Increased Arctic Ocean sea ice loss through the Canadian Arctic Archipelago under a warmer climate

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The ice arches that ring the northern Canadian Arctic Archipelago have historically blocked the inflow of Arctic Ocean sea ice for the majority of the year. However, annual average air temperature in northern Canada has increased by more than 2°C over the past 65+ years and a warmer climate is expected to contribute to the deterioration of these ice arches, which in turn has implications for the overall loss of Arctic Ocean sea ice. We investigated the effect of warming on the Arctic Ocean ice area flux into the Canadian Arctic Archipelago using a 22-year record (1997-2018) of ice exchange derived from RADARSAT-1 and RADARSAT-2 imagery. Results indicated that there has been a significant increase in the amount of Arctic Ocean sea ice \(10^3 \text{ km}^2/\text{year}\) entering the northern Canadian Arctic Archipelago over the period of 1997-2018. The increased Arctic Ocean ice area flux was associated with reduced ice arch duration but also with faster (thinner) moving ice and more southern latitude open water leeway as a result of the Canadian Arctic Archipelago’s long-term transition to a younger and thinner ice regime. Remarkably, in 2016, the Arctic Ocean ice area flux into the Canadian Arctic Archipelago \(161\times10^3 \text{ km}^2\) was 7 times greater than the 1997-2018 average \(23\times10^3 \text{ km}^2\) and almost double the 2007 ice area flux into Nares Strait \(87\times10^3 \text{ km}^2\). Indeed, Nares Strait is known to be an important pathway for Arctic Ocean ice loss however, the results of this study suggest that with continued warming, the Canadian Arctic Archipelago may also become a large contributor to Arctic Ocean ice loss.