Author Response to "Topical Editor Decision: Publish subject to technical corrections (04 Feb 2017)"

Andreas Will and colleagues

February 12, 2017

Cottbus, 12 Feb. 2017

Dear Dr. Fyke,

we would like to thank you for your carefull reading of the revised manuscript and the suggestions and comments you made. The 2nd revised version (5.12 is our number) uploaded consideres all of them and we hope that it improved the understandability of the results, the consistency of the presentation and the readability.
We also tried to improve the language as much as possible. However, wa are non-native speakers english.

You may find our answers to your detailed comments in the following.

Wer are looking forward to your final decision and remain with kind regards, Andreas Will and co-authors

Ms. Jeremy Fyke's review of the revised manuscript (4 Feb 2017) and author response:

Thank you for providing a revised manuscript. In reviewing it, I have found it quite dense and disjointed (even for a model description paper). Hopefully we can improve it prior to publication, so it will be accessible and helpful to readers. To that end I have the following suggestions for technical corrections prior to publication:

1. Improve English and conciseness of Abstract and Introduction Answer: We revised the abstract, introduction and conclusions and hope that we improved the language and readability.

2. better differentiation of COSMO-CLM and Community Land Model (CLM) acronyms. Quite confusing for the reader
   Answer: We fear, this problem cannot be solved. Both models have their acronyms for more than 10 years and it is not wise to introduce a new acronym in this article. Usually COSMO-CLM is used in the text and CCLM in figure captions. However, here we need to

use CCLM+VEG3D etc. and we agree that using both COSMO-CLM and CCLM in the text is even more confusing. Thus we removed COSMO-CLM everywhere but at positions at which the full name is used "COSMO model in Climate Mode". We hope, it's the best solution possible.

3. A more comprehensive tie-together of all the models used. Currently, to the fist-time reader it appears as somewhat of a laundry list. For example:

   - better high-level justification of reasoning for tying together so many disparate models
   - Justification for the couplings to different ocean models, depending on basin
   - A better model-specific justification for why each model was chosen

   Answer: Thank you for the suggestion. We revised the paragraph introducing the individual couplings (line 56 ff.) accordingly. Furthermore, the abstract is rewritten and the conclusions are substantially revised.

4. is the full MPI-ESM coupled model is used, or just the atmosphere? The first time reader is left confused as to the explicit connections between this coarse global model, and COSMO-CLM, which are only revealed as 2-way coupled, deep in the technical descriptions (unless I missed something)
   Answer: Thank you for this hint. We removed the ambiguity and explain the general aspects of the coupling in the introduction. We explain now the method of coupling (atmosphere-atmosphere) between CCLM and MPI-ESM in the interface description only.

5. "An overview of the coupled models selected for coupling with COSMO-CLM (CCLM) is given in table 3": the term coupled models implies they already all coupled. It is thus confusing to read that they will be coupled *again* to something else.
   Answer: We agree that the wording is confusing. We replaced "coupled models" by "models coupled (with CCLM)" throughout the text or replaced it by *components* of the coupled system throughout the text. Furthermore, we also replaced "model components" and "component models" by *components*. We hope this improves the readability.

6. confusing: "atmosphere-atmosphere coupling" or "ocean-ocean coupling". Need to be more clear that it is globalTOregional one/two way coupling (if I understand correctly).
   Answer: Thank you for the hint. We removed this wording from the introduction and highlight in the introduction now that all couplings are between the regional climate model CCLM and another model and leave the details of the coupling method for the interface description section.

7. It is confusing that some models being coupled to COSMO are component models (e.g. CLM), while MPI-ESM is a full coupled model. A clearer up-front description of this differentiation (if correct) is necessary.
   Answer: We agree that MPI-ESM is an earth system model while e.g. NEMO or CLM are models of one component of the earth system, i.e. component models. We follow the

wording in OASIS3-MCT and name all models coupled now "components" (of the coupled system throughout the paper.

8. The climatological means of freshwater inflow of 33 rivers to the North Sea and the Baltic Sea are collected from Wikipedia. A more robust source is needed here. Answer: We removed the citation of Wikipedia. Instead we give a more precise description of the numbers used and cite the author of that approach as personal communication. Unfortunately, there is no more precise citation available.

9. Check that all acronyms are first defined in the text, and then the acronyms are only used in the future. For example, COSMO-CLM is defined as "CCLM", but then "COSMO-CLM" is used again in full, later. Answer: Thank you for this hint. We replaced now COSMO-CLM and COSMO by CCLM throughout the text.

10. There are two sections, titled "OASIS3-MCT coupling method and performance optimization", followed by "OASIS3-MCT coupling method". These titles are redundant, and I suggest a careful merge and re-write of these sections into one coherent section. Answer: We followed the suggestion and merged the sections.

11. It is not clear to me early in the manuscript, whether MPI-ESM is used only as generators of boundary conditions for the regional model, or if two-way coupled has been implemented between these. Please clarify early on, so the readers are prepared for the later, more detailed descriptions. Answer: Thank you for the hint. Throughout the paper we investigate a two-way coupling between MPI-ESM and CCLM. We revised the description of the coupling CCLM+MPI-ESM in the introduction (line 71 ff) and at other places of the article to clarify this point.

12. "Here `send_fld` ends": what is `send_fld`? Answer: Thank you for this question. `send_fld` is a coupling routine in CCLM. We revised section 3.2 by adding the references to the time-step organisation figure and gave a more precise overview of what is done in which routine.

13. Has the two-way-coupled CCLM+MPI-ESM system actually been prognostically run (as opposed to using a prescribed COSMO-CLM solution)? Answer: Thank you for this question. We added a sentence in the introduction clarifying that all coupled systems presented have been used successfully on climatological time scales. For CCLM+MPI-ESM we added this comment in 3.2 as well.

14. In Conclusions: perhaps make a more 'tied togetherÂ´ set of conclusions, from the many paragraphs that start with the words: "The optimum configuration of the coupling". Or alternatively, make bullet points. In either case, the optimal coupling strategies should be more accessible to readers, who are potentially interested in each individual coupling. Answer: Thank you for the suggestion. We revised the conclusions accordingly.

15. In Conclusions: I think it is necessary in the concluding section, to return to the initial scientific reasons for constructing COSMO-CLM couplings in the first place. This will

remind the reader why this technical work is relevant to a broader research efforts, and perhaps motivate the reader to work with these couplings themselves. Answer: Thank you for this suggestion as well. We revised the fist paragraph of the conclusions accordingly.