MODEM ArcGIS Pro Python Toolbox

QUICK START GUIDE

Table of Contents

Overview

- MODEM is an application for co-registering spatial data
  - Digital Elevation Models (GeoTIFF)
  - Point clouds (LAS, LAZ, and BPF)
  - Mesh data (PLY and OBJ)

- MODEM's ArcGIS implementation focuses on DEM to DEM registration
  - Python toolbox in ArcGIS Pro

- Two GeoTIFF raster files (or ArcGIS raster layers) are required:
  - **AOI** (Area of Interest): the data being registered
  - **Foundation**: the fixed data to which the AOI is being registered

Installation: Requirements

1. Windows 10 with ArcGIS Pro and Docker Desktop installed
   ▶ ArcGIS Pro: https://www.esri.com/en-us/arcgis/products/arcgis-pro/overview
   ▶ Docker Desktop: https://www.docker.com/products/docker-desktop

2. MODEM Project Repository
   ▶ Assumption is that you have the project files
   ▶ If not, they can be downloaded from DI2E Bitbucket:
      ▶ Go to https://bitbucket.di2e.net/projects/CRRELNEGGS/repos/modem/browse
      ▶ Click the ellipsis (⋯) next to the branch dropdown and select Download
      ▶ Unzip the files when the download is complete
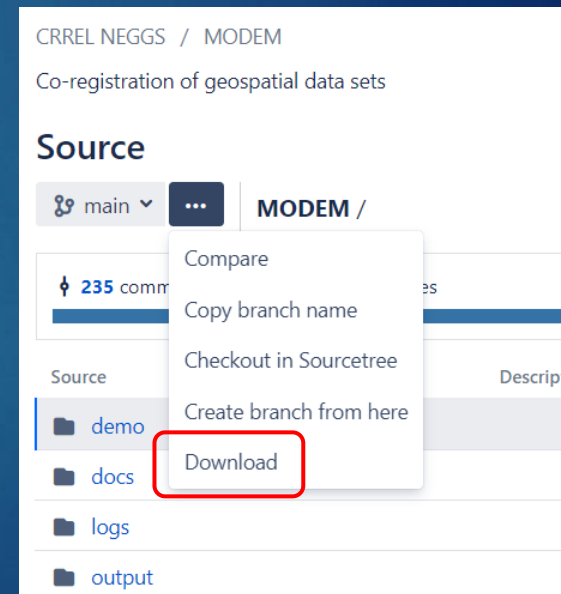
Installation: Docker Image

1. Open a terminal and navigate to the project root directory:

```
C:\>cd dev\modem

C:\dev\modem>
```

2. Build the Docker image:

```
C:\dev\modem>docker build --tag modem:0.21 .
[+] Building 505.9s (17/17) FINISHED
 => [internal] load build definition from Dockerfile                          0.7s
 => => transferring dockerfile: 813B                                          0.7s
 => [internal] load .dockerignore                                            0.7s

 ...

 => => exporting layers                                                      18.6s
 => => writing image sha256:c9d0c3300ef02598cd454d4669604c9dd4877688b075c79a0671071d26e65ef2    0.0s
 => => naming to docker.io/library/modem:0.21                                 0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them

E:\dev\modem>
```

3. Confirm the image was created:
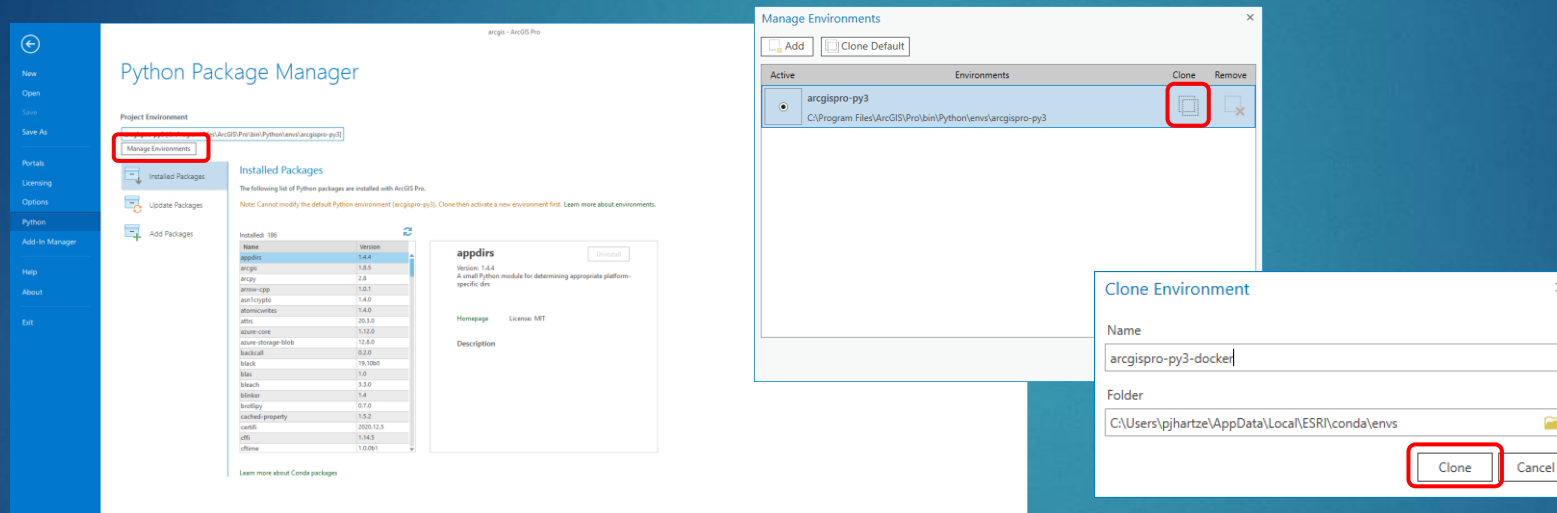
```
C:\dev\modem>docker image list
REPOSITORY                          TAG         IMAGE ID        CREATED         SIZE
modem                               0.21        c9d0c3300ef0    6 minutes ago   4.19GB

E:\dev\modem>
```

Installation: ArcGIS Pro Conda Environment
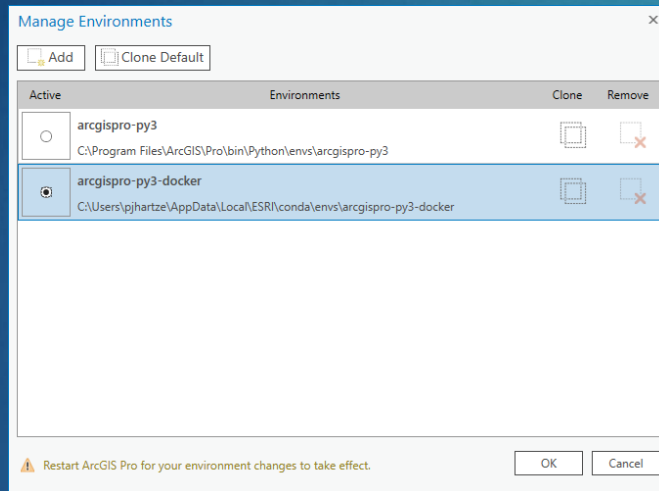
1. In ArcGIS Pro: Project > Python > Manage Environments

2. Use the Clone option on the right side of the arcgispro-py3 entry
   ▶ Do not use the Clone Default button at the top

Installation: ArcGIS Pro Conda Environment

3. Select the newly created environment (arcgispro-py3-docker in this example) environment and click OK.

4. Close ArcGIS Pro

Installation: ArcGIS Pro Conda Environment

5. Open ArcGIS Pro's Python Command Prompt
   - The new environment should be active (in parenthesis in front of the prompt).
   - If not, run `activate <environment name>`.

6. Run `conda install docker-py`:

```
(arcgispro-py3-docker) C:\Users\pjhartze\AppData\Local\ESRI\conda\envs\arcgispro-py3-docker>conda install docker-py
Collecting package metadata (current_repodata.json): done
Solving environment: done

...

Proceed ([y]/n)?y


Downloading and Extracting Packages
wheel-0.37.0          | 32 KB     | ############################################################################### | 100%
Preparing transaction: done
Verifying transaction: done
Executing transaction: done

(arcgispro-py3-docker) C:\Users\pjhartze\AppData\Local\ESRI\conda\envs\arcgispro-py3-docker>
```
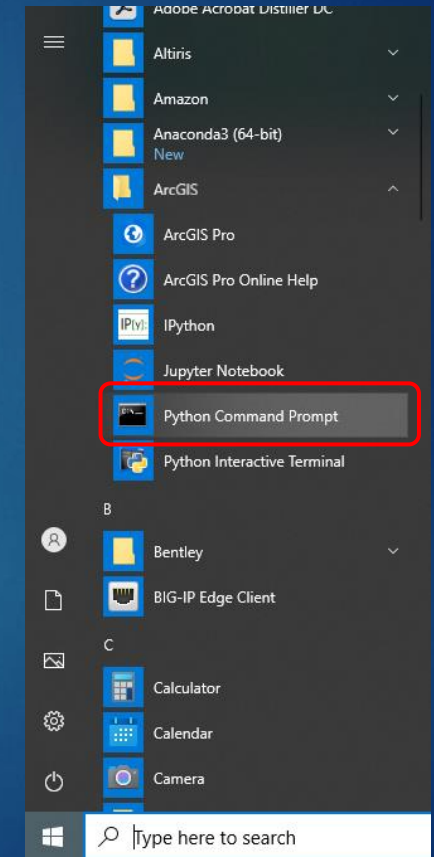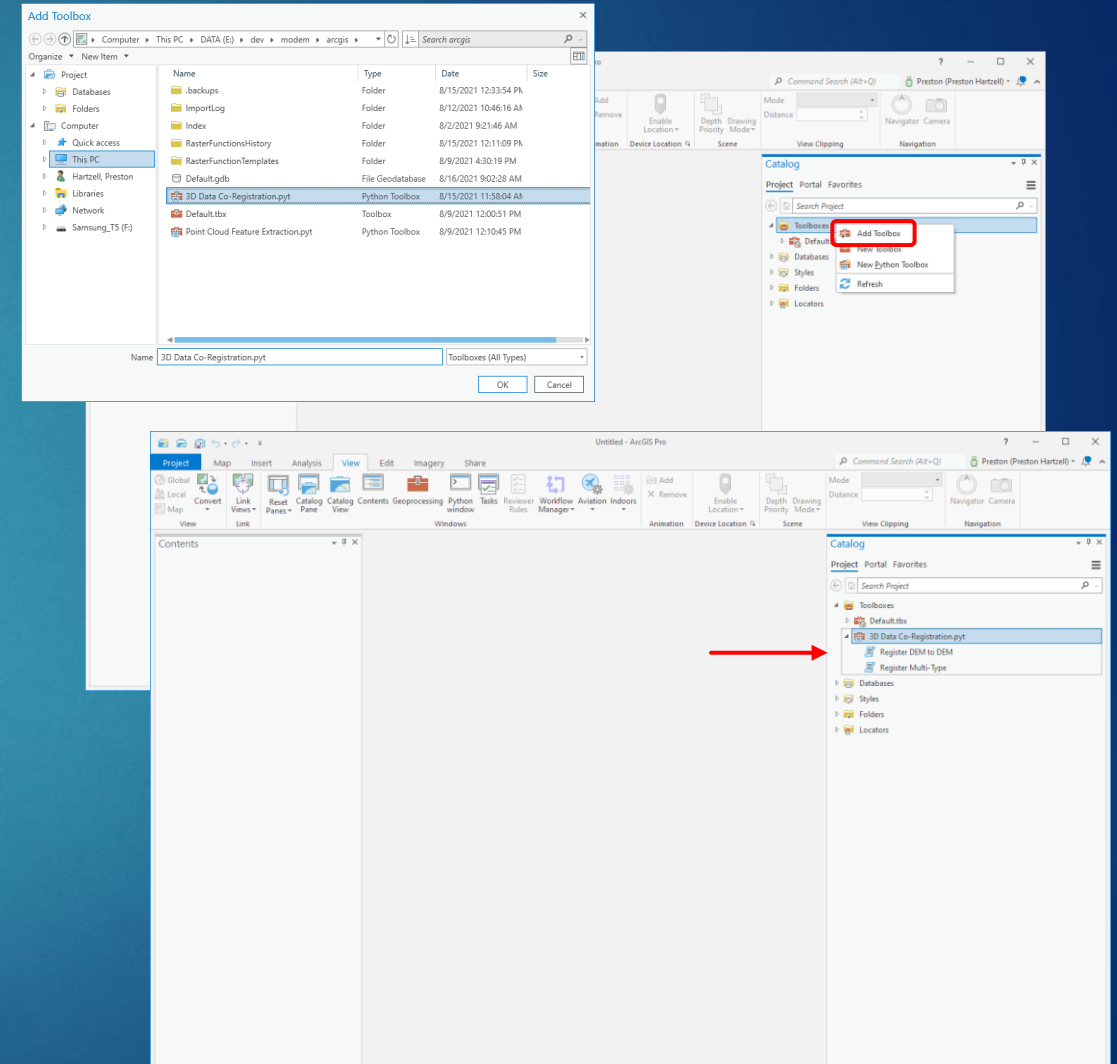
7. Close the command prompt

# Installation: ArcGIS Pro Python Toolbox

1. Open ArcGIS Pro and go to the Catalog pane

2. Right-click Toolboxes and select Add Toolbox

3. Navigate to the **arcgis** directory inside the MODEM project directory
   - Select the 3D Data Co-Registration.pyt file

4. You should see a new toolbox with two tools:
   - Register DEM to DEM
   - Register Multi-Type

Using the Register DEM to DEM Tool

1. If no map is open, insert a new one

   ▶ Insert > New Map

2. Open two DEMs to co-register

   ▶ A Foundation DEM in GeoTIFF format

   ▶ An Area Of Interest (AOI) DEM in GeoTIFF format

      ▶ The AOI DEM will be registered to the Foundation DEM

3. Double-click the Register DEM to DEM tool in the 3D Data Co-Registration toolbox
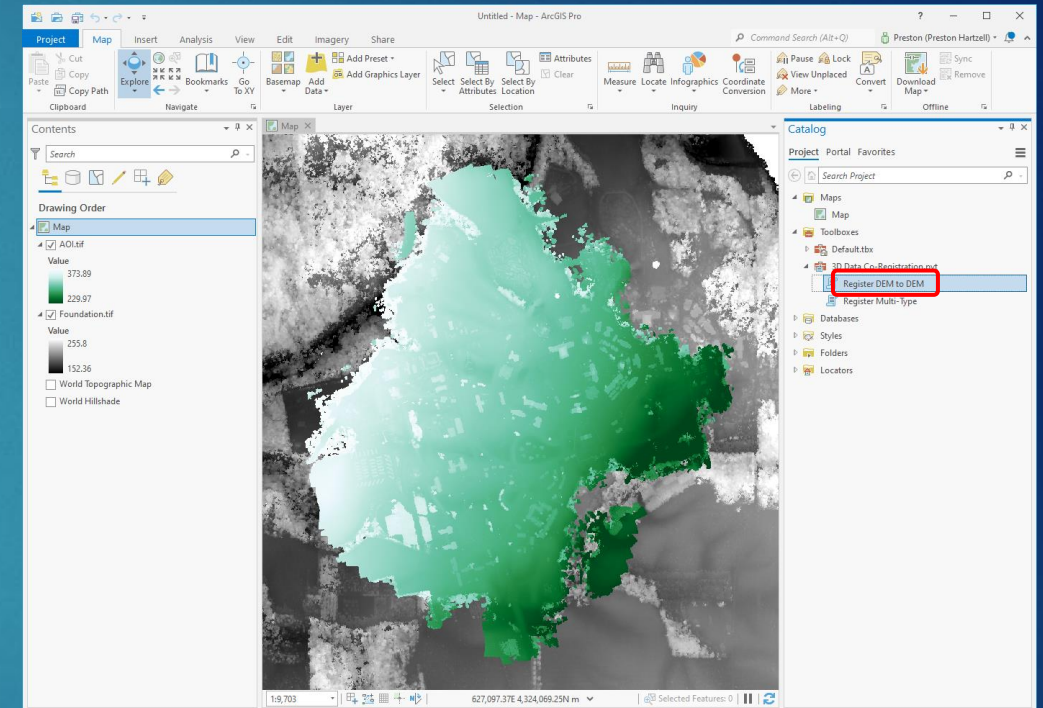
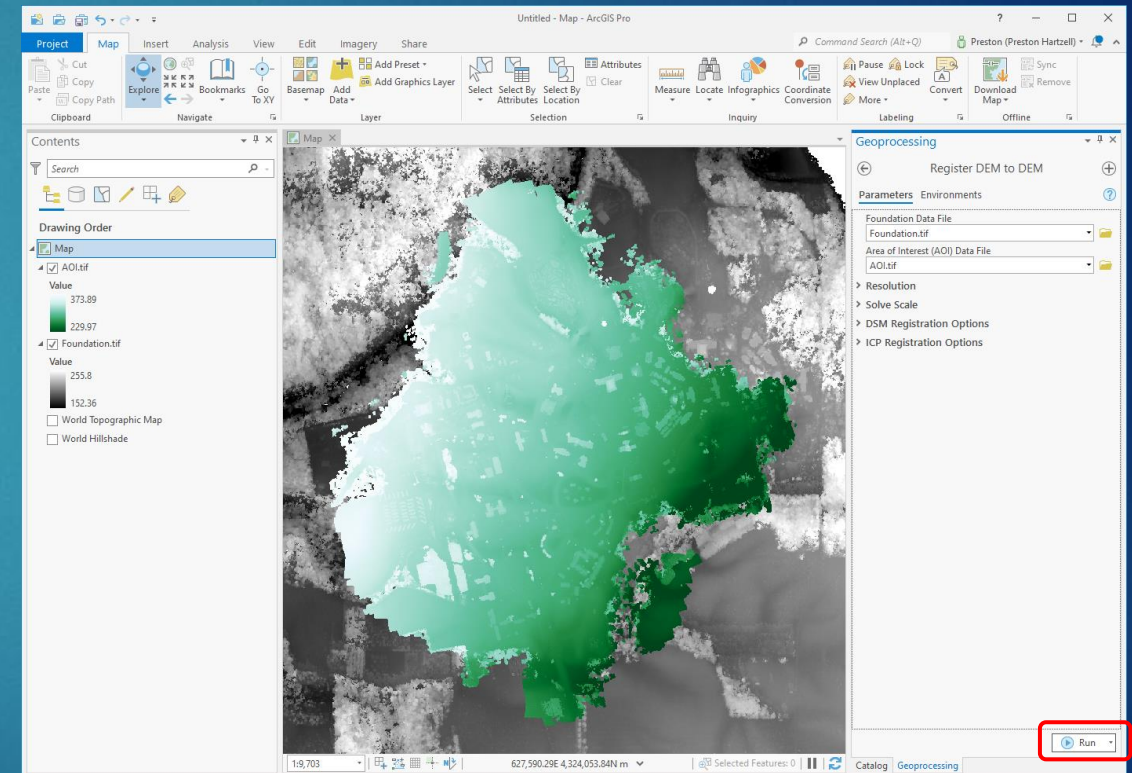Note: The color of the AOI DEM shown in the above screenshot was changed for clarity

Revised 2021-08-16

Using the Register DEM to DEM Tool

4. Select the Foundation and AOI DEM layers:

   ▶ **Foundation Data File** dropdown
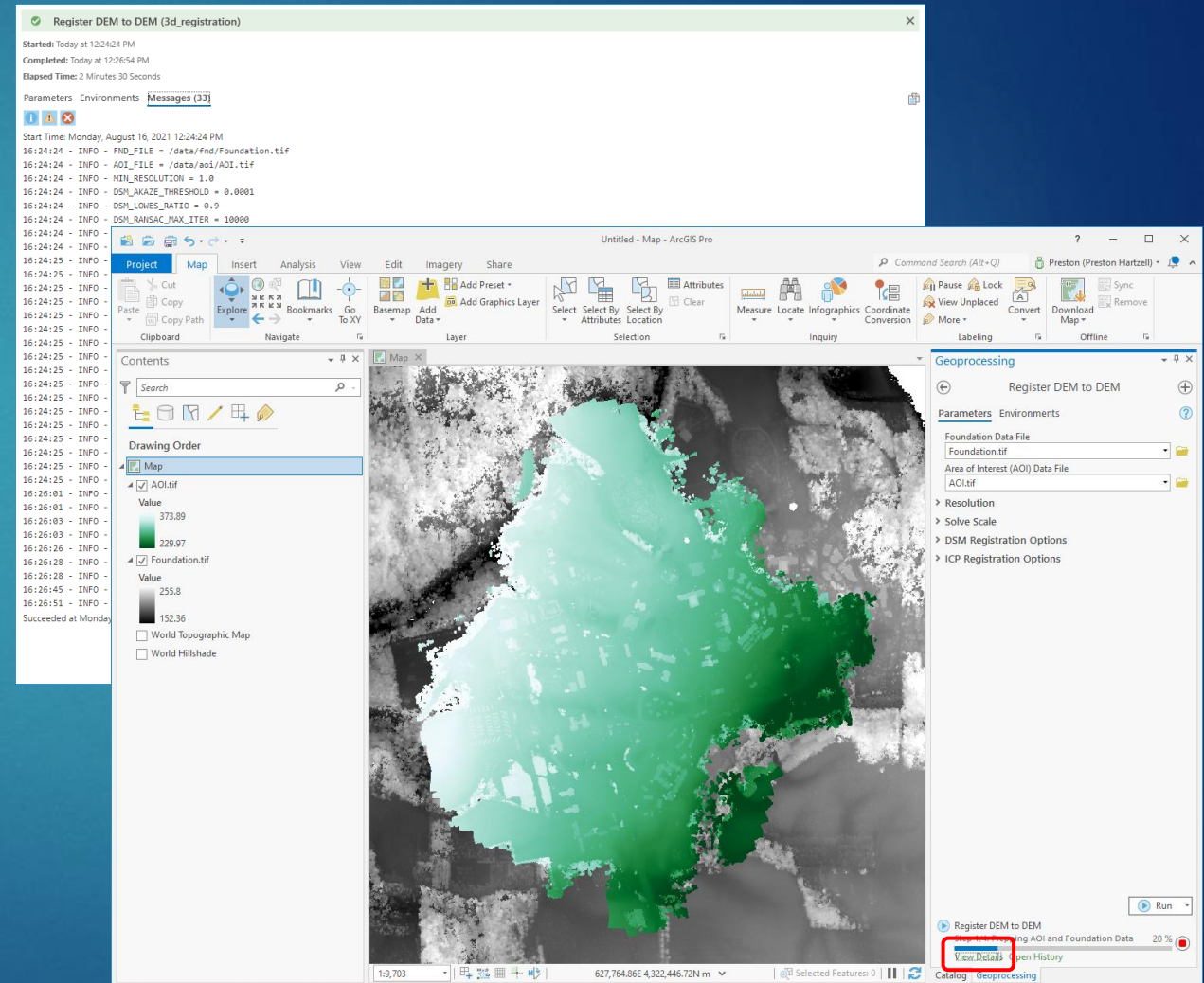
   ▶ **Area of Interest (AOI) Data File** dropdown

5. Click the Run button

Using the Register DEM to DEM Tool

6. A progress bar indicates each stage of the registration algorithm

7. Logging information is found in the Messages

   ▶ View Details > Messages

Using the Register DEM to DEM Tool

8. When complete:

▶ The registered AOI DEM is displayed

▶ The registered AOI DEM source file is saved inside a new directory created in the location of the original AOI data file

  ▶ The new directory name is "registration_YYYY-MM-DD_HH-MM-SS", where YYYY is the year and so on.

  ▶ The phrase "_registered" is appended to the original AOI source file name.
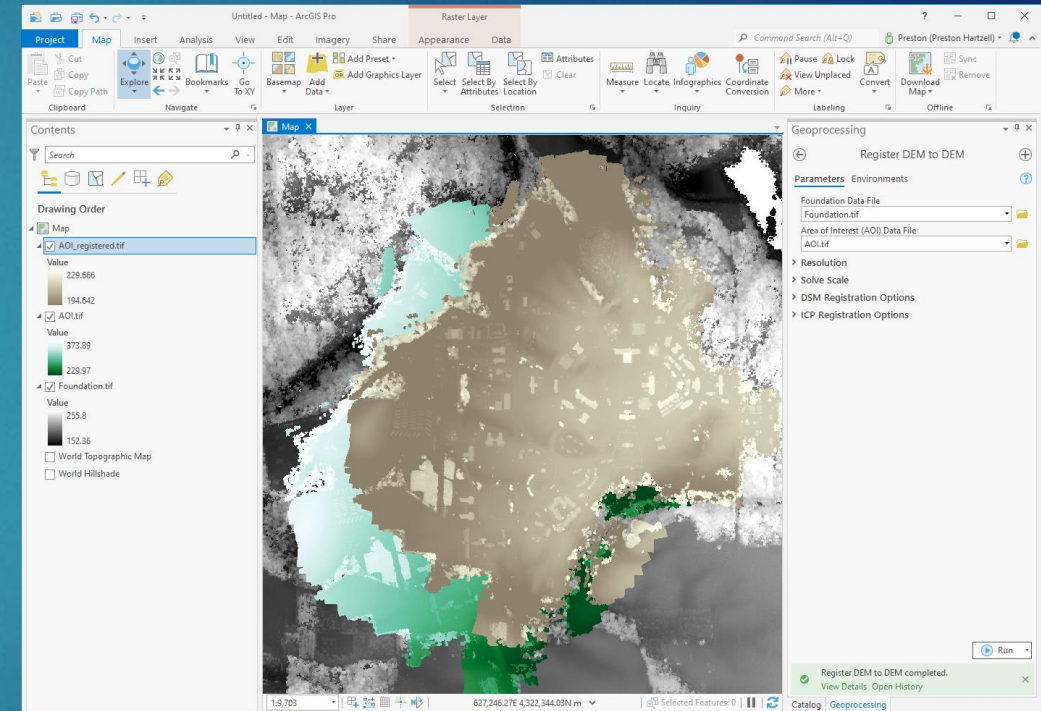
Note: The color of the registered DEM shown in the above screenshot was changed for clarity

Revised 2021-08-16

Options & Information Resources

- Options

  - There are a number of parameters that can be optionally tuned

    - Found by expanding the option categories in the tool

  - The default option values should be sufficient for most landscapes

  - Option explanations and default values are found in the project directory:

    - `docs\configuration.md`

- Algorithm details and information on the command line interface (CLI) form of the MODEM registration tool are found in the project directory:

  - `docs\details.md`