

Publication

Snowfall in Northern Finland derives mostly from ice clouds

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Clouds and precipitation play a critical role in the Earth's water cycle and energy budget. We present ground-level observations of snowfall coinciding with radiosonde launches in Sodankyla, Finland (67.367 degrees N, 26.629 degrees E) through a period of 8 cold months (October-April) in 2019 and 2020. They comprise 7401 depositing snow particles detected by a snowflake camera and 468 radiosonde profiles. Our results show that precipitating clouds were extending from ground to at least 2.7 km in altitude. Approximately one-quarter of them were mixed phase and the rest were likely fully glaciated. Estimations of the cloud top temperatures indicate that in roughly half of the snowfall events, ice might have been initiated through heterogeneous freezing. For such cases, the predicted ice-nucleating particle concentrations active at cloud top temperatures could explain the analysed ice crystal particle concentrations observed near ground in approximately one- to two-thirds of the cases. For the rest, ice multiplication was likely active. In a warmer climate, the relative proportion of solid to liquid cloud particles will probably decrease, with implications on the radiation balance.

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