Southwestern Ontario Orthophotography Project (SWOOP) 2015 Digital Elevation Model
User Guide

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Additional Information

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Executive Summary

Key Words

Southwestern Ontario Orthophotography Project, Digital Elevation Model, Provincial Mapping Unit, Elevation.

Abstract

Southwestern Ontario Orthophotography Project (SWOOP) 2015 Digital Elevation Model (DEM) is a 2m raster elevation product that represents a generalized representation of both surface and ground features. The product was generated by an imagery contractor for the purpose of ortho-rectifying the SWOOP 2015 orthophotography.

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List of Acronyms

ADS: Airborne Digital Sensor

AMT: Above Mean Terrain

CGVD: Canadian Geodetic Vertical Datum

DEM: Digital Elevation Model

DMC: Digital Mapping Camera

DSM: Digital Surface Model

DTM: Digital Terrain Model

GeoTIFF: Georeferenced TIFF

GIS: Geographic Information Systems

GSD: Ground Sample Distance

IfSAR: Interferometric Synthetic Aperture Radar

IMU: Inertial Measuring Unit

LAS: Laser File Exchange Format

LiDAR: Light Detection and Ranging

LIO: Land Information Ontario

MrSID: Multi-resolution Seamless Image Database

NAD: North American Datum

NIR: Near Infrared

PMU: Provincial Mapping Unit

RGB: Red Green Blue

TIFF: Tagged Image File Format

TIN: Triangular Irregular Networks

UTM: Universal Transverse Mercator

List of Definitions

Mass Points

Mass points are irregularly spaced points, each with x/y location coordinates and z-values, typically (but not always) used to form a TIN. When generated manually, mass points are ideally chosen to depict the most significant variations in the slope or aspect of TIN triangles. However, when generated automatically, e.g., by LiDAR or IfSAR scanner, mass point spacing and patterns depend upon the characteristics of the technologies used to acquire the data.

Digital Elevation Model (DEM)

A generic term for digital topographic and/or bathymetric data that is comprised of x/y coordinates and z-values to represent an elevation surface.

The terms 'DTM' and 'DSM' should be used over the term 'DEM' to more specifically reference 'bare-earth' or 'surface elevation' model products when possible.

The term 'DEM' is to be used as a broader term when referencing a generic elevation data product. The Provincial DEM is an example of a generic elevation product given that it has been constructed using a combination of both 'DTM' and 'DSM' elevation datasets to achieve Provincial coverage.

Digital Terrain Model (DTM)

The bare earth surface (lowest surface, last reflective surface, or LiDAR last-return) represents the surface of the "bare-earth" terrain, after removal of vegetation and constructed features.

Photogrammetry has traditionally generated DTMs when elevations are generated by manual compilation techniques. Unless specified to the contrary, the bare-earth surface includes the top surface of water bodies, rather than the submerged surface of underwater terrain.

Similar to a DSM, a DTM can be structured either as a vector dataset (comprised of mass points and optionally 3D breaklines) to model bare-earth elevations or a raster dataset that is interpolated from the vector elevation data to model bare-earth terrain elevations.

Using modern elevation point cloud classification algorithms and file formats, such as LAS, a DTM can represent a mass point dataset that has been classified for 'bare-earth' terrain elevations.

1. Product Description

1.1 Acquisition

SWOOP 2015 was collected by an imagery contractor for areas in Southwestern Ontario between April 12th and May 23rd of 2015. In total, there were more than 40 funding partners involved in SWOOP. The project encompassed an area of approximately 49,167 square kilometres.

1.2 Geographic Extent

The SWOOP 2015 DEM contains 44,631 non-overlapping tiles (1km by 1km) covering Southwestern Ontario including Owen Sound, Lambton Shores, Chatham-Kent, Windsor, London, St. Thomas, Woodstock, Waterloo, Kitchener, Brantford, Hamilton, Niagara Falls, Stratford, Cambridge, Welland, Port Colborne, St. Catharines and surrounding areas.
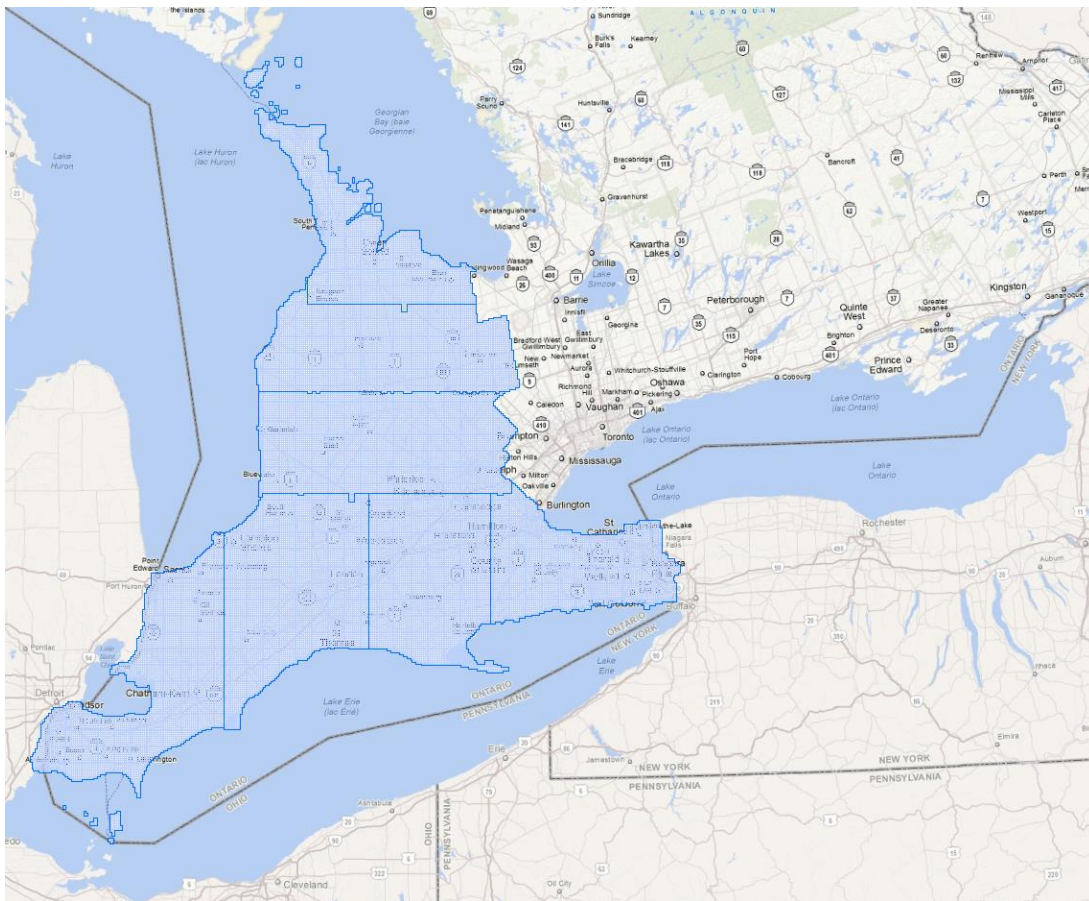

Figure 1: SWOOP 2015 DEM Tiles

1.3 Reference System

1.3.1 Horizontal Reference System

The horizontal coordinate system of the DEM is Universal Transverse Mercator (UTM) zone 17. The horizontal datum of the DEM is the North American Datum of 1983 (NAD83).

The horizontal unit of measure (coordinate system axis units) for all raster grid cells in the DEM is metres (m).

1.3.2 Vertical Reference System

The vertical coordinate system of the DEM is based on the Canadian Geodetic Vertical Datum 1928 (CGVD28) of the Geodetic Survey Division, and is measured in metres above mean sea level. For more information please see the Geodetic Survey Division of Natural Resources Canada (http://webapp.geod.nrcan.gc.ca/geod/).

The vertical unit of measure (coordinate system axis units) for all raster grid cells in the DEM is metres (m). One single vertical elevation value represents each raster grid cell in the DEM.

1.4 Resolution

1.4.1 Spatial Resolution

The grid spacing is based on Universal Transverse Mercator (UTM) projection with a raster cell resolution of 2 metres.

2. Product Details

2.1 DEM Product

The SWOOP 2015 DEM is a 2m raster product that has been generated by an imagery contractor from the Raw LAS vector elevation dataset. The primary purpose for generating the DEM was to allow for the imagery to be ortho-rectified by the imagery contractor. A proprietary 'steam rolling' algorithm was used to reduce raised surface features in the Raw LAS dataset. The DEM was delivered to MNRF as a derivative product as part of the imagery contract.

It is important to note that the DEM does not represent a full 'bare-earth' elevation surface. While the 'steam-rolling' algorithm has allowed for some raised features to be reduced closer to 'bare-earth' elevations (e.g. small buildings, small blocks of forest cover), many features are still raised above ground surface, such as larger buildings, larger forest stands and other raised features. The product is being distributed in the original state delivered by the imagery contractor without modification.

2.2 Data Delivery Format

The SWOOP 2015 DEM is currently stored and distributed through the Land Information Ontario (LIO) Metadata Tool (https://www.javacoeapp.lrc.gov.on.ca/geonetwork/srv/en/main.home).

The SWOOP 2015 DEM can be downloaded in seven packages: A, B, C, D, E, F and G (see Figure 2). Each package contains multiple DEM tiles in image (.IMG) format (see Table 1).
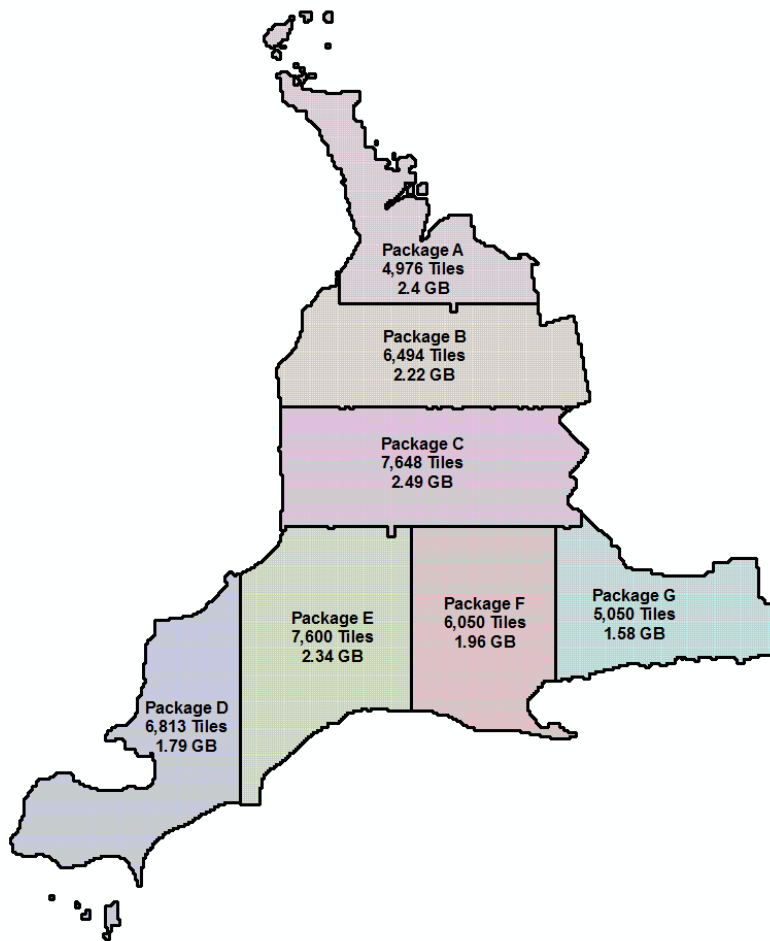

Figure 2: Seven Downloadable Packages

Table 1: Downloadable Packages

Package	IMG Files Included	Compressed Size
Package A	4,976	2.4 Gigabytes
Package B	6,494	2.22 Gigabytes
Package C	7,648	2.49 Gigabytes
Package D	6,813	1.79 Gigabytes
Package E	7,600	2.34 Gigabytes
Package F	6,050	1.96 Gigabytes
Package G	5,050	1.58 Gigabytes

2.3 Use Restrictions

The SWOOP 2015 DEM is considered Open Data and has no restrictions.

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