Using a coordinated glider fleet to investigate drivers of a biological hotspot in the Western Antarctic Peninsula

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Abstract (Oral Presentation)

Gliders have become a standard platform for oceanographic research, however, their relatively slow transit speeds often make it difficult to discern if the changes observed along a transect are due to conditions changing in time or space. We attempted to address this issue by deploying two gliders in a cross pattern, with a third station-keeping glider at their intersection. We then used the differences in the decorrelation time scales of the station-keeping glider and the two transecting gliders to discern spatial differences Palmer Deep Canyon, a submarine canyon along the West Antarctic Peninsula.

This glider fleet was deployed to investigate potential mechanisms that allow for persistent and increased biological activity within the canyon. One possible mechanism that links these canyons to increased biological productivity is the local upwelling of nutrient rich modified Upper Circumpolar Deep Water (mUCDW) to the surface, which supports high phytoplankton stocks, krill, penguins, and whales. The decorrelation time scales were used to determine which mechanisms likely drive differences throughout the canyon above and below the mixed layer, and whether any potential upwelling signal could be attributed to the presence of Palmer Deep Canyon.

We observed a homogeneous surface mixed layer and did not observe a clear upwelling signal in Palmer Deep Canyon. Differences in decorrelation time scales below the mixed layer depth, however, were strongly coherent with canyon bathymetry, suggesting that the canyon has a strong influence structuring this system. Over the deepest parts of the canyon, there was a strong optical backscatter signal below the mixed layer, which may reflect organic particles caught in a sub-surface recirculating eddy over Palmer Deep Canyon. These observations, made possible by the sampling pattern of the glider fleet, suggest a strong imprint of Palmer Deep Canyon on the local oceanography, and possibly the local retention of organic particles. Therefore, the mechanism that supports the biological hotspot may not be local upwelling but could be related to the retention of organic particles. Testing this new hypothesis requires new biological sampling, which can be facilitated by similar glider fleets focused on these canyon regions.