

Interactive comment on “Cloud and aerosol radiative effects as key players for anthropogenic changes in atmospheric dynamics over southern West Africa” by Konrad Deetz et al.

Anonymous Referee #3

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In this study, the authors ran a regional climate model COSMO-ART at convection-permitting resolutions to examine the effects of aerosols on weather and climate based on a 2-day case study. They documented in detail how aerosol affects cloud and atmospheric dynamics over southern West Africa. They further presented detailed analysis of mechanisms that leads to these changes, and provide a conceptual model for this. I think overall the paper is well written, and it is great addition to existing literatures on aerosols effects on climate over Africa. I would recommend it publication after my following comments are addressed:

Major comments: 1. I understand these are expensive simulations, but I still think it

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would be really nice if the authors can run model longer, say a month. The current results are interesting, but it is less clear how robust these results are. A longer simulation would definitely be more interesting, and may also produce more robust results.

2. Their model does have the capability to separately treat AIE and ADE. But in the paper, the authors examined the two effects together. Separating these two may help to answer whether AIE or ADE dominates in this case study.

Specific comments: Title: The paper is about aerosol effects on atmospheric dynamics in a case study. But the title said “cloud and aerosol radiative effects as key players for anthropogenic changes in atmospheric dynamics over southern West Africa”. I think the title is misleading and confusing. First, the paper is not about cloud radiative effects although it does talk about aerosol radiative effects through its impact on clouds. But this is different from cloud radiative effects. Second, the paper only documents aerosol effects on atmospheric dynamics based a case study from model simulations. “anthropogenic changes in atmospheric dynamics” may sound like this is what you observed. As this effect is purely a modeling study, I suggest the authors to clarify this in the title.

Section 2.1: model experiments and AIE. It looks like the authors can separately examine the effects of AIE and ADE, but in all model experiments documented here, AIE and ADE are examined together. If the authors examine AIE and ADE separately, this may help to clarify some points the authors made regarding the relative roles of AIE and ADE on SWA. This relates to some of the discussions in Section 6 (e.g., the last paragraph).

Section 5: the first paragraph is overly long. Suggest to separate it into several short paragraphs with a focus theme in individual paragraphs.

Page 9, line 21: what are these two numbers? The same question is also applied for next three lines (lines 22-24)

Page 10, line 4-5: an aerosol increase has large impacts than the aerosol decrease.

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This is a little bit surprise to me. I would expect when aerosol concentrations further increases, its effects saturate, and its effects decreases (e.g., numerous small particles compete for water vapor so a lower maximum supersaturation is expected). So can you elaborate what might happen here.

Page 10, lines 12-14: The Twomey effect is also through changes in cloud optical thickness, but not through cloud water. So the second half of this statement is confusing.

Page 10, lines 28-29: this statement is not clear to me (“it is interesting that . . .”).

Page 10, the pressure gradient mechanisms: Here sea surface temperature was not affected by aerosol loading. So this overestimates the effects of aerosols on land-sea temperature differences. Any discussion on this?

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