EGU2020-1735
https://doi.org/10.5194/egusphere-egu2020-1735
EGU General Assembly 2020

Seasonal Variations of Arctic Low□Level Clouds and Its Linkage to Sea Ice Seasonal Variations

Yueyue Yu[1], Patrick Taylor[2], and Ming Cai[3]
[1]School of Atmospheric Sciences, Nanjing University of Information Science and Technology, Nanjing, Jiangsu, China (yuyy@nuist.edu.cn)
[2]NASA Langley Research Center, Climate Science Branch, Hampton, Virginia, USA
[3]Department of Earth, Ocean & Atmospheric Sciences, Florida State University, Tallahassee, Florida, USA

Using CALIPSO□CloudSat□Clouds and the Earth's Radiant Energy System (CERES)□Moderate Resolution Imaging Spectrometer (MODIS) (C3M) dataset, this study documents the seasonal variation of sea ice, cloud, and atmospheric properties in the Arctic (70°N–82°N) for 2007–2010. A surface type stratification—consisting Permanent Ocean, Land, Permanent Ice, and Transient Sea Ice—is used to investigate the influence of surface type on low-level Arctic cloud liquid water path (LWP) seasonality. The results show significant variations in the Arctic low-level cloud LWP by surface type linked to differences in thermodynamic state. Subdividing the Transient Ice region (seasonal sea ice zone) by melt/freeze season onset dates reveals a complex influence of sea ice variations on low cloud LWP seasonality. We find that lower tropospheric stability (LTS) is the primary factor affecting the seasonality of cloud LWP. Our results suggest that variations in sea ice melt/freeze onset have a significant influence on the seasonality of low-level cloud LWP by modulating the lower tropospheric thermal structure and not by modifying the surface evaporation rate in late spring and mid-summer. We find no significant dependence of the May low-level cloud LWP peak on the melt/freeze onset dates, whereas and September/October low-level cloud LWP maximum shifts later in the season for earlier melt/later freeze onset regions. The Arctic low cloud LWP seasonality is controlled by several surface-atmosphere interaction processes; the importance of each varies seasonally due to the thermodynamic properties of sea ice. Our results demonstrate that when analyzing Arctic cloud-sea ice interactions, a seasonal perspective is critical.