Review of: essd-2023-140
Ground- and ship-based microwave radiometer measurements during EUREC4A
By Schnitt et al.,

This manuscript describes the passive microwave measurements and the LWP and IWV retrievals based on them from multi-wavelength K- and V-band radiometer on the Meteor and at BCO, and single-wavelength radiometer retrievals using radar-determined cloud identification on the Meteor and Merian.

There is a lot of good information in this manuscript, but the presentation is of poor quality and I was left wondering why I should care about these measurements. This is a data paper but there is nothing wrong with including some science analysis to wet the reader's appetite for the dataset. Of interest is a basic analysis of the diurnal cycle, especially from the Meteor, as the ship was in a truly marine location unaffected by land and not moving around as much as the Merian. The ability to do a 24/7 analysis is a strength of these measurements I feel. Such an assessment could perhaps also shed light on whether BCO experiences an island effect. Also of interest is how the IWV/LWP vary with cloud morphology in EUREC4A - those identifications are readily available.

The presentation of the measurements themselves is also poor. A flowchart would help with discerning the subtleties between the different platforms. Fig. 1 should be a stand-alone map, a larger but more zoomed-in version of Fig. 1d, with the ship tracks superimposed on a geophysical variable of relevance such as SST or low cloud cover. The organization of the manuscript also needs further attention - the cloud mask should be described before the IWV retrievals as the cloud mask is also of relevant for the MSMRAD and LIMRAD retrievals. There was also often references to other papers (Kalesse-Los, Acquistapace) that seemed relevant but left the reader hanging.

Please give this another go. A lot of useful effort has gone into this endeavor already, but a bit more polish would make the work much more impactful.

Specific comments:

Abstract: needs to include something on the retrievals, shouldn't assume the reader knows W- K- and V- band, include the actual frequencies or wavelengths, include some basic information on where the 3 platforms were locations. A science nugget - the diurnal cycle should be a piece of cake right? - should also be included.

Introduction:
Lines 18-26: these contain some motivational platitudes, none of which convince me that these microwave measurements were really necessary. Can you come up with something more specific?
Line 27: this should start a new paragraph, needs a segue sentence.
Lines 32-38: any interesting science tidbits from these previous analyses you can mention? Would also be good to reference something from ENA and other subtropical marine campaigns, MAGIC and LASIC from DOE come to mind for me, also VOCALS.
Line 38-39: the reference to a satellite product is jarring here but you could use it as an opportunity to mention what can be done from the surface that can't be done from satellite.
Line 45: please include wavelength/frequencies for the various bands mentioned here.
Line 52: I didn't see mention anywhere as to whether ice cloud scattering could be occurring.
Lines 53-64: this paragraph is going into the instrument details, not appropriate for an introduction. This language should all go into section 2. Instead briefly describe the environmental setting EUREC4A provided for the 3 platforms and that you are evaluating two different retrievals, "HAT" and "RAD". You could also mention there was a time period with

colocated measurements, and that slight differences exist even in the treatment of identical instruments, further justifying the intercomparison. Also, one would expect from the outset that "RAD" is less precise than "HAT", no? Just because one is multi-wavelength, the other is single-wavelength. Yet the authors never say this.

Section 2:
Line 71: this would go into the introduction.
Line 73: "Tab" should be "Table" throughout.
Describe table 1 and fig 1 together.
I also think a flowchart would be nice to include here, that could be referred to as the authors go into further detail.
Personally I think you might want to begin by describing the cloud masks and how those are used. These are called 'precipitation masks' in table 1, right? Would be good to just use one nomenclature.

BCO:
Line 82: I'm confused why we need to be told the azimuth setting of a zenith measurement .
Meteor:
Line 97: what is a chirp program? And why can't we just be told what they are rather than needing to go to Kalesse-Los et al. 2023?
Lines 108-110: should go into the beginning of the section.
Merian:
Line 113-114: description of LIMRAD is out of place here.

Retrievals:
Lines 123-125: an overview of the logic would be nice here. Justify using two different retrievals. Describe the climatological training dataset. Reference a flowchart. Mention the different approaches to identifying clear-sky and why. Why do you explain the LWP retrievals before the IWV ones?
Line 133: first mention of a climatological training data set without describing what it is is a faux pas….it just means reorganizing a few sentences here.
Line 135: describe the RT model rather than telling us what other papers we need to go to to find out about it.
Line ~150: why is HATPRO being used to ID clear-sky rather than ceiloemter/radar? I've gotten confused about the different approaches and what justifies when they are applied.
Lines 154-174: you talk about how the clear-sky Tb is applied before mentioning how clear-sky is determined on the very last line (which now invokes the radar rather than HATPRO, is this because you want it to be stand-alone?)

Line 178: very unsatistifying to be told Kalesse-Los 2020 has a different LIMHAT retrieval with no explanation. Is this one better? What's different?
Line 194: why clip LWP/IWV? Do the precip masks not always work?
Line 199: don't need to be told again the BCOHAT weather station didn't work…
Line 201: are you sure reflectivity> -50dBZ indicates precip? That is an awfully low value. Does it indicate conditions that require 'clipping' of LWP/IWV? And Why -50dBZ threshold at BCO and -40dBZ at Meteor/Merian? Why not just one consistent value?

Line 215: now we learn about a radar/ceilometer cloud mask. I really think the precip/cloud masks deserve a section of their own.
Line 230: ice/cirrus is not an issue, right?

Page 11: the skewness in the IWV is rather remarkable. Did the high IWV values correspond to a particular synoptic situation? On fig. 3 it looks like the Merian maybe experienced deep tropical convective conditions around 1/26 - was it close to Brazil at the time? Worth

mentioning it's not typical of the wintertime trades if so. Which then raises the question whether the IWV distribution within the wintertime trades is genuinely log-normally distributed. I'm not sure any of the locations indicated in Fig. 2 of Foster et al. 2006 can be considered subtropical suppressed.

P.13: the ship colocation results deserve their own subsection I feel.

Line 284: doesn't ERA5 have a dry bias in the boundary layer relative to the HALO soundings? I feel I read/heard that somewhere - Geet George's paper?

Section 6.1: now we learn about the cloud mask….this section should come earlier.
Line 295: here you mention using a -50dBZ, earlier you also mentioned -40dBZ. Best to just describe in one place, correctly, and be done with it. Radar-detected sea spray is more plausible than precipitation at these low values. Doesn't Marcus Klingebiel have a paper on it? A sensitivity analysis to your choice of threshold could be good. It will mostly affect the %age of detected cloud as opposed to your LWP statistics I suspect.

Line 300: please summarize discussion in Konow et al 2021 as opposed to telling us we need to read the Konow paper to learn these things.

Line 324: I think BCO has about a half-day's advection downstream of the Meteor, over a warmer ocean with one would expect a slightly moister atmosphere. I think all you can say is that your two mean LWP values can't resolve this evolution (though is not in disagreement either).

Section 8:
Overall very disappointed to see no EUREC4A-relevant science in this manuscript, in particular, nothing on the diurnal cycle. Please do something on the diurnal cycle - it's so easy with the data you have.

Figures
Fig. 1: see top of review
Fig. 3: the red colors indicating BCO and Merian can be difficult to distinguish. Would suggest selecting a completely different color, like green.
Fig. 4: inset difficult to read, in part before of the color choices (the two reds are fairly similar)

Tables
Table 4: why so many more ERA5 soundings than radiosondes if the closest ERA5 fields are selected? Bias is calculated relative to what? Mention in caption.