Response to RC1 of amt-2024-19

We want to thank the first referee of our paper for the review and comments.

The reviewer posed the following question:

This is very nice but ignores the fact that the clouds are convective, and the vertical growth rate of the clouds can be in the order of half of the horizontal wind speed of 7 m/s in this case. An interesting question is to what extent can the remaining error be caused by the cloud's vertical growth rate?

From a theoretical point of view, one could expect that neglecting the vertical wind speed in our consideration could explain parts of the determined uncertainty. For example, a vertical growing cloud with a growth rate of 3-4 m/s could lead to a height difference of 60 – 80 m within 20 images, which is the maximum number of frames taken into account by the stereographic reconstruction method for a single point. Hence, this could lead to "errors" in the estimation of the cloud top height of 30 – 40 m when compared to the beginning or the end of the tracking time. Here, one can ask the question what the true "cloud top height" actually is. In our model study, we chose to compare to the cloud top heights after half of the simulation time such that this effect should cancel out.

One can further argue that clouds are turbulent. In particular, the cloud edges of shallow cumulus clouds show turbulent eddies and hence, usually up- and downward movements. Thus, one probably does not observe purely growing/shrinking clouds, which will cancel out the described effect.

As described in Sec. 4 l. 154f., a large part of the uncertainty might be explained by small uncertainties in the viewing angles of the camera. This effect dominates over errors made by not considering the vertical wind.

Finally, we performed a simulation without any cloud development, and hence no wind movement (Volkmer et al., 2024, https://doi.org/10.5194/amt-17-1703-2024). We found an uncertainty of about (46 ± 140) m, which thus is in the same order as with the wind movement. We added the following paragraph from l. 155f.:

"One possible error source, the evolution of the observed clouds, has been studied by Volkmer et al. (2023b), using a similar setup as described above but with non-developing and non-moving clouds. Hereby, an absolute mean bias of (46 ± 140) m was found. While the larger mean bias might be explained by a remaining uncertainty in the wind estimation and a cancellation of the error sources, the standard deviation and hence, the error of the single measurement, remains approximately constant."

A missing number is the simulated flight height above the simulated cloud.

We added the missing simulated flight altitude at the beginning of Sec. 4 in line 130: "A flight altitude of 10 km was assumed."