Hydrol. Earth Syst. Sci. Discuss., 9, C2185–C2188, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C2185/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Climate change effects on irrigation demands and minimum stream discharge: impact of bias-correction method" *by* J. Rasmussen et al.

Anonymous Referee #2

Received and published: 13 June 2012

The authors compare, in a well organised manuscript, the influence of different downscaling techniques on the projected impact of climate change on irrigation demands and low flow of streams. I think more insight in the influence of downscaling technique on the projected impact is very useful and should be the main focus of this paper rather than (again) comparing the DC and DBS method.

This can be achieved by two major adjustments/extensions. The uncertainty related to the choice of downscaling technique should be compared to the uncertainty related to the choice of RCM, GCM and/or emission scenario. Therefore some additional RCM-

GCM scenarios should be added to the study.

The other point is the inappropriateness of the set of downscaling techniques. The applied delta change methods only adjust for changes in the mean, which obviously is not sufficient as other important characteristics, like different modes of variability are projected to change too. Yet, more sophisticated delta change methods have been successfully applied (Bakker and Bessembinder, 2012; Van Pelt et al., 2012). As a matter of fact the transformation algorithms (here referred to as "flavours") for delta change methods and bias correction methods are interchangeable. Thus, the flavour applied in DBS could also be applied in the delta change method, maybe in a slightly adjusted form.

For the choice of different downscaling techniques, obviously insufficient methods should be left out. For the bias correction methods at least a control period should be included to test the appropriateness of the method (how well does the DBS method reproduce the irrigation regime and low flow of streams in the control period?). Besides, it would be interesting to consider methods that adjust the multi-day variability rather than daily variability (van Pelt et al., 2012, Wood et al., 2002; 2004).

The study would seriously benefit from including more RCM-GCM combinations and a more elaborate choice and evaluation of the chosen downscaling methods. In the following, some minor points are summed.

2 Methods

2.2.1. Current climate

- The observed dataset is rather short (1990-2010 or 1991-2010?) for analysing year-to-year variability. Why not using alternatives like E-OBS (Haylock et al., 2008)? - Please, explain a the Makkink equation, adjusted for Denmark. Reference is hard to trace.

2.1.2. Future climate

- Christensen et al. (2010) is wrongly referenced as they did not analyse RCMs nested in GCMs, but nested in the reanalysis ERA40. Also manuscript title of Christensen et al. (2010) is wrong. It should be “Weight assignment in regional climate models” rather than “weight assessment”. Please, include doi numbers if possible. This substantially improves the traceability of the referred documents in case of slightly incorrect citations.
- Why a different ETref is used for the future climate? How do both methods compare?
- “bias correction” mentioned between equations 2 and 3 is not a bias correction, but an adjustment or perturbation etc.

2.2.1 Estimation of the CO2-effect on crop evapotranspiration

- SWAP needs a reference

4.2 Evaluation of model performance

- Introduce stations before. Which stations show good performance (R2-NS of 0.75 and 0.89)? - A R2-NS of -0.02 and 0.07 means absolutely no skill. You should argue why this model is good enough for this study anyway.

5 Results

- Please, better explain the evaluation metrics. - Comparison of minimum and maximum yearly values is pointless. They are too much influenced by natural variability. Besides, two periods of different length are evaluated (20 years and 30 years) - Show the performance of the DBS in the control period

REFERENCES

Bakker A, Bessembinder J (2012) Time series transformation tool: description of the program to generate time series consistent with the KNMI ’06 climate scenarios. Technical Report TR-326, KNMI, Netherlands.

Christensen J, Kjellström E, Giorgi F, Lenderink G, Rummukainen M. (2010) Weight assignment in regional climate models. Climate Research 44(2-3):179-194,

doi:10.3354/cr00916

Haylock M, Hofstra N, Klein Tank A, Klok E, Jones P, New M (2008) A European daily high-resolution gridded dataset of surface temperature and precipitation. Journal of Geophysical Research (Atmospheres) 113:D20,119, doi:10.1029/2008JD10201

van Pelt SC, Beersma JJ, Buishand TA, van den Hurk BJJM, Kabat P (2012) Future changes in extreme precipitation in the Rhine basin based on global and regional climate model simulations. HESS Discussions, 9, 6533–6568, 2012, doi:10.5194/hessd-9-6533-2012

Wood AW, Maurer, EP, Kumar, A, Lettenmaier, DP (2002) Long Range Experimental Hydrologic Forecasting for the Eastern U.S. J. Geophys. Res. 107 (D20), 4429

Wood AW, Leung LR, Sridhar V, Lettenmaier DP (2004) Hydrologic implications of dynamical and statistical approaches to downscaling climate model outputs. Climatic Change 62:189-216

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 4989, 2012.