Using NASA Data to Enhance Earth Science Education & Make STEM Connections

NSTA 2018, Science on My Mind

Elizabeth Joyner, NASA Langley Research Center, Hampton, VA
Please sit in groups by Grade Band: 3-5, 6-8, 9-12

Survey

https://b.socrative.com/login/student/

Room ID:

MYNASADATA
About Me...

Elizabeth Joyner
Goals:
1. Current My NASA Data (MND)
2. MND STEM connection
3. Future MND
4. Engage Prior Knowledge
5. Group Activities: 1.) Beginner Data Cubes -or- 2.) Intermediate Data Cubes
6. Reflect
7.
What is My NASA Data?

- Started in 2004
- User group: teachers, students, citizen scientists, scientists, & data users
- Offers Earth Science data, organized by sphere in the Earth System
- Data Visualization tool - known as a Live Access Server (LAS)
- Lesson plans illustrate how to use LAS with data sets and graphs
Seeing MND through a STEM Context
“S” in STEM - Earth System Science data
“S” + “T” in STEM - Data Visualization

Current Data Visualization Tool - Live Access Server (LAS)
Precipitation, March 2016

Cloud Cover, Sept. 2016

Vegetation, Sept 2016
"E" in STEM - Satellite Data

- MND leverages Earth Science data made available through NASA engineering and technology
  - Does not offer integrated engineering design challenges

- Engineering Enables NASA to do Science!

- Pulls data collected on NASA’s A-Train, as well as other satellite missions!
NASA & International partners

6 satellites that fly in a coordinated orbit to collect data on Earth system.

15+ scientific instruments

Satellites on nearly same polar orbital “track.”

Cross the equator northbound at about 1:30 p.m. local time, within seconds to minutes of each other.
Monthly Aerosol Optical Depth (MISR) (dimensionless)
LATITUDE: 28.8N, 16-APR-2015 00:00

Monthly Cloud Coverage (CERES) (percent)
LATITUDE: 28.8N, 16-APR-2015 00:00
Formal evaluations from educators underscore these informal insights.
Time for Change
Identify and Focus on Teachers’ Needs

Dedicated to helping teachers of grades 3-12 teach Earth System phenomenon using NASA Earth System data

- Pulling resources from a variety of NASA visualizations
- Organizing resources by Earth System phenomenon
- Prepackaging Maps & Data = “Just in Time”
Tell A Story...

Identify what stories need to be told:

- NGSS-inspired tools to:
  - structure of phenomenon
  - systems approach
  - spatial and temporal scales
  - leveraging GLOBE activities and protocols
Supports NGSS IN YOUR CLASSROOM

Science & Engineering Practices
Crosscutting Concepts
Disciplinary Core Ideas

**Disciplinary Core Ideas**

**PHYSICAL SCIENCES**
- PS1: Matter and Its Interactions
- PS2: Motion and Stability: Forces and Interactions
- PS3: Energy
- PS4: Waves and Their Applications in Technologies for Information Transfer

**LIFE SCIENCES**
- LS1: From Molecules to Organisms: Structures and Processes
- LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS3: Heredity: Inheritance and Variation of Traits
- LS4: Biological Evolution: Unity and Diversity

**EARTH AND SPACE SCIENCES**
- ESS1: Earth's Place in the Universe
- ESS2: Earth's Systems
- ESS3: Earth and Human Activity

**ENGINEERING, TECHNOLOGY, AND APPLICATIONS OF SCIENCE**
- ETS1: Engineering Design
- ETS2: Links Among Engineering, Technology, Science, and Society

**Crosscutting Concepts**

1. Patterns
2. Cause and Effect: Mechanisms and Explanation
3. Scale, Proportion, and Quantity
4. Systems and System Models
6. Structure and Function
7. Stability and Change
Core Inquiries Supported by MND

- Exploring an Earth System Variable over Space and Time
- Exploring Relationships between & among Variables
What is My NASA Data?

The collection of My NASA Data lesson plans is intended to provide the educator with a variety of specific examples, incorporating a more “teacher-directed” strategy, of how authentic satellite data can be integrated into the curriculum.
Atmosphere – Featured Lessons


Basic Line Plots

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit.

Recent Topics

- **Hurricanes: What Are They?**
  - 4/15/2018
  - Atmosphere, Teaching, K-6

- **How the Water Cycle Works**
  - 3/25/2018
  - Hydrosphere, Teaching, K-6

- **Clouds Affecting Temperature**
  - 3/22/2018
  - Atmosphere, Teaching, K-6
<table>
<thead>
<tr>
<th>Date</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-Jan-2016</td>
<td>37.4</td>
</tr>
<tr>
<td>15-Feb-2016</td>
<td>42.1</td>
</tr>
<tr>
<td>15-Mar-2016</td>
<td>58.7</td>
</tr>
<tr>
<td>15-Apr-2016</td>
<td>62.4</td>
</tr>
<tr>
<td>15-May-2016</td>
<td>67.8</td>
</tr>
<tr>
<td>15-Jun-2016</td>
<td>77.1</td>
</tr>
<tr>
<td>15-Jul-2016</td>
<td>81.0</td>
</tr>
<tr>
<td>15-Aug-2016</td>
<td>79.9</td>
</tr>
<tr>
<td>15-Sep-2016</td>
<td>75.1</td>
</tr>
<tr>
<td>15-Oct-2016</td>
<td>64.7</td>
</tr>
<tr>
<td>15-Nov-2016</td>
<td>53.8</td>
</tr>
<tr>
<td>15-Dec-2016</td>
<td>43.8</td>
</tr>
<tr>
<td>15-Jan-2017</td>
<td>45.0</td>
</tr>
<tr>
<td>15-Feb-2017</td>
<td>51.7</td>
</tr>
</tbody>
</table>
Group Work!
1. **Identify the Earth Science variables affecting Seasons.**
   Put individual variables on a Post-It. (One Post-it per idea.)
   a. Put up at the front of the board in the different spheres of the Earth System
2. Share out.
**Earth System Variables Defined**

**Monthly Surface Skin Temperature** is the temperature on the surface of the Earth (its “skin”), where humans, plants, and animals live. Monthly average of the temperature on the surface of the Earth (not the air temperature near the surface).

**Leaf Area Index** (LAI) is an unitless quantity that characterizes plant canopies.

\[ \text{LAI} = \frac{\text{leaf area}}{\text{ground area}}, \ m^2 / m^2 \]

0 (bare ground) - over 10 (dense conifer forests).
Data Literacy Activity

**Beginner Activity** - Analyze three mapped images of Surface Skin Temperature using the Beginner Map Cube

**Intermediate Group** - Analyze graphs (2010-2017) for the following datasets using the Intermediate Graph Cube:

- Average Surface Temperature
- Leaf Area Index
As you move through the activity, think of the following:

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?
Beginner Cube: Monthly Surface Skin Temperature (Celsius)

Map Data Cube Questions:

1. What colors do you see the most? Least?
2. What color seems to cover the most? What does this mean?
3. What color do you not see very much? What does this mean?

Where on Earth is the map?
1. What hemisphere (north, south, equator, on/stripe) do you see?
2. Is your school shown on the map? If so, where is it?

What do the colors mean?
1. What science variable is shown by the range of colors?
2. The color with the biggest value number is __________.
3. The color with the smallest value number is __________.
4. The color in the middle is __________. Its value is ________.

What areas of the map have the highest values? Lowest?
1. What areas have the highest values? What does this mean?
2. What areas have the lowest values? What does this mean?
3. What data does this map represent?

Where was the data on this map collected?
1. What data is represented on this map?
2. What kind of data is found with this? Daily, weekly, monthly, yearly.

What questions do you have about the map?
1. How does ...?
2. I wonder if ...?
3. How is ...? The same as? Different than?
4. How many ...? How long ...? How often ...?
Interpret two graphs:

1. Average Surface Temp (°F) vs. Date (2010-2017) (Atlanta, GA Lat: 33.74N, Long: 84.38W)
2. Leaf Area Index vs. Date (2010-2017) (Atlanta, GA Lat: 33.74N, Long: 84.38W)
Interpret two graphs:

Average Leaf Area Index for Atlanta, GA (2010 - 2017)

Monthly Average Surface Skin Temperature for Atlanta, GA (2010 - 2017)
Share Out

Setting students up for success:

- What should students be doing?
- How do we measure success?
- What modifications may you want to make?
AVOID This...

Receive these materials via mail or email by completing the form found linked with QR Code or URL.

Contact Me...

Elizabeth R. Joyner
Education Coordinator
NASA Langley Research Center
elizabeth.r.joyner@nasa.gov