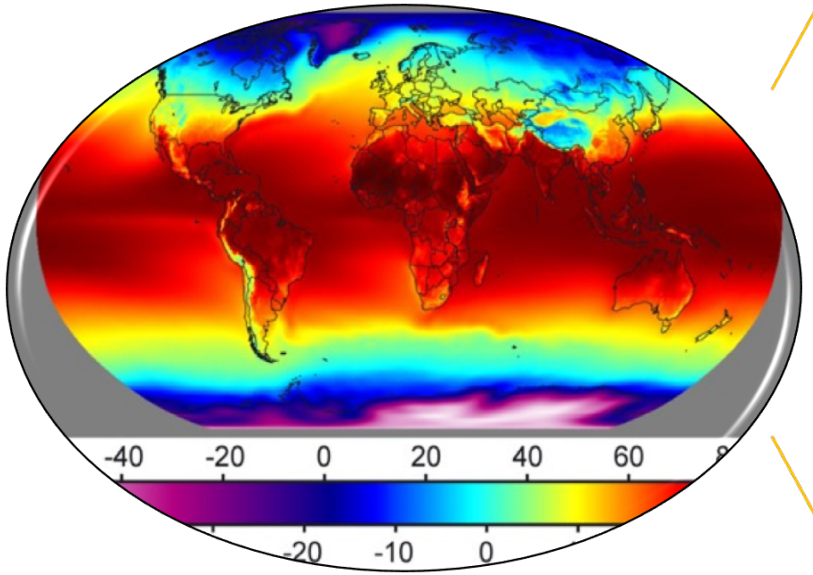
GLOBE Opportunity to Study the Urban Heat Island Effect



When: Wednesday
Time: 8:30 am -12:00 pm
Where: Grand BC

End Goal

- Students Doing Research

Info

- Meet Lead Scientist & Team
- Science Content

Training

- Surface Temperature Protocol
- Collect & Enter Data

NASA

- Data
- Classroom Resources

GLOBE Mission EARTH: Fusing GLOBE and NASA Assets to Build Systemic Innovation in STEM Education

PI: **Kevin Czajkowski**, The University of Toledo
Co-I: **Peter Garik**, Boston University
Co-I: **David Padgett**, Tennessee State University
Co-I: **Svetlana Darche**, *WestEd*/UC Berkeley
Co-I: **Jessica Taylor**, NASA Langley Research Center

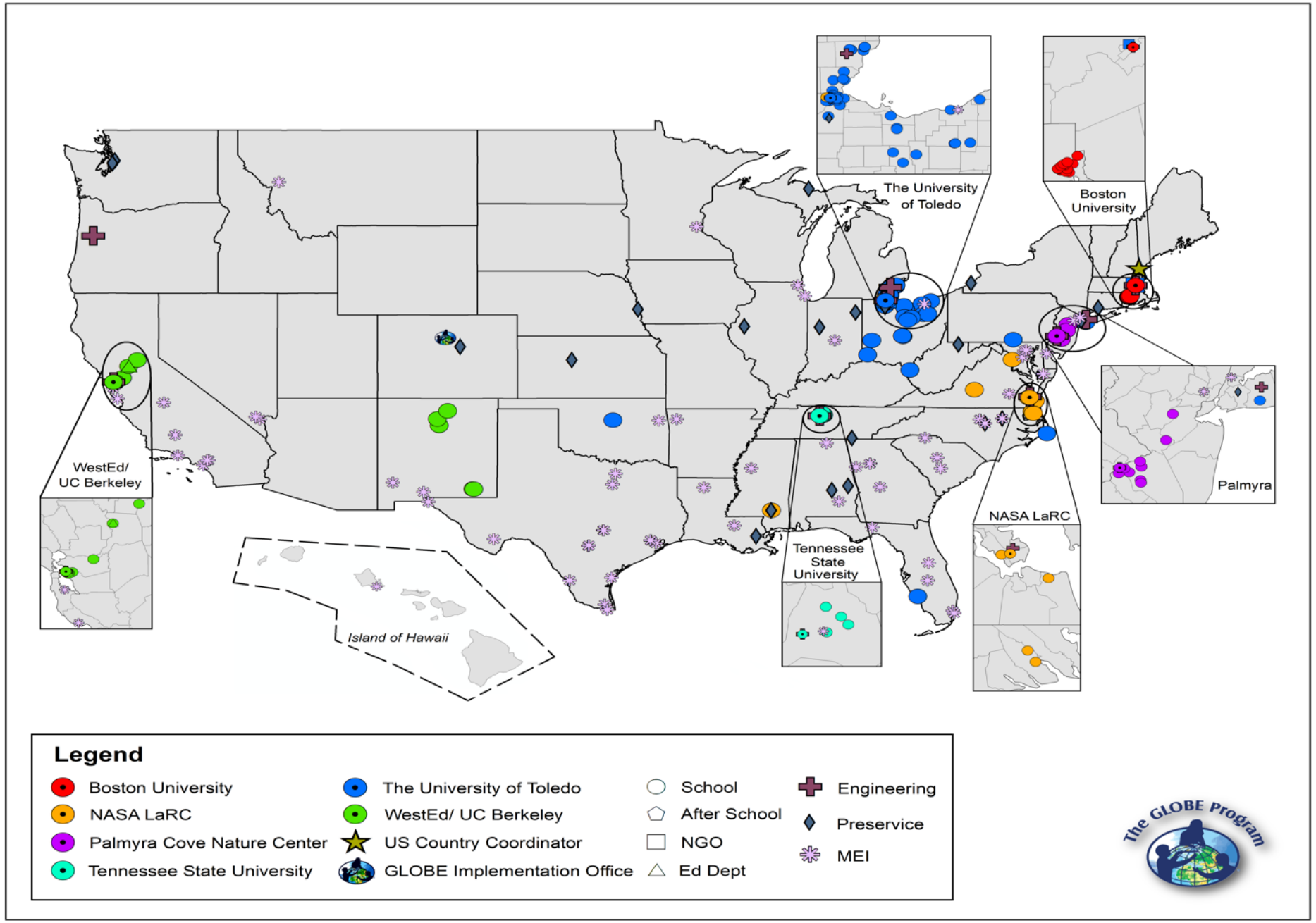
Project Manager: **Janet Struble**
Evaluator: **Nektaria Adaktilou**

Your Turn

GLOBE

Mission EARTH

Reach Map



I
V
S
S

How does elevation affect surface temperature?

Organization: Main Street Intermediate School

Student(s): Brynn Prack Brook Elizabeth Heyman Kayli Bergman

Grade Level: Upper Primary (grades 3-5, ages 8-11)

GLOBE Teacher: Marcy Burns

Contributors:

Report Type(s): International Virtual Science Symposium Report, Mission Earth Report

Protocols: Surface Temperature

Presentation Poster: View Document

Optional Badges: Be a Collaborator

Date Submitted: 03/29/2019

View Research Report

Our school has been measuring surface temperature during the month of December each year since 2006. We thought it would be interesting to compare surface temperature data taken at schools at different elevations. We found 8 schools in addition to our school that collected data at the same time. We thought the schools at the higher elevations would have colder surface temperature and the lower elevations would show warmer surface temperatures. We learned from the data that, for the most part, that our hypothesis was correct. However, the data also suggests that other things may also affect the data. More research needs to be done to find out how air temperature, distance from the equator, and landforms might also affect surface temperature data.

How Do Air and Surface Temperature Affect Bulb Growth?

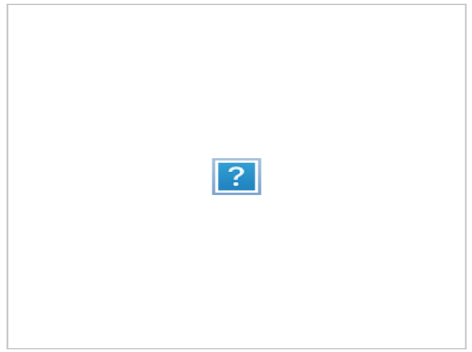
Organization: Nathan Bishop Middle School

Student(s): Rory Merritt George Groves

Grade Level: Middle School (grades 6-8, ages 11-14)

GLOBE Teacher: Eileen Nugent

Contributors: Peter Garik, PhD, GLOBE Mission Earth Kathleen Johnson, MS, GLOBE Mission Earth



Report Type(s): Standard Research Report, International Virtual Science Symposium Report

Protocols: Air Temperature, Surface Temperature

Presentation Video: View Video

Optional Badges: Be a Collaborator, Be a Data Scientist

Date Submitted: 04/10/2019

View Research Report

Background: We are investigating the question “How does the temperature affect the growth of bulbs?” because we find it fascinating and interesting because we like to plant things and record data about them.
Methods: We measured the growth of crocus and grape hyacinth bulbs through January, February, and March and recorded the temperatures and how much the plants grew through the months. We used GLOBE Air and Surface Temperature protocols, infrared thermometers, rulers, and alcohol thermometers.
Results: We got most of our data except for some outside because of snow. And our inside plants grew! But our outside plants didn't.
Conclusions: In conclusion we discovered that as the temperature/weather got colder it was harder for the bulbs to grow so temperature does affect a bulbs growth.

The Urban Heat Island Effect in a Small Town

Organization: St. Francis Xavier Catholic School

Student(s): Jacob Fleming

Grade Level: Middle School (grades 6-8, ages 11-14)

GLOBE Teacher: Amy Woods

Contributors:

Report Type(s): International Virtual Science Symposium Report, U.S. Student Research Symposia (SRS)

Protocols: Surface Temperature

Presentation Video: View Video

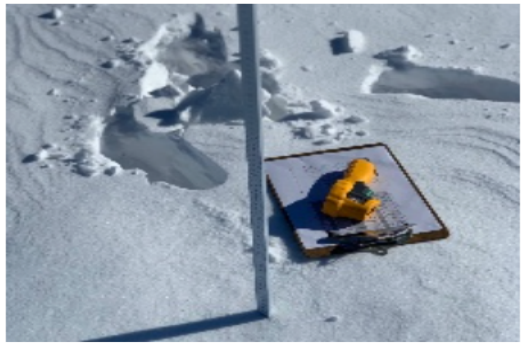
Optional Badges: Make An Impact, Be a STEM Professional

Date Submitted: 04/10/2019

View Research Report

This experiment focused on the question, how will the Urban Heat Island Effect be shown when taking surface temperature measurements in Gettysburg, PA and at St. Francis? The hypothesis states that if surface temperature measurements are taken in an urban environment, then the surface temperature reading will be higher because there is more asphalt, tall buildings, and dark surfaces in cities which will absorb more heat, increasing surface temperature. The independent variable is the location that surface temperature testings are being taken. These locations are in downtown Gettysburg and on the rural campus of St. Francis Xavier School. The dependent variable is the surface temperature taken in Celsius. The controlled variables are the GLOBE Surface Temperature Protocol, the instruments used, and the surfaces the surface temperature is being taken on. This experiment was conducted by taking surface temperature with an infrared thermometer according to GLOBE protocols in Gettysburg downtown and near school. Grass, concrete, and asphalt were tested at both locations. Testings were being taken after school on Mondays and Fridays. The data supported the hypothesis because the in town averages were normally above the school averages. If this project was continued more data would be taken in more places.
Keywords: surface temperature, urban heat island, asphalt, dark surfaces

Effects of Select Weather Factors on Surface Temperature During a Polar Vortex



Organization: Crestwood High School

Student(s): Ali Akil and Adam Ali

Grade Level: Secondary School (grades 9-12, ages 14-18)

GLOBE Teacher: Diana Rae Johns

Contributors:

Report Type(s): International Virtual Science Symposium Report

Protocols: Clouds, Surface Temperature, Air Temperature

Presentation Poster: View Document

Optional Badges: Be a Collaborator, Be a Data Scientist

Date Submitted: 04/10/2019

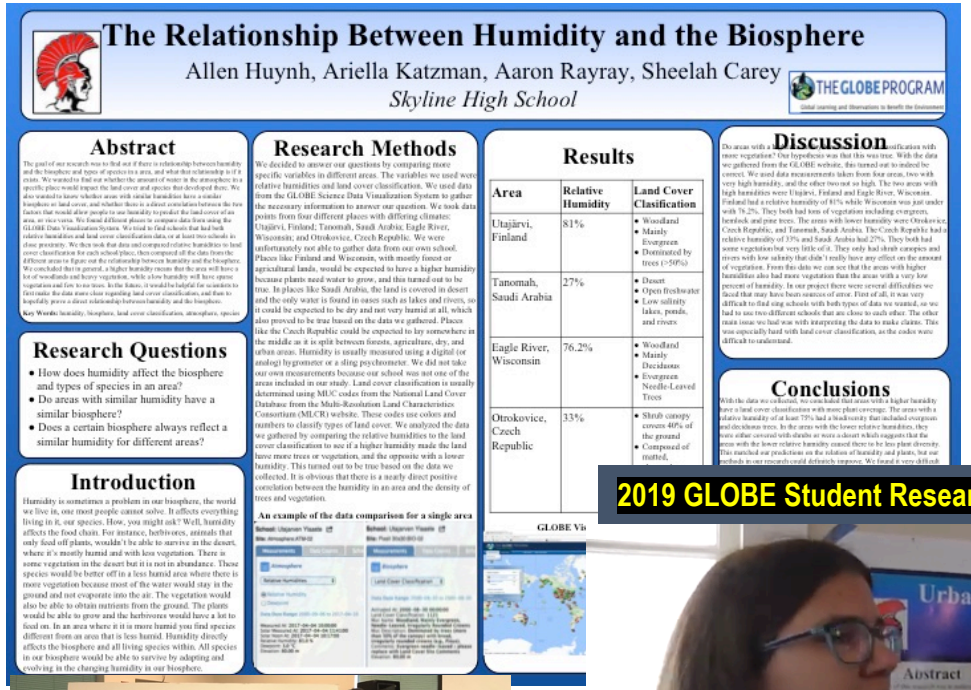
View Research Report

Surface temperature is a critical factor that influences local and regional heating because the troposphere we live in warms from the bottom up. Scientists closely monitor the surface temperature in their efforts to document and explain our rising worldwide temperatures. This year's polar vortex in January was a recent weather phenomenon. With our research, we sought to determine if there is a correlation between the air temperatures and surface temperatures during this frosty period and if the polar vortex had an effect on the data we collected at all. For the majority of this school year, we have been collecting surface and air temperature data as well as cloud types and other select atmospheric parameters. We found that wind chill was consistently lower than air and surface temperature and the surface temperature was lower than air temperature on all but 2 days. It was also observed that the cloud cover doesn't correlate with the surface temperature during this period but further research has to be done. When comparing our temperatures with the average Detroit Metropolitan area it was noted that the average of Detroit was consistently higher due to recordings taken at higher altitudes.

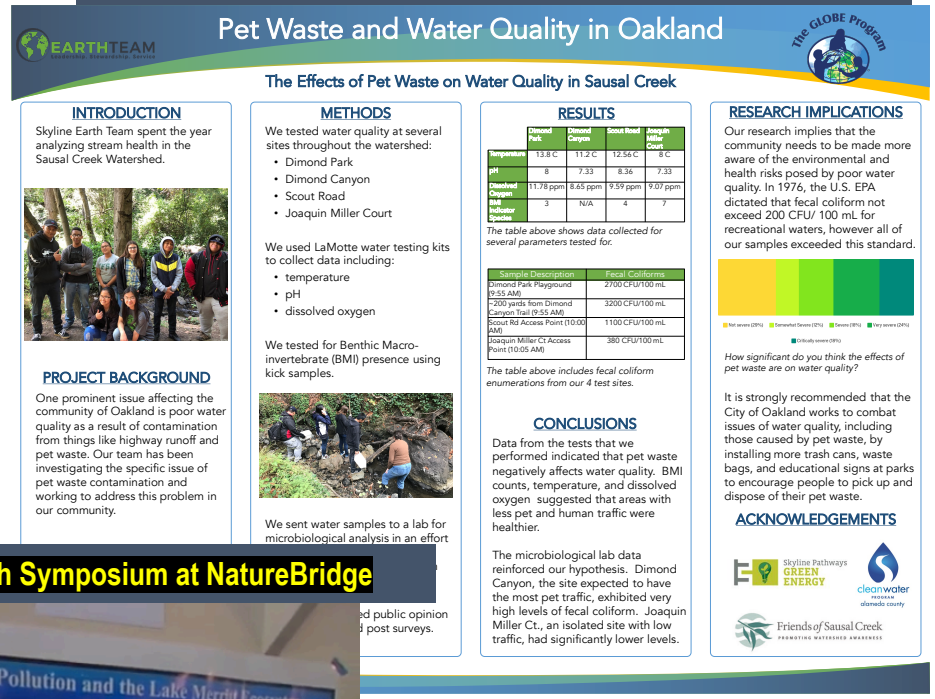
Vertical Integration: Students Learning & Growing

One approach to vertical integration of GLOBE and NASA assets has been to encourage students in Career Technical Education (CTE) Academies at GME high schools to conduct and present their scientific research through their CTE coursework each year. For example, students at Skyline High School in Oakland, California have presented GLOBE research work as sophomores, juniors and seniors in the Green Academy.

2017 GLOBE Student Research Symposium at NASA JPL



2018 Student Research Symposium at NASA AMES



2019 GLOBE Student Research Symposium at NatureBridge

Abstract

The urban heat island(UHI)is the increase in temperature in urban areas. UHI contribute to climate change which cause droughts, rise of ocean levels leading to floods. The hypothesis was the surface temperature of Waite High School (Urban area)is warmer than the surface temperature of Lake High School (rural area). We took surface temperature measurements outside Waite High School using infrared thermometer following GLOBE protocols. We used the globe website to get the data for Lake High School. The surface temperature was warmer at Waite High School than Lake High School. My hypothesis was supported by the data.Our recommendation is to take data measurements in multiple sites at each location.

Problem

Climate change is the warming of temperatures of the Earth. Carbon dioxide causes Global warming. Sea level rises causing flooding which causes damage to environments and habitats. Urban heat Island contributes to climate change because they are a lot warmer areas and are densely populated . We took surface temperature around our school to see if Toledo contributes to climate change.

Hypothesis

The surface temperature of Waite High School is warmer than the surface temperature of Lake High School.

Procedure

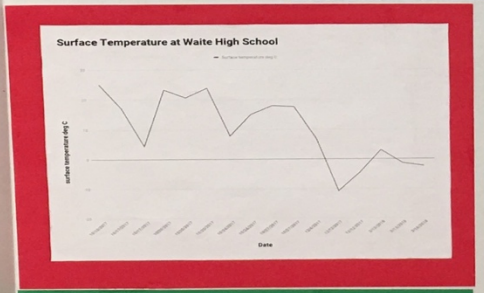
We took measurements of the surface temperature at Waite High School which is an urban area by using an infrared thermometer (IRT). We used the globe website to get the surface temperature data from Lake High School is a rural area.Finally,we compared the two which one was colder or hotter.

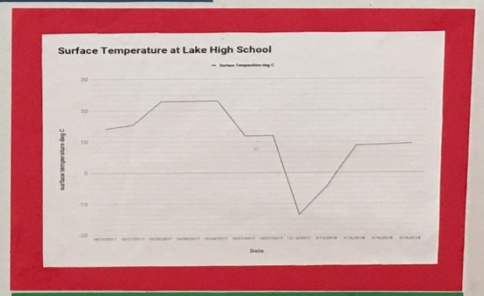
Surface Temperatures of Waite High School

By: Ralph Snyder
and
Valente Villegas

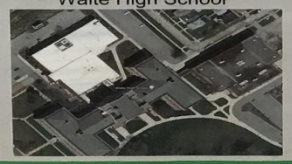
Waite High School

Location	Date	Surface Temperature °C	Longitude	Latitude
Lake	10/10/2017	14.1	41.55938	-83.4688
Waite	10/10/2017	25.1	41.64871	-83.5172
Lake	10/17/2017	15.4	41.55935	-83.4688
Waite	10/17/2017	17.1, 4.4	41.64871	-83.5172
Lake	10/27/2017	11.9	41.559448	-83.4694
Waite	10/27/2017	17.6,19	41.64871	-83.5172
Lake	12/4/2017	1.3	41.55932	-83.4689
Waite	12/4/2017	7	41.64871	-83.5172
Lake	12/12/2017	-13.5	41.55953	-83.4699
Waite	12/12/2017	-10.8, -4.6	41.64871	-83.5172
Lake	3/13/2018	-4.3	41.5601	-83.4703
Waite	3/13/2018	3, -1.4	41.64871	-83.5172
Lake	3/16/2018	8.8, 9.3	41.5601, 41.55973	-83.4703, -83.4696
Waite	3/16/2018	-2.4	41.64871	-83.5172





Waite High School



Lake High School

Results

The surface temperature was higher at Waite High School than at Lake High School.Waite surface temperature was higher in Fall and Winter. Lakes was higher in Spring on only one day 3/16/2018.

Conclusion

My hypothesis was the surface temperature was higher at Waite High School than Lake High School, was supported by the data.

Recommendations

- Instead of recording measurements in one site. Record the surface temperature in multiple sites.
- Measure the grass and cement in urban and rural areas.

References

https://www.globe.gov/

- Googleearth.com
-

Comparing Average Surface Temperatures of Kaohsiung, Taiwan and Wyandotte, Michigan

Ottawa Hills High School

THE GLOBE PROGRAM
Global Learning and Observations to Benefit the Environment

Abstract

We both had some questions about the research questions and we had to change our research question multiple times. Why we made our research question is because we were both interested on both places and to see how hot it would get in Taiwan vs Wyandotte michigan. Because both of our surface temperatures are across the world from each other. We both agreed that we would find the surface temperature for one of these places Jovan would find Kaohsiung Taiwan and Julian would find Wyandotte michigan this was how we planned our project and eventually finished it

Research Question

Asking Questions

Our research question was how does surface temperature in Wyandotte, Michigan compare to the surface temperature of the city Kaohsiung in Taiwan and why? Our surface temperature results can be important for scientific research because scientists are doing studies of antarctica and the glaciers melting so our surface temperatures are very spread out, then we can give the scientist surface temperature information about the world and how this can also tell us about the ocean and how it affects surface temperature. Some people take temperature of the earth but then they do not take in all the other factors that affect the surface temperature such as climate change and the condition of the material such as "dry" and "wet" factors, these are some conditions that affect surface temperature that some scientist do not address. You can change the surface temperature of the material fairly easy. For example you could poor cold water on grass then the surface temperature will be lowered on the area you put water then the rest of the grass.

Introduction

Content Knowledge

For our globe project, Jovan and I are going to compare the surface temperature of two very different places: Wyandotte, Michigan and Kaohsiung, Taiwan. The surface temperatures of Wyandotte, Michigan and Kaohsiung, Taiwan are different because of where each city is located with respect to the equator, the difference in altitude each city is from sea level, and the distance each city is from a body of water. These factors can affect the surface temperature of the Earth and are important to explore to identify why the temperature of Wyandotte, Michigan and Kaohsiung, Taiwan are different. It is important to understand the difference in temperatures of all across the globe overall, because then, we can learn more about global climate change and find ways to improve and/or prevent it.

Research Methods

Planning Investigations

Describes the planning process

While I was getting my research I think that the globe protocols for the surface temperature of Kaohsiung, Taiwan and Wyandotte, Michigan is very convenient because you can pick the protocol layers and how you want to see the globe in surface temperature. Globe protocols has many modifications and it is easy access to find the information you need. The main resource we used was Globe.gov. Our First step we did was we came up with the locations we were going to do. Then me and my partner Jovan picked Kaohsiung,Taiwan and I choose Wyandotte, Michigan. Then we went to the Globe.gov and clicked globe Database which then went to the surface temperature measurements and other schools gave us data for our project. The average surface temperature of Wyandotte Michigan is 3.0 C the condition was wet and the elevation was 177.60m and the ground material is asphalt. Now for the average surface temp of kaohsiung Taiwan is 40.8 C the number of samples taken was 9 and the surface cover type is short grass 0.5m and elevation is 15.00.m, also the time of day of Kaohsiung, Taiwan was taken at 03:16:00 PM and the time of day of Wyandotte, Michigan is 08:08:00 PM.

Carrying Out Investigations

Describes what happened

We first went to the globe website and then went to globe data Vizulize system and went to surface temperature and found our data and that is how we got the data from Michigan and Taiwan. We went to different places on the map in the Visualize system and we found different places on the map. In the Visualize system in globe and it told us that Wyandotte michigan had 8 samples taken and it was moist in the area.

For Kaohsiung taiwan it told us that it was dry and there was sunshine. The specifics for Kaohsiung taiwan were Measured At: 2018-11-21 12:34:00 Solar Measured At: 2018-11-21 20:50:00 Solar Noon At: 2018-11-21 03:44:00 Average Surface Temperature: 36.5 °C Surface Condition: dry Number Of Samples Taken: 9 Surface Cover Type: short grass (< 0.5m)Homogeneous Site Short Length M: 2.25 Homogeneous Site Long Length M: 2.25 Site Area M Squared: 5.1 Elevation: 15.00 m.

The data in Wyandotte Michigan the data was Measured 018-11-30 08:06:00 Solar Measured At: 2018-11-30 02:45:00 Solar Noon At: 2018-11-30 17:21:00 Average Surface Temperature: 28.0 °C Surface Condition: Moist Number Of Samples Taken: 1 Elevation: 177.60 m.

The steps for our data collection was going into globe ,Visualization system ,then clicked surface temperature the Jovan found the data of Kaohsiung Taiwan while I was looking for data on Wyandotte Michigan. Jovan found 8 samples of data in Kaohsiung Taiwan and Julian found 1 data sample for Wyandotte Michigan.

Results

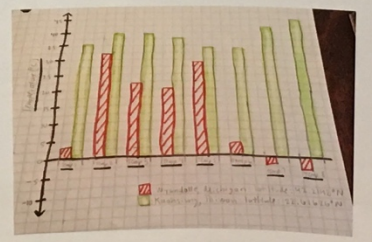
Analyzing Data

Analyzing data: Our research question is how does surface temperature in Wyandotte, Michigan compare to the surface temperature of the city Kaohsiung in Taiwan and why?. One of our realizations were the elevation was very different. This can affect many things such as the air pressure. So like in mountains, the higher you are the lower the air pressure and the colder it is since Wyandotte has a higher elevation it is colder than taiwan already so Wyandotte has a disadvantage in the surface temperature for the hottest surface temperature this shows that elevation does affect surface temperature.

Figure #1

Distance each city is from equator:
Blue: Wyandotte, Michigan
Red: Kaohsiung, Taiwan

Figure #2



8 different temperature points in degrees Celsius of Wyandotte, Michigan and Kaoshing, Taiwan

Discussion

Interpreting Data

One of the main reasons we got 3.0 C in Wydonnate michigan is because of the climate of when we took the data was wet. This affected the temperature greatly because of all the clouds that sent the rain down they also covered the sun up which means that you are going to lower the surface temperature by a substantial amount. Why the surface temperature for kaohsiung Taiwan was 40.8 C because of the time of day that the temperature was taken because in wydonate michigan the temperature was taken at 8:08pm but in kaohsiung kaohsiung taiwan it was at 3:16 PM So the sun was higher in the ski in kaohsiung then in wydonatte.

Yes our data does support our hypothesis because The temperature measurements were very different in Kaohsiung Taiwan compared to Wyandotte Michigan.

This could help with finding out how temperature is affected by the time or climate that it is taken at. Because then we can find out when the hottest time of the day is for our two locations. Sometimes the measurements that people take can be incorrect or at the wrong time they submitted it so the data could be invalid or incorrect.

Conclusions

Drawing Conclusions & Next Steps

In conclusion, Jovan and I are compared the surface temperature of two very different places: Wyandotte, Michigan and Kaohsiung, Taiwan. From our research we found that Kaohsiung, Taiwan has an average surface temperature of 36.5 °C and Wyandotte, Michigan has an average surface temperature of 28.6°C. One reason why the surface temperatures of these places are different is because of their climates. In Taiwan the the climate is dry. This leads to a higher surface temperature because the sunlight directly hits the earth and it is less humid making it hotter. In contrast, Michigan has a wet climate making it colder. Another reason why the temperature in Michigan is colder is because it has an elevation of 177.60 m, whereas Taiwan has an elevation of only 15.00 m. The higher the elevation the lower the pressure because there is less air above you. This lower pressure lets air molecules spread out which decreases the temperature. Lastly, the difference in temperature is because of how far each city is from the equator. The closer a place is to the equator the warmer it is. The measurement of a place from the equator is based on the latitude. Kaohsiung, Taiwan has a latitude of 22.61626° N and Wyandotte, Michigan has a latitude of 42.2142° N. Taiwan has a higher surface temperature because it is closer to the equator than Michigan. Therefore, Kaohsiung, Taiwan has a hotter surface temperature than Wyandotte, Michigan because of its type of climate, its distance from water based on its elevation, and its distance from the equator based on its latitude. Understanding the causes in temperature difference between these two cities is important because we can see how global climate change is affecting places all over the globe.

Bibliography

References

- Chiang, Yi chen. "Kaohsiung Municipal Cianjin Junior High School." *The Globe Program* , Nasa , 9 Jan. 2018, 8:08 pm, www.globe.gov/web/kaohsiung-municipal-cianjin-junior-high-school.
- Lenar , Linda. "Michigan GLOBE v-School." *Michigan GLOBE v-School*, Nasa , 4 Mar. 2019, 3:16 pm , www.globe.gov/web/michigan-globe-v-school.

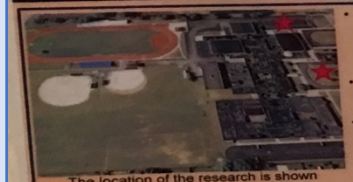
Analysis of Data Collected During the 2017 Solar Eclipse at Eighty Percent Totality

Maysam Aidibi, Leanne Alawieh, Ali Eter, Sara Komaiha, and Hana Salami – *Crestwood High School – Dearborn Heights, MI*

Abstract

A total solar eclipse occurs when the moon passes directly through the sun and earth. The most recent eclipse in North America took place on August 21st of 2017. On the 20th and 21st of August, a group took surface temperature, air temperature, light intensity, and cloud observation measurements on grass and asphalt sites, in addition to other weather parameters. Students took data in 10 minute intervals from 12:27 P.M. to 4:27 P.M. on both days. This information was then inputted into the GLOBE website and a spreadsheet was made out of the data. After analyzing the data, several differences were found- not only when comparing the two days, but comparing the separate sites. For example, light intensity levels were much lower on the day of the eclipse when compared to the day before. However, light intensity showed little variation when student researchers compared the asphalt and grass sites. Surface temperature and air temperature were also compared on both days/sites. The student researchers also made several unusual observations on the day of the eclipse. Not only did the bindweed- a local flower that grows on site- close during maximum coverage, the students were also able to hear crickets chirping while coverage of the sun increased. Finally, the student researchers found that data from their site, Crestwood High School, was inversely correlated to Lake High School, a site near Toledo with similar maximum coverage. From here, the researchers can evaluate the data to identify factors that may explain these results, such as cloud coverage, humidity, etc. The importance of taking and submitting this data is that these ground-level measurements can be utilized by NASA and GLOBE, two organizations who encourage the measuring of data during events like this.

Research Questions



The location of the research is shown above in a Google maps photo.

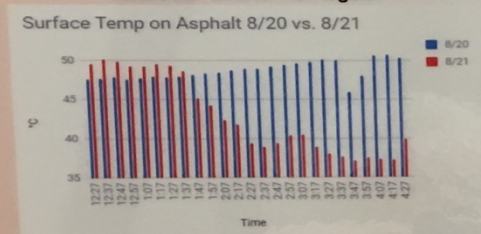
- Will select parameters such as surface temperature, light intensity, and air temperature differ on the days leading up to the eclipse versus the day of?
- Will these parameters also differ on grass sites versus asphalt sites?
- What observations will be observed during maximum coverage?
- How will data from one site compare to another with similar totality?

Null Hypotheses

- Surface temperature, light intensity, and air temperature will not differ from the day before the eclipse when compared to the day of.
- Surface temperature, light intensity, and air temperature will not differ when tested on grass and asphalt sites.
- No unusual observations of the surrounding environment will be made on the day of the eclipse.
- Data from Crestwood High School will not differ from data collected at a separate site with similar maximum coverage.

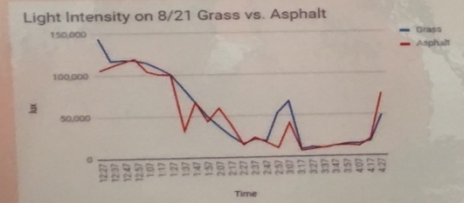
Results

Comparison of Surface Temperature on the 20th and 21st of August



One of the correlations tested for on asphalt sites was surface temperature. The data demonstrates that as the day progressed on the 20th, the measurements tended to increase. However, on the 21st, as totality approached, surface temperature only decreased, proving the sun is a big factor in determining surface temperature.

Comparison of Light Intensity on Grass vs. Asphalt Sites on the 21st of August

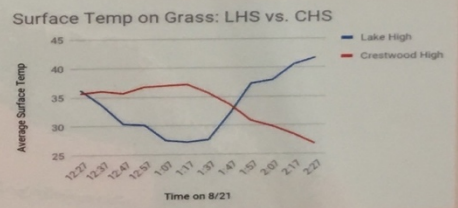


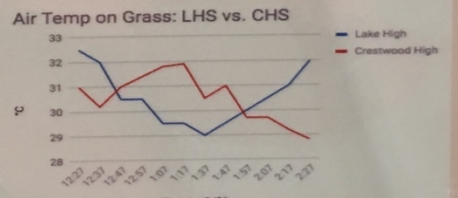
Light intensity was one of the several measurements that was compared between grass and asphalt sites. The graph illustrates that there is very little variation between the two sites. Light intensity stayed consistent, regardless of where it was tested. The data also suggests the influence of the sun on light intensity as when the sun reached 80% coverage, light intensity reached its lowest value.

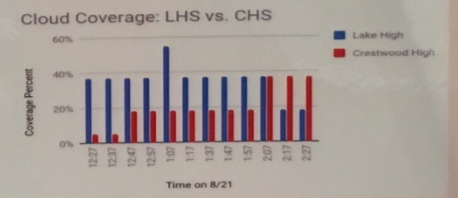
Observation of Local Bindweed on August 21st

One of the observations recorded was the closing of a local plant- bindweed. The left picture shows the plant two hours before maximum coverage, whereas the right picture shows the effect of the eclipse on the plant, as it had closed up.

Comparison of Data Between CHS and LHS







Comparing surface and air temperatures between the two schools proved an inversely correlated relationship. Namely, as Crestwood's surface temperature fell, Lakewood's surface temperature increased; the same pattern was true for air temperature. Students hypothesize that this correlation is attributed to cloud coverage. As seen on the graphs, as cloud coverage decreased at Lake High, air temperature and surface temperature were able to rise, which is thought to be due to a more sunny environment. Likewise, as Crestwood's site became increasingly cloudy, both air and surface temperature decreased.

Implications and Limitations

Due to the rarity of solar eclipses, it is imperative that accurate and persistent measurements are taken on these days. The work done by researchers including the students in this project is valuable as it involves ground-level data, which is comparable to the measurements taken by satellite measurements. Eclipses can provide data regarding the lunar orbit, and recently it has been discovered that it may also provide insight on new particle formation. For these reasons, it is necessary that data is collected on solar eclipses. However, there are various potential errors that could have affected the results and therefore made them inaccurate. For example, a difference in cloud coverage could affect the data comparisons between the two separate sites (grass and asphalt) as well as the two different schools taking data. Another potential error would be the possibility of a cloud passing over during one of the times of measurement during the day. This could be the reason for the few outliers in our graphs. Furthermore, when comparing the two high schools, Lake High only had 12 data points that matched up to the times of Crestwood High School, which could cause some gaps in the data.

Methods

Conclusions

- Significant differences can be seen when comparing data taken on the day of the eclipse versus the day before, especially when comparing light intensity and surface temperature.
- Air temperature showed a significant difference, but it isn't likely that this is due to the eclipse, and can rather be attributed to cloud coverage. This rejects our null hypothesis that there will be no differences in data taken on the two separate days.
- Data was taken on two separate sites as well. It was found that the separate sites had a significant impact on surface temperature and a slight impact on air temperature. As expected, light intensity didn't seem to be affected by the differing sites. The surface temperature and air temperature reject our null hypothesis that data on two separate sites will not differ when taken on the day of the eclipse.
- There were also several observations made on the day of the eclipse, including the surrounding plants and animals. Due to unusual behaviors of plants such as the bindweed growing on the site and the early hearing of crickets chirping, our null hypothesis that states that there would be no uncommon behaviors observed can be declined.
- Findings from CHS were compared to those of a school in Ohio with similar maximum coverage. The inverse correlation enabled the students to reject the final null hypothesis that the results from both sites would not differ.

Acknowledgements

We'd like to thank the GLOBE program for making our research possible and for giving us a place to store our data. Also, a huge thanks to not only our adviser, but our number one supporter, Mrs. Diana Johns. We would also like to thank Dr. Kevin Czajkowski for giving us the opportunity to interact with several STEM professionals as well as himself. In addition, thanks to Mr. David Bydlowski and the AREN project for helping to provide the technology to do this research. Thank you for all your work and encouragement. None of this research would have been possible without the help we received!

Works Cited

- Garner, Rob. "Eclipse 2017: NASA Supports a Unique Opportunity For Science In the Shadow." *Nasa.gov*, 6 Aug. 2017. www.nasa.gov/feature/goddard/2017/eclipse-2017-nasa-supports-a-unique-opportunity-for-science-in-the-shadow.
- GLOBE gov
- Ostrom, Tracy. *"SRS 2018 Webinar: Creating a Research Poster 13 February 2018"*. The GLOBE Implementation Office, 27 Feb. 2018 www.youtube.com/watch?v=5kA65aQB2g4
- Rao, Joe. "Total Solar Eclipses: How Often Do They Occur (and Why)?" *Space.com*, 25 Apr. 2017, www.space.com/25644-total-solar-eclipses-frequency-explained.html.
- "2017 Solar Eclipse: When It Will Start and End in Metro Detroit." *WXYZ*, 21 Aug. 2017, www.wxyz.com/news/2017-solar-eclipse-when-it-will-start-and-end-in-metro-detroit.

Surface Temperature and Lyme Disease Correlation

Saumya Talla and Aava Paudel

Ottawa Hills Junior High

Ottawa Hills Local Schools

THE GLOBE PROGRAM
Global Learning and Observations to Benefit the Environment

Abstract

There are many cases of Lyme disease now a days that have been reported in the United States. In addition, many people think rarely about getting this disease. So whenever they go outdoors, they take very little action in trying to prevent it. In our results, we came to a conclusion that surface temperature does not relate to the cases of lyme disease reported. Although ticks that transmit lyme disease are likely to be found in humid environments, especially during the spring and summer. To collect all of our research, we used information from NASA's GLOBE Mission Earth and AREN projects as well as other sources stated in the bibliography. Using the information that was collected, we found out some data that conflicted from our hypothesis. Even though our hypothesis was not supported, we learned many new aspects of our topic that we didn't know before.

Research Question

How does surface temperature affect whether you get Lyme disease or not?

- This is an important question of scientific interest because this disease is common in the northeastern part of the United States, which is the region where Ohio is located in.
- Where did Lyme disease originate from?
- How does climate change affect the rate of Lyme disease?
- Does the number of blacklegged ticks decrease in the winter?

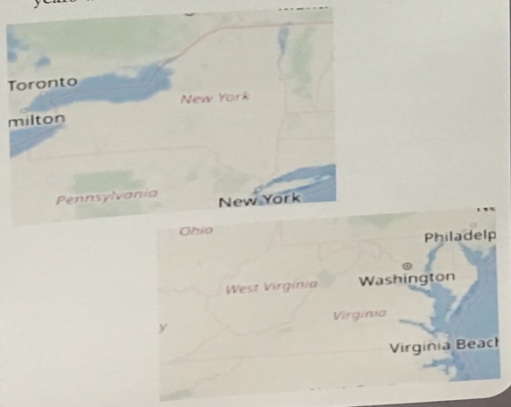
Introduction

There are many cases of people who get Lyme disease due to the lethal exposure of blacklegged ticks or otherwise known as deer ticks. My partner and I have found a great interest in this particular topic that we have chosen. We have decided to conduct research to learn more about our question on whether or not surface temperature affects your chances of getting Lyme disease or not. Blacklegged nymph ticks are very difficult to spot with the naked eye, since they are less than 2 mm in size. Lyme disease is a multisystem bacterial infection caused by the bacterium called *Borrelia burgdorferi*, according to the Children's Hospital of Philadelphia. This infection is transmitted by the bite of a blacklegged tick. They are most active during the the spring and summer months, which is when most people spend their time outdoors. These ticks are most often found in wooded and grassy areas, and could also be transported by animals.

Lyme disease is accompanied by symptoms such as fever, fatigue, headache, as well as muscle and joint aches. However, there were very few reported cases of individuals who showed no signs of illness. The annual number of cases in the United States per year has increased by 25-fold since national surveillance for Lyme disease began in 1982. Furthermore, a mean of about 12,500 cases were reported to the Centers for Disease Control and Prevention from 1993 to 1997. Stated in the multiple website, we found out that ticks need either deer or rodents as their main blood hosts. Moreover, the number of these animals have increased as forests suburbs have gotten thicker. Blacklegged ticks are common in certain areas in the United States including, the northeast, mid-Atlantic states, north central states of Wisconsin and Minnesota, and Northern California. This shows the relevance of research to the community, since Ohio is located in the northeast region. The purpose of this research is to help educate others on the factors of Lyme disease to prevent from getting it.

Research Methods

- Our investigation focuses on surface temperature data from Virginia and New York, which are both humid.
- For our data, we compared 2 sets from 2016 and 2017 which was represented in a bar graph.
- Our computers were the only instruments we used to gather research and collect data.
- We used information we collected from the Globe website, from which we figured out the mean surface temperature, while we used various government sites to find our lyme disease count.
- We each performed different roles in data collection. Saumya collected the number of Lyme disease counts reported in each state, while Aava calculated the average surface temperature. We both took a part in organizing and analyzing the data.
- In preparation for our data collection, we added all of the daily surface temperature and divided by the number of data points there were. We then repeated this process four more times. This way we were able to find the average surface temperature for the two states along with the schools we chose, which was 2 years worth of data in each state.



Results

Analyzing Data

- Figure #1 represents the average surface temperature and the number of Lyme disease counts reported in Virginia and New York from 2016 and 2017.
- Figure #2 represents the Lyme disease count and the average surface temperature in Virginia for 2016 and 2017.
- Figure #3 represents the Lyme disease count and the average surface temperature in New York for 2016 and 2017.
- The last two figures are just a representation of each state in which the data was collected from.
- This data does not show a trendline that suggests surface temperature is related to the number of lyme disease reported.
- The data analysis was completed in a Google spreadsheet.

Figure #1

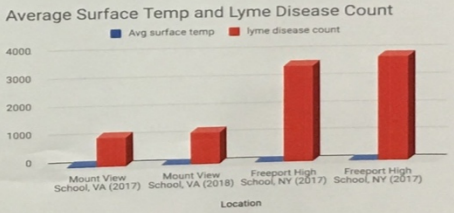


Figure #2

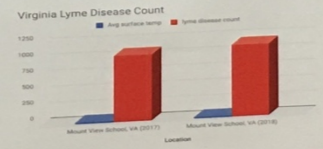
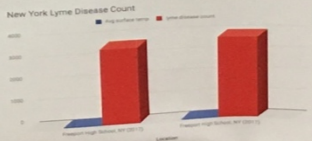


Figure #3



Discussion

Interpreting Data

- The results do not support our hypothesis. This is because the comparison between the average surface temperature to the cases of Lyme disease do not have a correlation, and are not close to being a linear relationship.
- Our results showed that even when the average surface temperature was very low, the Lyme disease count was very high which meant that there was no impact.
- The importance of this analyses regarding to science, is that it can help to provide information to those who tend to spend more time outdoors during the summer when it is more humid, so that they will know how to take safety precautions. This way, we can hopefully contribute to the reduction of Lyme disease.
- This was a limited study as we only did two data collections between two different states. If we were to conduct more trials with this study again, we would collect more data points within each state to be more precise and accurate.
- According to the results from other studies, it appears that temperature does affect the chances of blacklegged ticks spreading this disease, but just not surface temperature.
- Possible sources of error may include only using two data points, not having the same amount of data for surface temperature provided by Globe, and we could have miscalculated the average surface temperature from each state.

Work Photos

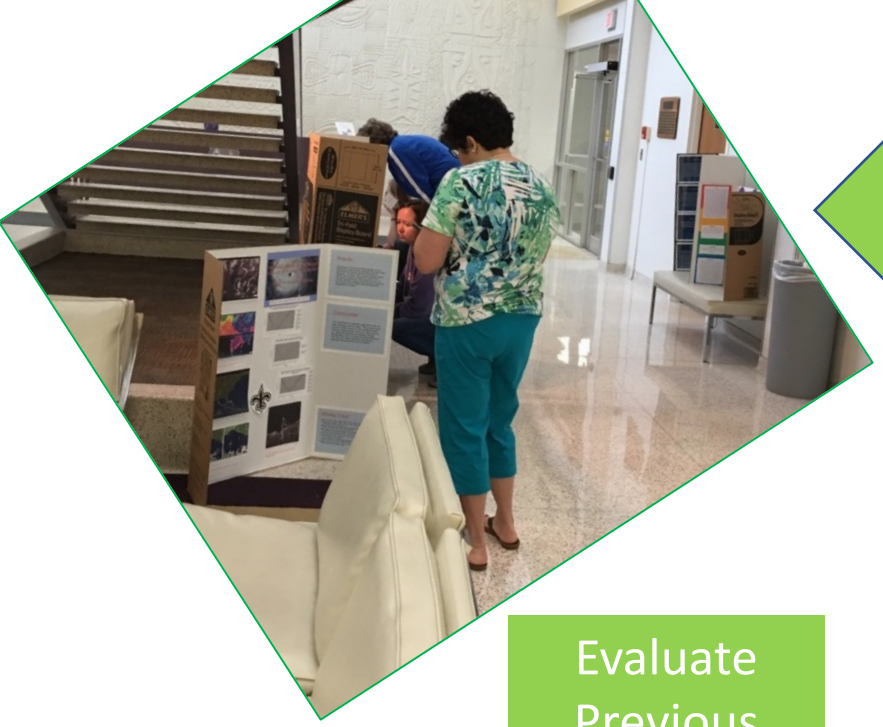
Conclusions

Overall, we did not find a relationship between the surface temperature and the many lyme disease cases reported. The conclusion was reached because our results showed that there was no correlation between these two factors. Some improvements that could be made next time would be to collect data from more than 2 states to make it more exact, and to make sure everything was completed thoroughly. For future research, we should collect more background information on the topic before consenting to a question just to make sure it is doable. Some follow-up research that should be taken, would be to get a clear visual on if your question fits in with the standards before continuing the whole project. There is a great impact with working with a project mentor. Seeking help from a mentor can really help to boost your understanding of a question you may have or just the project as a whole. This way you can tie up any loose ends you may have.

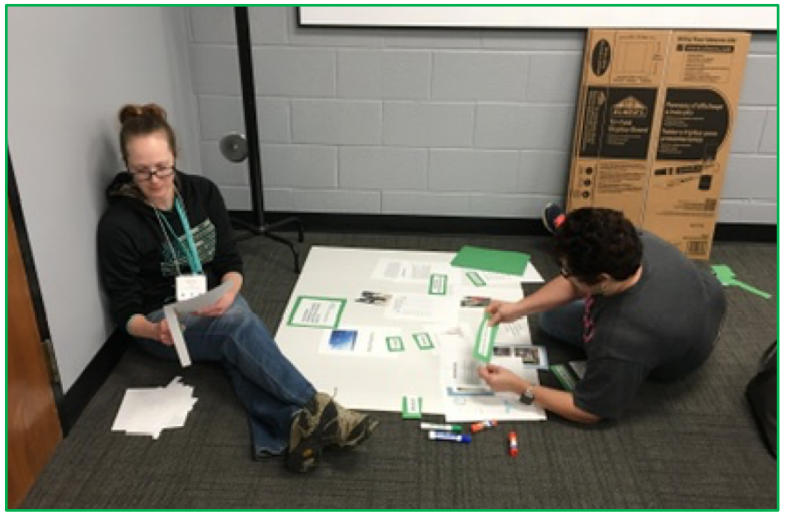
Bibliography

References

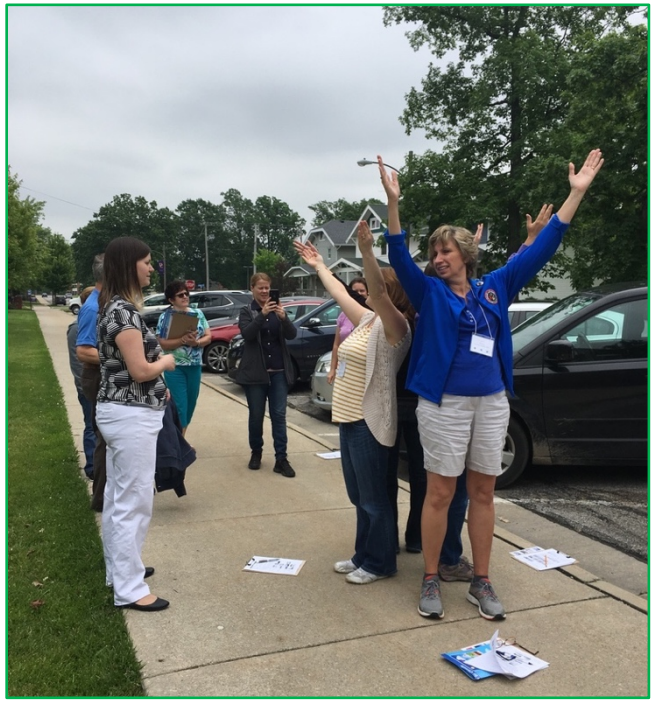
- Lyme Disease, Centers for Disease Control and Prevention, April 01, 2019
- Lyme Disease in Children, Children's Hospital of Philadelphia, August 24, 2014
- NY's Gov. Cuomo includes Lyme in 2018 "State of State" agenda, LymeDisease.org, January 05, 2018
- Climate Influences on Specific Diseases, Under the Weather: Climate, Ecosystems, and Infectious Disease, January 01, 1970
- GLOBE Science Data Visualization, April 10, 2019



Begin with the End in Mind

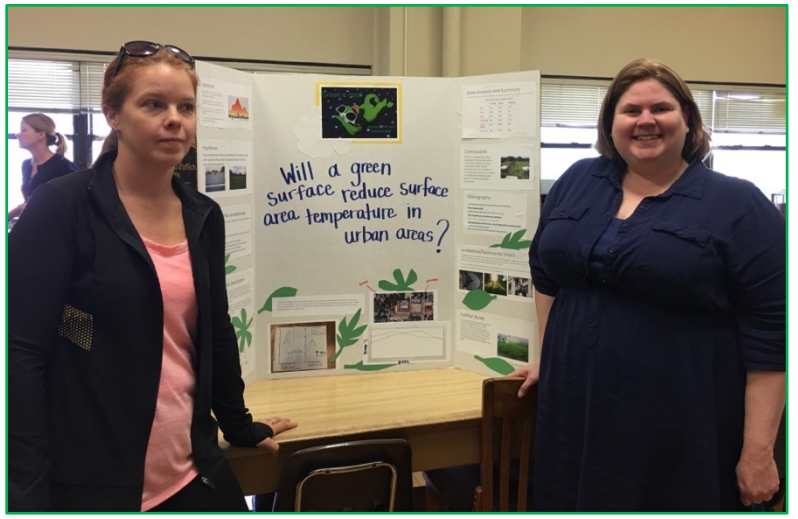


Evaluate Previous Projects



Develop Research Question
Complete a Research Project & Present to Peers

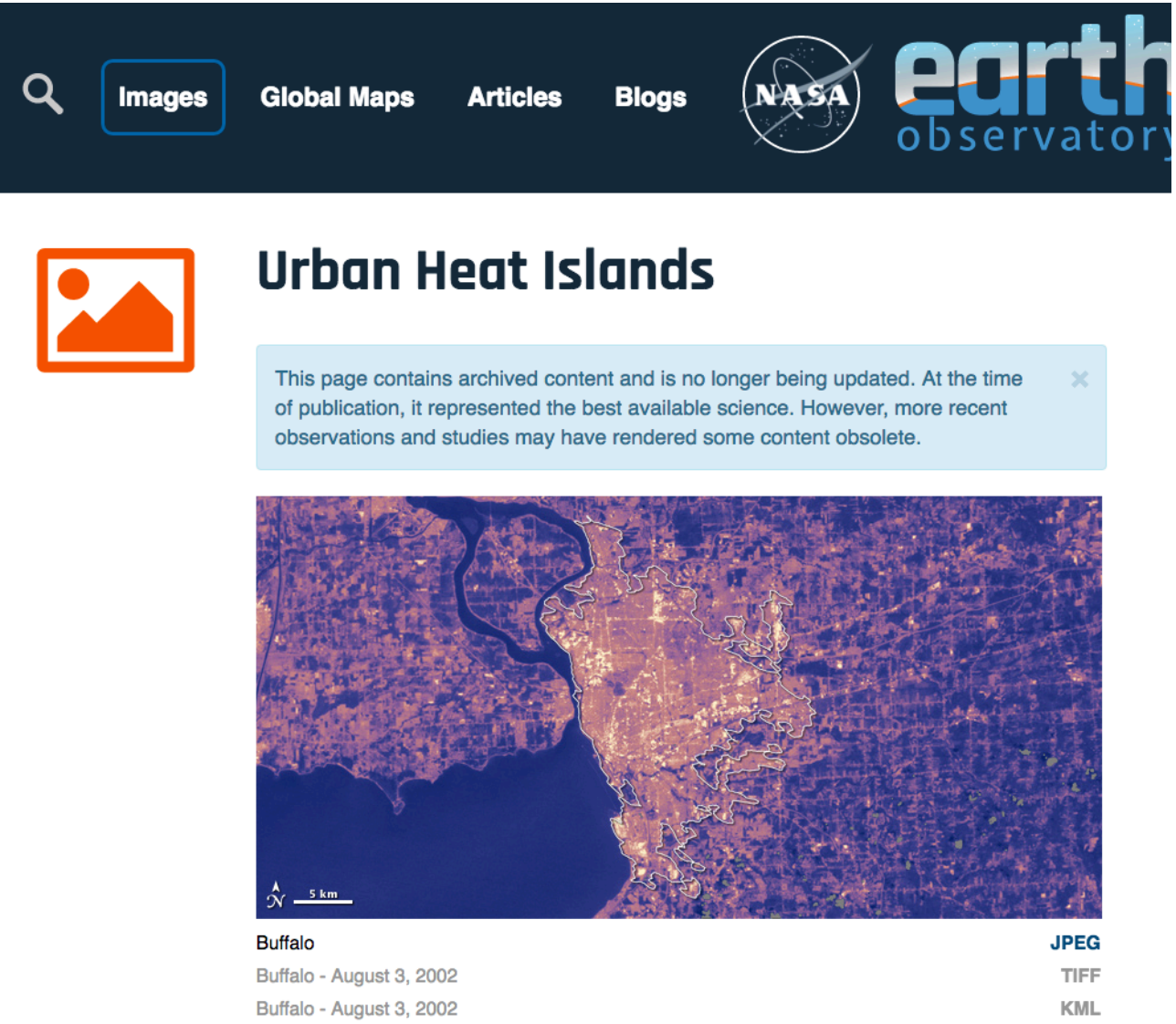
Collect GLOBE Data & Submit Data to GLOBE



TENNESSEE STATE UNIVERSITY

- Students become GLOBE certified and work with high school students for 3-4 days. Trained in Atmosphere Protocols
- Uses the Climate Study Curriculum
- Early Childhood Education Course - Elementary GLOBE Facebook Live presentations
- Student teachers hone their skills in teaching GLOBE content prior to education careers

Urban Heat Island Impacts



- Increased energy consumption
- Elevated emissions of air pollutants and greenhouse gases – ozone
- Compromised human health – increased death rate

Recording surface temperature is important

To help verify surface temperature readings collected by NASA satellites.

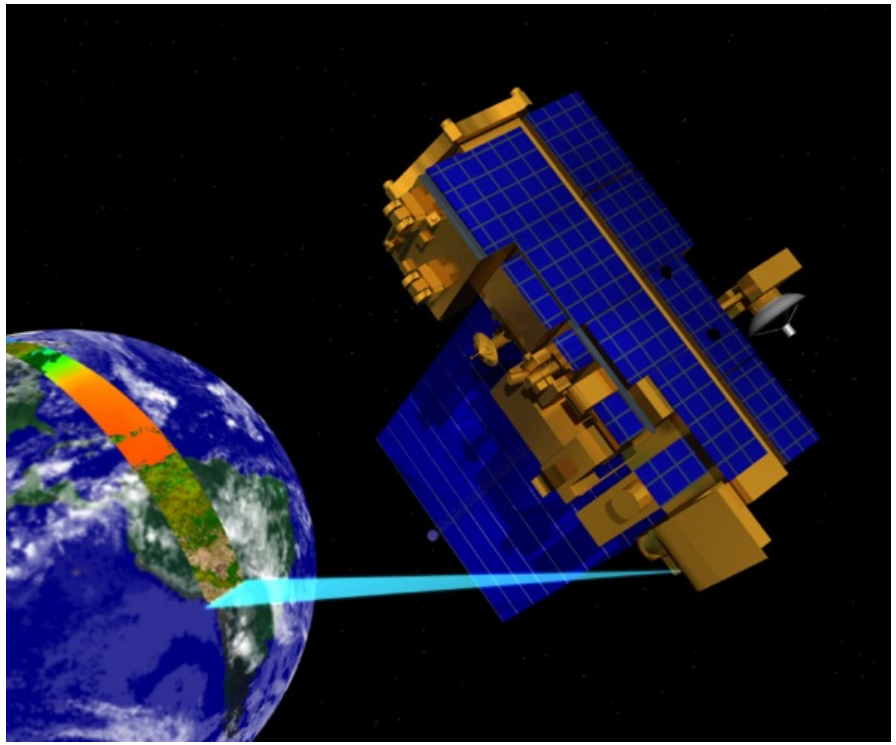


Image: NASA

Find out more about
NASA's MODIS Imagery

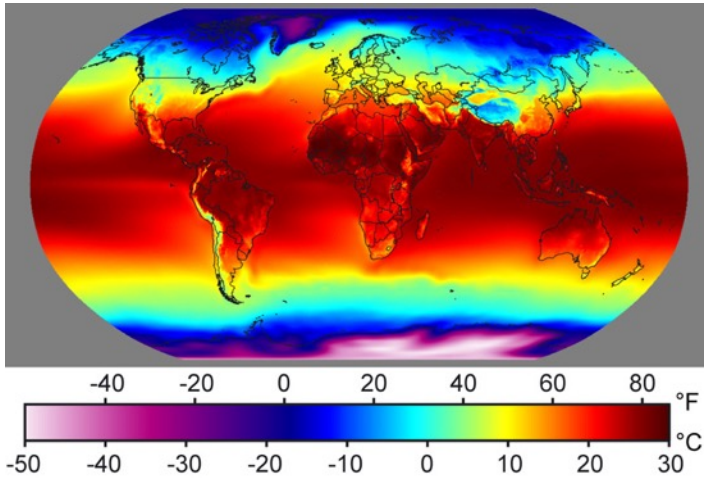
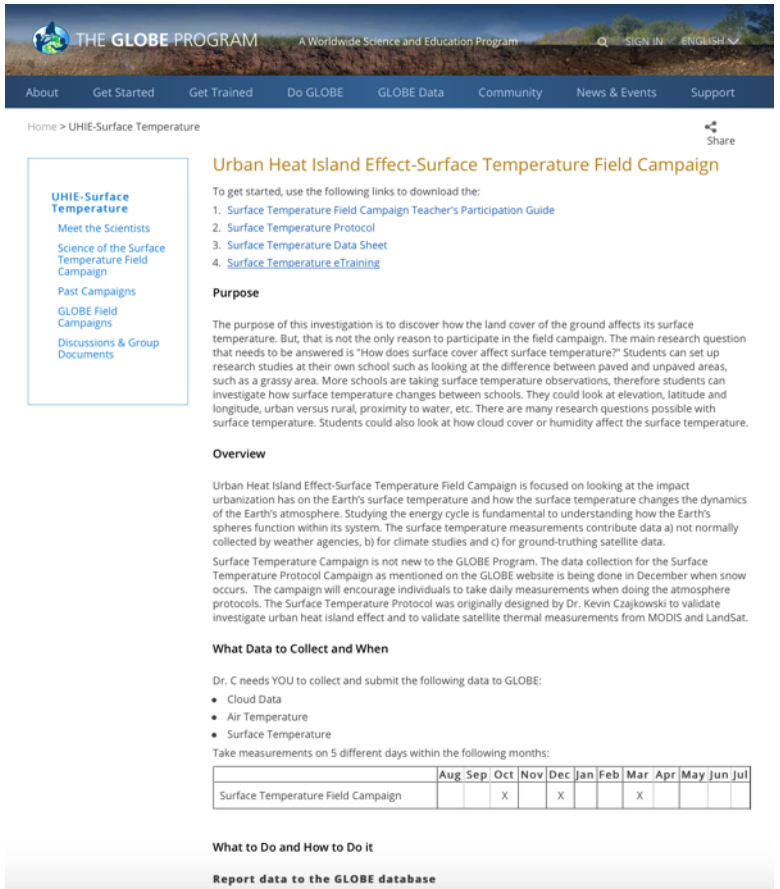
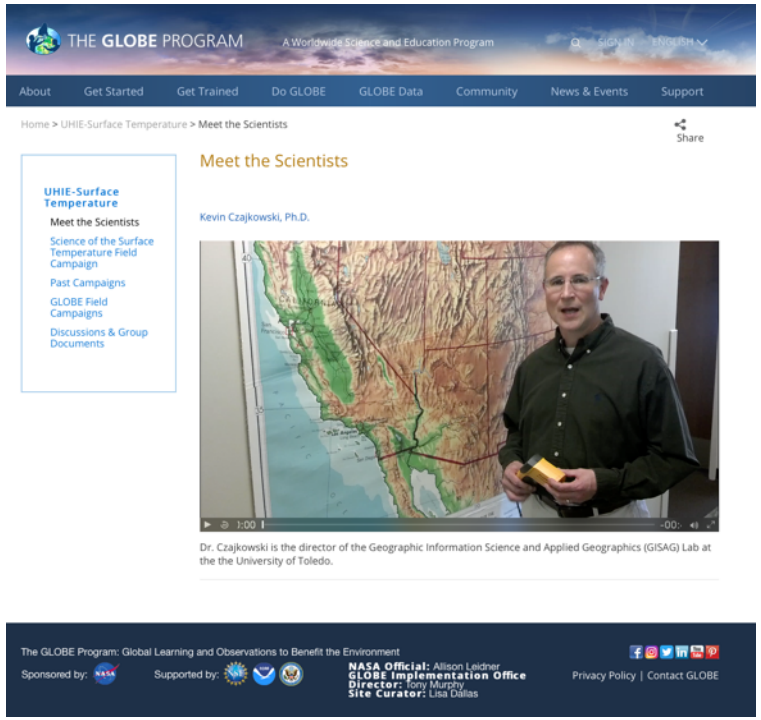


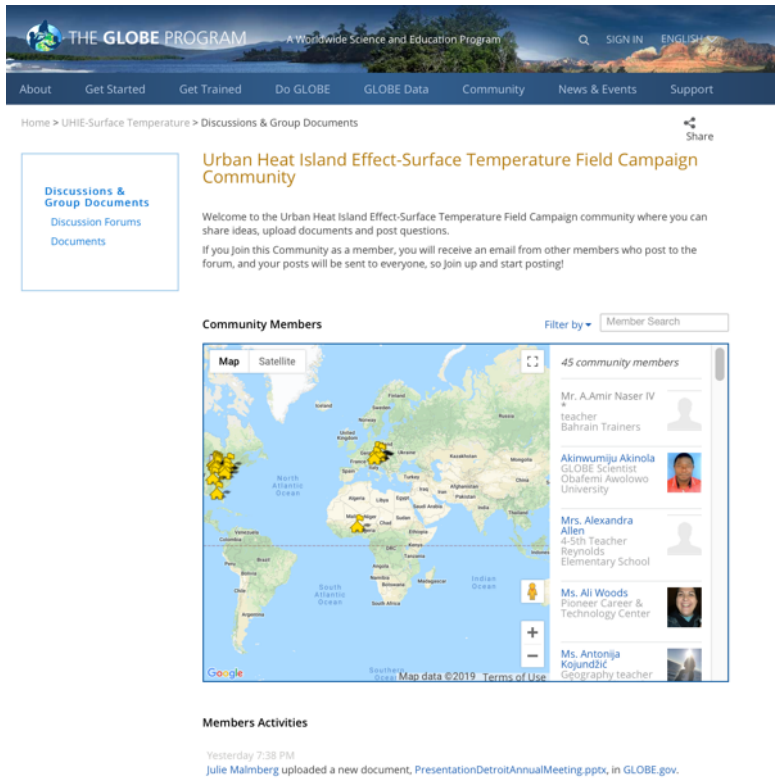
Image: Windows to the Universe

Image: Kevn Czajkowski

GLOBE Urban Heat Island Effect-Surface Temperature Field Campaign







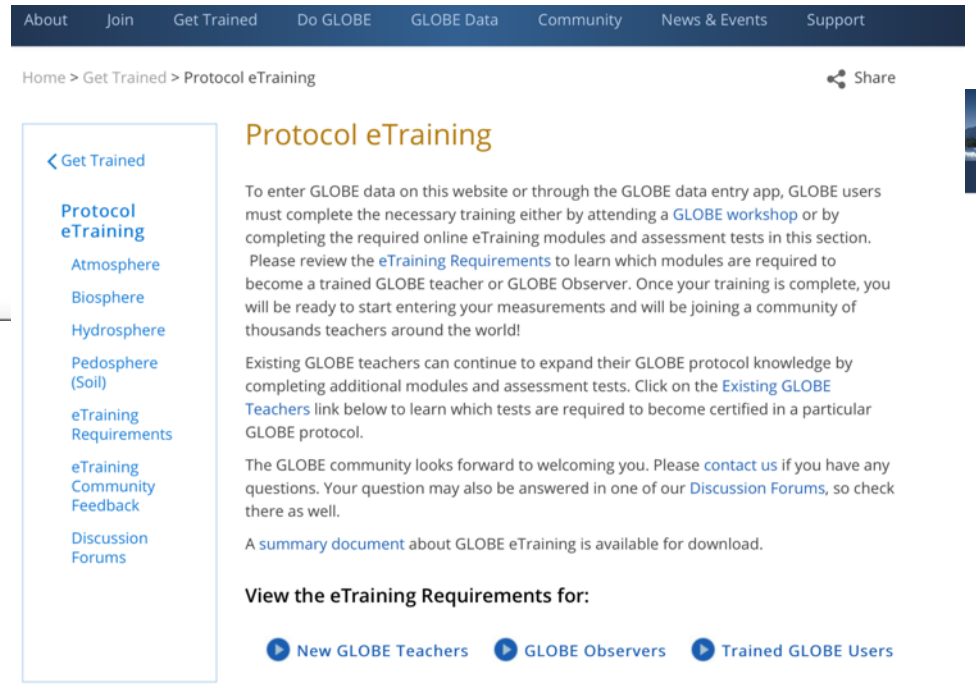
https://www.globe.gov/web/surface-temperature-field-campaign

Urban Heat Island Effect-
Surface Temperature Field Campaign

- October, December and March
- Need both urban and rural schools so we can compare.
- 5 different days each month.
- Take observations on a variety of land cover around your school

GLOBE E-Training/Atmosphere/Surface Temperature

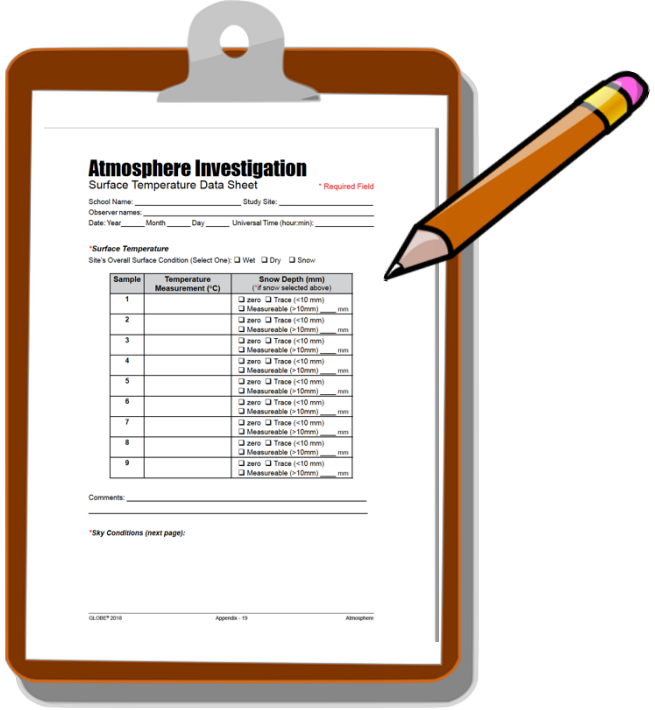
http://www.globe.gov/get-trained

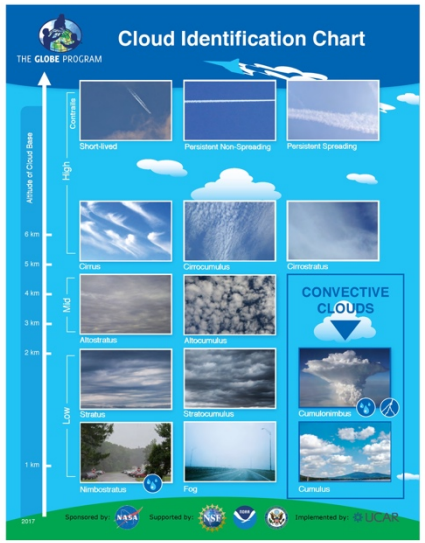


https://www.globe.gov/get-trained/protocol-etraining

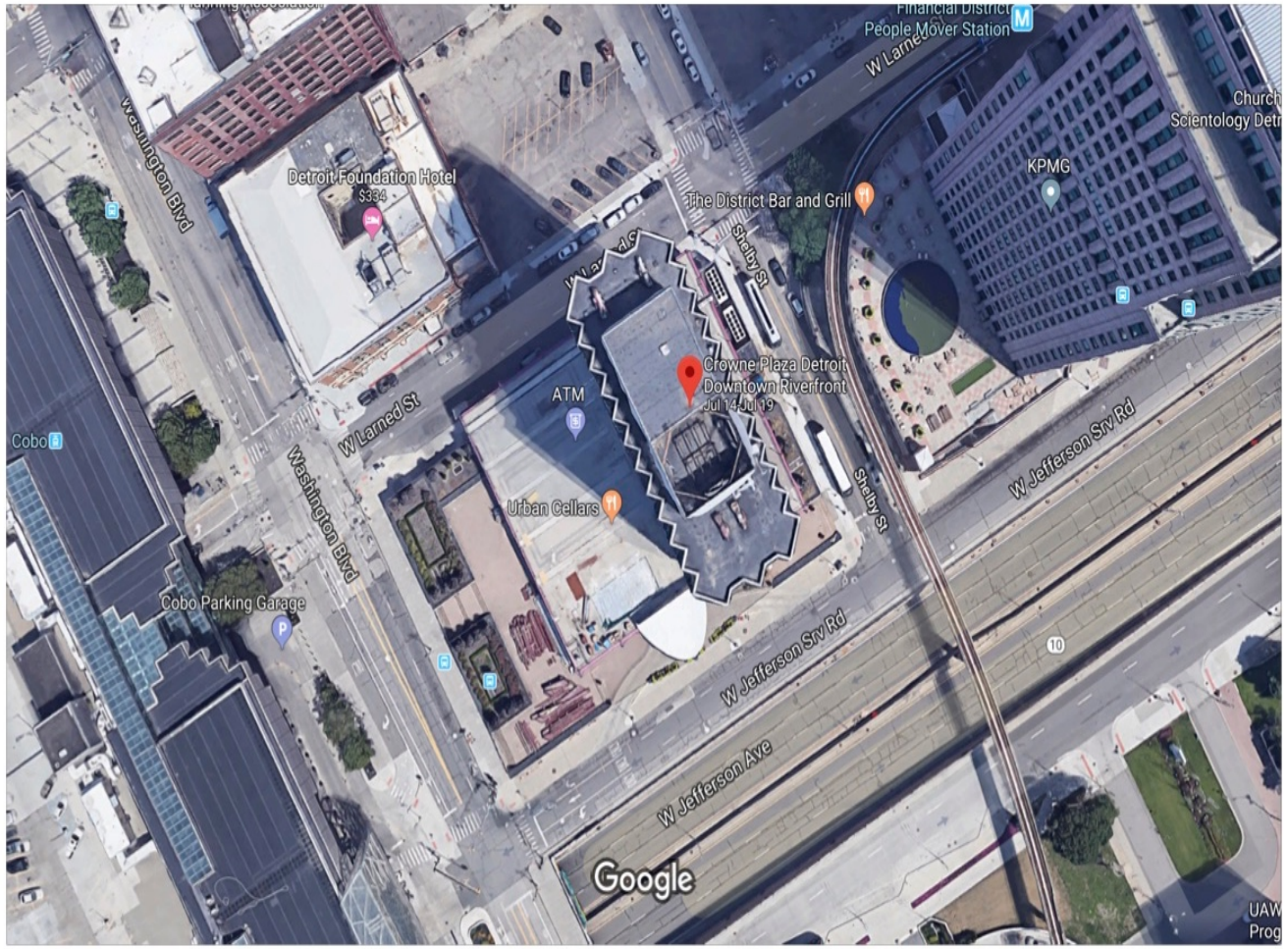
https://www.globe.gov/get-trained/protocol-etraining/etraining-modules/16867642/12267

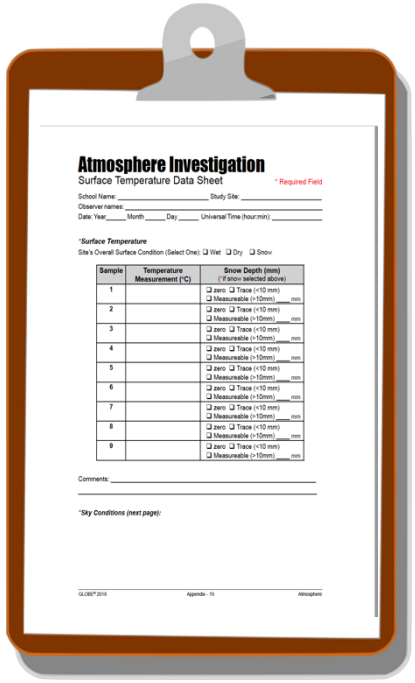
Collect Surface Temperature Data!



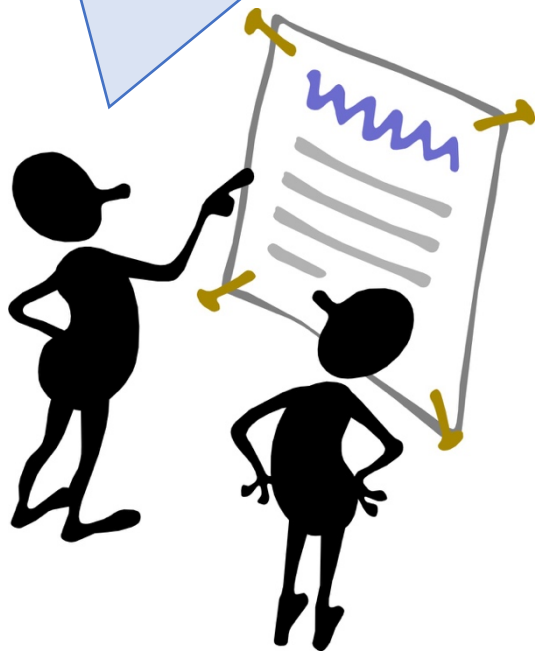


Google Maps Crowne Plaza Detroit Downtown Riverfront

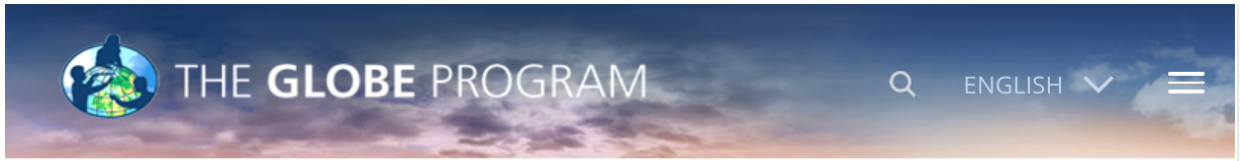




What did you find out about today's surface temperature?



https://www.globe.gov/globe-data/data-entry



Data Entry

Share

Data Entry

GLOBE Data Entry consists of several options:

Liquid-filled Maximum/Minimum Thermometers - GLOBE no longer recommends the U tube thermometer for recording maximum and minimum air temperatures. The thermometer magnet for resetting the floats becomes demagnetized and/or the floats stick in the tube. GLOBE encourages the use of a digital maximum/minimum thermometer for these air temperature measurements. If you are currently using a U-tube thermometer please consider replacing it with a digital model.

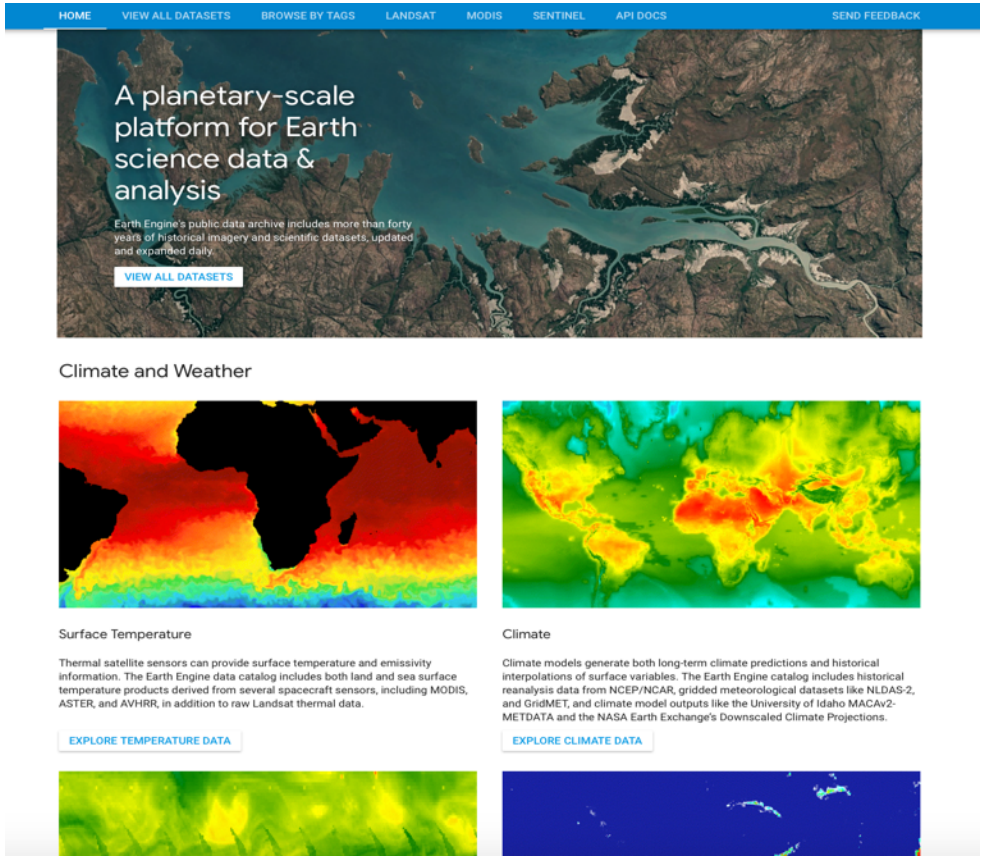
Data Entry - Desktop Forms – These pages are for entering environmental data – collected at defined sites, according to protocol, and using approved instrumentation – for entry into the official GLOBE science database.

Data Entry - Mobile App – The app allows users to enter data directly from an iOS or Android device for any GLOBE protocol.

Training Data Entry – These pages are for practicing data entry, either during workshops or when providing others a view of the data entry process. These data entry pages are based on the newer designed data entry pages. These data are not intended for entry into the official GLOBE science database.

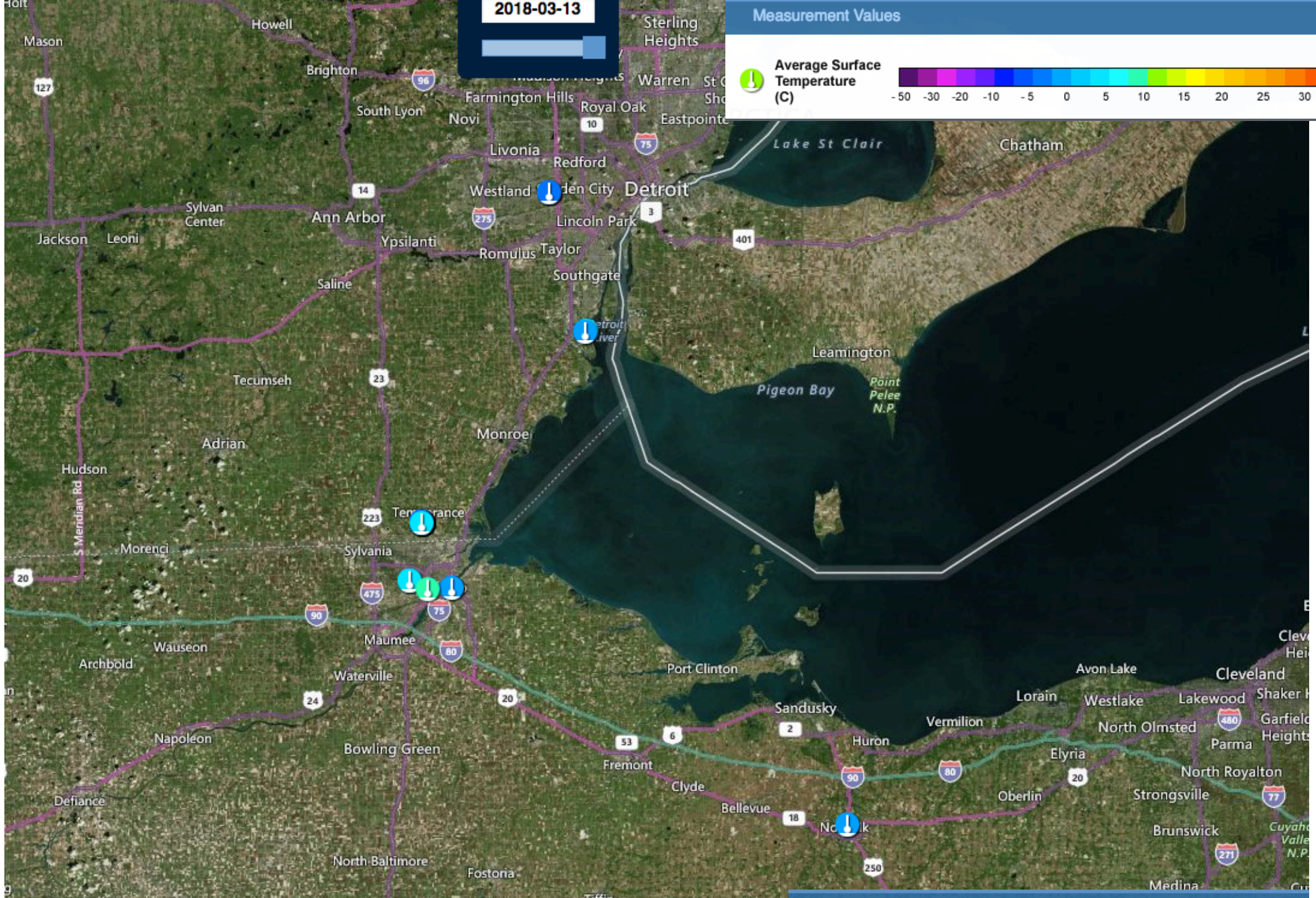
Datasets from NASA Satellites

https://earthdata.nasa.gov/special-feature-modis-global-land-surface-temperature



https://developers.google.com/earth-engine/datasets/

Help Guide Under the AREN Project:
https://www.globe.gov/documents/23174792/24151782/AREN+GLOBE+Program+Quick+Guide+for+Accessing+Satellite+Data.pdf/7cf42c4a-c7bc-44f1-8e2c-252a26ef0c8b


2018-03-13
Measurement Values
Average Surface Temperature (C)
- 50 -30 -20 -10 - 5 0 5 10 15 20 25 30 35 40 50
Howell
Mason
Brighton
Sterling Heights
Warren
Farmington Hills
Royal Oak
South Lyon
Novi
Eastpointe
Livonia
Redford
Lake St Clair
Chatham
Westland
Detroit
Sylvan Center
Ann Arbor
Lincoln Park
Jackson
Leoni
Ypsilanti
Romulus
Taylor
Southgate
Saline
Leamington
Tecumseh
Pigeon Bay
Point Pelee N.P.
Monroe
Adrian
Hudson
S Meridian Rd
Morenci
Sylvania
Maumee
Wauseon
Archbold
Waterville
Port Clinton
Avon Lake
Cleveland
Lorain
Westlake
Lakewood
Sandusky
Vermilion
North Olmsted
Parma
Huron
Elyria
Napoleon
Bowling Green
Fremont
Clyde
Bellevue
Oberlin
North Royalton
Strongsville
Defiance
Brunswick
North Baltimore
Fostoria
Medina

Student Research Questions

1. Which surfaces have warmer or cooler surface temperature?
2. How do local weather conditions affect surface temperatures of different materials over time?
3. How do surface temperatures at my school compare with another school in a different environment (ex. Urban vs. Rural)?

What are your research questions?


15
Minute
Break


Welcome
Back!

NASA's Interest in Urban Heat Island

https://youtu.be/Od2d1bYQVHs

More NASA Resources

https://climatekids.nasa.gov/heat-islands/

https://earthobservatory.nasa.gov/blogs/eokids/eo-kids-urban-heat-islands/

Data Analysis

- Creation of Urban Heat Island Story Map
- Data Literacy Cubes
- Practice with Graph Cube

Creation of Urban Heat Islands

Purpose:

This story map allows students to explore the urban heat island effect using land surface temperature and vegetation data. Students will investigate the processes that create differences in surface temperatures, as well as how human activities have led to the creation of urban heat islands.

Phenomenon: Urban Heat Island Effect

Sphere(s):

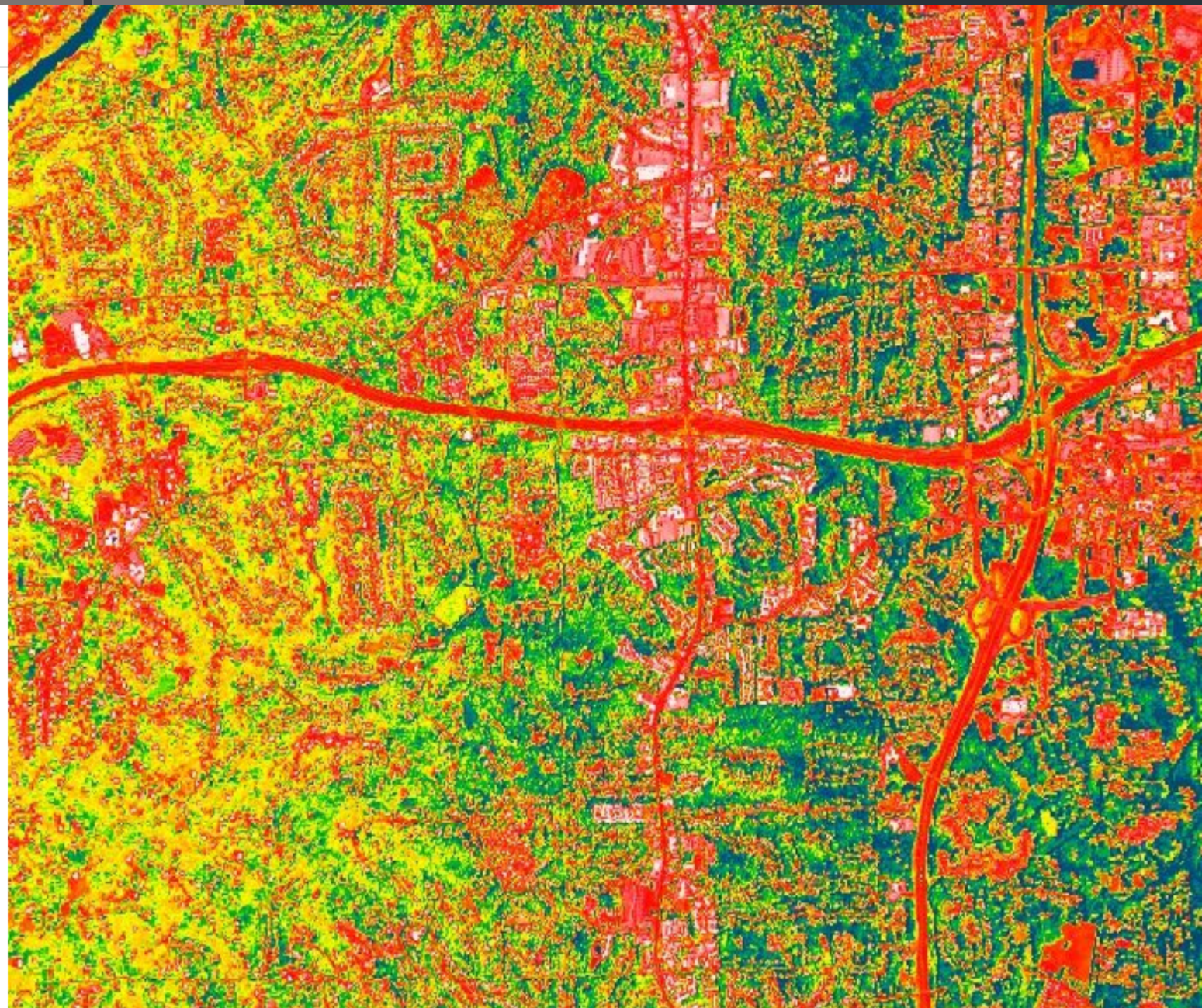
- Geosphere
- Atmosphere
- Biosphere

Grade Level: 6 - 12

Essential Questions:

1. Why do different materials experience differences in surface temperature?
2. What is the role of Urban Heat Islands in Earth's Energy Balance?
3. How has human activity led to the creation of Urban Heat Islands?

Estimated Time for Completing Activity: 90 Minutes



My NASA Data

Student Name: Date: Period:

Creation of Urban Heat Islands

Link to Story Map:
https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=44b9c8738f0e47e68d9e8ae2c530ed08

Part I: Engage

1. On the following chart, fill in whether the surfaces shown in the image are typically warmer or cooler than the air temperature on a hot summer day.

Surface	Warmer or Cooler than Air Temperature?
Grass	
Concrete	
Water	
Wood	

2. What is the temperature difference between sunlit concrete and shaded concrete? What does this difference in temperature tell you about how surfaces are heated?

3. Based on what you have seen in this image, which type of area do you think is warmer, urban areas (cities and towns) or rural areas (countrysides)?

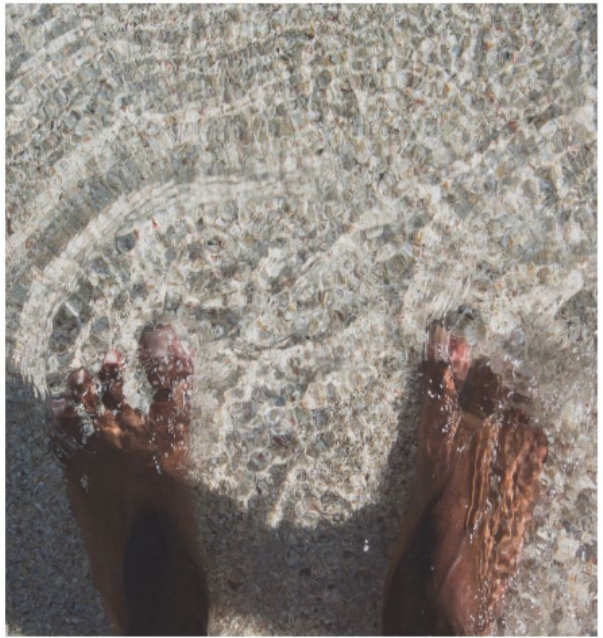
Surface Temperature Differences

Analyze the images of people walking barefoot on different surfaces. Think about the times you have walked on these surfaces during a hot, summer day. What was the experience like? Do you ever notice a difference between the temperature of these surfaces and the temperature of the air?

On a bright, hot summer day, if you had to walk barefoot down a dark sidewalk or along pavement lined with green grass, which surface would feel most comfortable to your feet?

Question A.1 : On the following chart, fill in whether the surfaces shown in the image are typically warmer or cooler than the air temperature on a hot summer day.

Surface	Warmer or Cooler than Air Temperature?
Grass	
Concrete	
Water	
Wood	



Surface Temperature Differences

In the image, different surface temperatures were measured on an Autumn afternoon. Notice that the temperatures of the various surfaces are different from the air temperature, which is 54° Fahrenheit. Also, notice that some temperatures were measured on the same surface both in the sunlight and in the shade.

Question A.2: What is the temperature difference between sunlit concrete and shaded concrete? What does this difference in temperature tell you about how surfaces are heated?

Question A.3: Based on what you have seen in this image, which type of area do you think is warmer, urban areas (cities and towns) or rural areas (countrysides)?

Image: Direct sunlight can heat surfaces well above air temperature
Credit: NASA Earth Observatory photograph by Robert Simmon

GLOBE Surface Temperature Field Campaign

Many schools around the world take part in the Global Learning and Observations to Benefit the Environment (GLOBE) Program. GLOBE is an educational program that provides students and the public worldwide with the opportunity to collect scientific data.

Surface Temperature Differences

Image: Direct sunlight can heat surfaces well above air temperature
Credit: NASA Earth Observatory photograph by Robert Simmon

GLOBE Surface Temperature Field Campaign

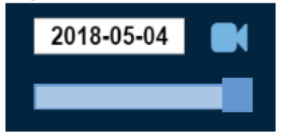
Many schools around the world take part in the Global Learning and Observations to Benefit the Environment (GLOBE) Program. GLOBE is an educational program that provides students and the public worldwide with the opportunity to collect scientific data.

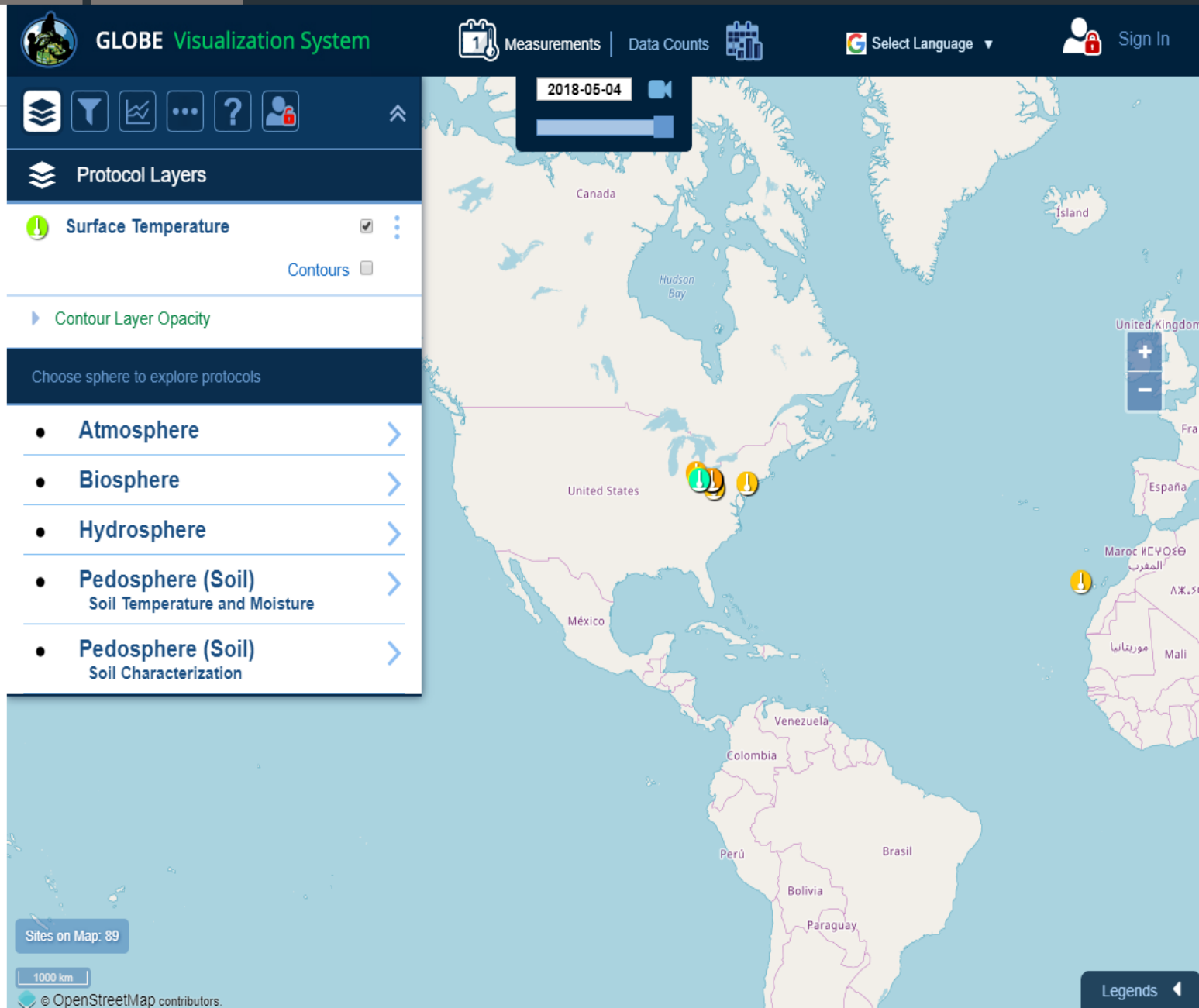
One of the measurement campaigns that students can take part in is the Surface Temperature Field Campaign. The purpose of the Surface Temperature Field Campaign is to answer the question, "How does surface cover affect surface temperature?"

Instructions:
Shown on the map are different surface temperature readings provided by schools around the world.

1. Click on a surface temperature data icon anywhere on the map to view the temperature data that were collected at that location.

2. Adjust the time slider to view surface temperature data from different dates





Creation of Urban Heat Islands

Surface Temperature Differences

Shumate Middle School's Surface Temperature Data Collection

In 2017, Shumate Middle School collected surface temperature data for the Surface Temperature Field Campaign. They chose two different surfaces to measure the temperature of, a sidewalk and a nearby pond, which are labeled on the image. Located on the next slide you will find a line plot of their surface temperature data for the month of October. Before moving on the the next slide, answer the following question.

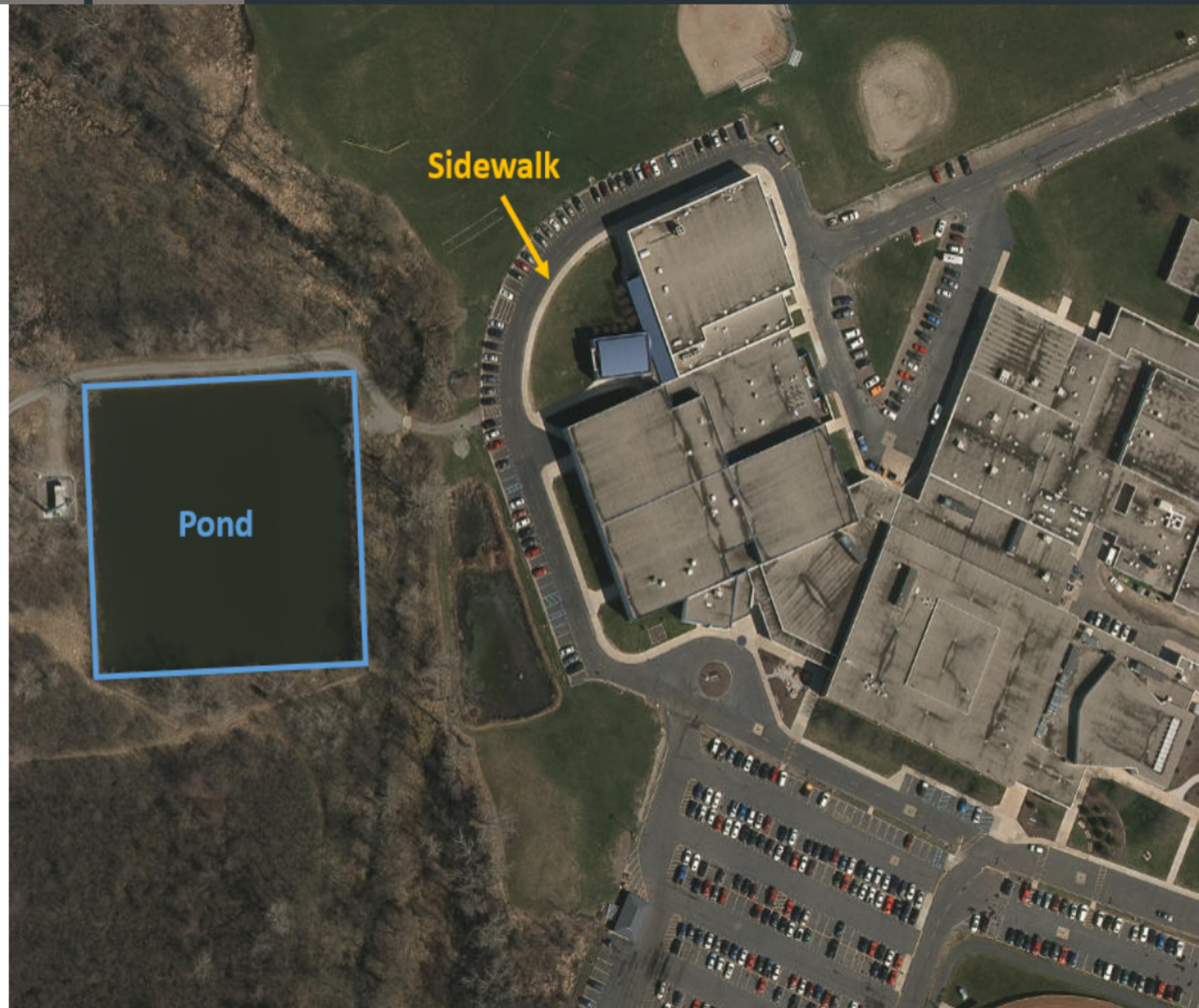
Question A.4: Based on what you already know about the temperatures of different surfaces, which surface do you predict was warmer during the month of October, the pond or the sidewalk?

Shumate Middle School's Surface Temperature Data

This line graph shows two sets of data, one for the sidewalk shown in blue, and another for the pond shown in orange. This way the data for both surfaces can be easily compared.

Was your prediction correct?

Question A.5: Describe what you see on the graph. How do the lines change?



Surface Temperature Differences

Shumate Middle School's Surface Temperature Data

This line graph shows two sets of data, one for the sidewalk shown in blue, and another for the pond shown in orange. This way the data for both surfaces can be easily compared.

Was your prediction correct?

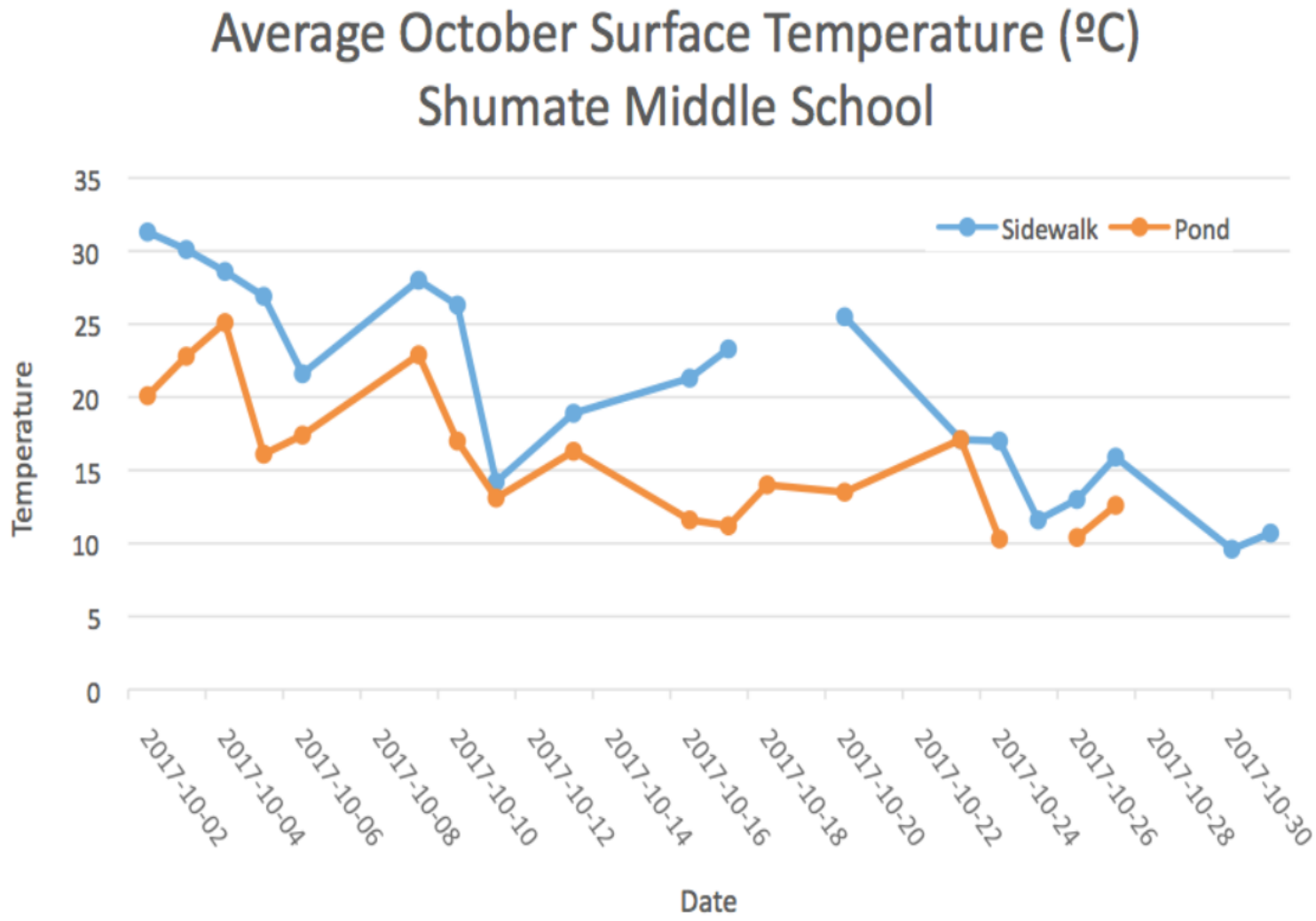
Question A.5: Describe what you see on the graph. How do the lines change?

Question A.6: What do these changes in the lines mean?

Question A.7: What patterns do you notice between the sidewalk and pond data?

Question A.8: What surprises you about this line graph? Come up with a research question you would like to know the answer to.

Image: Average October Surface Temperature Shumate Middle School
Credit: Kevin Czajkowski, The GLOBE Program



Surface Temperatures in Your Community

Note: Alternatively, this activity can be completed by going outside to the school grounds.

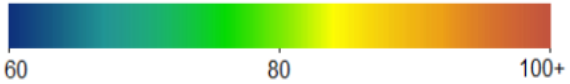
Surface Temperature of Urban Areas

Shown to the right is an image of the surface temperatures in the city of Atlanta, Georgia on May 1st of 2018.

Data: Landsat Provisional Surface Temperature

Credit: Landsat Level 2 Surface Temperature Science Product courtesy of the U.S. Geological Survey

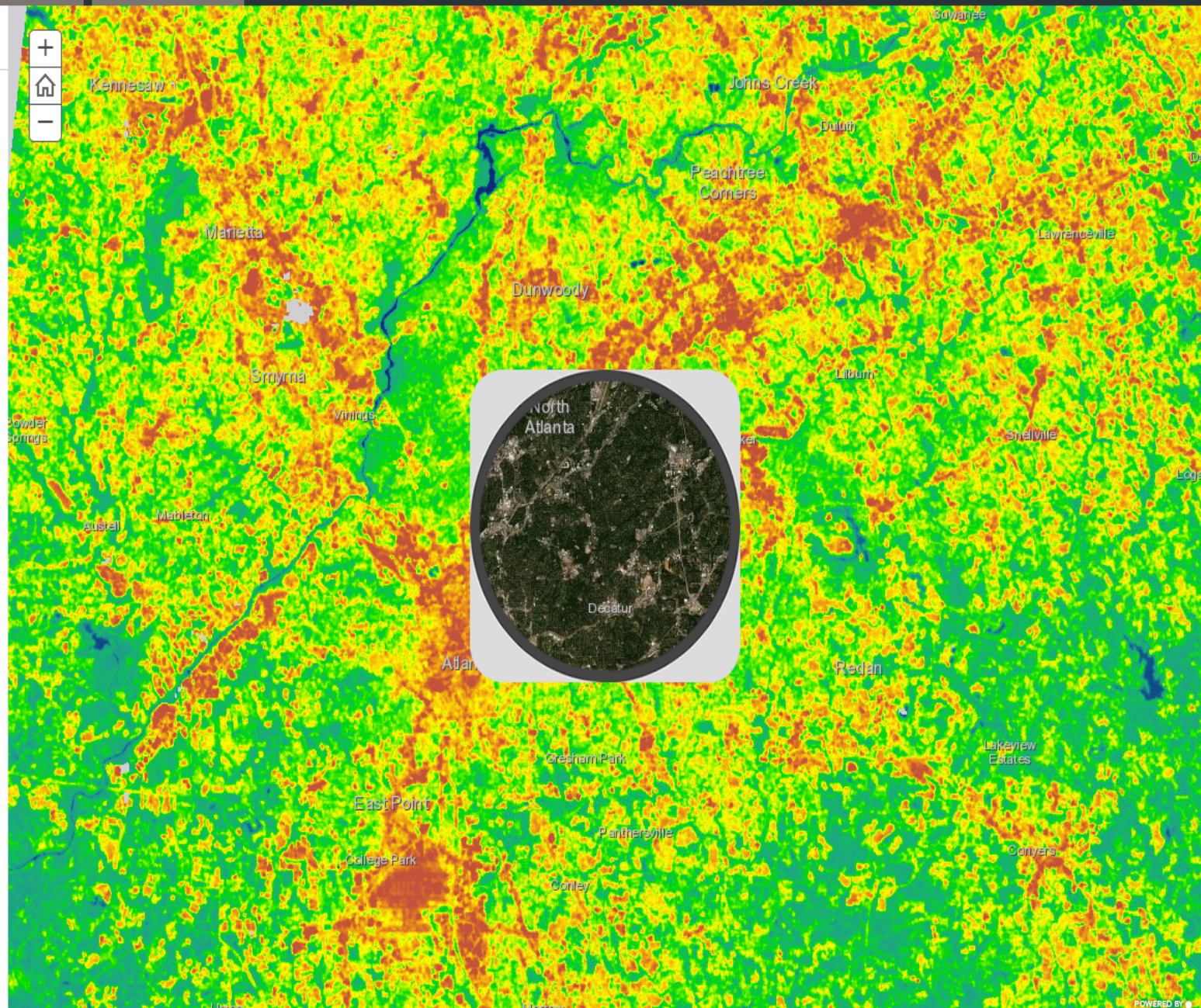
Surface Temperature (degrees Fahrenheit)



Instructions:

Adjust the spyglass to view how surface temperature differs between materials.

Spyglass



Surface Temperature of Urban Areas

Question B.1: Fill in the following chart with three different surface types that you identify in the image of Atlanta, Georgia. Next, fill in the surface temperature of that material.

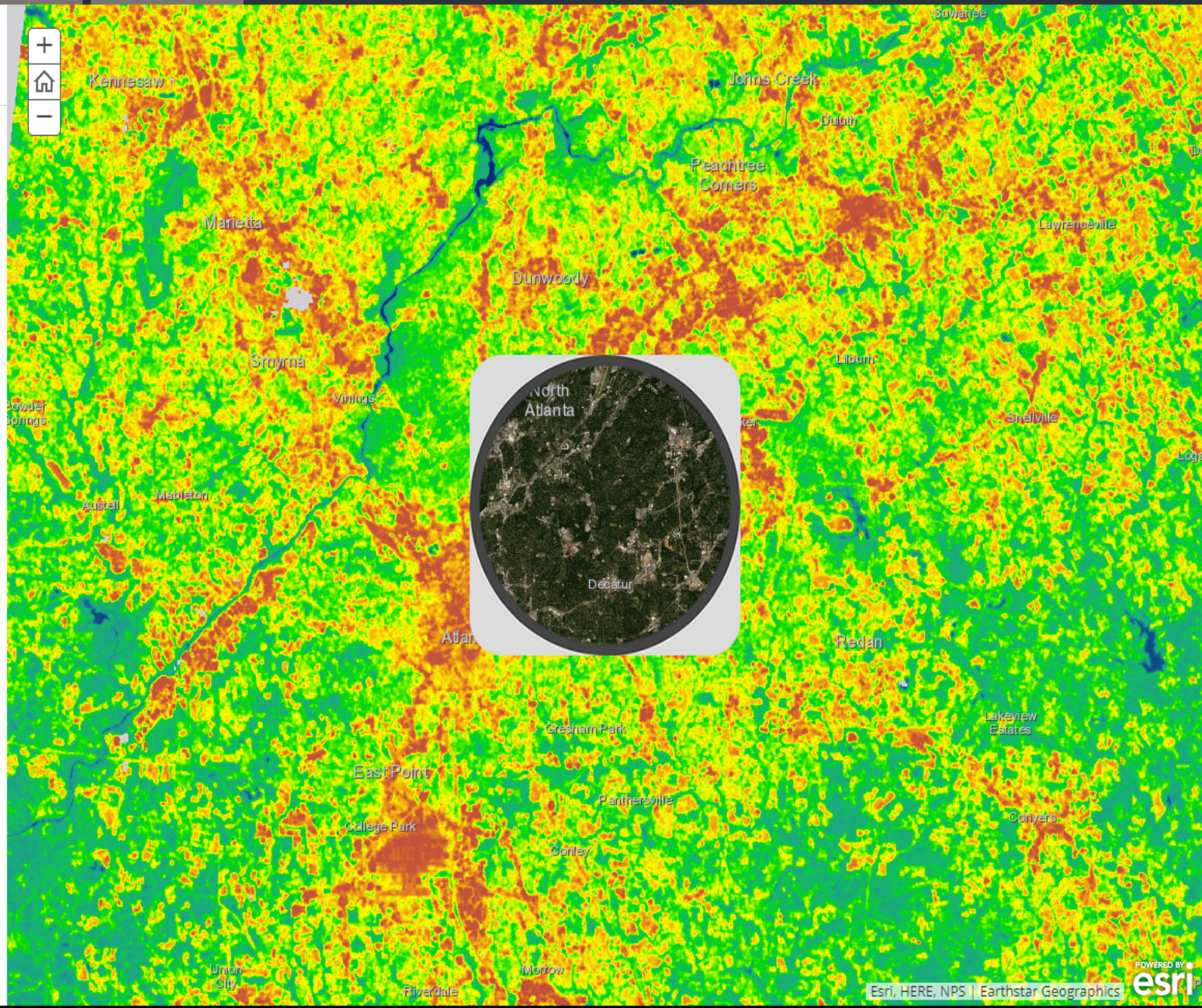
Item (object or organism)	Artificial or Natural?	Temperature
1.		
2.		
3.		
4.		
5.		

Question B.2: What patterns do you see?

Question B.3: What do these patterns mean?

Plotting Temperature: Bar Graph

Look back at the chart you filled out in Question 1. Now, we will create a bar graph that displays the different temperatures of each of the surfaces you



my NASA data

Surface Temperature of Urban Areas

Relationship Between Surface Temperature and Vegetation

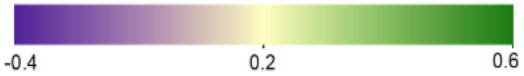
Once again, the image to the right shows Atlanta, Georgia. This time we will compare surface temperature and vegetation.

Data: Landsat Provisional Surface Temperature
Credit: Landsat Level 2 Surface Temperature Science Product courtesy of the U.S. Geological Survey

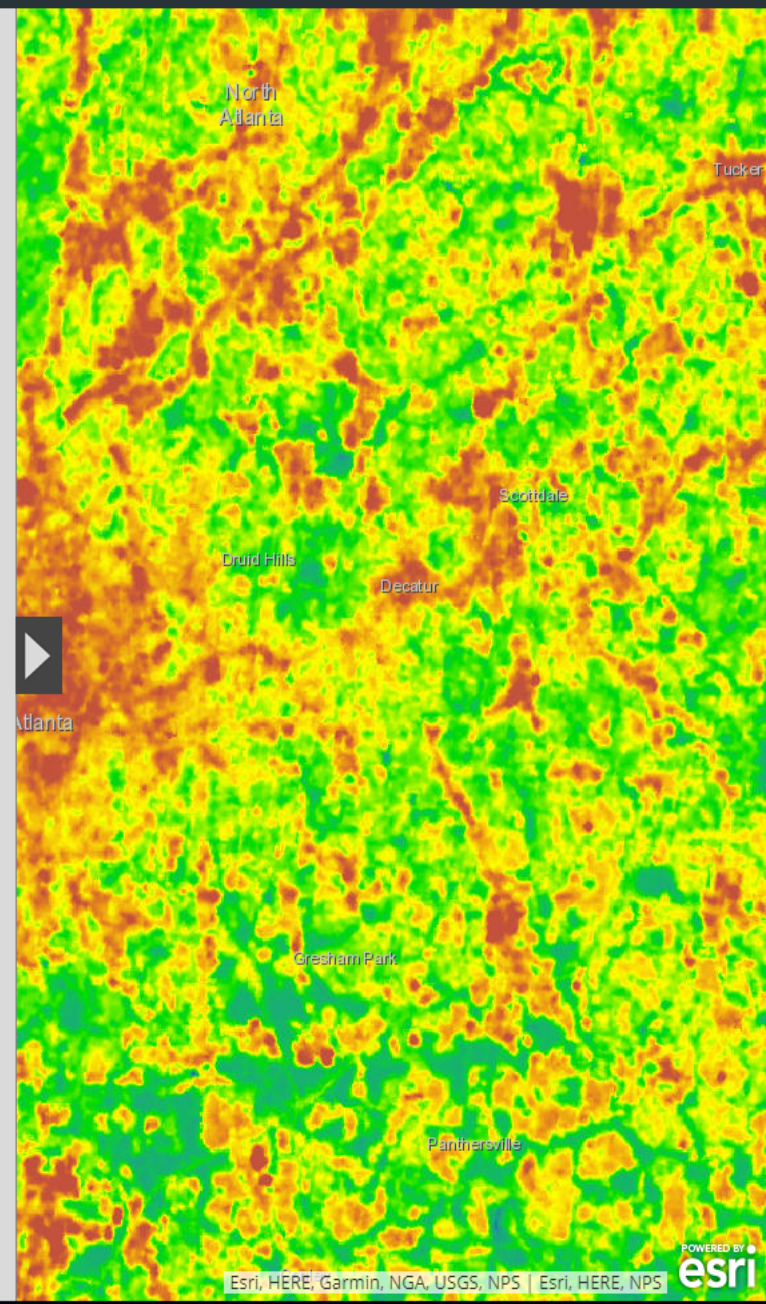
Data: Landsat Normalized Difference Vegetation Index
Credit: Landsat Product courtesy of the U.S. Geological Survey

Surface Temperature (degrees Fahrenheit)

Vegetation Index



Vegetation Index is a measure of how much near-infrared radiation is reflected at the surface and can be used to identify the locations of plants. On the legend above, green areas with a vegetation index closer to 1 contain plant life, while purple areas less than 0 represent areas that do not contain plant life.



Surface Temperature of Urban Areas

Come up with a research question you would like to know the answer to.

Surface Temperature Changes

Note:
For the next activity, please visit the Earth System Data Explorer directly at the following hyperlink: Earth System Data Explorer

When you arrive at the Earth System Data Explorer you should see a page similar to the image shown on the right.

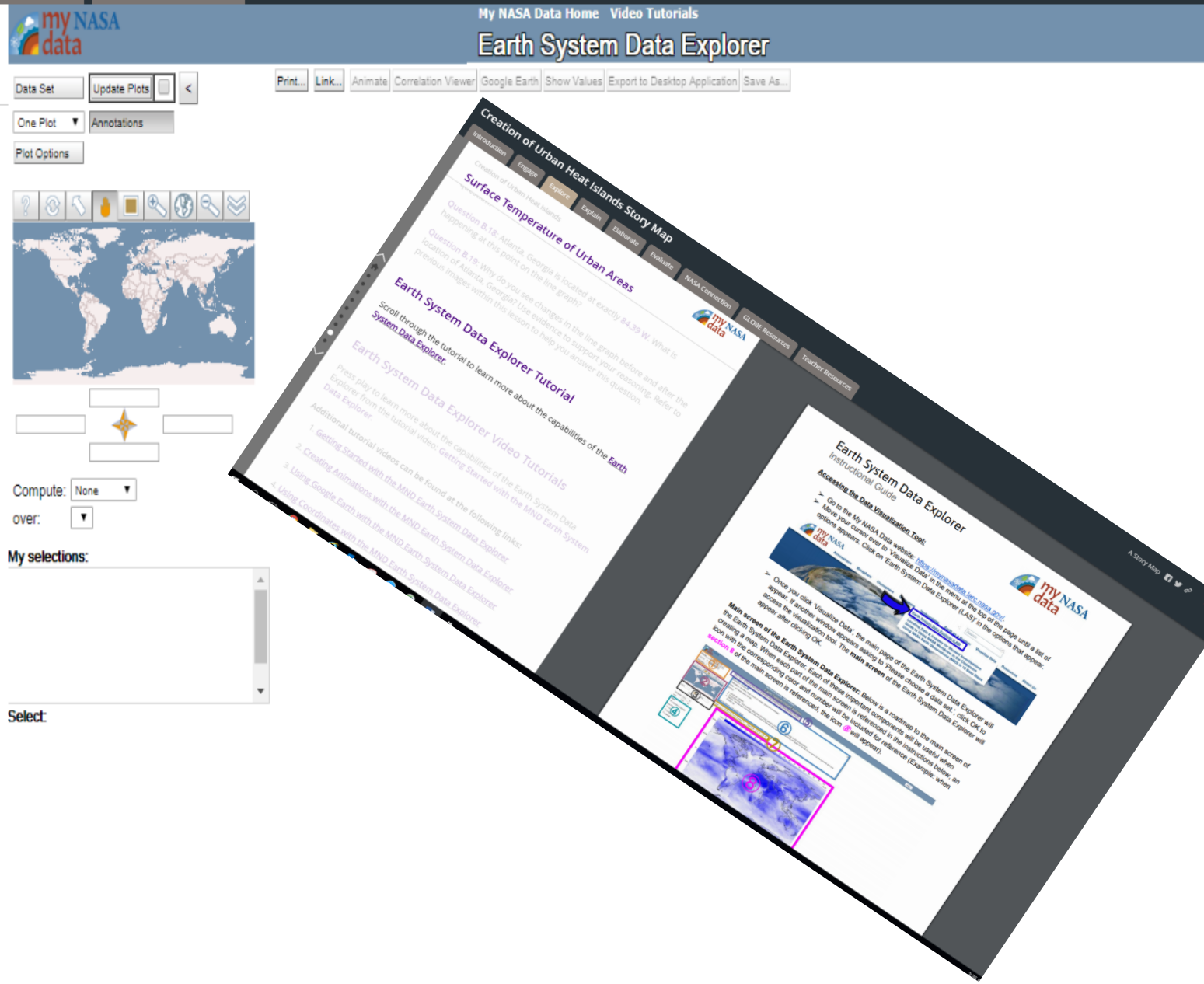
Imagine that you are the city planner for Atlanta, Georgia. You have heard about the Urban Heat Island Effect, and would like to collect data on its impact to Atlanta, Georgia. You will use the Earth System Data Explorer to make a line plot of skin temperature changes throughout the city into surrounding areas.

1. Navigate to 'Data Set', 'Geosphere', 'All Data', 'Skin Temperature', and select the data set called 'Daytime Skin Temperature'.

2. Select the option for 'Longitude Plot'.

3. Enter the coordinates '33.75 N' and '86 W' and '82 W'. Change the date to show 'July 2018'.

4. Select 'Update Plot'. Now you should be viewing a line graph of skin temperature changes along the latitude containing Atlanta, Georgia and its surrounding areas.



What Are Urban Heat Islands?

An urban heat island occurs when a city experiences much warmer temperatures than nearby rural areas. The sun's heat and light reach the city and the country in the same way. The difference in temperature between urban and less-developed rural areas has to do with how well the surfaces in each environment absorb and hold heat.

Instructions:

Watch the NASA Youtube video on the Earth's Energy Budget, review the vocabulary, and then answer the questions.

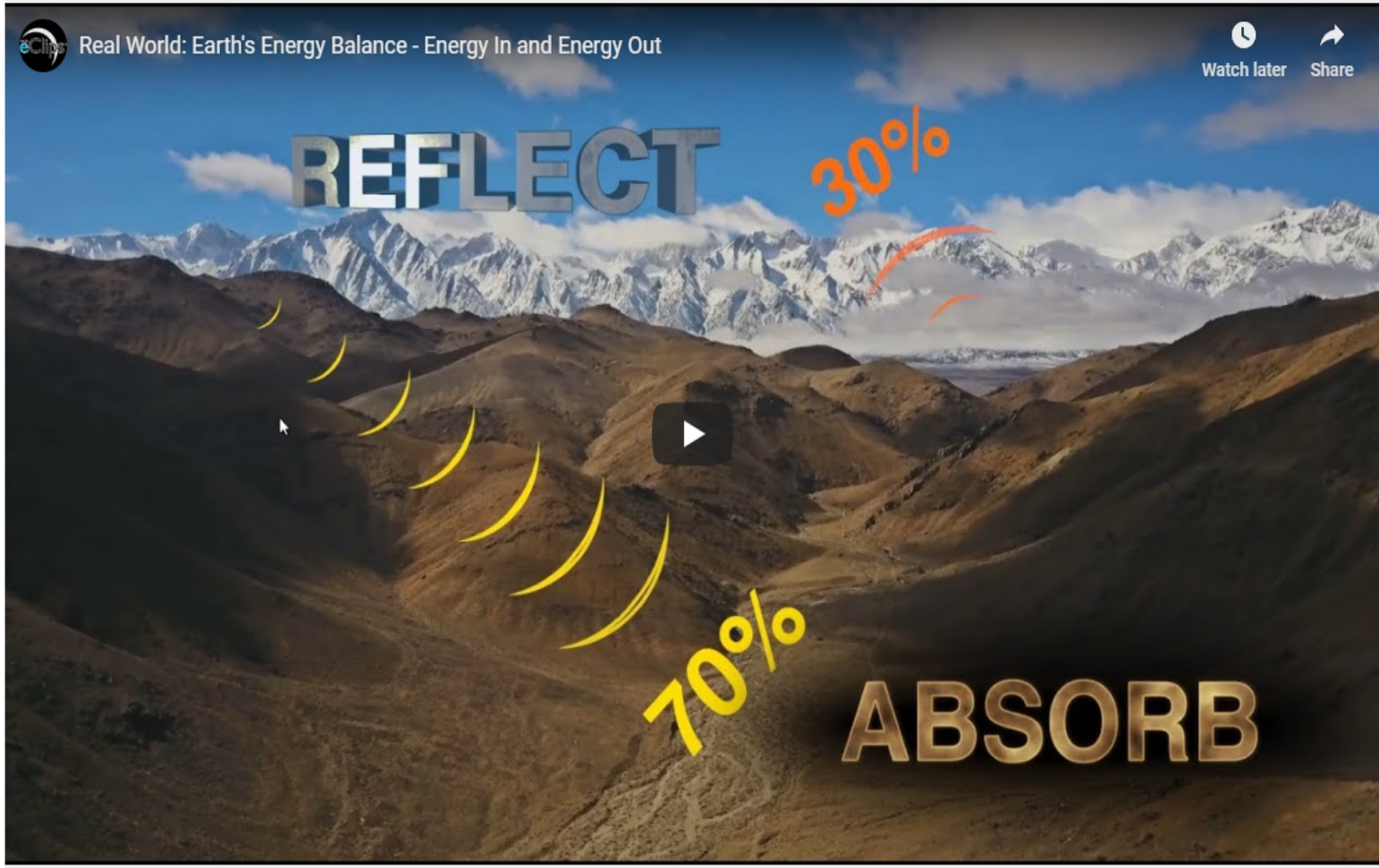
Air Temperature: Describes the temperature of air close to the surface (about 2 meters above the surface).

Albedo: the fraction of sunlight that is reflected by a surface or body (such as vegetation or a cloud)

Radiation: the emission of energy as particles or waves. X-rays, visible light, infrared, microwave, and radio waves are all examples of radiation.

Rural: A geographic area in the countryside or away from cities and towns, typically with agricultural or natural land cover.

Skin Temperature: Describes the temperature of the top few centimeters of a surface



What Are Urban Heat Islands?

Question C.4: In what form is the majority of energy released from the Earth's surface in?

Question C.5: Why does the air above hot pavement appear to shimmer?

Question C.6: How does evaporation cool the Earth's surface?

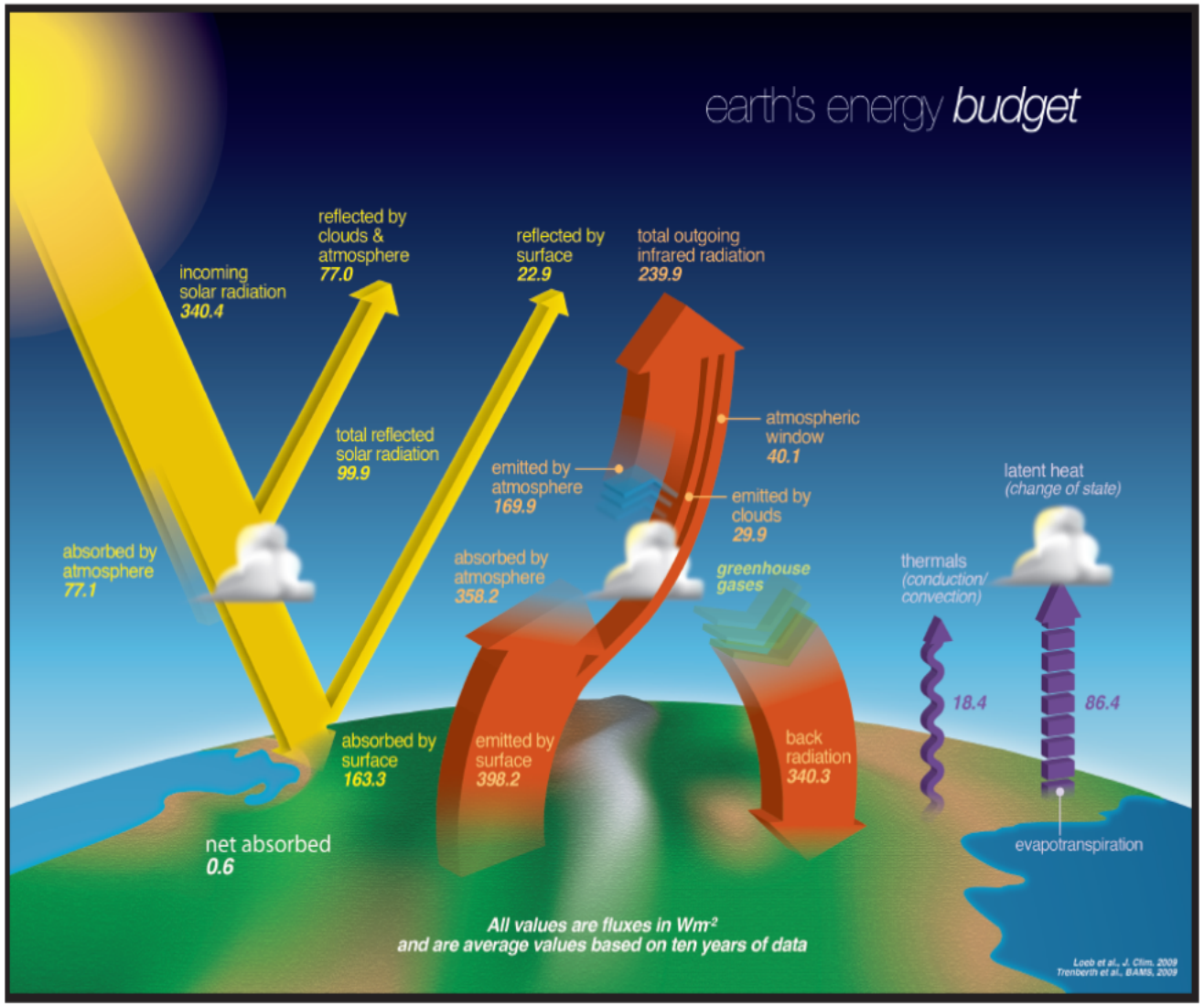
Image: Earth's energy budget describes the balance between the radiant energy that reaches Earth from the sun and the energy that flows from Earth back out to space
Credits: NASA

What is Albedo and How is it Related to Energy?

Part of the reason for differences in surface temperature over different types of surfaces comes from differences in Albedo. As mentioned on the previous slide, some materials reflect more sunlight than others. This has a lot to do with the color of the surface. Have you ever noticed that you get hotter outside in the summer when you wear black and you feel cooler when you wear white? This is the effect of Albedo.

Albedo indicates what percentage of the incoming solar radiation (sunlight) is **reflected** by a surface. The less albedo a surface has, the more energy contained in solar radiation (sunlight) is getting **absorbed**. So if the moon has an albedo of 6%, that means 6% of the incoming solar energy that reaches the moon's surface is reflected and the other 94% of the energy is absorbed by the surface.

National Aeronautics and Space Administration



www.nasa.gov

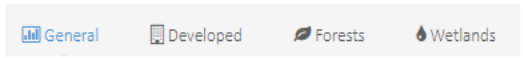
Future of Urban Heat Islands

3. Notice the legend. Based on the map alone, has there been a change in land use for this county?

La

nd Cover Changes

4. Look through the '**General**', '**Developed**', '**Forests**', and '**Wetlands**

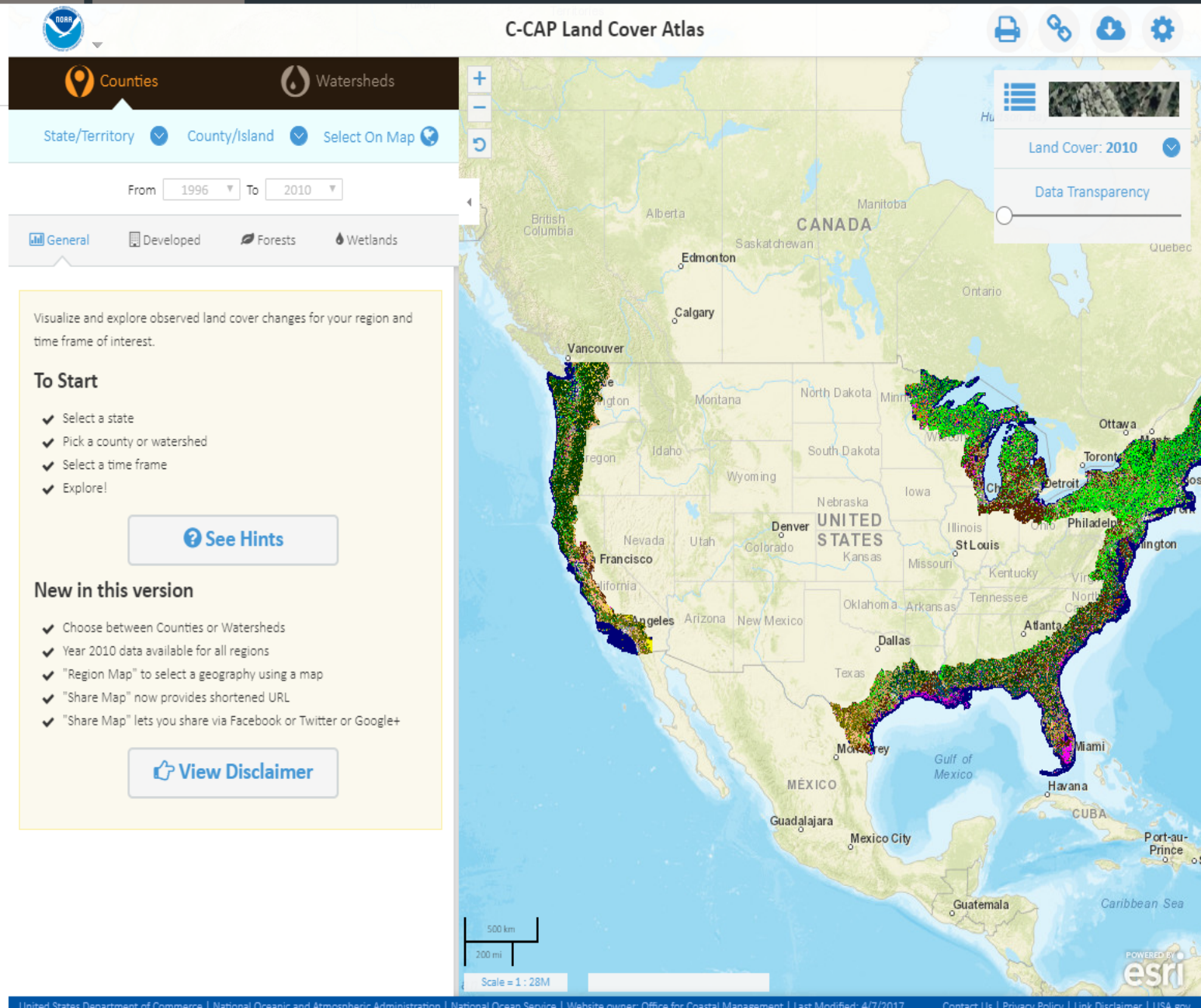


Question D.1: What is the percentage of San Diego County that has changed? (Listed under '**General**' tab)

Question D.2: Between 1996 and 2010, did development increase or decrease? By how much?

Question D.3: Between 1996 and 2010, did forested areas increase or decrease? By how much?

Question D.4: Repeat steps 1-4 for a coastal county of your choice. Look for the same results that you found in questions 1-3. How does the county you chose compare to San Diego County?



A Case Study: Peachtree Road Race in Atlanta, Georgia

Design an Experiment

As a city planner, you have been tasked with coming up with a way to alleviate the effects of the Urban Heat Island Effect for the upcoming Peachtree Road Race in Atlanta, Georgia.

You have decided that easiest way to cool the area off would be to change the material of the roofs in the area. Decide on a material and create an experiment that you could use to see if the rooftops will be effective. Fill in the blanks with information about your experiment.

Question E.3:

Material to be placed on rooftops:

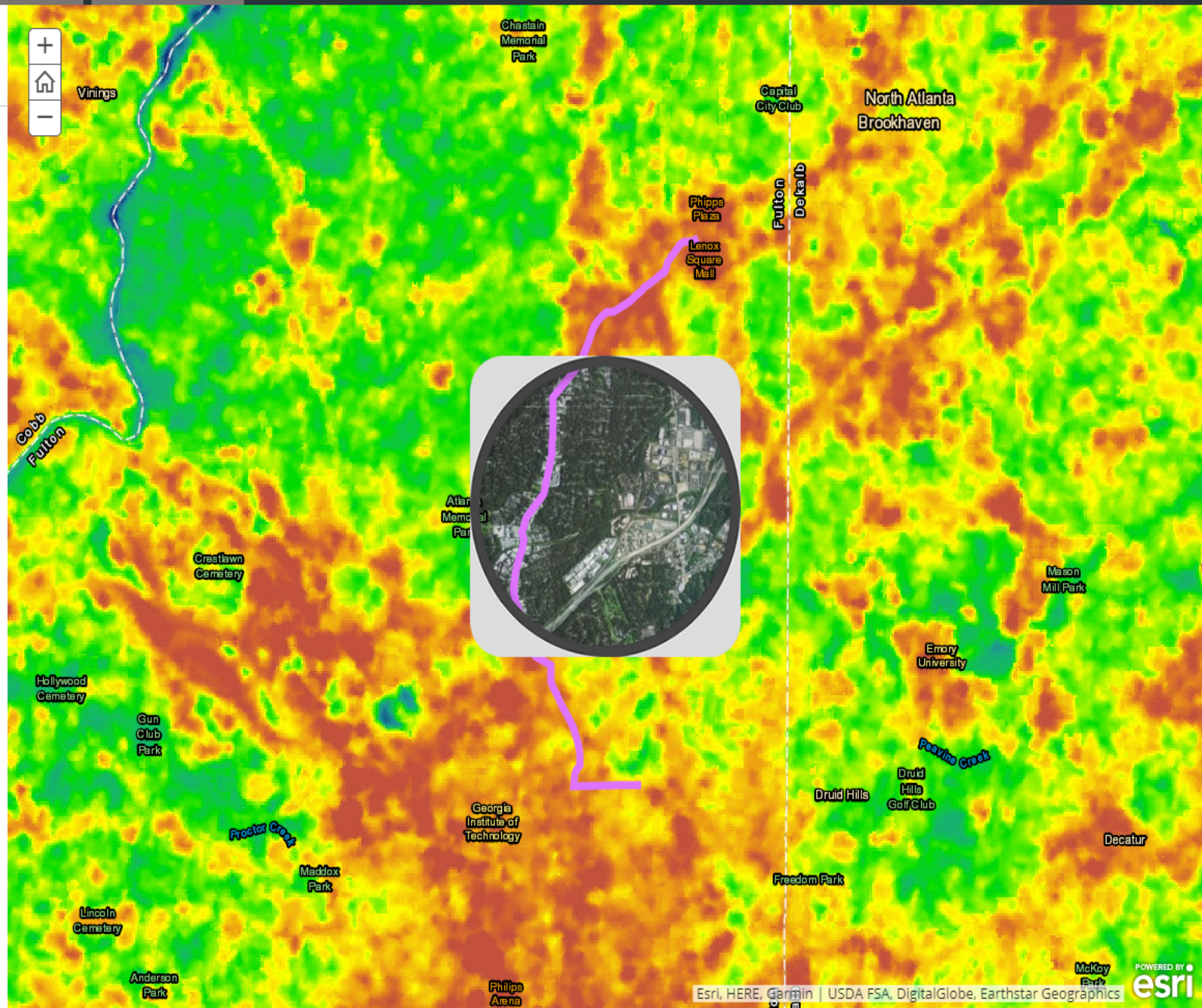
What evidence do you have to claim that this material will cool off parts of the city?

Design of the experiment: (What will you measure? How will you measure it?)

How will you measure the effectiveness of your experiment? What is your control?

Rooftop Temperatures

Shown to the right is a graph displaying the temperatures of different types of



My NASA Data

The My NASA Data website offers a variety of opportunities to explore Earth Science phenomena of the Atmosphere, Biosphere, Cryosphere, Geosphere, and Hydrosphere using uniquely NASA related content. Come and explore the site to learn about the following content types in each of the sphere pages:

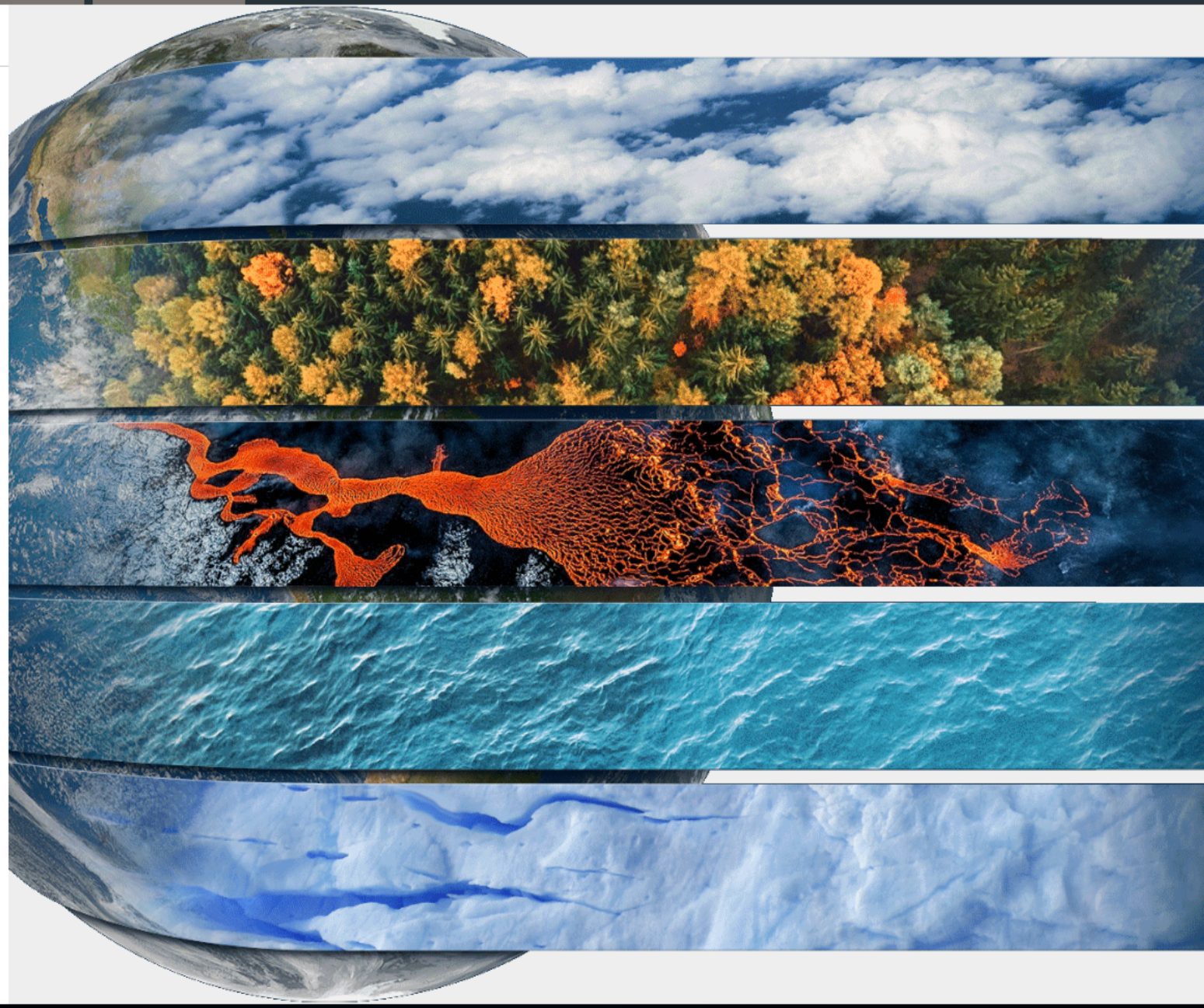
- Maps, Data, and Models
- Lesson Plans
- STEM Career Connections
- GLOBE Connections
- Data Visualization: Earth System Data Explorer
- Related Resources

Earth System Data Explorer

Learn how to visualize data on the Earth System Data Explorer using the instructional guide.

Why Does NASA Study the Urban Heat Island Effect?

NASA studies urban heat islands because they can impact human health. In the middle of an already hot summer, the urban heat island effect can be deadly



The GLOBE Program

Getting Started with the Surface Temperature Field Campaign

Overview

Urban Heat Island Effect-Surface Temperature Field Campaign is focused on looking at the impact urbanization has on the Earth's surface temperature and how the surface temperature changes the dynamics of the Earth's atmosphere. Studying the energy cycle is fundamental to understanding how the Earth's spheres function within its system. The surface temperature measurements contribute data a) not normally collected by weather agencies, b) for climate studies and c) for ground-truthing satellite data.

What Data to Collect:

Dr. C needs YOU to collect and submit the following data to GLOBE:

- Cloud Data
- Air Temperature
- Surface Temperature

To get started, use the following links to download the:

1. Surface Temperature Field Campaign Teacher's Participation Guide
2. Surface Temperature Protocol
3. Surface Temperature Data Sheet
4. Surface Temperature eTraining

Questions?

Contact Dr. Kevin Czajkowski, kevin.czajkowski@utoledo.edu

Surface Temperature Protocol

Purpose

To measure surface temperature.

Overview

Surface temperature is measured with a hand-held Infrared Thermometer (IRT) that, when necessary, is wrapped in a thermal glove or has been placed outdoors for at least 30 minutes prior to data collection. The instrument is pointed at the ground to take surface temperature readings. *Cloud Protocols* are performed along with the *Surface Temperature Protocol*.

Student Outcomes

Students will learn to use an infrared thermometer, and understand how different surfaces radiate energy.

Science Concepts

Earth and Space Sciences
- Clouds affect weather and climate.
- The diurnal and seasonal motion of the sun across the sky can be observed and described.
- Materials from human societies affect the chemical cycles of Earth.
- The Sun is a major source of energy for Earth surface processes.
- The Sun is a major source of energy at Earth's surface.
- Solar isolation drives atmospheric and ocean circulation.

Physical Sciences
- Heat transfer occurs by radiation, conduction, and convection.
- Light radiation interacts with matter.

Life Sciences
- Sunlight is the major source of energy for ecosystems.
- Energy for life derives mainly from the Sun.

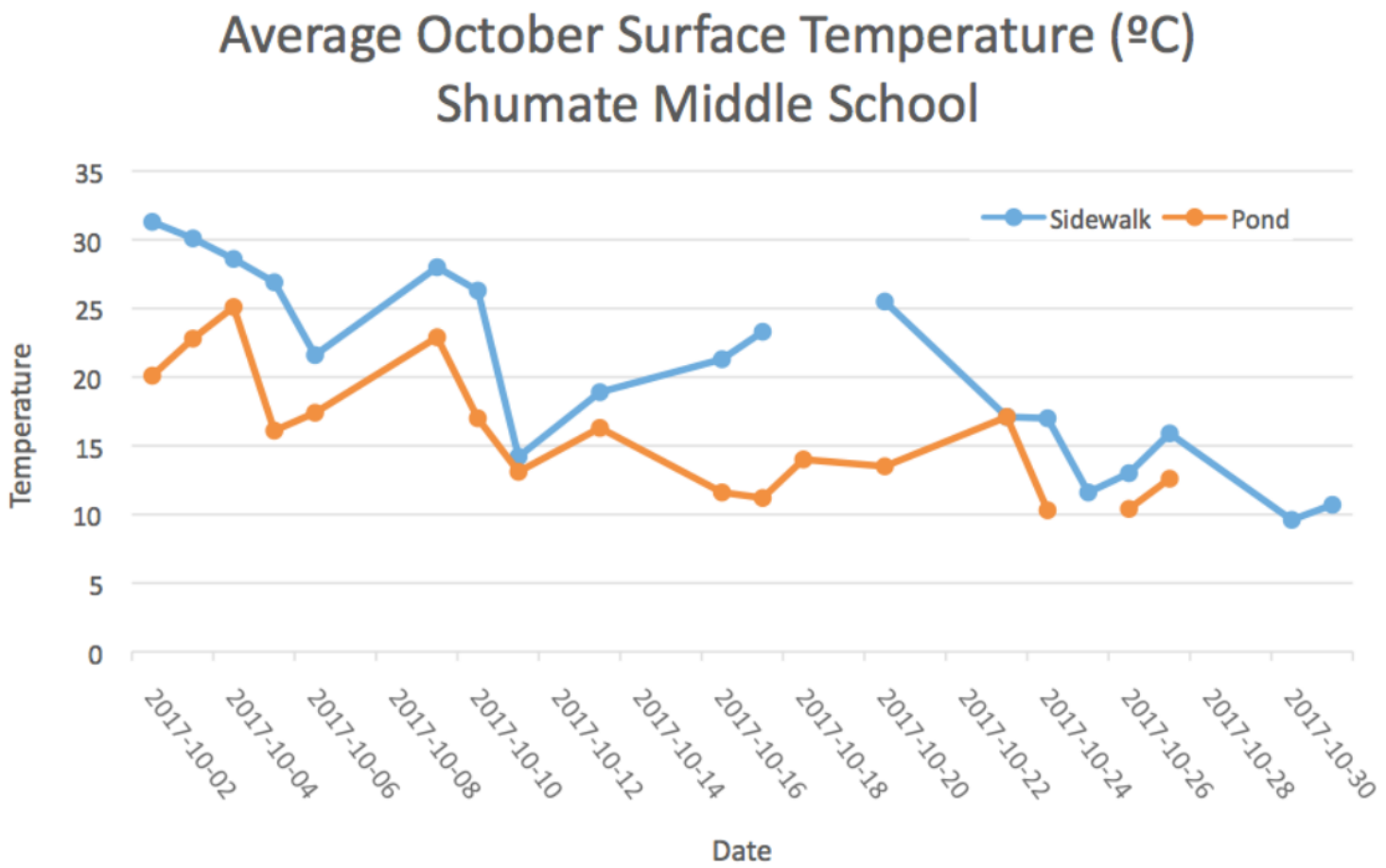
General Science
- Visual models help us to analyze and interpret data.

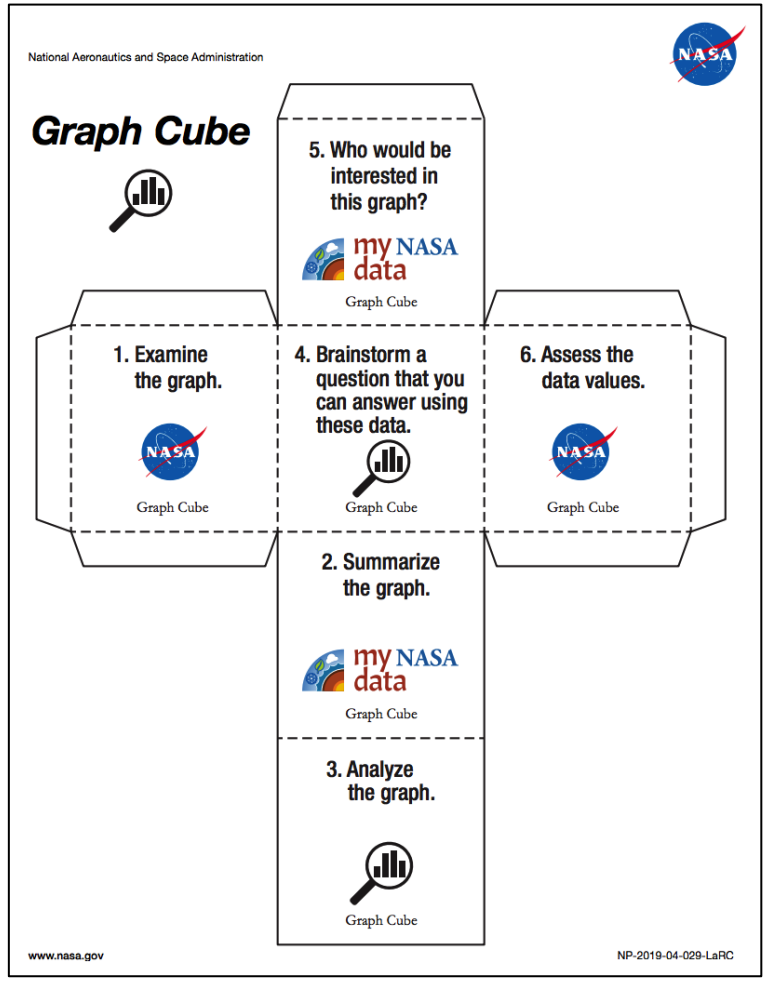
Geography
- The temperature variability of a location affects the characteristics of Earth's physical geographic system.
- The nature and extent of cloud cover affects the characteristics of Earth's physical geographic system.
- The nature and extent of precipitation affects the characteristics of Earth's physical geographic system.
- Human activities can modify the physical environment.

Scientific Inquiry Abilities

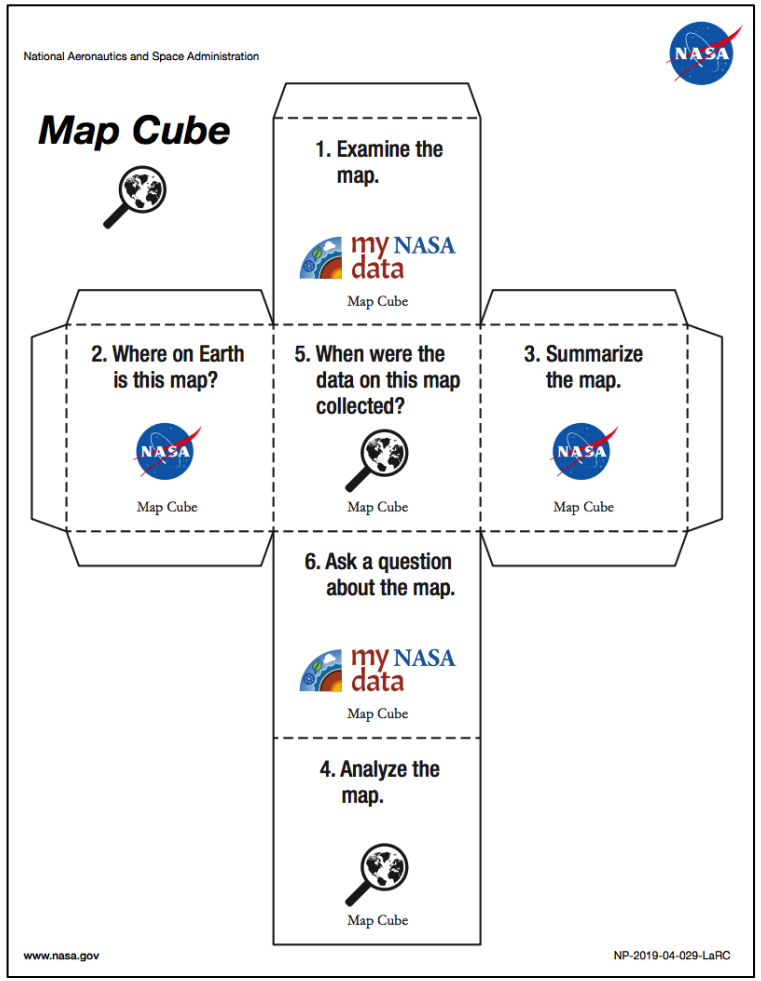
Inquiry skills
- Students will learn to use an infrared thermometer.
- Use appropriate tools and techniques.
- Identify answerable questions.
- Design and conduct scientific investigations.
- Use appropriate mathematics to analyze data.
- Develop descriptions and predictions using evidence.
- Recognize and analyze alternative explanations.
- Communicate procedures, descriptions, and predictions.
- Use a thermometer to measure

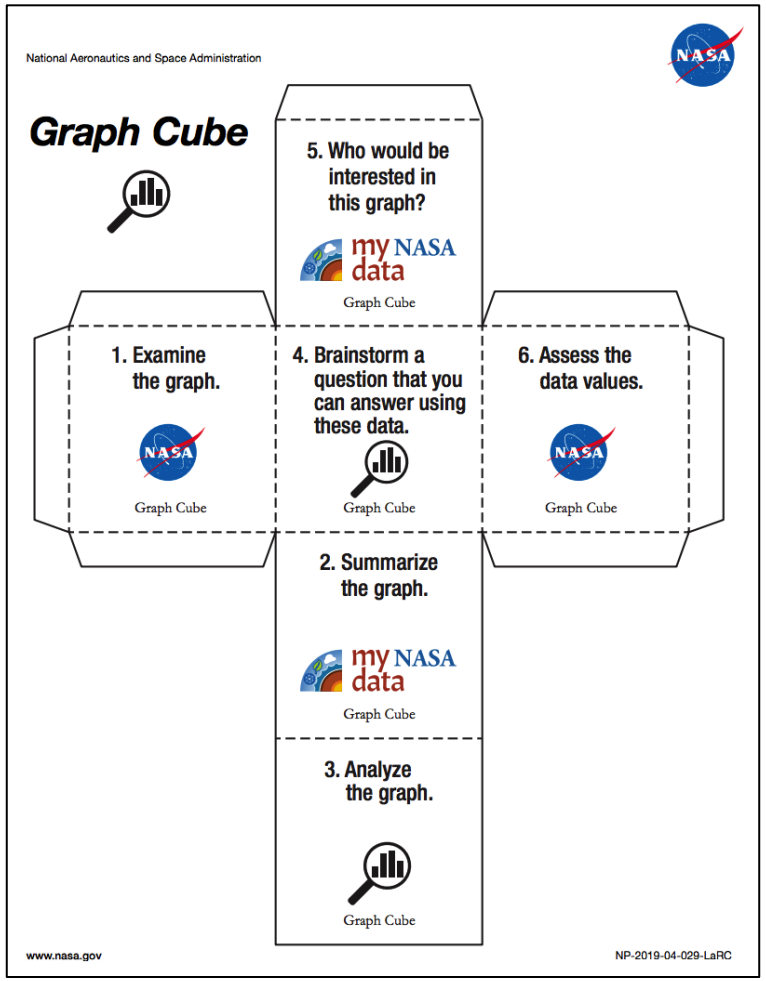
Activity: Analyze Shumate Middle School Data – using Data Literacy Cubes

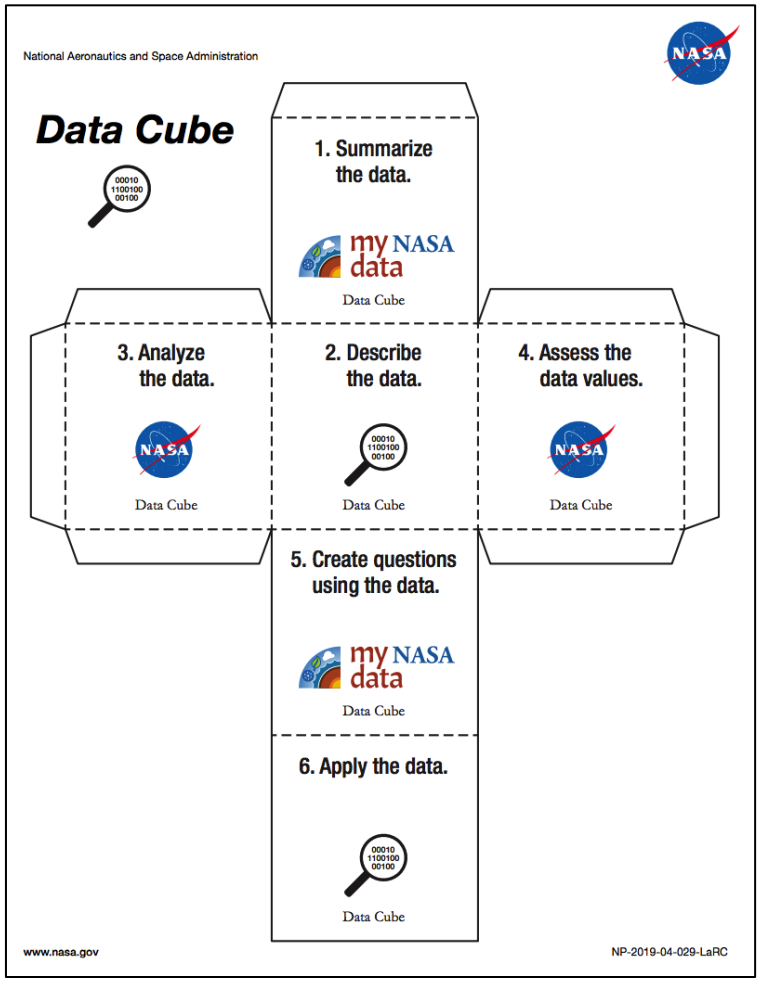




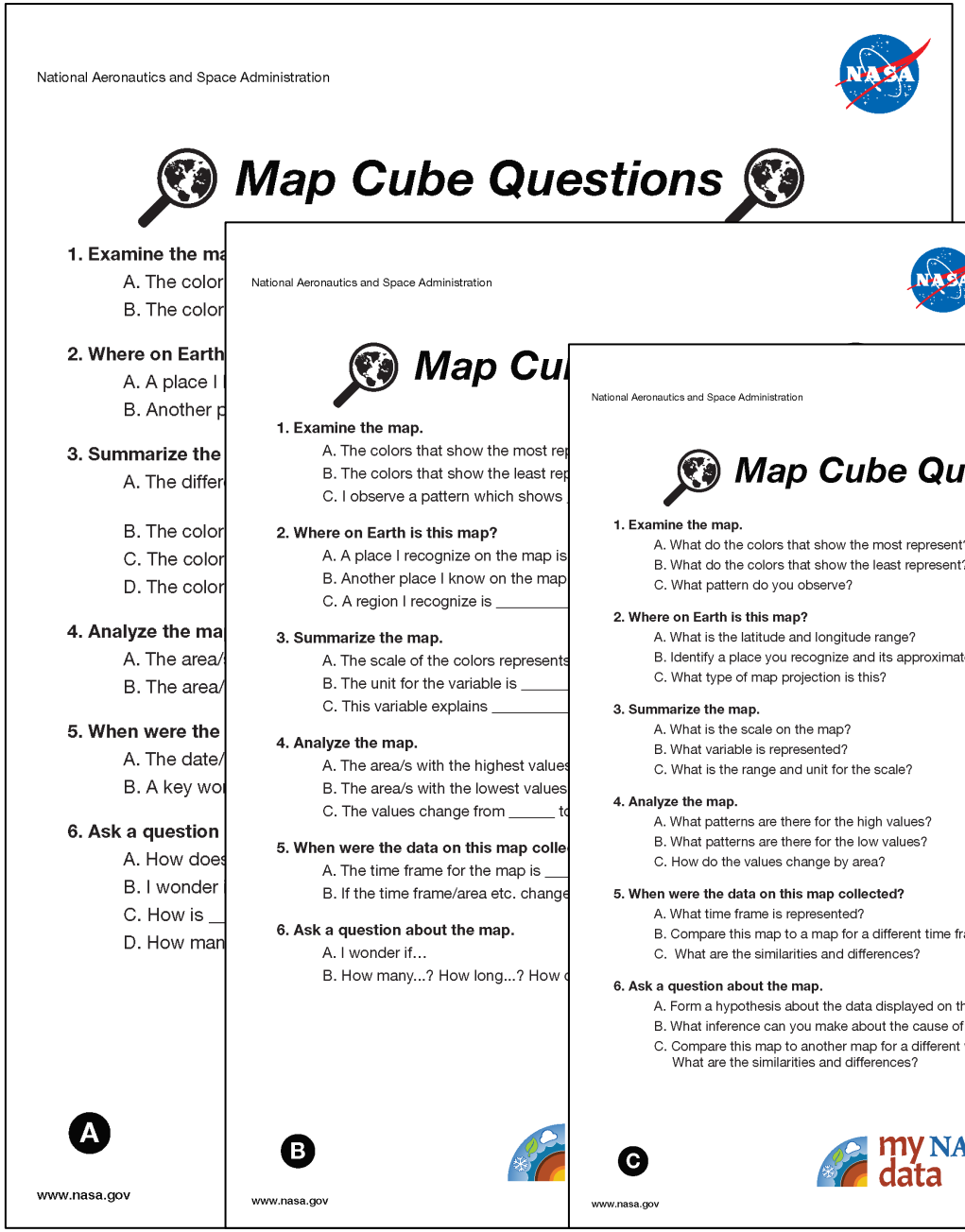
Data Literacy Cubes

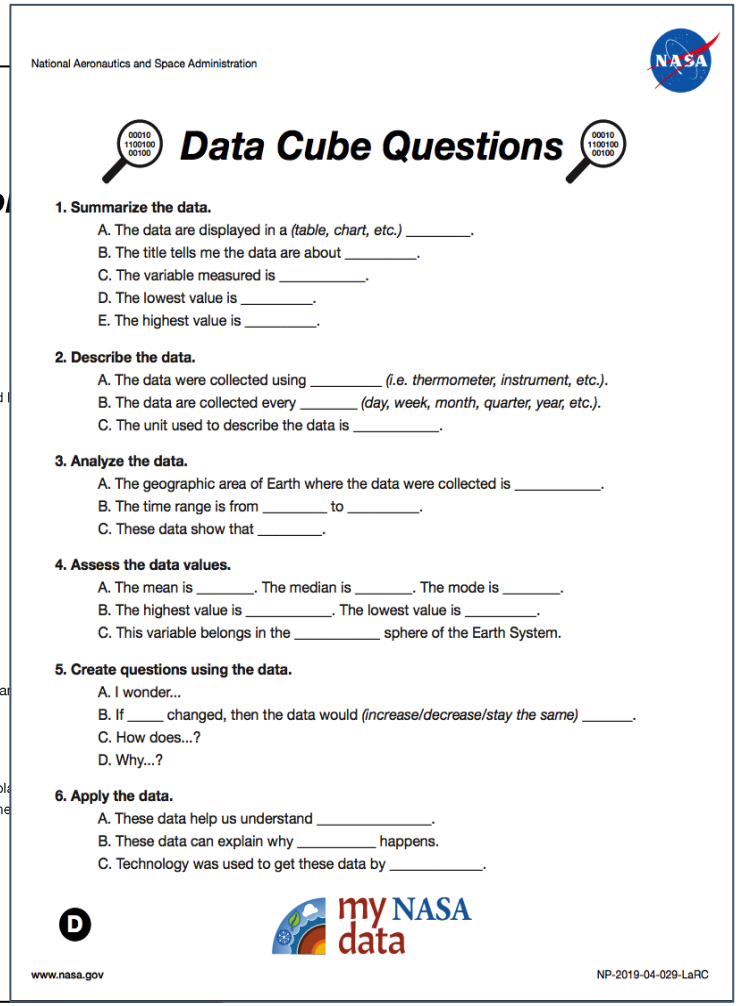






Data Literacy Cube Questions





Beginner A

Intermediate B

Advanced C

English Language Learners D

Graph Cube Activity

- Divide into groups
- Use Shumate Middle School Graphs
- Use the Graph Cubes and one differentiated question sheet from your table
- Explore these maps using the cube and cards as your guide
- Share out (End by 11:10 AM)

Setting students up for success:

1. What modifications may you want to make?

2. What should students be doing?
   How will they demonstrate success?

3. How do we measure success?

Keeping the End in Mind for your Students

International Virtual Science Symposium (IVSS)

Research Question Progression

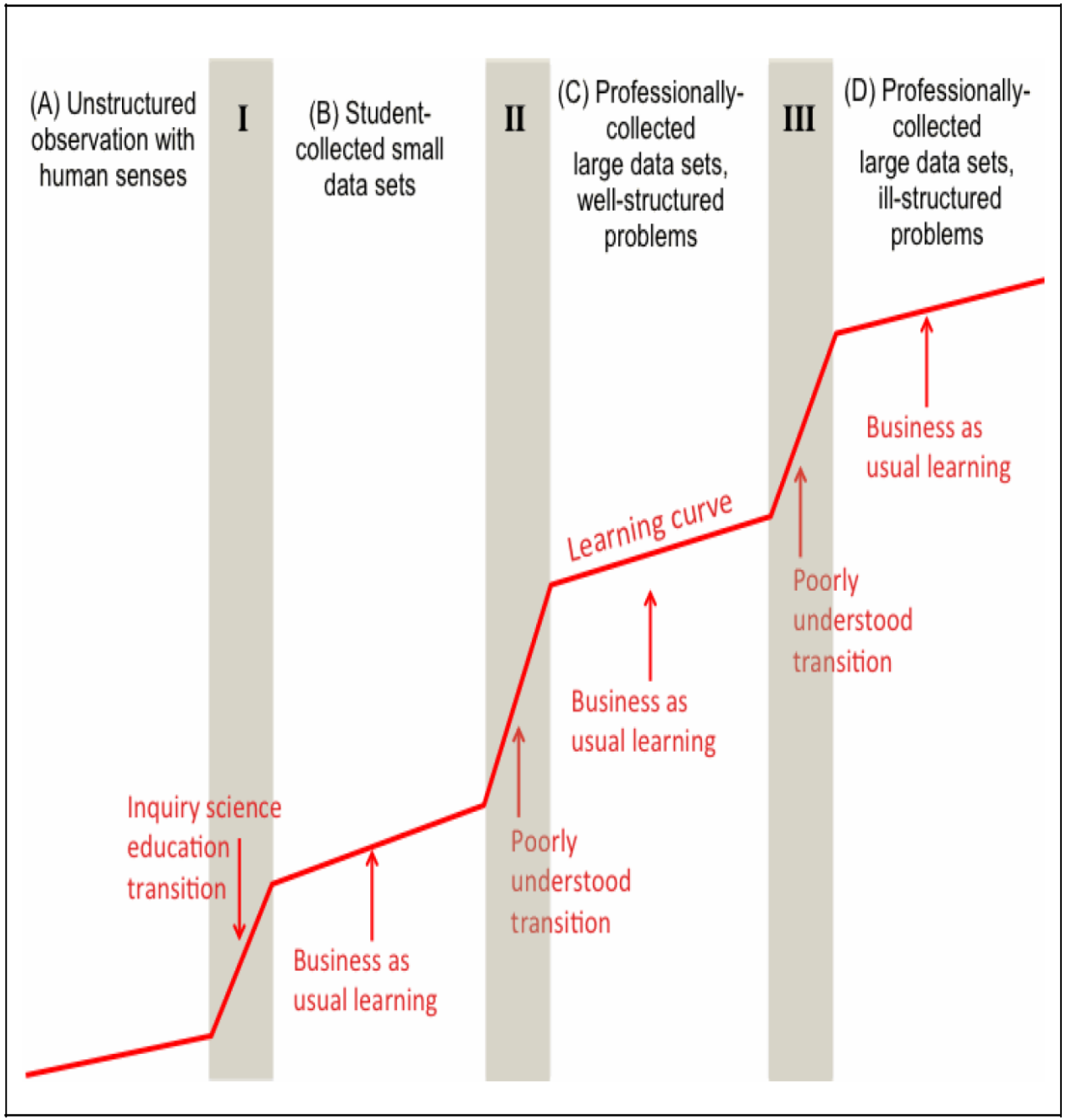


Figure 1 sketches the broad outline of a sequence of stages that could culminate in an individual who can use large, professionally collected datasets to solve the sort of ill-structured, complex problems that abound in adult life.

In domains (A) and (B), people are directly engaged with materials and phenomena of the real world, whereas in domains (C) and (D) they are engaged with representations.

IVSS Planning Guide

STUDENT OUTCOME: Students will be prepared to submit to their research to the GLOBE International Virtual Science Symposium.

(RUBRICS Link is at the bottom of document.)

TIMELINE IVSS:

☐ **12 weeks prior to IVSS deadline: Assign Groups:**

- Student groups assigned
- Research question assigned to student groups

☐ **10-11 weeks prior to IVSS: *The Research Question and Revision of Research Question***

- Three types of Research Questions:
  - **Descriptive.** When a study is designed primarily to describe what is going on or what exists.
    - Public opinion polls compared to GLOBE data can be used to describe we are simply interested in describing something.
  - **Relational.** When a study is designed to look at the relationships between two or more variables.
    - How does ___ and ___ compare?
  - **Causal.** When a study is designed to determine whether one or more variables causes or affects one or more outcome variables. n
    - What affect does ___ have on ___?
- Write a one sentence HYPOTHESIS that answers your question.

☐ **4-9 weeks prior to IVSS: *Collect Data and UPLOAD to GLOBE website***

- Determine equipment need to perform field work
- Design data collection plan
  - Determine frequency of data collection
  - Decide where will data be collected
  - Identify who will collect data
  - Identify who will enter data into GLOBE database
- Data Collection from:
  - Field work from data collection plan
  - GLOBE Visualization Tool
  - NASA Satellite data/images

☐ **6 weeks prior to IVSS: *Write Introduction***

- Obtain poster template and IVSS rubric
- Write about the following:
  - Describe the problem you are trying to solve
  - State of the science of your topics
  - Why is this research important to your group?
  - What is the community connection of your research?

☐ **5 weeks prior to IVSS: *Write About Your Research Method***

- Write about the following:
  - Describe what you did for your research.

IVSS Submission Webpage

Home > News & Events > Events > Virtual Science Symposia > 2019 International Virtual Science Symposium > Instructions

Share

2019 International Virtual Science Symposium

- Instructions
- Rubrics and Badges
- Resources
- FAQs
- Virtual Science Symposium Reports
- List of Judges
- Students Needing Mentors
- Shareable Images
- Metrics

2019 GLOBE IVSS - Instructions

Instrucciones en Español

Please send translated instructions to help@globe.gov. Thank you!

How and What to Submit:

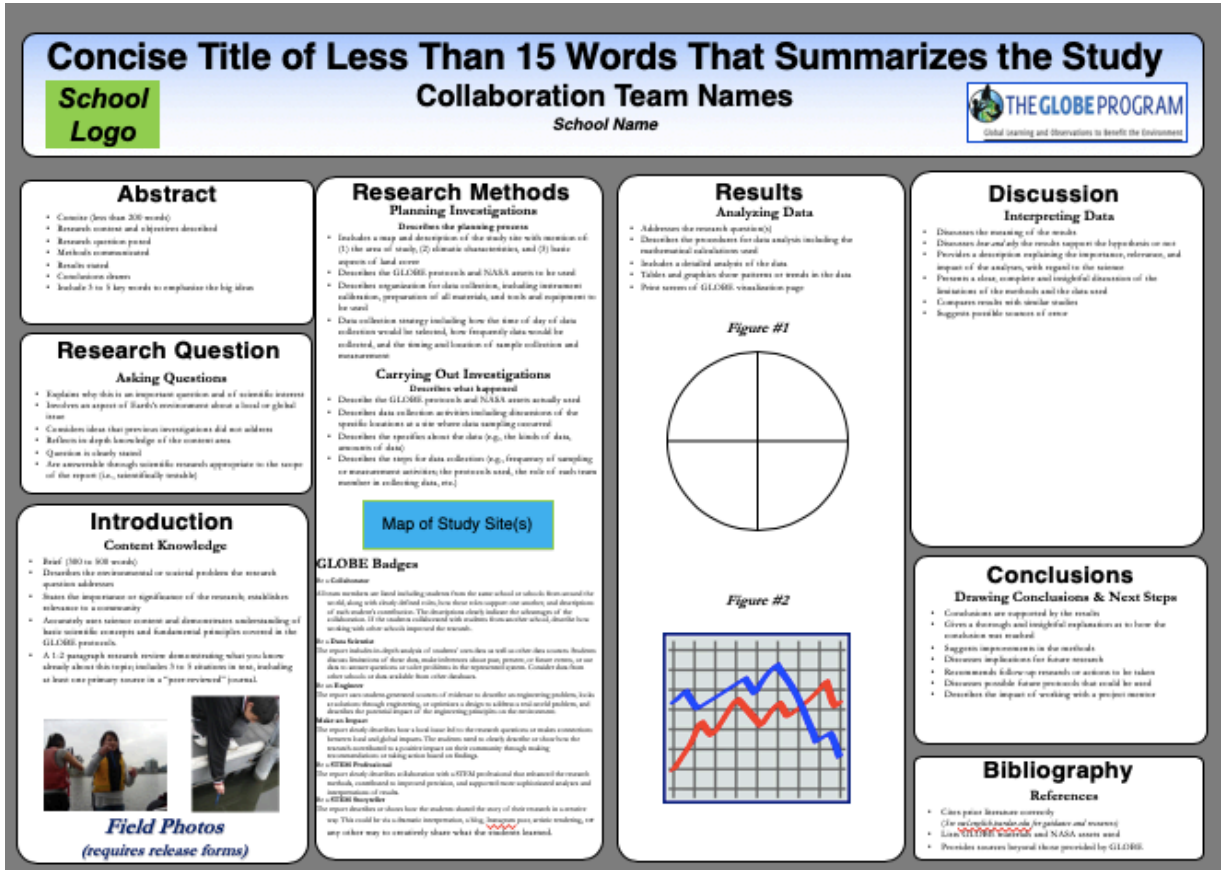
Each student project should include the following components and should be submitted via the Virtual Science Symposium Report Tool. Make sure to have all the items prepared when accessing the tool.

1. **Abstract or Summary**: A 200 word or less description of the research project.
2. **Research Report**: The complete research report as .PDF or .DOCX/.DOC. If including more than one language, make sure the report is just one file. Elements of the Research Report are described in the rubrics.
3. **Badge Description**: For any of the optional badges (you may select up to three), include a short summary of how each badge has been completed.
4. **Presentation**: Either the link to an uploaded video hosted on an online video sharing site (YouTube, Vimeo, TeacherTube, etc) or the presentation poster. Please do not upload the actual video, just the video link! Whether presented as a video, a narrated PowerPoint, or as a poster, the presentation should describe the student research. Videos should be 10 minutes or less.
5. **Thumbnail Image**: An image to be displayed with the student report.
6. **Photo Release Forms**: All individuals who appear in photos or video must send in a photo release. Save all the photo releases into one file.

Reports are due 10 April 2019. Project submitted after this date will not be scored.

https://www.globe.gov/news-events/globe-events/virtual-conferences/2019-international-virtual-science-symposium/instructions

Poster Template



https://www.globe.gov/web/united-states-of-america/home/student-research-symposia/student-resources

IVSS Rubrics

Each of the rubrics below will be used to evaluate the reports. There are required report components for each grade band. See https://www.globe.gov/news-events/globe-events/virtual-conferences/2019-international-virtual-science-symposium/rubrics-and-badges

GLOBE INTERNATIONAL VIRTUAL SCIENCE SYMPOSIUM—BADGES AND CRITERIA FOR K–2 SCIENCE PROJECTS

GLOBE INTERNATIONAL SCIENCE SYMPOSIUM
STUDENT RESEARCH BADGE (ALL PROJECTS—OVERALL REPORT)

★★★★	★★★	★★	★	
• Report contains **all** of the criteria listed below and makes clear **connections** among them. • The report is well organized, neat and well presented. • The writing is **clear** and **focused**. • The report contains the five elements required for acceptance, clearly labeled.	• Report contains **all** of the elements and **most** of the criteria listed below. • The report is well organized, neat and well presented. • The writing is **clear**. • The report contains the five elements required for acceptance, clearly labeled.	• Report contains **most** of the criteria listed below. • The report is well organized. • The report contains the five elements required for acceptance, clearly labeled.	• Report contains the **five** elements required for acceptance, clearly labeled. (1, 2, 3, 4 & 6)	• Report submitted, but does not contain all five elements required for acceptance.

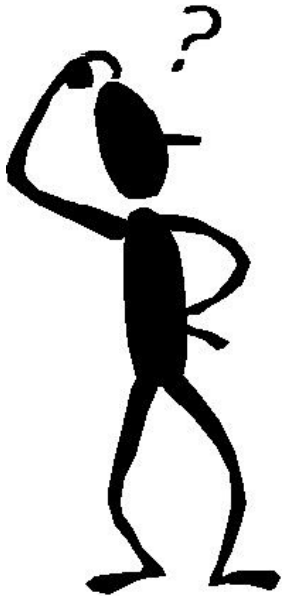
GLOBE INTERNATIONAL VIRTUAL SCIENCE SYMPOSIUM—BADGES AND CRITERIA FOR 3–5 SCIENCE PROJECTS

GLOBE INTERNATIONAL SCIENCE SYMPOSIUM
STUDENT RESEARCH BADGE (ALL PROJECTS—OVERALL REPORT)

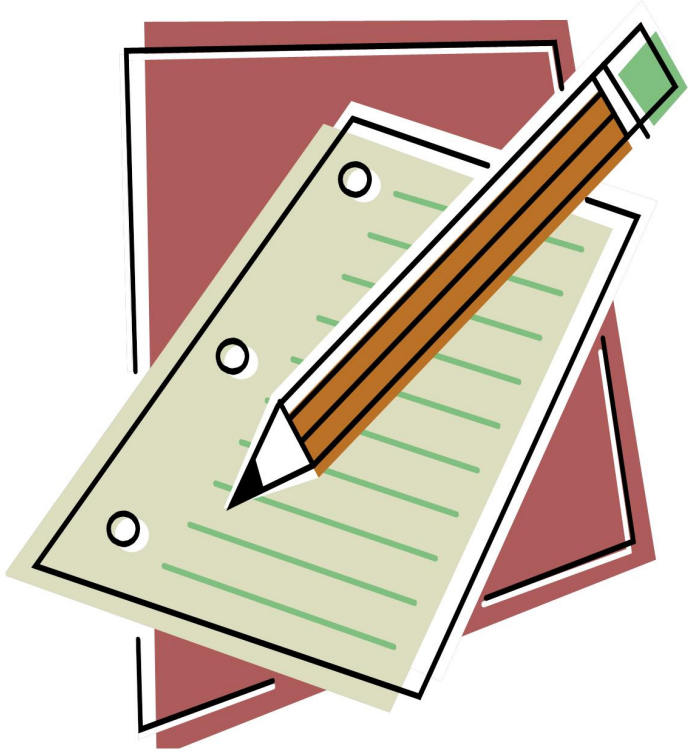
★★★★	★★★	★★	★	
• Report contains **all** of the criteria listed below and makes clear **connections** among them. • The report is well organized, neat and well presented. • The writing is **clear** and **concise**. • The report contains the five elements required for acceptance, clearly labeled. • Members of the project team respond to judges' comments with additional insights gained.	• Report contains **all** of the elements and **most** of the criteria listed below and makes clear **connections** among them. • The report is well organized, neat and well presented. • The writing is **clear**. • The report contains the five elements required for acceptance, clearly labeled.	• Report contains **most** of the criteria listed below. • The report is well organized. • The report contains the five elements required for acceptance, clearly labeled.	• Report contains the **five** elements required for acceptance, clearly labeled. (1, 2, 3, 5 & 7)	• Report submitted, but does not contain all five elements required for acceptance.

Questions

- What do you need to implement the UHIE campaign?
- How will you engage your teachers in the UHIE campaign?



Exit Slips



QR Code for GME Presentations

Contact Information

Dr. Kevin Czajkowski

GEPL Professor and PI

Kevin.czajkowski@utoledo.edu

Janet Struble

Project Manager

Janet.struble2@utoledo.edu

Website: http://www.globe.gov/web/mission-earth

Email: http://globe.mission.earth@gmail.com

Facebook: https://www.facebook.com/globemissionearth/

YouTube channel: http:tinyurl.com/globemissionearth ← webinars

Twitter: @globemissionear

The material in this document is based upon work supported by NASA under grant award No. NNX16AC54A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.