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### Cover Image

**Icescapes of the Anzhu Islands**

This image is a mosaic using data from Landsat 8, Aqua, and Terra satellites. The Anzhu Islands are remote Siberian islands that are commonly cloaked with sea ice that changes seasonally. The image is part of NASA’s Visible Earth catalog of images and animations about our home planet.

You can read more about the image here:  
https://visibleearth.nasa.gov/view.php?id=144323

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[https://www.facebook.com/mestarocks/](https://www.facebook.com/mestarocks/)  
President’s Letter, December 2018

Hello MESTA Members!

The Greenhouse Effect, Global Warming, Climate Change. During my teaching career, the terms have changed and so has how people perceive this concept. When Al Gore’s movie, *An Inconvenient Truth* premiered in 2006, it revolutionized how the common person viewed climate change. Before this Oscar award winning movie, climate change was not in the mainstream media. But then in 2006, just about every Earth Science teacher in the country received a free DVD of *An Inconvenient Truth* in their mailboxes. The movie was being discussed between children and parents. The topic was being brought up everywhere. This was the beginning of my personal conceptual change as well.

When I first started teaching about Global Warming, I thought, “climate has always been changing on Earth. Look at the Mesozoic, global temperatures were way hotter than today. This is a natural part of Earth’s cycle.” Many years have passed and more and more data has been collected. The topic is not just for scientific circles, most American people have an opinion about it. I would expect that all of our students have heard the term. The more research I did into the matter, the more my mind-set was changing. My view has now shifted to, “the temperature is increasing way too fast; this must be a result of human activity.”

Like so many topics today, climate change has become a divisive issue. It seems that if you vote for one political party you are either for or against climate change. My personal opinion is that you can’t be “for or against” scientific data. We owe it to our students to present the science behind climate change; such as the amount of greenhouse gases vs. temperature change seen in the Vostok Ice Cores. Or the computer models showing future sea levels and the science behind what was involved in creating these models. Students need to know the difference between weather and climate. Students need to know the changes a warming planet will experience. Please do not shy away from teaching climate change. There are a multitude of teaching resources regarding this topic. (PLEASE CONTINUE TO READ THIS JOURNAL FOR SOME EXAMPLES) Our students need to be informed citizens.

Lisa Bouda, MESTA President

Our oceans continue to warm as they act as a sink for excess heat from the atmosphere. This trend is accentuated in the Arctic region, where impacts will be felt soonest. Check out the activity on thermal expansion of seawater later in this issue!
### MESTA Board Meeting  
**December 1, 2018**

Members in attendance: Lisa Bouda, Carrie Cook, Cris DeWolf (Via Zoom), Peter Voice (Via Zoom), Andrea Williams, Jay Sinclair, Parker Pennington IV, Shawn McNamara, Chuck Schepke (Via Zoom), Dave Chapman, Kevin Dehne (Via Zoom), Reggie Mulligan, Sherry Claflin (Via Zoom)

#### Saturday – December 1, 2019: 977 Broadstone, Grosse Pointe Woods

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>What We are Doing</th>
<th>Notes / Discussion Points / Actions to Be Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 – 10 min</td>
<td>Review Agenda / Last Board Minutes</td>
<td>Discuss</td>
<td>Dave moved to approve minutes from September minutes. Parker seconded it. Parker asked if these minutes were being published in Michigan Earth Scientist. Cris confirmed that they are. A concern was made that the minutes were being published before they were approved by the board. Minutes will be approved electronically in the future to avoid this. Lisa will make this happen. Minutes were approved unanimously. Agenda was approved by the board. Jay moved to approve. Dave seconded. Vote passed unanimously.</td>
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<tr>
<td>10 min</td>
<td>Rock Shop (Parker)</td>
<td>Discuss / Recommended Action</td>
<td>MSTA in Grand Rapids on March 1 &amp; 2, 2018: Parker was concerned with the member participation in Rock Shop in Grand Rapids. Sherry, Andrea, Cris, Jay, Parker, Peter, and Chuck are confirmed to help. It is possible that Kevin and Bill could help out. TBD Lisa will send out an email to the membership to encourage people to participate. Help is needed Thursday - Saturday, respond with the day you will be willing to help. It was suggested that the email be sent in January and February.</td>
</tr>
<tr>
<td>5 min</td>
<td>Treasury (Andrea)</td>
<td>Discuss / Recommended Action</td>
<td>A concern was raised about the grant money in terms of combining the register proceeds from F&amp;I and Rock Shop. Andrea suggested, as a possible solution to account for F &amp; I sales, could we just “earmark” a certain amount off the top of total sales (say $1000) to be set aside for awards and grants BEFORE calculating the 70% that goes back to Rock Shop at the start of the year. Decision was made that we will keep running only one register and the allocations as is. If the number of grants increase in the future, we will revisit this issue.</td>
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<tr>
<td>10 min</td>
<td>Membership (Ardis)</td>
<td>Discuss / Recommended Action</td>
<td>98 Life members - 215 members Parker proposed that we figure out a way to keep the people who have the one year free membership after that membership has expired.</td>
</tr>
<tr>
<td>5 min</td>
<td>F &amp; I Report (Chuck)</td>
<td>Discuss / Recommended Action</td>
<td>Judy and Bill will continue collecting for F &amp; I, and Chuck will transport them back and forth. Will be up and running for MSTA.</td>
</tr>
<tr>
<td>20 min</td>
<td>OESTA / Salotti (Andrea/Chuck)</td>
<td>Discuss / Recommended Action</td>
<td>Kaz has been notified this week about winning the Salotti award and he said is very honored and humbled. I plan to contact the chairman of the department, dean of the college of natural sciences, and the university president after the board meeting. I have told him and Ted Bornhorst/Seaman Mineral Museum/MTU that the awards banquet was Friday evening per se what we agreed on in the last board meeting. There was some confusion as to contacting Rod about his award. E-mails were sent out, but no response. Lisa and Andrea are working to contact him. In any</td>
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case, it was decided that both awards would be presented on March 1st during the MSTA conference.

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<tr>
<th>15 min</th>
<th>Kits (Maria)</th>
<th>Discuss / Recommended Action</th>
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|        | Looking to make a new set of inexpensive but effective rock kits sets for teachers to purchase at MSTA. This set will contain a dichotomous key and 8-12 samples for students to sort in groups sorting based of igneous, sedimentary, and metamorphic rocks. Below is a list of categories and possible samples to use in those categories from the following characteristics and types:  
  **Igneous**  
  - vesicular/porosity extrusive (scoria or pumice)  
  - large crystal intrusive (pegmatite, granite, gabbro, or diorite)  
  - small/no crystal extrusive (basalt, rhyolite, obsidian)  
  - high silica (rhyolite, diorite)  
  - low silica (basalt, gabbro)  
  **Sedimentary**  
  - chemical (limestone, halite, chert)  
  - organic (coal, fossiliferous limestone, amber)  
  - clastic (shale, conglomerate, breccia, sandstone)  
  **Metamorphic**  
  - foliated (slate, phyllite, schist, gneiss, jaspilite)  
  - non-foliated (quartzite, marble)  
  If anyone has other suggestions or samples we can easily source, I will be happy for the ideas. I am hoping to make 30-50 kits (So that teachers can purchase multiple sets) for MSTA. What I really just need is help getting samples to put in the kits. Pricing will be based on cost of materials in kits, but I would like to keep them very affordable for teacher’s budgets.  
  Lisa will have Maria put a Help Wanted ad in the E-news. Kevin will also look at the list to see what he has. Carrie will work with Maria to develop a lesson plan to go along with the kit. |

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<tr>
<th>15 min</th>
<th>Cave Geology Field Trip (Dave C.)</th>
<th>Discuss/Recommended Action</th>
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|        | Dave went over the tentative itinerary for the field trip.  
  **Issues:**  
  1. Food - Can the people who stay at the facility make meals? Especially breakfast. This would save time and money. Kevin and Sherry said that they would be willing to be in charge of two of the breakfasts. We are looking to have two diners at the facility. One bring in outside food, and the other cook. Cost for trip per person is around $125.  
  2. Scheduling activities: Offer times for people to do things on their own. Distillery will have to be scheduled as a group tour. Refunds? When will money be due? |

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<th>10 min</th>
<th>MESTA (Dave, Peter, Sherry)</th>
<th>Discuss/Recommended Action</th>
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|        | It looks like the best dates for our fall conference will be October 4 and 5. We have Mona Shores middle school for our venue on Saturday thanks to Matt Schu. On Friday, I have GVSU Annis Water Resources Institute for 2 Research vessel trips to do water quality testing in Muskegon Lake and Lake Michigan (weather contingent for Lake Michigan) each trip is 2.5 hours. (Times are flexible, but suggested 9:30 to 12 and 1 to 3:30. Boats can hold 28 max.) Cost TBD.  
  Using AWRI for lunch in the Multipurpose room on site. I have contacted the wastewater facility for a tour on Friday morning, October 4. We can also do a Dune study along the shoreline in the pm opposite the research vessel at PJ Hoffmaster State Park or Muskegon and Duck Lake State Parks. This will allow people who do not want to go on the boat trip both a morning and afternoon |
activity.
I’d like to talk about where you would like to hold the Friday evening awards - dinner. I’d like to hold it at the Observatory - basically in the Barn and open the Observatory for viewing after the dinner as an additional fun activity for people. I know this doesn’t match the water theme we are going with, but it is another activity that people may enjoy. Or we could hold it at Mona Shores. I am also in the process of contacting AGU for Earth Science Week toolkits. Since our conference will kick off Earth Science week 2019, it might be really cool to give everyone the toolkit as part of their registration.

F&I and raffle will be there.

We need a keynote speaker. Sherry has some ideas. Peter is willing to do one of the sessions at the conference. Sherry will be working on a flyer to take to MSTA - Hopefully by February’s meeting.

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<tr>
<th>10 min</th>
<th>MSO (Sheila)</th>
<th>Discuss / Recommended Action</th>
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<td></td>
<td>Do we want to donate money to MSO or have a volunteer to score the event? Looks like volunteers is not an option. Cris added a Help Wanted section on Facebook to see if we can get some people to help. People should contact Lisa if they are interested in helping.</td>
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<tr>
<th>10 min</th>
<th>MESTA Listserv (Parker)</th>
<th>Discuss / Recommended Action</th>
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<td>Parker recommended that people already on the NESTA boards with the appropriate account be the ones that will manage the listserv. (Parker, Jay, and possibly Ardis). Seems that this will possibly be a smooth transition. Parker will provide an article in the E-News about the changes in the in the listserv.</td>
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<tr>
<th>5 min</th>
<th>Michigan Section, American Institute of Professional Geologists (Peter)</th>
<th>Discuss / Recommended Action</th>
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<td>I met with Amy Hoeksema after their meeting last night. She is their incoming president. She wants to develop resources for teachers – including a guest speaker program. Teachers would be able to sign up for guest speakers from their membership (a variety of more applied geoscientists – hydrogeologists, environmental geologists, state regulators, etc.) This could be in E-News or on Facebook page when up and running. Lisa will be in contact with Amy to discuss how to set something up through MESTA for this.</td>
<td></td>
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<tr>
<th>5 min</th>
<th>Fish Lake Field trip (Kevin)</th>
<th>Discuss / Recommended Action</th>
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<tbody>
<tr>
<td></td>
<td>Fish Lake - July 26 - 29th. Cost $68. Add to MESTA calendar and to Facebook page.</td>
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Motion to adjourn - Jay
Seconded - Andrea
Unanimously passed.
Meeting Adjourned at 1:45
Yooperlites – Lake Superior Fluorescent Rocks!

Michigan’s newest mineral was discovered by Erik Rintamaki, a resident of Brimley - a small town southwest of Sault Ste. Marie in Chippewa County. He had been an avid agate collector along Lake Superior beaches for years. After getting an inexpensive black light, Erik headed out one June evening in 2017 to see what would show up - he found two dime size specimens. After upgrading his black light equipment Erik began finding many more and started selling pebbles and cobbles of fluorescent syenite. He gave them the unofficial name of Yooperlites.

The fluorescent material in these syenites was visually identified as sodalite. This was a surprise as the mineral sodalite had not been reported in any Michigan mineral references. Verification of the mineral was achieved with further study including thin section examination and detailed chemical analysis at Michigan Technological University. Thus, Erik’s discovery of Yooperlites is the first verified sodalite documented from the state of Michigan.

Syenite is an igneous rock similar to granite, but with little or no quartz. It occurs primarily in small intrusive bodies or dikes and is a relatively uncommon rock. It tends to be medium to coarse-grained and light colored - pink, white, gray pale green or pale brown. The yooperlite syenites are a medium gray and fine-grained with the fluorescence sodalite as clasts. Although the discovery was along Lake Superior beaches, yooperlites can be found along many of the Great Lake beaches and even in some gravel pits within the interior of Michigan.

Examples of fluorescence yooperlites.

Typical syenite yooperlite rocks.

Yooperlite discover Erik Rintamaki

Erik’s discovery created something of a phenomenon that was featured on CBS, FOX, ABC, NBC, Forbes and other media outlets. And the ultimate honor is about to occur - an article in Rock & Gem Magazine in the next few months (with a cover image in March 2019?). As part of his business, Erik leads tours along Lake Superior beaches to search for yooperlites. His web site: www.yooperlites.com, features some nice images of fluorescent yooperlites.
Thermal Expansion Model

As the average global temperature continues to rise, governments with extensive populations living near coastlines will have to take measures to mitigate the effects of sea level rise on their citizens – and the infrastructure they rely on. Not all sea level rise is due to melting of glaciers and ice caps on land, like in Greenland. Some is due to simple heating of ocean water. When the water heats, it expands. This process of thermal expansion is responsible for at least 50% of the total increase in sea level over the past 25 years. (Weeman & Lynch, 2018)

This major contributor to sea level rise can be modeled in your classroom. Students will find it easier to understand the concept when they can see it happening. The NASA Jet Propulsion Laboratory (JPL) at this URL contributed a simple way to model thermal expansion: https://www.jpl.nasa.gov/edu/teach/activity/thermal-expansion-model/. What follows is an adaptation of this lesson I used with my students.

Why is Sea-Level Rising?

Average global temperatures have been increasing in recent decades. The ocean absorbs much of the excess heat in the atmosphere. What happens to the height of the seas along our coastlines as a result of this? In this activity you will be exploring the effect of excess heat on sea level.

Materials
*Per group of 2-3 students
- 1 disposable plastic water bottle w/flip-top lid.
- Bottles made with sturdier plastic work best.
- 1 clear plastic straw
- Scissors
- Food coloring
- Ruler
- Dark felt-tip pen
- Liquid crystal temperature strip
- Low-temperature hot-glue gun
- Heat source (Incandescent lamp w/hood)
- Paper towels
- Safety goggles

Procedure
- Use scissors to remove the flip-top cap cover from the plastic water bottle.
- Insert the plastic straw into the opening of the water bottle cap. If it does not fit, have you teacher help you enlarge the hole.
- Use the hot-glue gun to seal the plastic straw to the water bottle lid.
- Fill the water bottle with water and add a few drops of food coloring. Replace the cap/straw and make sure everything is airtight.
- Attach the liquid crystal thermometer to the side of the plastic water bottle. Record the starting temperature of the water.
- Measure the current height of water inside the plastic straw relative to the surface of the water in the bottle.
- Place your water bottle in front of a heat source. If sunshine is available, try that. If not, use a shielded lamp with an incandescent bulb. Be sure that the thermometer is on the side of the bottle opposite the light.
- Every 3 minutes, record both the temperature of the bottle and the height of the water level in the straw.
- Continue recording data to complete the table

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Temperature °C</th>
<th>Height (mm)</th>
<th>Change in Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>12</td>
<td>15</td>
<td>18</td>
<td>21</td>
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<tr>
<td>24</td>
<td>27</td>
<td>30</td>
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Data Analysis & Visualization
- Construct a graph of temperature versus change in height.
- From your graph, determine the expansion rate of the water in mm/Celsius degree.
- If you continued to heat the water for another 30 minutes, how much higher would the water rise?

Image Credit NASA/JPL-CalTech
Questions
1. If our ocean is absorbing much of the excess heat from increases in average global temperature since the Industrial Revolution, what should be happening to sea level?
2. What will some potential impacts of this be on people living near coasts?

Using jAmaSeis to Analyze an Earthquake

On November 30th, 2018, a magnitude 7.0 earthquake occurred near Anchorage, Alaska. The earthquake caused extensive damage to highways, buildings, power lines and water mains near and in the city. Students were on their way to school when the quake struck, while here at Chippewa Hills High School we were just starting our 4th period Earth & Space Science class when the students noticed the arrival of strong seismic waves on the monitor for our MIQuakes seismograph station – CHMI. Of course, they wanted to know where it was and how strong it was.

I use Java-based software called jAmaSeis to interpret data from our seismograph. This software is freely available from IRIS on their website (https://www.iris.edu/hq/jamaseis/). You can also use it to stream data from remote stations across the country on your own computer. I use it with my students to find the distance to an earthquake we record – and to calculate the quake’s magnitude.

This is a screenshot from CHMI of the seismogram of the November 30th Anchorage earthquake. To find the distance to the quake, you highlight the portion of the display that you want to examine and extract it. The extracted view opens in a new window.

There are tools you can use to select a portion of what is seen here and to zoom both horizontally and vertically. When you have your area of interest selected, you press the “OK” button found near the lower right corner of the window.

You are now at a window where you have an image displaying your station on a globe with a circle drawn around it representing the distance to the earthquake. You will need to click the box titled “Display Curves” to have the travel time curves for the defaults of p, s, and surface wave arrivals displayed. Then you click and drag the seismogram to line up with the arrival of these waves. You will also need to zoom out on the globe and possibly rotate it to you can see the whole circle. Once you have everything lined up – the earthquake occurred somewhere on that circle and the distance is reported in degrees and kilometers. When you click the “OK” button on this screen you will be taken to a screen where you can compute the magnitude.

Citations
On this window you need to zoom in on the beginning of the seismogram so you can clearly see the largest peak and the next peak after it. Be sure to move the red slider markers (red) so you do not lose them. Place the left red slider so that it is aligned with the highest wave peak. Move the right red slider to the top of the next peak. The magnitude is displayed on the purple box on the lower right side of the window. We found the magnitude for this earthquake to be 7.17 – very close to the official USGS reported magnitude of 7.0.

Some of my students wondered how I knew the earthquake happened in Alaska. Of course, it was all over the news (especially online) and the United States Geologic Service (USGS) maintains a site that displays recent earthquakes (https://earthquake.usgs.gov/earthquakes/map/). I showed them the USGS site and then we talked about how we could find where an earthquake occurred. Obviously, local reports after an earthquake occurs are available fairly quickly – depending on the extent of the damage. Pinpointing the exact location of the earthquake epicenter – the location at the surface above where the fault ruptured – requires triangulation of distances from at least 3 seismograph stations. This was the focus of our next investigation, using an app called Station Monitor, also from IRIS.

If you do not have your own classroom seismograph, you can still use jAmaSeis to analyze earthquakes from remote stations you live stream to your classroom over the Internet. A future article will explain how to set this up.

Cris L. DeWolf

A Compendium of Climate Change Classroom Resources

Climate change is a fact. Our planet has gone through cycles of warmth transitioning to cold and then back again since Earth first formed. What we are facing now are dramatic changes in global temperature, precipitation patterns, sea level, and regional ecosystems. These changes, while slow in a human time frame, or very rapid geologically. If we are unable to slow, or even reverse, these changes, we must take steps to limit their impact on future generations. Teaching the science behind climate change is essential to help inform those who soon will be in positions to take steps to accomplish these goals. Materials from the sites discussed here may be useful.

High School and Middle School NGSS Standards

HS-ESS3-6 Earth and Human Activity
Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ESS3-5 Earth and Human Activity
Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

MS-ESS3-5 Earth and Human Activity
Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Carbon Time - http://carbontime.bscs.org/units

The Carbon Time (CTIME) project is a collaboration of scientists, teachers, graduate students, and IT specialists with the overall arching goal to refine K-12 frameworks and assessments for learning progressions that lead to environmental science literacy. Given the above, we have developed a series of six teaching modules that can be used at the middle school or high school level. Each of these learning modules are nested within this website along with assessments for each learning module.

In this project, the Human Energy Systems unit has the most relevance to climate change education. This unit focuses students on how three carbon-transforming processes (photosynthesis, cellular respiration, and combustion) work in global systems to balance carbon pools and fluxes. Overall, this Unit has four important goals for student learning:

1. Using knowledge of representations, generalizability, short-term variation, and long-term trends to interpret large-scale data sets related to climate change;
2. Relating changes in carbon pools to the balance of movement between these pools;
3. Relating carbon emissions to energy use;
4. Relating local systems, actions, and choices to global effects and future outcomes.
Carbon Connections: The Carbon Cycle and the Science of Climate –
http://carbonconnections.bscs.org/curriculum/

BSCS also offers a series of computer-based interactive models and classroom activities that are the foundation of three units:

1. Carbon and Climate in the past;
2. Carbon Now;

A “Teacher Support” page is included, as well as a page of additional NASA resources for teaching about climate. Each unit relates the material back to a list of key concepts with key ideas and linking questions connecting each part of the unit to the next. An example from the 1st unit is shared here.

**Data Nuggets** –
http://datanuggets.org/tag/climate-change/

Data Nuggets are free classroom activities, co-designed by scientists and teachers, designed to bring contemporary research and authentic data into the classroom. Data Nuggets include a connection to the scientist behind the data and the true story of their research. Each activity gives students practice working with “messy data” and interpreting quantitative information. Students are guided through the entire process of science, including identifying hypotheses and predictions, visualizing and interpreting data, making evidence based claims, and asking their own questions for future research. Because of their simplicity and flexibility, Data Nuggets can be used throughout the school year and across grades K-16, as students grow in their quantitative abilities and gain confidence. Data Nuggets have the potential to improve the understanding of science in society while engaging and motivating the next generation of scientists and engineers. These materials were also created through collaboration between Michigan State University and BSCS.

Lessons are available thematically. Those that relate to climate change are listed at the URL above. Some examples include: Beetle, It’s Cold Outside, Are Forests Helping in the Fight Against Climate Change?, and The Arctic is Melting – So What?

**CLEAN – Climate Literacy & Energy Awareness Network** - https://cleanet.org/index.html

One of CLEAN’s goals is to help teachers be as effective as possible when teaching climate science. This series of web pages introduces climate science in a sequence that illustrates different aspects of the climate system. Natural and human influences on climate are presented here, as well as the effects of interactions between parts of Earth’s systems. Special emphasis is placed on the methods that scientists use to study the climate and make predictions about future impacts, as this is a topic that is sometimes misunderstood. The overarching Guiding Principle states that humans can take actions to reduce climate change and its impacts, which is a key part of teaching climate science. Taken together, these concepts describe climate literacy.

Each of these topics is linked on the website to more information about the topic as well as a series of teaching strategies and materials.

1. The Sun is the primary source of energy for Earth’s climate system.
2. Climate is regulated by complex interactions among components of the Earth system.
3. Life on Earth depends on, is shaped by, and affects climate.
4. Climate varies over space and time through both natural and man-made processes.
5. Our understanding of the climate system is improved through observations, theoretical studies, and modeling.
6. Human activities are impacting the climate system.
7. Climate change will have consequences for the Earth system and human lives.

**NASA Wavelength** - http://nasawavelength.org/

NASA Wavelength is a searchable archive of teaching resources that when searched currently returns a listing of 183 resources. You can also create an account, and from this account save lists of resources you find.

There are many more resources than there is room here to list. If you have favorite resources feel free to share them with the rest of us via our Facebook page!

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