O-25: A RAINDROP SIMULATOR FOR CALIBRATION OF NON-CATCHING PRECIPITATION MEASURING INSTRUMENTS

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The increasing use of Non-Catching Gauges (NCGs) is driven by the need of high resolution and low maintenance automatic weather stations. The calibration of NCGs is however more challenging than for catching instruments, since hydrometeor characteristics such as particle size and fall velocity must be carefully reproduced to provide the reference precipitation. Currently, no standard calibration procedure for NCGs is available, and manufacturers use internal procedures of which little to no information is often available.

A calibration device has been developed at the University of Genova to generate individual drops and measure them contactless in flight. Drops in the range of 0.5 to 6 mm in diameter are formed at the tip of a calibrated nozzle using a high precision syringe pump. Then, a high voltage power supply creates a large potential difference between the nozzle and a metal ring resulting in the release of the drop. Depending on the drop size and release height, different fractions of the terminal velocity can be achieved. A precision motorised gantry allows for different positions of the gauge sensing area to be sampled. A second gantry aligns the focal plane of a high-resolution camera with the trajectory of the drop. Using speedlights triggered at fixed time intervals, three images of the same drop are captured in a single picture. The shape, size and speed of the drop are determined using photogrammetric techniques once the interval between flashes is known. The instrumental measurement bias is then obtained by comparison with the gauge reading. The drop generation system was validated in a series of laboratory tests against gravimetric cumulative measurements of the released drops.

The rainfall generator was then used to evaluate the performance of different NCGs that use optical principles to sense incoming hydrometeors. Results show significant biases in both the drop size and fall velocity measurements, which propagates on the derivation of the precipitation intensity. Measurements were also found to be affected by the light emitted by the speedlights, requiring dedicated shielding against flashes.

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