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/m²
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