ANSWER TO REVIEWER

Manuscript egusphere-2025-1914 "First insights into deep convection by the Doppler velocity measurements of the Earth- CARE's Cloud Profiling Radar"

This manuscript describes initial Doppler velocity measurements made by the EarthCARE Cloud Profiling Radar. These initial measurements are exciting and are the initial "pay back" for years of analysis and feasibility studies this team has made exploring the challenges of making Doppler velocity measurements from space. This manuscript is appropriate for Atmospheric Measurement Techniques and will need some minor changes before being ready for publication.

We appreciate the reviewer's careful reading of the manuscript and their constructive comments, which have contributed to improving the clarity and focus of the paper.

General Comments.

This reviewer's comments are aimed at clarifying text that could be confusing to the reader. In general, the manuscript is well written. However, there are a couple paragraphs in the middle of the manuscript that are not of the same quality as the rest of the manuscript and will need editing and clarification (details are described below). One concern in these paragraphs is the inclusion and analysis of Doppler velocity estimates in the regions below multiple scattering, which, I believe, should not have valid atmospheric observations.

Specific Comments.

1. **Line 74. Please correct satellite speed (7.6 km/s).**

   Thank you for highlighting the typo. It has been corrected in the revised version of the manuscript.

2. **Line 99 and Fig. 1a. Please clarify for the reader whether the spatial resolution of the reflectivity measurements shown in Fig. 1a is at 500-m, 4-km, or some other spatial resolution.**

   In Fig. 1a, the resolution of the reflectivity measurements is 1km. It has been clarified in the text of the revised version of the manuscript.

3. **Line 102. Please clarify for the reader, is the averaging immune to velocity folding, or is the lag-1 velocity estimator immune to velocity folding? Or, is this statement even necessary?**

   The average is performed in the complex space, to keep it as less sensitive as possible to the velocity folding.

4. **Line 122. Please inform the reader the value of the Pulse Repetition Frequency and the Nyquist velocity for the examples shown in the manuscript.**

   Frame 1752E (Fig. 3): V_N=5.08 m/s; PRF=6.38 kHz .

   Frame 1760E (Fig. 1): V_N=5.09 m/s ; PRF=6.38 kHz.

   This has been added in the revised version of the manuscript.

5. **Line 126. Please inform the reader that this estimated maximum value of 6.5 m/s is obtained only when using a radar operating at W-band and that larger reflectivity-weighted mean velocities are measured when using radars operating at lower**

frequencies. (Readers may be more familiar with Ka-, Ku-, or X-band airborne radars; or Ka-, K-, C-, or S-band ground based radars.)

Because Doppler velocities are reflectivity-weighted, and non-Rayleigh scattering effects tend to reduce the reflectivity of large particles, the maximum reflectivity-weighted terminal velocity at W-band does not exceed 6.5 m/s. We have clarified this point in the revised manuscript.

6. **Line 136. The phrase 'requires knowledge' is the incorrect phrase to use here because we will never "know" the exact Doppler terminal fall speed (aka, reflectivity-weighted mean fall speed) of the hydrometeors within the radar resolution volume. This sentence is shifting from observations to a retrieval algorithm, so a more appropriate phrase to use here is 'requires parameterization', or some other expression that reflects that the Doppler terminal fall speed is not measured.**

This is clarified in the revised paper.

7. **Line 136. Please clarify the text. As written, the phrase "...VT^D can be..." is equivalent to the phrase "...it could be done, but was not done in this study".**

This is clarified in the revised version of the manuscript.

8. **Line 135-137. After reviewing comments #6 and #7, maybe the discussion of retrieving air motion will be confusing to the reader because air motion is not retrieved in this manuscript. Possibly, the sentences from lines 135 to 137 can be deleted.**

Thank you for spotting this, probably best choice is to delete it.

9. **Lines 143 to 188. The paragraphs from line 143 through 188 are not of the same quality as other paragraphs in this manuscript. These paragraphs contain grammar errors, errors in logic, and a change in variable notation. These paragraphs need to be rewritten and then proof-read for consistency with the rest of the manuscript. A couple major concerns (and not all concerns) include:**

    1. **Line 170, the text is, "...VD is positive indicating the presence of an updraft." This is inconsistent with Equation (1) that defines positive values as downward motion.**

    It is an error, the convention is to have positive sign for downward velocity, negative velocities are updrafts. We are correcting it in the revised version of the paper. Equation (1) thus is correct.

    2. **Figures 4 and 5. The variable VSED is shown in Fig. 4 and 5, but it is not described in the body. Also, is VSED the same as VT^D?**

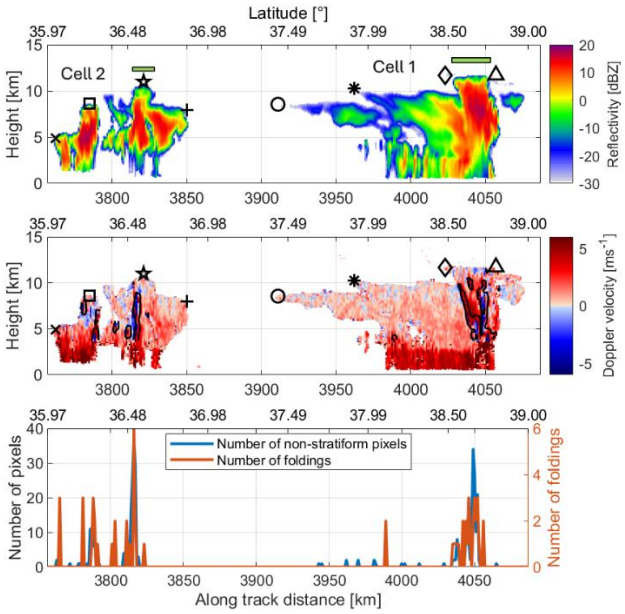
    Yes, they are the same variable. It is clarified in the revised text.

    3. **Line 185, Fig. 4b and 4c below 11 km, and Fig. 5b and 5c below 14 km. Are the authors suggesting that the Doppler velocity measurements below the reflectivity 'knee" corresponding to the height region below multiple scattering are valid and represent atmospheric observations? The authors will need to describe how the change in phase of signals coming from non-radial directions are representative of motions along the radial direction.**

Doppler velocity measurements in regions affected by multiple scattering cannot be considered reliable. Although these regions were expected to exhibit significantly more noise,

this is not always observed. Nevertheless, the Doppler velocity values in such parts of convective cell profiles should not be trusted as accurate.

10. Lines 257 to 259 and Figure 8. Where are the green bars in Fig. 8a?

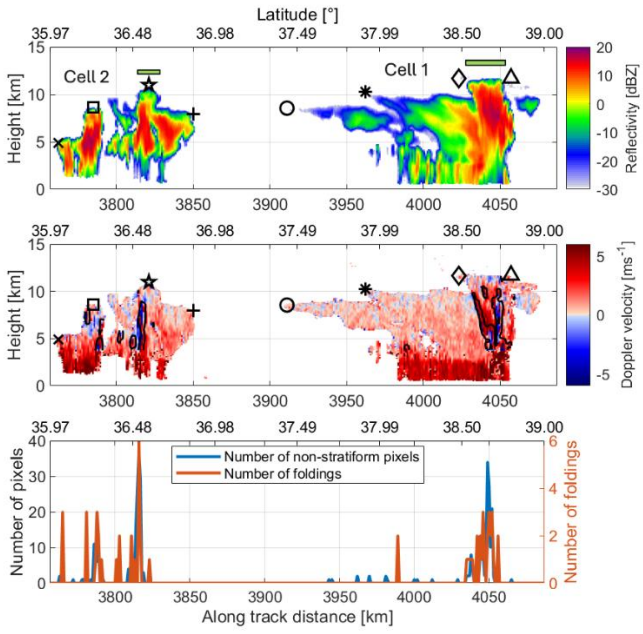


Added the corrected figure in the revised version of the manuscript.

11. Figure 8. What are the symbols in Fig. 8a and 8b?

The symbols in Fig. 8 are intended to guide the reader in matching the imagery from different instruments. Indeed, they are reported both on the CPR image and on the MSG image (accounting for parallax correction). A sentence for clarification of this point has been added in the revised version of the manuscript.

12. Figure 8. Can you please label Cell 1 and Cell 2 in the figure to help follow the discussion in the text?



Done in the revised paper.

13. **Line 316, the phrase "…unprecedented view of convective motions on a global scale" is incorrect and very misleading. The satellite makes nadir measurements and is in an orbit around the globe. These measurements are not at a "global scale". Also, this work shows images of a few individual precipitation events that do not represent motions on the global scale. Therefore, the phrase can be reduced to, "…unprecedented view of convective motions."**

We agree, it has been updated in the revised version of the manuscript. In the updated conclusion we will mention the new global perspective.