SESSION: Oceans 3 (Chairs: Sarah Fawcett & Susanne Fietz)

MARS Themes:

Oceans and marine ecosystems under global change

Title:

The seasonality and origins of nitrous oxide in the Atlantic sector of the Southern Ocean

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Abstract:

Nitrous oxide (N_2O) is a strong greenhouse gas with a radiative forcing that is ~300 times that of CO_2 and is the largest contributor to stratospheric ozone depletion in the 21st century. However, its oceanic emissions are still poorly constrained. Current estimates of Southern Ocean contributions to total oceanic N_2O flux are ~17%, however, a paucity of data challenges this in addition to a pronounced seasonal variability which has been found to exist. In winter, deep mixed layers expose older, N_2O-rich waters to the atmosphere. In spring, a more stratified ocean may inhibit as much exposure, but in-situ production may occur in certain regions with high phytoplankton productivity. Moreover, seasonal ice melt may act to turn surface waters into a N_2O sink. In both winter and spring 2019 (SCALE) we covered a transect from Cape Town to the Antarctic Marginal Ice Zone (MIZ). We measured N_2O concentrations (and subsequent sea-air fluxes), as well as the bulk isotopes ($\delta^{15}N^{bulk}$-N_2O, $\delta^{18}O$-N_2O) and isotopomers ($\delta^{15}N\alpha$-N_2O and $\delta^{15}N^{\beta}$- N_2O) of N_2O. The primary objectives of this study are twofold: firstly, to unravel the seasonality of N_2O fluxes in the Southern Ocean, providing more precise estimates of its contribution to global emissions. Secondly, through the analysis of isotopic and isotopomer values of N_2O, we aim to shed light on its origins and production mechanisms. Specifically, we seek to discern whether N_2O fluxes are solely a by-product of water mass transportation or if additional in-situ biogeochemical processes exert an influence on its presence in the Southern Ocean.

Format:

Oral presentation

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nitrous oxide; nitrogen cycling; isotopes; biogeochemistry; greenhouse gases