

Sand & dust storms: Comprehensive insights for operational resilience

Solutions Brochure



See, track, and prepare for every kind of storm

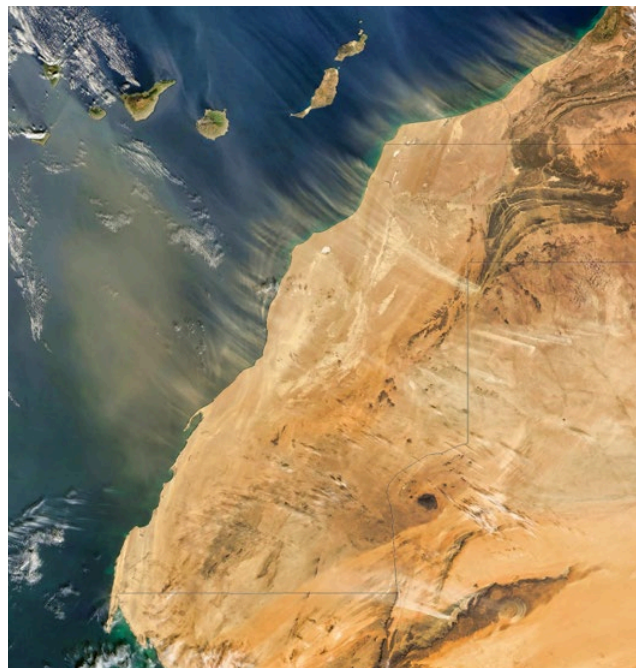
Powerful winds sweep sand and dust from arid soils into the atmosphere – creating sand and dust storms that impact nearly every aspect of life and operations. Modern measurement technologies are key to tracking particle types and trajectories for preparedness and resilience.

These storms affect climate, weather and ecosystems, while also posing significant risks to human health, agriculture, transportation and solar energy. Paradoxically, they also provide essential nutrients to ocean ecosystems.

Major challenges across industries

The impact for many industries is nothing short of a perfect storm that affects visibility, infrastructure, and operations. These storms can force the closure of roads and airports, leaving critical operations in a state of paralysis. Climate change alters weather patterns and reduces vegetation cover, adding to the problem.

The ability to detect and track airborne particles is crucial for meteorology, aviation, and defense applications. Vaisala's instruments and intelligence support timely decision-making with actionable data to safeguard lives and operations.



According to the World Meteorological Organization*:

- 330 million people are affected by sand and dust storms globally
- 25% of global dust emissions stem from human activities
- 80% of global dust is from the North Africa and Middle East deserts, with an annual emission of approximately 2,000 million tons – equivalent to 307 Great Pyramids of Giza

* World Meteorological Organization, Sand and dust storms, 2025: <https://wmo.int/topics/sand-and-dust-storms>

Navigating the storms safely and with precision

Sand and dust storms can severely impact visibility, compromise safety, and disrupt critical operations. Vaisala's advanced technology is designed to provide the reliable, real-time data needed to make informed decisions, ensuring the protection of people and operations before and during these events.

The following instruments represent the most effective approaches to detecting visibility range as well as measuring and tracking particle types, amounts, concentration and movement – from the ground to the air, at the local level or up to 10 km away.



Vaisala Forward Scatter Sensor FD70

Exceptional all-weather visibility and detection sensitivity

FD70 is powerful technology that delivers highly accurate visibility and precipitation reporting in all weather conditions, as well as unsurpassed detection sensitivity and reliable identification of present weather.

In addition to sand and dust obscuration, FD70 reports present precipitation type/intensity/accumulation, visibility, temperature, humidity, droplet size distribution, fall speed distribution, kinetic energy and radar reflectivity. State-of-the-art, forward scatter technology detects and analyzes current precipitation to identify type, intensity, accumulation, particle size and fall speed distributions with a visibility sensor range up to 100 km (62 mi) Meteorological Optical Range (MOR).

Sand and dust identification algorithm: FD70 measures scattering properties and scatter ratio of the obscuration, allowing it to distinguish between sand & dust and water-based phenomena. The sensor uses a specific sand and dust algorithm to calculate MOR. This results in more accurate visibility reporting and reduces unnecessary alerts, ensuring that critical decisions are based on reliable data.

[Learn more about FD70](#)



10 ways FD70 excels at sand and dust detection

- **Uses atmospheric model and field data** for accurate sand and dust identification
- **Uses lithometeors identification** rather than relying solely on relative humidity
- **Dual-angle light scattering** using two receiver units for robust identification
- **Field data verification** to ensure accuracy
- **Reports SYNOP weather codes** for sand and dust exposure (DUST for dense, HAZE for lighter)
- **Scattering ratio algorithm** distinguishes sand and dust from water-based phenomena
- **Reduces unnecessary alerts** by providing reliable data for critical decisions
- While no other technology can beat a transmissometer in MOR reporting accuracy in low visibility, **FD70 can distinguish sand and dust from aqueous obscuration and mimic transmissometers** with the maximum accuracy of forward scatter technology
- **Matched visibility calculation** to sand and dust conditions

Vaisala Lidar Ceilometer CL61

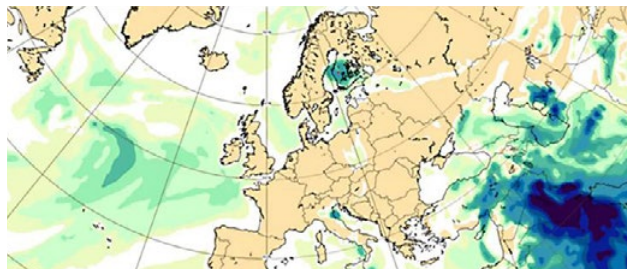
Precise particle differentiation with depolarization

CL61 combines standard ceilometer measurements, like cloud base and ceiling heights, with new depolarization that allows for precise particle and precipitation type differentiation – enabling dramatically improved situational awareness and forecasting.

CL61 is also easy to integrate, cost-effective, and backed by Vaisala's globally trusted sensor technology and service capabilities. All this makes CL61 unique among ceilometers – an outstanding, cost-effective tool for improving decision-making and safety across several key applications.

Depolarization capabilities: CL61 measures the depolarization ratio, which helps identify and characterize sand and dust layers in the atmosphere. This capability is crucial for monitoring the extent and movement of sand and dust storms, enabling timely warnings and effective mitigation measures.

[Learn more about CL61](#)



CL61 unveils the Saharan dust outbreak

On April 10, 2024, a CL61 detected a Saharan dust storm traveling over Finland with exceptional accuracy. Its powerful visualization tools make it easy to identify the movement and concentration of particles over time.

- **Enhanced visualization of particle movement:** Powerful visualization tools provide clear and detailed insights into the movement and concentration of particles over time, including the detection of Saharan dust layers and nighttime precipitation events.
- **Precise depolarization ratio:** The depolarization ratio identifies values consistent with sand or dust particles (0.3 to 0.4) to ensure accurate differentiation of particle types, enhancing situational awareness and forecasting.
- **Improved decision-making for resilience:** By accurately visualizing and detecting dust, CL61 empowers industry decision-makers to make informed decisions, protecting public health, ensuring aviation safety, and managing urban and industrial environments more effectively.

Read the blog:
[Unveiling the Saharan dust outbreak](#)

Vaisala WindCube® Scan

Particle movement tracking with long-range, 3D awareness

Trusted globally across multiple industries, WindCube Scan offers ideal, full spatial awareness wherever you are.

WindCube Scan performs simultaneous, state-of-the-art wind, aerosol backscatter, cloud and boundary layer height measurements 24/7 with high-level data processing. It is a versatile tool for recovering accurate wind and aerosol backscatter measurements in real time, in any scanning geometry up to 10 km (depending on model).

360°/3D wind awareness at long range: This capability provides real-time data on the direction and speed of the wind, which is crucial for identifying the movement of particles. By offering advanced detection and alerts about approaching sand and dust storms, WindCube Scan helps organizations take proactive measures to protect people and operations.

[Learn more about WindCube Scan](#)



Transforming atmospheric monitoring with real-time analysis in Belgium

The Royal Meteorological Institute of Belgium combined CL61 depolarization data and WindCube Scan lidar data to tackle complex atmospheric monitoring challenges, improve ABL understanding, and pave the way for future advancements.

- **360°/3D wind awareness:** WindCube Scan provides comprehensive 360°/3D wind data, essential for tracking the movement and direction of particles, which is crucial for understanding the dynamics of sand and dust storms.
- **Enhanced aerosol identification:** When combined with CL61's depolarization feature, WindCube Scan enables accurate identification of aerosol types, such as marine aerosols and Saharan dust, improving the precision of air quality monitoring and dispersion modeling.
- **Improved forecasting and real-time monitoring:** The integration of WindCube Scan and CL61 enhances the accuracy of dispersion modeling, enabling better forecasting and real-time monitoring of dust outbreaks. This data can inform emergency response planning, public health alerts, and safety measures, ensuring more effective protection of infrastructure and personnel.

[Read the case study](#)

Vaisala Air Quality Transmitter AQT560

A generational leap in air quality detection for particles and gases.

Dependable accuracy and performance take the guesswork out of monitoring the most common particulate and gas air pollutants. Easy to integrate into existing networks and reliable under the most extreme conditions, AQT560 is the industry's most trustworthy choice for assessing critical particles (PM10, PM2.5, PM1) and pollutant gases (NO2, NO, O3, and CO).

The sensor's outstanding precision and flexibility, coupled with Vaisala's well-known, global service network, enhance all kinds of operations over a long and trouble-free service life.

Advanced laser particle counter technology:

AQT560 can measure particles down to 0.30 microns, ensuring consistent and accurate measurements of both large and small particles. This reliability in challenging conditions like sand storms makes it an essential tool for monitoring air quality and protecting health and operations.

[Learn more about AQT560](#)

How the invisible is now visible with AQT560

Air quality measurement experts discuss AQT560's detection performance, use cases and more.

- Capabilities for helping Environmental Protection Agencies and other air quality monitoring professionals take action to protect public health, avoid pollution hot spots, optimize infrastructures, and plan more confidently and strategically
- Exceptional detection performance for particulates and gases, plus flexible integration and networking options
- How AQT560 gives you a higher-resolution picture of air quality conditions with more precise data points to make your measurements more accurate

[Watch the recording](#)



Technology that stands the test of time



Industry decision-makers can significantly enhance situational awareness and resilience against sand and dust storms by integrating the Forward Scatter Sensor FD70, Lidar Ceilometer CL61, WindCube Scan, and Air Quality Transmitter AQT560. This powerful synergy provides comprehensive real-time data on visibility, particle differentiation, wind patterns, and air quality.

The result: precise detection, tracking, and forecasting of sand and dust storms, enabling proactive measures to protect operations and infrastructure. By leveraging these complementary tools, organizations can ensure safety, maintain operational continuity, and make informed decisions based on reliable, actionable data.

As the global leader in weather and environmental measurements, Vaisala provides trusted weather observations for a sustainable future. With nearly 90 years of innovation and expertise plus customers in 170+ countries from the North and South Poles to Mars, we help provide the most reliable and accurate weather and climate information for better and safer daily lives.

Our instruments and intelligence are known as the gold standard for precision and reliability. As a sustainability leader we enable meteorology professionals to better understand, forecast and explain climate change. We continue to channel our curiosity into climate action and new ways of enabling a better planet for all.

