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Analysis of weather radar and raingauges for flood forecasting

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Flooding is a natural phenomenon which can cause serious property damage and endanger lives. Accurate flood forecasts need quality rainfall input. Currently, rainfall is predominately measured by raingauges and weather radars. A good understanding of raingauge network and its intergration with weather radars are crucial for real time flood forecasting systems. To achieve this, a study was conducted to analyse rainfall data measured simultaneously by a dense raingauge network (49 gauges) and two C-band weather radars over an experimental catchment (The Brue catchment) located in the South West of England over a period of six years. Principle component analysis (PCA) was used to find the minimum number of raingauges which could be used in this catchment with the least loss of information. This was followed by cluster analysis which was employed to identify the best locations for the given number of raingauges found by the PCA. Further research was then conducted using the twelve greatest storm events in order to compare the rainfall measured by the raingauge network and the weather radar. This study produced three interesting results: 1) PCA showed that one raingauge could account for 80% of the total variance measured by all 49 raingauges. By increasing the number of raingauges used to three, the total amount of variance accounted for increased to 90%, indicating a strong cross correlation between the gauges; 2) Cluster analysis showed that raingauge grouping varied from season to season and from year to year, hence no fixed ideal location for a chosen number of raingauges could be found for this catchment; 3) From a catchment average rainfall point of view, the performance of the raingauge network decreased with the reduction of density of raingauges as expected. However, unexpectedly, different combinations and densities of raingauges, (ranging from just one raingauge to all 49) all performed better than the weather radar. This should not be interpreted as weather radar no good for realtime rainfall measurement. Whilst raingauges appear to produce a more accu-

rate absolute value of rainfall, the authors hypothesise that weather radar will produce better spatial rainfall representation. Better rainfall information could be derived from an integration of both weather radar and raingauges. This integration should be adaptively based on the varied reliability of raingauges and weather radars with their own strengths and weaknesses which may differ in different storm situations.