Imperial College London

THE ADDED VALUE OF THE UK MET OFFICE SUPER RESOLUTION RADAR PRODUCT

E22

Maria H. G. Akerboom

Department of Civil and Environmental Engineering, South Kensington Campus, Imperial College London.

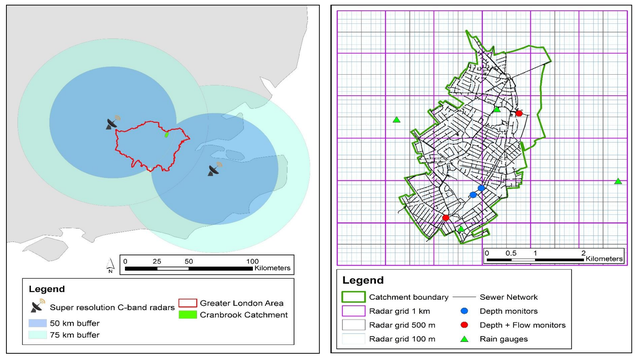
INTRODUCTION

OVERALL PROBLEM Intensification of precipitation extremes due to climate change[1] and rapid urban development resulting in fast runoff processes and short response times increases flooding threats in the UK.

FINAL SOLUTION Provision of high resolution rainfall estimates to urban water managers to improve flood forecasting in terms of intensity and location.

STUDY GOAL Quality asses the high spatial resolution rainfall estimates (100 m/5 min)

CATCHMENT AND DATASET



Seven storm events were used as case study in the Cranbrook catchment (8.5 km^2) in North-East London (fig. 1). A dense local rain gauge (RG) and flow/depth monitoring network and a hydrological model were available in this catchment to evaluate the quality and the added value of the UK Met Office (UKMO) super resolution product.

Fig. 1: Left: UKMO Dual polarisation C-band radars. Right: Pilot area Cranbrook catchment: Sewer network and monitoring system

SUPER RESOLUTION C-BAND RADAR PRODUCT

The UKMO C-band radar network normally operates in long pulse mode. In this mode quantitative precipitation estimations at a spatial resolution of 500 m/1 km and a temporal resolution of 5 minutes are produced. The super resolution product is generated operating two available dual polarisation C-band radars (Greater London Area) in short pulse mode; estimates from each radar are interpolated onto a 100 m resolution grid every 5 minutes.

METHODS TO QUALITY ASSES

Quality assessment is done based on visual inspection, error comparisons and pattern (R^2) and magnitude (β) comparison by analysing the linear relationship between measurements, model outputs (hydrological assessment part) and data processing outputs (rainfall data processing). A simple representation of the process is given in figure 2. Note: only the most relevant outputs are given from the rainfall data processing part.

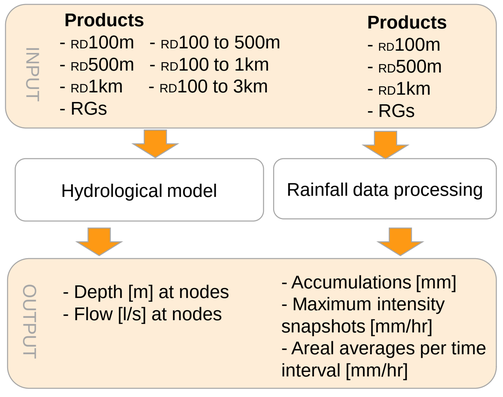


Fig. 2: General overview of the data processing path in order to quality asses the high resolution radar product

ACKNOWLEDGEMENTS

Special thanks to Dr Christian Onof and Susana Ochoa-Rodriquez for their guidance and work in reviewing throughout the process. Credit to Katie Norman from the UK Met Office and Lipen Wang who provided much of the data used in this study.

RESULTS – SUPER RESOLUTION RADAR PRODUCT PERFORMANCE

- The super resolution radar product performs well in terms of accumulations, especially pattern wise better than traditional radar products (fig. 3)
- The product tends to overestimate heavy rainfall events more than others, however at low rainfall rates (below 15 mm/hr) it outperforms the traditional radar products (fig. 3)
- Not always reliable results are found, rain voids and shifts are observed in several storm events (fig. 4)

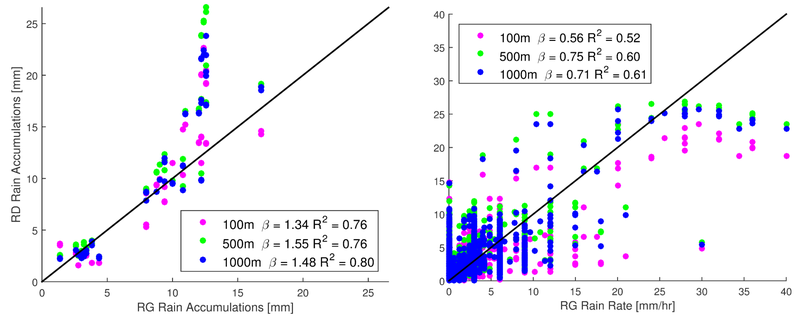


Fig. 3: Areal Av. radar-rain gauge accumulation and intensity scatterplots (combined results of all storm events)

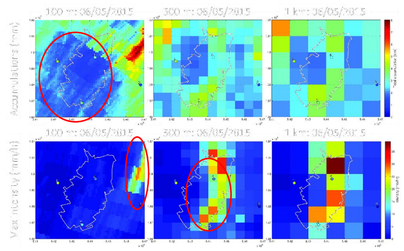


Fig. 4: Examples of problems affecting quality of SR product: Top- rain void; Bottom- shift

- In some cases (event 09-19-2014) it has the most poor RD vs. RG performance but gives the best hydrological results which is due to a better ability to capture small scale storm dynamics (fig. 5)

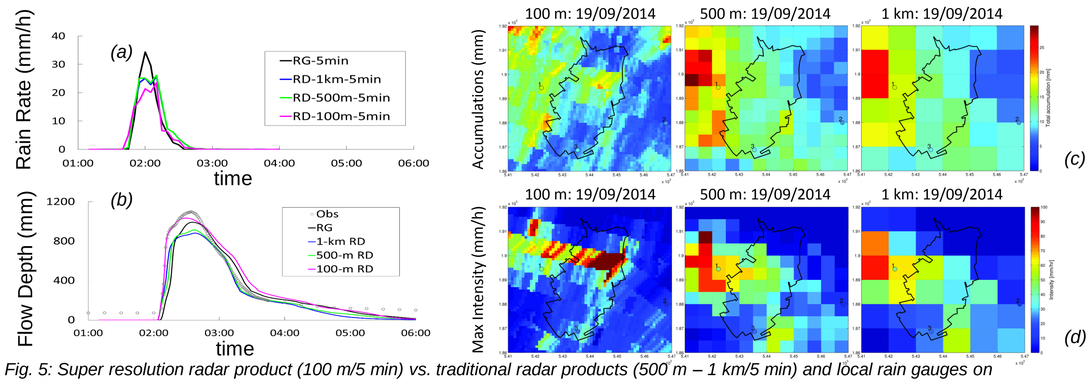


Fig. 5: Super resolution radar product (100 m/5 min) vs. traditional radar products (500 m – 1 km/5 min) and local rain gauges on 19/09/2014: (a) Areal average rain rate profiles; (b) Simulated vs. observed water depths; (c) Event accumulations; (d) Max. intensity

CONCLUSIONS

The super resolution product shows great potential to provide high-accuracy quantitative precipitation estimation suitable for urban hydrological applications. However, for now its performance is unstable due to problems with signal to noise ratios and wind drifts [2].

REFERENCES

[1] Kendon, E.J., Robers. N.M. Fowler H.J. Roberts M.J. Chan-S.C. Senior C.A. 2014. Havier summer downpours with climate change revealed by weather forecast resolution model. Nature climate change, 4, 570-576.

[2] Sandford, C. (2015). Correcting for wind drift in high resolution radar rainfall products: a feasibility study. *Journal of Hydrology* (In Press).