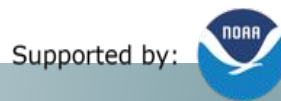
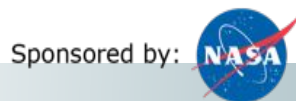





El Niño Data Comparison Project

Shumate Middle School
Gibraltar School District

The ENSO Student
Research Campaign



Implemented by:  UCAR

Shumate Middle School - GLOBE ENSO Team

Shumate Middle School Students

- **Kaydin Fowler** - 2nd Hour GLOBE Team Leader (2016 - 2017)
 - Manages the 2016 - 2017 - 2nd Hour - The Pond GLOBE Site
- **Hailey Holbdy** - 3rd Hour GLOBE Team Leader (2016 - 2017)
 - Manages the 2016 - 2017 - 3rd Hour - Locust Tree GLOBE Site
- **Sienna Roll** - 5th Hour GLOBE Team Leader (2016 - 2017)
 - Manages the 2016 - 2017 - 5th Hour - Science Lab GLOBE Site
- **Jalyn Bongiorno** - 6th Hour GLOBE Team Leader (2016 - 2017)
 - Manages the 2016 - 2017 - 6th Hour - 300 Hallway Sidewalk GLOBE Site

**Students meet during Advisory period to collaborate and complete this report.*

Teacher and Principal (Gibraltar School District)

- **Mr. Jeffrey Bouwman** - 6th and 7th Grade Science Teacher
- **Mrs. Els Ferguson** - Shumate Middle School Principal

Shumate Middle School - El Niño Data Comparison Project

Abstract:

Many people in Michigan believe that the El Niño period will generally result in a warmer winter. Does this phenomenon yield a warmer Michigan winter? To find out we are going to compare data collected during an El Niño period and a Non- El Niño period.

Research Question:

Does the El Niño phenomenon yield a warmer Michigan winter (surface, soil, and daily high temperatures)?

Importance of Project:

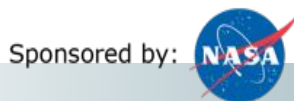
- Monitor El Niño's impact on Gibraltar, Michigan - United States of America.
- Collect, submit, and analyze citizen science data via GLOBE and CoCoRaHS.
- Monitoring the Shumate/Carlson campus is important because our school is located directly next to a local wetland and Lake Erie.

El Niño Perception Data

What do we know about El Niño at Shumate Middle School?

To see what people know, we asked the Shumate staff and sixth grade students to take a short (two question) survey focusing on El Niño. The survey was created using Google Forms and hosted on Google Classroom for all to take.


The results of our survey can be found on the next few slides.



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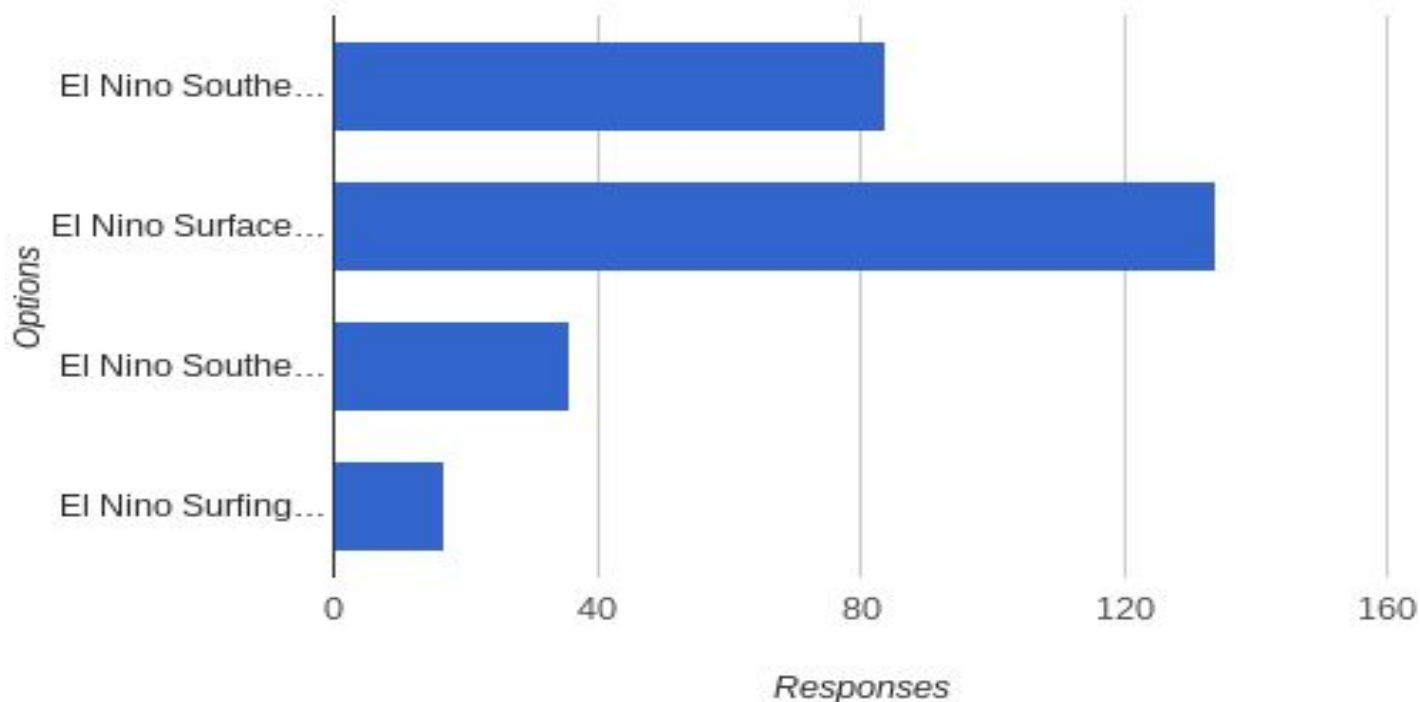
Our El Niño Quiz

1. What does ENSO stand for?
 - a. El Niño Surface Oscillation
 - b. El Nino Southern Oscillation.
 - c. El Nino Southern Ocean.
 - d. El Niño Surfing Organization.
2. What does El Niño involve?
 - a. Warmer water moves eastward along the equator.
 - b. A slackening in the trade winds.
 - c. Making waves in a pool.
 - d. First two choices.

This quiz was taken by 271 sixth grade students and Gibraltar staff members.

El Niño Perception Data - Question 1

What does ENSO stand for?



El Niño Perception Data - Question 1

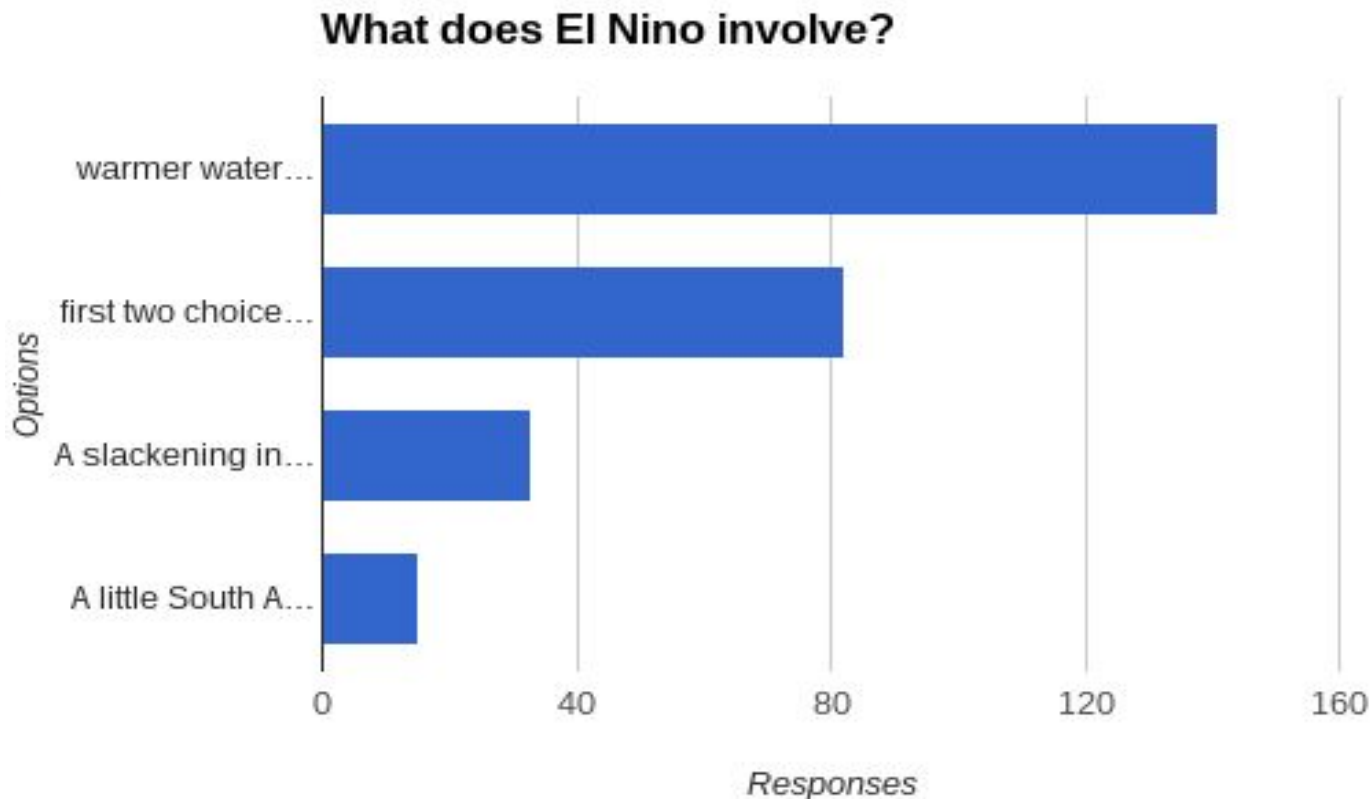
Results:

31% of the sample population answered correctly.

Group Reflection:

Our group was not surprised because people in Michigan don't really understand the importance of El Niño. In Michigan, many people are more familiar with lake effect snow, polar vortex, and the overall cold conditions. As stated before, many Michigan residents believe that El Niño will result in a warmer winter.

El Niño Perception Data - Question 2



El Niño Perception Data - Question 2

Results:

52% percent of the sampled population answered question two correctly (141 correct responses).

Group Reflection:

Our group was a little surprised as we thought more people would understand what the El Niño phenomena involves - warmer water moving eastward along the equator.

The Comparison

Details:

- For this study, we are comparing data collected during an El Niño period and a non - El Niño period.

Dates:

- September 21, 2015 - March 21, 2016 - El Niño Period
- September 21, 2016 - March 21, 2017 - Non - El Niño Period

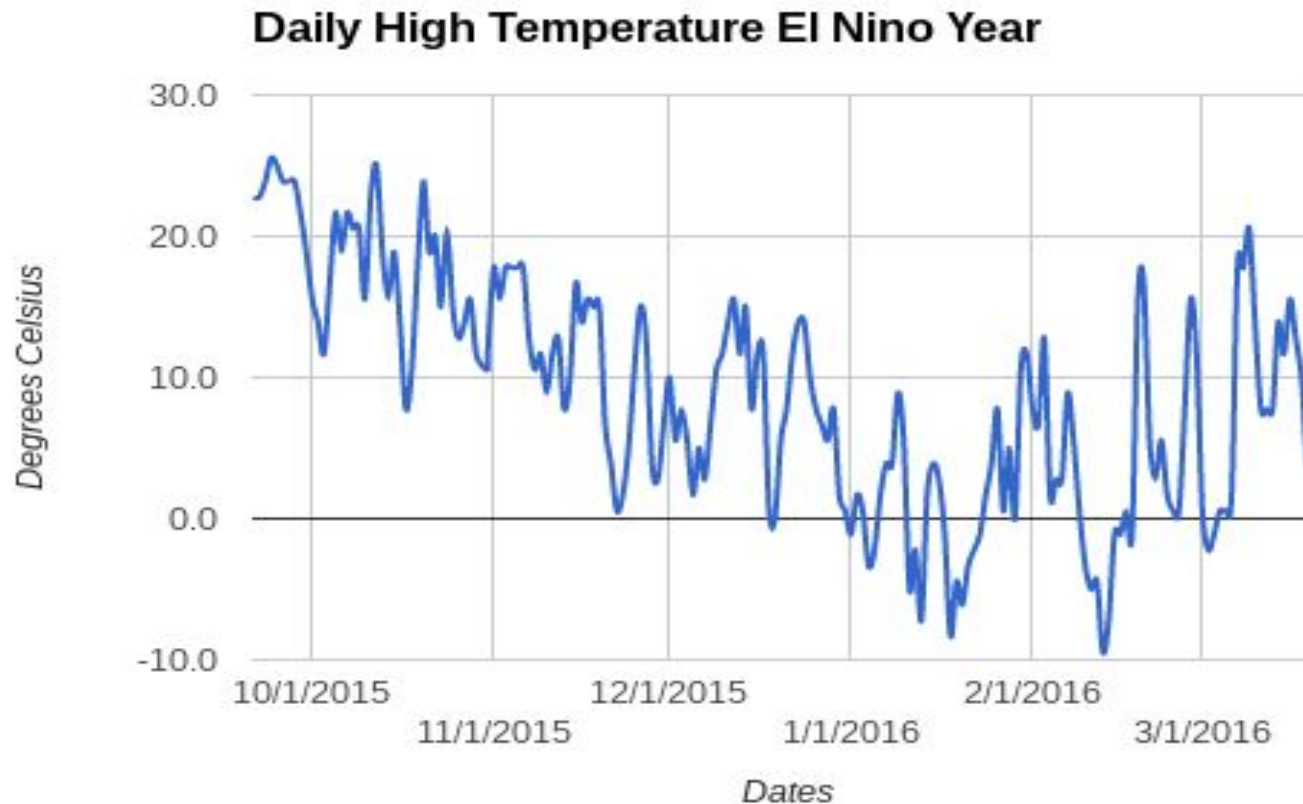
Comparing:

- Daily High Temperature
- Precipitation
- Soil Temperature (5 cm and 10 cm)
- Surface Temperature

Daily High Temperatures (Data) - El Niño Year

<i>Gibraltar, Michigan - USA</i>	<i>Degrees Celsius</i>	<i>Degrees Fahrenheit</i>
<i>Average</i>	<i>22.8</i>	<i>48.1</i>
<i>Maximum</i>	<i>25.6</i>	<i>78</i>
<i>Minimum</i>	<i>-9.4</i>	<i>15</i>
Data Source: Weather Underground		

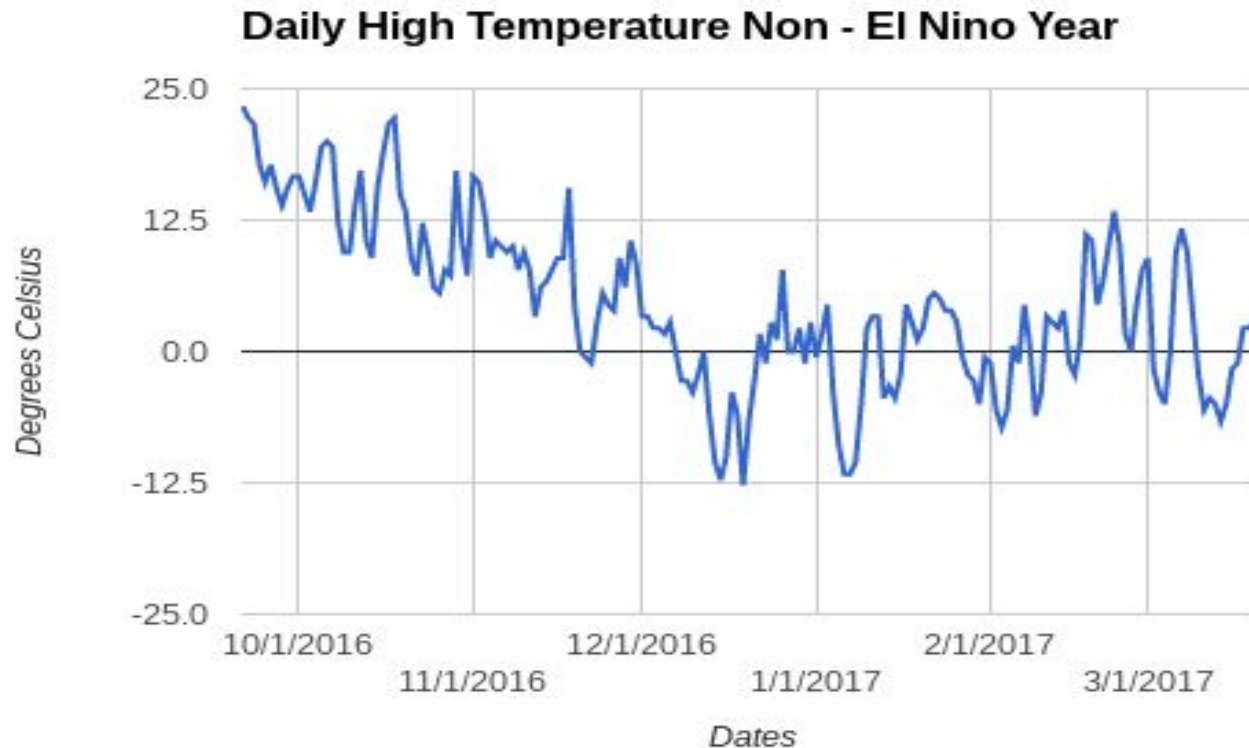
Daily High Temperatures (Graph) - El Niño Year



Daily High Temperatures (Data) - Non - El Niño Year

<i>Gibraltar, Michigan - USA</i>	<i>Degrees Celsius</i>	<i>Degrees Fahrenheit</i>
<i>Average</i>	<i>4.5</i>	<i>40.1</i>
<i>Maximum</i>	<i>23.3</i>	<i>74</i>
<i>Minimum</i>	<i>-12.8</i>	<i>9</i>
Data Source: WeatherSTEM - Gibraltar School District		

Daily High Temperatures (Graph) - Non- El Niño Year



Daily High Temperatures - Comparison

- The Average Daily High Temperature was 18.3 degrees Celsius warmer during the El Niño period.
- The Maximum Temperature was 2.3 degrees Celsius warmer during the El Niño period.
- The Minimum Temperature was 3.4 degrees Celsius colder during the non- El Niño period.
- Overall, we believe the El Niño period was warmer than the Non- El Niño period.

Precipitation Comparison

El Nino Period			Non - El Nino Period			Comparison	
Month	Total (mm)	Total (Inches)	Month	Total (mm)	Total (Inches)	Difference (mm)	Greater Total
September 2015	8.6	0.34	September 2016	6.6	0.26	2	Sept. 15
October 2015	60.2	2.37	October 2016	76.7	3.02	16.5	Oct. 16
November 2015	52.8	2.08	November 2016	59.9	2.36	7.1	Nov. 16
December 2015	73.2	2.88	December 2016	81	3.19	7.8	Dec. 16
January 2016	34	1.34	January 2017	55.3	2.18	21.3	Jan. 17
February 2016	37.1	1.46	February 2017	39.1	1.54	2	Feb. 17
March 2016	41.9	1.65	March 2017	83.1	3.27	41.2	Mar. 17
Total	307.8	12.12	Total	401.7	15.82	Greater Total - Non - El Nino Period	
Average	44.0	1.7	Average	57.4	2.26	Higher Average - Non - El Nino Period	
Maximum	73.2	2.88	Maximum	83.1	3.27		
Minimum	8.6	0.3	Minimum	6.6	0.26		
Data Collected: September 21, 2015 - March 21, 2016			Data Collected: September 21, 2016 - March 21, 2017				

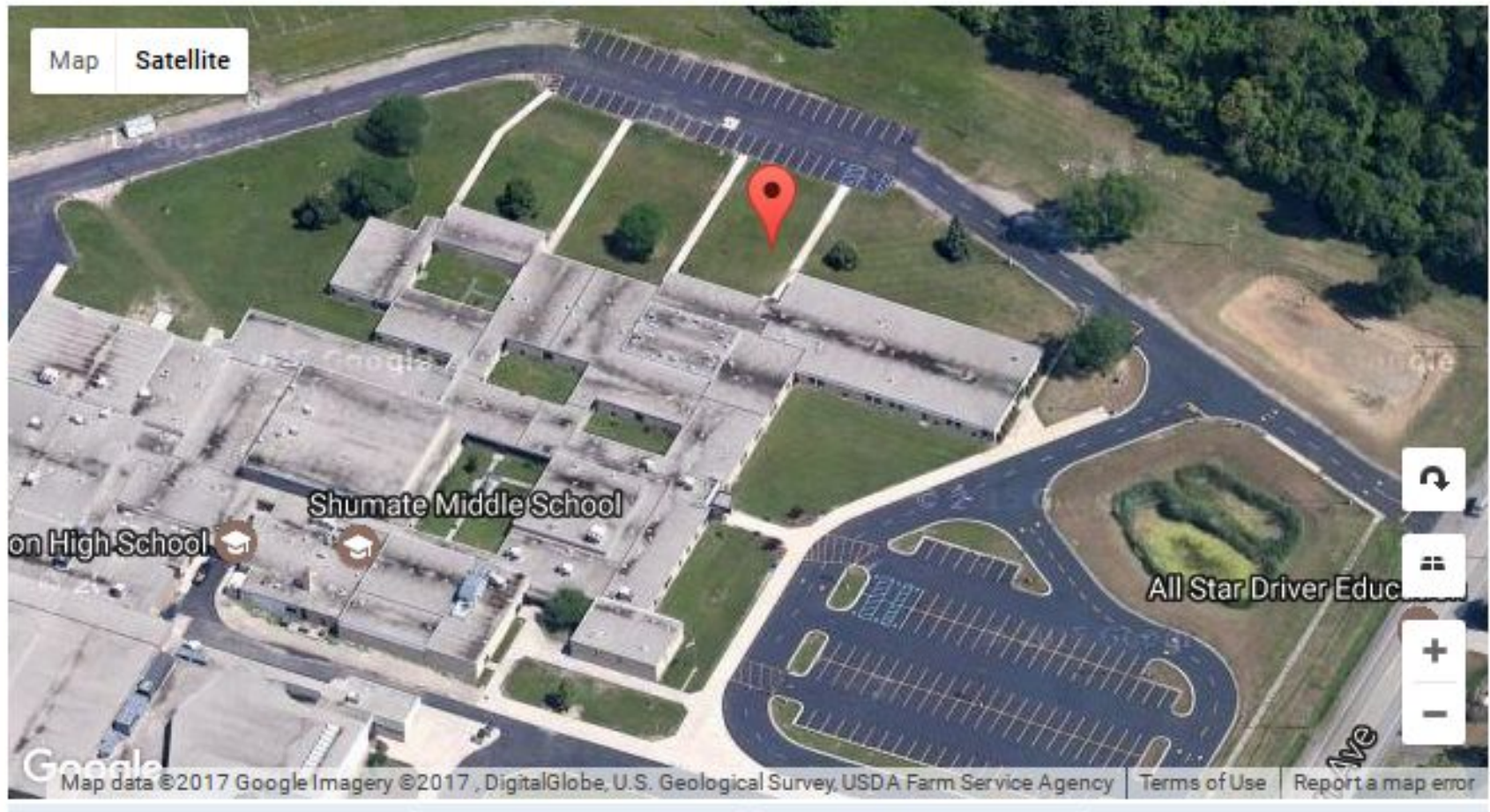
Precipitation Comparison - Reflection

- More precipitation (93.9 mm) was collected during the Non -El Niño period.
- A higher monthly precipitation value was observed during five out of the six months studied during the Non - El Niño period.

Precipitation Collection Dates:

- **Data Collected: September 21, 2015 - March 21, 2016**
- **Data Collected: September 21, 2016 - March 21, 2017**

1st Hour - 7th Grade 2015 - 2016 (El Niño Year)



1st Hour - 7th Grade 2015 - 2016 (El Niño Year)

Latitude 42.0862, Longitude -83.21021, Elevation 170.1m

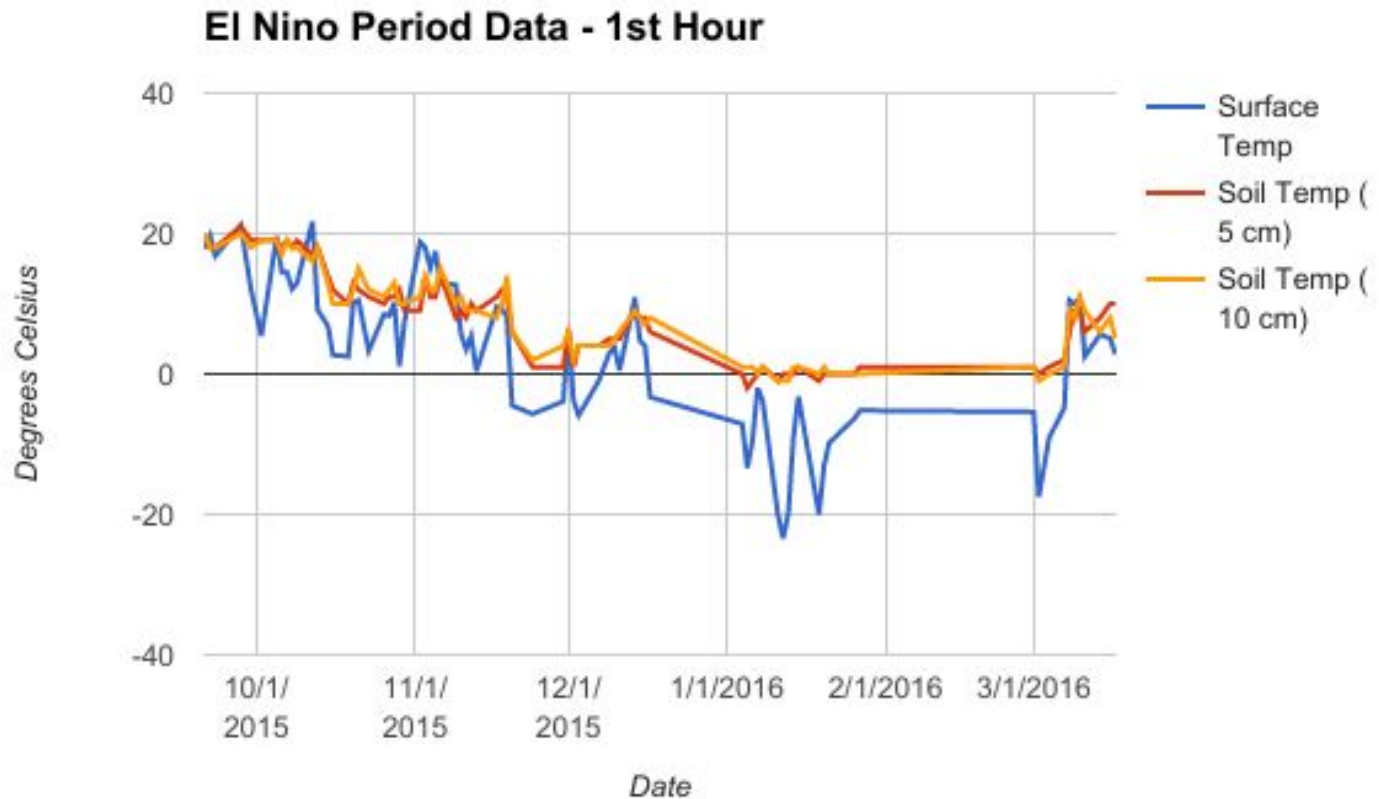
	<u>Surface Temp</u>	<u>Soil Temp (5 cm)</u>	<u>Soil Temp (10 cm)</u>
<i>Average</i>	3.22	8.13	8.32
<i>Maximum</i>	21.7	21	20
<i>Minimum</i>	-23.4	-2	-1

Data Note:

- Data was collected by Mr. Bouwman's 1st Hour Seventh Grade Science Students.
- The data was collected at the site (2015 - 2016 - Shumate - 1st Hour - Sidewalk) was taken during the El Niño period (2015 - 2016). This site is our only GLOBE site with a significant amount of data collected during the 2015 - 2016 school year.

1st Hour - 7th Grade 2015 - 2016 (El Nino Year)

Latitude 42.0862, Longitude -83.21021, Elevation 170.1m

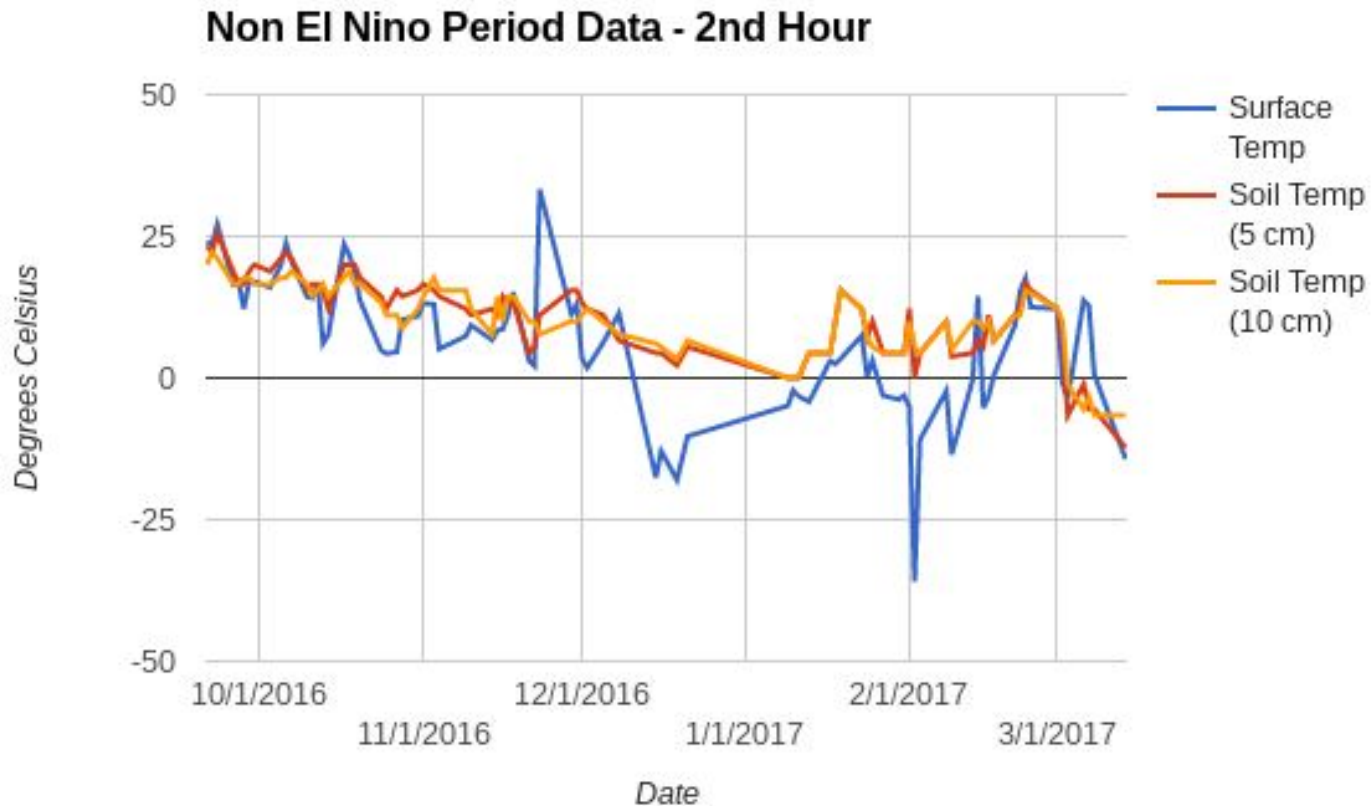


2nd Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)



2nd Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08629, Longitude -83.20921, Elevation 176.4m



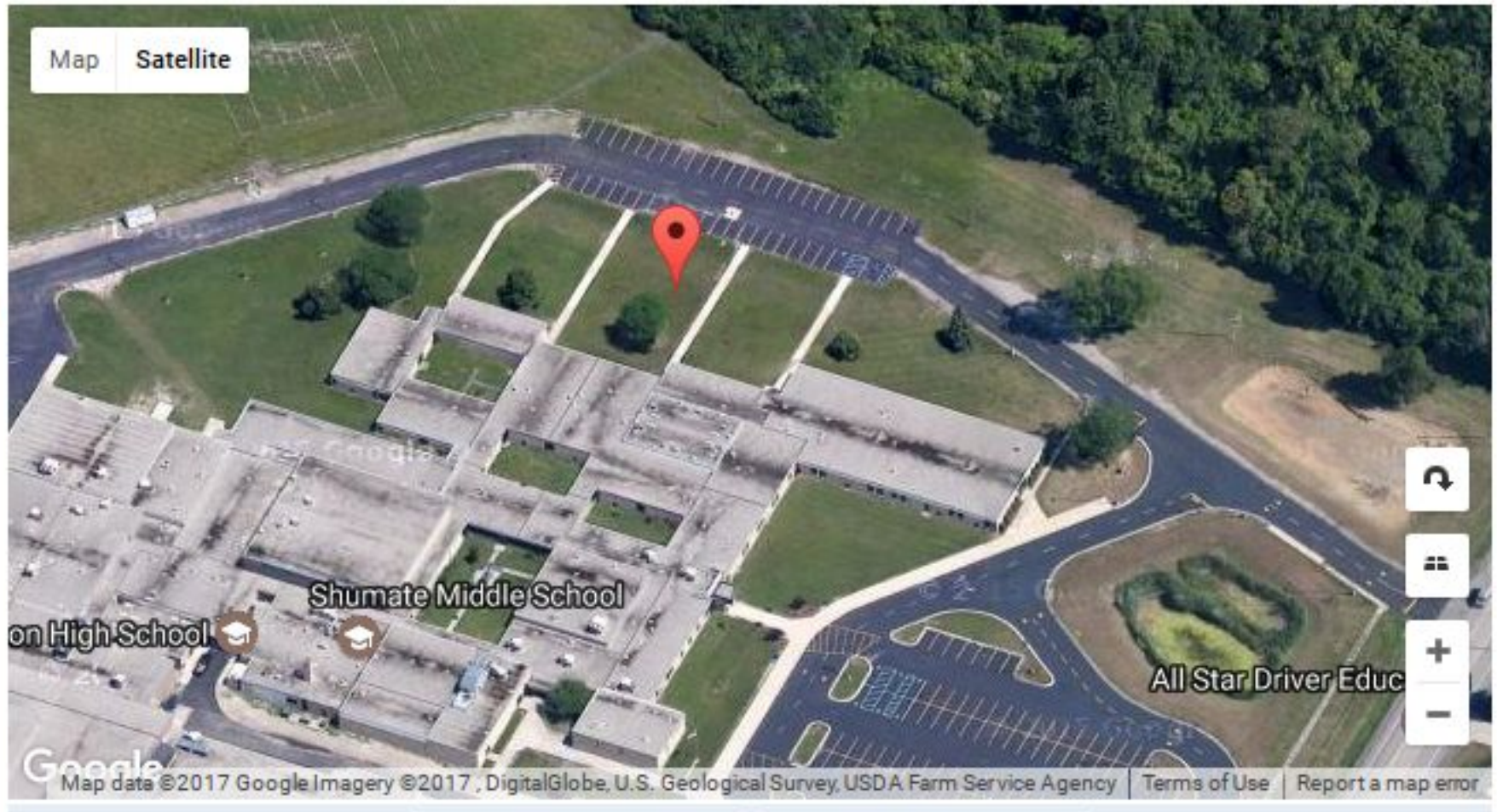
2nd Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08629, Longitude -83.20921, Elevation 176.4m

	<u>Surface Temp</u>	<u>Soil Temp (5 cm)</u>	<u>Soil Temp (10 cm)</u>
<i>Average</i>	6.5	10.9	10.5
<i>Maximum</i>	33.3	25.5	22.2
<i>Minimum</i>	-36	-12.3	-6.6

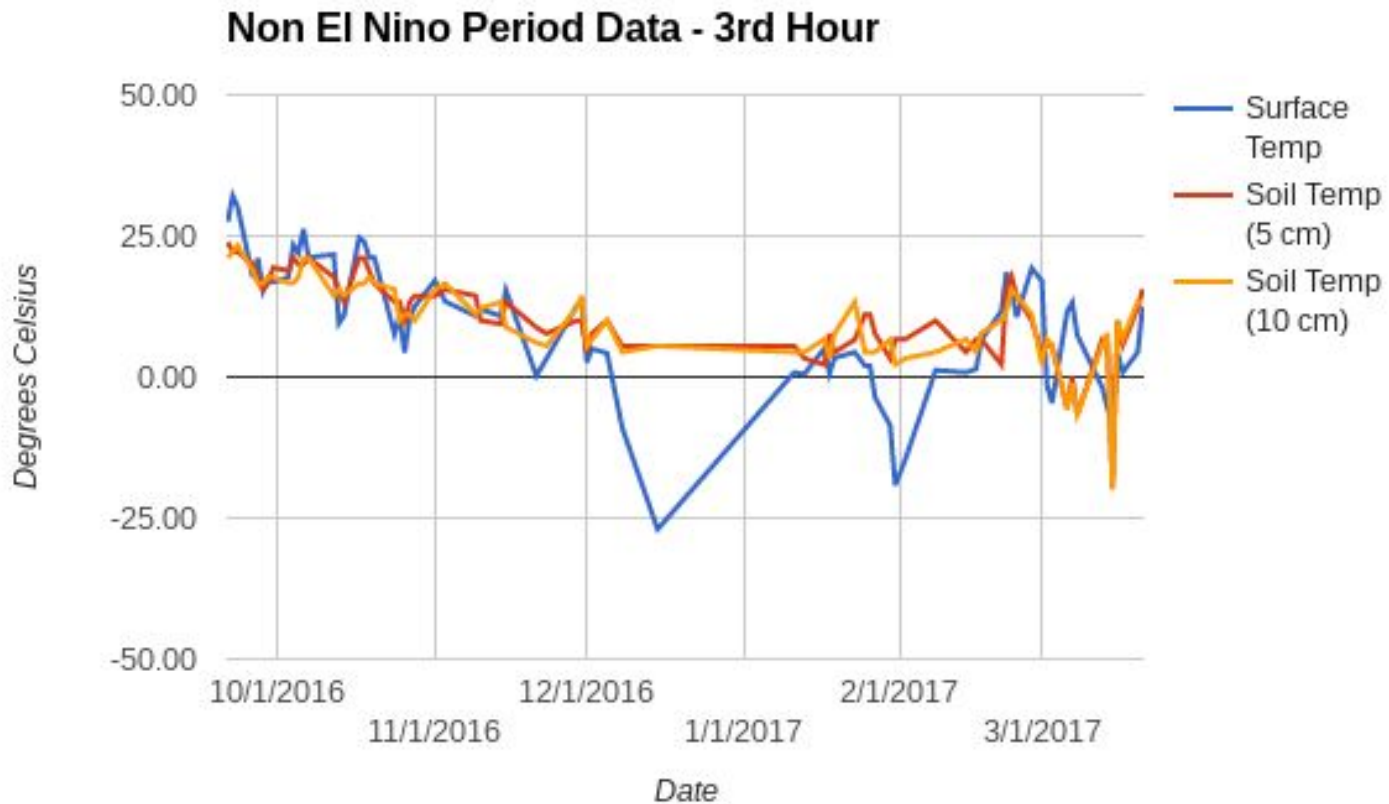
- Average Surface Temperature was 3.28 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 5 cm was 2.77 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 10 cm was 2.18 degrees Celsius warmer than the El Niño period.
- All maximum data values (Surface Temperature and Soil Temperature) were warmer than the El Niño period.
- However, all minimum data values (Surface Temperature and Soil Temperature) were colder than the EL Niño period.

3rd Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)



3rd Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08639, Longitude -83.21049, Elevation 175.5m



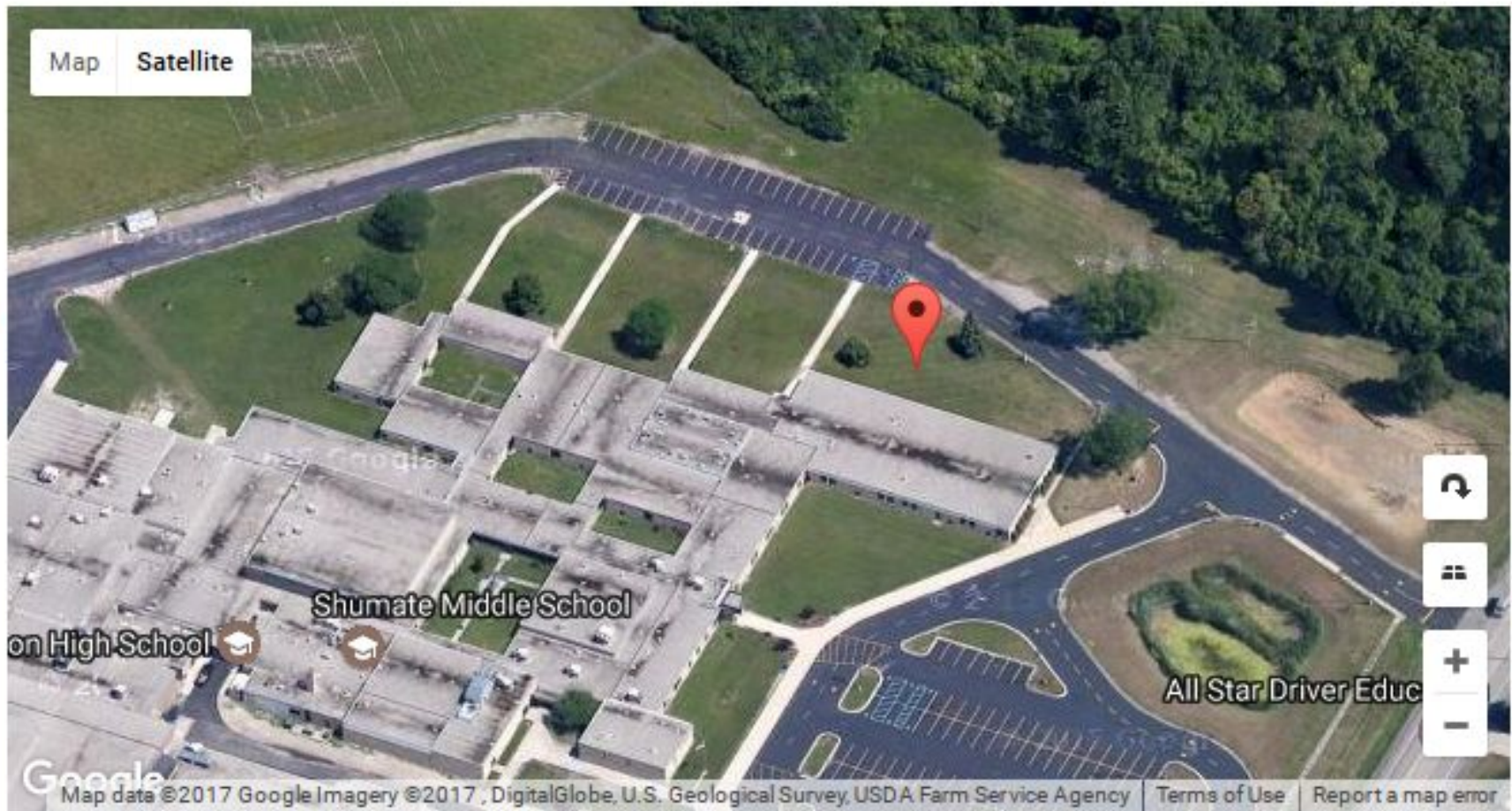
3rd Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08639, Longitude -83.21049, Elevation 175.5m

	<u>Surface Temp</u>	<u>Soil Temp (5 cm)</u>	<u>Soil Temp (10 cm)</u>
<i>Average</i>	8.91	10.78	10.18
<i>Maximum</i>	32.10	23.90	23.30
<i>Minimum</i>	-27.00	-19.40	-20.00

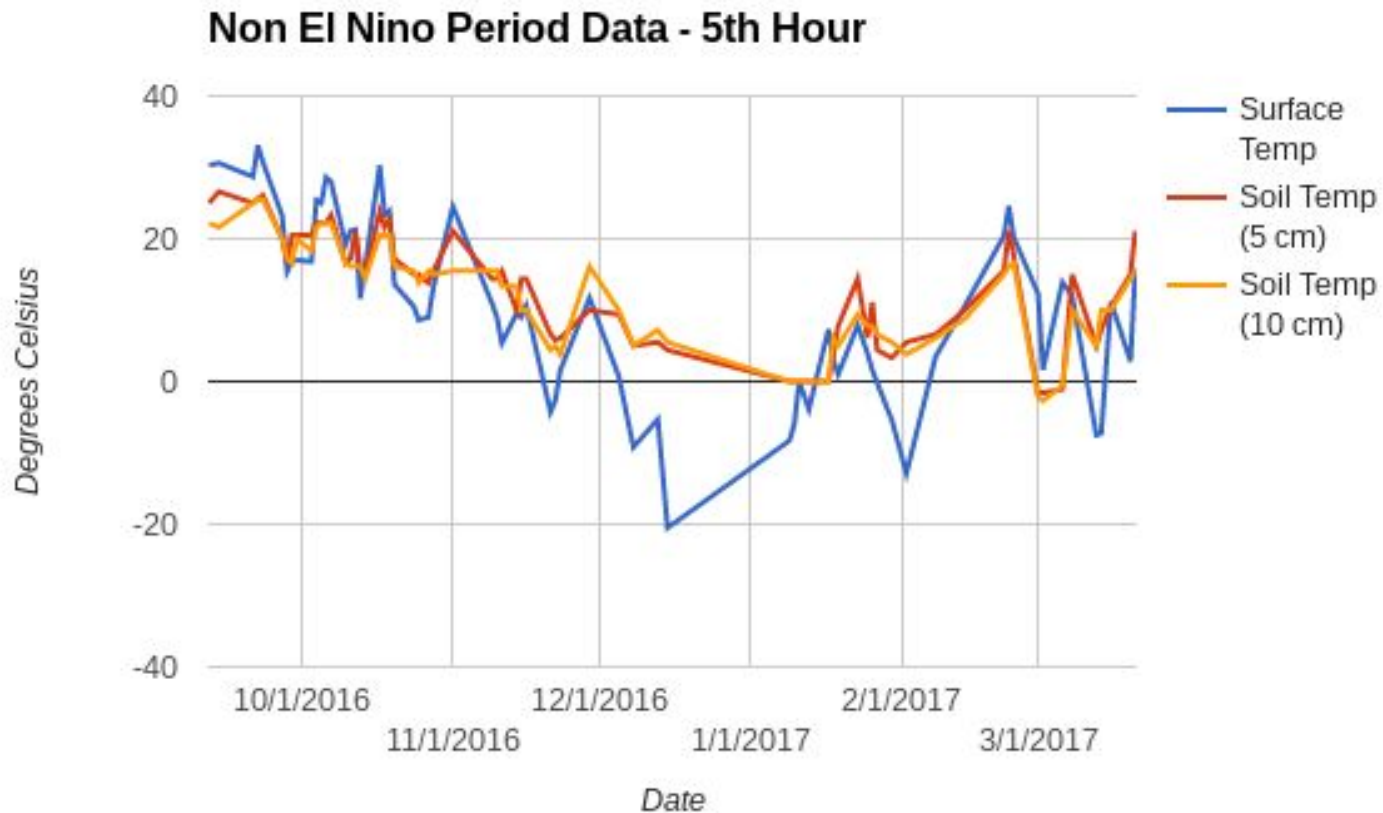
- Average Surface Temperature was 5.69 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 5 cm was 2.65 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 10 cm was 1.86 degrees Celsius warmer than the El Niño period.
- All maximum data values (Surface Temperature and Soil Temperature) were warmer than the El Niño period.
- However, all minimum data values (Surface Temperature and Soil Temperature) were colder than the EL Niño period.

5th Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)



5th Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08613, Longitude -83.20995, Elevation 171.3m



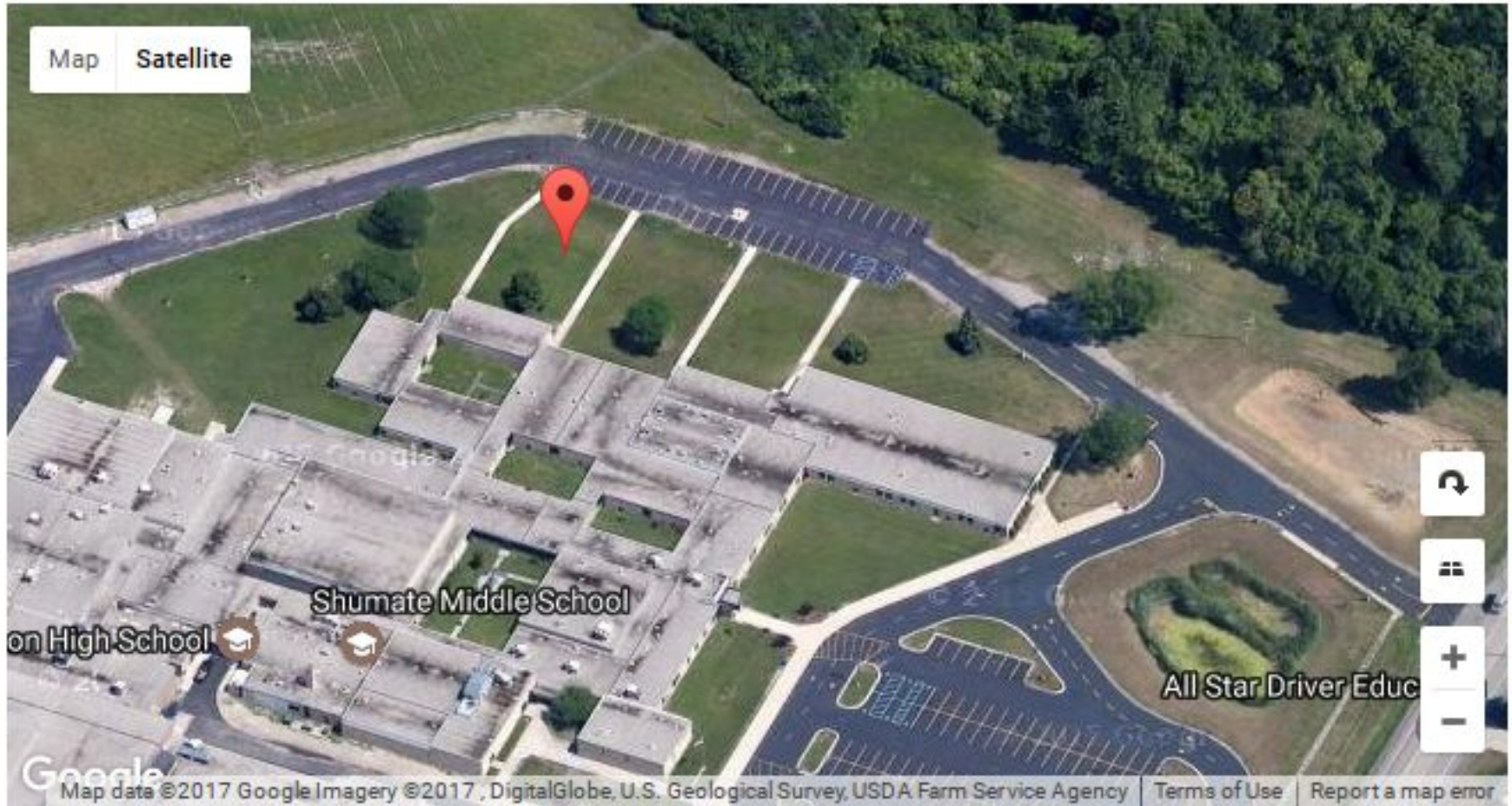
5th Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08613, Longitude -83.20995, Elevation 171.3m

	<u>Surface Temp</u>	<u>Soil Temp (5 cm)</u>	<u>Soil Temp (10 cm)</u>
<i>Average</i>	10.8	13.1	12.2
<i>Maximum</i>	33.1	26.6	25.6
<i>Minimum</i>	-20.5	-1.6	-2.7

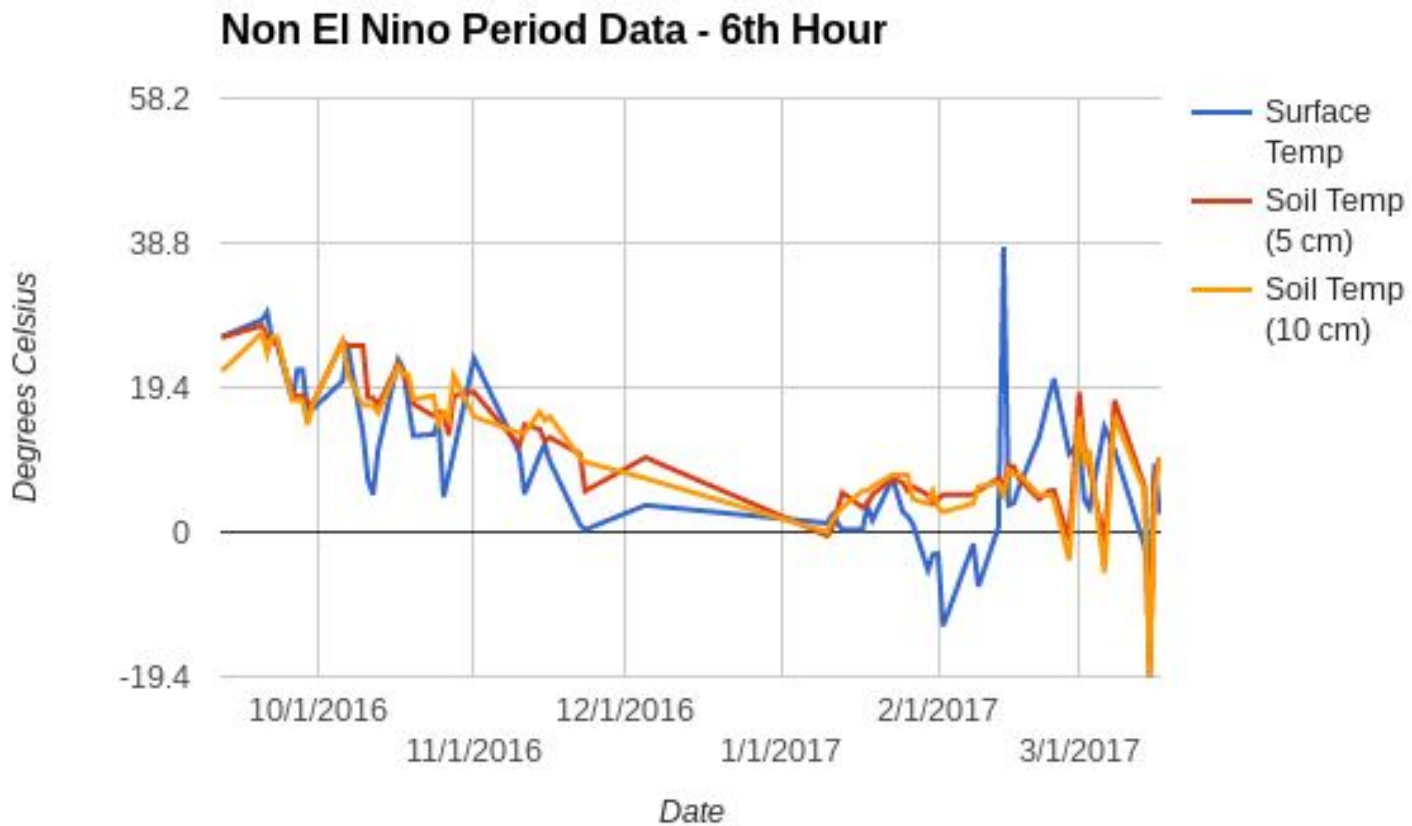
- Average Surface Temperature was 7.58 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 5 cm was 4.97 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 10 cm was 3.88 degrees Celsius warmer than the El Niño period.
- All maximum data values (Surface Temperature and Soil Temperature) were warmer than the El Niño period.
- However, two of the minimum data values (Surface Temperature and Soil Temperature at 5 cm) were warmer than the EL Niño period, and Soil Temperature at 10 cm was colder than the El Niño period.

Site 6 - 6th Grade 2016 - 2017 (Non -El Niño Year)



6th Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08638, Longitude -83.21073, Elevation 175.2m



6th Hour - 6th Grade 2016 - 2017 (Non -El Niño Year)

Latitude 42.08638, Longitude -83.21073, Elevation 175.2m

	<u>Surface Temp</u>	<u>Soil Temp (5 cm)</u>	<u>Soil Temp (10 cm)</u>
<i>Average</i>	9.8	11.8	11.4
<i>Maximum</i>	38.3	27.7	26.7
<i>Minimum</i>	-12.6	-19.4	-19.4


- Average Surface Temperature was 6.58 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 5 cm was 3.67 degrees Celsius warmer than the El Niño period.
- Average Soil Temperature at 10 cm was 3.08 degrees Celsius warmer than the El Niño period.
- All maximum data values (Surface Temperature and Soil Temperature) were warmer than the El Niño period.
- The minimum data value for Surface Temperature was warmer than the El Niño period, and the Soil Temperature (at both 5cm and 10 cm) values was colder than the El Niño period.

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Conclusion

- Similar to what many believe, the El Niño period did produce a warmer winter in regards to daily high temperature. The data collected indicates that the daily high temperature was warmer than the Non - El Niño period.
- However, all four GLOBE sites (2016 - 2017) had a higher average Surface Temperature and Soil Temperature (5 cm and 10 cm) during the Non - El Niño period.
- More precipitation was collected during the non - El Niño period.
- Overall, based on the data collected, there were no major differences as the data values were very close to each other. Our group found this surprising as we expected to see colder surface and soil temperatures during the Non - El Niño period.

Protocols Utilized and Data Specifics

GLOBE Protocols

- Daily High Temperature (Atmosphere Max/Min)
 - All data collected and submitted by Gibraltar School District WeatherSTEM for the 2016 - 2017 school year.
- Soil Temperature (Pedosphere)
- Surface Temperature (Atmosphere)

Precipitation Measurements taken via CoCoRaHS

- Stations MI-WY-69 and MI-WY-116

Weather Underground

- Daily High Temperature
 - Daily high temperature for the 2015 - 2016 school year.

****Possible Sources of Error: Human Error While Taking and Submitting Measurements***

****All US Standard Measurements were Converted to Metric Measurements***

Materials Utilized

- Pink Flags - Establish GLOBE Sites
- Thermometers - Soil Temperature
- Spacer Blocks - Soil Temperature
- Infrared Thermometer - Surface Temperature
- Cloud Chart - Surface Temperature
- Ruler - Surface Temperature
- WeatherSTEM - Gibraltar School District - Atmosphere
- Rain Gauges - Precipitation
- Google Chromebooks - Technology and Collaboration
- Google Spreadsheet - Technology and Collaboration
- Google Slides - Technology and Collaboration
- Google Form - Technology and Perception Survey Data