

High Spectral Resolution Lidar Observations of Diamond Dust Layers in Eureka, Canada.

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Surface-based ice crystal layers, also referred to as diamond dust layers, occur frequently during the dark season in the Canadian High Arctic. They form under cold winter conditions (temperatures below 260K) in the stable boundary layer. With an average height of 400m, as calculated from a data set spanning the winter months of 2006, they are typically decoupled from higher cloud features, but can also be capped by a thin layer of supercooled water. In the present work, diamond dust layers are observed with the University of Wisconsin Arctic High Spectral Resolution Lidar (AHSRL) based in Eureka (79.99N, 86.93W), in the Nunavut Territory. The different ice crystal layers are characterized in terms of backscatter cross section and depolarization ratio. Large variability in linear depolarization ratio within single or multiple diamond dust events is observed. Possible causes are variations in particle size, particle shape and orientation, and the presence of aerosols and/or liquid water within the diamond dust layer's volume. The latter possibility is investigated as part of the Canadian Network for the Detection of Atmospheric Change (CANDAC). We expect the results to improve the understanding of diamond dust formation processes and physical structure. These have numerous implications for boundary layer processes, such as radiative transfer, moisture exchanges and pollution events.