# Offre de Stage IPSL 2020

(soutenu par le programme EUR IPSL-*Climate Graduate School)*

Titre du sujet de stage : Abyssal circulation in the Glacial North Pacific and its role in regulating atmospheric $CO_2$

Description du sujet Changes in the circulation of the abyssal ocean are thought to drive the ~80 ppm changes in atmospheric $CO_2$ observed over Glacial – Interglacial cycles, although the exact mechanisms responsible remain elusive. Recent work has suggested diffusive mixing along deep ocean topography plays an important role in abyssal circulation, and highlights the mid-depth North Pacific as a possible location for glacial carbon storage (de Lavergne et al., 2017). Furthermore, enhanced intermediate overturning circulation in the glacial North Pacific has been suggested as a mechanism to lower the ocean's preformed nutrient content and thus atmospheric $CO_2$ (Gray et al., 2018). This project will utilise the $\delta^{18}O$ of benthic foraminifera as conservative watermass tracer to look at the ratio of meridional overturning to diffusive mixing in the glacial North Pacific. Vertical profiles of $\delta^{18}O$ have been successfully utilised in the Atlantic to look at changes in the ratio of meridional overturning to diffusive mixing (e.g. Lund et al., 2011), but has not been applied to the North Pacific, despite its greater volume and thus importance for the carbon cycle. The student will be first required to compile and quality control published benthic $\delta^{18}O$ data from North Pacific. They will then develop and apply the method of Lund et al 2011 to the compiled $\delta^{18}O$ dataset. The student will then compare their results to a large collection of Earth System model simulations (Galbraith and de Lavergne, 2017) to better understand the effects of the glacial circulation changes on the carbon cycle. This will be a desk-based project, although the student will develop knowledge of foraminferal geochemistry in addition to data analysis skills.

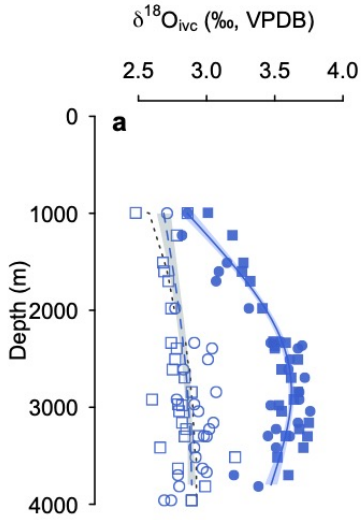


Figure: Holocene (open symbols) and LGM (filled symbols) $\delta^{18}O$ of benthic foraminifera from the North Pacific (Keigwin, 1998). Large changes in the abyssal circulation are suggested by these data, and this project aims to quantify those changes in circulation and their implications for the carbon cycle.

*Key References*

**de Lavergne** et al. (2017) Nature, **Gray** et al. (2018) Nature Geoscience, **Lund** et al. (2011) Paleoceanography, **Galbraith and de Lavergne** (2018) Climate Dynamics, **Keigwin** (1998) Paleoceanography

Résumé en anglais (5 lignes) :
Changes in the circulation of the abyssal ocean are thought to drive the ~80 ppm changes in atmospheric $CO_2$ observed over Glacial – Interglacial cycles, although the exact mechanisms responsible remain elusive. This project will utilise the $\delta^{18}O$ of benthic foraminifera as conservative watermass tracer to look at the ratio of meridional overturning to diffusive mixing in the glacial North Pacific then analyse climate model output to better understand the implications of the glacial circulation changes on the carbon cycle.

Responsable du stage (Nom/prénom/statut) : William Gray (LSCE Chercheur, william.gray@lsce.ipsl.fr) and Casimir de Lavergne (LOCEAN Chercheur)

Laboratoires concernés : LSCE and LOCEAN

Equipe de recherche concernée (si pertinent) : PALEOCEAN (LSCE)

Niveau du stage (Licence, M1, M2, internship) : M2

Licence ou Master(s) où sera proposé le sujet : StePE, CLEAR-ICE, Sorbonne/Jussieu

Thème scientifique de l'IPSL concerné : PALEOCLIMATE

Durée du stage : _~5_ mois

Période : du 1/02/19 au 30/06/20

Est-il prévu une thèse dans le prolongement du stage ? Non