Point-to-Point response to Reviewer #2

We thank the Reviewer for the constructive comments and suggestions, which helped to improve the manuscript. We have carefully considered all points raised and addressed them in the revised version of the manuscript. Below, we provide a point-by-point response to each comment and describe the corresponding revisions.

Kind regards,

Niklas Neckel

General Comments

***General comment 1**: I am thrilled to see the use of UAVs, as I wholeheartedly believe they will become a standard tool for sea-ice observations. The effort put into planning a photogrammetry flight over moving ice is incredibly relevant, and the use of moving GCPs is a solid approach. The paper would have a greater impact by emphasizing universal insights rather than focusing on the limitations of specific DJI products.*

Reply: we thank the reviewer for this positive comment. We are pleased that the reviewer recognizes the great potential of UAVs for sea-ice observations and appreciates our approach to plan photogrammetric grid surveys over drifting sea ice.

We agree that a more holistic perspective strengthens the manuscript and increases its relevance beyond a single UAV manufacturer. In response to this suggestion, we have revised the manuscript to place greater emphasis on general recommendations and best practices for UAV operations over drifting sea ice, including aspects of flight planning and post-processing. We now clearly distinguish platform-specific issues from generally applicable findings. Limitations and solutions that are specific to DJI systems are explicitly identified as such, while the broader lessons learned are presented in a platform-independent way.

Specific comments

***Title**: The title and the content don't match. The title is "Lessons Learned," but the valuable universal learnings are only single notes in the conclusion. The majority of the paper discusses planning and processing, with a disproportionate amount of text devoted to workarounds for the limitations of DJI products, which are constantly being updated and changed. The work is good, but it can be presented much better by focusing on what will remain after DJI decides to push a software update and by keeping the DJI workarounds grouped together. This way, when they inevitably change, the rest of the paper will still be useful.*

Reply: we thank the reviewer for this valuable suggestion. We agree that the manuscript should emphasize lessons that remain broadly applicable beyond a specific UAV platform. In response, we have revised the manuscript to more clearly distinguish between platform-specific issues and generally applicable recommendations and we have grouped DJI-specific limitations and workarounds accordingly.

While we appreciate the reviewer's suggestion regarding the title, we have decided to retain it. We believe that the planning, execution, and post-processing of UAV surveys are integral components of conducting UAV operations over drifting sea ice and therefore constitute essential "lessons learned" alongside the flight itself. Since manual UAV operation over drifting sea ice is comparatively straightforward, the principal challenges—and thus the key lessons—lie in the preparation and processing workflows. We hope that the revised manuscript now better reflects this broader interpretation of the title.

***DJI point 1**: Additionally, even though DJI leads the drone industry, there are other options, and using a different tool would have had a completely different impact on your experience. Even though I agree that the lessons about this particular equipment are crucial, they shouldn't take centre stage in the paper, even if they were the primary cause of the problems encountered.*

Reply: we agree with the reviewer's comment. In line with our responses to the previous comments, we have revised the manuscript to more clearly distinguish between the general challenges associated with UAV operations over drifting sea ice and issues that are specific to DJI platforms. While DJI is currently the leading UAV manufacturer and the platform used in our study, we have reduced the emphasis on manufacturer-specific aspects and focused the discussion on lessons that are broadly applicable. Nevertheless, we retain a concise discussion of DJI-specific issues where relevant, as these are likely to be useful to a large portion of the UAV research community.

***DJI point 2**: You should specifically call out the manufacturer DJI instead of "consumer drones as a whole," because you assessed the performance of only one option in the market segment. Rating consumer drones as a whole would be a different study entirely.*

Reply: we thank the reviewer for this valuable suggestion and agree with the point raised. Throughout the revised manuscript, we have replaced references to "consumer drones" with the specific manufacturer, DJI, wherever appropriate.

***Learnings**: Provide examples of good and bad environmental conditions, as many readers may not grasp the challenges posed by perfectly flat light on snow. After reading your conclusion, I feel it is missing a concise list of the learnings that the reader can take with them. An example could be a wishlist of features for a drone system for these conditions. Or a list of must-haves, etc. All the information is scattered around the paper.*
Reply: we thank the reviewer for these helpful suggestions. We agree that illustrative examples of favorable and unfavorable environmental conditions can help readers better appreciate the operational challenges associated with UAV deployments over snow and sea ice. To address this, we have added Figure 1 to the revised manuscript, which provides representative examples of different lighting conditions encountered during the ArcWatch-2 campaign.
We also appreciate the suggestion to provide a concise summary of the key practical takeaways. In response, we have included the recommended wishlist of desirable UAV system capabilities in the revised Discussion and Conclusions section. This list summarizes the main lessons learned and highlights the features we consider essential for successful UAV operations in Arctic sea-ice environments.

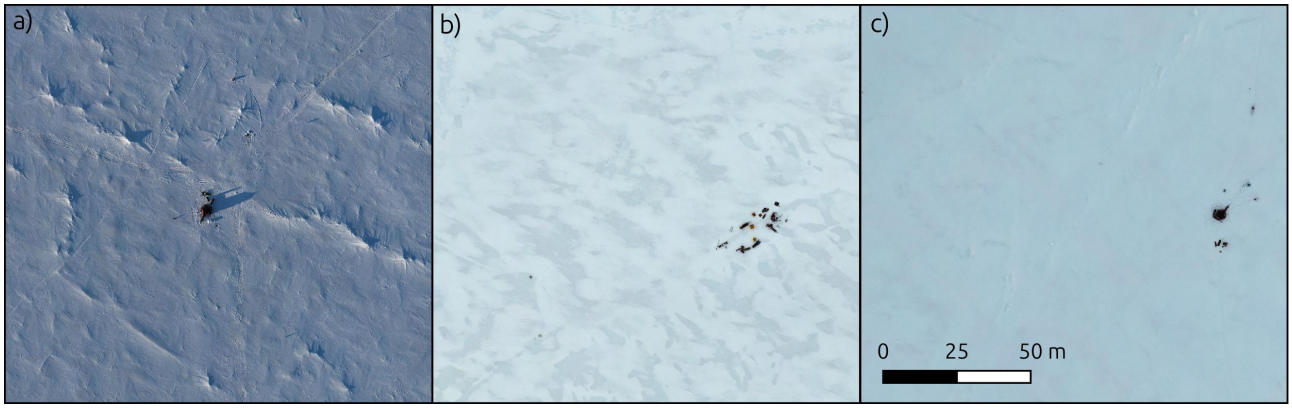

Figure 1: Varying lighting and surface conditions during ArcWatch-2. Excellent conditions on 2024-09-08 (ICE05, **a**) with direct sunlight illuminating a ridged surface. Moderate conditions on 2024-09-11 (ICE06, **b**) with a low cloud ceiling over a snow/ice surface. Poor conditions on 2024-09-13 (ICE07, **c**) with diffuse lighting over a uniform snow surface. All panels are shown at the same scale.

***Technical corrections**: The statement that "there is no commercial solution for operating UAV grid flight missions north of 85° N latitude" is incorrect; although few systems exist, some are much better than DJI in arctic conditions, so the claim is overly broad and unsupported.*
Reply: we thank the reviewer for raising this point. Prior to the ArcWatch-2 expedition, we conducted an extensive survey of commercially available UAV mission-planning software to identify solutions that fully support automated grid flight operations north of 85° N. Despite our efforts, including discussions with software providers such as UgCS, we were unable to identify a commercial solution that met these requirements. This limitation was one of the primary motivations for developing our own mission-planning approach.
That said, we acknowledge that our original statement was too broad and may not accurately reflect the current state of the market. We have therefore removed this claim from the revised manuscript. If the reviewer is aware of commercial solutions that support automated grid flight planning north of 85° N, we would be very interested to learn about them and would be happy to revise the manuscript accordingly.