

# Setting Zoom Levels

Custom tilesets that you create in TNTmips for use in Google Maps, Microsoft Bing Maps, NASA World Wind, or Google Earth contain several tiers or levels of tiles at different spatial resolutions covering the entire area of the tileset. These pre-rendered pyramids of tile files ensure rapid retrieval and display of the required tiles at any zoom level. The Export to Tilesets and Auto Mosaic processes allow you to set the highest zoom level to be created in your tileset (and thus its maximum spatial detail) as well as the total number of zoom levels to be created. The Maximum Zoom Level menu in these process windows presents a choice of zoom levels using the numbering system of the selected tileset target. The zoom level systems used in the various tileset structures are described below.

## Google Maps and Microsoft Bing Maps

Google Maps Tile Overlays and Microsoft Bing Maps Custom Tile Layers consist of uniform tiles, 256 by 256 pixels in size, that are aligned on a predetermined global grid. Both of these tileset types use the same system of numbered zoom levels, differing only in the starting (lowest) zoom level. Google Maps zoom levels begin with level 0, which represents the entire globe with a single tile centered at 0 degrees longitude and 0 degrees latitude. Each integer increase in zoom level doubles the number of tiles in both the north-south and east-west directions. Level 1 (the lowest zoom level for Bing Maps) covers the globe with a 2 x 2 grid of tiles, level 2 with a 4 x 4 grid, and so on (see illustrations to the right). Because the tile size is fixed, each increase in zoom level also reduces the size of the area on the ground represented by one pixel in a tile by a factor of 2, providing increasing visual detail in the tileset at higher zoom levels.

Variation in Ground Pixel Size and Map Scale with Latitude for Google / Bing Maps		
Example: Zoom Level 13		
Latitude N or S	Pixel Size (m)	Map Scale (1 : value)
0	19.1	72,224
5	19.0	71,949
10	18.8	71,127
15	18.5	69,763
20	18.0	67,868
25	17.3	65,457
30	16.6	62,548
35	15.7	59,162
40	14.6	55,327
45	13.5	51,070
50	12.3	46,425
55	11.0	41,426
60	9.6	36,112
65	8.1	30,523
70	6.5	24,702
75	5.0	18,693

The Maximum Zoom Level menu for these tileset targets includes the approximate pixel size at the equator for each numbered zoom level (as shown in the table to the right). In the Spherical Web Mercator projection used by these tilesets, each zoom level has a fixed map width (in pixels) at all latitudes. This means that east-west ground dimensions of a tile pixel at a particular zoom level (and thus the

map scale of that zoom level) varies with the cosine of latitude. The tile pixel size on the ground decreases with increasing latitude north and south of the equator. This variation is shown in the table above using Google / Bing Maps zoom level 13 as an example.

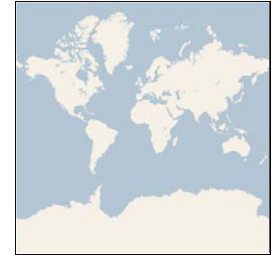
scale of that zoom level) varies with the cosine of latitude. The tile pixel size on the ground decreases with increasing latitude north and south of the equator. This variation is shown in the table above using Google / Bing Maps zoom level 13 as an example.

## NASA World Wind

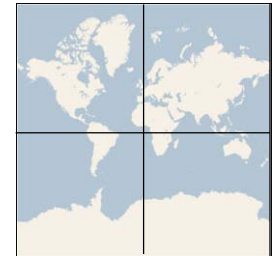
NASA World Wind tilesets are made up of tiles 512 by 512 pixels in size aligned on an equirectangular (Plate Carree) global grid. The lowest zoom level (0) covers this rectangular Earth model with an array of 50 tiles (5 north-south by 10 east-west), each of which is 36 degrees of latitude by 36 degrees of longitude. Each integer increase in zoom level doubles the number of tiles in both the north-south and east-west directions.

World Wind Zoom Level	Pixel Size	Approximate Pixel Size at Equator
0	4.2 arc-min	7.8 km
1	2.1 arc-min	3.9 km
2	1.1 arc-min	2 km
3	32 arc-sec	978 m
4	16 arc-sec	489 m
5	7.9 arc-sec	245 m
6	4.0 arc-sec	122 m
7	2.0 arc-sec	61 m
8	0.99 arc-sec	31 m
9	0.49 arc-sec	15 m
10	0.25 arc-sec	7.6 m
11	0.12 arc-sec	3.8 m
12	0.062 arc-sec	1.9 m
13	0.031 arc-sec	1 m
14	0.015 arc-sec	48 cm
15	0.0077 arc-sec	24 cm

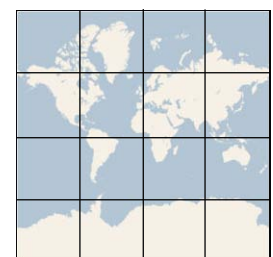
Google Maps and Bing Maps Zoom Levels	
Zoom Level	Pixel Size at Equator
0	157 km
1	78 km
2	39 km
3	19.6 km
4	9.8 km
5	4.9 km
6	2.4 km
7	1.2 km
8	611 m
9	306 m
10	153 m
11	76 m
12	39 m
13	19 m
14	10 m
15	5 m
16	2.4 m
17	1.2 m
18	60 cm
19	30 cm
20	15 cm
21	7.5 cm
22	3.7 cm
23	1.9 cm
24	9.3 mm



Zoom Level 0: 1 tile  
Google Maps Base Level



Zoom Level 1: 4 tiles  
Bing Maps Base Level



Zoom Level 2: 16 tiles

Above, table showing range of possible pre-rendered, fixed zoom levels in a Google Maps tileset. The Bing Maps tiling scheme is identical except that it begins at Level 1 (a 2 x 2 array of tiles). Both schemes represent the globe with a spherical Mercator projection. The illustrations to the right of the table show the tile grids at the three lowest Google Maps zoom levels.



Left, table showing range of possible pre-rendered, fixed zoom levels in a NASA World Wind tileset. World Wind uses an equirectangular (Plate Carree) earth model and a tile size of 512 pixels. Its lowest zoom level is a 5 x 10 array of tiles with each tile covering 36 degrees of latitude and longitude, as shown in the illustration above. Each subsequent zoom level doubles the number of tiles in both directions, as in Google Maps and Bing Maps.

(over)

## Google Earth

Google Earth Super-Overlays use geographic coordinates for tile positions and do not require a particular tile size or that tiles be aligned on a predefined global grid. To accommodate subsequent merging and interchangeable use of Google Earth tilesets, the Export to Tilesets process provides the option to align the Google Earth tileset to the Google Maps global grid. When you choose this option, you are presented with an appropriate range of choices for maximum zoom level according to the selected tile size and the extents of your tileset. If you do not choose the global alignment option, an appropriate set of zoom levels are automatically created.

## Auto Mosaic Process

The Auto Mosaic process allows you to assemble many input images into a single output tileset. Mosaic uses the smallest cell size among your input images to automatically set a default selection on the Maximum Zoom Level menu. This level is chosen to produce a maximum zoom level with spatial resolution at least as detailed as your most detailed input image, taking into account the geographic position (latitude) of the input data and the change in map projection.

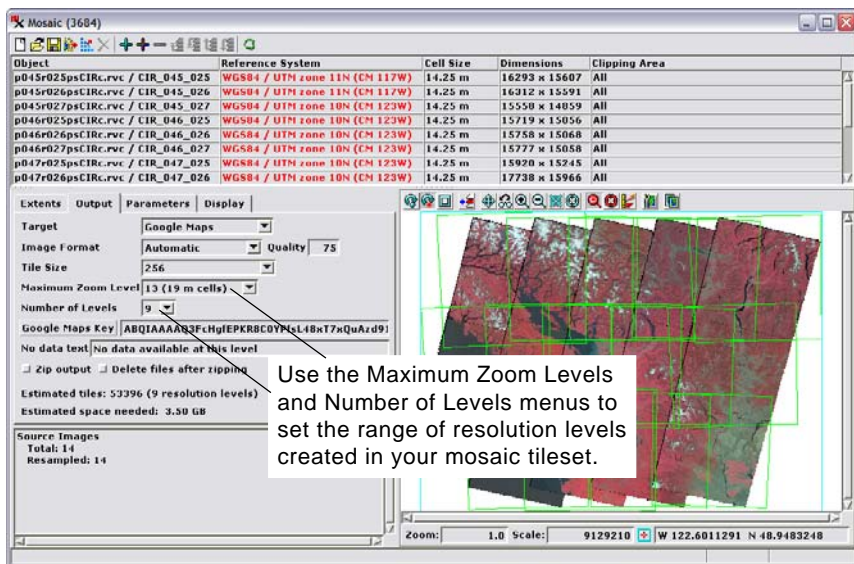
In the example shown in the illustrated Mosaic window above, all of the input images have a cell size of 14.25 m, and the image area is between 46 and 51 degrees north latitude. The default Maximum Zoom Level has been set automatically to zoom level 13 (19 m cell size at the equator). Although this nominal cell size at the equator is greater than that of input images, the actual size of level 13 tile cells at this range of latitudes (see table listing latitudinal variations on the reverse) is less than the input 14.25 meters, so zoom level 13 is the appropriate choice to preserve the maximum detail in the input imagery.

The Number of Levels menu sets the total number of zoom levels created in the tileset. Mosaic sets the default value on this menu so that the lowest-numbered zoom level produced is the level in which the image area in the tileset falls below 256 by 256 cells. Thus the entire image area could fit on one tile, although the geographic position of your image might cause it to cross tile boundaries, resulting in up to 4 tiles at this level.

## Export to Tilesets Process

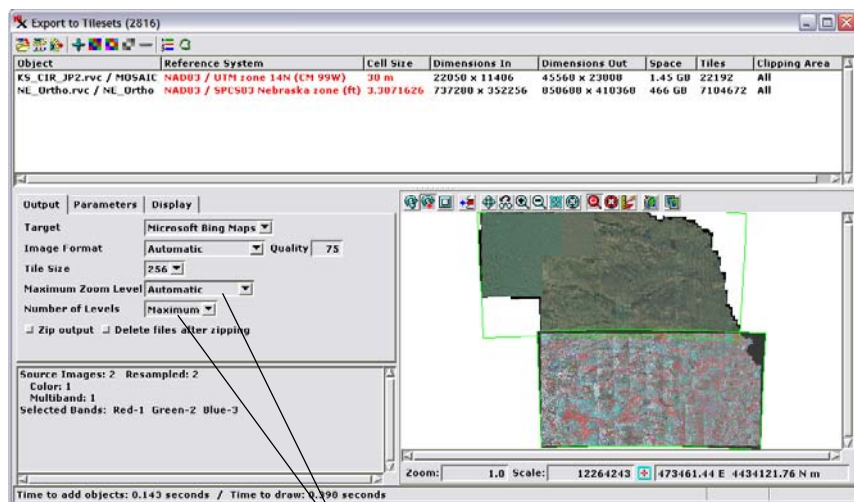
In the Export to Tilesets process each input image is processed to a separate output tileset. If all of the selected input images have the same cell size, the Maximum Zoom Level menu shows a default zoom level choice that is set as described above for the Auto Mosaic process. If the input images include a mixture of cell sizes, the default setting on this menu is Automatic. This Automatic option sets a maximum zoom level independently for each tileset to capture the full spatial detail in its parent image.

The Number of Levels menu in the Export to Tilesets process includes a Maximum option to cope with the possibility of output tilesets with differing maximum zoom levels. The Maximum option sets the



number of zoom levels uniquely for each tileset based on its maximum zoom level and the aerial extents of the image, using the minimum zoom level criterion described above for the Auto Mosaic process.

You can override the default settings in Mosaic or Export to Tilesets and choose a particular maximum zoom level and number of levels for your tileset(s). Keep in mind that choosing a higher zoom level than the default is not advisable, as this choice would create additional high-resolution tile layers (each with 4 times as many tile files as the previous layer; see the Technical Guide entitled *Tilesets: Understanding Sizes*) that exceed the spatial resolution inherent in the original imagery and thus provide no visual benefit. If you are creating a number of tilesets for subsequent assembly into a single tileset in the Merge Tilesets process, there is no need to produce component tilesets with identical maximum zoom levels and number of levels. The Merge Tilesets process can cope with either of these conditions (see the TechGuide entitled *Tilesets: Merge Tilesets*).



The Automatic setting on the Maximum Zoom Level menu in the Create Tilesets window sets an appropriate maximum zoom level individually for each of the output tilesets based on the cell size of the input image. Likewise, the Maximum setting on the Number of Levels menu automatically sets an appropriate range of zoom levels for each tileset based on its maximum zoom level and aerial extents.