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The Seasonality of submesoscale variability in the Antarctic Seasonal Ice Zone

Isabelle Giddy[1,2,3], Sarah Nicholson[3], Marcel Du Plessis[2,3], Andy Thompson[4], and Sebastiaan Swart[2]

[1]Department of Oceanography, University of Cape Town, Cape Town, South Africa
[2]Gothenberg University, Gothenberg, Sweden
[3]Southern Ocean Carbon and Climate Observatory, CSIR, South Africa
[4]Caltech, Pasadena, USA

The ocean surface boundary layer in the Southern Ocean plays a critical role in heat and carbon exchange with the atmosphere. Submesoscale flows have been found to be important in setting mixed layer variability in the Antarctic Circumpolar Current (ACC). However, sparsity in observations, particularly south of the ACC in the Antarctic Seasonal Ice Zone (SIZ) where the horizontal density structure of the mixed layer is influenced by sea ice melt/formation and mesoscale stirring, brings into question the ability of climate models to correctly resolve mixed layer variability. We present novel fine-scale observations of the activity of submesoscale variability in the ice-free Antarctic SIZ using three deployments of underwater gliders over an annual cycle. Salinity-dominated density fronts of O(1)km associated with strong horizontal buoyancy gradients are observed during all deployments. There is evidence that stratifying ageostrophic eddies, energised by salinity driven submesoscale fronts are active across seasons, with intermittent equivalent heat fluxes of the same order to, or greater than local atmospheric forcing. This study highlights the need to consider future changes of Antarctic sea-ice in respect to feedback mechanisms associated with salinity (sea-ice) driven submesoscale flows.