Atmos. Chem. Phys. Discuss., 13, C1086–C1091, 2013
www.atmos-chem-phys-discuss.net/13/C1086/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "European atmosphere in 2050, a regional air quality and climate perspective under CMIP5 scenarios" *by* A. Colette et al.

Anonymous Referee #1

Received and published: 8 April 2013

This paper presents an interesting analysis of the possible changes in ozone and PM over Europe at the 2050 horizon. In particular, the information summarised in Figs. 5 and 6 should be very useful to the community. I also liked that the issue of re-analysed versus GCM historical were clearly addressed and quantified.

There are a number of areas where the presented work should be improved however. In many cases, more information and better phrasing is needed, as discussed below. One large weakness is that no information is given on the components of "PM". It is treated as a black box, whereas it would be much more useful to see how the different inorganic and organic components change as a result of these scenarios. I do not propose lots of new maps, but a Table and/or Figure should be added with these components. (Possibly as averages over the box shown in Fig. 7.)

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

Another worry is that this paper claims (section 4.2.1) that isoprene emissions were 68% higher in the hindcast than in the historical simulation, and that this is due to sensitivity to radiation being twice as large as to the temperature bias. This is surprising. Fig. 2 and the text show that the hindcast has a strong temperature bias (as high as 5 K); I would have expected this to lead to roughly a 50% increase in BVOC without any radiation effects. The authors should add some material to explain this unusual claim, possibly in a Supplementary.

A final general complaint is that the Figures were very hard to read; I sometimes had to use the PC to zoom in with the pdf file rather than being able to read from the paper. The maps (e.g. Fig. 3) tend to show large areas of dark blue. As well as looking ugly it is hard to distinguish concentrations levels. The text in the legends of these maps also needs to be bigger. Figures 5 and 6 are in my opinion the most important result of this paper, but the text on these Figures is also nearly impossible to read.

Abstract.

Some phrases are not defined and unclear. One is long-range transport (LRT). Later in the text I think they mean intercontinental transport with scales of order 1000 km say. Many other papers use the term LRT for transport scales of 100-1000 km. Similarly, climate penalty is used without being defined. Be precise with these things, also elsewhere in the text.

Last sentence. The statement here that the climate penalty has been overstated in the past is not supported in the relevant text. There are a range of estimates of the climate penalty, and no proof that the numbers calculated in this particular paper are better than any of the previous ones!

Introduction

p6458 line 6. Add references for these statements.

p6458 line 19. Again, the term climate penalty needs to be defined.

ACPD

13, C1086–C1091, 2013

p6458 line 20. What is a "full frame" model?

p6458 line 22. ensembles

p6459 line 16. Again, LRT is used without definition. In Europe one has to be careful since LRT (as in the LRTAP Convention) usually refers to transport between European countries.

Emissions

Table 1 was rather short of information given that emission changes are an important part of this paper. The Table should be expanded to reflect: (i) emissions of SOx, BC, OM, other PM species and CO, and (ii) to show biogenic emissions of VOC and if appropriate other natural sources (soil NO?). Units should be more explicit - is NOx given as NO2? Which size range do particulate emissions represent?

Section 3.1 and later terminology.

I found the simple terms hindcast and historical a little confusing, since the latter sounds more like the result of the re-analysis. I would suggest more explanatory terms such as GCM-historical and ERA-hindcast.

Section 3.3.

I miss information on what does change for the 2050 scenario. What kind of ozone increase is predicted, what happens to PAN and other N-compounds (are these important for regional pollution?). Also, it becomes clear in section 4.2.2 that dust is also included; how much does this affect PM?

Section 3.4

Is the coarse resolution a "necessary" trade-off, or just convenient? (I would just remove the word necessary, since it raises discussions such as this, and the phrase depends on the modelling system in use.)

ACPD

13, C1086–C1091, 2013

Section 4.

The terminology concerning number of scenarios and model runs is rather confusing. The introduction to section 4 says 4 scenarios, but then Table 2 shows six "R" scenarios and 6 "M" scenarios (16 in all?). In this Table though, what is the difference between R2 and R4, and M2 and M4? Both have the same emissions, meteorology and boundary conditions according to the Table.

Section 4.1.1.

Some words should be added to put the changes found from this modelling system in the context of other GCM results for the year 2050. Are these results typical? If not, in which way? I appreciate that the authors have been careful in acknowledging the limitations of a ten-year period, but some perspective on the quantitative implications of this could also be added here.

No need for the words "Whereas it is meaningless .... can mention that". This was a confusing phrase which either needs more explanation of just dropping.

Last sentence. Which "two" future scenarios. Sometimes the paper has 4 scenarios, sometimes 6, sometimes 12 and now 2.

Section 4.1.2.

Last paragraph. Precipitation is also an important sink for some gases.

Section 4.1.3.

Change "At this stage we exhibited" to some simpler phrase, e.g. Sections xxx to yyy above have shown.

Section 4.2.

Here I really miss knowing which aerosol components are changing, and how. As discussed above, at least a Table should be added.

ACPD

13, C1086–C1091, 2013

Also, spelling, insignificant, not un-significant.

Section 4.2.1

Add reference for SOMO35.

As noted above, the 68% isoprene increase requires further explanation. Also, as suggested above, the isoprene emissions should be added to Table 1. It would be useful to compare these to those shown in the Langner et al. paper - that paper suggests both a rather worrying discrepancy in BVOC emissions between different models, and that these discrepancies can explain a lot with regard to model sensitivity.

Another point to note is that several papers suggest that BVOC emissions should decrease in the future, an effect caused by incrasing CO2 emissions. This effects adds substantial uncertainty to perdictions of future ozone changes (e.g. Wilkinson et al, Global Change Biology, 2009).

Section 4.2.2

Here desert dust is mentioned for the first time, which again raises the question as to what the PM consists of, and indeed which size-range the paper is discussing.

The comments about the changes in NH4 were interesting, but does sulphur play any role?

Section 4.3.1

Say "subtracting", not withdrawing

Last paragraph. I don't see why the results presented here emphasise the need for transient experiments. What is the connection?

Section 4.3.2

Sometimes ppb are used, sometimes ug/m3. Be consistent.

It is not made clear here or in the caption to Fig. 5 where the background (violet)

ACPD

13, C1086–C1091, 2013

changes come from, and it is confusing that this is not part of Table 2.

This paper claims that decreases in ozone as a result of climate-change have never been reported before. Yes they have, see for example Langner et al (2012b). Section 5.

Page 6479, line 29 to first lines of page 6480, "must be related to the spread of precipitation"? Can no other factors explain these differences, for example dispersion conditions?

Page 6480, lines 5-6. Which studies are the authors referring to?

Table 1 . See comments above.

Figures. As note above, the fonts, labels, legends, etc. need to be larger in all Figures, i.e. readable.

Figure 2. Is this rain or precipitation?

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 6455, 2013.