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Interannual variability in primary productivity driven by sea-ice phenology in the Amundsen Sea polynyas, not ice shelves melting.

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Ice shelves have been melting, thinning and retreating along the coast of West Antarctica for the past four decades, most notably in the Amundsen Sea sector. This area hosts two highly productive coastal polynyas, the Pine Island polynya and the Amundsen Sea polynya, whose opening triggers two of the largest phytoplankton blooms in the Southern Ocean. Previous work in the area suggests that ice shelf melting and thinning increases the iron content of coastal seawater, which could potentially boost ocean primary productivity locally. In this work, we use historical (1992-2017) remote sensing observations of net primary productivity, sea-ice concentration and rate of ice shelves melting to investigate the strength of this connection for these two large polynyas. We used the Abbot, Cosgrove, Pine Island, Thwaites, Dotson and Getz ice shelves for our analyses. Our initial results suggest no significant trends in net primary productivity though time but a large interannual variability for both polynyas. The basal melt rate and ice thinning seem to not be the main drivers of this interannual variability in these polynyas, but sea-ice coverage variability does seem to play a strong role, potentially allowing increased light availability and stratification. Further investigations of circumpolar deep water inputs and climate modes related to ice shelves melting such as El Niño or the southern annular mode are needed to clarify our findings. Our preliminary study points the complexity of ice-ocean systems, where several co-occurring processes influence coastal primary productivity, with consequences for carbon cycling and the climate system.