Atmospheric
Chemistry
and Physics
Discussions

# Interactive comment on "Cloud macro-physical properties in Saharan dust laden and dust free North Atlantic trade wind regimes: A lidar study" by Manuel Gutleben et al.

**Anonymous Referee #1**

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General comments: This paper investigates the link between the Saharan aerosol layer and cloudiness using lidar measurements and dropsondes data of few selected NAR-VAL flights. They find that situations with SAL correlate with lower cloud top heights and a larger fraction of small clouds. The study is very detailed in presenting numbers and doing appropriate statistical testing. Reading through the paper suggests that the aerosols are causing the differences in cloudiness but how can an elevated dust layer imprint itself on the lower laying clouds? Furthermore, what is not quite clear to me is how the meteorology during periods of SAL differs to periods without dust and how this might influence the cloudiness. Other studies (e.g. Lonitz et. al 2015) have shown, that e.g. slight differences in relative humidity can also cause differences in trade wind

clouds to a comparable level as differences in aerosol load can do. Also effects of wind should be discussed, as done by Nuijens and Stevens in 2012 using Large Eddy Simulations. Having access to meteorological data from the dropsondes, I would like to see that the differences in relative humidity and wind are analysed in greater depth (not just shown as done in Fig. 4 for humidity) and a discussion about if dust or the meteorology associated with dust could potentially can cause the observed changes in cloudiness.

Specific comments:

Introduction: Please elaborate in more detail how dust and the formation of cloud interact, how the aerosol could alter clouds and why dust can act as a good CCN.

p2, l18/19 is not true. Lonitz et al 2015 (https://journals.ametsoc.org/doi/10.1175/JAS-D-14-0348.1) have studied this.

Section 2.4: Do you also check if the neighbouring cloudy profiles have the cloud in similar height levels? If not, this might have an impact on the results shown in section 3.3.

Figure 4 and p15, l 5-7: Was the relative humidity measured by the dropsondes or derived by the lidar? How does dry Saharan air layers relate to an increase in humidity?

P15, l14/15: How does the suppression work. Please elaborate

Technical comments:

Often the word "underneath" is used instead of "below", e.g. p2 l8, caption of figure 7

P2, l35: Citation incorrect: Stevens et al 2019.

P10, l19: "first" instead of "fist"

Sec 3.3.2: How do you derive the cloud length in kilometers? My guess is that you assume some relationship between the speed of the aircraft and time?!

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