

Merge Structures

The Merge Tilesets process allows you to merge a few or many standard web tilesets into a single larger tileset. You can assemble many spatially-adjacent smaller tilesets created in the Export to Tilesets process (spatially merging or “mosaicking” tilesets). You can also construct a single tileset from a number of spatially-coincident tilesets that contain different zoom level ranges (zoom level merge). A zoom-level merge allows you to combine imagery tilesets produced from input images with different spatial resolutions (e.g., aerial orthophoto and satellite images) or a number of single-zoom-level tilesets created from geometric layers in the Render to Tileset procedure in the Display process (see the Technical Guide entitled *Tilesets: Render from Displayed Layers*).

The output of any merge process can be written to a new tileset with its own directory structure and .TSD link file, or you can merge one or more tilesets into an existing tileset in place. You can merge standard web tilesets whose structures conform to those described by Google, Microsoft, and NASA for their popular viewers:

The Export to Tilesets and Merge Tilesets processes are designed to work together to efficiently assemble very large tilesets. You can first prepare multiple, spatially-adjointing smaller tilesets in the Export to Tilesets process, where TNT Job Processing allows you to run concurrent tileset operations to exploit your system’s multiple processor cores. You then use the Merge Tileset process to assemble these individual tilesets into a single larger tileset. See the Technical Guide entitled *Tilesets: Assembling Very Large Tilesets*.

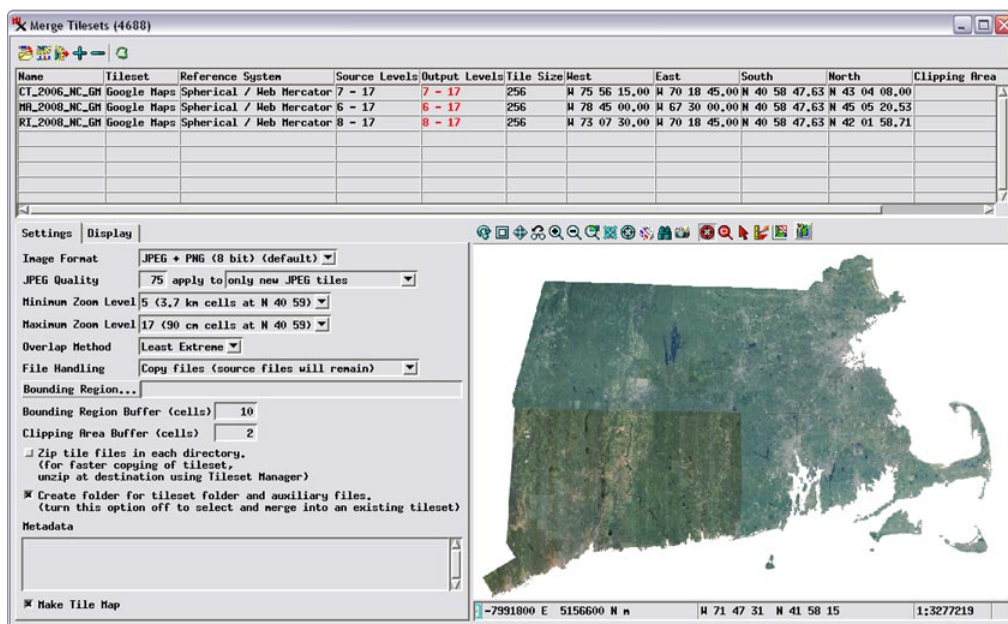
- Tile Overlays for Google Maps
- Super-Overlays for Google Earth
- Custom Tile Layers for Microsoft Bing Maps
- Tile Layers for NASA’s World Wind.

All of the tilesets you select for a single merge operation must be of the same tileset type. Merge Tilesets copies or moves the constituent tiles to the new physical drive location you designate. For spatial merges it also merges tiles in any overlapping areas and recomputes tiles for any lower-resolution zoom levels specified.

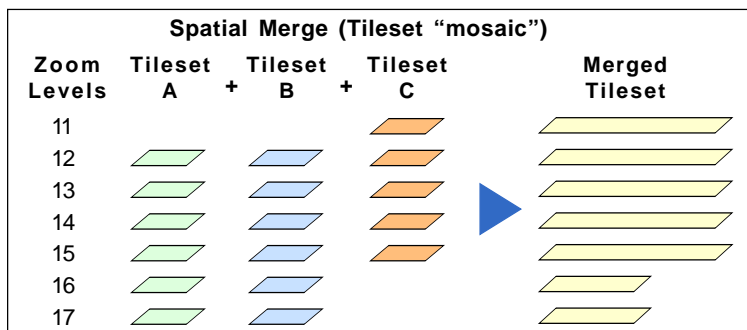
File Handling

Merging tilesets assembles all output tiles into a single consistent directory structure. Therefore, tiles from the input tilesets that can be reused without modification in the merged tileset are either copied or moved to the destination directory. Use the File Handling menu to choose between copying (which leaves the input tilesets in place) or moving (which deletes the input tilesets).

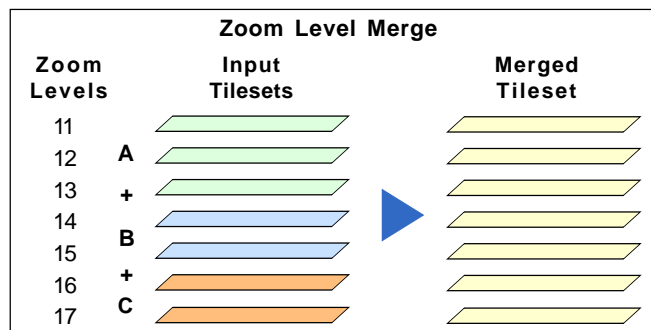
(over)



Merge Tilesets process window set to merge individual Google Maps natural-color orthoimage tilesets for three states: Massachusetts, Connecticut, and Rhode Island.



A *spatial merge* combines spatially-adjacent tilesets of the same type. In this example two tilesets (A and B) with zoom levels 12 to 17 are merged with tileset C, which has zoom levels 11 to 15. A Minimum Zoom Level setting of 11 (the minimum of the three tilesets) creates a minimum zoom level of 11 for the entire merged tileset. In contrast, the highest zoom levels (16 and 17) are only present in the merged tileset for the areas created from tilesets A and B. The area in the merged tileset created from tileset C has a maximum zoom level of 15.



A zoom level merge combines tilesets with different zoom level ranges that have the same (or approximately the same) spatial extents. In this example three tilesets are being merged. Tileset A has zoom levels 11 to 13, tileset B has zoom levels 14 and 15, and tileset C has zoom levels 16 and 17. These input tilesets could have been produced from images with differing spatial resolution (e.g., orthophoto and satellite images) or rendered separately from geometric data.

Spatial Merge and Zoom Level Merge

The Merge Tilesets process switches automatically between spatial merge and zoom-level merge modes after analyzing the extents of the input tilesets. Spatial merge mode is set when the input tilesets have adjacent or only partially overlapping extents and coincident or overlapping ranges of zoom levels. Zoom-level merge mode is set when the input tilesets have coincident or near-coincident spatial extents and zoom level ranges that do not overlap (see illustrations at the bottom of the front side of this page).

Spatial Merge

A spatial merge begins with the highest-resolution (highest-numbered) zoom level. That zoom level is merged from all of the contributing tilesets, then each progressively lower-numbered zoom level is merged. In areas covered by only one input tileset, tiles are simply copied or moved to the output tileset structure. In the overlap areas, tiles from adjacent tilesets are merged using the method set on the Overlap Method menu. The choices for resolving coincident tiles are First, Last, Minimum, Maximum, and Least Extreme. The first two options use the order in which the input tilesets were selected to determine the overlap output. The latter three options perform a cell-by-cell comparison of the cell values in the overlapping tiles to determine the output for each cell in a new tile, and thus may result in slower processing times compared to the first two options.

The input tilesets for a spatial merge do not have to have the same range of zoom levels. If the input tilesets have different minimum zoom levels, low-resolution tiles are computed automatically from the next-higher zoom level as needed to produce a consistent minimum zoom level across the entire merged tileset. If the input tilesets do not have the same maximum zoom level (highest spatial resolution), each area of the merged tileset is created with the maximum zoom level of the input tileset that does have coverage for that area (unless a lower maximum zoom level is manually set). This procedure avoids creating any zoom level tiles with higher spatial resolution than the maximum in the corresponding input tileset, which would inflate the size of the merged tileset and provide no visual benefit.

Zoom Level Merge

In a zoom-level merge, tiles are simply moved or copied to the output tileset beginning with the highest-resolution (highest-numbered zoom level). Each zoom level is derived from only one of the input tilesets, thus there is no overlap between tiles at a particular zoom level and no merging of individual tiles.

When you render tilesets from geometric layers in the Display process, you may need to render each output zoom level as a separate tileset using a different version of the input data with feature density and styling appropriate for the viewing scale of that tileset zoom level (see the TechGuide entitled *Tilesets: Render from Displayed Layers*). The automatic zoom-level merge mode in Merge Tilesets provides the most efficient way to assemble those separate zoom-level tilesets into a single unified tileset structure for use in TNTmips and in web geomashups.

New Tileset or Merging in Place

When you run the Merge Tilesets process, you designate the name and location of an output TSD link file to describe the tileset struc-

ture and allow it to be used in TNTmips. To create the output as a new tileset, simply specify a new TSD file. All tiles are then copied, moved, or created in the designated location.

Alternatively, you can merge one or more tilesets into an existing tileset in place by selecting the TSD file of the target tileset as the output of the process. The input tilesets are then merged into this existing tileset, modifying its structure and its TSD file. (You do not need to select the target tileset as an input to the process.) This procedure can be useful if you need to add a small area to an existing large tileset (e.g. adding a missing county to a statewide orthoimage tileset). In that case merging in place can be much faster than creating a completely new tileset, as the existing tiles in the large target tileset do not need to be moved or copied to a new location. Because this procedure permanently modifies the target tileset, however, several warnings are presented when you select an existing tileset as the process output.

Zoom Level Range

The Minimum Zoom Level and Maximum Zoom Level menus on the Merge Tilesets window by default are set to the minimum and maximum zoom levels (respectively) among all of the input tilesets. You can set either of these menus to a zoom level setting lower than the default value. When you set a lower minimum zoom level than present in the inputs, tiles for the additional zoom levels are simply computed as needed from the existing zoom levels. Setting a lower maximum zoom level means that any higher zoom levels in the input tilesets are ignored and not used to create the output.

Source Levels	Output Levels
7 - 17	7 - 17
6 - 17	6 - 17
8 - 17	8 - 17

Left-clicking on the Output Levels field in the tileset list opens a window from which you can set the minimum and maximum zoom levels to use for that input tileset.

You can also set minimum and maximum output zoom levels to utilize from any individual input tileset. A left mouse-click on the Output Levels field for the desired tileset opens a window that lets you select the desired minimum and maximum zoom levels to use from that tileset (see illustration to the left).

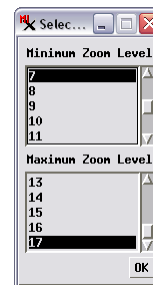


Image Format

The Image Format menu allows you to set the tile file format(s) to use in the merged tileset. If the format selection includes JPEG, you can set a quality percentage value for the JPEG compression and choose whether to apply this quality setting only to new JPEG tiles (created by merging overlapping input tiles) or to also recompress existing JPEG tiles. See the TechGuide entitled *Tilesets: Tile Image Formats* for more information about image formats.

Clipping Areas and Bounding Region

You can define a specific spatial portion of any input tileset(s) to use within the merge operation by designating a clipping area for each of the desired tilesets. You can also define a project boundary (bounding region) to limit the overall extents of the output tileset, and set buffer distances for the bounding region and clipping areas. Procedures for setting clipping areas and a bounding region are described in the TechGuides *Tilesets: Extract Structures* and *Tilesets: Clipping to a Project Boundary*.