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Interactive comment on "Atmospheric radiative profiles during EUREC^{4}A" *by* Anna Lea Albright et al.

Anonymous Referee #2

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This paper describes the underlying algorithm and preliminary analysis of a clear-sky radiative heating dataset derived from airborne and ground-based soundings collected during EUREC4A. The paper is well-written and the material is appropriate for ESSD. The dataset introduced here is unique and has clear value for studying the radiative environment around trade cumulus clouds relative to existing satellite products. The methods are robust and applied to a novel regime that is poorly captured by satellites. The dataset is new and not yet described in the literature. The dataset meets the required criteria of being archived and freely available and having a DOI.

The associated analysis is understandably cursory but designed to generate interest in the dataset and demonstrate its utility (see comment above). The authors go as far as to articulate a set of questions for which the dataset may be well-suited. The only

significant weakness is the lack of rigorous uncertainty assessment which is essential for documenting the quality of datasets reported in ESSD. Some justifiable measure of the accuracy of the radiative heating rate profiles is required to allow future users to assess its value for their applications. Currently no quantitative estimates of uncertainty are provided. This shortcoming could likely be resolved through sensitivity studies that simulate the effects of uncertainties in the input datasets (soundings and reanalyses) used to drive them like those employed by others who have produced analogous satellite datasets (e.g. Henderson et al, 2013; Cesana et al, 2019).

Additional Comments:

1. Line 73: A brief discussion of the accuracy of the radiosondes and dropsondes and their implications for errors in computed clear-sky radiative heating should be captured somewhere here. These (in combination with uncertainties in the ERA5 reanalyses) could be used to drive the error required uncertainty analyses. 2. Line 85: It is a little surprising that ERA5 is used to supply SST information. Were no independent SST measurements available during EUREC4A? 3. Line 96: The assumption of clear-skies simplifies the calculations while providing useful information. It would be interesting to generate all-sky profiles in a future study. I do have a minor concern regarding terminology here, though. By convention 'clear-sky' is often adopted to indicate that no clouds were present when the observations were taken. What is actually computed here are 'cloud-free' radiative heating profiles with the understanding that any given profile may or may not have actually contained a cloud. 4. Section 3.2 could be improved to focus on the day-to-day/persistence aspect of the results. As written the primary conclusion that comes across is that the sun comes up and goes down each day. After quickly noting this, it would be better to remove the mean diurnal cycle from Figure 4 and focus on the day-to-day variations in the absence of the DC that's already been covered. The persistence comment on Line 134, for example, is far more interesting than the diurnal cycle. More discussion of this phenomenon as well as the factors that may be responsible for diurnal variations in the LW are warranted. 5. Line 146: Related to (4),

how is the 4-8 hour timescale of trade-wind air masses reconciled with the multi-day persistence noted in Section 3.2?

References:

Henderson, D. S., T. L'Ecuyer, G. Stephens, P. Partain, and M. Sekiguchi, 2013: A multi-sensor perspective on the radiative impacts of clouds and aerosols, J. Appl. Meteor. and Climatol. 52, 853-871.

Cesana, G., D. E. Waliser, T. L'Ecuyer, X. Jiang, and J.-L. Li, 2019: How clouds affect the vertical structure of radiative heating rates: A multi-model evaluation using A-Train satellite observations, J. Climate 32, 1573-1590.

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