THE UPPER LAYER STRUCTURE AND VARIABILITY OF AN ANTARCTIC GLACIO-MARINE FJORD: *ANDVORD BAY, WESTERN ANTARCTIC PENINSULA*

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ABSTRACT

Glacio-marine fjords on the Western Antarctic Peninsula (WAP) are relatively unstudied, rapidly changing systems of high biological productivity. The goal of this research is to characterize the upper layer physical structure and variability of a representative fjord, Andvord Bay, to determine how it changes in time and space in response to external forcing on seasonal and shorter time scales. To analyze the upper layer of Andvord Bay, CTD (Conductivity/Temperature/Depth) profiles and shipboard thermosalinograph data are used from two cruises in the National Science Foundation (NSF) supported project, Fjord ECO. First, the mixed layer depth (MLD) is determined using two different methods: higher order weighting and vertical differences of density above threshold with different commonly used threshold values. The variability of the upper layer salinity, temperature, density, and MLD are analyzed in relation to changes in space, time, and wind forcing. The threshold method using a threshold value of $\Delta\sigma = 0.03$ kg/m^3 is used to define the MLD, with inaccuracies in detection primarily due to the presence of weakly stratified layers at the surface. In the variability analysis, results show that seasonal heat flux is the largest factor impacting the changes in the upper layer of WAP fjords, although wind forcing does play an occasional role. Geographic influences are less prominent and are only relevant between the inside and outside of the fjord. Understanding the upper layer is an important part of understanding the water column dynamics, the chemical characteristics, and the biological diversity of glacio-marine fjords along the WAP.

Keywords: Fjord, Antarctica, Upper Layer, Physical Oceanography