



Stotz Equipment - R Package for GDH and GDD Calculation Case Study

The Customer

Stotz Equipment is a leading supplier of agricultural and turf equipment, offering a wide range of products, services, and solutions to meet the needs of farmers, ranchers, and landscapers. With over 25 locations across the western United States, Stotz Equipment is committed to providing its customers with the latest technology, equipment, and knowledge to optimize their operations and improve their bottom line.

The Situation

Farmers need to be able to accurately predict harvest time to plan and execute various activities, such as sprays, timing of harvest labor, and market planning. Growing Degree Hours (GDH) are a measure of heat accumulation used to predict plant development. However, calculating GDH can be a time-consuming and complex process, and farmers often need to rely on external data sources to accurately predict harvest time.

The Solution

In collaboration with Stotz Equipment, our data science consulting team created an R package and script that pulls temperature data for areas of interest (farm locations) identified by the user, calculates GDD taking into consideration each crop type and characteristics, and saves this new table locally. The package was designed to be easily accessible and customizable, enabling Stotz Equipment to accurately predict harvest time based on a specific farm location and crop.



Focus

Deliverables

- R package with documentation
- An R script that implements the functionality of the package and outputs cop GDD

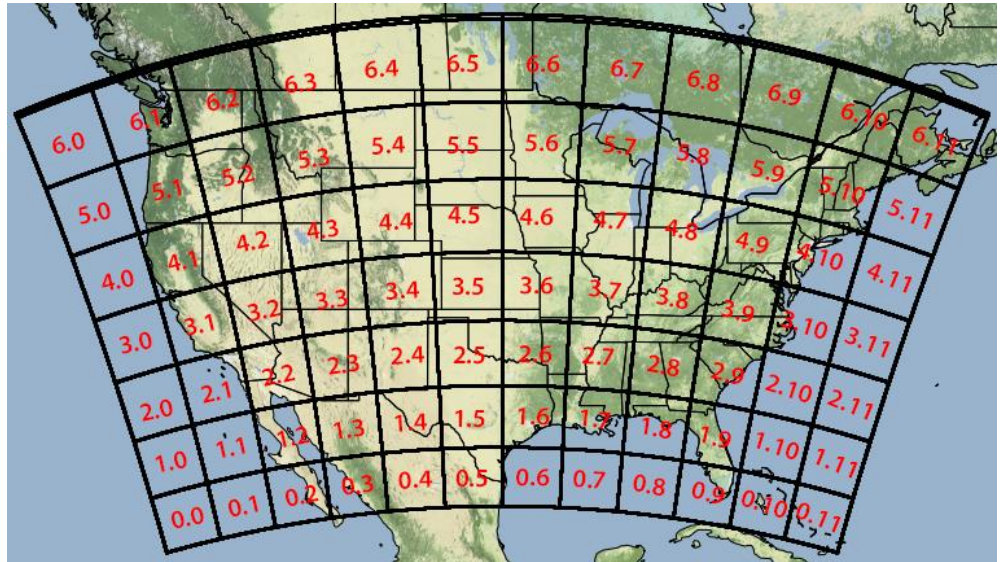
Package Structure:

- Load areas of interested identified by user
 - Data matching latitude and longitude from user input with field IDs from temperature data
- Load and extract temperature data information
- Calculate GDD for each location and crop
 - Identify base and high threshold temperatures for each crop
 - Transform temperature data unit from hours to days by summing up the cumulative temperature for each day
 - Convert Cumulative GDH into GDD
- Return a table of GDD for specified fields, crops, and date ranges

Data Retrieval

The user loads a .csv file containing the crop season, crop name, latitude and longitude, seeding date and harvest date. A function will then map the latitude and longitude data to the chunks in the HRRR model (see image) to get the temperature data for the field.

This process allows the program to run a lot faster, since data is only being loaded for the areas of interest and not the entire grid.



GDD Function

The formula for GDD is equal to the sum of GDH divided by the base temperature for a specific crop type. The student consulting team researched the base and high threshold temperatures for each crop type requested by the client. The team included an *If-Else* statement in the script to show crop names that don't match any of the previously identified crops, and displays the crop names in the database.

$$GDD = \frac{\sum GDH}{\text{Base Temperature}}$$

The final output is a .csv file containing all the original input information along with the GDD.