

## **Melting west Antarctic Ice sheets fuels high biological productivity in the coastal ocean**

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Polynyas of the Amundsen Sea in West Antarctica harbor the highest concentrations of phytoplankton anywhere in the Southern Ocean. At the southern end of Pine Island Bay, circumpolar deep water upwells under the Pine Island Glacier, bringing nutrients (including iron) to the surface and melting the base of the glacier. Concentrations of dissolved iron (DFe) in waters near the Pine Island Glacier and the more westward lying Crosson, Dotson, and Getz Ice Shelves varied between 0.40 and 1.31 nM, depending on the relative magnitude of upwelling, turbulent mixing, and glacial melting. These values represent maximum concentrations since associated ligands (which increase the solubility of Fe in seawater) were saturated with Fe. DFe concentrations were very high compared to what previously has been measured in the Southern Ocean. In the Pine Island Polynya, macronutrients and DFe were consumed by the phytoplankton bloom and concentrations were very low. Atmospheric dust contributed <1% of the Fe necessary to sustain the phytoplankton bloom, while vertical turbulent eddy diffusion from the sediment, sea ice melt, and upwelling contributed 1.0-3.8%, 0.7-2.9%, and 0.4-1.7%, respectively. The largest source was Fe input from the Pine Island Glacier, which satisfied the total Fe demand by the phytoplankton bloom by lateral advection of Fe over a range of 150 km from the glacier. The role of TDFe as a phytoplankton nutrient remains unclear, perhaps representing an important indirect Fe source via dissolution and complexation by dissolved organic ligands.