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Quantitative rainfall measurements: a comparison of Micro Rain Radars (MRRs) and Rain Gauges

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The measurement of precipitation, particularly rainfall, is extremely important for a range of applications including hydrology, water resource management, meteorology and climatology, as well as the validation or verification of other precipitation estimation schemes, such as satellite precipitation estimates. Current measurements have a number of advantages and disadvantages: rain gauges provide the only physically direct method of collecting and measuring rain water over time, but are limited to point locations. Radars, whilst providing information on the spatial extent and intensity of precipitation, rely upon indirect measurements at instantaneous intervals. This paper outlines a comparison made between vertically-pointing radars and rain gauges. The University of Birmingham set up an array of 4 vertically-pointing Doppler micro rain radars (MRRs) with 8 rain gauges in order to assess the measurement errors between the different instrumentation. The MRRs measure the backscatter of radiation from precipitation-sized particles between the surface and 3000m enabling a number of parameters to be generated. These include the drop size distribution, the fall velocity and the rain intensity. The rain gauges are primarily tipping bucket gauges with 0.1 and 0.2 mm tip resolutions, together with a standard climatological rain gauge. Measurements are taken by the MRRs every 30 seconds and compared with the rain gauges to establish both the absolute measurement errors (i.e. accumulated rainfall) and the rain intensity errors. These results are then interpreted with regard to the larger-scale satellite precipitation estimate versus surface gauge and radar comparisons.