

Interactive comment on “The CAMS interim Reanalysis of Carbon Monoxide, Ozone and Aerosol for 2003–2015” by J. Flemming et al.

Anonymous Referee #2

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This manuscript presents a thirteen-year reanalysis of Carbon Monoxide, Ozone and Aerosol obtained from the CAMS system. Satellite measurements were assimilated using the 4D-VAR technique. The obtained data sets were validated against various independent observations, and then the validation results were compared with those of the previous MACC reanalysis and the control experiment. Compared to the previous MACC reanalysis, there were clear improvements in the CAMS system for most cases, owing to the improved data assimilation system including the improved treatment of observational data and improved emission setting. The manuscript is generally well written, and I believe it can contribute to various studies. As this study represents the first trial reanalysis of trace gases and aerosols simultaneously, I was expecting more discussions on the synergetic effect. I recommend this manuscript to be accepted for publication after a few revisions.

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Major comments:

1. An important advantage of this study is the simultaneous analysis of trace gases and aerosols within the same data assimilation framework. However, it is unfortunate that their interactions were not considered in the current setting. More discussions on their potential would still be useful. I suggest discussing this topic in an additional section, for instance, how much changes in trace gas concentration can be expected using the analyzed aerosol fields, and if these changes bring further improvements in the trace gas analysis (and vice versa). Although the paper is already very long, presenting several sensitivity calculation results could be helpful.
2. As the system was developed at meteorological operational centers, the authors may want to discuss more about the contribution of the CAMS interim reanalysis to meteorological and climate activities. This discussion would be useful to many readers in understanding how the composition and aerosol reanalysis will be helpful in wide research fields.
3. In Section 3, the differences in CO between the systems are primarily explained by surface emissions. There could also be clear differences in OH and natural CO sources by oxidation, which may explain the CO differences. Further discussions may be required on the estimated CO error difference.

Specific comments:

L. 394: “Owing to the hemispheric...”. This sentence is not clear.

L.404-407: It is surprising that, even after correcting the concentration by data assimilation, the influence of different emission data is so large. Does this mean that the observational constraints are insufficient to remove the influence of a priori model errors? Further discussions would be helpful.

L. 437-440: How does the bias vary with year?

L. 798-799: “However, the change of...” This sentence is not clear.

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L. 1008-1010: How long was the spin-up period?

Interactive comment on *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2016-666, 2016.

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