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The problems of rain gauge measurement undercatch: an inconvenient truth

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There exists an extensive historical body of work documenting the difficulties in accurately measuring precipitation, in particular, wind induced undercatching. The implications of this are discussed and addressed. Although the problem has been cited many times it has become 'an inconvenient truth' to hydrologists that major inaccuracies in rainfall measurement exist. To date, no universally, all encompassing solution has been proposed to mitigate or quantify these inherent systematic biases, either in historic time series or real-time high resolution measurements used for forecasting. In the context of a changing climate the importance of accurately measuring the precipitation events causing catastrophic flooding is rising to ever greater prominence (e.g. the UK floods of December 2013 and January 2014). Only by improving the ability to accurately measure all types of precipitation in all environmental and atmospheric conditions, will it be possible to augment the efficiency of flood defences, improve the spatiotemporal accuracy of flood forecasting services, plan water resources and calibrate numerical weather prediction models more precisely.

An experimental design is proposed and implemented to address this issue. Phase 1 of this project compared numerous rain gauges and in situ wind speed. Results from this work propose that the annual systematic undercatch can be in the order of 20 percent in the UK. During specific events (measured at high temporal resolution), this can rise to as high as 50 percent for single wind impacted events. Phase 2 of this experiment is now commencing and will compare all instruments against pit rain gauge measurements. This consists of pairing accepted meteorological standard techniques with new and innovative equipment in four experimental locations representative of 'typical' UK rainfall patterns: upland (both west and east coast) and lowland (both west and east coast). By carrying out high resolution testing at these locations, using a robust experimental design, it will be possible to produce either a correction algorithm to mitigate the precipitation losses, or to communicate the uncertainty in measurements. By covering typical European rainfall patterns it is hopeful that a statistically robust method will emerge to characterise the rainfall and produce uncertainty estimates or correction algorithms regionally.