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Interactive Comment

Interactive comment on "Aerosols-cloud microphysics-thermodynamics-turbulence: evaluating supersaturation in a marine stratocumulus cloud" *by* F. Ditas et al.

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First of all we want to thank both reviewers for their helpful comments and their positive evaluations of this work.

1) median vs. mean droplet number concentration

The reviewers are right that we did not use median and mean droplet number concentration consistently. In this work, we use exclusively median droplet number concentrations and unified all mentioned statements. Additionally, we used the standard deviation in combination with the mean droplet concentration on page 29783. Instead, we now use the median concentration (464 cm^{-3}) with an interquartile spread of 180 cm^{-3}.

2) physical meaning of 50% activation diameter

If we had a single updraft and perfect homogeneous aerosol composition we would expect a step function for the activated fraction. As discussed in the paper this is not the case. To find a meaningful value for the activation diameter we chose the diameter where the activated fraction is 0.5. This definition is meant to characterize the typical diameter and does not have any special meaning otherwise.

3) collocated temperature and humidity measurements

We missed including information about the collocated temperature and humidity measurements on ACTOS. The derived supersaturation fluctuations in section 4.2 are based on measurements by an ultra-fast thermometer (UFT) and infra-red absorption hygrometer as described in Siebert et al. 2006. Both instruments are located in the outrigger of ACTOS. The longitudinal separation between both sensors was considered before combining the two measurements.

We added following sentences at the end of paragraph 2.2: "Temperature and humidity measurements at cloud base were performed by an ultra-fast thermometer (UFT) and an infra-red absorption hygrometer, respectively (Siebert et al., 2006). Both sensors are located in the frontal outrigger of the measurement platform."

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Furthermore, we change the sentence "We derive rh from temperature and..." into "We derive rh from collocated temperature..." (section 4.2, line 23)

Following sentence was added in section 4.2 line 25: "The longitudinal separation between both sensors was considered before combining the two measurements."

4) discussion on time scales in section 4.3

Referee 1 suggested that we clarify our discussions on time scales in section 4.3. Basically, we use Taylors frozen flow hypothesis (Taylor, 1938) to convert measured time series of wind velocity ($w(t)$) with a moving probe into $w(x)$ taking into account the motion of the measurement platform. The spatial distribution of vertical wind velocity ($w(x)$) is then used as input to drive the cloud microphysical model in a Lagrangian reference frame. This is applicable since the probability density functions (pdf) of "one-point one-time" velocity fluctuations (Eulerian reference frame) can be taken as equivalent to Lagrangian velocity fluctuations (see e.g., Pope, 2000, p. 483). We realized this concept by comparing two different time scales: i) the time $\mathcal{T}$ ACTOS needs to pass an eddy of typical size L and ii) the typical eddy turn-over time τ_{eddy}, which describes the typical residence time of an air parcel in the same eddy.

Instead of drawing a cartoon we have changed paragraph 3 of section 6.3 in the following way:

"Basically, with this approach we compare two different reference frames. We use Eulerian measurements to drive a spectral cloud microphysical parcel model in a Lagrangian reference frame. In principle, the conversion of measured time series of wind fluctuations into spatially resolved fluctuations is possible by using Taylors frozen flow hypothesis (Taylor, 1938). Furthermore, for homogeneous turbulence the

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probability density functions (pdf) of "one-point one-time" velocity fluctuations (Eulerian reference frame) can be taken as equivalent to Lagrangian velocity fluctuations (see e.g., Pope, 2000, p. 483). Instead of multiplying the measured time series $w(t)$ with the true airspeed of the measurement platform to get $w(x)$ (Taylors frozen flow hypothesis) we considered the ratio of two different time scales: i) the time . . ." (line 23 on page 29788 follows)

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Siebert, H., Franke, H., Lehmann, K., Maser, R., Saw, E. W., Schell, D., Shaw, R. A., and Wendisch, M.: Probing finescale dynamics and microphysics of clouds with helicopter-borne measurements, B. Am. Meteorol. Soc., 87, 1727–1738, doi:10.1175/BAMS-87-12-1727, 2006.

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 29777, 2011.

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