UAV Photogrammetry During the 2020 SnowEX Campaign

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Introduction

UAVs have proven to be useful instruments platforms for snow research. Small commercial UAVs can be used to perform aerial surveys that create high resolution ortho graphic photos and digital elevation models of plots approximately 130 square meters. These surveys can be successfully conducted in a variety of terrain including both open prairie and forest.

During the SnowEX winter campaign in early 2020 several lidar plots were surveyed via small commercial UAV at the same time lidar scans were conducted by CRREL. Flights were conducted with both a DJI Phantom 4 and a DJI Mavic Pro 2 at 50 meters altitude resulting photographs are processed in software to produce end products such as orthographic photos, digital elevation models, and point clouds.

Figures 1 & 2

These two figures are for lidar plot FL2D. Flight data for this area was processed and used to produce the orthophoto (Figure 1) and the digital elevation model (Figure 2) shown here. Snow surface elevations are shown in Figure 2 for areas beneath the forest canopy. Bright blocks with higher elevations throughout the image represent elevations on the trees where the snow on the ground was unable to be imaged from overhead. Although this area is dominated by large trees, the snow surface elevations are resolved at a high rate.
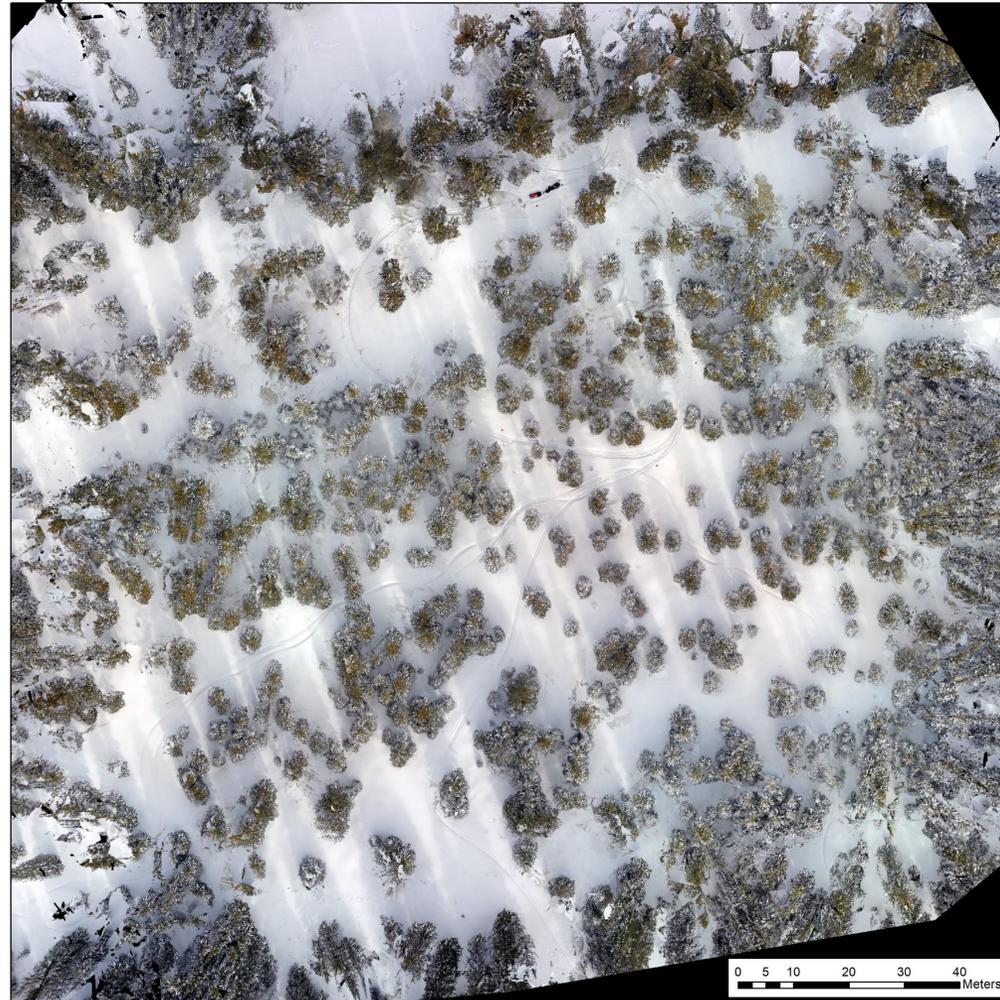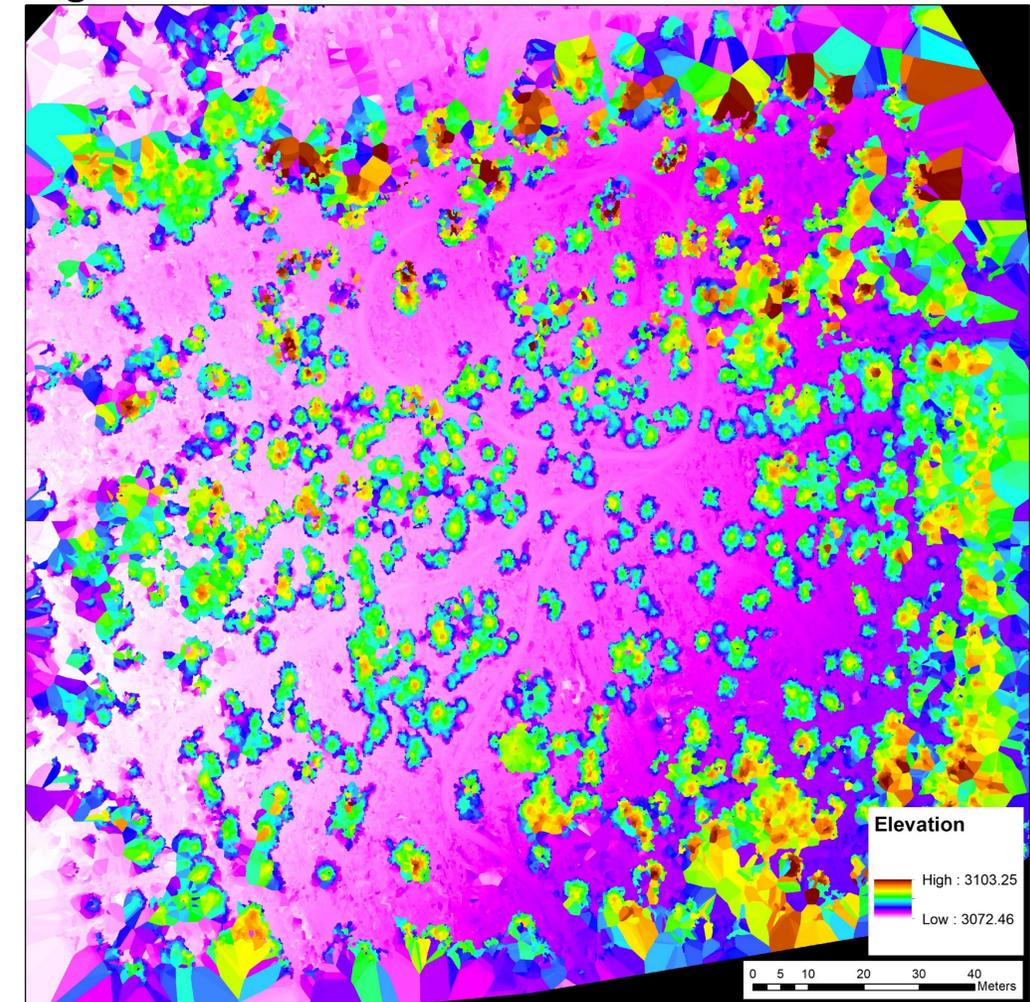
Figure 3

Figure 3 is composed of two screen shots from image files driveled from the two UAV platforms used. The image on top is from the older Phantom 4 model, with the image on the bottom being from the newer Mavic 2 Pro. Although the P4 camera is able to resolve many of the surface features, these features are clearer on the Mavic's imagery. The smaller field of view of the Mavic camera combined with a higher sensor resolution allows for more detail in the snow surface. The more detail that is visible in the images, the more that the photogrammetry software can resolve.
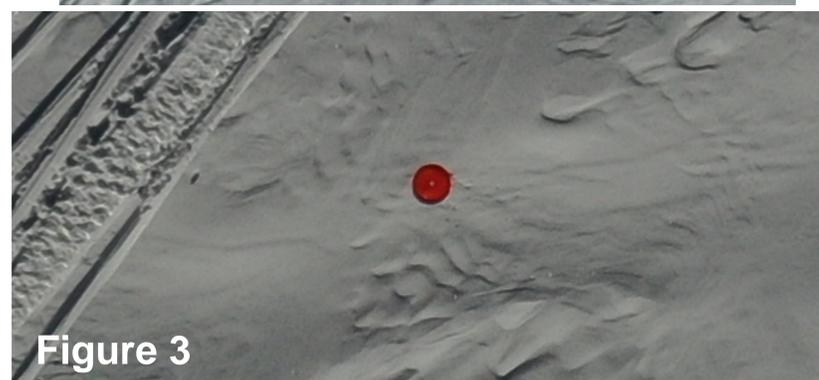
Figure 4

This image is a screen shot of a colorized point cloud produced from plot FL2A. Visible are a snow machine, sled, tripod, lidar, features in the snow surface, and CRREL scientist, Art Gelvin. Comparisons between point clouds produced via drone and those produced via the terrestrial lidar pictured are part of future analysis.
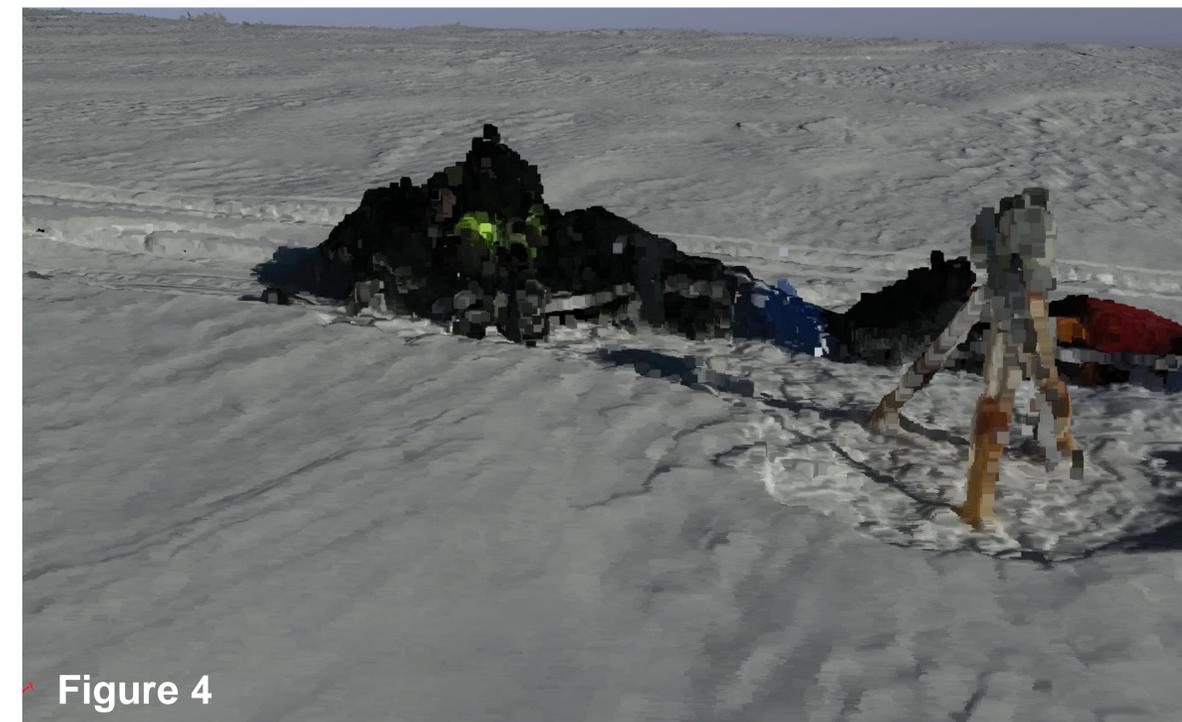

Figure 1

Figure 2

Elevation

High : 3103.25
Low : 3072.46

Figure 3

Figure 4