Tool Development for Analysis of Boundary Layer Characteristics Using LiDAR

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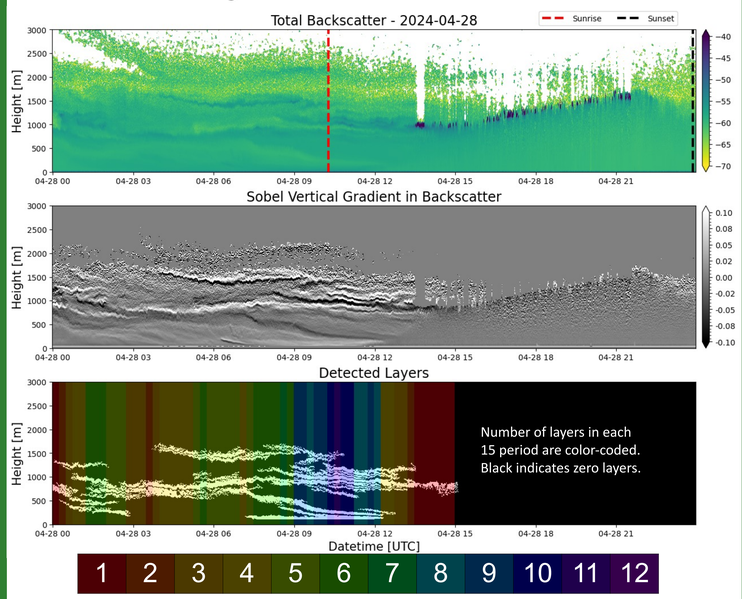
Motivation

The atmospheric boundary layer is directly influenced by its contact with the Earth's surface. Mechanical interactions from friction of the wind against the surface and thermal interactions from variations in temperatures in the horizontal and vertical influence the transport of moisture from the surface up into clouds. The characteristics of the boundary layer are a primary control on the formation and dissipation of low clouds.

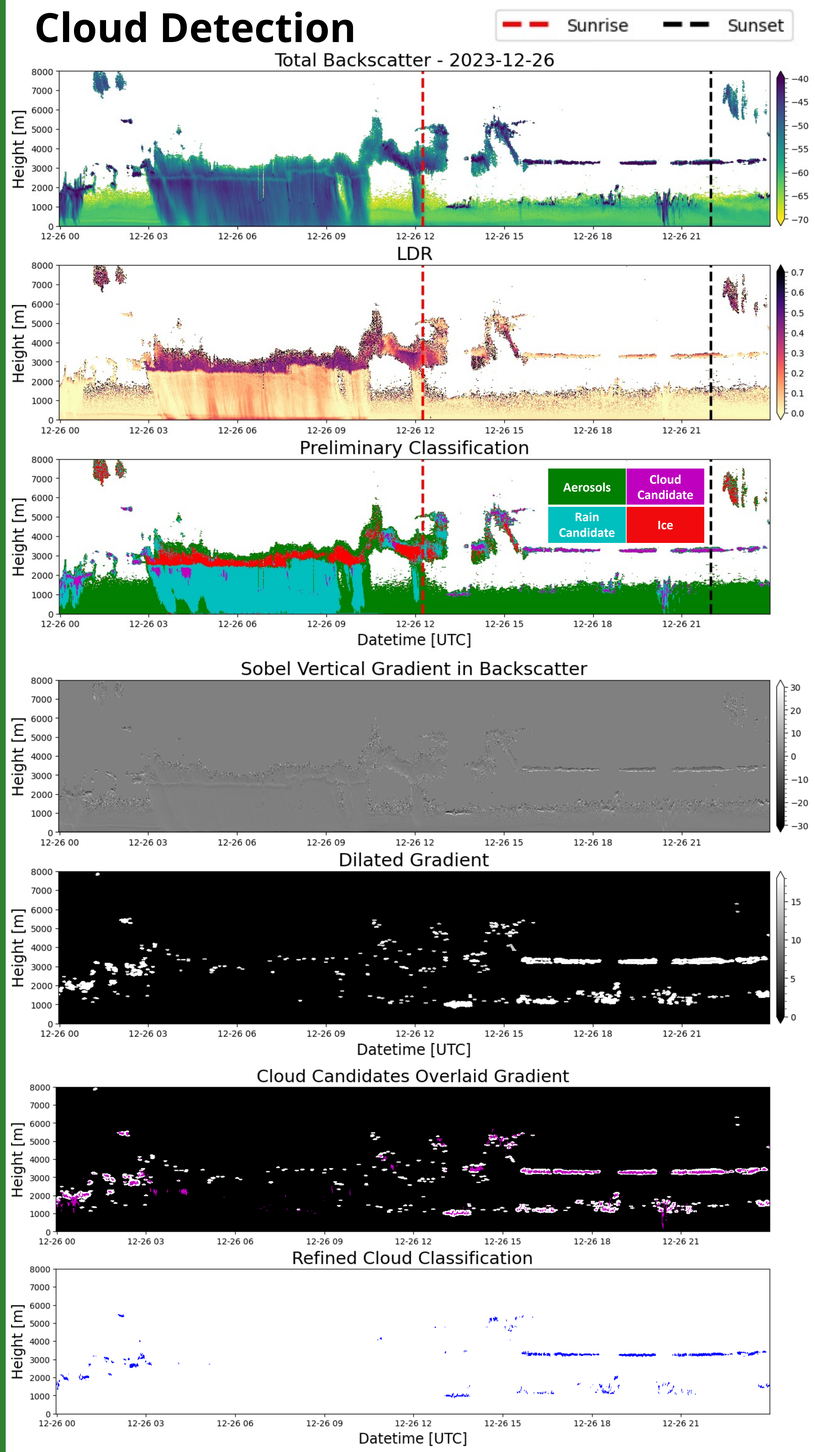
Data and Methods

Lidars use backscatter and linear depolarization ratio (LDR) to observe aerosols as well as cloud ice and liquid particles, and light precipitation. We use time-height data from a Vaisala CL61 911 nm wavelength ceilometer located at a field site in Plymouth, NC near the Atlantic coast. We combine pixel-by-pixel classification methods with image processing techniques to 1) identify periods with aerosol layering associated with strong stability and 2) refine the identification of clouds to remove misclassified pixels. The work shown here focuses on periods without heavy precipitation.

Aerosol Layer Detection



Cloud Detection



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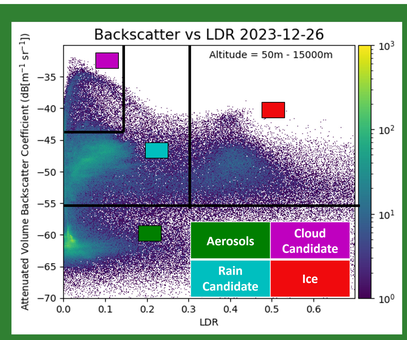

Future Work

Refine the tools and use them on multiple months of data to examine relationships among low level cloud properties and stable versus mixed periods across varied weather conditions. Add information from surface-based radiation sensors.

Examples of Combined Result