

STAGE DE RECHERCHE de MASTER 2^{ème} ANNEE

Master MOCIS / WAPE
Année Universitaire 2022-2023

LABORATOIRE : LOCEAN

SUJET DU STAGE : Analyse de la dynamique physique menant à d'intenses blooms phytoplanctoniques dans une région spécifique de l'Océan Austral reconnue pour son importance climatique.

COORDONNEES DES RESPONSABLES :

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NATURE DU SUJET :

Théorie	<u>Pas du tout</u>	Un peu	Beaucoup
Modélisation num.	<u>Pas du tout</u>	Un peu	Beaucoup
Expérimentation	<u>Pas du tout</u>	Un peu	Beaucoup
Analyse de données	Pas du tout	Un peu	<u>Beaucoup</u>
Instrumentation	Pas du tout	<u>Un peu</u>	Beaucoup

SUJET :

The Southern Ocean is known for a low primary productivity, which has large implications for the marine ecosystems, but also for carbon uptake from the atmosphere into the ocean through photosynthesis. The low phytoplankton concentration is mainly due to the iron limitation in the Southern Ocean, which prevents the phytoplankton from making use of the high nutrient concentrations in the Southern Ocean. The availability of iron at the surface is therefore key for a high productivity in the Southern Ocean, and iron concentration is increased through upwelling of iron-rich deeper waters and close to iron sources such as islands and underwater features.

Maud Rise is a 4000 m high underwater seamount in the Weddell Sea sector in the Southern Ocean that is of great interest for the ocean dynamics. Ocean currents are steered around this seamount rather than flowing over it, leading to very special ocean conditions: The Warm Deep Water (WDW; $T > 0^{\circ}\text{C}$, $S > 34.65$) that is usually found beneath a colder and fresher layer of Surface Water (SW; $T \sim -1.8^{\circ}\text{C}$, $S < 34.5$) upwells over the slopes of Maud Rise, creating a circular cell of warm water, referred to as the Maud Rise 'Halo'. In the centre of this Halo, the so-called 'Taylor cap' is a water column of cold and fresher water that prevents the warmer and saline water in the Halo to flow over the top of the Maud Rise. In spring when the sea ice retreats, it sometimes melts first over the Maud Rise, opening a polynya (i.e. a hole in the sea ice).

During a Southern Ocean cruise in January 2022 as part of the European project SO-CHIC, we took measurements of the ocean temperature and salinity over the Maud Rise area that showed the presence of the warm water Halo and the cold Taylor cap. Before the ship reached the area in mid-November, satellite images of the sea ice concentration showed the opening of a polynya over Maud Rise. During the cruise period, satellite images and in-situ ocean samples of chlorophyll showed relatively high chlorophyll concentrations that roughly align with the shape of the warm water Halo. The objective of this study is to explore the importance of this phytoplankton bloom over the Maud Rise area relative to the surrounding ocean and to find a link between the high productivity with the special ocean dynamics of upwelling WDW. Is the bloom related to iron brought to the surface through the upwelling WDW or is it linked to the early sea ice retreat over the Maud Rise? To study these questions, the student will analyse the data gathered during the cruise, data from autonomous vehicles, as well as satellite images of sea ice concentration and chlorophyll.

This project will contribute to the European project SOCHIC (<http://www.sochic-h2020.eu/>) coordinated by Jean-Baptiste Sallée. It will be primarily supervised by Nadine Steiger, and be done in close collaboration with the Uni of Gothenburg. SOCHIC is a wide European project allowing the student to develop collaborations and discussions directly connected to the present M2 project, with a number of phds and scientists both locally at LOCEAN, and more generally across Europe.

POURSUIITE :

Ce stage peut-il donner lieu à un sujet de thèse ? Oui

Noter que le stage de M2 peut être totalement indépendant du sujet de thèse.