

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on **essd-2021-265**

Martin Hagen (Referee)

Referee comment on "EUREC⁴A's *Maria S. Merian* ship-based cloud and micro rain radar observations of clouds and precipitation" by Claudia Acquistapace et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-265-RC1>, 2021

The manuscript describes the set-up, attitude control, and exemplary measurements of two vertical pointing radars onboard RV MS Merian during Eurec4a. Main focus of this data paper is the compensation of the ship motion in situations where the active stabilization platform was properly working and different treatment of data in situations where the platform got stuck in arbitrary orientations.

The manuscript is consistent and well written and certainly deserves publication as data paper. There are only minor modifications required. I like the lessons learned section, I hope that this will be considered in future campaigns.

Some general comments:

Obviously, the authors did develop the methods behind the ship motion correction by themselves, without borrowing from the airborne radar community (e.g. Bange, J. et al., 2013: Measurement of aircraft state and thermodynamic and dynamic variable, in: Airborne Measurements for Environmental Research: Methods and Instruments, edited by: Wendisch, M. and Brenguier, J-L., <https://doi.org/10.1002/9783527653218.ch2>). The methods are the same and there is an agreement between the two worlds (air - sea).

For the W-band radar you do not mention anything about attenuation (gaseous, liquid) which certainly has to be considered, you call it just reflectivity (factor). Whereas for the MRR you talk about attenuated equivalent reflectivity (factor). This should be consistent. Otherwise one might assume that data from W-band radar are corrected for gaseous and liquid attenuation as well as for Mie effects. Reflectivity factor z implies Rayleigh approximation. However, since both systems are mm-wave systems you better write

about effective reflectivity factor. This implies that Mie scattering effects have to be considered in the interpretation of reflectivity factor.

I think the labels/numbers in the figures are too small, but I leave this to the technical editor.

Minor specific comments and hints in the order of appearance in the text:

Line 14: I think DOI's have to be given in the abstract, but this is a task for the technical editor

Line 22: What does OA stand for?

Line 69: Section instead of Session

Line 78: can you give here some numbers about the temporal drift

Line 127: Why longitude and latitude with the same temporal resolution as the radar data are not copied to the radar dataset?

Lines 170 - 175: can you also give the temporal resolution of the MRU?

Lines 179 - 184: this should go to section 2.3

Figure 5 is hardly readable, the sketch of MS Merian is 2D, whereas the vectors are 3D; this figure should be improved considerable

Lines 206 + 207: "whereas w_heave ... gates" is repeated from above

Lines 224 - 230: confusing, e_x, e_y, e_z is first ship relative and later horizon relative, maybe you could use different notations for the two reference systems

Line 226: appendix C or equation C4

Figure 6: faint lines are hard to read, you could also use dashed lines instead

Line 239: horizontal or ship relative coordination system? These are different reference systems

Line 262: v_{trans} would be more memorable for the translation velocity than v_{trasl}

Line 264? - rotation vector: what is about bending and twisting of the ship body (I remember a video you showed once at a workshop)

Figure 7: maybe panels a), b), c), e), f), g) could be larger, and d) and h) could be smaller (or omitted)

Line 296: Figure 7 e)-g)

Line 298: the high fall velocities in the second half of the plot and persistent through all heights seem unrealistic, can you comment on this?

Line 311: signal to noise "ratio"

Line 313: Table 2 gives 7.5 to 34 m resolution. For the horizontal resolution also beamwidth has to be considered

Line 321: numbering Fig. A1 is confusing. The figure does not belong to Appendix A

Figure 9 caption: interpretation "and made a hook rain structure ... wind mixing" should not go to caption

Figure 12: I think, images from both radars should have the identical height axis range and identical color bar range and color map. This makes comparisons between W- and K-band much easier, even though it is not the objective of the paper.

Line 399: It might be worth to discuss shortly the observed differences between both radars and how they complement each other. Different attenuation due to different wavelengths, different sensitivity, ...

Line 434: just a comment: some airborne systems (unfortunately not HALO/HAMP) have an IRS/IMU as close as possible to the radar antenna

Line 507: ... by alpha clockwise from North

Line 507: for non-meteorologists you could add "(the direction where the wind is coming from)" this makes it easier to understand the minus signs in Eq. B1

Line 514: If "yaw" psi is indeed ...

Line 523: heave is not discussed here

Line 531 till end of page: check order of description of r_{rot} and v_{rot} , looks like repeating of definitions

Line 544, Eq. D1: should be $e_{p0} = \dots$ (?)

Line 547, Eq. D2: why not t_{final} for $\theta_{tbl,S}$