

# Tracking Air Pollution with Mini Micro Pulse LiDAR

## Portable Monitoring Solution Offers Valuable Insight Into Haze Problem

Poor air quality in large urban population centers has a negative impact on health and quality of life. To address these issues, the Institute of Urban Meteorology (IUM) in Beijing, China, is conducting fundamental research to better understand, forecast and mitigate atmospheric haze, i.e., air pollution. Over the past two years, IUM has studied the movement of haze through Beijing based on data collected with two Mini Micro Pulse LiDAR scanners. This scientific research will improve urban meteorological services and guide government policies pertaining to urban development.

## Why Mini Micro Pulse LiDAR?

Mini Micro Pulse LiDAR (MiniMPL) is an attractive solution for IUM to meet its needs for continuous haze monitoring over a large geographic area. A MiniMPL unit transmits laser pulses that reflect off particles in the atmosphere. The MiniMPL then measures the intensity of backscattered light using photon-counting detectors and transforms the signal into real-time atmospheric information. These returns provide a snapshot of conditions over the area of interest and are the basis for vertical aerosol profiles and time sequence plots used by meteorologists, air traffic controllers, atmospheric regulators and others.

Sigma Space Corporation manufactured MPL instruments for NASA beginning in 2004. It is the only LiDAR technology approved by NASA for use in the MPLNET, a global atmospheric monitoring network. The MiniMPL, introduced in 2010, incorporates the highly regarded MPL technology into a single container weighing just 13kg and monitors clouds and aerosols up to 15km away. The compact size allows IUM to easily transport the units between monitoring sites or to use them in a static network for collection and comparison of data over time.

“Our decision to purchase the MiniMPLs was based on their excellent reputation in the industry, its relationship with NASA, and the superior results we could expect from this type of system,” explained Ju Li, Chief of Urban Meteorological Observation Branch at IUM. “The high signal-to-noise ratio and sensitivity of the portable scanner results in very clear sharp data, with the added benefit of continuous collection with an integrated solution.”

## Seeing the Big Picture

To record the transport of haze in Beijing, IUM follows the movement of the atmosphere across a wide swath of the city with two MiniMPLs. Each fully programmable MiniMPL is capable of scanning approximately 56 km<sup>2</sup> with a 180-degree scanning angle at a maximum scan speed of 5 degrees per second. To avoid gaps in atmospheric data, the movement of haze through an urban setting is best monitored with a static network of GPS-equipped sensors.

“By utilizing the networking capability, researchers develop a seamless pattern of haze and how it flows through a city throughout the day,” said Justin Fisher, VP of Atmospheric LiDAR. “The particulate make-up of the atmosphere is recorded real time and compared to every other day at the same time. This supports analysis and predictive modeling that expands meteorological services to the population.”

The MiniMPLs collect a variety of data, including AOD (aerosol optical depth) and PBL (planetary boundary layer). Doppler LiDAR is used in conjunction with the MPLs to include wind field observations in the analysis.

“Radiometer data collected onsite is also integrated into the LiDAR data, and readings from high accuracy particle counters help calibrate and improve the accuracy of the LiDAR data,” said Yunhui Zheng, Director of Optical Engineering at Sigma Space. “Combining data from multiple instruments enhances the resulting models.”

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In addition to the large collection area capability, users benefit from the remote download of MPL data via Sigma Space’s Web interface network product, which streams data to any designated server. Specifications such as the accumulation time at each stop or the degrees between each scan line may be adjusted remotely as well.

## Atmospheric Information Addresses Public Health Hazards

IUM’s atmospheric data is the basis for academic and white papers focused on understanding pollutant transportation, vertical and horizontal distribution of aerosols, and variations in pollutant distribution during heavy smog events. By disseminating its findings based on the Micro Pulse LiDAR data, IUM is educating the public about the potential hazards of

atmospheric particulates, assisting the Beijing Meteorology Bureau with improving forecast accuracy and providing support for government policies to protect the health and well-being of its populace.

### About Micro Pulse LiDAR

#### Elevating Atmospheric Monitoring

Micro Pulse LiDAR (MPL) instruments help scientists, meteorologists and air quality professionals monitor aerosols to better understand the structure of our atmosphere.

*Micro Pulse LiDAR is part of Droplet Measurement Technologies, LLC a leading solution provider cloud and aerosol instruments.*

