Hydrol. Earth Syst. Sci. Discuss., 8, C1344–C1345, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C1344/2011/

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.

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Received and published: 5 May 2011

1 General comments

The paper discusses an application of harmonic functions to describe changes in the annual cycle of climatic variables. The authors show that their approach removes random fluctuations due to natural climate variability more effectively than traditional smoothing average. The paper is well written, the figures are great, the methods are technically sound and the ideas have a clear relevance to climate science.

2 Specific comments

For a single simulation, the authors present a compelling case showing that random fluctuations affect the annual cycle delta and could lead to spurious conclusions about the climate change signal. However, climate change signals are usually inferred from an ensemble of simulations. Hence, random fluctuations affecting individual simulations are expected to be smoothed out by averaging over the ensemble. I'd like the authors to show that their approach also provides benefit after averaging over the ensemble. This could be done for example in Figure 7 by adding a dashed line representing the ensemble mean for 31d MA, similar to what is done in Figure 6.

The authors state that large relative precipitation changes led to the rejection of one simulation because of an overshooting problem. Considering the amount of time and energy that goes into the production of regional climate simulations, it feels like a waste to reject a simulation over a relatively minor technical issue related to the smoothing algorithm for the annual cycle. The authors should provide an acceptable work-around for this problem and include the simulation within their analysis. If this is not possible or within the scope of the paper, I believe including the simulation would still be informative as it could help readers recognize a potential pitfall of the approach.

Finally, it may be worth pointing out the method could also be relevant for the bias correction of future climate scenarios.

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