European Pavilion

Digital Ocean

Nice | France

2 - 13 JUNE 2025

One Ocean Expedition

June 12

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Haakon Vatle

CEO / Expedition Leader

Statsraad Lehmkuhl Foundation
One Ocean Expedition

ONE OCEAN EXPEDITION
2025 - 2026
SETTING SAIL FOR THE FUTURE

ONE OCEAN EXPEDITION

2021 - 2023

SETTING SAIL FOR THE FUTURE

Around the world for knowledge, education and diplomacy by the Norwegian tall ship Statsraad Lehmkuhl.

A part of the UN Decade of Ocean Science for Sustainable Development.

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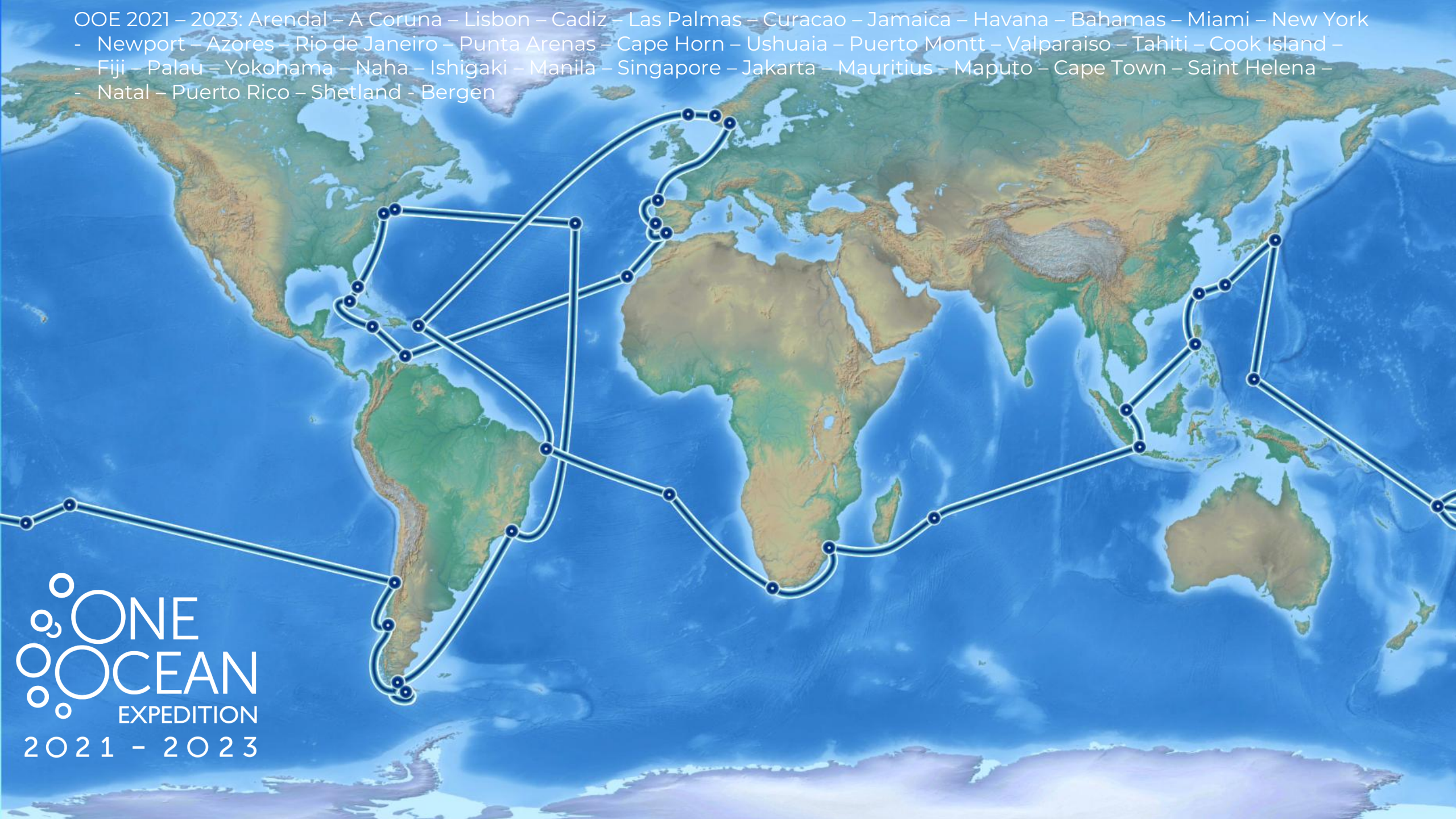
OOE 2021 – 2023: Arendal – A Coruna – Lisbon – Cadiz – Las Palmas – Curacao – Jamaica – Havana – Bahamas – Miami – New York
- Newport – Azores – Rio de Janeiro – Punta Arenas – Cape Horn – Ushuaia – Puerto Montt – Valparaiso – Tahiti – Cook Island –
- Fiji – Palau – Yokohama – Naha – Ishigaki – Manila – Singapore – Jakarta – Mauritius – Maputo – Cape Town – Saint Helena –
- Natal – Puerto Rico – Shetland - Bergen
ONE OCEAN EXPEDITION
2021 - 2023

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Where are we heading?

- **Our course**
  - A dedicated ambassador for the UN Ocean Decade
  - A global ambassador for the Ocean Rise & Resilience Coalition – global network of coastal cities & regions
  - Strengthen and develop partnerships within public sector, science, education, innovation and commerce (national and globally)

- **Coming expeditions**
  - One Ocean Expedition 2025 – 2026: Global partners
  - 2027 – Europe – no expedition, prepare for 2028
  - One Ocean Expedition 2028 – 2030: Global partners – possible return to Bergen for an international conference?

United Nations Educational, Scientific and Cultural Organization · Intergovernmental Oceanographic Commission · 2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Copernicus Europe's eyes on Earth

EU MISSIONS RESTORE OUR OCEAN & WATERS

Copernicus Marine Service

PAVILION IMPLEMENTED BY MERCATOR OCEAN INTERNATIONAL

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UN Ocean Decade 2021 - 2030

Vision: The science we need for the ocean we want.

The 7 Ocean Decade Outcomes describe the Ocean We Want:

- A clean ocean
- A healthy and resilient ocean
- A productive ocean
- A predicted ocean
- A safe ocean
- An accessible ocean
- An inspiring and engaging ocean

United Nations Educational, Scientific and Cultural Organization · Intergovernmental Oceanographic Commission · 2021 2030 United Nations Decade of Ocean Science for Sustainable Development

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One Ocean Expedition 2025 – 2026

Why (Role)
- Create attention and share knowledge of the crucial role of the Ocean for a sustainable future in a global perspective

How
- The people we need for the ocean we want (not only the science)
- Reduce the gap between science and the public
- We cannot save the ocean alone, together we make a positive impact
- Create hope and remember to have fun along the way

What
- Gather and share knowledge
- Mobilize, inspire and engage
- Accelerate action

United Nations Educational, Scientific and Cultural Organization · Intergovernmental Oceanographic Commission · 2021 2030 United Nations Decade of Ocean Science for Sustainable Development

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Data management & availability
(Kongsberg Discovery)
- Real-time data processing
- Geomatics - Blue Insight

Atmosphere / Surface observations
Weather station

360 optical camera
Light measurement

Gyro compass / IMU

Onboard lab:
- eDNA
- Microplastics
- Water isotopes

Rosette water sample with:
- CTD
- Niskin bottles
- Additional sensors

Visual observations

Drifter floats

Towed sampler

Net fishing

Citizen Science projects:
- Calitoo
- PlanktonPlanet
- ...

Underway water sampler
SooGuard (Ferrybox)

Hydrophone array

Broadband echosounder
ADCPs

Sailing route
One Ocean Expedition 2025-2026


Pond Inlet
Cambridge Bay
Nuuk
Tromsø
Reykjavik
Lerwick
Whittier
Gjøa Haven
Bergen
Dublin
Vancouver
Brest
Seattle
Nice
Ponta Delgada
Monaco
Cadiz
Norfolk
San Francisco
Mahon
San Diego
La Paz
Cartagena
Herradura Bay
Panama

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Dr Craig Donlon

ESA Ocean Training Course Leader

European Space Agency

ONE OCEAN EXPEDITION
2025 - 2026
SETTING SAIL FOR THE FUTURE

ADVANCED TRAINING COURSE ON OCEAN SYNERGY REMOTE SENSING 2025

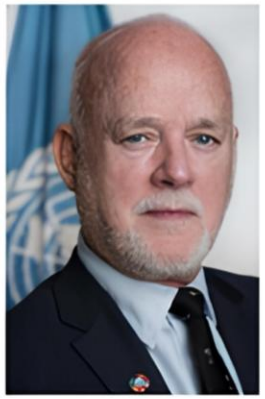
Our Ocean, Our Future, Our Responsability

© ESA 2024

Goal

Our goal during ESA #OTC25 is to help you to understand and exploit data from ESA and operational EO satellite missions for science and application development and prepare you as future ambassadors of Ocean Science.

Peter Thompson, United Nations Special Envoy for the Ocean, explains why this is so important:



There can be no healthy planet without a healthy ocean and the ocean's health is currently measurably in decline. As the future generation of ocean scientists, it is upon your shoulders to advance ocean science to overcome the drastically incomplete knowledge we have of the ocean's properties. Only through respect for the best of ocean science can we achieve SDG 14 goal of conserving and sustainably using the ocean's resources.

Challenge to students of the ESA #OTC25 from Peter Thompson, United Nations Special Envoy for the Ocean.

United Nations

SUSTAINABLE DEVELOPMENT GOALS

14
Conserve and sustainably use the oceans, seas and marine resources for sustainable development

A unique multi disciplinary training course

ESA's leading role

ESA: Advancing Ocean Monitoring from Space for Ocean Sustainability

The European Space Agency (ESA) is a global leader in climate monitoring and environmental conservation. Leveraging its expertise in Earth observation, ESA pioneers innovative satellite tools that provide critical insights into our planet's health.

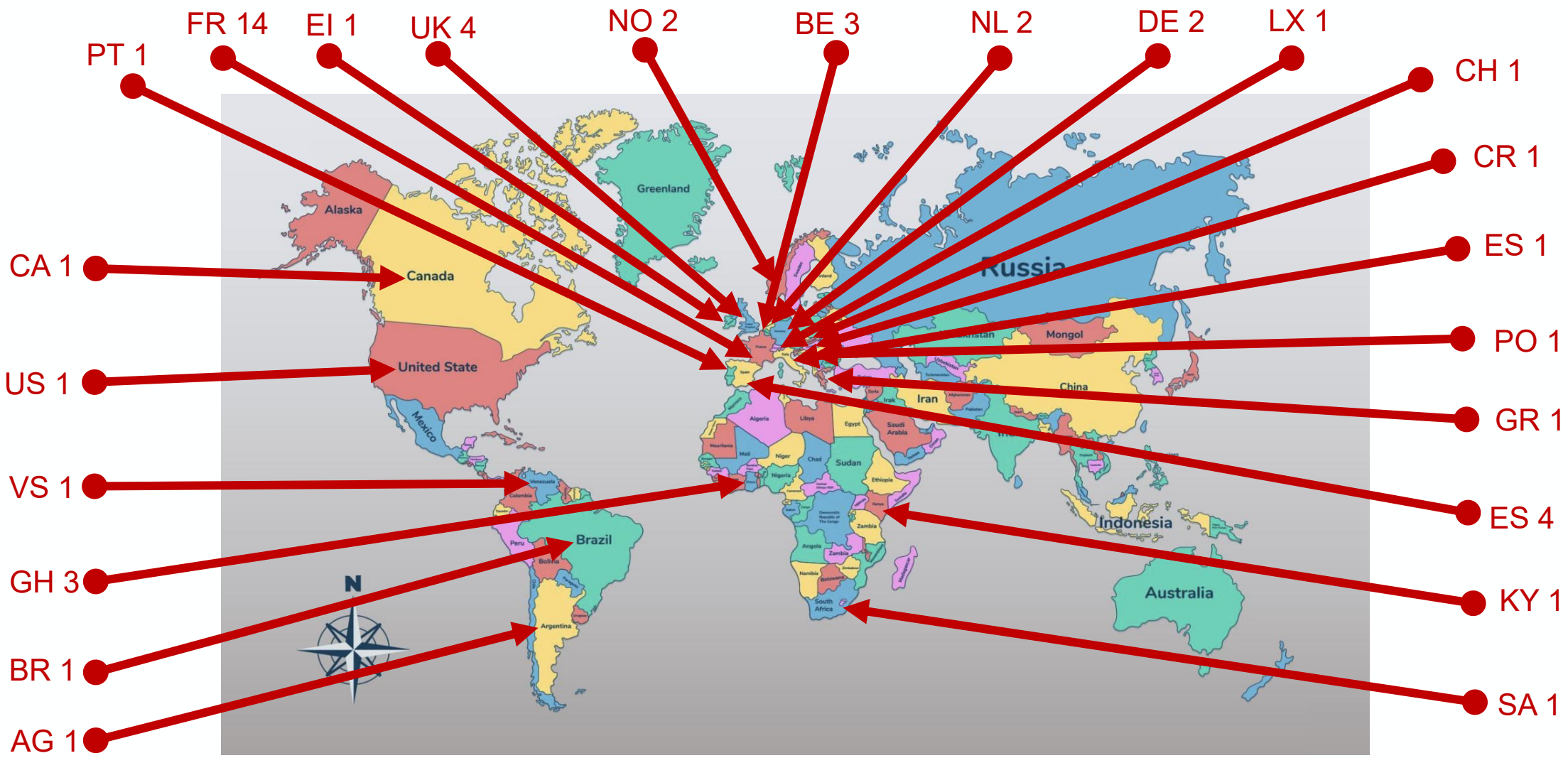
Ocean Training Course (OTC) 2025: A Mission for the Ocean

Through satellite tools, in-situ research, and ocean modeling, the team bridges the gap between space and sea to protect the lifeblood of our planet.

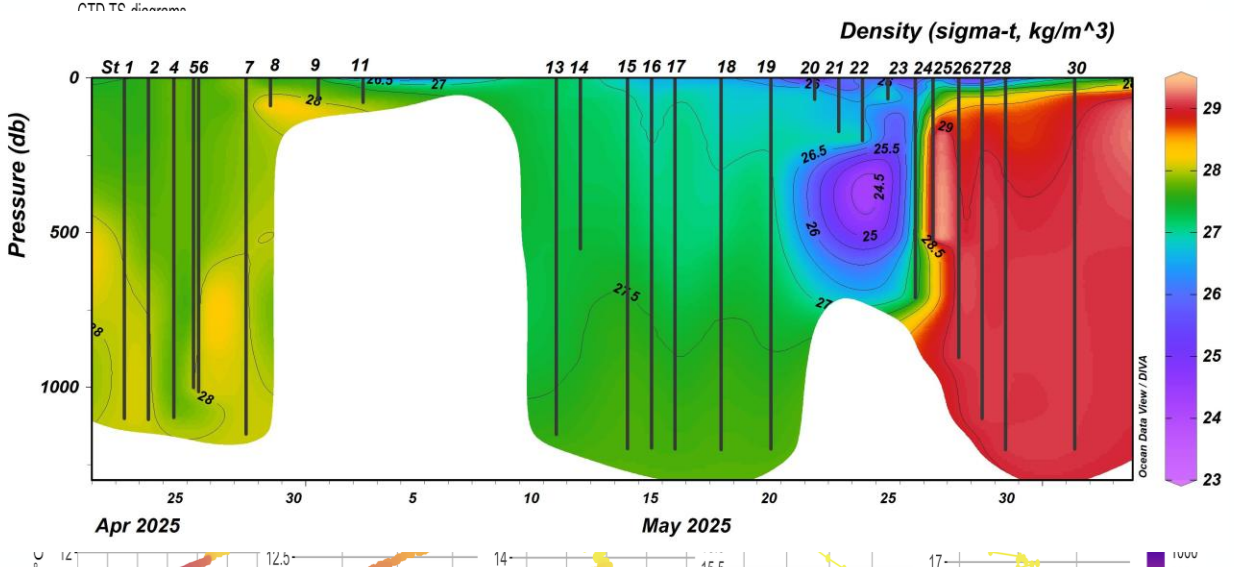
Official Supporter

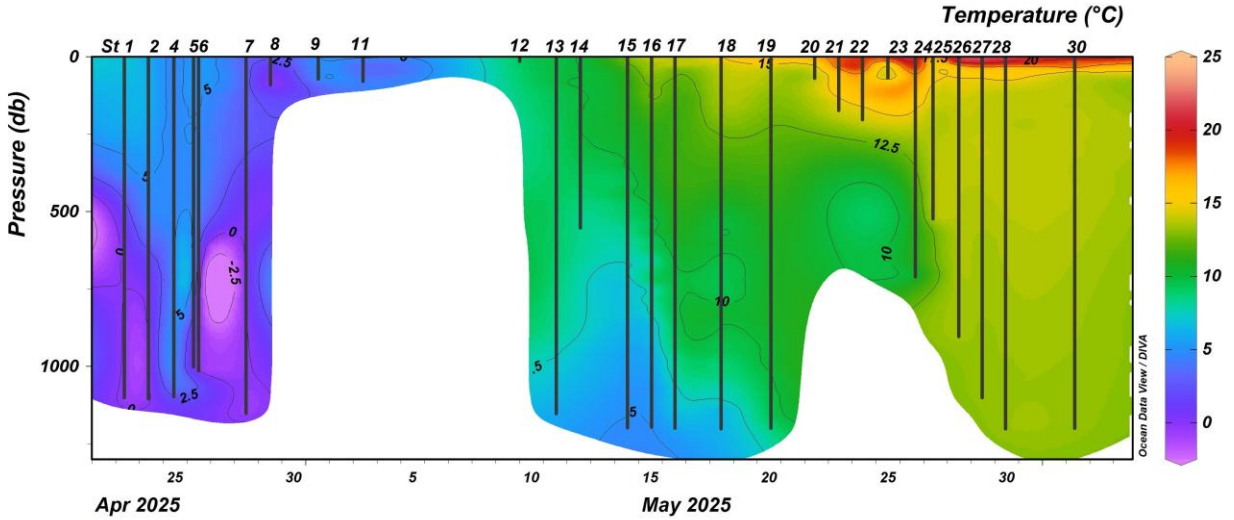
ESA - NASA - NERSC - TPS - Ocean Data Lab

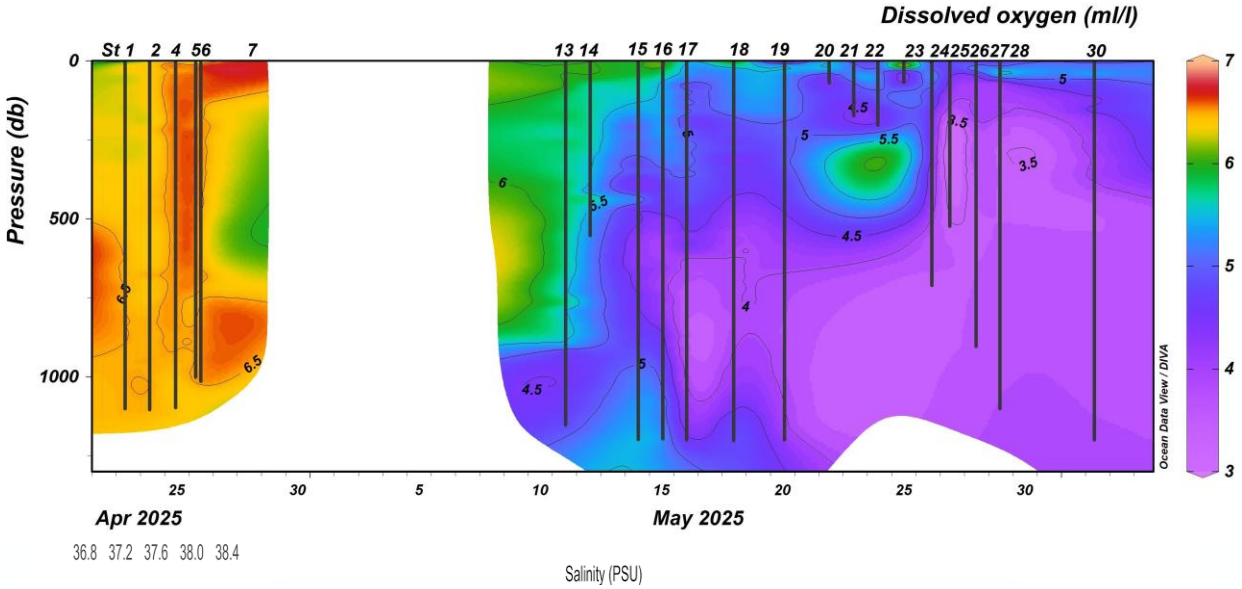
OTC25 geographic distribution: 22 countries

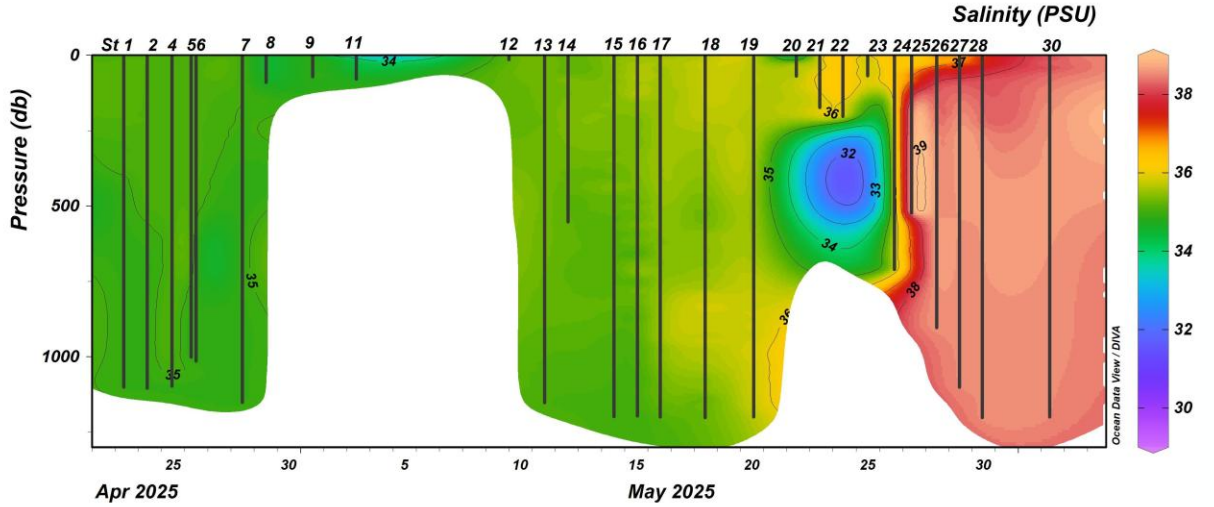


Hydrography







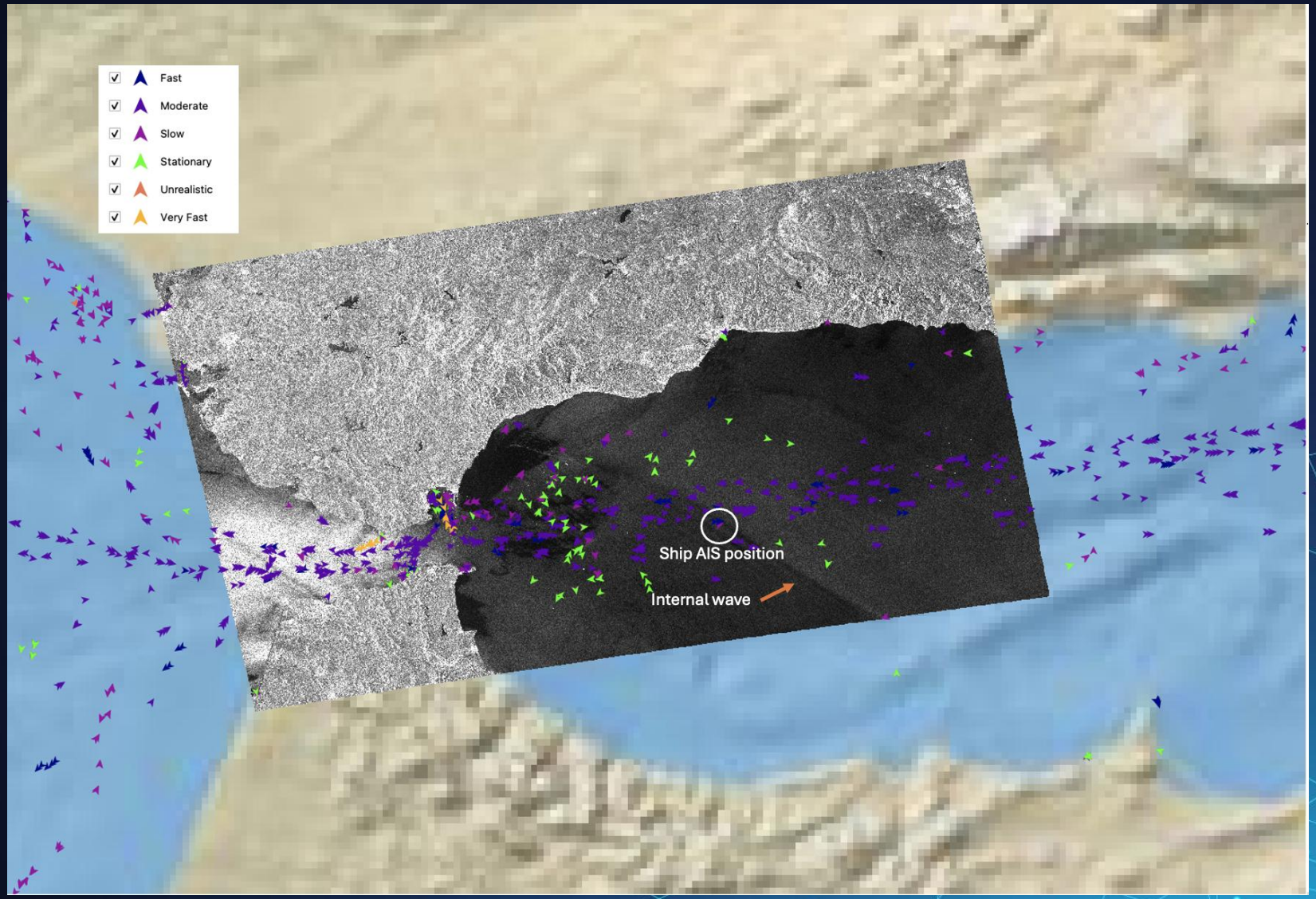


36.8 37.2 37.6 38.0 38.4

Salinity (PSU)

First Automated Information System (AIS) from Sentinel-1C

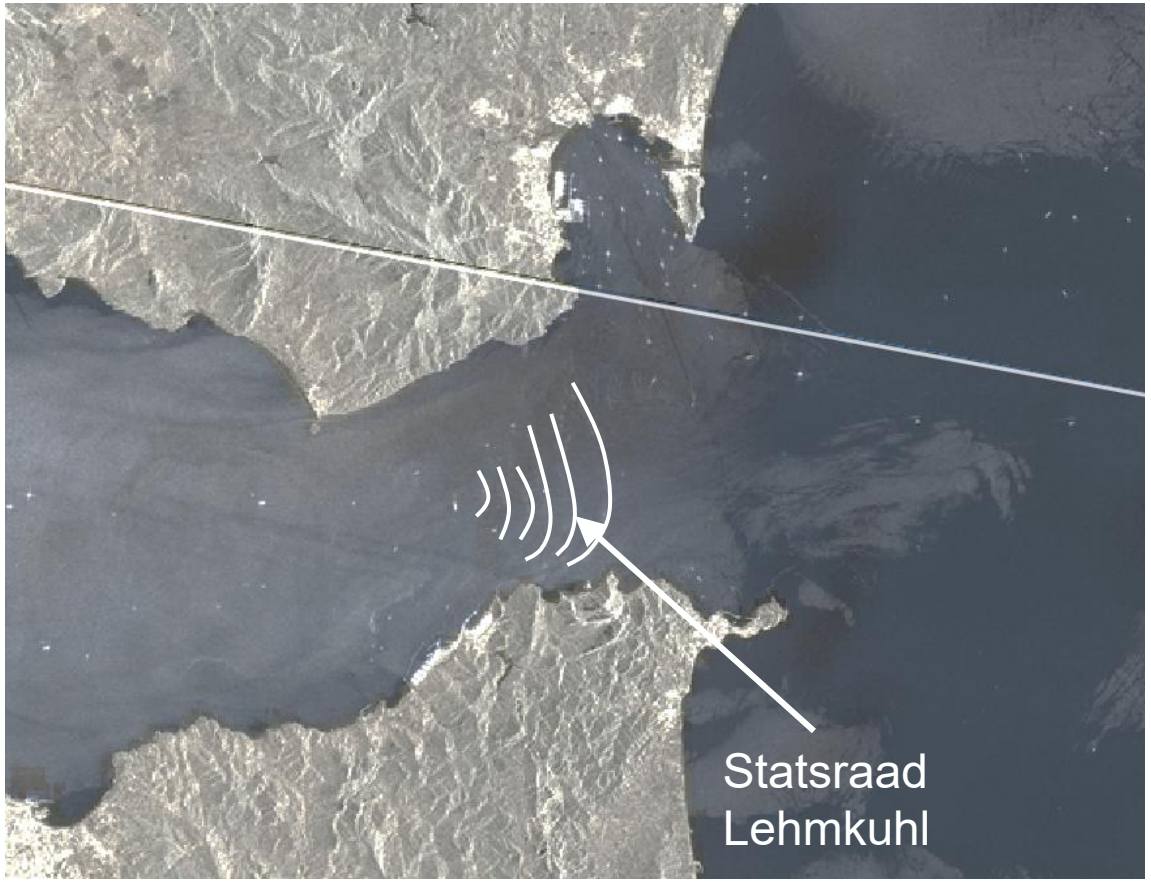
- Example Sentinel-1C satellite image showing AIS information derived from the satellite
- The OTC25 passed through this region and are working on validation of this new and exciting capability
- Allows polluters to be identified immediately from space with EO evidence



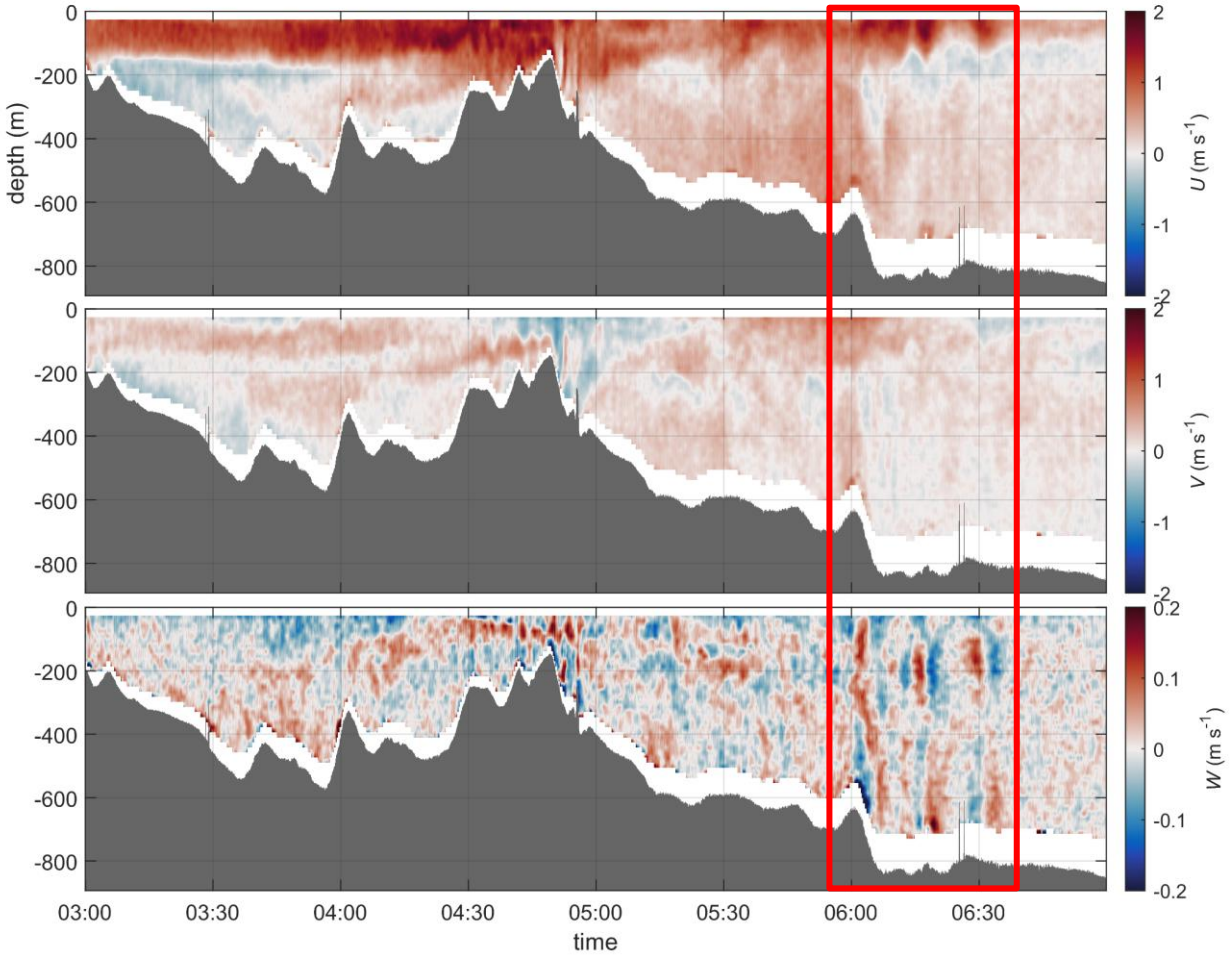
Internal solitary waves in Gibraltar Strait

Internal solitary waves in Gibraltar Strait

SAR – *Sentinel 1*
06:28

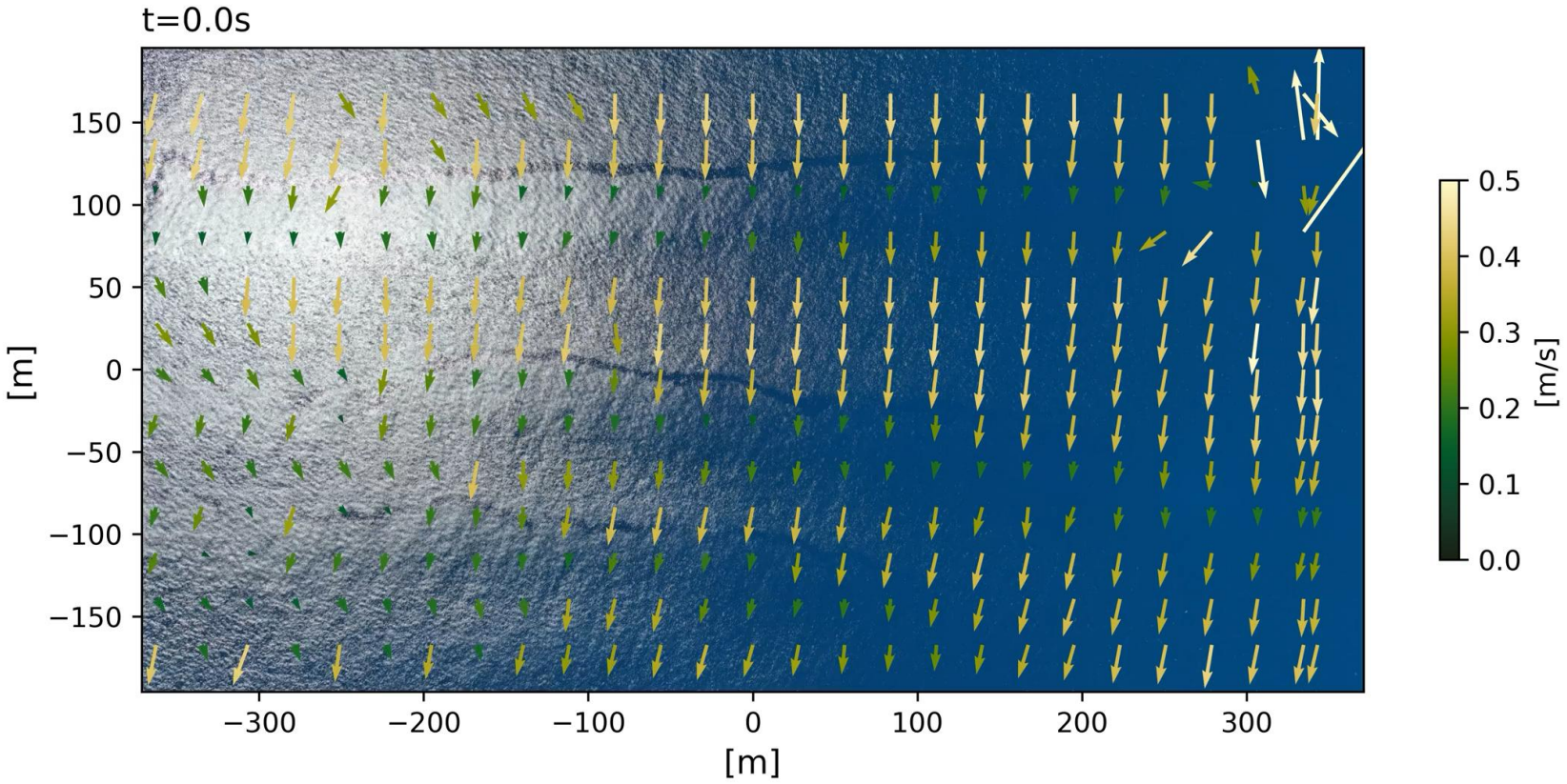


Teledyne ADCP

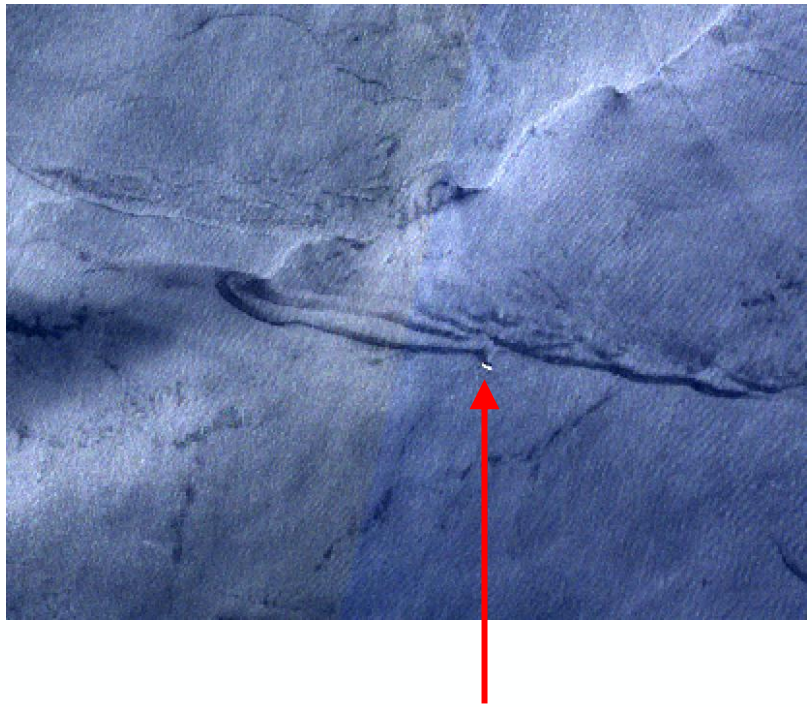


Ocean current retrieval from sun glitter

Surface velocity reconstruction of potential internal waves



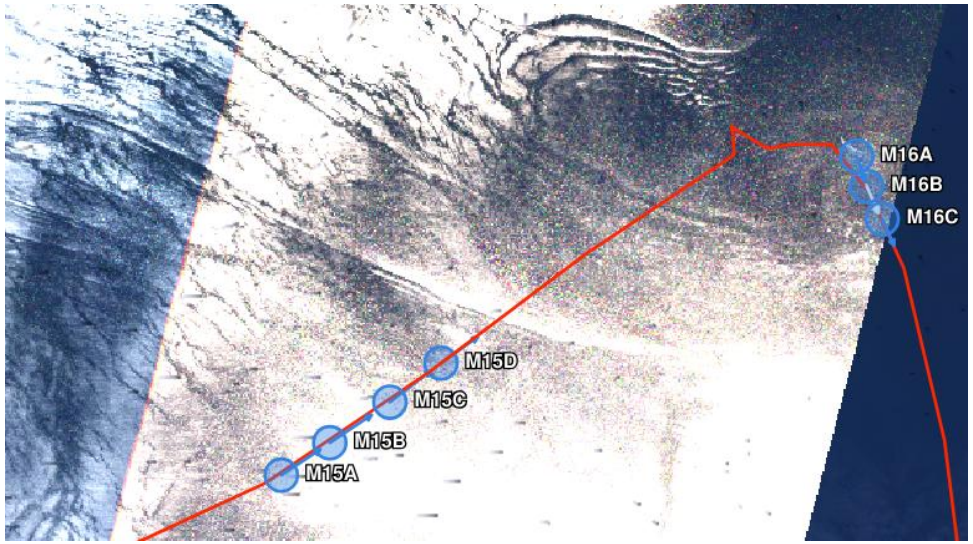
True Color – *Sentinel 2*

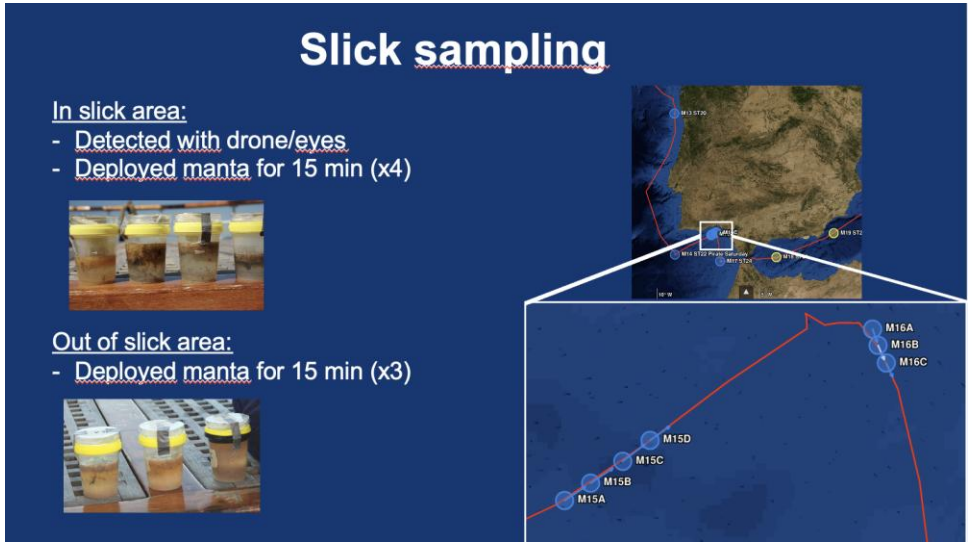


Statsraad
Lehmkuhl

Marine Debris monitoring

Sentinel-2

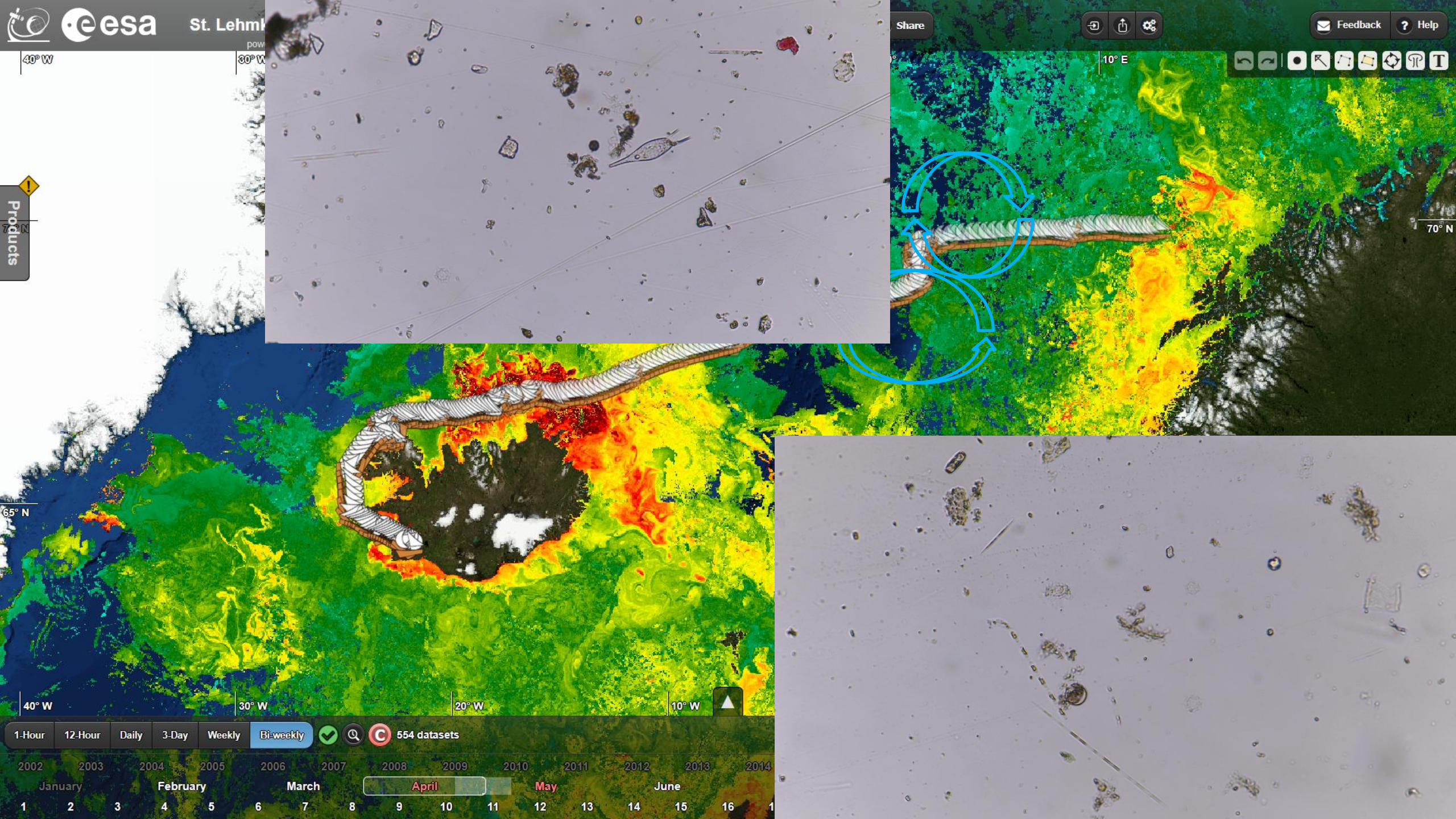




Tromso

Nice

Dramatic samples across the voyage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554 datasets
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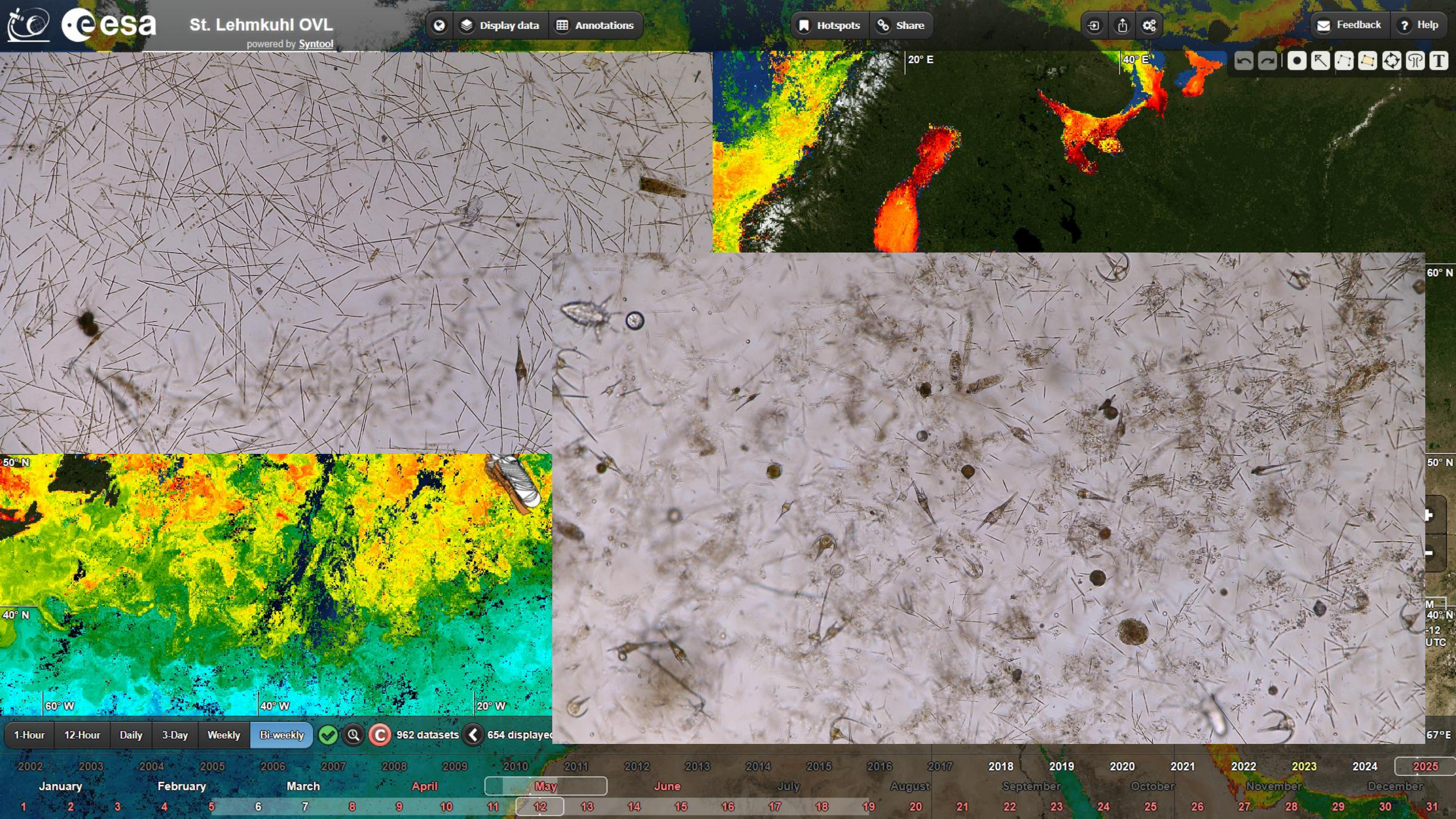
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Annotations
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Bi-weekly
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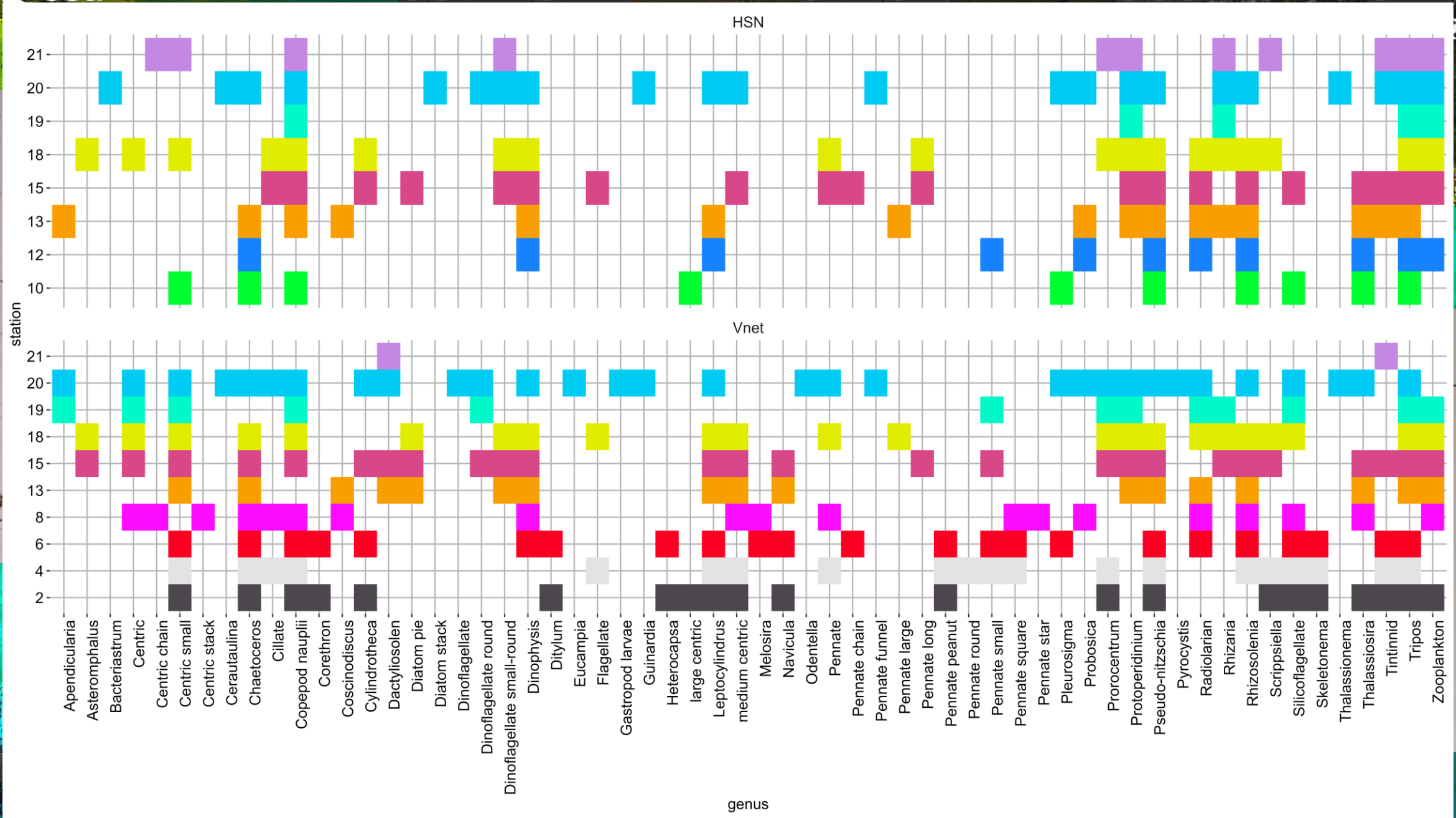
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Asteromphalus
Bacteriastrum
Centric
Centric chain
Centric small
Centric stack
Cerautaulina
Chaetoceros
Cillate
Copepod nauplii
Corethron
Coscinodiscus
Cylindrotheca
Dactyliosolen
Diatom pie
Diatom stack
Dinoflagellate
Dinoflagellate round
Dinoflagellate small-round
Dinophysis
Ditylum
Eucampia
Flagellate
Gastropod larvae
Guinardia
Heterocapsa
large centric
Leptocylindrus
medium centric
Melosira
Navicula
Odentella
Pennate
Pennate chain
Pennate funnel
Pennate large
Pennate long
Pennate peanut
Pennate round
Pennate small
Pennate square
Pennate star
Pleurosigma
Probosica
Prorocentrum
Protoperidinium
Pseudo-nitzschia
Pyrocystis
Radiolarian
Rhizaria
Rhizosolenia
Scrippsiella
Silicoflagellate
Skeletonema
Thalassionema
Thalassiosira
Tintinnid
Tripos
Zooplankton
genus

The OTC25 Lehmkuhl Manifesto

OTC25 LEHMKUHL MANIFESTO

WE **ALL** NEED A PROTECTED OCEAN. WE CANNOT PROTECT WHAT WE DON'T KNOW.

OUR OCEAN NEEDS LOVE, CARE AND MAINTENANCE.

We are 100 ocean scientists from 25 different countries. 100 passionate people working in biology, air-sea interactions and ocean physics. A 100 people mix of lecturers, students and citizen scientists who lived together as a microsociety. And this is what we advocate for after spending 46 days at sea.

We've sailed around 4500 nautical miles, from Tromso to Nice, passing through Reykjavik and Mahon. We managed to both do our science – i.e setting up the 31 CTD stations, deploying drifters, manta trawls, plankton nets, many other devices, and starting up to process the data – and live at sea – i.e. cleaning the deck, the toilets, taking care of the trash, sleeping in hammocks, and make the Statsraad Lehmkuhl actually *sail* during our eight-hour watches a day (the sails do not set themselves). Sometimes, we even managed to catch a bit of a sleep. After seven weeks at sea, we can claim that it is possible to conduct an oceanographic campaign on a sailing ship!

Though the European Space Agency and European Union are deploying a lot of new satellites, there is still a huge lack of in-situ observations, which are vital to validate satellite data and work in synergy with it. This voyage was also aimed to train the future generation of ocean scientists to collect in-situ measurements, and to understand the complexity of those – a full day of work is just one new data point at the end of the day, and we fully understand why the in-situ coverage is sparse. This experience at sea in a challenging environment involved collaboration and friendship: « *bonding, sailing, easing out communications, to come up with interesting results* » (Perrine), « *If you wanna go fast, go alone, but if you wanna go far, go together* » (Sejal)

From Tromso to Nice, we saw the icy Norwegian fjords, we observed the Arctic waters rotating around the permanent Lofoten vortex, essential for heat and energy redistribution. We have been able to observe the beauty of the spring bloom in different flourishing states along our way to Iceland. There, we also identified Arctic Ocean species, like whales and puffins. We witnessed the anger of the North-Atlantic Ocean and its 8 m waves with wave drifters. Below the surface, major changes are also taking place. The ocean can get angry, but it is today mostly getting warm. Too warm. We went through a marine heat wave which reached category 4 out of 4 on the peak day in the Atlantic Ocean. Water was on average 5°C higher than usual. In the Gibraltar Strait, we were fascinated by the beauty of both internal waves and dolphins, who may have struggled to make their way through maritime trafic noise and oil spills we spotted through satellite data. As we approached the coasts, we saw more and more waste drifting by - the microplastics we found in the water we sampled may fill the bodies of marine animals as well as ours.

But we also grew from a community standpoint. As scientists, our capacity to bond, to adapt, to help and learn from each other, became clear, and even more than necessary, in such a challenging and ever moving environment. We wish to build a scientific future that embodies the values we cultivated on board the Statsraad Lehmkuhl: respect, cohesion instead of competition, helping each other even during the hardest times. We realized that we were all here for the same purpose, all driven by the same mission. We have become spokespeople for ocean science and ocean observation. This experience will empower us and will shape the rest of our careers. We also realized the importance of each of us to achieve what we consider to be amongst our greatest responsibilities: providing oceanographic information of the highest quality, enabling every citizen to understand the importance of the ocean for their dearly lives.

There can be no green without blue.

We ask you all to embrace this challenge with us !

To achieve these goals together, we will need to :

- **Educate everyone:**
  - Kids, grandparents, decision makers, corporations and others
  - Use the arts as a medium to heighten awareness
  - Raise awareness worldwide (both within and beyond Europe)
  - Include ocean science in school curriculum
  - Support interdisciplinary ocean training at sea
  - Expand Ocean Literacy
  - Bring the Ocean to hearts and minds

- **Implement effective policies:**
  - Inform environmental policy making with scientific knowledge
  - Train scientists to talk to citizens/policy makers
  - Strengthen and develop environmental protection policies (carbon footprint) that are people friendly
  - Protect remote and pristine ocean regions from abusive exploitation

- **Cooperate and share:**
  - Increase cooperation with the least developed countries and Small Island States
  - Enhance international cooperation between space agencies and ocean policy makers
  - Support international scientific cooperation on ocean research
  - Integrate in situ measurements, space observations and modeling
  - Ensure free and open access to data
  - Promote open access publication

- **Extend and enhance ocean observations**
  - Increase monitoring of remote and/or vulnerable regions (eg polar oceans)
  - Invest in continous in situ measurements
  - Continuously improve accuracy resolution and frequency of ocean data
  - Dive into the abyssal knowledge gap on deep oceans

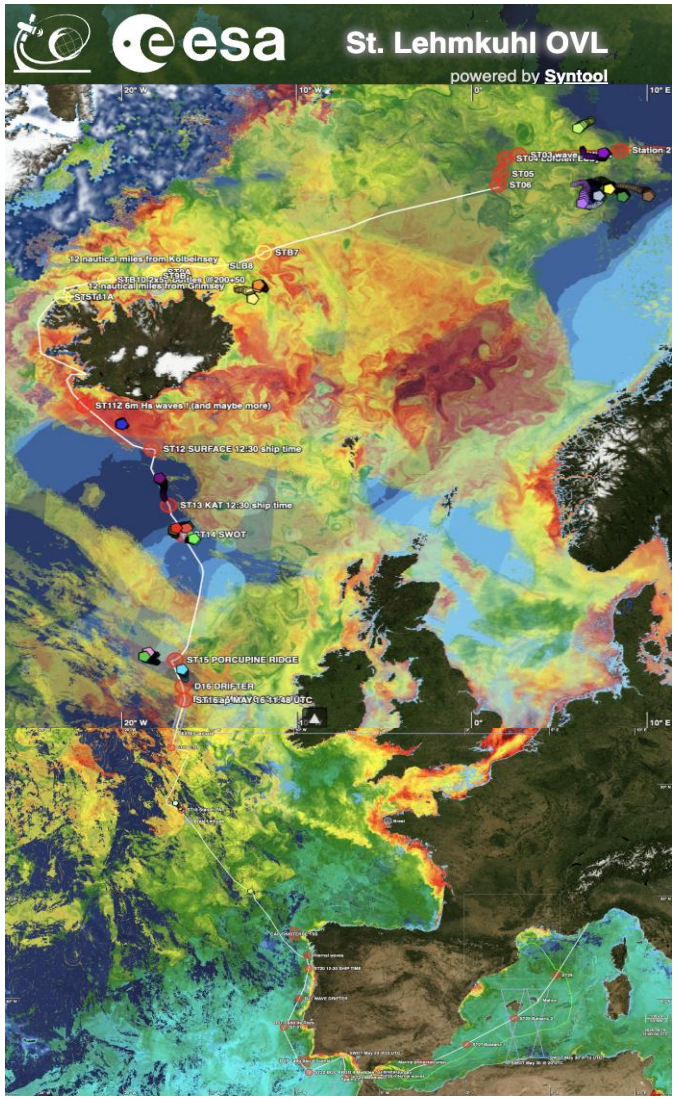
- **Imagine and create**
  - Promote projects to use existing data and long-term monitoring with the greatest impact for society
  - Accelerate cutting edge measurement technologies and advanced processing capability

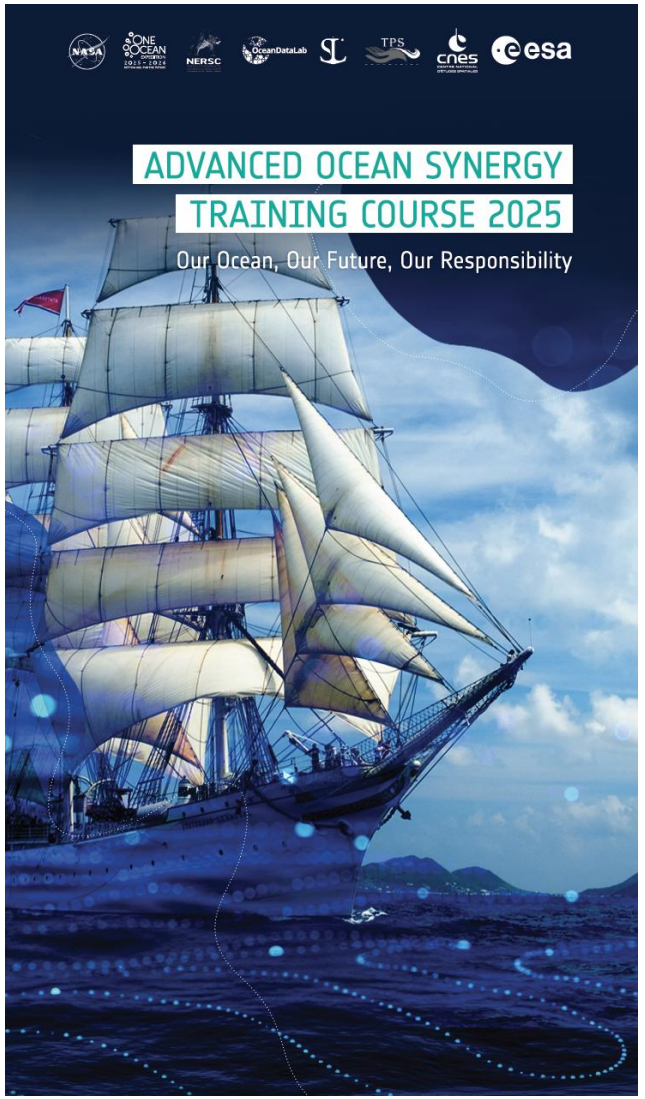
- **Build the work force for the future (us !)**
  - Improve opportunities and conditions for early career scientists
  - Embrace and promote diversity and equality
  - - Whatever background, gender, culture, age, sexual orientation
  - - Listen to their voices without prejudice

The ESA Advanced Ocean Training Course 2025

A unique co-located satellite and in situ data set

- 50 students, 21 lecturers, 22 countries
- ~4500 nautical miles
- 46 days at sea
- 1 marine heatwave, 1 marine cold spell
- Amazing biological succession/biodiversity
- 30 Oceanographic stations
- 63 CTD profiles
- 61 Phytoplankton nets
- 43 Zooplankton nets
- 157 ocean current drone flights
- 2 BGC-ARGO deployments
- 55 drifting buoys (35 wave drifters) deployed
- 38 lectures at sea
- Continuous sampling underway
- >15 Tb data acquired on the ship
- Unprecedented satellite imagery/data form Sentinel-1, -2, -3, -6, EnMAP and others
- First test of Sentinel-1C AIS with in-situ application
- >8 Journal articles in preparation





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THANK YOU !

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