Vaisala CEILOMETER – CL61

An Advanced Doppler Lidar System for Atmospheric Profiling

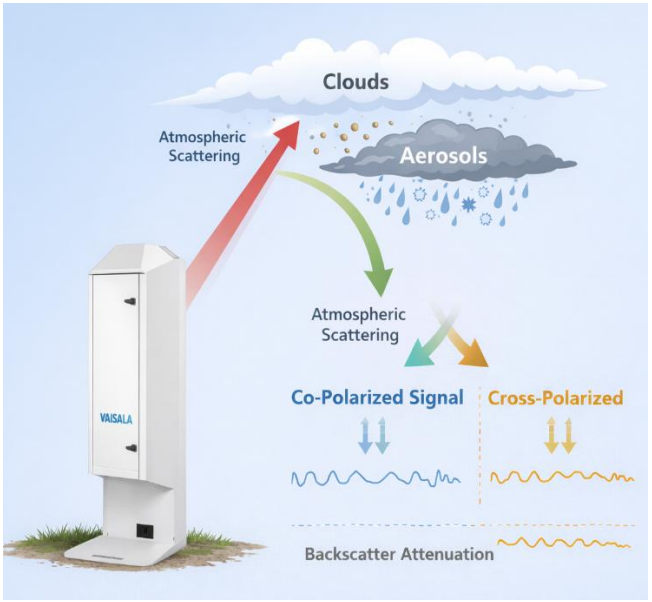
INTRODUCTION:

The **Vaisala Ceilometer CL61** is a high-performance, lidar-based atmospheric profiling instrument designed to continuously measure cloud base heights, aerosol backscatter profiles, depolarization ratio, vertical visibility, and boundary layer structures. The system operates using a **near-infrared diode laser at 910.55 nm** and supports **dual-polarization measurements.**

Its depolarization capability allows improved discrimination between spherical and non-spherical particles, enabling enhanced aerosol and hydrometeor characterization.

The instrument is widely used in **operational meteorology, aviation weather services, climate monitoring, air-quality studies, and boundary layer research**, as well as for validation of satellite products and numerical weather prediction models.

FLOW DAIGRAM:



OBJECTIVES:

- Determination of cloud base heights and multiple cloud layers.
- Continuous profiling of atmospheric aerosols.
- Measurement of attenuated backscatter profiles.
- Estimation of depolarization ratio for aerosol and hydrometeor classification.
- Assessment of vertical visibility and sky condition.
- Monitoring fog, precipitation, and boundary layer evolution.

DATA OUTPUT:

- Attenuated backscatter coefficient profiles.
- Co-polarized and cross-polarized signal profiles (Depolarization ratio profiles).
- Cloud base height (CBH) up to 5 layers.
- Aerosol layer heights.
- Vertical visibility (VV).
- Planetary boundary layer (PBL) height

KEY FEATURES:

- High vertical resolution (~4.8 m) with fast temporal sampling.
- Dual-polarization measurement for aerosol and hydrometeor classification.
- Reliable performance in extreme weather conditions.
- Automatic window blower and heater system.
- Compact, rugged design for long-term field deployment.

KEY SPECIFICATIONS:

- Measuring Range: 0 – 15.4 km
- Vertical Resolution: ~4.8 m
- Measurement Interval: 5 s
- Laser Source: Near-infrared diode laser, 910.55 nm
- Polarization Channels: Co-polarized and cross-polarized
- Data Format: NetCDF
- Operating Temperature: –50 °C to +55 °C
- Environmental Protection: IP66 / NEMA 4X
- Laser Safety Class: Eye-safe (Class 1)

MEASUREMENT AND WORKING PRINCIPLE:

The Vaisala CL61 operates on the lidar (Light Detection and Ranging) principle. Short laser pulses are emitted vertically into the atmosphere from the instrument. When these pulses encounter atmospheric constituents such as aerosols, cloud droplets, ice crystals, or precipitation particles, a portion of the light is scattered back toward the instrument.

The returned signal is separated into co-polarized and cross-polarized components. The co-polarized signal represents scattering from spherical particles, while the cross-polarized signal indicates non-spherical particles such as ice crystals or dust. The ratio of these signals provides the depolarization ratio, which is used for particle type discrimination.

The time delay between emission and reception of the backscattered signal is used to calculate the height of scattering layers. Signal attenuation with height is analyzed to derive cloud bases, aerosol layers, and boundary layer structures.

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