

VAISALA

Get the whole picture of air quality in your community

With ground-based measurements and atmospheric profiling





Ground level monitoring is important for air quality observation, but weather and atmospheric conditions have a significant effect on air pollution concentrations. Accurate local weather observations are critical for both air quality forecasting and accidental hazardous emissions, while wind affects the generation, emission and chemistry of pollutants as well as their movement.

Now you can get a complete picture of air quality conditions in your community.

Understanding air quality requires measurements of different parts of the atmosphere. By combining ground-based measurements with boundary layer profiling, you get in-depth, accurate information that empowers better decision-making to mitigate air pollution.

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The challenge for environmental protection agencies

Environmental protection agencies and similar organizations around the world are working to make our cities more breathable and sustainable. There are three aspects to achieving these goals:

- 1 The drivers:** Improve air quality to save lives and fight climate change
- 2 The challenge:** Fixed reference stations provide accurate data but are often sparsely located around the city
- 3 The solution:** Dense and real-time supplementary air quality observations

Improving air quality is critical, as improving the air we breathe can potentially save millions of lives and billions in costs. While many cities have fixed reference stations, these are usually sparsely located — leaving significant gaps of information between the stations. Adding supplementary air quality and meteorological sensors fills the gaps to provide complete data of air quality throughout a region.



The questions most agencies ask:

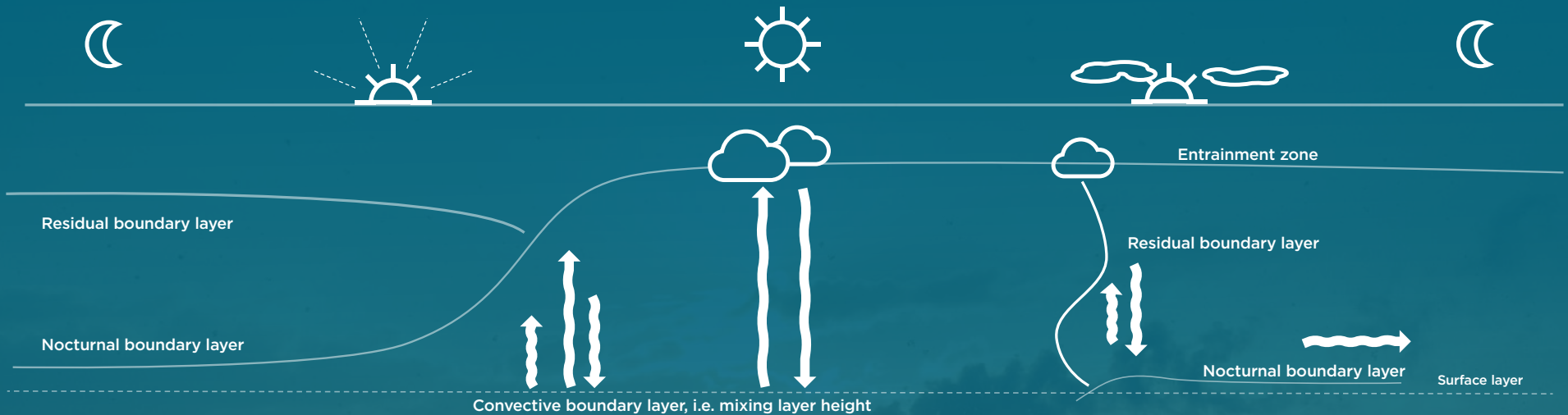
How many sensors do I need and where do I put them?

How can I integrate the effects of atmospheric boundary layer variations?

How do I make the most of the data?

How the boundary layer affects air quality

Here is an example of how the boundary layer evolves over the course of a clear day, which depends on the diurnal evolution, and how it affects pollution concentration.



Before dawn:

You can see the shallow nocturnal boundary layer. This is typically at around couple of hundred meters. You may also see the residual layer above it which is typically left over from the previous day or wind-driven long range emissions.

Sunrise:

Thermals rise and the convective layer starts. The thermals combine or mix pollutants here and defines the volume where emissions mix.

As emission concentrations dilute to this volume, the mixing layer height plays a significant role in perceived air quality. When the mixing layer height is low, then the volume is low: As a result, pollutant concentration is high and air quality is poor. The reverse is also true.

Afternoon:

The boundary layer reaches its maximum height. The top of the mixing layer or entrainment zone is where the boundary layer and free atmosphere meet.

These are the phenomena that lidar ceilometers and wind lidars measure to report the mixing layer height.

Sunset:

The convective layer collapses, creating a night-time nocturnal layer close to the ground. It is common to have a residual layer from the day, but the height that effects air quality on ground is caused by the nocturnal layer. Emissions are typically lower at night.

Creating an air quality monitoring network

The keys to setting up an efficient and effective air quality monitoring network are:



Location: Choose sensor locations so they represent each type of environment in the city along with an understanding of pollution sources.



Meteorological conditions: Factors such as temperature, humidity, barometric pressure and rainfall as well as wind speed and direction are important to consider in order to design the most effective network.



Microscale effects and sensor siting: The sensors should be placed in a way that provides free circulation of air around the sensor, away from buildings, balconies and trees.



Areas of interest: Examples include areas where there are permanent or occasional elevated emissions, often referred to as hotspots.

In addition to understanding the principles of setting up an air quality network, getting the right technology in place will give you a complete picture that supports accurate decision making.



VAISALA

White paper
Compact air quality sensors
and their use in local air
quality management
Part 1: Technology

Download the white paper

Download our white paper which explains how to best benefit from the easy deployment and relatively low cost of air quality sensors, how to optimally deploy and manage sensor networks, and how to best interpret and utilize their data.

[Download Part 1](#) [Download Part 2](#)



The four technologies of a complete air quality monitoring system

The combined power of Vaisala's weather and environmental solutions provide dependable intelligence people can confidently act on — enabling businesses and communities to make better decisions.

The four technologies of a complete air quality monitoring system

Surface air quality and environmental sensors

Both measurements are important, as weather affects pollutant concentration and movement.

Connectivity and visualization

An efficient method of acquiring and displaying the data must provide real-time and historical insights.

Ceilmeters

These provide boundary layer measurement, essential for improving air quality monitoring and forecasting.

Wind lidars

These provide continuous observations of the lower troposphere for insight on how and where wind is transporting pollutants.

Vaisala Beacon Station



Air quality and environmental sensors + connectivity and visualization

Vaisala Beacon™ Station is a full environmental monitoring solution including air quality and weather measurements for a complete understanding of air quality, its fluctuations, and the drivers affecting it.

Vaisala Air Quality Transmitter AQT530

- Measures nitrogen dioxide (NO₂), nitrogen monoxide (NO), ozone (O₃), and carbon monoxide (CO), as well as PM_{2.5} and PM₁₀ particulate matter
- Integrates with Beacon Station or can be connected to your own system

Vaisala Weather Transmitter WXT530 Series

- Measures the six most important weather parameters: wind speed and direction, air pressure, temperature, humidity and rainfall
- Solid-state technologies minimize operation and maintenance costs
- Integrates with Beacon Station or can be connected to your own system

Connection and visualization

- Integrated SIM card and cellular data plan make the station ready for use as soon as it is installed
- Wx Beacon software collects and visualizes measurement data from the station for easy sharing with third-party systems
- Edge Gateway EGW501 provides a secure data transfer between the sensors and Vaisala Wx Beacon cloud software

Ceilometers

Ceilometers measure variations in the boundary layer and provide insight into the volume and quantity of air in which pollutants can be mixed — ultimately affecting pollutant concentrations.



CL31

Compact basic model for 24/7 boundary layer analysis and cloud detection in all weather conditions.



CL51

Enhanced performance over CL31 to provide higher details on boundary layer structure including high-altitude clouds.



CL61

High-end model features depolarization to characterize aerosols, differentiates liquid/frozen precipitation, and detects dust, sand and ash layers.



Wind lidars

Wind can either bring in pollutants or remove them, depending on their source and its location, and local winds transport pollutants and dust from one part of the city to another. WindCube® lidars are known the world over as the gold standard in accurate wind measurements.

WindCube vertical profiling lidar

A highly refined, mature technology, the WindCube vertical profiling lidar provides unrivalled wind profile measurement capabilities and services for accurate, real-time wind data.

- Provides accurate, local wind measurements up to 300m with 20 simultaneous heights measured per second
- Includes WindCube Insights — Fleet software, an easy-to-use, secure, cloud-based tool that provides real-time insights and simple management
- Simple to deploy in urban areas such as rooftops and other structures



WindCube Scan

WindCube Scan provides accurate wind mapping with long-range, fully flexible wind data. Full 3D scanning models measure ranges up to 3km, 6km or 10km.

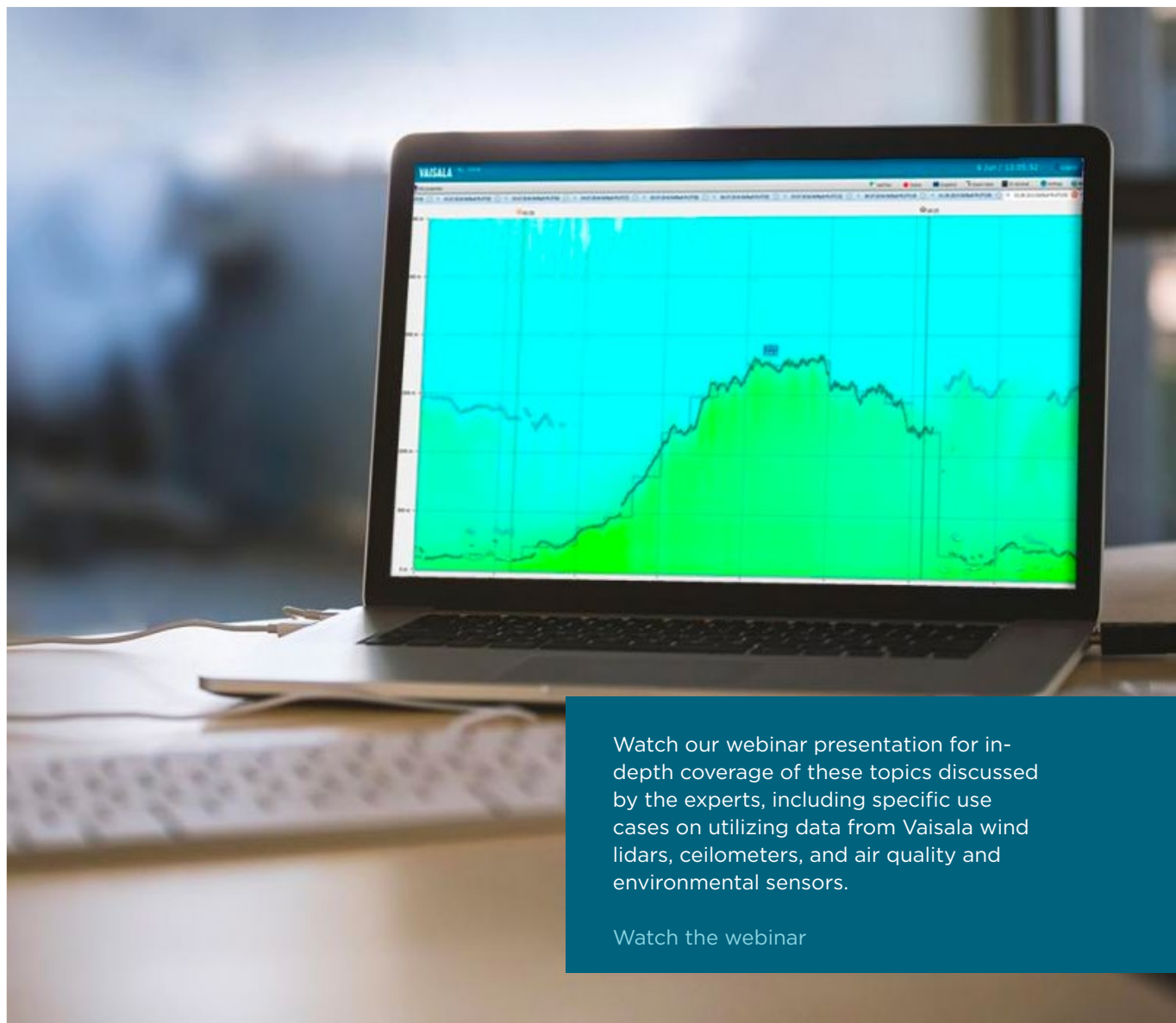
- Rugged design is suitable for urban or industrial deployment
- Highly accurate and flexible technology for wind monitoring, wind profiling or atmospheric cross-sectioning
- Provides simultaneous, state-of-the-art wind, aerosol backscatter, cloud and boundary layer height measurements



What to do with the data

The combined data from a comprehensive air quality network will improve your situational awareness as well as your understanding of local ground measurements.

- The mixing layer height defines the volume where the emissions mix, and therefore pollution concentration will change accordingly
- A ceilometer intensity graph can also be used to understand the emission levels in the vertical domain
- Wind often drives the dispersion of pollutants: WindCube and WindCube Scan accurate local wind measurements are critical to understand complex patterns within the boundary layer
- The mixing layer height and the wind profile can be integrated with your air quality prediction models to improve them or verify them with real-time data



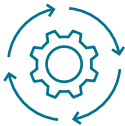
Watch our webinar presentation for in-depth coverage of these topics discussed by the experts, including specific use cases on utilizing data from Vaisala wind lidars, ceilometers, and air quality and environmental sensors.

[Watch the webinar](#)

Air quality has never been more important. The technology for assessing it has never been better.

Your communities, customers and consumers rely on you to provide solutions for the most reliable and accurate air quality information available. You can rely on Vaisala for the globally recognized, reliable technology you need to succeed, even when communities and industries are changing rapidly.

Why Vaisala?



Exceptional products grounded in science and innovation

Vaisala's scientific leadership and innovation in inventing unrivaled weather and environmental products have reflected the spirit of our company for 85 years. Our founder established a ground breaking new technology category to solve problems that no one had ever solved and made meteorology modern. Vaisala has been creating accredited products to empower communities across the world ever since.



Champions for smarter, safer, and more sustainable urban communities

Vaisala empowers businesses and community leaders, helping them to fulfill their operational missions for their cities. Our innovations support an enhanced quality of life, safety, efficiency, and sustainability — all of which make communities more resilient given today's environmental challenges. Vaisala's spirit of partnership and world-class service has earned the trust of leaders in more than 170 countries, from the north pole to the south pole and even on Mars.



Insight every day

The combined power of our weather and environmental solutions provides dependable intelligence people can confidently act on, enabling businesses and communities to make better decisions. With Vaisala, you can count on our 360-degree solutions that are extensively put to the test across the world and proven to consistently provide superior performance.



The Finnish way

Finland has boldly demonstrated that a culture of resilience and a connection to nature can create new ways of smarter, sustainable living. Vaisala began in true Finnish character with honesty, curiosity, and determination; exploring the unknown and pushing the boundaries of innovation. We continue to honor this tradition today with our commitment to providing trusted, unsurpassed weather and environmental solutions that improve daily lives in urban communities across the world.

A city skyline, likely Chicago, is shown in a hazy, blue-tinted style. A large teal diagonal shape cuts across the image from the top-left towards the bottom-right. The skyline includes several prominent skyscrapers, such as the Willis Tower with its two spires.

www.vaisala.com

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