

Interactive comment on “Indirect downscaling of global circulation model data based on atmospheric circulation and temperature for projections of future precipitation in hourly resolution” by F. Beck and A. Bárdossy

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Thank you very much for your comments. We revisited the paper, adding some information to point out the temperature subdivision more clearly and adapting the title and the introduction according to your helpful suggestions. In the following you find the responses to your questions one by one and how we incorporated them in the new version of the paper draft:

1 Title: The title is a bit long. I would suggest the following: “Indirect downscaling of

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hourly precipitation based on atmospheric circulation and temperature”

Thank you very much for the suggestion. We agree with the new title.

2 Introduction & Conclusion: I would not place here the main application focus on urban hydrology. The temporal resolution of hourly rainfall is too coarse for modeling of urban sewage systems; for that a resolution of 5 minutes would be required.

We canceled this part of the introduction. We now start with the third paragraph.

3 P. 8847: line 17: replace “temporal” by “spatial”

Of course you are right. When correcting, we added the “temporal resolution of one day”.

4 P. 8849 – 8850: Temperature subdivision: How is this relative subdivision in 5 temperature classes projected into the future for downscaling. Since the future temperature is increasing the same relative subdivision (5x20%) applied to a future data set would have different absolute temperature class limits. Does the assumption of the constant distribution of rainfall intensities still hold for different classes? This needs discussion.

For the projection into the future the CP-specific class-limits of the temperature anomalies that were derived during the calibration period are kept constant. The temperature anomalies of the ECHAM5 runs are calculated in reference to the average annual cycle during the 20th century run. This means that the distribution will shift with rising temperature in the scenario run. “Cold” and “cool” days will become less frequent, “warm” and “hot” days more frequent.

To assume that the precipitation reaction is not changing over time is an approximation. “Cold” days in the future are less frequent and, therefore, might represent a more particular situation than “cold” days during the calibration period with a different precipitation response.

5 P. 8852: More information about grouping of the CPs is required. How exactly is

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decided if the CP is cyclonic or anti-cyclonic. Generally, I would recommend including a table listing the 12 CPs, their main statistical characteristics and the associated group.

A table was added which states the daily rainfall probability and the average daily rainfall depth over all stations of each CP and the location of the high and low pressure zones of each CPs. The two groups of cyclonic and anticyclonic CPs are now defined in the text.

6 P. 8856, line 5 “during the calibration period from 1991 to 2003” This is somehow confusing, since the figure refers to the two ECHAM runs with different periods. Please try to make this clearer.

The figure captions were changed to: “Linear trend in the expected yearly precipitation sum and the yearly probability of values exceeding the 95% and 99% quantile according to the CP sequence derived from ECHAM5 without temperature information; quantiles referring to the calibration period from 1991 to 2003 The explanation of these figures in the text has been reformulated: “. . .the expected exceedance frequencies of the station specific histogram class limits that mark the 95% and 99% quantile during the calibration period from 1991 and 2003.” We suppose that this becomes clearer now in the new version.

7. P. 8858: Is the discontinuity an indication of a non-stationary bias of the GCM with possible implications for bias correction? It would be good to discuss this briefly.

The following was added in the conclusions: The assumption that the model bias is constant over time is a necessary condition for most statistical downscaling techniques. If this assumption is disproved by GCM data, the results of many statistical methods become doubtful, e. g. the delta change or the analogous method.

8. Outlook: This outlook is a bit outside the scope of this paper and it addresses again urban hydrology (see above). I would recommend to include information about

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future work in the conclusion section with a reference to “NiedSim” (but without more description).

This was changed according to your suggestion. The outlook was omitted.

9. Fig. 10: reference to C20 and A1B ECHAM runs is missing

The reference has been added.

10. Fig. 10, 11: I would recommend to us the same scale for the y-axis of the corresponding figures for the C20 and A1B runs; then the trend lines can be compared more easily

The y-axis has been rescaled according to your suggestion.

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