Title: Digital Elevation Model (DEM) and Orthophoto for the SAVANT Field Site

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1.0 Data Set Overview:

A fixed wing unmanned aerial system (UAS) was used to obtain a dense array of overlapping images of the SAVANT field site, from which a high-resolution, geographically registered digital elevation model (DEM) and orthophoto were derived photogrammetrically. The survey flight was conducted on April 24, 2019 at a time when there was no crop cover, thus derived elevations correspond to actual topography except in heavily wooded areas.

Time Period of Interest:

Begin: 2018/08/01 00:00:00

End: 2019/04/25 00:00:00

Note: Topographic data collection occurred on 04 April 2019 but is believed to be representative for the entire SAVANT field campaign.

Area of Interest:

Latitude/longitude box bounded by the following coordinates:

Latitude northern boundary: 40.21614
Latitude southern boundary: 40.20627
Longitude eastern boundary: –88.39609
Longitude western boundary: –88.41600

Data Frequency

One time collection

Data Spatial Type

2-D raster grids with georeferencing metadata.

DOI: Requested

2.0 Instrument Description:

The instrument is an Elanus Duo twin-motor fixed-wing UAS equipped with a FLIR Duo Pro R combined RGB and thermal IR camera. The RGB portion of the camera provided nadir-viewing 3000x4000 pixel images from an altitude 120 m above ground level. Images were tagged with GPS location and orientation from the camera's built-in GPS/IMU system. Image ground resolution at nadir was approximately 2.5 cm.

3.0 Data Collection and Processing:

A dense east-west oriented rectangular survey pattern was flown over the entire SAVANT field site, with images collected at a frequency of 1 per second as the UAS flew with an average speed of 18 m/sec. A total of 4215 nadir-viewing images were utilized for the analysis. 9 manual ground control points (GCPs) estimated from Google Earth (5 GCPs) or using a handheld Bad Elf Pro GPS unit (4 GCPs) were utilized to improve geographic registration of the final products. Commercial Agitsoft Metashape software was used to process the images into a 1–m horizontal resolution digital elevation model (DEM) and a 10 cm–resolution orthophoto.

4.0 Data Files and Formats:

Filename	Format	Description
SAVANT_10cm_DEM	GeoTIFF	Georeferenced digital elevation in meters at approximately 10cm horizontal resolution, world coordinates (latitude,longitude), WGS 84 (EPSG::4326)
SAVANT_1m_DEM.tif	GeoTIFF	Same as above, but at approximately 1m resolution
SAVANT_1m_DEM_projected.tif	GeoTIFF	Same as above, but projected onto the NAD83/Illinois East (EPSG::26971) coordinate system.
SAVANT_1m_DEM_projected.asc	Arc/Info ASCII	Same as above, but saved in Arc/Info ASCII format.
SAVANT_1m_DEM_projected.prj	ASCII	Metadata concerning the projection used in the previous two files.
SAVANT_ortho_10cm.tif	GeoTIFF	Georeferenced orthophoto at 10 cm horizontal resolution
SAVANT_ortho_reduced.png	PNG	Quick look orthophoto at reduced resolution
SAVANT_1m_contours.PNG	PNG	Quick look orthophoto overlaid with contours at 1 m intervals

SAVANT_1m_DEM.kml	KML	Bounding box data for DEM and orthophoto
SAVANT_Agisoft_Report.pdf	PDF	Processing and quality report automatically generated by AgitSoft Metashape
SAVANT_1m_DEM.tfw	Text	Ancilliary metadata output by Agitsoft Metashape
SAVANT_DEM_and_orthophoto_readme	Word Doc	This file

The DEM and orthophoto files are in standard/open GeoTIFF format and should be easily imported, and automatically georegistered by any common GIS software package such as ArcGIS or QGIS. Most modern GIS packages offer rendering and visualization (including contouring and 3D projecting), editing (e.g. cropping or resampling), and export functions.

5.0 Data Remarks:

The images from which the files were generated were collected on April 24, 2019 but are believed to be equally representative of the topography and appearance of the SAVANT field site during late Fall 2018 following harvest.

The resulting GeoTIFF have been successfully imported into the free GQIS software package under Windows 10/64. Compatibility with other GIS software or computer platforms has not been evaluated, but compatibility is not expected to be an issue given both the well-established non-proprietary data format employed and the industry-recognized cross-platform commercial software utilized to produce the files.

Horizontal registration of the final DEM and orthophoto was subjectively compared with Google Earth images and appeared to be consistent to within at least 1–2 meters over most of the area. Horizontal registration was somewhat poorer in the southwest portion of the domain but was still within a few meters of the imagery displayed in Google Earth. Prospective users can independently evaluate the registration by loading the orthophoto into Google Earth.

While we have no basis for a quantitative assessment of accuracy in the absence of a professional ground survey, we believe that the *relative* elevations and slopes obtained via the survey flight are likely to be considerably more detailed (higher horizontal and vertical resolution) and more accurate than those readily available from other sources.

6.0 References:

None applicable.

7.0 GCMD Keywords

EARTH SCIENCE	LAND SURFACE	TOPOGRAPHY	TERRAIN ELEVATION	DIGITAL ELEVATION/TERRAIN MODEL (DEM)
EARTH SCIENCE	LAND SURFACE	TOPOGRAPHY	TERRAIN ELEVATION	CONTOUR MAPS