



Image courtesy of Mr Jack Triest  
Laboratoire de Glaciologie et  
Géophysique de l'Environnement

# Welcome to Campbell Scientific, leaders in weather monitoring solutions



From multi-station meteorological networks to individual turnkey systems or individual dataloggers and sensors with supporting software and peripherals, Campbell Scientific has the solution for any weather monitoring application.

Our clients include national met services, leading research centres and universities, airports, renewable energy providers, local authorities, transport management, agricultural concerns and many more besides.

Campbell Scientific are well known for robust, reliable, open, low power systems and being a leading innovator for weather applications.

Our systems are easily customisable and extendable and offer a wide choice of communication options.

**For further information**  
call our weather team on  
+44 (0)1509 828888 or email:  
[sales@campbellsci.co.uk](mailto:sales@campbellsci.co.uk)

# Weather Monitoring



## Measurements Matter in Weather Monitoring

Campbell Scientific has been providing research grade weather stations and equipment since its very beginning. Our field-proven automatic weather stations are deployed on every continent in a diverse range of situations and offer high reliability and system flexibility. Below are just a few of the many weather applications we support:

### Applications:

Pic courtesy of Dr Liz Bagshaw Cardiff University



*Installing a weather station in a challenging mountain environment.*

### Hydrometeorology & Climatology

Campbell Scientific dataloggers and weather stations have a long standing, field proven reputation for power efficiency and rugged reliability making them ideal for all hydrometeorological applications. Whether for long-term climate studies or shorter term weather studies Campbell Scientific solutions can be relied upon to operate without human intervention, using minimal power for autonomous applications in virtually any environment and for both scientific research or commercial purposes.

Our solutions range from single pre-wired, pre-programmed turnkey stand-alone stations through to multi-station networks where each station is custom configured to measure a specific range of parameters particular to the customer and the site. The open nature of our systems means that we can easily integrate with third party equipment and existing infrastructure arrangement. An extensive array of communication options are available to provide data access from wherever a station is situated on the planet.

### Air Quality & Pollution

Air quality measurements are important in applications where pollution caused by gases, odours and particulates have to be monitored, perhaps for compliance, for warning systems or for data modelling of dispersion or air quality. Landfill and construction sites, cities, refineries and land remediation are just some of the locations where air quality is likely to be monitored.

Campbell Scientific systems measure the full range of meteorological parameters that are important considerations alongside other specific air quality measurements. Our ceilometer provides a Mixing Layer Height calculation option useful in determining the likely height of trapped pollution.



*Meteorological data is important in predicting air quality problems.*



*Avalanche prediction and control is just one application using mountain weather data.*

## Mountain and Polar Weather

Campbell Scientific provides rugged, low-power measurement systems for many applications in snowy climates. Our systems measure snow depth, snow-water equivalent, air temperature, relative humidity, and wind speed and direction. This data is useful for displaying current weather conditions, identifying snow-making conditions, forecasting spring runoff and summer water availability, and modelling avalanche conditions.



*The water contained in snow can be a drinking water resource or a flood risk.*

## Snow Measurement

In many parts of the world snow is an important aspect of everyday life – in terms of transportation, water resource, structural load bearing, flood risk, avalanche control and sports and leisure activities. Campbell Scientific has been supplying autonomous measurement solutions into areas subject to harsh winter conditions for many years. High reliability and power efficiency being two stand-out benefits.

Solutions specific to snow include depth measurement and snow water equivalence or SWE where our solution offers a non-invasive, no chemical alternative to the commonly used snow pillow method. A rugged high definition network digital still/video camera is also available for use in these tough environments.



*A best of both worlds solution offers both advance warning and strike detection.*

## Lightning Warning Systems

Lightning is one of the world's most lethal weather phenomena and reliable systems for advanced warning and strike detection are a vital tool in saving lives. From golf courses to school sports fields; from wind turbines to munitions, mining and refuelling operations, lightning warning are a necessity.

Campbell Scientific offer a 'best of both worlds' solution that combines advance lightning warning using atmospheric electric field measurements with actual strike detection providing range and direction information.



*Wildfires can travel fast and understanding wind speed and direction is vital.*

## Wild Fire Weather

In areas at risk from wildfires live weather information is of vital importance to those monitoring and fighting outbreaks. Where conditions are dry, wind and temperature measurements are used as risk factors in determining the level of warning.

If a fire starts, quick deploy stations provide vital information about the wind speed to assist with the warning and possible evacuation of those in the path of the fire as well as to those tackling the fire.

Konect GDS, our managed data service, can additionally poll stations, QC data and send out alerts via email or SMS; data can be accessed by any authorised user 24/7/365 using any suitable internet browser.



*Measuring CO<sub>2</sub> and H<sub>2</sub>O fluxes with open or closed-path Eddy Covariance systems.*

## Micrometeorology

Measuring the exchanges between ecosystems and greenhouse gases (GHG) at the earth's boundary layer is important to scientists working towards a better understanding of net greenhouse gas and heat fluxes.

Through the statistical analysis of high frequency measurements of CO<sub>2</sub> and H<sub>2</sub>O densities synchronously taken alongside temperature and three dimensional wind speed and direction measurements, scientists can determine the net emission/absorption of greenhouse gases at tree canopies, lakes, oceans and even urban environments across the world.

Our turnkey open path and closed path systems feature unique attributes such as low power consumption, co-located measurement volumes and temporal synchronisation between wind and gas measurement and simple installation.



*Irrigation systems can be directly controlled by a weather station.*

## Evapotranspiration & Commercial Irrigation

Campbell Scientific's reliable weather and environmental measurement systems can be utilised in both agricultural and commercial irrigation systems, used to either trigger warnings or even directly control water systems – turning on sprinklers or opening sluice gates for instance.

Utilising a flexible system design means that a wide range of meteorological and other parameters can be measured, these might include calculated ETo (evapotranspiration), soil moisture profiles, and leaf wetness.



*Automatic glasshouse temperature control is a typical agricultural application for Campbell Scientific systems.*

## Agriculture & Plants

Campbell Scientific systems have extensive measurement and control features and it is this control capability that attracts many users with agricultural applications. Campbell Scientific systems can be used to control external devices such as sprinklers, greenhouse windows, irrigation systems, heaters and so on based on either time or event. System flexibility means that additional measurements such as soil moisture, leaf wetness, PAR (Photosynthetically Active Radiation) or evapotranspiration can be included alongside more traditional meteorological data.

Our systems are well suited to both research applications and commercial operations.



*Safe and efficient airport operations are reliant upon accurate and timely weather data.*

## Aviation Weather

Airport weather systems are relied upon for passenger and ground crew safety as well as for efficient operations. Campbell Scientific provide systems which include weather stations, ceilometers reporting cloud base and sky condition, visibility sensors and full IRVR systems.

Our Metcom software package is a scalable airport weather monitoring package (AWOS) capable of collating and reporting weather data in standard aviation formats. From a single station version for small airfields and helipads right through to multi failover server based systems suited to international airports; there is a Metcom solution for all aviation locations.

Metcom complies with CAA and ICAO guidance and meets or exceeds all recommendations and specifications.



*Real time weather data helps keep traffic flowing and safe in adverse driving conditions.*



*Metoccean parameters can be measured from buoys, boats, oil and gas platforms or even from onshore.*



*Reliable long term weather data is vital for accurate wind resource assessment.*



*Accurate solar and other met data is used in the pre-installation and operational phases of a solar farm.*

## Road Weather

Those in charge of road management require real time weather data to enable informed decision making on, for example, winter gritting and flood, high wind or fog warning. Better informed decisions lead to improved safety, better traffic flow and lower operational costs as gritting materials are only implemented when and where required – this also reduces the impact on the environment.

Campbell Scientific offer a range of road weather solutions from stand-alone roadside visibility sensors to full Road Weather Information System (RWIS) and Environmental Sensor Stations (ESS). Systems include either contactless or surface embedded road sensor condition monitoring options. Our data management service, Konect GDS, further enhances the provision with data collection, data quality checks and data archiving and more, all handled within this highly secure, cloud based service. Data is owned by the customer and is accessible in tabular and graphical form 24/7/365 via any suitable browser over the internet.

## Marine Weather & Oceanography

Campbell Scientific supply measurement equipment for use on buoys, oil and offshore wind platforms, piers and in harbours to provide information for use by those involved in helicopter and boat operations, by harbourmasters, by wind energy providers and by those involved in oceanographic research.

Systems can provide standard meteorological data or additional parameters such as visibility, cloud height, tidal height and flow, sea state, sea temperature and wave information can be included.

Konect GDS, our managed data service, can be utilised to automatically collect, check and archive data, which can be accessed over the internet using any suitable browser. Displays can be tabular or graphical in format.

## Weather in Wind Energy

Our solutions are used from the early stages of resource assessment whereby our systems are installed on instrumented met masts and where they are utilised to determine a sites prospective wind yield, through to operational usages for forecasting, warning systems and maintenance planning. Systems comply with all industry recommendations and best practices and sensors can be supplied with MEASNET calibration.

Obstruction lights used on tall structures such as wind turbines can be a nuisance to local residents. Our visibility sensors can be used to control the intensity these lights based on visibility conditions and thereby help improve the quality of life for those living in the vicinity of wind turbines.

Given the nature of structures in wind farms, they can be prone to lightning strikes. This not only has implications for the structures but also for the safety of any operation and maintenance personnel working in the area. Campbell's lightning warning system can be used to maximise advance notice of imminent lightning risk.

## Weather in Solar Energy

Obtaining accurate site specific meteorological data provides the best method of assessing the true return on investment for a solar power plant installation. Efficient ongoing operation, supply forecasting and site maintenance planning can all be enhanced by the integration of met measurement data.

Our turnkey measurement systems including our PV panel soiling profiler comply with all relevant industry standards and provide field proven reliability. With options on datalogger, sensor, communication, power and mounting these systems can be tailored to meet the project requirements.

Station data can either be client collected or managed through our secure cloud based data management service, Konect GDS. This offers integrated data quality checks, web based data access 24/7 and options for text or email alerts for a nominal monthly fee.

[www.campbellsci.eu/weather](http://www.campbellsci.eu/weather)

## Weather Case Studies

When the UK Met Office wished to replace its network of around 250 automatic weather stations it chose Campbell Scientific to provide complete stations pre-built and configured for each site. In most cases the new weather stations had to accommodate existing sensors, filed cabling and communication infrastructure, making the design that much more challenging.

Campbell Scientific successfully installed over 400 logger systems in approximately 250 sites, including re-commissioning and testing of existing site instruments before handing the site back to the Met Office

[www.campbellsci.eu/met-office-mms](http://www.campbellsci.eu/met-office-mms)

Forty-nine Campbell Scientific weather stations make up North Dakota's Agricultural Weather Network (NDAWN). Data from the network is used by an increasing number of individuals and organizations for a variety of purposes, such as irrigation scheduling, pesticide application scheduling, and various research projects. The standard stations monitor air temperature, relative humidity, wind speed and direction, solar radiation, rainfall, and soil temperature. Data is transmitted by phone and cellular phone. Additional parameters are measured in conjunction with seasonal changes or research.

[www.campbellsci.eu/north-dakota-network](http://www.campbellsci.eu/north-dakota-network)

A long-term scientific study to monitor trends in the biodiversity and structure of ecosystems of tropical forests is making use of a network of Campbell Scientific field stations in Central America. Taking advantage of standardized protocols, each station will obtain data using the same methods, making the results consistent and comparable.

[www.campbellsci.eu/cost-rica-biodiversity](http://www.campbellsci.eu/cost-rica-biodiversity)

Understanding the exchanges of energy, water, and carbon dioxide between the atmosphere, land, and plants provides a basis for understanding elements of weather, climate, and agriculture. Studying the turbulence, or eddies, in and around the canopy of trees is helpful in piecing together this understanding.

[www.campbellsci.eu/chats-csat3](http://www.campbellsci.eu/chats-csat3)

The Channel Tunnel connects the United Kingdom with France. It is actually a set of three tunnels, over 31 miles long, that pass beneath the seabed of the English Channel. Because of the huge amount of road and rail traffic at the large terminals at each end of the tunnels, a road-weather information system (RWIS) is critical for safety and efficiency.

[www.campbellsci.eu/channel-tunnel](http://www.campbellsci.eu/channel-tunnel)

Campbell Scientific worked with a local integrator partner to install an Automatic Weather Station in a Portuguese Military Air Base, to support the air operations, in accordance with ICAO and WMO recommendations for equipment and infrastructures.

[www.campbellsci.eu/military-aviation](http://www.campbellsci.eu/military-aviation)

The Mexican Aerospace Navigation Service (SENEAM) is the agency responsible for providing meteorological data to airports in Mexico. To capture and make available to airports more of this critical weather data, SENEAM contracted with Disime, Campbell Scientific's representative in Mexico and a highly-qualified integrator and consultant, to install comprehensive weather stations at six airports.

[www.campbellsci.eu/mexico-aviation](http://www.campbellsci.eu/mexico-aviation)

CalWind Resources owns and operates a wind farm in Tehachapi, California. The wind farm has been in operation for many years, but with the new requirement to report data to the California ISO, CalWind Resources needed to procure and install new measurement and communication equipment. Campbell Scientific equipment was chosen to be installed on the wind farm in order to meet the measurement and communication needs.

[www.campbellsci.eu/calwind](http://www.campbellsci.eu/calwind)

In 2006 a cooperative Japanese-Chinese science organization, the Japan International Cooperation Agency (JICA), began a project to measure the atmospheric boundary-level flux near Erhai Lake in Yunnan province in China. To correct for the influence of the large lake on the flux measurements, a combination hydrological-meteorological station was installed out on the lake in January 2008. The station was required to be solar powered, communicate via GPRS modems, and not detract from the natural setting.

[www.campbellsci.eu/china-lake](http://www.campbellsci.eu/china-lake)

Pont del Petroli was built in the 1960s to enable the transfer of oil from tankers onto land. The pier extends some 250m over the sea near Badalona's sandy beach, close to Barcelona. The platform is 6m above mean water level; water depth is 12m at the deepest point.

[www.campbellsci.eu/badalona-oil](http://www.campbellsci.eu/badalona-oil)

Dr. Joan Girona of the Institute of Agroalimentary Research and Technology in Catalonia, Spain, studies irrigation and the water and nutrient needs of fruit trees. In a recent study, he wanted to measure the absorption of photosynthetically active radiation (PAR) for use in analyzing growth and fruit production issues.

[www.campbellsci.eu/spain-train](http://www.campbellsci.eu/spain-train)

Since its beginning in 1981, the main purpose of the Community Environmental Monitoring Program (CEMP) has been to involve the people from the communities around the Nevada Test Site (NTS) in its off-site monitoring program for radiation. After all, who would you rather ask if it is safe to live in your community, your neighbour who shares your concerns or a stranger who lives elsewhere?

[www.campbellsci.eu/nevada-cemp](http://www.campbellsci.eu/nevada-cemp)

## Significant Systems & Products

### Weather Stations

For professional weather monitoring we offer pre-configured, pre-programmed turnkey stations through to more complex systems built bespoke to meet specific customer requirements and complete networks of stations. Communication options include Ethernet, direct, GPRS/GSM, radio, satellite, short haul and fixed line to ensure contact with the station is possible no matter where in the world it is situated.



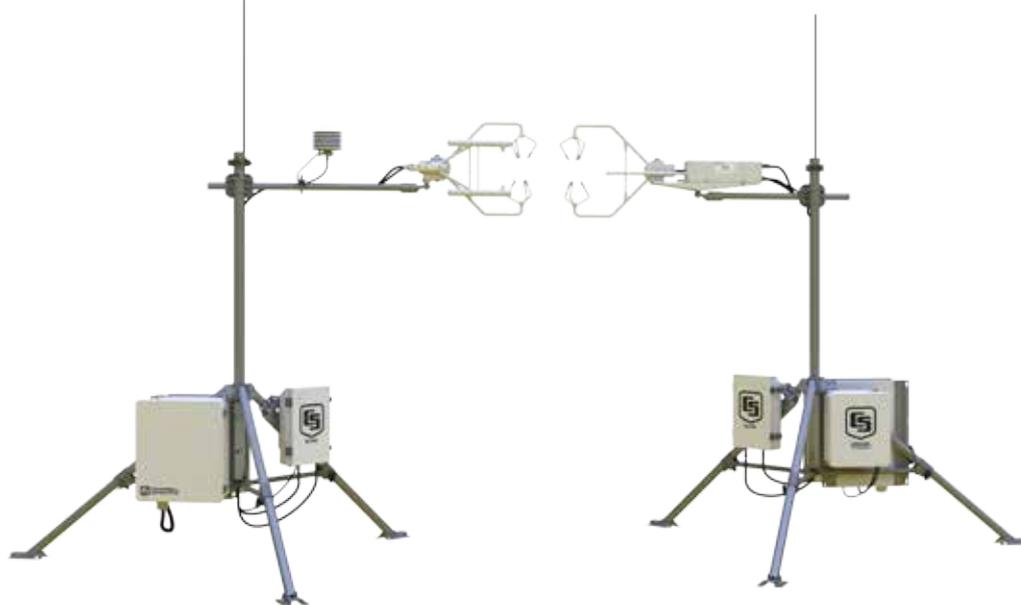
Our stations include many sensors of our own manufacture but we also support most leading 3rd party manufactured sensors too, so you can be certain of us meeting your required specification through the use of 'best of breed' sensors.

Systems can be pole, tower or tripod mounted and powered via solar/battery or mains.

A wide range of supporting software and system enhancing peripherals are available.



### Micrometeorology Systems



Since the early days of micrometeorology Campbell Scientific have been at the forefront of instrumentation design.

Recent innovations have included the IRGASON, the worlds only integrated 3D Sonic Anemometer and IR Gas Analyser. The IRGASON provide co-located measurement volumes for gas and wind measurements whilst the shared electronic control box significantly reduces power consumption and system complexity. Solar powered Eddy Covariance measurements are a

reality with this system.

As well as the IRGASON based Open Path Eddy Covariance system we also offer a closed path option (CPEC) which has the advantage of being able to operate during rain. Featuring the EC155 gas analyser and CSAT3B sonic anemometer which have been designed to co-locate measurement volumes as closely as possible and which also share a standard control box for reduced system power consumption.

## Significant Systems & Products

### Dataloggers



Campbell Scientific dataloggers are at the centre of our rugged, reliable data acquisition systems. They are known for their flexibility, precision measurements, and dependability—even in harsh, remote environments.

As for functionality, all of our dataloggers:

- » Measure sensors
- » Process data onboard
- » Initiate measurement and control functions based on time or event
- » Store data in multiple tables that can be individually sized and collected
- » Control external devices such as pumps, motors, alarms, freezers, and valves
- » Operate independently of ac power, computers, and human interaction
- » Use our PC support software to program the datalogger
- » Consume minimal power from a 12 Vdc source
- » Interface with on-site and telemetry devices
- » Perform reliably under adverse conditions



We offer a choice of datalogger models to cover a range of budgets and project requirements.

**CR300-series** - Our entry level but highly capable logger ideal for smaller projects requiring just a few sensors to be measured. Options available with intergrated WiFi or radio communications. The CR310 model also includes integrated Ethernet port.

**CR800/CR850** - the same internal electronics and specifications as our most popular logger, the CR1000, with slightly fewer channels and lower price tag. The CR850 features an integrated keyboard/display.

**CR1000** - Our most popular datalogger offers a large channel count, 100Hz scan rate, low power, high reliability and supports a wide range of peripherals.

**CR6** - Featuring universal channels, integrated Ethernet, integrated MicroSD card and true 24Bit A/D resolution. Option variants include integrated WiFi or radio communications.

**CR3000** - For demanding applications requiring either a high channel count or fast scan rate.

**CR9000X** - A modular datalogger capable of high frequency measurements of up to 100,000 Hz.



## Significant Systems & Products

### Optical Weather Sensors



Campbell Scientific have a range of specialist optical weather sensors which all offer outstanding features and exceptional value for money. All models comply with CAA and ICAO guidance and meet or exceed all recommendations and specifications (including CAP437, CAP670 and CAP746). Models include:

CS135 Lidar Ceilometer - accurately reports up to 4 layers of clouds in the range 0m to 10,000m. A chargeable option for Mixing Layer Height calculation for air quality assessments is available.

CS120A Visibility Sensor - reports Meteorological Optical Range (MOR) in the range 5m to 75,000m. Features user-configurable alarm outputs which can trigger relays (for example to control aircraft warning light intensity on wind turbines).

CS125 Present Weather Sensor - reports visibility as per CS120A, with additional present weather capability - outputs 56 SYNOP present weather codes and associated METAR present weather codes.

CS140 Background Luminance Sensor - used in conjunction with the CS120A/CS125 to enable the calculation of Instrumented Runway Visual Range (IRVR).

PWS100 Present Weather Sensor - our top level present weather sensor reports a wide range of present weather codes and in addition offers detailed precipitation data such as rain rate (intensity), drop-size distribution accumulation. Unprocessed raw data output available.

### Specialist Devices

We offer a number of specialist sensors and devices which have been designed to meet quite specific requirements - here are a couple of examples:



CC5MPX - HD Digital Still & Video Network camera. This camera, capable of delivering up to 5MB HD still images and video footage is designed to operate in extreme environments to capture images in locations no ordinary camera could cope with. Image capture is triggered either by time, movement detection or by remote trigger, such as a datalogger.

The camera offers a choice of power saving options for extended field operation.

CS725 - Snow Water Equivalence Sensor.

Snow water equivalence (SWE) is an important measure in areas with regular high snow levels where the water contained in a snow bank might contribute to drinking water resources or be a flood risk on melt; structural load bearing considerations is another use.

The CS725 is non-invasive and simple-to-install; it measures changes to the attenuation of the background signal from naturally occurring bedrock emissions to determine SWE. The more commonly used method 'snow pillows' requires ground work, uses environmentally harmful chemicals and which can be subject to errors cause by ice 'bridging' over the pillow.



## Programming, Data Collection & Display Options



Konec Global Data Management is a highly secure cloud based data collection, archive and display system that allows a user to simply access their station data with minimal technical knowledge.

The system will routinely collect data, apply any of the integrated quality checks selected and store the data securely on Microsoft's Azure platform. Data can be accessed 24/7/365 using any suitable browser on any suitable internet enabled device (laptop, tablet, phone etc.).



Tabular or graphical views are provided and configurable alarms can easily be set to notify via SMS, email or on the Konec GDS interface.

Additional users can easily be added and managed allowing simple data sharing with authorised third parties.

Customers wanting to arrange their own data collection but who wish to simplify the process will be interested to hear about Konec Data Routing service which allows easy configuration of corporate firewall issues.



LoggerNet is our main datalogger support software package. It supports programming, communication, and data retrieval between dataloggers and a PC.

LoggerNet consists of a server application and several client applications integrated into a single product. It can support connection to a single datalogger, but it is especially adept in applications that require telecommunications or scheduled data retrieval used in large datalogger networks.

Version 4 is our most recent major upgrade to LoggerNet that features a new tool for designing and configuring PakBus® networks, a more powerful file viewer, an upgrade to RTMC, a redesigned toolbar, and many updates to existing clients. Learn more about the upgrade in the brochure and manual linked at [www.campbellsci.eu/loggernet](http://www.campbellsci.eu/loggernet)

Additional software for display and analysis includes:

RTMC Pro - used to create and run graphical screens that provide real-time monitor and control capabilities. This separately-purchased product is an enhanced version of the RTMC client included with LoggerNet, LoggerNetAdmin, and RTDAQ.

We also offer a free software package, PC200W, which supports direct connection to a datalogger and PC400 which is chargeable but provides extended communications support for projects that do not require full blown Loggernet.

# Measurement Solutions for Weather Applications

For further information call our weather team on +44 (0)1509 828888  
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Picture courtesy of Romain Biron, Université Joseph Fourier, Grenoble

