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Sea ice thickness and production in Weddell Sea polynyas

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Open-ocean and coastal polynyas, the result of high-latitude atmosphere-ocean circulation interannual variability, alter the local air-ocean heat exchange and sea ice production. Yet, the role of the ocean, especially its thermal flux, is rarely discussed. Here we examine the surface heat budget and sea ice changes during open-ocean and coastal polynya events in the Weddell Sea using satellite retrievals, in-situ observations, and the Japanese 55-year Reanalysis (JRA55). We find that the oceanic heat flux amounts to about 57.5 ± 4 and 39 ± 3 W/m^2 within the 2016 and 2017 polynyas events, respectively; including these values in sea ice thickness parameterizations significantly reduced their biases. Moreover, we compare sea ice mass productions within coastal and open-ocean polynyas using three methods. The results suggest that more ice production, albeit thinner ice thickness, occurs within the open-ocean than the coastal polynya. Finally, we find that wind and air temperature directly play a crucial role in controlling sea ice production in open-ocean polynyas, and indirectly via their impact on the polynya extent for coastal polynyas. The presence of wide open-ocean polynya does appear to reduce this influences on the ice production within the coastal polynya.