EGU22-101
https://doi.org/10.5194/egusphere-egu22-101
EGU General Assembly 2022

Subtropical contribution to Subantarctic Mode Waters

Bieito Fernández Castro[1], Matthew Mazloff[2], Richard G Williams[3], and Alberto Naveira Garabato[1]
[1]Ocean and Earth Science, National Oceanography Centre, University of Southampton, Southampton, UK
[2]Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA, USA
[3]Department of Earth, Ocean, and Ecological Sciences, School of Environmental Sciences, University of Liverpool, UK

Subantarctic Mode Waters (SAMW), forming in the deep winter mixed layers in the Subantarctic Zone (SAZ) to the north of the Antarctic Circumpolar Current (ACC), connect the ocean thermocline with the atmosphere, contributing to ocean carbon and heat uptake and transporting high-latitude nutrients northward, to fuel primary production at low latitudes. Many aspects of SAMW formation are poorly understood due to the data scarcity during Austral winter. Here, we use biogeochemical Argo float observations to investigate the seasonal development, origin and significance of a subsurface salinity maximum in the SAMW formation regions. This conspicuous feature develops every summer in the seasonal thermocline of the SAMW formation regions as a consequence of the advection along the ACC of warmer and saltier waters from the western boundaries of the subtropical gyres, in particular the Agulhas Return current. The salinity maximum acts as a gatekeeper for SAMW ventilation, since it controls the seasonal evolution of stratification at the base of the mixed layer, modulating its rate of deepening during autumn and winter and re-stratifying the SAMW pool when winter mixing ceases. We also show that the subtropical influx, often overlooked, is key to understand the variability of SAMW properties, since it represents a leading order term in the heat and salt budgets at the formation regions. Finally, the analysis of the nitrate seasonal cycle at the SAMW formation regions as recorded by the Argo floats, revealed that the seasonal salinity increase goes along with a decrease in the concentration of this nutrient, as a consequence of the advection of subtropical waters containing low preformed nitrate. These results suggest that nutrient concentration in SAMW is controlled not only by the rate of upwelling of high-nutrient waters south of the ACC and the degree of biological drawdown during their northward transit, as frequently assumed, but also by the influx of subtropical waters, pointing to previously overlooked feedbacks in the redistribution of nutrients between high and low latitudes.