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Hydrology and Earth System Sciences Discussions



# *Interactive comment on* "Influence of rainfall observation network on model calibration and application" *by* A. Bárdossy and T. Das

**A. Montanari (Referee)**

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My review of this paper is made available on line well after the report of the Anonymous Referee #2, who was much faster than me. I wish to clarify that I did not read the review of the other Referee before completing mine, in order to make my assessment independent of the evaluation that was previously made available on line.

The paper analyses the effects of the resolution of the raingauge network on the performances of a rainfall-runoff model that is applied to the case study of a river located in Germany. I believe this experiment is interesting and relevant for practical applications. A similar experience, which referred to the case study of an Italian catchment, was presented in a previous paper that was co-authored by myself. This paper is cited in

the present contribution. The existence of a previous and analogous experience does not diminish the value of the present study, that refers to a different climatic context and provides some additional elements of interest. In fact, the effect on the model performances of missing rainfall data was analysed too.

In my opinion, the paper is significant. However, I found some difficulties in understanding some parts of the text. In particular, I think the calibration procedure of the rainfall-runoff model and the way the mean areal precipitation was estimated by using the reduced raingauge networks need to be explained with more detail. Moreover I believe some relevant references are missing. In summary, I believe the paper deserves publication on HESS subject to a minor revision. My specific remarks are listed here below.

1) References: I believe the literature is rich of previous contributions about this subject. I think some of them would deserve to be cited, if the authors agree. For instance, Wilson et al., 1979; Michaud and Sorooshian, 1994; Sun et al., 2002; Booji, 2002.

2) Abstract, line 14; I believe the synthetic description of the three experiments is not clear. It took to me a while to understand that in lines 14 and 15 the authors are still talking about the analysis of the effects of missing data. Moreover, I would mention the case study well before the end of the abstract. I would say that it would be appropriate to mention it around line 5, when the rainfall-runoff model is introduced.

3) I do not understand Figure 2. Is it representing the standard deviation of the daily mean areal rainfall data, computed with the different network densities, over the whole period? If yes, I hardly understand the reason why the standard deviation decreases so significantly when passing from 5 to 10 raingauges. First, I would say that the standard deviation is constant for more than 5 raingauges, if one accounts the significant uncertainty that affects the estimates. Second, I believe it would be interesting to provide an explanation for the sudden decrease in the first part of the curve (from 5 to 10 raingauges, as I mentioned before). This is extremely relevant in view of the susequent



HESSD

3, S1796–S1799, 2007

results, which show a significant decrease of the rainfall-runoff model performances when using the 5-raingauge network.

4) I believe it would be interesting to know some more details about the spatial variability of rainfall in the study area. The results are likely to be strictly dependent on the spatial variation of the meteorological input.

5) Model calibration is performed with respect to different river cross sections. In fact, Table 2 shows the calibration performances with respect to three different locations. I would expect that the raingauge network varied when referring to different cross sections. Looking at table 2, it seems that the same networks were used for the different locations. The sentence at line 22, page 3701, namely "The number of raingauges is different for different subcatchments within each selected network (Fig. 2)" did not help me to clarify this issue. How can the number of rainguages be different in the same nework? If the same network was used, I wonder whether the same areal precipitation was used for all the locations (subcatchments). I think it would be more reasonable to exclude the raingauges that are located far from the considered subcatchment, or at least to change the weights that are assigned to each raingauge when computing the mean areal precipitation in different subcatchements.

Another possibility is that only the raingauges that are located inside the subcatchment were used, but in this case the actual number of raingauges would be different with respect to what is indicated in the first column of Table 2.

5) Another question that came to my mind is related to how the calibration was performed with respect to each subcatchment. Was the simulation of the river flows related to each subcatchment optimised in turn or was the optimisation carried out just once with respect to the closure section of the whole basin? In general I think a more detailed description is needed about how the calibration was carried out.

6) The locations of Suessen and Plochingen are not shown in Figure 1.



HESSD

3, S1796–S1799, 2007

7) In general, I found that the model performances were always good.The minimum value of the Nash efficiency that I could find in the paper is 0.66. This mean that the uncertainty (model uncertainty but also input uncertainty) is quite limited with respect to what is usually experienced in hydrological applications. My feeling is that the results could be different if the inherent uncertainty was more significant. It could be the case that even a coarse raingauge network can provide a satisfactory representation of the meteorological input for the region of interest. I think this issue could be worth discussing in the conclusions of the paper.

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