RC1: 'Comment on essd-2025-160', Anonymous Referee #1, 4 July 2025

Review of the manuscript “The Dutch real-time gauge-adjusted radar precipitation product” by Overeem et al submitted to ESSD.

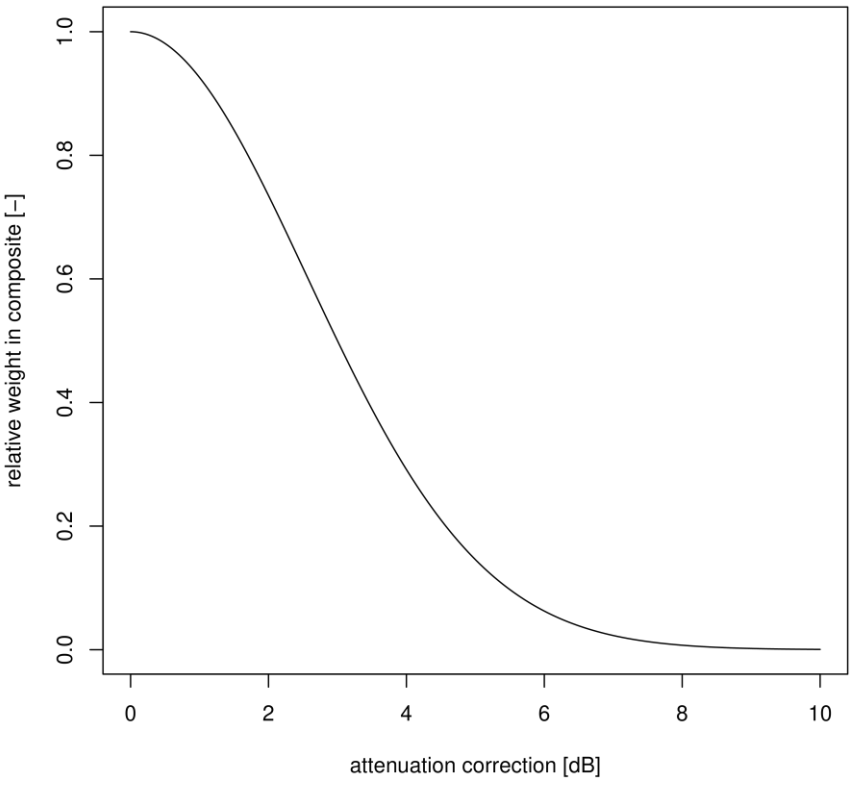
The authors clarified all the points and responded to all the comments in a satisfactory way. At this moment the only point that I would still like to raise concerns the double attenuation correction of the German radars. I understand that this is done inadvertently and that recalculating may not be practical at this point, but what is the impact on the final product? Could the authors try to estimate the error caused by this problem? And maybe a note should be made in the metadata about this or somewhere where the users of the dataset can be made aware of the issue.

Apart from this I think the manuscript is improved and should be published at ESSD.

We thank the reviewer for the positive assessment of our manuscript. Below we address the double attenuation correction on German radar data.

We expect that the effect of the double attenuation correction is generally limited because of the following reasons:

1. **A 1-year evaluation of the modified Kraemer attenuation correction method on Dutch unadjusted radar data (Overeem et al., 2021) shows that underestimation decreases by only 3.4 percentage points on average for 1-h accumulations. It will have a much larger effect for strong convective cases, which are relatively rare: if radar and/or rain gauge 1-h accumulations are larger than 10 mm, a 15.2 percentage point decrease in underestimation is found.**
2. **Using reflectivities that have already been corrected for attenuation in this attenuation correction scheme may lead to extreme overestimates of reflectivity (Hitschfeld and Bordan, 1954). However, the modified Kraemer attenuation correction method ensures that the attenuation correction and the resulting reflectivities are limited (to 10 dB and 59 dBZ_h in our case, respectively; see Overeem et al., 2021). In addition, the reduction of the quality index resulting from the attenuation correction depends on the amount of applied attenuation correction, as shown in the figure below. This implies that the contribution to the composite (and hence the final product) of a pixel that has undergone strong attenuation correction will be small.**

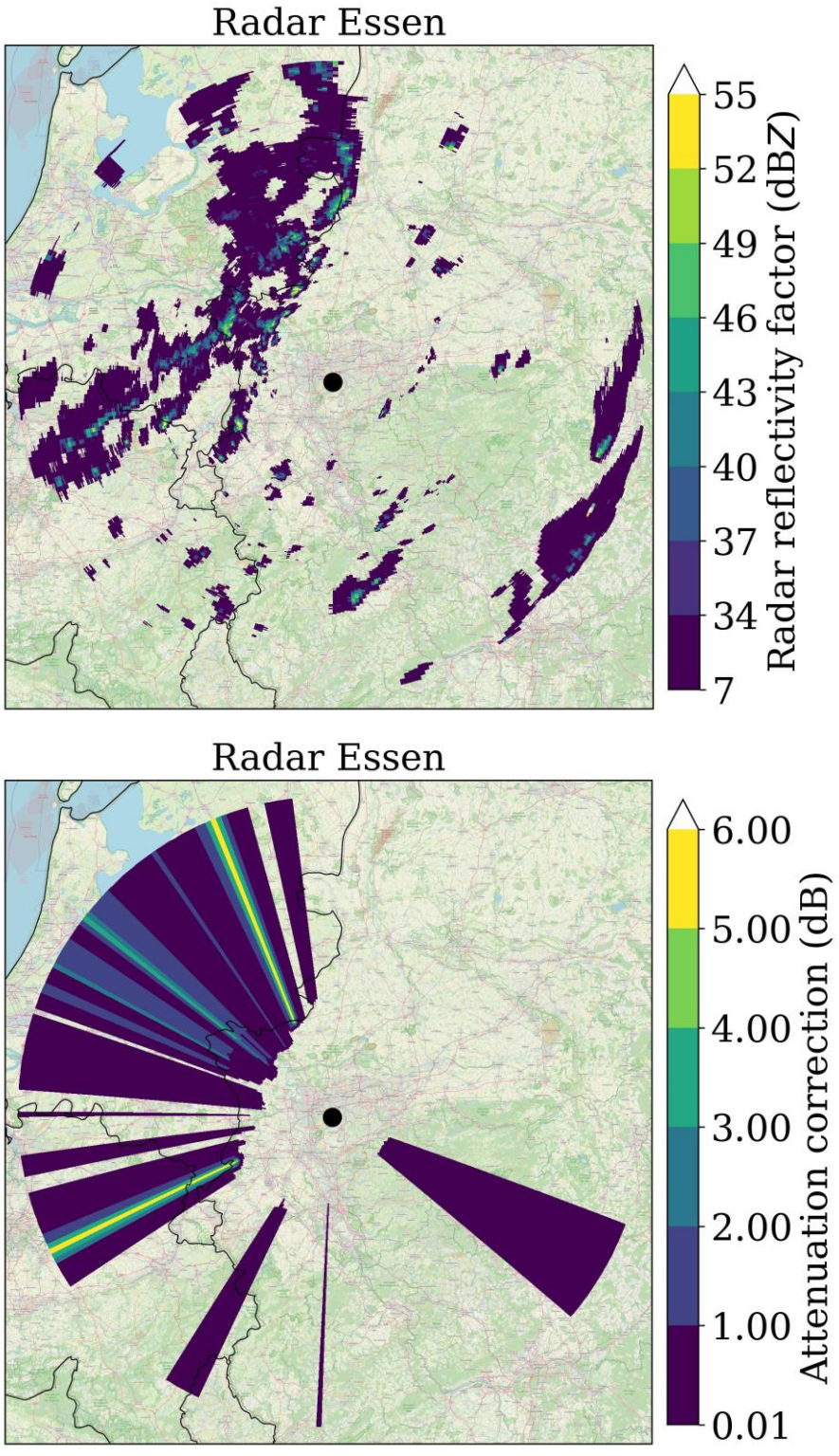


Based on the above reasoning, we added to the results section that already addressed the double attenuation correction (*italic font*):

3. **"Another explanation is that the German Weather Service has already corrected their radar data for attenuation, so it has been corrected for attenuation twice (although this also holds for the old product). This was not done on purpose, but only because it was assumed that attenuation correction had not been applied yet. Since its application was not mentioned in the metadata, this indicates the importance of provenance in radar metadata. *This double attenuation correction will likely result in overestimation in case of (strong) convective rainfall. The overall effect is expected to be limited, mainly because the contribution to the composite of pixels that have undergone relatively strong attenuation correction is limited due to the reduction of the quality index associated with attenuation correction (Eq. A4).*"**

We assessed the influence of the double attenuation correction for a convective case study employing the horizontally polarized reflectivity factor data from the 0.5-degree elevation scan of the German radar in Essen (top panel, the already attenuation corrected data as obtained from DWD, so without the double attenuation correction). For some azimuths high values for the attenuation

correction are found (bottom panel), implying that the Essen radar data overestimates precipitation by a factor of up to 2.4 (corresponding to a 6 dB overestimate; using the Marshall-Palmer Z-R relation), but that it will receive a much lower weight (0.06 for a 6 dB attenuation correction; see figure above) in the composite for these regions.



Finally, we are planning to update the metadata on the KNMI Data Platform to mention the double attenuation correction.

Bibliography

Hitschfeld, W., and J. Bordan, 1954: Errors inherent in the radar measurement of rainfall at attenuating wavelengths. *J. Meteor.*, *11*, 58–67, https://doi.org/10.1175/1520-0469(1954)011<0058:EIITRM>2.0.CO;2.

Overeem, A., H. de Vries, H. Al Sakka, R. Uijlenhoet, and H. Leijnse, 2021: Rainfall-Induced Attenuation Correction for Two Operational Dual-Polarization C-Band Radars in the Netherlands. *J. Atmos. Oceanic Technol.*, 38, 1125–1142, https://doi.org/10.1175/JTECH-D-20-0113.1.