**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Copula-based assimilation of radar and gauge information to derive bias corrected precipitation fields" *by* S. Vogl et al.

Anonymous Referee #2

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The paper introduces and describes a procedure to assimilate rainfall radar and gauge information using copula function.

The topic is interesting and the proposed approach potentially useful, however there are several issues to clarify.

In the following general and detailed comments are listed.

General comments

1) The manuscript is too elaborate. Different methodologies are included and explained in details making difficult an easy comprehension. So, the first suggestion would be

to exclude from the text some useless analytical developments and include it in an appendix.

2) The manuscript introduces two methods (Multiple theta and Maximum theta). I do not think that there is much difference between them and, at the same time, keeping both the paper is heavy to read. So, the suggestion is to remove one of them or including it in the discussion section just to compare the results.

3) The manuscript would like to propose a general methodology but, actually, the adopted simplifications reduce drastically its generality. I am referring to the three main hypotheses proposed by the authors: 3.1)The rainfall time series are affected by autocorrelation. In this case authors suggest to apply the ARMA-GARCH approach, but since the case study does not show this behavior they skip this step in the paper. What happen when an analyst founds the autocorrelation in his time series? Probably an autocorrelated case study would have been more general. 3.2)The marginal distribution was chosen equal for all time series. 3.3) The copula function was chosen equal for all time series.

4) The ARMA-GARCH model useful to remove the time dependence is just mentioned. This is an important point. If the analyst has to filter the series to remove the correlation, he should apply the inverse transformation at the end of the analysis to have actual rainfall data. This double steps could affect the data distribution and include additional uncertainty in to the analysis. So it is important to better clarify the ARMA-GARCH role and effect in the procedure.

5) Considering the same marginals and the same copula function for the entire data set is in contradiction with using the copula approach. The added value of copula is to provide a flexible tool that allows to vary marginals and dependence structure. If the analyst does not use this potentiality probably it would not be worth to use copula function. My feeling is that using a simple linear regression tool, same results would be obtained.

Specific comments section by section

Introduction

page 939 line 2. the reference Colins and Bolstadt, 1996 is not consisted with the same one shown in the reference list;

page 940 line 9 & page 940 line 13-17 Dupuis instead of Dupois;

page 940 lines 11- 20. It is my personal opinion that the cited references are not fully representative of the copula literature, there are many other important missed. I understand that it is almost impossible to provide an exhaustive literature review on copula, so I would suggest to mention the website of the ICSH-IAHS (www.stahy.org) where a "complete" list is present and continuously updated.

page 941 line 11. The acronym CDF is not specified.

Section 2

page 942 formula 1. I am not expert in radar analysis and consequently I was wondering on which data set is calibrated the formula 1- I suppose that this is not a local formula, I mean, that the rainfall data used in the proposed analysis have a limited role in the formula 1 parameter calibration.

Section 2.2

It is not clear which is the rainfall data resolution. At page 945 line 11 it is mentioned daily, while at page 952 line 22 it is mentioned hourly. Probably in this section it should be clarified.

In this section I would also include a picture with the raingauge and grid cells (it could be adapted from/or in figure 1). It could help to clarify the other sections.

Section 3.1

Formulas 2, 3, 4, and 5 could be included in a Table.

Section 3.2

- Formulas 9, 10, 11, and 12 could be removed.

- From page 946 to page 948 line 10 . All this information could organized in appendix and/or Tables cited in the text.

- Estimation procedure is missing

- Section 3.3 Although I appreciate the author effort in including a picture and listing the procedure steps, the two methods are still not fully clear to me, but it could be my fault.

Section 4.

page 952 line 25. I am really surprised to see that so long hourly rainfall time series (6 months: around 4000 data) do not show at least significant ACF rho1. The autocorrelation is the statistical trace of the rainfall storm time aggregation, so I am surprised.

Section 4.1

It is not clear which is the approximation that authors are doing choosing the Weibull distribution. Table 3 and Figure 4 can help the reader to understand what is happening to Garmisch station not for the whole data set.

Section 4.2

The same comment is valid for the copula function choice.

Section 5

page 959 lines 1-11. I agree to recall the aim of the paper to introduce the discussion, but probably this period could be shortened.

Section 6

page 962 line "It is found that the data is intrinsically iid and no transformation is nec-

essary" I do not think that it is a conclusion....it is something that is never shown in the paper but just mentioned.

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