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Observing the Cloud Response to Arctic Sea Ice Loss

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Observed sea ice loss since 1979 is the most visible signal of anthropogenic Arctic warming. While the influence of clouds on Arctic sea ice is known, the influence of sea ice loss on Arctic clouds is challenging to detect and has never been isolated. Here, we use 8 years (2008 - 2015) of spaceborne lidar observations from the CALIPSO satellite to isolate the cloud response to sea ice loss from cloud changes due to atmospheric circulation. We focus on the liquid cloud response to observed sea ice loss because liquid-containing clouds are the most important cloud type for sea ice melt and growth. There is no observed change in liquid clouds in response to sea ice loss during summer. The absence of a summer cloud response indicates that a summer cloud-sea ice feedback cannot be relied upon to slow the rate of sea ice loss. In contrast, we find more liquid clouds over open water than over sea ice during fall. Thus, human-caused sea ice loss is increasing fall clouds over the Arctic Ocean. Since we robustly isolate the cloud response to sea ice loss, we can for the first time attribute an Arctic cloud change to human activities.