

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on **essd-2021-18**

Anonymous Referee #1

Referee comment on "EUREC⁴A" by Bjorn Stevens et al., Earth Syst. Sci. Data Discuss.,
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General comments

This paper is a comprehensive review of the data collected during EUREC⁴A, which was conducted in the Atlantic trade wind region near Barbados in January-February 2020. The goal of the EUREC⁴A was to observe the atmosphere and ocean on multiple time and space scales using a large array of ocean and atmosphere instrumentation in order to better constrain environmental controls on trade wind cloud fields. It is anticipated that the experiment will lead to an improved understanding of how global warming might influence such clouds and their climate impacts.

EUREC⁴A was a massive, complex field campaign involving many measurement systems and numerous investigators from many nations. As such, undertaking a review of the measurement systems and data collected is daunting, but the authors have successfully created a readable, interesting, and comprehensible narrative. The paper contains lucid and pertinent graphics of the data collected, showing both some preliminary results and evidence of how the measurements link together to address the common goal of the paper. It is a credit to the project lead scientists to include all participants as co-authors of the paper. This is one of the best papers on field campaign data that I have read.

Specific comments

I have only minor comments.

- What are the impacts of Barbados island on measurements taken on and near the island? Data from the lidar on the island show a prominent diurnal cycle. Can you comment on the issue of representativeness of those island observations with respect to open-ocean conditions? Also, with the 300 m+ Barbados terrain, there may be some blocking effects on the flow upstream of the barrier that would influence observations there.
- Figure 12 shows that about half the campaign had elevated background concentrations of aerosols, presumably from African dust. The rest of the period had more-typical open-ocean concentrations, which would argue that for those times EURIC⁴A results might be transferrable to other ocean basins. The rapid ramp-ups and ramp-downs in February suggest there may sharp horizontal gradients in aerosols over the domain. While the variability offers the opportunity to investigate aerosol impacts on warm-rain formation, it may also present analysis challenges owing to large horizontal and vertical variations in CCN concentrations.
- Figure 17 figure shows a diurnal cycle of the SST. Will the data collected in EURIC⁴A be sufficient for a thorough analysis of effects of the radiation diurnal cycle on the cloud fields?
- Data policy on p. 38: "To actively support the initial dispersal of data by making (even preliminary) data available to everyone as quickly as possible through the AERIS archive." Is it possible to be more specific about timing on data release?

Technical comments

- 16: In Fig. 8, define S and "black dashed line shows."
- 23: Explain in caption the arrow in the upper panel and the vertical gray lines in the lower panels.
- 24, line 360: "The latter is the focus of the zoom in the lower panels of Fig. 13..."
- 29, Fig. 17: Define p in the caption.

- 38, line 585: Word missing after “resultant”