

## ***Interactive comment on* “Formulating and testing a method for perturbing precipitation time series to reflect anticipated climatic changes” by Hjalte Jomo Danielsen Sørup et al.**

**Anonymous Referee #2**

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MS Title: Formulating and testing a method for perturbing precipitation time series to reflect anticipated climatic changes

Authors: Hjalte Jomo Danielsen Sørup et al.

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MS Type: Research article

Special Issue: Rainfall and urban hydrology

In this paper the authors introduce a methodology to perturb historical precipitation time series at the minute scale to model non-linear expectations of climate change.

C1

This is an innovative method because very few previous research studies have dealt with such fine resolution time series. One of the important limitations of the proposed approach is that it is a deterministic model that may be questionable under climate change scenarios.

The literature review presented in this manuscript could be improved. A more specific literature review should also be included in the introduction section. In particular, the cited studies do not adequately support the proposed methodology. The method presented could also be presented more clearly. Perhaps a flow diagram in the methodology section would add clarity.

The authors have categorized extreme events based on 2, 10 and 100-year return periods. It would be interesting to include other categories between 10 and 100 years and at least a 50-year return period should be included, as there is a big difference between a 10 and 100 year return period event.

As per the authors' description (page 2, lines 11 – 17), the rainfall time series for a changed future climate is generated by perturbing expectations of future precipitation into the observed time series. The authors should perhaps explain how they propose to incorporate persistence in the generated future series because persistence is important when precipitation series are used in a hydrological model.

The authors claim that they have generated time series for future changed climates, and so it would be interesting to see some time series figures and statistics to show that these are indeed realistic.

On what basis do the authors set the selection criteria to determine the states of each event as listed in Table 5, particularly for the 100 year events? Why did they use three/two points? This selection should be explained in more detail. Perhaps include references that justify this selection process or explain why a subjective approach was taken?

C2

The following two references are included in this manuscript and seem to be quite important because the authors use information from those references (expected change factor listed in Tables 3 and 4 and for the perturbation analysis). But unfortunately, these references were not accessible and/or were in another language and so it was difficult to look into these aspects in more detail:

1. Gregersen, I.B. Madsen, H., Linde, J.J. and Arnbjerg-Nielsen, K.: Opdaterede kl 5 imafaktorer og dimensionsgivende regnintensiteter (Updated climate factors and design rain intensities) - Spildevandskomiteen, Skrift nr. 30. The Danish Water and Wastewater Committee under the Danish Engineering Society, Copenhagen, Denmark. In Danish. 2014.

2. Olsen, M., Madsen, K.S., Ludwigsen, C.A, Boberg, F., Christensen, T., Cappelen, J., Christensen, O.B., Andersen, K.K. and Christensen, J.H.: Fremtidige klimaforandringer i Danmark 5 (Future climate changes in Denmark). Danmarks Klimacenter rapport nr. 6 2014. Danish Meteorological Institute, Copenhagen, Denmark. In Danish. 2014.

Either alternative references should be provided or if this is not possible then more detail on the information used should be provided.

Minor corrections:

1. The statement on page 1, line 31 is not always true. There have been research studies undertaken where streamflow directly is downscaled from GCMs to assess the future changes due to a warmer climate without using hydrological models.

2. In section 2.1 Modelling Framework (page 3, line 6), the meaning of lowercase "d" is not clear. Please explain "d".

3. The manuscript needs more careful proofreading, i.e. the reference to Table 4 on page 10 should be corrected to Table 5.

4. The English and grammar also need further attention, i.e. straight forward should read straightforward on page 10.

C3

5. "Has" should read "have" in several instances in Table 5.

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C4