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Hydrology and Earth System Sciences Discussions

Interactive comment on "Robust assessment of future changes in extreme precipitation over the Rhine basin using a GCM" *by* S. F. Kew et al.

Anonymous Referee #1

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GENERAL COMMENTS

The paper uses a 17-member ensemble of a GCM and investigates the changes in future precipitation over the Rhine basin compared to a reference period. The main contributions of the paper are: (1) the analysis of the precipitation changes for different accumulation periods, the explanation in terms of changes in spell length and intensity, and the implications for the use of the delta change downscaling method, (2) the demonstration of the necessity of a sufficiently large data set in order to distinguish the signal from the natural variability.

The paper is a very valuable contribution to the current discussion on future changes in precipitation and, in particular, on methodological issues. It makes the point (in a quan-

titative way) that small ensembles or short GCM integrations may lead to inadequate sampling of natural variability.

The paper is well written and organized. It is concise and technically sound (some exceptions are given below).

SPECIFIC COMMENTS

I would like to see a short discussion on the limitations of the approach, given the fact that it is based on 1 GCM and 1 emission scenario only. The paper has clearly a number of merits since it tackles important methodological issues. However, it also derives statements about the future precipitation in the Rhine basin, and the validity of these statements should be discussed in view of the large uncertainty due to different GCMs and possibly emission scenarios.

P 9044, L 10 (and other locations in the manuscript): The authors use the term 'scaling' or 'simple scaling' for refering to the relative change of future precipitation quantile with respect to control period quantile. In my view, this may cause confusion. Scaling (simple scaling, multiscaling) is often used to express the variation of a quantity with (spatial or temporal) scale, e.g., frequency of an event varies as a power of some attribute of that event. The authors should define, very early in the paper, what they understand by scaling.

P 9045, L 4: The authors should add that the given design return period (1250 yrs) is only valid for the river dikes in The Netherlands.

P 9047, L 10: 2 of the 8 ESSENCE grid cells (east cell of region North Rhine, west cell of region Central Rhine) are only covered to a rather small fraction by the Rhine basin. Could this mismatch between observation area and model area cause problems?

P 9048, L 14: I have some problems in understanding the 2 questions. Could they be reformulated in order to be better intelligible?

P 9051, L 23: The authors conclude that the increasing winter precipitation must be

due almost entirely to an increase in event intensity, whilst wet-day frequency remains largely unchanged. It could be interesting to discuss this finding in view of other literature which, based on observation data, found increases in frequency and duration of westerly atmospheric circulation types for the winter season (e.g. Petrow et al., Changes in the flood hazard in Germany through changing frequency and persistence of circulation patterns, nhess, 2009). Although 'detected' past changes should not necessarily be expected in the future as well, it could be interesting to discuss this issue.

TECHNICAL CORRECTIONS

P 9047, L 10: I suppose that it would be clearer if the authors wrote "...size of the three zonal regions, North Rhine, Central Rhine, Alpine Rhine, by ...

P 9051: There are flaws concerning the reference to fig. numbers. The text on page 9051 refers to Fig. 3, 4 and NOT to Fig. 6: - L 4, 7, 13, 22, 23: Fig. 3 (not Fig. 6) - L 28: Fig. 4 (not Fig. 6)

P 9052, 9053, 9054: Similarly to P 9051, the text refers to Fig. 6, however, it should refer to Fig. 3, 4, 5 or 7.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 9043, 2010.