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The Role of Sea Ice Extent in High Latitude Greenhouse Gas Exchange

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The extensive loss of sea ice extent and alterations in the greenhouse gas exchange of the Arctic are commonly portrayed as instances where the impact of global warming is most pronounced. The impact of global warming is more apparent in the Arctic, since the temperature increase at high latitudes is amplified compared to lower latitudes. Although many previous studies on polar amplification focused on the underlying causes, including the contribution of the sea ice albedo feedback, the effect of the disappearing sea ice extent has a farther reach than warming alone. For example, changes in sea ice extent have also been connected to an increase in atmospheric moisture, which in theory could lead to more precipitation. Both temperature and precipitation have the potential to influence the exchange of CO_2 and methane in the terrestrial realm around the Arctic. At the same time in the marine environment, biotic and abiotic processes are altering the air to sea exchange of CO_2 in response to the lower sea ice extent and warmer ocean temperatures. It has also been suggested that the warming of ocean waters will influence emissions from marine sediments, for example from methane hydrates. However, the impact of the lower sea ice-extent on the future of high latitude greenhouse gas exchange remains unclear, since a lack of circumpolar measurements makes it difficult to draw conclusive connections. In this study, we aim to gather our knowledge on the connections between sea ice extent and arctic greenhouse gas exchange both in the terrestrial and marine systems, to more accurately predict the future state of greenhouse gas exchange in an increasingly seasonally sea ice-free Arctic.