Evaluation of the Met Office super-resolution C-band radar rainfall product over London

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Investing in Opportunities

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INTERREG IVB

1. WHY HIGH RESOLUTION RAIN DATA?

High resolution rainfall estimates are required for urban hydrological applications in order to well represent the **high spatial variability, fast runoff processes and short response times of urban catchment**s. As part of the RainGain project and with the purpose of meeting the stringent requirements of urban-scale hydrological applications, **a high spatial resolution (100 m/5 min) radar rainfall product has been developed and trialled** over the Greater London Area.

2. SUPER-RESOLUTION C-BAND RADAR PRODUCT

The UK Met Office (UKMO) operates a network of 18 C-band radars across the UK. These radars are **normally operated in "long-pulse"** mode and provide QPEs at resolutions of 500 m and 1 km in space and 5 min in time. Higher spatial resolution or "**super-resolution" (100 m / 5 min) QPEs** over the **Greater London Area** were generated using data from two dual polarisation C-band radars (**Fig.1**) operating in **"short-pulse"** mode with a pulse length of 0.5 microseconds (75 m) and half power beam width of 1 degree. QPEs from each radar were interpolated onto a 100 m resolution grid every 5 minutes, and the use of advection and rain-gauge merging techniques to improve rainfall accumulation estimates are being investigated [1,2].

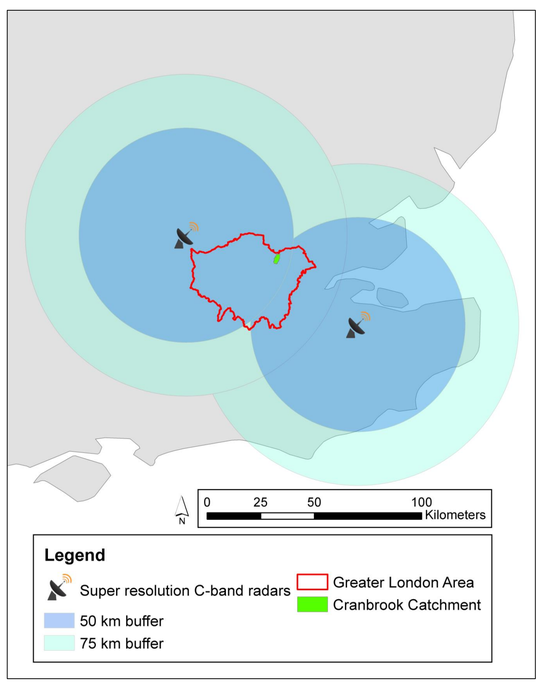

Fig. 1: UKMO C-band radars used to generate super-resolution QPEs

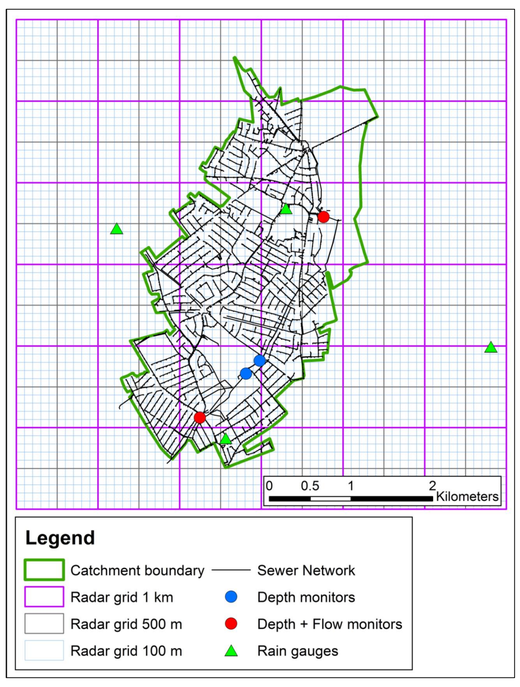

Fig. 2: Pilot area Cranbrook catchment: Sewer network and monitoring system

3. PILOT AREA AND DATASET

The quality and added value of the super-resolution QPEs for urban hydrological applications were evaluated using as case study 4 summer storms observed in the Cranbrook catchment (8.5 km^2; NE London, **Fig.1**), for which local rain gauge (RG) and runoff records, and a hydraulic model were available (**Fig.2**).

4. RESULTS

- The super-resolution product can well capture storm dynamics and small scale rain structures (**Fig.3**), providing more detail than the traditional products.
- Quantitatively, super-resolution QPEs perform well, both in terms of accumulations and instantaneous rainfall rates (**Table 1 & Fig. 4**). However, similar to the traditional products, the super-resolution product shows a tendency to underestimate high rainfall rates (**Fig. 4**).
- The higher spatial resolution of the super-res. QPEs often leads to better reproduction of urban runoff **(Fig. 3d)**

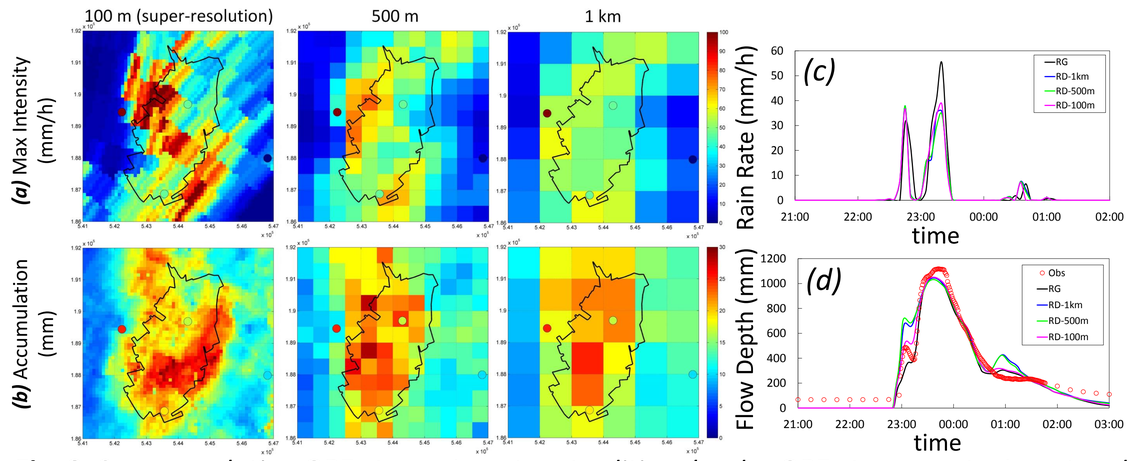

***Fig. 3:** Super resolution QPEs (100 m/5 min) vs. traditional radar QPEs (500 m – 1 km/5 min) and local rain gauges (RG) during intense event on 03/07/2015: (a) Max. Intensity; (b) Event accumulations; (c) Areal average rain rate profiles; (c) Simulated vs. observed water depths*

Event	Duration (h)	Accumulations (mm)			
		Rain Gauge	RD-1km	RD-500m	RD-100m
20/06/15	4	12.00	10.56	10.86	10.53
03/07/15	5	18.15	15.54	15.01	15.30
24/07/15	26	30.40	25.46	26.26	26.90
24/08/15	20	23.85	17.35	17.52	17.13

***Table 1:** Areal average radar & rain gauge accumulations (all storm events)*

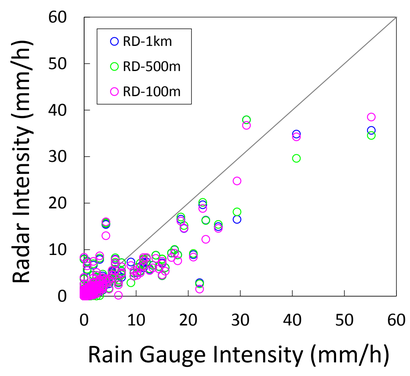

***Fig. 4:** Areal average radar-rain gauge intensity scatterplots (combined results of all storm events)*

5. CONCLUSIONS

The super-resolution C-band radar product shows great potential to provide high-resolution high-accuracy QPEs suitable for urban hydrological applications. Further testing is required to confirm initial findings.

[1] Jewell, S. A. & Gaussiat, N. (2015). An assessment of kriging-based rain-gauge-radar merging techniques. *Quarterly Journal of the Royal Meteorological Society*.
[2] Sandford, C. (2015). Correcting for wind drift in high resolution radar rainfall products: a feasibility study. *Journal of Hydrology* (In Press).