Final Project 1st Draft

Title: Growing Degree Day
Notice: Dr. Bryan Runck
Author: Samikshya Subedi
Date: 11/15/2022

Project Repository: *https://github.com/Samikshya036/GIS5571*
Time Spent: 12 hours

Abstract

Farmers in Minnesota lack a model to forecast when their harvest will be fully grown. This study's goals is to calculate the number of accumulated growth degree days (AGDD) that crops would require (corn and wheat). The Growing Degree Day tool is a web-based tool that integrates current conditions, historical climate data, and projections of GDD through the end of the growing season based on various weather stations computer model forecasts and climatology to provide decision support on a variety of issues throughout the crop growth

I selected the following cities: ADA, Becker, Campbell and Clarissa to complete this project. Firstly, I will download the historical climate data from web (NDAWN). Moreover, I will build ETL pipeline and calculate the accumulated GDDs for Corn and Wheat from downloaded data and plot them for the selected cities. I will also plot the accumulated GDD for several years (2018, 2019, 2020, 2021) in a selected city and for several cities in the same year for both wheat and corn.

Problem Statement

1. To compare Calculated Growing Degree Day for Corn and Wheat for 4 different cities in Minnesota in years 2018, 2019, 2020 and 2021
2. To build an ETL in ArcPro Jupyter Notebooks that downloads the daily temperature data .csv files for min/max temperature from NDAWN, use data into Growing Degree day calculation.

Table 1. Data requirement for GDD calculation

#	Requirement	Defined As	Attribute Data	Dataset	Preparation
1	Daily Temperature (Max/Min)	.CSV files from NDAWN	Temperature on Degrees/Fahrenheit	NDAWN Daily	Input predicted first planting date and ending date
3	Base temperature for wheat	Constant base temp	degrees	constant	No

4	Base Temperature for corn	Constant Base temp	degrees	constant	No

Input Data

Table 2: Table showing purpose of analysis of the data

#	Title	Purpose in Analysis	Link to Source
1	Annual Accumulated Growing Degree Day in North Dakota (2018-2021)	Spatial interpolation of annual Growing degree day of Corn and Wheat in North Dakota	NDAWN Daily

Methods

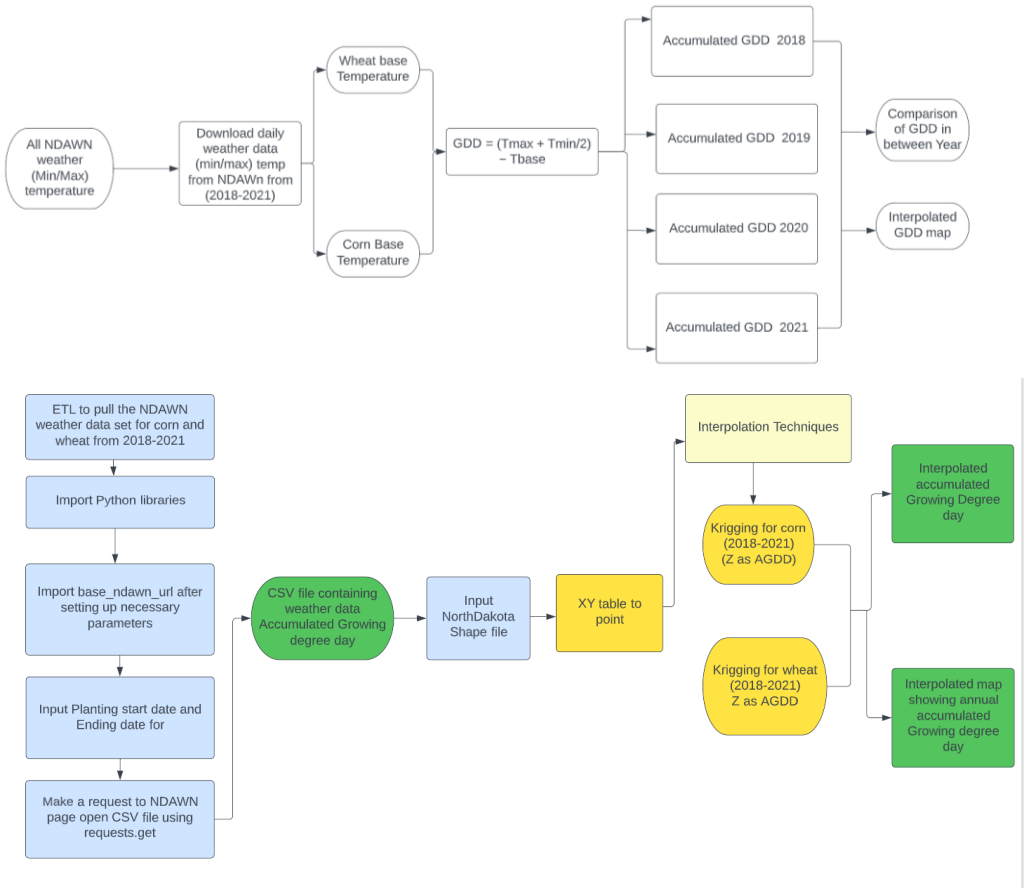

Figure 2: Figure showing work and data flow diagram for spatial interpolation of annual accumulated Growing Degree days.

Growing Degree day calculation:

Growing Degree Day(GDD) are calculated by taking the integral of warmth above a base temperature. Or simply, approximately equivalent to take the average temperature and minus base temperature in the following equation:

$$GDD = (Tmax + Tmin)/2 - Tbase$$

Tmax, Tmin, and Tbase are the daily maximum, daily minimum and base temperatures, respectively. Normally the maximum and minimum daily temperatures are pre-calculated before the above equation. If the maximum or minimum daily temperature is lower than the base temperature, then we set the maximum or minimum daily temperature equal to the base temperature.

For example, if the maximum daily temperature is 20, the minimum daily temperature is 5 and the base temperature is 10, we will have the GDD in the following equation: $GDD = (20 + 10)/2 - 10 = 5$

Results

The result will show Growing degree days in 4 locations of Minnesota and will be compared within years and within locations. the accumulated GDD for several years (2018, 2019, 2020, 2021) in a selected city and for several cities in the same year for both wheat and corn will be shown in the result.

Results Verification

After comparing the results of different cities with different temperature. If it differes then we can verify that results are correct.

Discussion and Conclusion

I learned to write project draft and calculation methods of growing degree day.

Self-score

Fill out this rubric for yourself and include it in your lab report. The same rubric will be used to generate a grade in proportion to the points assigned in the syllabus to the assignment.

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	**23**
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	**20**
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	**91**