**Review of "A new approach to estimate supersaturation fluctuations in stratocumulus cloud using ground-based remote sensing measurements" by Yang et al. (amt-2019-222)**

The manuscript describes a new approach to retrieve in-cloud water vapor supersaturations based on radar and lidar measurements. The approach is applied to data of the ACE-ENA field campaign, including a comparison with in-situ measurements and an assessment of uncertainties. The manuscript is overall interesting, well-written, and I support its publication in Atmospheric Measurement Techniques once my minor concerns are addressed.

**Minor Comments**

P. 1, l. 13: The supersaturation in clouds does not only depend on the updraft velocity of a cloud (to which "calm" and "energetic" most likely refer to) but also on the cloud microphysical composition (see, e.g., Grabowski and Wang (2013, doi: 10.1146/annurev-fluid-011212-140750)).

P. 2, ll. 1 – 2: The adverb "simultaneously" describes a process happening at the same time. It is, however, also important that the measurements are co-located in physical space.

P. 2, ll. 11 – 12: It is misleading to write about a specific location of the effective *s* determined by the CDNC closure method ("*s* in the CCN counter"). To my understanding, the *s* describes the maximum *s* at cloud base where it is able to activate the number of CCN that are measured in the CCN counter.

P. 2, ll. 19 – 21: Since Eq. 2 is not an integral, changes in the microphysical composition in time and space are not important. However, I agree that once Eq. 2 is applied to a larger volume (i.e., it is integrated), changes in the microphysical composition will matter, especially if they are **<u>fast</u>** as it is the case for small $N_d$ and large *w* as stated correctly by the authors. Therefore, the sentence should read as: "[…] for which the time scale for the change of cloud microphysical properties is **<u>shorter</u>** than the time scale for the change of environmental conditions."

P. 3, Eq. 4: It might be helpful to give the reader a hint on why one can neglect the time dependency of *f(r)* during integration (although it becomes apparent after some thinking).

P. 3, Eq. 8: By restricting the temporal change of *LWC* to changes in height and then vertical velocity (Eq. 8), other important processes affecting the supersaturation (foremost entrainment and mixing processes) are neglected. I believe that this simplification is valid in stratocumulus, in which entrainment and mixing are less important than in cumulus clouds. And in fact, the authors have chosen a relatively low turbulent stratocumulus cloud (p. 4, ll. 19 – 20) in which the inherent assumptions of Eq. 8 are probably fulfilled. However, I strongly recommend the authors to comment more on the implications of Eq. 8, especially the neglected cloud processes, to account for potential other applications of this approach.

P. 5, l. 8: It probably will not change the results significantly, but why do the authors not assume a Weibull distribution here (as done in Sec. 2)?

P. 8, l. 7: *s* fluctuations at the cloud base could also arise from changes in cloud base height, and therefore differences in thermodynamics and not turbulence.

P. 9, ll. 4 – 5, "[…] large drizzle and raindrops which are abundant in marine stratocumulus clouds […]": This means that all marine stratocumulus clouds are drizzling or raining which is not true. In fact, the authors state that the analyzed stratocumulus cloud does not precipitate (p. 4, ll. 18 – 20).

P. 12, Eqs. A2, A3, A4: There are some typos in the equations. Check Korolev and Mazin (2003, doi:10.1175/1520-0469(2003)060<2957:SOWVIC>2.0.CO;2) for details. Please also check if these errors affected the results of the manuscript. I state the corrected equations below (changes are highlighted in red):

$$Q_1 = \left(\frac{M_w}{M_a}\frac{l_v}{c_p T} - 1\right)\frac{M_a g}{RT}$$

$$Q_2 = \frac{M_w l_v^2}{M_a c_p p T} + \frac{RT}{M_w e_s}$$

$$G = \left[\frac{\rho_l RT}{M_w D_v e_s} + \frac{\rho_l l_v M_w}{k_v T}\left(\frac{l_v}{RT} - 1\right)\right]^{-1}$$

**Technical Comments**

P. 3, l. 1: It should read "k-th" or "$k^{th}$", but not "$k_{th}$".

P. 3, Eq. 8: The equation should read: $\frac{d lnLWC}{dt} = \frac{\partial lnLWC}{\partial z}\frac{dz}{dt} = w\frac{\partial lnLWC}{\partial z}$, with a total derivative of *z.*

P. 7, l. 8: The flight was probably at 1.471 $\pm$ 0.004 **k**m above sea level and not 1.471 $\pm$ 0.004 m.

P. 11, l. 7: Add parentheses to all squared percentage values, e.g., $(20\ \%)^2$.