

## ***Interactive comment on “Arctic aerosol net indirect effects on thin, mid-altitude, liquid-bearing clouds” by Lauren M. Zamora et al.***

**Anonymous Referee #2**

Received and published: 25 January 2017

General comments: This manuscript by Zamora et al. presents an extensive study of thin liquid clouds over the Arctic and how these are affected by aerosol loading. The study combines satellite data from CALIPSO and CloudSat with FLEXPART modeling and aircraft measurements to better distinguish to which degree that the clouds were affected by aerosols. The study is limited to nighttime thin clouds between 1 and 8 km height and an estimation of the radiative impact of these clouds is provided. The manuscript is well written and contains detailed discussions regarding the uncertainties in the method and results. I recommend that the manuscript be published after answers to the following comments have been provided.

Specific comments: The study only includes nighttime clouds that have an COD < 3 and that are liquid. For the clouds to be included in the study they also must have an altitude between 1 and 8 km. In the methods section there are detailed descriptions of removal

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of data due to several other criteria considering confidence in data etc. My question is how representative the clouds included in the study are for the general conditions in the Arctic. Could you provide an estimate of how common these liquid clouds are? If the clouds in this study represents the conditions during 80% of the time or 20% of the time makes a big difference. I believe that the second sentence in the abstract may be a bit bold if it turns out that these clouds are not very common in the Arctic.

The description of the data selections is very well written and detailed. However, it would be nice to know approximately how much data are lost at each step in the selection process.

Page 4, line 11: There are large land areas in parts of the described regions. Were these removed from the dataset?

Page 4, line 22: Were all the cases averaged to 80km resolution or do the different cases have different resolutions?

Page 7, line 9: Why is data 10 degrees further south than the satellite data included in the comparison?

Page 15, line 12: In the calculations of the indirect radiative effect of aerosols on MOONLiT clouds you write that you use the clean background cloud subset. Previously in the method you write that the parameters used in the calculations are cloud base height, cloud thickness and COD. For the cases over sea ice the COD is the same for the clean background and all cases datasets which means that the differences in the radiative effects is due to the difference in cloud base height (1.8 km vs. 1.9 km) and the difference in the cloud thickness (0.9 km vs 1.2 km). Did I understand this correctly? Could you comment on this?

Figure text figure 3: “where a value of 0 indicates that the ocean surface was the next lowest feature”. Does ocean surface here also mean sea ice?

Technical corrections:

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Page 12, line 7: optical thickness should be changed to COD.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2016-1037, 2016.

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