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Increased ice algae in the water column after melting of sea ice off Vincennes Bay, East Antarctica, during the austral summer

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Several factors (e.g. mixed layer depth, iron, seeding by ice algae into the water column) trigger spatiotemporally heterogeneous phytoplankton blooms in the marginal ice zone (MIZ). However, few studies have addressed the degree to which ice algae contribute to blooms after melting of sea ice. We compared the abundances of ice algae and phytoplankton to estimate the apparent growth of common species. Pack ice and adjacent seawater was sampled off Vincennes Bay in the Indian sector of the Southern Ocean in January 2016 and 2017. Mean ice-algal abundance was approximately six times higher in 2016 (2.9 ± 4.7 × 107 cells/L) versus 2017, although this difference was not significant. Fragilariopsis nana (F. cylindrus smaller than 10 µm) and F. cylindrus were the predominant species in sea ice in both years. We estimated the total abundance of ice-algal cells released into the water column based on the thickness of melted sea ice, as calculated from the vertical profile of the winter mixed layer. Relative to this estimated abundance, total phytoplankton abundance in the seasonal mixed layer was 310% in 2016 and 180% in 2017, indicating that phytoplankton and released ice algae had increased in the water column by the time of observation. Several ice-algal taxa were likely to seed and dominate (> 1% in relative abundance) in the mixed layer. These seeding species were generally common in both years, increasing by 3–1,535%. Remarkable growth was observed in Pseudo-nitzschia prolongatoides and P-n. subcurvata (> 1,200%). The apparent growth (%) of all seeding species, apart from F. nana and F. cylindrus, was higher in 2017, indicating that seeding occurs even when no prominent bloom forms. These results suggest that the abundance of released ice algae and species-specific adaptation to seawater environment are critical factors determining phytoplankton abundance in the MIZ in summer.