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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 #1

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1 General comments

The manuscript addresses the problem of combining radar information and gauge measurements by using a novel approach based on copulas.

Two methods have been introduced: the Multiple Theta Approach and the Maximum Theta Approach (section 3.3). These methods are grounded on the estimation of the parameter of the copula joining the dependence between radar and gauge data. I have three main comments on this procedure.

1. In order to apply these methods the dependence structure (i.e. the copula) between the data should be *uniquely* selected. However, it may happen that two or more copulas seem "good" for the problem at hand (for instance, a formal goodness-of-fit test gives no evidence against them).
2. The methods are based on the implicit assumption that the copula is described by one parameter. This could be quite restrictive, since, for instance, data with both lower and upper non-trivial tail dependence coefficient are more conveniently described by mult-parameter copulas.
3. When the copula is known, the methods are based on the estimation of the parameter. Now, the following problems should be explained better in the paper:
    - how are these parameters estimated?
    - how much robust are the methods with respect to the estimation method used in getting the parameters? It is known, in fact, that different methods (maximum-likelihood estimation, estimation based on Kendall's tau, etc.) may produce quite different results.

All the above reasons may constitute serious inconveniences to the whole procedure and should be carefully analysed in the manuscript.

2 Specific comments

- Formulas (20) and (21) are wrong.
- Page 4, page 952: please, give full details about the methods for testing the absence of autocorrelation.

- Page 4, page 952: please, clarify how absence of heteroskedasticity has been tested.
- Page 953, section 4.1: some formal goodness-of-fit test could be used to validate the choice of the marginals.
- Page 953, section 4.2: while the empirical copula density is asymmetric with respect to the opposite diagonal, the Frank copula is used for modelling the data. This is not satisfactory, since Frank copula cannot capture this asymmetry.
- Page 958, section 4.4.2: Instead of the standard correlation, I would use some concordance measure like Kendall's tau in order to validate the result. In fact, (Pearson) correlation measures only linear dependence.
- Page 959, section 5: The use of ARMA-GARCH filter to daily precipitation data should be better explained. Is there some volatility cluster in these data? Should the seasonality also be removed? I think that GARCH models have a natural interpretation in financial time series, but I do not see their relevance with precipitation data. Please, explain better.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 937, 2012.