

Interactive comment on “Evaluation of near surface ozone over Europe from the MACC reanalysis” by E. Katragkou et al.

Anonymous Referee #2

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Review of “Evaluation of near surface ozone over Europe from the MACC reanalysis” by Katragkou et al., submitted to GMD

This manuscript discusses the near surface ozone produced by the MACC reanalysis system, which combines a chemistry scheme with data assimilation of various composition measurements to provide a gridded time series of atmospheric composition over Europe. The authors use a bias and correlation statistics to evaluate the near surface ozone against observations from several sites in the EMEP and AirBase networks, as well as a limited comparison against NO_x measurements (limited by observation availability). They identify regions and times of year where the ozone agrees well/less well with the observations, and suggest some reasons for the mismatch worthy of further investigation. In addition, the authors compare their “full model” (chemistry plus data

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assimilation) against a control simulation where data assimilation for composition was turned off, finding that agreement with observations was occasionally better with the control model.

Overall, the manuscript covers a suitable topic for GMD and will be of interest to modellers and data analysts who are interested in working with the MACC reanalysis. However, I have some issues with the manuscript that I would ask the authors to consider before publication, mainly centered about better exploitation of the CTRL simulation, their use of language, and the data presentation. I would class my comments as minor revisions.

Main comments

1. It is not clear to me why the authors do not make more use of the CTRL simulations in their comparisons. While the CTRL simulation does not extend to 2012 like the MRE, comparison of the MRE statistics for 2003–2012 (table 1) and 2003–2010 (table 2) suggests little difference when the extra 2 years are included. If the authors restricted all their analysis to the common 2003–2010 period, they could add the CTRL results to the seasonal cycle plots. I would be interested in seeing this, particularly as the CTRL simulation’s seasonal cycle agrees better with observations (at least marginally). Might an extended comparison of MRE against CTRL hint at further drivers of observation/MRE discrepancies?

2. The language is often imprecise when discussing the comparisons. For example, what are “acceptable temporal correlations” (P1085, L20)? What does “reasonably well” (P1091, L2) mean? In addition, for the discussion on CTRL vs MRE, if $r = 0.74$ to 0.49 is “slightly reduced” (P1087, L10), what should we make of the bias improvements discussed on P1087, L1–5?

3. The font size on the figures is too small and there are often too many panels to give a useful picture of what’s going on (esp. fig 5 and fig 7). In addition, the authors could consider plotting the biases and correlations on maps like Figure 1 (e.g. coloring the

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dots by the r and FGE values).

Specific comments (including technical corrections)

P1078, L24: “and MACC-II. . .”

P1079, L8: Define ECMWF (you do it for all other acronyms)

P1079, L12: year-long -> long

P1079, L20: “(AQME)”

P1079, L25-: Near surface ozone is not very important as a GHG

P1080, L2-: Mention chemical loss and deposition

P1080, L7: “soil, vegetation”

P1080, L25: “Monks, 2000”

Section 2.1: Would be useful to know which species/observations are assimilation which are relevant for ozone

P1081, L18: Define “variational bias correction”

P1081, L19 (and several other places): Mind that -> Note that (former sounds like an admonishment)

P1082, L9: What are “types 1-3”? Need more detail

P1082, L14: “corresponding observational data” (data can be from a model too)

P1082, L26: Is there any rationale for these regions beyond geographical convenience? E.g. can you demonstrate that similar processes control ozone in each region. This is important for making inferences about the regional statistics.

P1083, L1 (and Fig 1): Could you indicate the region codes on the figure? Additionally, using the full name for the region in the text makes for easier reading (there are some

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instances where just “BI” etc are used)

P1083, L16-21: This paragraph could do with re-phrasing and making into <1 sentence.

P1085, L3: Be clear that you’re using R to refer to the seasonal cycle, rather than correlating the whole time series (or time series of DJFs etc). The latter might be interesting though to investigate interannual variability.

P1085, L5: SD -> standard deviation (at least the first time)

P1086, L3-6: This information can go in the caption

P1086, L11-: This is repeating the point in L8 (i.e. not “On the other hand”) P1087, L27: however, -> but

P1088, L3 (and throughout): depicted -> found

P1088, L14: revealing -> causing (?)

P1089, L18: “captures the shape. . .cycles quite well, but with a. . .”

P1090, L14 (and throughout): You’ve changed from “ozone” to “O3”. I much prefer the former for easier reading.

P1092, L16: suggests that -> is consistent with (and then “being resolved. . .”)

P1092, L5-: Whether an environment is “NOx-limited” will also depend on the mix of VOCs (their reactivity, propensity to form NOy etc), and presumably the VOC mix differs across Europe.

P1093, L1 -: Do you know that the NOx diurnal cycle is all chemical, with no transport? In general, these arguments might be more convincing if you were able to demonstrate them with (e.g.) a box model.

P1093, L24: “. . .adequately capture the seasonality. . .”

P1095, L27: Final paragraph should be aligned to the left margin.

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Table 2: The FGE, MNMB and R should be centered above the MRE and CTRL columns.

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