**Geoscientific
Model Development
Discussions**

Interactive comment on "Regional atmospheric composition modeling with CHIMERE" *by* L. Menut et al.

Anonymous Referee #1

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This paper is partly a description of the CHIMERE-CTM, but largely a review of the CHIMERE-CTM research already published. As far as I can tell, it does not contain any new research. The manuscript bears the impression that it was not fully read through before submission, even containing a paragraph or two that clearly should have been deleted.

The abstract does not indicate the purpose of the paper. Is it a description of the CHIMERE-CTM, or is it a review of existing research using it? The title indicates the latter, for which I think GMD is the wrong place.

There is no conclusion in the conclusions section.

A thorough model description is useful and should be suitable for GMD, but at this

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stage I think the paper lacks substance and details: Several equations in the describing/technical sections lack references, which needs to be sorted out. Other equations are given along with references, so it would be good to comment on why equations are repeated. I agree that repeating would be suitable for a proper manual or technical document, if that is what the authors aim at. The last sections (11-12) do not really describe much, other than listing earlier research and that the model can assimilate observations and be run in forecast. I find the review of existing research too long and uninteresting, mainly listing results from previous studies.

That said, although a model description paper should have some model evaluations included, it may be that it can be enough to refer to other publications instead of repeating it. But I struggle to find the news in this paper, and also to see the aim of it. I think that for GMD the paper should be more technical than it is, really describing the model. However, I wonder, with the large amount of publications referred to, aren't the parts of the model description already included in those papers? Or is the aim of this paper to collect all the bits and pieces to one reference and in that sense to produce a CHIMERE review?

I would not suggest publication at this stage; I think you need to do major changes depending on what kind of paper this is (description vs. model review). As already said, I do not think GMD is the place for a model review without any scientific news.

However, I have still included my list of general and specific comments below, that also should be addressed before a possible publication, should the editor decide upon that.

1 General comments

In addition to the above comments, I have only few general comments: There is inconsistent use of e.g. modeling/modelling. I assume GMD prefer English (not US-English), so the author should use "modelling" consistently, also in the title. Also "on-line" vs.

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"online" should be checked.

2   Specific comments

Abstract

As already said, the abstract lacks the purpose of the paper.

Introduction

Page 206, Line 11: Remove comma after community.

P206, L12: "Local" and "urban" are good words; I don't see any reason for putting quotation marks around them.

P206, L29: Change "trends" to "trend". P207, L13: Are there several chemical schemes? If not, change "schemes" to "scheme".

Section 2

P208, L6: I find the "scenarios" a bit vague, or "scenario studies", for that matter. With a CTM you can argue that all simulations are scenario studies. What I understand from "scenario studies" is that you run two simulations with different input.

P208, L6: "operational" is misspelled ("operationnal")

P208, L24: Misspelled "northen"

P208, L26-27: I suggest to remove the last part of the sentence, starting with: "an its first . . .". Having a parallel code is the important part; it is of no interest what kind of machine it uses. If you don't remove it, at least correct "an" -> "and".

P209, L5: Reference for the AQMEII?

P209, L16: Suggest "the most simple as possible" -> "an easy"

P209, L17: What is GPL?

P209, L23: Why quotation marks around the Institute name?

P210, L3: "completely" -> "solely".

P210, L5: Change "ifort" to "Intel's ifort".

P210, L13: "an MPI": Either "a MPI" or remove "an".

P210, L28: Remove ". . .", you have already written "e.g.".

P211, L5 and throughout the document: "Splitted" is wrong, correct word is "split".

P211, L15: "if the user time step is too low . . .": I think you mean either "too long", and that the sentence should be: "If the specified time step is longer than the recommended time step, the recommended time step will be used in model integrations."

P211, L17: "lower" should then be "shorter".

P212, L18: "but can be changed to the recommended one": What would then be the purpose of the user time step?

P212, L23: Remove comma after "formulation" and change "step," with "step and".

Section 3

P213, L13-14: Is it not inconsistent if you have a varying grid, but assume it is equal over 5 boxes for transport?

P213, L17-23: What is the typical minimum pressure (i.e. model top)? Typical number of levels?

P213, L24: Remove "otherwise".

P215, L6: Suggest change "whole" to "temporal and spatial extent of the".

Section 4

P218, L19: Change to lower-case on "Summer".

P221, L1: Remove "takes".

P222, L13: Where are these observed? In the model or by observations? Reference?

P223, L10: Misspelled "poollutant".

Section 5

P223, L21: At the end of the sentence, add "with velocity v".

P224, L19: I don't understand "parallel strategy"; please clarify.

P224, L20: "cancel out" -> "cancel"

P224, L22-24: I don't understand the sentence "The way these ...". Do the different fluxes use different schemes? The sentence should be clarified.

P225, L10: "CHIMERE model": i.e. not the CTM?

P225, L12-13: The sentence "in the direction orthogonal to the interface ..." is difficult. Rewrite, e.g. by removing most of the sentence "... at the interfaces is interpolated linearly from grid center winds."

P225, L16: Misspelled "Independant" -> "Independent"

P226, L1-4: The word "constant" indicates that it does not change, but transport will change it. You mean that there is no gradient information; please consider rewriting. Also "which imposes the tracer concentration at the cell interface" is a weird sentence. I would suggest rewriting the whole paragraph.

P227, L5-11: So it is not really of second order, but approximately because the cross derivatives cancel?

P228, L5: Comma after "user".

P229, L19: Reference on this? Seems like this is something found in a study.

P229, L24: "seems important" is vague. Better to use "is important".

P229, L25: Can you represent thin dust layers in the vertical resolution of the model? Which I do not know what is (see earlier comment).

Section 6

P230, L5: "shall therefore": I would suggest rewriting to "is planned to" or "will".

P230, L11: Define Kz and hk. Change "enables to diagnose ..." to "allows ... to be diagnosed as" and then give equation (27).

P230, L12: A physical interpretation of "(...)/hk" would be appreciated.

P230, L9: Suggest "it has also used" -> "the model is also used with"

P231, L9: What is SNAP? It is not defined.

P232, L4: "soil NO": But since you are talking about anthropogenic emissions; I see no need for this parenthesis – it is only confusing.

P232, L4-6: "This leads to 12x nspec ...": Remove this sentence. The number of files are irrelevant, besides, you have specified that they are monthly.

P232, L6-8: Skip "for example ..."; suggest rewriting sentence: " For the Melchior chemical mechanism implemented by default in chimere, emitted species are listed in Table 2."

P232, L12-14: "In both cases ...": Suggest simplifying: "These data are spatially interpolated to the model grid."

P232, L18: Here it says yearly emissions; wasn't it monthly?

P232, L18-20: Perhaps it is better to rewrite sentence: "Menut et al quantified the improvement by using an hourly profile on a yearly mean dataset, showing that ..."

P233, L21: Add "diameters" in front of Ø.

P233, L26: "often called in this manual" "we refer to them as"

P233, L27-: Again, why is soil NO in the anthropogenic section?

P235, L17-23: I think you could have a separate section on sea salt. Also, I find the wording "because they depend on meteorology" weird. It seems to me that you have to specify whether an emission dataset is anthropogenic or biogenic, but strictly speaking, I'm not sure why you make a point out if it, unless you want to describe how to include emissions. I would suggest a separate section, and call it sea salt emissions.

P235, L25-26: I suggest rather starting with why dust is important in the first place, then mention physical processes and parameterizations and long-range transport.

P236, L22: ". This shows this is possible to calculate" -> ", showing it is possible to model"

P239, L2: Where is the web page? Give URL.

P239, L3: Add ":" or ";" after "Particles"

P239, L4-: Suggest "In Chimere, where dust production generally depend on wind and land cover, dust emissions are mainly found over Africa, and seldom over Europe."

P239, L7-8: "This was only shown ..." Already mentioned.

P239, L15: Consider "that this" vs. "that the"

P240, L2: "close the PM10 mass": Missing a "budget", or I don't understand the meaning.

P240, L3: "absence of any information": from where?

P240, L4: "supposed to be": I believe it either is or isn't. "Supposed to be" sounds like the model does not work as was intended.

P240, L6: Suggest "distributed as for the" -> "in the same three modes as". Also, what about PM1-2.5?

Section 7

P240, L11: "human readable" -> "ascii"

P240, L12-14: Not very relevant; consider removing.

P240, L18: comma after "aerosols",

P240, L18-19: "At the end ...": I don't see how this is relevant.

P240, L19-20: "To add ...": Already mentioned in L11-12.

P240, L22: "photorates" -> "photodissociation rates"

P240, L23-25: "the sum operator": I don't know what this is, but I suggest rewriting the sentence. E.g. "... may also be changed and chemical families may be defined, e.g. NOx=NO+NO2. This is the processed by the pre-processor. Families can be diagnosed as other tracers."

P241, L1-7: Suggest change to: "By default, there exist one aerosol scheme and two versions of the gas phase schemes. The complete gas scheme, which is the original (ref), describes ... gaseous species. In Chimere this is used by a suite of scripts and programs called "chemprep"."

P241, L8: Is this the same as in the EMEP model now?

P241, L10: Surely, this is updated to more recent IUPAC and JPL versions? 2006 or 2010, perhaps?

P241, L15-16: "etc..." Perhaps rather include a table of species?

P241, L21: "latter being" -> "latter only"

P242, L2: What is COV? Do you mean VOC?

P242, L2: "than in": I think you mean "as in"?

P242, L7: "would have been resulted" -> "also results"

P242, L15: "oxydes" -> "oxides"

P242, L27: Perhaps add ", and is useful for forecasts".

P242, L27: Skip "in particular".

P243, L1-2: Suggest ". In a general way, in this concept" -> ", where"

P243, L7: Missing "polluted" in "moderately conditions"?

P243, L10: I assume there is a reference for this?

P243, L12: What is TUV?

P244, L1: Suggest "longitudinal cut in" -> "latitude-height cross section of"

P244, L9-17: Remove. This is clearly left-overs that should have been removed earlier; much of the text is already mentioned above.

P244, L26: After "base converted " add "to ammonium".

P244, L27: "Ammonia" -> "Ammonia, ammonium"

P245, L3: "etc.": please specify. "other dissolved salts"?

P245, L16-17: Remove "If", change "then" -> "giving". Or rewrite e.g.: "Discretising Q for a given l and for aerosol components k as Qk, the total mass ..."

P246, L6-9: Please explain which terms are what. I would assume one term is coagulation of smaller sizes into l (production for l) and growth to larger particles (i.e. loss term for l)?

P247, L10: Skip line break; do not start new paragraph.

P248, L7-8: Suggest "a precalculated look-up table" -> "from pre-calculated values"

P248, L11: Small letters on sodium and chloride.

P248, L14: After "some errors can occur" -> "at the expense of accuracy"

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P248, L16: ". The use" -> ", finding that the use"

P249, L13: "there" -> "however,"

P249, L14: Remove comma after "since"

P249, L15: "it" = "the nucleation"

P250, L10: Remove "but", correct spelling of "uncontroled"

P250, L11: "to be realistic" -> "for the results to be realistic"

P250, L13: "onto" -> "on"

P251, L1: "go" ???

P251, L7: deMore 1994: Not any recent update? JPL 2006? 2010?

P251, L8: Can you really say 2003 is recent?

P251, L10: "so a new reaction is added" -> "which is included in chimere"

P252, L26: "and the results have shown ..." -> showing a tendency to underpredict 2-8 times ..."

P253, L4: I don't understand what you mean by "modern carbon amounts".

Section 8

P253, L15: Comma after "Second"

P253, L16: Remove "and" after "Third,".

P253, L17: "solubility" -> "water solubility"

P253, L18-19: "the particle ..." Velocity is not a force, rewrite e.g. as "the particle is subject to gravity, falling with a settling velocity vs".

P254, L6: What do you mean by "slip correction factor"? What is it physically? Drag?

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Wind resistance?

P255, L3: Reference for Ψ (psi)?

P255, L7-10: Change "=" to "ff". I've seen this when you cut and paste from pdf into text editors. **NOTE that there are several of these in this section!**

Section 9

P256, L20-21: And for each of the partial COD, the model picks one, right?

P257, L1: "using an assumption" -> "assuming"

P257, L2: "an assumption" -> "and"

P257, L6: Reference for this?

P257, L15-19: Reference?

P257, L23: put "and" between "acid" and "ammonia".

P257, L24: Consider "revertible" vs. "reversible".

P258, L1: "two phases ..." -> "gas and aqueous phases, there are two simultaneous reactions occurring"

L258, L5-6: Reference?

L258, L16: Reference?

L259, L2-3: This sentence seem out of place.

L259, L23: Why will it be improved?

Section 10

P260, L2: Remove "fields".

P260, L19: Remove "...", instead use "e.g." up front.

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P261, L4: "which constitute an opportunity to use" -> "which comprise"

P261, L29: Misspelled "campaing" -> "campaign". Change "ran" after "model".

P261, L29: What is previsibility?

P262, L2: "aerosols": which aerosols? All?

P262, L14: "faithfully"? Use a better word.

P263, L6-8: Sentences are, or seem, irrelevant.

P263, L11: "certainly" -> "probably"

P264, L18-19: "were the duration of these comparisons ...": This makes no sense, please correct what is wrong or rewrite sentence.

Section 11

P265, L20: Are you introducing "hybridation" as another word for "assimilation"? What is the difference?

P265, L21: "direct": Is there an indirect CTM?

P266, L2: "these" -> "the mentioned". But which of the applications are not powerful tools?

P266, L3: "adjoint": I'm not familiar with this use of the word. Do you mean "version"? "branch"? What is the difference to the "model" only?

P266, L10: "model adjoint" see point above.

P266, L10: "to have a parallel version to apply to": weird/difficult or wrong sentence.

P266, L13: "were for the Paris area pollution" -> "were for pollution in the Paris area"

P266, L19: "NOx are" -> "NOx is"

P267, L8: "specie" -> "species", "than" -> "as"

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P267, L24: "surface and satellite ozone" -> "surface and satellite measurements of ozone"

Section 12

P268, L 5-6: Remove "by studying its predictability", it is included in "to validate".

P268, L9: "developments" -> "development"

P268, L16: "LSM": define this.

P269, L2: "in several" -> "on several"

P269, L3: "...": Use "e.g. O3, NO2, PM10, PM2.5."

P269, L7-9: "recommendations for the protection of sensitive people": Rephrase the whole sentence, e.g. "Forecasts of pollution above accepted threshold levels are essential for public information."

P269, L13: "to set-up": Either remove "-" ("set up") or remove "to set-up" altogether.

P269, L14: Remove "to communicate"

P269, L25: "modulation": I don't know what it means, but remove comma after. Also, the sentence is difficult; perhaps better as "the modulation of wood burning emissions from residential heating with temperature" or "the temperature modulation of ..."

P269, L26: Misspelled "contitions" -> "conditions"

Section 13

I don't see any conclusions here. The subsections are not conclusions, hence misplaced. They seem to be future aspects, which you could put into a section before conclusions.

P271, L21: "plumes" -> "emission plumes"

P271, L22: Remove "The main specificity", change "(" and ")" into commas, change

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"their" -> "having", remove "is that they".

P272, L1-4 : Do these act as clouds above the model also ?

P272, L16: "default" -> "standard"

P274, L2: "associated to": I think you mean "were set for"

P274, L19: "contours" -> "conditions"

P276, L12: Comma after "scenarios"

P277, L20: "we are interested to" -> "are"

Tables & Figures

Table 1: "needleaf" -> "needleleaf"

Table 4: There are several "(*)", but it does not say what it means.

Table 8: "which data were used": Used for what? That has been used in Chimere comparisons?

Figure 1: misspelled "stabds" -> "stands"

Figure 4: "et" -> ""

Figure 5: "needleaf" -> "needleleaf"

Figure 20: "After Valari and Menut": Shouldn't it be "Valari et al (2011)"?

Interactive comment on Geosci. Model Dev. Discuss., 6, 203, 2013.