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Hydrology and Earth System Sciences Discussions

Interactive comment on "Statistical analysis of error propagation from radar rainfall to hydrological models" *by* D. H. Zhu et al.

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Anonymous Referee #2:

Question (1): In page 10282, the authors mentioned that the radar rainfall: ' ... is the best possible estimate of rainfall at the ground in the UK and can be regarded to be the error-free data.' However, this is not accurate. There are a lot of errors in radar rainfall estimations and there are quite a few references about this in the literature. I am not sure why the authors made this assumption. Please explain and justify this assumption.

Reply: The aim of this work is to analyse the error propagation of radar rainfall in the

context of hydrological models. And the analysed error in this study was assumed to be derived from the proposed error model only, instead of the errors contained in the raw radar rainfall and hydrological models. In order to achieve that, the raw radar rainfall data in this study was extracted from Nimrod data, which can be considered to be error-free after it has gone through the state-of-the-art error mitigation processes by Met Office.

The reason for those assumptions is to set up a conditional environment to trace the error in the rainfall through the hydrological models, without the interference of internal error from the raw radar rainfall data and hydrological models.

Question (2): Page 10286, It is not clear why the true rainfall was assumed to be the original radar rainfall. Clearly radar rainfall is uncertain (see above comment) and this assumption is not justified. Please explain. German et al. (2009) developed an approach to generate radar rainfall ensembles by looking at the covariance between radar rainfall and raingauge measurements. In your approach, you are perturbing the radar rainfall fields with a simple bias and random error. Can you use something more realistic such as the approach proposed by German et al (2009) or Ciach et al (2007)?

My recommendation is this: 1- Develop a model for radar errors 2- Perturb the radar rainfall fields using a realistic radar error model 3- Generate ensembles. 4- Use these radar rainfall ensembles in your hydrological models to look at the propagation of this radar rainfall uncertainty in hydrological modelling. 5- Discuss in more detail your results.

Reply: The main limitations on the implementation of realistic radar error model are not only the requirement to have access to a dense raingauge network that can be used to approximate 'true' surface rainfall, but also the uncertainties induced to the spatial structure of radar rainfall field in the ensemble members, which may lead to the difficulties in interpreting the error propagation through hydrological models.

Therefore, again, as the error-mitigation processed Nimrod radar rainfall data was the

best-possible radar estimation in the UK, it can be assumed to be 'true' rainfall to generate perturbation in this study, which will certainly preserve the spatial structure of radar rainfall field in all ensemble members and thus is immune to uncertainties that possibly be induced to rainfall distribution in space.

Although the error model is relatively simple in this study, but the readers would still benefit from this paper, as the proposed error model has preserved the spatial structure of the radar rainfall field, but effectively reflect error distribution in time domain, which provide a different insight to study error propagation. The simulation results can be interpreted and referred in further studies.

Moreover, this error model is easy to replicate and apply to different catchments, without the requirement of a dense of raingauge network. More importantly, the error propagation from national radar based rainfall data (Nimrod radar rainfall data) to various hydrological simulations, ranging from fully distributed through semi-distributed to lumped models, has not been previously addressed in a quantitative mode, which differs from prior studies on the propagation of radar estimation errors.

Minor issues:

(1) Page 10298. Fig.1. In the upper part of the catchment (upstream from Weir Wood tbr) seems to be a small catchment area that was not included as part of the catchment. why?

Reply: There is a reservoir in the upstream from Weir Wood tbr, which is difficult to include it in the model without the operational regulation data.

(2) Page 10299. Figs 2 and 3 are difficult to follow. Please use solid thin lines with different colours to show the results from the different models.

Reply: Please refer to revised manuscript.

(3) Page 10300. Validation is only shown for 4 months (Nov 2006 - Feb 2007). However, in the manuscript you are talking about 18 months for validation. Where are these

results?

Reply: The process from Nov 2006 - Feb 2007 was used for model validation, instead of the error propagation analysis. Please refer to revised manuscript for clarification.

(4) Page 10300. - Y-axis in fig 3 is missing

Reply: Please refer to revised manuscript.

(5) Page 10301 & 10302. X- and Y- Axes in figures 4 and 5 are missing and therefore difficult to follow.

Reply: Please refer to revised manuscript.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 10277, 2012.