

# GO-SHIP: general introduction

The background of the slide is a scenic photograph of a sunset over a vast ocean. The sun is positioned in the upper left quadrant, creating a bright lens flare and casting a shimmering path of light across the water's surface. In the distance, a range of mountains or hills is visible, partially obscured by a layer of low-lying clouds or mist. The sky transitions from a pale blue near the horizon to a deeper blue at the top.

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**Verónica Caínzos**

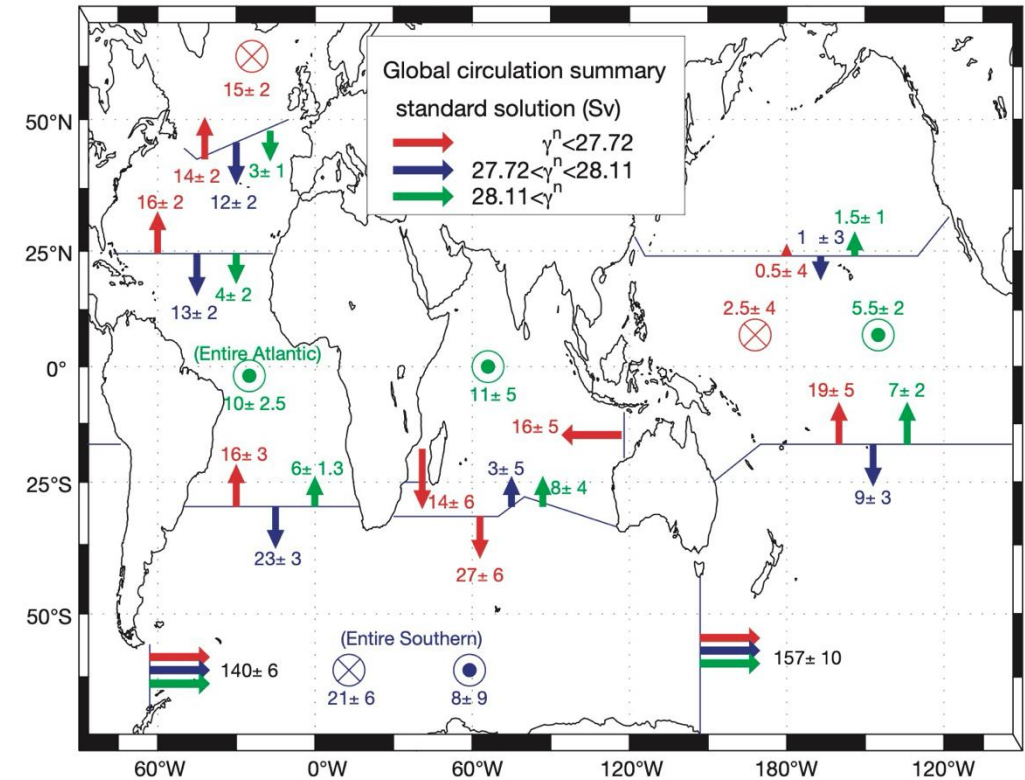
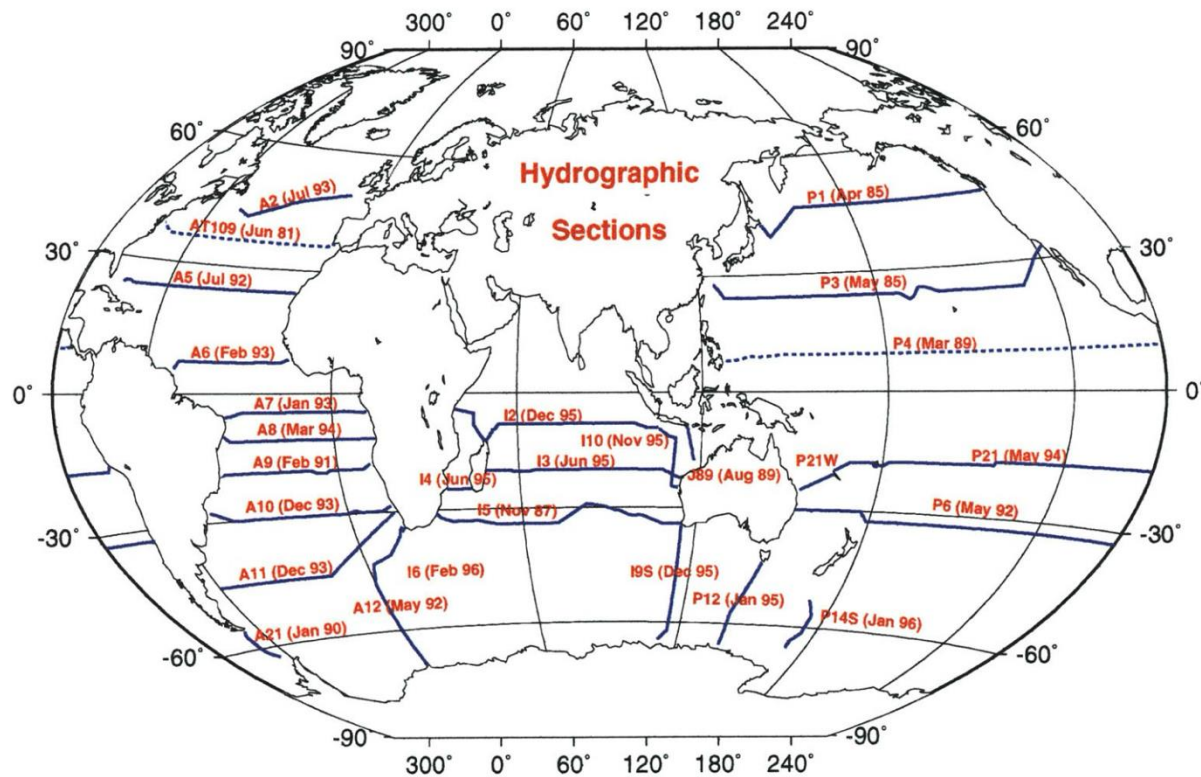
**7th Summer School on Theory, Mechanisms and Hierarchical Modelling of Climate Dynamics**  
**Estimating Ocean Transports: Single Sections, Box Models and Reanalysis Products**  
ICTP Trieste, Italy | 29 June - 11 July, 2026



1988-1998

# WOCE: World Ocean Circulation Experiment

*Ganachaud & Wunsch (2000): Improved estimates of global ocean circulation, heat transport and mixing from hydrographic data*



# What is GO-SHIP? The international effort

WWW.GO-SHIP.ORG



THE GLOBAL OCEAN SHIP-BASED HYDROGRAPHIC INVESTIGATIONS PROGRAM

The GO-SHIP Panel was established in 2007 by the IOCCP and CLIVAR

## *Aims:*

- Develop a strategy for a sustained global repeat hydrography program (update and revision of WOCE).
- Open and rapid dissemination of data for utilization by the community at large

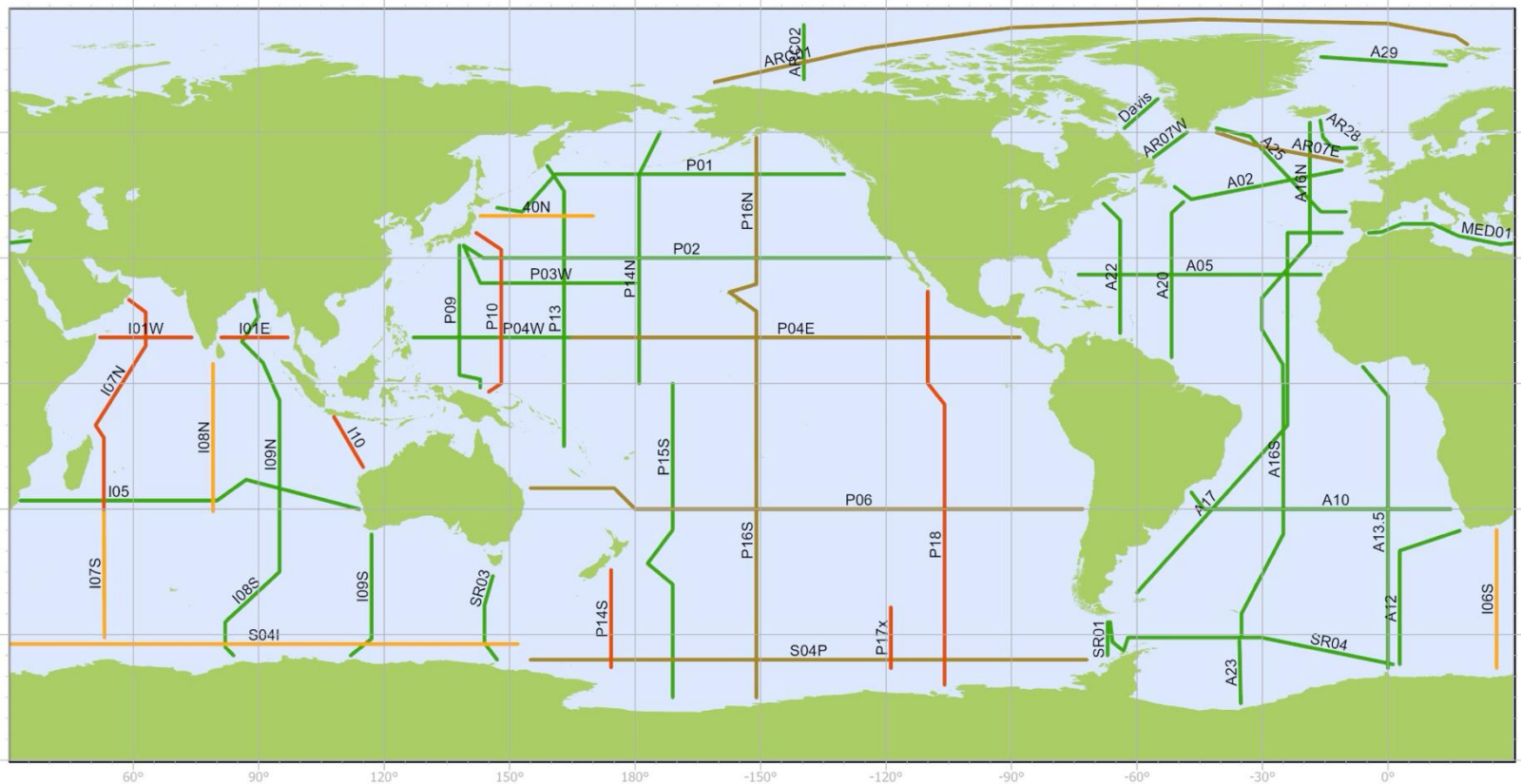
## *Result:*

GO-SHIP provides approximately decadal resolution of the changes in inventories of heat, freshwater, carbon, oxygen, nutrients and transient tracers, covering the ocean basins from coast to coast and full depth.

You will be able to meet members of the GO-SHIP Science Committee:

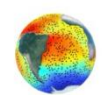
- *Bernadette Sloyan (Executive Group Member; CSIRO, Australia)*
- *Alonso Hernandez Guerra (Committee Member; ULPGC, Spain)*
- *Lynne Talley (Committee Member; SIO, USA)*

# What is GO-SHIP? The international effort



GO-SHIP Floating status of GO-SHIP (53 Core Lines) June 2025

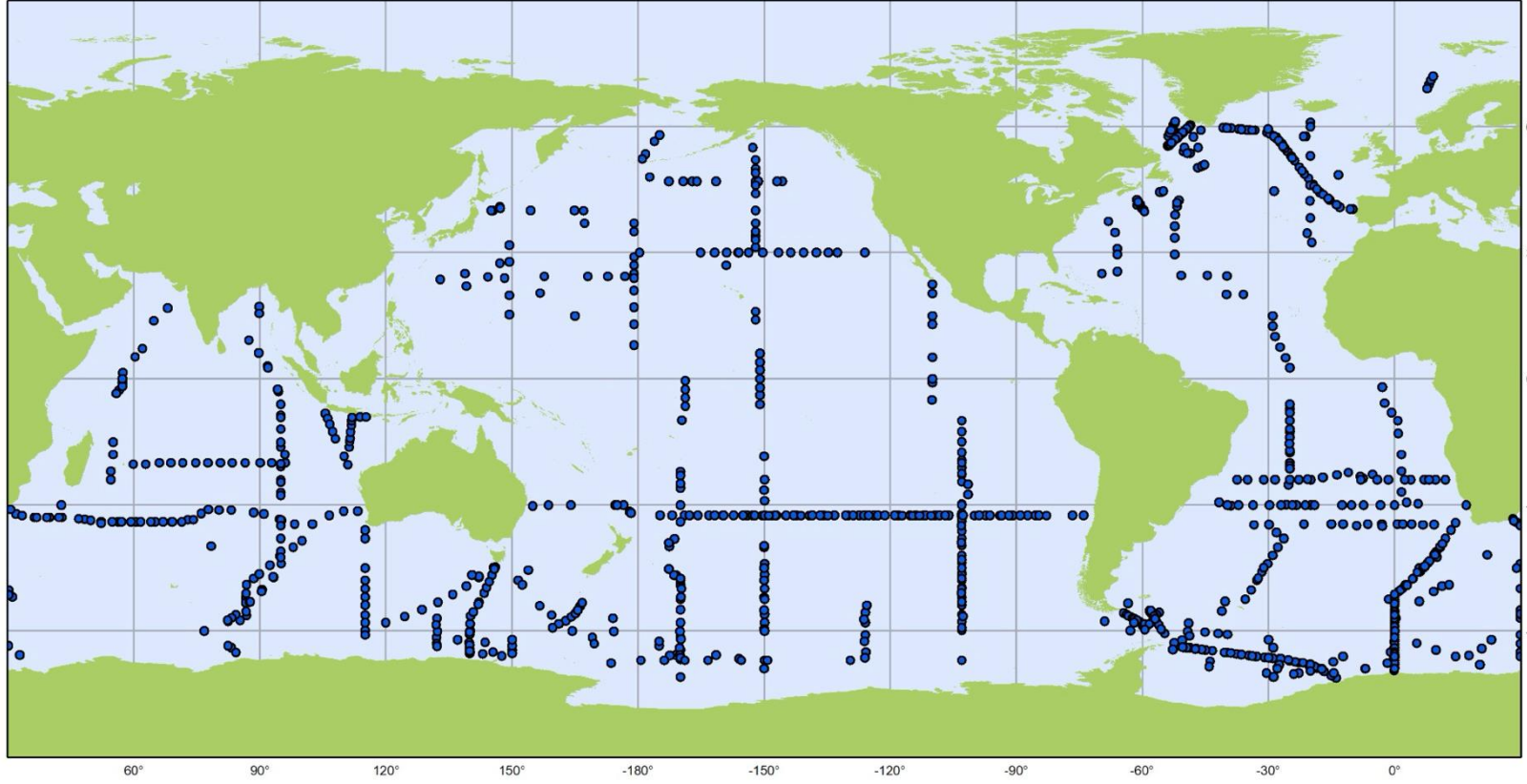
- Occupied: sampled in last 5 years, or confirmed in next 4 years (33)
- Securing: sampled between 5 and 7 years ago, with planned but unconfirmed cruise in next 4 years (0)
- Watching: sampled between 5 and 7 years ago, with nothing planned in next 4 years (5)
- At risk: Not sampled for more than 7 years, with planned but unconfirmed cruise in next 4 years (7)
- Alarm: Not sampled for more than 7 years, and nothing planned in next 4 years (8)



Generated by ocean-ops.org, 2025-07-18  
Projection: Plate Carree (-150,0000)

Year	Line	Segment	Nation	Sponsor	Committee Representative	Status
Annual	AR07	West	CANADA		Kumiko Azetsu-Scott	last 2023, next 2024
Annual	ARC02		CANADA		Kumiko Azetsu-Scott	Last 2023; next 2024
Annual	A23		UK		Yvonne Firing	last 2023, 2025
Annual	GSA-Radprof		SPAIN		Alonso Hernandez Guerra	last 2023, next 2024?
Annual	GSA-Samba		SOUTH AFRICA		Isabelle Ansonge	last 2022; discontinued?
Annual	GSA-Line P		CANADA		Kumiko Azetsu-Scott	last 2023; next 2024
Annual	GSA-Rockall		Ireland		Caroline Cusack	last 2022; next 2025?
Biennial	A25		FRANCE-SPAIN		Pascale Lherminier	last 2023, next 2026
Biennial	GSA-Arctic		SWEDEN		Leif Anderson	pending
Biennial	Davis		CANADA		Kumiko Azetsu-Scott	next 2024
2014	AR07	West	UK		Elaine McDonagh	completed
2014	AR07	East	UK		Elaine McDonagh	completed
2014	P01		JAPAN	JAMSTEC	Kasuro Katsumata	completed
2014	P10		JAPAN	JMA	Masao Ishii	completed
2014	P16S	South	USA	NSF	Lynne Talley	completed
2014	A12		GERMANY		Toste Tanhua	completed
2015	A05		UK		Elaine McDonagh	completed
2015	AR07	East	NORWAY		Emil Jeans son	completed
2015	I10		JAPAN	JAMSTEC	Kasuro Katsumata	completed
2015	P16	North	USA	NSF	Lynne Talley	completed
2015	ARC01	West	USA	NSF	Lynne Talley	completed
2015	ARC01	East	GERMANY		Toste Tanhua	completed
2015	P04	West	JAPAN	JMA	Masao Ishii	completed
2016	I08	South	USA	NSF	Lynne Talley	completed
2016	I09	North	USA	NSF	Lynne Talley	completed
2016	P18		USA	NOAA	Gregory Johnson	completed
2016	P15	South	AUSTRALIA	CSIRO	Bernadette Sloyan	completed
2016	P09		JAPAN	JMA	Masao Ishii	completed
2016	A12		GERMANY		Toste Tanhua	completed (limited casts)
2017	SR04		GERMANY		Toste Tanhua	completed (limited casts)
2017	A10.5		GERMANY		Toste Tanhua	completed
2017	P06		USA	NSF	Lynne Talley	completed
2017	A02		IRELAND		Caroline Cusack	completed
2017	P17	East	Japan	JAMSTEC	Kasuro Katsumata	completed
2018	P13		JAPAN	JMA	Masao Ishii	completed
2018	SR03		AUSTRALIA	CSIRO	Bernadette Sloyan	completed
2018	S4P		USA	NSF	Lynne Talley	completed
2018	A9.5		UK		Elaine McDonagh	completed
2018	I7	North	USA	NOAA	Gregory Johnson	completed
2018	MED01		GERMANY		Toste Tanhua	completed
2018	A12		GERMANY		Mario Hoppema	completed
2019	SR4		GERMANY		Mario Hoppema	completed
2019	I06	South	USA		Lynne Talley	completed
2019	40N		JAPAN	JMA	Masao Ishii	completed
2019	A17		SPAIN		Fiz Perez	completed
2019	I08	North	JAPAN	JAMSTEC	Kasuro Katsumata	completed
2020	A5		UK		Penny Holiday	completed
2020	I07	South	JAPAN	JAMSTEC	Kasuro Katsumata	completed
2021	P3	West	JAPAN	JMA	Masao Ishii	completed
2021	P1		JAPAN	JAMSTEC	Kasuro Katsumata	completed
2021	A20/A22		UK	NSF	Lynne Talley	completed
2022	A10.5	East	SPAIN	CSIC	Alonso Hernandez Guerra	completed
2022	AR28		UK		Yvonne Firing	completed
2022	A12/SR4		GERMANY	AWI	Mario Hoppema	completed
2022	P9		JAPAN	JMA	Masao Ishii	completed
2022	P2		USA	NSF	Alison Macdonald	completed
2022	MED01	North-South	EU	Eurofleets+	Katrin Schroeder	completed
2025	P4	East	USA	NSF	Alison Macdonald	planned
2025	P4	West	JAPAN	JAMSTEC	Kasuro Katsumata	planned
2024	I09	South	AUSTRALIA	CSIRO	Bernadette Sloyan	funded
2023	A10.5	West	Spain		Alonso Hernandez Guerra	cancelled
2023	A16	North/Center	USA	NOAA	Gregory Johnson	completed
2023	I05		USA	NSF	Alison Macdonald	completed
2023	P14	North	JAPAN	JAMSTEC	Kasuro Katsumata	completed
2024	A13.5		USA	NOAA	Gregory Johnson	completed
2024	I08	South	USA	NSF	Alison Macdonald	funded
2025	I09	North	USA	NSF	Alison Macdonald	at sea
2025	A12/SR4		GERMANY	AWI	Mario Hoppema	completed early 2025, next 2028
2024	AR28		UK		Yvonne Firing	planned
2024	A16	South	USA	NOAA	Gregory Johnson	planned (vs A13.5)
2026	P16	South	USA	NSF	Alison Macdonald	funded
2026	P16	Center	USA	NSF	Alison Macdonald	funded
2026	P15	South	AUSTRALIA	CSIRO	Bernadette Sloyan	funded (29 Sep - 19 Dec)
2026	MED01	East-West	GERMANY		Katrin Schroeder (with Toste Tanhua CS)	Jan Feb 2026 funded
2026	P16	North	USA	NOAA	Gregory Johnson	funded
2025	S4P		USA	NSF	Alison Macdonald	funded
2026	ARC01		USA	NSF	Alison Macdonald	funded
2025	AR07	East	UK	NOC	Yvonne Firing	funded
2026	A25		FRANCE-SPAIN		Pascale Lherminier	planned
2026	A29		NORWAY		Emil Jeans son	planned
2026	SR01		UK		Yvonne Firing	planned
2025	P09		JAPAN	JMA	Masao Ishii	funded Jul-Aug
2027	A2		Ireland		Caroline Cusack	planned
2027	P06		USA	NSF	Alison Macdonald	planned
2027	SR3		AUSTRALIA	CSIRO	Bernadette Sloyan	funded (11 Jan - 14 Mar)
2028	A9.5		UK		Yvonne Firing	planned
2030	A5		UK		Yvonne Firing	planned
2030	P13		JAPAN	JMA	Masao Ishii	planned

# What is GO-SHIP? The international effort



GO-SHIP and Argo

Deployment of Argo Floats from GO-SHIP Cruises  
(including Transit)

June 2019

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Annual	AR07	West	CANADA		Kumiko Azetsu-Scott	last 2023, next 2024
Annual	ARC02		CANADA		Kumiko Azetsu-Scott	Last 2023; next 2024
biennial	A23		UK		Yvonne Firing	last 2023, 2025
Annual	GSA-Radprof		SPAIN		Alonso Hernández Guerra	last 2023, next 2024?
Annual	GSA-Samba		SOUTH AFRICA		Isabelle Ansoez	last 2022; discontinued?
Annual	GSA-Line P		CANADA		Kumiko Azetsu-Scott	last 2023; next 2024
Annual	GSA-Rockall		Ireland		Caroline Cusack	last 2022; next 2025?
Biennial	A25		FRANCE-SPAIN		Pascale Lherminier	last 2023, next 2026
Biennial	GSA-Arctic		SWEDEN		Leif Andersson	pending
Biennial	Davis		CANADA		Kumiko Azetsu-Scott	next 2024
2014	AR07	West	UK		Elaine McDonagh	completed
2014	AR07	East	UK		Elaine McDonagh	completed
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2014	P10		JAPAN	JMA	Masao Ishii	completed
2014	P16S	South	USA	NSF	Lynne Talley	completed
2015	A12		GERMANY		Toste Tanhua	completed
2015	A05		UK		Elaine McDonagh	completed
2015	AR07	East	NORWAY		Emil Jeansson	completed
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2017	A10.5		GERMANY		Toste Tanhua	completed
2017	P06		USA	NSF	Lynne Talley	completed
2017	A02		IRELAND		Caroline Cusack	completed
2017	P17	East	JAPAN	JAMSTEC	Kasuro Katsumata	completed
2018	P13		JAPAN	JMA	Masao Ishii	completed
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2018	S4P		USA	NSF	Lynne Talley	completed
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2021	P1		JAPAN	JAMSTEC	Kasuro Katsumata	completed
2021	A20/A22		USA	NSF	Lynne Talley	completed
2022	A10.5	East	SPAIN	CSIC	Alonso Hernández Guerra	completed
2022	AR28		UK		Yvonne Firing	completed
2022	A12/SR4		GERMANY	AWI	Mario Hoppema	completed
2022	P8		JAPAN	JMA	Masao Ishii	completed
2022	P2		USA	NSF	Alison Macdonald	completed
2022	MED01	North-South	EU	Eurofleets+	Katrin Schroeder	completed
2025	P4	East	USA	NSF	Alison Macdonald	planned
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2023	A10.5	West	Spain		Alonso Hernández Guerra	cancelled
2023	A16	North/Center	USA	NOAA	Gregory Johnson	completed
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2023	P14	North	JAPAN	JAMSTEC	Kasuro Katsumata	completed
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2026	ARC01		USA	NSF	Alison Macdonald	funded
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2026	A25		FRANCE-SPAIN		Pascale Lherminier	planned
2026	A29		NORWAY		Emil Jeansson	planned
2026	SR01		UK		Yvonne Firing	planned
2025	P09		JAPAN	JMA	Masao Ishii	funded Jul-Aug
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2027	P06		USA	NSF	Alison Macdonald	planned
2027	SR3		AUSTRALIA	CSIRO	Bernadette Sloyan	funded (11 Jan - 14 Mar)
2028	A9.5		UK		Yvonne Firing	planned
2030	A5		UK		Yvonne Firing	planned
2030	P13		JAPAN	JMA	Masao Ishii	planned

## ***Data Directory***

### **CTD and Bottle Data**

#### **CLIVAR and Carbon Hydrographic Data Office (CCHDO)**

Principal Contact: Karen Stocks, Director

Email: [kstocks@ucsd.edu](mailto:kstocks@ucsd.edu)

Web-site: <http://cchdo.ucsd.edu/>

### **Carbon Data**

#### **Ocean Carbon Data System (OCADS, former CDIAC)**

Principal Contact: Alex Kozyr

Email: [alex.kozyr@noaa.gov](mailto:alex.kozyr@noaa.gov)

Web-site: <https://www.nodc.noaa.gov/ocads/>

### **S-ADCP Data**

#### **Hawaii Joint Archive for Shipboard ADCP**

Principal Contact: Patrick Caldwell

Email: [Patrick.Caldwell@noaa.gov](mailto:Patrick.Caldwell@noaa.gov)

Web-site: <http://ilikai.soest.hawaii.edu/sadcp/clivar.html>

Data: [http://ilikai.soest.hawaii.edu/sadcp/main\\_inv.html](http://ilikai.soest.hawaii.edu/sadcp/main_inv.html)

### **L-ADCP Data**

#### **Currents group at University of Hawaii**

Principal Contact: Eric Firing

Email: [efiring@hawaii.edu](mailto:efiring@hawaii.edu)

Web-site with data: <http://currents.soest.hawaii.edu/clivar/ladcp>

### **Surface Meteorological Data**

#### **Surface Marine Meteorological Data Assembly Center, COAPS, FSU**

Principal Contact: Shawn R. Smith

Email: [smith@coaps.fsu.edu](mailto:smith@coaps.fsu.edu)

Web-site: <http://www.coaps.fsu.edu/RVSMDC/CLIVAR/>

Data: <http://www.coaps.fsu.edu/RVSMDC/html/data.shtml>

### **Underway Data**

#### **The Global Ocean Surface Underway Data Project (GOSUD)**

Principal Contact: Ludovic Drouineau

Email: [ludovic.drouineau@ifremer.fr](mailto:ludovic.drouineau@ifremer.fr)

Web-site: <http://www.gosud.org/>

## Data Directory

### CTD and Bottle Data

### CLIVAR and Carbon Hydrographic Data Office (CCHDO)

Principal Contact: Karen Stocks, Director

Email: [kstocks@ucsd.edu](mailto:kstocks@ucsd.edu)

Web-site: <http://cchdo.ucsd.edu/>



CCHDO

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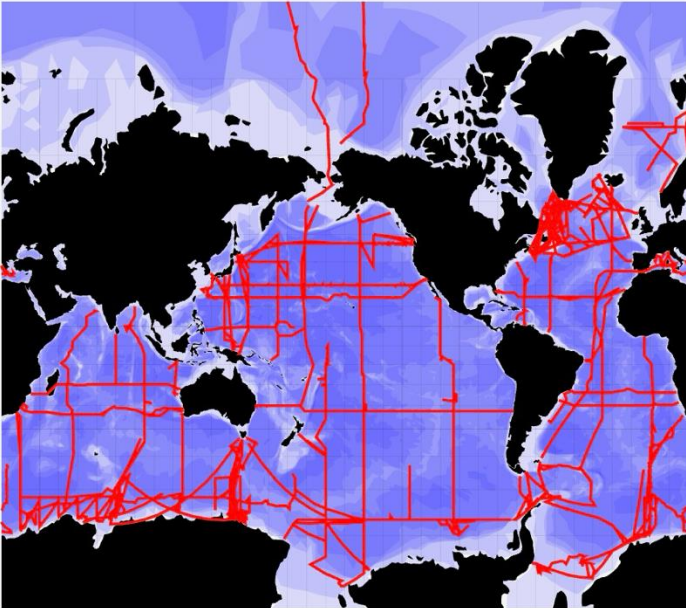
[Submit Data](#)

[Information](#) ▾

Data

Site

GO-SHIP



### Search Results

Expocode	Line(s)	Ship	Country	Start Date	End Date	PI
<a href="#">49NZ20250405</a>	• P04W	MIRAI	JP	2025-04-05	2025-05-12	• Shinya Kouketsu
<a href="#">325020250321</a>	• I09N	THOMAS G. THOMPSON	US	2025-03-21	2025-04-27	• Viviane Menezes
<a href="#">325020240221</a>	• I08S	THOMAS G. THOMPSON	US	2024-02-21	2024-04-01	• Sebastien Bigorre
<a href="#">33H320240201</a>	• A13.5	MARCUS G. LANGSETH	US	2024-02-01	2024-03-23	• Zachary Erickson
<a href="#">49NZ20231006</a>	• P14N	MIRAI	JP	2023-10-06	2023-11-09	• Katsuro Katsumata
<a href="#">33RR20230722</a>	• I05	ROGER REVELLE	US	2023-07-22	2023-09-14	• Brendan Carter
<a href="#">33RO20230413</a>	• A16N	RONALD H. BROWN	US	2023-04-13	2023-05-09	• Leticia Barbero
<a href="#">33RO20230306</a>	• A16N	RONALD H. BROWN	US	2023-03-06	2023-04-07	• Zachary Erickson

**GO-SHIP Easy Ocean** is a user-friendly, gridded database of quality controlled ship-based hydrographic observations. It converts complex, raw global ocean data (spanning over 40 years) into an analysis-ready Temperature, Salinity, and Dissolved Oxygen measurements.

The screenshot shows the Zenodo dataset page for 'GO-SHIP Easy Ocean: Formatted and gridded ship-based hydrographic section data'. The page features a blue header with the Zenodo logo, a search bar, and navigation links for 'Communities' and 'My dashboard'. On the right, there are 'Log in' and 'Sign up' buttons. The main content area includes a 'Published August 29, 2025 | Version 2025update' notice, a 'Dataset' label, and an 'Open' button. The title is 'GO-SHIP Easy Ocean: Formatted and gridded ship-based hydrographic section data'. Below the title, a list of contributors is shown with ORCID iD icons, and a 'Show affiliations' button is present. A 'Contributors' section lists 'Data manager: Barna, Andrew' with an ORCID iD icon and another 'Show affiliations' button. A descriptive paragraph explains that GO-SHIP (The Global Ocean Ship-based Hydrographic Investigations Program) has developed protocols and methods to generate a data product that concatenates all occupations of individual sections into a time-series; the GO-SHIP Easy Ocean. Here we provide access to the analysis-ready gridded GO-SHIP Easy Ocean product that enhances the accessibility of this unique data set that spans four decades, comprised of more than 40 cross-ocean transects, many with multiple repeats. A second paragraph states that this product, of uniformly calibrated CTD (temperature, salinity and oxygen) data, provides easy access to and use of the high-quality hydrographic temperature and salinity data that span more than 40 years. The GO-SHIP Easy Ocean product will underpin the quality control of autonomous platforms, provide a ready assessment of ocean-only and coupled climate model simulations, and be used in specific research projects. The GO-SHIP Easy Ocean is a companion to the GLODAP inorganic and carbon product. The section data are available from Zenodo in two standard arrangements: Uninterpolated (reported) and interpolated (gridded). For both arrangements, five quantities are recorded; in situ temperature in ITS-90 scale, in situ salinity in PSS-78 scale, the dissolved oxygen concentration in  $\mu\text{mol/kg}$ , Conservative Temperature in  $^{\circ}\text{C}$ , and Absolute Salinity in  $\text{g/kg}$ . The data are available in various formats. On the right side, a statistics box shows '3K VIEWS' and '2K DOWNLOADS' with a 'Show more details' link. Below that is a 'Versions' section with a table of three versions: 'Version 2025update' (Aug 29, 2025), 'Version 2024UpdateBugfix1' (Aug 14, 2024), and 'Version 2024update' (Oct 1, 2020). A 'View all 3 versions' link is provided. At the bottom of the versions section, there is a 'Cite all versions?' section with a DOI (10.5281/zenodo.13261285) and a 'Read more' link.

Published August 29, 2025 | Version 2025update

Dataset Open

## GO-SHIP Easy Ocean: Formatted and gridded ship-based hydrographic section data

Katsumata, Katsuro ; Purkey, Sarah<sup>1</sup> ; Cowley, Rebecca<sup>2</sup> ; Sloyan, Bernadette ; Diggs, Stephen<sup>1</sup> ; Moore, Thomas<sup>3</sup> ; Talley, Lynne ; Swift, James

Show affiliations

### Contributors

**Data manager:** Barna, Andrew<sup>1</sup>

Show affiliations

GO-SHIP (The Global Ocean Ship-based Hydrographic Investigations Program) has developed the protocols and methods to generate a data product that concatenates all occupations of individual sections into a time-series; the GO-SHIP Easy Ocean. Here we provide access to the analysis-ready gridded GO-SHIP Easy Ocean product that enhances the accessibility of this unique data set that spans four decades, comprised of more than 40 cross-ocean transects, many with multiple repeats.

This product, of uniformly calibrated CTD (temperature, salinity and oxygen) data, provides easy access to and use of the high-quality hydrographic temperature and salinity data that span more than 40 years. The GO-SHIP Easy Ocean product will underpin the quality control of autonomous platforms, provide a ready assessment of ocean-only and coupled climate model simulations, and be used in specific research projects. The GO-SHIP Easy Ocean is a companion to the GLODAP inorganic and carbon product. The section data are available from Zenodo in two standard arrangements: Uninterpolated (reported) and interpolated (gridded). For both arrangements, five quantities are recorded; in situ temperature in ITS-90 scale, in situ salinity in PSS-78 scale, the dissolved oxygen concentration in  $\mu\text{mol/kg}$ , Conservative Temperature in  $^{\circ}\text{C}$ , and Absolute Salinity in  $\text{g/kg}$ . The data are available in various formats.

3K VIEWS 2K DOWNLOADS

Show more details

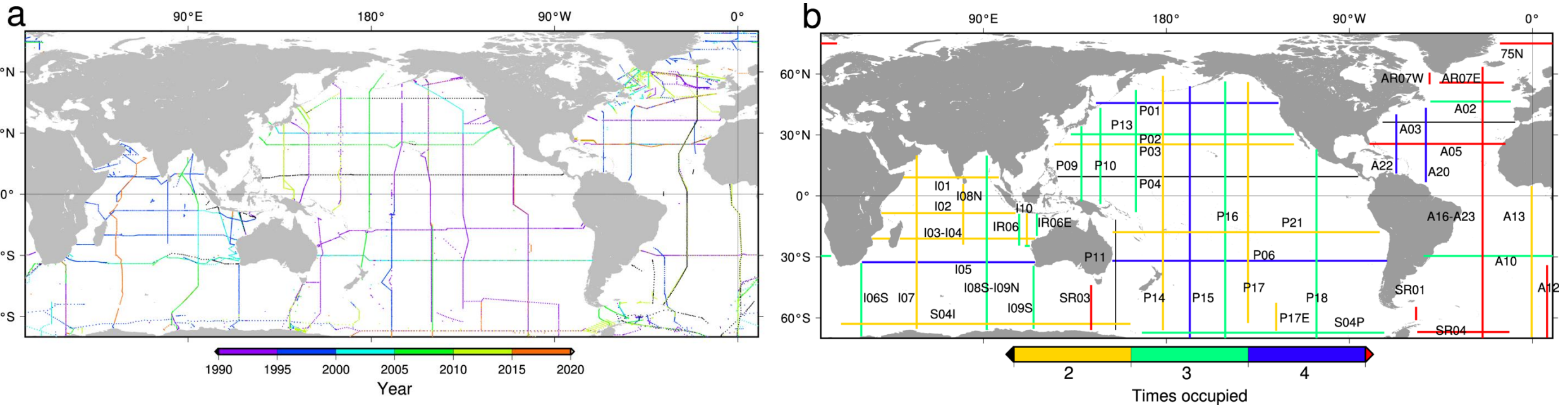
### Versions

Version 2025update	Aug 29, 2025
10.5281/zenodo.16991635	
Version 2024UpdateBugfix1	Aug 14, 2024
10.5281/zenodo.13315689	
Version 2024update	Oct 1, 2020
10.5281/zenodo.13261286	

View all 3 versions

**Cite all versions?** You can cite all versions by using the DOI [10.5281/zenodo.13261285](https://doi.org/10.5281/zenodo.13261285). This DOI represents all versions, and will always resolve to the latest one. [Read more.](#)

**GO-SHIP Easy Ocean** is a user-friendly, gridded database of quality controlled ship-based hydrographic observations. It converts complex, raw global ocean data (spanning over 40 years) into an analysis-ready Temperature, Salinity, and Dissolved Oxygen measurements.



*Katsumata et al. (2022)*

## Key scientific achievements enabled by GO-SHIP

### Data Harmonization & Standardization

*International effort:* GO-SHIP efforts created an uninterrupted 40-year data legacy spanning over 50 cross-ocean transects.

*Calibration and validation:* Data from GO-SHIP remains the primary source of reference data for other networks in the Global Ocean Observing System.

## Key scientific achievements enabled by GO-SHIP

### Data Harmonization & Standardization

*International effort:* GO-SHIP efforts created an uninterrupted 40-year data legacy spanning over 50 cross-ocean transects.

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### Deep Ocean Characterization

*Bottom water warming:* Provided definitive verification that the deep and abyssal ocean waters (below 2,000 m) are actively warming, absorbing a significant portion of the Earth's excess heat energy.

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### Monitorization of strength of ocean currents

Analyses of GO-SHIP observations indicate no statistically significant multi-decadal changes in the AMOC.

## Key scientific achievements enabled by GO-SHIP

### Use of transient tracers to evaluate the ocean ventilation

Sustained GO-SHIP data provide a new tracer-based estimate of ocean warming related to anthropogenic forcing.

A dynamic interpretation of the co-variability of GO-SHIP observations allows ocean ventilation sources, timescales, and pathways to be determined which are all key factors in regulating the sequestration and storage of carbon, heat, nutrients and oxygen.

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### Changes in the ocean chemistry

*Ocean Carbon Increase:* Measured a steady, small, but highly significant accumulation of anthropogenic carbon, especially in the deep ocean, over multi-decadal timelines.

*Deoxygenation Trends:* Provided high-accuracy baseline data showing expanding oxygen minimum zones (OMZs) and general deoxygenation especially in the upper 1200 m that accelerated in recent decades.

*Trends in nutrients:* A method of data quality control for inorganic nutrient measurements has developed sufficiently to assess their trends and variability.

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## Determining the biological communities

Adding biological observations to GO-SHIP enabled precise calculations of net community production and other ecosystem variables across different oceanic regions.

*Sloyan et al. (2019); McDonagh et al. (2026, accepted)*

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### Maintaining high-resolution, full-column observations

At a time when changes linked to anthropogenic forcing are expected to accelerate, maintaining surface-to-bottom, high quality ship-based observations of the physical and biogeochemical ocean coordinated by the GO-SHIP programme remains a priority.

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### Continuing international collaboration to sustain the data available

Maintaining network quality and delivery through up-to-date best practices, succession planning so that observing capability is maintained, maintaining accessible data and data products and including more nations to sample unadopted sections.

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### **Providing high-quality, standardized data**

Ensuring that all GO-SHIP data are standardized, machine readable, and fully documented will be critical to ensuring that they are broadly reusable, including for interdisciplinary work and AI applications. This is a particular issue for the nascent GO-SHIP expansion into biological variables.

**What are the advantages and disadvantages of using GO-SHIP data for our studies?**

**How can we overcome any of these issues?**