

Environment Agency Builds New Technology into Rain Monitoring Network

During recent trials conducted by the Environment Agency (EA) and the Scottish Environment Protection Agency (SEPA), in cooperation with the UK Met Office, OTT Hydrometry's Pluvio² raingauge exceeded the target performance requirements of the assessment and over 100 units have now been purchased by the EA. As a result, the quality of monitoring data will be improved and the cost of running the more remote sites will be significantly reduced because site visits are only necessary once or twice per year, instead of approximately quarterly, which is the typical frequency undertaken for tipping bucket raingauges by the EA.

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Background

In the 17th century Sir Christopher Wren, a designer, astronomer, geometer, and one of the greatest English architects of his time, was best known for the design of 53 London churches, including St Paul's Cathedral. However, one of his lesser known achievements was the creation in 1662, of a raingauge that did not require daily visits - the world's first tipping bucket raingauge (TBR). The real advantage of this technique was that it enabled a clockwork chart to record rainfall so that Sir Christopher did not need to read and record every single day's data. Since that time the same principle has formed the basis of almost all national rainfall monitoring networks around the world. However, a TBR requires regular maintenance to ensure that its funnel and filter are not blocked, and the 'buckets' require regular cleaning and calibration to ensure that all of the collected water 'tips' and does not adhere to accumulated dirt and that the raingauge operates within specification.

Latest Precipitation Monitoring Technology

In contrast with traditional techniques, the Pluvio² measures rainfall by collecting precipitation and weighing the collected liquid with a highly accurate load cell.

The Pluvio was first launched in 1994 and there are now more than 5000 units in operation all over the world, this has been followed by the development and implementation of a successor; the 'OTT Pluvio²', which provides even better precipitation measurement and at a proven lower cost of ownership, which makes it accessible to a wide range of applications.

The key feature of the Pluvio² is that it can measure precipitation accurately and reliably in all weather conditions, while requiring minimal maintenance.

The instrument's accuracy is not diminished by the intensity of precipitation - the measurement range extends from 0.1 to 30 mm/min. This technology is also well suited to freezing conditions because the EA uses a physical frost protector to preserve the gauge during freezing conditions - the measurement range extends from -40 to +60 °C. An optional heating ring is available to prevent snow capping.

TBRs occasionally include thermostatically controlled internal heaters to address the problem of snow/ice accumulation, but this can incur a delay in the measurement and may be impractical in remote locations



Pluvio²

for reasons of power consumption. In contrast, the unheated version of the OTT Pluvio² operates on very low power - typically 12 mA at 12V.

A sophisticated software filter eliminates the potential effects of wind and each OTT Pluvio² is individually temperature calibrated.

The OTT Pluvio² weighing measuring principle is based upon an edge compensated and sealed single load cell, with inbuilt overload protection, direct mounting on the weighing platform and highly sophisticated electronics and algorithm features as standard. The individual temperature characteristics of the load cell are memorised in the electronics and corrected by in-situ temperature compensation. This achieves precise weight measurements with incremental accuracy of 2 grams equal to 0.10 mm and provides resolution of 0.01 mm of precipitation. The load cell is also insensitive to eccentric load that may occur for example, as a result of unsymmetrical distribution of snow in the buckets.

Standard Methods

The committee which recently updated the British Standard on the acquisition and management of meteorological precipitation data



OTT Reading RG

from a raingauge network (BS 7843-1:2012) was chaired by the Environment Agency's Dave Stewart, who was also involved in the trial to evaluate the Pluvio². Dave says: "BS7843 includes raingauges that operate on the weighing principle and it is likely that the new European CEN standard that is currently being developed will incorporate the content of the British Standard."

OTT Pluvio² Trials

The objectives of the trials were as follows:

- to compare performance against existing technology
- to test the equipment as a potential low maintenance raingauge in remote areas that will allow reduced frequency of site visits compared to existing practice for TBRs
- to investigate the instrument accuracy and reliability to allow its operation without the need for a comparison gauge e.g. a monthly check gauge
- to assess its performance in the measurement of solid precipitation

The trial was undertaken at sites in both Scotland and North Wales. An observer-read daily raingauge was the reference for

the daily rainfall total. The Pluvio² performance was measured by its deviation from the observer-read daily gauge over periods of one month and the target was for this deviation not to exceed 10% (SEPA) and 8% (EA). These data were quality controlled by the Met Office.

Results and Conclusions

The Pluvio² passed the success criteria at both trials, showing a very close relationship with the storage daily reference raingauge over the period of both trials. The Pluvio² also outperformed all of the TBRs in the trial during snowfall events.

Over 100 Pluvio² raingauges have now been purchased by the EA with further purchases planned for the near future. Dave Stewart has been responsible for the implementation of Pluvio² into the EA's network and says "Initial results look promising; the Pluvio² is proving to be very reliable, so we have been able to reduce the frequency with which we have to make site visits. This is particularly advantageous with remote sites where we are making considerable savings in time and travel; payback periods vary from almost immediate, up to several years."

Further information is available at www.ott-hydrometry.co.uk