Lufft

Lufft Ceilometer Series
CHM 15k and CHM 8k

Meteorology Division of OTT HydroMet

Lufft Ceilometers
CHM Series

A ceilometer is a device which uses a laser or other light source to determine the height of a cloud ceiling or cloud base. Ceilometers can also be used to measure the aerosol concentration within the atmosphere. When based on laser, it is a variant of atmospheric lidars (light detection and ranging) which send short laser pulses into the atmosphere and measure the backscattering of molecules and aerosols. From the backscatter signal, such ceilometers determine cloud bases and aerosol layer heights.

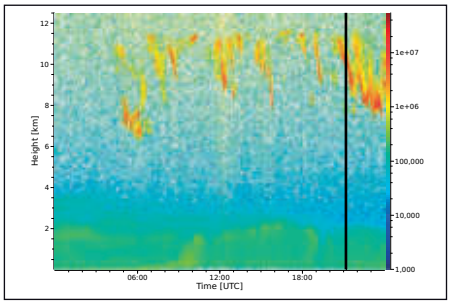
Using the single-wavelength, backscatter Lidar technology, Lufft ceilometers deliver cloud base heights, cloud penetration depths, aerosol layer heights like the boundary layer, vertical visibility, and the sky condition index.

They have a double-walled housing combined with an integrated fan and automatic heating system and provide reliable protection against misting, precipitation, freezing or overheating. They deliver exact results due to high sensitivity. Reliable and accurate results at any time of the day or night are ensured by the use of long-life laser sources, filters with narrow bandwidth and highly sensitive photo-detectors. The CHM 8k and the CHM 15k are equipped with an integrated controller offering a fully embedded real-time calculation of all target parameters. Moreover, Lufft offers comfortable user web interfaces for data monitoring.

The CHM 8k is the new ceilometer from Lufft and has a measuring range from 0 m to 10 km (0 to 32,808 ft) and a cloud detection range from 5 m to 8 km (16 to 26,246 ft). The tried-and-tested Lufft CHM 15k has a measuring range of 15 km (49,212 ft).

Measurement Examples

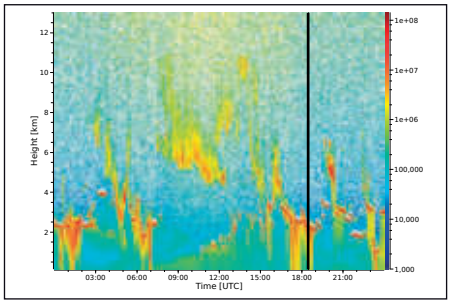
Cirrus Clouds



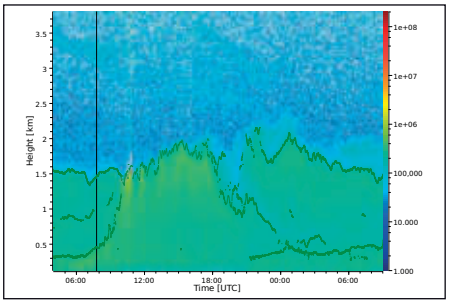
The graphical view of backscatter activity shows a cirrus cloud structure over the course of the day between 6 and 12 km and an aerosol layer structure up to 2 km altitude. The related height profile (black line at 21:00 UTC) is shown at the right side of the diagram.

Rain

This graphic shows a rain situation. A certain drop in cloud height and an increase in cloud mass and volume can easily be perceived in the graphical view by evaluation of the height profile (black line at 18:30 UTC) shown in the right sub-area of the graphical view. One can identify precipitation and estimate the intensity of a likely precipitation event.



Planetary Boundary Layer

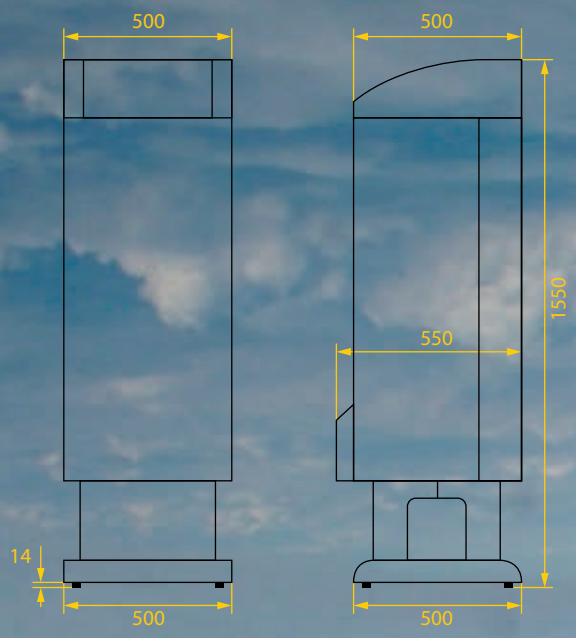


The planetary boundary layer (PBL) or atmospheric boundary layer (ABL) is the lowest part of the atmosphere. It is affected by heat, wind, moisture or momentum transfer from the ground. Within the PBL, the mixed layer (MXL) height is of interest, because all particles and gases arising from the Earth surface are first concentrated and mixed within it. Therefore, the ceilometer's measurement of the aerosol layer height gives valuable information about the particle concentration, e.g. PM2.5 fine dust. The diagram to the left shows an aerosol profile for a typical mixing layer as it develops over the course of the day.

Product Description & Technical Data

The main difference between the two Lufft ceilometers is the laser source, the detection method (analog versus photon counting method) and the sensivity at ground level. The field of view of the receiver is larger on the Lufft CHM 8k cloud height sensor.

Dimensions



CHM 8k

- Cloud Height Detection up to 8 km / 26,500 ft
- Application focus on aviation and environmental services
- Sophisticated housing, ventilation and heating withstands even extreme conditions
- Low-maintenance through self-monitoring function
- Data output in NetCDF format available
- Various interfaces (LAN, serial)

CHM 15k

- Cloud Height Detection up to 15 km / 50,000 ft
- Application focus on meteorological and environmental services
- Sophisticated housing, ventilation and heating withstands even extreme conditions
- Based on micro chip laser
- Data output in NetCDF format available
- Multiple interfaces (LAN, serial)

Fields of Application

- Weather services
- ASOS systems, aviation market
- EPA/ Universities: Environmental studies of fine dust, mixing layer
- Renewable energy market
  - solar energy (cloud cover)
  - wind energy (cloud base)

Benefits

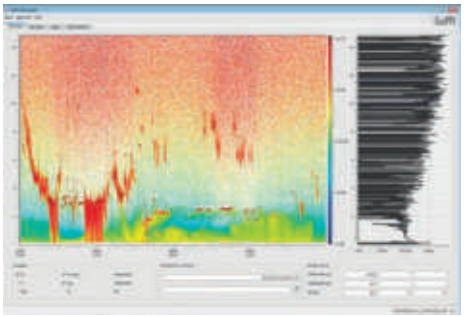
- Low false alarm rate and high probability of cloud detection under all weather conditions
- Rugged housing
- Service-friendly operation
- Easy installation
- Self-diagnostics
- High accuracy and simultaneous measurement of several parameters
- In-field performance test with dedicated Cloud Height Simulator device

Technical Specifications

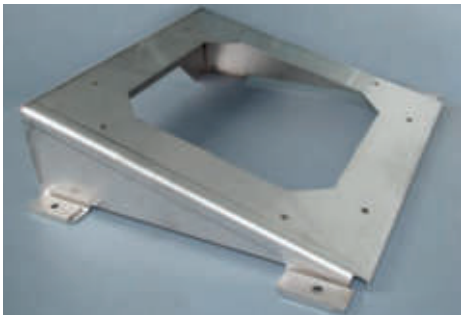
	Lufft CHM 8k	Lufft CHM 15k
Measuring principle	LIDAR (optical, time of flight)	LIDAR (optical, time of flight)
Measuring parameter	Aerosol backscatter profile $ß_{att}(r)$	Aerosol backscatter profile $ß_{att}(r)$
Measuring range	0 m ... 10,000 m (0 ft ... 32,808 ft)	0 m ... 15,000 m (0 ft ... 49,212 ft)
Cloud detection range	5 m ... 8,000 m (16 ft ... 26,246 ft)	10 m ... 15,000 m (33 ft ... 49,212 ft)
Time resolution	2 ... 600 s	2 ... 600 s
Range resolution	5 m (16 ft)	5 m (16 ft)
Quality and auxiliary values	External and internal temperature, window status, laser status, receiver status	
Quantities given in layers	Cloud base height, cloud penetration depth, aerosol layer height and measured uncertainties	
Accuracy (measured on hard target in 10 km distance)	±5 m (±16 ft)	±5 m (±16 ft)
Additional quantities	Cloud cover, vertical visibility, Sky Condition Index	Cloud cover, vertical visibility, Sky Condition Index
Standard interfaces	RS485 (ASCII communication); LAN (web interface, (S-)FTP, NetTools)	RS485 (ASCII communication); LAN (web interface, (S-)FTP, NetTools)
Optional interfaces	DSL modem	DSL modem
Power supply	230 VAC or 115 VAC, ±10 %	230 VAC or 115 VAC, ±10 %
Power consumption	Measuring unit heater: 250 W @115/230 VAC Case heater: 150 W @115/230 VAC 450 W (in maximum heating mode)	LOM heater: 250 W @115 / 230 VAC Case heater: 450 W @115 / 230 VAC 800 W (in maximum heating mode)
UPS functionality (opt.)	Internal backup battery for electronics, > 1 hrs	Internal backup battery for electronics, > 1 hrs
Light source	Laserdiode	Nd:YAG solid-state laser
Wavelength	905 nm	1064 nm
Laser protection class	1M, IEC 60825-1:2014	1M, IEC 60825-1:2014
Protection level housing	IP65	IP65
Electrical safety	EN 61326 - 1 Class B	EN 61326 - 1 Class B
Certifications	CE	CE
Temperature range	-40 ... +60 °C	-40 ... +50 °C
Operational altitude	up to 5000 m	up to 5000 m
Relative humidity	0 ... 100 %	0 ... 100 %
Wind	60 m/s	60 m/s
Dimensions	500 x 500 x 1550 mm	500 x 500 x 1550 mm
Weight	70 kg (130 kg incl. packaging)	70 kg (130 kg incl. packaging)
Accessories	CHM Cloud Height Simulator CHM Data Viewer - Software Adapter Bracket	CHM Cloud Height Simulator CHM Data Viewer - Software Adapter Bracket

Accessories

CHM Cloud Height Simulator
Simulates different cloud heights to check the proper functioning of the device. Generates light pulses that correspond to well-defined clouds. Enables independent in-field quality check within 15 minutes.



CHM Data Viewer – Software
Special software developed by Lufft is available to visualize the data that is measured by the CHM.



Adapter Bracket
Tilts the device at an angle (5° or 15° available). Strongly recommended for installations below 35° latitude.

Application AVIATION

In Ukraine, thanks to Lufft partner Dataspektr, the state aviation administration certified that the Lufft ceilometers comply with the ICAO standards.

One important use of the ceilometer is to determine cloud ceilings at airports. CHM 8k can identify up to 9 cloud layers and is very sensitive even at ground level.

The CHM series is part of the Lufft sensor range for Airport Weather Observation Systems (AWOS) and Runway Ice Detection Systems (IDS).

Further sensors in this range:

Mobile Runway Sensor MARWIS

MARWIS is the first road and runway weather sensor detecting road conditions, temperatures, friction, and other parameters – mobile and in real-time from driving vehicles.

Lufft ARS31 embedded runway sensors

The embedded active road weather sensor ARS31 detects freezing temperatures independently from de-icing materials and is easy to maintain due to its two parted housing.

Lufft WS3000

All-in-one weather sensor to measure temperature and relative humidity with the highest possible accuracy.

Application
RESEARCH

Dutch Weather Service KNMI
A network of more than 40 Lufft ceilometers will support the Dutch Weather Service for precise and real-time monitoring of all aerosol and clouds activities over the Netherlands itself as well as on various offshore locations in the North Sea.

MeteoSwiss Payerne
CHM 15k mounted with a tilt of 45° to measure aerosols in the air. It masters the challenge to measure in the Alps over the valley. Thanks to the special installation, the application has delivered stunning results.

German Weather Service DWD
Measurement campaign from DWD in Falkenberg, Germany in 2005: Lufft CHM 15k is combined with a microwave radiometer and a cloud radar. The DWD has a network of more than 100 CHM 15k for detecting aerosol layers and retrieving vertical profiles of particle backscatter coefficients. The large number of installed ceilometers form a network to monitor the movement and vertical distribution of aerosol particles in the troposphere.

Insights for Experts

For more information, please contact:

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