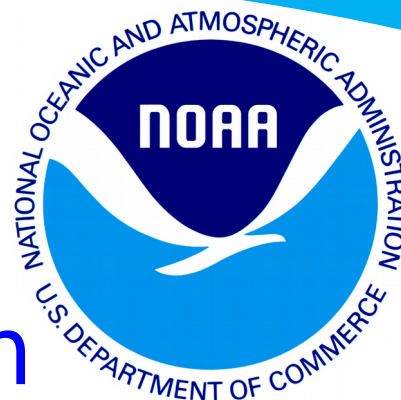


National Oceanic and Atmospheric Administration
Atlantic Oceanographic and Meteorological Laboratory
Miami, Florida, USA.



The Ship of Opportunity Program



Hapag Lloyd's Hamburg Express

<http://www.aoml.noaa.gov/phod/goos>





The Ship of Opportunity Program

Ships at sea require up-to-date and accurate weather information, often in the form of forecasts describing marine weather, sea state, ice cover, and surface currents for safe and efficient operations. Surface marine weather and subsurface oceanographic observations collected by commercial mariners have long aided the National Oceanographic and Atmospheric Administration's (NOAA) National Weather Service to produce accurate forecasts.

This partnership between NOAA and the maritime industry has endured for more than 50 years. NOAA's efforts are a key component of the global Ship Of Opportunity Program administered by the United Nation's World Meteorological Organization (WMO) and the International Oceanographic Commission to collect marine observations.

The Atlantic Oceanographic and Meteorological Laboratory (NOAA/AOML) manages this program for the National Oceanographic and Atmospheric Administration (NOAA). AOML continuously recruits ships to assist scientists in collecting oceanographic data from all world oceans. Once a vessel has been recruited it is equipped with the instrumentation required for each cruise at no charge to the vessel or vessel owners. Some of the data collection operations are very simple, quick, and are easily performed by the crew of the ship. Other operations are labor intensive and require an AOML scientific technician on board the ship.

There are currently more than 1,200 ships aiding NOAA and the scientific community in the collection of meteorological observation and more than 50 ships dedicated to collecting oceanographic data. More than 90 percent of data collected at sea for marine weather forecasts are from cargo ships. This brochure describes the different ways that ships can volunteer to participate in the Ship Of Opportunity Program.(SOOP)

AMVER/SEAS and Search and Rescue

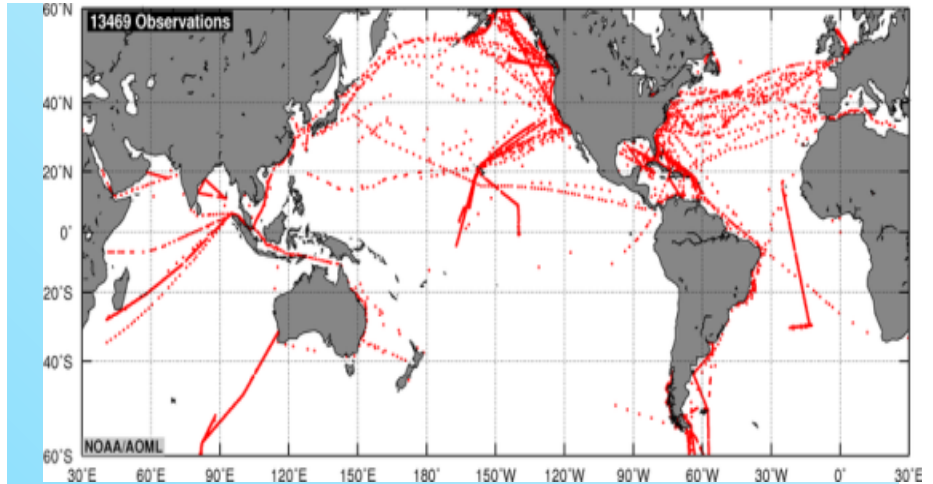
<http://www.aoml.noaa.gov/phod/goos/seas/>

NOAA's primary means of coordinating and transmitting meteorological and oceanographic data through the ships of the SOOP is using the AMVER/SEAS software. Each year, more than 1,200,000 of these observations are collected, transmitted, and used for marine weather forecast purposes.

Read the AMVER bulletin at: www.amver.com



Crew of the M/V Cape Nelson and survivors from the fishing vessel Abound that sank 625 miles off the coast of San Francisco, whose rescue was facilitated through AMVER/SEAS on October 26, 2005



Locations of SEAS Observations for February 2016

Although the AMVER/SEAS software was originally developed for transmission of oceanographic and meteorological observations it has now evolved to include a **safety at sea** module. NOAA and the United States Coast Guard now cooperate allowing SEAS to transmit the Automated Mutual-Assistance Vessel Rescue system (AMVER) reports. The AMVER system allows ships to report their intended voyage track so that in the event of an emergency all available resources may be focused on aiding ships in distress. Both of these systems are intended to facilitate ship traffic on the high seas. All transmission costs are paid by NOAA.

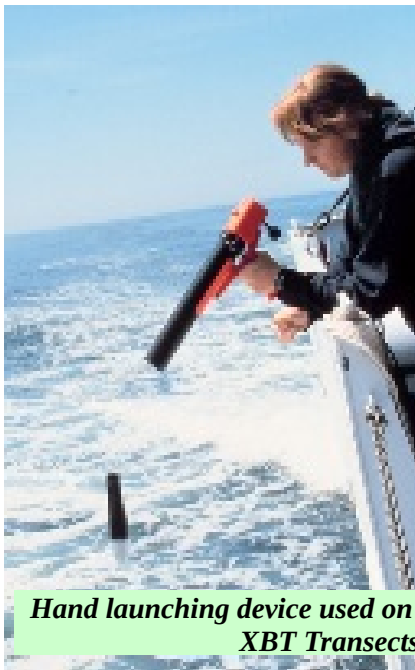
More than 1,200 ships participate in the AMVER/SEAS Program



eXpendable BathyThermograph

http://www.aoml.noaa.gov/phod/goos/xbt_network/

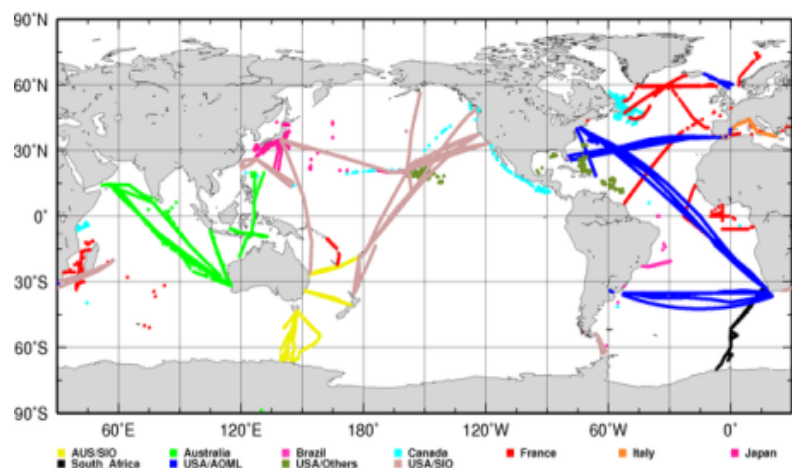
An eXpendable BathyThermograph (XBT) is a temperature probe that is launched from the stern or the bridge wing of a ship using a hand launcher or AOML's automatic launcher. The data are logged to a computer provided by NOAA, where it is processed and formatted for satellite transmission in real-time through the Global Telecommunications System (GTS). The data are then used by national and international organizations, universities, and government laboratories for weather and climate forecasting and for climate research.



Hand launching device used on XBT Transects

Why help deploy XBTs?

Because XBTs provide vital observations to estimate the heat contained in the upper ocean and the surface currents, which drive the sea surface temperatures, a critical ocean variable determining the locations of high and low atmospheric pressure systems.



Location of XBT observations received from Ships of Opportunity during 2014

Observations Collected by a Scientific Technician

High-Density XBT Transects

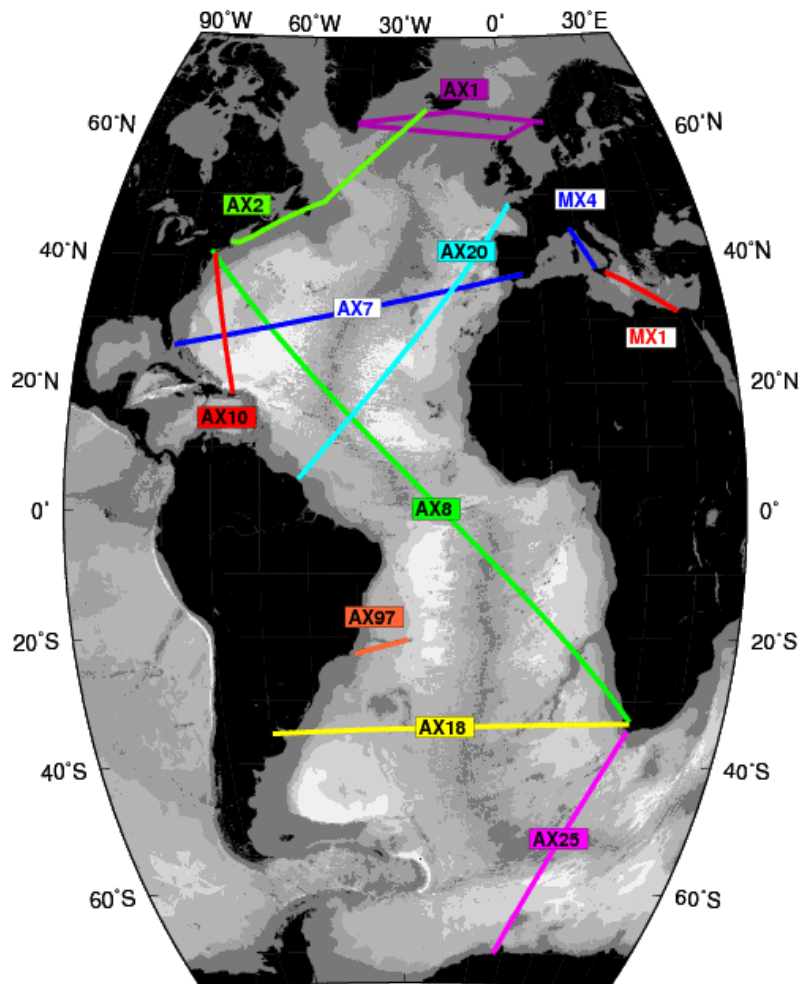
<http://www.aoml.noaa.gov/phod/hdenxbt/>



*Autolauncher installed on a
Horizon Lines vessel*

Some scientific studies require the deployment of XBTs more closely spaced than what can be feasibly collected by a crewmember. For this type of studies, XBTs need to be deployed 20 to 30 times per day and, hence, a scientific technician is required to be on board. With the ship consent the technician will temporarily install an automatic launching system on a stern railing, which will never interfere with normal ship operations.

These observations are collected and transmitted in real time and are available to data centers worldwide for weather and climate studies and forecasts. AOML currently maintains 9 high-density transects in the Atlantic Ocean. Other institutions operate similar transects in the Pacific and Indian oceans with the support of AOML



Location of high-density transects occupied by AOML

Argo Floats

<http://www.aoml.noaa.gov/phod/argo/>

In addition to deploying XBTs, a scientific technician will occasionally deploy Argo floats from the ship while on board.

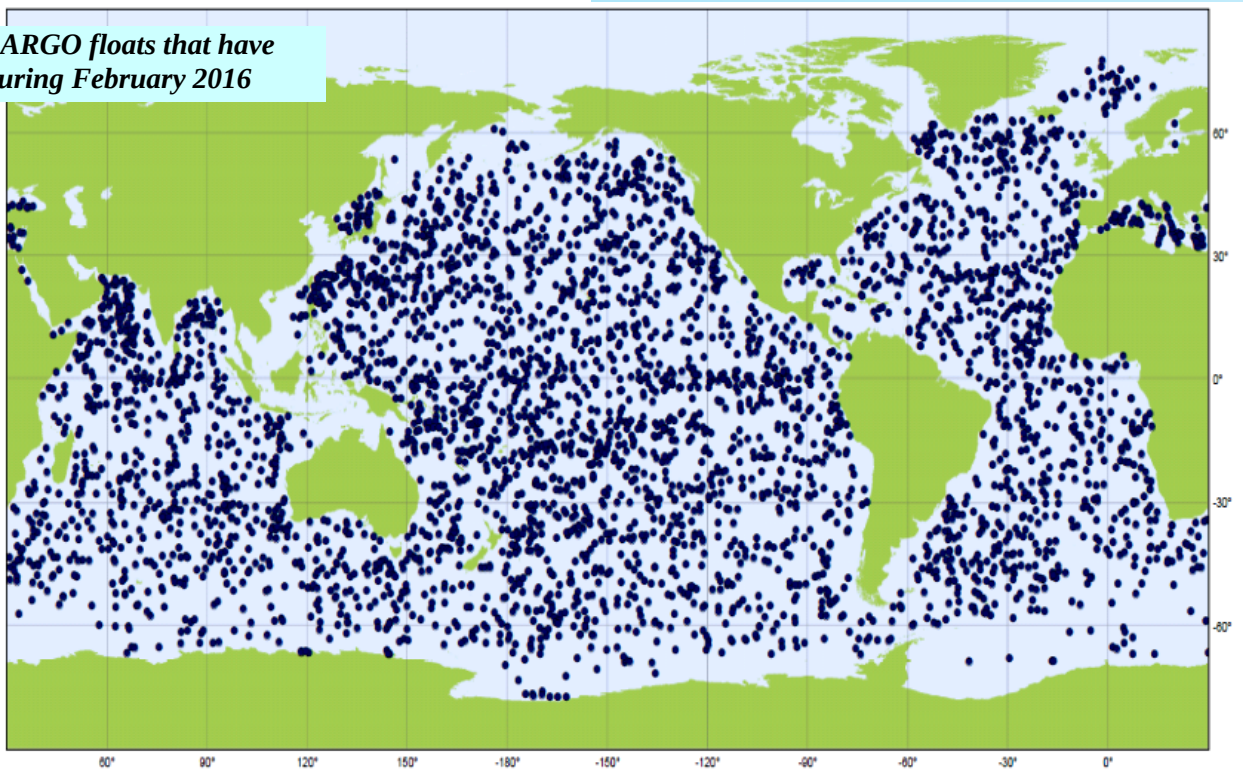
Argo is an international program that calls for the deployment of 3,000 autonomous floats distributed over the global oceans. Most floats measure the temperature and salinity profiles from depths of as great as 2000 m to the surface by ascending to the surface for a few hours after having been submerged for 10 days. The Argo array provides approximately 120,000 profiles and reference velocity measurements per year.

Ships of the SOOP aid in the worldwide effort to deploy Argo Floats.



Argo float being deployed by an AOML technician from the Horizon Hawaii

Positions of the ARGO floats that have delivered data during February 2016

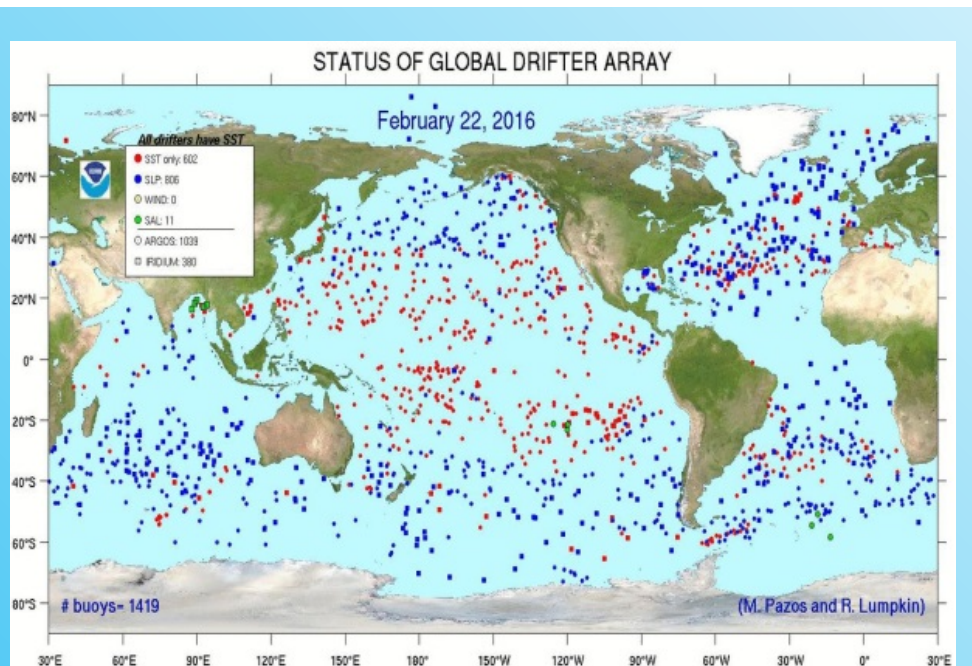


Why help NOAA deploy ARGO floats?

This will allow continuous monitoring the state of the ocean climate that has been proven to be linked to extreme weather conditions. All data are made publicly available to data centers within hours of collection.

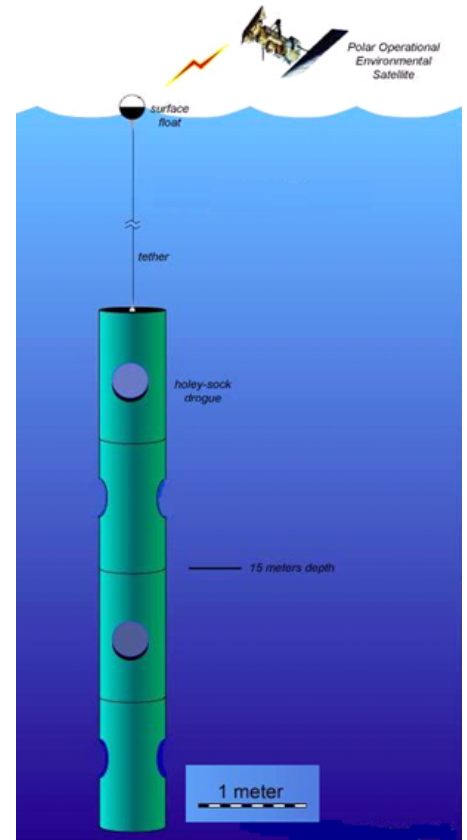
Global Drifter Program

<http://www.aoml.noaa.gov/phod/dac/gdp.html>



A worldwide array of satellite-tracked drifting buoys (“drifters”) measure sea surface temperature and near surface currents. Temperature is measured at the surface float, which also contains the satellite transmitter. Drifters have a large holey-sock drogue (sea anchor) that extends after deployment to follow currents at a depth of 15m. Some drifters can also include sea level pressure, wind speed, direction, and salinity sensors.

Drifters are packaged in a tight bundle for deployment, held together with paper tape. Each drifter is shrink-wrapped with plastic to protect the paper tape before deployment. Deployment is simple: remove the plastic wrap and throw the drifter over the side, paper tape and all. The paper tape dissolves, the drogue opens, and the drifter begins transmitting to passing satellites. Ships of the SOOP participate in the deployment of many global drifters.



A drifter consists of a surface float that sits on top of the water and a drogue that extends 15 meters beneath the sea surface.

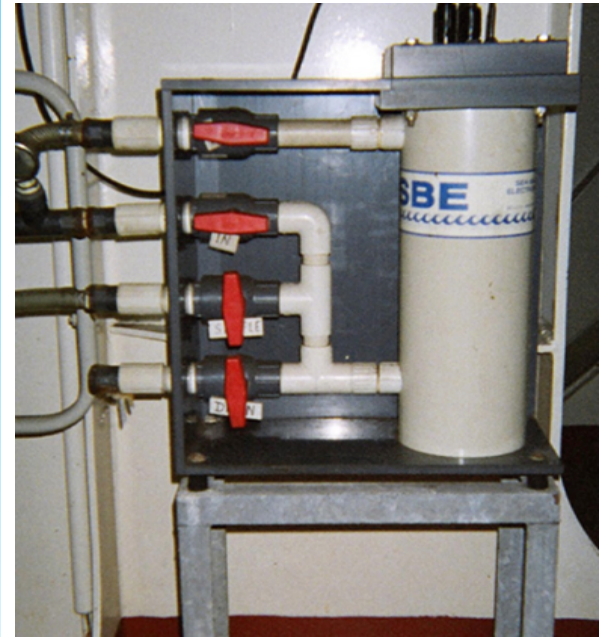


Drifter measurements are used in operational weather forecasts and seasonal to interannual climate prediction.

Thermosalinographs

<http://www.aoml.noaa.gov/phod/tsg>

ThermoSalinoGraphs (TSG) are instruments that measure salinity and sea surface temperature every 10 seconds, or approximately 100m along the ship track. TSGs are simple instruments; they can be automatically operated, are easy to maintain and calibrate, and their data can be transmitted in real-time. TSGs have been utilized for more than 30 years on research and cargo ships and have been the single largest contributor of sea surface salinity observations.



View of a TSG as installed in a vessel



M/V Oleander.

This cargo ship deploys XBTs and has a TSG installed

AOML currently operates several TSG transects from several Ships Of Opportunity in the Atlantic ocean, including Royal Caribbean Cruise Line's Allure of the Seas, the M/V Skogafoss, and the R/V Bernardo Houssay. Data from these transects are routinely quality controlled and provided to data distribution centers, to be used by weather forecasting offices.

Why help NOAA operate a Thermosalinograph?

Because TSG observations are critical to initialize weather and climate forecast model results and to validate satellite observations. Also, TSG observations are used in conjunction with pCO₂ observations and provide critical information to determine frontal regions and mixed layer depths for ocean acidification assessments.



Applications of Observations

Weather Forecasting

Why help NOAA perform marine observations?

The National Weather Service (NWS) uses SOOP data and meteorological bulletins for publicly available free products including marine, aviation, fire, weather, hydrologic, tropical, public and climate forecasting.

Of particular interest to mariners are the free monitoring and forecast products from the NWS Marine and Coastal Weather Services Branch covering areas such as the High Seas, Offshore, NAVTEK, Coastal Waters, Storm Surges, Tsunamis, Tides, and Hurricanes.

The NWS also provides text and graphic-based reports on Marine and Hazardous Weather, Surface Conditions, and Global Wind and Currents.



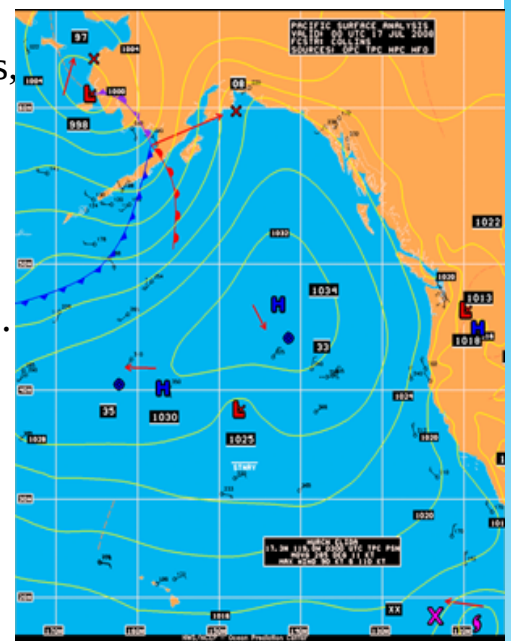
*Tracking Hurricane Katrina (2005),
NWS National Hurricane Center (NHC)*

National Weather Service

<http://www.nws.noaa.gov/>

Marine and Coastal Weather Services Branch

<http://www.nws.noaa.gov/om/marine/marine.shtml>



*North Pacific Surface Analysis from the
NWS Marine Forecast Center*

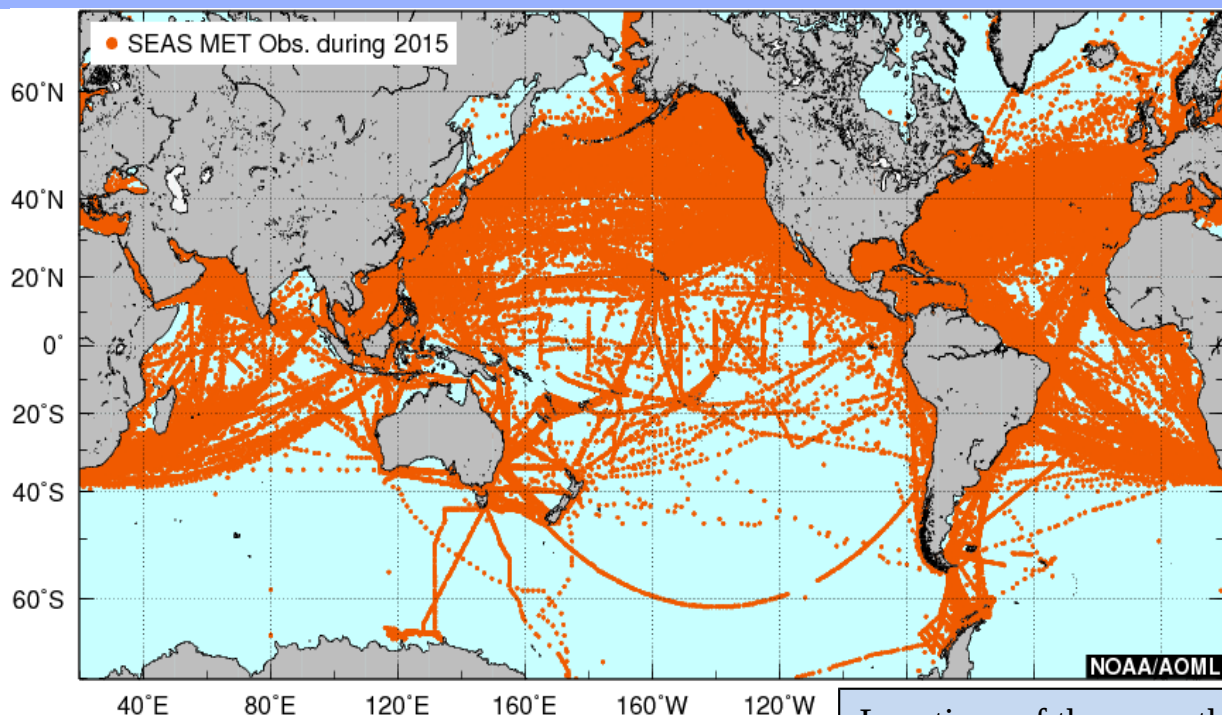
Shipboard Weather Observations

NOAA's Ship Of Opportunity Program provides real-time data management and distribution of shipboard meteorological Observations to the Global Telecommunications System (GTS). There are more than 1,200 ships worldwide that send over 3 million measurements to AOML for processing and distribution every year. This important data is used for weather forecasting, weather monitoring, and climate studies.

For a look at a real-time 3-D map of observations that are sent to the GTS, please visit: <http://www.aoml.noaa.gov/phod/VOS/SOOP/>

For a look at NOAA generated weather forecasts, please visit: www.weather.gov

To see a map of meteorological observations for a given period which are similar to the figure below, please visit: <http://www.aoml.noaa.gov/phod/goos/seas/latest/metobs.php>



Locations of the more than 3 million marine weather observations from 1,200 ships of the VOS during 2015



Hapag-Lloyd's Norfolk Express. This cargo ship deployed XBTs in high-density mode.

Participation

NOAA is constantly seeking new ships to aid in this program. We appreciate continued participation and would welcome participants in any of the elements mentioned in this brochure.

The following are just some of the more than 50 ships that have participated in the Ship of Opportunity Program collecting oceanographic data:

Horizon Navigator	Laurence M. Gould	Barcelona Express
CMA-CGM Moliere	Cap Van Diemen	S/A Agulhas II
Reykjafoss	Hansa Flensburg	Conrad S
Maersk Vilnius	Elegant Ace	Nathaniel B. Palmer
Oleander	M/N Colibri	Hansa Rendsburg
S.F. Sederberg	Cap Van Diemen	Horizon Trader
M/V Explorer	Explorer of the Seas	Nuka Arctica
CMA-CGM Racine	M/V Monte Azul	M/V Monte Samiento

We would especially like to thank the following companies for allowing us the use of their vessels:

Hapag-Lloyd	Maersk Sea Land
Horizon Lines, LLC	Alpha Shipping
Safmarine / Maersk Line	P&O Nedllyod
Royal Caribbean Cruise Line	Rickmers Reederei
Semester At Sea Program	Leonhardt & Bloomberg
Polynesia Lines	Mitsui O.S.K. Lines
Hamburg Sud	CMA-CGM



For further information pertaining to ship recruitment please contact:

Gustavo Jorge Goni (Gustavo.Goni@noaa.gov) or Zach Barton (Zach.barton@noaa.gov)

For further information regarding each of the specific programs please contact:

<i>Drifter Program</i>	<i>Rick Lumpkin</i>	<i>Rick.Lumpkin@noaa.gov</i>
<i>Argo Program</i>	<i>Claudia Schmid</i>	<i>Claudia.Schmid@noaa.gov</i>
<i>Thermosalinographs</i>	<i>Gustavo Goni</i>	<i>Gustavo.Goni@noaa.gov</i>
<i>High Density XBTs</i>	<i>Gustavo Goni</i>	<i>Gustavo.Goni@noaa.gov</i>
<i>SEAS Program</i>	<i>Gustavo Goni</i>	<i>Gustavo.Goni@noaa.gov</i>

For more information on the World Meteorological Organization's Ship Of Opportunity Program please refer to: <http://www.jcommops.org/soopip/>

***National Oceanic and Atmospheric Administration
Physical Oceanography Division
4301 Rickenbacker Causeway
Miami, FL 33149
(305) 361-4340***