# What Causes the Low-Level Cloud Increase from April to May Over the Arctic?

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## Introduction

- Knowing how Arctic clouds change throughout the year is crucial for understanding their impact on Arctic amplification.
- Understanding the spatial and vertical extent of Arctic clouds in May is very important, as May marks the onset of the melt season.
- Research suggests a link between enhanced Arctic cloud cover and sea ice loss in the fall (Kay et al., 2016). Does a similar relationship exist in the spring?

## Methods

- This research focused on analyzing average variations in Arctic cloud cover from April to May and searching for changes in corresponding cloud-controlling factors
- Arctic cloud data from 2006 to 2019 was collected from the 3S-GEOPROF-COMB product created by Bertrand et al. (2024). This globally gridded data product contains cloud vertical structure data from the CloudSat radar and CALIPSO lidar. Together, this monthly dataset provides a comprehensive climatology that is perfect for visualizing patterns in Arctic clouds that emerge throughout the year.
- Arctic sea ice data (Figure 3a) is from the National Snow and Ice Data Center (Meier et al., 2021).
- Mean low-level stability, precipitable water, MSLP, geopotential height, and wind speed and direction data is from NOAA Physical Sciences Laboratory, website at https://psl.noaa.gov.

## Acknowledgements

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## Results

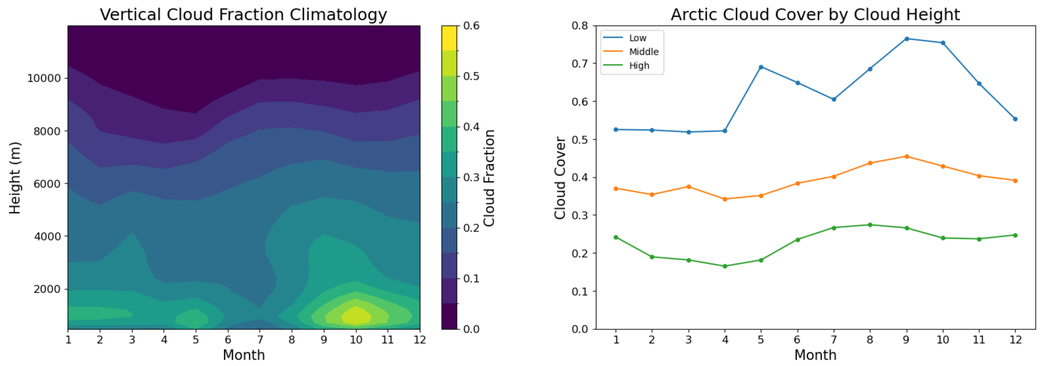



**Figure 1:** The figure on the left shows a vertical profile of the cloud fraction throughout the year from 360m to 12km over the Arctic (70-82N). The figure on the right shows the Arctic cloud cover throughout the year as a function of cloud height, where 'low' indicates a cloud base below 3.2km, 'middle' indicates a cloud base between 3.2km and 6.6km, and 'high' indicates a base above 6.6km.

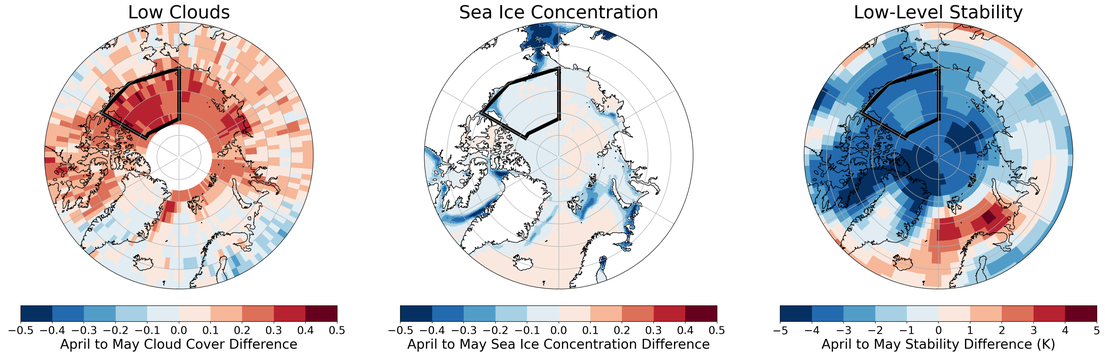



**Figure 2:** The map on the left shows the difference in low cloud cover between April and May. The central figure shows the May minus April difference in sea ice concentration. The figure on the right portrays the difference in low-level stability between the two months, which is represented by the potential temperature difference between 700 hPa and 1000 hPa. The black box outlines the area with the most significant low cloud cover increase.

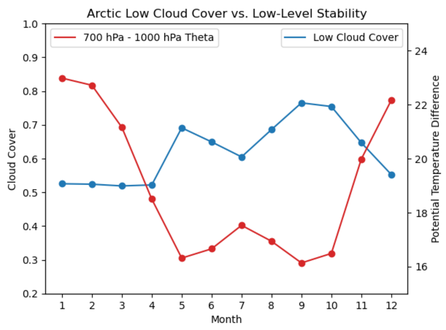



**Figure 3:** The figure illustrates the variation in low cloud cover and low-level stability throughout the year across the Arctic.

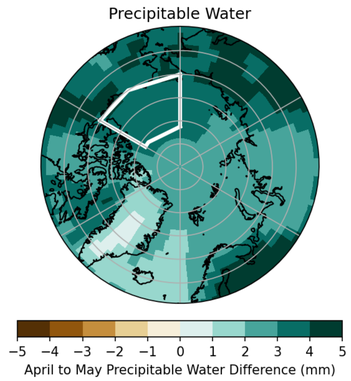



**Figure 4:** The figure shows the May minus April difference in precipitable water values. The white box outlines the area with the greatest low cloud cover increase.

## Conclusion

- There is a notable increase in low cloud cover from April to May throughout the Arctic Ocean, which coincides with a decrease in low-level stability. This May cloud blip is not correlated with sea ice unlike in early autumn. Throughout the year, there is a negative correlation between low cloud cover and low-level stability in the Arctic.
- From April to May, the Beaufort High shifts eastward and weakens, decreasing subsidence over the Beaufort Sea. A low-level southerly wind reversal over Canada and the Arctic Ocean likely results in enhanced low-level moisture advection during May.

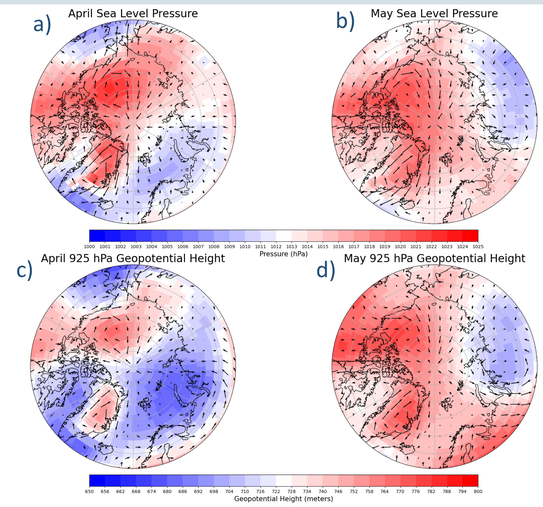



**Figure 5:** Figures a) and b) show the mean sea level pressure for April and May, respectively. Figures c) and d) display the 925 hPa geopotential height. The arrows indicate the wind speed and direction at 1000 hPa for a) and b), and at 925 hPa for c) and d).

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