COMP 4304 / 6934 – Assignment 7 (7%)

MEMORIAL UNIVERSITY

Due: 11:59pm, Mar. 28, 2024

Learning Objectives

The goal of this assignment is to become familiar with spatial data visualizations.

Introduction

There is a total solar eclipse on April 8, 2024. It will pass directly through the middle of the island of Newfoundland, as well as other points through Southern Ontario, Quebec and Atlantic Canada.

Here in St. John's, we will experience 99.2% totality (i.e., not completely a total eclipse). The peak of the eclipse in St. John's will be at approximately 5:15pm. At no time will be it safe to view the sun without proper eyeware (ISO certified solar eclipse viewing glasses). It is only ever safe to view an eclipse with the naked eye during the 2–3 minute window where the Sun is 100% blocked by the Moon (this will not happen in St. John's).

Solar eclipses are rare, wonderful events. If you can travel outside of St. John's to see totality, then it is highly recommended. There are astronomy and eclipse events running in Gander throughout the weekend leading up to the solar eclipse (April 5-7).

If you can't travel outside of St. John's, the Johnson Geo Centre will be hosting a Sun Block Party from 3–7pm on April 8. There will be games, activities, crafts, eclipse information videos, and a food truck on site along with solar telescopes. It may be busy. See the Facebook event page.

Data

Download the `canada.shp` and `umbra_lo.shp` and associated shape files from Brightspace.

The `canada.shp` shapefiles contain a high-quality geographic map of Canada.

The `umbra_lo.shp` shapefiles contains the locations of the Moon's shadow for the April 8, 2024 total solar eclipse. Each row contains the location of the shadow (umbra) in intervals of 10 seconds.

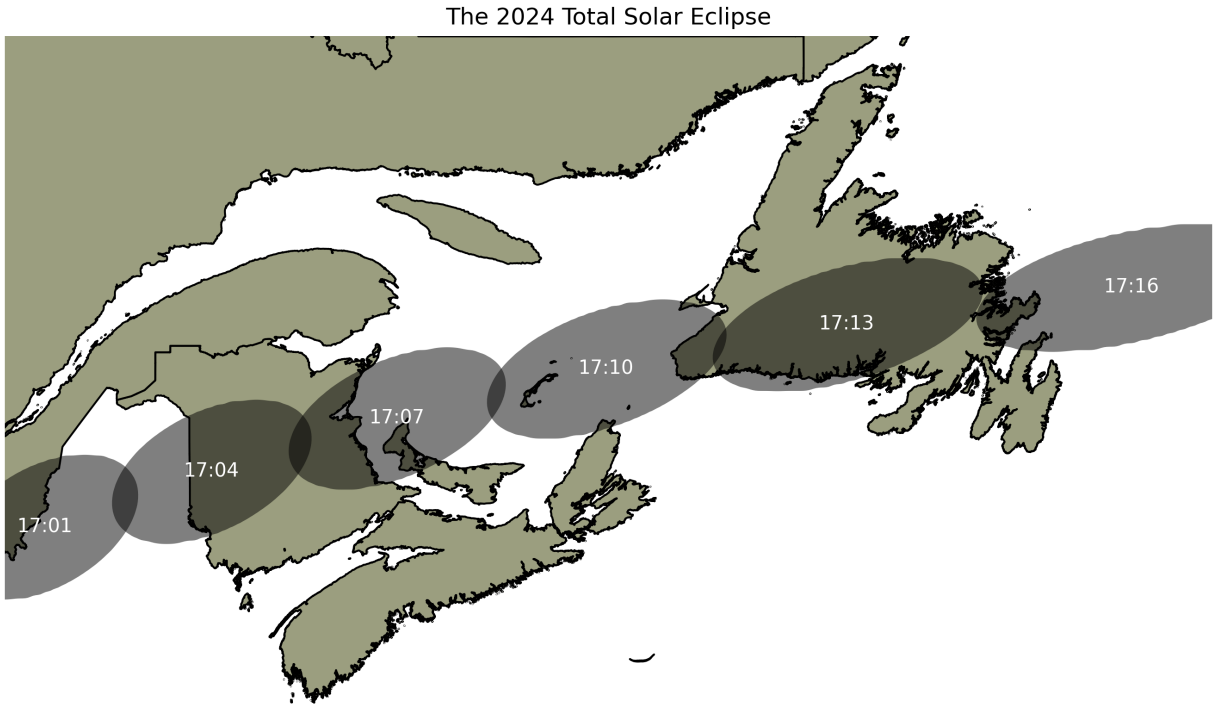
Instructions

Using the provided data sets, create a Jupyter notebook to answer the following questions.

You may only import the pandas, Matplotlib, Seaborn, GeoPandas, Folium and math or NumPy packages.

Question 1 – GeoPandas: (50 pts)

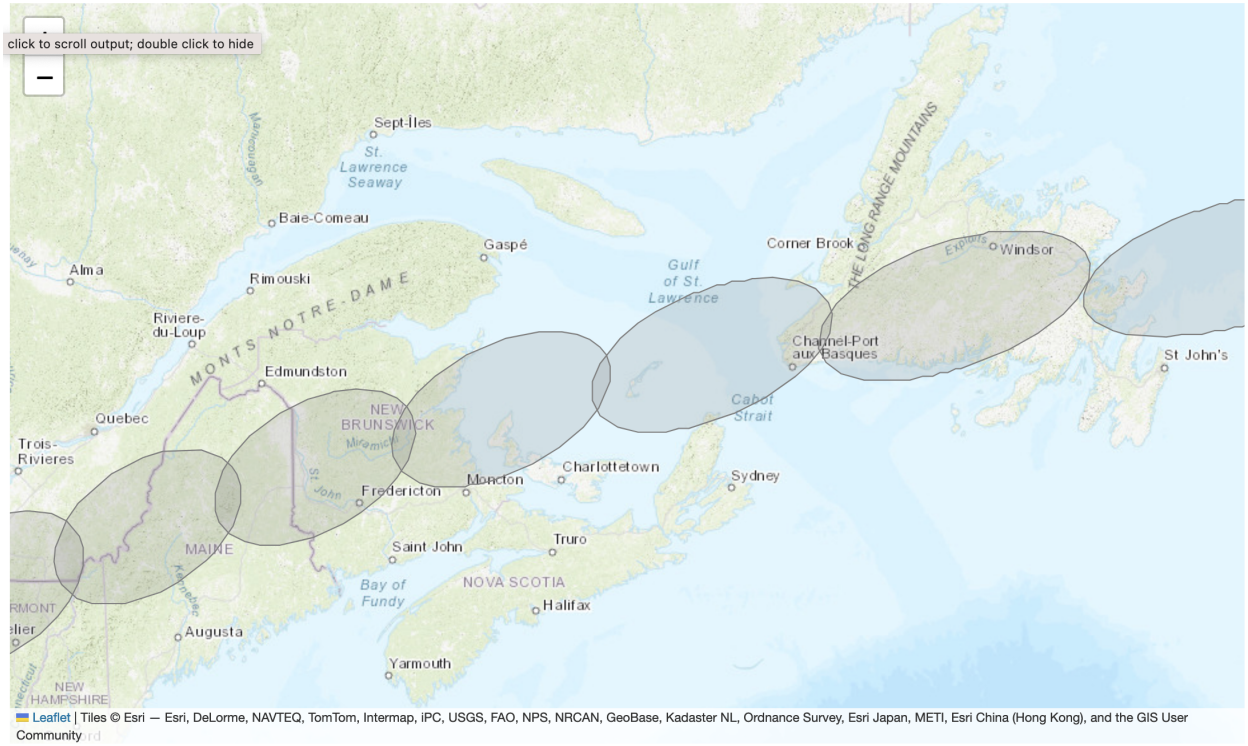
The following visualization shows the path of the April 8 total solar eclipse throughout Atlantic Canada. The circles are the locations of the Moon's shadow (specifically the umbra, the darkest part) in 3-minute intervals. That the shadows are not perfect circles is a reflection of the curvature of the Earth.



Re-create the above visualization using GeoPandas and Matplotlib. The land areas are coloured with colour '#9b9e7f'. Make sure to use the coordinate reference system associated with the `umbra_lo.shp` data set. The shadows should be a partially transparent black colour. Each shadow has text giving its timestamp, with the times and format as given in the image above. The title should be present.

Question 2 – Folium: (50 pts)

The interactive visualization below shows the path of the total solar eclipse for Atlantic Canada, similar to Question 1, but made using Folium.



Re-create the above visualization using Folium. (Hint: try Folium's `GeoJson()` function.) The tile set is "ESRI WorldTopoMap". The timing of the shadows is the same as in Question 1. Each shadow has a filled grey colour that is partially transparent. The map should be initially centred on the Atlantic Canadian provinces.

Submission

Submit your Jupyter notebook (`.ipynb`) through Brightspace.

Late submissions will be subject to a 10% penalty for each hour past the deadline.

Attribution

Submissions should include an attribution section indicating any sources of material, ideas or contribution of others to the submission.

Submissions must represent your independent work.

You are encouraged to use any resources to help with your solution, but your solution must represent independent work. If your submitted work includes unacknowledged collaboration, code materials, ideas or other elements that are not your original work, it may be considered plagiarism or some other form of cheating under MUN general regulations 6.12.4.2 (4.12.4.2 for graduate students) and academic penalties will be applied accordingly.

Avoid academic penalties by properly attributing any contribution to your submission by others, including internet sources and classmates. This will also help distinguish what elements of the submission are original. You may not receive full credit if your original elements are insufficient, but you can avoid penalties for plagiarism or copying if you acknowledge your sources.

Github

I encourage you to store and version your work on GitHub. It is good practice to do so as everyone uses git in the real world.

However, **it is a requirement that git repositories containing assignment material be private.** University regulations (undergraduate 6.12.4.2 and graduate 4.12.4.2) consider it cheating if you allow your work to be copied. There will be zero tolerance for this.