***Manuscript: acp-2022-256**, titled **"A meteorological overview of the ORACLES (Observations of Aerosols above CLouds and their intEractionS) campaign over the southeast Atlantic during 2016-2018: Part 2 - daily and synoptic characteristics"** by J.-M. Ryoo, L. Pfister, R. Ueyama, P. Zuidema, R. Wood, I. Chang, and J. Redemann*

Response to RC1 (Referee #2)

In this response letter, we repeat the reviewer's questions and answer them individually. Our response is marked in blue letters.

This is a detailed study involving black carbon aerosol interactions with clouds in the tropical Southern Atlantic ocean off the coast of west Africa. The study is exhaustive in that it addresses aircraft measurements and meteorology to explain the seasonality of aerosol and moisture transport and their relation to cloud fraction. Though the dataset is small (2016-2017), the study uses reanalysis climatology data to point out any climate anomalies during this period which is a good idea.

I have concerns over the constant supposition that the African continent can be a moisture "source". It is not correct to assume this even though the study shows moisture transport (via elevated relative humidity values) advecting off of the continent due to moist deep convection. It may be more correct to say something to the effect that 'parcels with elevated relative humidity, possibly due to evaporation of raindrops from the moist deep convection, are being transported along with the smoke/black carbon'. The study seems to imply some kind of "green ocean" or "brown ocean" effect going on, but does not explicitly say it. It is confusing to imply that a continent can be a source of moisture that rivals the neighboring marine region. This needs to be cleared up as it may take away from the general merits of the study.

Further comments/suggestions are in the enclosed PDF.

⇨ Thank you for your valuable comments. We do respect your comments on this.

Your statement, 'parcels with elevated relative humidity, possibly due to evaporation of raindrops from the moist deep convection, are being transported along with the smoke/black carbon'., sounds reasonable.

However, we are concerned that this statement may miss the key finding we want to deliver - not only moist convection but also dry convection can produce moist plumes over the land, transporting them to the ocean with aerosols. And ORACLES campaign measurement does have not only "black carbon aerosol" but also other aerosols along with gases (CO, water vapor etc).

Regarding your concern about the moisture source, as we responded to the reviewer's comment earlier, the convection over land can be a source of moisture in the free troposphere (typically 2 km above the ocean, and 2-6 km above the land). We think you may consider the moisture source in the boundary layer. Indeed, the ocean is the major moisture source region, but this moisture remains in the boundary layer because the strong inversion cap prevents upper movement. Over the southeast Atlantic, free-tropospheric moisture can be laterally transported from the continent, where the moisture originates either from dry convection (south of 5-10° S) or moist convection (north of 5° S). The free troposphere would otherwise be very dry over the southeastern Atlantic ocean because of the large-scale subsidence

– e.g., the corresponding free troposphere over the southeast Pacific has above-cloud water vapor paths of only one-two mm (Zuidema et al., 2012). We made this statement clear in the revised manuscript.

The altitude of the convection reaches around 600-700 hPa (about 3 - 4.2 km with moist (dry) convection during October to the north of 5S (south of 5°S)). This moisture is transported by the mid-tropospheric southern African easterly jet (AEJ-S) at that level, as shown in time-longitude plots within the manuscript (Figs. 2, 7, 12(a-c)). The transport of elevated moisture from land to the ocean along with CO and aerosols was well documented in the literature (Pistone et al., 2021).

Specific Comments (in the supplementary document)

Line 75-76: may be better to say 'mean low-level cloud fraction'

⇨ We changed it.

Line 238: southward?

⇨ We think northward is correct because of a mid-latitude cyclonic circulation with its center at 30-40°S. This circulation is expanding “northward” to the North Pole.

Line 452: This looks like a conflicting statement. Instead of "high" consider 'elevated', 'increased', or 'higher low-level CF values', or something that would make more sense.

⇨ Thank you for the comments. We will change it into a more appropriate word, such as ‘increased’.

Line 458: changes => patterns

⇨ Changed.

Line 691: advection => advected

⇨ Changed.

Reference

Zuidema, P., Leon, D., Pazmany, A., and Cadeddu, M.: Aircraft millimeter-wave passive sensing of cloud liquid water and water vapor during VOCALS-REx, Atmos. Chem. Phys., 12, 355–369, https://doi.org/10.5194/acp-12-355-2012, 2012.

Pistone, K., Zuidema, P., Wood, R., Diamond, M., da Silva Arlindo M., Ferrada, G., Saide, P. E., Ueyama, R., Ryoo, J.-M., Pfister, L., Podolske, J., Noone, D., Bennett, R., Stith, E., Carmichael, G., Redemann, J., Flynn, C., LeBlanc, S., Segal-Rozenhaimer, M., and Shinozuka, Y.: Exploring the elevated water vapor signal associated with the free tropospheric biomass burning plume over

the southeast Atlantic Ocean, Atmos. Chem. Phys., 21, 9643–9668, 2021, https://doi.org/10.5194/acp-21-9643-2021, 2021.