The SAMOS Initiative – A Decade of Successful Data Stewardship

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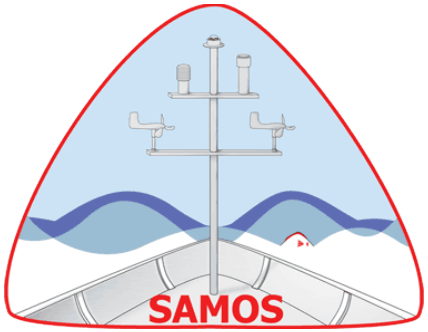


SAMOS Overview

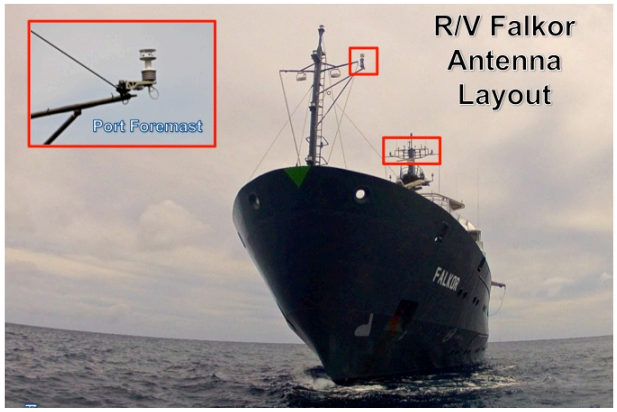
- Since 2005, have collected, evaluated, distributed and archived underway meteorology and surface ocean data from research vessels
  - Position, course, speed, heading
  - Air temperature, humidity, winds, pressure, radiation
  - Sea temp., salinity, conductivity
- Active contributors in 2016:
  - NOAA (16), USCG (1), IMOS (2), NSF Antarctic (2), WHOI (2), BIOS(1), SIO (2), UW (1), U. Hawaii (1), SOI (1), U. Alaska (1), LUMCON (1)
  - *Neil Armstrong* and *Investigator* new in 2016

Number of ships contributing and records processed by SAMOS

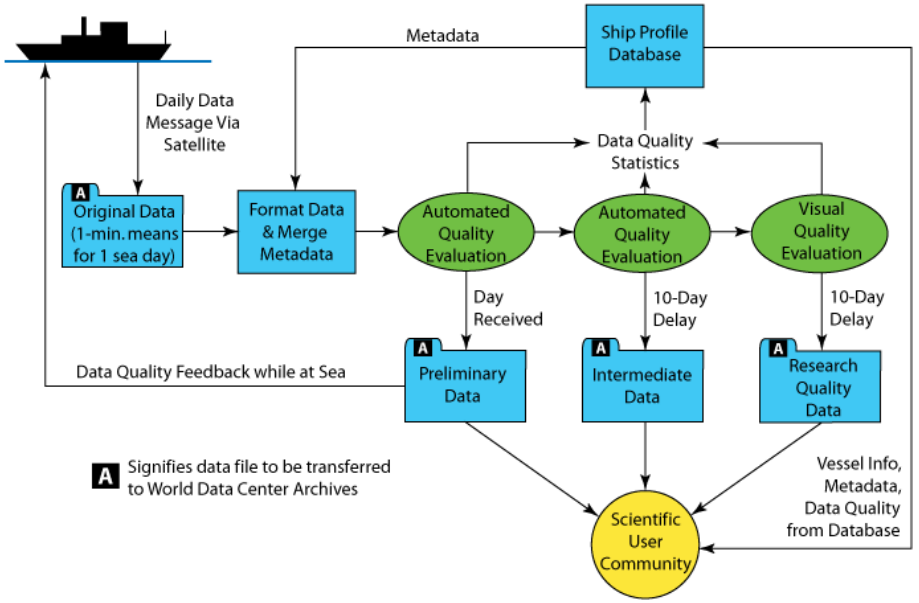
Year	Ships	1-min Records
2005	2	445846
2006	3	761753
2007	13	2407649
2008	21	4989685
2009	27	4894855
2010	28	6072321
2011	28	6190191
2012	35	6872249
2013	35	6996322
2014	35	6877784
2015	33	7775116
2016	31	3663909*

SAMOS Data Processing

- One-minute samples are bundled in daily email messages.
- Automated processing merges data with extensive vessel metadata (based on VOSClim).
- Data are routinely evaluated.
  - Automated QC (preliminary)
  - Visual QC
    - Research data product
    - For NOAA vessels and *Falkor*
  - Shore-side data monitoring and feedback to technicians at sea
- Distribution is via web, ftp, and OPeNDAP servers.
- Archival occurs at U.S. NCEI.
  - Monthly transfers to archive

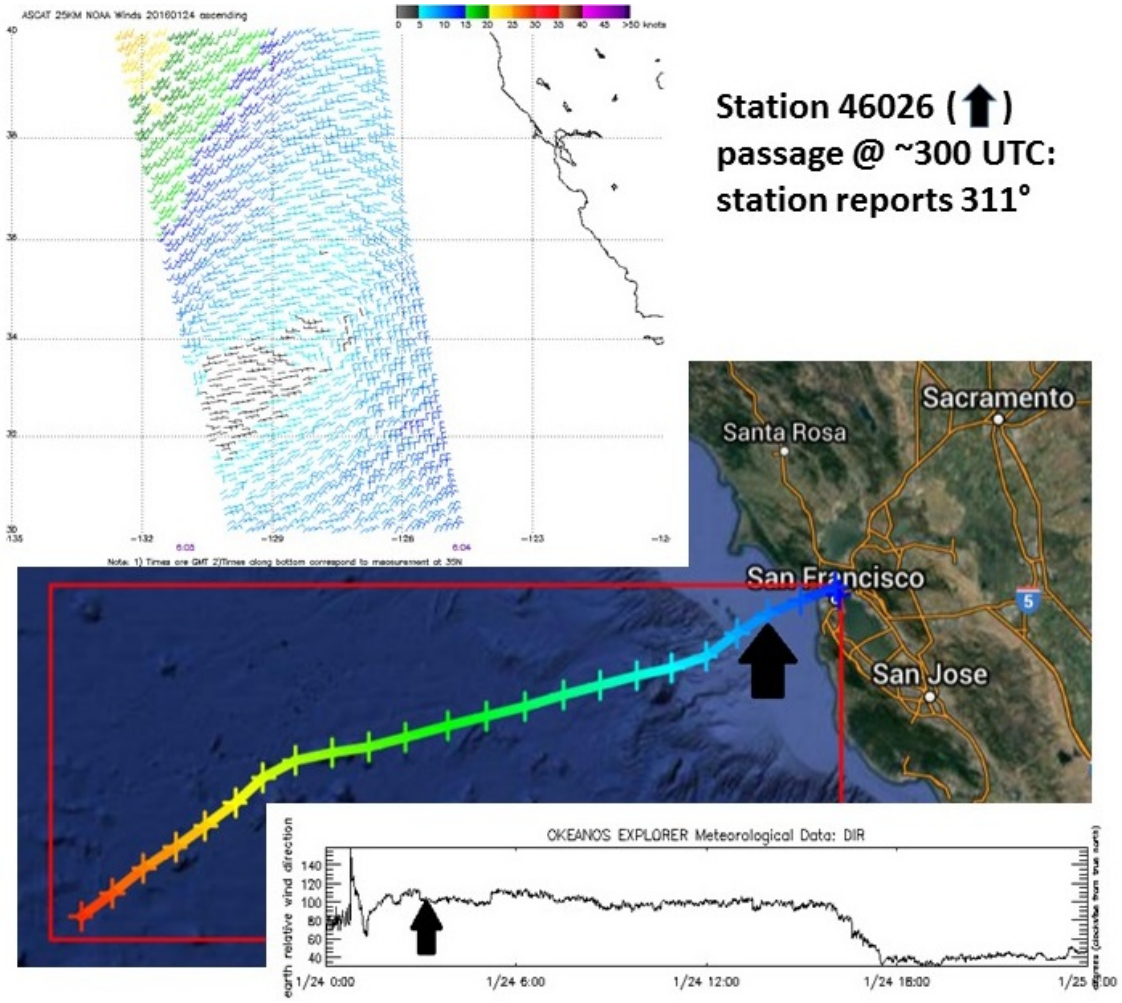


SAMOS Data Flow



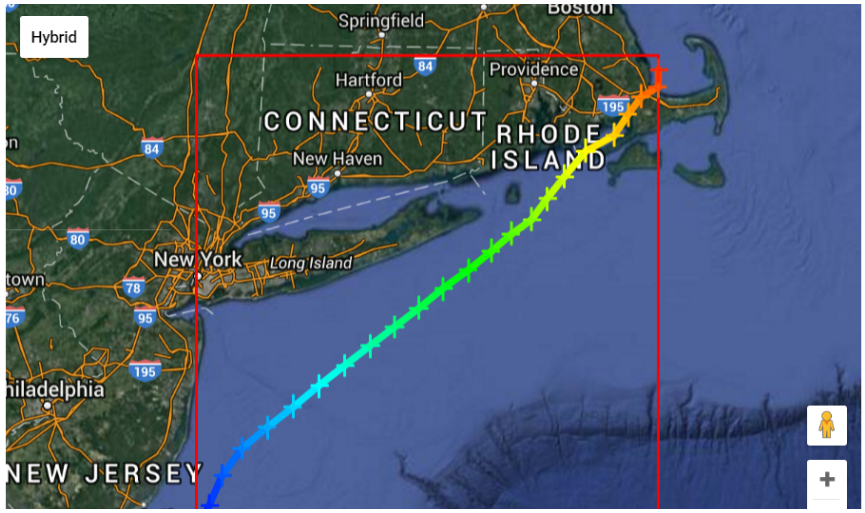
Lessons Learned (1)

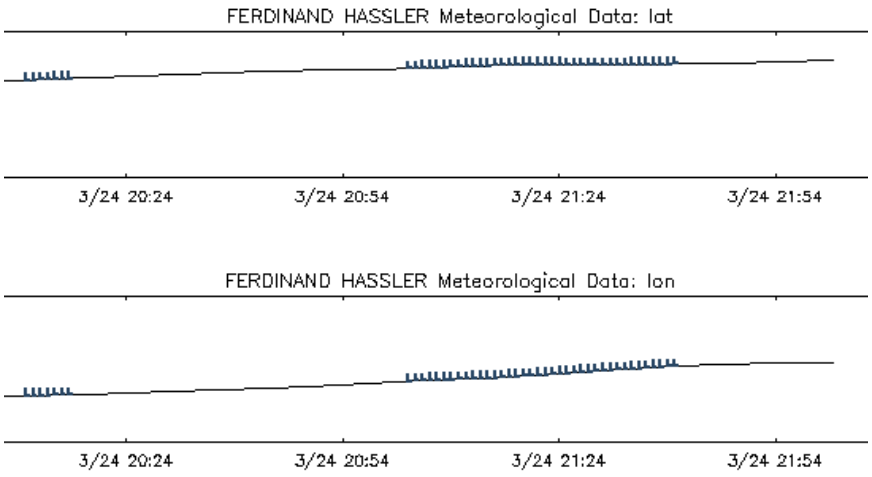
- Shore-side data monitoring works!
  - Disciplinary data centers provide expertise that shipboard technicians may not possess.
- Shipboard technicians benefit from at-sea feedback
- Corrects problems before a whole cruise of useless data is collected



Lessons Learned (2)

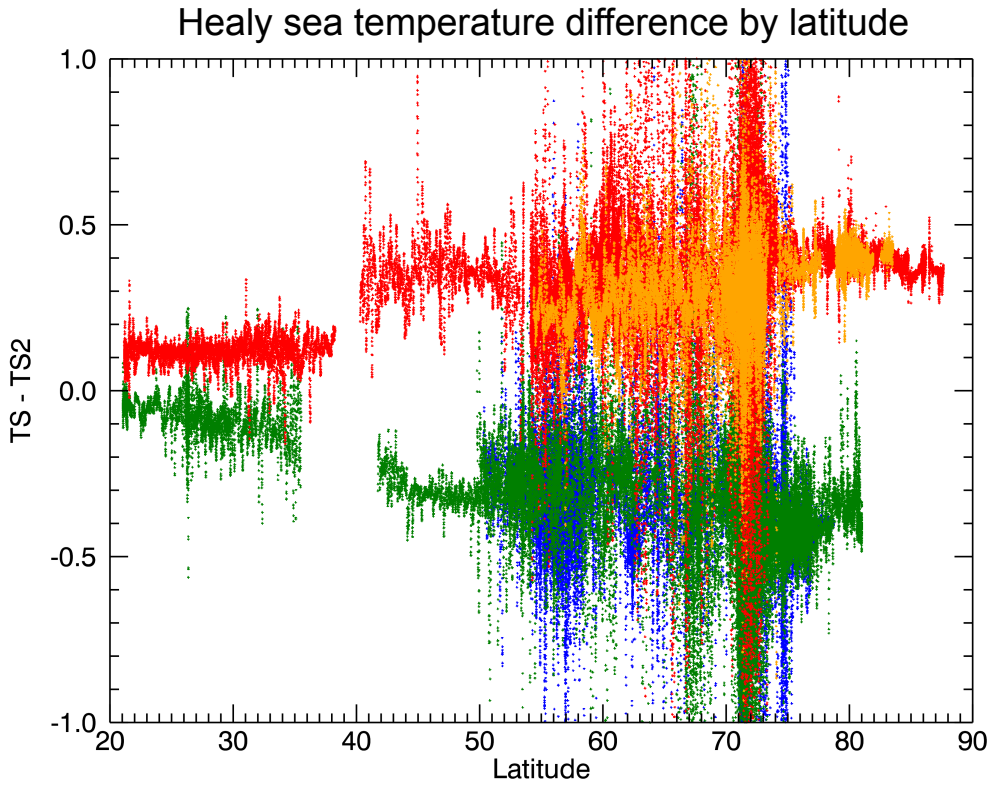
- Automated quality control misses problems in data
  - Landmasks do not contain all canals and smaller waterways
  - Airflow distortion, stack exhaust, electronic noise hard to diagnose
- Duplicate sensors can help, but third data source often needed to verify which sensor is correct
- Visual QC frequently 5-10% more data





Lessons Learned (3)

- Never enough metadata!
  - Critical for data reuse
  - Supports visual QC
  - Recommend controlled vocabularies (no free text)
- Never enough focus on metadata collection and preservation
  - Easier to capture as data collected
- Example: Sea temperature
  - Need absolute knowledge of sensor location
  - Distance from water intake affects measurement
  - See Carstens et al. poster



2008-2010: Blue, Green
2011-2012: Red, Orange

Lessons Learned (4)

- SAMOS has advocated for fluid dynamics modeling of ship structures in design phase
  - Implemented for *Sikuliaq* and new U.S. regional class R/Vs
  - Allows instrument mast changes early in process
- SAMOS reviewed results and made recommendations for sensor exposure on new R/Vs

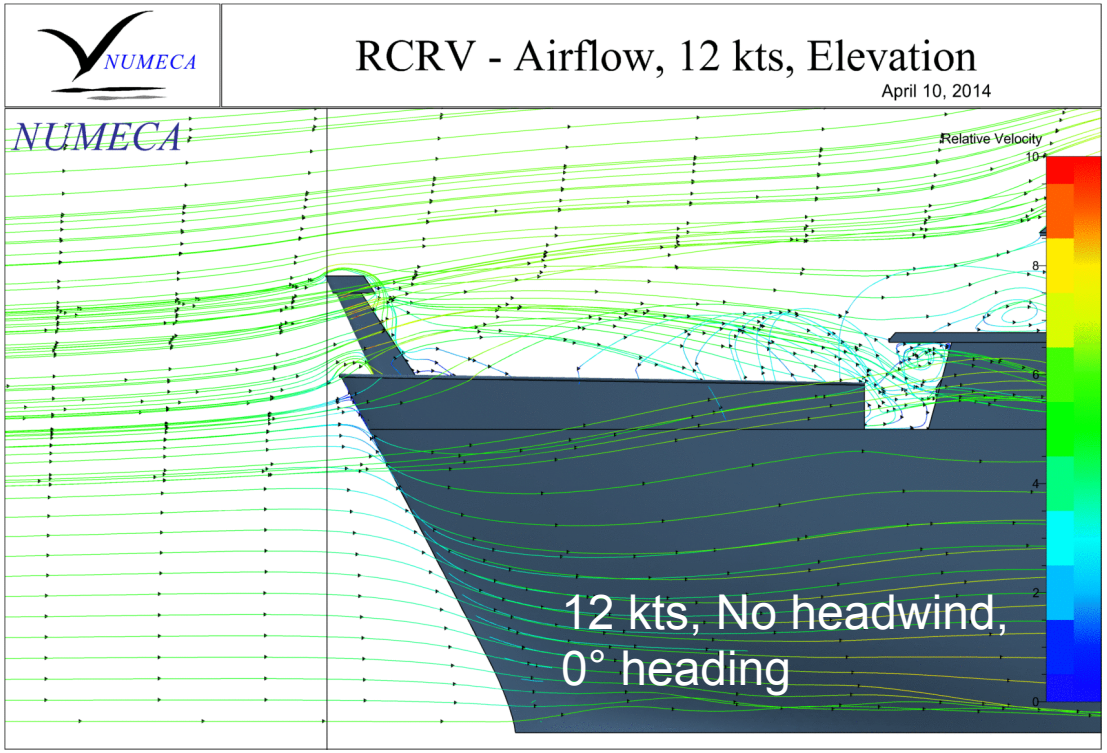
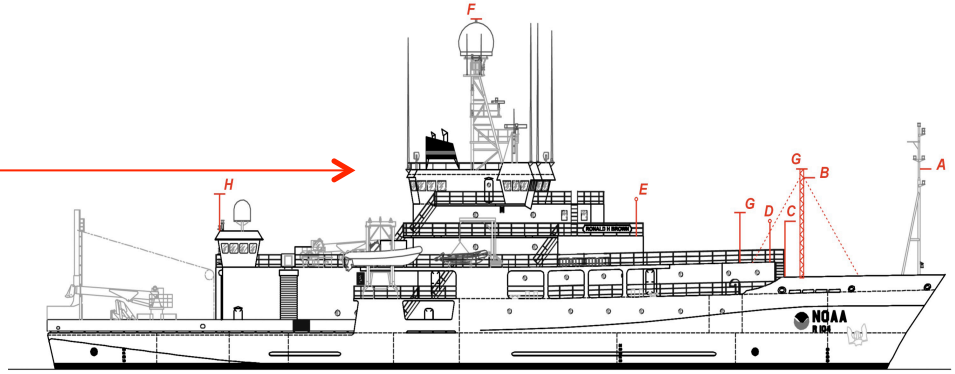


Image courtesy The Glosten Associates

Operator Best Practices

- Site meteorological sensors as far forward and as high as possible to avoid influence of ship on measurements
- Avoid sources of RF on vessel, which result in noisy data – particularly from radiation sensors.
- Avoid sources of heat.
- Record sensor locations w.r.t. known vessel coordinate system.
  - Document system with data
- Ensure proper calculation of true winds to remove ship motion.

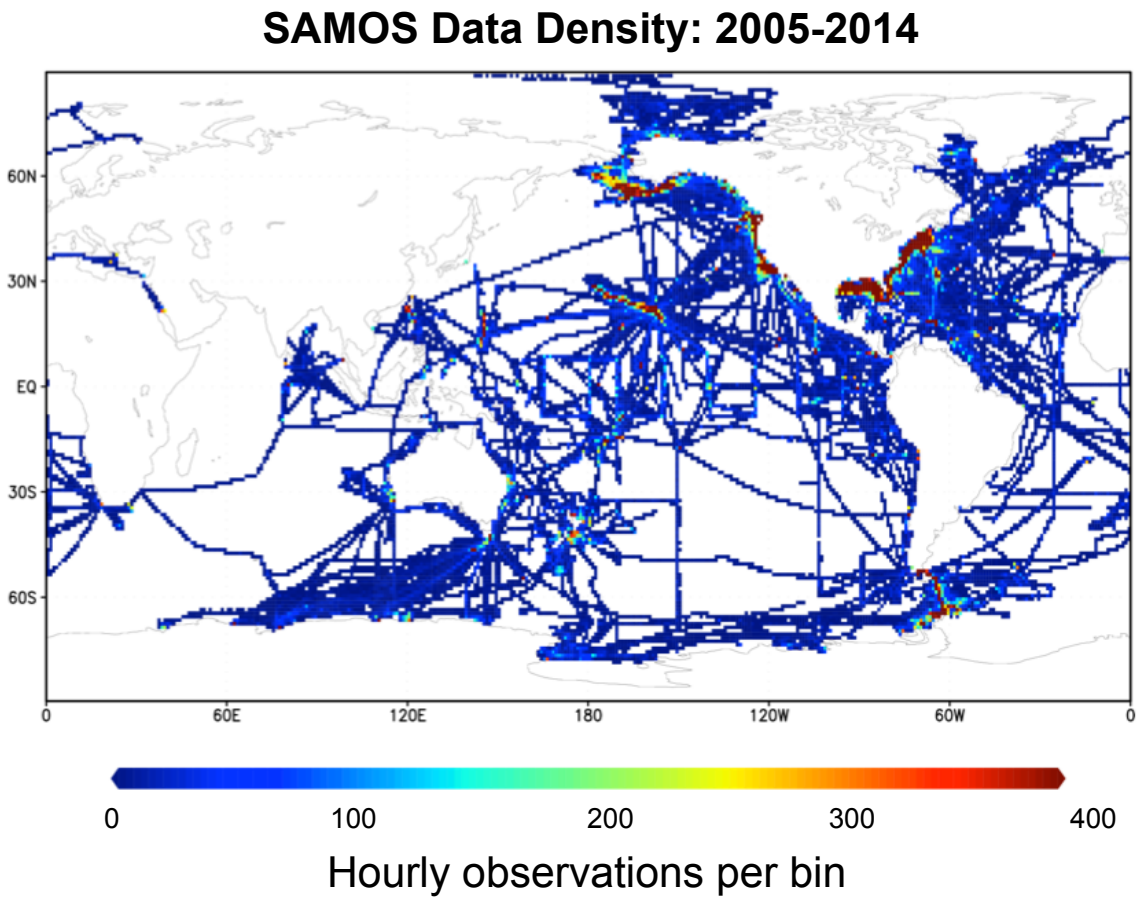


Homogeneity

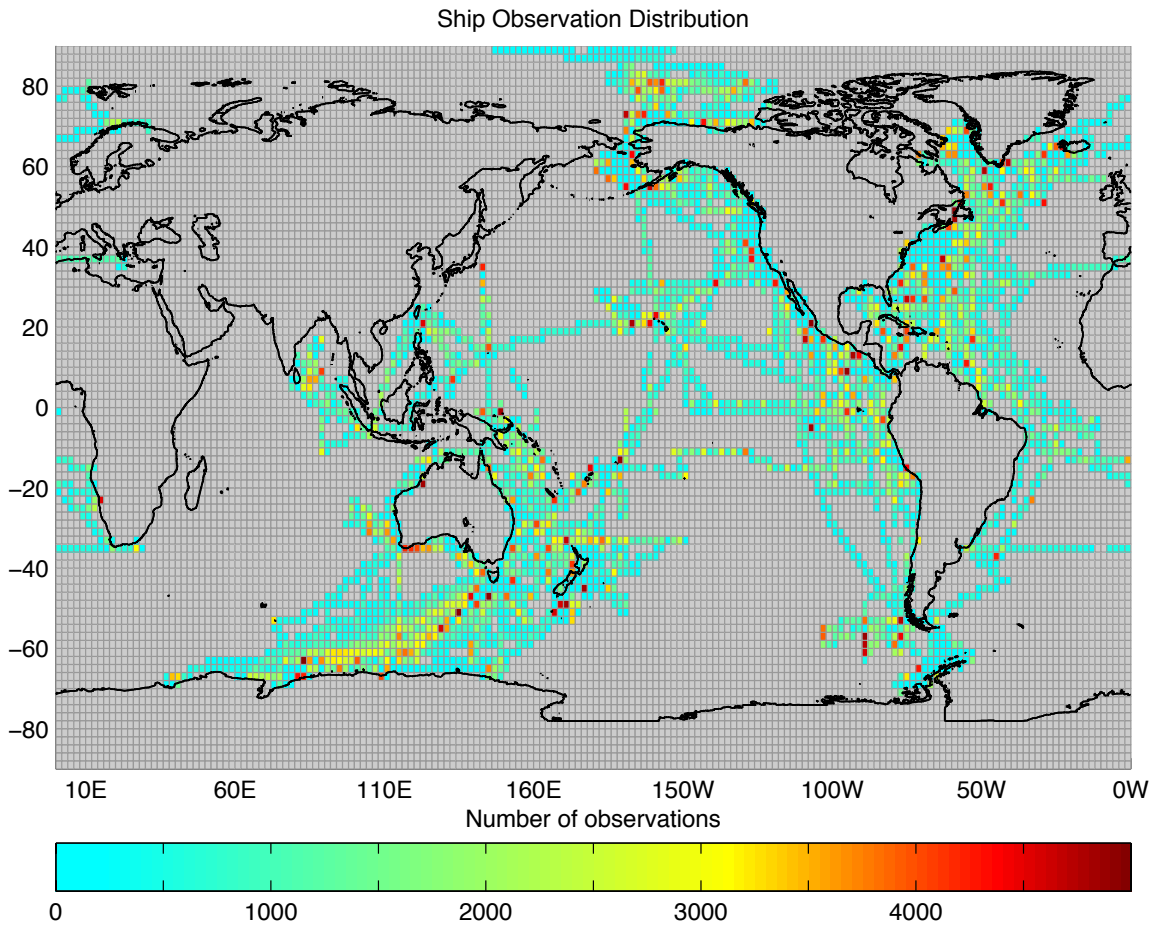
Challenges	How Addressed
• Instrument deployment by vessel operators (Not by NMS) • Diverse set of devices	• SAMOS provides accuracy targets and sensor recommendations
• Uneven metadata collection	• Metadata forms, minimum requirements • Moving towards standard vocabularies (SeaDataNet, CF)
• Varying data acquisition procedures	• Providing best practices for data averaging, sampling rates, true wind calculation, etc.
• Varying data quality	• Structured automated and visual quality control

SAMOS in ICOADS

- An hourly subset of SAMOS 1-min data is included in Release 3.0 of ICOADS.
  - Averaging over 10-min. at top of hour mimics synoptic reports from merchant vessels
  - Takes advantage of SAMOS QC
  - ~750 K hourly reports: 2005-2014
  - Data formatted to ICOADS submission specifications (IMMA1)



Along Track Fluxes



- Version 2 of the SAMOS air-sea flux product released early in 2016
  - One-minute interval latent and sensible heat flux, wind stress, and height adjusted (10m) wind speed, specific humidity, and potential temperature
  - 3 algorithms – Smith88, COARE3.5, Bourassa2012
  - Period: 2005-2014
- Data available from NCAR
  - doi: 10.5065/D6930R70
- Described in Smith et al., *Geosci. Data J.* (2016), doi: 10.1002/gdj3.34

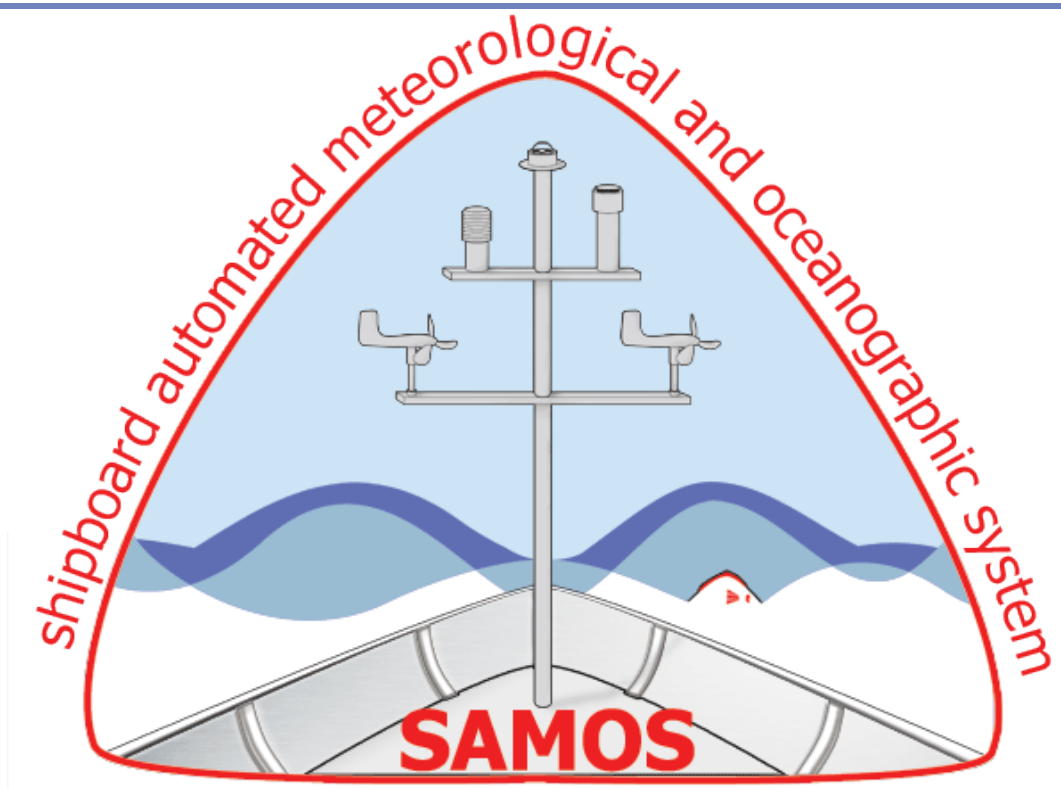
Future

- Seeking opportunities to expand contributions to SAMOS
  - Open source codes and procedures
  - Support distributed data center activities (hard to fund U.S. processing of international vessels)

- Moving forward with development of QC procedures for other flow water parameters
  - Partnering with U.S. Rolling Deck to Repository program
  - Reviewing IOOS, GOSUD procedures

- Additional product development (as resources allow)
  - Routine contributions to ICOADS
  - Improved along track air-sea flux products

Questions?



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