Response to Reviewer #1's Comments:

Jiming Li et al. (Author)

We are very grateful for the Review #1's detailed comments and suggestions, which help us to improve this paper significantly. We made some revisions based on two reviewers' comments. The detailed information includes:

(1) Some grammatical errors and inaccurate statements already were corrected in the revision and the paper also be edited by the nature language editing service to make it more readable.

(2) Based on the reviewer #2's suggestion, we restart this investigation using only nighttime data to avoid artifacts due to noise from scattering of sunlight, thus some statistical results are different from original version. But, it is noting that different result does not mean that original conclusions are wrong.

As stated by reviewer #2, the inconsistency is because that our results are based on the day+night time data, whereas the studies from Cesana et al. (2015; 2016) only used the nighttime cloud phase. Indeed, it is well known that strong solar noise can contaminate the lidar signal during daytime and cause the uncertainty of cloud phase product. In the previous versions of our paper (Line 285-295), we also emphasized that "to avoid artifacts due to noise from scattering of sunlight, it is better to conduct the CALIOP retrieval during nighttime. However, in view of the lack of CALIPSO observations at high latitudes of the northern Hemisphere during boreal summer nights, this study utilizes the mean values of SCFs, meteorological parameters and RAFs during daytime and nighttime to perform the temporal and spatial correlations analysis". However, Sassen et al. (2008) have pointed out that the effect of CALIOP signal noise from scattered sunlight only can cause a small part uncertainty of the observed day–night variations in cirrus. The diurnal cirrus patterns mostly still reflect real cloud processes (Sassen et al., 2009). Based on their conclusions, we possible infer that the obvious different patterns of SCF during day- and night-time can't be fully attributed to solar noise signature. However, to minimize the impact of SCF during daytime due to solar noise signature on the statistical results, we followed the suggestion from reviewer#2 to perform same analysis by using the nighttime only data in the revised paper.

Special responses:

(1) Lines 70-73: There needs to be a reference after this statement, e.g…

Response: we already added the related references after this statement.

(2)**Lines 116-118: I know what the authors are saying here, but this needs to be more thoroughly explained to a reader who is not familiar with this study.**

Response: We already re-organized this sentence and make it more readable.

(3) **Section 3.2: I appreciate the explanations provided by the authors, but this section is not well-organized and needs to be re-written for the sake of the read.**

Response: We already revised this section in the revised paper.

(4) Figure 11 and lines 547-556: Coming back to this, the original results combining the two hemispheres shown in the second round of revisions (originally d to f) should be shown here instead of the results separating the southern hemisphere (new figures g to i), the reason being that the southern hemisphere has far fewer aerosols compared to the northern hemisphere. Thus, just as how the correlations weaken or even vanish at colder temperatures as the authors have shown, the correlations between SCFs and aerosol frequencies are less likely to be statistically significant in the southern hemisphere, as the authors have already pointed out on lines 552-553 (the confidence level was reduced). It would therefore be more appropriate to show the more statistically robust results shown in the original Figure 11 instead of the less statistically robust results presented in the current version of the manuscript. Moreover, the fact that the aerosol product used in this study was the Level 2 product, which does not have the additional level of screening that the Level 3 product that Tan et al. (2014) used, adds to the level of uncertainty.

Response: We appreciated the insightful suggestion from reviewer #1. Indeed, the southern hemisphere and tropics have far fewer aerosols compared to the northern hemisphere. Thus, the correlations between SCFs and aerosol frequencies are less likely to be statistically significant in the southern hemisphere and tropics. In the revised paper, we only presented the global results by combining the two hemispheres. The statistical

results show that the impact of aerosol on the SCFs is obvious at a global scale and a fixed isotherm (such as, -20 ℃). That is, the SCFs almost decrease with increasing RAF (please section 3.3). In addition, we also agree the comment from reviewer #1: “the aerosol product used in this study was the Level 2 product, which does not have the additional level of screening that the Level 3 product that Tan et al. (2014) used, adds to the level of uncertainty”. But, by performing same correlation analysis with Level 3 aerosol product in the second round of revisions, we found the results are similar.