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Hydrology and Earth System Sciences Discussions

Interactive comment on "Spectral representation of the annual cycle in the climate change signal" *by* T. Bosshard et al.

Anonymous Referee #1

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1 General Comments

In the manuscript "Spectral representation of the annual cycle in the climate change signal" T. Bosshard, S. Korlarski, T. Ewen and C. Schär suggest a parametric model based on harmonic functions to describe the annual cycle in temperature and precipitation data. Compared to a moving average, this approach yields a smoother estimate of the annual cycle, is less sensitive to sampling artefacts and allows a more robust estimation of the change signal of control and scenario runs. A nice illustration of the sampling problem for moving averages is given on the basis of synthetically generated precipitation series. The order of harmonic functions is chosen by cross validation on a set of observations. For a large set of various GCM-RCM chains, the parameters

of the harmonic functions describing temperature and precipitation in a control and two scenario runs are estimated. The difference between control and scenario runs are calculated and discussed. This discussion includes comparison to an estimate of natural variability.

The manuscript is very well written and clearly understandable. The methods used are briefly but sufficiently described. The illustrative simulation study for sampling problems is exemplary; as is the selection of harmonic orders based on cross validation. Using harmonic functions in this case (in particular for temperature) is self-evident and I wonder that this has not already become a standard approach. I consider this approach more difficult for precipitation due to the problems addressed by the authors (skewed distribution, zero values); a Box-Cox transformation with a small offset is here a straight forward but not necessarily the most sophisticated approach.

It was a pleasure to read the paper.

2 Specific Comments

2.1 Introduction

Another recent review on precipitation downscaling is D. Maraun et al., "Precipitation Downscaling under Climate Change. Recent Developments to Bridge the Gap Between Dynamical Models and the End User", *Rev. Gopher.* 48:RG3003 (2010).

2.2 Techniques

I wonder, how well the Box-Cox transform does in transforming the precipitation distribution towards a Gaussian. This might be a point to discuss.

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A different approach to describe, in particular non-normal harmonic cycles is generalised linear modelling, R. E. Chandler, “On the use of generalized linear models for interpreting climate variability”, *Environmetrics*, 16:699-715 (2005), or as an example in, H. W. Rust, “Modelling Seasonality in Extreme Rainfall: a UK case study”, *Europ. Phys. J. Special Topics*, 174:99-111 (2009).

2.3 Figures

Figures are in general well designed and informative. There seems to be a problem in Fig. 5, left column, panel 1 and 3: I suppose the black lines should be grey, indicating observations not changes in the cycle.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 1161, 2011.