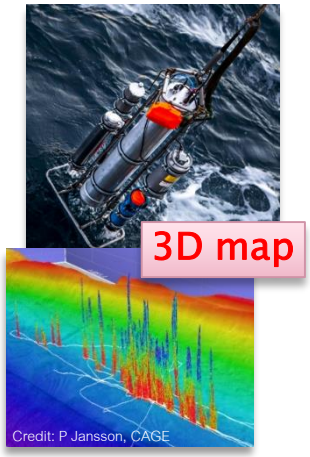
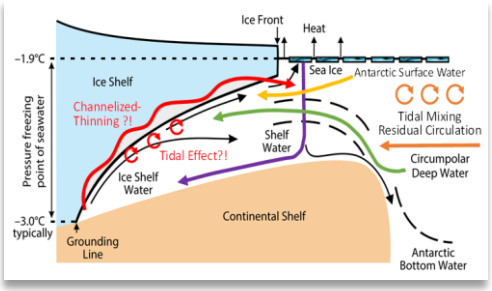
Capteurs optiques pour les mesures isotopiques in situ des gaz dissous ($\delta^{13}CH_4$ et isotopes de l'eau)



L. Lechevallier
C. Blouzon
D. Romanini
E. Kerstel



C. Blouzon
A. Wohleber

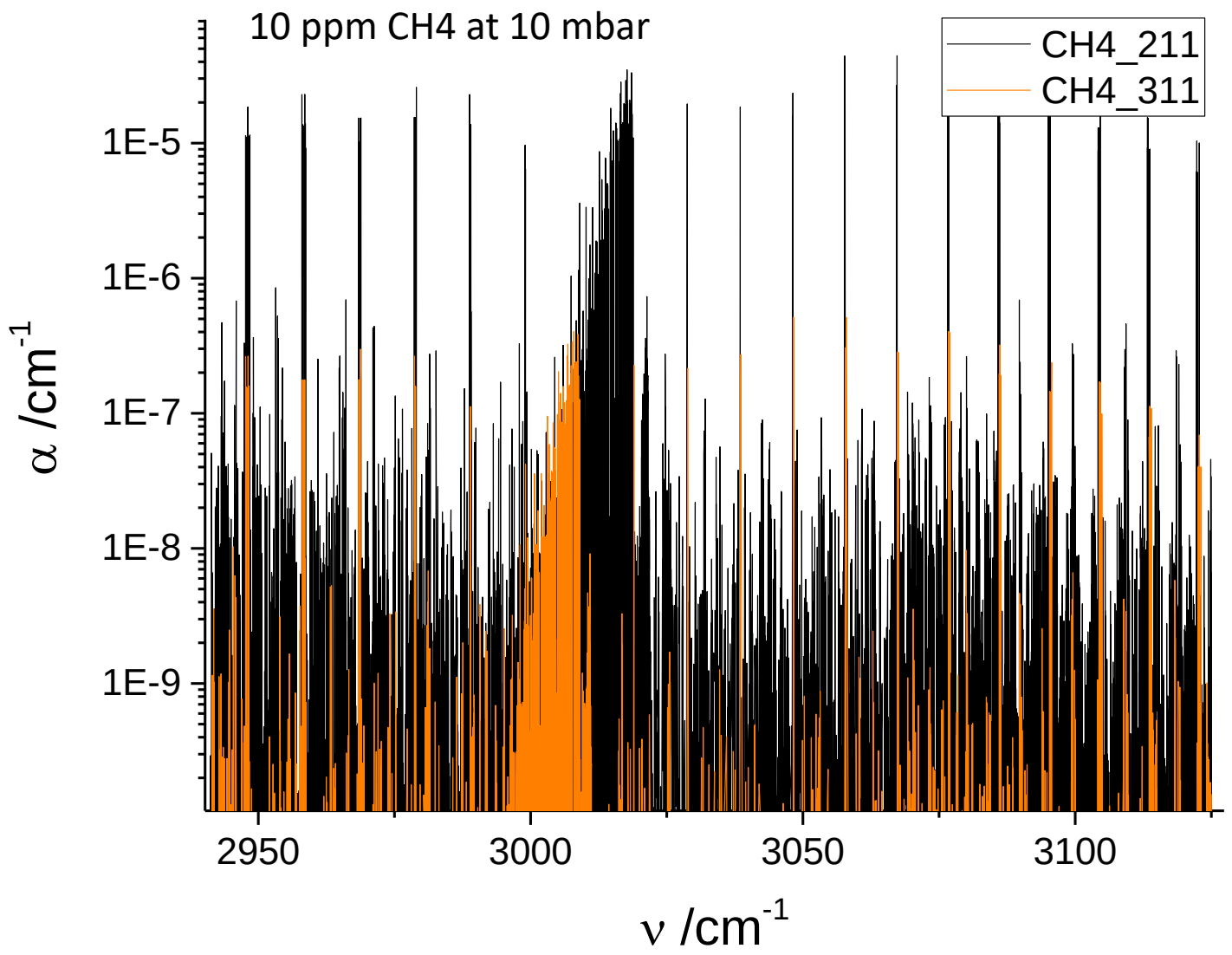
et l'analyse en laboratoire des bulles d'air piégées dans les carottes de glace ($\delta^{13}CO_2$)

E. Negre
S. Kassi
G. Teste

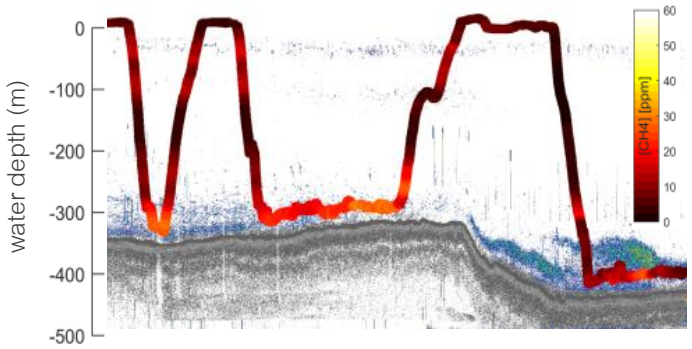
IGE
Institut des géosciences de l'environnement

LIPhy
Laboratoire interdisciplinaire de Physique

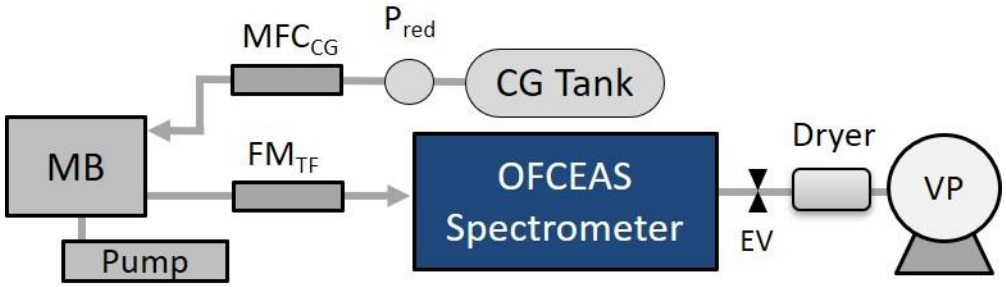
The optical spectroscopy… use of cavities for isotope ratio meas



Dissolved gas measurements



Continuous CH_4 concentration profile from the Arctic Ocean together with echo-sounder data.



Main Features:

1) **Fast response** (t90 <30s)

2) In situ measurements (6000m depth)

3 **Autonomous** (10-12h for profiling)

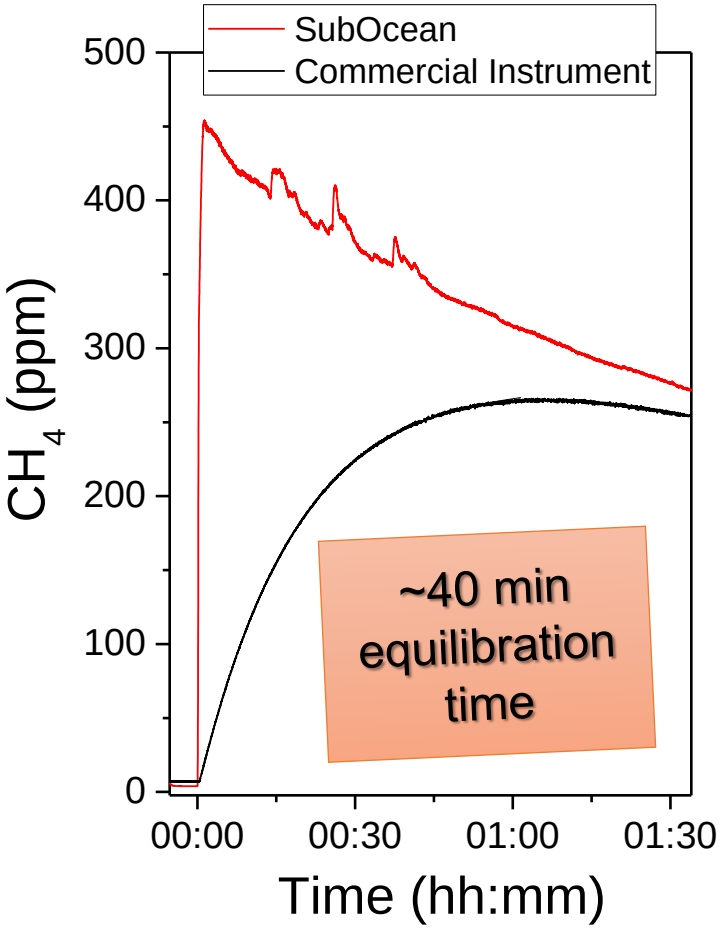
3) Relatively **compact**

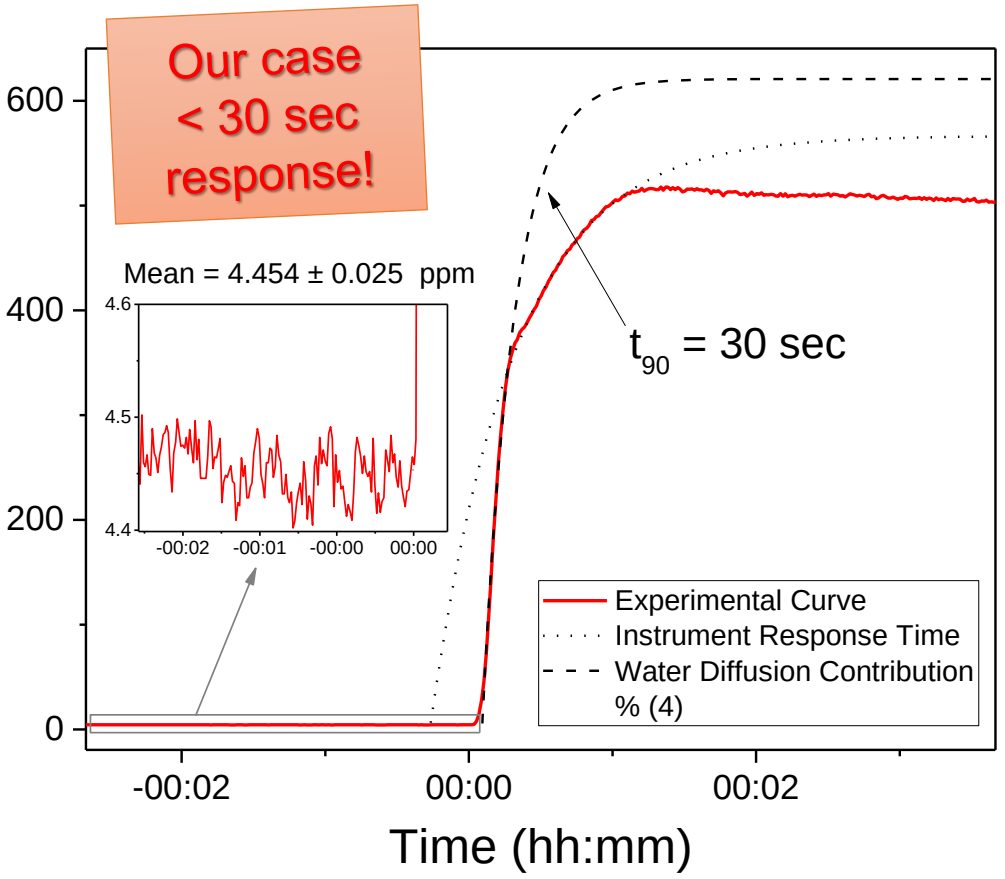
(to be mounted on AUV/ROV

actual size 19cm diam 9à cm long)

Triest et al. WO2018127516A1 **2017 (Patent)**
Grilli et al. *EST* ***2018 (Mediterranean Sea)***
Jansson et al Ocean Sic. **2019 (Arctic)**
Grilli et al. Geosci. Instrum. Methods Data Syst. **2020 (Lake Kivu)**
Grilli et al. Frontiers Earth Sci. **2021 (Black Sea)**

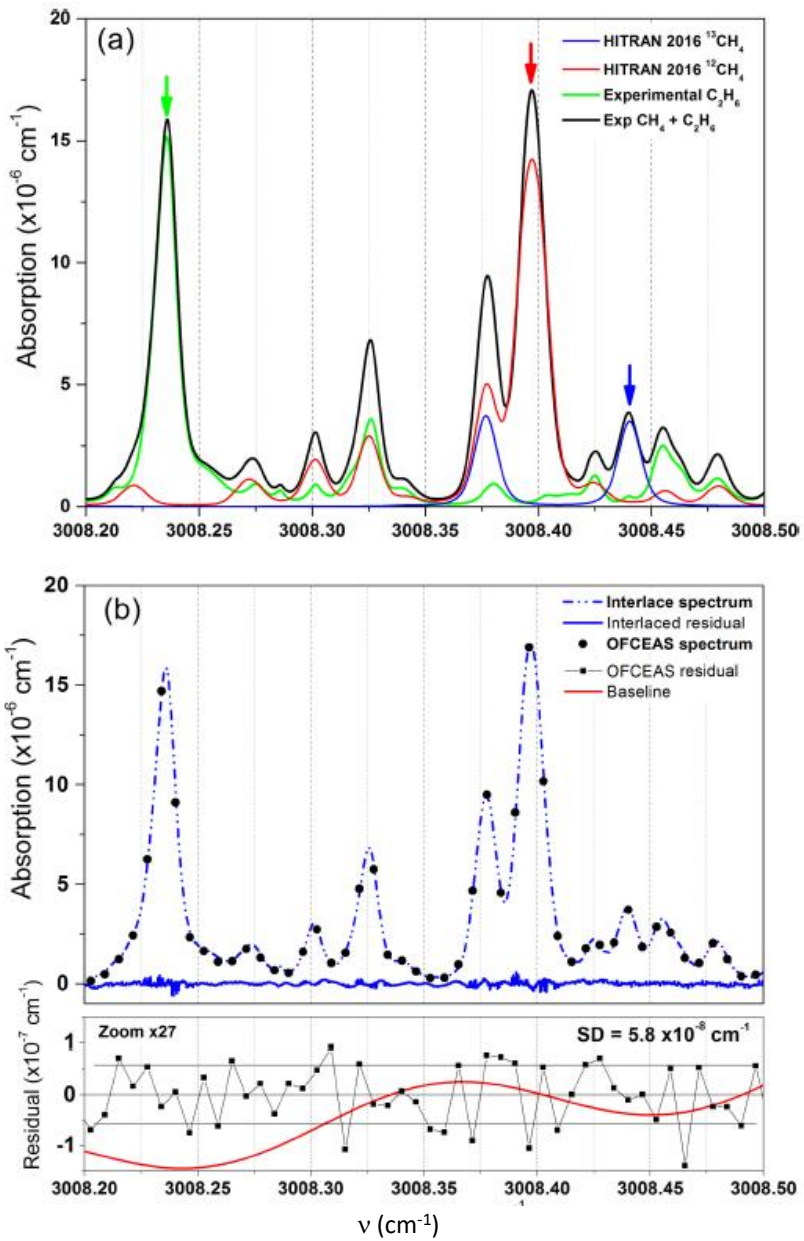
The fast response

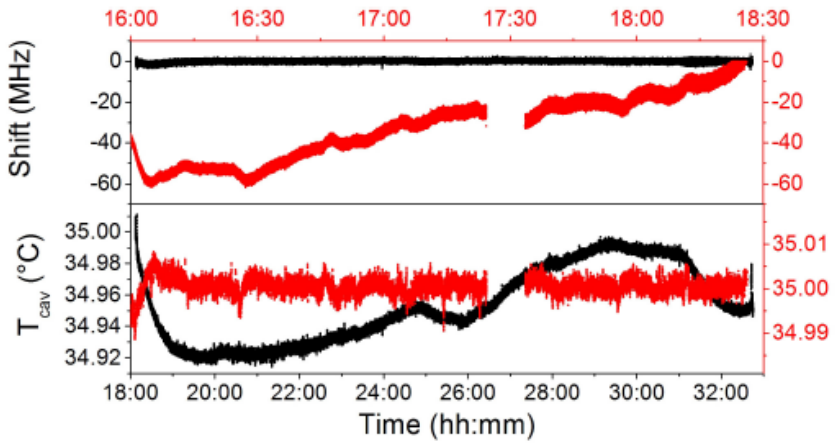


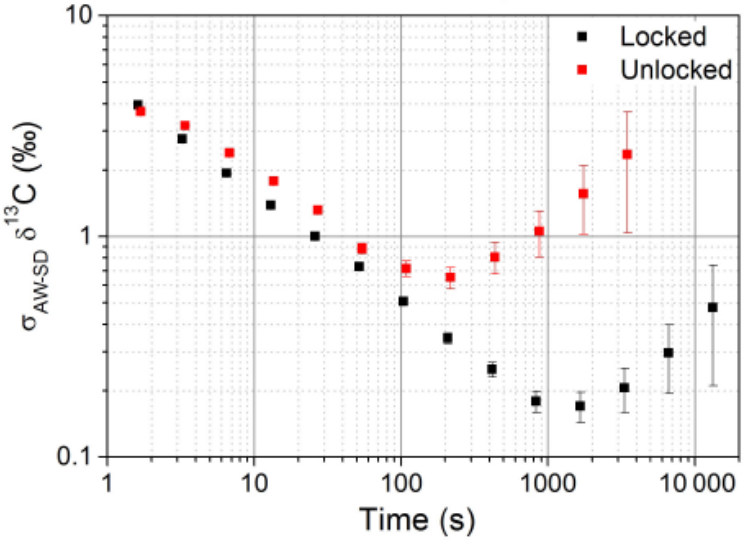


Triest et al., Patent WO2018127516A1 **2017**
Grilli et al. *EST* ***2018***

Spectrometer for CH_4, C_2H_6 and $\delta^{13}CH_4$

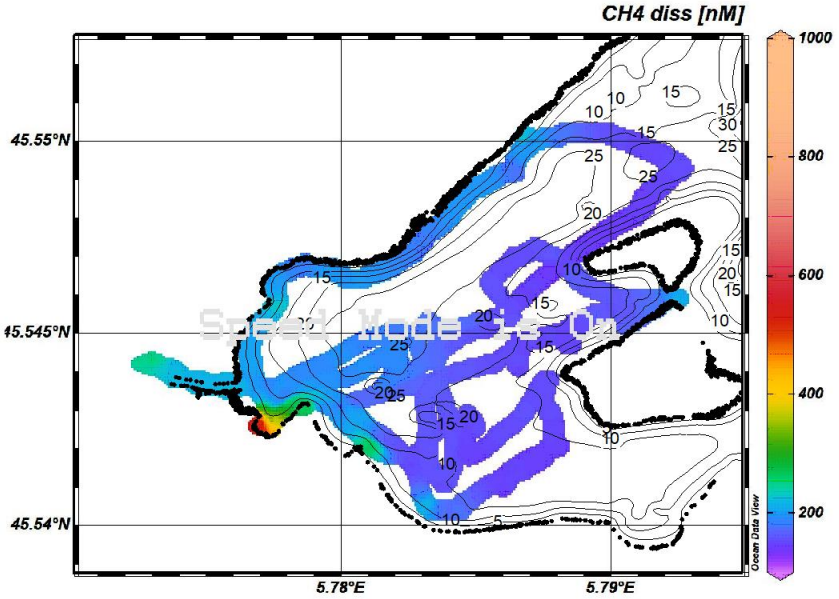




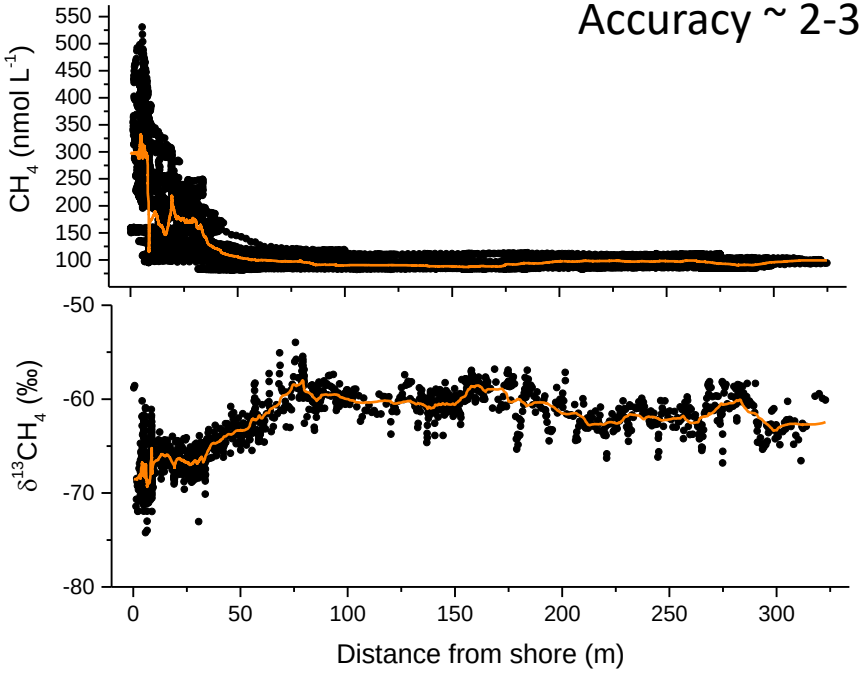


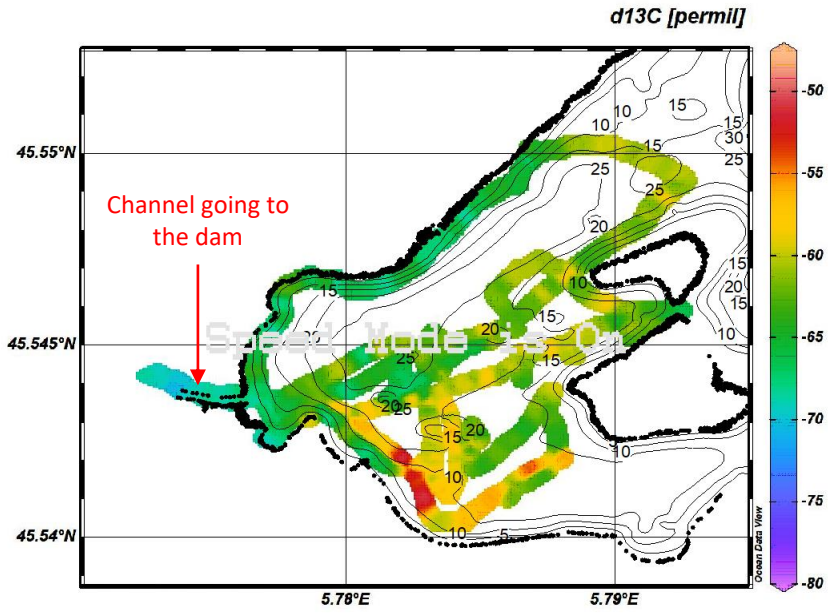
Lechevallier et al. *AMT* ***2019***

Aiguebelette Lake Mai 2019: CH_4, C_2H_6 and $d^{13}C$–CH_4



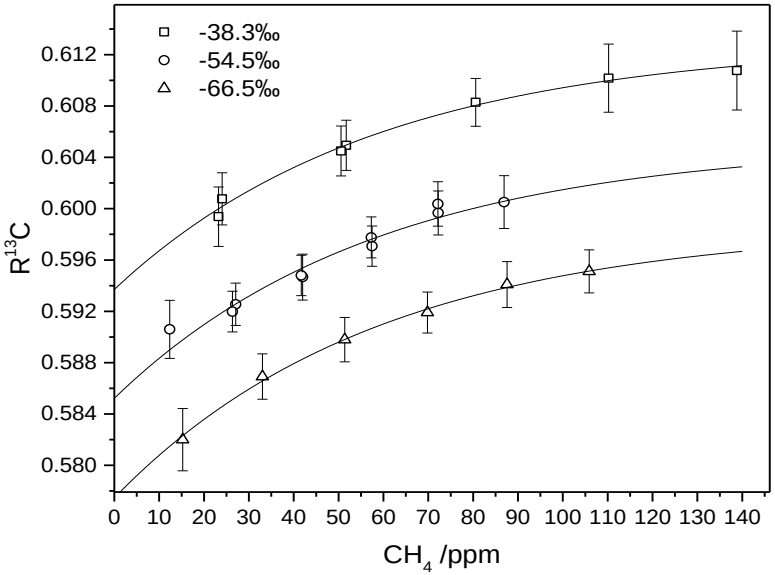
Accuracy ~ 2-3 ‰

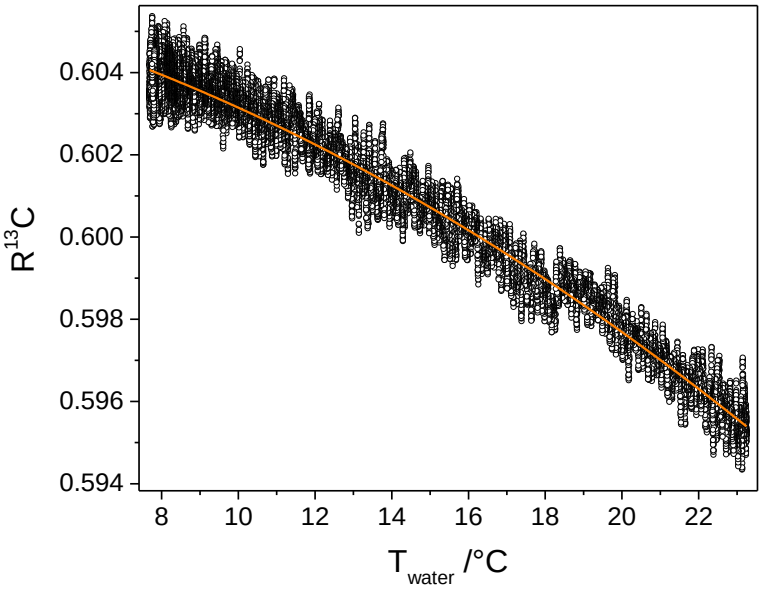


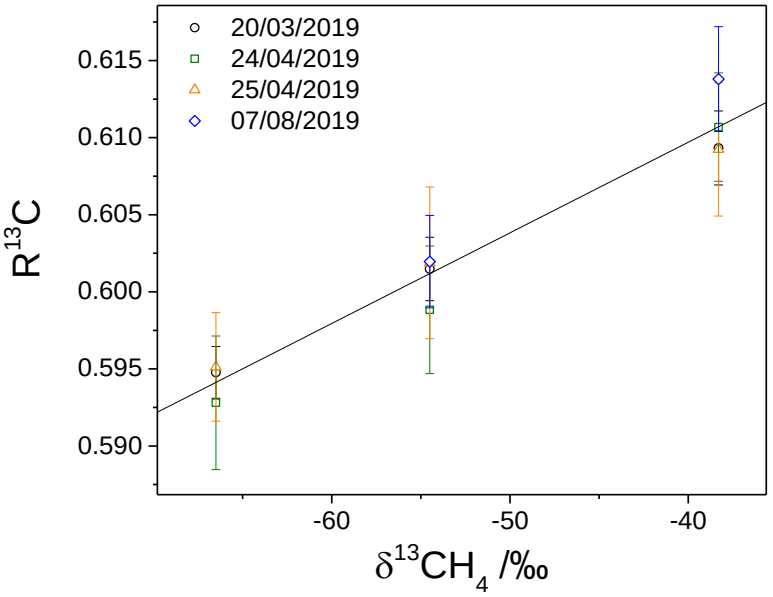


Undergoing publication

Calibration for isotopic composition measurements







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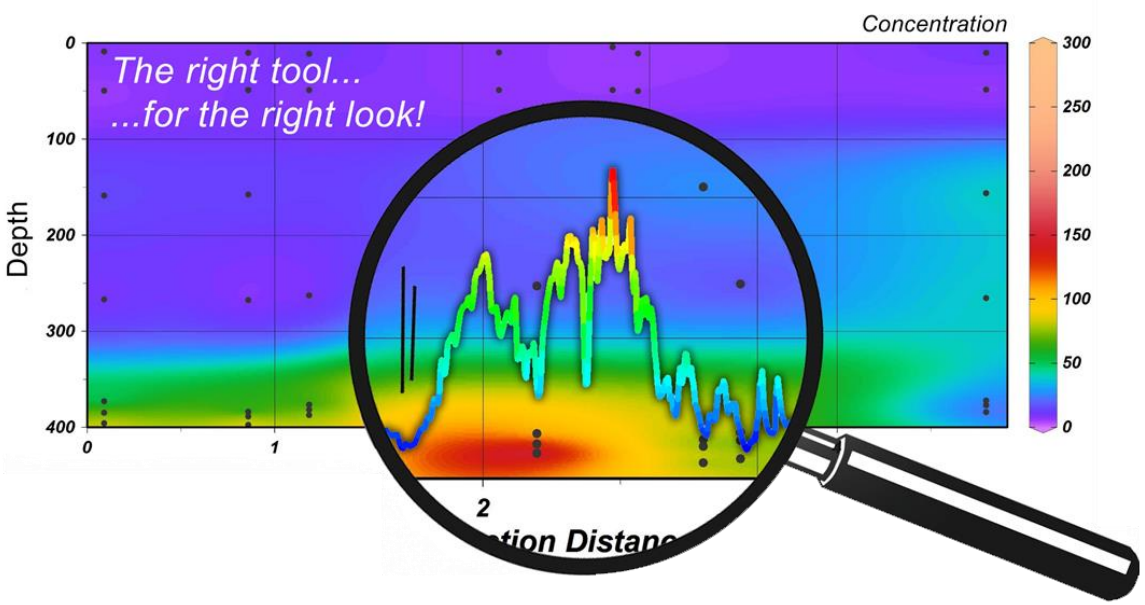
AGENCE NATIONALE DE LA RECHERCHE

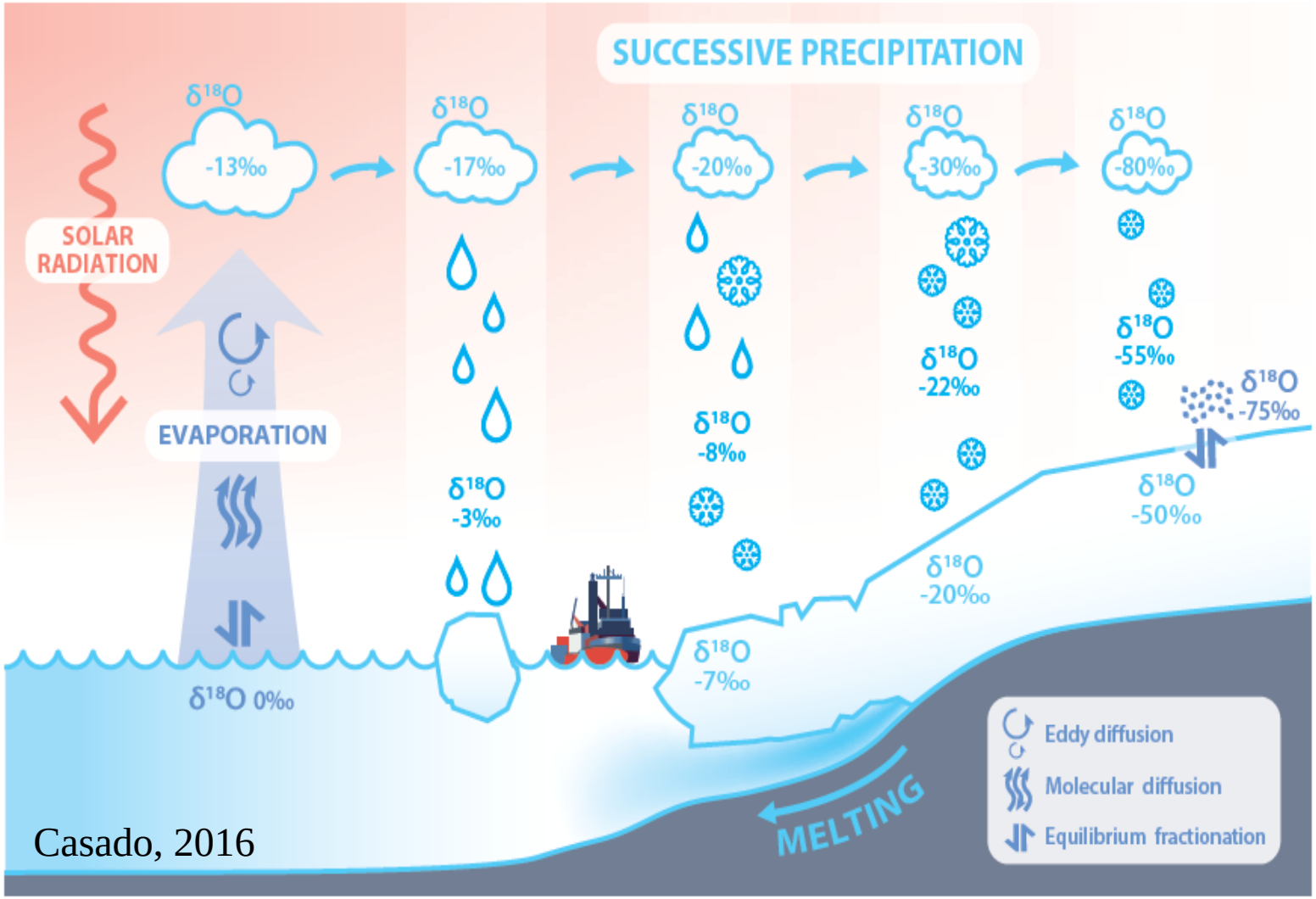
2019-2022

Subsea Water Isotope Sensors

A novel tool for continuous and in-situ analysis

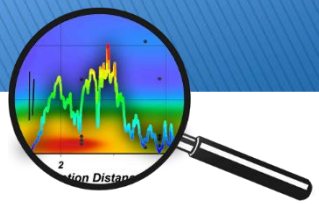


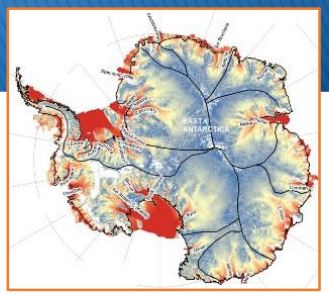
water isotope fractionation

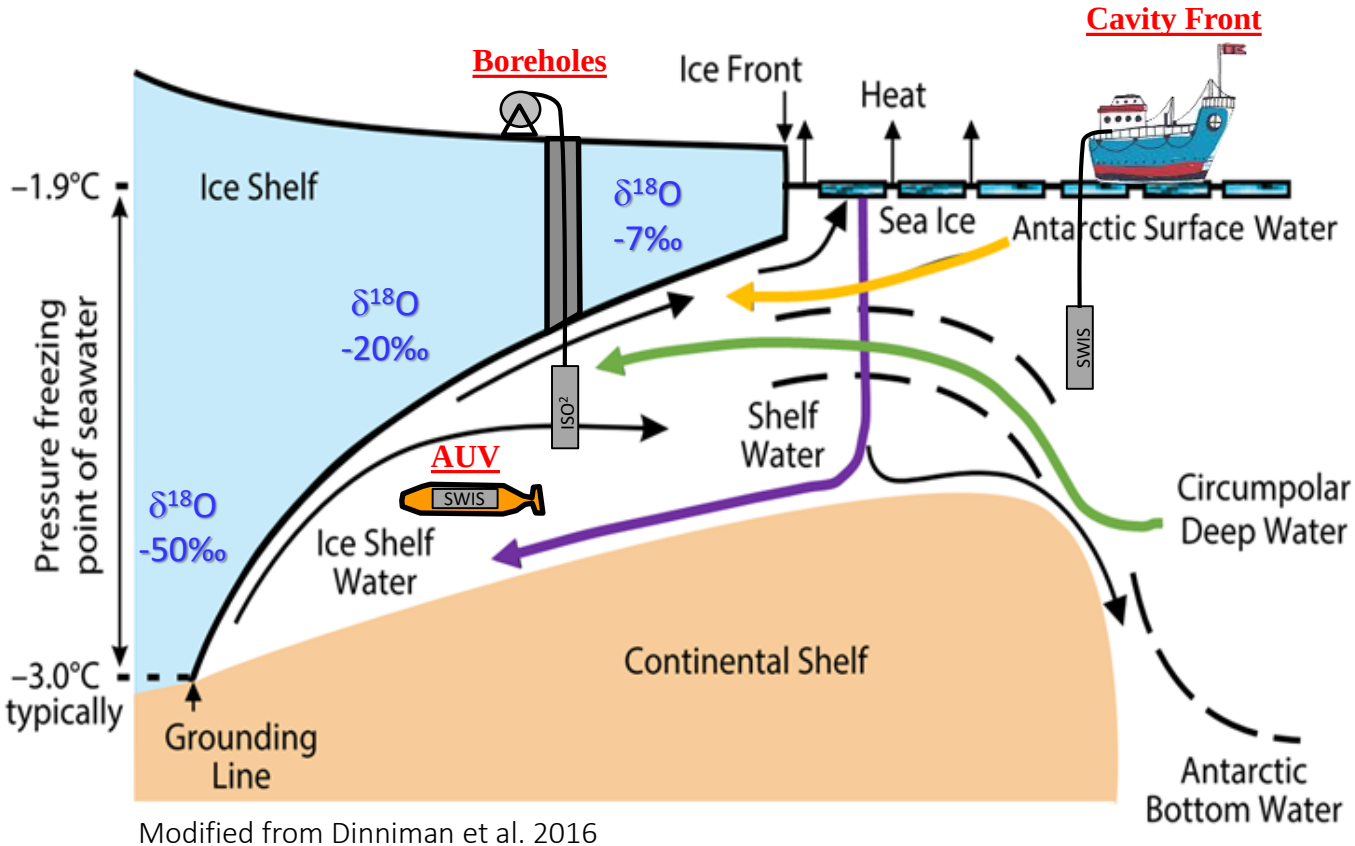


Casado, 2016

Ice Shelf - Ocean Interactions





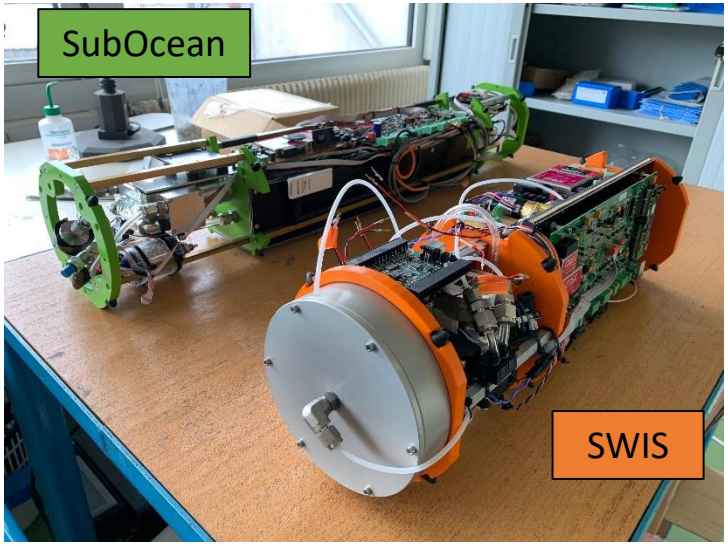


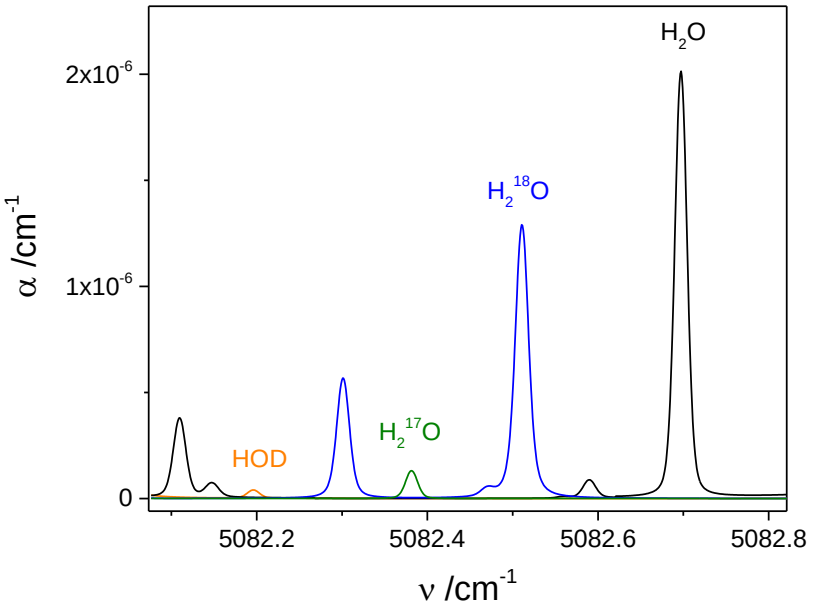
Modified from Dinniman et al. 2016

T, S, O_2, currents
$d^{18}O$, δD

A better tool to distinguish the different processes…

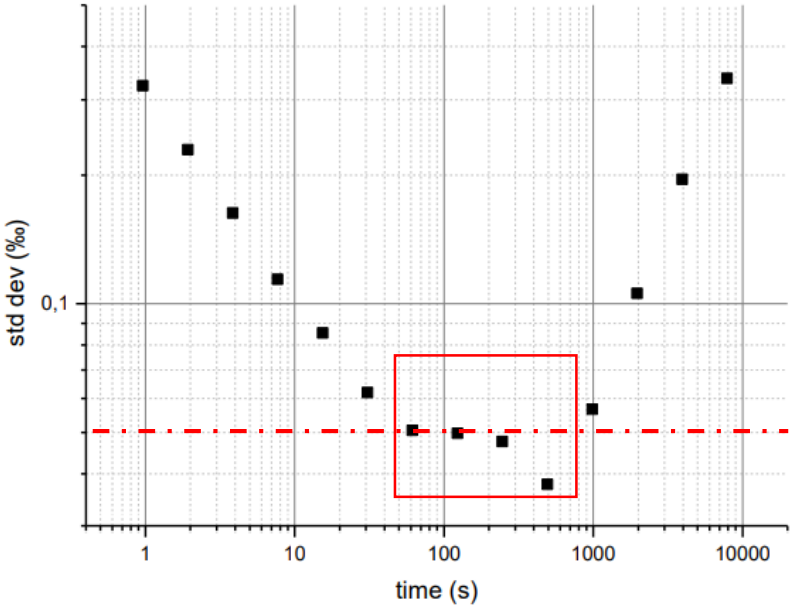
Subsea Water Isotope Sensor



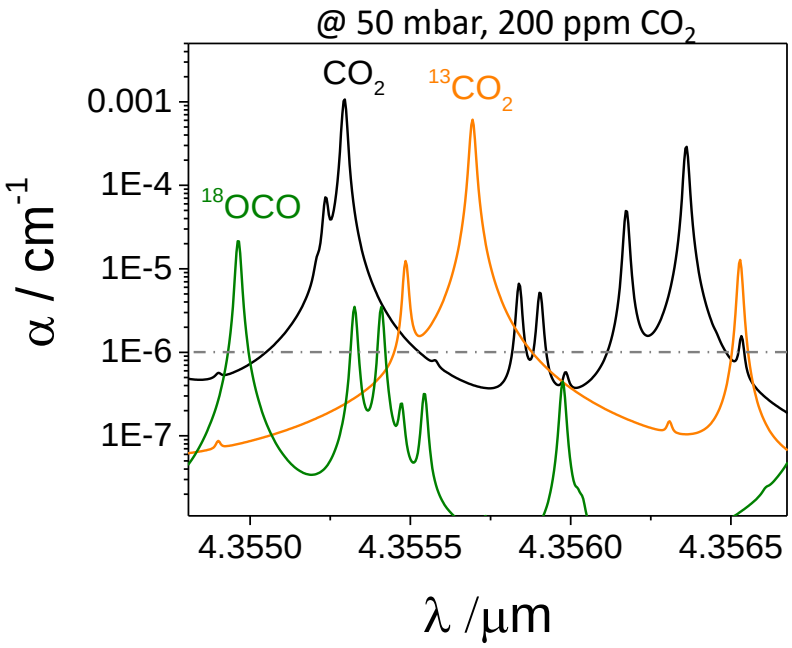


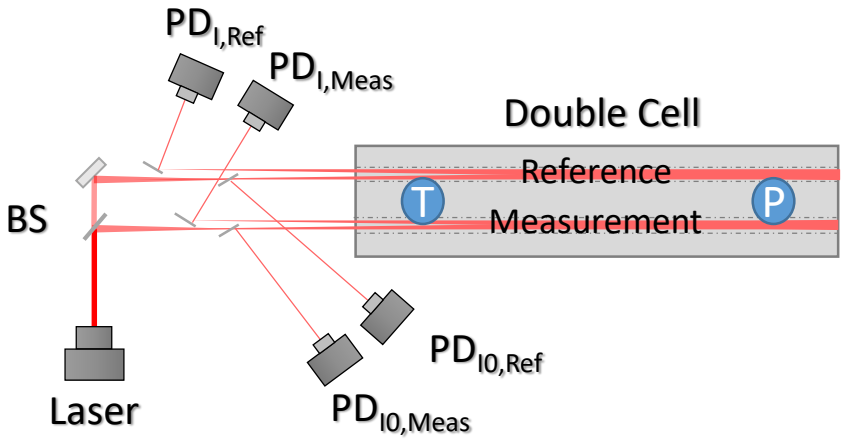
One membrane for vaporise water sample
+ a 2nd membraine for reference water

- ✓ 0.05 ‰ precision on the d18O
- ✓ Stable up to more than 10 min
- ➢ But precision not confirmed yet in the field

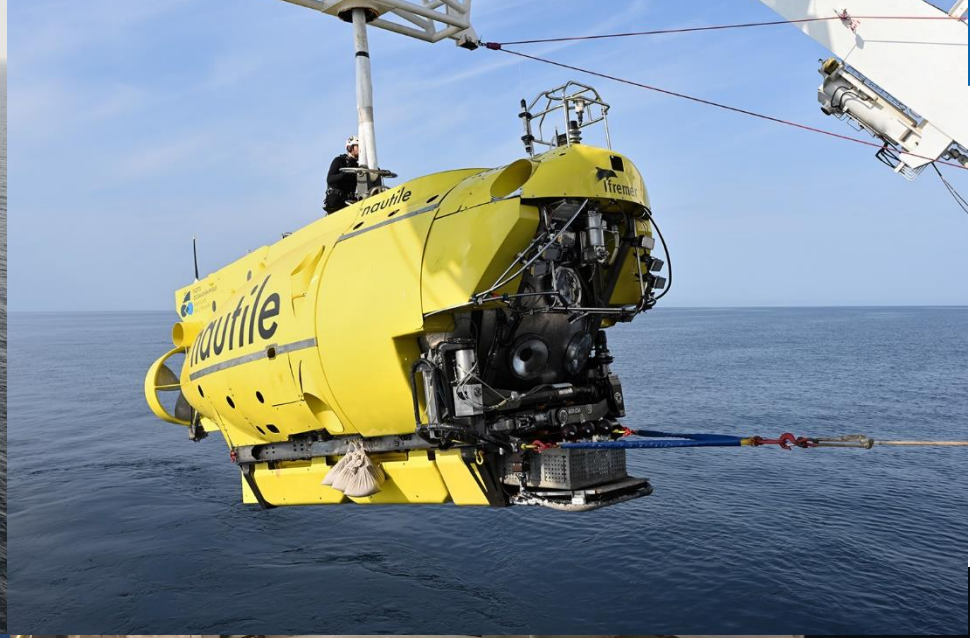


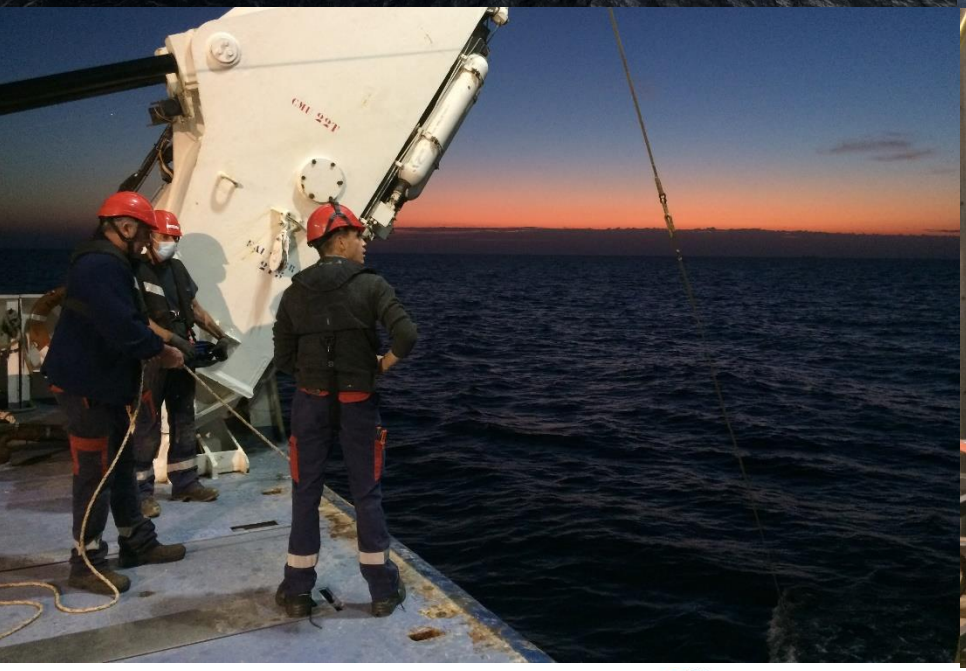
New spectrometer for $\delta^{13}CO_2$ measurements…





- ✓ Possible by direct absorption ! (less problematic with respect to the saturation of the absorption lines)
- ✓ Same spectrometer for ice-core analysis as well as dissolved gas measurements
- ✓ Involved in the Equipex TERRA FORMA for studying the metabolism in aquatic systems.
- ✓ Funded by Labex OSUG





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