SESSION: Oceans 3 (Chairs: Sarah Fawcett & Susanne Fietz)

MARS Themes:

Earth systems observations

Title:

The role of the island mass effect in enhancing productivity and carbon export in the Subantarctic Ocean

Ecosystems, biodiversity and biodiscovery

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Abstract:

The Indian Subantarctic Ocean is host to various island groups that sustain a wide range of marine life. Near these islands, local upwelling, resuspension of shallow basaltic sediments, and terrestrial runoff fertilize surface waters with iron, which is scarce across much of the open Southern Ocean, strongly limiting phytoplankton growth. Primary production and carbon export should thus be enhanced near the islands. To investigate the "island mass effect" (IME) in the Indian Subantarctic, we sampled 22 stations spanning the Subtropical, Subantarctic, and Polar Frontal Zones in late summer during the GEOTRACES SWINGS cruise, measuring net primary production, nitrate and ammonium uptake, and phytoplankton photophysiology and community composition. Since primary production fueled by "new" nitrate (i.e., upwelled from depth) is quantitatively related to carbon drawdown, we could also evaluate carbon export potential. At stations downstream of the islands that appeared iron-replete, nitrate uptake was higher than ammonium uptake, indicating relatively high carbon export potential. By contrast, at the iron-deplete open ocean stations, ammonium uptake rates were higher, indicating that phytoplankton growth was mostly sustained by regenerated nutrients and carbon export potential was reduced. The IME thus does appear to enhance carbon production and export in the Indian Subantarctic Ocean. Across the transect, nanophytoplankton (2.7-10 µm) contributed most to both ammonium and nitrate uptake, while microphytoplankton (≥10 µm) contributed more to nitrate than ammonium uptake, consistent with expectations for this group. Interestingly, our preliminary data indicate that while phytoplankton community composition varied among hydrographic zones, the assemblages were similar at the near-island and open ocean stations within zones even as iron availability changed. This result suggests that the IME caused changes in phytoplankton community function rather than community composition, which drove variations in carbon production and export potential.

Format:

Oral presentation

Keywords: (add ; between keywords)

Island mass effect; primary productivity; nitrogen cycling; carbon export potential; phytoplankton size