We thank Reviewer #1 for his/her constructive comments. The main concern raised by the Reviewer was the lack of direct comparison of the results with observations. We will improve upon this to the extent allowed by the fact that comparing the results from the semi-idealized setup of UCLALES-SALSA with aircraft measurements, where conditions vary significantly even during a single flight leg, is not very straightforward. Below, we will list all of the Reviewer comments, followed by our response highlighted in *italics*

1) P2, L10: To help put the present model developments in context, are you able to point out any previous LES models that have developed similar aerosol-cloud couplings? The text only mentions that such aerosol-cloud schemes are sparse.

Aerosol-cloud interactions have been available also in previously published models, but the approach we take to describe the evolution of the aerosol size distribution for both activated and non-activated particles in a bin model is rather unique. To account for this comment, we will add further discussion and references on aerosol-cloud modeling frameworks of similar level of sophistication (e.g. the LIMA scheme; Vié et al., 2016). We will also implement the suggestions by Reviewer #2 concerning the same topic.

2) P3, L19: The sub-range indices 1a and 2a do not appear on Fig. 1 (only a and b are shown, not 1 and 2). Please check this on the figure and check the later references in this paragraph to 2a and 2b. The labels 1 and 2 are confusing because they do not appear on Fig. 1.

We will modify the figure according to the Reviewers suggestions.

3) P4, L3-4: One goal of this work is stated as 'to reproduce the evolution of the aerosol size distribution through cloud processing and wet scavenging by precipitation accurately'. Please consider whether the manuscript would be improved by showing aerosol size distributions. Figure 7 does show the time series of the number concentrations in each bin – would a size distribution figure for hours 0 and 8 be helpful to illustrate the changes? Also please consider showing observed size distributions to improve confidence in the simulations.

Figures showing the simulated size distributions as suggested by the Reviewer will be added. They show that the evolution of the dry as well as the total (activated+non-activated) aerosol size distributions remain consistent and robust with respect to the presented model processes. The initial aerosol conditions used in the model runs are based on the data given by Ackerman et al. 2009, which are somewhat idealized due to the high variability of the aerosol size distributions even within a flight leg.

4) P4, L8: 'defined to be parallel' – the meaning of this is not quite clear – please clarify.

The "parallel bins" in the text refer to setting the cloud droplet bin edges (according to the dry CCN size) identical to those in the corresponding non-activated aerosol bins. i.e. the bins are defined for same dry particle sizes. We have reiterated this in the manuscript.

5) P4, L9-11: ‘ This way, the properties of the aerosol size distribution are preserved upon cloud droplet activation, as well as evaporation of cloud droplet, though subject to the typical uncertainties inherent in the sectional approach’ – please consider rewording this sentence to clarify what is meant by ‘properties’.

We will reword “properties” as the shape of the distribution and number concentration of particles.

6) Section 2: Could equations be added to describe the key microphysical processes?

We will add equations for the key processes and also provide some further details about their implementation.

7) P5, L29: Please provide further details about the source for the coagulation kernels.

A reference for the source of the kernels will be added.

8) P5, L30-32: How is the dry size of the particle determined when the drizzle drop evaporates? Please clarify.

Upon evaporation of drizzle, the particle size is obtained by assuming that a single particle per droplet is released. The particle diameter is then the result from dividing the total aerosol mass with the bulk particle density. This will be stated more clearly in the text.

9) P8, L17: How do you define ‘deeper and more massive shallow convection elements’?

By the deeper elements we refer to the cumulus clouds occasionally arising from about 400 m height (about the decoupling inversion height), supported by the build-up of heat and moisture from the surface. A more detailed description will be given in the manuscript.

10) P8, L32-34: In comparing the LEV3 and LEV4 simulations, it would be helpful to have a clearer description of the parameterization of drizzle formation/loss in LEV3 (the default UCLALES configuration). Perhaps this could be added earlier on in the model description.

We will add a more detailed description of these processes for the default UCLALES.

11) Fig 4: Where is LEV3 on panel 4b?

The LEV3 (as in the default UCLALES) does not contain a description for aerosols (apart from the prescribed CCN concentration used to yield the number of cloud droplets). Therefore this cannot be added. The panel 4b serves the purpose of illustrating the abilities of UCLALES-SALSA. We will make a better note of this in the manuscript to avoid confusion.

12) P9, L33-35: How is scavenging treated in the below-cloud layers? Please consider adding this information.

Collision and collection processes are treated between all different particle and droplet classes using the coagulation equations. Upon collision between an aerosol particle and drizzle drop, the mass of the aerosol particle is moved to the drizzle bin in question. This will be elaborated on in the manuscript.

13) P10 L6: ‘lack of representation for aerosol scavenging’ – How is aerosol scavenging represented in LEV3? Consider adding this information earlier on in the text to help the reader in understanding these comparisons between the LEV3 and LEV4 simulations.

As stated in the response to comment No 11, LEV3 does not contain a representation for aerosols, and therefore the wet scavenging process is not represented by LEV3. This will be stated more clearly in the manuscript.

14) P10, L11-12: ‘LWP and rain water path show quite similar features as those obtained with a cloud system resolving model with interactive aerosols’ – Please state these ‘similar features’ more explicitly.

The results in the low aerosol cases of this paper showed a similar depletion of cloud water caused by aerosol scavenging and drizzle. We will explain this more clearly.

15) Section 3.2: This section includes a detailed discussion of the simulation results for the case DYCOMS-II flight RF02, which was a marine stratocumulus case that took place off the coast of California. Would there be observations available that could be explicitly compared to the simulation output presented here?

We will add flight-mean estimates of LWP and surface precipitation to Figures 3 and 4, respectively. It is shown that the model results fit the observed values quite well, given the assumptions used in the model runs. A more detailed discussion will be added to the manuscript.

16) P11, L22: Why was the drizzle formation switched off for this fog case?

Even though the drizzle formation was not explicitly used in these simulations, the fog droplets can grow freely, given the ambient conditions, and reach the size range when they begin to be removed by sedimentation. However, as stated also by Porson et al. (2011), the liquid water content remains relatively small, so explicit drizzle parameterization is not needed. We follow this notion to conform with their model setup.

17) P12, L19: Consider adding a table to describe the simulations A200, A400, A800 A400W.

We will add a table with the details of the simulation setups.

18) P13, L4-5: ‘These findings illustrate the ability of the UCLALES-SALSA to provide a realistic description of not only the thermodynamic and microphysical properties. . ..’ – Please consider if this statement would be better supported by explicitly showing model-observation comparisons in the manuscript.

Here, we refer to the results presented in Porson et al. (2011) and Price (2011). More elaborate discussion about comparing our model results with the afore mentioned data will be added to the manuscript.

19) P 13, L8-9 ‘growth rate is considerably lower than the observed’. . .‘see figure 5 in Porson et al., 2011’ – are there observations that could be explicitly shown here to help the reader understand these comparisons?

We will use the data on fog layer growth presented in Porson et al. (2011) based on tethered balloon measurements. The data points are added to our Figure 9.

20) P13, L21: ‘These results point towards the importance of detailed representation of the microphysical processes.’ This sentence does not appear to be finished – do you mean in cases of fog?

Yes, in this context we refer to the fog case. We will reword the sentence.

21) P13, L22: ‘UCLALES-SALSA does well’ – Are you able to quantify what is meant by ‘does well’?

This refers to the occurrence of the peak droplet number concentration mentioned in the next sentence. We will adjust the wording.

22) P13, L26 ‘UCLALES-SLASA also agrees well with observations’ – again please quantify what is meant by ‘agrees well’ and consider showing model-observation comparisons in the manuscript.

Again we refer to Porson et al. (2011) where it is shown that droplet concentrations between 20 and 60 cm-3 were measured for this forg case. The droplet concentrations in the experiment A400 fit to this range, except when the fog layer eventually transforms into a shallow cloud later in the morning. We will discuss this in more detail in the manuscript.

23) P13, L30: ‘a more detailed land surface scheme is needed’ – did you test any limiting cases?

No, we did not. The surface heat capacity was tuned to match the observed surface temperature, and the surface was assumed to be wet.

24) P14, L29-30 ‘very similar to the observations’. . ..’even more resembles the observed properties’ – Please consider showing these comparisons in the manuscript, likewise showing some model-observations comparisons would be helpful for understanding the model performance for the stratocumulus case.

Measured data is added to Figure 9 of the revised manuscript for fog layer growth (comment #19). Moreover, observed estimates of LWP and surface precipitation are now shown in Figures 3 and 4 (comment #15).

25) P14, L29: If a realistic wind profile improved the model-measurement agreement – why was the case with winds not used as a default? Did you test A200W and A800W?

We wouldn’t consider the no-wind simulations as the “default”. Instead, they were considered first, because such a simple setup allows us to demonstrate the effect of aerosols specifically, which we are most interested in. With a realistic wind profile, the simulations were performed also with other aerosol

concentrations. However, the mixing caused by wind shear dominates the growth rate of the fog layer over the initial aerosol concentration. Moreover, supersaturation inside the fog is also strongly affected by mixing, which makes the differences in fog droplet concentrations less clearly defined between the different aerosol concentrations.

Technical corrections:

1) P2,L10: Do you mean ‘of’ instead of ‘off’? *- Corrected*
C42) P5, L20: ‘Evolution of the drizzle droplet population’ – should this read drizzle/rain since the upper diameter limit is 2mm? *- Done.*
3) Fig. 3a: Should HI be removed from the legend? *- Done.*
4) P12, L27: Do you mean Fig 8 as opposed to Fig. 9? *- No, Fig 9 is correct.*
5) P12, L31: Consider starting a new paragraph with the start of the Fig. 11 discussion. *- Done.*
6) P13, L13: Do you mean Fig. 9 as opposed to Fig. 10? There is no dashed line on Fig. 9. *- Corrected.*
7) Fig. 1: What is the meaning of the light blue arrows on the dark blue for the drizzle rain bins? What is the size range for the cloud droplets? *– They were to represent the rain drop growth, but indeed might be misleading. They are removed. Size range is added.*
8) Fig 2: Could g kgˆ-1 be placed beside the color bar? *- Done.*
9) Fig 3: Could drizzle be added to the title of panel b? Also, please check legend for error in simulation names. *- Done.*
10) Fig 7: Please check units on the legend – did you mean m? *- Yes, corrected.*