Improving the accuracy of temporally and spatially interpolated radar Quantitative Precipitation Forecasts (QPF) using Bayesian analysis

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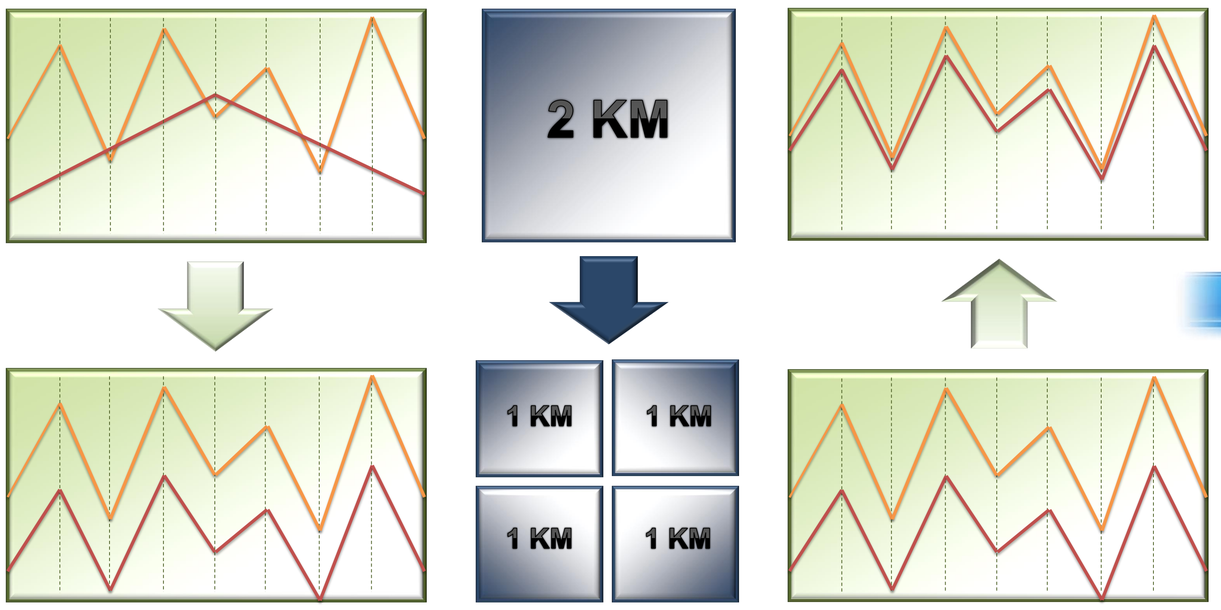
1 THE PROBLEM

- It can be difficult to obtain radar rainfall forecasts (QPF) and observed rainfall data (QPE) that **match in time and spatial resolutions at high scales**. Modifying the original forecasts to match the QPE is a more challenging task because different factors will influence the rainfall values at smaller scales, such as wind, storm movement etc (Seo & Krajewski 2015)
- Rainfall forecasts can be **very inaccurate** and can therefore produce **unreliable flood forecasts**

2 THE SOLUTION

Increase the **temporal and spatial resolution** of QPF to better reflect the **rainfall patterns** of the corresponding observed data (radar QPE) (Wang et al 2015). This two stage interpolation process will then allow historical comparisons to be made between the QPF and QPE data in a **Bayesian process.** The outputs of this will be used to produce a more accurate QPF product using any live QPF data



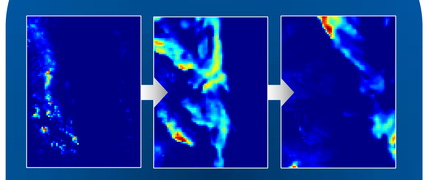
3 … GOALS

- **Increase the temporal resolution of Met Office Nowcast product from 15 min to 5 min**
- **Increase the spatial resolution of this product from 2km to 1km**
- **Improve the overall accuracy of live QPFs**

4 METHODOLOGY

The methodology consists of four processes:

- Temporal interpolation
- Spatial interpolation
- Merging two rainfall products via Kalman Filter
- Derivation of final rainfall product via linear regression



- **Obtain movement vectors using the OPTICAL FLOW EQUATION**
- **Interpolate values between 0 and 15th minute using these vectors**

- **Use of BLOCK KRIGING to interpolate four 1km² QPE grids from a single 2km² QPF grid**
- **Considers the QPF values surrounding the QPF grid used for interpolation**

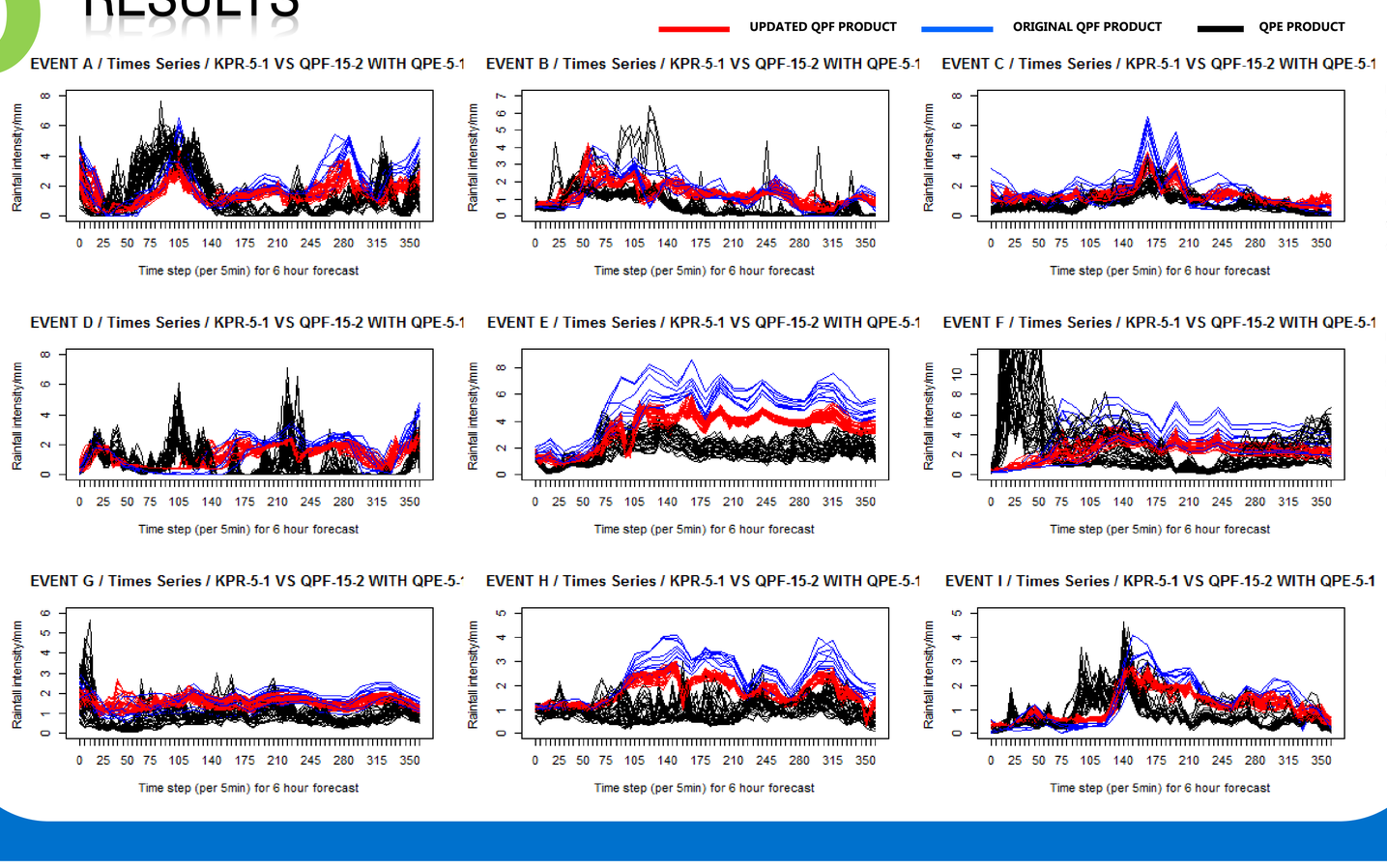
Bayesian

- **Use of KALMAN FILTER to merge the interpolated QPE data (observed data) with the interpolated QPF data**
- **Perform on many historical data sets**
- **Fit the historical data points to a LINEAR REGRESSION model**
- **Use the regression model to predict a new data set using a live QPF**

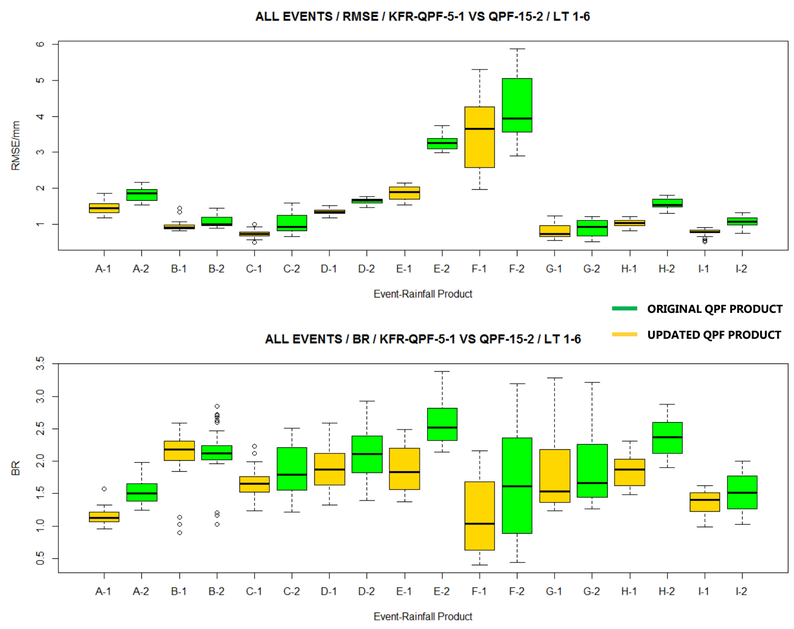
6 CONCLUSIONS

- Clear overall **improvement** in reducing bias and better matching QPE data
- Reduction of **variation** across all grids shows more reliability
- More work to be done to identify **peaks**
- More work to address periods of no rainfall (or **singularities**)

5 RESULTS



Left: Time series graphs show the full 6 hour forecasts for 3 rainfall products. 9 events (A – B) were used to validate our results



Right: Boxplots have been used to show the Root Mean Square Error (RMSE) of each event for 2 rainfall products

REFERENCES

Wang, L.-P. et al., 2015. Enhancement of radar rainfall estimates for urban hydrology through optical flow temporal interpolation and Bayesian gauge-based adjustment. *Journal of Hydrology*

Seo, B.-C. & Krajewski, W.F., 2015. Correcting temporal sampling error in radar-rainfall: Effect of advection parameters and rain storm characteristics on the correction accuracy. *Journal of Hydrology*, 1, pp.1–12

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