

Interactive comment on “Retrieval of ice nucleating particle concentrations from lidar observations: Comparison with airborne in-situ measurements from UAVs” by Eleni Marinou et al.

Anonymous Referee #2

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This study introduces a new methodology for detecting INP, which combines several information sources: the INP concentration profiles derived by lidar measurements; their comparison with UAVs measurements, and use of INP parameterizations for different freezing mechanisms. Necessary thermodynamic parameters are obtained from an atmospheric model.

The proposed approach contributes to better understanding of the complex process of cold cloud formation - one of the emerging issues attracting substantial attention of the scientific community. The article's subject is clearly presented with conclusions of high scientific relevance. It is well structured and provides detailed evidence on the IN

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subject published in the community. However, in order to more improve the quality of the paper, I invite the authors to consider the following recommendations, comments and questions prior to the publication of the article:

Section 4 Results and discussion is the most important part of the paper which describes in details the evaluated results of the study. Figure 4 is excellent way to introduce a reader, in general, on considered processes (aerosol, clouds) over the selected observation period. After presenting evaluation of n250 and nINP retrievals (4.1 and 4.2 sub-sessions), Figure 10 is summarizing the major results of the proposed methodology. However, I find it not sufficient to promote the full value of the study. Namely, the figure shows INPs for only two instances of the 2-day selected period. From the figure, it is not possible to have evidence on the INP time evolution over the period, and also to conclude how INP correlates to cloud observations. I therefore ask the authors to generate a time-height INP graph (of a similar format as the one in Figure 4). For this additional result, PollyXT data should be adjusted to the time/height output of the WRF thermodynamic parameters. Consider also to compare the evaluated results with some satellite relevant cloud-related data such as e.g. ice water path, in order to show if the proposed method indicates the occurrence of cold clouds.

There are few minor issues to be also considered:

I suggest the following more concise article title: Retrieval of ice nucleating particle concentrations from lidar observations and comparison with UAVs measurements

Please provide more details on the WRF model data used to complement the observations: reference; resolution; source of the data; are the model temperature and humidity both used in the calculations?

P9 L22-23: 'Figure 4 provides an overview of the times and heights of the PollyXT and CALIPSO lidar measurements, along with the UAV measurements, between 20 and 22 April 2016'. What are the arguments that this particular period of observations is selected for detailed analysis but not some other similar ones during the April campaign?

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What is the acronym OPC?

P10 L21: It should be useful to also show the volume depolarization ratio image.

Figure 4: Please include date markers on the x-axis (together with corresponding times)

Figure 1 (left) Why D15-dust is shown for $T > -18\text{C}$ which is out of the validity range of this parameterization? Similar done for U17. Are the dashed lines extrapolations of D15 and U17? Please comment in the text.

Specify what are continental aerosols Figure 3: Include please a reference for the selected bimodal distribution, if any

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-1203>, 2018.