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Comparison of Doppler micro rain radars and tipping bucket rain gauges

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The University of Birmingham recently provided some capital investment to investigate the effects of the urban area upon precipitation. Four Doppler micro rain radars and eight tipping bucket rain gauges have been bought. For the past year they have been undergoing cross-validation tests before deployment across the urban area. The four Doppler radars, operating at 24 GHz, provide 100m vertical sampling of precipitation from the surface up to 3000m. From the backscatter and Doppler spectrum the radars provide information on drop-size distribution and vertical velocity which can then be used to determine rain intensity. Three of the radars are located at the University of Birmingham Elms Road Observation Site (EROS) with the fourth located about 400m away on the roof of the School of Geography: both sites are within 500m of the Edgbaston Climatological Station. A total of eight tipping rain gauges are located alongside the radars at the EROS site to provide conventional precipitation measurements. Four of the gauges have a quantitative resolution of 0.1 mm/tip, with the other four gauges having a resolution of 0.2 mm/tip: each gauge has a separate data logger that logs the time of a tip to the nearest 0.5 seconds.

Data has been collected for over one year and analysed on a near real-time basis. The results should be interesting to those involved with the measurement of precipitation. Variations in the measured precipitation can be significant: the Doppler radars appear to be in greatest agreement with one another, although some subtleties do exist, particularly with light precipitation. Large differences between gauges are apparent, with similar gauge types showing significant differences: the accuracy of the gauge data is very much dependent upon the maintenance of the gauges themselves, with blockages,

deposits, insects etc all contributing to errors. Measurements between the gauges and the radars varies somewhat, with the greatest level of agreement being at moderate rain rates..

The radars provide information on the intensity of precipitation on a small time integral, rather than a quantitative integral as in the case of gauges. This means that the radars are able to provide much greater information on the occurrence of light precipitation, particularly with intensities less than 1 mm/hr.