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Canada3D

Product Standard

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Canada

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1- Context

Canada3D is a digital elevation model (DEM) produced by the Canadian Forestry Service, Ontario region. The DEM consists of an ordered array of ground elevations providing coverage of the entire Canadian landmass. It has been derived from the cells of the Canadian Digital Elevation Data (CDED) at the 1:250 000 scale. Canada3D is available in two forms: grids regularly spaced at 30 or 300 arc-seconds. Canada3D 30 and 300 are recorded separately in the ASCII file format. The elevation values are expressed in metres with respect to mean sea level (MSL), in accordance with the North American Datum of 1983 (NAD83).

DEMs have assumed a major role in digital mapping. They are used in geographic information systems (GIS) for land-management applications. Moreover, they play the same role as contours and relief shading on conventional paper maps but offer greater analytical potential. DEMs can also be used for terrain modeling, for calculating the influence of the terrain on line-of-sight, for radar imaging, for simulating flooding, and similar applications.

2- Product Specifications

2.1- Coverage of the DEM

In both forms of Canada3D, DEM coverage corresponds to a cell (or file) that lies between 41° and 83° of latitude north (N) and 52° and 148° of longitude west (W).

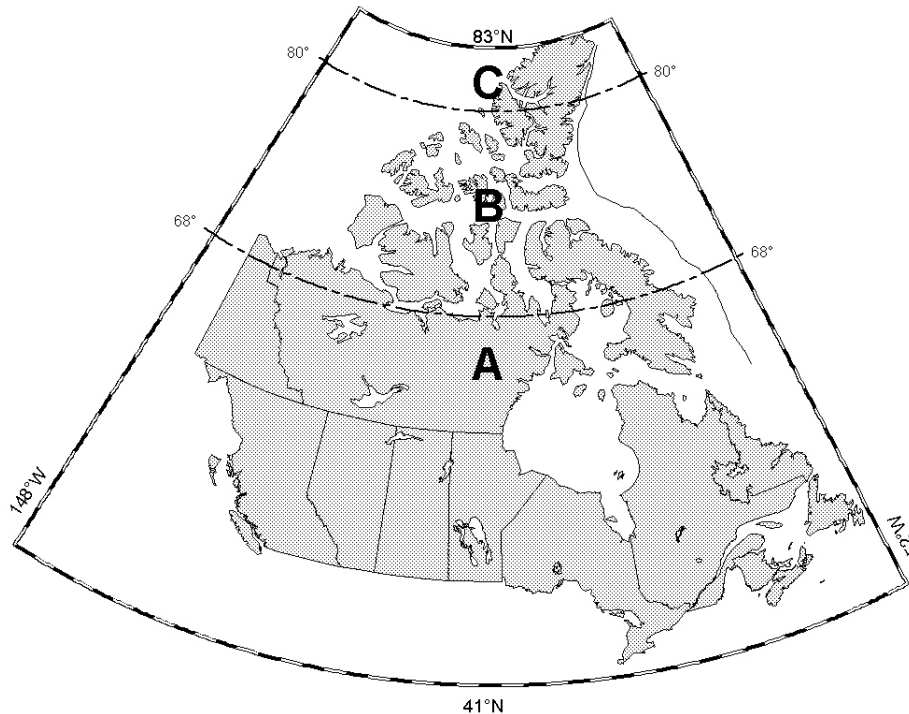


Figure 1- Geographic representation of Canada3D coverage

Each cell (or file) contains elevation points along north-south profiles. The spacing between the elevation points and profiles describe a regular grid. Depending on grid resolution or spacing, the cell (or file) contains a greater or lesser number of elevation points. The 30'' x 30'' grid (Canada3D 30), the denser model, contains a total of 58 060 800 elevation points, compared to 100 times fewer points in the 300'' x 300'' grid (Canada3D 300). The table below provides the characteristics of each Canada3D cell.

	Canada3D 30 (30'' x 30'' grid)	Canada3D 300 (300'' x 300'' grid)
Cell Extent (or file)	42° x 96°	42° x 96°
Number of Profiles (north-south)	11 520	1 152
Number of Lines (west-east)	5 040	504

Tableau 1- *Characteristics of Canada3D Cells according to Grid Interval*

2.2- Generalization Method

Canada3D was produced by generalizing CDED cells at the 1:250 000 scale using ESRI's ArcInfo® software. This method is often used to combine many elevation points (or pixels) from DEM files. The figure below illustrates that each elevation result value is obtained by calculating the mathematical average of the values contained in a 100-point elevation matrix (10 points of latitude x 10 points of longitude).

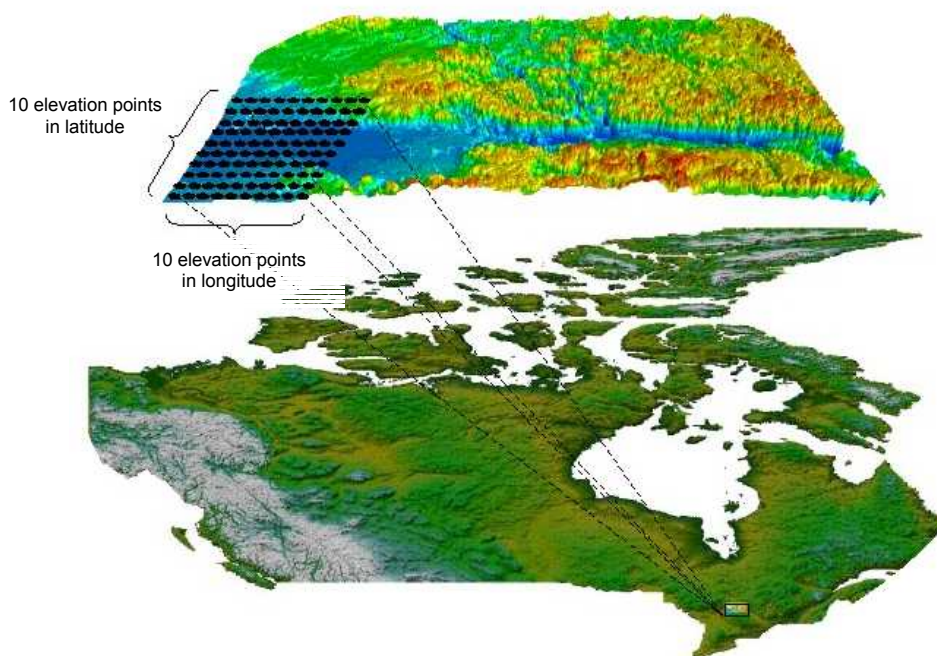


Figure 2- *Generalization method for Canada3D files*

2.3- Reference Systems

The North American Datum of 1983 (NAD83) is used as the horizontal reference system. As for the vertical reference system, elevations are orthometric and expressed in reference to mean sea level (MSL, Canadian Vertical Geodetic Datum).

2.4- Accuracy

Basically, the vertical accuracy of Canada3D DEM files depends on measurable horizontal errors inherent in the data source used to generate the CDED (errors normally generated by the process of scanning National Topographic System (NTS) map sheets) at the 1:250 000 scale. Accuracy also depends on the level of grid refinement obtained by aggregating CDED cells within three geographic zones (see Figure 1).

3- Storage Format

Canada3D 30 and 300 DEM files are stored in simple text format (ASCII "grid" format), which is supported by the great majority of geographic information systems (GIS) on the market.

3.1- File Logical Structure

As illustrated in the table below, the logical structure of Canada3D files begins with a file header (containing descriptive information about the cell or file), followed by elevation values, which are ordered along west-east lines.

<ncols xxx>	<i>Number of north-south profiles (where "xxx" ≥ 1)</i>
<nrows yyy>	<i>Number of west-east lines (where "yyy" ≥ 1)</i>
<xllcenter lon>	<i>Longitude of the lower left elevation point of the cell (where "lon" is in decimal degrees)</i>
<yllcenter lat>	<i>Latitude of the lower left elevation point of the cell (where "lat" is in decimal degrees)</i>
<cellsize zzz>	<i>Spacing between the elevation points (where "zzz" is in decimal degrees)</i>
<nodata_value www>	<i>Value assigned to elevation points for which there are no values (where "www" = -999)</i>
line_1	<i>List of ordered elevation values along the first line</i>
line_2	<i>List of ordered elevation values along the second line</i>
.	
.	
.	
line_n	<i>List of ordered elevation values along the nth line</i>

Table 2- Logical Structure of Canada3D Files

The following conventions apply to the ASCII Grid format.

- ◆ Each line ends with a carriage return.
- ◆ This format contains integer digital data.

3.2- File Name

File names depend on DEM resolution: "can3d30" for Canada3D 30 and "can3d300" for Canada3D 300, without file extensions. Once compressed, these files take up 37 688 608 bytes and 486 462 bytes of memory, respectively.