Geoscientific
Model Development
Discussions

Interactive
Comment

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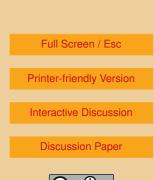
Anonymous Referee #2

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The authors present a new version of the MESSy infrastructure which is currently used in the chemistry-climate model ECHAM5/MESSy for Atmospheric chemistry (EMAC). The authors have developed an improved and extended MESSy2 infrastructure, have improved existing and have created new diagnostic and process submodels. The new updated version of MESSy and its combined submodels includes very much useful advancements and is certainly a further step to a comprehensive and flexible earth system model. The performed changes are described understandable and the paper includes many details of the technical parts of MESSy. I recommend this paper for publication after some minor revisions.

General Comment:

The paper includes many details of new aspects in MESSy. I support this overall model

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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.

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. 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.

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").

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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.

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.

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.

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.

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.

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?

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

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

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

1438, 17: Maybe you can add (in °E) and (in °N) after longitude and latitude.

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

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

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.

Sect. 6) New process submodels

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

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

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

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

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

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

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

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

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

Fig. 15 and Fig.17: Please use the same colour bars in the panels in one figure. In Fig. 17 the description "middle panel" is not correct.

Sect. 7) Improvements of the chemistry setup

1452, 10: Why MECCA and not MECCA2?

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

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.

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

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.

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

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