"Regional atmospheric composition modeling with CHIMERE"

L. Menut *et al*, 2013

1. General summary

This paper presents a very detailed overview of the CHIMERE model from its initial development to current ongoing work. The model structure, including the dynamical and physical cores, is described in great detail and plenty of references are given for further reading. Ample space is also given to the description of the input data (emissions) and the possible applications of this type of model. Evaluation and data assimilation are also discussed in dedicated sections.

The paper is written with a pedagogical application in mind and I can see its usefulness for new users of the model, as well as PhD students wanting to learn about atmospheric composition modelling. I assume that this type of detailed description is appropriate for the readership of GMD.

The paper is well-written. I only have a few comments to improve readibility (see below), but I do recommend publication without any doubts.

2.Specific comments

Abstract

p. 205 l. 15: "It is a part..." Replace with "CHIMERE is also a part..."

p. 205 l. 20: Full-stop after "scale". Please remove "or at the other end of the spectrum" with "CHIMERE is also being used".

p.205 l.22: Replace "but also, at larger scale" with ", as well as"

Introduction

p. 206 l. 9: remove "and although it has always existed"

p. 206 l. 14: "over long distances"

p.206 l. 23: remove "calculations"

p.206 l.25: "for community use"

p.206 l.28: "experiments, analysis studies, and for long-range…"

p.207 l.13: remove "preparation" and add "and"

p.207 l.16: full-stop after "10". "The hybridation (is that a word?) between model and observations… is discussed in Section 11."

CHIMERE model overview

p.208 l.6: "operational"

p. 208 l.7: "over health"

p.208 l.9: "(1997)" replace with "released in 1997"

p.208 l.13: "At the same time…"

p.209 l.12: Remove "finely". "Describe" instead of "described"

p. 209 l.18: replace "technic" with "technical"

p. 209 l.21: move "files" before the parenthesis

p. 209 l.27: "two-day"

Emissions

p.230 l.22: "split"

p.230 l.11: replace "in the course" with "on-going"

p.231:"anthropogenic emissions have to be prepared in a bottom-up way" - there has been studies showing that inverse modelling (i.e. top-down) approaches can also work well. Could you reword the sentence to make a more general statement and mention also "new" approaches by giving a reference? For example:

Huneeus, N., O. Boucher, and F. Chevallier: Atmospheric inversion of SO2 and primary aerosol emissions for the year 2010, Atmos. Chem. Phys. Discuss., 13(3), 6165-6218, 2013.

Huneeus, N., Chevallier, F., and Boucher, O.: Estimating aerosol emissions by assimilating observed aerosol optical depth in a global aerosol model, Atmos. Chem. Phys., 12, 4585-4606, doi:10.5194/acp-12-4585-2012, 2012.

p.232 l.18: "The data is delivered as tons per year. A sensitivity study…profiles. It was shown that…"

p.233 l.21: strange symbol for size, use "r" or "D"

p.233 l.28: "This inventory estimates the soil emission to be of the order of 20% of the emissions from combustion on a European average, during the summer months, but with large difference between the countries."

p. 234: "Biogenic and sea-salt emissions"

p.234 l.5: "CHIMERE"

p.235 l.17: "Sea salt emissions **are** processed"

p.235 l.25: "and estimate the relative part of mineral dust in the total budget of aerosols near the surface, after long-range transport. This latter process influences air quality in Europe and needs to be accounted for."

p.236 l.22: "This shows that it is possible…"

p.236 l.23: before "observed", put "such as those"

p.236 l.26: please provide a short one-line summary of the findings from Menut (2008) relating to the impact of the meteorological forcing.

p.238 l.26: replace "under experiment" with "on-going"

p.239: I would suggest moving section 6.5 to be 6.4 as it is more relevant right after the discussion of the dust emissions. The fire emission section can be last.

Chemistry

p.239 l.6: remove parenthesis.

p.239 l.7: remove "only"

p.239 l.11: "…by turbulence is also a distinct process. The extraction results from the…"

p.240 l.3: "In absence"

p.241 l.4: put "applications" after "forecast"

p.242 l.22: "The results show that MELCHIOR1 simulated yields agree within 20% with the reference mechanisms. This agreement increases to 5%..."

p.243 l.15: "COD" in parenthesis.

p.244 lines 6-17: repeated lines, please remove.

 p.248 l.2: remove the extra "the"

p.248 l.4: numerate 1. and 2. the bullet points and then refer to them as "Case 1" and "Case 2".

p.248 l.10: 3% and 99%

p.248 l.14: "but" before "some errors"

p.251 l.10: replace "is" with "has been2 and remove parenthesis

8. Dry Deposition

p.253 l7: remove "as" before "commonly"

p253. l.9: Figure 13 is not very clear

p.253 l.20: "The dry deposition velocity fore gaseous species is expressed as"

p.254: replace "used as" with "set to"

p.254 l.13: "where M_air is …"

p.254: Section 8.2 should come directly after the description of "Dry deposition"

p.255 l.14: "summer"

p.256 l.13: COD is already defined

p.257 l.6: I actually disagree with this statement. Liquid/ice water contents receive a lot of attention so you cannot say that they are "unverified" and "unstable" parameters. You can say that they are uncertain parameters but so is cloud fraction. I actually think that a parameterization for COD based on LWC and IWC would be better than what currently in the model. It would be something worth looking at. Perhaps the impact will be small but the current parameterizations for COD seem too crude.

p.257 l.24: "reversible"

p.258 l.14: "irreversible"

p.259, Equation 59: is "Q" defined? In general, please double-check that all symbols are defined.

p.260 l.19: "(i.e. monthly variability, …, emissions)"

p.261 l.3: "French, Spanish, Italian"

p.261 l.18: "speciated"

p.261 l.20: "campaign"

p.261 l.29: "campaign"

p.261 l.21-22: "exercises" and "developing"

p.263 l.3: after "Eyjafjallajokull" add "volcanic plume"

p.263 l.11: replace "certainly the oldest" with "a good"

p.263 l.17: remove "always", full-stop after "surface data". Rephrase "the changes during the last ten years….capabilities" as it's not very clear.

p.263 l.21: "larger domains"

p.263 l.23: replace "a lot" with "many"

p.264 l.19: replace "its" with "their"

p.264 l.28: replace "an overestimation" with "to overestimate"

Hybridation between model and observations

p.266 l.26: full-stop after "area".

p.267 l.10: full-stop after "large". Add "therefore" after "was"

p.267 l.13:"suburban"

p.268 l.11: "simulations"

Forecast

p.269 l.16: LSM, has the acronym been defined - please check all acronyms.

p.270 l.13: remove "to set up".

p.270 l.21: "Current research efforts"

Conclusions

p.271: Add "and remaining challenges" to the title of the section

p.271 l.25: Replace "But" with "However,"

p.273 l.25: remove "unfortunately"

p.274 l.19: replace "contours" with "conditions"

Figure 1: replace "stabds" with "stands"

Figure 3: "with respect to". Define CFL.

Figure 13: not clear