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**Geoscientific
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Discussions**

Interactive comment on "Development cycle 2 of the Modular Earth Submodel System (MESSy2)" *by* P. Jöckel et al.

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We thank referee #2 for the very helpful and encouraging comments. Here are our replies:

- *The paper includes many details of new aspects in MESSy. I support this overall model documentation and also the attached user manuals for CHANNEL and TIMER. I have only two principal problems with the paper: First, I think the supplemental should be independent and not direct interfere with the paper itself. In my opinion, the supplemental should only contain additional information, which are not necessary for the paper itself. Unfortunately in the paper exists many direct links to figures from the MESSy2_evaluation.pdf. If this figures from the*

supplement are necessary for the discussion, so they should be also in the paper.

We completely agree that the supplementary material should be independent and not directly interfere with the paper itself. Therefore we will, as suggested by referee #1, add the required figures to the manuscript.

- *Second, I think the evaluation of MESSy2 in Sect.9 is not completely done satisfactorily, because many facts which are described have to believe by the readers without exact explanation. Also the evaluation is not complete comprehensive but rather specific to selected substances. But I also think it would not be helpful, if the evaluation is done properly within this more technical paper, because the paper is currently still very long. Therefore I would suggest skipping the section "A re-evaluation simulation" and publishing the evaluation more comprehensive in a companion paper. Also I would not attach the MESSy2_evaluation.pdf and skip all links to figures to this pdf. After this correction the length of the manuscript will be (in my opinion) acceptable. Therefore I would not move more parts of the paper in separate user manuals.*

  First of all we thank referee #2 for giving us the opportunity to keep the namelists in the paper (and to encourage us to add even more).

  As also replied to referee #1, the main focus of this manuscript is on the technical documentation and less on the results, in accordance with the GMD(D) policy. This is why we kept the evaluation section so short. Nevertheless, we think that we are obliged to show that the model modifications and extensions do not deteriorate (but hopefully improve) previous results. Therefore, we mainly refer to the earlier evaluation of the model system (Jöckel et al., 2006; Pozzer et al., 2007) and mention only those results that deviate. Consequently, we prefer to put some more effort into a revised re-evaluation section (including figures) to carry out our duty.

A separate paper for the re-evaluation would increase the overhead, since some model descriptions need to be repeated there to make this separate paper self-contained. Moreover, we risk that eventually no re-evaluation at all will be published, since we think that the material is not sufficient to justify a paper on its own in addition to Jöckel et al. (2006), Pozzer et al. (2007) and some others of the same special issue.

Moreover, we would like to point out that the supplementary MESSy2_evaluation.pdf can nicely be used as a reference by users of the model system to compare with their own simulations. Therefore, we prefer to keep it, but we are also willing to move / copy those figures to the main text, which are mentioned explicitly in connection to results there.

And last but not least, we would like to point out that the length of this manuscript for such a complex model system should not be an issue.

- *I also would not skip Sect. 7.1.1, because if the performed KPP changes lead to a factor 10 speedup of MECCA this is absolutely essential and should be mentioned as an important improvement.*

  We completely agree and will keep this section.

Comments to the separate sections:

Sect. 1) Introduction

- *Page 1425, Line 8-11: Here I miss some important MESSy submodels as JVAL, CONVECT, CLOUD, RAD4ALL, LNOX... Also I would prefer a short description for the submodel (for example: "JVAL, for the calculation of photolysis rates").*

  We will add a table with brief descriptions and references and highlight those which are used in this study.

- *1426, 13: The AC-GCM is here introduced with the name ECHAM5/MESSy1 with reference to Jöckel et al., 2005. But in Fig.2 and Fig.4 the authors use the abbreviation EMAC. But the acronym EMAC is first explained on Page 1439, 27. Maybe here can already be used the name EMAC instead or additional to ECHAM5/MESSy1.*

  We will introduce the acronym EMAC at this position in the text.

- *1426, 20-27: The description of BMIL is up to line 22 well comprehensive, but the rest of the description from line 23 to 27 is very short. Maybe here should the SMIL and SMCL and also the reason why the authors develop the new submodels mentioned.*

  This paragraph gives only a brief outline of the manuscript. The reasons why the particular submodels have been developed are, in our opinion, sufficiently mentioned in the corresponding sections.

Sect. 2) CHANNEL

- *1428, 13: It is not clear what kind of two namelists is meant, because they are not mentioned before. Maybe here or in the introduction should be a short description of the difference of CPL, CTRL and/or other namelists. I would prefer if an example of the CTRL and CPL namelist (maybe shortened) of CHANNEL are added as figures in this section. At least these figures should be in the supplemented CHANNEL user manual.*

  The concept of CTRL and CPL namelists has been already introduced by Jöckel et al. (2005), but we agree that it might be helpful to briefly review it. We will add a small paragraph on the MESSy user interface to the revised introduction.

  However, we are very hesitant to add the channel namelist to the manuscript for two reasons: (1) This will probably not be possible without lengthy additional

information (a figure caption is not sufficient in this case) to make it clear and self contained, and (2) therefore add a lot of redundancy with the CHANNEL manual. Nevertheless, we agree to add exemplary namelists as figures to the supplement.

Sect. 3) TIMER

- *In my opinion the CPL namelist of TIMER should also be added and briefly described (maybe in the caption as in Fig. 1) in this section and not only in the supplement.*

  The same arguments as for the CHANNEL namelists also hold for the TIMER namelist. For the non-generic submodels presented in the manuscript, the description of the namelists is much simpler and it is possible to link them nicely with illustrating examples. In this case, detaching them from the text into a supplement would increase the overhead. Overall, we tried to choose the most concise way for the presentation and documentation. Please, see also our reply to referee #1.

Sect. 4) QTIMER

- *1431, 27: Here it is also not clear what a CTRL namelist is. Please introduce the CTRL and CPL namelists in Sect.1 or Sect. 2.*

  As mentioned above, we will add a small paragraph on the MESSy user interface basics to the revised introduction.

Sect. 5) New diagnostic submodels

- *1436, 10: For me it is not clear, how you get the model values for the location of the measuring instrument? Exist a (bi-)linear interpolation involving the four*

  nearest horizontal grid boxes (as in S4D) or is the grid box used which covers the location?

  In S4D a bi-linear interpolation method is used, for SCOUT the nearest grid point to the location is used. We will add this information.

- *1436, 16: Please add "(see Sect. 8)" after TRANSFORM.*

  We will add this.

- *1436, 21: If the sampling frequency in SCOUT always one hour or it is possible to change this frequency?*

  Since for each location a separate channel is created, the output is completely controlled via the channel namelists. This implies that the output interval can be chosen (via a standard namelist) independent of all other output intervals, even individually for each SCOUT location. See our reply to the corresponding question of referee #1.

- *1438, 5: What will happen if this switch is set to False?*

  Sorry. The "(F)" is missing after "only ... listed in the position file" and will be added. In case the frequency of the track position information is higher than the model time stepping frequency, this switch has no effect.

- *1438, 17: Maybe you can add (in ^{o}E) and (in ^{o}N) after longitude and latitude.*

  We will add the units.

- *1443, 21-22: Please add the deviation in minutes of the strict and weaker definition.*

  A deviation in minutes cannot be given, since it depends on the horizontal model resolution and on the model time step. The formulas are given on the same page in lines 2-3, (where the "(T)" is missing and will be added), but for clarity we will repeat it in the text.

- *Fig.5: Is "in degrees west (between -180 and 360)" correct? I think it have to be east.*

  Thank you for pointing this out. It will be corrected.

- *Fig.12: Please change the sequence of colours in the panels, so that in every panel the same sequence is used. Please also don't use the blue colour for the highest values as by the ozone panel.*

  The lower panels show differences, for which a centered color palette is most suited, in contrast to the upper and middle panels, which show absolute values. Therefore a common color palette for all panels is not feasible. However, we will try the colors used for NO also for ozone or another color palette for both, ozone and NO.

Sect. 6) New process submodels

- *1445, 7: Maybe you can add the atomic numbers of the elements in this reaction (R1)*

  We will add the atomic numbers.

- *1445, 8: "ice and snow free" should be in parentheses (as in the caption in Fig.13)*

  We will add parentheses.

- *1447, 2-4: I would skip the sentence: "The individual .." (see my remarks in the general comment).*

  We prefer to keep this additional information as a reference for future simulations and other users.

- *1447, 14-15: I would also skip the links to the figures of the MESSy2_evaluation.pdf*

  If we skip these, how can we proof the important contents of this sentence without adding two more figures to the main manuscript? Here, we would like to hear the opinion of the editor.

- *1448, 23: Please add also the stratospheric lifetime of 14CO. This is important for the understanding of the panels in Fig. 17.*

  We will add 5.9 ± 1.3 months stratospheric lifetime of ^{14}CO, as estimated by Jöckel et al. (2000), see their Table 1.

- *1449, 11: "Upper and middle" panel is not correct. In Fig. 17 the middle panel is top, right.*

  This is a matter of typesetting of the manuscript for GMDD. In our original pdf (in the GMD layout) the three panels were ordered in one column. We will take care that it becomes corrected in the revised manuscript.

- *1449, 23: Pleas use instead "the models"* $\rightarrow$ *"the two CTMs" with regard to "three models" in the same line.*

  Thank you very much for this suggestion. It will be changed.

- *1450, 14-16: Please insert the abbreviations ka and Ta.*

  Will be introduced.

- *1451, 17: Maybe here can still insert in one sentence what is the content of Fig. 19.*

  We will add this information.

- *Fig. 15 and Fig.17: Please use the same colour bars in the panels in one figure.*

  This is not feasible, since then the details are not visible in all panels. The different panels show different quantities (e.g., differences requiring centered palettes and absolute values of different ranges).

- *In Fig. 17 the description "middle panel" is not correct.*

  This is a matter of typesetting of the manuscript for GMDD. In our original pdf (in the GMD layout) the three panels were ordered in one column. We will take care that it becomes corrected in the revised manuscript.

Sect. 7) Improvements of the chemistry setup

- *1452, 10: Why MECCA and not MECCA2?*

  Initially, we thought about calling the new version MECCA2. However, we then decided that the submodel name of the current, up-to-date version should always be without a number. MECCA1 was only kept for backward-compatibility (like PSC and HETCHEM).

- *1458, 14: Please change "will be published elsewhere (Kirner et al., 2010)" in "is published in Kirner et al. (2010)".*

  We will update this reference.

- *1459, 12: I don't know if the availability of PSC and HETCHEM in MESSy2 is reasonable? Maybe this leads to confusion in the user community. If you get the same results by using the submodels MECCA (with MECCA_KHET) and MSBM instead of MECCA1, PSC, HETCHEM than there is no reason to maintain PSC and HETCHEM. But this is of course a decision of the authors.*

  Please see our reply to a similar comment by referee #1.

- *Maybe in this section should be inserted figures with examples of the namelists of the MSBM and LNOx submodel.*

  The MSBM namelists are essentially the same as the PSC namelists documented by Kirner et al. (2010). We will add this information to the revised manuscript.

  We will add the LNOX namelists to the revised manuscript.

Sect. 9) A re-evaluation simulation

- *How mentioned in the general comments, I would skip this section and publish the re-evaluation in a companion paper.*

  Please see our reply to the general comments above.

References

- *I miss following papers: Sander et al., 2010; cited on page 1452,11 Kirner et al., 2010; 1456,5 and 1458,14 Pozzer et al., 2010; 1461,7*

  We can only add Kirner et al. (2010), since this is now in ACPD. The others are still in preparation and will be cited accordingly, i.e., as "manuscript in preparation".

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Interactive comment on Geosci. Model Dev. Discuss., 3, 1423, 2010.