Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Meteorological and cloud conditions during the Arctic Ocean 2018 expedition" *by* Jutta Vüllers et al.

Anonymous Referee #2

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This manuscript describes shipborne and ice pack observations taken during the AO2018 expedition in the Arctic Ocean. High-level motivating factors for this deployment and instrumentation are described. General results from the campaign are also provided that summarize overall atmospheric state, near-surface energy exchanges, and cloud-related properties (composition, occurrence, and macrophysical properties). Special attention is given to low-level thermodynamic properties that are especially important in the Arctic environment. Gross comparisons between the current study and previous Arctic observations are also provided for necessary context.

Overall, the manuscript provides valuable information that should appeal to a wide range of Arctic-centric researchers. It nicely describes the motivation for undertaking the AO2018 campaigns and conveys high-level results that are interesting and com-

pelling. The topic is also relevant for ACP. I encourage the authors to consider addressing the mostly minor clarifying issues outlined below. I look forward to seeing this manuscript published in ACP.

Note: I reviewed this manuscript with the expectation that its purpose is to first and foremost advertise the AO2018 field campaign. Its secondary purpose is to provide high-level, general results that illustrate the utility of the observations. I do not expect every outstanding Arctic-related scientific puzzle to be answered within this manuscript, but hope that it properly sets the stage for future research using this dataset and future observational campaigns.

********************* Specific Comments *********************

Introduction: Nicely done. The introduction properly motivates the AO2018 deployment within the broader context of Arctic research issues that still need to be addressed by the community. It is succinct, yet manages to provide ample background information. Reviews too often focus on items that should be changed or clarified, so I wanted to take the opportunity to express positive feedback regarding the introduction.

Lines 164-165: How is shortwave albedo quantitatively estimated using imagery?

Line 168 and Fig. 4: How is near-surface temperature defined? Is this 2-meter temperature, or some other level?

Sections 4.3 and 4.4: A few sentences could benefit from simple restructuring or key comma insertions to reduce run-on sentences. Similar minor issues also appeared in other sections, but can also be rectified during final editing processes. I wanted to mention them here, though, since I found them marginally distracting. A few examples are provided below.

Lines 232-233: "If no temperature inversion could be identified, the strongest stable layer..."

Lines 239-240: "...to the lowest measurement heights of the radiosonde (30m), it was

classified. . ."

Lines 257-258: A general question regarding Cloudnet and radars employed in this campaign. The authors mention that Cloudnet does not observe 49% of fog events since the first usable radar observation is about 150m above ground level (i.e., many fog events are very shallow). Does radar sensitivity also affect fog detection statistics? Stated another way, it would be nice for the authors to advertise instrument sensitivity somewhere in the manuscript (e.g., minimum radar detectable signal).

General Cloudnet question: I assume Cloudnet algorithms are only applied to scanning radar observations and not the Micro Rain Radar (MRR)? Depending on how the MRR is configured, it can provide valuable observations below 150 m. But MRR sensitivity probably will not detect fog and non-precipitating clouds.

Section 4.4: How are cloud phases determined? Combined radar-lidar observations? Radar only?

Lines 332-334 and a few other locations throughout the manuscript: I suggest economizing wording and removing nominalisations to improve readability. I definitely do not want to completely alter the authors' voice, but simple changes like the following will be impactful:

"Equivalent potential temperature profiles are strongly stratified in the lowest 150 m, ..."

Section 6: This is an important section. I found myself begging for comparisons to previous research when results were presented in earlier sections. In hindsight, though, I like how the authors refrained from comparing to previous studies until this discussion-like section. It serves as a nice overall summary that effectively complements the conclusions.

Conclusion: I like how the last paragraph begins, but I somehow feel that it ends in a disappointing fashion. It feels. . ..incomplete? I am not sure how to properly describe

it. Maybe ending with a strong statement about how observations can help answer the lingering question of increasing Arctic cyclone activity shown by reanalyses? Simply swapping the second and third sentences might help, with an appropriate bridge that connects the first and second sentences. Something like "For instance, reanalysis data indicates an increase. . . . . .". Then relate the observations from the current study and need for continued observations to definitively answer this outstanding scientific question. The manuscript will not suffer tremendously if the last paragraph is not altered, but I encourage the authors to concoct a more impactful ending paragraph.

Fig. 2: Suggest adding [hPA] units to colorbars or figure caption.

Fig. 3: Wind speed colorbar labels quite difficult to discern. Are the blue and red numbers located at regular grid intervals the surface temperature?

Fig. 4: Suggest adding "vertical dashed lines" to the last sentence of the caption to distinguish between horizontal dash-dot lines in a few of the figure panels. Also consider adding "(e.g., P1, P2, . . ., P8)" to the figure caption to explicitly advertise that these labels are associated with respective observational periods.

General Question: Is there any reason why precipitation statistics were not shown? I completely understand the need to draw a proverbial analysis line somewhere – every detail cannot be shown. But I am curious if precipitation statistics have been analysed or plan to be analysed in a separate study. At the very least, this topic could be added to the future research discussion in the conclusion.

General Question: Did this campaign encounter any specific measurement complications (e.g., instrument performance, logistics, etc.)? If yes, it would be great to briefly describe some of them to both advertise how difficult it is to operate shipborne instrumentation thousands of kilometers from population centers in a rather hostile environment and serve as valuable feedback for other researches that might consider adopting similar measurement techniques in future field campaigns.

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