Quantifying Chukchi Polynya Occurrence Using Passive Microwave and Local Indigenous Observational Data

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Polynyas are recurring areas where sea ice thins or opens to reveal an ocean-atmosphere interface. They have the potential to affect moisture and heat flux, warming local temperatures, and initiating feedbacks on Arctic atmospheric and oceanographic systems. The Barrow Coastal Polynya and the Chukchi Polynya, found in the Northeastern Chukchi Sea off the Alaskan coast, have widespread implications as they foster the survival of biodiverse marine animals and impact Iñupiat sea ice hunting practices. We develop a database of the timing and spatial extent of the Barrow Coastal Polynya (between Pt. Barrow and Icy Cape, Alaska) and Chukchi Polynya (between Icy Cape and Cape Lisburne) between November 1 and May 31, for the years 2002 through 2019 using 12.5 km resolution satellite passive microwave data from the Japan Aerospace Exploration Agency’ s Advanced Microwave Scanning Radiometer (AMSR-E/AMSR-2) sensors. An automated system identifies polynya events based on annual time series of total water percent over each polynya’ s domain area. Polynya timing and spatial characteristics are verified with sea ice concentration maps, and integrated with local Iñupiat observations from near Utqiagvik, Alaska using the Seasonal Ice Zone Observing Network and Alaska Arctic Observatory & Knowledge Hub. This database of polynya events reveals inter-annual variability in the timing and frequency of both polynyas in response to synoptic scale wind forcing. Between 2002 and 2019 the Chukchi Polynya has typically opened more frequently, but with lower total water coverage than the Barrow Coastal Polynya. Comparing passive microwave-derived polynya identifications to local observations of polynya indicators reveal that these two datasets should be used in tandem to thoroughly characterize the polynyas. By accurately quantifying these polynya events, we lay the groundwork to understand the impacts of coastal polynyas on regional wintertime atmospheric moisture and heat flux.

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