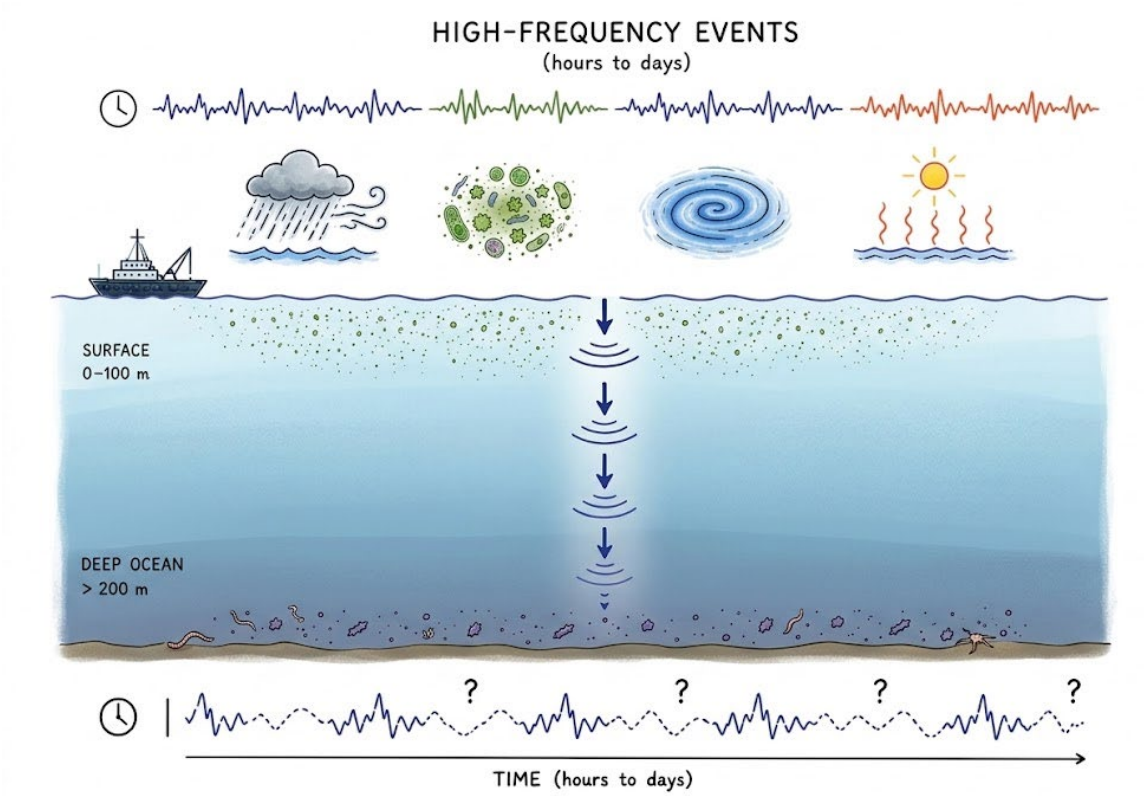
PhD position

Research unit: ISMER – Université du Québec à Rimouski (UQAR), Canada; CEREGE (European Centre for Research and Teaching in Environmental Geosciences, UMR 7330, AMU/CNRS/IRD/INRAE/Collège de France); MIO (Mediterranean Institute of Oceanography, UMR 7294, AMU/CNRS/IRD/Université de Toulon).
Position location: Multiple sites — Rimouski (ISMER, Quebec), Aix-en-Provence (CEREGE, Technopôle de l'Arbois, France), Marseille (MIO, Luminy campus, France) — within the framework of the joint doctoral supervision (cotutelle).
Expected duration : 4 years, with a start date in September 2026 or January 2027.
Working time: 100% (full-time).



NAME AND DESCRIPTION OF THE DOCTORAL PROJECT:

Project title: *Abyssal repercussions of high-frequency events on the North Atlantic biological carbon pump: from storms, blooms and eddy fronts to deep microbes and carbon storage.*

The ocean plays a central role in climate regulation, having absorbed roughly 30% of anthropogenic CO_2 emissions. In turn, it is subject to the effects of climate change, in particular increasing deoxygenation and acidification. The deep ocean (below 200 m) nevertheless remains largely understudied, owing to the limited availability of data and the small amplitude of variability observed at such depths. Furthermore, while long-term trends in marine biogeochemistry have been well documented, short-timescale variations associated with extreme events remain poorly characterised, even though several recent studies suggest that they influence the underlying long-term trends. The development of autonomous observing platforms now makes it possible to jointly explore these great depths and these short timescales.

This project aims to characterise these variations and to identify which high-frequency events, storms, phytoplankton blooms, eddies and associated fronts, marine heatwaves, affect the biogeochemistry of the North Atlantic, and down to what depths. To this end, the PhD student will combine satellite observations, BGC-Argo float data, and hydrographic data, including those from the APERO cruise, in order to identify the mechanisms driving the observed variations and their repercussions on the biological carbon pump and on deep carbon storage.

MAIN MISSIONS AND ACTIVITIES OF THE PHD STUDENT:

Under the joint supervision of the advisory team, the PhD student will be responsible for the following main missions:

- Compile, process and analyse a multi-source oceanographic dataset: satellite products, autonomous BGC-Argo floats, hydrographic data from research cruises (notably APERO), and other relevant datasets.
- Detect and characterise high-frequency events (storms, blooms, mesoscale eddies and fronts, marine heatwaves) in the North Atlantic and quantify their imprint on biogeochemistry, at the surface and at depth.
- Identify the physical and biogeochemical mechanisms linking these events to the variability observed down into the deep ocean (> 1,000 m), and their implications for the biological carbon pump and carbon storage.
- Develop and maintain reproducible processing pipelines in Python for time-series analysis, dataset integration, and visualisation.
- Disseminate results through articles in peer-reviewed journals and through presentations at national and international conferences.
- Take part in the scientific life of the three host laboratories (CEREGE, MIO, ISMER): seminars, summer schools, research stays in Québec, and possibly research cruises at sea.

EXPECTED OUTCOMES AT THE END OF THE DOCTORAL CONTRACT:

- Defence of a PhD thesis under international joint supervision (cotutelle), with a degree jointly awarded by Aix-Marseille Université and Université du Québec à Rimouski.
- Publication of at least two or three first-authored scientific articles in international peer-reviewed journals.
- Oral and poster presentations at international scientific conferences (e.g. EGU, Ocean Sciences Meeting, Argo Science Workshop).
- Production of analysis code and datasets, documented and shared according to FAIR principles.
- Acquisition of recognised expertise in physical and biogeochemical oceanography, in multi-platform ocean data analysis, and in international scientific collaboration.

REQUIRED SKILLS:

Scientific and technical skills:

- Solid foundations in physical and/or biogeochemical oceanography, or in climate science.
- Experience with, or strong interest in, scientific programming, particularly in Python.
- Interest in approaches combining ocean physical dynamics and biogeochemistry, and in the analysis of observational datasets.
- Ability to analyse time series, to handle large volumes of data, and to compare observations with conceptual models.

Transferable skills:

- Good written and oral communication skills in English (the working language of the project); a working knowledge of French is appreciated but not necessary.
- Autonomy, scientific rigour, and good organisational skills.
- Enjoyment of teamwork and ability to thrive in an international collaborative environment (France–Québec).
- Scientific curiosity and ability to integrate interdisciplinary approaches (physics, biogeochemistry, marine microbiology).

Required degree: Master's degree (M2) or equivalent in oceanography, climate science, Earth science, or a related field.

ENVIRONMENT / CONTEXT / WORKING CONDITIONS

The project is carried out within the framework of an **international joint doctoral supervision (cotutelle)** between Aix-Marseille Université (France) and Université du Québec à Rimouski (UQAR, Canada). The PhD student will be affiliated with **CEREGE** (Aix-en-Provence) and **MIO** (Marseille) on the French side, and with **ISMER-UQAR** (Rimouski) on the Québec side, with regular research stays in both countries.

ISMER, located in the coastal town of Rimouski, is the largest French-speaking oceanography institute in North America, bringing together specialists in physical, chemical, biological and geological oceanography. The project is also embedded in the *Transforming Climate Action* programme and in the *Québec-Océan* strategic network.

The supervisory team is composed of:

- Mathilde Jutras, tenured Professor of Oceanography at UQAR-ISMER and holder of the research chair on marine carbon dynamics ("Transforming Climate Action" programme); email: mathilde_jutras@uqar.ca.
- Olivier Sulpis, Research Scientist (Chargé de recherche) at CEREGE; email: sulpis@cerege.fr.
- Christian Tamburini, Senior Research Scientist (Directeur de recherche) at MIO; email: christian.tamburini@mio.osupytheas.fr.

Application: interested candidates are invited to send, as soon as possible, and before June 19th 2026, a cover letter, a CV, university transcripts, and the contact details of two references to Mathilde Jutras (mathilde_jutras@uqar.ca) and/or Olivier Sulpis (sulpis@cerege.fr).