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Correction techniques for tipping-bucket rain gauges and their influence on the accuracy of rain intensity measurements

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The measurement of liquid precipitation is affected by a number of catching and counting errors, due to various sources depending both on the measuring principle and the instrument manufacture. In particular, tipping-bucket rain gauges are known to underestimate rainfall at high intensity because of the systematic mechanical errors due to water losses during the tipping movement of the bucket. Corrections can be applied to such instruments in order to reduce the error. The resolution of the instrument also affects the total error observed on the measurement of rainfall intensity, especially at low to medium rain rates. In spite of this, the adoption of appropriate correction techniques could lead to residual errors within $\pm 2\%$ under constant flow rate conditions. This paper provides a comparison between a few suitable techniques used to apply correction to the raw data. The comparison is based on the simulation of rainfall events with different characteristics, starting from the constant flow rate conditions used in the tests performed during the WMO Laboratory Intercomparison of Rainfall Intensity Gauges (Lanza *et al.*, 2005). The results are reported in terms of efficiency of the various correction techniques and their ability to properly report rainfall intensity figures at one minute time resolution. Systematic mechanical errors are also compared with the uncertainty related to the volumetric resolution of tipping-bucket rain gauges, which depends on the nominal volume of the bucket and the size of the collector.