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Università degli Studi di Napoli "Parthenope"

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Topic: Biogeochemistry

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ABSTRACT Subject :

Quantifying Seasonal Particulate Organic Carbon Concentrations and Export Potential in the Southwestern Ross Sea Using Autonomous Gliders

Abstract 10/01/2023 00:09:09

Biogeochemical dynamics of the Ross Sea have been observed for decades, but logistical and environmental constraints have limited the scope and continuity of data, leading to an incomplete understanding of these processes in space and time. However, technological advances, such as autonomous vehicles, have allowed researchers to expand the scope of observation. To assess the temporal biological and hydrographic features of the southwestern Ross Sea, we deployed a glider in a spatially restricted, ice-free area during the austral summer (Dec. 1 – Feb. 6) and quantified from sensor measurements the particulate organic carbon (POC; via particulate backscatter) concentrations, their changes through time, and net community production (NCP; via dissolved O₂ concentrations). The POC levels could be divided into three distinct phases (I, II, and III, respectively) characterized by changes in NCP, surface-layer POC concentrations, remineralization, and export. Surface POC concentrations increased from 215 mg C m⁻³ in early December to a peak of >400 mg C m⁻³ by mid-December, before decreasing to 227 mg C m⁻³ in late January- early February. NCP was highly variable throughout the summer, becoming maximal in mid-December. By constructing a carbon budget, we estimated rates of change of POC and export potential to the mesopelagic in each phase. Changes in euphotic zone POC concentrations and NCP suggested that the system is slightly net autotrophic during the observational period (average NCP is 0.05 g C m⁻² d⁻¹), and POC removal from the top 240 m of the water column averaged 0.22 g C m⁻² d⁻¹. Our data confirm that the southern Ross Sea during the ice-free season is a high productivity, low export system while providing high-resolution POC dynamics that had not been previously observed. Although the Ross Sea is a site of substantial carbon fixation, there remains an incomplete understanding both of the processes involved in export and the rates and controls of remineralization. This study serves as one of the first high resolution surveys of changes in POC, NCP, and export potential to which future glider deployments can be compared.

