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Biogeosciences Discussions

Interactive comment on "Water supply patterns in two agricultural areas of Central Germany under climate change conditions" *by* M. H. Tölle et al.

M. H. Tölle et al.

mschlue@gwdg.de

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We thank the anonymous referee #2 for his/her helpful and valuable comments. We address each comment below and explain how we revise the manuscript in response.

GENERAL COMMENTS There is a concrete need for climate change information that is relevant for specific sites and sectorial uses by policy-makers and practitioners. It is also clear, that downscaling may be a useful technique for this, not least in areas with marked topographic features. Due to systematic biases in (all) climate models, bias corrections may still be needed. Research on such has increased over the past few years not least among the climate change impact study community, where the so-called "delta-change" method has for a quite a long time being used to a large extent. The current manuscript makes an effort on this and focuses on two specific areas in

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Germany, looking into precipitation in light of some regional climate change scenarios, and making some inferences on possible consequences for agriculture including energy crops. It seems, however, that the study would deserve various improvements. First, the specification and analysis of the regional climate scenario information is very brief and could be developed.

Answer: Thank you very much for the suggestion. In our opinion the detailed information on climate scenarios is provided in IPCC SRES, so there is no need to repeat any of it in the present manuscript. However, the SPI related regional information should be provided indeed, therefore we will describe the precipitation changes in Germany.

Second, in order to analyse changing water supply patterns in an "available water" sense, precipitation alone does not necessarily provide a complete picture.

Answer: The SPI is the most useful index for our study because it just considers precipitation for which bias corrected data are available for Germany which is not so true for other values. The choice of the drought index is dictated by the purpose and context of our particular study undertaken. To show and evaluate uncertainties in the projection of future regions of relative wetness and dryness taking into account the usefulness of bias correction the SPI is a good index for such a study. Other approaches might be useful for different research and be experienced differently for different sectors. However, researchers found significant correlations between different drought indices. For example, Burke and Brown (2008) showed that changes in SPI are generally correlated with all other indices also taking potential evapotranspiration and temperature into account.

E. J. Burke and S. J. Brown 2008: Evaluating Uncertainties in the Projection of Future Drought. J. Hydrometeor, 9, 292–299. doi: http://dx.doi.org/10.1175/2007JHM929.1

Third, it is likely that the referenced literature is not optimal for the study at hand, nor provides a good overview of the relevant topics.

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Answer: We will revise the referenced literature.

The English should be revised. Some of the sentences are difficult to follow which may be due to the choice of terms, punctuation and sentence construction.

Answer: We will improve the English language as proposed.

Overall, the manuscript could either be developed further along the lines of providing assessment for specific users, or be focused on the bias correction method development and elaboration on this so as to report on methodological development.

Answer: Please see comment to reviewer #1 and #3.

SPECIFIC COMMENTS The quote of the AR4 results (page 5155, line 6-8) is not clear. Does it refer to ensemble best estimates and the preindustrial as the baseline?

Answer: We will be clearer about this. Please see the method section in the revised manuscript.

The referenced literature on, for example, page 5155 and in the discussion-section consists of fairly old entries, many of which are rather remotely related to the study region (e.g. regions in China, the New York metropolitan area). There is more and more appropriate literature to consider for Europe.

Answer: We will refer to more appropriate related literature in the revised manuscript.

On page 5156, there are aspects which would need to be developed (or omitted) as their relation to the study at hand is not clear. Rather, the thoughts are left "hanging". For example, the, precipitation trend study mentioned on lines 17-18, and the results of Hirschi et al. on lines 21-24.

Answer: The introduction will be revised so that the link of the cited reference to the overall aim of the manuscript becomes clearer.

Concerning the regional climate scenario information, it would be good to develop

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some what is now on page 5159, lines 2-8 (which scenarios and how many are used?) and on page 5156-5157, lines 28-29 and 1-3, respectively (what is the overall "skill" of the COSMO-CLM model and how known biases may affect the result?)

Answer: The RCM information will be rewritten. In the revised manuscript we use an extended model ensemble with 4 COSMO-CLM and 8 REMO simulations.

Page 5159, under "Bias correction" could be developed a bit more on considering the delta-change approach, and other bias correction methods from the international literature. On page 5164, lines 1-5, the bias correction literature is referred to with two articles from 2011 and from 2001, respectively.

Answer: A recent paper by Themeßl et al. 2011 compared different bias correction methods and found quantile mapping after Piani et al. 2010 performing best. Therefore, in our opinion it is enough to use this method for our particular study. However, we will mention the other methods in the manuscript.

Piani, C., Weedon, G. P., Best, M., Gomes, S. M., Viterbo, P., Hagemann, S., and Haerter, J. O (2010): Statistical bias correction of global simulated daily precipitation and temperature for the application of hydrological models, J. Hydrol., 395, 199–215, doi:10.1016/j.jhydrol.2010.10.024.

Themeßl, M. J., A. Gobiet, and A. Leuprecht (2011): Empirical-statistical downscaling and error correction of daily precipitation from regional climate models. Int. J. Climatol., 31, 1530–1544, doi:10.1002/joc.2168

Page 5161, it is stated that the bias correction improves greatly the results for the Göttingen area. At face value, however, Table 1 shows for the winter season, that the bias goes from +8% to -12% (i.e., increases in magnitude). See also page 5163, lines 15-17.

Answer: We will be more precise in the discussion of the results separating the effects of bias corrections in winter and summer. Here we will now consider two RCMs.

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Page 5162, line 15; what does “only marginally insignificant” mean? Almost significant?

Answer: We will correct this sentence. Please see the revised manuscript.

Interactive comment on Biogeosciences Discuss., 9, 5153, 2012.