

## Post-doctoral position available in assessing the Black Sea physical and biogeochemical budget dynamics and trends from earth observations and modelling.

A 2-year post-doctoral position is available at the Modelling for Aquatic Systems research group (MAST) from the University of Liège (ULiège), Belgium for understanding and assessing the Black Sea hydrodynamics and biogeochemical budgets (mainly oxygen and nitrogen) variability and trends on seasonal to climate scales combining Earth Observation analysis and numerical modelling.

### Context

The Black Sea's is the world's largest anoxic marine environment where only the first ~100 m contains oxygen and aerobic life while, below that depth, only bacterial life can be found with large amounts of sulphide and ammonium accumulating up to the bottom (~2000m). Its biogeochemistry has some similarities with that of global ocean Oxygen Minimum Zones with anoxic processes like denitrification and anaerobic ammonium oxidation (i.e. anammox) constituting a loss of fixed nitrogen with a basin scale intensity that is still unclear. The long-term evolution of the Black Sea nitrogen budget over decades is uncertain and, in particular, we ignore if the input of fixed nitrogen by the rivers, the atmosphere and nitrogen fixation can compensate for the large loss due to denitrification and anammox. Moreover, there are evidences that the Black Sea dynamics has been affected by climate change with a reduction in the formation of the cold-rich-oxygen intermediate layer, an essential contributor to water ventilation and a shoaling of its oxygenated layer. These changes have occurred over the last decades and the understanding of these trends remain challenging in terms of modelling and observation. For instance, it is still not yet known how the deoxygenation trend has affected the budget of other chemical elements.

### Research activities

The aim of this post-doctoral position is to combine model and observation analysis for gaining a better understanding of physical and biogeochemical functioning with a focus on the deoxygenation process in view of forecasting and medium-term projections. The position is offered in the frame of the European Union Copernicus Marine Environment Monitoring Service ([CMEMS](#)) and a recently starting ESA project (coordinated by the group) on Earth Observations for Science and Innovation in the Black Sea ([EO4SIBS](#)).

The successful candidate will have to work on:

- (1) The refinement (e.g. adding an explicit representation of iron, calcification) and the evaluation of the three-dimensional coupled hydrodynamical-biogeochemical Black Sea's forecasting and reanalysis system which consists of the Biogeochemical Model for Hypoxic and Benthic Influenced areas (BAMHBI) online-coupled with the hydrodynamical Nucleus for European Modelling of the Ocean ([NEMO](#)). The ability of the model to simulate the long-term trend, seasonal and weekly variability, mean state and spatial patterns will be evaluated by assessing model skills against Argo floats and novel Earth Observation products delivered in EO4SIBS. A particular focus will be on a quantification of the budget of essential elements (e.g. nitrogen, phosphorus, carbon and oxygen) with a focus on the long-term balance of nitrogen and oxygen budgets that are suspected to have been modified in answer to climate change and eutrophication;

- (2) the production of added-value products characterizing the distribution and characteristics of coherent meso-scale structures (eddies) and to investigate in combination with the model and other observations (Argo) the contribution of these eddies to the ventilation mechanism;
- (3) the fine-tuning of an existing data assimilation system for state and parameters estimation based on the Kalman filter for the assimilation of the new satellite products produced in EO4SIBS.

**In addition to the scientific project described here above, the successful candidate will have to:**

- be involved in the supervision of master theses (related to his/her research topic) in the frame of master programs in ocean science organized by the Liège University including Erasmus mundus programs (details [here](#) and [here](#)). This would allow to help him/her in progressing in his/her research field (max. 1 master thesis/year).
- Travel to other research groups, to project and scientific meetings (e.g; EGU, AGU, IMBER).
- To contribute to the writing of research proposals in the group.
- To actively participate to the life of the group (group meetings, research day, organisation of the annual International [Liege colloquium on ocean dynamics](#)).
- To contribute to dissemination and communication activities (punctual).

**Requirements for application:**

- PhD in ocean numerical modelling or equivalent.
- A capacity to work in different fields of marine science including physics, biogeochemistry, ecological processes, data assimilation techniques.
- Experience with marine biogeochemical modelling and computational scientific work are necessary
- Very good written and verbal English communication skills are required.
- Good communication skills for communicating results to different audiences including general public in relation to dissemination activities to which the MAST group contributes.

**Our offer:**

- A 2-year full time contract starting in January 2020 (with mid-term evaluation) with possibility of one-year extension if fundings permit.
- An attractive salary valuing the PhD and seniority of the applicant.
- The successful candidate will benefit from a dynamic working environment benefiting from the research projects of the group in different fields of ocean physical and biogeochemical modelling connecting modelled predictions with observations and end-users requirements. He/she will be integrated in the Freshwater and Oceanic sScience Unit of research ([FOCUS](#)) from the ULiege Science Faculty that gathers 80 persons working in ocean and fresh water science. The group contributes to the organisation of the annual [international Liege colloquium on ocean dynamics](#).
- A stimulating international environment within the Marine Copernicus international program, the ESA EO4SIBS that gathers experts in altimetry, optics and other research programs from the group.
- Enjoyable living and working conditions. The University of Liège offers a comprehensive and innovative training program, which enables early-career scientists to carry out their research in the best possible conditions, in compliance with the European Charter for Researchers.

**How to Apply:** The candidate should send by e-mail his/her curriculum vitae, a covering letter of motivation, together with two references (name and email address), to [Marilaure Grégoire](mailto:Marilaure.Gregoire@uliege.be) (email: [mgregoire@uliege.be](mailto:mgregoire@uliege.be)) with copy to [oceanphys@ulg.ac.be](mailto:oceanphys@ulg.ac.be). Applications will be considered until the position is filled. Short-listed candidates will be invited for an oral (skype) interview. The positions will remain open until filled; but the selection will start from November 15th, 2019. Starting date is expected in January 2020