Drone2Map:
Measuring Stockpile Volumes

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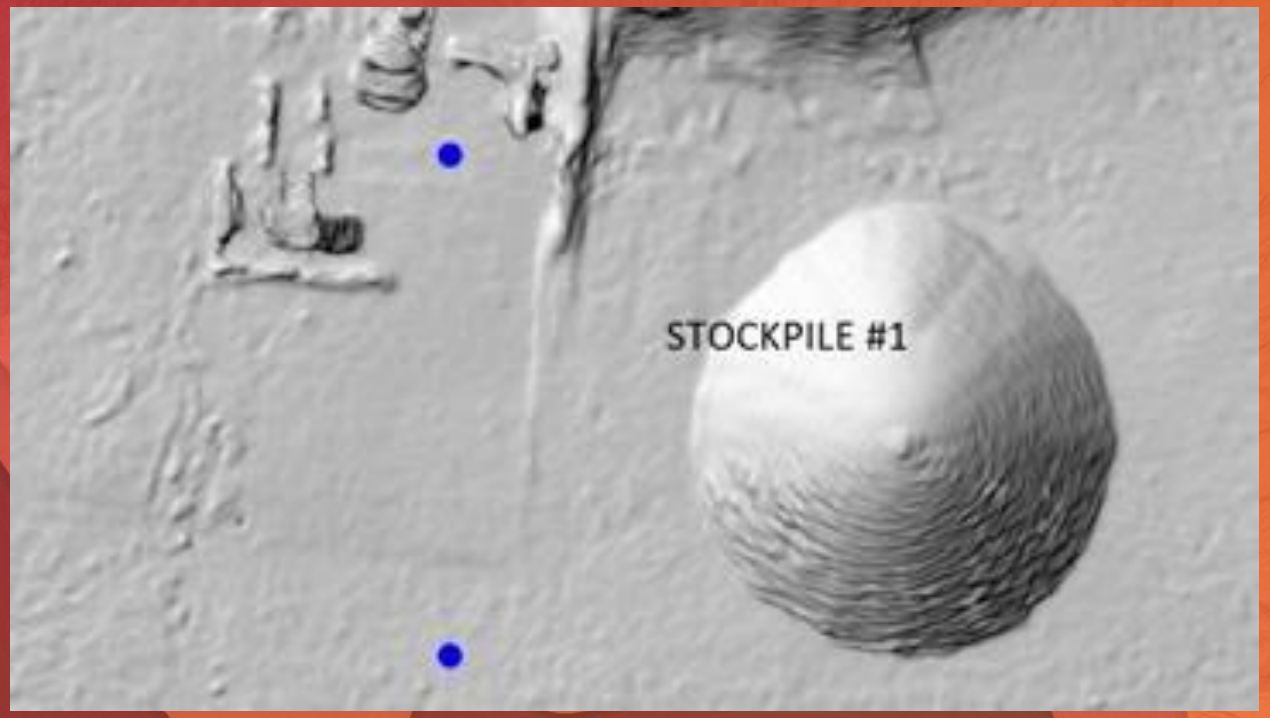
Outline

- Stockpile measurements in Drone2Map
  - Requirements
  - Basic workflow
- Accuracy
- Stockpile measurements in ArcGIS Pro
  - Multi-date comparisons
  - Sloping ground

Stockpile measurements in Drone2Map

- **Requirements**
  - **Must have ArcGIS Pro installed, with Spatial Analyst license**
  - **Must generate 3D products (point cloud)**

- **Ground control**
  - **Z accuracy from AGOL 3D terrain**



Stockpile measurements in Drone2Map

Demo

Data courtesy of GeoCue/AirGon

Evaluating Accuracy

- Do the tools provide accurate measurements of the input data?
  - Point cloud vs. DSM
  - Challenge of (manually) defining the base plane
- Does the photogrammetric process give me an accurate surface to measure?

Demonstration Project

- Data Provided by
  - USACE, Wilmington, NC
  - McKim & Creed Engineers, Wilmington, NC
- Wrightsville Beach, North Carolina
  - Post-hurricane Beach Restoration Project
  - Independently Established Ground Control Points for Accuracy Assessment
  - Demonstrate Alternative To Terrestrial LIDAR
  - Platform Specifications DJI / ILCE QX1
  - 195 Images @ 3 cm GSD
  - **<2 Hours** Hour of Field Collection
  - **~4 Hours** for Final Product Generation

RMS Error [ft]

- X 0.053
- Y 0.034
- Z 0.118

Point Cloud – 450 Million+ Points
Average Point Density 30 Pt/m^2

Stockpile measurements in ArcGIS Desktop (Pro or ArcMap)

- **Several geoprocessing (GP) tools available – Pro's and Con's**
  - ***Polygon Volume*** **(**volume between point cloud and reference height, constrained by polygon**)**
  - ***Surface Volume*** **(**difference between TIN or raster and a reference plane → **must clip DSM first)**
  - ***Cut Fill*** **(**difference between 2 raster surfaces**)**
  - ***Surface Difference*** **(**difference between 2 TINs**)**

- **Custom tools (ModelBuilder)**
  - **For sloping ground**
  - **To add polygon for clipping**

Best Practices

- Use ground control
  - Repeat same control with every date
  - Put control some distance away from stockpiles
- Recommendations on drone, camera, flights
  - 80% overlap between frames
  - Good quality camera
  - Avoid fisheye lenses
  - QC check for blurry images
- For longterm monitoring, use Mosaic Dataset w/ multi-date DSMs in ArcGIS Pro

Summary

- **Stockpile measurements in Drone2Map**
  - Fast & easy to use
  - Effective for infrequent measurements
- **Stockpile measurements in ArcGIS Pro**
  - Support for multiple measurements & statistical analysis
  - Sloping ground
  - Authoritative (“System of Record”) measurement history

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