Weather Stations:
Saving Time and Money with Remote Communications

Data logging weather stations can be valuable tools in many research applications in a wide variety of environments. In addition to collecting data regularly and reliably and reducing human error, the right type of weather station can save you research dollars, labor and time.

The latest generation of weather stations with remote communications capabilities can save you even more by dramatically reducing the costs associated with station maintenance, data download, and data loss.

This paper will provide specific information about three ways weather stations with remote communications can save time and money, and will help guide you in deciding whether such systems are right for your application.

Weather Station Basics

Data logging weather stations are used by a wide range of researchers in environments all over the world. These stations contribute to successful work in applied and basic research in agriculture, ecology, climate studies, water resources management, green technology, and other fields.

Weather stations monitor such parameters as temperature, rainfall, wind speed, wind direction, soil moisture, light intensity and others. The sensors are mounted on a tripod, and are connected with cables to a data logger that stores measurements. Units typically run on battery and/or solar power, and all components must be designed to withstand long-term outdoor weather conditions.

Weather stations allow for unattended data collection 24 hours a day, seven days a week, and users designate sampling intervals appropriate to their application.

Stand-alone Stations vs. Remote

Essentially, two types of data logging weather stations exist: stand-alone weather stations, and weather stations with integrated remote communications.

Stand-alone systems require the user to visit the station to download data, adjust configurations, and/or launch new sensors. In order to perform any of these actions, the user must travel to the field site where the weather station equipment is deployed.

Weather stations with remote communications allow users to access collected data and perform system management and control functions over the Internet without having to go into the field. These systems may feature similar sensors, hardware, and power options as their stand-alone counterparts, but provide the advantage of integrated remote communications technologies.

Rather than having to go out into the field, the user simply logs onto a website to view and download data, check sensor and battery status, or make adjustments to logging intervals. By having these capabilities, the user saves time and money on travel and labor, and can check that sensors are working properly. He or she can even receive alarm notification when sensor parameters are out of a set range, if battery power is low, or if other problems exist.

Weather stations with remote communications can help boost research efficiency in three ways by:

- Reducing the cost of maintaining a weather station
- Reducing the cost of retrieving data
- Reducing the costs associated with losing data.

Saving Time and Money with Remote Communications

Though either type of weather station can be a valuable tool for many research projects, a remote communications-enabled system might be the most cost-effective option, even taking into account the expense of the hardware and data communications.

1. Reduce the Cost of Maintaining a Weather Station

After initial system deployment in the field, many things can happen. No matter how well-built and durable the hardware and sensors, rodents and bears have chewed and clawed through cables; birds nest in rain gauges; and lightning and vandals strike. What's more, different phases of your research may require you to change logging intervals or set an alarm weeks or months after you deploy your station.

The truth is, many users check on their weather stations, if possible. Their data is just too valuable to risk losing it.

Peace of mind can be yours with a remote communications weather station. Just log on to the Internet to ensure that things are running smoothly and make adjustments. If a problem is detected, you can plan a field visit to fix the problem.

2. Reduce the cost of retrieving data

Retrieving data from a stand-alone weather station means visiting the station. This is a straightforward operation if your weather station is close by, or if you only need to download data infrequently. But what if you need growing degree day data from a test plot, or if you need to know soil moisture levels in a crop field? In these cases, you may want to consider a remote communications weather station.

Visiting field sites requires money and time. And there are other factors, such as the challenge of finding a weather station in a corn field in late summer, as opposed to when it was deployed in May. There may also be instances where you will need to do more than

just download your data; field sampling or qualitative observations may be best done under certain environmental conditions, and it is good to know that you are not wasting time and energy visiting a field site under suboptimal conditions.

Downloading your data remotely also means that there's no need to worry about taking a laptop computer out into the field. And since your data is available over the Internet, you can share it with colleagues from the comfort of your office or laboratory.

3. *Reduce the costs associated with losing data*

Without data, what have you got? It depends. For a climate researcher, losing two weeks of wind speed data might not be catastrophic, but for an irrigation researcher, losing two weeks of rain data may mean having to do the project over next year.

Remote communications lets you know if something is wrong as soon as you check your data on the Internet, or you can even set up sensor and system alarms that immediately notify you by email or text message when something goes wrong. It may even be possible to fix the problem from your desk.

If you have lost data or know someone who has, consider what it meant to the project. Was it a disaster or a minor glitch? Depending on your application, knowing that something is amiss as soon as it happens can make all the difference in the world.

How much will it cost?

Use this worksheet to approximate the cost of each system for your application.

	Hardware/ Software	Communications Plan	Maintenance Visits (travel & labor x #)	Data Download (travel & labor)	Lost Data Factor	Total Cost
Stand-alone weather station	$	N/A	$	$	$	?
Weather station with remote communication	$	$	$	N/A	$	?

Real-world Examples

As you begin thinking about important factors such as distance to the field site, how often data is required, and travel and time costs for data retrieval, consider the following real-world examples:

- A crop consultant monitors rainfall, soil temperature, soil moisture, and solar radiation in bean and corn fields all over the state of Illinois. He reports conditions and makes recommendations to the farmers weekly throughout the growing season, from seed to harvest.

  Because he has multiple field sites spread out over large geographic areas, and must submit reports and recommendations weekly, his application is a good candidate for remote communications-enabled weather stations to help reduce the costs associated with labor, time and transportation.

Are Remote Communications Right for Your Application?

Answering the questions below will help you decide whether remote communications is the right choice for your monitoring application. These questions apply whether you are a current stand-alone weather station user, or are completely new to using weather stations.

Consider the following for each weather station you need:

- Where is the station deployed?
- Is there adequate cellular coverage at the site location?
- How far away from your office or laboratory is it, and how do you get there?
- What are the costs associated with that travel?
- Do you have to visit field sites for purposes other than checking your weather station (for example, to collect soil or water samples)?
- Would it be useful to know what the current conditions are or what they have been at your site?
- Ideally, how often should you visit a stand-alone station (consider data downloads and maintenance checks)?
- How often do you actually visit the stand-alone station?
- Have you had problems with lost data? How would your application be affected by lost data?
- For how long do you typically deploy the weather station?
- What is your budget for a weather station (including costs associated with system maintenance, analysis, travel, etc.)
- How important to you are alarm notifications (for example, parameters go out of a certain range, battery level is low, a sensor malfunctions)?
- Will you use the weather station for future projects?

- An environmental chemist working for a large fertilizer company monitors soil conditions at multiple sites on the West Coast in order to provide data for fertilizer dissipation models. She requires weekly rainfall and soil moisture data for the model.

  Having to travel to various sites to manually retrieve data, her application could benefit from remote communications-enabled weather stations.

- A farmer uses soil moisture and temperature sensors to monitor a compost pile and help determine optimal turning times. The goal is to save labor, equipment and fuel costs associated with inappropriately-timed compost turnovers.

  Depending on how frequently he is in the field and how often he needs to access data, a remote-communications enabled weather station may or may not be advantageous.

Conclusion

Today, with the capacity for remote communications and web access to data and system functions, data logging weather stations are more powerful than ever before. New, affordable remote monitoring systems can revolutionize the way researchers, consultants and project managers carry out their work, and can save significant time and money.

About Onset

Onset Computer Corporation has been producing small, inexpensive, battery-powered data loggers and embedded controllers since 1981, and has sold over one million loggers that are used around the world by over 50,000 customers. The company manufactures a broad range of data logger and weather station products that are used to measure temperature, humidity, light intensity, voltage, and a broad range of other parameters. Onset products are used widely in research, commercial, industrial, and educational applications.

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