

# GPS-H v3.1

**GPS-H v3.1** provides a completely new interface, including a powerful spreadsheet to load and view data. It can accept different types of coordinates: geographic (DMS.s, DM.m and D.d), Cartesian and Mercator projections. Users can create and save custom input and output formats for their data sets. It allows data processing in a batch mode. It can provide error estimates for the geoid heights if errors are provided with the model. **GPS-H v3.1** does not only convert from h to H, but also the inverse conversion from H to h.

Please tour this document for a quick reference or read GPS-H v3.1 Help file for a complete list of all the options.

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$$h = H + N$$

h: Ellipsoidal height

H: Orthometric height

N: Geoid height



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Canada 

# GPS-H v3.1

## Installing the application

- Start GPSHsetup.exe

## Running the application

1. Select a geoid model
2. Select the reference frame of the coordinates
3. Select the epoch (if applicable)
4. Select the ellipsoid
5. Load coordinates
  - a. Enter data directly in spreadsheet or
  - b. Select format and load file
6. Save results
  - a. Select format and save results in a file

## Initial setting

- Model: HTv2.0
- Ref. Frame: NAD83(CSRS)
- Ellipsoid: GRS80
- Coordinates: Geographic
- Longitude code: West
- Formats: GHOST

The screenshot shows the GPS-H 3.0.33 application window. The interface includes a top menu bar, a main settings area, a data table, and a bottom status area. Numbered callouts (1-6) and labels (Help, Terms and Conditions, 6, Quit the application) point to specific elements in the interface.

**Callouts and Labels:**

- 1: Points to the Geoid Model dropdown menu.
- 2: Points to the Reference Frame dropdown menu.
- 3: Points to the Epoch data dropdown menu.
- 4: Points to the Ellipsoid dropdown menu.
- 5a: Points to the 'Input...' button.
- 5b: Points to the 'GHOST' format dropdown menu.
- 6: Points to the 'Save...' button.
- Help: Points to the question mark icon.
- Terms and Conditions: Points to the 'Terms and conditions' link.
- Quit the application: Points to the 'X' button in the window title bar.

**Application Settings:**

- Geoid Model: HT2\_0 [Height Transformation]
- Reference Frame: ITRF2000
- Epoch data: 1997/01/01
- Ellipsoid: GRS80
- Coordinates: Geographic
- Longitude code: West
- Format: GHOST
- Data File: DATA\_DONNEES (4071)

**Data Table:**

Station	Latitude (DMS)	Longitude (DMS)	h (m)	N (m)	H (m)
73N372	N45 35 14.22751	W 62 19 03.25593	73.674	-17.465	91.139
73T046X	N63 13 38.74026	W123 28 08.37968	129.955	-9.698	139.653
73T095	N63 12 54.56143	W123 26 14.25592	140.620	-9.754	150.374
73U114	N45 20 14.81204	W 80 02 11.0932	141.476	-36.432	177.908
73U238X	N44 33 48.23317	W 80 55 36.27399	197.887	-37.046	234.933
73VH068	N55 29 22.12321	W102 18 18.10334	267.572	-31.523	299.096
73VT060	N55 58 05.13689	W104 08 39.69277	395.742	-30.572	426.314
73Y063	N61 34 55.96	W133 05 10.1835	1087.454	5.592	1081.862
73Y141	N62 37 24.35805	W131 16 56.31299	892.527	2.725	889.802
73Y180	N63 10 30.26758	W130 12 02.00817	1179.053	3.004	1176.049
741000	N45 43 11.66588	W 63 48 18 75167	88 936	-19 787	108 722

**Bottom Status Area:**

- Computation Method: Geoid + Corrector Surface
- Summary: Stations 4024 Non defined 13
- Language: Français
- Batch processing:
- h = H + N:
- Terms and conditions: [Terms and conditions](#)
- Logos: Natural Resources Canada, Ressources naturelles Canada

# Quick Start

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The screenshot shows the main window of the GPS-H v3.1 software. The interface includes a top menu bar, a main data table, and a bottom control panel. Callout boxes provide detailed explanations of key features:

- Active model:** Points to the 'Geoid Model' dropdown menu, currently set to 'HT2\_0 [Height Transformation]'.
- View model parameters:** Points to the information icon (i) next to the Geoid Model dropdown.
- Load a model:** Points to the globe icon next to the Geoid Model dropdown.
- Load a coordinates file:** Points to the 'Input...' button in the Data section.
- Select either NAD83(CSRS) or one of the 12 ITRF realizations:** Points to the 'Reference Frame' dropdown menu, currently set to 'ITRF2000'.
- Choose between 4 ellipsoids:** Points to the 'Ellipsoid' dropdown menu, currently set to 'GRS80'.
- Change view for the types of coordinates:** Points to the 'Coordinates' section with radio buttons for 'Geographic', 'Cartesian', and 'UTM/MTM'.
- User friendly spreadsheet:** Points to the data table, which is styled as a spreadsheet.
- Clear datasheet:** Points to the 'Reset' button at the bottom of the data table.
- Apply bias or planar correction to geoid heights through control stations:** Points to the 'Advanced mode >>' button.
- Activate inverse conversion:** Points to the 'h = H + N' checkbox.
- Save your results:** Points to the 'Save...' button.
- Select or create your own output format:** Points to the 'UNICSV' dropdown menu.
- Select or create your own input format. It accepts geographic, Cartesian and Mercator:** Points to the 'GHOST' dropdown menu.

The data table contains the following information:

Station	Latitude (DMS)	Longitude (DMS)	h (m)	N (m)	H (m)
73N372	N45 35 14.22751	W 62 19 03.25593	73.674	-17.465	91.139
73T046X	N63 13 38.74026	W123 28 08.37968	129.955	9.698	139.653
73T095	N63 12 30.56143	W123 26 14.25592	140.620	-9.754	150.374
73U114	N45 20 14.81204	W 80 02 11.0932	141.476	-36.432	177.908
73U238X	N44 33 48.23317	W 80 55 36.27399	197.887	-37.046	234.933
73VH068	N55 29 22.12321	W102 18 18.10334	267.572	-31.523	299.096
73VT060	N55 58 05.13689	W104 08 39.69277	395.742	-30.572	426.314
73Y063	N61 34 55.96	W133 05 10.1835	1087.454	5.592	1081.862
73Y141	N62 37 24.35805	W131 16 56.31299	892.527	2.725	889.802
73Y180	N63 10 30.26758	W130 12 02.00817	1179.053	3.004	1176.049
741000	N45 43 11.66588	W 63 48 18.75167	88.936	-19.787	108.722

## Main window

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Right click options on the data sheet:

Copy (^C) and paste (^V) highlighted data from data sheet to commercial spreadsheet or reverse direction

Delete highlighted rows

Option to highlight all data

Right click header Latitude or Longitude to toggle view between D.D, DM.M and DMS.S

Enter coordinates as D.D, DM.M and DMS.S

Error estimates for N (CGG2010)

Station	Latitude (D)	Longitude (D)	h (m)	N (m)	H (m)
0023010	N46.73322569	W63.8538	-23.006	-29.214 ±0.011	6.208
00L9519	N48.34616891	W63.0244	-23.910	-27.568 ±0.013	3.659
03B9000X	N46.22544606	W63.05105	-17.294	-19.609 ±0.008	2.315
03M125	N48.18287549	W64.96157026	-18.045	-19.561 ±0.013	1.516
047013	N49.00007737	W118.52670352	615.789	-16.207 ±0.056	631.996
04F9001	N59.39205631	W63.87747067	-2.844	-5.721 ±0.053	2.876
04F9004	N59.69435167	W64.13259738	-2.537	-6.096 ±0.039	3.559
04F9007	N60.33469198	W64.45180559	-2.798	-5.418 ±0.024	2.619
04P9201	N46.23013151	W63.12217699	-16.051	-18.346 ±0.007	2.295

Drag and drop to load a file



Right click header Zone to select UTM, Provincial MTM or your own Mercator projection

Geographic View

UTM/MTM View

Load multiple files; each file can have different types of coordinates (make sure to select proper format before loading). Enter extra records manually.

Create your own MTM projections

Station	Zone	Easting (m)	Northing (m)	h (m)	N (m)	H (m)
047013	11	28587.299	615.789	-16.207 ±0.056	631.996	
04F9001	20	44	-5.721 ±0.053	2.876		
04F9004	20	37	-6.096 ±0.039	3.559		
04F9007	20	419845.357	6689568.502	-2.798	-5.418 ±0.024	2.619
04P9201	20	490578.851	5119624.452	-16.051	-18.346 ±0.007	2.295
078010	7	499934.890	7106651.198	1304.197	11.491 ±0.032	1292.705
08205	18	552393.204	5008227.459	25.909	-31.124 ±0.005	57.033
088009	7	502674.498	6993145.870	1318.639	12.758 ±0.036	1305.881
08L1116	19	384333.081	5205277.450	-12.254	-28.430 ±0.012	16.176

Scroll through your data

# Data sheet (Geographic and UTM/MTM)

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The screenshot shows the main window of the GPS-H v3.1 software. The interface includes a top menu bar, a central data table, and a bottom control panel. Callouts provide detailed information about various components:

- NS Deflections** and **EW Deflections**: Callouts pointing to the 'NS (sec)' and 'EW (sec)' columns in the data table.
- Enter data date for the proper transformation between ITRF and NAD83(CSRs)**: Callout pointing to the 'Epoch of data' field.
- Select a UTM/MTM projection or create your own projection**: Callout pointing to the 'Geoid Model' dropdown menu.
- File loaded and number of records in file**: Callout pointing to the 'DATA\_DONNEES (4071)' field.
- Toggle between English and French**: Callout pointing to the language selection buttons.
- Call Help file**: Callout pointing to the help icon.
- Geoid Heights**: Callout pointing to the 'N (m)' column in the data table.
- Provide a summary of the number of loaded data**: Callout pointing to the 'Summary' section at the bottom.
- Switch to Batch processing (Data sheet must be empty to be active)**: Callout pointing to the 'Batch processing' checkbox.
- Activate/Deactivate the view for the deflections of the vertical**: Callout pointing to the 'Show deflections of vertical' checkbox.

Station	Zone	Easting (m)	Northing (m)	NS (sec)	EW (sec)	N (m)
0023010	19	318886.674	5178248.108	-4.1	-1.4	-29.215 ±0.011
00L9519	19	471065.709	5354850.298	-4.5	3.9	-27.570 ±0.013
027001	11	434600.331	5427886.443	-7.5	2.7	-16.096 ±0.069
037016	11	592994.657	5428334.012	-1.6	3.9	-14.441 ±0.070
03B9000X	20	380958.503	5120254.634	0.5	-2.8	-19.611 ±0.008
03M125	20	354196.689	5338486.845	-7.1	-0.6	-19.563 ±0.013
047013	11	388335.047	5428587.299	-1.8	3.1	-16.208 ±0.056
04F9001	20	450162.493	6584037.501	-2.3	-9.6	-5.722 ±0.053
04F9004	20	436246.567	6617916.669	-3.2	-12.3	-6.097 ±0.039
04F9007	20	419845.357	6689568.502	-3.5	-12.5	-5.419 ±0.024
04P9201	20	490578.851	5119624.452	-0.6	-1.9	-18.347 ±0.007

## Main window (Deflections)

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Define positive direction for the manually entered longitudes

Geoid Model: iCGG2005 [Geoid Height]

Reference Frame: NAD83(CSRs) ITRF2005

Epoch of data: 1997/01/01

Ellipsoid: GRS80

Data: Coordinates: Geographic Cartesian UTM/MTM Longitude code: West East

Station	Latitude (D)	Longitude (D)	h (m)	N (m)	H (m)	Control
0023010	N46.73322569	W71.37053538	-23.006	-29.634 ±0.011	6.473	<input checked="" type="checkbox"/>
00L9519	N48.34616891	W69.39050244	-23.910	-27.988 ±0.013		<input type="checkbox"/>
027001	N49.00040938	W117.8941525	1525.752	-16.514 ±0.069	1542.266	<input type="checkbox"/>
037016	N49.00089446	W115.72854573	1787.336	-14.859 ±0.070	1802.195	<input type="checkbox"/>
03B9000X	N46.22544606	W64.54365105	-17.294	-20.029 ±0.008	2.626	<input checked="" type="checkbox"/>
03M125	N48.18287549	W64.96157026	-18.045	-19.981 ±0.013	1.936	<input type="checkbox"/>
047013	N49.00007737	W118.52670352	615.789	-16.626 ±0.056	632.415	<input type="checkbox"/>
04F9001	N59.39205631	W63.87747067	-2.845	-6.141 ±0.053	3.296	<input type="checkbox"/>
04F9004	N59.69435167	W64.13259738	-2.537	-6.516 ±0.039	3.978	<input type="checkbox"/>
04F9007	N60.33469198	W64.45180559	-2.799	-5.837 ±0.024	3.039	<input type="checkbox"/>
04P9201	N46.23013151	W63.12217699	-16.051	-18.766 ±0.007	2.715	<input type="checkbox"/>

Computation Method: Geoid Model Geoid Model + Bias Geoid Model + Plane

Statistics of discrepancies (h - H - N): Stations 4024, Non defined 0, Controls 2447. Bias: -0.418m

Place the cursor above the height to see the discrepancy at a control station

Identify manually the control stations and edit the orthometric heights

Choose between bias or planar correction

Load control stations

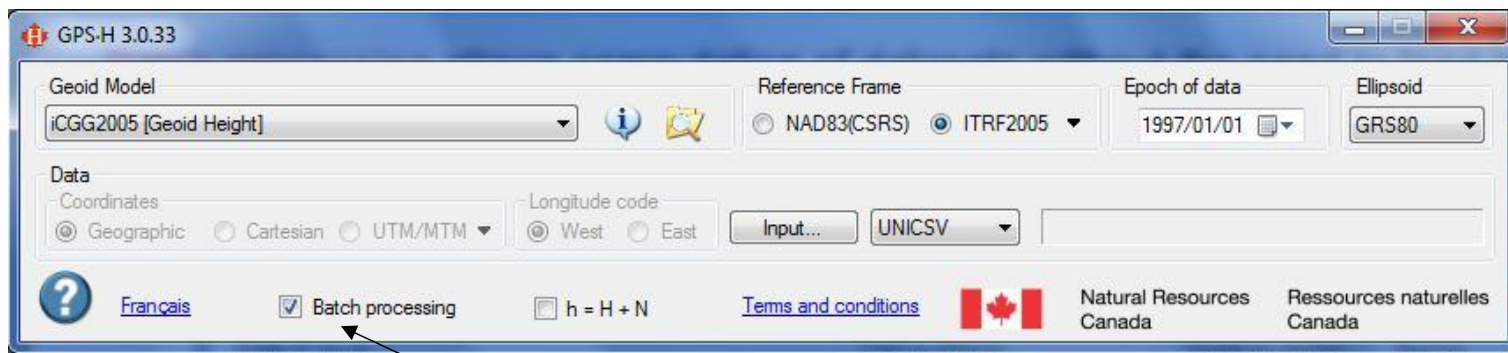
Reset data prior to apply corrections (bias or plan)

Provide statistics of the adjustment of the control stations

## Main window (Advanced Mode)

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**Batch processing** allows computation of datasets without the need to load them into the spreadsheet. The results are saved directly into an output file with the associated output format of the input file.



Activate/Deactivate Batch processing

**Batch processing** allows:

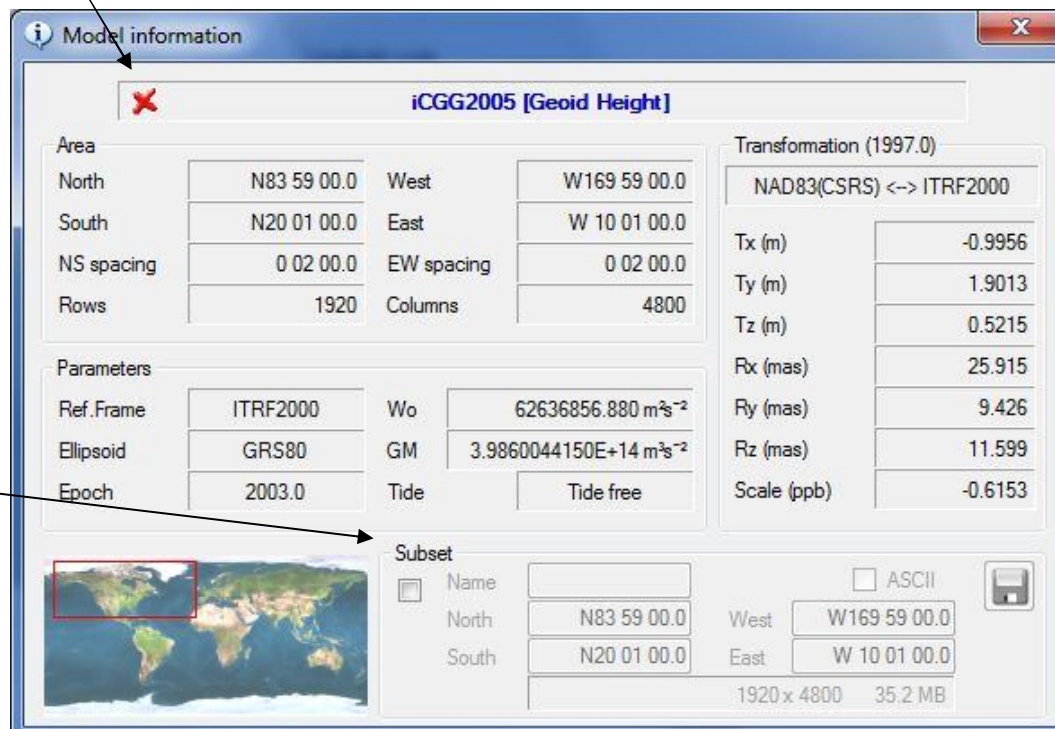
- The direct conversion (ellipsoidal heights ( $h$ ) to orthometric height ( $H$ )) and
- The inverse conversion (orthometric height ( $H$ ) to ellipsoidal height ( $h$ )).

## Batch Processing

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**Model Information** Window allows you to view the **parameters of the geoid models** and the **seven-transformation parameters**. Transformation parameters convert geoid heights and ellipsoidal heights to a common geometric reference frame.

Delete the identified geoid model



GPS-H v3.1 allows you to extract a **Subset** of a geoid model. The option is activated by clicking the check box.

The **Subset** can be saved in a binary format (byn) or ASCII format ( $\phi$ ,  $\lambda$ ,  $N$ ).

Key components of a geoid model:

- Reference Frame
- Ellipsoid
- $W_0$

$W_0$  is the vertical reference surface ( $H = 0$ ) for the orthometric heights

## Model Information Window

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**My Format** Window allows you to customize your own input and output formats. The formats can be either **Free** or **Fixed**. For the **Free** format, each field is separated by a delimiter of your choice.

Click the arrow to view the list of your formats or enter a name to save a new format

Delete a format

Select the type of coordinates

Save your format

You can save as many personal formats for geographic, Cartesian and MTM coordinates.

The screenshot shows the 'My Format' window with the following settings:

- Format: MyGeo
- Coordinates: Geographic (selected), Cartesian, MTM
- Longitude code: West (selected), East
- Free/Fixed: Free (selected)
- Delimiters: Tab (selected), Space, Comma, Other
- Input fields (checked): Station (Col 1), Latitude (Col 2), Longitude (Col 3), Ellipsoidal Height (Col 4)
- Output fields (checked): Station (Col 1), Latitude (Col 2), Longitude (Col 3), Ellipsoidal Height (Col 4), Geoid Height (Col 5), Orthometric Height (Col 6)
- Lines in header: 0

Identify the column number for each field selected by a check mark.

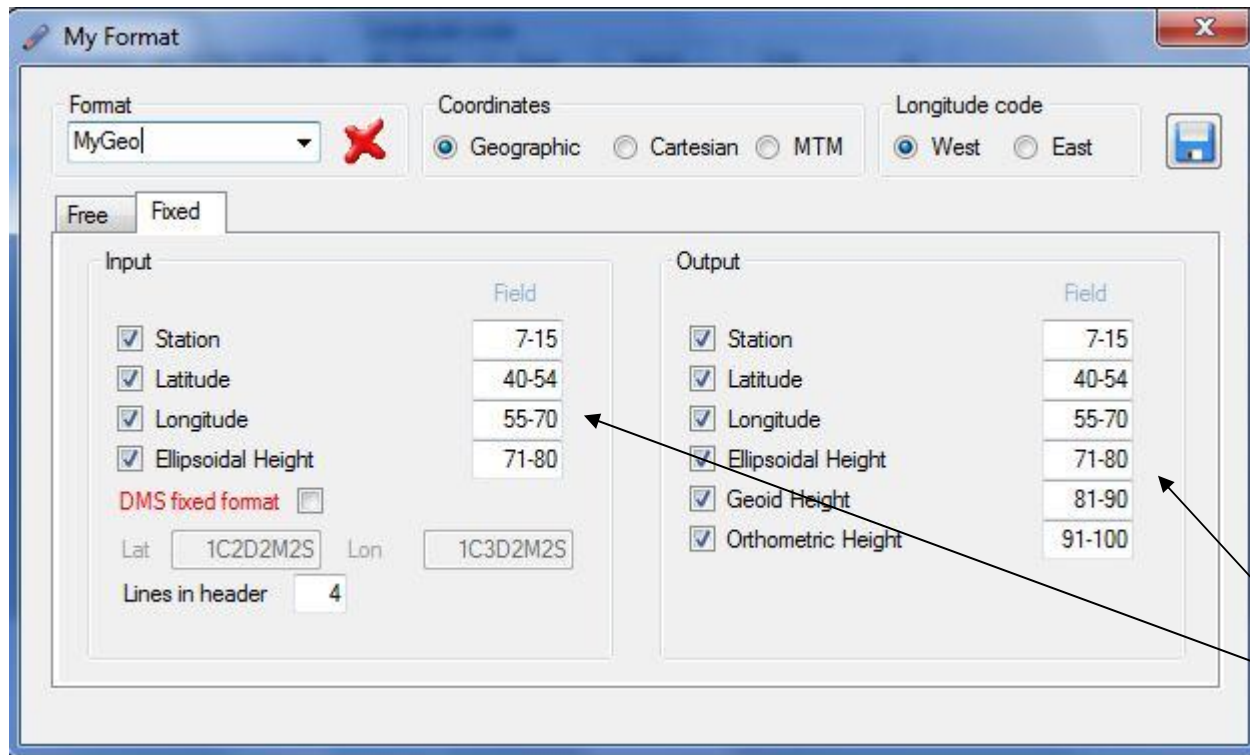
Enter column

Number of header lines to skip in input file

## My Format Window (Free)

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**My Format** Window allows you to customize your own input and output formats. The formats can be either **Free** or **Fixed**. For the **Fixed** format, each field is defined in specific columns.



You can save as many personal formats for geographic, Cartesian and MTM coordinates.

Identify the starting and ending columns for each field selected by a check mark (e.g., 25-31).

The **DMS fixed format** allows you to read DMS latitudes and longitudes that are not separated by an empty space between each component.

## My Format Window (Fixed)

**My MTM** Window allows you to define your own MTM projections. You need to define the **Central meridian**, **False Easting**, **False Northing** and **Scale Factor**. Enter a **Name** to identify your projection and save it by clicking the disk icon.

Click the arrow to view the list of your MTM projections or enter a name to save a new projection

Delete a MTM Projection

The screenshot shows the 'My MTM' window with the following fields and controls:

Name	Test 1	X	Save
Central Meridian	W 70 00 00.0		
False Easting (m)	500000.000		
False Northing (m)	0.000		
Scale Factor			0.9996
			<input checked="" type="radio"/> 6° zone
			<input type="radio"/> 3° zone
			<input type="radio"/> Defined

Save your MTM Projection

You can create as many personnel projections and select them using the arrow in the name box. Each projection can be edited and saved again or can be deleted from your list by clicking the **X** icon

GPS-H v3.1 already comes with the standard UTM projections and provincial MTM projections.

## MTM Window