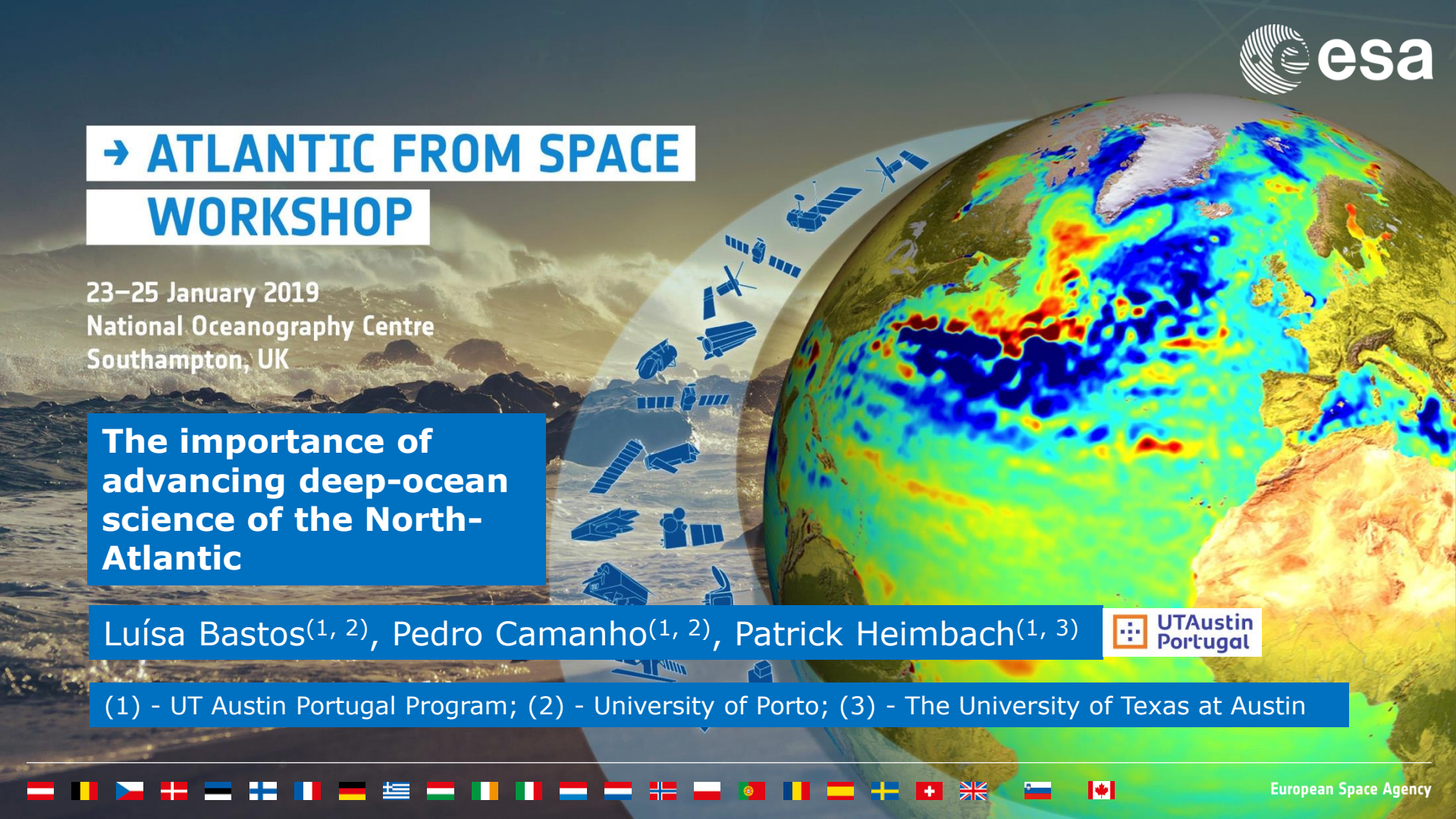

→ ATLANTIC FROM SPACE
WORKSHOP
23–25 January 2019
National Oceanography Centre
Southampton, UK
The importance of advancing deep-ocean science of the North-Atlantic
Luísa Bastos(1, 2), Pedro Camanho(1, 2), Patrick Heimbach(1, 3)
UTAustin Portugal
(1) - UT Austin Portugal Program; (2) - University of Porto; (3) - The University of Texas at Austin
European Space Agency

UT Austin-Portugal Program overview

Purpose

Promote new frontiers of knowledge in emerging themes worldwide, through the advancement of high-level education, research, and commercialization activities.

launched in 2007

↓

partnership renewed in 2018

↓

towards a new decade until 2030

Vision

Develop a knowledge-base society, and foster science and innovation-based companies to help Portugal face the challenges of the future.

Mission

Address a number of knowledge areas where scientists and companies in Portugal will engage with the University and other institutions in Texas in multidisciplinary research and technology transfer and commercialization.

UTAustin Portugal

UT Austin-Portugal Program overview

scientific areas

Advanced Computing	Nanotechnologies	Space-Earth Interactions	Medical Physics	TIE | UTEN
High Performance Computing, Data Analytics and Visualization	Materials for New Markets	Space Technologies Sea Climate Clean Energy	Emerging Cancer Therapies	Technology Innovation Entrepreneurship

instruments

research

- Exploratory Research Projects
- Strategic Research Projects

education

- Advanced Training Programs
- Research Exchanges

innovation

- Training
- Mentoring
- Residency in Austin
- Industrial affiliates

for tech startups

UTAustin Portugal

UT Austin Portugal Program – AIR/Space Priority Areas

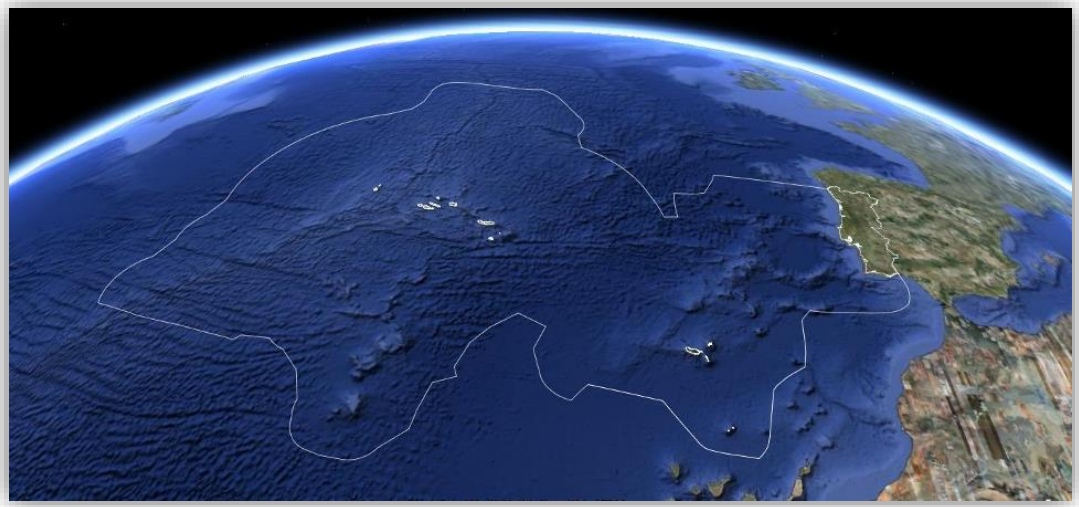
- Remote sensing of the oceans
- Deep ocean science and exploration
- Computational science and engineering
- Natural hazard monitoring & analytics

Innovative methods for existing or new data exploitation & simulation; New observation platforms and sensor technology scalable for surface and deep sea monitoring across the physical, biogeochemical, biological and ecosystems disciplines; Developments towards next generation of spacecraft; are some of the **key factors to push towards new advances in the Space area**.

Due to its relevance, **ocean RS and deep-ocean science in the North Atlantic** are research foci that **UT Austin-Portugal program** seeks to promote

Drivers

The Portuguese Continental Platform is about to be extended to an area that covers more than ten times its continental size



Credit: EMEPC

Big ocean territory no yet well mapped and understood

UTAustin Portugal

Drivers

- Higher responsibilities in terms of fulfilling EU directives (MFSD) towards the establishment of the **Good Environmental Status** (GES) of marine waters.
- Need to **monitor the different ocean components** (physical, biogeochemical and biological) to understand, exploit, manage and protect.
- Deeper understanding is critical to **improve predictive capabilities** and provide sustainable environmental stewardship of the ocean.
- **Responsible ocean exploitation**, namely mineral and biodiversity resources, is highly dependent on our knowledge of the deep-ocean environment, including sediment transport and ecosystems characterisation.

Expanded monitoring capabilities are needed from coastal to deep-ocean

Some ocean related initiatives - Portugal

iFADO - Innovation in the Framework of the Atlantic Deep Ocean

SCOOP - SAR Altimetry Coastal & Open Ocean - Performance Exploitation and Roadmap Study

JERICO-NEXT - Joint European Research Infrastructure network for Coastal Observatory – Novel European eXpertise for coastal observaTories

MyCOAST - Coordinated Atlantic Coastal Operational Oceanographic Observatory

AtlantOS - Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems

RAIA – Oceanographic Observatory of the Iberian Margin

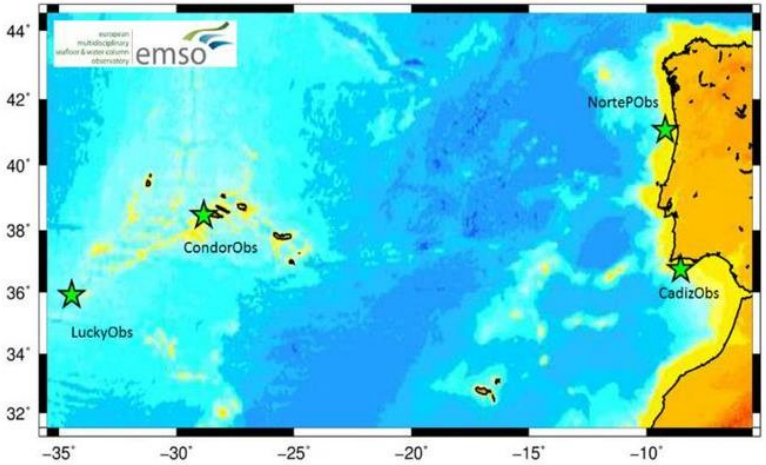
MyOcean - Development and Pre-operational validation of GMES Marine Core Services

…

Deep-ocean monitoring - Portugal

The **EMSO-PT** project (European Multidisciplinary Seafloor and Water Column Observatory – Portugal) seeks to contribute to the monitoring of the deep-ocean, by gathering and curation of long time series data on the North Atlantic, and also to the development of innovative technological solutions for ocean exploration.

EMSO-PT integrates EMSO, is aligned with DOOS strategies, and contributes to GOOS.



Credit: Nuno Lourenço

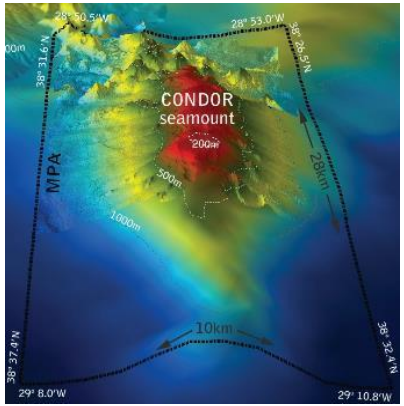
EMSO-PT Nodes

european multidisciplinary seafloor & water column observatory

- Cadiz Obs (deep water)
- Condor Obs (mid to shallow water)
- NorteP Obs (shallow water)

Deep-ocean monitoring – Portugal (Azores)

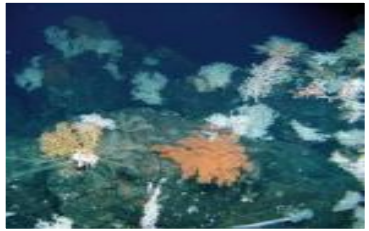
- European Multidisciplinary Seafloor Observatory (EMSO)
- CONDOR Observatory
- Open Ocean Observatories (FixO^3)
- Monitoring of the Mid Atlantic Ridge (MoMAR)



Diverse deep-ocean environments: **Potential for exploitation of non-living and living resources** (mining, energy, fishing, genetics, …)

Deep-sea hydro-thermal vents

Abyssal plains



Deep seamount summits

Credit: Fernando Tempera

Deep-ocean monitoring - North Atlantic region

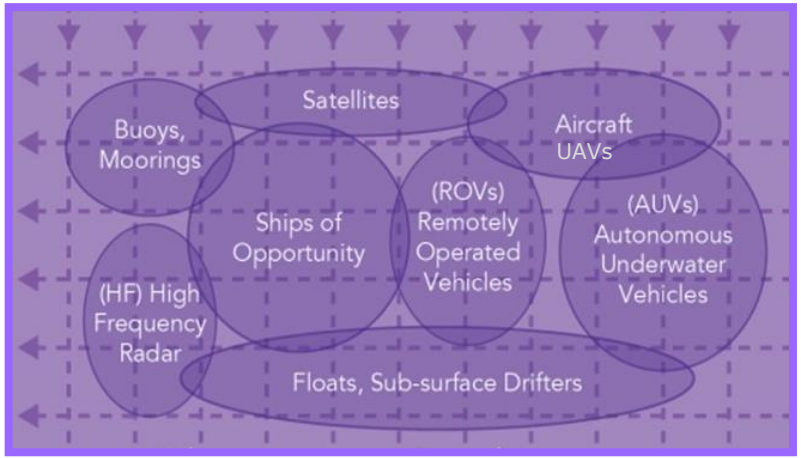
Existing ***in-situ*** **measurements are sparse** and therefore **much denser observing networks**, supported in a multi-technique multi-sensor approach, **must be implemented**.

Credit: EMSO (adapted)

Deep-ocean exploration

- Satellite monitoring plays an important role towards a better knowledge of deep ocean dynamics – e. g. inferring features in the ocean bottom from satellite altimetry and monitoring internal waves from SAR as it can give relevant contributions for understanding mixing mechanisms in the oceans.
- Availability of high-resolution satellite data and mapping of meteo-oceanographic conditions are key for better understanding the connections between surface and deep-ocean dynamics and for the development of realistic oceanographic models.
- These models require extreme-scale high-performance computing (HPC) infrastructure, novel algorithmic approaches, as well as an advanced cyberinfrastructure for deploying cutting-edge data analytics tools.

Ocean knowledge needs complementary techniques



- Multi-satellite multi-systems integration
- Observations deployment and maintenance
- Data standardisation and curation

Integration of Remote Sensing and *in-situ* observations towards

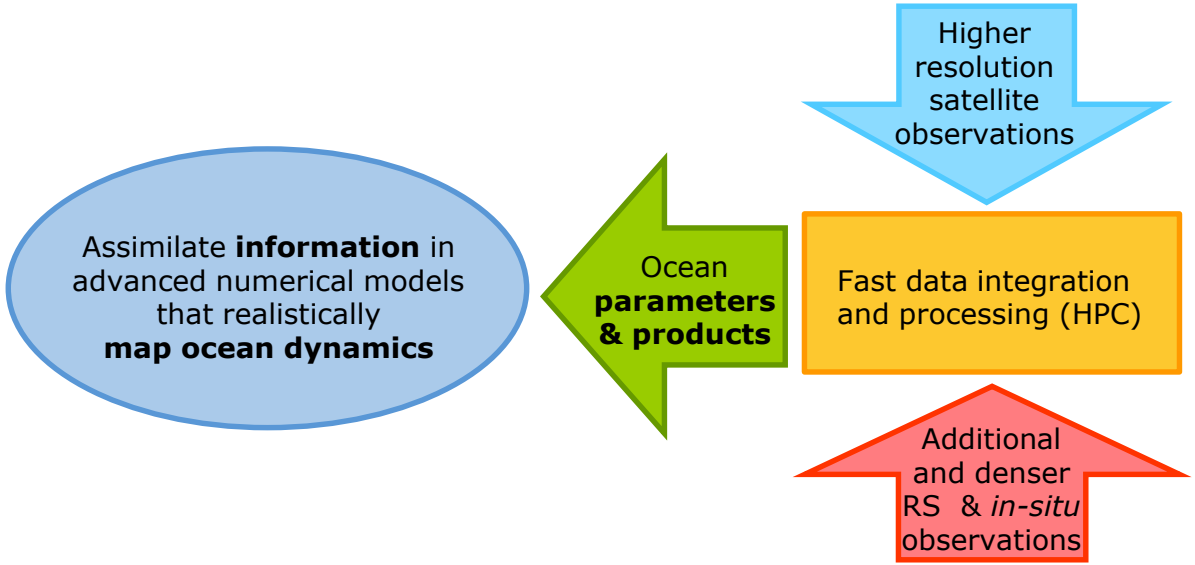
→ Improved understanding and representation of ocean dynamics

→ Implementation of advanced models able to anticipate response to climate variability, external disturbances and other societal needs

UTAustin Portugal

Ocean knowledge needs complementary techniques

- Development of advanced data assimilation tools to synthesize satellite and *in-situ* observations into a coherent depiction of the ocean.



UTAustin- Portugal – First project call

Space-Earth Interactions

Research involving **transatlantic and north-south cooperation** in complex systems engineering and science towards an integrative approach to space technologies, climate and clean energy, earth and ocean science in the Atlantic, together with emerging methods of data science, where synergies with the AIR Centre are desirable;

This call should focus on exploiting the potential of **integrating spaceborne, airborne, and in-situ (including underwater) data**, towards a better understanding of the ocean. Special emphasis will be placed on the **deep sea**, and the ocean's interaction with the other components of the Earth system, in order to improve predictive capabilities under climate change scenarios.

Recommendations

- **Higher resolution satellite observations in time and scale** (coordinated with other observation techniques)
- **Promote a Platform** (satellite, micro/nano-satellite, UAVs, …) **Independent Data and Products Exchange format**
- **Advanced processing and fast distribution of oceanographic standard products for quasi-real time assimilation in numerical models**
- **Remote Sensing derived information easily available to the citizens**