ARM

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ATMOSPHERIC RADIATION MEASUREMENT

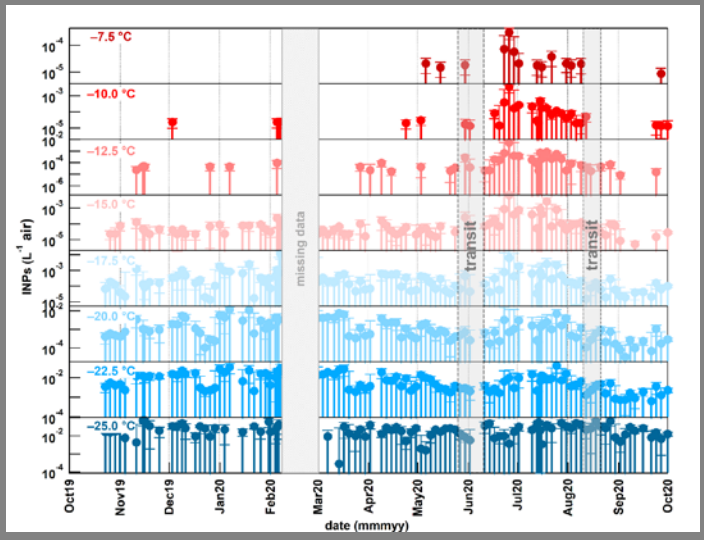
U.S. DEPARTMENT OF ENERGY

Data Reveal Seasonal Atmospheric Processes in the Central Arctic

Ice-nucleating particles (INPs), which seed the formation of ice in clouds, are key players in climate change. But little is known about the effects of INPs in the Arctic, the world's fastest-warming region.

As part of the 2019–2020 Multidisciplinary Drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition, scientists aimed to report never-before-seen observations of INPs in the central Arctic. They collected the data necessary to determine where INPs in the region come from and how they might affect the clouds that form during different seasons. A June 2022 paper in *Nature Communications*, led by ARM INP co-mentor Jessie Creamean, describes the observations.

Researchers found that INPs are strongly seasonal, with lower concentrations in the winter, spring, and fall coming from lower latitudes. The biology associated with melt leads to greater INP concentrations in the summer.



Analyzing data from the MOSAiC expedition, scientists noted a difference in ice-nucleating particle concentration scales between different temperatures. Error bars represent standard deviation. (*Copyrighted image from the journal***.)**

Reference

Creamean J, K Barry, T Hill, C Hume, P DeMott, M Shupe, S Dahlke, S Willmes, J Schmale, I Beck, C Hoppe, A Fong, E Chamberlain, J Bowman, R Scharien, and O Persson. 2022. "Annual cycle observations of aerosols capable of ice formation in central Arctic clouds." *Nature Communications* 13:3537, https://doi.org/10.1038/s41467-022-31182-x.

Cloud-Land Coupling Examined at Southern Great Plains Observatory

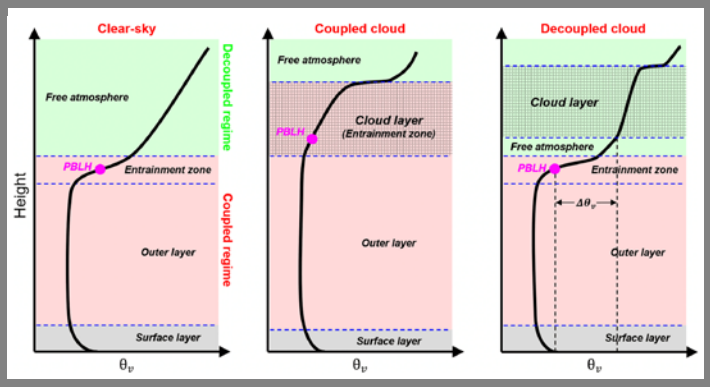
Connections between the surface and clouds are important for understanding how clouds develop. Most previous work on these connections has centered on oceans rather than land. Data from ARM's Southern Great Plains atmospheric observatory allowed researchers to study the coupling between clouds and land.

In research published by *Atmospheric Chemistry and Physics* in January 2022, scientists simultaneously measured the planetary boundary-layer height and coupled states under cloudy conditions. A lidar-based method developed by the researchers relies on the planetary boundary-layer height, lifted condensation level (the altitude at which a moist but unsaturated air parcel becomes saturated), and cloud base height to identify cloud coupling.

As coupled and decoupled clouds have distinct features, the new method offers an advanced tool to separately investigate them. Researchers generated a 20-year climatology by using the method.

Reference

Su T, Y Zheng, and Z Li. 2022. "Methodology to determine the coupling of continental clouds with surface and boundary layer height under cloudy conditions from lidar and meteorological data." *Atmospheric Chemistry and Physics* 22(2):1453-1466, https://doi.org/10.5194/acp-22-1453-2022.



Analyzing data from the MOSAiC expedition, scientists noted a difference in ice-nucleating particle concentration scales between different temperatures. Error bars represent standard deviation. (*Copyrighted image from the journal***.)**