Hydrology and Earth System Sciences Discussions

Interactive comment on "Copula-based statistical refinement of precipitation in RCM simulations over complex terrain" *by* P. Laux et al.

Anonymous Referee #2

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Overview

This manuscript presents a new application for the copulas in the area of bias correction, to improve RCM simulations. The authors further included large-scale weather scenarios to improve and analyse the effects of these weather patterns. This manuscript could potentially be more significant if the issues below are addressed. One main comment:

1. The author suggested in the Introduction that multivariate distributions such as multivariate normal could be used and that an alternative is a copula approach.

My question is whether the copula approach significantly improves the modelling to warrant its use. That is, more justification may be required for using the copula approach over a multivariate normal.

Comments

Abstract

1. Line 5: Wrong spelling "continuous"

Introduction

1. Pg 3002, Line 15: Consider rephrasing to "for conducting climate change impact . . ."

2. Pg 3003, Line 5: spelling "gridd" incorrect

3. Pg 3003, Line 15: would be good to explain why using simple correlation of multivariate normal is not appropriate in this case.

4. Pg 3003, Line 28: spelling "parametrisations" incorrect.

5. Pg 3004, Line 23: spelling "intermittend" incorrect.

6. Pg 3004, LIne 27: "studied" instead of "studies".

Modelling the dependence structure between modelled and observed rainfall

1. Pg 3007, Line 1: spelling "independend" incorrect.

2. Pg 3007, Line 19: please be consistent with how ARMA-GARCH is stated in the entire manuscript

3. Pg 3008, Eqn 1 should be revised, not immediately clear.

4. Pg 3008, Eqn 2: κ is not defined here.

5. Pg 3009, Line 3-5 and Eqn 5 do not seem to correspond. There is no z term in Eqn 5. Please re-check this equation.

6. Pg 3010, Line 8-9: this sentence is unclear, by "steady" I assume you mean constant.

7. Pg 3010, Line 14-17: sentence is convoluted and more justification should be considered for the use of copulas here.

8. Pg 3010, Line 20-21: this sentence "no unique characterization of the copula for dry days" is not clear what the author is trying to convey. Consider rephrasing.

9. Pg 3011, Line 19: missing reference.

10. Pg 3012, Line 1: incomplete reference to Salvadori and line 2: "Copulas Salvadori et al." does not make sense.

Simulation results

1. Pg 3014, Line 16: would be informative to have p-value or Q-statistic of the test stated here.

2. Pg 3015, LIne 18-26: Does this mean that you do not use the Gumbel-Hougaard copula if the p-value is under 0.01? Because most of your analysis and results were based on Garmisch-Partenkirchen, which showed a p-value of 0.00.

3. Pg 3016, Line 1-9: How does Table 1 show the dependence of the altitude? This is not immediately obvious to the reader. Similarly with the next 2 statements, more background/justfication/statistics is required for such conclusions. Furthermore, are these dependence to altitude and distance statistically significant? Are they purely due to difference in elevation, as the text seem to indicate?

4. Pg 3016, Line 10-12: Fig 17 does not correspond to your description here. Are you referring to Fig 14 instead?

5. Pg 3016, Line 25: It appears that the 'copula map' is missing and does not correspond to FIg 17. Hence any subsequent conclusions drawn from this figure cannot be verified.

6. Fig 9 caption: "quartile" spelling incorrect.

7. Table 3: Showing the correlation values between RCM and copula-based simulations on the same table may be misleading since one is used to inform the other, which is not the case with the observed data.