



EXPLORING KEY SCIENTIFIC QUESTIONS WITH THE EMSO REGIONAL FACILITIES OR GROUP OF REGIONAL FACILITIES

EMSO-Azores
Marjolaine Matabos New Regional Facility Leader



presented by Pierre-Marie Sarradin
BEEP, Ifremer,
EMSO Strategic Workshop
Rome, 11-13th March 2025



EMSO-AZORES IN A NUTSHELL

Location: Lucky Strike vent field, Mid-Atlantic Ridge

Distance from land: 200 nautical miles

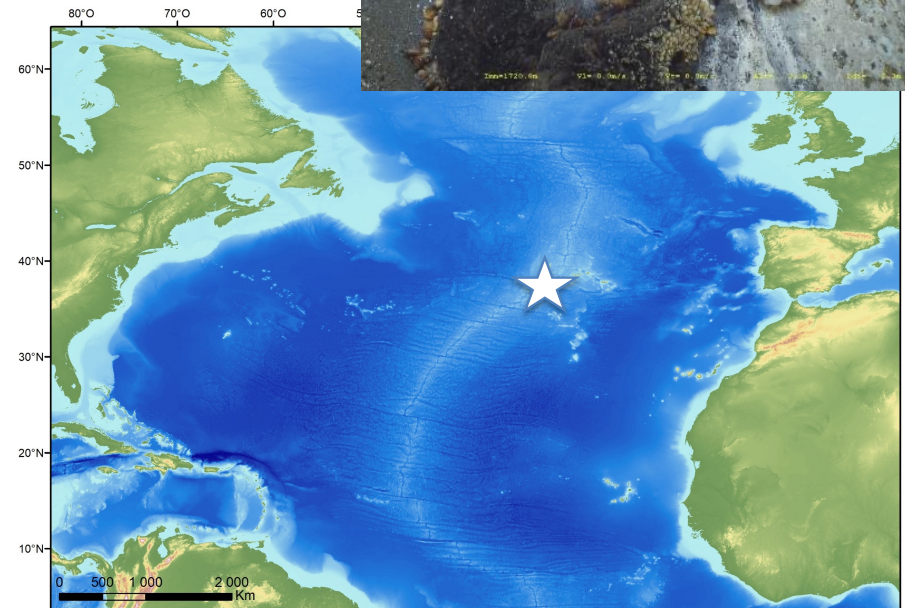
Max water depth: 2000 m

Date 1st deployment: 2010

Supported by: Ifremer, CNRS

Operated by: Ifremer, CNRS

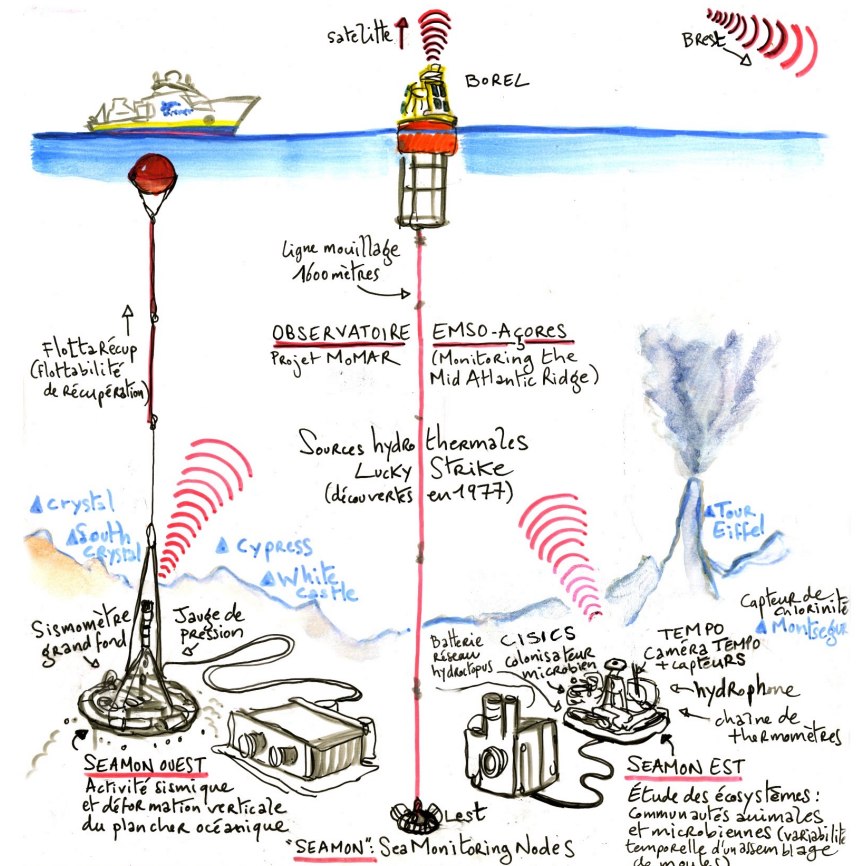
Regional Team Leader: Marjolaine Matabos, Ifremer



EMSO-AZORES IN A NUTSHELL

RF specificity Science and technology

- **SCIENCE OBJECTIVE:** Understand the links between geological, physical and chemical processes at a mid-oceanic ridge and their effects on the dynamics of biological communities at different spatial and temporal scales at the Lucky Strike hydrothermal vent field.
- **TECHNOLOGY:**
 - two seabed stations that connect sensors. Seamon West is dedicated to geophysical studies and host an EGIM for the monitoring of regional water mass conditions. Seamon East is dedicated to the monitoring of the hydrothermal vent environment through the combination of geophysical, chemical and biological measurements
 - A wide array of autonomous sensors: current meters, temperature sensors, autonomous cameras, fluid sampler, colonisers
 - Repeated sampling and experimental approaches during the Momarsat maintenance cruises



EMSO-AZORES: SCIENTIFIC CHALLENGES

Key scientific question 1:

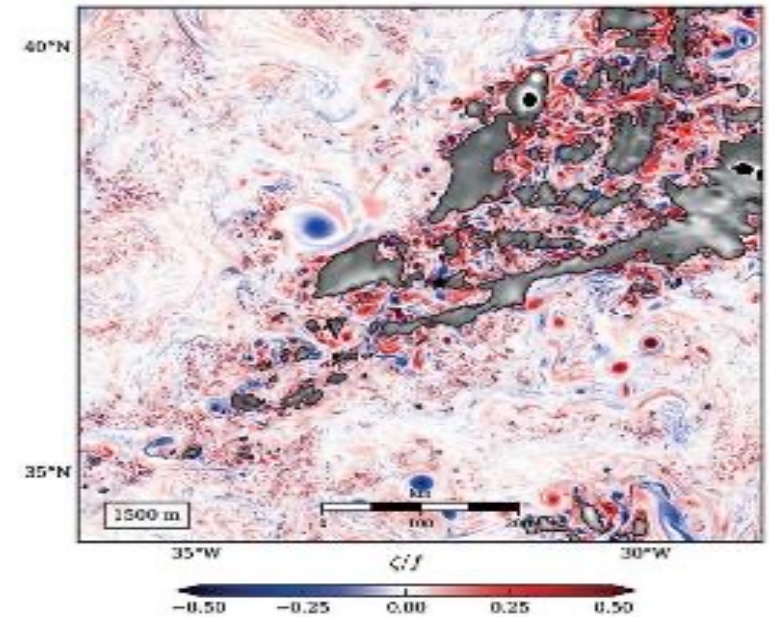
How does the temporal variability of open ocean EOVs impact and propagate from local to regional scales?

KSQ1.1: How do long-term trends influence the open ocean environment and lead to long-lasting (or irreversible) impacts at regional and local scales?

- Interactions between currents, ridge topography and mesoscale eddies from local to the ridge scale.

Existing status :

- Hydrodynamics and hydrology: Monitoring bottom and water column currents from local to the ridge segment scale.



Vic et al. 2018

EMSO-AZORES: SCIENTIFIC CHALLENGES

Key scientific question 2:

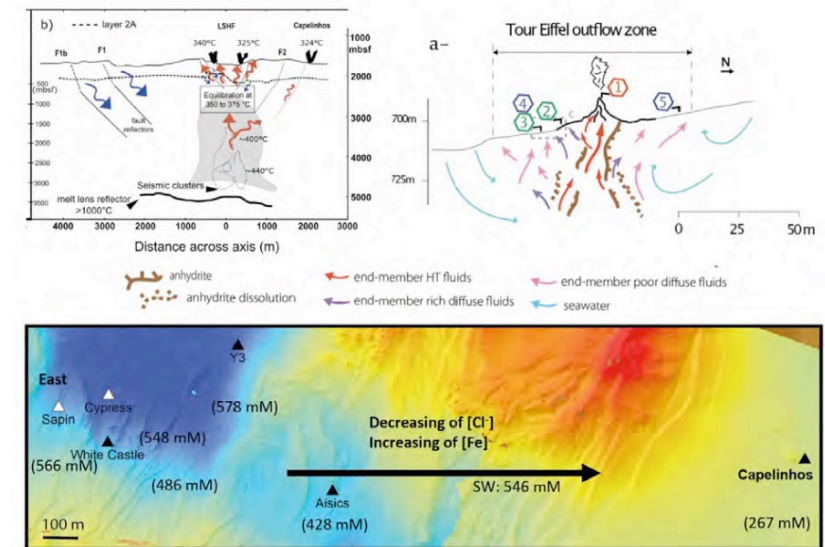
What are the spatiotemporal scales and variability of the processes preconditioning and triggering natural hazards events?

KSQ 2.3. What are the processes and scales of variability that affect fluid flow and seepage to the water column ?

- Response of hydrothermal circulation and associated heat and matter fluxes to crustal and oceanographic forces
- Impact of the interaction between hydrothermal circulation and shallow mixing with seawater on fluid chemistry, flux and temperature in the mixing zone
- Impact of fluid emissions on water column chemistry and geochemical cycles

Current status

- Hydrodynamics and hydrology: monitoring bottom and water column currents
- Biochemistry, ecology: monitoring fluid chemistry (repeated sampling)
- Geology and Geophysics: monitoring tectonic events, and fluid temperature in time and space





EMSO-AZORES : SCIENTIFIC CHALLENGES

Key scientific question 3:

What is the impact of environmental variability, geophysical events, and anthropogenic changes on open ocean benthic and pelagic ecosystems ?

KSQ 3.1: Ecosystem responses to environmental variability and disturbances, and impact on the surrounding benthic and pelagic ecosystems?

- Influence of geological features, fluid chemistry and circulation on biodiversity and species distribution
- Impact of hydrothermal production on biological communities in the surrounding deep sea (carbon flux)
- Role of the interaction between hydrothermal plume, local topography and currents on larval dispersal

KSQ 3.2: Impact of environmental variability on biological processes and ecosystem functioning

- Role of biological rhythms, growth, animal behaviour and biotic interactions on communities structure
- Processes controlling colonisation and recruitment

KSQ 3.3 Impact of anthropogenic pressures on the functioning and resilience of benthic and pelagic communities?

- Impact of light, sampling and habitat destruction on ecosystem functioning (research activity and deep-sea mining)



Mat et al. 2020



EMSO-AZORES : SCIENTIFIC CHALLENGES

Key scientific question 3:

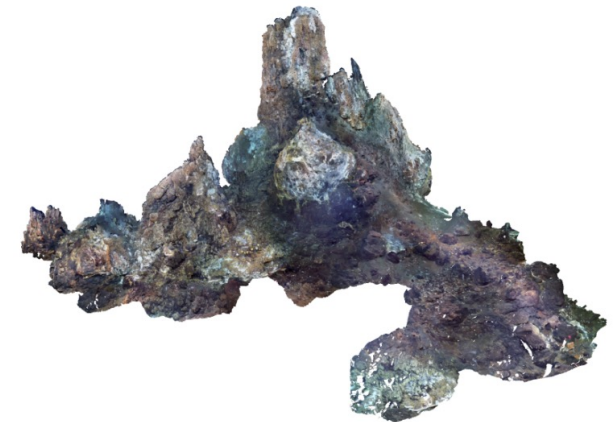
What is the impact of geophysics dynamic events, climatic and anthropogenic changes on open ocean benthic and pelagic ecosystems from local scales to connected regions?

KSQ 3.3. How EMSO RI can improve prediction of ecosystem shifts?

- Define indicators/essential biological variables of ecosystem change
- Develop standard methodology for environmental monitoring (3D reconstruction, numerical approaches, AI)

Existing status

- Hydrodynamics and hydrology: monitoring of bottom and water column currents in space and time
- Biochemistry, ecology: video, sampling and experiments for the study of biological processes (biodiversity, species distribution, behaviour, growth, physiology, colonisation and recruitment patterns)
- Geology and Geophysics: monitoring fluid temperature and chemistry in space and time





EMSO-AZORES: LOOKING AHEAD

How does your Facility represent regional scale ?

	Hydrodynamics and hydrology	Biochemistry, ecology	Geology and Geophysics	Long-term maintenance
Future objectives	Better constraint mesoscale currents and eddies	Soundscape : cetaceans, biological rhythms Plume studies in the water column	Increase OBS array Soundscape: characterise hydrothermal flux variability	Address RSE challenges Operational maintenance Scientific Impacts
Challenges/Technology that EMSO ERIC may provide to support		Sensor in biology and biodiversity, preservation of samples at the bottom, eDNA Include experiments as part of the observatory program Analyses of large volume of imagery data (IA development)	2 years autonomy on OBS	RI sustainability, secure maintenance cruise on the long run (CNFH, until 2029) Change in scientific team: after 15 years, it becomes hard to maintain long term engagement of small scientific and technical teams and a minimal task force for science, technological development and implication in the EMSO-Eric 2-year maintenance: use of IA for energy consumption reduction

Impact of research activity: how to reduce our environmental footprint (shiptime, litter on the seafloor)





Thank you for your attention!





Observing the ocean to save the earth

