# Lab 3- Introduction to Agisoft Metashape

## Objective

The main goal of this lab exercise is to familiarize students to:

- the Agisoft Metashape interface
- the main steps involved in the generation of 3D point clouds and orthomosaics

## Reference Sources

Agisoft Metashape User Manual, Professional Edition, Version 1.6 - https://www.agisoft.com/pdf/metashape-pro_1_6_en.pdf

## Deliverables

A report generated from Metashape that describes the photogrammetric products created from the input images.

*Note: Please refer to the class Canvas site for lab due dates*

## Part 1: Setting Up Agisoft Metashape

Agisoft Metashape is a digital photogrammetry software application that can be used to create high-quality map products from drone imagery. The University of Idaho has a 25-seat license for Metashape that we'll use in this class. You will need to download and install Metashape on your computer and then connect it to the license server.

1. For this first lab you will need to download and install Agisoft Metashape on your computer. You can obtain the installer for Metashape from: https://www.agisoft.com/downloads/installer/. You will want to download the Professional Edition (see Figure 1) of the most recent version.

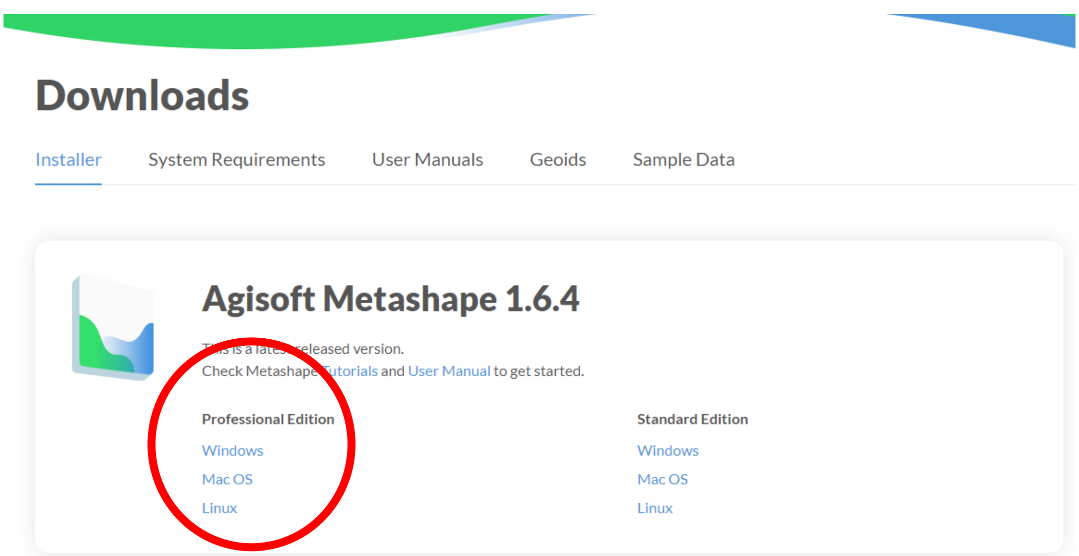



**Figure 1. Download the Professional Edition of Metashape (most recent version).**

2. Install the license file and connect to the license server. The video linked below details the steps for installing the license file (available on Canvas) and connecting to the license server.

https://web.microsoftstream.com/video/bb1721ba-3d8b-4c09-b141-b6e71cc53dae

If you are not on a UI network (i.e., you are off campus), you will need to first connect to the UI network system through a VPN connection. Instructions for how to do this are at:

Service - VPN Access (uidaho.edu) (See the links on the right-hand side of the page for specific instructions for different operating systems)

## Part 2: Processing Photographs with Agisoft Metashape

This lab exercise will introduce you to the processing UAV images using Metashape. You will use a set of images collected at UI's Rinker Rock Creek Ranch to learn about the Metashape interface and processing workflow.

Generally, the final goal of photo processing with Metashape is to build a textured 3D model, DEM, or orthomosaic. The procedure of processing photographs and constructing 3D models comprises four main stages:

1) ***Camera and Image alignment:*** In this stage Metashape searches for tie points in photographs and matches them. From those tie points, Metashape then estimates the position and orientation of the camera (exterior orientation) for each picture and refines camera interior orientation parameters. Metashape then creates 3D coordinate estimates for each of the tie points. Outputs from this stage are the set of camera positions/orientations and a sparse point cloud of the tie points.

   The sparse point cloud represents the results of photo alignment. It can be used to identify and remove low accuracy tie points, but generally it is not directly used in further processing. Conversely, the set of camera positions (exterior orientation) is required for further 3D surface reconstruction by Metashape.

2) The next stage is ***generating a dense point cloud*** that is built by Metashape based on the estimated camera positions and pictures themselves. Dense point cloud may be edited and classified prior to exporting or proceeding to the next stage

3) The third stage is ***generation of a surface mesh and/or DEM***. 3D polygonal mesh models represent the object surface based on the dense or sparse point cloud. Alternatively, a digital elevation model (DEM) can be built from the dense point cloud by assigning a specific raster cell size.

4) After the surface is reconstructed and a DEM or surface mesh is created, an ***Orthomosaic*** can be generated. Orthomosaic is a merged version of the original images that has been corrected for relief and perspective displacement. The orthomosaic is projected onto the DEM or mesh model.

In this lab exercise, you will carry out all the stages above using mostly Metashape's default values. This will get you familiar with Metashape and the photogrammetric workflow. In subsequent labs we will dive deeper into each step and how the various options improve accuracy or detail.

Follow the steps below to complete this lab:

1) If you have not done so already, **download the Lab 3 data from the Datasets module on Canvas** and unzip the file into a folder that will contain all the files for this lab. Make note of where you saved the photos so you can find them from Metashape.

2) Launch the Metashape application. Once the program is open you should see an interface like in Figure 2. The interface comprises the *Main view,* where you may open a new or existing project or see previously opened projects; the *Menu bar* - with menus to manage your project, process data and view output datasets and shortcut toolbars for Project and View menus. Spend time to learn the menus, icons and the various functionalities.

3) The first step in a Metashape project is loading the photos you will be using as a source for 3D reconstruction. To load a set of photos, select *Add Photos...* command from the Workflow menu or click Add Photos button located on Workspace toolbar (Figure 2). In the Add Photos dialog browse the source folder and select files to be processed. Click the Open button. You may select all images at once by using the Select all the images by using the CTRL + A shortcut. If all your photos are in the same directory, you can choose the *Add Folder* option from the Workflow menu.

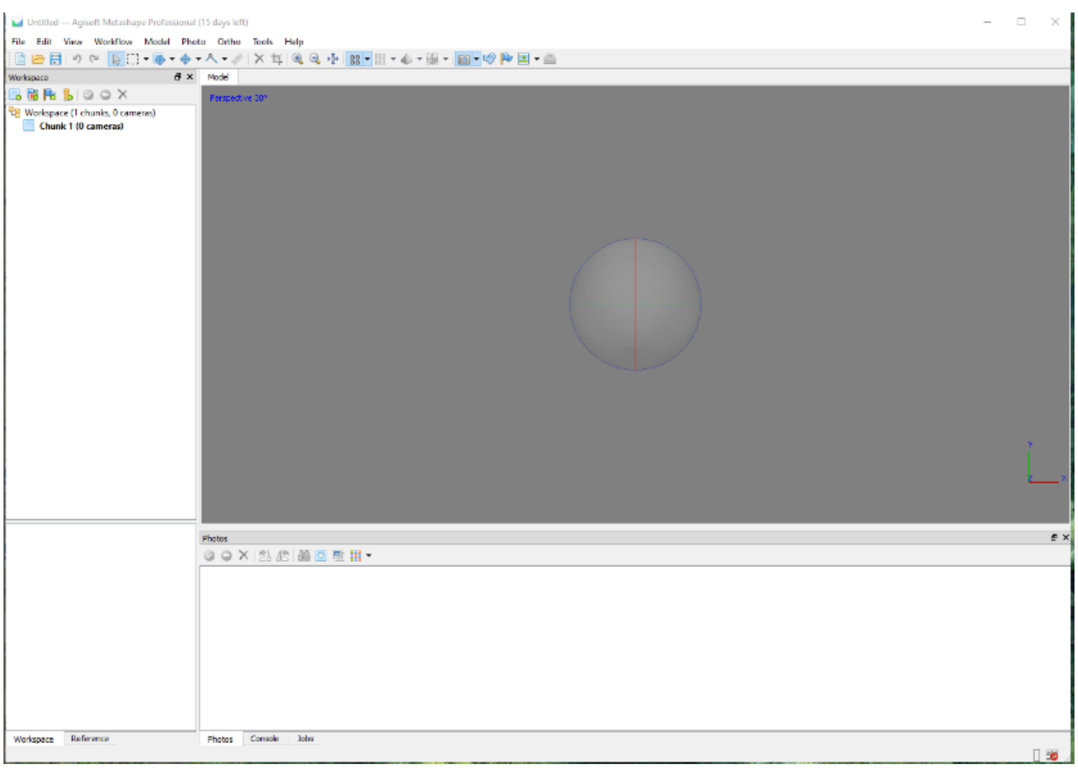


*Figure 2. Metashape main view upon starting a new project.*

4) The selected photos will appear in the Workspace pane and in the photo tray at the bottom of the application window (Figure 3).

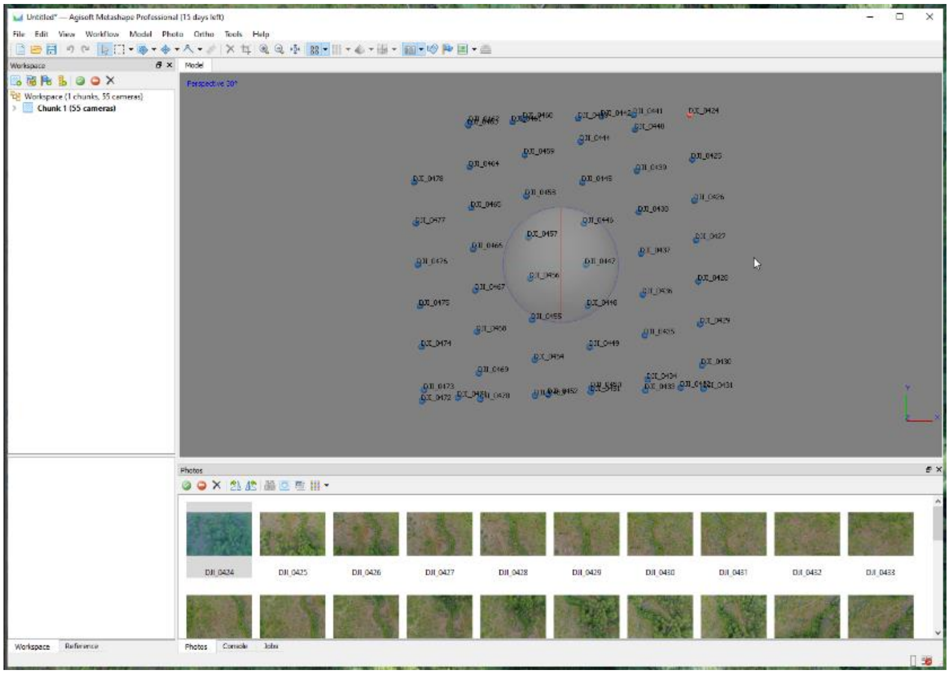



***Figure 3. Added photos will initially appear as dots corresponding to the rough GPS locations given in the photo file header. Photos appear in the photo tray at the bottom.***

Unwanted photos can be removed at any time by right-clicking on the photo and choosing, "Remove Photo."

5) The first stage in the photogrammetric process is aligning the images. To do this, from the Workflow menu, choose *Align Photos* (Figure 4). Accept the default options and click OK to start the photo alignment. This process may take a while (it's the most intensive part of the process).

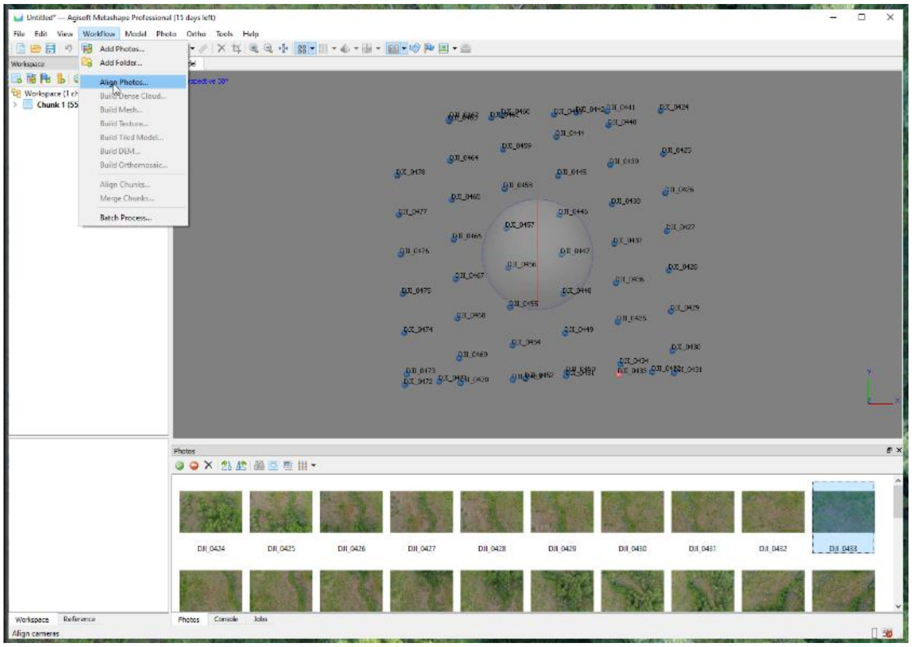



***Figure 4. Align Photos.***

6) Once the photos are aligned, you will see that the dots corresponding to each photo have been replaced with a representation of each photo showing its exterior orientation and a sparse point cloud that represents the estimated 3D coordinates for the tie points that were generated during image alignment (Figure 5). Take a minute to familiarize yourself with Agisoft's 3D map interface – rotating, panning, zooming.

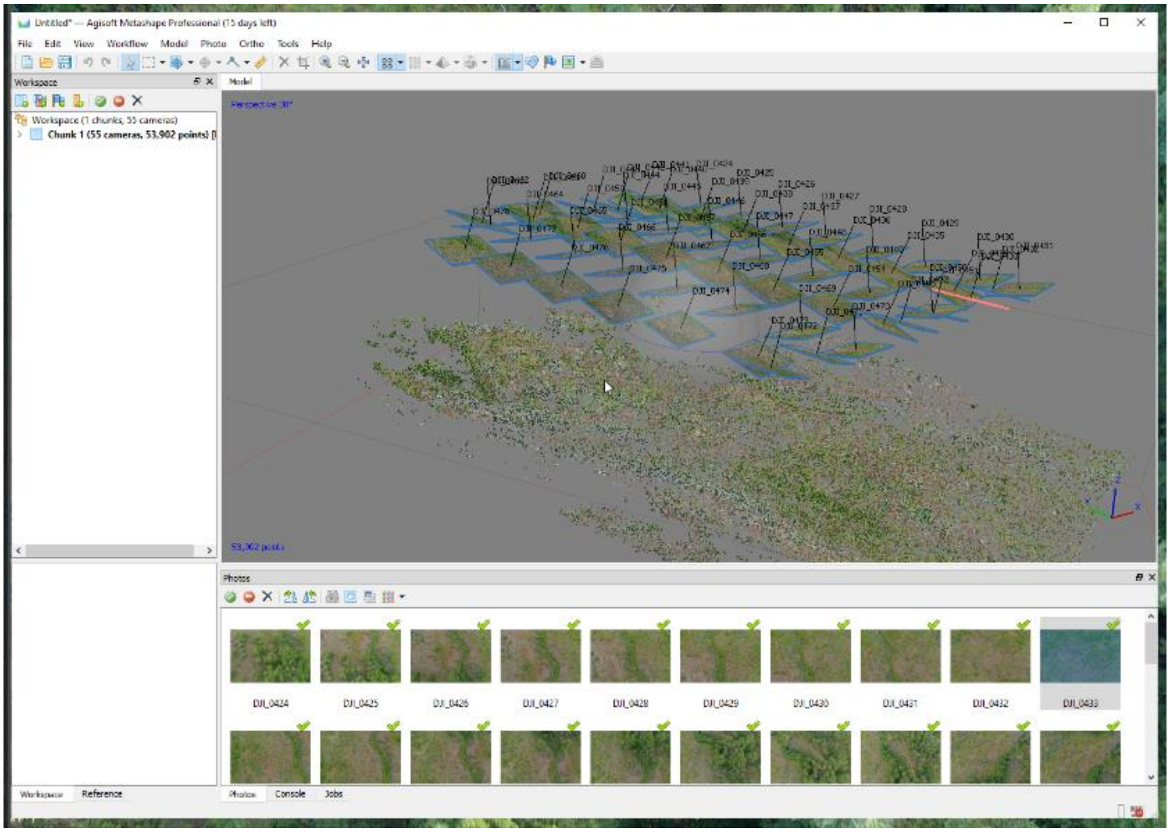
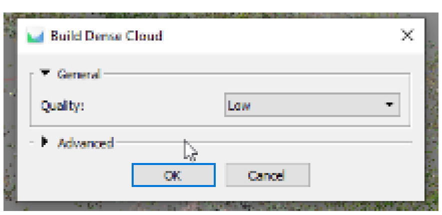



***Figure 5. Results of image alignment showing the calculated exterior orientation of the photos and the sparse point cloud of the tie points.***

7) The sparse point cloud will be used to refine the exterior orientation and the stereoscopic model (we'll look at that in a subsequent lab). Then the stereoscopic model will be used to create a dense point cloud that is the 3D reconstruction of the scene. To do this, from the Workflow menu, select *Build Dense Cloud*. To cut down on processing time, choose "Low" for quality and then click OK.




8) The densified point cloud can be viewed by clicking on the Dense Cloud button (Figure 6). Note how many points are in the dense point cloud.

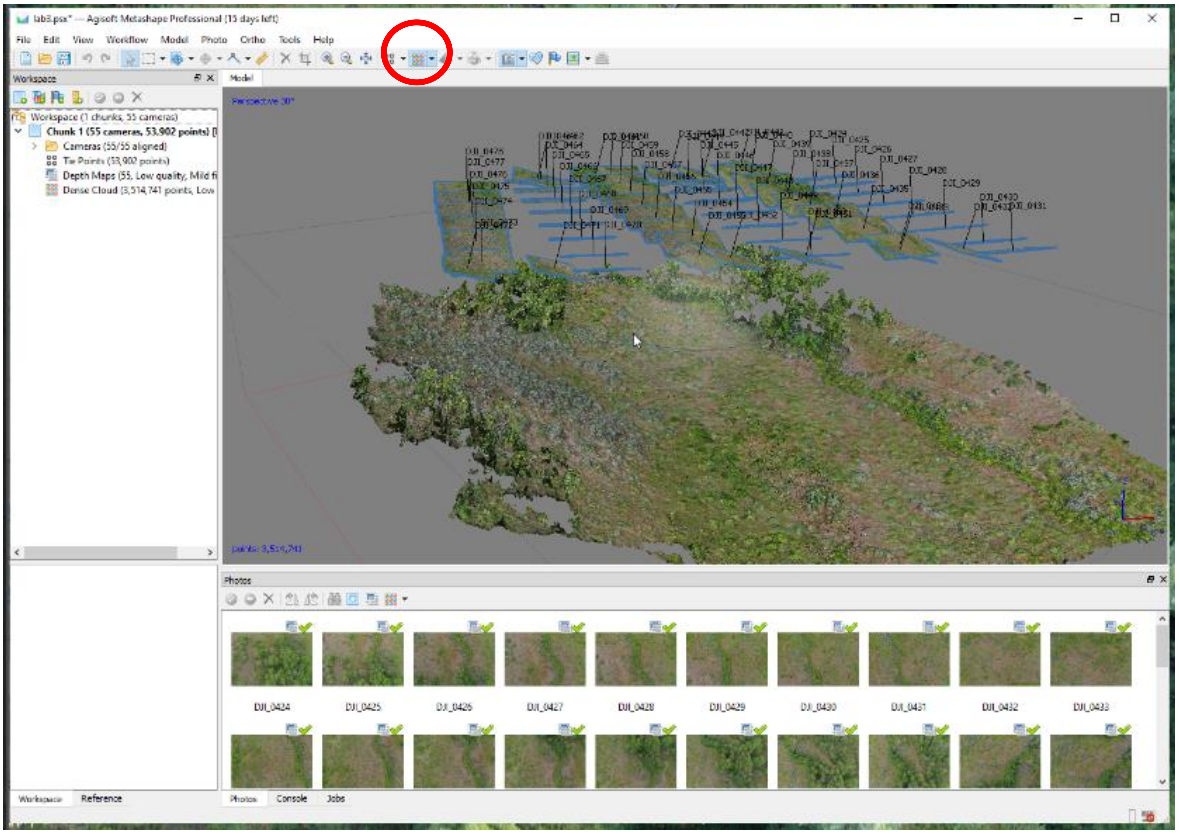
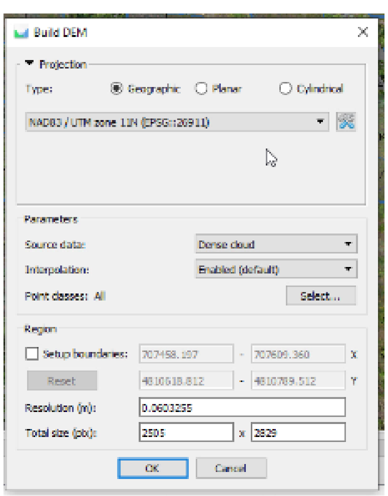


*Figure 6. Dense point cloud. Button to display the dense cloud is highlighted (red circle).*

9) The next step is to create a digital elevation model (DEM) from the dense point cloud. This is simply a raster version of the point cloud where you set the cell size and it calculates the mean elevation per cell. To do this, from the Workflow menu, select *Build DEM*. In the DEM options, <u>*choose NAD83/UTM Zone 11N as the projection*</u> (you may need to search for it). Leave the other options with their default values. Then click OK.



**10)** When the DEM has finished processing, click on the *Show DEM* button to view the DEM. Note raster products such as DEMs and Orthomosaics will open in a separate tab from the point cloud and mesh products. Observe the changes in elevation across the study area.

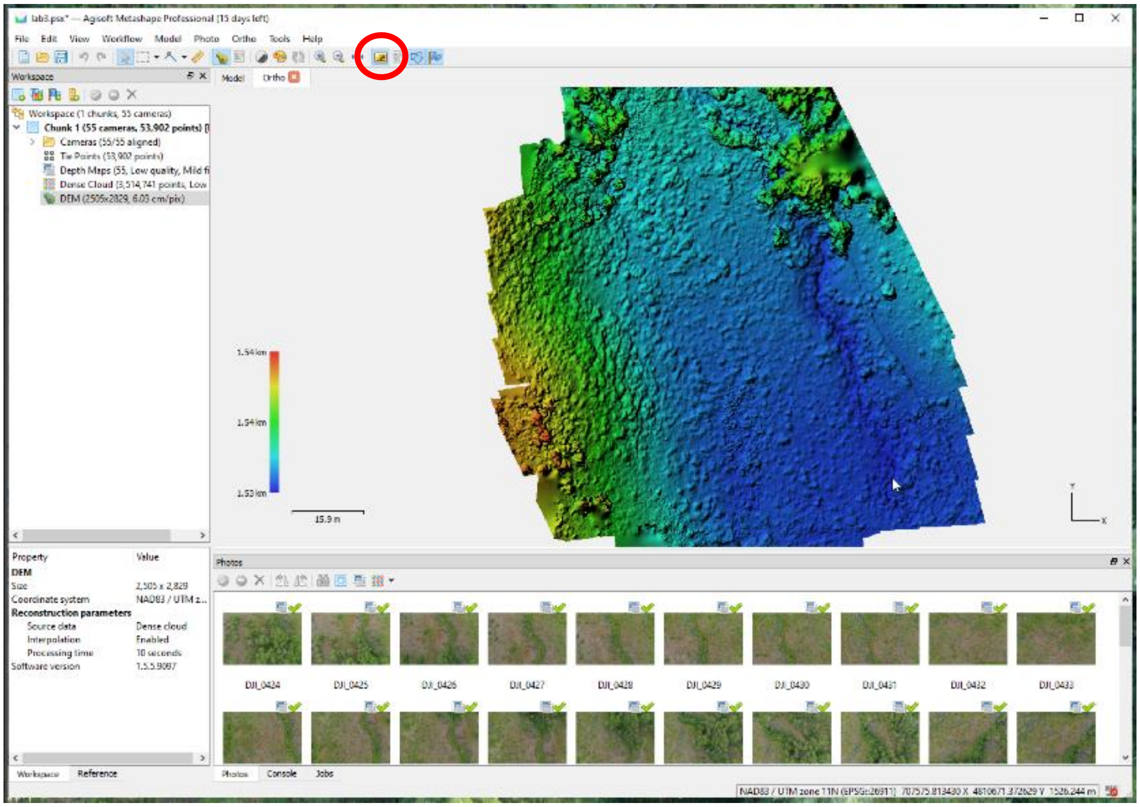



***Figure 7. The DEM is displayed in a separate tab from the 3D point cloud products. Red circle highlights the Show DEM button.***

**11)** The last step is to build the orthomosaic from the original images. Orthomosaics first orthorectify the original images to remove the relief and perspective distortion and then combine the images into a single map layer. To create the orthomosaic, from the Workflow menu, choose *Build Orthomosaic*. Use the default options and click OK to build the orthomosaic (Figure 8).

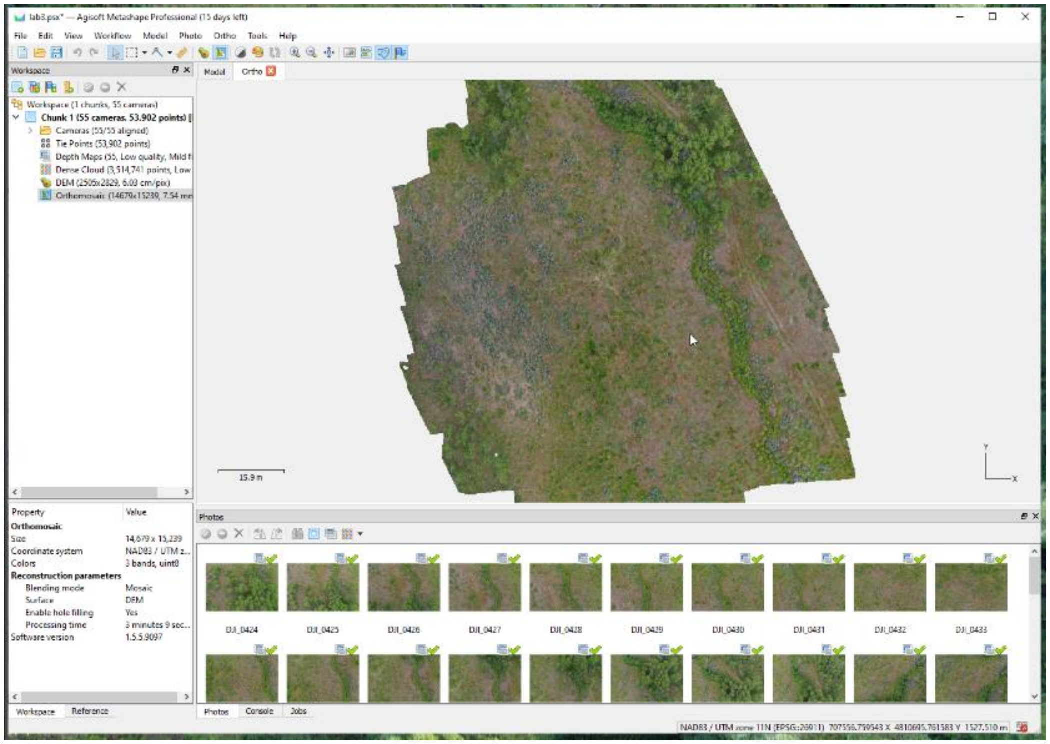



***Figure 8. Constructed orthomosaic.***

12. Metashape can create a report that summarizes the photogrammetric products and their overall quality. These reports are useful to understand the accuracy of the products and where any problems might have originated. To complete the lab, generate a report from Metashape. From the File menu, choose, *Export, Generate Report*. <u>Title the report with your name followed by "Lab #3"</u>. Click OK for Metashape to generate the PDF report. Familiarize yourself with the different sections of the report. **To complete the lab, submit the report via Canvas. Make sure to save your project before closing Metashape.**