Engaging Context Data Integration
Latitude, Topography, and Surface Temperatures Lesson Update

Data Source: Using NASA Earth Observations at https://neo.sci.gsfc.nasa.gov/, students will evaluate the relationship between latitude, topography, and surface temperatures for land and water during day and night time periods. Sample student directions and images are provided at the end of this write up.

Lesson Enhancement: The data from this site will help address the underlined section of the disciplinary core idea ESS2.D: Weather and Climate which states that weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) (Achieve, 2013)

This site will be utilized early in the unit to introduce students to the relationships between latitude, topography, and surface temperatures on Earth. Using this data will enhance my current lesson because the labs we have been using for several years result in a good amount of variation in student results. Students then focus more on what they view as unreliability of lab work, equipment errors, and their peers' efforts rather than on the main concept of uneven heating of Earth's surfaces. Although a discussion on the acceptable variation in data is a worthwhile conversation, the students tend to remember that the results were confusing rather than remember that latitude and altitude affect temperatures due to uneven heating of surfaces. Since this is a major concept that is carried throughout the unit as we address MS-ESS2-4, MS-ESS2-5, and MS-ESS2-6, I am excited to use a new strategy which will allow students to come to the expected conclusion using real world data and their collaborative sense-making skills. Additionally, we have never been able to use actual lab collected data for the temperature differences associated with altitude and not all of my students have personal experiences with living/visiting mountains on which to base their knowledge.

Using this data source will also allow me to bring in the CCC dimension of NGSS lesson planning. Incorporating cross cutting concepts has been the weakest part of my lesson planning. Using data from NEO, students will be able to select many years and/or months in order to identify a consistent pattern in surface temperatures and latitudes and therefore more clearly address patterns. Using the NEO data will also provide students an opportunity to quickly evaluate any competing ideas they come up with because they can just analyze a new map or region of the map.

This update to the lesson changes the learning opportunity for students because it

empowers them to come up with the questions to ask and then decide on the maps to analyze. The previously used labs were very teacher driven and led to more confusion on the reliability of data. Overall, I think the use of the NEO data source will allow me to present a more thorough, clear, and memorable connection of the concept of uneven heating of Earth's surfaces for the weather and climate units of study.

Using Data:
Using data in the classroom is necessary in order to provide students the opportunity to make sense and build connections to concepts. Without data, students are simply memorizing isolated facts we provide. With data, students are challenged to make sense of its meaning and then use it to try and make predictions about additional situations and generate explanations. When students design experiments and collect data in class, they tend to focus on small differences in results as significant. Especially in the younger grades, like 6th grade, students do not have an understanding of statistics and reasonable error so when they conduct an experiment to get their own data, they tend to focus too much on the differences rather than recognize patterns or trends. However, teacher provided data removes the personal connection to the data that students get from gathering their own data. Using reliable online data sources collected over numerous years seems to be the answer. Students have control over the design of how they want to look at data and they are also more confident that the data is reliable and reasonable. Students have the opportunity to make sense of the data <u>and</u> have a personal connection to being involved in the discovery process.

Visual Presentation:
A benefit from using the NEO data source is that my students who typically struggle with math and science are likely to do well with this type of activity. The images are visually engaging and the mechanics of graphing are completed for them. They can easily access the information to begin making sense of it.

As already mentioned, another benefit is that students have a reliable set of data and must now use the actual science and engineering practices of data analysis and computational thinking to make sense of the data (another integration of math, science, and technology). In all my previous years of teaching this topic, students get distracted by the errors in lab design and differences in data collected. The data in this data source is much better than taping thermometers to a globe and shining a light on the globe; it is actual satellite recordings!

Interdisciplinary STEM:
Using the NEO data as described below clearly integrates science, technology, and math. I am excited to discuss with our math department the graphs that are generated as part of this data set and get their feedback on what student understanding is likely to

be. I think they will be excited to see the real world data that can be used to connect the two departments. Students will benefit because they will be learning both content areas using one assignment being bridged by the technology/data set. This gives much more purpose to both content areas and is likely to be more meaningful and engaging for the students. It will be important to include the math department in using this data because they can facilitate student learning about data analysis.

Engineering could be touched upon by having the students read the section "about this dataset" below the selected map and discussing additional devices that could be used to collect similar data. Perhaps students could design their own weather recording tools or learn how satellites work.

**Students will follow these steps initially**:
1. Click on the "Energy" tab.
2. Select "land surface temperature (day)" and select year and any month you want. Set the "view by date" to 1 month.
3. Click "add to analysis."
4. Under the "energy" tab, select "land surface temperature (night)" and select the same year, month, and "view by date" to the same setting as above.
5. Click "add to analysis."
6. Under the "land" tab, select "topography" and select the same time period as above.
7. Click "add to analysis."
8. Click the "analyze" tab in the top toolbar.
9. Select an area covering a wide range of latitudes (from the top of the map to the bottom of the map).
10. Click the blue "launch analysis" button below the image.

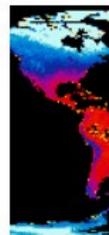1. Land Surface Temperature [Day] (1 month - Terra/MODIS) February 2017

2. Land Surface Temperature [Night] (1 month - Terra/MODIS) February 2017

3. Topography 2000
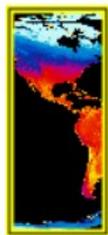
11. On the right of the screen, select the "data probe" button and scroll around the map paying attention to the different temperatures that occur at the locations. Is

there a pattern?

12. Select "plot transect" and draw a vertical line vertically from the top of the map to the bottom. Make sure the line is as straight as possible along one longitude line.

13. What patterns do you notice in the resulting graph? You can redraw the transect line slowly and watch the data being graphed to help you identify when the line changes.

Example graph:
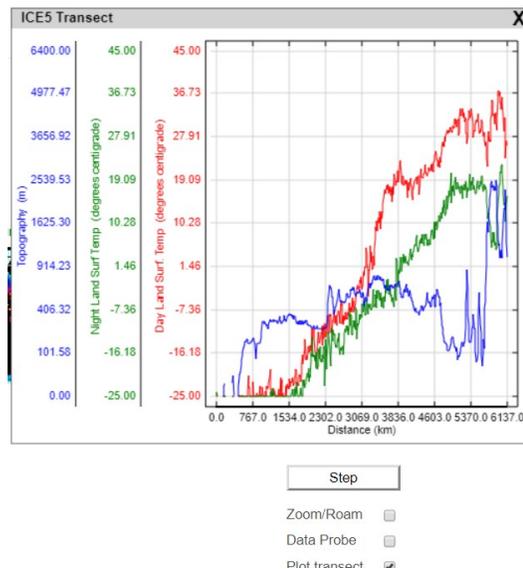
14. Select the "outline region"   tab on the right side of the page and select a region to outline.

15. Select the "scatter" tab. What does the scatter plot tell you about the relationship between the variables?

16. Select the "select region" tab and draw a square on the histogram. The square will be in pink outline and on the map a pink area will appear that corresponds to the data points on the histogram.

Topography 2000
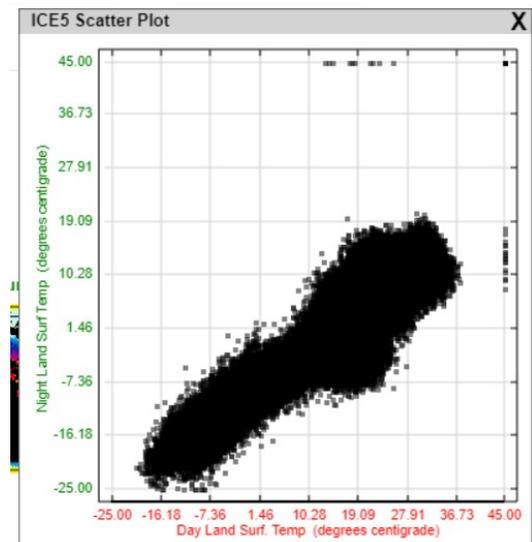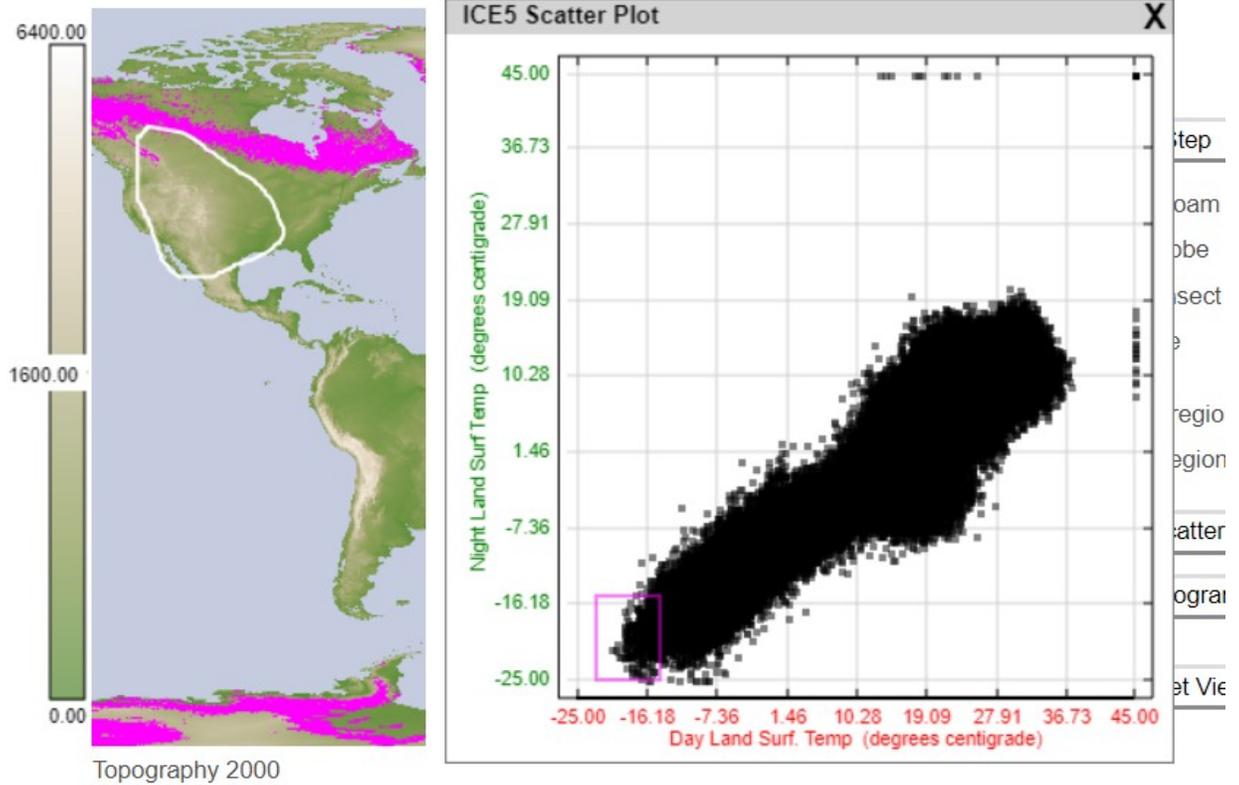
17. Using this tool, you can identify where the coolest day and night land temperatures are on the map by selecting the histogram points closest to the origin. Similarly you can identify the hottest day and night temperatures on the map by selecting the histogram points towards the upper right of the histogram. What patterns do you notice?

References:
NASA Earth Observations. (2018). NASA EOS Project Science Office. Retrieved from https://neo.sci.gsfc.nasa.gov/.

NGSS Lead States. (2013). The Next Generation Science Standards: For States, By States MS-ESS3. Retrieved from https://www.nextgenscience.org/dci-arrangement/ms-ess3-earth-and-human-activity.

Additional Resources used but not referenced:
NASA. Quick Start Guide. Retrieved from https://www.strategies.org/wp-content/uploads/2017/08/DataTable_QuickStartGuide_Final_HiRes.pdf

NASA. NEO Analysis in 10 easy steps. Retrieved from

https://neo.sci.gsfc.nasa.gov/blog/2017/03/21/neo-analysis-in-10-easy-steps/