Geoscientific
Model Development
Discussions

Interactive comment on "Validation of reactive gases and aerosols in the MACC global analysis and forecast system" *by* H. Eskes et al.

Anonymous Referee #3

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Referee comments on 'Validation of reactive gases and aerosols in the MACC global analysis and forecast system'

This paper provides an extensive overview of the MACC global forecast system. The main aim of the paper is to document the data that is assimilated into the MACC system and to provide a detailed description of the methods and the data used for the validation of the modeling suite (VAL). The paper will be of particular use to the community that will be using the MACC data analysis and forecast system and those who are involved in the development of the MACC system. However, I feel it will also be of interest to wider modeling community. I believe the content of the paper is ideally placed for publication in GMD and recommend publication after the authors have addressed the relatively minor corrections below.

Main comments: There is a large amount of data being assimilated into the MACC system and being used for validation so I believe the paper would benefit from a table that gives the reader an overview of the measurement uncertainties and an idea of the temporal and spatial frequency of the observations. This has been discussed during some sections in reference to specific observational datasets; however there are many observations whose uncertainties are not discussed specifically.

My other main comment is that sometimes the language/sentence structure is a little mixed up and that the paper would benefit from a careful read through to check the English and grammar used. I have noted a few of these occasions below.

Minor comments:

Pg 1121, L22-28: Refer to the section numbers.

Pg 1123, L12-25: This paragraph is hard to follow. Please restructure and shorten to make a bit clearer.

Pg 1124, L7-25: This paragraph is a bit hard to follow. It may be better condensed as a table?

Pg 1129, L7: Add a reference for MOCAGE

Pg 1135, L8: 'out through the Sahel,' – Check grammar.

Pg 1135, L10-11: Is it surprising that the MACC system can capture the MODIS AOD when it assimilates MODIS AOD? Maybe mention here that the comparison to MODIS is not totally independent whereas the surface sites are.

Pg 1135, L24: Add reference for uncertainty of ceilometer.

Figure 3: Make labels clearer.

Pg 1136, L4-6: What do you mean by 'representativity' issues? Do you mean concentration bias or location bias? What improvements are planned?

Pg 1136, L19: Add reference to the other POLMIP studies – Arnold et al (2014) and Monks et al., (2015).

Pg 1138, L4: Do you mean the number of observations being assimilated are more sparse in the SH so the model bias is larger or do you mean that the model has undergone little previous evaluation and therefore model improvements that benefit the SH?

Figure 4: You discuss comparisons to the other model simulations without data assimilation but they are not included in Fig 4. It would be interesting to see these model runs also.

Pg 1138, L14-17: You say 'The comparisons with SCIAMACHY/GOME-2 show that spatial distributions of tropospheric NO_2 columns are well reproduced by all three NRT model runs throughout all seasons, indicating that emission patterns and NO_x photochemistry are generally well represented.' I don't see this from the figures included (Fig 5). I'd say the models capture the seasonality, however, I wouldn't say they capture the emission patterns as SCIAMACHY indicates larger NO_2 over Asia compared to Europe whereas the model indicates larger NO_2 over Europe. Are you referring to comparisons that aren't included or from one of the other scientific papers in the special issues? If so, say 'not shown' or reference the paper.

Pg1139, L21-28: You say there is an improvement when assimilating data (o-suite) . However when you look at Fig. 6, it seems the C-IFS run does a better job at capturing CO. The correlation coefficients are also better for this run than the o-suite run (pg1140, L1-2). Can you please check this paragraph and clarify why you think the o-suite run gives a better performance.

Figure 7: Say what data the correlations coefficients have been calculated for. Is it daily/hourly data within each month?

Figure 8: Make plot lines and text thicker to ensure quality of figures when printing.

C448

Pg 1141, L27: Check sentence structure: MACC o-suite captures almost all dust outbreaks tracking fairly well their spatiotemporal evolution over the North Atlantic and the Mediterranean.

Figure 9: Caption – Define SD.

Pg 1142, L23: Check sentence grammar: 'The impact of data assimilation at other locations is confirmed'. Do you mean 'the impact of data assimilation at other locations can be seen'?

Pg 1144, L13: Check sentence: 'More research and technical work is needed to use e.g. the climatological aerosol composition and variation as used for AeroCom model'

Technical corrections: Pg 1120, L1: remove 'even'.

Pg 1120, L14: remove 'to' before respond.

Pg 1120, L: Define IFS properly in the following sentence - 'the numerical weather prediction forecasting system of ECMWF (IFS)'.

Pg 1123, L16: ranging -> range

Pg 1128, L8&9: in case -> in the case

Pg 1129, L5: insert comma after MACC.

Pg 1130, L25: Insert 'of' after 'all'

Pg 1131, L21: profiles -> Profiles

Pg 1132, L 2-3: Check sentence structure and grammar.

Pg 1132, 9: The second and final -> the second is the final

Pg 1132, L23: Assimilation O3 results –> O3 results

Pg 1135, L19: I don't see the need for starting a new paragraph.

C449

Pg 1136, L8: which -> that

Pg 1136, L20: Remove 'e.g'

Pg 1138, L3: Insert comma after stations.

Pg1140, L21: , see Fig. 7 -> (see Fig. 7)

Pg 1141, L15: Aeronet -> AERONET

Pg 1141, L18: , see Fig. 8 -> (see Fig. 8)

Pg 1142, L4: and -> an

Pg 1142, L6: Add units (0.08 to 0.24)

Pg 1142, L26: show always good agreement -> show good agreement

Pg 1145, L10: remove 'model'.