

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

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mschlue@gwdg.de

Received and published: 8 June 2012

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Answer: We thank the Referees's #1 for constructive comments on our manuscript. Taking these comments into consideration we now have strengthened the focus of the manuscript on our robust findings and reduced the discussion on research ambition. We now clearly demonstrate the scientific merits of the study. We have also addressed in detail all points raised by the reviewer. Below is our response with explanations of changes and with additional suggestions.

Anonymous Referee #1 Thanks for submitting this manuscript to BG. I think it's relevant

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and good that scientists start using climate projection data for science and application. One crucial requirement for a successful review process in BG is however the answer to ‘does the manuscript represent substantial contribution to scientific progress within the scope of this journal (substantial new concepts, ideas, methods, or data)?’. Reading the manuscript I wasn't yet entirely sure how this work would contribute to the development of science in this area. You make an interesting data analysis, but the analysis stays descriptive and general scientific achievements from this study cannot yet be seen. You reveal much of your research ambition, but this makes the reader expect more than you actually provide in this manuscript. You should decide whether this is meant to be a study on vulnerability of future bioenergy cropping to altered climatic variability or rather a methodological study on the impact of the bias correction at the example of two regions that differ with respect to shading effects from mountain ridges. In the first case you might want to make sure that the SPI is especially relevant for bioenergy cropping (e.g. with a crop specific impact model analysis, which you mention as an outlook), in the latter case you should make sure that you have more to offer than previous work done from others that have developed, used and discussed bias corrections before. This would at least make it easier for me to answer the above question positively. I hope that a revised manuscript will demonstrate the scientific merits from this work stronger.

Answer: A full-scale analysis of how the future climatic variations might affect the growth of bioenergy cropping using one or (better) several crop-specific impact models is clearly out of scope of this analysis, but does not warrant more investigations in future research as expressed in the discussion section. Thus following the advice of the reviewer we focused the study on the “biologically related” climatological aspects. There are several drought indices which can be used for this purpose and we implemented the commonly used SPI as a suitable drought index as the focus of our study is also on the effect of bias correction. For this purpose, bias corrected and non bias corrected data are readily available. Thus, in the new version we will strengthen our answer to the question what is the regional climate change signal in terms of precipitation variabil-

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ity under different climate projections. To assess the uncertainties of droughts/floods projections and following the state-of-the-art standards of climate projection analysis, we consider not only a range of emission scenarios (SRES A1B and B1), but also a range of regional climate models (CCLM and REMO). To address the bias correction issue we then compare the spread of the projections ensemble with and without bias correction. These issues are highly relevant and of interest to many researchers. First we test whether the RCMs provide suitable data for the selected region by comparing them with observations. We want to know if the RCMs selected are reasonably reliable in reproducing the observed mean climatology. The combined use of the ensemble approach and the bias correction approach is advantageous since it allows the consideration of three types of uncertainties: Uncertainties related to the global warming response for different emissions scenarios, uncertainties related to the regional climate response to global warming as indicated by a range of RCMs, and the uncertainties related to the bias correction. However, the bias correction approach assumes that the biases in the model for the observed period remain the same in the future. Nobody has shown this analysis for these areas before and most studies concentrate on a larger scale, but agricultural management requires studies and knowledge of changes on a very small scale.

The use of the English language needs to be improved (see some suggestions below).

Answer: The English language now is improved as was suggested by the Referee.

Detailed comments: px, ly refer to page x and line number y of the print version of the manuscript. The title is very clear but reflects only the climatological aspects of precipitation of your work. Was this intended? (C1)

Answer: See answer to first comment. We investigate the climate sensitivity of the two regions and examine the dynamics of aridity using the SPI calculated from the six previous months. Many studies have shown that the SPI is relevant to vegetation and there is a relationship between the SPI and productivity, we will insert the correspond-

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ing references.

Reading the abstract I didn't quite see the relationship between your analysis and carbon neutral bioenergy cropping and use in particular. You mention it only in the beginning, but during the rest you concentrate on climate change only. (C2)

Answer: Our research project is a part of joint project dealing with different aspects of bioenergy plants and bioenergy production and is aimed at quantifying the interactions between bioenergy plants and regional climate under current and projected climate conditions. We started with the description of present and future growth conditions for bioenergy plants and with precipitation in particular. The biological aspects are therefore negligible at this stage, but will be addressed later.

The way you express the results from your study, e.g. 'highlight', 'emphasize', is very cautious, but this lets your statements sound speculative and vague. Try to concentrate on the robust findings from your study and reflect this in the wording (C3)

Answer: Thanks, we corrected the manuscript and reflect our findings in the wording now.

p5154, l21: 'Increasing winter availability of water' consider: 'Increasing availability of water during winter'

Answer: Thanks, we changed the sentence.

p5154, l23: 'climate change signal of the SPI' reword

Answer: OK, done.

p5154, l23: indicate-> indicates

Answer: Corrected.

p5155, l11: 'highlighted' -> 'demonstrated'; 'this'-> 'these'

Answer: Corrected.

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p5156, l6 – l8: consider: 'Therefore the joint research project BEST (BioEnergy regions STrengthening) started investigating the success of various bioenergy plantations in Germany at the example of the two investigated areas.'

Answer: Agreed, we clarified it now.

p5157, l4: replace 'in' by 'the'

Answer: Done

p5157, l10: 1. 'For future water availability and its surplus or deficit over the two regions the SPI is analysed' this sentence doesn't sound correct. Please reword.

Answer: Ok, we corrected the sentence.

p5157, l14: The wording 'chosen for a case study for analyses' doesn't make sense to me

Answer: Agreed, we corrected it.

p5157, l 25: The wording 'These conditions serve these areas as a diverse agricultural base.' doesn't make sense to me

Answer: OK, deleted.

p5157, l 25: Why 'field areas'

Answer: Why not? We can rename it into "bioenergy areas"

p5158, l 14: The wording 'by the landform configuration. ' doesn't make sense to me, try 'topography'

Answer: Corrected as was suggested, sentence also clarified.

p5160, l 10: in your introduction you mention explicitly bioenergy cropping; is the SPI especially relevant for this kind of land use? (C5)

Answer: OK, we are now more explicit about the relevance of the SPI to bioenergy

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cropping.

p5160, l 25: why do you use quotation marks "minimizing ..residual" ? p5161, l 12: why '(R)' do you mean registered trade mark? Or do you want to abbreviate the abbreviation?

Answer: Agreed, corrected now.

p5161, l20: please replace 'quiet' by 'quite' if not even using a more exact formulation (quantify how close observations and simulations were)

Answer: OK, corrected.

p5161, l26: consider use of 'values are' 'already'

Answer: Corrected.

p5162, l4: 'are significantly not different' -> 'are not significantly different'

Answer: Corrected.

p5162, l24-25: 'Changes in precipitation for SRES A1B and B1 in Göttingen and Großfahner area are less marked compared to the whole area (see Fig. 5a-d) in both seasonal time period differences.' difficult to understand, please reword.

Answer: OK, reworded.

p5162, l5: 'The climate change signal of SPI'-> 'The SPI'

Answer: We do not agree with the suggested improvement: it is not the SPI itself that demonstrates the "wetting" of the winter in future, but the SPI-change.

p5163, l20: less->smaller

Answer: Corrected.

p5164, l1 – 5: Why did you not test apply approaches and compare them with the method you selected. This would have strengthened the methodical aspects of your

C1819

work (C6)

Answer: Good point. We now have outlined our scientific merits more clearly and propose to include the results of REMO as well.

p5164, l6 – 8: are the data bases of you study and the IPCC assessment independent? (C7)

Answer: Strictly to say our study is indeed based on the same scenarios as IPCC. However, while IPCC used the outputs of GCMs, we took the results of regional down-scalings. It is expected and demonstrated that under the same scenario in some areas the regional climate projections can show climate change signal opposite to the forcing GCM as a result of higher spatial resolution. That's why we emphasized that in our case (scenario, region and model combination) the climate change signal was similar to the larger scale projections of IPCC.

p 5164, l 26: what do you mean with a 'high water gauge'?

Answer: Ok, we corrected the sentence and clarified the text.

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