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Interactive comment on "The 1-way on-line coupled atmospheric chemistry model system MECO(n) – Part 2: On-line coupling" *by* A. Kerkweg and P. Jöckel

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We thank referee #1 for her/his valuable comments, which helped to improve the quality of our manuscript.

- *[...] As it is, the paper is a technical description of the developed software and its implementation: more a manual than a scientific paper.*
  Indeed, GMD was set up to provide a platform for publishing code developments in the peer-reviewed literature (see e.g., the GMD white paper *http://www.geoscientific-model-development.net/gmd_journal_white_paper.pdf*).

- *Therefore, I recommend a major revision of MS in which the authors discuss the nesting procedures and the one applied here, the problems related to the different model spinup periods and their coupling, and show data/comparison with literature with the aim of proving the advantage of new coupler objectively.*

To our knowledge, there is currently no comparable model system available, which provides an online coupling of limited area model instances to a global model - thus there is nothing we could compare to. Offline coupling (via data files), however, is a state-of-the-art technique, but the on-line coupling is advantageous for several reasons provided in our manuscript. An detailed intercomparison between online and offline coupling and the influence of lead times is provided in the third part of this article series. Here, only the technical coupling procedure is describes - the rest is beyond the scope of this manuscript (see also our replies to the comments by referee #2 of the first part of this article series).

Regarding alternative couplers: When we started the development, some universal couplers (at least they are claimed to be universal) have been available, among them the OASIS3 (*http://www.cerfacs.fr/globc/publication/technicalreport/2006/OASIS3_UserGuide.pdf*,) coupler which is probably the most widely used, at least in the European climate modeling community. OASIS3 has some major limitations which prevented us from its application for our purpose: First, it can only exchange 2-D fields (but we require to exchange numerous 3-D fields for chemical boundary conditions), second it can only be operated in a "per-field parallel mode". OASIS4 (Redler et al., Geosci. Model Dev., 3, 87-104, 2010), which is supposed to overcome these limitations, is still under development.

Moreover, a universal coupler needs to contain numerous generalised grid-transformations, i.e., for our application between the Gaussian grid of ECHAM/MESSy and the rotated grid of COSMO/MESSy. The application of very

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general transformation procedures, however, generate a lot of overhead with a potential run-time performance decrease and thus the external universal coupler potentially becomes an avoidable bottleneck. Therefore, we decided to go for the presented client-server architecture, where the coupled models communicate directly, without an additional program in between. As an advantage, the tailor made grid-transformation routines, which have been available anyway from the offline coupling approach, could be directly re-used as part of the client submodel. This makes the coupling much more efficient, with, however, the drawback that the client submodel needs to be adapted, if other clients should be coupled.

Where appropriate, we will add this discussion to the revises manuscript.

- *The MS should also contain discussions about the generality of MMD software and the possibility to be used for coupling other models.*
  The answer to this question really depends on the parts of the MMD software you refer to. The MMD library could be used to couple other models as well, but the interface to the ECHAM/MESSy and the COSMO/MESSy models (i.e., the submodels MMDSERV and MMDCLNT) are rather specific for the present case and need to be adapted; in particular, as MMDCLNT includes INT2COSMO, which is tailor made for grid-transformations to the COSMO grid. Nevertheless, any adaption is straightforward due to the standard MESSy infrastructure. We will add this discussion to the revised text.

- *The title of the MS does not reflect the actual content: Part 2 should be renamed from "On-line coupling" in "Description of Multi-Model-Driver coupling software".*
  We will change the title to: "Part 2: On-line coupling with the Multi-Model-Driver (MMD) software.", since the manuscript also contains specifics about the online coupling in addition to the mere MMD description.

- *Many sections can be completed eliminated or re-written in few phrases to sum-*

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marize their main content (such as 7.3.1, 7.3.2, etc). These part of the MS should be in the Manual.
As this is a technical documentation and the methodology is of potential interest also for other modelers, we are very hesitating to entirely eliminate the information about the sequence of the coupling completely. Nevertheless, we will shorten those parts, which go too much into the details of the coding of the coupling, e.g., the variable or pointer names etc.

- *pg. 1387: the content of the phrase "More exactly..." is not clear.*
The idea is, that writing the "n" (here with n=12) as explicit sum of the COSMO model instances in the respective MECO(n) setup provides the possibility to describe the hierarchy of COSMO/MESSy instances, i.e., how many instances are directly coupled to ECHAM/MESSy or how many instances of COSMO/MESSy are nested into each other. To clarify this, we will explain the idea more explicitly in the revised text.

Interactive comment on Geosci. Model Dev. Discuss., 4, 1359, 2011.