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Hydrology and Earth System Sciences Discussions

Interactive comment on "Effects of spatial variability of precipitation for process-orientated hydrological modelling: results from two nested catchments" *by* D. Tetzlaff and U. Uhlenbrook

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The invaluable help of the referee 1 is gratefully acknowledged. We are grateful to the reviewers for his/her very helpful comments on the initial manuscript and have attempted to revise it accordingly. We restructured some sections, added additional information, clarified the text where necessary and changed figures as requested. We feel the paper has benefited substantially from these changes.

Specific comment:

1. The title is modified (in consideration of suggestion of referee 2 and 1): "Significance of spatial variability in precipitation for process-orientated modelling: results from two nested catchments using radar and ground station data."

2. Text is modified; and the confusion about the location of seven stations used for

model calibration is clarified (five stations within the catchment, two stations nearby)

3. There is not really a “combination” of ground station and radar data. The authors think that the need of considering ground station data for radar calibration is discussed in the methodology section.

4. The text is modified. The authors are aware of the fact that a total consistency between rain amounts measured with ground stations and radar data can’t be reached (due to above mentioned and the limitations discussed in the text). The authors attempt to express that an “as good as possible” calibration is aimed - regarding the limitations that are connected with applying radar data in hydrological modelling.

5. The third objective was partly reworded. The runoff simulations were influenced in areas where the spatial precipitation pattern was predicted differently using the two different data sources. This is an advantage of the chosen model approach and it is discussed in the manuscript. This is clarified in the objectives.

6. Ground stations recorded in temporal resolutions between 1-15 minutes. Hence, data were either aggregated to 5 minutes (sum) or disaggregated (equal distribution of rainfall intensity with the recorded 10 or 15 minutes step).

7. In general the coefficient of correlation, r, was given as the correlation between both data sets is of interest here. The authors agree that this value of (at least) 0.69 is not very high. But still, the time shift corrections was applied and allowed an improvement in consistency between both data sets compared to “original”, operational available data. Please note, that the value of r expressed the correlation BEFORE radar data calibration, but after time shift correction.

8. The authors are not entirely sure for what the reviewer asks here. Of course, the model efficiency is a crucial parameter that describes the goodness of fit of the model simulations. The widely used Nash-Sutcliffe criterium was computed and reported for the model calibration, model validation and the simulation of the investigated events

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using different precpitation input data. As the model was calibrated with the aim to maximise the model efficiency, we belief that it a good measure to assess the model output during the event simulations.

9. The authors are not sure if they understand this comment correctly. Within this study, widely used Nash and Sutcliffe model efficiency is used as a statistical measure for model goodness, hence it is used to assess the model error during the model calibration, model validation and further event simulations (using different rain input data). This is absolutely coherent. The partly worse efficiency values during the simulation of events using different precipitation data sets are discussed extensively.

10. The application of the distributed, process-oriented model TACD allows the consideration of rainfall information in high spatial distribution. The mean values and total amounts of the different data sources don not seem to be the most influencing factor for simulation results. The results suggest that the differences in the higher intensities and hence, extreme values, and the location where they happened are the main factor influencing simulation results (demonstrated through the comparison of simulations in both basins). The differences in the extreme rainfall intensity values are due to using data in different spatial resolution and not simply spatially averaged values. Therefore the authors think a statement about the role of spatial distribution of the rainfall intensity is appropriate.

11. Text is slightly modified. Event characteristics and antecedent conditions result in different catchment responses. Field investigations showed that dominant runoff processes are likely to be dependent on these conditions. If high rain falls on areas dominated by deep subsurface runoff instead by shallow subsurface or surface runoff, such “smoothing the runoff response” of the differences of rainfall is likely to occur. These effects are considered due to the process-oriented model structure of TACD.

12. We added some text and few references. However, as the parameter uncertainty of the used model was not investigated in this study, we feel that a broader discussion

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of this issue does not fit to the purpose of this paper.

Technical comments:

1. The authors want to show with this table how “damped/smoothed” the statistical properties of the rainfall distribution are using ground station data in comparison to radar data. The differences of the two data sources are clearly demonstrated. Showing the deviation of one data set from the other would imply that one data set is more correct than the other. Giving the relative deviation might be also misleading as than the event size would be reflected. Therefore, we would like to leave it like it is.

2. It was clarified in the text that five stations (already indicated in the legend) are located directly in the basin and that two stations are nearby.

3. These figures are plotted directly from the model output. The authors think that the important information - the differences in spatial distribution of the rain fields - is shown clearly even if graphically the ground stations are not shown again (cf. figure 1).

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 119, 2005.