

Interactive comment on “Observations and regional modeling of aerosol speciation and size distribution over Africa and Europe” by Laurent Menut et al.

Anonymous Referee #2

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This paper provides a thorough comparison of the performance of the CHIMERE model against a range of ground-based (EMEP stations) and column integrated (NASA-AERONET) aerosol observations and tests the capacity of the model to reproduce critical properties like chemical composition and size distribution over a vast region (Africa/Europe) with contrasted aerosol sources.

This paper provides a substantial contribution to scientific progress within the scope of ACP (substantial new concepts, ideas, methods, and data). The scientific approach and applied methods are correctly presented and the results discussed in an appropriate and balanced way. The scientific results and conclusions presented in a clear, concise, and well-structured way. I do recommend the publication of this paper after

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addressing the few minor comments reported below:

Introduction: Can the authors better justify (in one or two sentences) why they have decided to focus on Europe/Mediterranean and why they have decided to use WRF + CHIMERE? Part of the explanation is provided at the beginning of the modelling section and could be moved in the introduction.

Page 2, line 10: “the size distribution modeling is poorly addressed in the literature”. Can the authors justify in one sentence why it is a critical parameter that needs to be better constrained by model?

Figure 1: Why the selected NASA-AERONET stations are mostly located in Africa and Southern Europe and the EMEP stations mostly in the Northern Europe? There are also NASA-AERONET stations in Northern Europe and EMEP stations in Southern Europe (Italy, Greece, Cyprus ...)

Page 5, line 18 : “... and transport of long-lived species across the Mediterranean Basin.” What are these long-lived species? Table 2: Can the authors add a column “country” to help the reader to better locate the stations?

Page 7, line 9 to 15 (section 3.1): An exhaustive description of the model is reported here. Is it the first time that all of these features are applied to CHIMERE? If not, can the authors provide some references which have used CHIMERE with these features?

Table 3: I still don't understand what are the chemical species behind the term “primary particulate matter” (PPM). Can you be more specific?

Page 9, line 5 (section 3.3.2.). Can the authors provide a size range for fine/coarse/big?

Table 4: What's about the other chemical species described in Table 3?

Figure 2: This figure provides the % distribution in the different modes for the different chemical species. Since this figure is scaled with relative contributions (%), it is not possible, for instance, to learn what is the fine versus coarse contribution of SO₄ (e.g.

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what is the contribution of fine SO₄ relatively to total SO₄)?

Table 5: Can the authors specify what the rationale of the classification of the stations is? (e.g. why this order?).

Page 13, line 17: Can the authors explain why they have selected specifically these 3 days?

Page 17, line 12: "... the important peak of PM_{2.5} observed around the 18 July ...". I cannot see clearly a peak of PM_{2.5} on 18.07 in Figure 5. Can the authors better point this peak?

Page 19, end of the page, discussion related to NH₄. The authors discuss on the model performance for NH₄ taken individually while this compound is intimately linked to fine SO₄ (and fine NO₃ if there is). How the neutralization of SO₄ by NH₄ is reproduced by the model?

Page 22, line 4. Although we usually find the highest concentrations of fine NO₃ close to the English channels, I would assume that it is rather due to thermodynamic equilibrium (cold and humid) rather than high NO_x from shipping emissions. Can the authors demonstrate that fine NO₃ in this region is mostly due to shipping rather than NO_x for the continental (transport) sector? Otherwise I would remain vague about the origin of NO_x in the region.

Figure 9: Why the authors did not take daily averages here (which are more representative than a given hour)?

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