

## ***Interactive comment on “Understanding the seasonality and climatology of aerosols in Africa through evaluation of CCAM aerosol simulations against AERONET measurements” by Hannah M. Horowitz et al.***

### **Anonymous Referee #2**

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Interactive comment on “Understanding the seasonality and climatology of aerosols in Africa through evaluation of CCAM aerosol simulations against AERONET measurements” by Hannah Horowitz et al.

General comments: In this study the regional and seasonal representation of aerosols in the global CCAM model is evaluated for the African domain, mainly through comparison of modeled and ground based retrievals of AOD from AERONET across Africa and parts of the Middle East.

I find the paper scientifically interesting and mostly well written, and the presentation

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of model and observationally based results should be useful for others planning to do similar model evaluation studies. Parts of the model description is vague, however, which makes it difficult for the reader to find necessary information about the aerosol treatment without actually reading many of the underlying papers for the model. The treatment of sea salt, in particular, is poorly described, and the potential impact of this component (on coastal and island sites) on the results has mainly been omitted, except (for some sites) in Figure 7.

Specific comments and technical corrections: (For simplicity, the arrow symbol “->” is used to suggest a change from text version A -> B)

Page 1, line 18: “ground-based observations” should be changed to “ground-based remote retrievals” or something along that line.

Page 3, line 8: “may also feedback on climate” -> “may also feed back on climate” (feedback is a noun)

Page 3, line 15: “first AeroCom” -> “first phase of AeroCom”

Page 3, line 30 and throughout Sect. 2.1: What does non-prognostic / diagnostic sea salt aerosols mean? Do you prescribe the emissions or the concentrations? A reference for this treatment should be added, e.g. after the additional (but not sufficient) info on page 5, line 3.

Page 4, line 12; “spun-up” -> “spun up”

Page 4, line 19: Is also the semi-direct effect taken into account?

Page 4, line 31: The “-“ in “-2” in the exponent ( $m^{**-2}$ ) is misplaced.

Page 5, line 13: “vary every 5 years” “they vary every 5 years”

Page 5, line 14: “anthropogenic” -> “non-biomass burning anthropogenic”

Page 5, line 17: “found a chemical” -> “found that a chemical”

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Page 5, line 17: Unless sea salt concentrations are prescribed, why are these large particles not also affected by gravitational settling?

Page 6, line 2: "AOD" -> "AOD at 550 nm" Page 6, line 5: "34 sites Africa" -> "34 sites in Africa"

Page 6, line 18: "bolded site names" -> "site names in bold font"

Page 6, lines 24-25: I would suggest to rewrite "where if more than 30% of the daily values were missing, a monthly average could not be calculated" to ". I.e., if more than 30% of the daily values were missing, a monthly average was not calculated".

Page 6, line 27: "This is to ensure the" -> "This is to ensure that the"

Page 6, lines 30 and 32: The sentence containing "and were aligned as possible" does not make sense, and the meaning of the following sentence is not clear to me either: Should it read "assessed for the averaging period in question" or "assessed for the respective averaging period"?

Page 7, lines 5-9: Unclear description of the 2 different calculations: "2) all model years" does not preclude 1). Should it be "2) all months of all model years"?

Page 7: Eqs. 4 and 5 are well known and can be skipped, or replaced with an equation for r. Line 17 also repeats the info on line 15.

Page 7, line 25: The Angstrom parameter does not equal 2 for all sub-micron particles. It is more correct to write "very fine particles" or "predominantly fine particles", or something along that line.

Page 7, line 27 (and throughout the manuscript): Small Angstrom parameter values can also be due to aerosols dominated by coarse sea salt aerosols. Perhaps this is not the case for this particular model and the sites studied here, but this should somehow be shown, at least for the coastal and island sites.

Page 9, line 4: As above.

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Page 10, line 31: "fraction wet deposition" -> "wet deposition fraction"

Pages 10-11: Whether this aerosol is prescribed or not, sea salt influences the total AOD and should be discussed and included in Table 2, and also in Fig. 5 if prescribed concentrations have not been used. The sea salt AOD values for coastal/island sites in Fig. 7 look small compared to many of the available AerCom models ([http://aerocom.met.no/cgi-bin/aerocom/surfobs\\_annuals.pl](http://aerocom.met.no/cgi-bin/aerocom/surfobs_annuals.pl)).

Page 11, line 1: "BC are higher" -> "BC burden and lifetime are higher". Page 11, line 23: "areas are  $\pm 1$  standard deviation" -> "areas are within  $\pm 1$  standard deviation" (and the same for the following line).

Page 12, line 1: "spurious summertime peaks" -> "missing summertime peaks"

Page 12, lines 11-12: Since there is a severe overestimate in modeled AOD for some sites and some months, the sentence starting with "The model generally represents the magnitude of AOD550nm" should be rephrased.

Page 13, line 8: "The AOD550" -> "The observed AOD550" (?)

Page 13, line 15: "at the source" -> "at the biomass burning source"

Page 14, line 1: Is the ERA wind bias in winter consistent with the magnitude of the AOD bias? Could you make a simple estimate of this?

Page 14, line 16: There is a "beta" to much in "0.27 m s-1 $\beta$ "

Page 14, line 31 and Page 16, lines 17-20: Can you show that the precipitation in the model is underestimated compared to observations (therefore explaining some of the positive dust emission bias)?

Page 16, line 31: "is slightly underestimated" -> "is underestimated"

Page 17, line 20: "CCAM is able to capture the general seasonal cycle of the emissions of dust, and the transport of all aerosol types". This has not been shown, and such a

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statement should be limited to the aerosol components covered by the study.

Table 1: The second sentence in the table caption is grammatically incomplete.

Table 2: The gray shading should be explained in the table caption (as in the text).

Figure 1, caption: “used in model comparison” -> “used in the model comparison”.

Figures 2-4, caption: Explain the whiskers.

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