

Interactive comment on “Increasing manmade air pollution likely to reduce rainfall in southern West Africa” by Gregor Pante et al.

Anonymous Referee #1

Received and published: 13 July 2020

General comments

The paper focuses on rainfall trends in southern West Africa from the 80s to present day. After removing the effect of regional and global SST forcing, the authors analyse the effect of aerosol on the “residual trend” of precipitation. By using direct observation and indirect assessment of atmospheric aerosol content, the authors show that the “residual” drying trend in the region can be explained by the increasing trend in air pollution.

The paper is very well written, existing literature is properly cited, motivation and objectives clearly stated, methods are correctly applied and explained in detail. Results follow from evidence, and the limitations of the study are discussed.

C1

As a reviewer, I first want to thank the authors for providing such a high level manuscript, which I really enjoyed to read for its clarity and rigor in the development of discussion. Unfortunately it is not always the case.

The paper adds an important piece of knowledge in a crucial topic such as the environmental effects of increasing air pollution in southern West Africa, which is still underrepresented in the atmospheric science literature. Although evidence for this effect is only indirect, the paper has the merit to highlight a possible/likely link and invite to further investigate. Finally, I definitely recommend the paper for publication.

Specific comments

However, I invite the authors to undertake few changes in the way they present the conclusions of the study, to make it even more rigorous. Although evidence is shown that the drying trend is accompanied by an increase in atmospheric aerosols in the region, no physical evidence is presented in the paper that this is at the origin of the drying trend. Moreover, the effect of manmade pollution is not quantified: no local sources of pollution are analysed, and a quantification of the ratio of manmade vs natural biomass burning aerosols is not presented. I recognise that all these aspects are openly and clearly discussed in the main text, however I feel that the title and abstract of the paper could be misleading in this sense. I'd suggest first to change the title in something sounding like: “Indications for increasing air pollution likely to reduce rainfall in southern West Africa”. I also suggest to make clear in the abstract that a quantification of the manmade impact is not possible at this stage.

In addition, I also believe that other possible forcings for the drying trend should be mentioned. For instance, the role of vegetation and land cover in controlling precipitation in the Sahel is well known (see e.g. <https://link.springer.com/article/10.1007/s00382-012-1397-x> and <https://www.nature.com/articles/s41467-017-02021-1>), and a possible role for southern West Africa should be discussed.

C2

Few minor points are listed below.

L90: "The two rainy seasons were not studied by DACCIWA, but compared to the LDS the climatology of wind and rainfall suggests a lesser import of aerosol from Central Africa, less spreading of coastal pollution inland with the monsoon winds, and more wet deposition due to the enhanced rainfall". Any reference?

L93: I feel that "equally" suggests that the increase in biomass burning aerosol equals the increase in anthropogenic emissions. Please rephrase.

L175: please add a short description of the Sen's slope method.

L305: I'd say that "indication" can be get from a personal communication, rather than "evidence".

L428: not clear to me the reference to the political situation (too vague) in this sentence, please clarify.

Trends significance: in the main text and captions, please explicitly mention when trends are not significant.

Figure 2: any indication on the statistical significance of the correlation coefficients?

Figure 5: note that positive trends inland could be associated with the observed delay in the retreat of the Sahelian rainy season in the last decades (see e.g. <https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/joc.4638>). This could also be associated with the reduction in aerosols (see L410).

Technical corrections

L339: missing reference.

Figure 7: what do red stars mean? (significance I guess)

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-463>, 2020.