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Interactive comment on "Analysis and quantification of the diversities of aerosol life cycles within AeroCom" *by* C. Textor et al.

Anonymous Referee #1

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The manuscript is among the first of a number of papers under preparation on the results of the Aerosol model intercomparison initiative- AEROCOM that aims the analysis of current global aerosol simulations based on harmonized diagnostics. This paper makes thorough presentation of 16 global models used for aerosol simulations. It analyses the coherence of the results with regard to the aerosol life cycles in a comprehensive way. It therefore provides insight to the robustness of the aerosol global simulations. At the end of the analysis, it summarizes the points on which the models agree and the processes and parameters that are associated with the highest diversities between models. The relevance for aerosol radiative forcing calculations is also discussed. This is a timely paper, issued by a collective effort that reflects on the large

number of participating global models and the number of authors. A significant and meritorious effort has been put on thorough interpretation of the diversities between models. It is a lengthy paper but to my opinion all figures and tables are required to properly describe the pool of models involved and the results and support the conclusions deduced. I consider this paper of great value for the aerosol modeling community and therefore it deserves publication in ACP after some corrections. A number of them has been already mentioned by ref #3, additional comments follow:

Page 8334, line 7: briefly provide the reason for this.

Page 8336, line 15: 'AER=total aerosol' mention here that it concerns the dry aerosol and provide also abbreviations for H2O and for the wet aerosol that have to be used also in the caption of Figure 9.

Page 8342, last line: An additional problem is that the participating models are not fully independent one from the other, as also shown in the description tables and discussed later in the analysis of the results.

Page 8344, equation 3, numerator : replace 'result' by 'individual model result'

Page 8344, line 13: close parenthesis Page 8345, line 24: ECMWF

Page 8346, line 9: 'emissions' do you mean 'size of emitted particles'?

Page 8347, lines 20- 21: This means that the total chemical production of the aerosol component is better constraint than the individual pathways.

Page 8350, equation (6): crosses should not be exponents

Equations (4) and (7) take care of the italics.

Page 8352, line 17, 75% should be 76% to agree with Table 10.

Page 8353, line 6, 'the sum' add 'of'

Page 8354, lines 15 & 16 : 'larger' do you want to say 'smaller'?

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Page 8354, line 22: ‘due’ add ‘to’

Page 8354, line 27: ‘weak correlations’ positive?

Page 8356, line 18: ‘the demand’ which one? Explain better.

Page 8359, reference to Figure 9: Figure 9 is not correct, (Figure 8 is shown twice) please correct figure and modify caption to fit the aerosol component abbreviations listed in the page 8336.

Page 8360, 2nd paragraph: Please rephrase this paragraph. It is not clear what the authors want to point out here, what is the significance of this no correlation?

Page 8360, line 13: particles.

Pgae 8363, lines 3-5, explanation of fig 11a: use this explanation to improve the figre caption.

Page 8363, line 12: simulated precipitation and nudging of ECWMF data as mentioned in page 8346, line 2 could be also reason for the discussed deviations.

Page 8364, line 11: The authors could refer to the recent review paper on organic aerosol published in ACP this year that provides some estimates on the contribution of the secondary organic aerosol to the organic aerosol mass in the free troposphere - Kanakidou et al. SRef-ID: 1680-7324/acp/2005-5-1053.

Page 8364, lines 15-16: What is the origin of the differences, the wet deposition or the vertical dispersive? Obviously the one could cause the other. Here the authors mention that the vertical dispersive is at the origin of the differences in the wet deposition whereas in the conclusion there is in a more general statement that leaves the question open (page 8368, lines 17-20). Some rephrasing here might help the reader.

Page 8365, line 15: As I translate Figure 6a, the model diversity of the wet deposition rate coefficients for sulfate is slightly lower than for BC and POM.

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Page 8366: Mass fractions at the poles depend also on the source location. Is it possible that model differences in source for instance boreal forest emissions of BC contribute to the diversity between models at the top of the long rage transport mechanism?

Page 8368: line 4: residence times: could you give range deduced from AEROCOM results?

Page 8369, line 4: remove ‘are’

Page 8396: Table 3: ‘using a factor’ provide it if constant.

Page 8405: Table 9: for the LSCE model information on RH max is missing.

Page 8406: Caption of Table 10. Close parenthesis. Last line of Table 10 in page 8407: ‘aerosol’

Figure 1 - caption mentions ‘199% and 176%’ whereas on figure 1b the numbers 625 and 550 are shown.

Figure 6: similar problem as for Fig. 1, numbers in caption do not fit with numbers in the figures.

Figure 7: caption line 2 ‘global annual convective add ‘wet deposition’

Figure 9 (see comment above).

Figure 10: Please clarify if it is dry aerosol (AER) or wet aerosol.

Figure 11: rephrase caption as explained in the text

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 8331, 2005.