

Atmos. Chem. Phys. Discuss., author comment AC3
<https://doi.org/10.5194/acp-2021-88-AC3>, 2021
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Reply on AC2

Elvis Torres-Delgado et al.

Author comment on "Measurement report: Impact of African aerosol particles on cloud evolution in a tropical montane cloud forest in the Caribbean" by Elvis Torres-Delgado et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-88-AC3>, 2021

The responses for the first reviewer were included here by mistake. These are the responses for the second reviewer:

The paper reports on three summers of measurements of aerosol optical properties and nss calcium at a coastal site (CSJ) and cloud properties at a mountain site (PDE) on Puerto Rico. These data are coupled with HYSPLIT back trajectories to assess the impacts of aerosols transported across the Atlantic on cloud properties and evolution at PDE. The bulk of the conclusions relies on meteorological parameters derived along the trajectories that are based on meteorological fields used when the HYSPLIT model is run. The end result is a study with provocative but speculative conclusions. The paper should be published as it provides information on the role of aerosol properties vs. atmospheric dynamics in cloud formation and evolution. It would be helpful to include a more detailed discussion of a follow-up study that could validate or inform the results presented here.

Lines 124 – 127: The accuracy of the position of the trajectories is discussed but, other than a brief mention of deriving precipitation from in situ and satellite observations (Lines 480 – 482), no mention is made of the uncertainty in deriving meteorological parameters along the trajectories. It would be helpful to add this information.

- Meteorological data used in the HYSPLIT model comes from the Global Data Assimilation System (GDAS). GDAS adds several observations into a gridded 3-D model for forecasting weather using observations, which includes surface observations, weather balloons, ocean buoys, aircraft measurements, radar, and satellite observations. Several observation system simulation experiments have been carried out and have found that the GDAS output is reasonably comparable to nature runs and observations (eg. Kleist and Ide, 2015; Kren et al., 2020; Rangsanseri et al., 2020).
- The above paragraph has been included in section 2.3 Classification of Sampling Periods

Figure 2: Please state in the caption what the black horizontal lines (solid and dashed) represent.

- Included.

Figure 3: Is the nss calcium shown in the figure in the aerosol or cloud phase? Please clarify in the caption.

- Included

Table 3: Please clarify exactly what sampling periods are represented in the table in the caption. Are these statistics for the combined low and high dust periods?

- This should be Table 1. It is the statistics for the whole sampling period. The sampling period dates are described in section 2.2 Sampling Campaigns. A clarification has been included in the table caption.

Figure 4: What are the units of accumulated precipitation?

- mm
- Units have been added to the caption description

Line 294: Please add "size distributions of CLOUD DROP number concentration" for clarification.

- Included

Line 389: What is meant here by "cloud concentration"? Cloud drop concentration? Cloud fraction?

- Cloud droplet concentration. This has been corrected.

Line 421: Should this be "...acting as cloud condensation nuclei and thus BE THE MAIN AEROSOL COMPONENT responsible...?"

- Corrected.

Lines 555 – 558: The conclusions are, indeed, highly speculative. What additional information is required to reach conclusions with more certainty? It would be helpful to have that information rather than the generic statement that "...a much more detailed and long-term measurement program..." is required. What measurements should be included both at PDE and CSJ? Add more specifics about the required cloud and chemistry models needed to validate the results presented here.

- Clearly, the conclusions posted here must be somewhat speculative in nature and require a much more detailed and long-term measurement program, coupled with cloud and chemistry models to validate these speculations. Nevertheless, the results are consistent with previous studies and, most importantly, provide a well-documented set of measurements to enhance the current data set of similar observations in the Caribbean.
- Currently in progress is the next step to extend this study with a more comprehensive suite of sensors over a period of time that covers several years in order to take into account the year-to-year variability in synoptic and mesoscale weather patterns that modify the trajectories of dust and pollution transported to the Caribbean. Following the passage of Hurricane Marie, in September 2017, two years after the current study ended, both the mountain and coastal research sites were destroyed with all the equipment. As a result, through funding from the National Science Foundation, these sites have been rebuilt and new cloud and aerosol instrumentation purchased and installed. This new facility will be fully on-line in October, 2021 and begin long-term measurements that will expand on the results that have been reported here. These new measurements, along with simulations with the Weather Research Forecast (WRF) will

directly address the questions raised in the current study and begin moving the conclusions from the realm of speculation to statistically supported facts.