POST-DOCTORAL POSITION

Organization	Sorbonne Université, France
Location	Laboratoire d'Océanographie de Villefranche (LOV), France
Research field	Biogeochemical oceanography
Type of contract	2-year postdoctoral position
Application deadline	31/06/2023
Position start date	01/09/2023

PRESENTATION

In the framework of the FORMAL project (https://iscd.sorbonne-universite.fr/research/sponsored-junior-teams/formal-2/), we are offering a two-year postdoctoral position. FORMAL focuses on studying marine life on all spatial and temporal scales, using a combination of observation and modeling tools, and is funded by the Institute of Computing and Data Sciences of Sorbonne Université (ISCD; http://iscd.sorbonne-universite.fr/). Within this context, the postdoc will use satellite-based products as well as BioGeoChemical-Argo (BGC-Argo; https://biogeochemical-argo.org) float observations to study the seasonal and sub-seasonal dynamics of plankton communities in the Southern Ocean.

The Southern Ocean (SO) is a major component of the Earth's climate system, in particular through its major contribution to the global ocean carbon sink. The Biological Carbon Pump (BCP) is known, with large uncertainties, to contribute a substantial portion of the SO carbon sink and to impart temporal fluctuations, in particular over seasonal to pluriannual timescales. Phytoplankton biomass and, especially, community composition have long been known as major drivers of the BCP. This could particularly be true for the SO where generally observed relationships between primary production and carbon export efficiency does not hold (e.g. Arteaga et al. 2018). The response of phytoplankton communities to changing oceanic conditions over a wide range of temporal scales is thus critical to better characterize the BCP in current conditions and anticipate its evolution in the future.

In this context, seminal studies (e.g. Sallée et al. 2015; Ardyna et al. 2017) have assessed the phenology of phytoplankton blooms and their connections to main environmental drivers in the different regimes of the SO, i.e. on a first order the seasonal mixing/stratification cycles that determines the balance between iron and light limitation. Nevertheless, in these studies, phytoplankton has been addressed through satellite chlorophyll (Chl) data, thus limited to the surface layer of the ocean and to a single compartment. On a second order, sub-seasonal scale environmental (mixing in particular) events have been shown to be dominant mode of the SO (Prend et al. 2022) and to modulate the mean seasonal (phenological) cycles (Fauchereau et al. 2011). Our knowledge of the biogeochemical significance of sub-seasonal scale processes remains limited while they could be critical to regulating phytoplankton bloom phenology and ecosystem composition and, thereby, the BCP.

Recent technological advances led to the implementation of the global BGC-Argo program which, in ~10 years, acquired more than 110,000 profiles of Chl and particulate organic carbon (POC) proxies in the ocean interior. These in situ measurements bear strong potential for synergistic use with global surface satellite data. In particular, our group at LOV has developed 4D products of Chl and POC based on the merging of satellite and BGC-Argo information using machine learning methods (Sauzède et al. 2022); a Phytoplankton Functional Type (PFT) product is also being developed. Moreover, our group has started to develop and deploy a new generation of profiling floats, the so-called "BGC-ECO-Argo" floats,

equipped with additional sensors (i.e. beam transmissometer and UVP6 imager) that permit to derive information not only phytoplankton biomass and carbon fluxes, but also on phyto- and zooplankton composition (https://erc-refine.eu).

Here the objective will be to address two main tasks:

(1) Using the global 4D products of Chla, POC and PFTs, the postdoc will re-evaluate existing bloom phenology for the main biogeochemical regimes of the SO, from the subtropical zone to the seasonal ice zone. The new phenology will account for the vertical dimension as well as the community composition (see, e.g., Bock et al. 2022).

(2) The postdoc will explore newly collected data by BGC-ECO-Argo floats deployed in the various regimes the Indian Sector of the SO. First, the mean phenological cycles derived in (1) will be used as a climatological reference to identify possible seasonal deviations (anomaly) in the float observations. Second, the multidisciplinary data collected by the floats will be used to characterize the environmental drivers underlying the anomalies and determine their influence on the (phyto- and zoo-) plankton composition.

POSITION

The position will be based at the Laboratoire d'Océanographie de Villefranche (LOV; https://lov.imev-mer.fr/web/). The contract will start on September 1, 2023. Gross salary between 2600€ and 2900€ depending on experience.

QUALIFICATIONS

- PhD in oceanography required
- Strong computational skills, proficiency in R, Python, Matlab (or similar)
- Expertise in data analysis (multi-variate analysis, machine learning)
- Ability to work independently
- Good communication skills in both written and spoken English
- Experience and knowledge in physical and biological oceanography desirable

APPLICATION

Interested candidates should send their application (CV including list of publications, motivation letter and names of at least two referees) to:

Dr. Julia Uitz [julia.uitz@imev-mer.fr], Laboratoire d'Océanographie de Villefranche (LOV), UMR 7093 Sorbonne Université & CNRS, https://lov.imev-mer.fr/web/member/julia-uitz/
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REFERENCES

Ardyna et al. (2017). Delineating environmental control of phytoplankton biomass and phenology in the Southern Ocean. *Geophysical Research Letters*, https://doi.org/10.1002/2016GL072428.

Arteaga et al. (2018). Assessment of Export Efficiency Equations in the Southern Ocean Applied to Satellite-Based Net Primary Production. *Journal of Geophysical Research: Oceans*, https://doi.org/10.1002/2018JC013787.

Bock et al. (2022). Biogeographical Classification of the Global Ocean From BGC-Argo Floats. *Global Biogeochemical Cycles*, https://doi.org/10.1029/2021GB007233.

Fauchereauet al. (2011). The response of phytoplankton biomass to transient mixing events in the Southern Ocean. *Geophysical Research Letters*, https://doi.org/10.1029/2011GL048498.

Prend et al. (2022). Sub-seasonal forcing drives year-to-year variations of Southern Ocean primary productivity. *Global Biogeochemical Cycles*, https://doi.org/10.1029/2022GB007329.

Sallée et al. (2015). Characterization of distinct bloom phenology regimes in the Southern Ocean. *ICES Journal of Marine Science*, https://doi.org/10.1093/icesjms/fsv069.

Sauzède et al. (2022). Global Ocean 3D Chlorophyll-a concentration, Particulate Backscattering coefficient and Particulate Organic Carbon. *Copernicus Marine Service*, https://doi.org/10.48670/moi-00046