

Interactive comment on “Curriculum Vitae of the LOTOS-EUROS (v2.0) chemistry transport model” by Astrid M. M. Manders et al.

Anonymous Referee #1

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Review: “Curriculum Vitae of the LOTOS-EUROS (v2.0) chemistry transport model” by Astrid M. M. Manders, et al. in GMD, manuscript number: gmd-2017-88

This paper presents the latest version of the LOTOS-EUROS model (v2.0) which is open source. It outlines typical model settings/conditions, as well as optional features that are under development. It also provides an historical perspective on the model development, and provides a substantial number of references for its application and improvements to the model performance. Overall I think this paper should be published, however there are a few revisions that I would recommend before publication. For one, there are a number of English language edits that should be taken care of that would improve the readability of the paper.

Comments:

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P4L1-2: Is this really a contrast? The US is also one country unless North America is being referred to. And in that sense, it was one community in the same way that each country in Europe has a community.

P4L14-17: These lines seem to be in direct disagreement with what this paper is doing. While the authors may argue that the paper is different from other model description papers, that is also basically what this paper is as well, even if there is some other information included. I would suggest removing this as it seems to be a contradiction.

P5: why is it that the LOTOS model development is described in detail whereas the EUROS model gets references. Even if it has been written about before, this is very unbalanced, it would be good to include some short summary for EUROS as well, so that the sections are a bit more similar.

P6L6: Why does this sentence say 2004 when all previous text says 2005?

P6L9: This section would be more appropriately titled if it included something like 'development and applications' in the subject heading.

P6L17: What 'new EU legislation' is being referred to? It would be good to include a year, also because PM10 and PM2.5 regulations came into effect at different times. Also what is meant by the 'new European monitoring capacity'?

P7: the paragraph that ends at the top of the page and the first full paragraph need a connecting sentence. The earlier paragraph ends as if the PM discussion were closed and then the authors go on to discuss nitrogen and ammonia emissions. I would suggest something along the lines of 'Another aspect of modeling PM that has received significant attention is secondary inorganic aerosol.'

P7L15: what is the 'compensation point for ammonia'? Please explain the concept as it is referred to multiple times throughout the manuscript. (also on P9L8)

P8L1: include a very short (less than a sentence) description of what AQMEII-2 is.

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P8L2-3: this sentence seems to be a bit of a non-sequitur to the sentences surrounding it.

P8L5-6: ref??

P8L8-10: This sentence is not clear at all.

P8L24: this doesn't make sense. What does it mean to 'warrant an availability' and what does that have to do with KNMI?

P9L5-6: that the VBS approach depends heavily on assumptions – isn't that true for many things in modelling? Be more specific rather than making such a vague statement. Why or what aspects make this more dependent on assumptions than any of the other inputs or modules? If it doesn't fit here, reference the discussion elsewhere.

P9L6-8: explain this, not clear currently. Level of detail of a process should match the general level of accuracy of a model????

Section 4: I assume that the description that is included about the features of the model includes the options used for the model evaluation/plots presented in this work, as well as additional options that could be used. It would be good to be more explicit about this here. The reason that I mention this is because in e.g., emissions, the TNO-MACC-III database is discussed as being used as input, but other EI can be used as well. So this isn't really a model feature.

P11L8-10: the description of the layers needs to be clarified. There are a lot of different layers mentioned that are all relatively close to the surface. Do any of these overlap? How do they fit together? It might be good to include a depiction of these.

P11L24-25: the tracers can be easily selected. Does this refer only to CO₂ or also other tracers? Please clarify.

P12L1: is the heterogeneous chemistry on wet aerosol also part of Isorropiall or is that a different module? Also, the cloud chemistry, no module is mentioned, is this part of

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the core model or ?

P12L5-7: so SOA isn't really taken into account, is anything used to compensate or otherwise account for SOA? Please address this.

P12L15-16: The authors mention that when not all met fields are available, representative average values can be used. Are there a minimum number of or certain critical parameters where an average would not be acceptable? E.g., for these certain parameters, rep avg values are acceptable?

P12L28: will people know what the 'sand blasting approach' is? Might be good to describe this a bit.

P12L30: 'region-specific' and 'local' seem redundant/one would supersede the other. Prob best to choose just one, or be more explicit.

P13L1-4: the TNO MACC III database was used for emissions. In this study for the model performance runs? In all of the papers presented? The context needs to be more explicitly clear. Also, why PPM and not PM?

P13L6-7: the temporal disaggregation that is mentioned, are these defined by the user? As part of the EI? If these are model defined, it would be good to include a table or similar, as in e.g., the Simpson paper on the EMEP model, to document what these are. Can be in the SI.

P13L27-29: Why is the reference for these processes that is included in Table 1 not included here? Also, it is not clear whether one approach needs to be chosen or if both are used in parallel given the following sentences.

P13L32-P14L1: this aspect of translating concentrations to obs height needs more explanation. It is not clear at all.

P14L22-25: if the effect of these is so large, what makes what is chosen the best? What should be considered?

P15L4-5: what does this sentence mean? What is being distinguished here with the aerosol samplers and PM10 samplers?

P15L27-28: why are dust and sea salt boundary conditions not used?

P15L32: explicitly mention what kind of emissions are coming from the Ruhr area as not everyone might know this.

P16:1-6: Couldn't this underestimate also be related to the lack of SOA in the model? How is this accounted for?

P16L8-13: Spatial correlation and spatial correlation for annual mean are both referred to, with one yielding good results and the other not, in addition Table 2 also has two columns (mean and spatial correlation). Please outline what the differences in these two different correlations are, with explanations as to why the differences exist, as it is not clear from the current text.

P16L26-27: How are Table 2 and Figure 3 showing a comparison with rain water conc observations? Rain water doesn't seem to be among any of the stats listed or plotted, unless this is a ref to the e.g., wetNH3 in table 2.

P16L31: as above, explain what exactly is being correlated.

P17L5 (also P21L13): technically, aerosol includes the gas-phase. I would aim to be consistent and refer to gas-phase and PM.

P17section6: I would suggest mentioning already how to get access to these features that are not part of the open source version, or where to find this information. It would make it more user/reader-friendly.

P17L11-12: please mention explicitly what the aim of these techniques are, so that the reader easily understands what is being improved through their application.

P17L24-26: as with the previous comment, please explain what this technique does – how is it different from all those already mentioned above?

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P18L1/Figure 6: is the black line the model w/o assimilation? If so, can the model output really be all that useful w/o incorporating assimilation techniques? Or was this example chosen because of the significant improvement?

P18L8-9: does the reference apply to both AOD and NO₂ or just AOD? If both, please move the reference, if only AOD, ok, but then please add a reference for NO₂ if possible.

P19L8: 'leads to better model performance' – can some more quantitative description be given for the improvement?

P21L2-3: this sentence is not clear and doesn't fit together. Need to extend the community and therefore the code was made open source? Or ?

P21L19-20: how is the improvement of the emissions one of the focal points of LOTOS-EUROS? These are two separate products, and models can be used to test changes to EI, but are model developers working on this? This doesn't really seem to fit?

P21L29-P22L6: all solid points, but it seems to be a bit of a laundry list. How realistic are these different points? Are they all equally close to realization? And even if all of these were implemented, would the model then even be able to run anymore in an acceptable amount of time? It would be good to have a somewhat more nuanced discussion of such points rather than just listing them off.

P22L13-14: the description of the vertical structure and the link to the horizontal grid is not at all clear, nor what the implications are. Also on L17, the layers of the driving met model??? Please clarify.

Figure 7: why is 'natural' all from 'shipping'? That does not line up.

Minor edits:

-there seem to be a lot of spacing issues where there are multiple spaces instead of 1. Make sure this is corrected at the proof stage.

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-various subscripts in chemical shorthand for e.g. NH₄ are missing. Please find and correct.

P2L2: 'combining' rather than 'combination of'

P2L13: no comma after the ()

P2L18: '...to keep a good...'

P2L19: '...to keep a good record of the effect...'

P3L16:) missing at end of reference

P3L23: 2nd reference needs an e.g.

P3L24: include the abbreviation CTMs here, as it needs to be defined before the abbreviation is used later; also in this line replace 'nowadays' with 'currently'

P3L29: '...(e.g. Baklanov et al., 2014), as well as informing the design of monitoring strategies...'

P4L1: '...were developed...'

P5L4: remove 'have'

P5L22: remove 'has'

P5L23: write out 'RCG' or explain

P5L23-24: '...sister models with intensive exchange among their developers during their development.' (or something similar, as the models themselves cannot exchange knowledge, only the people behind the models)

P5L29: no apostrophe in POPs. That indicates possession. There is an extra (in the Jacobs and van Pul ref.

P6L11: '... specific feature that uses a dynamic ...'

P6L12: ‘...enabling the application of the model...’

P6L14: ‘...and advances in remote ...’

P6L22:) needed after 2012

P6L25: in the references, either a ref is missing, or the ; is in error

P6L31: ‘To better understand the origin of PM, a ...’

P6L32: ‘...which enables quantification of the ...’

P7L18: remove ‘also’

P7L21: ‘...improve the model’s skill to capture the intra-annual ...’

P7L24: ozone is not capitalized

P7L28: remove ‘to perform’ and add at the end ‘to be run’ or ‘to be performed’

P7L29: ‘...to evaluate scenarios including ...’ The following list is confusing, is it climate change and energy policies, air quality mitigation, and land use change. Or separate climate change futures, energy policies, etc? Please clarify.

P7L31/L34: be consistent with abbreviation for RACMO-2

P7L31: explain transient scenario simulations.

P8L16: ‘...project was preparation for the ...’

P8L17: ‘... forecasts made it possible to use ...’

P8L22: a.o. ??

P9L15: ‘adds’

P9L28: remove ‘also’; ‘...test was updated to cover 2012 as well.’; Make sure the cases in your sentences and paragraphs match. This is not the only occurrence of this.

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P9L10: explicitly mention that 2003 was the heatwave

P9L29: ‘... in a new way to investigate behavior...’

P9L31: something seems to be missing in this sentence. As compared to what??

P11L20: was aimed at?? Is still primarily aimed at??

P11L30: remove ‘the’

P12L5: ‘...is not currently taken...’

P12L11: replace ‘also’ with ‘and’

P12L13: ‘The default for the model is 3-hourly ECMWF...’

P12L15: ‘online’ is one word

P12L22: do you mean ‘variables’ when you use ‘relations’? or relationships? Relations is not correct.

P12L25: ‘are’ not ‘was’

P13L8: ‘in the vertical, fixed emission profiles...’

P13L9: ‘If desired, scenario factors for specific ... can be integrated without changes to the code.’

P13L19: 1/112th as a decimal for consistency.

P13L23-24: ‘...database, were relabeled as “ocean or sea”, since...’

P13L27: replace ‘over’ with ‘between’; ‘...and below-cloud scavenging.’

P14L13-14: move ‘also’ to ‘... data are also available...’

P14L22-23: move ‘often’ to ‘...models are often used...’

Section 5.2: consistency in case – sometimes past, sometimes present, edit this

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P15L7: ‘.. all data points with ...’

P15L14: write out RMSE the first time it is used

P15L31: ‘Figure 4 illustrates a time series for ozone and PM10 for a station in the Netherlands, comparing observed and modeled concentrations.’

-There are a lot of other edits that should be taken care of for English, please have a native English speaker read through the paper to catch these things.

P19L31/P20L10: why are these words bolded?

P20L17: the BL is part of the troposphere, please edit wording to make this clear.

P20L16: include a reference for the original nucleation scheme by Vehkamäki

P21L16: ‘the role of reactive nitrogen becomes more clear’ please rephrase. How so?

P21L22-23: how are met conditions going to be modeled more realistically in the future? Do the authors mean that ‘by taking met conditions into account’, the soil Nox, etc will be modeled more accurately?

Table 1: for anthro emissions, please be consistent with the EI abbreviation. Previously it was TNO-MACC-III; for fire emission, is this the same as the Kaiser ref? please add it if so.

Figure 4: please add labels to each of the plots (a, b, c) and update the references to them in the text. In the legend, an explanation for the red dots is missing.

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