Lab Report

Title: Lab 2
Notice: Dr. Bryan Runck
Author: Yaxuan Zhang
Date: 10/31/2023

Project Repository: https://github.com/YaxuanSeanZhang/MGIS_ARCGIS/tree/main/GIS%205571/Lab1
Google Drive Link:
Time Spent: 8 hrs

Abstract

ETL is used to gather, process, and transfer data from various sources to a data warehouse or other target systems for analysis and reporting. In this lab, we will build ETL pipeline to conduct API queries with raster, cube, TIN, and Terrain data transformation steps to create an extract, transfer, and load system for LiDAR data and .bil file. We will also convert the .bil data into spacetime cubes to show the spatiotemporal trends of precipitation.

Problem Statement

In this lab, we will implement ETL process for lidar and .bil data. For lidar data, we will convert it into DEM and TIN, and visualize them as pdf files. For .bil data, we will conver it into spatiotemporal cube and visualize it as an animation of the timeseries.

Table 1. Main Steps

#	Requirement	Defined As	(Spatial) Data	Attribute Data	Dataset	Preparation
1	Extract Data from API	Raw input dataset pulling from different API (i.e., DNR and PRISM)	LIDAR; .BIL	Various	DNR; PRISM	Define API, and pull data
2	Convert Data	DEM/TIN	Lidar	elevation	DNR	Convert lidar into dem/tin data
3	Spacetime Analysis	Spacetime Cube	.BIL	precipitation	PRISM	Converts the data into a spacetime cube

Input Data

We will use data from two sources Minnesota DNR's FTP server and PRISM.

Table 2. Required Dataset

#	Title	Purpose in Analysis	Link to Source
1	MN DNR elevation	LIDAR	https://resources.gisdata.mn.gov/pub/data/elevation/lidar/

2	annual 30-Year Normals .bil files for precipitation	.BIL	https://prism.oregonstate.edu/normals/

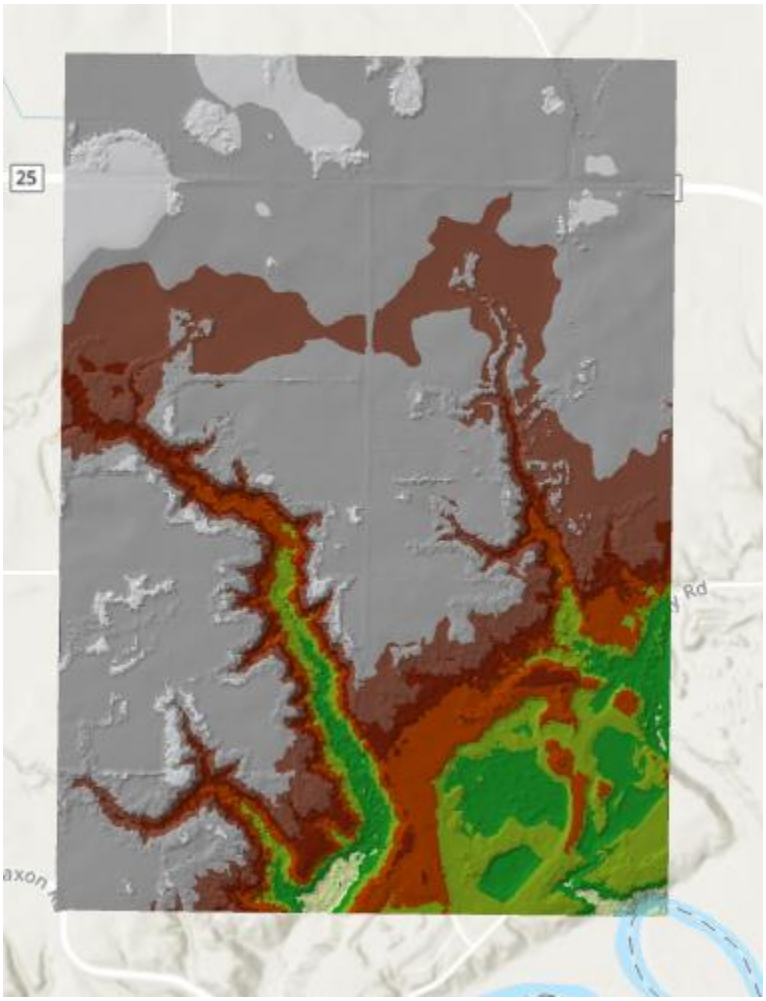
Methods

DNR (Lidar): After pulling data from API, I used arcpy.conversion.LasDatasetToRaster and arcpy.ddd.LasDatasetToTin to convert lidar data to DEM and TIN. After that, I created layout to reprent dem and tin, and used exportToPDF to export layout to a pdf file.

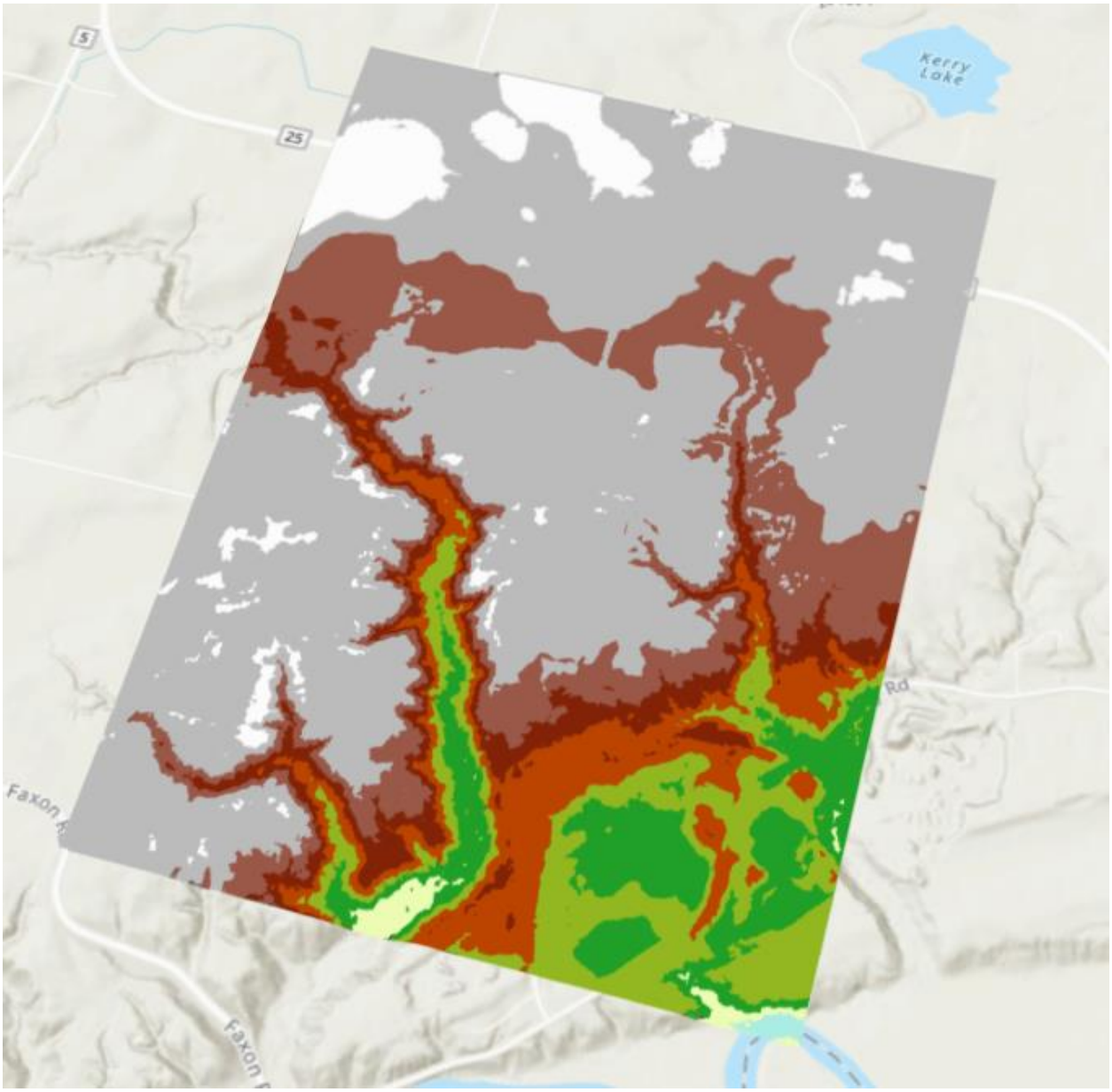
PRISM (.BIL): After pulling data from API, I followed the tutorial to create space time cubes. The steps include Add Rasters To Mosaic Dataset, Make Multidimensional Raster Layer, Create Space Time Cube MD Raster Layer, and Visualize Space Time Cube 3D.

Results

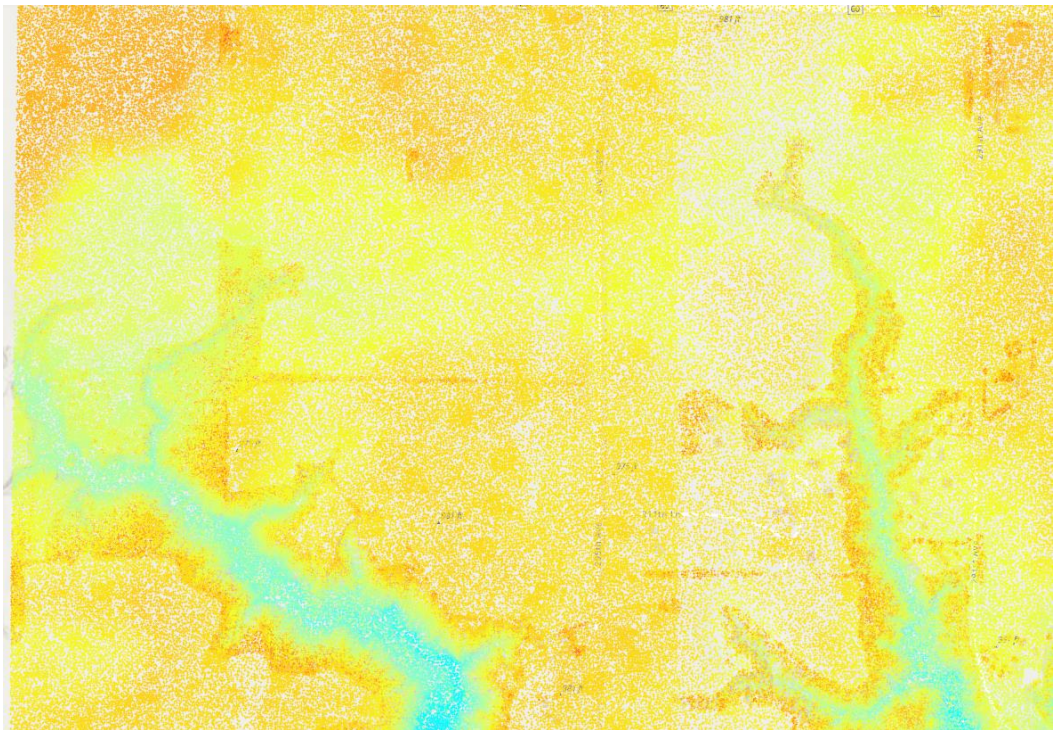
2d DEM



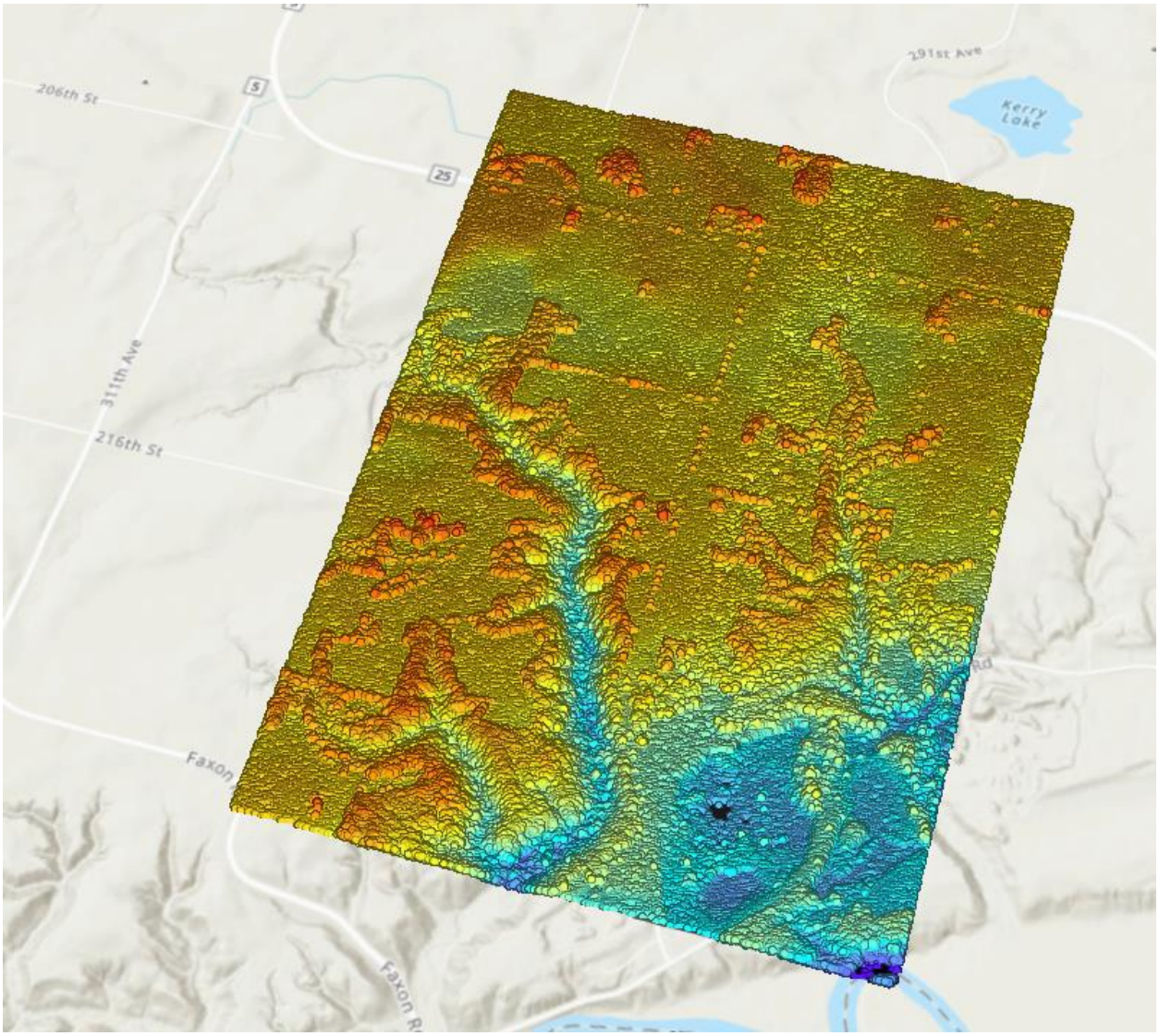
3d DEM



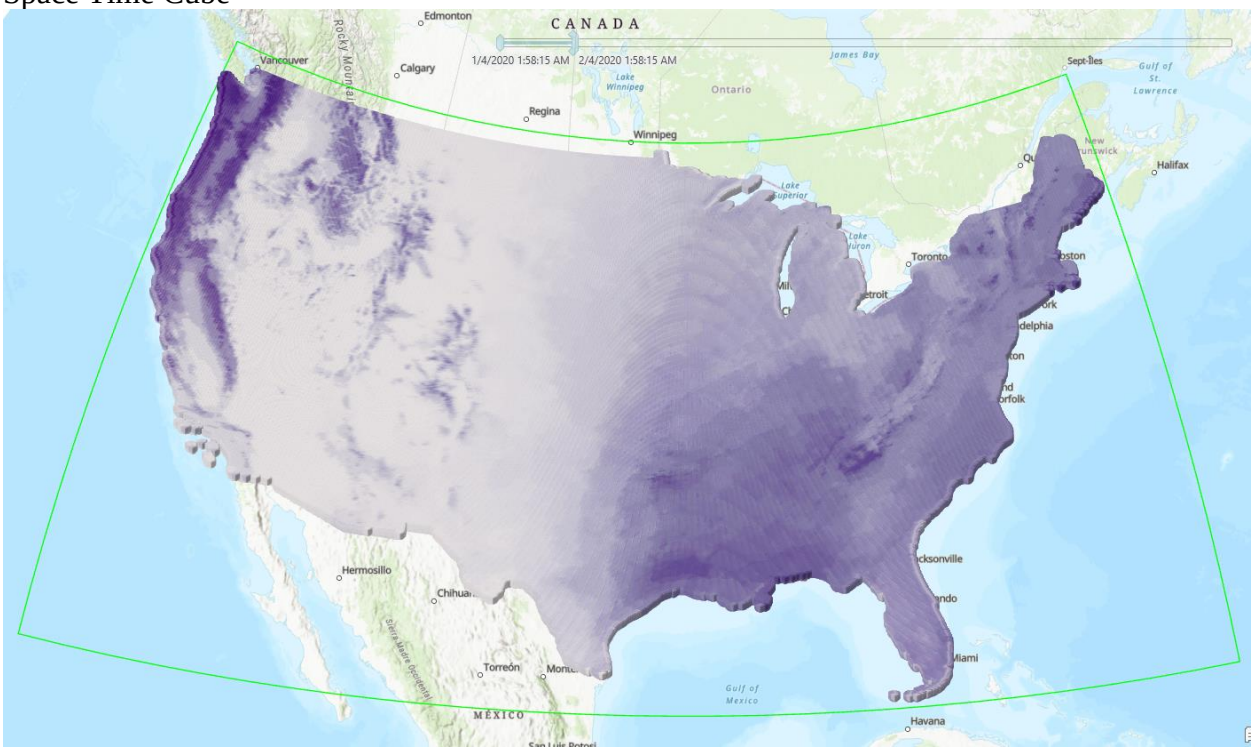
2d TIN



3d DEM



Space Time Cube



Results Verification

I ran the whole workflow and there was no error. Also, I visualized the data and analyzed the results to make sure the code was working properly.

Discussion and Conclusion

I have reached the goal of this lab:

- 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.
- Use ArcPro to perform side-by-side exploratory spatial data analysis using 2D and Scene views.
- Use ArcPy to export to a PDF a visualization of LiDAR data

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	24	24

	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)**.		
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