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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Hydrological appraisal of operational weather radar rainfall estimates in the context of different modelling structures" *by* D. Zhu et al.

Anonymous Referee #1

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The paper evaluates the performance of operational radar rainfall products at 5km and 1km resolution in the context of hydrological modelling using 3 different hydrological models PDM (lumped), PRTF (lumped) and MIKE-SHE (distributed). The paper is well written and reads well. HESS readers would benefit from this paper. However, the authors should address the following comments before the paper is accepted for publication.

Page 10497, line 10, 'intertwined'

Page 10501, line 5. It would be worth to make a reference to [1] who also implemented the PDM model for the same catchment for the assessment of probabilistic flow predictions, and [2] who also used the PDM model in the same catchment for testing different radar rainfall algorithms.

Page 10502, line 5, It would be worth to make a reference to [3] who was one of the pioneers in the development of the PRTF model, and [4] who described the applications of such a model.

Page 10503, line 15, 'The result of model calibration was assessed by four indices ...'. Please expand further on how the calibration of the model parameters was carried out using 4 performance indicators (i.e. MAE, RMSE, R and R2). Usually the model parameters are adjusted by comparing the simulated and measured hydrographs by reducing the error of one performance indicator. However, the use of 4 performance indicators makes things more complicated. Please expand on this.

Page 10504, line 15. 'The areal rainfall from raingauges measurements was computed using the conventional Thiessen Polygon method'. Is there any difference using more advanced interpolation techniques such as kriging? Please comment on this.

Page 10504, line 20. Figs 4 and 5 compares the 5km and 1km catchment radar rainfall against the catchment averaged raingauge measurements. In these comparisons, there will be an error due to the fact that raingauge measurements are point measurements and not able to represent the 'true' catchment averaged rainfall (there are 9 raingauges representing a catchment of 220km2, that is, 24km2 per raingauge). How much of the scatter in the comparisons is due to this error and how much is due to the fact that there is an error in the radar measurements. For instance, [5] showed that when comparing point to area rainfall measurements on a 4km2 radar pixel, the point to area difference (i.e. the variance reduction factor) is around 20% for light rain (R>1mm/h) and around 40% for heavy rain (R>6mm/h). This error is entirely due to the raingauge not being able to represent the areal measurement and will contribute to the

overall error. Please comment on this.

Page 10524, fig 1. There is a small catchment area upstream of Weir Wood TBR that was left outside the catchment, but that also contributes to the flow downstream. Please explain.

Page 10526 figs 2 and 3. The calibration and validation data sets are from 2003/2004 and 2006/2007 respectively. Is the quality of both data sets similar?

Discussion. Please comment on the use of more advanced radar-gauge merging techniques such as kriging with external drift (see [6]) to improve the rainfall estimation and hydrological modelling. This technique takes into account quantitative measurements from raingauges and the spatial variability of precipitation measured by radar.

References:

[1] Liguori et al (2013) A practical approach to the assessment of probabilistic flow predictions, Hydrological Processes, 27, 18-32.

[2] Rico-Ramirez et al (2012) River flow simulations with polarimetric weather radar, In Weather Radar and Hydrology (Proceedings of a symposium held in Exeter, UK, April 2011). Moore, R. J., Cole, S. J. & Illingworth, A. J. (eds.). IAHS Press, 351, p. 466-471.

[3] Yang, Z., and D. Han (2006), Derivation of unit hydrograph using a transfer function approach, Water Resour. Res., 42, W01501, doi:10.1029/2005WR004227.

[4] Pollard, O. and Han, D. (2012) Making calibration objectives relevant for flood forecasting, Proceedings of the Institution of Civil Engineers, Water Management, Volume 165 Issue WM2, 121-136.

[5] Bringi et al (2011) Rainfall Estimation with an Operational Polarimetric C-band Radar in the UK: Comparison with a Gage Network and Error Analysis, Journal of Hydrometeorology, 12, 935-954.

[6] Velasco-Forero et al (2009). A non-parametric automatic blending methodology to

estimate rainfall fields from rain gauge and radar data, Advances in water Resources, 32, 986-1002.

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