# Access guide to the High Resolution Digital Elevation Model Mosaic (HRDEM Mosaic)

*Version 2.0*

*February 2025*

# Use of WMS and WCS services

The HRDEM Mosaic product can be accessed via WMS and WCS services.

The WMS service allows you to view all the derived products for the entire product coverage.

WMS URL :
https://datacube.services.geo.ca/ows/elevation?service=wms&request=GetCapabilities

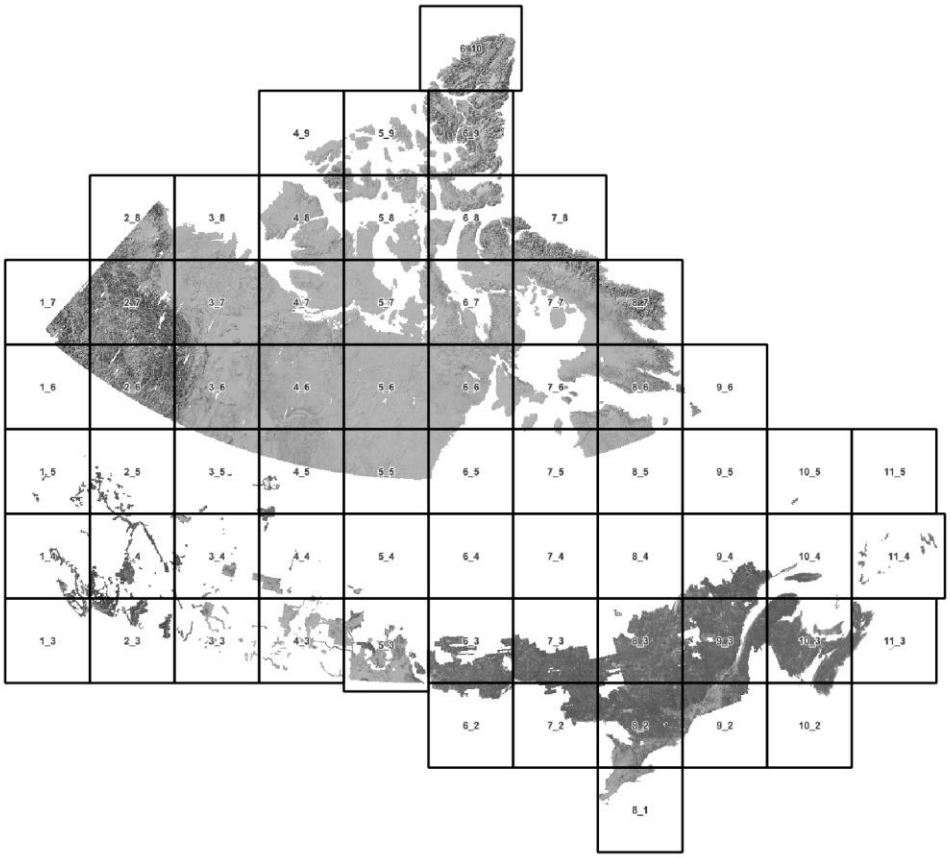
The WCS service allows you to view and access elevation data from the HRDEM Mosaic product. Please note that the WCS access method will be phased out in the future. The Cloud Optimized Geotiffs (COGs) method and the STAC catalog are therefore preferred when you want direct access to the product's elevation data.

WCS URL :
https://datacube.services.geo.ca/ows/elevation?service=wcs&request=GetCapabilities

# QGIS, use through the STAC catalog

In order to optimize product display and handling, the HRDEM Mosaic elevation data is divided into 66 sub-units of around 500km x 500km (see map below) and made available in the form of COGs in a STAC catalog. The product is available in 1m and 2m resolution collections.

In this section, we present two approaches for efficiently accessing these data.



## Approach via the STAC API Browser extension

Loading COG files via the STAC catalog is possible in QGIS using the [QGIS STAC API Browser extension]. Please see the extension page for details of how it works.

URL of the STAC Catalog: https://datacube.services.geo.ca/stac/api/

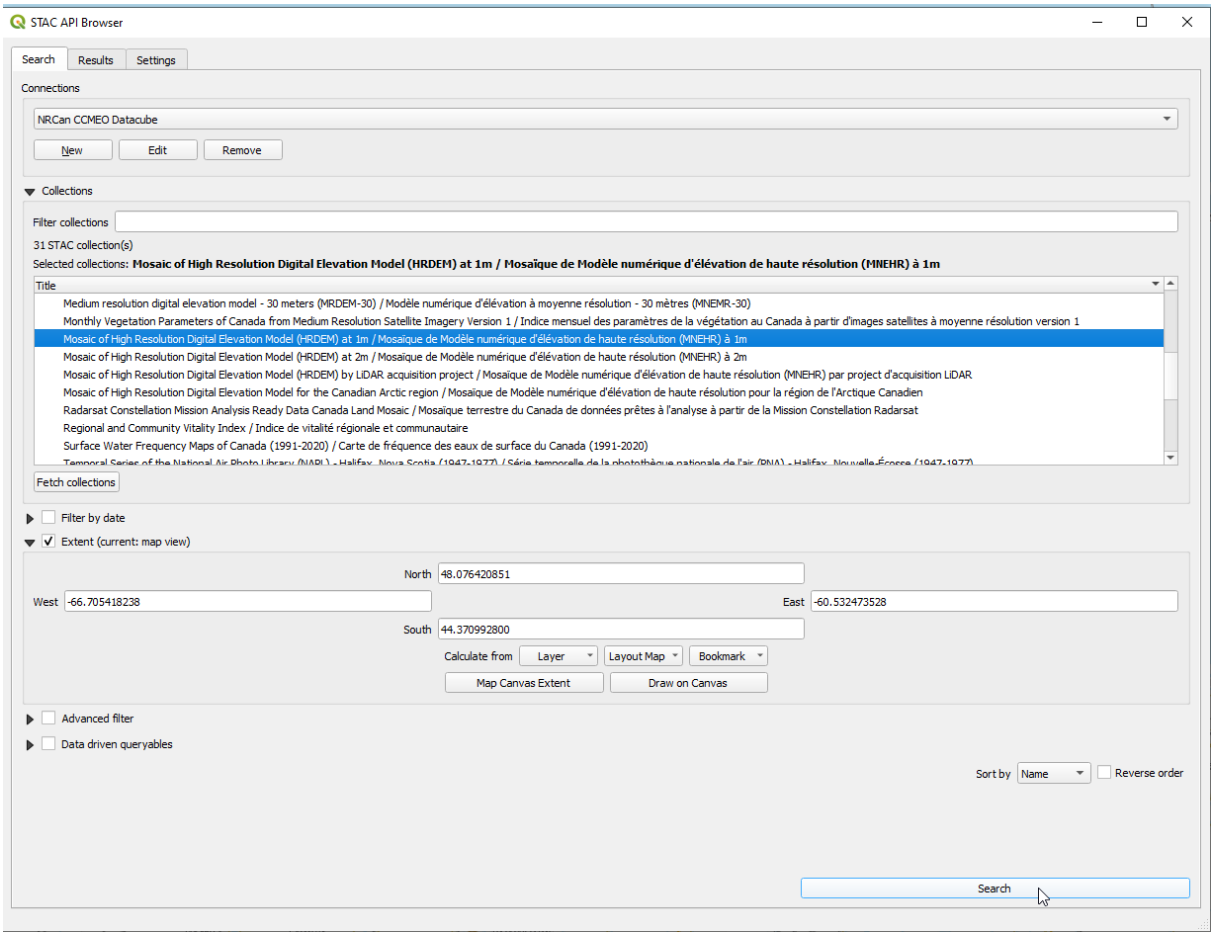
1. **Choose a collection**

The example shown here is for the 1m resolution collection.

In the list of collections from the STAC catalog, select the **Mosaic of HRDEM at 1m / Mosaïque de MNEHR à 1m collection.**

To limit the search to items that spatially cover your area of interest, you can use the extent filter tool (i.e. *Map Canvas Extent* or *Draw on Canvas*).

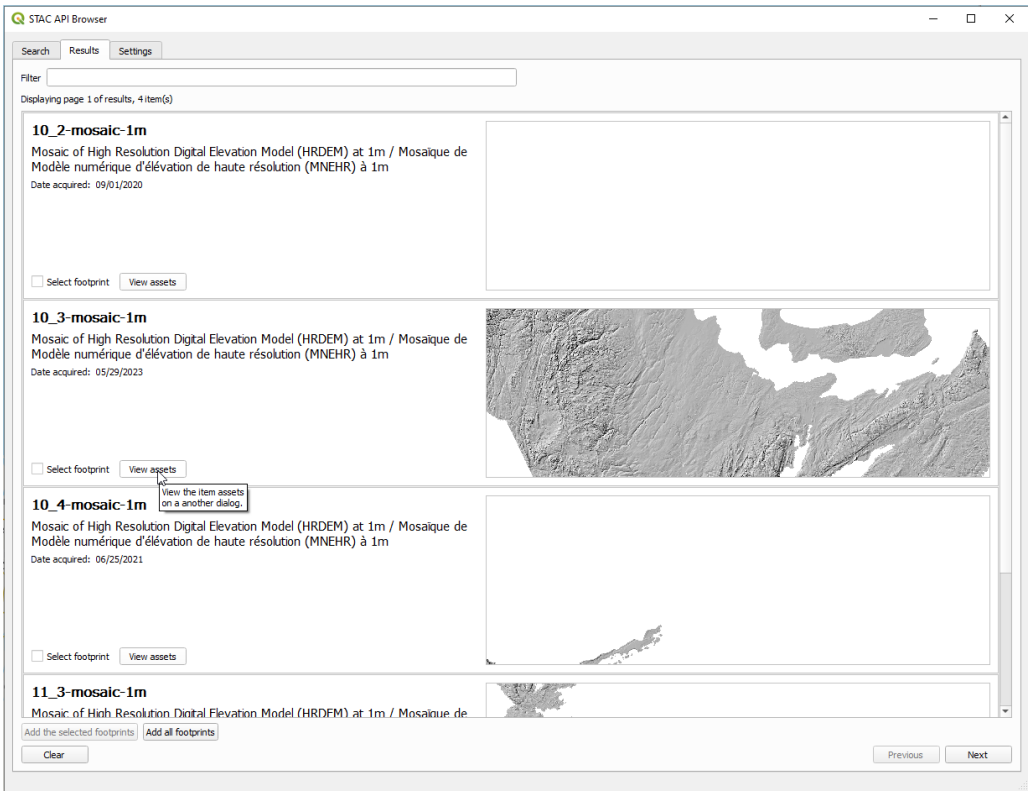
Then click on ***Search*** to search for records.




## 2. Load the data

The number of items in the results will depend on the collection requested and the filters used.

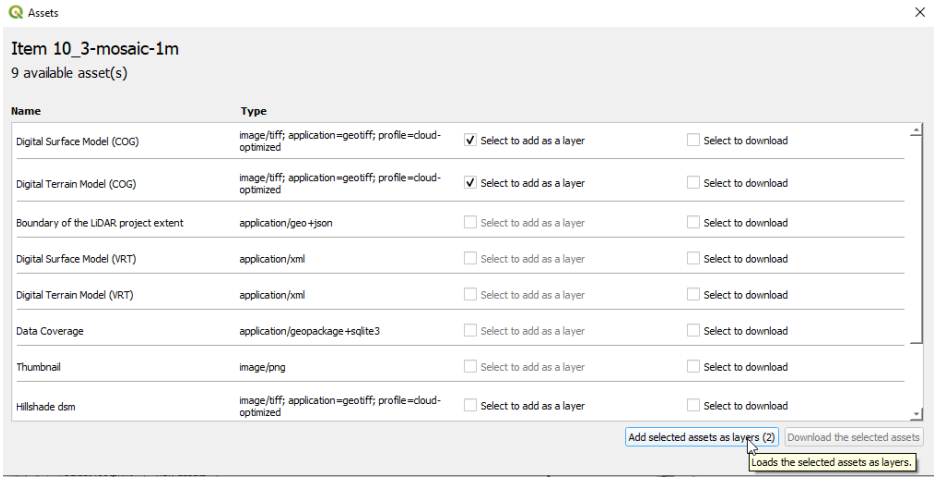
For items of interest, click on the item's ***View assets*** button to see the associated resources.




Then select one or more resources associated with the item.

The ***Select to add as a layer*** checkbox lets you add them directly to the map, while ***Select to download*** lets you download them locally.

In the example shown, we add the COGs of the terrain and surface models of the item 10_3-mosaic-1m as layers in QGIS. This is one of the 66 sub-tiles that make up the HRDEM Mosaic.

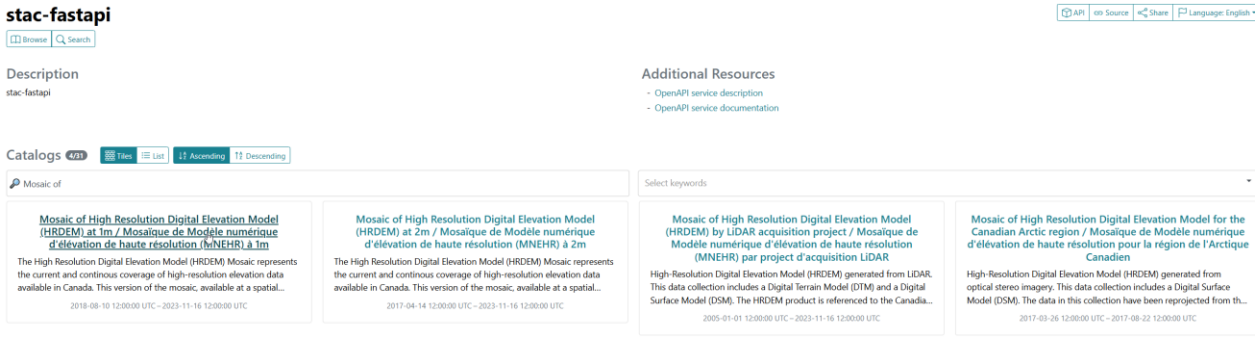


## Approach via the stac-browser web interface

It is also possible to search the HRDEM Mosaic collections at 1m and 2m resolution via the stac-browser web interface.

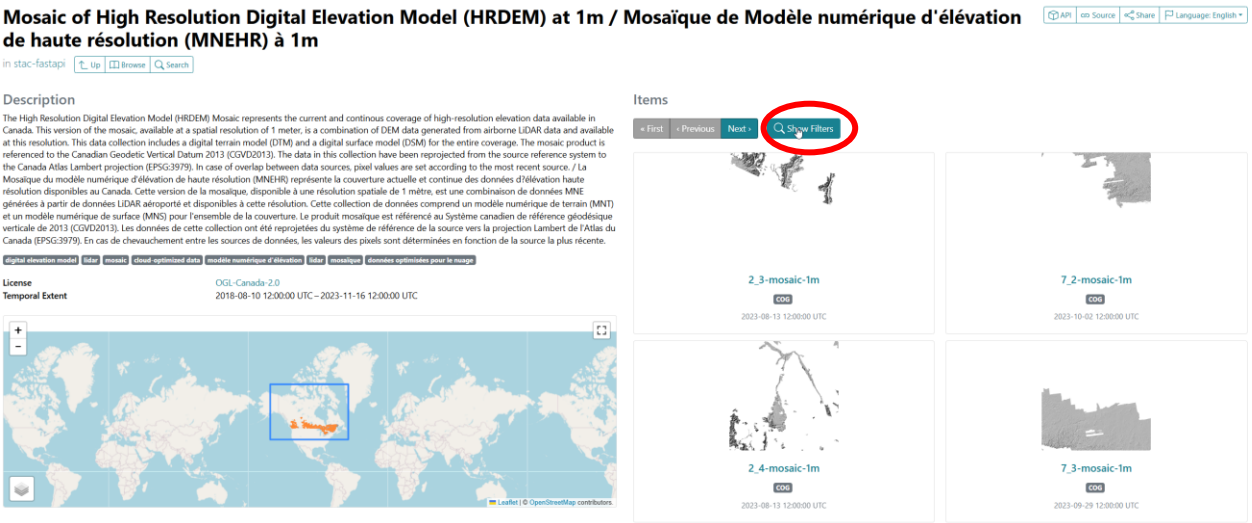
URL of the STAC catalogs of the NRCan Data Cube on stac-browser:
https://radiantearth.github.io/stac-browser/#/external/datacube.services.geo.ca/stac/api/?.language=en

First, search for collections starting with "**Mosaic of High Resolution**...". Then choose the collection you're interested in. In this example, we choose the 1m resolution collection.

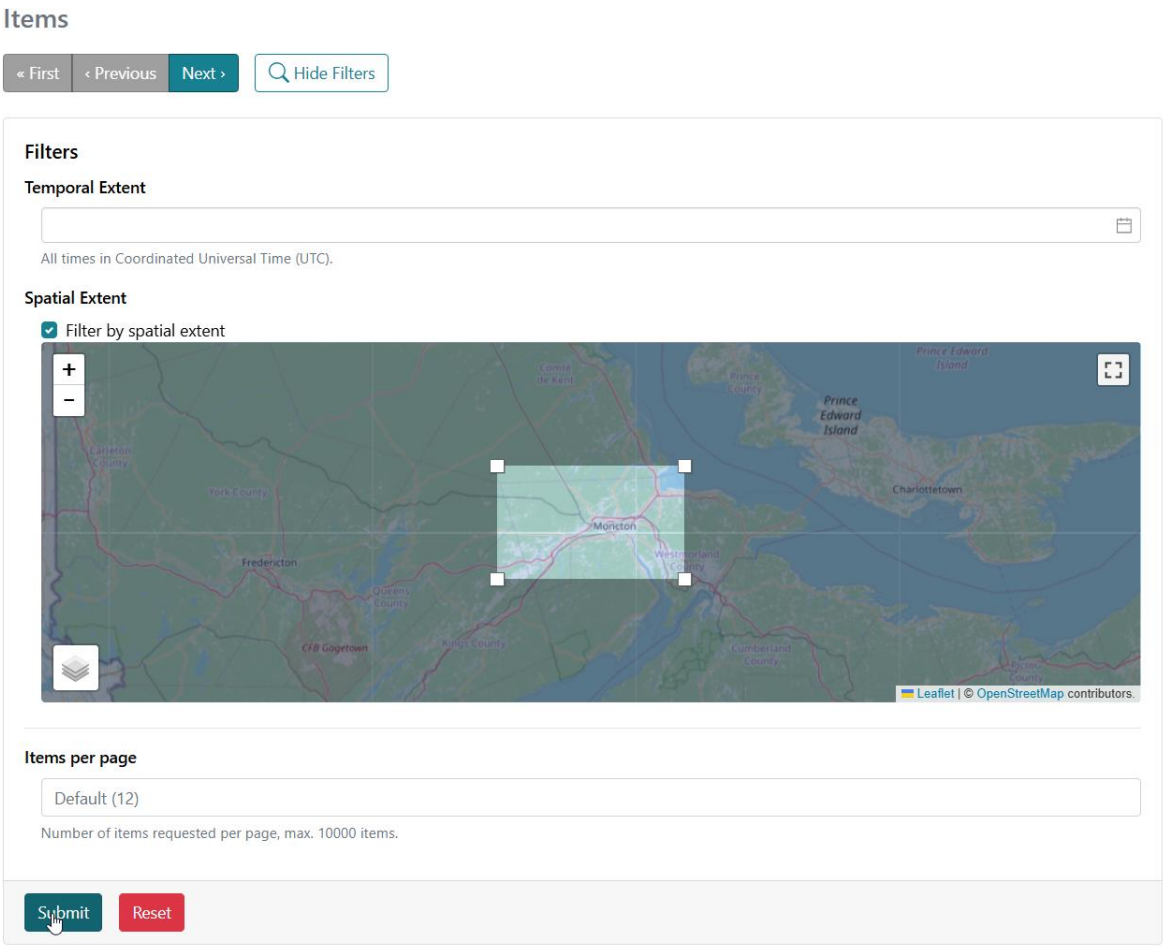



You will then have access to the various COG sub-tiles that make up the HRDEM Mosaic.

To facilitate your search, use the ***Show Filters*** tool.

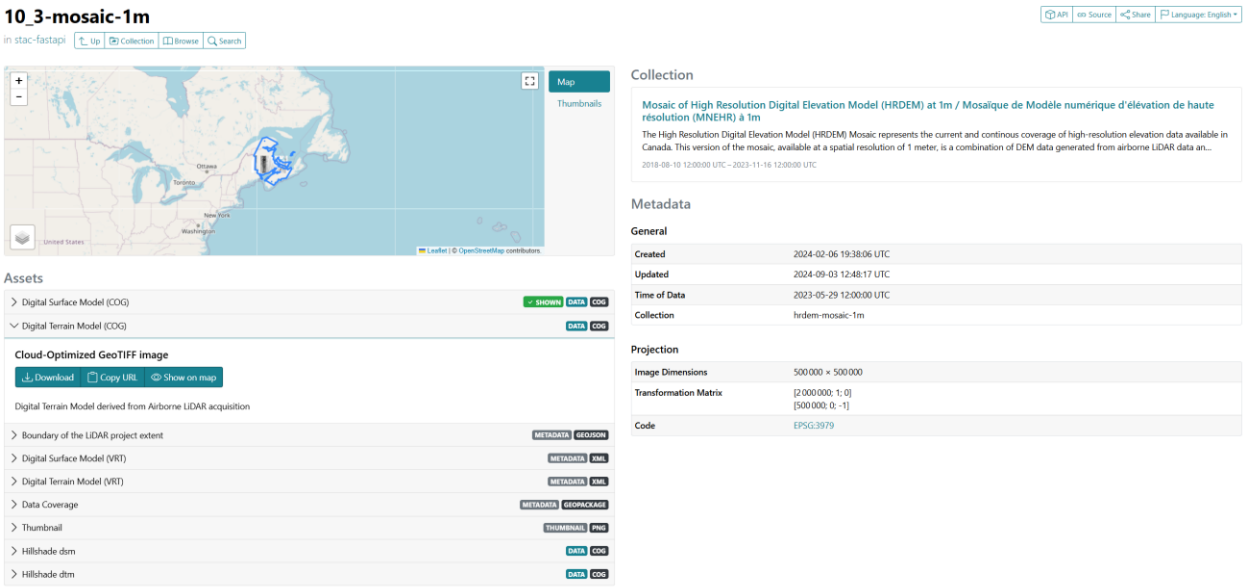


***Filter by spatial extent*** allows you to specify your area of interest geographically. Once you've defined your area, click on ***Submit***.



Here is the result of the items available for the example:


For the item in question, you then have access to downloads and URLs for assets associated to this item, including COGs and .vrt files for terrain and surface models, as well as shaded relief. These assets can then be used in a GIS software.

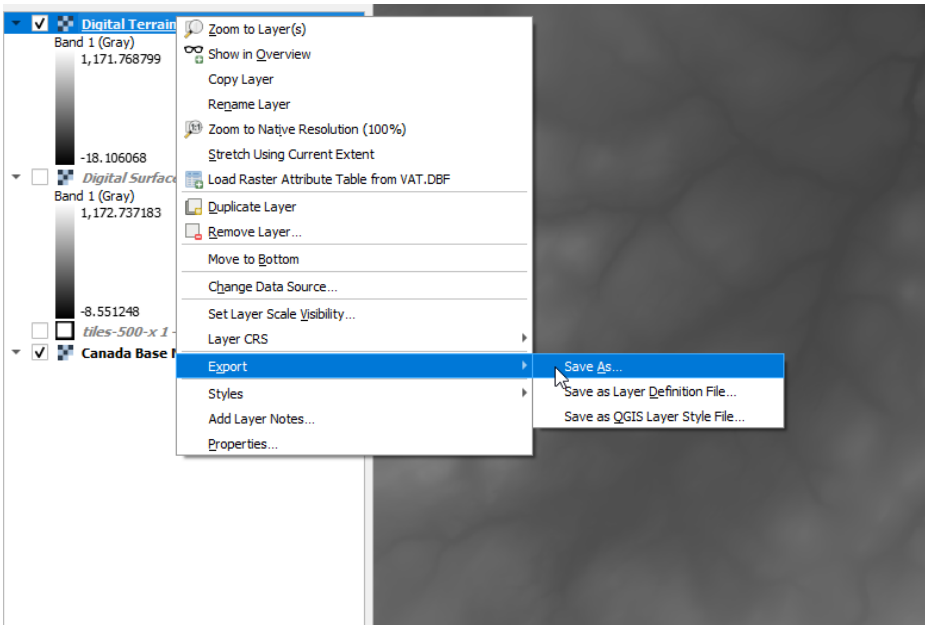


# QGIS, extraction of a zone into a local file

Once the HRDEM Mosaic COGs have been opened in QGIS, either directly via COGs or .vrt files, it is possible to extract a file for a specific area.

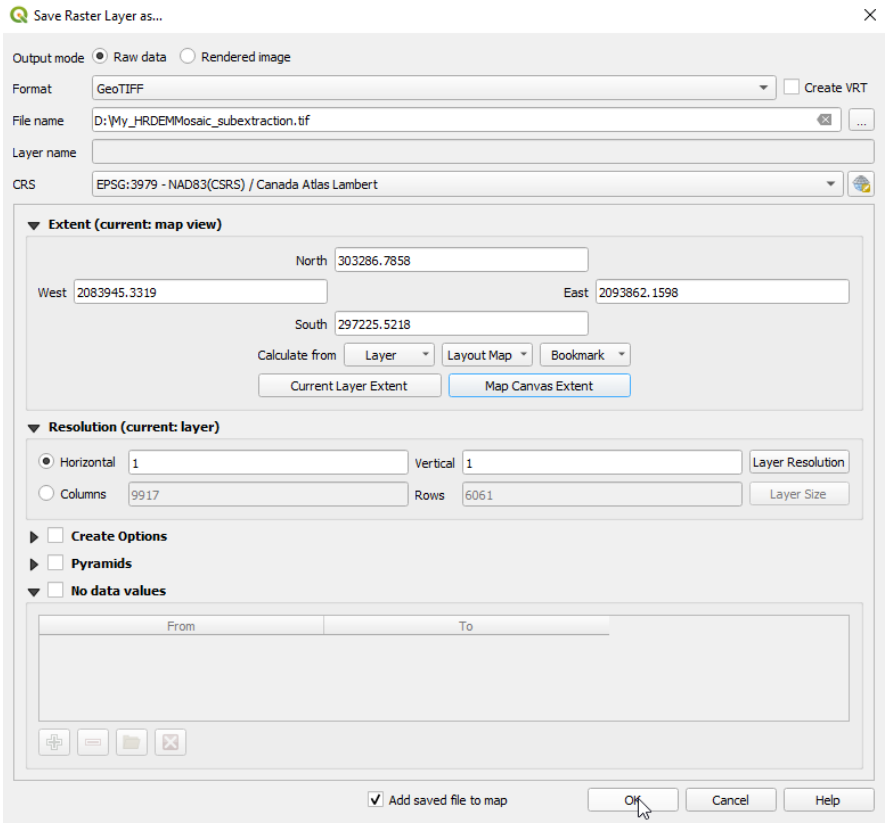
First, frame the map on the area of interest using the tool .

In the layer panel, go to the context menu of the HRDEM Mosaic layer and select ***Export***, then ***Save as***.




In the next window, click on the ***Map Canvas Extent*** button to extract the area covered by the map only. The larger the area and the lower the resolution, the larger the file will be. You must also enter a file path.

Confirm extraction by clicking on ***Ok***.


Save Raster Layer as...
Output mode
Raw data
Rendered image
Format
GeoTIFF
Create VRT
File name
D:\My_HRDEMMosaic_subextraction.tif
Layer name
CRS
EPSG:3979 - NAD83(CSRS) / Canada Atlas Lambert
Extent (current: map view)
North
303286.7858
West
2083945.3319
East
2093862.1598
South
297225.5218
Calculate from
Layer
Layout Map
Bookmark
Current Layer Extent
Map Canvas Extent
Resolution (current: layer)
Horizontal
1
Vertical
1
Layer Resolution
Columns
9917
Rows
6061
Layer Size
Create Options
Pyramids
No data values
From
To
Add saved file to map
OK
Cancel
Help

# ESRI ArcGIS Pro (3.4)

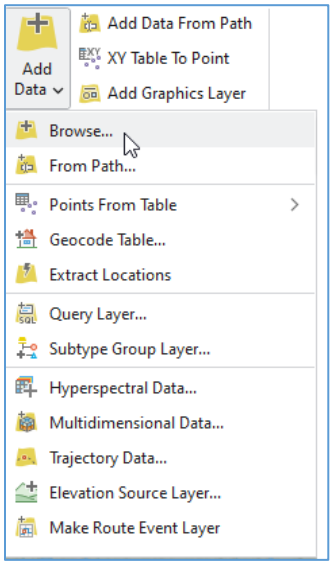
Beyond the use of the product's web services, our tests have shown that the use of COGs is not functional in all versions of ArcGIS Pro. A good alternative is to use the GDAL virtual format (VRT).

To obtain the .vrt links specific to your area of interest, you can use the web interface approach (see above). Once the mosaic sub-tile has been identified, you can retrieve the link to the corresponding .vrt file.

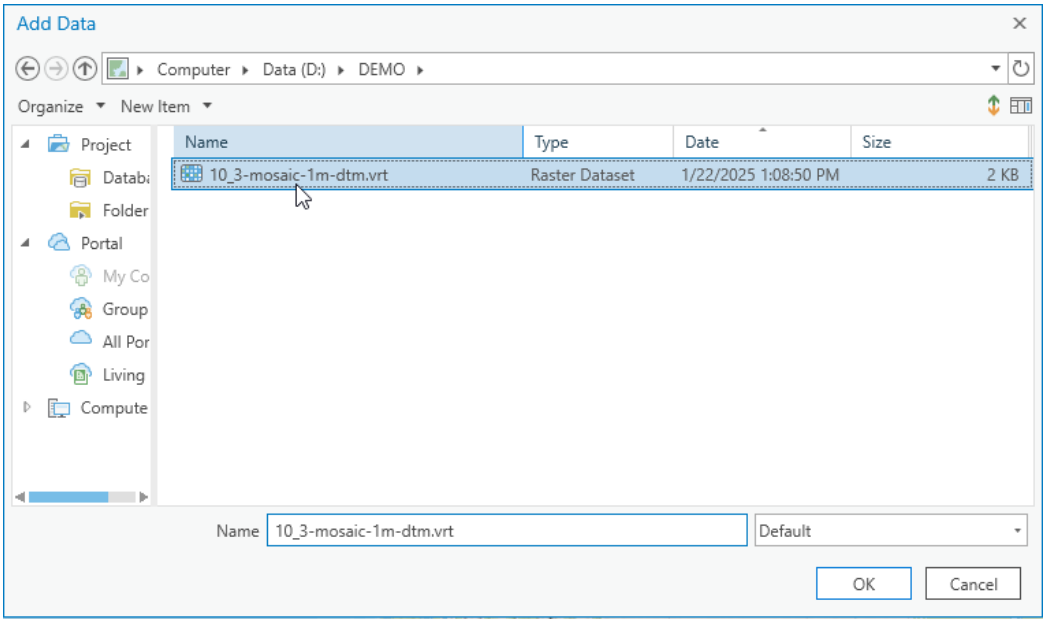
We suggest you download the .vrt. of interest locally.

1. **Adding the raster source**

Once the .vrt file has been downloaded, click on ***Add Data*** in the toolbar and then ***Browse***.

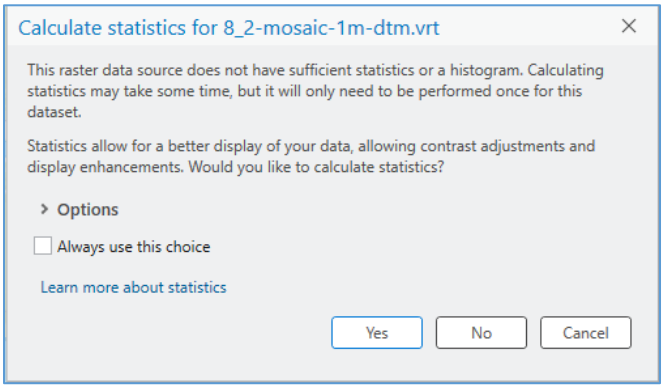


Select the downloaded .vrt file and add it to the map.

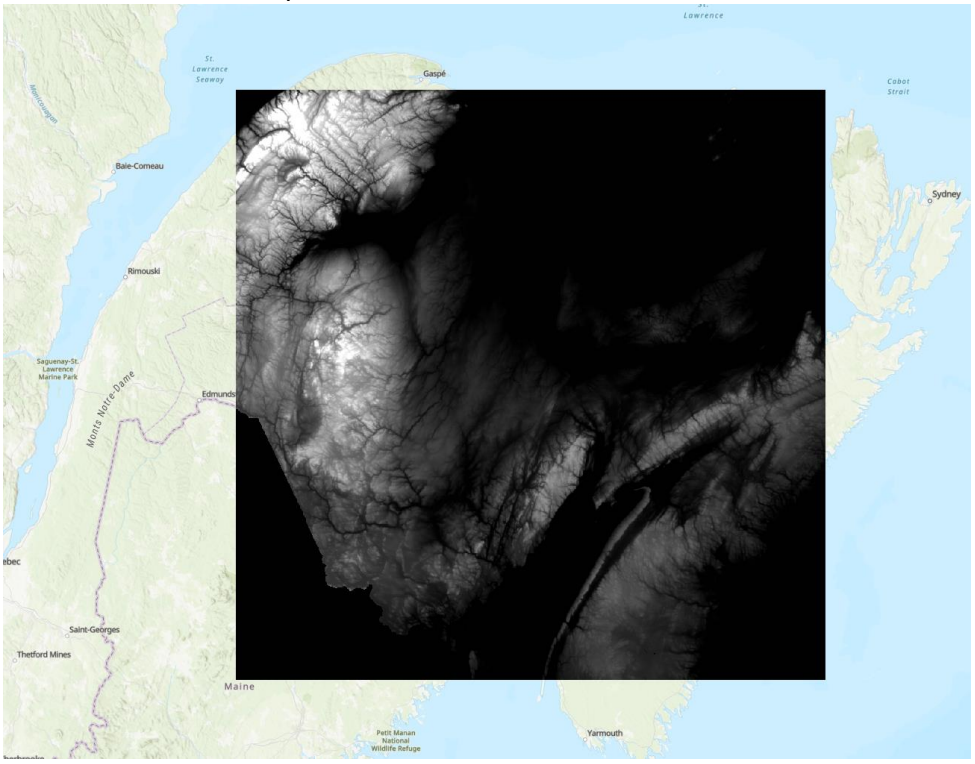



**ATTENTION!**

**By default, ArcGIS Pro asks whether the user wishes to calculate the file's statistics before loading it into the map. As the file is very large and that this operation requires a complete reading of the values, it is very time and resource consuming. We therefore advise you not to calculate them.**



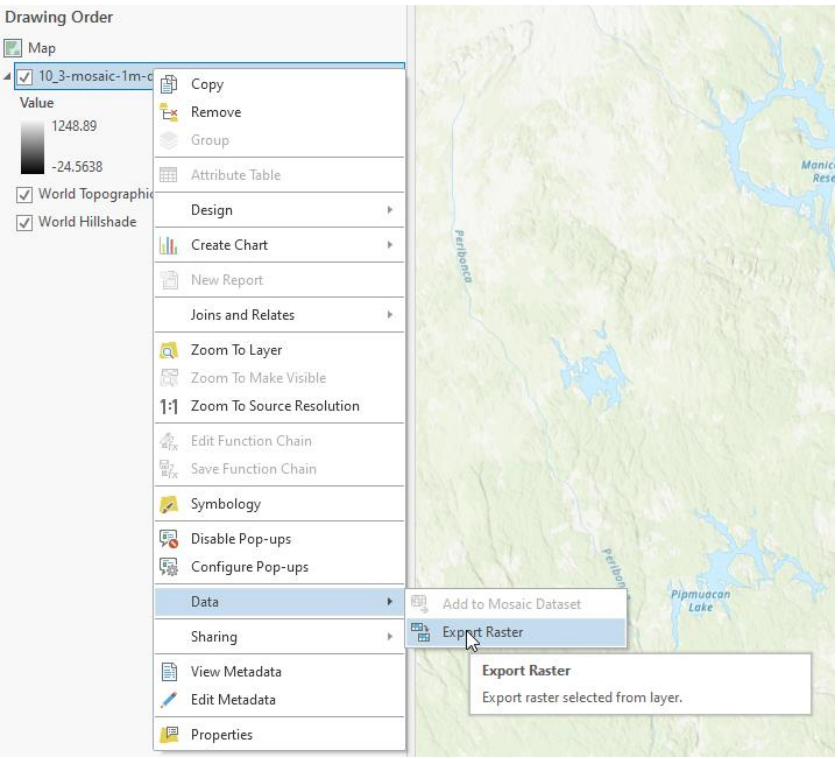
The file should then open.




## 2. Extract a specific zone in a local file

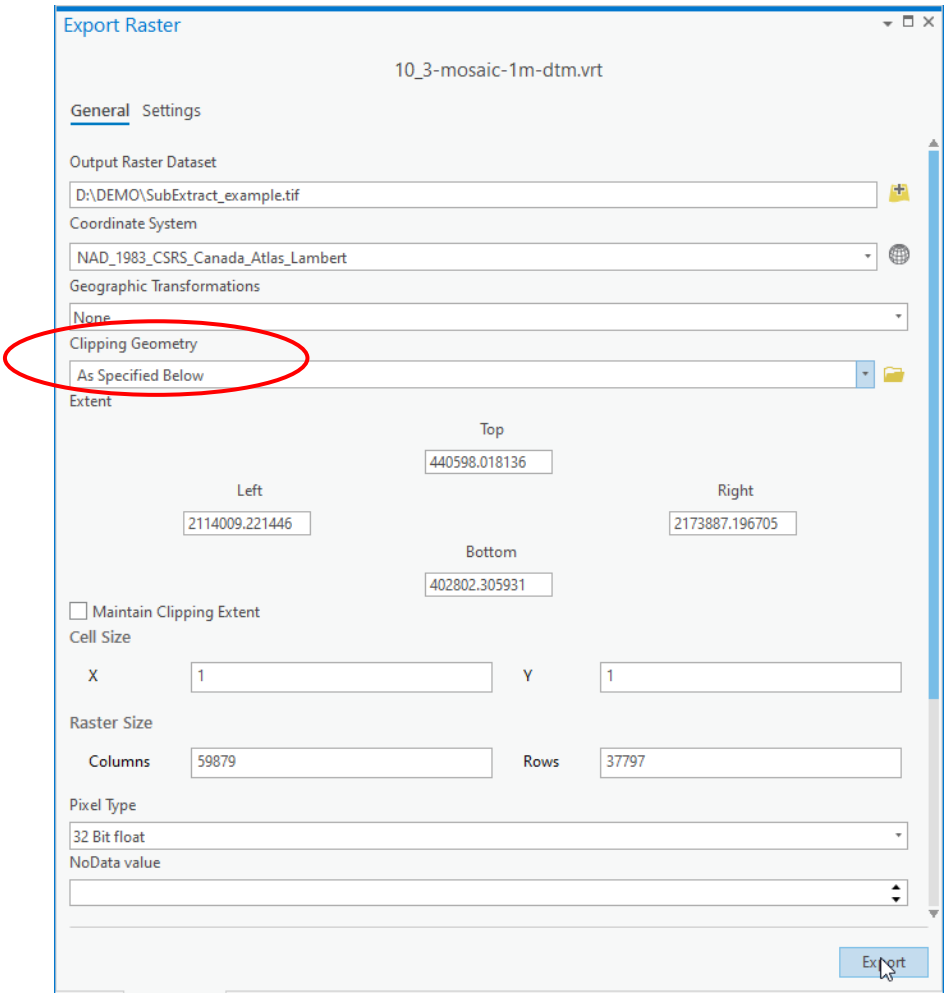
By first approaching an area of interest, it is possible to extract a portion of the data into a file. First frame the map over the area of interest.

In the map contents panel (Contents), go to the MRDEM layer context menu and select ***Data***, then ***Export Raster***.




A panel will then open.

In this panel, select the ***Current Display Extent*** option for the ***Clipping Geometry*** field, to extract the area covered by the map only. You must also enter a path to write the file to. Confirm the extraction by clicking on ***Export***.




# Geospatial Data Extraction Tool

It is also possible to download portions of the HRDEM Mosaic (Terrain, surface or derived products) using the Geospatial data extraction tool offered by NRCan here: [https://maps.canada.ca/czs/index-en.html](https://maps.canada.ca/czs/index-en.html)

The maximum size of the AOI to extract with this tool is 500 km2. Once your task is submitted, you will receive the result of your task by email a few minutes after.

# WCS GetCoverage and WMS GetMap queries

The HRDEM Mosaic can be accessed through GetCoverage queries using the WCS endpoint.

The WCS services are compliant with the version 1.1.1 of the OGC WCS standard. This specification version offers extra query parameters on the GetCoverage query that allow controlling the resolution of the resulting coverage. These extra parameters allow defining the bounding box (BOUNDINGBOX), the grid origin (GRIDORIGIN - always the upper left corner) and the spatial resolution (GRIDOFFSETS). These

parameters also help to adjust the size of the query to ensure it can be requested within the current timeout threshold defined on our web servers. This limit is currently set at 5 minutes on our web servers.

The WCS services require the output resolution to be explicitly included in the GetCoverage request in order to avoid being determined in an approximate or erroneous way. We therefore recommend that GetCoverage requests include the following parameter: GRIDOFFSETS. It is also possible to control other properties of the resulting grid via the parameters GRIDBASECRS and GRIDORIGIN.

For a complete list of the available parameters, please visit the WCS standard specification.

Here are some GetCoverage query examples performed on the dtm layer. The other layers available through the WCS are dsm, dtm-slope, dtm-aspect, dsm-slope and dsm-aspect.

*Maritime Provinces (200 m resolution, using the EPSG:3979 coordinate system)*

https://datacube.services.geo.ca/ows/elevation?SERVICE=WCS&VERSION=1.1.1&REQUEST=GetCoverage&FORMAT=image/geotiff&IDENTIFIER=dtm&BOUNDINGBOX=1897100.0,-176900.0,2851900.0,510100.0,urn:ogc:def:crs:EPSG::3979&GRIDBASECRS=urn:ogc:def:crs:EPSG::3979&GRIDOFFSETS=200.0,-200.0

*Coastal area near Halifax (resolution of 5m, using the EPSG:2961 projected coordinate system)*

https://datacube.services.geo.ca/ows/elevation?SERVICE=WCS&VERSION=1.1.1&REQUEST=GetCoverage&FORMAT=image/geotiff&IDENTIFIER=dtm&BOUNDINGBOX=536284.0004916692,4967490.7738740705,551051.9872473435,4992494.7738740705,urn:ogc:def:crs:EPSG::2961&GRIDBASECRS=urn:ogc:def:crs:EPSG::2961&GRIDOFFSETS=5,-5.0&GRIDORIGIN=536284.0004916692,4992494.7738740705&Gridcs=urn:ogc:def:cs:OGC:0.0:Grid2dSquareCS&gridtype=urn:ogc:def:method:WCS:1.1:2dSimpleGrid

**NOTE: When extracting elevation data from the WCS at high resolution and for large AOIs, we suggest 'chopping' the extents of the AOI in smaller areas (therefore meeting the timeout set on our servers), and then merge back the downloaded grid tiles to create a merged DEM of your large AOI.**

For visualisation of the data, it is preferable to use a GetMap query on the alternate WMS endpoint. Here are some examples using geographic coordinates.

*Canada extent:*
https://datacube.services.geo.ca/ows/elevation?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&BBOX=35.77539765623554047,-163.8115225421603327,84.3195656233574482,-32.40629995016166731&CRS=EPSG:4326&WIDTH=644&HEIGHT=239&LAYERS=dsm-hillshade&STYLES=&FORMAT=image/png&DPI=120&MAP_RESOLUTION=120&FORMAT_OPTIONS=dpi:120&TRANSPARENT=TRUE

*Province of New-Brunswick:*
https://datacube.services.geo.ca/ows/elevation?SERVICE=WMS&VERSION=1.3.0&REQUEST=GetMap&BBOX=43.7148898963398409,-70.62212673819233544,49.04109302822782013,-62.4093003261924153&CRS=EPSG:4326&WIDTH=643&HEIGHT=418&LAYERS=dsm-

hillshade&STYLES=&FORMAT=image/png&DPI=120&MAP_RESOLUTION=120&FORMAT_OPTIONS=dpi:120&TRANSPARENT=TRUE

The BBOX, HEIGHT and WIDTH parameters should be adjusted to follow the user requirements. The examples above are based on the dsm-hillshade layer but other related layers are also available such as: dtm, dtm-hillshade, dtm-slope, dtm-aspect, dsm, dsm-hillshade, dsm-slope and dsm-aspect.

For a complete list of the available parameters, please visit the WMS standard specification.

# Python programming

Here's an example of code using the rasterio library. The code extracts pixels from a region of interest and writes the result to another file. The output_path variable must be adjusted to suit your needs.

```
import os, rasterio

#Path to the COG
#Chemin vers le fichier COG
cog_path = 'https://datacube-prod-data-public.s3.amazonaws.com/store/elevation/hrdem/hrdem-mosaic-1m/9_2-mosaic-1m-dtm.tif'

# Zone d'intérêt pour l'extraction en EPSG:3979
# AOI extraction bounds
#(min_x, min_y, max_x, max_y)
aoi_bounds = (1774874, -89162, 1818832, -52305)

# Chemin d'accès pour l'extraction de la zone
# Output path for the extracted AOI
output_path = r'D:\extract_aoi.tif'
os.makedirs(os.path.dirname(output_path), exist_ok=True)

with rasterio.open(cog_path) as src:
    min_x, min_y, max_x, max_y = aoi_bounds

    # Lecture des pixels la zone d'intérêt
    # Reading of the aoi pixels
    window = src.window(min_x, min_y, max_x, max_y)
    raster_data = src.read(window=window)

    # Prepare metadata for writing
    # transform object of the source is needed to write output
    # Préparation des informations de méta pour l'écriture
    # L'objet transform de la source est nécessaire pour l'écriture
    metadata = src.meta.copy()
    metadata.update({
        'height': raster_data.shape[1],
        'width': raster_data.shape[2],
        'count': raster_data.shape[0],
        'transform': rasterio.windows.transform(window, src.transform)
    })
# Write the raster data to a new file
# Écriture du raster dans le nouveau fichier
with rasterio.open(output_path, 'w', **metadata) as dst:
    dst.write(raster_data)
```