

# Aerodynamic Rain Gauges

*by EML*



**Cost effective, professional Hydro-Met instrumentation and  
data systems from EML**

# Accurate Rain Gauges in all Environments

EML's rainfall systems are underpinned by aerodynamic rain gauges of exceptional quality, used by many technologically leading National Meteorological and Hydrological Services, including UK Meteorological Office, Uruguayan Institute of Meteorology (INUMET) and Scottish Environment Protection Agency (SEPA). Systems can be designed around the clients' needs and budget. We work with international partners to deliver customer-specific solutions.

## Flagship Product: The SBS

- Optimum aerodynamic shape from 10 years of research
- Marine Grade Aluminium – Robust, for extreme environments
- Low Total Cost of Ownership
- Self-emptying instrument
- Dual, removable reed switches
- Multiple resolutions available
- WMO Complaint
- Low maintenance requirements
- Siphon version available



## Example Applications of EML Rain Gauges

- National hydrological and meteorological networks
- Industrial applications where Class A accurate data are required
- Flood warning systems and flood risk management
- Agricultural sector
- Hydrology catchment projects
- Urban monitoring networks
- Weather enthusiasts
- Scientific research

All EML gauges are rigorously laboratory and field tested. Outdoor field testing is carried out for a minimum of 12-months against a WMO compliant pit gauge at multiple sites.

**\* New Product for 2019 \***

**The ARG314**

- Optimum aerodynamic shape from 10 years of research – same profile as the internationally proven SBS.
- Injection moulded UV-protected plastic – suitable for most locations
- Low Total Cost of Ownership
- Self-emptying instrument
- Multiple resolutions available
- WMO Complaint
- Low maintenance requirements
- Available with LCD Display
- Siphon version available



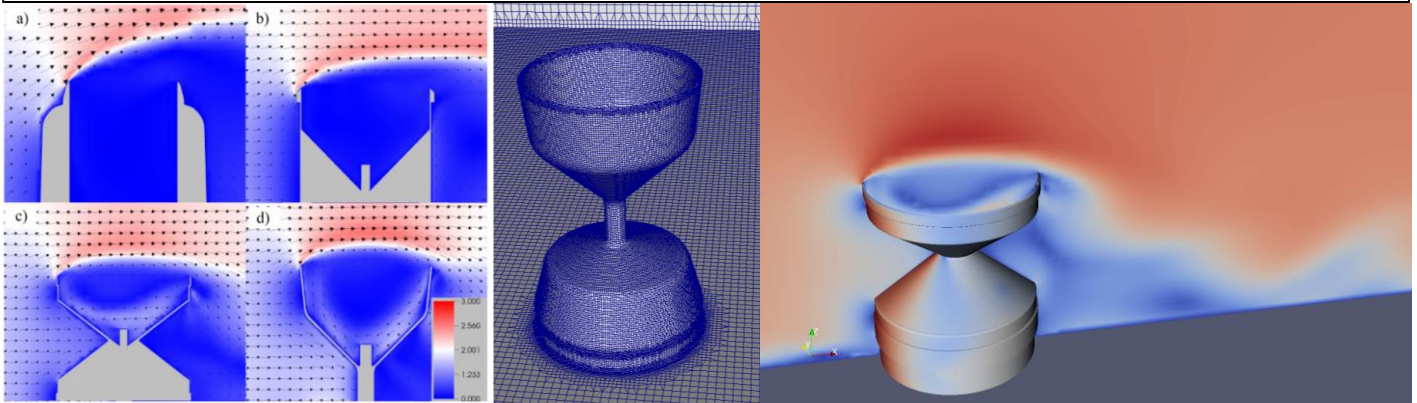
EML Rain Gauges can be integrated flexibly with most data logging or display platform, just contact us to discuss your requirements. Different options can be selected, such as the following typical examples:

<b><u>Features:</u></b>	<b><u>Benefits:</u></b>
Low power consumption	Long-term operation
Cellular modem	Web-based data delivery
International GPRS coverage	Low data costs
Solar charging unit	Remote untended operation
Dual rainfall output	Built-in system redundancy
LCD display	Easy and convenient operation
Gauge / Mounting options	Tailored to specific climates and customers
Intuitive web-based software platform	Visualise and analyse data easily
Real-time data delivery	Suitable where rapid action is critical (Flood, etc)
Alarm trigger thresholds	Detection and reporting of events or low voltage
Spare logging channels	Plug in other sensors
Optional 'multi-gauge' solution (K <sup>2</sup> version)	System redundancy and error checking



## Academic Research in Rainfall (CFD)

EML collaborated with the WMO Lead Centre on Precipitation Intensity (LC-PrIn) to undertake an assessment of the improved performance of aerodynamic rain gauges using Computational Fluid Dynamics (CFD). Results of the research, [published in the Journal of Water Resources Research](#), highlight the benefits of using the EML aerodynamic shape to measure rainfall.



Results from the collaboration illustrate how EML's aerodynamic rain gauges cause a recirculating convergent airflow structure above and within the gauge orifice, whereas the conventional shape gauges do not. This enhances the catch efficiency of the aerodynamic rain gauges by encouraging raindrops to fall within the collecting orifice rather than being carried away, to land on the ground surface downstream of the rain gauge. Another finding was that the aerodynamic shape reduces the extent of the turbulence above the collecting orifice, which is illustrated in the captioned figure above. Increased turbulence was thought to cause a reduction of the catch efficiency, and to make it less predictable. The reference for the paper is cited below, with the DOI hyperlink. In summary, EML's aerodynamic rain gauges are more accurate in the real-world environment than conventional gauges!

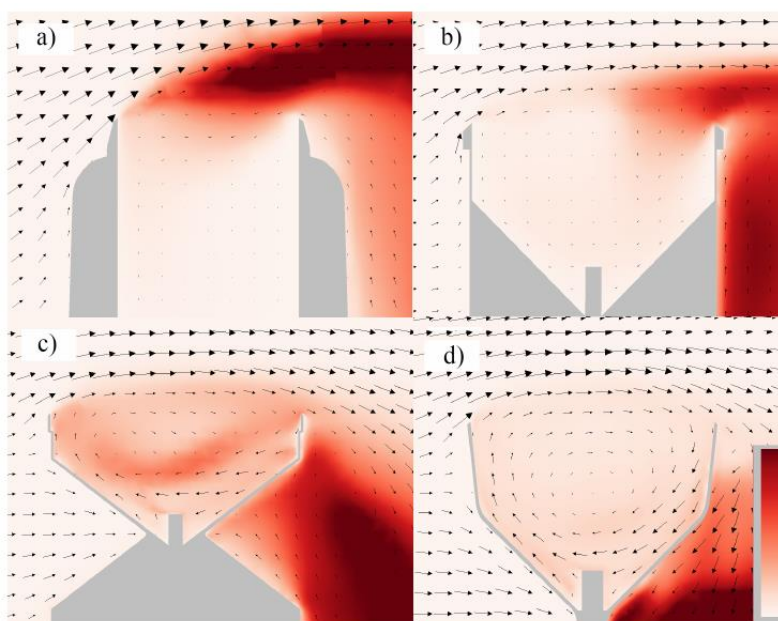


Image caption (left): Turbulence above the orifice of four rain gauges at an input wind speed of 18m/s, with red indicating strong turbulence and white illustrating no turbulence. The gauges are: **a)** Ott Pluvio<sup>2</sup> **b)** Casella CEL, **c)** EML ARG100 and **d)** EML SBS500. **a)** and **b)** are examples of conventional rain gauges, **c)** and **d)** are aerodynamic gauge shapes.

Reference: Colli, M., Pollock, M., Stagnaro, M., Lanza, L. G., Dutton, M., & O'Connell, P. E. (2018). A computational fluid-dynamics assessment of the improved performance of aerodynamic rain gauges. *Water Resources Research*, 54, 779–796. <https://doi.org/10.1002/2017WR020549>

## Academic Research in Rainfall (Field)

EML collaborated with Newcastle University to instrument four field sites with state-of-the-art Hydro-Met equipment to try to understand and mitigate the problem of wind-induced undercatch in rainfall measurements. All sites used a pit gauge as the reference, where rainfall was measured beneath the ground surface. Results [published in the internationally leading Journal of Water Resources Research](#) show that the aerodynamic rain gauge performs much better than conventional shape rain gauges, in particular at windy upland sites.



**State-of-the-art Hydro-Met sites in the lowlands (left) and the uplands (right)**

Rainfall is difficult to measure because it varies so much in time and space, and the measurement of rain is highly affected by how windy it is, which also varies in time and space. When it rains at the same time as being very windy, which is common during many storms, rainfall measurements are greatly underestimated. The uplands generally receive more rainfall and higher wind speeds than the lowlands, therefore it follows that we underestimate rainfall by more in the uplands. This is important because rainfall measurements in the uplands are sparse, yet it is in such areas where many floods originate. This study showed that the underestimation of rainfall at a site in the windy Scottish uplands was more than 23% on average. It also showed that using EML's aerodynamic rain gauges reduced the problem significantly!

Reference: Pollock, M. D., O'Donnell, G., Quinn, P., Dutton, M., Black, A., Wilkinson, M. E., Colli, M., Stagnaro, M., Lanza, L. G., Lewis, E., Kilsby, C.G., O'Connell, P. E. (2018). Quantifying and mitigating wind-induced undercatch in rainfall measurements. *Water Resources Research*, 54, 3863–3875. <https://doi.org/10.1029/2017WR022421>





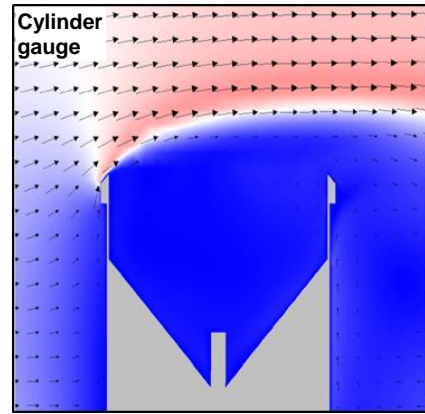
### **‘REMATCH’**

Building **RE**silience to **M**ulti-source Flooding in South/Southeast **A**sia through a **T**echnology-informed **C**ommunity-based approach

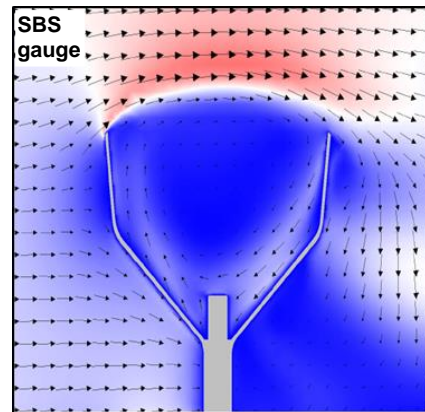
### **Project Facts:**

- 2 EML ‘SlingShot’ systems installed
- Real-time rainfall data reported live to the internet
- Data used to monitor rainfall; model flooding and its impacts
- Helping rural communities to live with flooding!





**Old Technology**



**New: Aerodynamic**

## Technical Specifications (EML Rain Gauges):

	Kalyx-RG	ARG Range	SBS Range
Resolution (mm):	0.2	0.1 / 0.2 (Inch versions available)	0.1 / 0.2 / 0.5 (Inch versions available)
Market	Low cost	Mid-range	Top of the range
Best Suited Climatology	High intensity	All intensities	All intensities (selectable funnel dia.)
Funnel Diameter	127mm / 5 inch	200mm	160, 200, 252 or 356 mm
Accuracy	Very Good	Excellent	Outstanding – best in class
Target markets	Amateur / Urban / Dense Gauge Networks	Water Authorities / Project Work	Research Organisations / Met Institutes / All!



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