

# VDBA

## Vineyard Database Analysis Program User Guide

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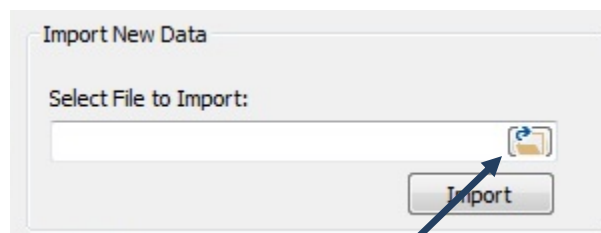
## Introduction:

The Vineyard Database Analysis Program (**VDBA**) can take temperature data from your vineyard and perform various types of analyses which are helpful for keeping track of vines' development and growth. **VDBA** can be used for practically any agricultural product that requires temperature assessments. The program takes the *EasyLog* climate files (.txt) from the weather station in the vineyard, and saves the data to the **VDBA** database, which you can then use for various types of analysis. The weather station retrieves data in increments of X minutes, whatever duration it is set at. The San Lorenzo vineyard weather station has most of its data in increments of 10 minutes (some 5).

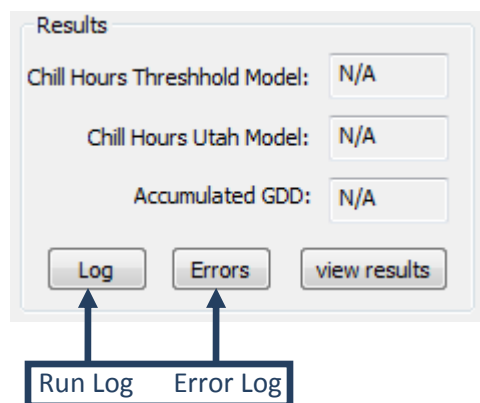
## 1. Importing New Data to the Database:

### 1.1 Importing Data with the User Interface

To import new *EasyLog* data to the database, use the *Import New Data* function in the **VDBA** program.



Open the file you wish to import using the *Browse Control*, select the desired file, and then left click the Import button. The function will import the data and report any error to the *Error Log*. (see *Error Log*, Section 4.1). The *Run Log* (Section 4.2) will record a step by step process of the import as well as list any duplicate data that was not added to the database.



Once data has been imported to the data base, it will remain there for analysis each time you open **VDBA**.

## 1.2 Input File: What are you working with? (Advanced Users)

Input files must have the following requirements met in order to be properly imported into the database:

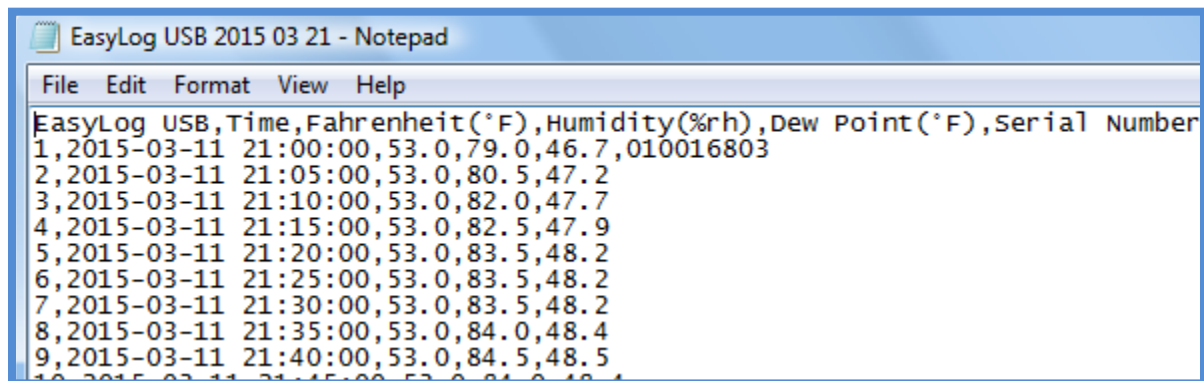
- 1) The input file must be a text file with the extension “.txt”
- 2) The input file must have, in the .txt document itself, the following header exactly as shown below:

```
EasyLog USB,Time,Fahrenheit(°F),Humidity(%rh),Dew Point(°F),Serial Number
```

- 3) The format of the data should be comma delimited as follows:

```
<Event#>,<Date> <Time>,<Temp°F > ,< Hum%rh>,<Dew°F>,<Serial>
```

### Example *EasyLog* File:



The screenshot shows a Notepad window titled "EasyLog USB 2015 03 21 - Notepad". The menu bar includes File, Edit, Format, View, and Help. The text content is as follows:

```
EasyLog USB,Time,Fahrenheit(°F),Humidity(%rh),Dew Point(°F),Serial Number
1,2015-03-11 21:00:00,53.0,79.0,46.7,010016803
2,2015-03-11 21:05:00,53.0,80.5,47.2
3,2015-03-11 21:10:00,53.0,82.0,47.7
4,2015-03-11 21:15:00,53.0,82.5,47.9
5,2015-03-11 21:20:00,53.0,83.5,48.2
6,2015-03-11 21:25:00,53.0,83.5,48.2
7,2015-03-11 21:30:00,53.0,83.5,48.2
8,2015-03-11 21:35:00,53.0,84.0,48.4
9,2015-03-11 21:40:00,53.0,84.5,48.5
10,2015-03-11 21:45:00,53.0,84.0,48.4
```

**Note (for manual data entry):** the Date and Time are not delimited with a *comma*, but with a *space*, and the Serial Number is only present in the first line of data. These are the requirements if someone wanted to make their own *EasyLog* file for import; **if the data was retrieved from the weather station in the vineyard it should already be in the proper format.** This is one way of importing data manually, however, if one wants to import data manually it would be easier to add it directly to the database file (*see Database Files, Section 1.3*).

### 1.3 Importing Data Directly into Database Files (Advanced Users)

When the *EasyLog* file is imported into the Database it separates the data into .txt files organized by day containing the data for each measurement from a specific day. This file is where you would place data that you are importing manually. The database .txt files have the following directory structure:

```
Database\year\month\day\Vinyard_weat_data_yyYYYYmmMMddDD.txt
```

To locate data for a given day, just navigate to and select the file with the date you are looking for.

The individual database files have the following headers:

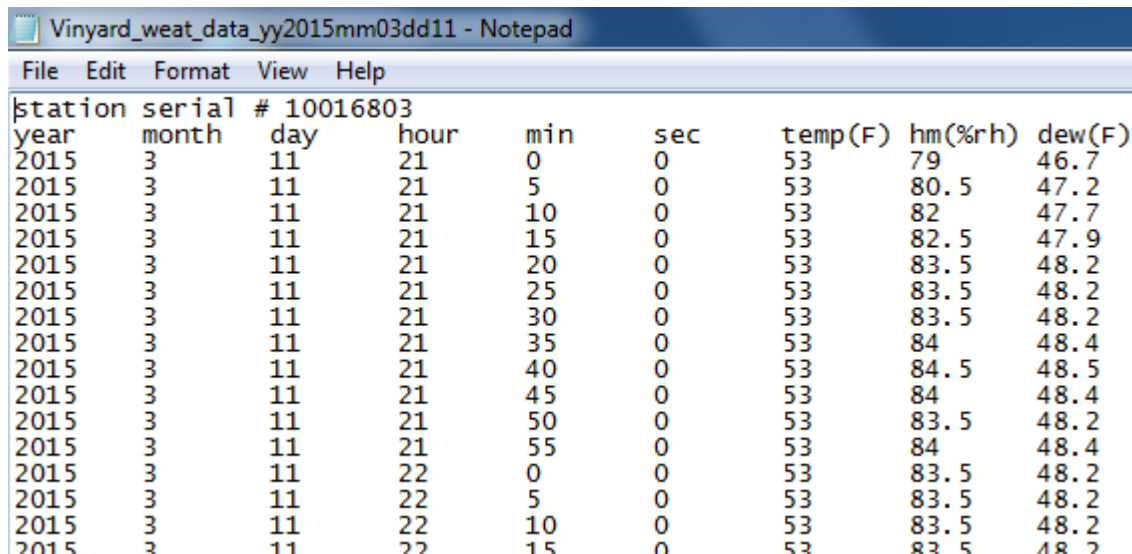
```
Header #1: station serial # 10016803
```

```
Header #2: year month day hour min sec temp(F) hm(%rh) dew(F)
```

Data is *space* delimited as follows:

```
<year> <month> <day> <hour> <min> <sec> <temp(F)> <hm(%rh)> <dew(F)>
```

**Example of Database File:** Vinyard\_weat\_data\_yy2015mm03dd11:



The screenshot shows a Notepad window titled "Vinyard\_weat\_data\_yy2015mm03dd11 - Notepad". The window contains the following text:

```
File Edit Format View Help
station serial # 10016803
year month day hour min sec temp(F) hm(%rh) dew(F)
2015 3 11 21 0 0 53 79 46.7
2015 3 11 21 5 0 53 80.5 47.2
2015 3 11 21 10 0 53 82 47.7
2015 3 11 21 15 0 53 82.5 47.9
2015 3 11 21 20 0 53 83.5 48.2
2015 3 11 21 25 0 53 83.5 48.2
2015 3 11 21 30 0 53 83.5 48.2
2015 3 11 21 35 0 53 84 48.4
2015 3 11 21 40 0 53 84.5 48.5
2015 3 11 21 45 0 53 84 48.4
2015 3 11 21 50 0 53 83.5 48.2
2015 3 11 21 55 0 53 84 48.4
2015 3 11 22 0 0 53 83.5 48.2
2015 3 11 22 5 0 53 83.5 48.2
2015 3 11 22 10 0 53 83.5 48.2
2015 3 11 22 15 0 53 82.5 48.2
```

If one is manually adding data to the database file (without using the *Import* function in the **VDBA** program) the added data must follow this format otherwise the database will be corrupt and all other functions in **VDBA** may not work properly.

### 1.4 Fixing a Corrupt Database:

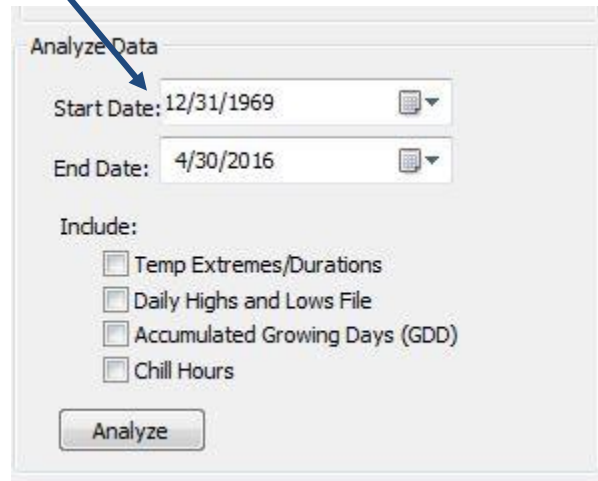
It is possible to rebuild a database by deleting the database directory and importing all the data again using the *Import* function in the **VDBA**, or by identifying the issue using the Run Log and/or Error Log.

## 2. Analyzing Your Data:

### 2.1 Selecting the Date Range:

When doing any sort of analysis one must first select the dates that are to be analyzed.

Do this using the **Date Selector:**



Analyze Data

Start Date: 12/31/1969

End Date: 4/30/2016

Include:

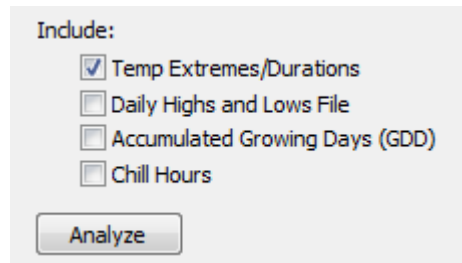
- Temp Extremes/Durations
- Daily Highs and Lows File
- Accumulated Growing Days (GDD)
- Chill Hours

Analyze

The *Start Date* and the *End Date* will tell the program what range of data to analyze for whichever analysis you are performing.

## 2.2 Calculating Duration of Temperature Extremes:

For a given date range, the **VDBA Program** can find when the weather rose above/below a specified temperature, and how much time it remained above/below that temperature. This is useful for getting measurements on the most frequent temperatures for a given period. To have the program make this calculation select the *Temp Extremes/Durations* check box...

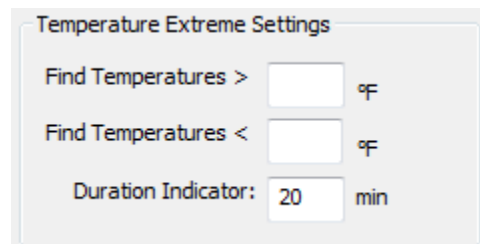


Include:

- Temp Extremes/Durations
- Daily Highs and Lows File
- Accumulated Growing Days (GDD)
- Chill Hours

Analyze

...and then fill out the *Temperature Extreme Settings*



Temperature Extreme Settings

Find Temperatures >  °F

Find Temperatures <  °F

Duration Indicator:  min

To find durations in which the data was above a certain temperature, put the threshold value in the *Find Temperatures >* field.

To find times in which the data was below a certain temperature, put the threshold value in the *Find Temperatures <* field.

The *Duration Indicator* field tells the program how long to continue searching the data before ending the duration set and beginning a new one, once the temperature no longer satisfies the threshold. For example, if the threshold is *Find Temperature < 50°F*, and the *Duration Indicator* is set to 30, the program will calculate the duration of time that the temperature was below 50°F until it is no longer below 50°F. The program will then search the next 30 minutes of data for a temperature that satisfies the <50°F requirement, and if none is found, the duration set ends and a new set will begin the next time the temperature satisfies the <50°F requirement.

However, if the temperature goes back to the required amount within the 30 minutes, the program will continue to count the duration as one duration set. Therefore, in the results, there will be a maximum 29 minute space where the temperature might be above 50°F.

Note: The number in the *Duration Indicator* field should be above ten minutes (the amount of time between data events).

Viewing the results for this analysis is covered in Part 3 (Section 3.1).

## 2.3 Calculating Chill Hours:

In order for grape vines to yield buds in the spring, the vine must spend a certain amount of time in a chilled temperature range (usually below 45-50 degrees F and above 32 degrees F). The amount of Chill Hours required differs from plant to plant. Most grapevines need at least 150 hours within this chilled temperature range. Chill Hours are a way of measuring the number of hours in which the chill requirements for the plant have been met during the chill season (usually winter in a given region).

The **VDBA** program calculates chill hours from two different models. The *Utah Model* and the simpler *Threshold Model*. Refer to Part 5 for more information on chill models.

When the *Chill Hours* check box is checked, the program will calculate the chill hours according to these models. The settings for the models include the *Threshold Setting*, which sets the threshold in degrees F for the *Threshold Model*. The other settings are for the chill season, measured in months. If there are data whose dates from the *Date Selector* are outside the range of the **chill season settings**, that data will not be used in the chill hour calculation.

The screenshot shows two panels. The left panel, titled 'Include:', contains four checkboxes: 'Temp Extremes/Durations' (unchecked), 'Daily Highs and Lows File' (unchecked), 'Accumulated Growing Days (GDD)' (checked), and 'Chill Hours' (checked). Below these is an 'Analyze' button. The right panel, titled 'Chill Hour Settings', contains a text input field 'Hours <' with the value '45' and a unit dropdown set to '°F'. Below this is the text '(for single threshold model)'. Further down are two dropdown menus: 'Chill Season Start Month:' set to '11' and 'Chill Season End Month:' set to '2'. A blue arrow points from the text 'chill season settings' in the paragraph above to the 'Chill Season Start Month' dropdown.

Viewing the results of this analysis is covered in Part 3 (Sections 3.1 and 3.3).

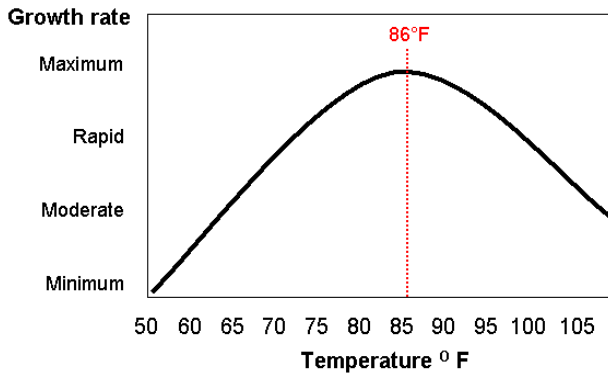
## 2.4 Calculate Daily High and Low Temperatures:

If the *Daily Highs and Lows* check box is checked the program will calculate the daily high and low temperatures for the range of dates specified by the *Date Selector*. Viewing the results for this analysis is covered in Part 3 (Section 3.2).

## 2.5 Calculate Growing Degree Days (GDD)

*Growing Degree Days (GDD)* is a calculation that measures the amount of time a plant has been in a warm enough temperature to grow and develop. In order for a plant to grow, its environment must be above a certain temperature throughout the growing season. In the case of most grapevines, this threshold is 50°F. Grapevines need a certain amount of time above the 50°F threshold in a growing season to achieve the best fruit development possible.

If the temperature is higher, the growth rate will be higher, up to a certain maximum, at which the growth rate begins to decline again, as can be seen in this diagram:



<http://agron-www.agron.iastate.edu/Courses/agron212/Calculations/GDD.htm>

In this example, the maximum growth rate temperature is 86°F, so at higher temperatures the growing rate declines.

The *GDD* calculator used in **VDBA** gives a close approximation of the *GDD*, with the formula:

$$(\text{High } ^\circ\text{F} + \text{Low } ^\circ\text{F})/2 - (\text{Threshold})^\circ\text{F} = \text{Average Degrees above Threshold (GDD)}$$

For example, the April 27<sup>th</sup>'s daily high was 70°F, while the low was 51°F.

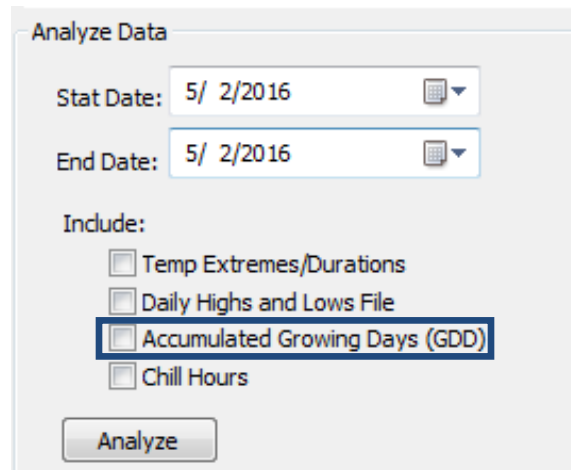
Plug these into the formula:  $(70^\circ\text{F} + 51^\circ\text{F})/2 - 50^\circ\text{F} = 10.5^\circ\text{F}$

The *GDD* for April 27<sup>th</sup> was 10.5°F.

In the **VDBA** analysis, the program takes the sum of each day's *Average Growing Degrees* into a single total for the growing season, or whichever range of dates you have selected. This is called the *Accumulated GDD*.

For example, the following day, April 28<sup>th</sup>, the *GDD* was 6.5°F (high of 65°F, low of 48°F). The *Accumulated GDD* for the two day period of April 27<sup>th</sup>-28<sup>th</sup> is 17°F.

To calculate the *GDD* in the **VDBA** program, check the box next to *Accumulated Growing Days*.



Analyze Data

Stat Date: 5/ 2/2016

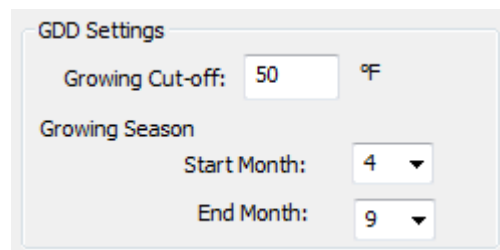
End Date: 5/ 2/2016

Include:

- Temp Extremes/Durations
- Daily Highs and Lows File
- Accumulated Growing Days (GDD)
- Chill Hours

Analyze

Then select the temperature threshold in the *GDD Settings* next to *Growing Cut-Off*, and give the range for the *Growing Season* in months.



GDD Settings

Growing Cut-off: 50 °F

Growing Season

Start Month: 4

End Month: 9

Viewing the results of this analysis is covered in Part 3 (Sections 3.1 and 3.3.)

The average *Accumulated GDD* for the California Central Coast region is 3400 GDD. Refer to Part 5 for more information about *GDD*.

### 3. Viewing Results:

#### 3.1 The Report File:

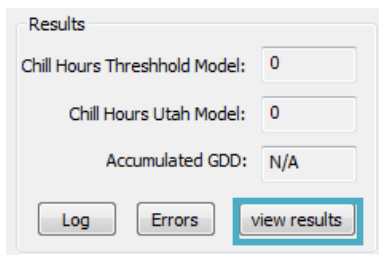
The *Report File* reports the *Temperature Extremes/Duration* information, as well as the *Chill Hour* and *Accumulated GDD* calculations.

The data sets are tab delimited starting with an event's *start* date and time, and *end* date and time, delimited by colon: (yyyy:mm:dd:hh:mm:ss).

Then the time duration of the event delimited by colon: (hh:mm:ss).

The final column gives the extreme temperature value for that duration (the high or low temperature).

The program makes two report files. One is a .txt file as shown in the example below. This can be viewed by selecting *View Results*. The second is a Microsoft Excel readable .csv file. Both of these report files should be located in the output\reports folder.



Each file has the naming scheme: AnalysisReport\_run\_<run Number>.txt

#### Example Report File: AnalysisReport\_run\_0000002.txt

```
AnalysisReport_run_0000002 - Notepad
File Edit Format View Help
Vineyard Database and Analysis: Developed by OFM CAPS San Lorenzo Friary, Santa Ynez California

Temperature Analysis for 2015:03:11:00:00:00 through 2015:04:28:00:00:00

Total Chill hours below 45°F and above 32°F :110
Total Chill hours using the utah chill model:-91

Accumulated GDD:495 (for Temperatures above 50):

*****
Durations for Temperatures below 50°F
*****

Begin                End                (dd:hh:mm)        Low °F
2015:03:12:03:50:00  2015:03:12:09:10:00  0:5:20            48
2015:03:13:04:20:00  2015:03:13:04:55:00  0:0:35            50
2015:03:13:06:00:00  2015:03:13:06:25:00  0:0:25            49
2015:03:13:06:50:00  2015:03:13:07:50:00  0:1:0             49
```

### 3.2 Daily Highs and Lows file:

The *Daily Highs and Lows* are recorded as .txt files and Microsoft Excel .csv readable files in the output\highs\_lows folder. You can also view the .txt file by selecting *View Results*, just like the *Report File*.

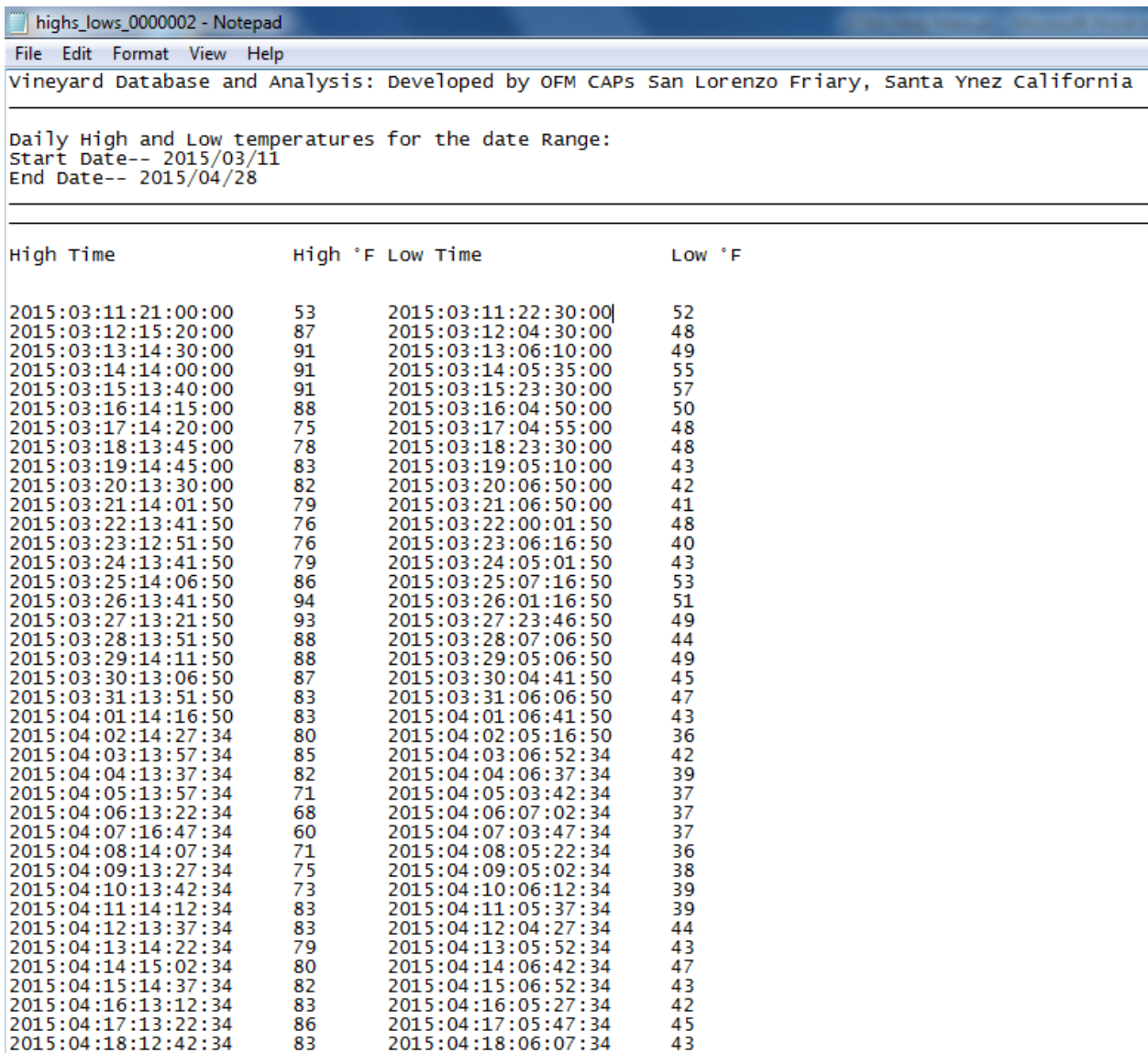
The *Daily Highs and Lows* files have the naming scheme:

highs\_lows\_<Run Number>.txt

The data sets are tab delimited with the following format:

<High:Date:Time> <High Value °F> <Low:Date:Time> <Low Value °F>

#### **Example *Daily Highs and Lows File*: highs\_lows\_0000002.txt**



High Time	High °F	Low Time	Low °F
2015:03:11:21:00:00	53	2015:03:11:22:30:00	52
2015:03:12:15:20:00	87	2015:03:12:04:30:00	48
2015:03:13:14:30:00	91	2015:03:13:06:10:00	49
2015:03:14:14:00:00	91	2015:03:14:05:35:00	55
2015:03:15:13:40:00	91	2015:03:15:23:30:00	57
2015:03:16:14:15:00	88	2015:03:16:04:50:00	50
2015:03:17:14:20:00	75	2015:03:17:04:55:00	48
2015:03:18:13:45:00	78	2015:03:18:23:30:00	48
2015:03:19:14:45:00	83	2015:03:19:05:10:00	43
2015:03:20:13:30:00	82	2015:03:20:06:50:00	42
2015:03:21:14:01:50	79	2015:03:21:06:50:00	41
2015:03:22:13:41:50	76	2015:03:22:00:01:50	48
2015:03:23:12:51:50	76	2015:03:23:06:16:50	40
2015:03:24:13:41:50	79	2015:03:24:05:01:50	43
2015:03:25:14:06:50	86	2015:03:25:07:16:50	53
2015:03:26:13:41:50	94	2015:03:26:01:16:50	51
2015:03:27:13:21:50	93	2015:03:27:23:46:50	49
2015:03:28:13:51:50	88	2015:03:28:07:06:50	44
2015:03:29:14:11:50	88	2015:03:29:05:06:50	49
2015:03:30:13:06:50	87	2015:03:30:04:41:50	45
2015:03:31:13:51:50	83	2015:03:31:06:06:50	47
2015:04:01:14:16:50	83	2015:04:01:06:41:50	43
2015:04:02:14:27:34	80	2015:04:02:05:16:50	36
2015:04:03:13:57:34	85	2015:04:03:06:52:34	42
2015:04:04:13:37:34	82	2015:04:04:06:37:34	39
2015:04:05:13:57:34	71	2015:04:05:03:42:34	37
2015:04:06:13:22:34	68	2015:04:06:07:02:34	37
2015:04:07:16:47:34	60	2015:04:07:03:47:34	37
2015:04:08:14:07:34	71	2015:04:08:05:22:34	36
2015:04:09:13:27:34	75	2015:04:09:05:02:34	38
2015:04:10:13:42:34	73	2015:04:10:06:12:34	39
2015:04:11:14:12:34	83	2015:04:11:05:37:34	39
2015:04:12:13:37:34	83	2015:04:12:04:27:34	44
2015:04:13:14:22:34	79	2015:04:13:05:52:34	43
2015:04:14:15:02:34	80	2015:04:14:06:42:34	47
2015:04:15:14:37:34	82	2015:04:15:06:52:34	43
2015:04:16:13:12:34	83	2015:04:16:05:27:34	42
2015:04:17:13:22:34	86	2015:04:17:05:47:34	45
2015:04:18:12:42:34	83	2015:04:18:06:07:34	43

### **3.3 Chill Hours and Accumulated GDD:**

The *Chill Hours* and the *Accumulated GDD* are displayed on the main **VDBA** window in the view results section as well as recorded in the *Report File*.

### **3.4 View Results Button:**

If both the *Temperature Extremes* and the *Daily Highs and Lows* analyses were run, clicking on the *View Results* button will open both the *Report File* and the *Daily Highs and Lows* file at once in a default program for viewing .txt files. Notepad is sufficient.

## **4. Viewing Logs:**

### **4.1 Error Log:**

Any errors that occur during the analysis will be recorded in the *Errors Log* file which is a .txt file located in the folder output\logs\errors.txt

This file is destroyed and re-created each time the **VDBA.exe** program is opened. Therefore, if one wishes to keep the error log for future reference, one must save it to another location (e.g. a flash drive) before starting up the program.

### **4.2 Run Log:**

The *Run Log* file is a .txt file that contains more verbose feedback on what the analysis program has done for a specific run. It may be helpful when the error log is too vague or when you wish to know exactly where an error occurred or what the program is doing. It is located in output\logs\Run\_log.txt.

## 5. Informative Links

For more information about chill hour models, refer to these links:

[Chilling Accumulation Models \(UC Davis\)](#)

[Prune Chilling Prediction \(UC Davis\)](#)

For more information about growing degree days (GDD), refer to these links:

[GDD Concepts \(UC Davis\)](#)

[Calculating GDD \(ISU\)](#)

[Grape GDD for California](#)

**Questions? Clarifications? Contact Michael Coco at:**

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