result of a data acquisition failure. This occurred during the installation of a new UPS on the vessel. We thank Anna and the electronics team for getting the data flowing again. The port anemometer (DIR, PL_WDIR, SPD, and PL_WSPD) also had some flatline values between 30 August and 16 September 2024. We notified the vessel and, although no reason was given, the problem was resolved on 16 September.

There were no other issues noted in 2024 for the *Palmer*. Looking to the flag percentages in Figure 67, ~59% of the total flags were applied to latitude (LAT) and longitude (LON), and ~23% to short wave atmospheric radiation (RAD_SW). These were almost exclusively L flags in the case of LAT and LON (Figure 68) that appear generally to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port. In the case of RAD_SW, all the flags were B flags (Figure 68) and appear to have been applied mainly to negative nighttime values. Once again, slightly negative values commonly occur with these sensors at night.

One interesting weather occurrence was captured by the *Palmer* when sailing through a deep low-pressure center in the South Pacific Ocean. The vessel recorded a minimum pressure of ~949 hPa which resulted in both B and "greater than four standard deviations from climatology" (G) flags on the pressure (P). A review of satellite imagery confirmed the existence of the deep low-pressure system and these observations should be treated as good. The vessel experienced high winds and extreme seas during the event, which was confirmed via email by the shipboard technician.

As a general note, it is known that *Palmer's* sensors are frequently affected by airflow being deflected around the super structure, as well as stack exhaust contamination, although, being a vessel that does not receive visual QC, none of this is evident in the flag percentages seen in Figure 67.

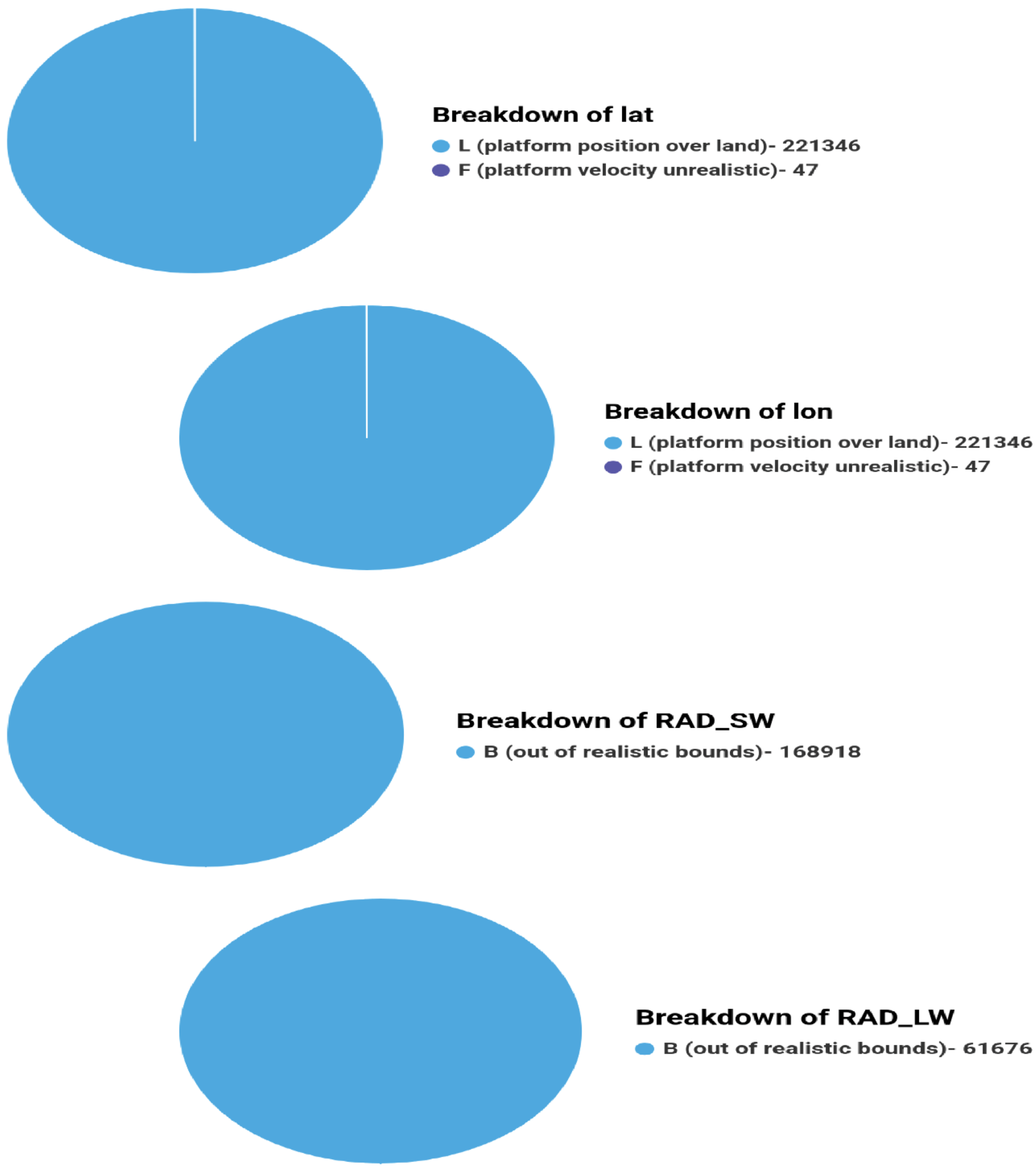
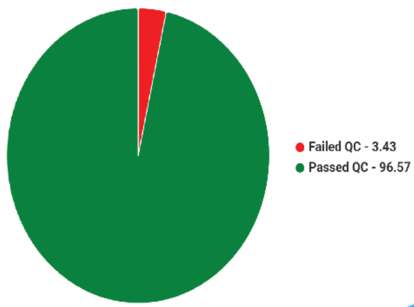


Figure 68: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) short wave atmospheric radiation – RAD_SW – and (last) long wave atmospheric radiation – RAD_LW – for the *Nathaniel B. Palmer* in 2024.

Robert Gordon Sproul



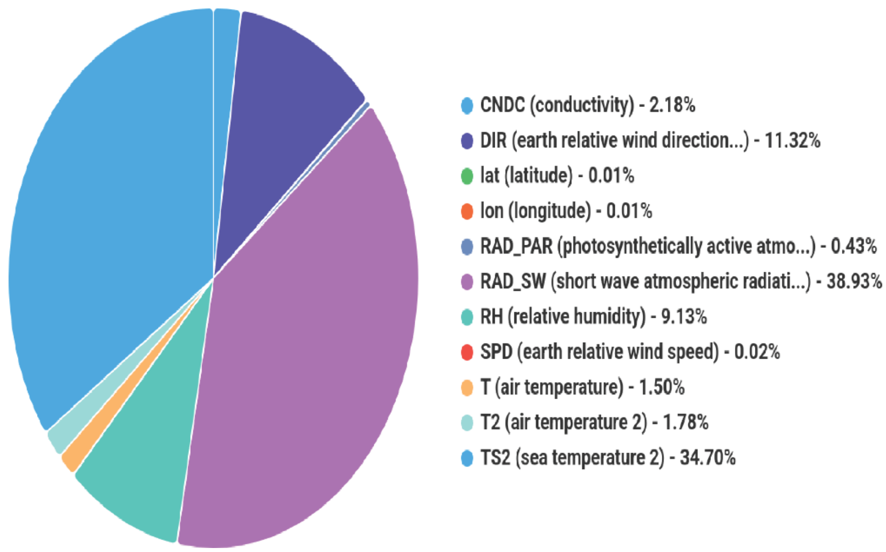


Figure 69: For the *Robert Gordon Sproul* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Robert Gordon Sproul* provided SAMOS data for 249ship days, resulting in 7,915,584 distinct data values. After automated QC, 3.43% of the data were flagged using A-Y flags (Figure 69). This is virtually the same as 2023 (3.87%) and keeps *Sproul* under the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. It should be noted the *Sproul* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only (no research-level files exist at the SAMOS DAC for the *Robert Gordon Sproul*).

Two issues occurred in 2024 that resulted in data that should not be used. First, 1-11 July all the meteorological data was affected by a failure of the mast holding these sensors. Although the techs made a temporary repair, they could not guarantee the orientation of the mast during this period, so certainly the wind direction data will be in error. In fact the true winds (DIR, SPD) show steps associated with changes in vessel orientation indicating an incorrect true wind calculation (E flags). So the data from early July should be treated as suspect at best. Also from 29 August – 9 September 2024, the photosynthetically active atmospheric radiation (RAD_PAR) values were highly suspect. This resulted from the PAR sensor being removed for use on another vessel, but the data feed still being logged (likely just electronic noise). So the RAD_PAR for this period should not be used. The sensor was replaced on 10 September 2024.

One notable data issue affects the relative humidity (RH) for the *Sproul* throughout 2024. The SIO team modified their software to record relative humidity values over 100% (previously these values were set to NaN and treated by SAMOS as missing values), so there are periods where the relative humidity (RH) received "out of bounds" (B) or "greater than four standard deviations from climatology" (G) flags for RH > 100% (Figure 70).

Another minor issue was the appearance of spikes in the precipitation data (PRECIP) from 15 July –12 September 2024. These random spikes looked like electronic noise. The technician noted the cable was a bit loose so they applied some dielectric grease to the connection and tightened it up. This seems to have resolved the issue.

There were no other issues of note for the *Sproul* in 2024. Looking to the flag percentages in Figure 69, nearly 35% of the total flags were applied to the thermosalinograph sea temperature (TS2). These were mostly G flags (Figure 70) and were mainly due to instances of the sea water system being off over the course of the year, generally when the vessel was in port (common) but also occasionally during a cruise in which the resident science party did not want the thermosalinograph running (common for this vessel). Short wave radiation (RAD_SW) also received ~39% of the total flags (Figure 69). Upon inspection the flags, which are unanimously B flags (Figure 70), appear to have been applied mainly to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.) Finally, there were periods when the TS2, conductivity (CNDC), and salinity (SSPS) data exhibited a smooth time series not representative of real ocean observations. This tends to occur when the pumps to the sea water system are shutdown, particularly when the vessel is still sending SAMOS data while in port. This sometimes results in B or G flags (Figure 70, only TS2 shown) being applied to these variables when the sea water in the pipes is not representative of the surrounding environment, but the autoQC does not flag all occurrences. When noted, the dates of these shutdowns are listed in Annex A.

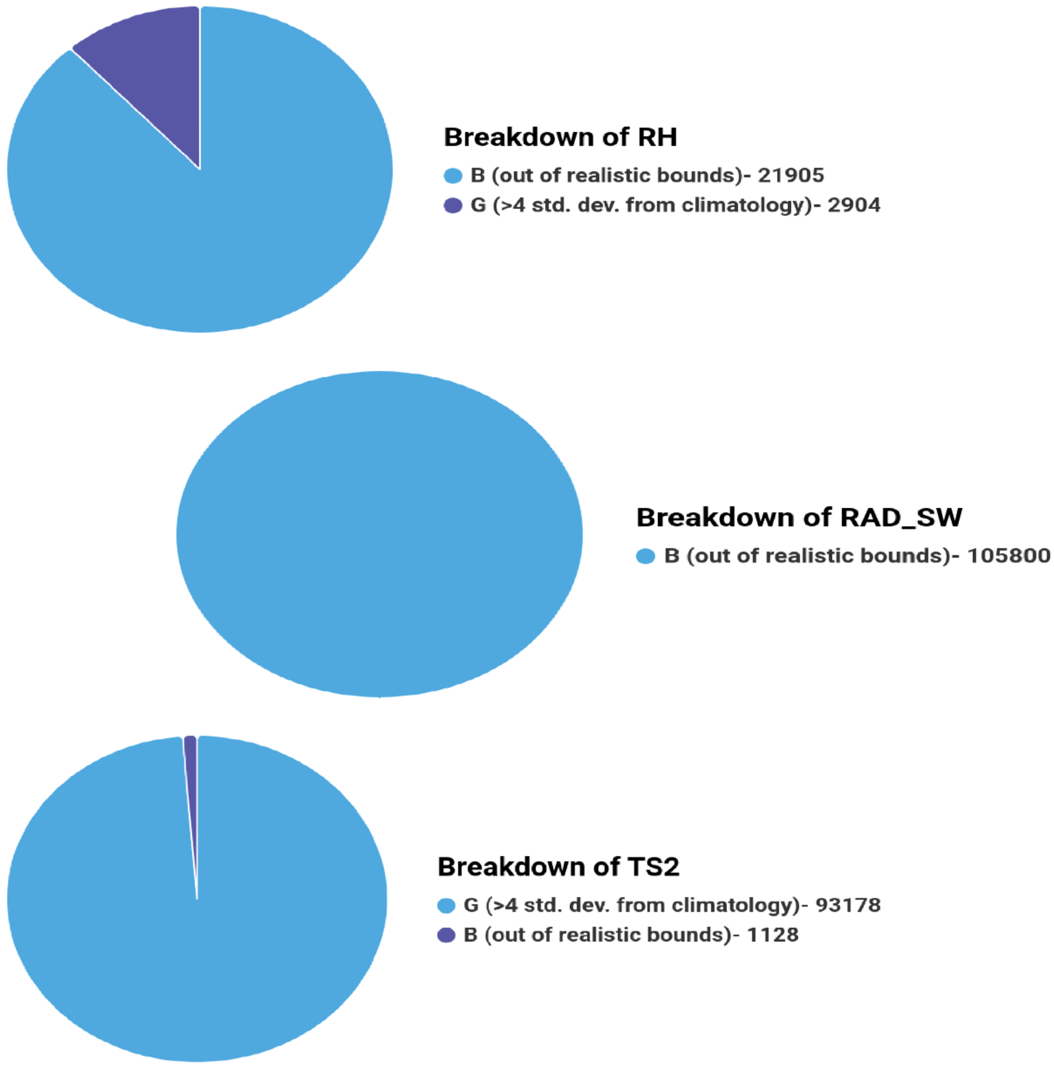


Figure 70: Distribution of SAMOS quality control flags for (top) relative humidity – RH – (middle) short wave atmospheric radiation – RAD_SW –and (bottom) sea temperature 2 – TS2 – for the *Robert Gordon Sproul* in 2024.

Roger Revelle

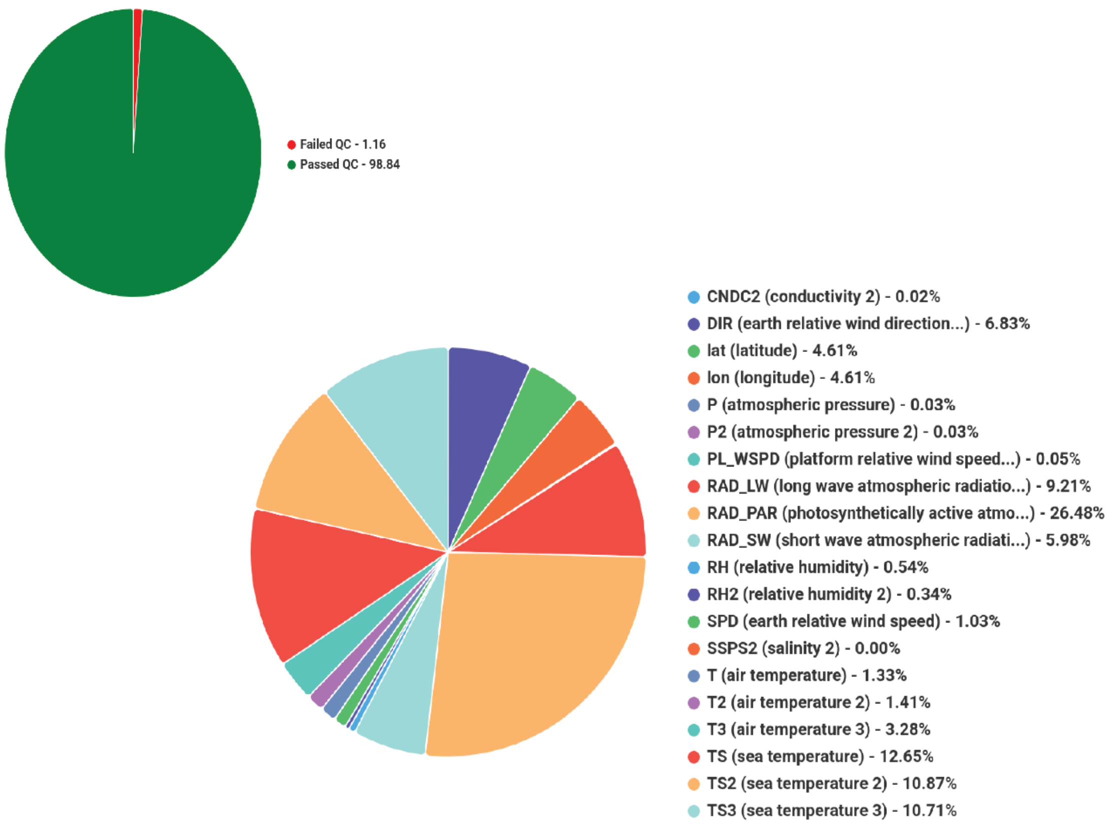


Figure 71: For the *Roger Revelle* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Roger Revelle* provided SAMOS data for 319 ship days, resulting in 12,122,480 distinct data values. After automated QC, 1.16% of the data were flagged using A-Y flags (Figure 71). This is a significant improvement in data quality compared to 2023 (4.33%) and *Revelle* is nearing the 1% total flagged cutoff regarded by SAMOS to represent "excellent" data. It should be noted that the *Revelle* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only (no research-level files exist at the SAMOS DAC for the *Roger Revelle*).

Around 18 October, the longwave radiation data (RAD_LW) started exhibiting extremely low (sometimes negative) values that were not representative of a realistic LW range. The techs noted some anomalous rises in the radiometer dome temperatures and indications were that the sensor was failing. Some attempts were made to fix the sensor over the next few weeks, but the problem persisted until 7 December 2024 when the meteorological systems were shut down for an extended shipyard period. This problem resulted in numerous “out of bounds” (B) flags (Figure 72) and the data in this period should be used with caution.

The air temperature and humidity sensors (T, T2, T3, RH, RH2) on the *Revelle* did see some unexpected data drifts and sensor failures over the year, but the existence of redundant sensors ensured that one or more temperature/humidity sensors were providing accurate data throughout the year. Instances of temperature/humidity sensor failures are noted in Annex A.

In June 2023, a unique issue was identified related to the SBE38 and thermosalinograph at the bow intake location. When travelling slow or on station, the TS, TS3, SSPS, and CNDC parameters showed a lot more spikes/noise. Originally thought to be related to bow thruster activity when the vessel was on station, much careful investigation by the shipboard techs and engineers concluded that the bow thruster was not the culprit. In fact, the problem was determined to be air in the lines, caused by wave action, but the problem seems to be amplified when the *Revelle* is travelling slow and against the predominant swell. The issue lessened when traveling with the swell. This intermittent problem continued off and on in 2023, but no clear instances were noted in 2024. Since this issue results from the overall flow-through system/hull design for the *Revelle* and prevailing vessel heading versus swell directions, it is likely to occur occasionally, so we left this note for 2024 to inform potential users of the TS, TS3, SSPS, or CNDC parameters.

There were no other issues of note for the *Revelle* in 2024. Looking to the flag percentages in Figure 71, approximately 9% of the total flags applied were assigned to latitude (LAT) and longitude (LON). These were almost exclusively “platform position over land” (L) flags in the case of LAT and LON (not shown) that appear generally to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port (and the *Revelle* typically sends data while dockside). Short wave atmospheric radiation (RAD_SW) and photosynthetically active atmospheric radiation (RAD_PAR) contributed 32% of the total flags when B flags (Figure 72) were applied when slightly negative values occurred at night (a consequence of instrument tuning, see 3b.) Finally, there were periods when the sea temperature (TS, TS2, TS3), conductivity (CNDC, CNDC2), and salinity (SSPS, SSPS2) data showed a smooth time series not representative of real ocean observations. This tends to occur when the pumps to the sea water system are shutdown, particularly when the vessel is in port or operating in an EEZ (or other restricted waters). This sometimes results in B or “greater than four standard deviations from climatology” (G) flags being applied to these variables when the sea water in the pipes is not representative of the surrounding environment, but the autoQC does not flag all occurrences. When noted, the dates of these shutdowns are listed in Annex A.

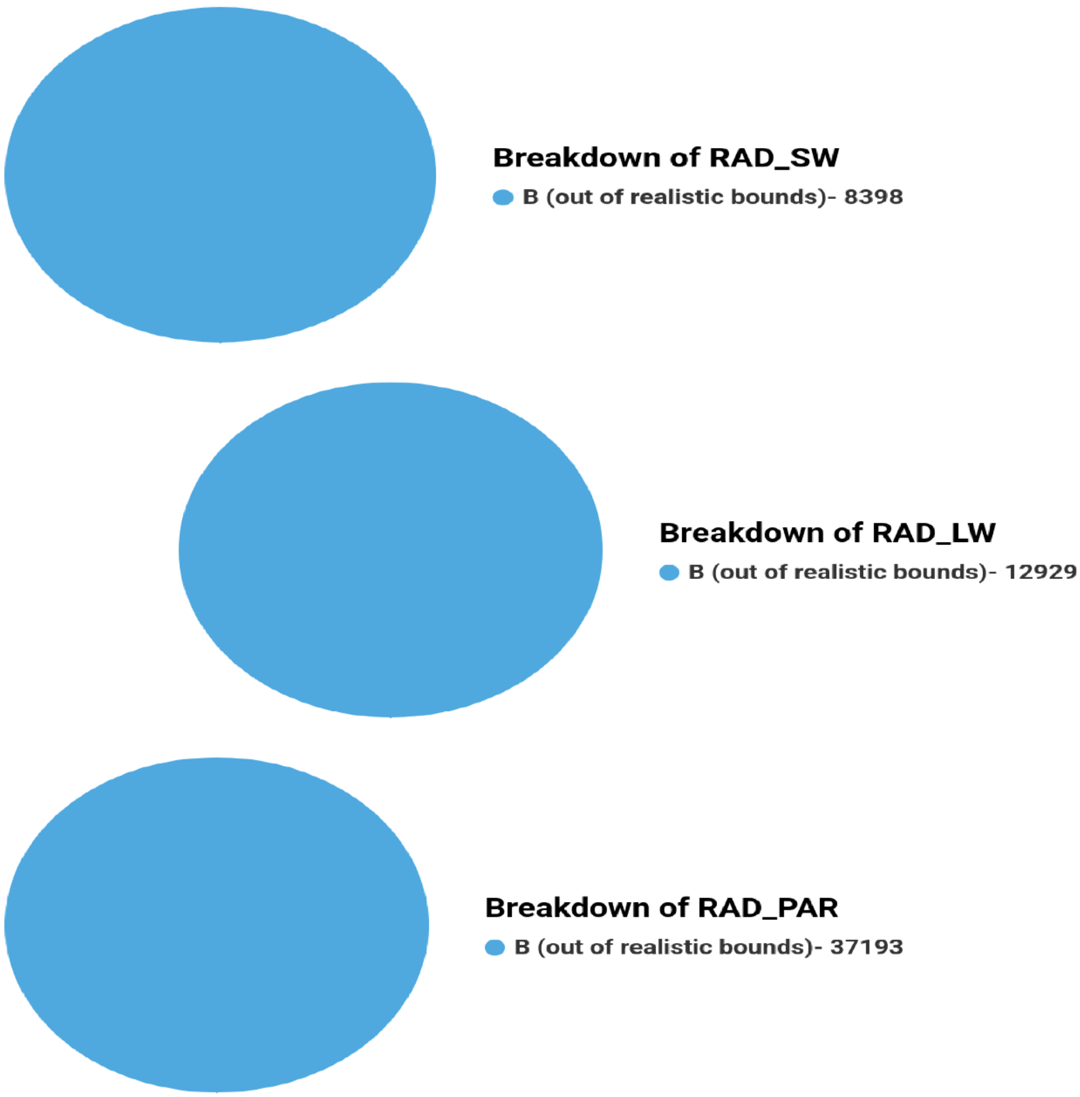


Figure 72: Distribution of SAMOS quality control flags for (top) short wave atmospheric radiation – RAD_SW – (middle) long wave atmospheric radiation – RAD_LW – and (bottom) photosynthetically active atmospheric radiation – RAD_PAR – for the *Roger Revelle* in 2024.

Sally Ride

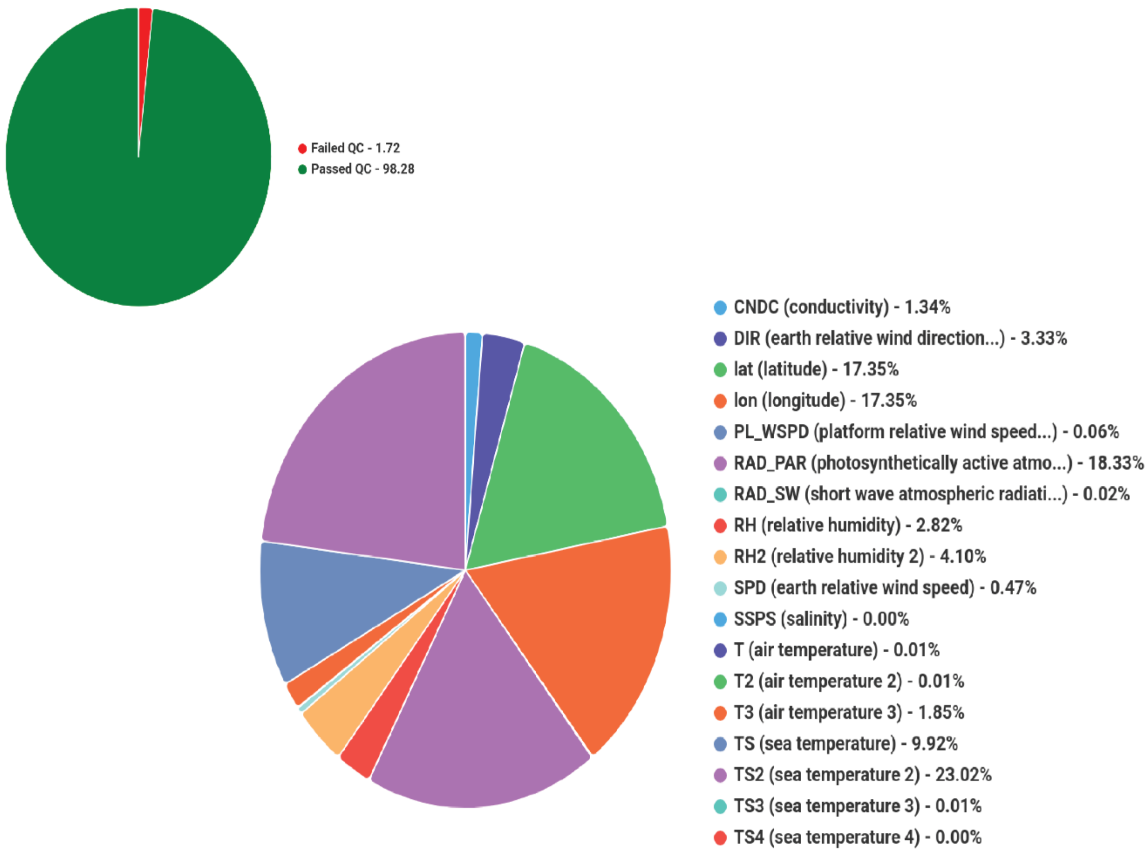


Figure 73: For the *Sally Ride* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Sally Ride* provided SAMOS data for 269 ship days, resulting in 10,488,600 distinct data values. After automated QC, 1.72% of the data were flagged using A-Y flags (Figure 73). This is virtually unchanged from 2023 (1.63%) and keeps *Sally Ride* inside the “under 5% total flagged” bracket regarded by SAMOS to represent "very good" data. It should be noted that the *Sally Ride* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only (no research-level files exist at the SAMOS DAC for the *Sally Ride*).

From 16 August – 5 September 2024, photosynthetically active atmospheric radiation (RAD_PAR) exhibited values that maximized over 3650 microeinstein m^{-2} s^{-1}, much larger than expected, with many values receiving “out of bounds” (B) flags. A comparison to the PAR sensor on the *R.G. Sproul* (docked nearby) showed the *Sally Ride* PAR to be about 1200 microeinstein m^{-2} s^{-1} higher at maximum daytime values. On 5

September, the techs lowered the mast and gave the PAR a good cleaning, which seems to have resolved the problem. PAR in this period should be used with caution.

There were no other issues of note for *Sally Ride* in 2024. Looking to the flag percentages in Figure 73, approximately 35% of the total flags applied were assigned to latitude (LAT) and longitude (LON). These were almost exclusively "platform position over land" (L) flags (Figure 74) that appear generally to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port (and the *Sally Ride* typically sends data while dockside). Another 33% of the total flags were applied to the first two sea temperature parameters (TS and TS2). In this case there was a mix of "greater than four standard deviations from climatology" (G) and B flags (Figure 74), mainly due to instances of the sea water system being off but the sensors still providing a data value over the course of the year, either when the vessel was in port (common) or during transit through an exclusive economic zone (also common). Shutdowns of the sea water system will also affect the conductivity (CNDC, CNDC2), and salinity (SSPS, SSPS2) data, prompting a smooth time series not representative of real ocean observations, but these variables tend not to receive flags from the automated QC in these situations. When noted, the dates of these shutdowns are listed in Annex A.

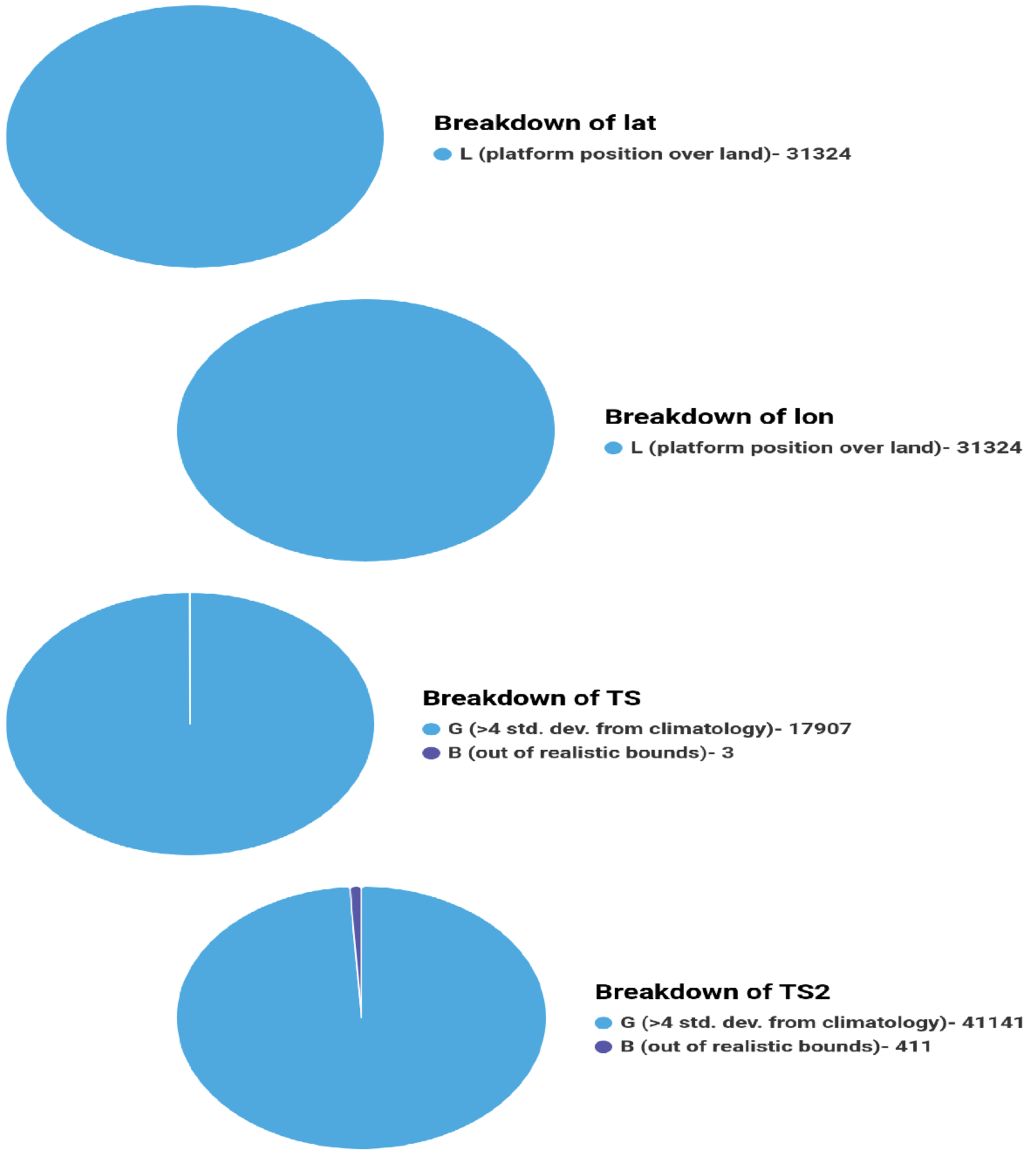
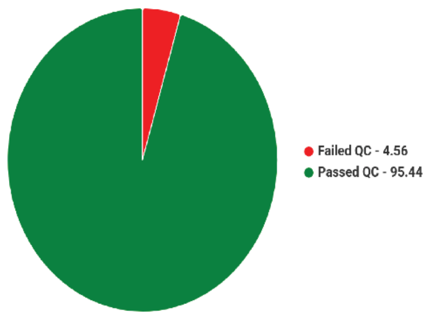


Figure 74: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) sea temperature – TS – and (last) sea temperature 2 – TS2 – for the *Sally Ride* in 2024.

Falkor (too)



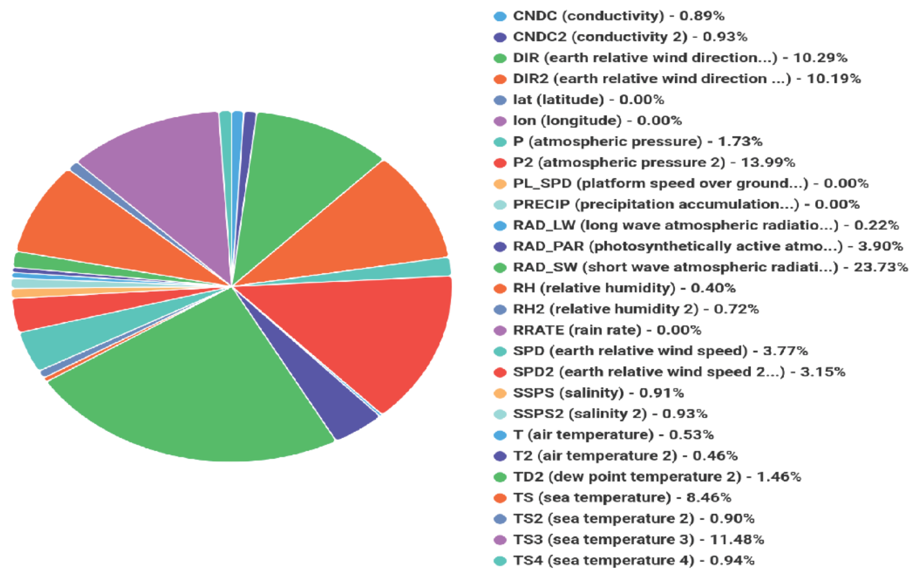


Figure 75: For the *Falkor (too)* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The Falkor (too) provided SAMOS data for 319 ship days, resulting in 15,216,981 distinct data values. After both automated and visual QC, 4.56% of the data were flagged using A-Y flags (Figure 75). This is about a percentage point higher than in 2023 (3.45%) and keeps Falkor (too) within the < 5% total flagged bracket regarded by SAMOS to represent "very good" data.

For much of the first half of 2024, Falkor (too) had a lot of trouble with their data logger and the moxa connections for their meteorology sensors, the results of which were some sporadic (but usually short lived) data outages. In the short term, they attempted to address these issues by constructing system alerts to tell them when things needed to be restarted, which helped some but did not provide a full resolution. The plan was to ultimately automate the restarts, and while we do not have confirmation that aim was achieved, we note the data gaps eventually went away.

In mid-July it was noted the average difference between Falkor (too)'s primary (P) and secondary (P2) barometers, from a Paroscientific MET4FMA and a Gill MetPakPro, respectively, was beginning to increase. From the time both were installed in 2023 the MetPakPro had averaged about 0.5 mb higher than the Paroscientific (note, they are both installed on the ship's bow platform, at the same height). Now, however, the average difference was found to be closer to 1.0 mb, which exceeds SAMOS's target tolerance for atmospheric pressure data in general, which in turn implied one (or perhaps both) of the sensors were slightly overshooting the target. There was some hint of increased incidence of "steps" in the MetPakPro P2 data, as well, so we reached out to the ship to see if anything had changed with the sensor recently. Marine technicians mentioned they had replaced the Progard filter on the MetPakPro during the previous port period, when the humidity (RH2) had reached 100%, but nothing else had been altered. A few days later they decided to also change the pressure filter on the MetPakPro, based off our analysis, though this unfortunately did nothing to narrow the gap between P and P2. By mid-October the difference between P and P2 had grown to more than 1.5 mb (with P2 still the higher value) and the odd "steps" that were only hinted at before were becoming more pronounced, so we notified the ship again (no response received). At the end of the month P2 took a clear turn for the worse, displaying some large, unexplained "mountains" and "valleys" in the data (see Figure 76, top) that were wholly absent from P (more notification at this point, with a suggestion it might be water inundation). Another two weeks went by and P2 was looking even more ragged (see Figure 76, bottom), another notification went out with our suspicions solidifying around a water-based cause. This time the techs responded and stated our notifications had inspired them to replace the MetPakPro with a Gill Maximet Marine weather station. The Maximet was procured and installed near the end of the year. Shortly after installing the Maximet technicians wrote to share that, when they'd opened the electronics box on the MetPakPro to check the wiring, they found (surprise!) water inside that would have been covering the pressure filter at the lowest part of the box. The instruments on the forward bow platform on the Falkor (too) are known to be vulnerable to at least occasional spray/wave hits, so this may have been a case where water was randomly getting into the MetPakPro's electronics box and slowly accumulating. We note P and P2 are in much better agreement again after the instrument replacement. Prior to the replacement P2 received a good amount of "caution/suspect" (K) flags (Figure 78).

One other issue with no good, easy solution came to light in 2024. It seems the ship's two Sea-Bird SBE38 sea temperature sensors (TS and TS3) are especially prone to biofouling. They require frequent cleaning, and the data are routinely noisy and erratic, sometimes displaying a bit of a "shark's tooth" pattern amongst the noise (see Figure 77). Where visibly affected these data are generally assigned K flags (Figure 78).

In general, the air temperatures (T, T2), moisture variables (TD2, RH, and RH2), and true and relative wind directions and speeds (DIR, DIR2, SPD, SPD2, PL_WDIR, PL_WDIR2, PL_WSPD, PL_WSPD2) are subject to the effects of flow distortion and/or ship heating when flow is from the stern. This makes sense, as all these sensors are located on the foremast/bow platform (forward of the bow) with all the ship's superstructure behind them. Whenever flow and/or heating effects are suspected, the data are typically assigned K flags (Figure 78, only DIR and DIR2 shown). Additionally, DIR, DIR2, SPD, and SPD2 sometimes receive "failed the true wind recomputation check" (E) flags (Figure 78) from autoQC when the relative wind is directly on or crosses over the bow. It has never been established precisely why this occurs, but the answer almost certainly lies buried somewhere among the shipboard true wind calculations and averaging routines. A few ideas are it could be a question of sensor inputs, or there could be inconsistencies among the polar directional ranges (for example, using 0-359 for relative wind direction and 1-360 for ship heading). In any case, the true wind data are still considered of good quality for distribution. All these sensors on the bow are also, as mentioned earlier, vulnerable to the occasional spray or wave hit. Lastly, Falkor (too) noted a distinct issue with birds roosting on the foremast in 2024. The radiometers, in particular, seemed to need frequent cleaning to "de-poop".

Looking to the flag percentages in (Figure 75), about 24% of the total flags were applied to the short-wave atmospheric radiation (RAD_SW). In this case, they were almost entirely "out of bounds" (B) flags (not shown) such as are applied to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.)

As a special note for interested users, the average depth of Falkor (too)'s longitudinal and transverse speed through water variables (PL_SOW and PL_SOW2, respectively, not shown here) from her ADCP is 14 meters below the water's surface.

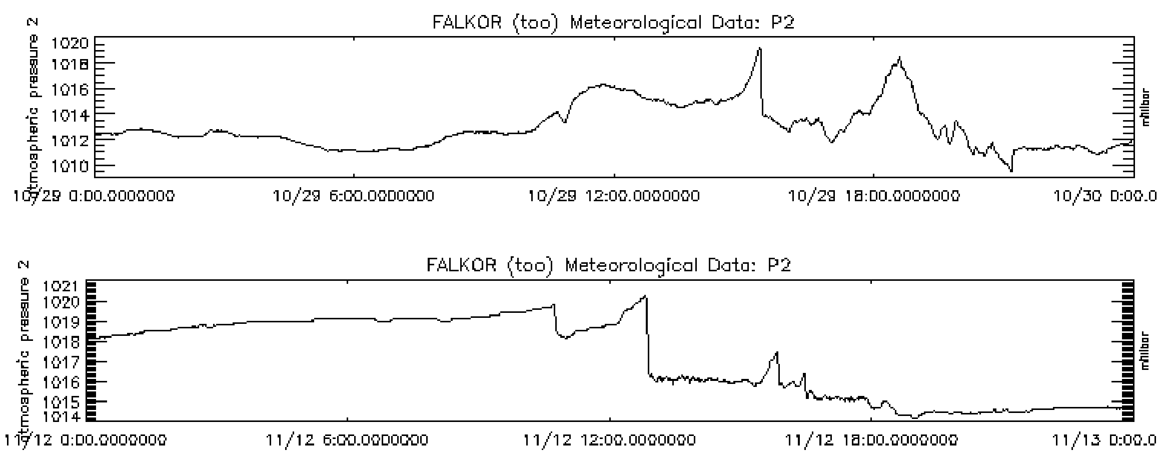


Figure 76: *Falkor (too)* SAMOS pressure 2 – P2 – data for (top) 29 October 2024 and (bottom) 12 November 2024. Note spurious "mountains" and "valleys" on 29 October after ~1600 UTC and "mountains" and even deeper (and more sustained) "valleys" on 12 November after ~1100 UTC.

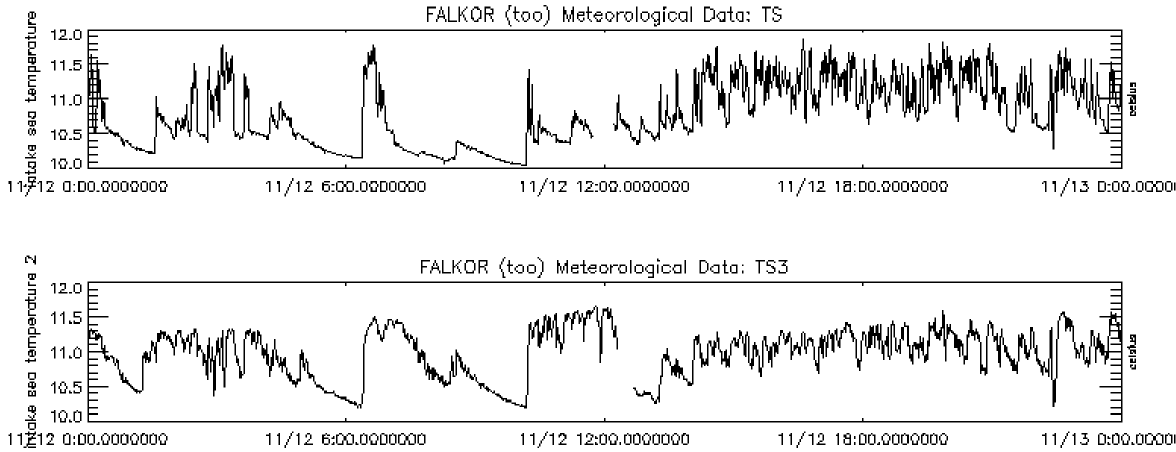


Figure 77: Falkor (too) SAMOS sea temperature – TS – and sea temperature 3 – TS3 – data for 12 November 2024. Note presence of noise and several instances of suspicious "shark tooth" shaped curves due to biofouling.

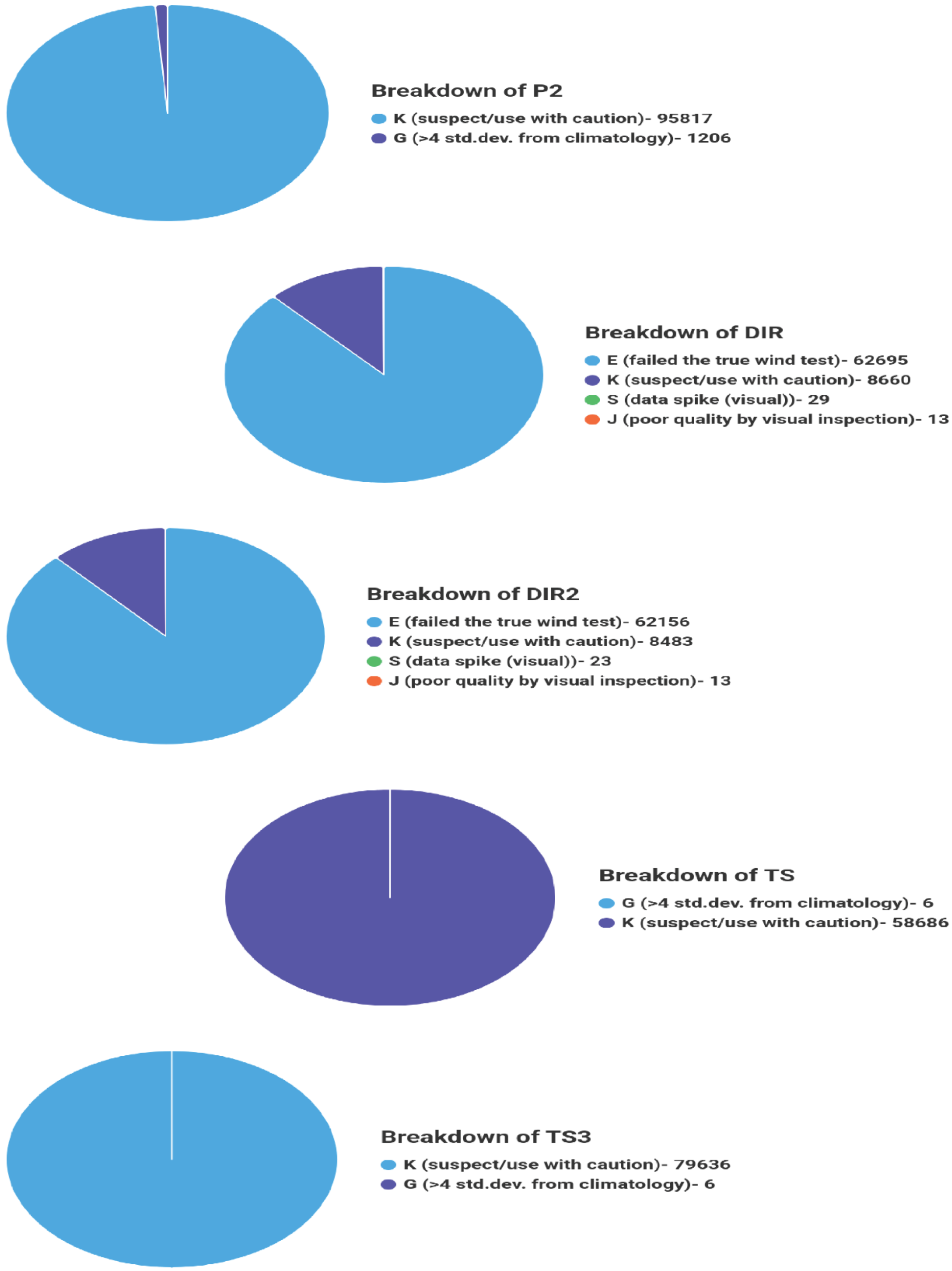
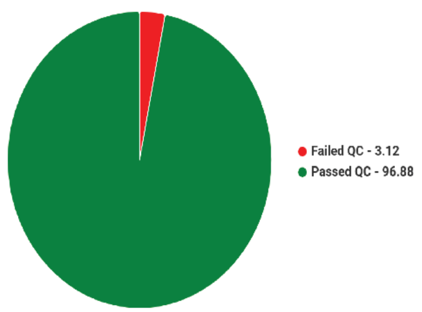


Figure 78: Distribution of SAMOS quality control flags for (first) atmospheric pressure 2 – P2 – (second) earth relative wind direction – DIR – (third) earth relative wind direction 2 – DIR2 –(fourth) sea temperature – TS – and (last) sea temperature 3 – TS3 – for the *Falkor (too)* in 2024.

Sikuliaq



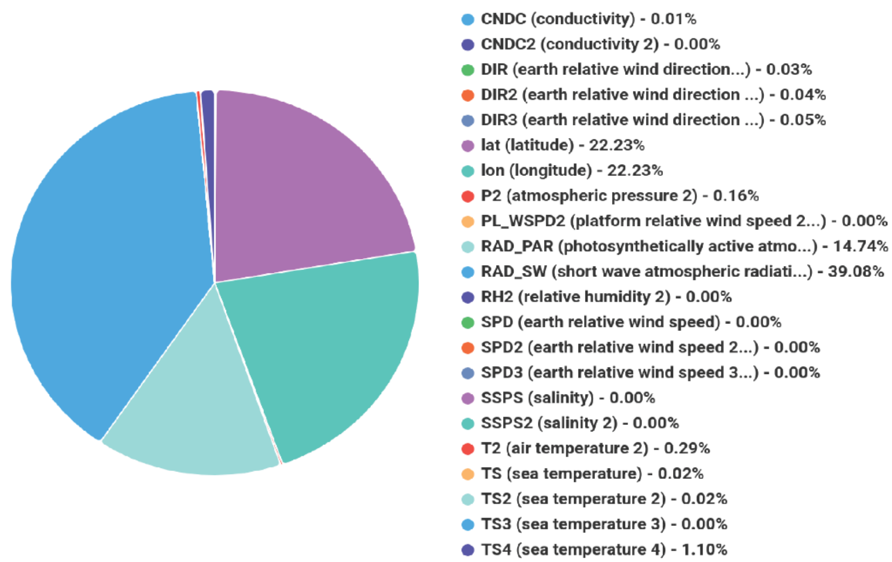


Figure 79: For the *Sikuliaq* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Sikuliaq* provided SAMOS data for 310 ship days, resulting in 14,919,080 distinct data values. After automated QC, 3.12% of the data were flagged using A-Y flags (Figure 79). This is about half a percentage point lower than in 2023 (3.54%) and keeps *Sikuliaq* under the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. It should be noted that the *Sikuliaq* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only (no research-level files exist at the SAMOS DAC for the *Sikuliaq*).

When in port, the infrared sea surface temperature sensor (TS4) on *Sikuliaq* is not turned off (all the other underway seawater sensors do not report in port). At these times, the sensor may be pointing at a feature other than sea water (e.g., dock, building), resulting in unrepresentative TS4 values. Values tend to be unrealistically high when pointed at a land surface. Notable occurrences in 2024 were in Newport, OR (30 Sept – 4 October) and Honolulu, HI (2-5 November and 8-13 December). These data should not be used. It is also worth noting this sensor will report values well below those of the other sea water temperature sensors when the *Sikuliaq* is operating in sea ice. In the ice, TS4 values well below a realistic -2˚C sea water temperature can occur. This has been confirmed in the past to be a good indicator of the vessel being in the sea ice pack.

There were no other data issues of note for *Sikuliaq* in 2024. Looking to the flag percentages in Figure 79, about 45% of the total flags were applied to latitude (LAT) and longitude (LON). These were exclusively "platform position over land" (L) flags (Figure 80) that appear generally to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port. A further 39% of the total flags were applied to shortwave atmospheric radiation (RAD_SW) and nearly 15% to photosynthetically active atmospheric radiation (RAD_PAR), in both cases exclusively "out of bounds" (B) flags (Figure 80) which are applied to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.) Finally, approximately 1% of the total flags were applied to TS4. These were mostly B flags or "greater than four standard deviations from climatology" (G) flags (Figure 80). In this case the flagged data mainly resulted from the infrared thermometer pointing at the dock or at pack ice, meaning it was not actually measuring the sea temperature. We note this does not indicate a problem with the sensor.

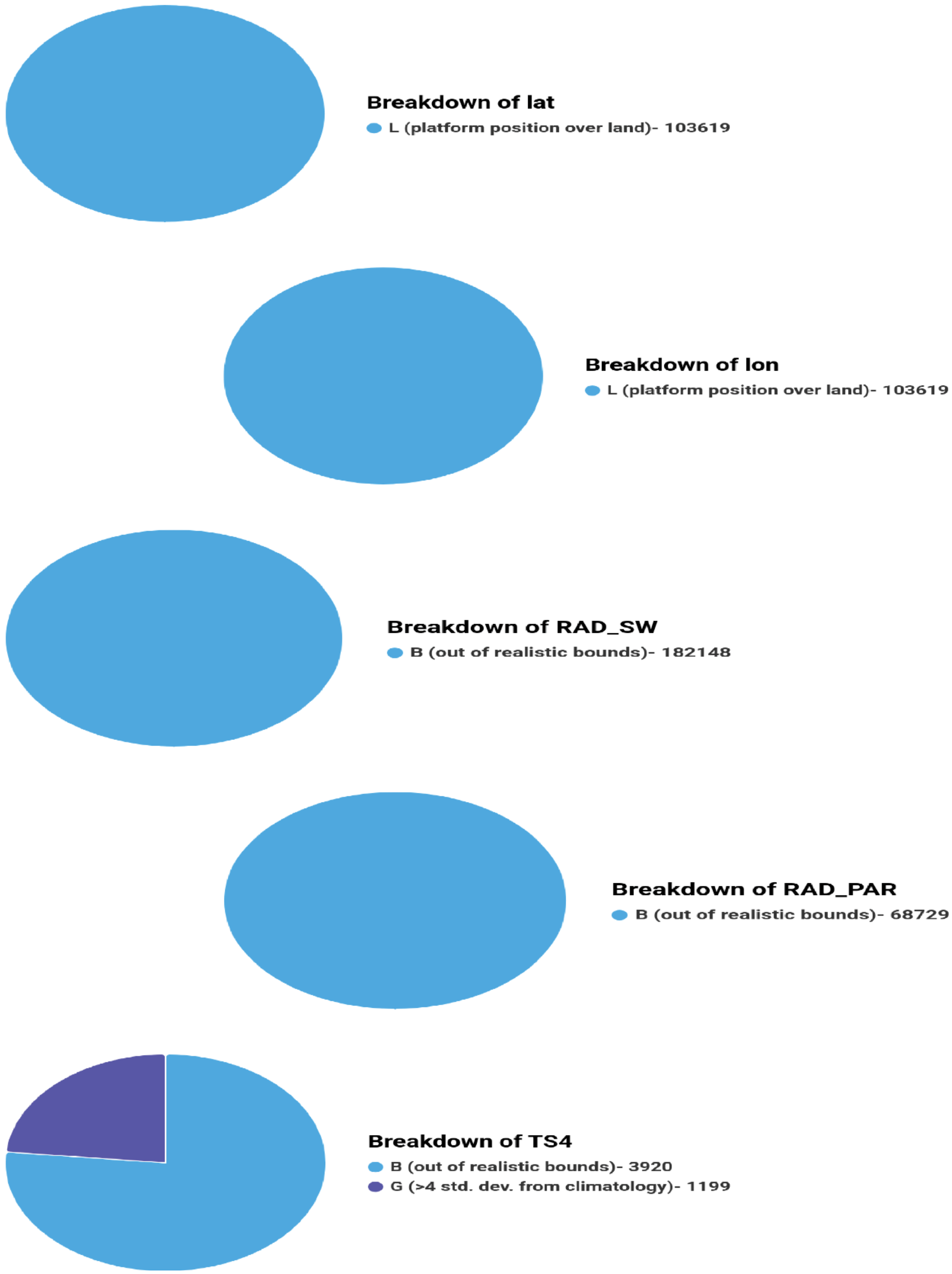


Figure 80: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) short wave atmospheric radiation – RAD_SW – (fourth) photosynthetically active atmospheric radiation – RAD_PAR – and (last) sea temperature 4 – TS4 – for the *Sikuliaq* in 2024.

Kilo Moana

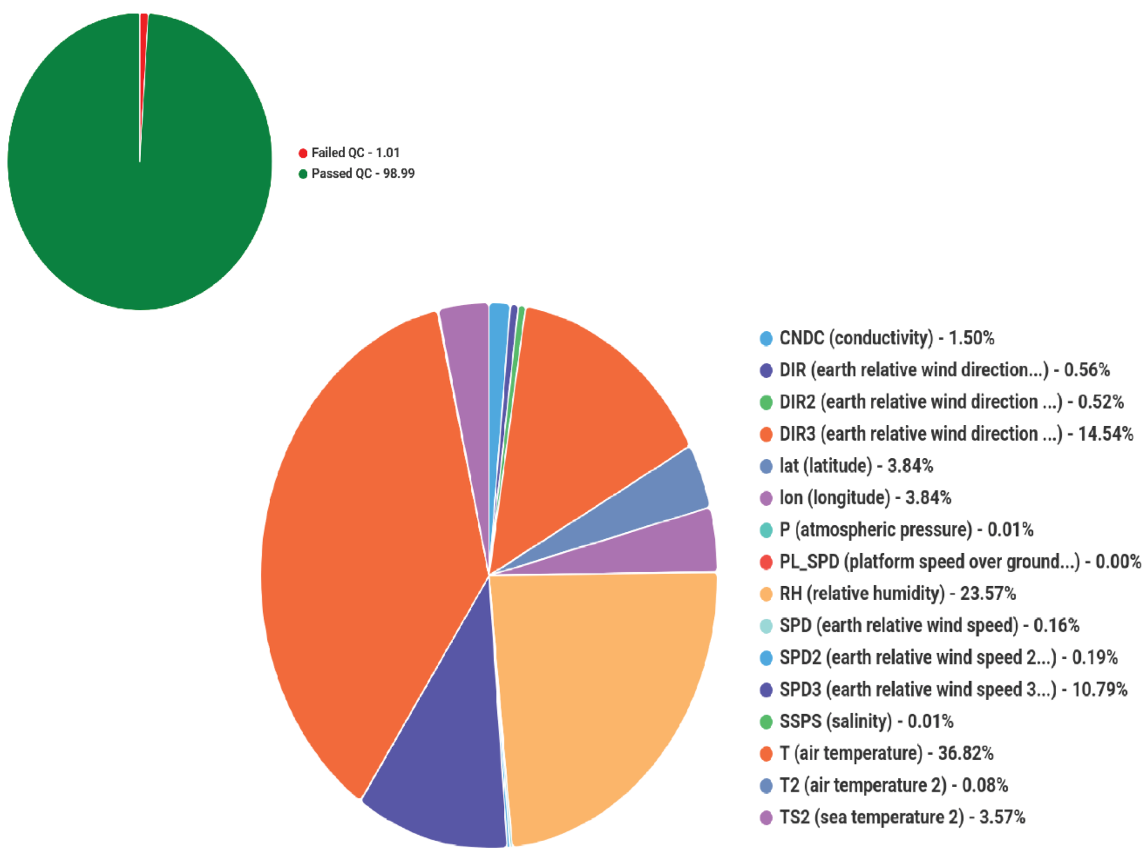


Figure 81: For the *Kilo Moana* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Kilo Moana* provided SAMOS data for 223 ship days, resulting in 8,288,471 distinct data values. After automated QC, just 1.01% of the data were flagged using A-Y flags (Figure 81). This is about half a percentage point higher than 2023 (0.56%) and maintains *Kilo Moana's* standing near the 1% total flagged cutoff regarded by SAMOS to represent "excellent" data. It should be noted that the *Kilo Moana* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only (no research-level files exist at the SAMOS DAC for the *Kilo Moana*).

From 6 January – 17 April 2024, the *Kilo Moana* experienced problems with their logging scripts and some file mounts, resulting in several missing parameters from their Vaisala WXT (P2, T2, RH2, PRECIP3, RRATE2). The scripts also recorded incorrect relative and true wind values (PL_WDIR3, PL_WSPD3, DIR3, SPD3), resulting in several "failed the true wind recomputation check" (E) and some "greater than four standard deviations from climatology” (G) flags on the WXT true winds (Figure 82, not all shown). None of the relative or true winds should be used during this period.

Around 20 May 2024, the WXT experienced another issue when it was struck by something unknown (bird, high winds), but the result was significant damage to the sensor mount (sensor dangling from the mast). The sensor was removed and not replaced until 26 July 2025, so early in this period there will be some bad data recorded by the WXT (noted by some “out of bounds” (B) flags on T2, not shown), but then all the WXT data will be missing.

The other major problem on the Kilo Moana in 2024 was the periodic failure of the Rotronic MP101A temperature (T) and humidity (RH) sensor. Several times when this sensor reported suspect observations are noted in Annex A and the result was many B and G flags on T and RH (Figure 82). The Rotronic sensors were discontinued on the Kilo Moana as of 12 September 2024 in lieu of using the Vaisala WXT as the primary air temperature and humidity sensor in the future.

There were no other major issues of note for *Kilo Moana* in 2024. Looking to the flag percentages (Figure 81), about 8% of the total flags were applied to latitude (LAT) and longitude (LON). These were exclusively “platform position over land” (L) flags (not shown) that appear generally to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port. Additionally, considering the very low total flagged percentage it is not worth drilling down into other individual parameter flag percentages.

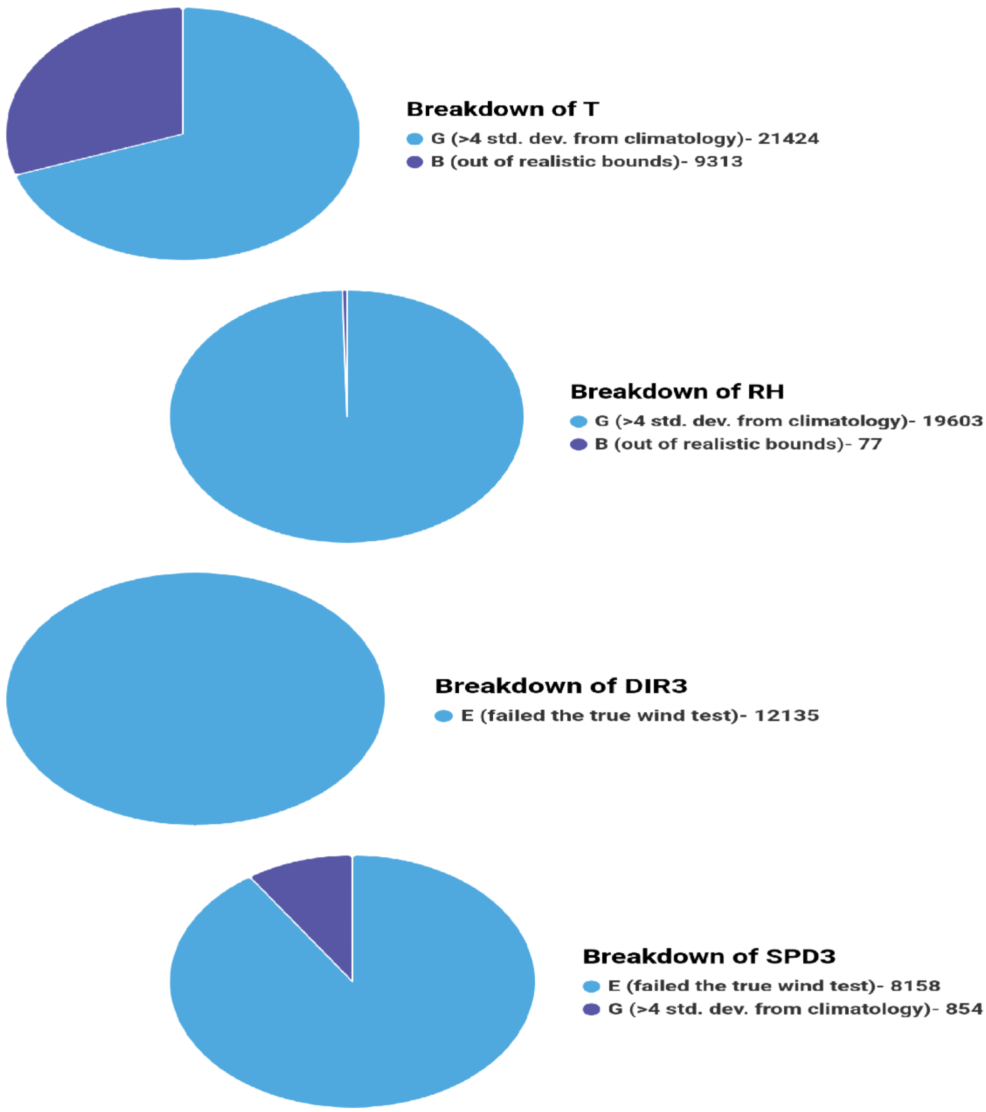


Figure 82: Distribution of SAMOS quality control flags for (first) air temperature – T – (second) relative humidity – RH – (third) earth relative wind direction 3 – DIR3 –and (last) earth relative wind speed 3 – SPD3 – for the *Kilo Moana* in 2024.

Thomas G. Thompson

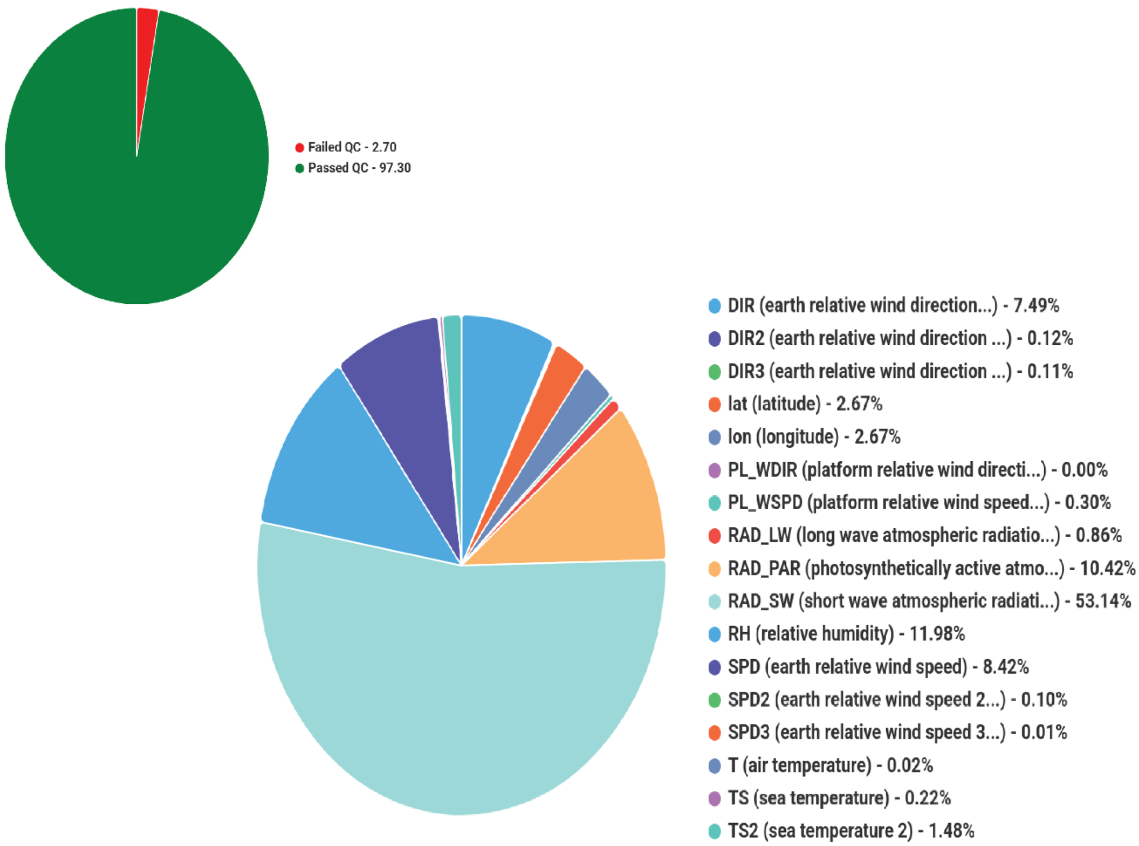


Figure 83: For the *Thomas G. Thompson* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Thomas G. Thompson* provided SAMOS data for 242 ship days, resulting in 8,372,100 distinct data values. After automated QC, 2.70% of the data were flagged using A-Y flags (Figure 83). This is several percentage points lower than in 2023 (6.16%) and places *Thompson* nicely within the “under 5% total flagged” bracket regarded by SAMOS to represent "very good" data. It should be noted the *T. G. Thompson* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only (no research-level files exist at the SAMOS DAC for the *T. G. Thompson*).

Problems with the Eppley short wave and long wave radiometers noted in the 2023 SAMOS report continued into early 2024, resulting in numerous “out of bounds” (B) flags on the RAD_SW and RAD_LW data (Figure 85). These data continued to be problematic into 2024 when the *Thompson* installed new Kipp and Zonen radiometers on 28 January 2024, replacing the Eppley sensors. Users should treat all the *Thompson*

RAD_SW and RAD_LW data reported prior to 28 January 2024 as suspicious and conduct some careful analysis before using these observations.

About 7% of the flags in 2024 were applied to true wind direction (DIR) (Figure 83). The flags on DIR were entirely “failed the wind recomputation check” (E) flags by the automated quality control (Figure 85). These flags, along with some B flags and “greater than four standard deviations from climatology” (G) flags on the true wind speed (SPD) were the result of intermittent problems with the sonic anemometer mounted on the bow mast. The cause of the problem was never determined but continued until the sonic anemometer was replaced with a new sensor on 25 April 2024. Prior to this time, the DIR and SPD data should be used with caution into 2024 when the anemometer was replaced with a new device.

Several instances are noted in Annex A when the bow sonic anemometer on the *Thompson* was the site of roosting tropical sea birds. This is a common problem when the vessel is operating in the tropics and results in numerous very large spikes (up to 50+ m/s) in the platform relative and earth relative wind speeds (PL_WSPD and SPD, respectively). When "bird events” occur in the *Thompson’s* SPD data, they are usually assigned either B, G, or E flags by automated quality control procedures (Figure 85, only SPD shown). A nice photo of a bird roosting on the anemometer was provided by the *Thompson’s* technician (Figure 84).

No other notable problems were identified in the data for the *Thompson* in 2024. Looking at the flag percentages in Figure 83, about 6% of the total flags were applied to latitude (LAT) and longitude (LON). These were exclusively “platform position over land” (L) flags that appear generally to have been applied when the vessel was either in port or very close to land (not shown). This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port. In addition to the problem noted above for the Eppley SW sensor, some of the 53% of the total flags applied to shortwave atmospheric radiation (RAD_SW) and nearly 11% to photosynthetically active atmospheric radiation (RAD_PAR), were the result of B flags (Figure 85) applied to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.)

Figure 84: Sea bird roosting on top of the bow sonic anemometer on the *Thompson* on 21 October 2024. Image courtesy of Elizabeth Ricci at the University of Washington.

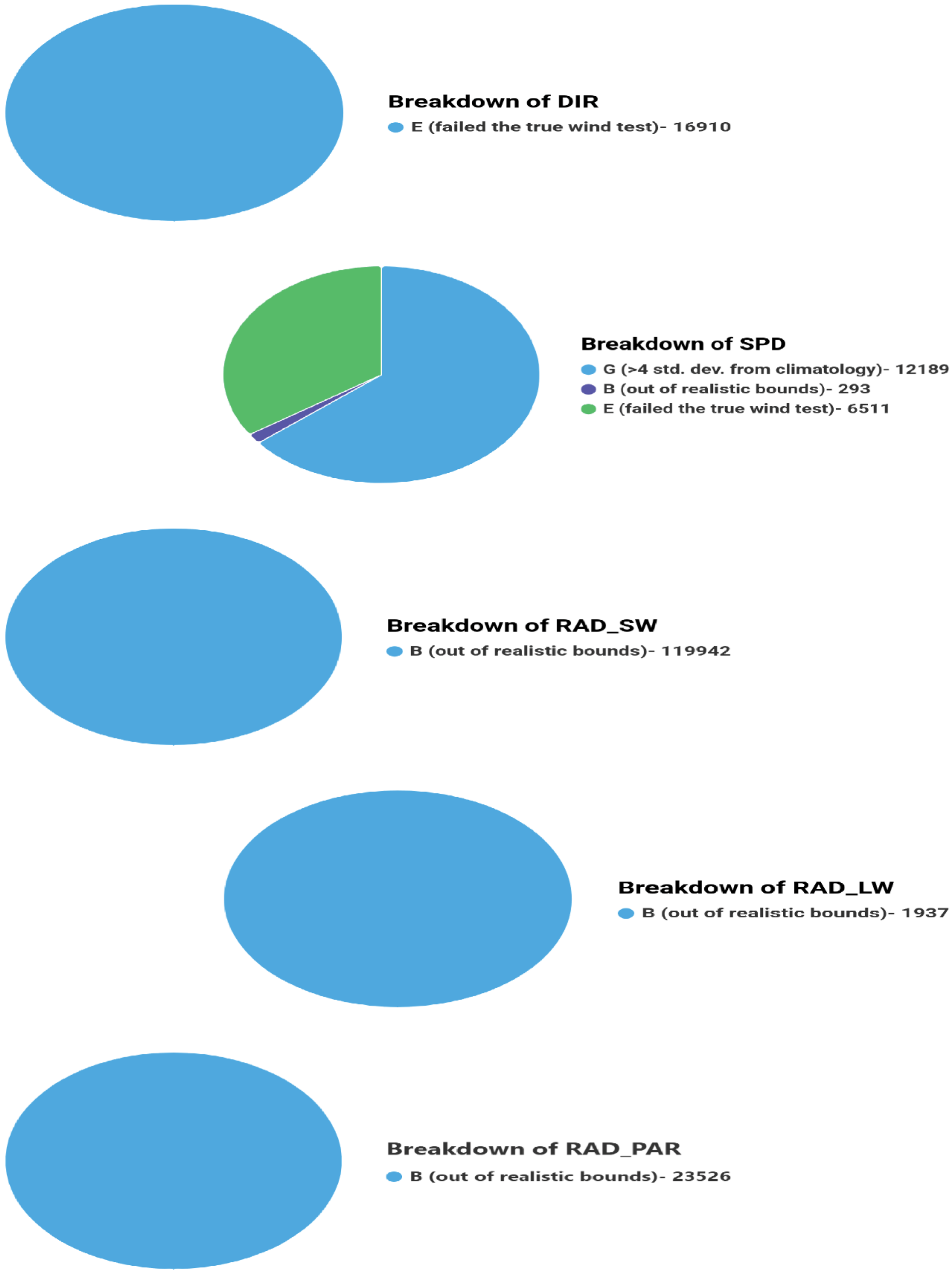


Figure 85: Distribution of SAMOS quality control flags for (first) – DIR – (second) earth relative wind speed – SPD – (third) short wave atmospheric radiation – RAD_SW –(fourth) long wave atmospheric radiation – RAD_LW – and (last) photosynthetically active atmospheric radiation – RAD_PAR – for the *Thomas G. Thompson* in 2024.

Healy

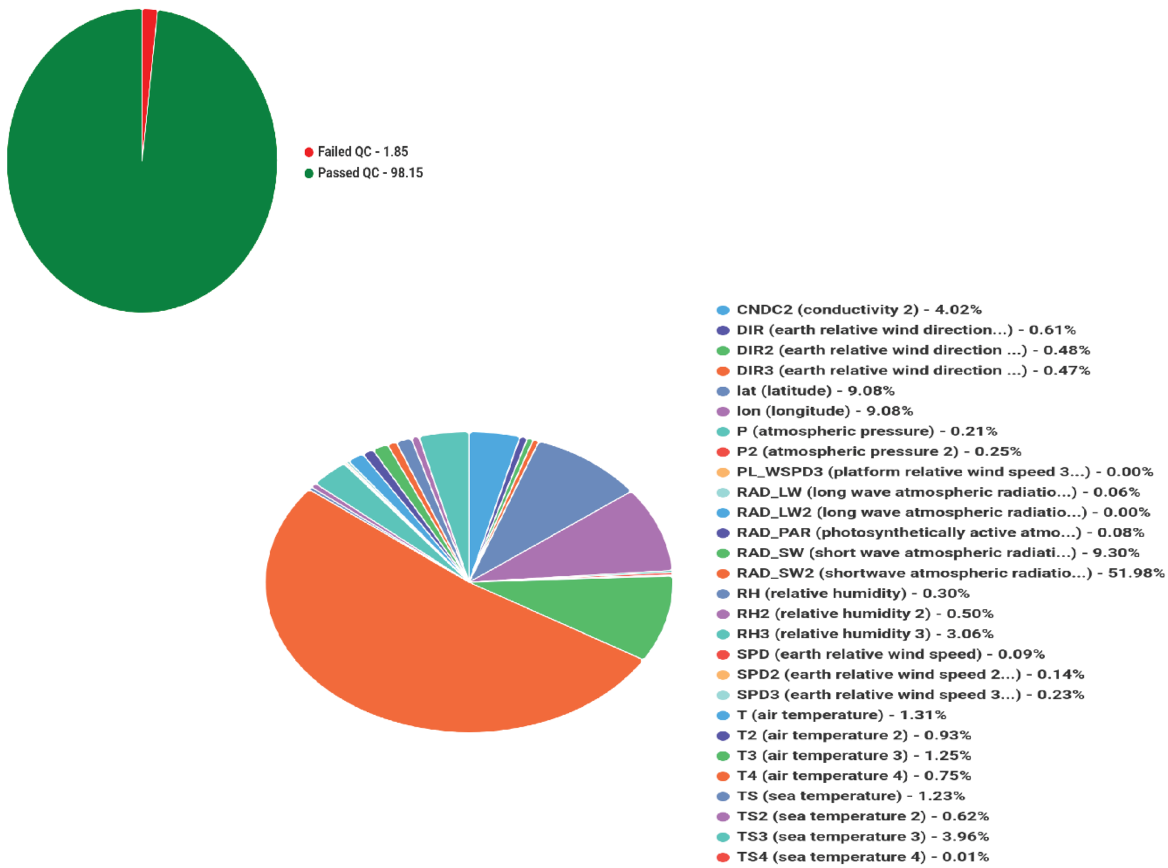


Figure 86: For the *Healy* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *Healy* provided SAMOS data for 173 ship days, resulting in 8,221,830 distinct data values. After automated QC, 1.85% of the data were flagged using A-Y flags (Figure 86). This is slightly more than one percentage point lower than 2023 (3.13%) and keeps *Healy* under the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. It should be noted *Healy* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only.

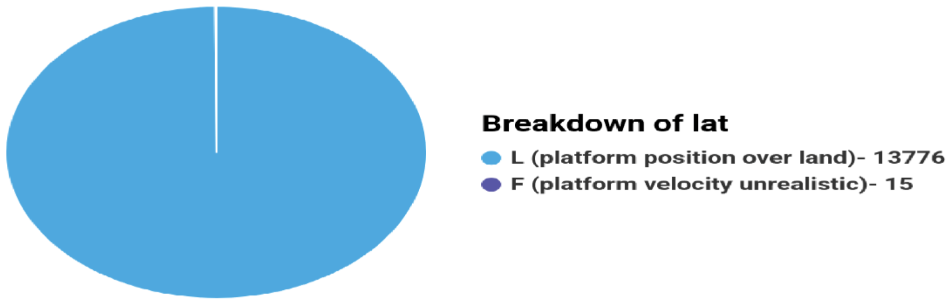
The two main issues in 2024 were related to periodic failures of temperature and humidity sensors and a calibration offset in the Eppley SW radiometer:

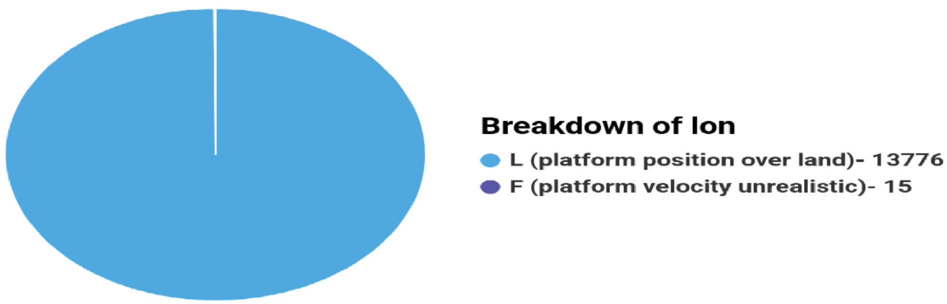
From 12-24 June 2024, the EE08 relative humidity (RH3) was stepping from realistic values around 70% down to values around 20%. The length of time the sensor stayed around 20% varies from minutes, to hours, to most of one whole day. The other two relative humidity sensors (EE260-GA1 on the bow, aka RH, EE HTP201 on the bridge top, aka RH2) look great and agree well with humidities around 70%. The malfunctioning EE08 was replaced on 24 June 2024. The bow hygrometer failed sometime around 22 July 2024 resulting in flatlined air temperature (T) and RH data values. The bow location is hard to access during the field season, so the sensor was not replaced until early October and did not report reasonable values until 18 October. All T and RH data between 22 July – 18 October should not be used. Finally, the hygrometer reporting RH3 was reporting humidities that did not compare well to the other two humidity sensors starting around 26 November 2024. There were no techs onboard at the time of the problem, so the RH3 data should be used with caution up until the sensor was removed on 10 January 2024.

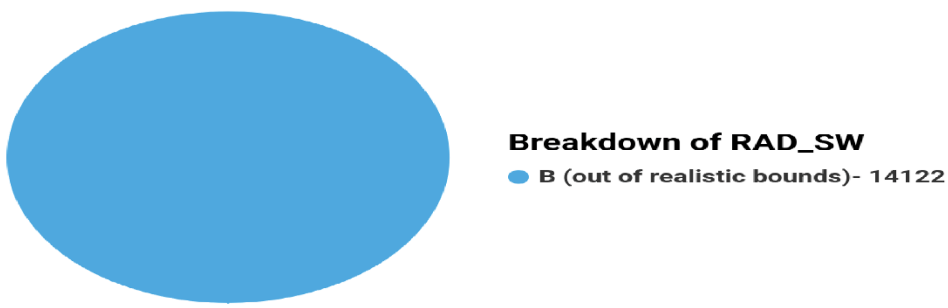
In 2024, the *Healy* was providing short wave and long wave radiation data from a pair of Eppley (RAD_SW, RAD_LW) and Kipp and Zonen (RAD_SW2, RAD_LW2) sensors. Over the year, we noted an increase in the nighttime negative SW radiation offset in the Eppley as compared to the Kipp and Zonen, with some nighttime offset values being above zero, which is very unexpected for an Eppley SW radiometer. We suspected the Eppley was drifting off calibration, but the problem was more complicated than that. On 26 November 2024, the technicians discovered an odd offset value entry of '0.032' for the Eppley SW in all versions of their 2024 acquisition files. Acquisition files from 2020 - 2023 sailing seasons had offsets that were all '0.0' for both the Eppley SW and LW sensors. As a test, the offset was changed from 0.032 to 0.0 and the W/m2 value instantly went from 2.11 to -2.24 at 0612 UTC on 26 November 2024. The techs checked some of the data collected earlier in 2024, and the positive nighttime offsets are consistently present, which is very suggestive of the 0.032 offset being the cause of the positive nighttime values. The problem is that this offset likely affected daytime SW radiation values as well, so there may be a slight offset in the RAD_SW data from the Eppley radiometer throughout the 2024 field season (up until the offset was removed on 26 November).

Generally, steps from suspected flow distortion have been observed in *Healy's* atmospheric pressure (P and P2) and main mast true wind speed (SPD2, SPD3) data when the relative wind is from abeam (either 90 or 270 degrees). In addition, P and P2 showed unrealistic upward jumps around 10 hPa during the daytime from 9 November to 10 January 2024 when the sensor was removed. This looked like a diurnal heating problem with the barometer. In both cases, given the blockhouse bridge/superstructure on *Healy* likely causing airflow issues around these sensors, there is probably no real solution without moving these sensors higher up on the main mast.

Looking again to the flag percentages in Figure 86, about 52% of the total flags were applied to RAD_SW2(the Kipp and Zonen), in this case exclusively "out of bounds" (B) flags (Figure 87) such as are applied to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.) RAD_SW (the Eppley) only contributed ~9% of the total flags (mostly B flags, Figure 87), but as noted above, we suspect the lower number of B-flags in RAD_SW as compared to RAD_SW2 is likely the result of an incorrect offset in the Eppley configuration in 2024. A further ~18% of the total flags were applied to latitude (LAT) and longitude (LON). These were virtually all "platform position over land" (L) flags (Figure 87) that were likely mainly to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port. Finally, several occurrences when the flow water system was shutdown resulting in smooth, unrealistic sea temperature, conductivity and salinity data, are documented in Annex A.







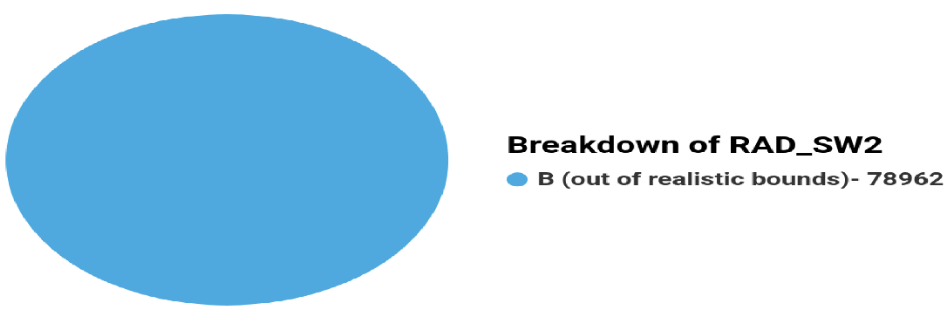
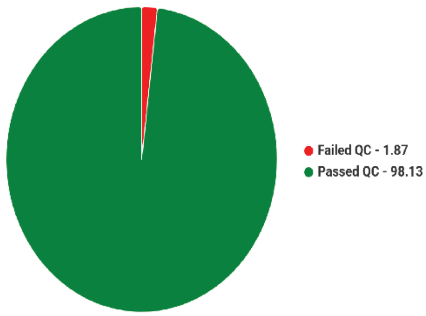


Figure 87: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) shortwave atmospheric radiation – RAD_SW – and (last) shortwave atmospheric radiation 2 – RAD_SW2 – for the *Healy* in 2024.

R/V Atlantis



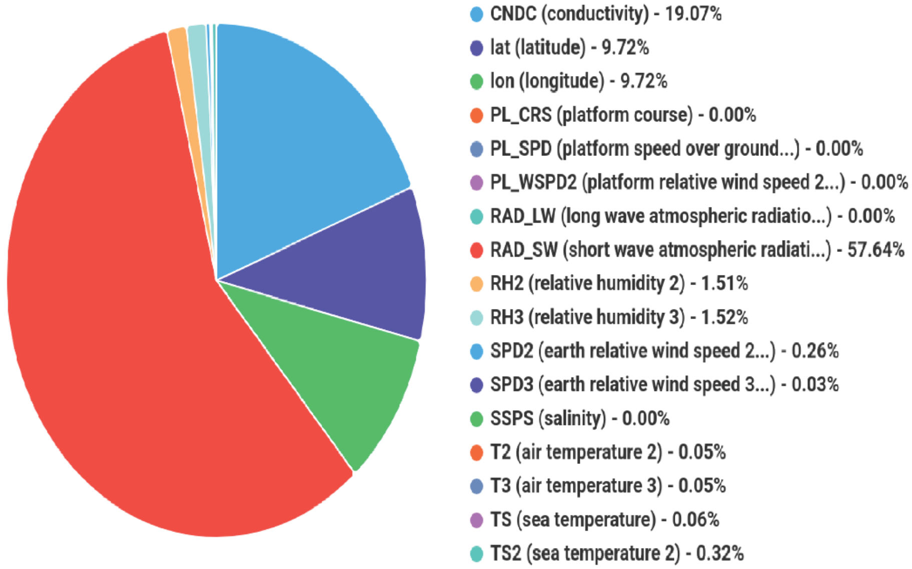


Figure 88: For the *R/V Atlantis* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Atlantis* provided SAMOS data for 348 ship days, resulting in 14,199,495 distinct data values. After automated QC, 1.87% of the data were flagged using A-Y flags (Figure 88). This is virtually unchanged from 2023 (1.68%) and maintains *Atlantis's* standing well under the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. It should be noted that the *R/V Atlantis* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only.

The *Atlantis* is another vessel that gets periodic visits from tropical seabirds, which, when they roost on the meteorological sensors (Figure 89), results in some very anomalous readings. Notable occurrences include 15 January – 10 February 2024 (affecting acoustic rain sensors; PRECIP, PRECIP2, RRATE, RRATE2), 2-16 March 2024 (affecting the stbd bow Vaisala WXT earth relative and ship relative wind speeds, precipitation, and rain rate, aka SPD3, PL_WSPD3, PRECIP3, and RRATE3, and long wave atmospheric radiation, aka RAD_LW) and 17-25 November 2024 (affecting the port bow Vaisala WXT earth relative and ship relative wind speeds, precipitation, and rain rate, aka SPD2, PL_WSPD2, PRECIP2, and RRATE2, and RAD_LW). Other examples are documented in Annex A. It is worth noting that many of the bird infestations occur at night, which was confirmed by the technicians and bridge crew with some nice photos. In many cases, the bird-affected data are not flagged by the SAMOS automated QC, though some “out of bounds” (B) or “greater than four standard deviations from climatology” (G) flags are applied to extreme values.

Two issues occurred in 2024 that resulted in data that should not be used. From 22 October – 21 November, the techs noted they did not enter new sensor coefficients into their RMRco RAD box when they installed new radiometers. This results in small offsets in the RAD_LW as well as short wave (RAD_SW) radiation data during this period. And from 20-22 November, they were having problems maintaining the flow rate to the Sea-Bird SBE45 thermosalinograph, so the sea temperature (TS2), conductivity (CNDC), and salinity (SSPS) values are suspect.

One other minor issue on the *Atlantis* is that the Vaisala WXTs periodically stop transmitting data. This affects the wind, pressure, air temperature, relative humidity, precipitation accumulation, and rain rate values from the affected instrument. These failures are random and are quickly resolved when the technicians power cycle the WXT. The cause is unknown, and it seems to affect mainly the port WXT, although occasionally the same situation is evident in the starboard WXT.

There were no other data issues of note for *Atlantis* in 2024. Looking to the flag percentages in Figure 88, over 57% of the total flags were applied to RAD_SW. These were exclusively B flags (Figure 90) and appear to have been applied mainly to the slightly negative values that can occur with these sensors at night (a consequence of instrument tuning, see 3b.). A further 20% of the total flags were applied to latitude (LAT) and longitude (LON). These were exclusively “platform position over land” (L) flags (Figure 90) that were likely mainly to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port.

As a final note, on many occasions the thermosalinograph on the *Atlantis* reported smooth/unrealistic data when the flow water system pumps were shut down (either in port or in a country’s EEZ). These events are noted in Annex A and the TS2, CNDC (much of it B-flagged), and SSPS data should not be used.

Figure 89: Nice image of tropical birds roosting on the Atlantis meteorological mast in January 2024. Image courtesy of WHOI ship technicians.

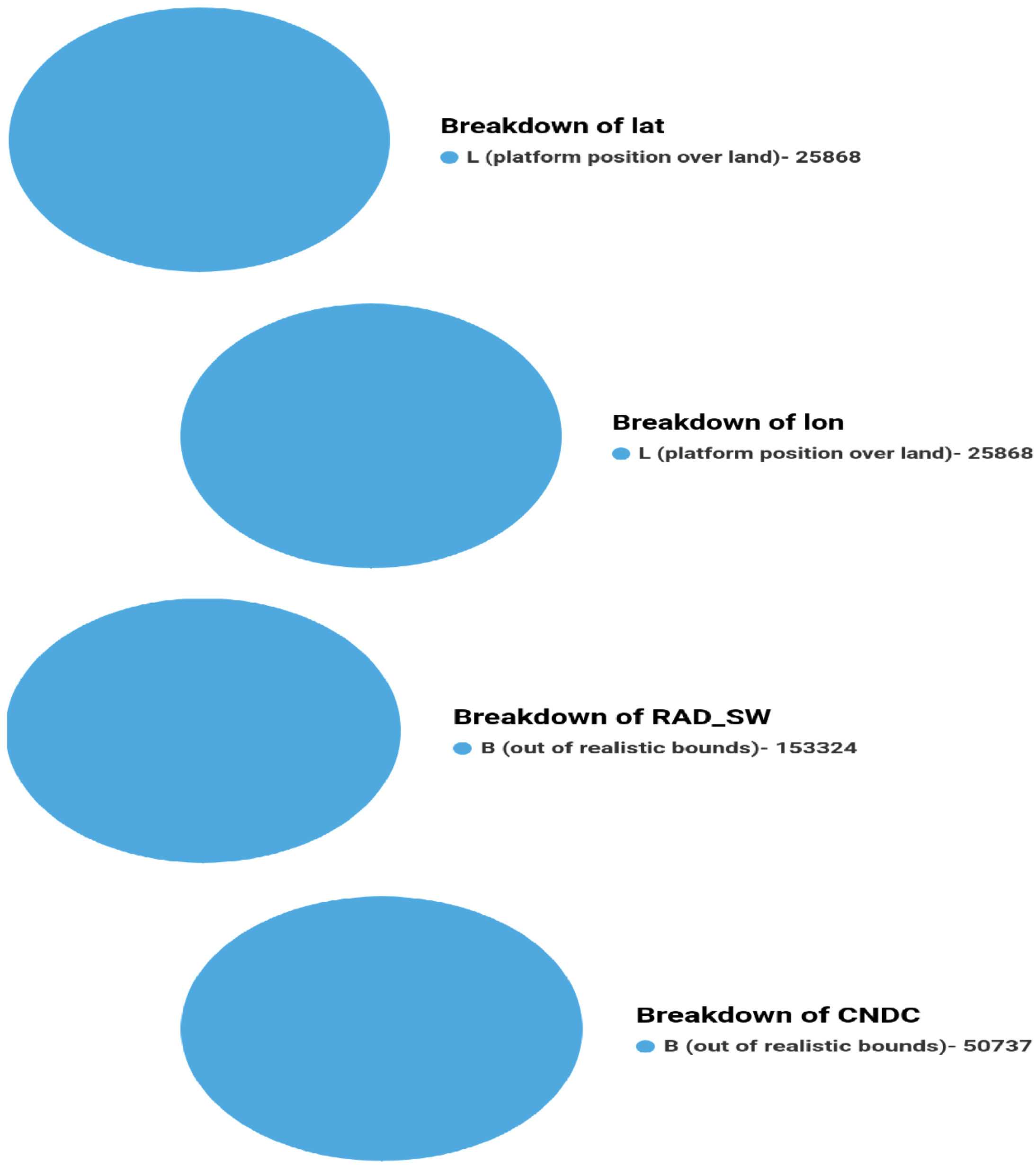
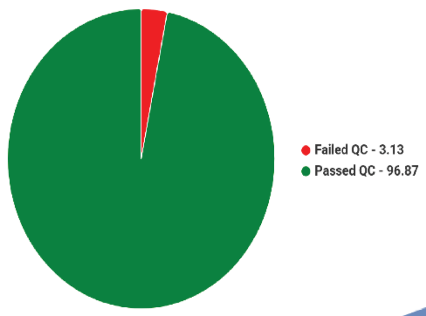


Figure 90: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) short wave atmospheric radiation – RAD_SW – and (last) conductivity – CNDC – for the *R/V Atlantis* in 2024.

R/V Neil Armstrong



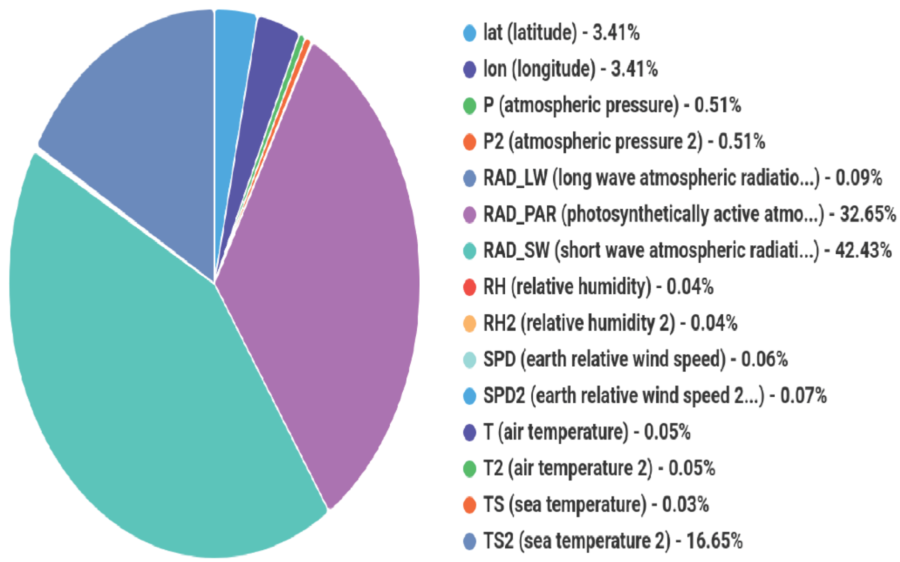


Figure 91: For the *R/V Neil Armstrong* from 1/1/24 through 12/31/24, (left) the percentage of all observations that passed vs. failed SAMOS quality control tests and (right) the percentage of the overall failed observations broken down by parameter.

The *R/V Neil Armstrong* provided SAMOS data for 277 ship days, resulting in 12,128,771 distinct data values. After automated QC, 3.13% of the data were flagged using A-Y flags (Figure 91). This is nearly identical to the flag percentage in 2023 (2.94%) and keeps *Armstrong* under the 5% total flagged cutoff regarded by SAMOS to represent "very good" data. It should be noted that the *R/V Neil Armstrong* receives only automated QC, and visual QC is when the bulk of flags are typically applied. All the flags are the result of automated QC only (no research-level files exist at the SAMOS DAC for the *R/V Neil Armstrong*).

From 27 December 2023 – 10 January 2024, the course over the ground (PL_CRS) and true winds (DIR, DIR2, SPD, SPD2) should not be used. Techs notified us that they had a course over the ground output failure on their newly installed CNAV X1 that took some time with Oceaneering to resolve. The result is incorrect COG values and subsequent suspect values for their true winds.

Like the *Atlantis*, the Vaisala WXTs on the *Neil Armstrong* spontaneously stop logging and the only solution is to power cycle all the met mast sensors. This spontaneous ceasing of data logging in *Armstrong's* WXT units results in gaps in the associated pressure (P, P2), air temperature (T, T2), relative humidity (RH, RH2), relative and true winds (PL_WDIR, PL_WDIR2, PL_WSPD, PL_WSPD2, DIR, DIR, SPD, SPD2), precipitation (PRECIP, PRECIP2), and rain rates (RRATE, RRATE2) from the affected WXT that can last hours to a day or more. The technicians are aware of the problem and, along with the SAMOS data analyst, endeavor to identify and promptly resolve these power events.

The *Neil Armstrong* tends to continue reporting data values from their thermosalinograph even when the flow water system pumps are off. This typically happens when the vessel is either in port or in an EEZ without clearance to collect ocean data. The result is a smooth data trace for the sea temperature (TS2), conductivity (CNDC), and salinity (SSPS) from their SBE45 and sometimes "out of bounds" (B) or "greater than four standard deviations from climatology" (G) flags on TS2 (Figure 92, only TS2 shown) as the water sitting in the pipes is no longer representative of the actual ocean conditions where the vessel is operating. These data should not be used and whenever possible the occurrences are noted in Annex A.

There are no other data issues of note for *Neil Armstrong* for 2024. Looking at the flag percentages in Figure 91, almost all the total flags applied were assigned to short wave atmospheric radiation (RAD_SW, 42%) and photosynthetically active radiation (RAD_PAR, 33%). In both cases these were exclusively B flags (Figure 92) that appear to have been applied mainly to the slightly negative values that can occur with these types of sensors at night (a consequence of instrument tuning, see 3b.) A further ~7% of the total flags were applied to latitude (LAT) and longitude (LON). These were exclusively "platform position over land" (L) flags (Figure 92) that were likely mainly to have been applied when the vessel was either in port or very close to land. This is not uncommon, as the land mask in use for the land check routine is often incapable of resolving the very fine detail of a coastline or an inland port.

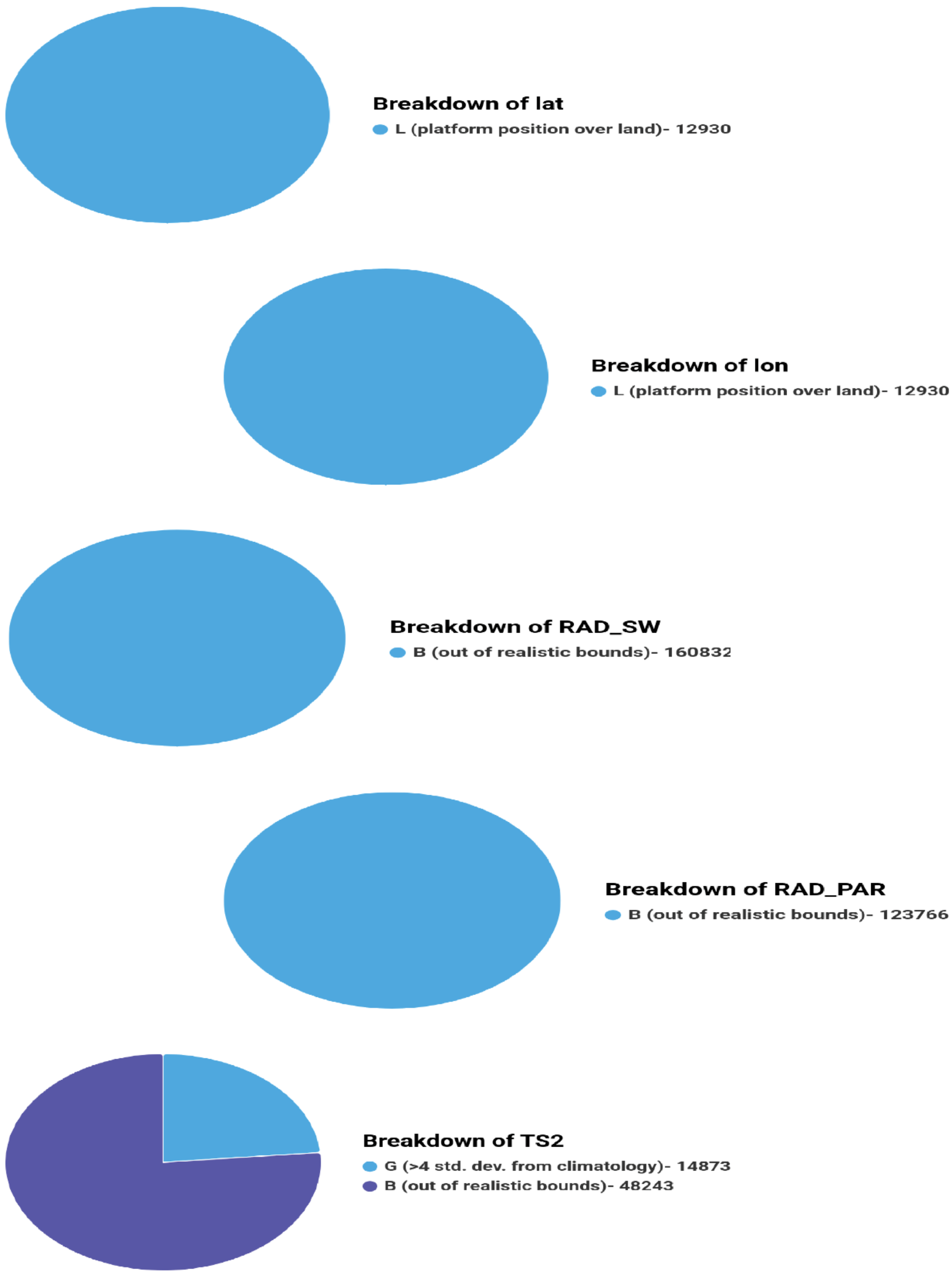


Figure 92: Distribution of SAMOS quality control flags for (first) latitude – LAT – (second) longitude – LON – (third) short wave atmospheric radiation – RAD_SW – (fourth) photosynthetically active radiation – RAD_PAR – and (last) sea temperature 2 – TS2 – for the *R/V Neil Armstrong* in 2024.

4. Metadata summary

Adequate metadata is the backbone of good visual QC. It also improves the utility of any data set. As such, vessel operators are strongly advised to keep vessel and parameter metadata complete and up to date. Annex B, Part Two, walks SAMOS operators through editing metadata online, step by step, while Part One offers instructions for monitoring metadata and data performance. For vessel metadata, the following are the minimum required items in consideration for completeness: Vessel information requires vessel name, call sign, IMO number, vessel type, operating country, home port, date of recruitment to the SAMOS initiative, data reporting interval, and instrument system name (i.e., data acquisition/assembly software) and, if applicable, version. Vessel layout requires length, breadth, freeboard, and draught measurements. Vessel contact information requires the name and address of the home institution, a named contact person and either a corresponding email address or phone number, and at least one onboard technician email address. A technician name, while helpful, is not vital. Vessel metadata should also include vessel imagery (highly desirable, see Figure 93 for examples) and a web address for a vessel's home page, if available.

Parameter metadata requirements for completeness vary among the different parameters, but in all cases "completeness" is founded on filling in all available fields in the SAMOS metadata form for that parameter, as demonstrated in Figure 94. (Any questions regarding the various fields should be directed to samos@coaps.fsu.edu. Helpful information may also be found at https://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 94 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. (Note that for those sensors not routinely calibrated, such as GPS instruments, an installation date is alternately desired.)

We note here that as of summer 2020 we are now collecting additional flow water metadata elements, namely, intake location and pipe run length. Knowing these details can help establish a basis for any unnatural increase or decrease seen in sea water variable values away from what they would have been directly at the sea water intake. Typically, the further water has travelled inside the ship, the greater the warming/cooling effects of the ship/pipes on the water.

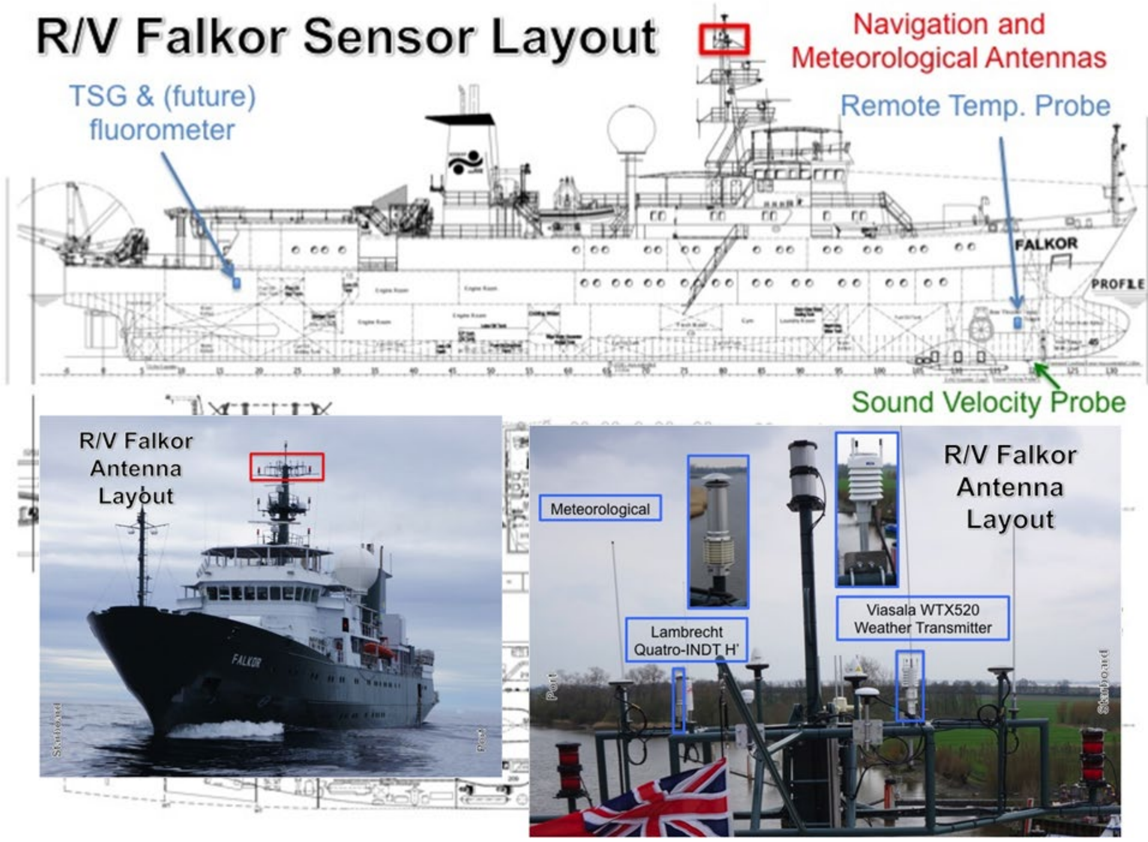


Figure 93: Examples of detailed vessel instrument imagery from the *R/V Falkor*.

a.

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

b.

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

Figure 94: Example showing parameter metadata completeness (a.) vs. incompleteness (b.). Note missing information in the "Last Calibration" field in (b.)

Following the above guidelines for completeness, Table 4 summarizes the current state of all SAMOS vessel and parameter metadata:

	Vessel Info	Contact Info	Vessel Layout	Digital Imagery	LATITUDE	LONGITUDE	PLATFORM HEADING	PLATFORM COURSE	PLATFORM SPEED	SEA TEMPERATURE	CONDUCTIVITY	SALINITY
KAOU	C	C	C	Yes	C	C	C	C	C	I,I,I	I,I	I,I
KAQP	C	C	C	Yes	C	C	C	C	C	I,I	I	I
KTDQ	C	C	C	Yes	I	I	I	I	I	C,C	C	C
NEPP	C	C	C	Yes	C	C	C,C	C	C	C,C,I	C,C	C,C
VLMJ	I	C	I	No	I	I	I	I	I	I,I		I
VMIC	I	C	C	Yes	I	I	I	I	I	I		I
WARL	C	C	I	Yes	C	C	I	C	I,I	I,I	I	I
WBP3210	C	C	C	Yes	I	I	I	I	I	I	I	I
WDA7827	C	C	C	Yes	I	I	I,I	I	I	I,I	I	I
WDC9417	C	C	C	Yes	I	I	I	I	I	C,C,C,C	C,C	C,C
WDN7246	C	C	C	Yes	I	I	I,C,C	I	I	C,C,C,I,I	C,C	C,C
WSAF	C	C	I	Yes	C	C	C	I	C	I,I,I,I,I	I,I	I,I
WSQ2674	C	C	I	Yes	C	C	C	C	C	I,I	I	I
WTDF	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
WTDH	C	C	C	Yes	I	I	I,I,I	I,I,I	I,I,I,I,I,I	I,I	I	I
WTDL	C	I	C	Yes	I	I	I,I	I,I	I,I,I,I	I,I,I,I,I,I	I,I	I,I
WTDO	C	I	C	Yes	I	I	I	I,I	I,I,I,I,I	I,I,I,I	I,I	I,I
WTEA	C	I	C	Yes	I	I	I,I	I,I	I,I	I	I	I
WTEB	C	I	C	No	I	I	I	I,I	I,I,I	I,I	I	I
WTEC	C	I	C	Yes	I	I	I	I	I	C,C	C	C
WTED	C	C	C	Yes	I	I	I,I	I,I	I,I,I,I	I,I,I,I,I,I	I,I	I,I
WTEE	C	C	C	No	I	I	I,I	I,I	I,I	I,I,I	I,I	I,I
WTEF	C	I	C	No	I	I	I,I	I,I	I,I			
WTEG	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
WTEK	I	I	C	No	I	I	I,I	I,I	I,I	I,I	I	I
WTEO	C	I	C	Yes	I	I	I,I	I,I,I	I,I,I,I,I	I,I,I	I	I
WTEP	C	C	C	Yes	I	I	I,I	I,I,I	I,I,I,I,I	I,I,I,I,I	I	I
WTER	C	I	I	Yes	I	I	I,I,I	I,I,I	I,I,I	I,I,I	I,I	I,I
ZGOJ7	C	C	C	Yes	C	C	C,C	C,C	C,C,C,C	C,C,C,C	C,C	C,C
ZMFR	I	C	C	No	I	I	I	I	I	I		

Table 4: Vessel and parameter metadata overview. Only metadata valid as of the writing of this report is shown. "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.

	RELATIVE WIND SPEED	RELATIVE WIND DIRECTION	TRUE WIND SPEED	TRUE WIND DIRECTION	AIR TEMP	DEW POINT TEMP	WET BULB TEMP	PRESSURE	RELATIVE HUMIDITY	PRECIP	RAIN RATE	LONG WAVE RADIATION	SHORT WAVE RADIATION	PHOTOSYNTHETICALLY ACTIVE RADIATION (PAR)
KAOU	C,I	C,I	C,I	C,I	C,I,C	I		C,C,I	I,C	C,I		C,I	C,I	C
KAQP	C,C	C,C	C,C	C,C	C,I			C,I	C,I	C,I	C,I	C	C	
KTDQ	C,C,C	C,C,C	C,C,C	C,C,C	C			C	C			C	C	C
NEPP	C,C,C	I,C,C	C,C,C	C,C,C	C,C,C,C			C,C	C,C,C			I	I	C
VLMJ	I,I,I	I,I,I	C,C,C	C,C,C	I,I			I	I,I	I,I		I,I	I,I	I,I
VMIC	I,I,I	I,I,I	I,I,I	I,I,I	I,I			I	I,I	I		I,I	I,I	I,I
WARL	C,C	C,C	C,C	C,C	C,C			C,C	C,C	C,C	C,C	C	C	C
WBP3210	I,I	I,I	I,I	I,I	I			I	I			I	I	I
WDA7827	I,I,I	I,I,I	I,I,I	I,I,I	I			I,I	I	I,I	I			
WDC9417	C,C	C,C	C,C	C,C	C,I			C,C	C,I	C		C	C	I
WDN7246	C,I,I	C,I,I	C,C,C	C,C,C	C			C	C			C	C	C
WSAF	I	I	I	I	I,I,I			I,I	I,I	I		I	I	I
WSQ2674	C	C	C	C	C,C			C,C	C	C		C,I	C,I	C
WTDF	I,I,I,I	I,I,I,I	I,I,I,I	I,I,I,I	I		I	I	I			I	I	
WTDH	I	I	I	I	I,I	I	I	I,I	I,I		I			
WTDL	I,I,I	I,I	I,I	I,I	I,I,I	I	I	I,I,I	I,I,I		I		I	
WTDO	I,I,I	I,I,I	I,I,I	I,I,I	I,I	I	I	I,I	I,I		I			
WTEA	I,I	I,I	I,I	I,I	I	I	I	I	I					
WTEB	I,I	I,I	I	I	I	I	I	I	I					
WTEC	C,C,I	I,I,I	C,C,I	C,C,I	C			C,C	C				C	
WTED	I,I	I,I	I,I	I,I	I	I	I	I,I	I					
WTEE	I,I	I,I	I,I	I,I	I,I			I,I	I,I		I			
WTEF	I	I	I,I	I,I	I,I	I	I	I,I	I,I		I			
WTEG	I,I	I,I	I,I	I,I	I			I	I				I	
WTEK	I,I	I,I	I	I	I			I	I					
WTEO	I,I,I,I	I,I,I,I	I,I,I,I	I,I,I,I	I	I	I	I	I					
WTEP	I,I,I	I,I,I	I,I,I	I,I,I	I			I	I			I	I	
WTER	I,I,I	I,I,I	I,I,I	I,I,I	I	I	I	I	I					
ZGOJ7	C,C	C,C	C,C	C,C	C,C	C		C,C	C,C	C	C	C	C	I
ZMFR			C	C	C			C	C	I		I,I	I,I	

(Table 4: cont'd)

5. Plans for 2025

2025 marks the 20th anniversary of the first ship (RV *Knorr*) to provide data to the SAMOS initiative. The SAMOS chairman would like to personally thank all the technicians, operators, captains, and crew of the SAMOS research vessels for their dedication to the project. In the past year, we continued to see the dedication of the vessel operators to provide high-quality underway observations and are pleased to continue to expand our two-way communications between the vessel operators/technicians and DAC personnel. The DAC team would also like to thank personnel within our funding agencies (see page 3), NOAA OMAO, NOAA NCEI, NOAA PSD, the Australian IMOS project, and the Schmidt Ocean Institute for their continued support of the SAMOS initiative.

The SAMOS DAC also recognizes an ongoing partnership with the Rolling deck To Repository (R2R; https://www.rvdata.us/) project. Funded by the National Science Foundation, R2R has developed procedures for transferring all underway data (navigation, meteorology, oceanographic, seismic, bathymetry, etc.) collected on U. S. academic research vessels and the U.S. Antarctic Program to a central onshore repository. So far in 2025, the university-operated vessels contributing to the SAMOS DAC were those operated by WHOI, SIO, UA, UH, UW, and BIOS. The focus of the R2R is collecting and archiving the full-sampling-level (e.g., sampling rates up to 1 Hz) underway data at the end of each planned cruise, which are the source data for the 1-min averages submitted to SAMOS in daily emails. In 2025, we are working with OSU and UA to test SAMOS data and metadata flow using the CORIOLIX data presence software. This will be prototyped for the RV *Sikuliaq* in preparation for future use for the Regional Class Research Vessels.

In 2025, we will continue to use the SAMOS data ingestion and processing system to take full advantage of the 5th version of NOAA's Scientific Computer System (SCS) software, but we are also preparing for the NOAA fleet to begin SAMOS data and metadata transfers using CORIOLIX. Both SCS5 and CORIOLIX support automated daily delivery of device metadata (down to the parameter level), which allows SAMOS to update our device metadata profile when changes are discovered and ensure the metadata are properly linked to the observations in the SAMOS netCDF files. Although this metadata exchange is operational for SCS5, there is still work to be done to improve the metadata content uploaded to SCS or CORIOLIX to support SAMOS data processing.

We also plan to meet virtually with many operators providing SAMOS observations in 2025 to review and update their respective instrumental metadata and to discuss any questions the operators may have regarding meteorological sensor selection, placement, etc. Frequent dialog with the operators results in fewer data problems and the up-to-date metadata benefits both the SAMOS team for our quality evaluation and the downstream data users.

6. References

Beggs, H., N. Morgan and J. Sisson (2017) IMOS Ship SST for Satellite SST Validation, In: Proceedings of the GHRSST XVIII Science Team Meeting, Qingdao, China, 5th - 9th June 2017, ISSN 2014-2529, p. 127-134. https://www.ghrsst.org/meetings/18th-international-ghrsst-science-team-meeting-ghrsst-xviii

Freeman, E., S. D. Woodruff, S. J. Worley, S. J. Lubker, E. C. Kent, W. E. Angel, D. I. Berry, P. Brohan, R. Eastman, L. Gates, W. Gloeden, Z. Ji, J. Lawrimore, N. A. Rayner, G. Rosenhagen, and S. R. Smith, 2016: ICOADS Release 3.0: a major update to the historical marine climate record. Int. J. Climatol. doi:10.1002/joc.4775

Hill, K., T. Moltmann, R. Proctor, S. Allen, 2010: The Australian Integrated Marine Observing System: Delivering Data Streams to Address National and International Research Priorities. *Marine Tech Society J*., **44**(6), 65-72. https://doi.org/10.4031/MTSJ.44.6.13

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

Smith, S. R., K. Briggs, M. A. Bourassa, J. Elya, and C. R. Paver, 2018: Shipboard automated meteorological and oceanographic system data archive: 2005–2017. *Geosci Data J*., **5**, 73–86. https://doi.org/10.1002/gdj3.59

Smith, S. R., and J. Elya: 2015. Procedure for placing hourly super-observations from the Shipboard Automated Meteorological and Oceanographic System (SAMOS) Initiative into ICOADS**.** COAPS, Tallahassee, FL, USA, 34 pp. Available from Center for Ocean-Atmospheric Prediction Studies, Florida State University, Tallahassee, Florida, 32306-2840, USA and online at http://icoads.noaa.gov/e-doc/other/transpec/samos/SAMOS_RVtoIMMAprocedure_v2p1.pdf.

Smith, S. R., J. J. Rolph, K. Briggs, M. A. Bourassa, 2009: Quality-Controlled Underway Oceanographic and Meteorological Data from the Center for Ocean-Atmospheric Predictions Center (COAPS) - Shipboard Automated Meteorological and Oceanographic System (SAMOS). National Oceanographic Data Center, NOAA. Dataset. doi:10.7289/V5QJ7F8R

Ship schedule references, publicly available only:

AAP vessel is found online at https://www.antarctica.gov.au/antarctic-operations/travel-and-logistics/shipping-and-air-schedules/ (*Nuyina*)

CSIRO vessel is found online at https://www.csiro.au/en/about/facilities-collections/MNF/Voyages-schedules/Voyage-schedules (*Investigator*)

IMOS SAMOS data availability is found online at http://opendap.bom.gov.au/thredds/catalog/imos_samos_archive/catalog.html (*Investigator*, *Nuyina*, and *Tangaroa)*

R2R vessels are found online at https://www.rvdata.us/browse_vessels (*Falkor (too)*, *Healy*, others)

UNOLS vessels are found online at https://www.mfp.us/programme (most other non-NOAA vessels)

USAP vessels are found online at https://www.usap.gov/vesselscienceandoperations/ (*Laurence M Gould* and *Nathaniel B Palmer)*

Annex A: Notifications and Data Subsets with Verified Issues, Unflagged or Only Partially Flagged (listed by vessel)

The vessels listed here generally do not receive visual quality control. As such, this compilation relies almost entirely on notifications sent to the DAC by vessel operators or email exchanges initiated by the DAC; in many cases the exact cause of any issues and/or the exact date range under impact are unknown.

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Atlantic Explorer	20240213 - 20240215	~2100 - ~1515	TS, TS2, TS3, TS4, SSPS, SSPS2, CNDC, CNDC2	values flatlined/smooth, but in real range.	looks like TSG and/or flow system shutdown in port at Bermuda.		
Atlantic Explorer	20240503 - 20240505	all day	T2, RH2	No flags on T2, but lots of missing RH2	T2 running 3C higher than T. RH flatlined or missing a lot of data. Possible sensor failure.	Lydia noted they swapped the fwd sensor prior to the 5/9 cruise departure. She said they tested the swap at the main mast location first and the T readings were only +0.5 greater than what the main mast T/RH sensor was outputting.	Several FWD sensors swapped prior to 5/9: T/RH, P, LW, SW, and PAR. All metadata updated and associated files scrubbed/reprocessed.
Atlantic Explorer	20240509	2025 - ~2300	TS, TS2, TS3, TS4, SSPS, SSPS2, CNDC, CNDC2	values flatlined/smooth, but in real range.	looks like TSG and/or flow system initially shutdown until ship reached open water.		
Atlantic Explorer	20240509 - 20240602	all day - ~1400	RAD_PAR	values mostly ~0 (some B flags)	intermittent short-lived stretches where values look normal (or just spikes in normal range), but the rest of the data near 0. connection may be faulty? (note this sensor was just swapped in prior to 5/9 departure)	Jace noted the foremast sensor has a bad plug and they do not have a spare yet. Set up a temporary PAR on the bridge rail.	Sensor stepped upwards and now reporting realistic data. Turns out the foremast sensor still needs repair, but the data is now coming from a temporary PAR sensor on the forward rail of the bridge. So temporarily solved, but foremast sensor still needs repaired.
Atlantic Explorer	20240524 - 20240531	all day	T2	some G flags	Forward mast T2 has again drifted away from main mast T values (differing by >4C).	Lydia noted the problem and reported to SAMOS.	Sensor data look better as of 31 May, but RH from 31 May - 2 June were way low. RH then returned abruptly to good values around 1550 on 2 June. Techs notified.
Atlantic Explorer	20240703 - 20240705	~1130 - ~1400	TS, TS2, TS3, TS4, SSPS, SSPS2, CNDC, CNDC2	values flatlined/smooth, but in real range.	looks like TSG and/or flow system shutdown in port at Puerto Rico		
Atlantic Explorer	20240509 - 20240726	all day - 1854	RAD_LW	Data in range, but reading higher than expected (plausible).	Readings at or above 500 W/m2 since installation.	Lydia confirmed high values and suspects they may have received a bad calibration from Eppley. They will set up a secondary LW on the bridge rail for comparison. Temporary PIR set up on bridge rail on 26 July. This sensor is reading realistic values (390-430 W/m2), so they disabled the PIR on the forward mast and replaced the data with this new sensor. It will be moved to the forward mast when they next have access.	For this period, use these data with caution.

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Atlantic Explorer	20240816 - 20240821	2300 - ~2000	T2, RH2	B, G flags	T2 and RH2 do not agree with T/RH values. T2 drops to unrealistic negative values and RH2 is over 40% lower than RH. Possible sensor issue after hurricane.	Jace confirmed this sensor was damaged during the hurricane and the data in this period SHOULD NOT BE USED.	NOTE: At 24/08/21 20:00 UTC BIOS installed the s/n 28624 sensor from the main mast to a temporary position going to the fwd mast data logger. It seemed to have been repaired when installed but it's data has since deteriorated and seems unreliable. It was installed in a temporary position about one meter below the temporary location for the LW radiation senser under a overhang of the 03 level deck. Note that since this time the sensor is displaying severe diurnal heating, likely a result of the new location nearer to the vessel's deck and rails. Sensor replaced 8 Sept 2024 on forward mast after wiring was fixed. Use T2/RH2 data prior to this date with caution.
Atlantic Explorer	20240915 - 20241012	~330 - 0000	P2	B flags	Values dropped abruptly to around 500 hPa (unrealistic values). Suspect sensor failure or wiring issue.		Never received a reply regarding P2, but the data looks reasonable again in mid-October (maybe even sooner).
Atlantic Explorer	20240915 - 20240919	~0545 - 1119	T2	G flags, then missing	Values rose abruptly to around 34C (not representative or comparing well to other sensor T). Suspect sensor failure or wiring issue.		Data looks Ok with cruise starting 20240919.
Atlantic Explorer	20241028 - 20241031	~2100 - ~1140	TS, TS2, TS3, TS4, SSPS, SSPS2, CNDC, CNDC2	values flatlined/smooth, but in real range.	looks like TSG and/or flow system shutdown in port at Bermuda.		
Atlantis	~20240115 - ~20240210	all day	PRECIP, PRECIP2, RRATE, RRATE2	No flags applied	Two sensors have very different precip traces for the most part (PRECIP2 is very steppy, PRECIP3 is more smooth slopes). PRECIP3 also tends to record more total precip than PRECIP2. Most of this is occurring at night. This kind of thing has happened before on Atlantis, and a pretty significant booby infestation was noted at the time. Suspect much of this may also be due to birds roosting, especially given an obvious step (increase) in LW both nights.	tech TR notes "WTX port and starboard could easily be affected by bird interference. I can't confirm that there was any rainfall during that time but it would not be surprised given our rain squallyness." He is planning to keep an eye out tonight to see if he can catch the birds in the act.	Note that LW may be suspect these nights, as well, depending on what TR finds. Also note there was a bit of steppiness observed in the stbd WXT rel/true winds overnight on the 16th. This may also have been from birds. To a much lesser degree, this questionable PRECIP/PRECIP2/RRATE/RRATE2 pattern has continued to occur past the 16th as well. Again, though, mostly at night, and much or all of it does not look to be from actual rain events (so likely birds). Catie on the Atlantis confirmed with video/photo evidence that birds are routinely roosting on the mast, particularly at night. This is resulting in false rain values when no rain is occurring. And is also likely affecting LW radiation and winds. Nighttime data from many of the WXT variables should be treated with caution in this period.
Atlantis	20240116	~1300- ~1700	DIR2, PL_WDIR2, SPD2, PL_WSPD2, P2, T2, RH2, PRECIP2, RRATE2	missing data	looks like another mysterious power cycle on the port WXT		
Atlantis	20240211 - 20240218	~0130 - ~2050	TS2, SSPS, CNDC	values flatlined/smooth, but in real range.	looks like TSG and/or flow system shut down nearing Costa Rica		Data also smooth for first day after departure on 17 Feb as they were in Costa Rican EEZ.
Atlantis	20240220, 20240225, 20240302 - 20240316	nighttime mostly, but also other times of day	SPD3, PL_WSPD3, PRECIP3, RRATE3, RAD_LW	spikes, unrealistic values	Looks to be a return of nocturnal bird roosting now that Atlantis is back on station in Pacific		Rain data likely incorrect and other variables likely suspect. Looks like birds flew away once they sailed north near the Baja peninsula.
Atlantis	20240315 - 20240406	~0300 - ~1830	TS2, SSPS, CNDC	values flatlined/smooth, but in real range.	looks like TSG and/or flow system shut down nearing Mexican EEZ		Shutdown continued into port in San Diego.
Atlantis	20240411, 20240414	nighttime	SPD2, SPD3, PL_WSPD2,PL_WSPD3, PRECIP2, PRECIP3, RRATE2, RRATE3, RAD_LW	lots of spikes, some B, E, G flags	Return of the Birds! Signal looks like nocturnal roosting activity.		As expected, the nocturnal roosting is intermittent. Not noted since 14 April, so closed out issue.

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Atlantis	20240430 - 20240505	~1930 - ~1645	TS2, SSPS, CNDC	values flatlined/smooth, but in real range.	looks like TSG and/or flow system shut down entering port in San Diego, CA		
Atlantis	20240512 - 20240516	~1700 - ~0600	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into port at Kodiak		
Atlantis	20240607 - 20240610	~1500 - ~2245	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into port at Kodiak		
Atlantis	20240613 - 20240621	0712 - ~1850	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into Canadian EEZ on their way to port in Astoria, OR	Notified of TSG shutdown by TR.	
Atlantis	20240621 - 20240622	all day - ~0415	TS	Flatlined	Values from SBE48 are all NaN since leaving port in Astoria, OR	Techs look to have resolved this without notice.	
Atlantis	20240623 - 20240625	~2145 - ~0210	TS2, SSPS, CNDC	smooth trace	Pump off heading into port in Astoria, OR	Notified of TSG shutdown by Allison	
Atlantis	20240702 - 20240705	~1640 - ~2030	TS2, SSPS, CNDC	smooth trace	Pump off heading into port in Astoria, OR		
Atlantis	20240802 - 20240808	~1130 - ~2010	TS2, SSPS, CNDC	smooth trace	Pump off heading into port in Astoria, OR		
Atlantis	20240816 - 20240819	~1535 - ~1450	TS2, SSPS, CNDC	smooth trace	Pump off heading into port in Newport, OR		
Atlantis	20240825 - 20240827	1414 - ~1725	TS2, SSPS, CNDC	smooth trace	Pump off heading into port in Newport, OR	TR notified us that they shutdown their flow system for a mid-cruise port stop.	
Atlantis	20240908 - 20240912	~1500 - ~1840	TS2, SSPS, CNDC	smooth trace	Pump off heading into port in Newport, OR		
Atlantis	20240912 - 20240913	1552 - ~1530	TS	flatlined values, no flags	SBE48 flatlined at 0, looks to have not started up at the beginning of the cruise.	Ella confirmed the 48 always loses its mind after a power outage. She just poked it and it is back to life.	
Atlantis	20240916 - 20241117	~0150 - ~1300	TS2, SSPS, CNDC	smooth trace	Pump off heading into port in San Diego, CA		
Atlantis	20241018 - 20241104	all day - 1833	PL_HD, DIR, SPD, DIR2, SPD2	Missing values	Data values are expected, but all values are NAN in the original file. Expect that missing heading values are resulting in missing true wind values.	Techs believe this may be related to ongoing work on the bridge while in shipyard. They will be in port until 13 November. Will be able to test data flow around 5 November when they depart for NSF inspection.	Problem may have started earlier than 20241018 while the vessel was dockside.
Atlantis	20241022 - 20241104	all day - 1833	all vars	No data	Techs informed SAMOS that the met mast will be down for sensor maintenance/replacement. So SAMOS daily emails have been turned off for this work.		
Atlantis	20241117 - 20241125	nighttime mostly, but also other times of day	SPD2, PL_WSPD2, PRECIP2, RRATE2, RAD_LW	spikes, unrealistic values	Looks to be a return of nocturnal bird roosting now that Atlantis is back in the tropics.	TR replied that he checked in with the bridge and their are boobies trying to land on the port WXT sensor but so far they have only been able to stand/hover for a few seconds before taking off again. He suspects that once we are on station the issue will worsen.	

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Atlantis	20241104 - 20241118	all day	TS2, SSPS, CNDC, RAD_SW, RAD_LW		Some metadata incorrect.	Allison provided some metadata updates that back date to 20241104. So for the netCDF files from 11/4 - 11/18, the included metadata will be incorrect. Correct values are: Radiation sensors were installed on Atlantis MET mast October 22 2024: S/N: SPP38175F3; PIR38137F3 SPP Calibrated: 2024 October 08 PIR Calibrated: 2024 October 09 The new thermosalinograph was installed 23-Oct-2024: Instrument Make and Model: SBE45 MicroTSG (Thermosalinograph) S/N: 0340 Calibration Date: 18-August-2023 (first use since calibration)	
Atlantis	20241022 - 20241121	all day - 2203	RAD_SW, RAD_LW	Incorrect coefficients used.		Techs informed SAMOS that they failed to enter new sensor coefficients into their RMRco RAD box when they installed the new radiomters. This results in small offsets in the SW and LW radiation data, which should be used with caution in this period.	
Atlantis	20241120 - 20241121, 20241122	1650 - ~2350, ~0300-2045	TS, TS2, CNDC, SSPS	TS, TS2 values significantly different	Problems with pumps continued into 20241122	Techs informed SAMOS that the main flow thru pump tripped the breaker. The SBE45 had drifted from the right temperature due to only getting a small amount of flow from the "mini" booster pump we have on the flow thru system. This also affected the SBE48, so all data in this period is suspect and SHOULD NOT BE USED. Techs noted continued problems on 20241122 with the pumps, which were finally resolved at 2045 UTC. TS2, CNDC, SSPS should not be used for this period on 20241122.	
Atlantis	20241127 - 20241128	~0400 - ~1900	TS2, SSPS, CNDC	smooth trace	Pump off heading into port at Easter Island	Shutdown noted by ship techs.	
Atlantis	20241219 - 20241225	1655 - ~0810	TS2, SSPS, CNDC	smooth trace	Pump off heading into Chilean EEZ.	Shutdown noted by ship techs.	
Gould	20230426 - 20230428	~1600 - ~1445	TS, SSPS, CNDC	Values flatlined	Looks like flow system shutdown entering port at Palmer Station		
Gould	20240131 - 20240501	~1730 - ~0515	TS, SSPS, CNDC	values flatlined, but in real range.	looks like TSG and/or flow system shut down nearing Chile		Vessel retired from SAMOS 1 May 2024

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Gould	20240327	various	T, RH, RAD_SW, RAD_LW, RAD_PAR	spikes in record	Sensor cleaning affecting data for about 10 minutes.	Jeff notified SAMOS that they cleaned the SW, LW, PAR, and GUV sensors at 18:12 GMT and the T/RH sensor at 18:30 GMT. They also swapped in a PSP with a newer calibration.	
Gould	20240404 - 20240411	~1730 - ~1245	TS, SSPS, CNDC	values flatlined, but in real range.	looks like TSG and/or flow system shut down nearing Palmer Station		
Gould	20240413 - 20240418	1225 - 1820	RH	No flags applied	Flatlined at 97.3%. Possible sensor failure	Sensor replaced with an older calibrated model. Data look OK.	
Gould	20240415 - 20240430	~1100 - 2359	TS, SSPS, CNDC	values flatlined, but in real range.	looks like TSG and/or flow system shut down nearing Punta Arenas, Chile		NOTE: Operator confirmed that this is likely the last cruise of the LMG for the USAP. NSF plans to decommission vessel. SAMOS will continue receiving in port data until the USAP comes up with a demobilization plan. Gould retired from SAMOS as of 1 May 2024
Gould	20240427 - 20240430	~1830 - 2359	T, RH	T values B flagged, RH no flags	T dropped and flatlined at -40C, RH dropped and flatlined at 0%. Looks like sensor failure.		Gould retired from SAMOS as of 1 May 2024
Healy	20240612 - 20240624	all day	RH3	Steps in data	EE08 (RH3) is stepping from realistic values around 70% down to values around 20%. The length of time the sensor stays around 20% varies from minutes, to hours, to most of one whole day. The other two RH sensors (EE260-GA1 on the bow, EE HTP201 on the bridge top) look great and agree well with humidities around 70%. Likely sensor malfunction.	Techs noted that they replaced this T/RH sensor.	
Healy	20240722 - 20241018	1004 - 0000	T, RH	flatlined	Sensor failure	Notified by Nick that the bow T/RH sensor failed and repairs will likely be delayed (hard to reach location). 17 October, Emily noted that they are methodically troubleshooting the forward bow (jackstaff) EE260 RH+Temp sensor so you will see some erratic values in the 10/16 and 10/17 DCC files. We have had some periods of more believable values, but it is still not performing optimally. Some data started to appear on 10/15, but the values continue to be unrealistic compared to other T/RH sensors - Do not use.	Note: T, RH not in files after 20240723 - values all NaN. Still troubleshooting this sensor at the start of October 2024 cruise. Techs note the sensor looks fine, but problem may be in a Jbox. Since 18 October 2024, the T/RH data now compare well to the other two hygrometers on the top of the bridge. Sensor looks to be fixed.
Healy	20241117 - 20241118	~1140 - ~2000	TS, TS2, TS3, SSPS, SSPS2, CNDC, CNDC2	No data		Emily confirmed a shutdown of their science sea water system during this period as the vessel was in an EEZ without clearance for ocean data collection.	

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Healy	20231109 - 20240110	daytime	P, P2	no flags	Unrealistic jump upward in pressure of 10+ hPa at sunrise and return at sunset. Timing confirmed with rise in air temperature and increase in SW radiation. Looks to be a sensor heating problem.		Continuing throughout time in Miami (11/19/23). 26 Nov 2023 - Brendon called to confirm that STARC will have no techs onboard for the rest of the year as Healy sails from Miami to Seattle. TSG sensors already removed. Can not affect any repairs to other sensors until vessel back in Seattle for demob in early/mid January 2024. Data flow stopped 20240110, Fixed for 2024 season.
Healy	20231126 - 20240110	all day	RH3	Some G flags	Data values not consistent with bow RH sensor. Large steps, lots of missing data. Possible sensor failure.		26 Nov 2023 - Brendon called to confirm that STARC will have no techs onboard for the rest of the year as Healy sails from Miami to Seattle. TSG sensors already removed. Can not affect any repairs to other sensors until vessel back in Seattle for demob in early/mid January 2024. Ship stopped transmitting on 20240110 - fixed for 2024 season.
Healy	~20241025 - 20241103	nighttime	RAD_SW	No flags	Nighttime offsets running positive (1 - 2 W/m2) as compared to expected slight negative offsets being recorded by RAD_SW2. Expect Eppley SW is off calibration as compared to newer Kipp and Zonen radiometer.	Sensor was swapped with another Eppley, but still seeing some positive nighttime offsets (though may be smaller than before). On 20241126 Emily discovered an odd offset value entry of '0.032' for SWR in all versions of our 2024 acquisition files from this year. I checked acquisition files from 2020 - 2023 sailing seasons and the offsets are all '0.0' for both the SPP and PSP. As a test, I edited the offset from 0.032 to 0.0 and the W/m2 value instantly went from 2.11 to -2.24 at 0612 UTC on 11/26/24. In looking through some of our data collected earlier this year, the positive nighttime offsets are present consistently, which makes me very suspicious of this entered value as possibly being our culprit. I have made a note of the offset change in our acquisition file and in ELOG and we can watch the data trend over the next 24 hours. The overall result is that there may be a slight offset in the SW radiation data from the Eppley radiometer (RAD_SW) throughout the 2024 field season (up until the offset was removed on 20241126).	
Investigator	20240301	~0700 - ~0930	TS	G flags	TS dropped from about 20C down to near zero in this period with lots of spikes. Looks like a result of the pumps being shutdown near the coast of Australia. Data missing after 0930 until 1200 on 20240302 when TS data looked reasonable again.		

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Investigator	20240702 - 20240707	~1830 - ~2230	TS, SSPS	no flags	SSPS unrealistic values (near zero) while in port at Brisbane, AU. TS reporting in realistic range, but in port and SBE38 relies on flowing water for accurate readings, so data should be used with caution.		
Investigator	20240713 - 20240914	~0300 - ~0300	RAD_LW	Jumps up 500 W/m2	Values then much higher than RAD_LW2. Looks like sensor failure.		Vessel in drydock and not reporting much of this period. LW data compare well once she went back to sea in September, so assume the sensor was replaced.
Investigator	unknown - 20241231	all day	PRECIP2	flatlined	Port rain sensor (PRECIP2) flatlined when starboard sensor (PRECIP) reports hourly rainfall. Possible blockage or other failure of port RM Young gauge.	Problem noted, but sensor can not be inspected until next port call.	Initial date of problem unknown. Problem temporarily fixed in 2025, but started to occur again in May 2025.
Kilo Moana	20240106 - 20240109* actual range appears likely to be 20240106 - 20240117 (see op comments next KM entry)	all day - ~1045	PL_WDIR3, PL_WSPD3, DIR3, SPD3	No flags	Data unrepresentative with low variability. Also does not match other wind sensors. Suspect WXT is offline or failed.		Other WXT values are missing entirely from the original file: RH_WXT, AT_WXT, RR_WXT, PA_WXT, BP_WXT Data flow from WXT looks fine after a restart on 20240109. No comment from onboard techs. (NOTE comment from Trevor in subsequent instance of this issue, beginning 20240114. According to him none of this data should be trusted.)
Kilo Moana	20240114 - 2024017	all day - ~2100	PL_WDIR3, PL_WSPD3, DIR3, SPD3	True winds all E flagged (no flags on relative winds)	Data unrepresentative with low variability. Also does not match other wind sensors. Suspect WXT is offline or failed. This is a repeat of the issue noted on 20240108 and resolved on 20240109 (no comment from techs that time, however).	Trevor first states: "There isn't anything wrong with the logging script, something funny is going on with synching changing the script's permissions preventing it from running properly. I'm not sure why you got any wxt values at all for the days where it reported funny values, we don't have any data files at all for those days due to the permissions issue. Something must be up with the python script generating the samos file. I'll look into it when I can. Until further notice just flag our wxt data." A few hours later he had an update: "Looks like I was missing a mount option on some file systems and the access control lists weren't being honored. Problem should be fixed." (Visual inspection WXT data verified ok after fix.) Data should not be used in this period.	Other WXT values are again missing entirely from the original file: RH_WXT, AT_WXT, RR_WXT, PA_WXT, BP_WXT NOTE Trevor's request to flag anything we've received recently from the WXT (meaning from the start of the first instance, on 20240106). We can't manually flag anything that isn't already flagged.

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Kilo Moana	20240217 - 20240401	all day	TS, TS2, SSPS, CNDC	data smooth, unrealistic values	Sensors off line because of leaking pipe	Trevor notes: The Kilo Moana is departing tahiti today. Daily emails will be sent, but our underway seawater system isn't running due to a cracked pipe, so any numbers from the underway system won't be valid data until further notice. Trevor notes: We replaced the tee and the system ran on the last HOT cruise. It isn't fully repaired though because in the process of replacing the tee, a contractor likely cracked two of the strainers. The two strainers were bypassed with straight pipe, but need to be put back in place. For now the data look ok.	TS actually missing from files starting on 19 Feb 2024
Kilo Moana	20240220 - 20240401	~0230 - all day	RH	Flatlined at 0.7%	Values do not compare with RH2 from WXT. Looks like a sensor failure.	Trevor confirmed the RH failure. Will not be repaired until they make port on 29 Feb. Trevor confirmed the RH sensor was "fixed", not replaced. They went up the met mast, removed it from the aspirated shield, jiggled the individual electronic sensor probes in the tip, didn't find anything obviously corroded or broken so we put it back in place since they were tight for time.	
Kilo Moana	20240419 - 20240421	~1300 - ~0100	TS2, SSPS, CNDC	values smooth, not flagged, but TS2 not consistent with TS	Suspect TSG shutdown for short port stop in Honolulu		
Kilo Moana	20240506 - 20240507	1100 - 0500	TS, TS2, SSPS, CNDC	no flags	Data very smooth but in real ranges.	Techs noted that they secured the underway seawater from 11:00 on JD 127 until 05:00 on JD 129 in order to chlorinate the system. DO NOT USE during this period.	
Kilo Moana	? - 20240507	? - ~2020	T	Some G flags	T reading 3-4 C lower than T2 for several days, but then abruptly jumped back up to match T2 around 2020 on 7 May. No reason known.		Start time of problem unknown.
Kilo Moana	20240513	~1500 - end of file	TS2, SSPS, CNDC	TS2 sudden ~12C increase not consistent with TS, SSPS/CNDC ~0	Suspect TSG shutdown for port call San Diego		
Kilo Moana	20240520 - 20240726	0910 - all day	DIR3, SPD3, PL_WDIR3, T	abrupt, inexplicable shift in PL_WDIR (~120 deg) and T (down to -5 C). DIR3/SPD3 also affected. Some B flags on T	this is the WXT wind and the Rotronic T (maybe inside the WXT?). Note WXT relative wind speed and Rotronic RH do not appear affected. Bird strike, maybe??	James notes the WXT is dangling so must have gotten hit pretty hard. Rough seas so they'll investigate it when they can. Trevor confirmed the WXT mount was severely damaged and the WXT has been removed. WXT reinstalled on 20240726.	

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Kilo Moana	~20240529 - 20240630	~0200 - 1600 daily	T	Some B, G flags	T reading drops from realistic values smoothly down to about -10C, then returns to reasonable values later in the day. Reason unknown.	Trevor confirmed noting this diurnal problem, but can not investigate until they return to port.	Never received confirmation of repair, but data looked fine after port stop that ended 30 June 2024.
Kilo Moana	20240729 - 20240729	~1745 - 2359	TS2, CNDC, SSPS	smooth data trace	Sea water system off while in port	Trevor notified us that their ussw system is off while in port.	Data flow from KM started on 20240729 in port to test reinstallation of WXT.
Kilo Moana	20240906 - 20240912	all day	RH	values way too low, B, G flagged.	Values do not compare with RH2 from WXT. Looks like a sensor failure.	Trevor replied that they may not have a spare, but he will look into it. This device was taken out of service as of 20240912.	No more T, RH values will be received after 20240912 from the Rotronic. The WXT will be the KM's primary temperature/humidity sensor.
Kilo Moana	20241014	0703 - 1636	TS2, SSPS, CNDC	Abrupt shift in times series, B and G flags on TS2		James informed us that they secured the USSW system on the Kilo Moana at 07:03 UTC on JD 288 to clean the system in preparation for an upcoming cruise.	
Kilo Moana	20241218 - 20241222	all day	PL_WDIR3, PL_WSPD3, DIR3, SPD3	Some E flags	Data do not agree with other two anemometers on vessel. Also no other parameters from WXT exist (e.g., P2, T2, RH2, ...). Expect the WXT has failed or is just offline for some reason.	Trevor noted on the last cruise the wxt accidentally got powered down during the prior demob, so there won't be any data for that sensor. We are about to go into drydock, so all the met sensors will be powered down.	
Nathaniel Palmer	20231201 - 20240409	periodic	RAD_LW	B-flags	Large negative spikes and steps. Spikes were prominent just after 0000 UTC on 12/1 and 12/2, with another batch around 1500 and 1900 on 12/3	Ben replied that it looks like their LW radiometer died. They will let us know when they can replace it.	LW data no longer being provided in SAMOS daily files, but sensor still needs replaced. Sensor repaired in April by "jiggling" some wires.
Nathaniel Palmer	20240120 - 20240205	~1330 - ~2100	TS, SSPS, CNDC	data flatlined	they're heading in to New Zealand, assume they probably turned the pumps/TSG off		
Nathaniel Palmer	20240222 - 20240225	~1100 - ~0530	TS, SSPS, CNDC	data flatlined	TSG pumps likely off for port stop in McMurdo, Antarctica.		
Nathaniel Palmer	20240325 - 20240327	all day - ~0200	CNDC, SSPS	flatlined/static value	Looks like sensor off, but reason unknown. Resolved itself on 27 March.		
Nathaniel Palmer	20240329	~1100	P	G, B flags	NBP passed through a deep low pressure (~949 mb) on its northward transit from Antarctica. This event was flagged by the SAMOS QC but satellite data confirm this to be a real extreme pressure event. Data should be considered good.		
Nathaniel Palmer	20240401-20240411	~2030 - ~2100	TS, SSPS, CNDC	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown entering New Zealand EEZ		
Nathaniel Palmer	20240430-20240502	~2145 - ~1300	TS, SSPS, CNDC	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown entering Palmer Station		
Nathaniel Palmer	20240504 - 20240507	~0600 - ~1630	TS, SSPS, CNDC	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown entering Chilean EEZ.		Returned to port in Chile on 20240506.

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Nathaniel Palmer	20240608 - 20240623	~1300 - all day	all vars	values constant	Data values stuck at constant values. System failure?	Anna replied that they installed a new UPS in shipyard and this is the reason for the acquisition failure. Data flow was restored after much effort by Anna and the electronics team on the NBP.	Removed data files for 9-17 June 2024 as data received all constant/bad.
Nathaniel Palmer	20240830 - 20240916	~0600 - ~0620	DIR, SPD, PL_WDIR, PL_WSPD	flatlined values, no flags	the port anemometer is showing some gaps/static data value periods starting around 0600 on 30 August 2024 (and maybe they existed earlier). The situation was getting steadily worse and for the entire day of 3 Sept 2024 the port wind values are a single constant value. Looks like some type of sensor failure.	Anna replied that she forwarded the message to the ETs, but presently they are not onboard. May not get fixed until they reach the ship later this fall.	Problem looks to have been resolved on 20240916.
Nathaniel Palmer	20241007 - 20241013	~1130 - ~1645	TS, SSPS, CNDC	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown arriving at Palmer Station		
Nathaniel Palmer	20241015 - 20241027	~1250 - ~2100	TS, SSPS, CNDC	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown entering Chilean EEZ		
Nathaniel Palmer	20241029 - 20241031	~1030 - ~1655	TS, SSPS, CNDC	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown nearing Palmer Station		
Nathaniel Palmer	20241102 - 20241103, 20241106 - 20241107, 20241125 - 20241126, 20241129 - 20241213	~0030 - ~2045, ~1100 - ~0700	RAD_LW	B-flags	Large negative spikes and steps. Step down to values as low as -600 W/m2. Values then return to normal range for hours to days at a time.	The outgoing techs did inspect the LW radiometer in NZ and they found nothing unusual. They left the same (s/n 32845) in place for this cruise. Glad that the data is looking good for you and we haven't noticed anything on our end. We are still in above freezing conditions so hopefully it did just fix itself.	Maybe repaired before cruise starting 20241213.
Nathaniel Palmer	20241108 - 20241111	2225 - 1614	all variables	No data	Data gap while the NBP was transiting the Southern Ocean. Suspect comms issue.		No reply from vessel, but data flow restarted 20241111
Nathaniel Palmer	20241203 - 20241216	0644 - ~1530	TS, SSPS, CNDC	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown entering New Zealand's EEZ		
Neil Armstrong	20231230 - 20240110	~0330 - 2359	TS2, SSPS, CNDC	smooth trace	looks like pump off while in port at Charleston, SC		SAMOS mailer shutdown for the remainder of shipyard period. Will return late Feb 2024.
Neil Armstrong	20240322 - 20240401	~2350 - ~1420	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into home port at WHOI		
Neil Armstrong	20240322 - 20240401	various	all vars	missing data	There are several gaps in the data during this in-port period. Expect this is a result of sensor maintenance, in port operations.		
Neil Armstrong	20240410 - 20240413	~1100 - 0930	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into home port at WHOI		
Neil Armstrong	20240421 - 20240426	~1045 - ~2230	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into home port at WHOI		
Neil Armstrong	20240506 - 20240510	~0220 - ~1730	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into home port at WHOI		
Neil Armstrong	20240525 - 20240602	~0220 - ~2215	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into home port at WHOI		

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Neil Armstrong	20240603 - 20240607	~0400 - ~0900	TS2, SSPS, CNDC	smooth trace	looks like pump off while transiting Canadian EEZ.		
Neil Armstrong	20240628 - 20240710	~2230 - ~1230	TS2, SSPS, CNDC	smooth trace	looks like pump off while entering Icelandic EEZ.		
Neil Armstrong	20231227 - 20240110	all day	PL_CRS, DIR, DIR2, SPD, SPD2		Techs notified us that they had a COG output failure on our newly installed CNAV X1 that we are working with Oceaneering to resolve. The result is incorrect COG values and subsequent suspect values for their true winds. True winds should NOT BE USED.	Operator notified us of COG issue on past cruise	Resolved while vessel is in shipyard. Data flow stopped on 20240110.
Neil Armstrong	20240812 - 20240819	~1010 - ~1150	TS2, SSPS, CNDC	smooth trace	looks like pump off while entering Icelandic EEZ.		
Neil Armstrong	20240827 - 20240828	~0000 - ~1200	TS2, SSPS, CNDC	smooth trace	looks like pump off while entering Faeroe Island EEZ.		
Neil Armstrong	20240909 - 20240913	~2130 - ~1800	TS2, CNDC, SSPS	Smooth data trace, B flags	Looks like flow water system shutdown while sheltering south of Jan Mayen Island.	Croy confirmed the TSG shutdown due to rough seas.	
Neil Armstrong	20240925 - 20241003	~1255 - ~1350	TS2, CNDC, SSPS	Smooth data trace, B flags	Looks like flow water system shutdown entering Icelandic EEZ.		
Neil Armstrong	20241006 - 20241009	~2100 - ~1145	TS2, CNDC, SSPS	Smooth data trace, B flags	Looks like flow water system shutdown entering Nuuk, Greenland		
Neil Armstrong	20241101 - 20241123	~0630 - ~1450	TS2, CNDC, SSPS	Smooth data trace, B, G flags on TS2	Looks like flow water system shutdown entering Nuuk, Greenland. System remained off for transit back to US through Canadian EEZ. Restarted on departure from WHOI 20241123.		
Neil Armstrong	20241223 - 20241225	~1850 - 2359	TS2, SSPS, CNDC	smooth trace	looks like pump off heading into home port at WHOI		Note: no data received other than time, lat, lon, PL_CRS, PL_SPD starting on 20241226 and continuing through 20250108.
Nuyina	20240531 - 20240707	~1430 - all day	DIR, SPD, PL_WDIR, PL_WSPD	flatlined values at zero	Possibly offline for maintenance. Vessel in port.	Data officer on the Nuyina confirmed that the port side foremast wind sensor was completely blown off on Saturday evening. The wind sensor took the connector out with it, so we won't be able to replace it until we get back from our next two voyages which will be towards the end of July. These variables disabled in SAMOS system as of 7 July 2024. Will readd when sensor is repaired. Reenabled on 29 August 2024	Sensor repaired/replaced on 20240829 ~0500 UTC.
Nuyina	20240601 - 20240606	all day	TS, SSPS	smooth data trace	Expect pumps off as vessel entered port at Hobart, Tasmania		
Nuyina	20240709 - 20240713	~1000 - 2359	TS, SSPS	smooth data trace	Expect pumps off as vessel entered port at Hobart, Tasmania		No data files received after 20240713, assume system shutdown in port.
Nuyina	20240719 - 20240919	all day - ~0030	TS, SSPS	smooth data trace	Expect pumps off as vessel entered port at Hobart, Tasmania		shutdown may have started earlier than 19 July.

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Nuyina	20241118 - 20241122	all day - ~2000	RAD_LW	RAD_LW and RAD_LW2 do not compare well	RAD_LW exhibiting oscillations in the data with an amplitude of about 40 W/m2 and a period of an hour. Not a typical LW data trace. Suspect a sensor issue.	Haifeng responded that the data officers on the Nuyina repaired the faulty LW sensor. Data are comparing well again.	
Nuyina	20241220 - 20241223	1030 - ~1820	TS	No flags	Values above expected range for region. See notes from Tech	Tess noted: We have arrived at Casey station, we went through some ice on the way here and have since noticed our sbe38 sea water temperature recording temperatures of 5-6°C (expected temperatures are 0-1°C). This sensor is located away from the other ocean sensors at an inlet in the bow and as such is our most accurate sea water temperature sensor. Based on some flow and pressure data we suspect that the pipe that the sbe38 sensor resides has been blocked. It is a difficult space to get into, up near the ice knife. We are working with crew now to investigate this. I suspect this blockage started to occur around 20-12-2024 10:30 UTC time.	
Nuyina	20241220 - 20241231	0000 - 2359	P	Pressure offset applied by operator.		Bureau of Meteorology informed SAMOS that they applied an offset of -2.88 hPa to Nuyina's underway pressure data from 2024-12-20 to 2025-03-03. This temporary solution was responding to a suspicious sensor overestimation at that time. It was removed following another test which shows that this offset is not necessary. The offset is included in the pressure data supplied in the SAMOS files, so use with caution.	

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Revelle	20230610 - 20231231	various	TS, TS3, SSPS, CNDC	intermittent noise in data	looks to be occurring when ship speed is very low (vessel on-station, etc.).	Howie responded: "Thanks for mentioning, I noticed the same thing earlier this morning in graphs of Bow TSG temperature we had on display. I took a closer look at the BOW TSG Flow rate, and saw every now and then it is dropping to a lower value, sometimes all the way down to zero, and then returning to normal. So if I can catch the behavior just by watching it, it means it's happening more often. Sea conditions aren't rough at all. We've been spending more time "on-station" for past day or so, which could be contributing to intake of air bubbles, but we've had plenty of periods on-station earlier in the cruise and I don't recall seeing this behavior. I'll discuss with Ship Engineering to see what steps we can take, maybe there's some accumulated air in the lines that we can bleed off. I'll let you know what I find out."	Problem noted again during August cruise from Perth Australia to South Africa. Looks like lots of time on station (CTD stops?). Interesting that the problem was very prominent on some days (e.g., 20230822) but not on others (20230824). Howie noted in his last email from 24 June that the problem does seem to be air in the lines, caused by wave action, but that the problem seems to be amplified when the Revelle is travelling slow and against the predominant swell. Issue lessened when traveling with the swell. This may/may not be a problem anymore so closed out at the end of 2023. I have not see this occur in 2024, yet. But since the problem is related to the vessel infrastructure, intake locations, it may recur.
Revelle	20240102 - 20240103	~0200 - 2359	TS, TS2, TS3, SSPS, SSPS2, CNDC, CNDC2	smooth trace	looks like pumps off while nearing Mexico (EEZ?)		TS2, SSPS2, and CNDC2 shutdown later in day (~1930 UTC). Sensors no longer included in SAMOS CSV as of 20240104.
Revelle	20231228 - 20240101	~0800 - 2359	T3	Sensor drift	T3 abruptly dropped to be 3-4 C lower than T,T2, then gradually drifted back to agree with these other sensors by the end of day on 1 Jan 2024. Reason unknown.		Problem may have been resolved with new sensor installation in Feb 2024.
Revelle	~20240217 - 20240327	all day	T3	Data values much higher than T, T2 (ranging from 1-3C higher).	Since the relative humidities from the two sensors is mostly comparable (EE08, RH2 averages only 6-8% higher than the HTP201, RH), I am wondering if the difference in the sensor's temperature has something to do with one sensor being actively heated, while the other is not. Can you confirm if either of the T/RH sensors is actively heated (or ventilated for that matter).		Sensor replace with newly calibrated Vaisala HMP110.
Revelle	20240318 - 20240329	~1845 - ~2045	TS, TS2, TS3, SSPS, SSPS2, CNDC, CNDC2	smooth trace	looks like pumps off entering home port at SIO		
Revelle	20240427 - 20240430	~1300 - ~0115	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	All sea water variables have unrealistic trace and variations. Looks like flow water shutdown entering port in Manzanillo MX.		NOTE: TS2, SSPS2, CNDC2 shutdown earlier at ~0530.
Revelle	20240429 - 20240507	all day	T3	No flags applied	T3 is again running 1.5 - 2 C higher than T or T2. Reason unknown.	Techs confirmed issue. Seeking solution.	Update 20240520: issue may have self-corrected on 20240507. Weird steps/noise in the data early, and afterwards differences are no greater than 0.5 C. (techs notified, response gave no indication they actively did anything.)

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Revelle	20240502 - 20240518	~1530 - ~1315/~1530 (TS, TS3, SSPS, CNDC / TS2, SSPS2, CNDC2	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	All sea water variables have unrealistic trace and variations. Looks like flow water shutdown for EEZ without clearance.	Techs confirmed EEZ entry. Expect to be shutdown for most of rest of transit.	Note TS/TS3/SSPS/CNDC (but not TS2/SSPS2/CNDC2) appears to have been briefly turned back on ~1430 UTC 20240511 (GOM approaching FL) Back off again ~0130 20240512 in port Tampa.
Revelle	20240520	0117	PRECIP	jumps 25 mm in one minute	extremely improbable measurement, dry all day otherwise. keep an eye out for repeat occurrences.		
Revelle	20240522 - 20240523	~1100 - ~0010	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	SSPS2/CNDC2 flatlined ~0, others smooth trace.	Looks like TSG and/or flow system shutdown entering Gulfport, LA.		
Revelle	20240528 - 20240601	~1445 - ~1520	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	SSPS2/CNDC2 flatlined ~0, others smooth trace.	Looks like TSG and/or flow system shutdown entering Tampa, FL		
Revelle	20240602 - 20240603	~1840 - ~1625	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	SSPS2/CNDC2 flatlined ~0, others smooth trace.	Looks like TSG and/or flow system shutdown. Possibly entering Bahamian EEZ.		
Revelle	20240603 - 20240606	~1910 - ~2025	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	SSPS2/CNDC2 flatlined ~0, others smooth trace.	Looks like TSG and/or flow system shutdown for port stop in Morehead City, NC		
Revelle	20240611 - 20240617	~1500 -	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at WHOI		
Revelle	20240701 - 20240711	~1500 - ~2220	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at WHOI		System still off during port stop in Newport RI on 20240709. Note: restart of TS2, CNDC2, and SSPS2 looks to be near the start of 20240710.
Revelle	20240730 - 20240808	~1350 - ~1400	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at WHOI		
Revelle	20240905 - 20240911	~1030 - ~1515	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at WHOI		
Revelle	20240930 - 20241004	~1400 - ~1725	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at WHOI		
Revelle	20241010 - 20241015	~1600 - ~1515	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at WHOI		

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Revelle	20241018 - 20241019, 20241021 - 20241207	0000 - ~1800	RAD_LW	B flags	Values negative or lower than expected (100 W/m2), stepped back to more reasonable 300 W/m2 range, reason unknown.	Techs reported seeing an issue where the dome temperature rises 20 degrees higher than the body temperature. This was happening before the 13th of October as well. The dome temperature was consistently high without fluctuations. On the 13th I went up the mast and cleaned both ends of the cable, as well as the connectors on the LWR and our junction box. That fixed our issue. We have been observing those fluctuations up and down of the dome temp since about the 18th. We're continuing to keep an eye on it, and think it could be the LWR or could be the cable since cleaning it fixed it once before. 11/1/24: Jeff B. noted the LWR has not been touched since we left in October. It will be replaced in shipyard in Tampa, FL. It will most likely continue to fluctuate for the next week or so. We will update you when we remove everything in shipyard.	Suspect possible dome or thermistor failure. MET system shutdown for shipyard period 20241207. Expect new LWR to be installed in 2025.
Revelle	20241030 - 20241102	~1115 - ~1620	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at WHOI		
Revelle	20241108 - 20241124	~1300 - ~1900	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at Tampa, FL		
Revelle	20241203 - 20241207	~0915 - 1540	TS, TS2, TS3, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like TSG and/or flow system shutdown for port stop at Tampa, FL	Operator notes Revelle entering shipyard, so data system will be shutdown at some point. System shutdown for shipyard occurred at 1540 on 20241207. The sensors were removed and will be reinstalled in 2025.	
Sally Ride	20240326 - 20240328	~2000 - ~1600	TS2, SSPS2, CNDC2	smooth trace	Pumps off to Main lab TSG entering SIO dock		
Sally Ride	20240330 - 20240402	2033 - ~1550	TS2, SSPS2, CNDC2	smooth trace	Pumps off to Main lab TSG entering SIO dock		
Sally Ride	20240324 - 20240402	all day - ~1600	TS, SSPS, CNDC	smooth trace	Pumps off to bow TSG		
Sally Ride	20240407 - 20240410	~1230 - ~1855	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	values flatlined, but in real range.	Looks like TSG and/or flow system shutdown nearing San Diego.		
Sally Ride	20240411 - 20240418	~1200 - 2135	T3, RH2	B, G flags	Temp dropped down to -30 - -40C and RH down to 10%. Values do not compare to other T/Rh sensors. Looks like sensor or wiring failure.	Jeff confirmed the sensor failure. Will have to wait until return to port to evaluate. Sensor replaced on 20240418 at 2135.	Note: on 20240413, T3 returned to positive values, but they are still 4-5C lower than the other two thermometers. DO NOT USE.
Sally Ride	20240418 - 20240426	~1500 - ~0140	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	Some values flatlined, but in real range. Other smooth, but TS, TS2, not consistent with TS3. Lots of G flags on TS, TS2	Looks like TSG and/or flow system shutdown nearing San Diego.		

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Sally Ride	20240501 - 20240503	~0820 - 0030	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	Some values flatlined, but in real range. Other smooth, but TS, TS2, not consistent with TS3.	Looks like TSG and/or flow system shutdown nearing La Paz, MX.		
Sally Ride	20240511 - 20240512	~1130 - 0030	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	smooth data trace	Looks like flow system shutdown near/in La Paz, MX.		
Sally Ride	20240513 - 20240514	~0900 - 0430	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	SSPS2/CNDC2 flatlined ~0, others smooth trace.	Looks like TSG and/or flow system shutdown near/in La Paz, MX.		
Sally Ride	20240520	~1200 - ~2100	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	shark fin curve all variables	Looks like brief flow system shutdown for underway EEZ encounter.		
Sally Ride	20240521 - 20240526	~1100 - ~0050	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	SSPS2/CNDC2 flatlined ~0, others smooth trace.	Looks like TSG and/or flow system shutdown near/in La Paz, MX.		
Sally Ride	20240530 - 20240608	~1640 - ~0030	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	SSPS2/CNDC2 flatlined ~0, others smooth trace.	Tech notified us that they are entering regions with no EEZ clearance. Shutting down underway system.		Continued into port in Costa Rica. Restarted on departure from CR.
Sally Ride	20240611 - 20240613	~1025 - 2243	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Tech notified us that they are anchoring near the Galapagos. Shutting down underway system.		Continued into port in Costa Rica. Restarted on departure from CR.
Sally Ride	20240703 - 20240704	~0830 - ~2340	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Tech notified us that they are anchoring near the Galapagos. Shutting down underway system.		
Sally Ride	20240709 - 20240727	~2115 - ~1545	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering Mexican EEZ. Continued through port arrival at SIO on 20240715		
Sally Ride	20240811 - 20240816	~1530 - ~1715	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at SIO		
Sally Ride	20240816 - 20240905	all day - ~2110	RAD_PAR	B flags	Values much higher than is reasonable. Comparing to the PAR on the Sproul (also in port) on 8/15 and maximum value for the Sproul was 2394 microeinstein m-2 s-1 while on the Sally Ride the max was 3658 microeinstein m-2 s-1. 1200 microeinstein m-2 s-1 is a pretty big difference.	Operator lowered mast and gave the PAR a thorough cleaning. Cut about 800 W/m2 from values and looks like sensor is working fine now.	Data in this period should be used with caution (and maybe even a bit before this start date).
Sally Ride	20240904 - 20240913	~2030 - ~2045	TS, CNDC, SSPS	Smooth data trace	Looks like flow water system shutdown entering port at Newport, OR	Murray confirmed this TSG is offline because it shares the salt water feed with the pCO2 system that is currently down for maintenance. It'll be up sporadically the rest of this mission as we test pCO2 and test the lines attached to the TSG for leaks.	Bow thruster TSG
Sally Ride	20240904 - 20240907	~2030 - ~2035	TS2, CNDC2, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at Newport, OR		Main lab TSG
Sally Ride	20240915 - 20240921	~1930 - ~1830	TS, CNDC, SSPS	Smooth data trace	Looks like flow water system shutdown entering port at Newport, OR		Bow thruster TSG
Sally Ride	20240915 - 20240920	~1830 - ~1630	TS2, CNDC2, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at Newport, OR		Main lab TSG

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Sally Ride	20240919 - 20240921	all day - ~1830	TS4	Smooth data trace	Looks like flow water system shutdown entering port at Newport, OR		Bow thruster room SBE38 - sensor data added during Newport stop.
Sally Ride	20240923 - 20240926	~1320 - ~1740	TS, TS2, TS4, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at Newport, OR		
Sally Ride	20240930 - 20241009	~1730 - ~1700	TS, TS2, TS4, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at San Diego, CA		
Sally Ride	20241015 - 20241026	~1930 - ~1540	TS, TS2, TS4, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at San Diego, CA		
Sally Ride	20241102 - 20241115	~1430 - ~1600	TS, TS2, TS4, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at San Diego, CA		
Sally Ride	20241124 - 20241206	~2100 - ~2025	TS, TS2, TS4, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at San Diego, CA		
Sally Ride	20241216 - 20241219	~2230 - 2359	TS, TS2, TS4, CNDC, CNDC2, SSPS, SSPS2	Smooth data trace	Looks like flow water system shutdown entering port at San Diego, CA	On 20241219 the Ride entered a maintenance period and all sensor data has been discontinued. New sensors will be installed in January prior to sailing around 25 Jan 2025.	
Sikuliaq	20240323	all day	TS, TS2, CNDC, CNDC2, SSPS, SSPS2	missing, unrealistic data	Some observations collected while in port. Unlikely real data, DO NOT USE.		
Sikuliaq	20240930 - 20241004	~1930 - ~2045	TS4	some B/G flags	Values anomalously high and tracking with solar radiation. I believe the IR sensor is pointing at shore or dock in Newport, OR. Data supsect: use with caution		
Sikuliaq	20241102 - 20241105	~1715 - ~1900	TS4	Some B/G flags	TS values rose abruptly to unrealistically high values (40C+) during daytime when the Sikuliaq docked in Honolulu. Suspect the IR SST sensor is pointing at the dock, not the water. Do NOT use.		
Sikuliaq	20241208 - 20241213	~1800 - ~1900	TS4	Some B/G flags	TS values rose abruptly to unrealistically high values (40C+) during daytime when the Sikuliaq docked in Honolulu. Suspect the IR SST sensor is pointing at the dock, not the water. Do NOT use.		
Sproul	20230427 - 20230429	~1330 - ~1500	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20230430 - 20230506	~0104 - ~1500	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240422 - 20240428	0000 - ~1520	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240429 - 20240501	~1640 - ~1515	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240508 - 20240510	~0250 - ~1600	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Sproul	20240507 - 20240509	~1400 - ~2130	T	Some G, B flags	looks like the primary air temperature sensor (RM Young 41342VC, designator ATT) on the Sproul may have failed around 1400 UTC on 20240507. At that time this air temperature jumped abruptly upwards and is now routinely reporting 10-15C higher than the T/RH sensor (E+E Elektronik HTP201, designator RTT).	Maya informed us they swapped the ATT sensor on 5/9.	updated ACQ file provided with new ATT sensor info. metadata updated. Air temp data from new sensor compare well with the E+E air temp; ATT only reads about 0.4 C higher than RTT now. (note this is a smaller difference than before the old sensor went bad, even.)
Sproul	20240513 - 20240514	1524 - ~1430	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240511 - 20240513	2352 - 1523	all	no data		acq frozen, data not recoverable	
Sproul	20240515 - 20240516	~0145 - ~1630	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240517 - 20240519	~1330 - ~1330	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240523 - 20240530	~1230 - ~1450	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240531- 20240613	~0000 - ~0420	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240614 - 20240627	~0045 - ~1620	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240701 - 20240711	All day - ~1500	all variables	DIR, SPD showing quite a bit of steps associated with changes in vessel heading/COG as they turn (E flags). Likely a problem with the true winds since the mast issue (maybe anemometer zero line change?). Use with caution.	Informed by techs that they had a mast break which may affect MET data. Data look OK, but use with Caution.	Sandra noted they had a problem on Sproul over the weekend where the mast with the sensors broke. The ship is currently deployed, so the fix was to tape it in place as much right way up as possible, however this might impact your measurements. All MET data in this period should be treated as suspect (USE WITH CAUTION).	
Sproul	20240715 - 20240725	~0300 - ~1530	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240731 - 20240802	2200 - ~1425	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240803 - 20240813	0004 - ~1630	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240814 - 20240816	~0115 - ~1620	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240820 - 20240825	~2350 - ~1610	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240715 - 20240912	all day	PRECIP	random spikes, no flags	random 0.3 to 0.4 mm spikes in the data. Looks like electronic noise.	Murray checked the sensor out and noticed the cable into the junction box was a hair loose. I applied a little dielectric grease and reseated the connection. If it spikes again we'll look further into it.	Problem seems to have been resolved as of 12 Sept 2024.
Sproul	20240829 - 20241008	~0230 - ~1520	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20240829 - 20240909	~1630 - ~2020	RAD_PAR	Rapid step down, then values near constant.	PAR radiometer looks to have failed around 1630 UTC on 240829 after the Sproul returned to port. PAR values since this time have hovered around 60 W/m2 and show none of the expected diurnal variability.	Sandra confirmed that the Sproul's PAR was removed at this time to send it to the Ride. Data values are likely spurious electrical noise. RAD_PAR in this period should not be used.	PAR looks to have been replaced on 20240909

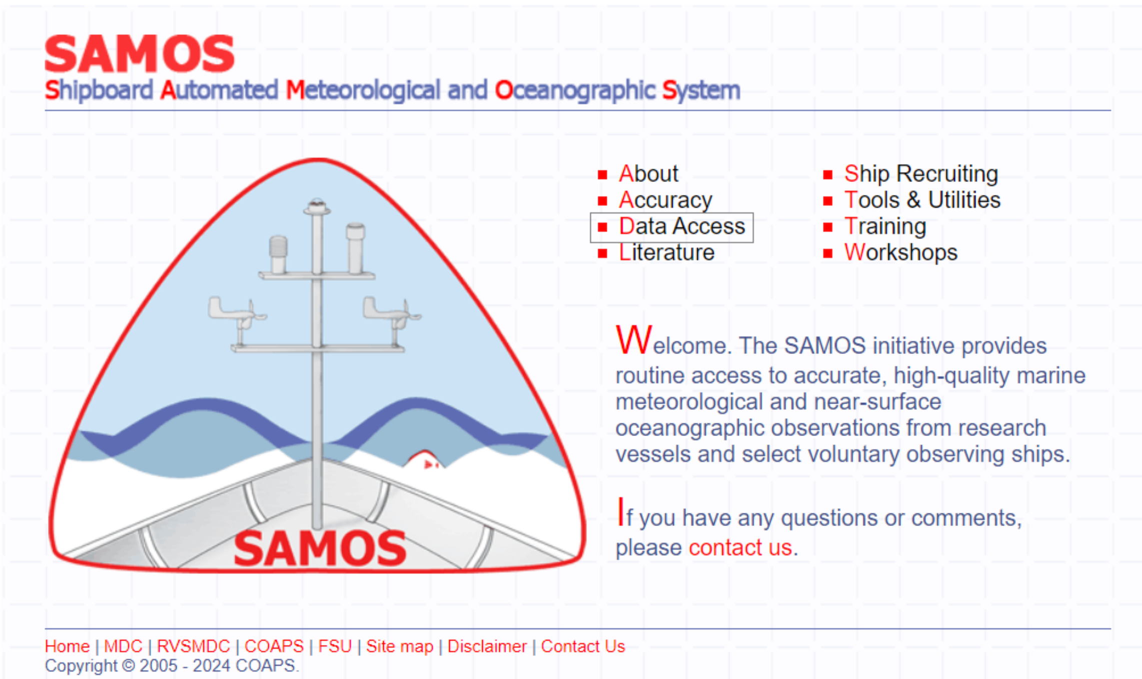
Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Sproul	20241015 - 20241019	~1410 - ~1530	TS2, SSPS, CNDC	smooth data trace	looks like pumps off while in port San Diego		
Sproul	20241020	~0230 - ~1620	TS2, SSPS, CNDC	smooth data trace	looks like pumps off for brief port stop in San Diego		
Sproul	20241021 - 20241102	~0130 - ~1550	TS2, SSPS, CNDC	smooth data trace	looks like pumps off for port stop in San Diego		
Sproul	20241103	~0150 - ~2110	TS2, SSPS, CNDC	smooth data trace	looks like pumps off for port stop in San Diego		
Sproul	20241104 - 20241231	~0312 - 2359	TS2, SSPS, CNDC	smooth data trace	looks like pumps off for port stop in San Diego		
Tangaroa	20240706 - 20240716	all day ~0200	T, P, RH	missing data		Tangaroa returned to port in Wellington this morning and will stay here until 21/07. They report problems with the MetService AWS (weather instruments) end of last week. A reboot of the AWS system restored the data feed to the DAS but with the instruments you note missing. This has been escalated to the MetService to investigate.	Variables restored at 0200 on 16 July 2024.
Thompson	20231104 - 20240203	all day	RAD_SW, RAD_LW	B, G flags	Data unrealistic. SW curve not realistic and stays well above zero at night, LW values too high (800-1400 W/m2)	Liz is working on restarting the SW/LW flow with a new data processing method.	Looks like problems since the vessel left shipyard. SW and LW no longer in files since 20231126. As of 20240110, techs notified us that they could not come up with a working solution for the Eppleys, so no SW/LW expected until they can install new Kipp and Zonen radiometers (maybe in a few months). New Kipp and Zonen SW/LW sensors installed on 4 Feb 2024.
Thompson	20231230 - 20240107	all day	DIR, SPD, PL_WDIR, PL_WSPD	B, G flags	Data values unrealistic, often too high, do not compare to satellite winds. DIR matches pattern of PL_HD.	Operator reported possible problem with sonic anemometer on bow (again) with start of this cruise. Not sure why as data looked good last cruise. SCS restart issue? Problem looks to have been resolved around 2300 UTC on 20240107. No reason given by techs.	Problem looks to have been resolved around 2300 UTC on 20240107. No reason given by techs.
Thompson	20240221 - 20240226	~1740 - ~0230	DIR, SPD, PL_WDIR, PL_WSPD	B, G flags	Data values unrealistic, often flatlined for PL_WDIR, PL_WSPD. DIR matches pattern of PL_HD. SPD matches PL_SPD exactly.	Liz noted that the problem resolved itself without any intervention when they hit an area of strong winds. Very odd.	
Thompson	20240315 - 20240407	~2100 - all day	RH	Values stuck at 0.5%	Values dropped sharply to 0.5% around 2100 UTC and stayed there. Looks like sensor failure. However T data still look good.	Emmett confirmed the sensor is stuck. Will not get a chance to repair until they reach port. Emmett confirmed sensor was replaced in Perth.	

Vessel	date	Time in File (UTC)	variable	problem	DQE comments	Operator Comments	Additional Notes
Thompson	20240328 (maybe earlier), 20240331 - 20240425	all day	PL_WDIR, PL_WSPD, DIR, SPD	lots of spikes, some B, E, G flags	Spikes well outside the trend of data. If removed, one may be able to "find" an OK wind signal, but lots of processing would be needed.	Operator added new feeds for true winds from port and starboard RM Young wind birds. I expect these are up on the main mast. Once implemented, the wind data from these sensors is far superior to the data from the bow sonic (matching well to satellite data). May help in QC of sonic data, but the sonic sensor needs to be replaced. Jen notified us the ultrasonic on the bow was replaced with a new device on 25 April 2024.	Fewer spikes in later days as they headed into Perth. Many spikes in the data as the TGT departed Perth on 8 April 2024, which continue to date. The overall trend line seems OK, but lots of spike removal would be needed to use these data (USE WITH CAUTION).
Thompson	20240824 - 20240825, 20240830	all day (mostly nighttime)	PL_WSPD, SPD, DIR	Some B/G flags	Lots of random spikes in the data. The birds are back!	Liz reached out to note they had birds periodically roosting on the sonic anemometer again. Clear groups of spiky data on these two days.	
Thompson	20240904	~1815 - ~2145	All data	Missing	Techs notified us that one of our UPS breakers tripped on 4Sept that led to a gap in the SCS data that is basis of the SAMOS observations.		
Thompson	20241018 - 20241025	all day (mostly nighttime)	PL_WSPD, PL_WDIR, SPD, DIR	Some B/G flags	Lots of random spikes in the data. Looks like the birds are back!	Techs confirmed birds are back and sent a nice photo for our annual report.	Particularly bad on the night of 19 October. Will monitor for more in coming days.
Thompson	20241226	mostly nighttime	PL_WSPD, PL_WDIR, SPD, DIR	Some B/G flags	Lots of random spikes in the data. Looks like the birds are back! Vessel operating near Guam.		
Thompson	20241203 - 20241204	~0200 - ~0700	TS, TS2, SSPS, CNDC	Smooth data trace	No flags, but techs reported they secured their flow water system for a brief port stop in Guam. Data in this period SHOULD NOT BE USED.	Techs reported flowthrough shutdown.	
Thompson	20241219 - 20241228	1645 - 2359	RAD_SW, RAD_LW	B flags	Data abruptly dropped to unrealistically low values. Looks like sensor failure/malfunction.	Liz replied that the fuse had blown for the radiometer's shared power supply which is why we lost both at the same time. The fuse has been replaced.	
Thompson	20241229	all day (mostly nighttime)	PL_WSPD, PL_WDIR, SPD, DIR	Some B/G flags	Lots of random spikes in the data. Looks like the birds are back!	Techs confirmed birds are back.	

Annex B: SAMOS Online Metadata System Walk-through Tutorial

PART 1: the end user
(NOTE PART 2 for the SAMOS operator not included this version; user login currently restricted. Contact samos@coaps.fsu.edu with metadata updates.)

The SAMOS public website can be entered via the main page at https://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:

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SAMOS

Shipboard Automated Meteorological and Oceanographic System

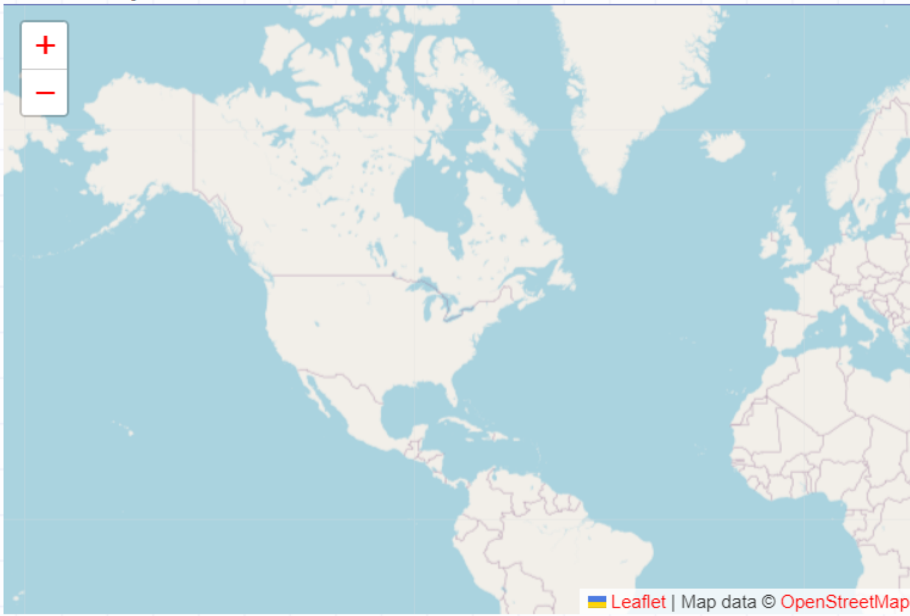
Data Access

Please choose a page from the following list:

Access Data by Date	Search and download data for all SAMOS ship by vessel and date range.
Access Data by Cruise	Search and download observations by R2R cruise identifiers. This page may take up to 30 seconds to load as there are a lot of cruises to index.
Access Data - THREDDS	Access preliminary, intermediate, or research-quality SAMOS netCDF files via our THREDDS catalog
Data Citation	How to cite SAMOS data downloaded from this website
View Data Map	Plot cruise tracks of each ship on a satellite map over a selected period of time
Web Services	Web Services
Additional RV data	Additional RV data
SAMOS Parameters	View a list of meteorological and oceanographic parameters that the initiative seeks to obtain from vessels
Metadata Portal	Access ship metadata database
User Metadata Tutorial	SAMOS Online Metadata System Walk-through tutorial. The document provides instruction on accessing cruise track maps, vessel and instrument metadata, data, and quality control statistics from the SAMOS web interface. [pdf]
SAMOS Fluxes	Access and download air-sea flux data calculated along ship tracks using SAMOS data. Note: data access provided by the Research Data Archive at NCAR.

The user highlights a set of ships from the available list (16 ships may be chosen at a time):

Data Map



To use the data map, select one ship from the menu. Then, using the drop-down menus, select a start and end year, month, and day, preferably in that order as the month (day) ranges will dynamically change based on your selection of year (month). The mapping tool relies on the intermediate version of the SAMOS data which is processed on a 10-day delay from the observation date, so please keep this in mind when selecting your end date range. A maximum of 16 ships can be displayed on the map at a single time. Please contact us if you have any questions.

Choose a Ship

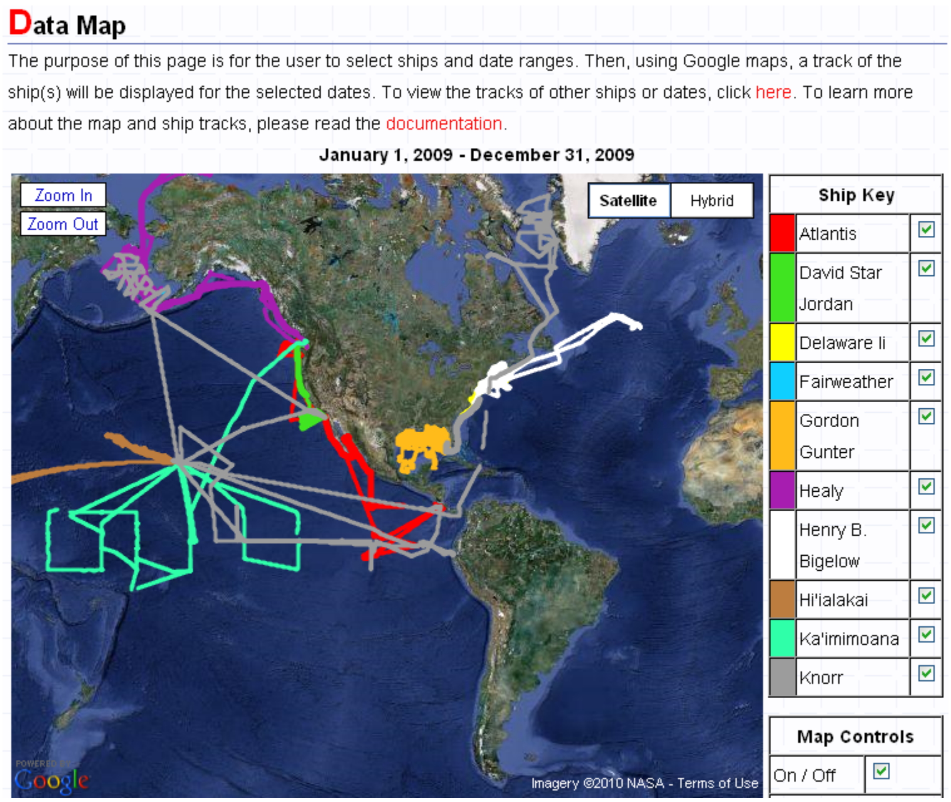
ATLANTIS (KAQP)
AURORA AUSTRALIS (VNAA)
BELL M. SHIMADA (WTED)
DAVID STARR JORDAN (WTD
DELAWARE II (KNBD)
ENDEAVOR (WCE5063)
FAIRWEATHER (WTEB)
FALKOR (ZCYL5)
FALKOR (too) (ZGOJ7)
FERDINAND HASSLER (WTEI
GORDON GUNTER (WTEO)
HEALY (NEPP)
HENRY B. BIGELOW (WTDF)
HI'IALAKAI (WTEY)
INVESTIGATOR (VLMJ)

Starting date: 20090101 **Ending date:** 20091231

Search

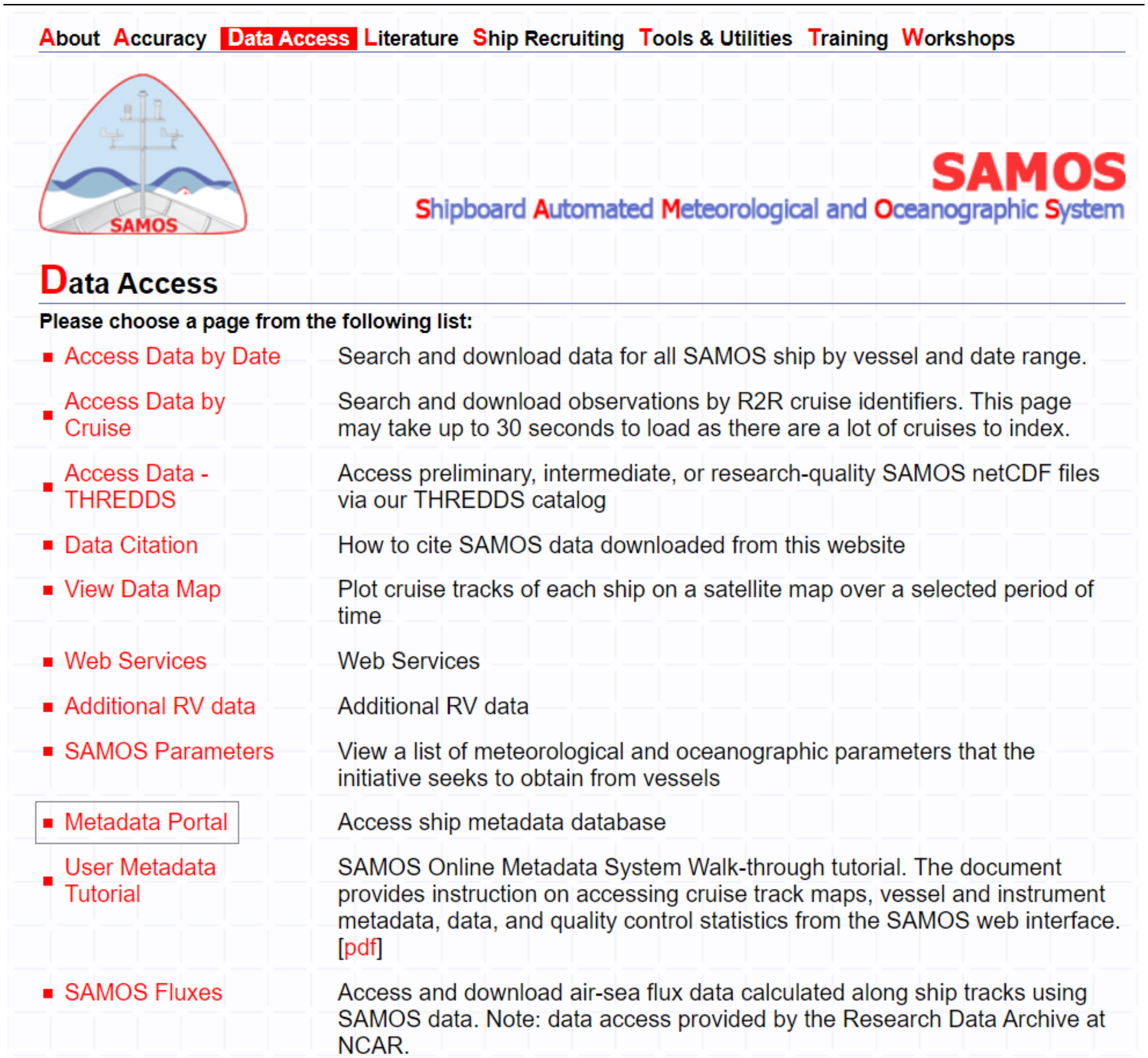
** NOTE: THE MAP TOOL IS IN NEED OF ADDITIONAL UPDATES. THE PRESENT TOOL WILL CREATE MAPS FOR A SINGLE SHIP AND SHORT PERIOD OF TIME, BUT IT IS VERY SLOW TO GENERATE THE PLOT. WE ARE WORKING TO COMPLETE THIS UPDATE AS SOON AS POSSIBLE.

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

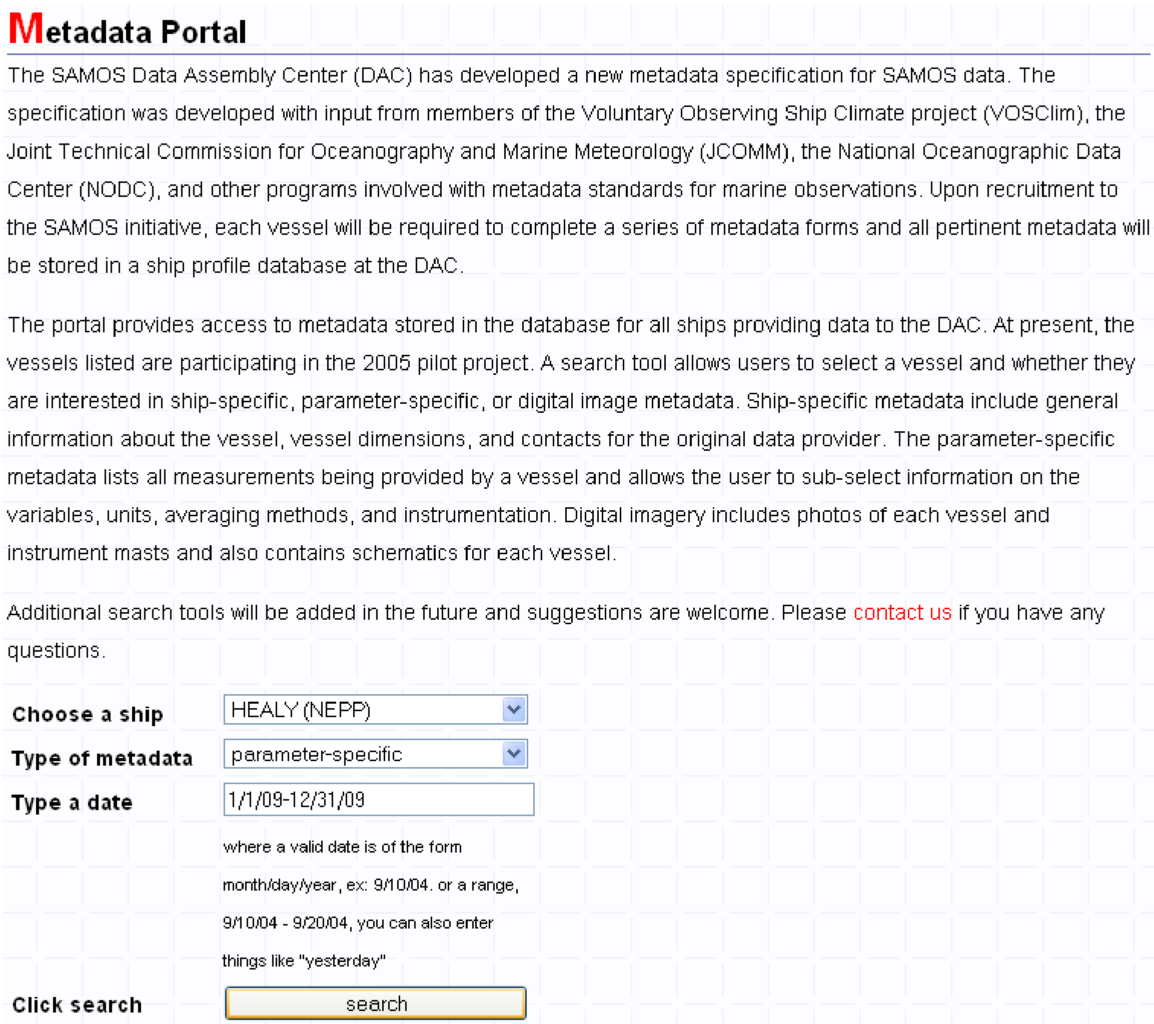


** NOTE: THE ABOVE IMAGE IS FROM THE PREVIOUS MAP TOOL (NO LONGER IN USE) AND IS FOR DEMONSTRATION PURPOSES ONLY. THE PRESENT TOOL IS EXPECTED TO FUNCTION SIMILARLY ONCE UPDATES TO THE TOOL ARE COMPLETED.

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



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



Metadata Portal

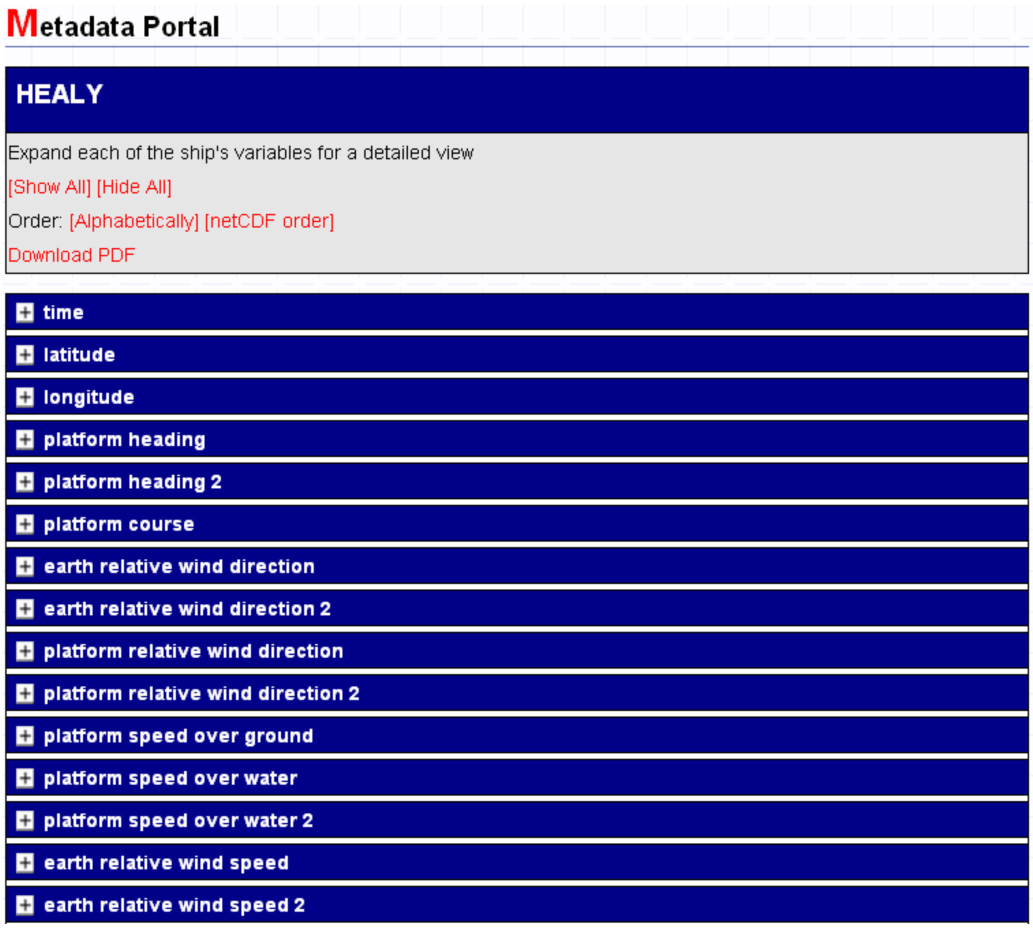
The SAMOS Data Assembly Center (DAC) has developed a new metadata specification for SAMOS data. The specification was developed with input from members of the Voluntary Observing Ship Climate project (VOSClim), the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), the National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

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

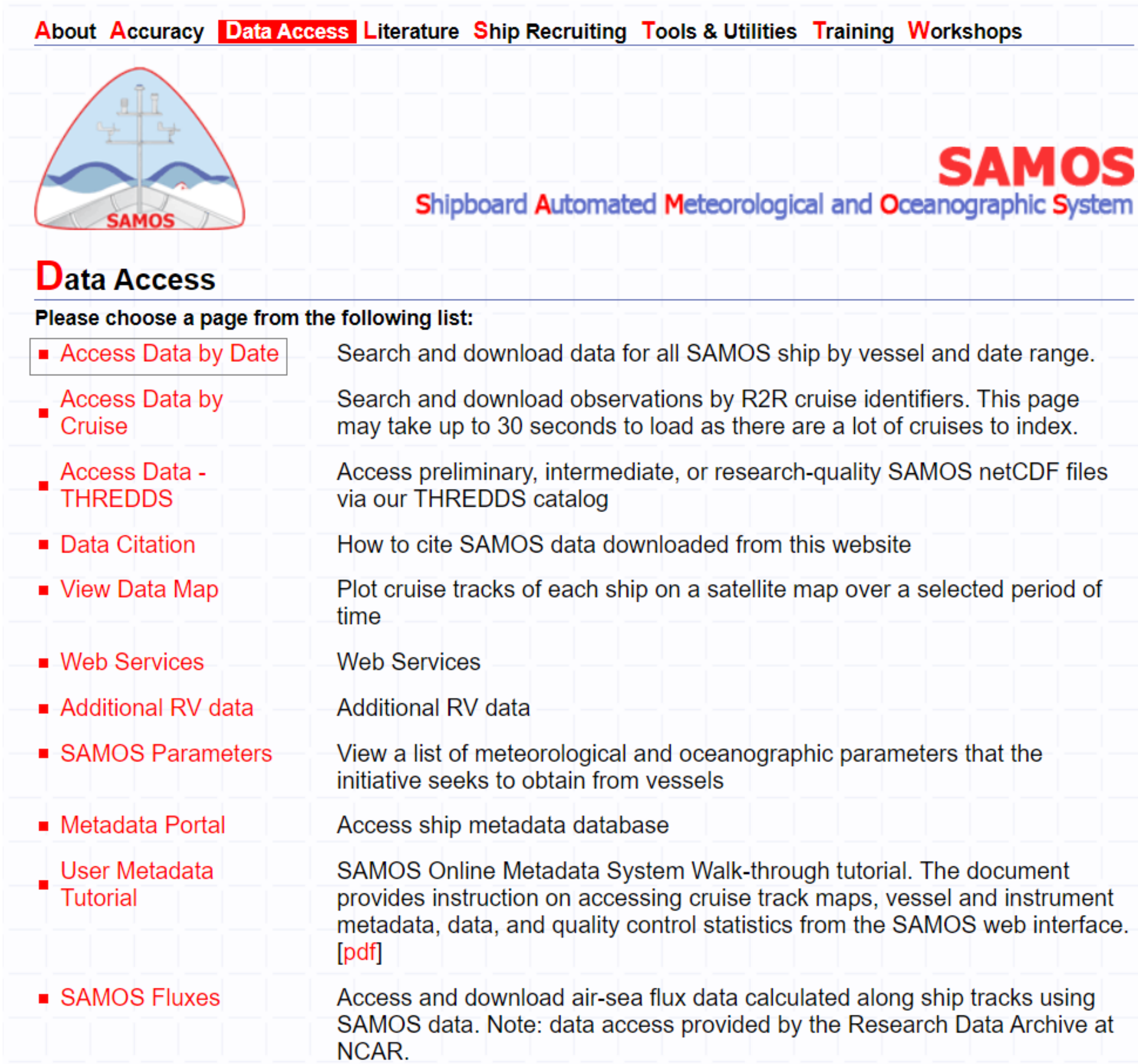
Additional search tools will be added in the future and suggestions are welcome. Please contact us if you have any questions.

Choose a ship	HEALY (NEPP)
Type of metadata	parameter-specific
Type a date	1/1/09-12/31/09
	where a valid date is of the form month/day/year, ex: 9/10/04. or a range, 9/10/04 - 9/20/04, you can also enter things like "yesterday"
Click search	search

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



A thorough investigation of the list (note: image is truncated) tells the user the *Healy* did in fact provide both wind and temperature data in 2009. (Throughout the online SAMOS system, clicking on a "+" will yield further information; in this case the result would be metadata for the individual parameters.)   Now the user will want to know the quality of the wind and temperature data. To find that, he returns once again to the Data Access page and this time chooses Access Data by Date: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SAMOS
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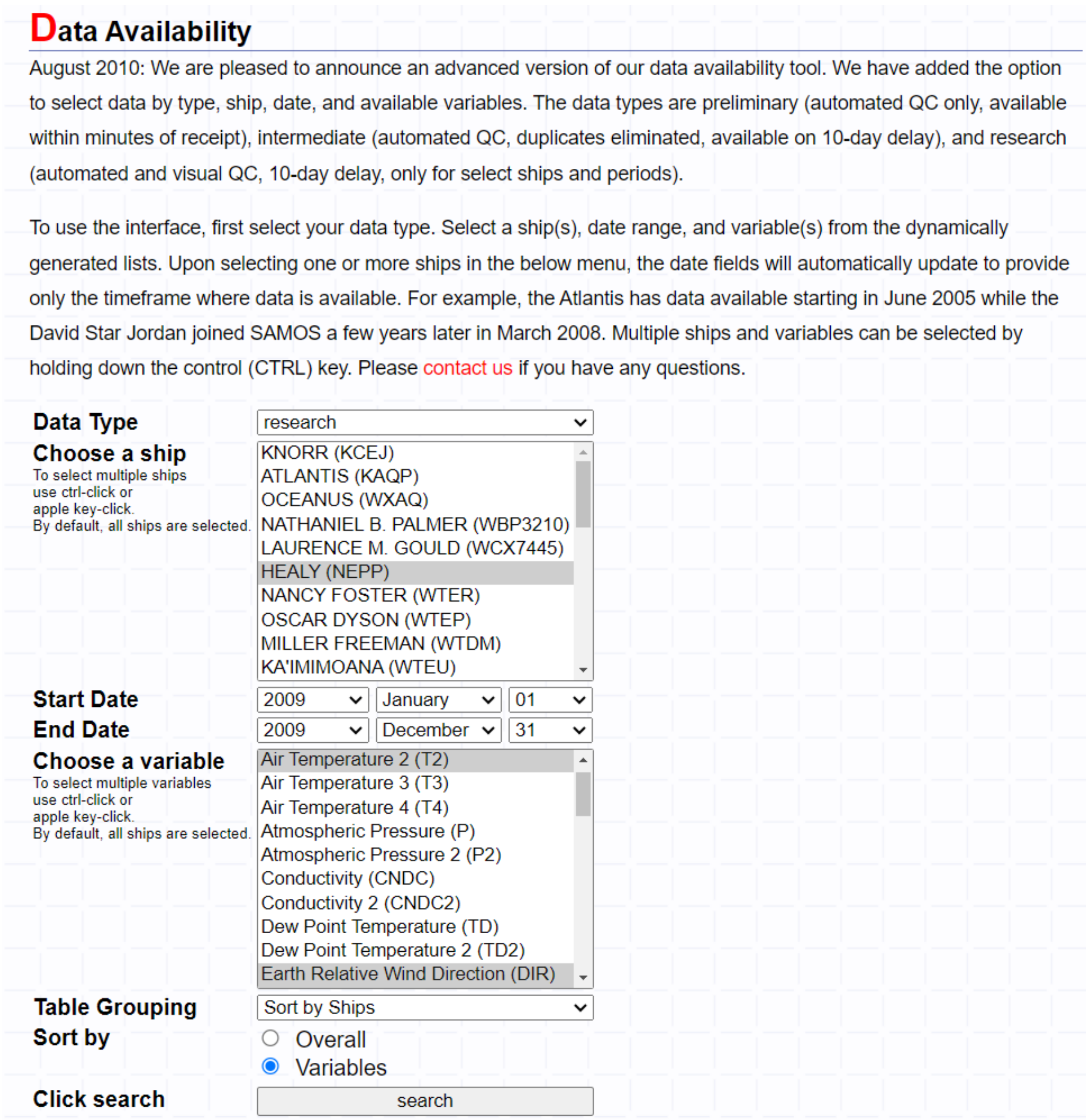
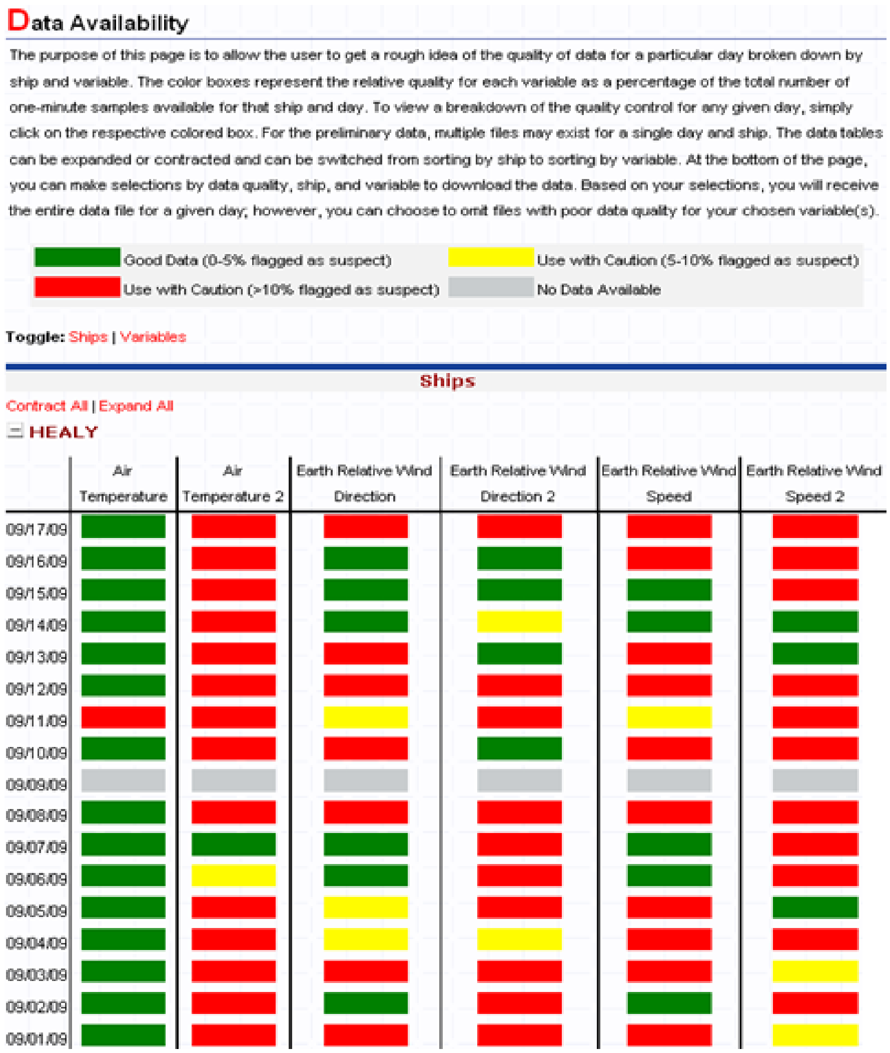
▪ Additional RV data	Additional RV data
▪ SAMOS Parameters	View a list of meteorological and oceanographic parameters that the initiative seeks to obtain from vessels
▪ Metadata Portal	Access ship metadata database
▪ User Metadata Tutorial	SAMOS Online Metadata System Walk-through tutorial. The document provides instruction on accessing cruise track maps, vessel and instrument metadata, data, and quality control statistics from the SAMOS web interface. [pdf]
▪ SAMOS Fluxes	Access and download air-sea flux data calculated along ship tracks using SAMOS data. Note: data access provided by the Research Data Archive at NCAR.

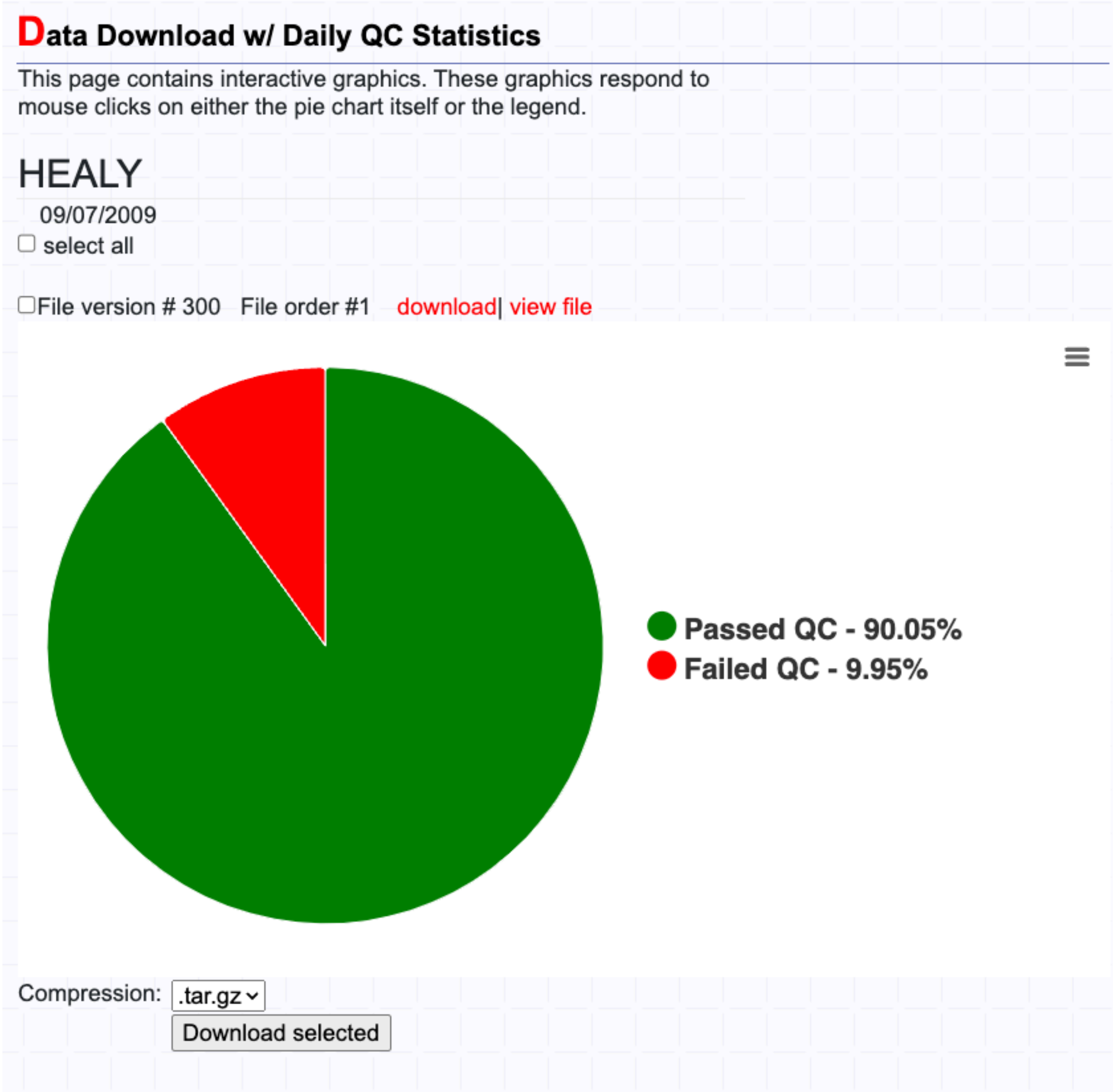
After selecting the *Healy* along with the desired parameter(s), date range, and data version (preliminary, intermediate, or research), noting that the default date range and available parameters will change once a vessel and data version are selected, and then clicking "search":



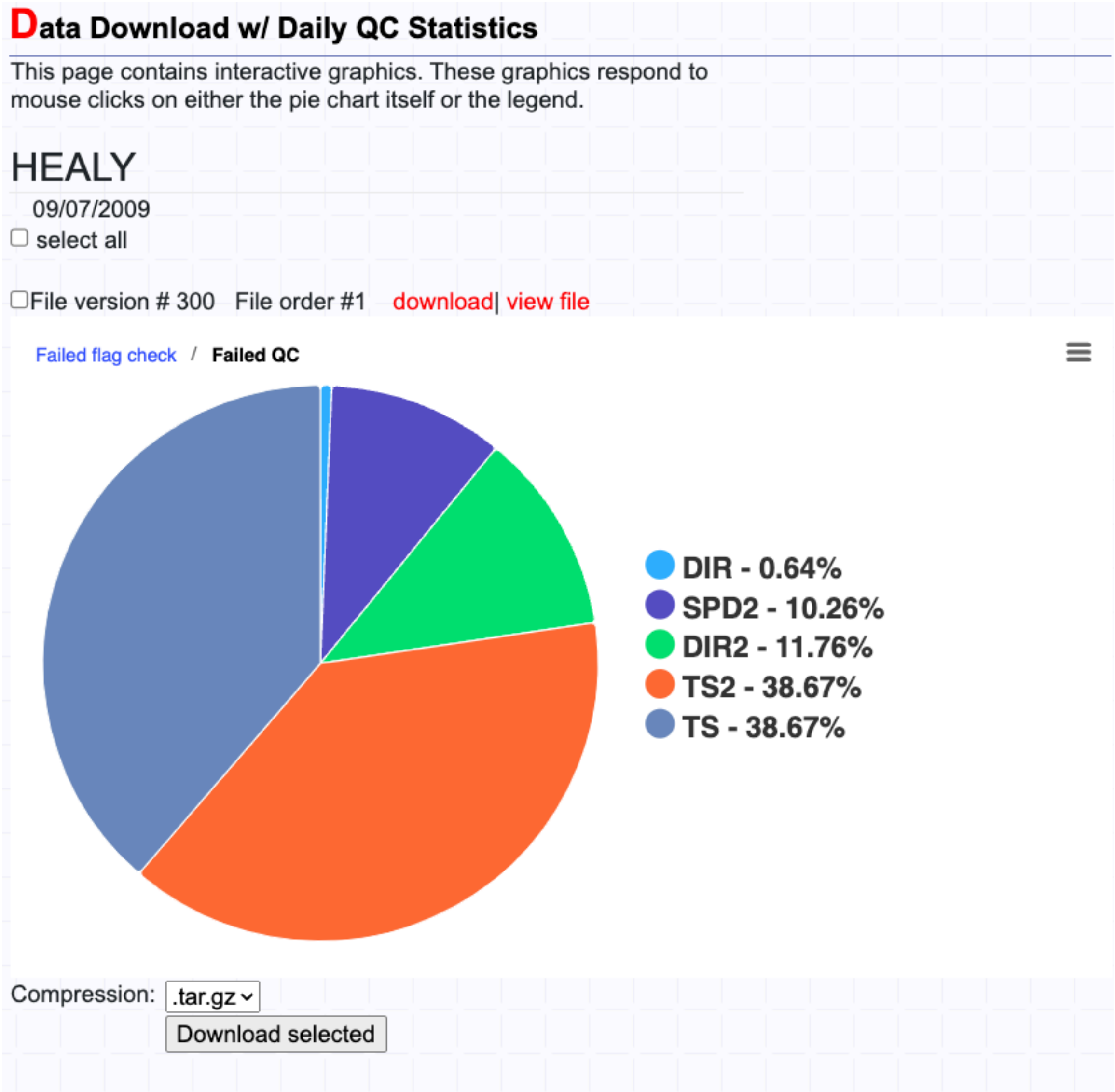
the user arrives at a timeline showing on which days in 2009 the Healy provided data for the chosen parameter(s), as well as the quality of that data for each calendar day (note: image has been customized):



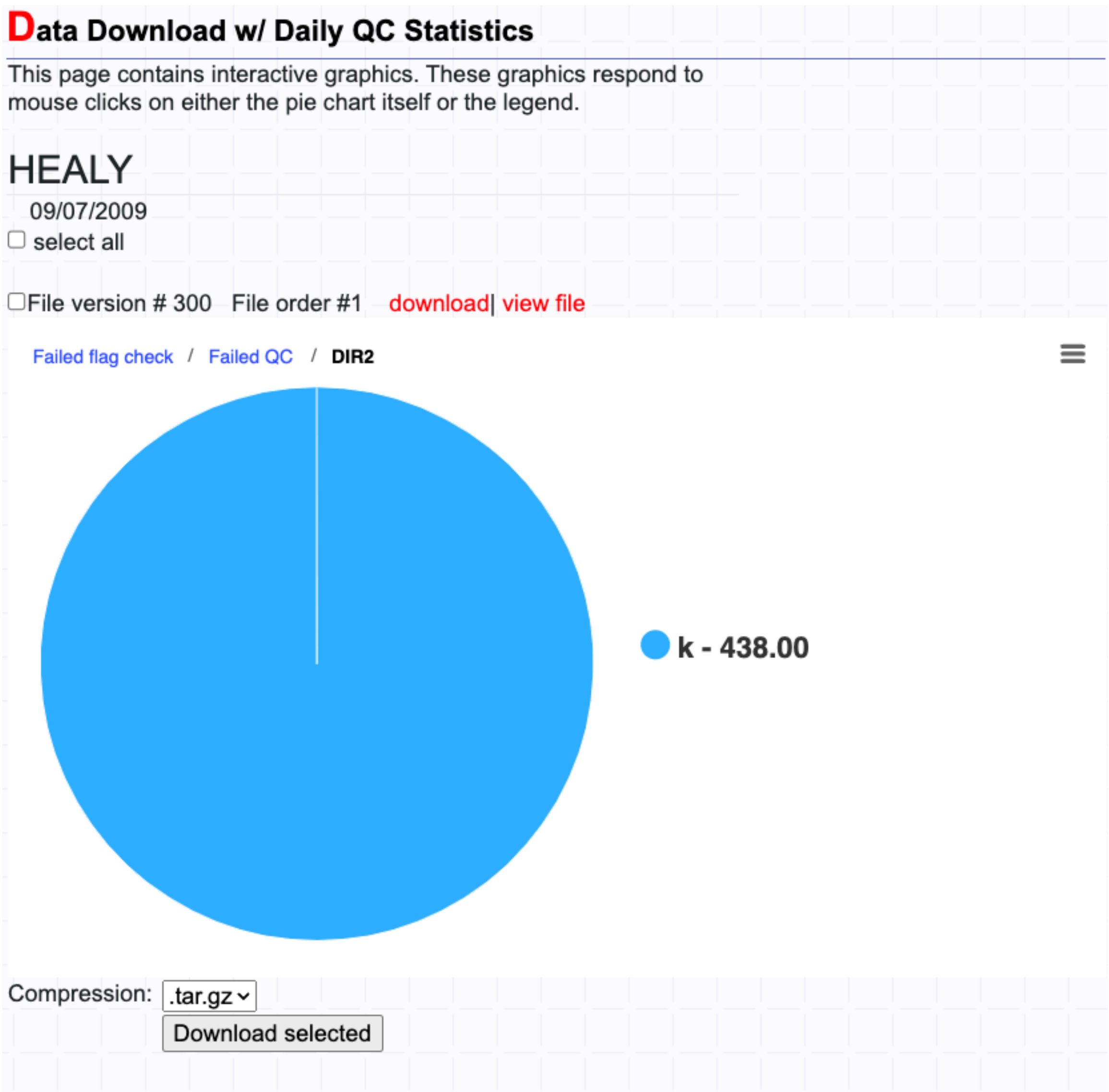
Color-coding alerts the user to the perceived quality of the data. As explained in the key at the top of the page, green indicates "Good Data" (with 0-5% flagged as suspect), yellow indicates "Use with Caution" (with 5-10% flagged as suspect), and red indicates a more emphatic "Use with Caution" (with >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 the *Healy's* temperature data and the winds from the first wind sensor are considered "Good Data." More detailed flag information, as well as information pertaining to all other available parameters, can be found by simply clicking on any colored box. As an example, by clicking over the red bar for DIR2 on the date 09/07/09 a user can find out more specific information about data quality to determine whether the wind data might also be useful. When the red bar is clicked, the user is first directed to a pie chart showing overall quality:



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

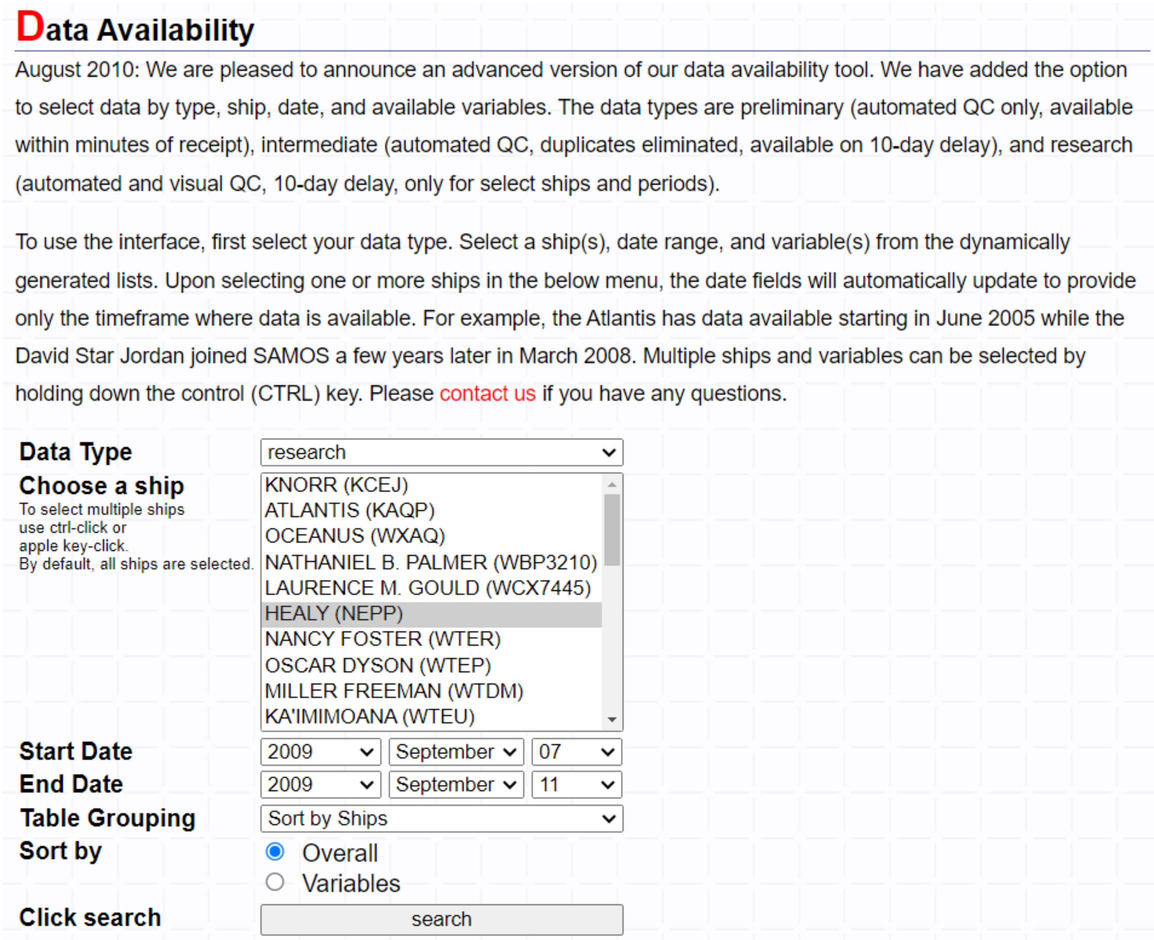


The user can now check to see precisely what types of flags were applied to the second wind sensor data, as only a portion of the data were flagged and they may still be usable. By clicking on the green pie slice for "DIR2", he determines that "caution" flags were applied to a portion of the data:



In this example, the user might repeat these steps to evaluate the quality of "SPD2" for 09/07/09. In the end, perhaps he decides the second wind sensor data will also be useful to him and now he would like to download the data. There are a couple of ways to accomplish this: By toggling a check mark in either the "File version # 300" box or the “select all” box and choosing the preferred file compression format (".tar.gz" 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.) Or the user may simply click “download” (in red) to automatically begin download of the NetCDF file without any compression. 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. To do this, the user can return to the Data Availability page, select the

Healy, desired date range, and data version as before, but this time simply select the "Overall" sorting choice and click search:



Data Availability

August 2010: We are pleased to announce an advanced version of our data availability tool. We have added the option to select data by type, ship, date, and available variables. The data types are preliminary (automated QC only, available within minutes of receipt), intermediate (automated QC, duplicates eliminated, available on 10-day delay), and research (automated and visual QC, 10-day delay, only for select ships and periods).

To use the interface, first select your data type. Select a ship(s), date range, and variable(s) from the dynamically generated lists. Upon selecting one or more ships in the below menu, the date fields will automatically update to provide only the timeframe where data is available. For example, the Atlantis has data available starting in June 2005 while the David Star Jordan joined SAMOS a few years later in March 2008. Multiple ships and variables can be selected by holding down the control (CTRL) key. Please contact us if you have any questions.

Data Type research

Choose a ship
To select multiple ships use ctrl-click or apple key-click.
By default, all ships are selected.

KNORR (KCEJ)
ATLANTIS (KAQP)
OCEANUS (WXAQ)
NATHANIEL B. PALMER (WBP3210)
LAURENCE M. GOULD (WCX7445)
HEALY (NEPP)
NANCY FOSTER (WTER)
OSCAR DYSON (WTEP)
MILLER FREEMAN (WTDM)
KA'IMIMOANA (WTEU)

Start Date 2009 September 07

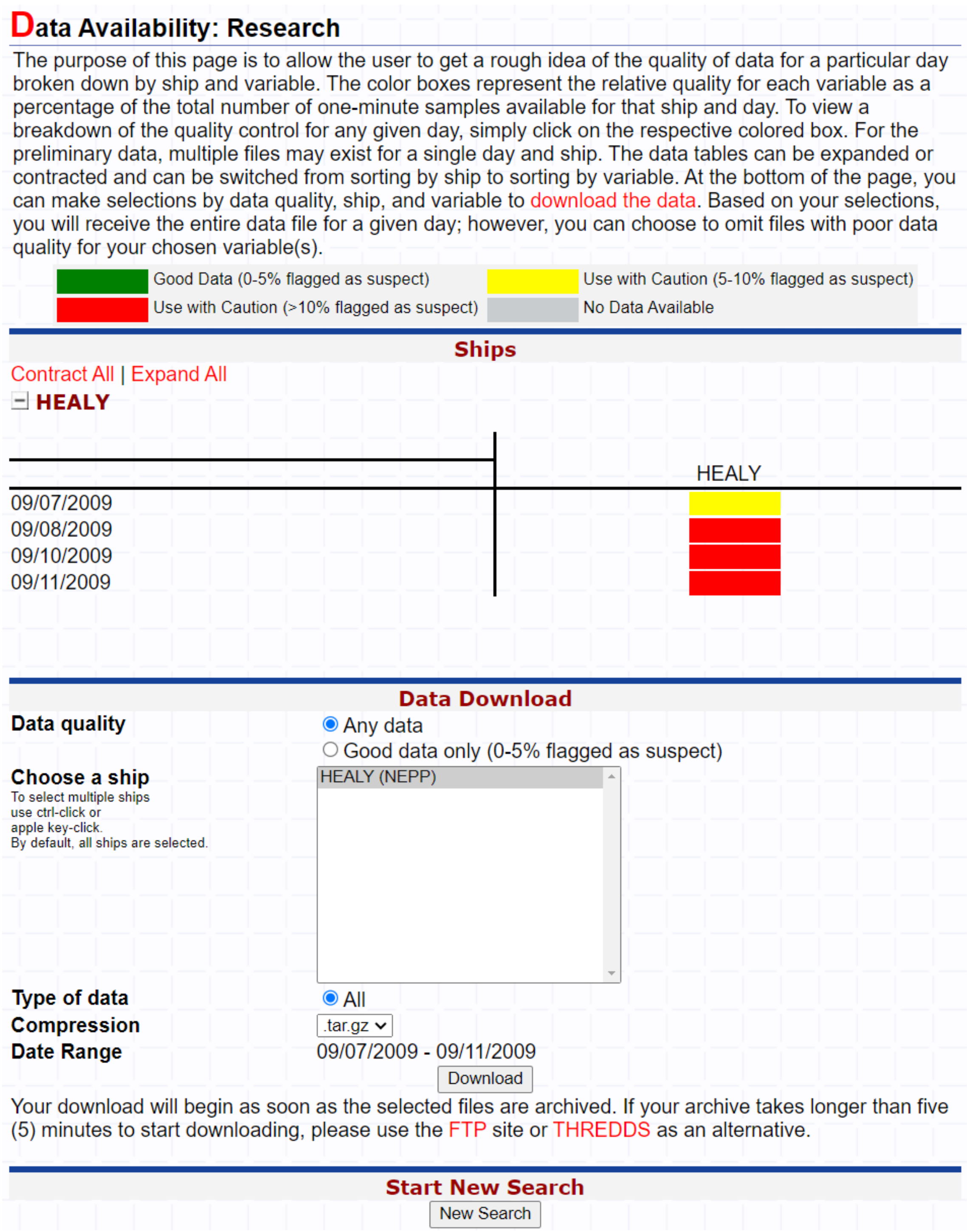
End Date 2009 September 11

Table Grouping Sort by Ships

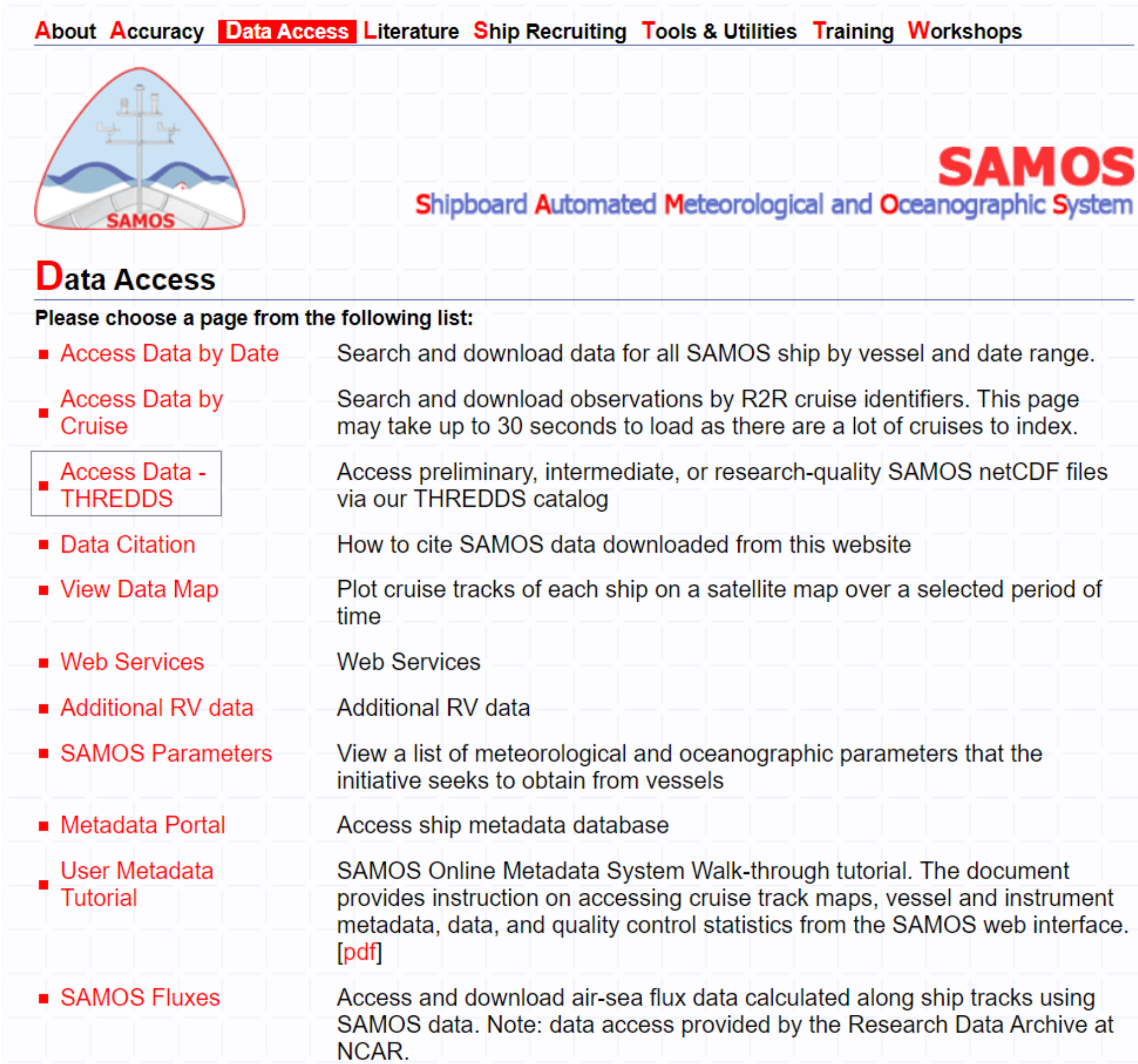
Sort by Overall / Variables

Click search search

From here he can choose the desired compression type and download the entire selected range of data with one click of the Download button:



Alternatively, he may return to the Data Access page and choose Access Data - THREDDS, where he will also have an opportunity to choose multiple files for download:



The desired files can be accessed by descending into the Research Ship Data > NEPP > 2009 THREDDS folder:

COAPS Catalog https://tds.coaps.fsu.edu/thredds/catalog/samos/data/research/NEPP/2009/catalog.html

Dataset	Size	Last Modified
2009		--
NEPP_20091007v30001.nc	231.7 Kbytes	2009-10-20T22:52:10Z
NEPP_20091006v30001.nc	231.7 Kbytes	2009-10-16T18:18:49Z
NEPP_20091005v30001.nc	231.7 Kbytes	2009-10-15T17:33:43Z
NEPP_20091004v30001.nc	231.7 Kbytes	2009-10-14T21:21:26Z
NEPP_20091003v30001.nc	231.7 Kbytes	2009-10-13T19:31:38Z
NEPP_20091002v30001.nc	231.7 Kbytes	2009-10-12T19:33:22Z
NEPP_20091001v30001.nc	70.17 Kbytes	2009-10-12T19:24:01Z
NEPP_20090930v30001.nc	244.3 Kbytes	2009-10-11T23:18:51Z
NEPP_20090929v30001.nc	244.3 Kbytes	2009-10-11T23:13:16Z
NEPP_20090928v30001.nc	244.3 Kbytes	2009-10-08T19:20:23Z
NEPP_20090927v30001.nc	244.3 Kbytes	2009-10-08T13:12:06Z
NEPP_20090926v30001.nc	244.6 Kbytes	2009-10-06T15:41:46Z
NEPP_20090925v30001.nc	244.6 Kbytes	2009-10-06T15:28:28Z
NEPP_20090924v30001.nc	244.6 Kbytes	2009-10-06T15:03:55Z
NEPP_20090923v30001.nc	244.6 Kbytes	2009-10-06T14:31:35Z
NEPP_20090922v30001.nc	244.6 Kbytes	2009-10-03T16:23:39Z
NEPP_20090921v30001.nc	244.6 Kbytes	2009-10-01T18:30:01Z
NEPP_20090920v30001.nc	244.6 Kbytes	2009-09-30T21:31:53Z
NEPP_20090919v30001.nc	244.6 Kbytes	2009-09-29T19:03:43Z
NEPP_20090918v30001.nc	244.6 Kbytes	2009-09-29T18:37:32Z
NEPP_20090917v30001.nc	244.6 Kbytes	2009-09-29T18:30:14Z
NEPP_20090916v30001.nc	203.0 Kbytes	2009-09-29T03:19:52Z
NEPP_20090915v30001.nc	236.6 Kbytes	2009-09-29T03:08:27Z
NEPP_20090914v30001.nc	244.6 Kbytes	2009-09-24T20:43:19Z
NEPP_20090913v30001.nc	231.9 Kbytes	2009-09-24T02:28:24Z
NEPP_20090912v30001.nc	231.9 Kbytes	2009-09-22T18:02:24Z
NEPP_20090911v30001.nc	231.9 Kbytes	2009-09-21T23:51:59Z
NEPP_20090910v30001.nc	231.5 Kbytes	2009-09-21T23:45:57Z
NEPP_20090908v30001.nc	231.9 Kbytes	2009-09-19T17:54:06Z
NEPP_20090907v30001.nc	231.9 Kbytes	2009-09-17T19:20:20Z

Simply click on each file individually and be presented with multiple, clickable Access choices:

COAPS THREDDS/OPeNDAP

THREDDS Data Server

Catalog https://tds.coaps.fsu.edu/thredds/catalog/samos/data/research/NEPP/2009/catalog.html

Dataset: 2009/NEPP_20090907v30001.nc

- *Data format:* netCDF
- *Data size:* 231.9 Kbytes
- *Data type:* GRID
- *ID:* samos/data/research/NEPP/2009/NEPP_20090907v30001.nc

Documentation:

- SAMOS at COAPS
- **rights:** Center for Ocean-Atmospheric Prediction Studies

Access:

1. **OPENDAP:** /thredds/dodsC/samos/data/research/NEPP/2009/NEPP_20090907v30001.nc
2. **WMS:** /thredds/wms/samos/data/research/NEPP/2009/NEPP_20090907v30001.nc
3. **HTTPServer:** /thredds/fileServer/samos/data/research/NEPP/2009/NEPP_20090907v30001.nc
4. **FTP:** //data.coaps.fsu.edu/pub/samos/data/research/NEPP/2009/NEPP_20090907v30001.nc

Dates:

- 2009-09-17T19:20:20Z **(modified)**

Creators:

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Publishers:

- COAPS
  - *email:* samos@coaps.fsu.edu
  - *//www.coaps.fsu.edu*

Viewers:

- Godiva2 (browser-based)
- NetCDF-Java ToolsUI (webstart)
- Integrated Data Viewer (IDV) (webstart)