**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 #2

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This paper uses global climate and chemistry models, and also downscales to regional climate and chemistry study. It uses the newest RCP scenarios to study the impact of climate on air quality including ozone and PM2.5. The regional model uses a horizontal resolution of 0.5 degree, which are not very high resolution in terms of regional scale. There are not enough comparisons between global and regional downscaling, which is hard to tell the merit of the downscaled results. There have a few minor comments as below:

Page 4: Given our goal of looking closer at 21 regional air quality issues, we selected air pollution scenarios from the more recent Global Energy Assessment Comments: Why authors do not use RCP scenarios directly? It is not clear. RCP scenarios include the projections of greenhouse gas emissions and also anthropogenic emissions. I think

it is more comparable to use RCP scenarios directly.

Page 5: The corresponding emissions of short lived species are used in the global chemistry model that will 15.. be used to constrain the regional air quality model at its boundaries. Comments: Do authors mean they use the emission projections in global models as boundary only? What about the regional model emissions? Do you use consistent emissions for global and regional models?

Page 5: The Reference scenario (also called CLE1) assumes no specific climate policy and has a climate response almost identical to the RCP8.5 while the mitigation scenario (CLE2) includes climate policies leading to a stabilisation of global warming (hence resembling the RCP2.6). Comments: In RCP 8.5, although the greenhouse gas emissions continue to increase from 2005 to 2100, the anthropogenic emissions still show decreasing trends except methane emissions. Did authors consider the emission projections in regional models?

Page 8: The spatial resolution is 50km and the domain covers the whole of Europe with 119x116 grid points. Comments: A resolution of 50 km is not quite fine. I understand the computational time could be an issue to go to higher resolution. To capture better regional climate and air quality, it should be reasonable that around 30 km or even 10-20 km is a better option.

Page 11: 4.1.2 Temperature and precipitations Comments: This section compares climate data with reanalysis simulations. How about comparing with observations? Reanalysis data might be different from observations in certain ways. It is recommended to use observation for the comparison.

Page 15: Both projections for 2050 indicate a decrease of daily maximum ozone compared to the historical climate simulation, but the magnitude of this decrease is moderate for the reference scenario. Comments: As a lot of literatures said (eg. Young et al., 2012, ACPD), under RCP 8.5, global ozone burden will increase. Here the author only simply indicates ozone decrease. It is recommended that the author needs to at

least compare with other documents and see why there are differences in this study compared to others. Are ozone decreasing everywhere? How about daily variations?

Page 18: Ozone is presented here (Figure 5), as in Section 4.2, as the average summertime daily maximum Comments: Why not use daily maximum 8 hour average?

Figure 4: Same as Figure 3, for PM2.5 (annual mean, μg m-3) Comments: The tile does not seem to be right. This figure is shown differently as Figure 3.

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