Physical and biological controls on phytoplankton blooms in the Amundsen Sea Polynya

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In the Southern Ocean, no region is more productive (per square meter) than the Amundsen Sea Polynya (ASP) [1]. We sought to determine the mechanisms behind the intense phytoplankton blooms with a physical-biogeochemical model (ROMS), with particular focus on the role of the delivery of glacial meltwater to the polynya from adjacent ice sheets, as a part of the NSF-funded INSPIRE project, the successor to ASPIRE (Amundsen Sea Polynya International Research Expedition). We compared model results with observations from the cruise ASPIRE 2010-11, during which the inception and rise of the bloom was well documented. With the model, we can determine how variability in stratification, wind mixing, and lateral iron inputs between potentially delivered with glacial meltwater, can influence the bloom's conditions between different stations. With the model, we observe how these factors influence light and nutrient limitation, timing of the blooms, chlorophyll concentration, primary productivity, and carbon export.

[1] Arrigo, K. R., & Van Dijken, G. L. (2003). Phytoplankton dynamics within 37 Antarctic coastal polynya systems. Journal of Geophysical Research: Oceans, 108(C8).