We thank the reviewer for his thoughtful comments and suggestions to improve the manuscript. Our responses immediately follow each reviewer comment numbered in order from 1-9.

1. In Section 2.1, it is stated that the analysis is restricted to clouds that exhibit lifetimes between 15 – 45 min. What fraction of the clouds are incorporated in the analysis, say, as defined by domain integrated LWP?

Response: In the text we previously referred the reader to Jiang et al. (2010) who present an in-depth discussion of the areal and lifetime statistics of clouds in the LES simulations. But to be more clear in the revised draft, we add an estimate of the fraction of clouds represented by the 15-45 min lifetime range (~ 30%). We explicitly refer the reader to Figure 4 in Jiang et al. (2010), as this figure plots the frequency of lifetimes for both simulations examined, and we also add text to clarify the rationale of choosing clouds within this range of lifetime.

The text added specifically states the following:
"The analysis is restricted to clouds that exhibit lifetimes between 15-45 minutes (~30% of clouds in each simulation), as these clouds reach sufficiently high LWP values to be classified as clouds and this discrimination also eliminated cases of merging clouds. Extensive details on lifetime and areal extent statistics for the entire cloud population are provided by Jiang et al. (2010; refer to their Figure 4)."

2. In Section 2.1 it is also stated that "Merging and non-precipitating clouds ($R<0.5$ mm day^{-1}) are excluded in the analysis". But this introduces a bias of incorporating the rare clouds with small effective radius that do precipitate, and excluding most of the low effective radius clouds that do no precipitate. This, in turn, causes an underestimate of the susceptibility. I understand the difficulty of including zero in the logarithmic conversion for the definition of the susceptibility. Work around could be another formulation of linear nature, or a shift in the logarithmic scale, where, say, 0.3 mm hr^{-1} is added to R, so that zero rain intensity would be R=0.3. See example in Eq. 2 of Nirel and Rosenfeld, 1995.

Response: The reviewer raises some interesting points. First, we clarify here that we tried to keep our analysis similar to Jiang et al. (2010) who used a minimum R value of 0.5 mm day^{-1}. However, in response to the reviewer's suggestion, we refer to a sensitivity analysis they conducted to obtain the value of β in the power law relating R to N_d and LWP:

$$R \sim LWP^{\alpha} N_d^{\beta}$$

where β is equivalent to S_o at fixed LWP. They showed that by lowering the lower R limit from 0.5 mm day^{-1} to 0.1 mm day^{-1}, that the value of β changed from -1.15 to -1.46. Therefore the higher R threshold yields an underestimate of the susceptibility as the reviewer suggested, and we make this clear in the text. We do not see the need for a logarithmic shift in the scale to account for negligible rainrates because we are always dealing with finite values of R for which we can take the logarithm. For example, even the negligible amount of 0.001 mm/hr yields a manageable value of "ln R = -7". We now add text to state that LES results for S_o and χ vary depending on the choice of the lower limit of R. We specifically add the following text:

"An important note is that the choice of the minimum rain rate can alter the absolute value of S_o and χ. The analysis with LES data was limited to R > 0.5 mm h^{-1} and this discrimination removes clouds with small drop effective radii that do not precipitate. Jiang et al. (2010) showed that lowering the R threshold value from 0.5 mm day^{-1} to 0.1 mm day^{-1} results in a change absolute value of x_2 in Eqn. 1 from -1.15 to -1.46, which is equivalent to an increase in S_o at fixed LWP. This is because the higher minimum R threshold removes more low-precipitation data points for polluted clouds relative to clean clouds, thereby reducing the slopes used to calculate S_o and χ as shown in Figure 1. Therefore, the choice of the minimum R threshold is important when comparing values of S_o and χ between studies as the analysis with LES shows that these values may tend to be lower when higher minimum R threshold values are applied."

3. The merging clouds are excluded in the analysis. Is the relation between rain and cloud microstructure there fundamentally different, or is it just because of some other difficulties? Either way, the reason and physical ramifications have to be given.

Response: Merging clouds are of great interest but they complicate the analysis by providing the equivalent of an abrupt perturbation to the microphysics of any individual cloud. For example, the maximum drop effective radius and precipitation rate of the newly merged clouds typically increase between a factor of two and four when compared to the original clouds prior to merging. Also, the relationship between rain rate and cloud microstructure is significantly altered in the merged clouds; for example, the value of R and r_e relative to N_d is much higher after merging occurs. The process of drop accretion becomes dominant during the merging, resulting in significantly larger r_e values. We now state in the text that we excluded merging clouds in the analysis because these cases are not representative of the microphysical evolution of single warm clouds.

We add the following text:
"Merging and non-precipitating ($R < 0.5$ mm day^{-1}) clouds are excluded in the analysis, to be consistent with the analysis of Jiang et al. (2010). Merging events are of great interest but significantly complicate the analysis because they provide the equivalent of a strong perturbation to the evolution of the microphysical and dynamical state of the individual clouds entering the merger. The cloud microphysical properties following a merging event change significantly as compared to the original clouds and therefore are not representative of the microphysical evolution of single clouds. For example, the maximum drop effective radius and precipitation rate of the newly merged clouds typically increase between a factor of two and four when compared to the original clouds prior to merging, predominantly owing to an acceleration in drop accretion. To avoid this complexity, we focus on the evolution of individual clouds."

4. What is the way by which the different resolutions are tested? Are the clouds being tracked and then analyzed independently based on the three resolutions?

Response: Yes, the clouds are tracked individually and then analyzed independently based on the three resolutions. The highest resolution among these three categories (0.3 x 0.3 km) is centered around the maximum LWP, and extended outward for the lower resolutions. We have added text to clarify this issue.

We add the following text:
"Individual clouds were manually tracked over the course of their lifetime, where a cloud is defined as having an average LWP exceeding 20 g m^{-2} and a minimum size of 0.3 km x 0.3 km."

"At each minute of a cloud's life the values of LWP, cloud-top drop effective radius ($r_{e,top}$), , column-maximum drop effective radius ($r_{e,max}$), column-maximum cloud drop concentration ($N_{d,max}$), and column-maximum precipitation rate (R_{max}) are calculated. These values are then averaged over three different spatial resolutions (0.3 km x 0.3 km, 0.5 km x 0.5 km, and 0.7 km x 0.7 km) at each sampling time. The highest resolution among these three resolutions (0.3 km x 0.3 km) is centered around the maximum LWP, and extended outward for the lower resolutions. Note that some clouds were not sufficiently large to allow averages over the larger spatial areas."

5. Page 29903, line 13: The text reads: "LWP is quantified as the vertical integration of the liquid water content measured by a PVM-100 probe". How is the vertical integration of LWP of the aircraft-measured cloud being done with measuring cloud drop liquid water content and effective radius at a single height, or at most three levels that are not exactly above each other in the same cloud? Some assumptions must have been made here. Please provide the way that the vertically integrated liquid water content is being calculated.

Response: The reviewer raises an important comment about clarifying assumptions used in calculation of LWP. We also respond to comment #9 here as well, as the reviewer asks how the column-integrated r_e and N_d are calculated. We add the following text to clarify this issue:

"LWP is quantified as the vertical integration of the liquid water content (LWC) measured by a PVM-100 probe (Gerber et al., 1994) during slant ascents and descents through the cloud decks. Depending on the spatial variability in the cloud, these will deviate from true profiles. Column-integrated values of r_e, N_d, and R are calculated using the slant ascent data as well. We assume that these data are representative of the profiles over a larger-scale cloud area defined by the level legs. The mean percentage difference for LWC, r_e, N_d, and R values between level legs in cloud and at the same altitude during the selected slant ascent/descent are less than 18%."

6. Page 29904, line 4: Please define LTSS and its units, because LTSS is used quantitatively later in the manuscript.

Response: We have added text to define LTSS: "LTSS (^{o} C) is defined as the potential temperature difference between 700 hPa and 1000 hPa."

7. Page 29904, line 25: From what height is the effective radius taken?

Response: The effective radius used from the LES output is the maximum value in a particular column in a cloud. Owing to the extensive amount of model output used and the large amount of clouds studied, it is difficult to identify a representative height that the effective radii were obtained, especially as this may depend on the lifetime of a cloud and state of precipitation in the cloud. Therefore, we cannot provide a straightforward answer to this question other than to note to the reviewer that the height of the maximum effective radius varies depending on various factors.

To clarify that we use the maximum r_e in the column we now write:

"At each minute of a cloud's life the values of LWP, cloud-top drop effective radius ($r_{e,top}$), , column-maximum drop effective radius ($r_{e,max}$), column-maximum cloud drop concentration ($N_{d,max}$), and column-maximum precipitation rate (R_{max}) are calculated."

8. Section 3.2: Please explain why lowering the resolution lowers the LWP values for the maximum susceptibility.

Response: We add text to address this issue. Specifically, we state that "The mean LWP is reduced at lower resolution while values of χ and S_o are preserved to a greater extent since r_e, R, and N_d are influenced to similar degrees."

9. Page 29907, line 4: Again, how is the "column-integrated in-cloud value" calculated?

Response: Refer to our response to Comment #5.