

NCEI-TSG AGlobal *in situ* Sea-surface Salinity and Temperature Database of Thermosalinograph (TSG) Observations

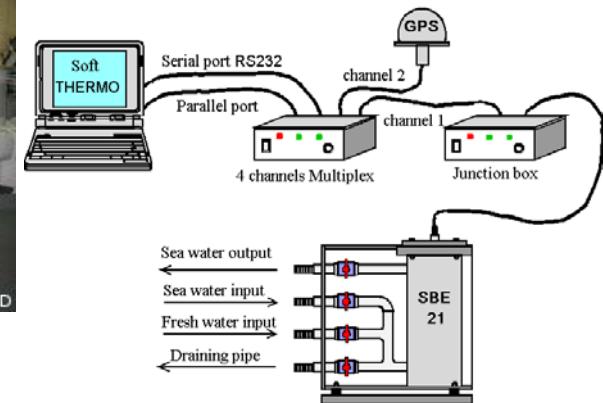
Zhankun Wang
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Outline

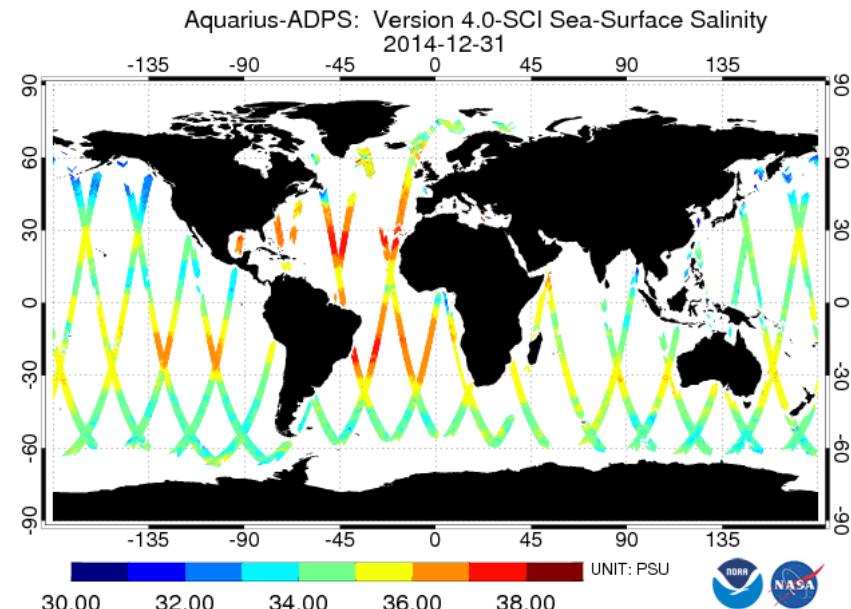
- Motivations and Background
- Development of the NCEI-TSG database
 - Data sources
 - Data flow, processing, QC
 - Data access and visualization
 - Advantages of NCEI-TSG database
- Future Work

What is a thermosalinograph (TSG)?



Motivations and Background

- ✓ Motivated by the Satellite SSS Quality Monitor (4SQM) project.
 - Satellites: Aquarius-ADPS, Aquarius-CAP and SMOS
 - In situ: TSG, drifter, buoys, moorings, ARGO etc.
- ✓ Different data centers using different format and different quality control procedures
 - GOSUD (IODE), SAMOS and AOML etc.
- ✓ NCEI AMS has large amount of TSG raw data that are not included in any of the TSG data assembly centers

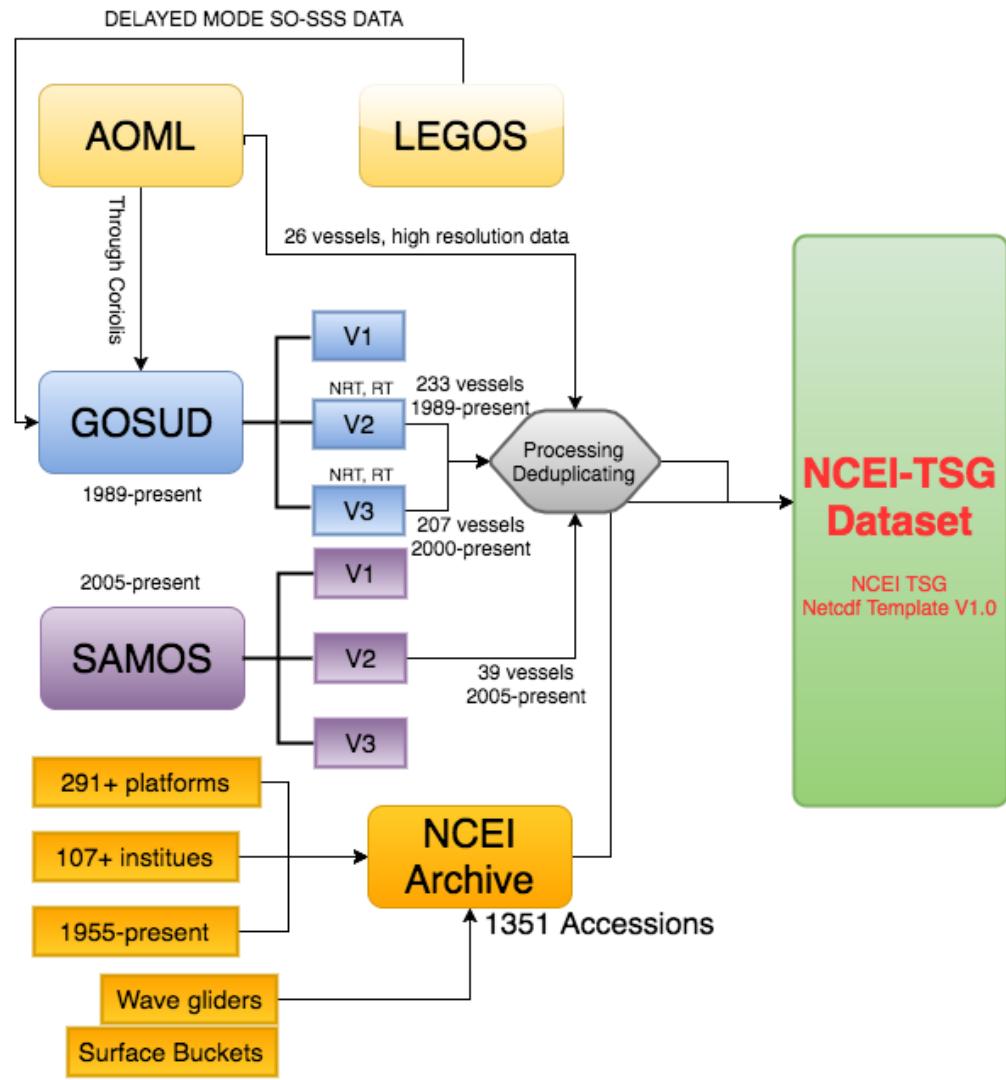


Goal of the project: to provide a well-organized, uniformly quality-controlled TSG database for the user community with granule search capability.

Datasources

There are mainly four data sources for the TSG data:

- o IODE Global Ocean Surface Underway Data (GOSUD)
- o Atlantic Oceanographic & Meteorological Laboratory (AOML) TSG
- o Shipboard Automated Meteorological and Oceanographic System (SAMOS) FSU
- o NCEI Archiving Management System



Daily updates flowchart

Sources

AOML:
raw
(monthly),
daily,

SAMOS:
V1, V2
and V3

GOSUD:g
osud2,RT
and NRT,
md5;
gosud3,
RT and
NRT, md5
, DM

Download:
download_TSG.bas

10:pm

AOML

AOML_nc2nc.py

12:pm

SAMOS

SAMOS_nc2nc.py

1:am

GOSUD

GOSUD2_nc2nc.py
GOSUD3.nc2nc.py

NCEI

NCEI_nc2nc.py

Deduplication

Python modules pool: save2nc.py;
TSG_qc.py, wmo_documents.py

Quality Control

Process data

07:am
create daily report

NCEI-TSG V1-
one file per vessel
per month per wmo
square

Daily update

08:am

NCEI Archive
Management
System
Monthly

Daily text files
for 4SQM
SSS_julianday.
txt

Update FTP
site to STAR
and other
users

Access to the data

Metadata: <http://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.nodc:0156189>

HTTP: <http://data.nodc.noaa.gov/ncei/tsg/>

FTP:

<ftp://ftp.nodc.noaa.gov/pub/data.nodc/ncei/tsg/>

OPeNDAP

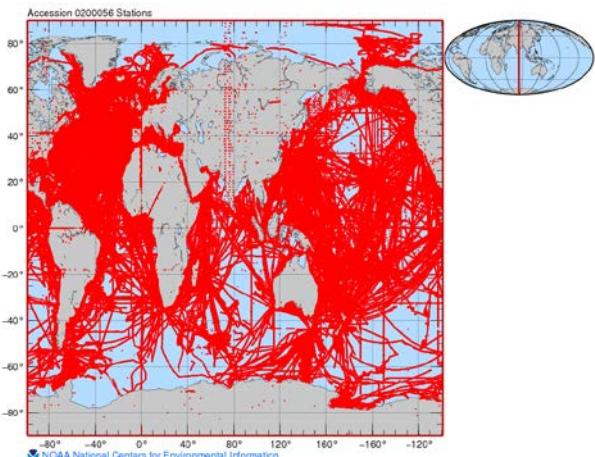
<http://data.nodc.noaa.gov/opendap/ncei/tsg/>

THREDDS

<http://data.nodc.noaa.gov/thredds/catalog/ncei/tsg/>

Setting up automation for the monthly data update/publish

The screenshot shows a web browser displaying the NOAA NCEI website. The URL in the address bar is <https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.nodc:0156189>. The page title is "NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION". The main content area describes a dataset of quality-controlled sea surface temperature, salinity, and other measurements from underway/intakes thermosalinographs (TSG) from 1989-7-20 to 2016-7-31. It includes a detailed description of the dataset's construction, sources, and resolution. A "Dataset Citation" box contains the citation information: Wang, Z. and US DOC, NOAA, NESDIS, National Centers for Environmental Information (2016). Quality-controlled sea surface temperature, salinity and other measurements from underway/intakes thermosalinographs (TSG) from the CORNIE DE SAAVEDRA, METEOR and 216 other platforms in the Atlantic, Pacific, Indian and other locations from 1989-7-20 to 2016-7-31 (NCEI Accession 0156189).



Data access-granule search portal

<https://test.nodc.noaa.gov/vgondle/tsg-portal/>

In testing

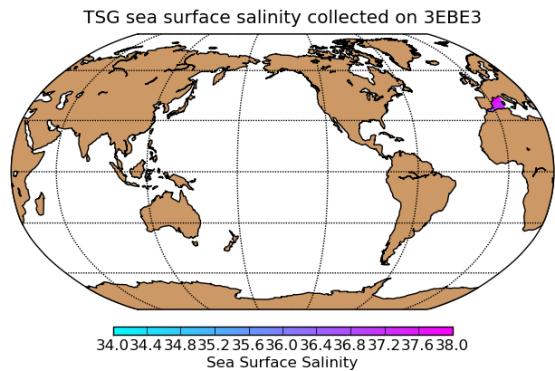
Searchable by time, location, parameters, platform names, data sources etc.

Bundle downloading

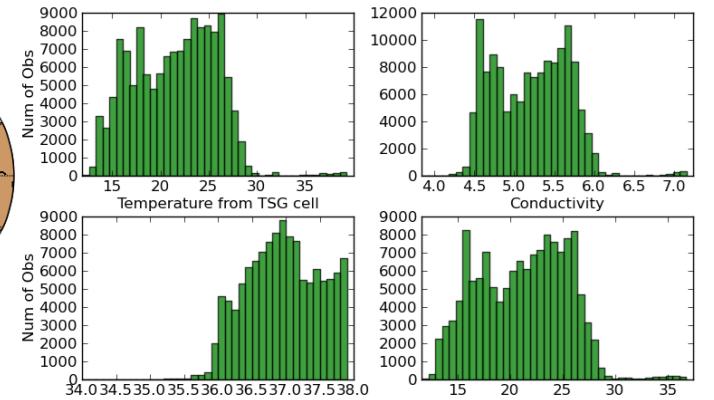
The screenshot shows a web browser window for the NOAA Thermosalinographs Data Portal. The URL in the address bar is <https://test.nodc.noaa.gov/vgondle/tsg-portal/>. The page features the NOAA logo and the text "NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION" and "NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION". A navigation bar includes links for Home, Access Data, Submit Data, Public Outreach, and About. Below the navigation bar, it says "You are here: Home > Thermosalinographs Data Portal". On the left, there's a sidebar with "Data Parameters" (checkboxes for Sea Surface Salinity, Sea Surface Temperature, Conductivity, and Jacket Temperature, with Sea Surface Salinity checked), "Data Sources" (dropdown menu set to "Global Ocean Surface Underway Data (GOSUD)"), and "Observation Dates" (date pickers for Start date [2016-01-06] and End date [2016-11-01], both in YYYY-MM-DD format). On the right, there's a "Geographic Coverage" section with a world map showing global coverage, and input fields for "North: 40", "West: -120", "Global", "East: 180", and "South: -30". At the bottom are "Search" and "Reset" buttons.

NCEI-TSGPython visualization modules - in progress

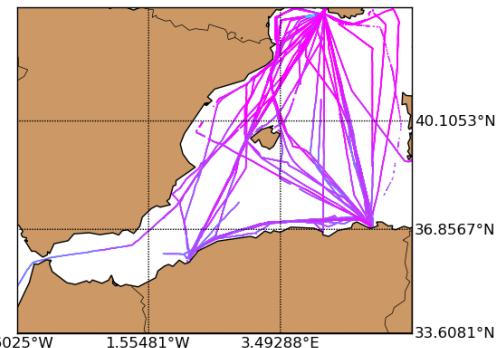
Plots for each platform



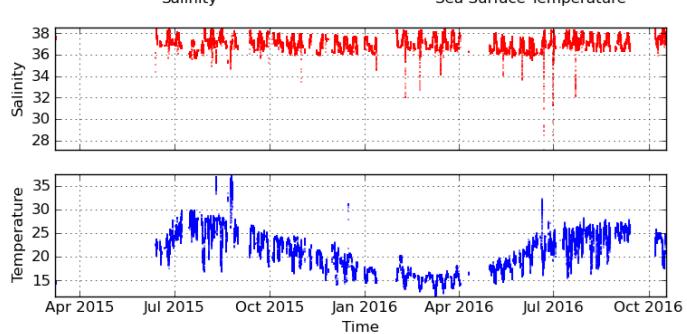
Plots for each year



Plots for most recent month



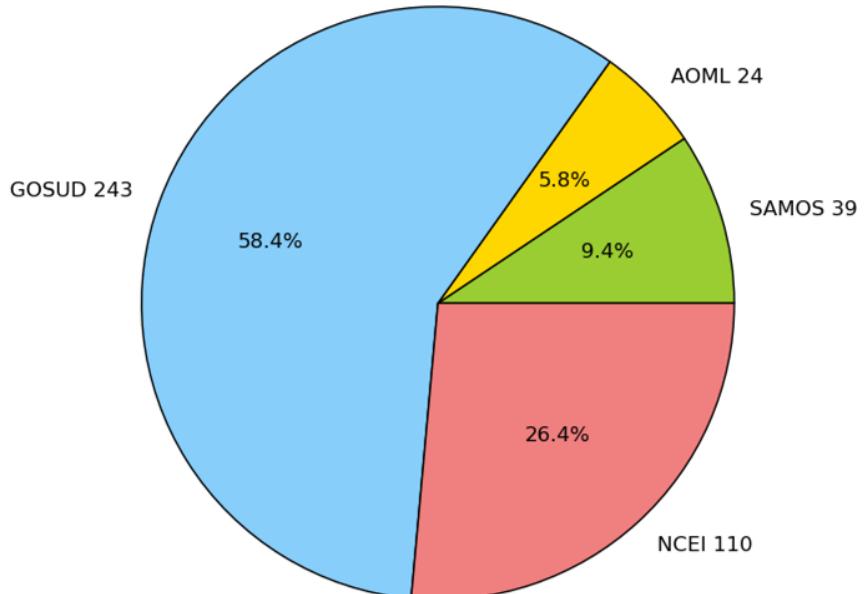
Statistic plots for each WMO square



Advantages of NCEI-TSG

- The world's most complete TSG dataset
 - Platforms: 339
 - Temporal coverage: 1989 - present
 - Spatial coverage: Global
 - Resolution: from 1s to 1h
 - containing all data from the different data assembly centers
 - with more historical data from NCEI archive to be added
- Highest resolution

Platform number distribution



Advantages of NCEI-TSG

- Common NetCDF format
 - following ACDD and CF conventions
 - NCEI netCDF template
 - 51 global attributes
- Same 11-step quality control procedures and criteria
 - flagged using a two-level flag system
 - Regional range check by defining the world oceans into 26 regions following WOD
- Granule search portal

QC in general

	QC step 1	QC step 2	QC step 3	QC step 4	QC step 5	QC step 6
General_q c_L2	platform, file check	time check	location check	ship speed check	landlocked check	flow rate check
Values	1,4,9	1,3,4,9	1,4,9	1,4,9	1,2,3,4,9	0,1, 6,9

QC for each variable

	QC step 7	QC step 8	QC step 9	QC step 10	QC step 11
Variable_q c_L2	Regional range check	climatology control	constant check	spike check	gradient check
Values	1,4	1,2,3,4	1,3	1,2,3,4	1,2,3,4

QC values	QC definition	Comments	
0	Not checked	No QC was performed	
1	Good/correct value	Value passed all the QC	
2	Probably good value		
3	Doubtful /suspect value		
4	Bad value	Value did not pass QC	
6	Flow rate	3 l/min < flow < 50 l/min	
9	Missing value		

Future Work

1. Monthly updates/maintenance
 - Set up automations
 - Monitoring the TSG automations. Solving any issues encountered
2. Expand the database
 - With more historical data from NCEI archive (1300+ accessions)
 - Adding meteorological and biochemical data concurrently collected, e.g. chl a, DO, air temp, RH etc
 - Replacing averaged data with high resolution data
 - Adding surface data from other instruments/platforms, e.g., data from wave gliders, sail gliders, drifters, water bucket etc
3. Metadata enhancement, such as water intake depth, instrument setup etc.
4. QC updates/ongoing: improving procedures for QC and DB monitoring
 - Improving the QC procedures. This will be ongoing effort
5. Collaborate with STAR/NOAA (Eric Bayler) to establish match-ups with satellite SSS and SST observations for validation and comparisons.
6. Scientific Research, such as water-front, global water cycle etc.

Thank you for your attention!

Thanks to NCEI (Krisa Arzayus/Rost Rarsons) and STAR (Eric Bayler) for funding/project support

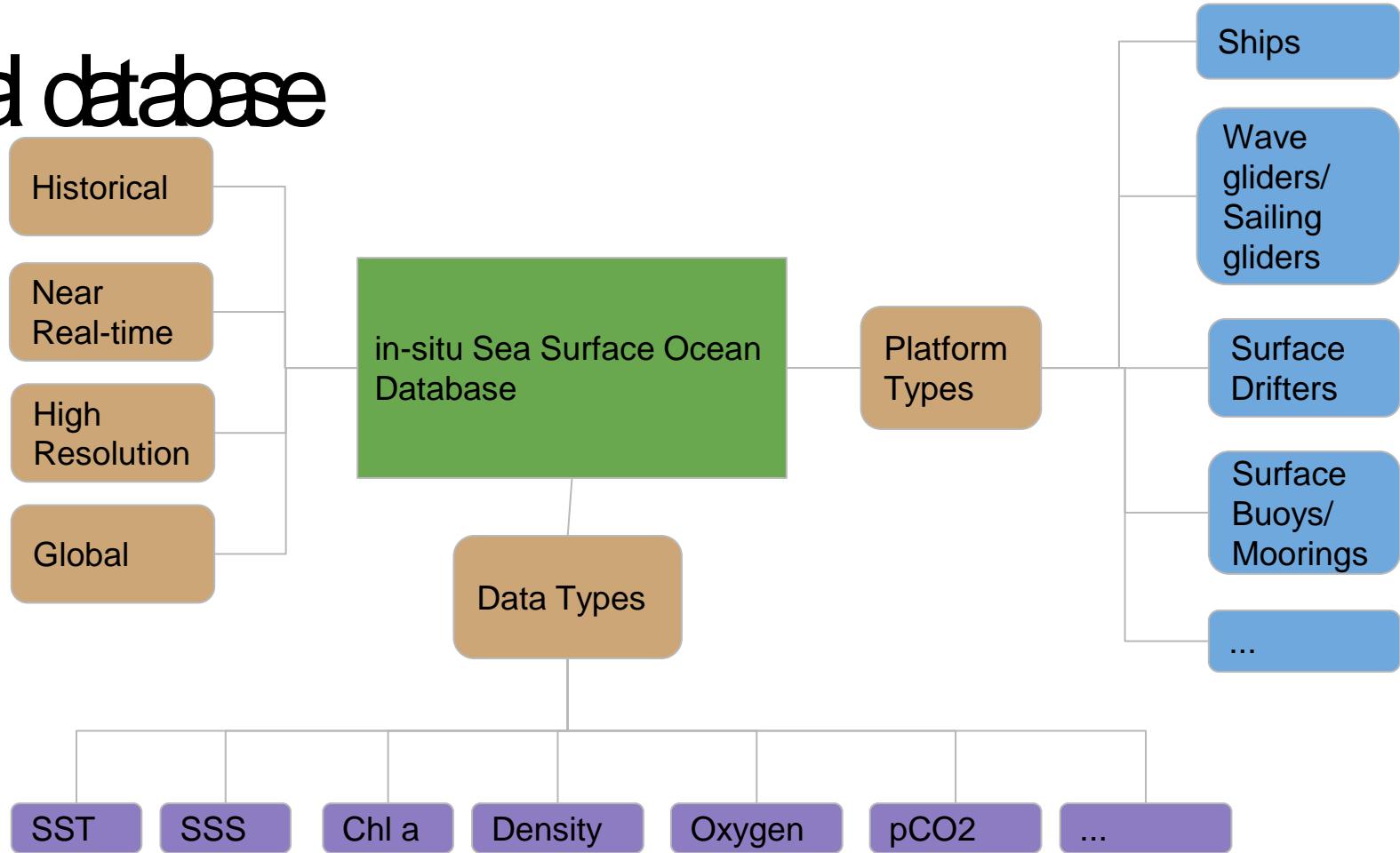
Special thanks to the NCEI-TSG team members: Tim Boyer, Huai-min Zhang, Matt Biddle for their great contributions to the project

Thanks to Yuanjie Li, Vidhya Gondle, Tom Ryan, John Relph, Ajay Krishnan for help on data archiving/publishing

Thanks to Eric Freeman, Sheekela Baker-Yeboah, Yongsheng Zhang, William Angel, Jim Reagan etc for valuable inputs.



Ideal database



Thermosalinographs (TSG)

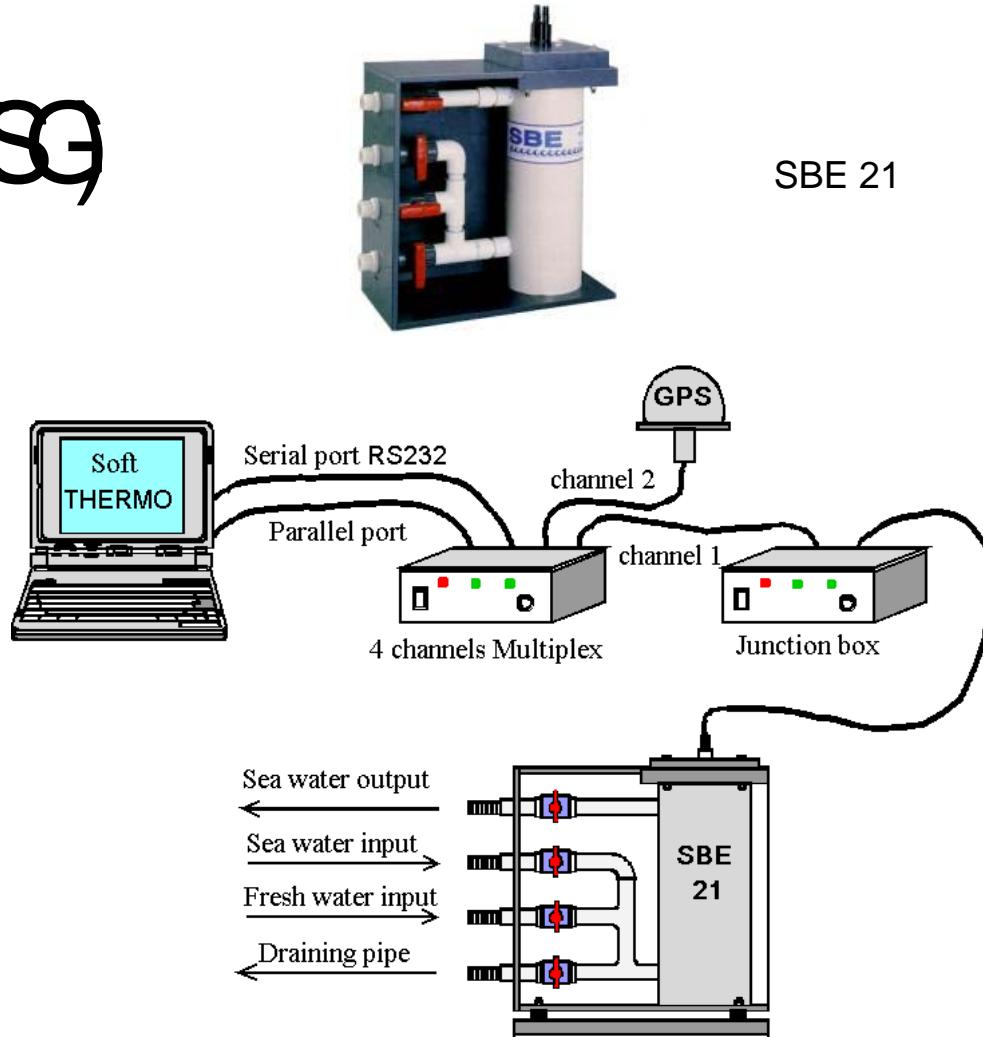
SBE 21

An instrument mounted near the water intake of ships to continuously measure sea surface temperature and conductivity while the ship is in motion.

Salinity, density, sound velocity and other parameters can be calculated.

Other Biochemical parameters might be collected concurrently, such as chl a, pCO₂, turbidity, Dissolved Oxygen, water current etc.

Types: SBE 21 SeaCAT Thermosalinograph and SBE 45 MicroTSG



Wave Gliders

Accession 0114435

4 Wave Gliders

NODC PLATFORM NAMES THESAURUS

[Benjamin](#)
[Fontaine Maru](#)
[Papa Mau](#)
[Piccard Maru](#)

NODC DATA TYPES THESAURUS

[AIR TEMPERATURE](#)
[BAROMETRIC PRESSURE](#)
[CHLOROPHYLL A](#)
[CONDUCTIVITY](#)
[DISSOLVED OXYGEN](#)
[FLUORESCENCE](#)
[HYDROSTATIC PRESSURE](#)
[SALINITY](#)
[turbidity](#)
[WAVE DIRECTION](#)
[WAVE HEIGHT - SIGNIFICANT](#)
[WAVE PERIOD - AVERAGE](#)
[WAVE PERIOD - DOMINANT](#)
[WIND DIRECTION](#)
[WIND GUST](#)
[WIND SPEED](#)

