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Investigation on the function of double tipping bucket for improvement of rainfall measurement

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The double-tipping bucket rain gauge (SL3-1) is widely used in meteorological stations to minimize the systematic errors by the influence of rainfall intensity on TBRs in China. With two tipping buckets, the upper tipping bucket turns over and injects rainwater into the converging funnel, and the lower tipping bucket can record the rainfall. In this study, CFD (computational fluid dynamic) simulations and experiments were performed to investigate the function of the double tipping bucket for TBRs in different rainfall intensity. In simulation, the volume-of-fluid model and Reynolds-averaged Navier–Stokes realizable k-ε model and dynamic mesh method were used. In experiments, electric balances, with accuracy of 0.001 g, were used to determine the water volume of the upper tipping bucket outflow. It shows that, with a converging funnel, natural precipitation is uniformed at a certain intensity around 1.9mm/min to control the rainwater outflow into blow tipping bucket to measure rainfall and reduce systematic errors caused by different precipitation intensities. Experimental results demonstrate that the outflow curve of the upper tipping bucket has high correspond with simulation results in tipping process. These results can provide knowledge of advantages of double tipping bucket rain gauge in rainfall measurement and improve the structure designs of double tipping bucket for TBRs and obtain more accurate rainfall data.