

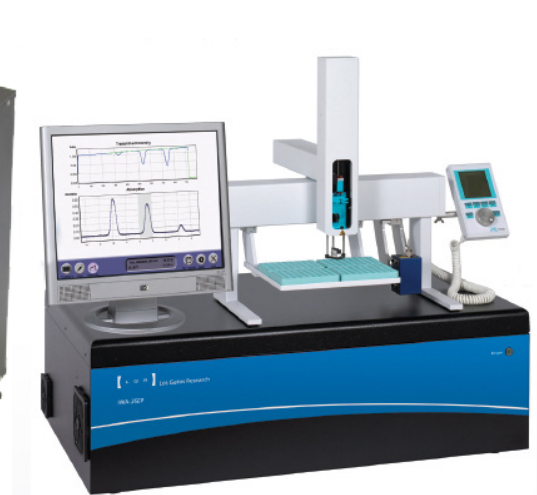
## In this issue:

- **Thermo-optical OC-EC analysers from Sunset Laboratory** - accurate measurements of organic carbon and elemental carbon in particulate matter.
- **Pollen Monitor BAA500 from Hund Wetzler** - fully automated system for the quantification and discrimination of different pollen types.
- **Sophisticated LiDAR system from Micro Pulse LiDAR** - for a variety of applications including planetary boundary layer measurements, plume tracking, and cloud observations.
- **Real-time particulate analyser EDM180 from Grimm** - using scattered light to calculate particle size.
- **LGR M-GGA-918 Microportable Greenhouse Gas Analyser** - substantially smaller than the UGGA and weighing only 5.5kg whilst maintaining parts-per-billion level precision for  $\text{CH}_4$ , and sub-ppm level precision for  $\text{CO}_2$ .
- **Soil flux measurement solutions from Eosense** - simple, easy to use flux measurement solutions for almost any application.
- **Portable particulate sampler from Airmetrics** - battery operated particulate sampler that provides accurate particulate data at a fraction of the cost of full-size samplers.

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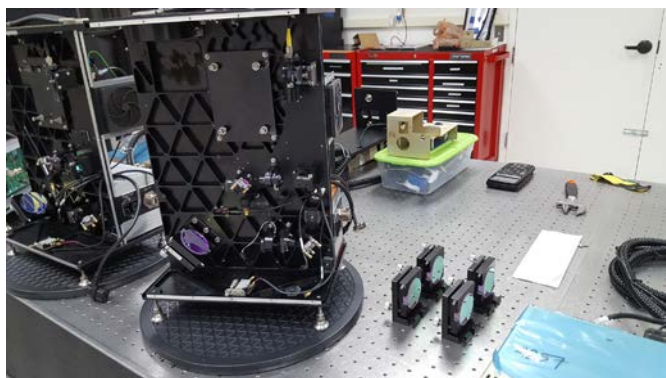


## Welcome to the third edition of *EnviroNews - Atmospheric / Environmental Science* Edition from *Enviro Technology Services*.

It has been two years since we released our second edition, and we have seen many interesting new instruments and developments from our suppliers in that time. We have also been busy ourselves, having supplied a wide variety of new instrumentation to universities and research institutes, both in the UK and overseas.

Many of these new and innovative instruments are mentioned elsewhere in this newsletter, but two instruments that deserve a special mention are the MiniMPL LiDAR system from Micro Pulse LiDAR, and the Thermo-Optical OC-EC analysers from Sunset Laboratory.

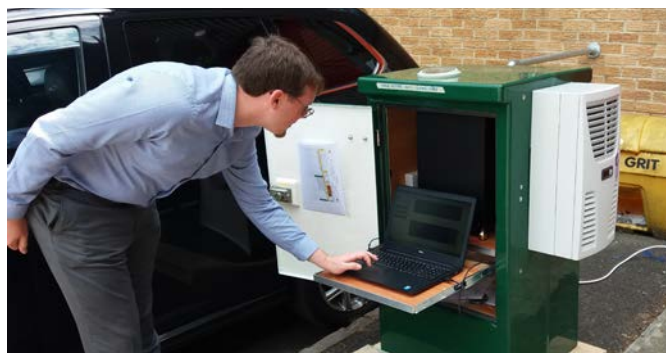
I was fortunate enough to visit both of these US-based companies earlier this year, and found the in-house expertise and attention to detail in their production facilities to be very impressive.



The MiniMPL, and the larger MPL, are 532nm pulsed LiDAR systems developed by Micro Pulse LiDAR in Maryland, USA. These are versatile instruments capable of accurately ranging and identifying aerosols and clouds at distances up to 25km. What sets these apart from other commercially available LiDARs is the fact that they can be run 24/7 without the need for regular maintenance and system downtime. Because the laser source is a reliable frequency-doubled Nd:YAG, the MiniMPL and MPL can run for years without needing replacement laser components. These LiDARs are also supplied with a comprehensive and user-friendly software package for operating the instrument and viewing data, allowing even inexperienced users to operate them with ease.

Micro Pulse LiDAR have generously given Enviro Technology the use of a MiniMPL demo unit, which has been successfully trailed at various universities and research institutes across the UK over the last year. Users have been particularly impressed with how easy it is to get the MiniMPL up and running, and to interpret the data using the graphing tools in the software package. I found this myself when the demo unit was first delivered to ET, as I was able to get the instrument

set up outside our building and start analysing clouds after just a quick read of the user manual, having never used a LiDAR before in my life!



Sunset Laboratory are a manufacturer of thermo-optical OC-EC analysers based in Oregon, USA. They produce two analysers, both for determining the relative concentrations of organic carbon and elemental carbon in particulate matter.

The thermo-optical measurement technique works by heating a sample to 850 C to desorb the elemental carbon from the filter. The carbon fragments then flow through a MnO<sub>2</sub> oxidising oven, where they are converted to CO<sub>2</sub> gas for subsequent measurement by FID or NDIR detector. After the elemental carbon has been measured, the instrument initiates a second temperature ramp in an oxidising gas stream, which oxidises any organic carbon off the filter and into the MnO<sub>2</sub> oven and FID/NDIR, where it is measured as CO<sub>2</sub> in the same way as elemental carbon.

Both the M4G (field) and M5L (lab) analysers use the same technique, but differ in terms of sample introduction. The M5L measures discrete samples, taken from a filter using a punch. In contrast, the M4G uses a vacuum pump to continuously draw air onto an internal sample filter, which is subjected to a thermo-optical analysis every 30 minutes. Because the previous sample is always desorbed during analysis, the system can be run unattended for up to a week before the filter must be replaced.

At Enviro Technology, we have always sought pioneering new instruments for the measurement of pollutant gases and particulate matter. However, measurements of the planetary boundary layer using LiDAR, and OC-EC using thermo-optical analysis, add an additional level of detail to our understanding of air pollution. One I am sure will prove to be increasingly important as research develops.

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Sunset  
Laboratory Inc.

## Sunset Laboratory Thermo-Optical OC-EC Analysers

The Model-4G (field) and Model-5L (laboratory) thermo-optical OC-EC analysers from Sunset Laboratory provide accurate measurements of organic carbon and elemental carbon in particulate matter. Analysis protocols can be selected to match

NIOSH, IMPROVE, and EUSAAR2, as well as customised user-created protocols. Accuracy and precision is ensured by the use of advanced optics and electronics, and a fixed volume loop which injects an external standard at the end of every analysis.



Model-4G Field Instrument	Model-5L Lab Instrument
Semi-continuous measurements – automated sampling	Discrete measurements – filter punches
NDIR detector	Available with NDIR detector or FID
Transmittance only measurement	Available with dual optics (transmittance & reflectance)
Reliable automated operation	Samples must be inserted and analysed manually
Less maintenance and support gases	More maintenance and support gases
Rack or bench-mounted	Bench-mounted
URG PM2.5 cyclone & denuder, external pump	No gas inlet or pump

## Met One Instruments BC-1050 & BC-1054 Black Carbon Monitors

The Met One BC-1050 & BC-1054 utilise the same reel-to-reel sampling system used in the market-leading, MCERTS-approved BAM-1020 beta-attenuation mass monitor. Like the BAM-1020, both models require very little maintenance, and are suitable for long-term unattended deployment, with the capability for remote control.

The BC-1050 measures absorption at 375 nm (organic carbon), and 935 nm (elemental carbon). The BC-1054 measures absorption at 10 different wavelengths from 375 to 950 nm, allowing contributions from black carbon, organic carbon, and brown carbon to be better distinguished.



## Grimm EDM 180

The GRIMM EDM 180 environmental dust monitor is a real-time particulate analyser that operates on the 90° laser scatter principal. Each dust particle that passes through the beam scatters the light, and the intensity of the scattered light is used to calculate particle size. Particle mass is then calculated by means of a proprietary algorithm. This measurement technique allows the EDM 180 to measure particles in 31 size channels simultaneously, from 0.25 – 32.0 µm.

- Aerosol focusing ensures each particle is counted individually, so important data are not “averaged out”.
- 90° scattering angle minimises inaccuracies due to varying reflectiveness.
- Light trap reduces noise from stray light.
- Nafion dryer ensures no loss of semi-volatiles.
- Flow of sheath air prevents particles from contaminating the optics.



## Airmetrics MiniVol TAS

The MiniVol TAS from Airmetrics is a portable, battery operated particulate sampler that provides accurate particulate data at a fraction of the cost of full-size samplers. The sampler is built into a rugged, weather-resistant case making it suitable for unattended deployment in almost any environment. The Li-ion battery pack provides power 60+ hours of sampling, and the sampler can be programmed to start and stop sampling at user defined intervals.

- Suitable for unattended operation in challenging environments.
- PM<sub>10</sub>, PM<sub>2.5</sub>, and TSP inlets available.
- Supplied in a carry case with universal mounting bracket, spare battery, charger, and 2 x size-selective inlets.
- Suitable for standalone use or “saturation” sampling.
- Can be mounted almost anywhere using the tripod or universal mounting bracket.

## Hund BAA500 Pollen Monitor

The Hund BAA500 is a fully automated system for the quantification and discrimination of different pollen types. Traditionally, pollen measurements are made by collecting airborne pollen onto adhesive tape using a volumetric sampler. The tape is then analysed by human operators using optical microscopy. With the BAA500, time-consuming and potentially error-prone manual pollen counting is not required. The detection algorithm can also be trained over time, resulting in ever-improving performance.

- Pollen samples are automatically collected and deposited onto a sample carrier covered with a special adhesive gel.
- Samples are scanned in 3D, and pollen types are assigned based on their morphological characteristics.
- Gel carriers are hermetically sealed and archived.
- 1-hour measurement interval.



## Micro Pulse LiDAR



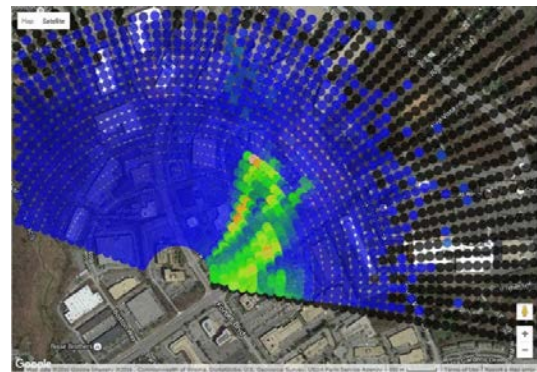
The Micro Pulse LiDAR MPL and MiniMPL are sophisticated 532nm LiDAR systems with a variety of applications including planetary boundary layer measurements, plume tracking, and cloud observations. Two polarisation channels are measured simultaneously, allowing the instrument to discern between different types of cloud and aerosol automatically. This capability, combined with the user-friendly software package, makes the MiniMPL ideal for applications such as volcanic ash detection at airports, as well as a variety of meteorological applications.

When used in conjunction with the weatherproof enclosure and 2-axis scanner (pictured top right), the MiniMPL can be deployed outdoors 24/7, and track plumes in 3-dimensions. Scan data can be automatically overlaid onto a satellite map, and a meteorological station can be integrated with the system, making it a powerful tool for source apportionment. A typical scan from a rooftop, showing dust propagation from a nearby construction site, is shown to the right.

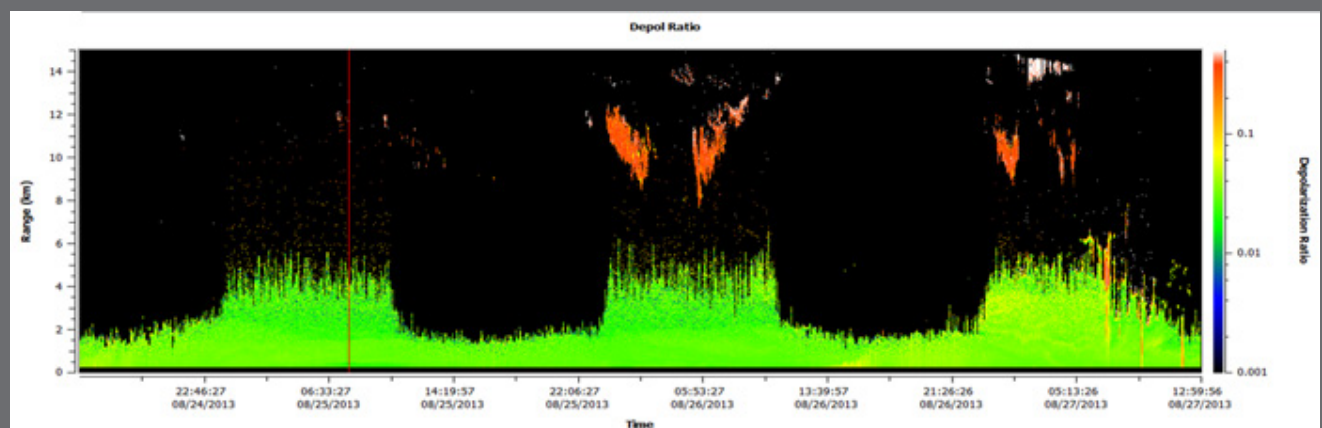
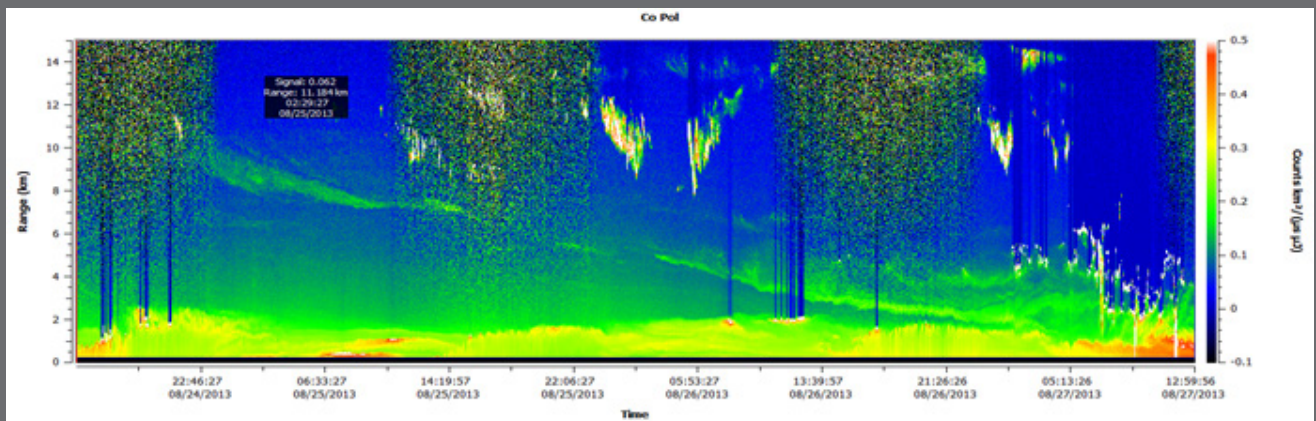


### Applications include:

- Cloud observations.
- Planetary boundary layer measurements.
- Vehicle-based measurements.
- Dust/plume tracking & source apportionment.
- Aviation safety.



Example vertical aerosol profiles showing descending dust and icy clouds.





Los Gatos Research have continued to innovate in making rugged, portable greenhouse gas analysers for use in the field. Their latest iteration of the Microportable Greenhouse Gas Analyser, the M-GGA-918, is substantially smaller than the flagship UGGA, weighing only 5.5kg and being powered from an internal 12V battery that can run for over 3 hours, all while maintaining parts-per-billion level precision for CH<sub>4</sub>, and sub-ppm level precision for CO<sub>2</sub>. Like all LGR analysers, the M-GGA-918 uses Off-Axis ICOS technology, with all of the inherent advantages such as wide linear dynamic range, true wavelength scanning, robustness to shocks and vibration, and user-cleanable optics.



In addition to the ever-popular UGGA (Ultraportable Greenhouse Gas Analyser), LGR now offer a wide range of other gas combinations in the 15kg Ultraportable package. The ultraportable methane/acetylene and methane/ethane analysers are ideal for applications such as landfill tracer studies and natural gas leak detection. With onshore fracking now fully underway in the UK, these specialist instruments will be of particular interest to those studying its environmental impact.



LGR have also released a few variations on the UGGA, which allow a fourth gas to be measured in addition to CH<sub>4</sub>, CO<sub>2</sub>, and H<sub>2</sub>O. Where the UGGA measures CH<sub>4</sub> & H<sub>2</sub>O on laser 1, and CO<sub>2</sub> on laser 2, these instruments measure CO<sub>2</sub> at a different absorption peak that is within the scanning range of laser 1, freeing up laser 2 for dedicated, precise measurements of a fourth gas.

- **Ultraportable Soil Gas Analyser (CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>O, NH<sub>3</sub>)**
- **Ultraportable Multi-Gas Carbon Emissions Analyser (CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>O, CO)**
- **Ultraportable Greenhouse Gas + O<sub>2</sub> Analyser (CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>O, O<sub>2</sub>)**

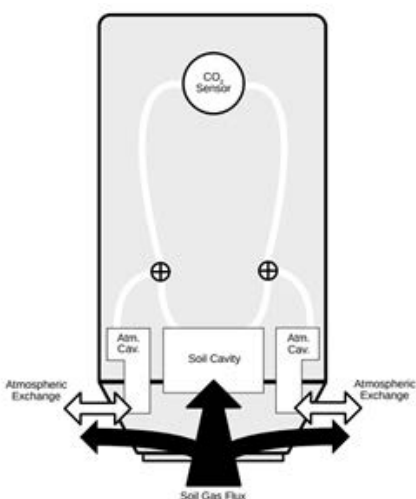
In addition to a vast range of analysers to measure various gases, LGR manufacture a range of isotopic analysers for gases such as N<sub>2</sub>O, CH<sub>4</sub>, CO<sub>2</sub>, and H<sub>2</sub>O vapour. Also available is the Liquid Water Isotope Analyser (LWIA) pictured below, which uses a CTC autoinjector to analyse over 1,000 injections per day. LGR are currently developing an Ultraportable LWIA, which will allow users to accurately determine isotope ratios without even leaving the glacier!



### LGR isotope analysers:

- N<sub>2</sub>O (δ<sup>15</sup>Na, δ<sup>15</sup>Nb, δ<sup>15</sup>N, δ<sup>17</sup>O, δ<sup>18</sup>O)
- CO<sub>2</sub> (δ<sup>13</sup>C, δ<sup>17</sup>O, δ<sup>18</sup>O)
- CH<sub>4</sub> (δ<sup>13</sup>C)
- H<sub>2</sub>O (δ<sup>2</sup>H, δ<sup>17</sup>O, δ<sup>18</sup>O)

Eosense are a Canadian manufacturer of soil flux measurement products. The company started as Forerunner Research, with a team of soil flux scientists and engineers fuelled by the need for better ways to measure and understand environmental gases. This led to the development of the eosFD standalone CO<sub>2</sub> flux sensor, using Eosense's patented "forced diffusion" technology.



The eosFD is ideal for long-term unattended monitoring of CO<sub>2</sub> fluxes in a variety of challenging environments. Requiring an average of less than 1 W from a 12 VDC power supply to run, the sensor can be run from a small (98 Wh) battery and solar panel. The inherent durability of Eosense's forced diffusion technology, and the lack of moving parts, results in the eosFD being suitable for use in a variety of challenging environments from -20 to +50 C. The sensor can even be strapped to a tree to measure tree stem flux, or floated on the surface of a lake to measure fluxes from the water's surface.

Since developing the eosFD, Eosense have integrated their forced diffusion technology into other flux measurement products, providing a simple, easy to use flux measurement solution for almost any application. All Eosense products are supplied with sophisticated, yet simple to use data logging/flux calculation software, which makes setting up an experiment quick and easy.



The eosMX-P multiplexer and eosAC autochambers can be interfaced with Los Gatos Research greenhouse gas analysers to create a fully automated soil flux measurement system with up to 12 chambers. The eosAC chambers open and close at user-defined intervals, and can be equipped with auxiliary sensors for soil moisture and temperature. Like the eosFD, the eosAC autochambers require very little power to operate, and are suitable for use in a variety of environments.



The eosGP waterproof CO<sub>2</sub> sensor packs the patented forced diffusion technology into a lightweight, portable sensor suitable for use in the field. The eosGP is submersible to a depth of 3 metres, allowing fluxes to be measured at various depths in a lake or river. Data can be logged via analog or RS-232, making the eosGP easy to integrate with other equipment. Eosense's software can even be used to log serial data on a laptop with the use of a USB serial converter.

## We're only as good as our staff - Testimonials

ET has had some great feedback from our lovely customers recently and we thought we'd share them with you.

*Just a quick note to thanks Lewis for delivering the uGGA. Really enjoyed meeting him, a credit to your team.*

*Mike Boniface, Exeter Atmospheric and Ocean Science, University of Exeter*

*I have been extremely impressed with Lewis' attention to detail, knowledge and hard work on helping us to purchase our equipment from you. He has made ET my "go to" company to deal with and have always received extremely professional, yet friendly and most importantly honest advice on equipment applicability and use. He has gone out of his way to help us make the right choice and provide excellent after sales support. All in all, an amazing member of staff that you should be proud to have!*

*Dr Paul Mann, Northumbria University*

*Thank you for the delivery note and thank you to everyone involved at ET for service we received in getting our analyser calibrated so quickly.*

*Best Regards, Gary Beckett - Lead Test Engineer, HS Marston Aerospace Limited*




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