FL Peninsular Pinellas County/ Hillsborough County 2018 Tie Analysis

Report Produced for the United States Geological Survey

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Introduction

Dewberry was tasked to evaluate how well the newly produced FL Peninsular Pinellas County (acquired in late 2018 and early 2019) ties spatially to preexisting lidar data produced for the SWFMD Hillsborough County. The lidar data acquired for Hillsborough County was originally acquired in mid to late 2016. Dewberry has compared the new Pinellas County lidar data to the existing Hillsborough County lidar data where the two datasets overlap.

Edge-Tie Analysis

There are 12 Pinellas County tiles which overlap with the Hillsborough County lidar data, shown in Figure 1 below. A difference raster was produced to analyze elevation differences between the two datasets in areas of overlap. Each pixel in the difference raster represents a value of elevation change between the two overlapping datasets. Profiles and visual reviews were used to compare the two datasets where the datasets are adjacent, but do not overlap. This review of the adjacent, non-overlapping areas was to ensure no obvious feature discontinuities exist between the datasets. Dewberry has determined that no gross feature discontinuities were identified.

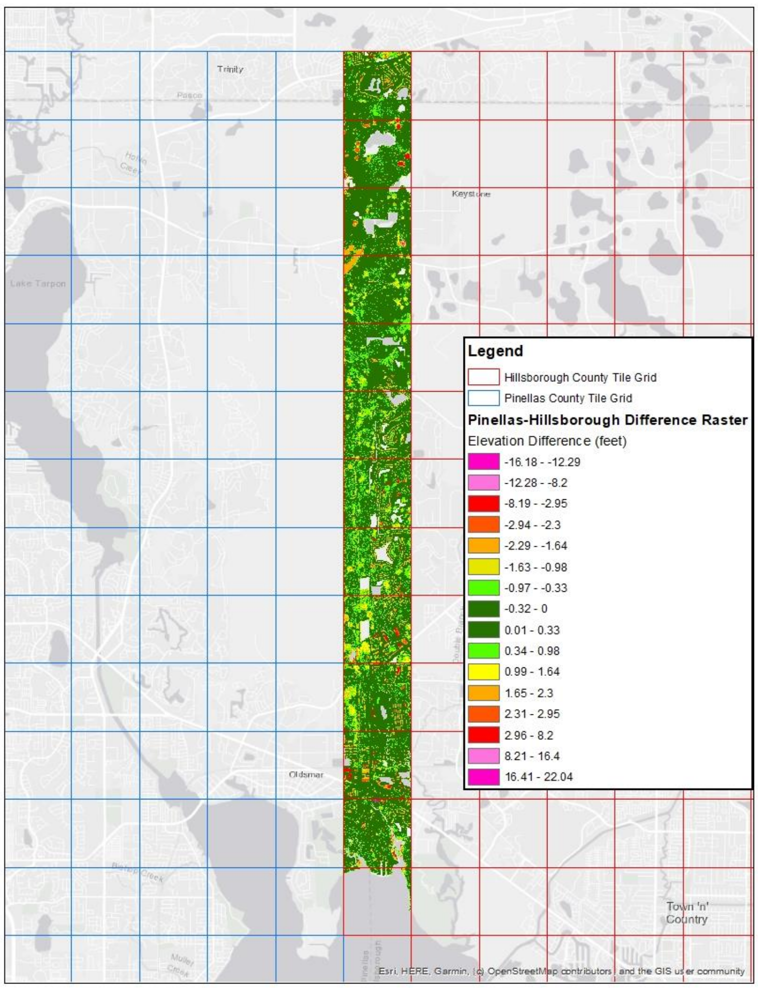

Figure 1 - Twelve tiles overlap between the Pinellas County AOI and previously collected Hillsborough County AOI.

DIFFERENCE RASTER

Reprojections and vertical unit conversions were performed if the two datasets had different Coordinate Reference Systems and/or different vertical units. Using the 2.5 ft bare-earth DEMs for each dataset, Dewberry created a difference raster by subtracting Hillsborough County data from Pinellas County (Pinellas[new]-Hillsborough [old]). This difference raster is binned according to pre-determined threhsolds, shown in Figure 2.

Per client discussions and requests, all overlapping data should be analyzed to show which areas have elevations within 10 cm (RMSEz requirements for USGS QL1 and QL2 data) of each other. As such, pixels in the difference raster representing 0 to+10 cm and 0 to -10 cm of elevation change between the two datasets are binned. From these initial bins, Dewberry then used thresholds of 20 cm up until +/-90 cm as this allows detailed analysis of changes occuring which are less than +/-1 m in difference. The 20 cm bins, starting from the required +/-10 cm bin also allows for analysis of change at +/-30 cm, which is the required VVA for USGS QL1 and QL2 data. Larger elevations differences tend to result from similar or consistent sources, so after the +/-90 cm bins, data are binned to +/-2 m, +/-5 m, and everything greater than +5 m or less than – 5 m. If the units of data are in feet, the metric values listed above are converted to feet for analysis.

Dewberry symbolized the difference raster for this analysis using the binned values and color schema shown below.

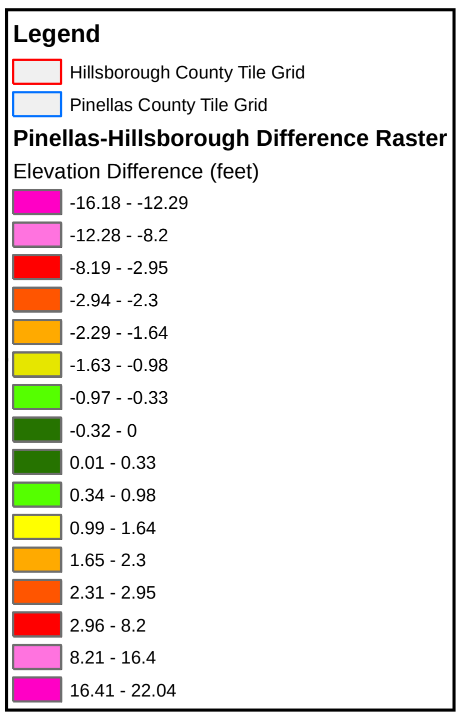

Figure 2 - Symbology key, in [feet], showing the values and colors used for each bin. These bins were used to symbolize the difference raster for visual review and quantitaive analysis.

Pixels within the 0 to +/-30 cm (0.98 ft) threshold are colored as green. Dark green is used for pixels in the 0 to +/- 10 cm (0.33 ft) bin and light green is used for the +/-10 cm (0.33 ft) to +/- 30 cm (0.98 ft) bin.

Figure 3 shows the full difference raster symbolized with the key outlined above.

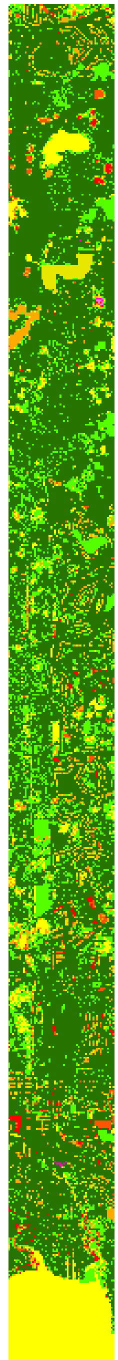

Figure 3 - Difference raster, binned using the symbology key outlined above, created for the Pinellas County-Hillsborough County overlap.

All hydrographic features breaklined in Pinellas including streams, rivers, ponds, lakes, and coastal were excluded from analysis as water levels varied between the two lidar acquisitions. Hydrographic features, overlaid on the difference raster, are shown in blue in Figure 4 below.

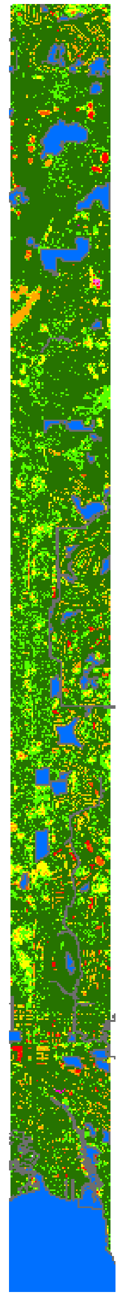

Figure 4 - Breaklined hydrographic features, shown in blue, were removed from statistical analysis generated from the difference raster as water levels may vary between the different lidar acquisition years.

EDGE-TIE RESULTS

When looking at all overlap areas consisting of all slopes and all land cover types, 74.4% of the overlapping points are within the 0 to +/10 cm (0.33 ft) threshold with the majority of these points being located in flat, open terrain. Additional analysis shows 88.7% of the overlapping points are within the 0 to +/-30 cm (0.98 ft) threshold with the majority of these points being located in vegetated areas. These variations are allowable elevation differences between the two datasets.

The remaining points that exceed +/-30 cm (0.98 ft) are located in areas with temporal offsets. The temporal offsets may occur in dynamic, non-static environments, such as wetlands, marsh, or floodplains, or may occur in less dynamic, upland areas due to man-made or cultural changes. The temporal offset causes in this overlap area result from changing water levels on non-breaklined hydrographic features (resulting in these changes being included in the difference analysis), erosion and/or deposition changes, bank or channel changes, vegetation changes with marsh or wetlands, new construction, and infrastructure changes. Differences also occur between task order breakline collection specifications. Hillsborough County required 2D building rooftop collection in the breakline geodatabase. The building rooftop heights were then derived from the lidar and represented in digital elevation model deliverables. The building footprints contributed to differences greater than 10 cm (0.33 ft). FL Peninsular Pinellas County does not require building rooftop collection or representation in digital elevation model deliverables. The differences greater than +/- 30 cm (0.98 ft) are described in the sections below.

Vegetation Temporal Differences

The majority of areas with larger vertical differences between these two datasets occur within vegetated areas. These types of changes are due to the ~2 year temproal difference between the two lidar acquisitions as there are clearly changes in the vegetation height.

The figure below shows an example of this temporal change.

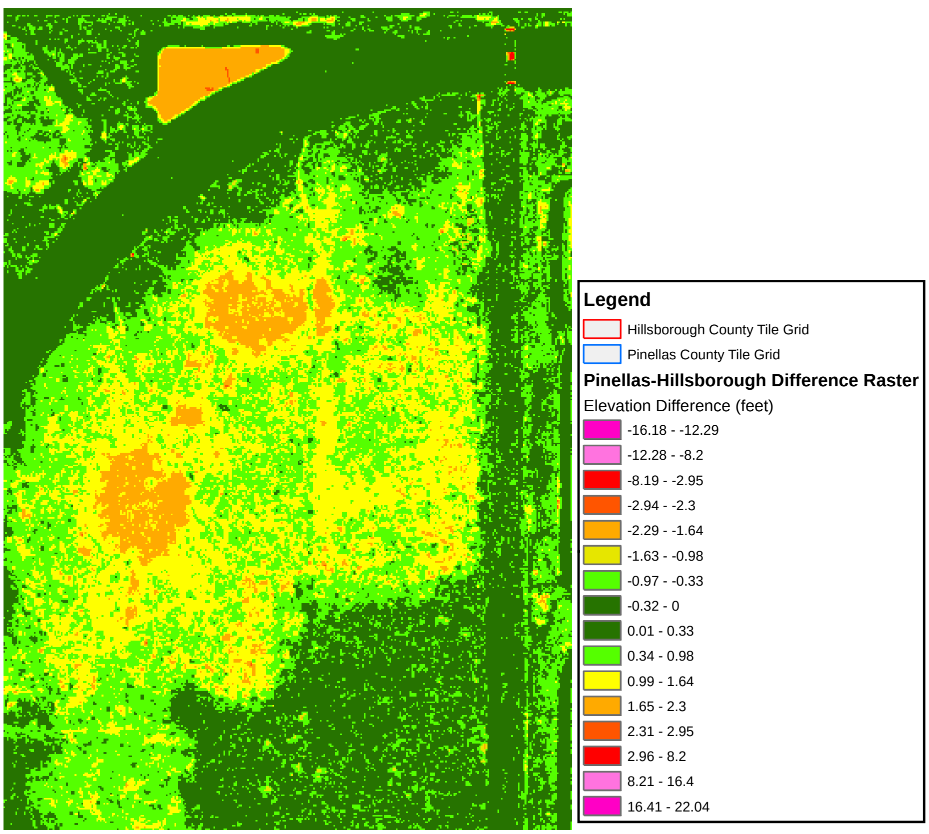

Figure 5 - The top image shows the Difference Raster. The larger elevation differences exist in vegetated areas. The difference raster symbology key, in feet, is hown to the right.

Buildings

In addition to vegetation differences, vertical differences between these two datasets occur within building rooftop outlines. These differences are due to breakline collection differences between Hillsborough County and FL Peninsular Pinellas County.

Figure 6 - The left image shows the final digital elevation models in Hillsborough County, with building rooftop heights represented. Elevation differences exist within building rooftop polygons, due to differences in breakline collection between Hillsborough County and FL Peninsular Pinellas County. The difference raster is shown on the right, displaying expected elevation differences between counties where buildings exist.

Summary

Overall the Pinellas County and Hillsborough County lidar data match well with 74.4% of the overlap data matching within ±10 cm and 88.7% of the overlap data matching within ±30 cm. The areas of largest vertical elevation change occur due to temporal differences and include varying levels of water in hydrographic features, shoreline changes, and changes in wetlands/marsh areas. Cultural or man-made changes also contribute to larger elevation differences, including new hydrographic control structures, new reservoirs or impoundments, and likely construction/roadway improvements.