Lab Report

Title: Raster, cube, TIN and terrain data fusion
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Date: 9/7/2024

Project Repository: GIS5571/Lab2 at main · alexxxroz/GIS5571
Google Drive Link: -
Time Spent: 4 h

Abstract

The first part of the Lab 2 was focused on transforming LiDAR data into raster and TIN format using arcpy capabilities with the following export of maps to a pdf format. The second part was focused on creating an animated visualization of precipitation over the US using a space time cube.

Problem Statement

The current lab posed the following goals:

1. Stitch together basic skills in API queries with raster, cube, TIN, and Terrain data transformation steps to create an extract, transfer, and load system for LiDAR data from the Minnesota DNR's FTP server.
2. Use ArcPro to perform side-by-side exploratory spatial data analysis using 2D and Scene views.
3. Use ArcPy to export to a PDF a visualization of LiDAR data

Table 1. Data requirements

#	Requirement	Defined As	(Spatial) Data	Attribute Data	Dataset	Preparation
1	Minnesota Geospatial Commons Dataset	.las	LiDAR data		Index of /pub/data/elevation/lidar	
2	PRISM data	.bil	Precipitation data		PRISM Climate Group at Oregon State University	
3						
4						

Input Data

Table 2. Data sources

#	Title	Purpose in Analysis	Link to Source

1	Minnesota Geospatial Commons Dataset		[Index of /pub/data/elevation/lidar]()
2	PRISM data		[PRISM Climate Group at Oregon State University]()

Methods

During the first part of the work .las LiDAR data were derived using API requests and then saved as raster and TIN files using `LasDatasetToRaster` and `LasDatasetToTin` functions respectively. Further, they were added to two newly created layouts and exported to pdfs.

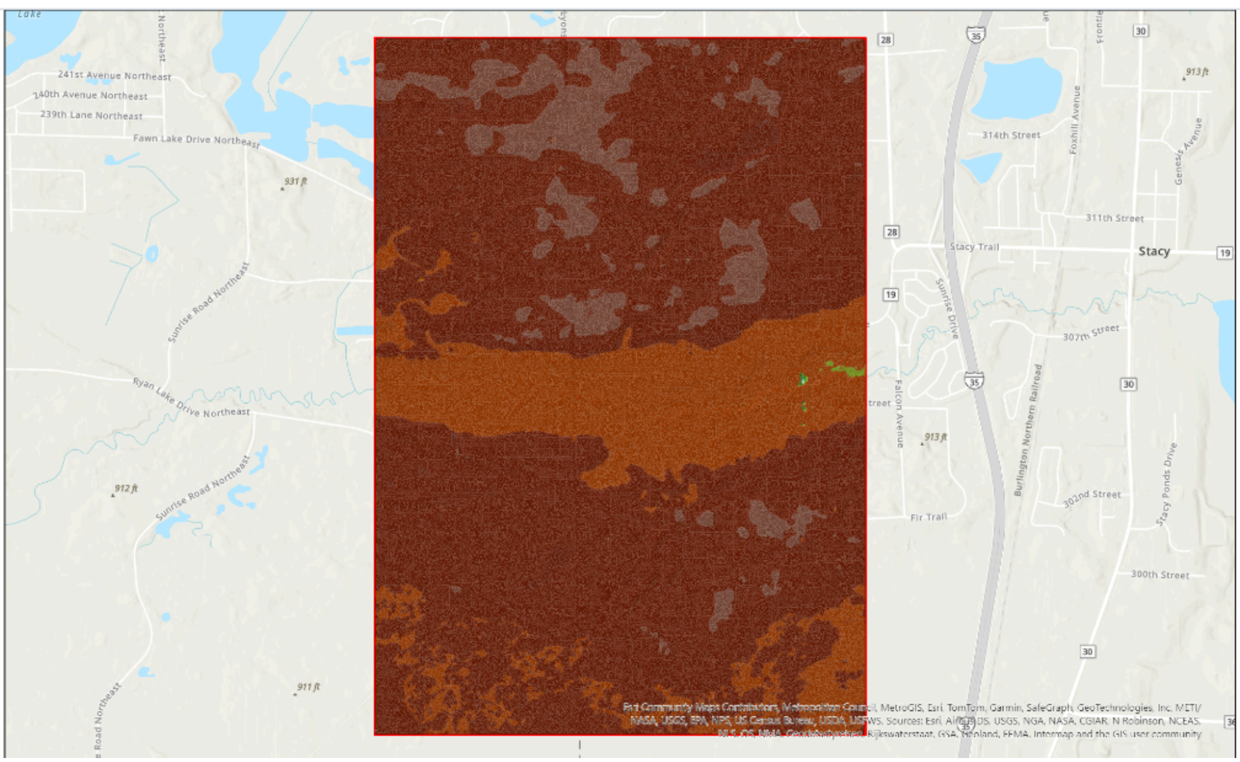

Fig. 1. TIN exported to pdf.

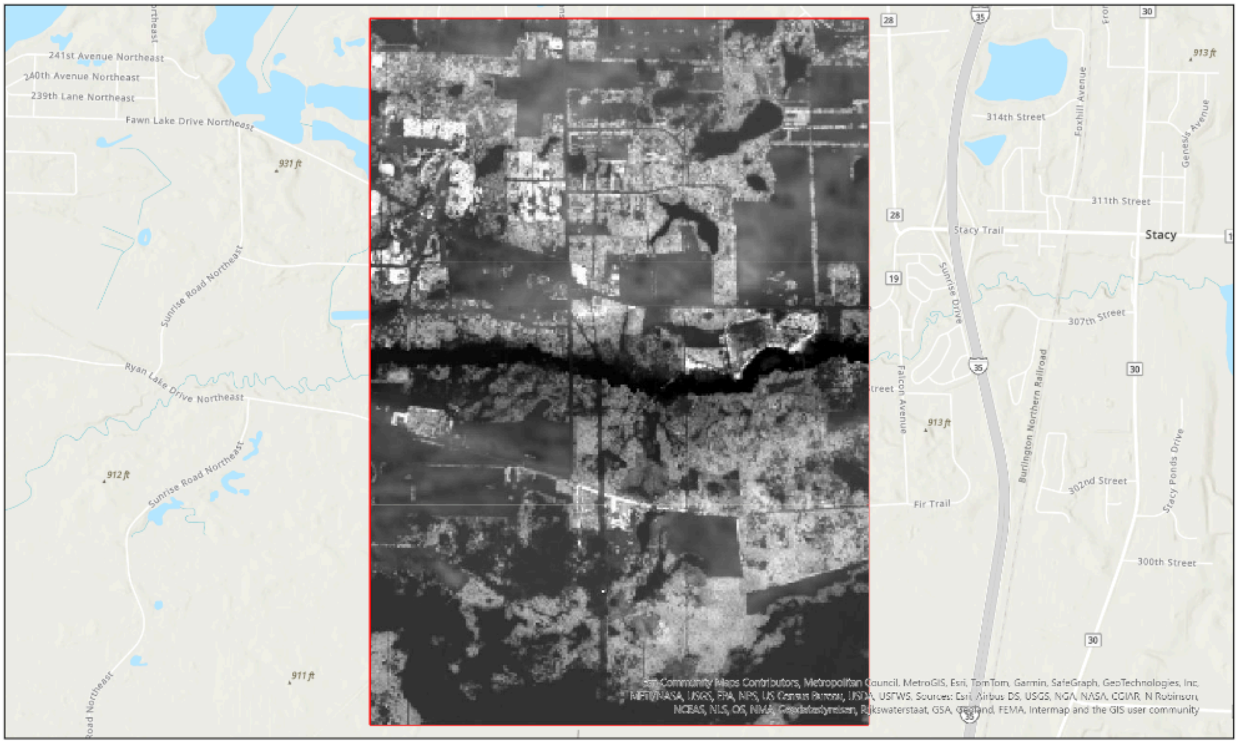

Fig. 2. DEM exported to pdf.

During the second part of Lab 2 Part 2 the PRISM dataset was acquired using an API request as well. The goal was to convert the dataset to a space time cube and save it as a netCDF4 file. Speaking from experience, the pipeline of converting the data to this format in arcpy is extremely inefficient. Several times ArcPro crashed and I started coding from scratch. Open-source python libraries like GDAL or Xarray are much more robust tools.
Nevertheless, what I did was converting the data to a mosaic dataset using CreateMosaicDataset function, then added raster to this mosaic using AddRastersToMosaicDataset. After that I needed to calculate two fields: one for precipitation and one for time dimension. Then after adding multidimensional info I applied MakeMultidimensionalRasterLayer function the output of which was passed to the CreateSpaceTimeCubeMDRasterLayer function, which generates a netCDF4 file as an output. This file can’t be uploaded to GitHub due to its weight, so Fig. 3 illustrates the screenshot with the file saved.

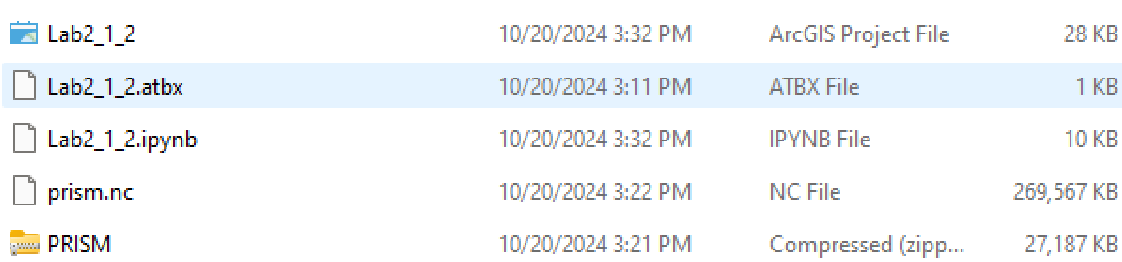

Fig. 3. PRISM data saved as netCDF4.

Results

LiDAR data were converted to raster, TIN and space time cube using capabilities of AcrPy in this work. All the three file formats illustrate the range of abstractions we can wrap geospatial data into to represent the real world and use it for modeling and analysis.

Self-score

Category	Description	Points Possible	Score
Structural Elements	All elements of a lab report are included **(2 points each)**: Title, Notice: Dr. Bryan Runck, Author, Project Repository, Date, Abstract, Problem Statement, Input Data w/ tables, Methods w/ Data, Flow Diagrams, Results, Results Verification, Discussion and Conclusion, References in common format, Self-score	28	**28**
Clarity of Content	Each element above is executed at a professional level so that someone can understand the goal, data, methods, results, and their validity and implications in a 5 minute reading at a cursory-level, and in a 30 minute meeting at a deep level **(12 points)**. There is a clear connection from data to results to discussion and conclusion **(12 points)**.	24	**24**
Reproducibility	Results are completely reproducible by someone with basic GIS training. There is no ambiguity in data flow or rationale for data operations. Every step is documented and justified.	28	**28**
Verification	Results are correct in that they have been verified in comparison to some standard. The standard is clearly stated **(10 points)**, the method of comparison is clearly stated **(5 points)**, and the result of verification is clearly stated **(5 points)**.	20	**20**
		100	**100**