Boundary layer heights from Doppler lidar using aerosol backscatter and wind data

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What is our demand for a today's BLH detection method?

- Reliability
- Objective determination
- High spatial and temporal resolution
- Operationalization and robustness

Doppler lidar gives the opportunity combining an high resolution aerosol measurement with a turbulence measurement
BLH Determination using aerosol backscatter

Threshold method  |  Min. gradient  |  Fit to an idealized profile  |  Wavelet analysis

Aerosol backscatter signal (not calibrated, arbitrary units)

Dilation (m)
BLH Determination using vertical velocity variance

Max. variance

Threshold method

Fit to an idealized profile

measured variance, error due to uncorrelated noise, variance, error due to limited time interval
Comparison methods within one concept

Threshold method

Min. gradient

Fit to an idealized profile

Wavelet analysis
Comparison methods among the two concepts
Comparison methods among the two concepts

Morning transition

During the day

Evening transition
Going a step further – an example of use

Small-scale BLH variations and their correlation with the current vertical wind field

![Diagram showing aerosol backscatter and vertical wind velocity over height and length using Taylor's hypothesis.](image)
So what is the boundary layer height?

So what is the boundary layer height?

The figure illustrates the boundary layer height (BLH) using aerosol backscatter and vertical wind velocity data. The upper graph shows the aerosol backscatter with time (UTC) plotted on the x-axis, height (m a.g.l.) on the y-axis. The lower graph displays the vertical wind velocity, again with time (UTC) on the x-axis and height (m a.g.l.) on the y-axis. The data appears to show variations in the BLH over time, influenced by changes in atmospheric conditions.