# Oceanography Seminar

## "Interannual and regional variability in the biogeochemical properties of Subantarctic Mode Water at the time of formation"

*Subantarctic mode waters (SAMW) form from deep winter Southern Ocean mixed layers and transport large amounts of carbon, nutrients, and oxygen to lower latitudes where they fuel primary productivity. Thanks to Argo floats, we now have much more information on the biogeochemical properties of these wintertime mixed layers and find substantial variability in nitrate, carbon, and oxygen concentrations in the different formation regions. In the case of carbon, we find increased concentrations in more recent years in the SAMW formation regions, likely due to the uptake of anthropogenic carbon from the atmosphere.*

**Thursday, March 28, 2024, 3:00p.m., MSB 100**

## Daniela Koenig

Postdoctoral Researcher
Department of Oceanography, University of Hawai'i at Mānoa

During wintertime formation of Subantarctic Mode Water (SAMW) large amounts of carbon, macronutrients, and oxygen subduct from the surface into the ocean interior. These waters subsequently fuel primary productivity in macronutrient-limited regions further north. While shipboard measurements are generally scarce during the winter in polar regions, observations obtained from biogeochemical ARGO floats deployed in the last decade provide a much more comprehensive data set of SAMW biogeochemical properties at the time of formation. When comparing biogeochemical properties with physical characteristics of the deep wintertime mixed layers in the main SAMW regions, we find a robust, inverse correlation with spiciness, whereby spicier SAMW contains less oxygen, nitrate, and dissolved inorganic carbon (DIC). We use this correlation in combination with gridded Argo temperature and salinity to assess variability in SAMW biogeochemistry in time and space. We find that, on average, there is a strong spatial gradient in spiciness from high values in the northwestern Indian SAMW region to low values in the southeastern Pacific, which translates into lower nitrate, oxygen, and DIC concentrations in the Indian compared to the (eastern) Pacific formation region. As the volume of SAMW formed in the different locations varies substantially between different years, this gradient impacts the amount of DIC, nutrients, and oxygen that is subducted

into the ocean interior and later exported equatorward each year. In addition, climate variability drives spiciness anomalies on longer, quasi-decadal timescales, which may correspond to similar shifts in nitrate, oxygen, and carbon concentrations. We also find increasing DIC concentrations, relative to spiciness, in more recent years in these SAMW formation regions, marking the first direct estimate of the increase in anthropogenic carbon of SAMW at the time of formation.

Schedule of upcoming seminars: Thursdays, 3:00pm, MSB 100