National Centre for Atmospheric Science
NATURAL ENVIRONMENT RESEARCH COUNCIL

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HydroLogic

A real-time procedure for adjusting radar data using raingauge information II: Initial performance of the PMM procedure

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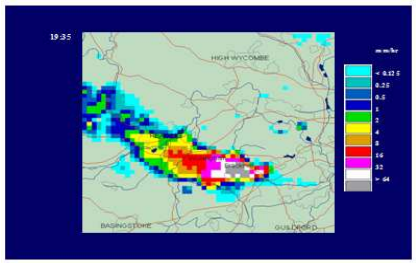


R&D through Knowledge Transfer



- **City RainNet KTP** is a government funded research project worth £260k
- Funded by the Technology Strategy Board, **TSB** (75%)and **NERC** (25%)
- Research partners – **Hydro-Logic Ltd** and **University of Leeds/NCAS**
- **Knowledge transfer** – Academic Partner benefits from commercial exposure, Company benefits from academic inputs
- KTP projects address **real needs** for innovation to **enhance profitability**
- Considers **whole project costs** (associate, support, equipment etc)
- **Commercial outcomes** kept in vision throughout – not ‘blue-sky’ research
- **Spin-off benefits OK** – equipment sales, VAR services, academic royalties

City RainNet KTP Partnership Project Motivation

YorkshireWater

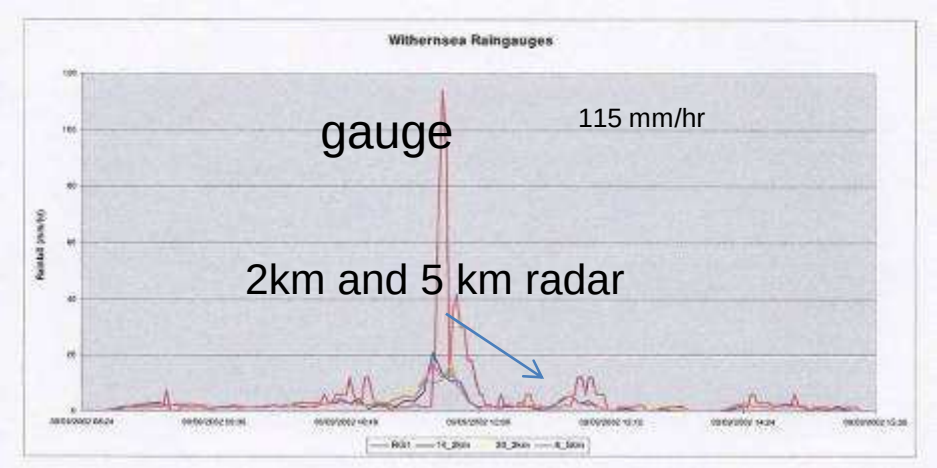
SCOTTISH WATER

NORTHUMBRIAN WATER

- **Sept. 2002 Yorkshire** – very intense rain underestimated by radar
- **Aug. 2004 Boscastle** - devastating convective rain event
- **June 2007** urban flooding Hull & E Yorkshire
  - Two months rainfall in one day at Saltend water treatment works
  - £70 million damage to Yorkshire Water, over 35 waste treatment works and 100 pumping stations flooded (Blackburn Meadows Works under 3m of water)
- **Nov. 2010** Cornwall Floods

City RainNet KTP Aims and Support

- “To develop, validate and embed a system for the acquisition and analysis of rain-gauge and radar rainfall data in real time for improving flood prediction”.
- Strongly supported by Natural Environment Research Council (NERC), Met Office, EA, SEPA; as well as Yorkshire, Scottish and Northumbrian Water.



Project rain-gauge technology

The requirements specified as:

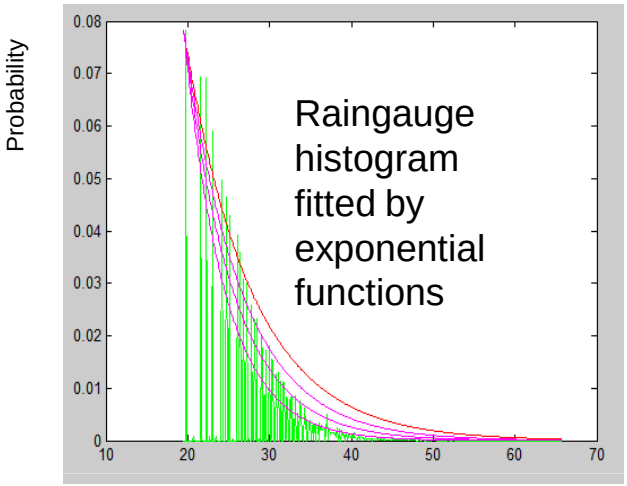
- Low maintenance – annual visits only
- Lower cost of ownership than T/B gauges
- Battery or mains powered
- Low cost GSM/GPRS telemetry
- Proven measurement technology
- Focus on medium to high intensity storms
- Good resolution and accuracy of data
- Ease of installation

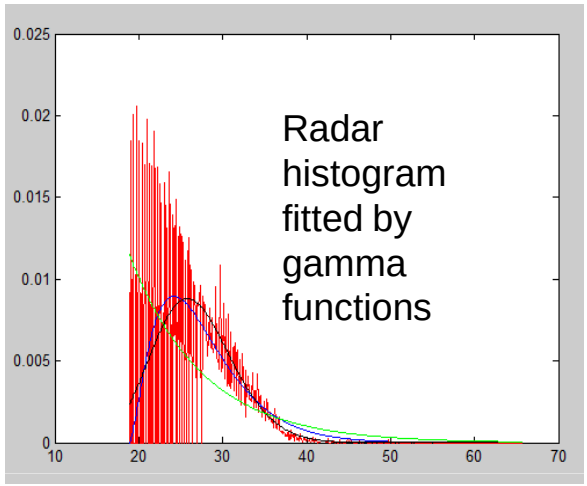
Selected equipment :-

- **Ott Pluvio2** Weighing Principal Gauge, 5* rating in 2009 WMO intercomparison trials
- **Isodaq Frog RX** GPRS telemetry logger, with Lithium battery
- Low-cost installation - no solar panel required

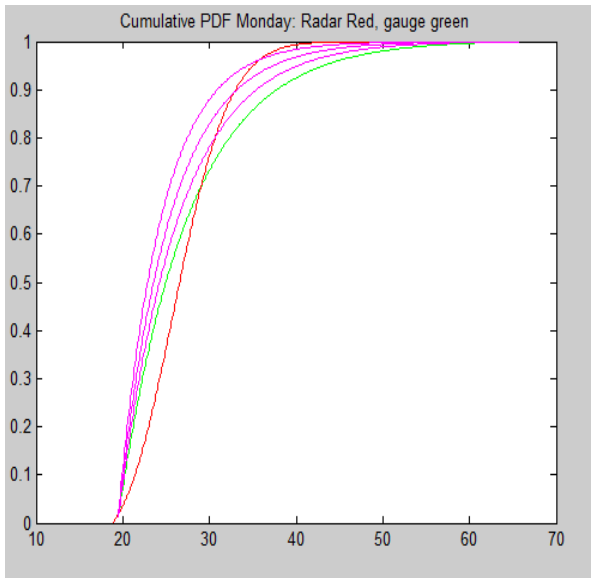
Probability Matching Method results

Adjustment is performed using a function to map the radar cumulative frequency histogram onto the raingauge histogram. Data for 1st March to 31st August 2011 were used.

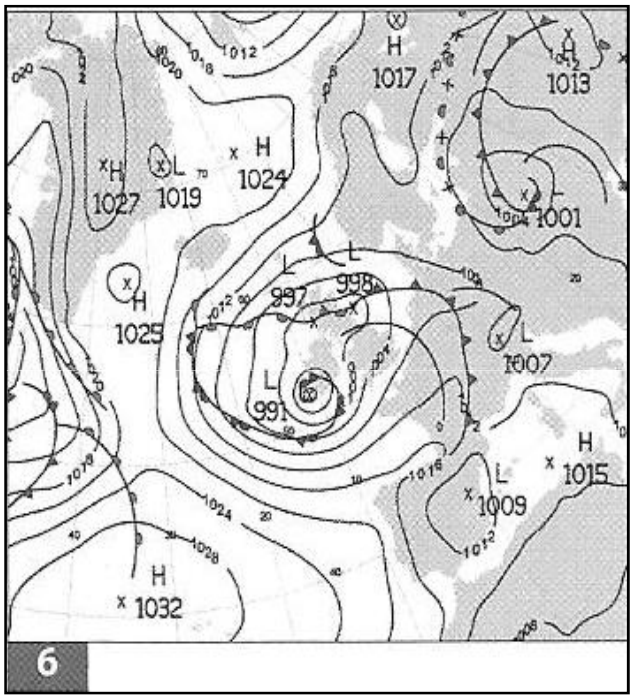


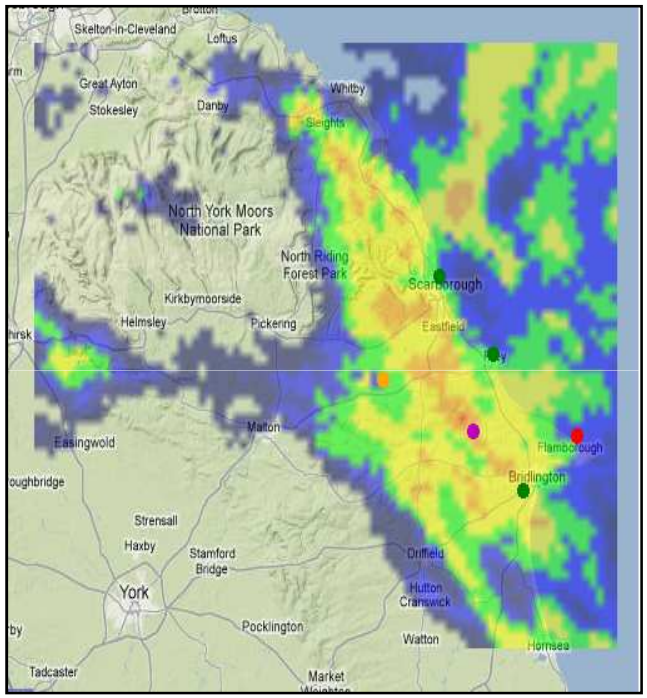


The chosen distributions were used as inputs to the PMM algorithm, which was modified to take account of the variability between the radar and raingauge values, and which is used to calculate adjustment factors for the radar rainfall data (right hand panel.



First case study from gauge network on NE Yorkshire coast 6th July 2011

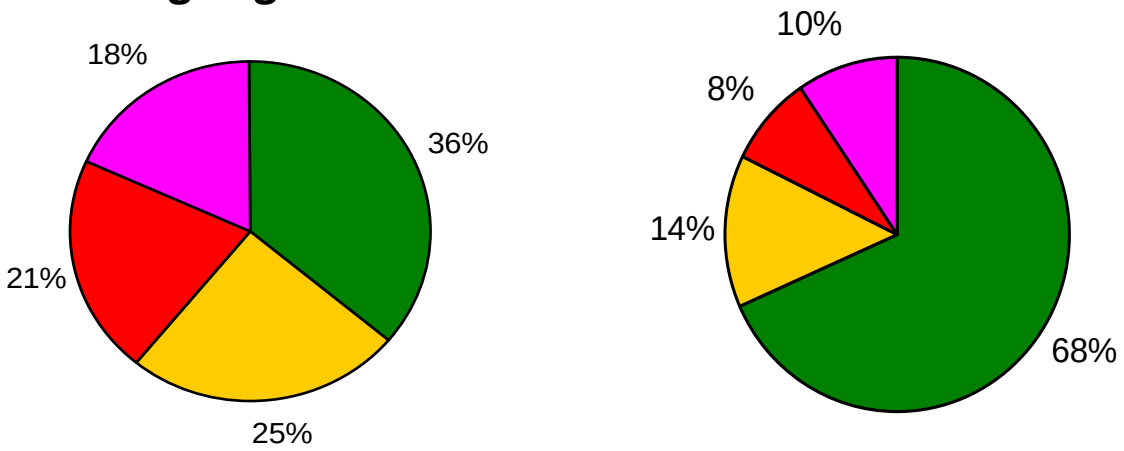




Synoptic situation 12:00 6 July 2011 (left hand panel), and screen shot of the prototype GIS radar image 03:50 6 July2011 (right hand panel)

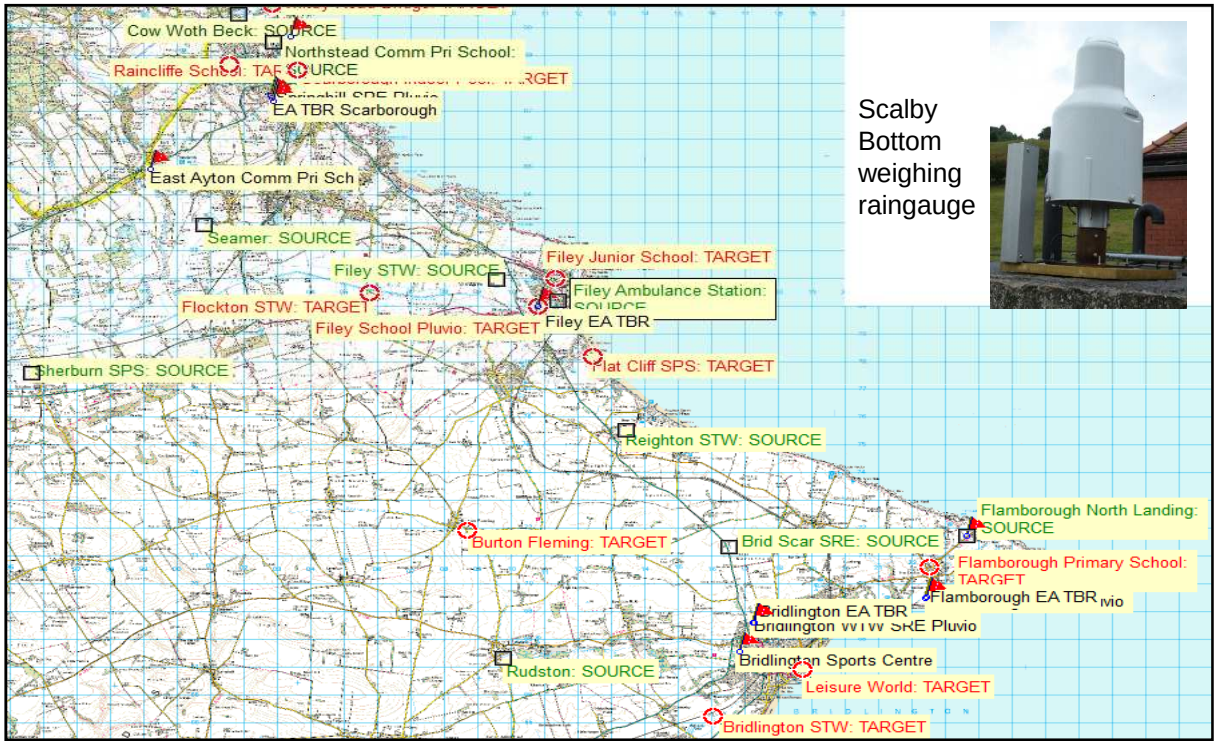
Applying the PMM technique to locations where there are raingauges

Pie charts showing results of traffic light analysis to input Met Office radar data (left) and modified PMM adjusted Met Office radar data (right) at 22 raingauge locations



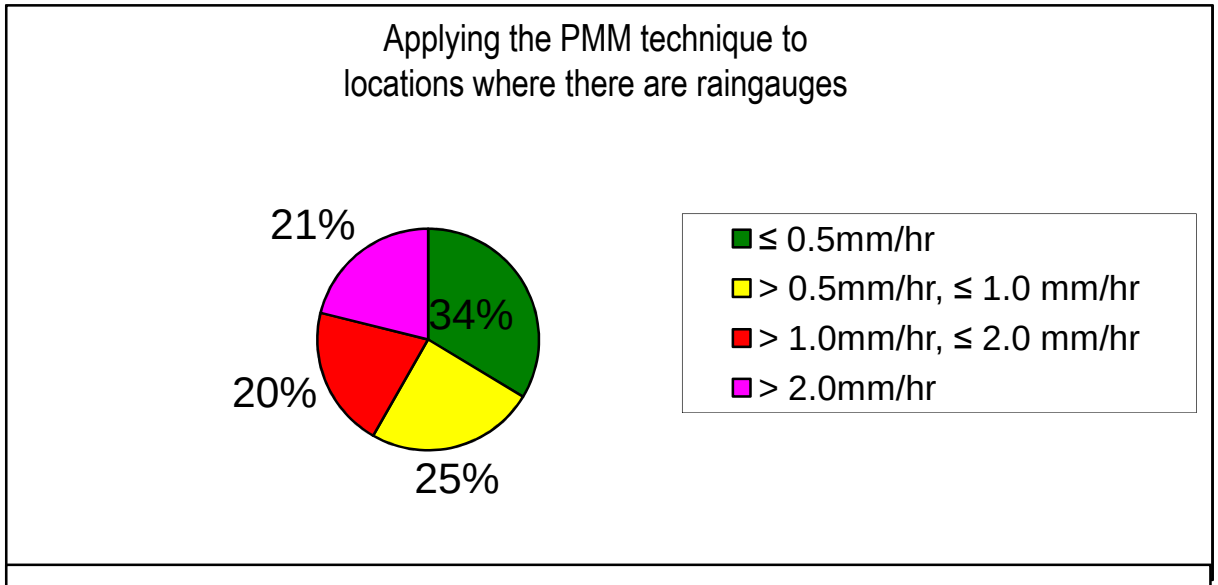
Green: absolute difference ≤ 0.5 mm/hr
Amber: absolute difference > 0.5 mm/hr and ≤ 1.0 mm/hr
Red: absolute difference > 1.0 mm/hr and ≤ 2.0 mm/hr
Purple: absolute difference > 2.0 mm/hr

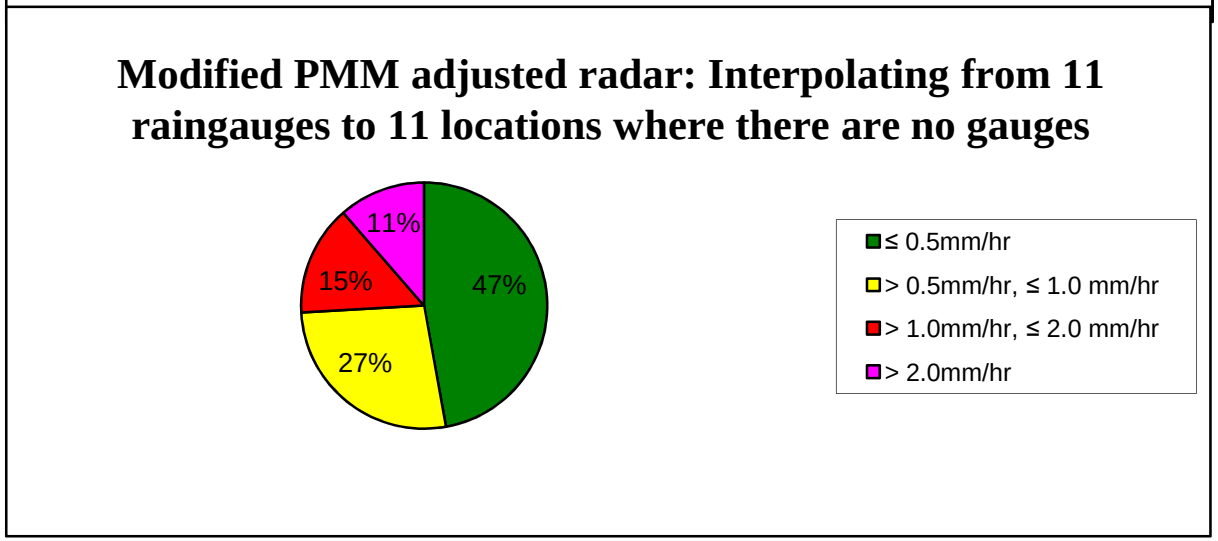
Assessing the performance of the modified PMM algorithm where there are *no* raingauges



The arrangement of the source and target raingauge locations. Target gauges are marked with a red circle; source gauges are marked with a square.

Applying the PMM technique to locations where there are no raingauges interpolating from only 11 gauges





Metric	Met Office radar input	Adjusted radar using 11 raingauges interpolated to sites without raingauges
Bias	0.11	-0.34
RMSE	3.24	3.02
RMSF	2.60	2.31
Mean Bias	0.0025	0.0019
Absolute Mean Bias	1.06	0.82
MAE	1.57	1.21

Next Steps

- Analyse much more data using the same and a reduced raingauge network density with the interpolation scheme.
- Investigate outliers and develop a way of coping with them.
- Aim to achieve an accuracy of 30% or better.