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Subsea Water Isotope Sensors: A novel tool for continuous and in-situ analysis

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The isotopic composition of seawater represents an important fingerprint of water masses, containing information about conditions during their formation and evolution. Following the spatial and temporal variability of either δD or $\delta^{18}O$ of water in the ocean will provide a direct link to the freshwater cycle, allowing to discriminate between different water masses, such as the one coming from glacier and sea ice melting, freshwater rivers and precipitations.

Information from physical parameters (e.g. temperature and salinity) are not always enough for identifying the undergoing processes, and current knowledge of water isotopes or noble gases in the ocean remains very poor due to scarcity of measurements obtained from discrete sampling followed by laboratory analysis.

Here we present a novel in-situ Membrane Inlet Laser Spectroscopy (MILS) sensor which is currently under development. The sensor will provide simultaneous and continuous measurements of water isotopes (both δD and $\delta^{18}O$, expected precision of ~0.05‰) and will be adapted for deployment from vessels, through boreholes into the ice shelves, and to be integrated in autonomous underwater vehicles (AUVs). The instrument will run on batteries, with an autonomy of ~12h.

From 2021, the MILS sensor will be ready for field deployments, particular in the Southern Ocean, where high resolution water isotope data inside ice shelf cavities could be coupled with modelling approaches for better understanding the processes at work in ocean - ice shelf interactions, and better constraint the ice melting processes in Antarctica, which remains today a major challenge.