

# 2nd Grade

## *Changes in the Earth's Surface*



Teaching the Science and Engineering Education (SEEd) Standards

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## SEEd Strand 2.1: Changes in the Earth's Surface

Earth has an ancient history of slow and gradual surface changes, punctuated with quick but powerful geologic events like volcanic eruptions, flooding, and earthquakes. Water and wind play a significant role in changing Earth's surface. The effects of wind and water can cause both slow and quick changes to the surface of the Earth. Scientists and engineers design solutions to slow or prevent wind or water from changing the land.

**Standard 2.1.1 Develop and use models** illustrating the patterns of landforms and water on Earth. Examples of models could include valleys, canyons, or floodplains and could depict water in the solid or liquid state. (ESS2.B)

**Standard 2.1.2 Construct an explanation** about changes in Earth's surface that happen quickly or slowly. Emphasize the contrast between fast and slow changes. Examples of fast changes could include volcanic eruptions, earthquakes, or landslides. Examples of slow changes could include the erosion of mountains or the shaping of canyons. (ESS1.C)

**Standard 2.1.3 Design solutions** to slow or prevent wind or water from changing the shape of land. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples of solutions could include retaining walls, dikes, windbreaks, shrubs, trees, and grass to hold back wind, water, and land. (ESS2.A, ESS2.C, ETS1.A, ETS1.B, ETS1.C)

## 2.1.1 Models of Landforms and Water

**Grade:** 2nd

**Time:** 2 days 30 minutes each

**Lesson Topic:** Landform and water patterns

**Utah SEEd Standard:**

**Standard 2.1.1 Develop and use models** illustrating the patterns of landforms and water on Earth. Examples of models could include valleys, canyons, or floodplains and could depict water in the solid or liquid state. (ESS2.B)

**Lesson Performance Expectations:**

- Students will be able to **obtain information** about what **causes** the given phenomenon.
- Students will be able to **develop and use a model** to explain the **causes** of the phenomenon.

**Phenomenon:** *Water plays a big role in the development of different landforms on earth. ( show pictures from below) <https://www.youtube.com/watch?v=qqsTS67BKmA>*

**Gather**

1. Students will **ask questions** about how water can **cause** different landforms.
2. Students will **obtain information** about different landforms **caused** by water (in liquid or solid form) and take note of what they look like.
3. Students will **use models** of landforms to observe what may have **caused** them to be the way they are.

**Reason**

4. Students will **develop and use a model** to show different landforms and how they are **caused** by water.

**Class Discussion:**

*Questions to initiate Discussion:*

*Q: What causes these landforms to occur?*

*Q: What role does water play in the formation of these landforms?*

*Q: If water didn't exist, do you think these landforms would look the way they do? Why or why not?*

*Q: What kinds of effects do you think water could continue to have on these landforms over time?*

*Q: Why do you think water causes these landforms?*

**Communicate Reasoning**

5. Students will **create an explanation** for how water can **cause** many different kinds of landforms to develop.

**Science and Engineering Practices**

Students will ask questions in order to prepare for researching the phenomenon.  
Students will be able to obtain adequate information about the



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Ask Questions Obtain Information Develop and use models Create and explanation	phenomenon. Students will use and develop models in order to best explain the causes of the phenomenon. Students will be able to have enough information gathered to be able to explain the causes of the given phenomenon.
<b>Crosscutting Concepts</b>	Students will be able to discern the cause of the phenomenon.
Cause and effect	
<b>Disciplinary Core Ideas</b>	Water in solid and liquid can bring changes in the earth ultimately developing different and new landforms.
Earth Science	

### Appendix A - Student Prompts for the Lesson

**Phenomenon:** Water plays a big role in the development of different landforms on earth.

**Group Performances:**

1. Students will ask questions about how water can cause different landforms.
2. Students will obtain information about different landforms caused by water (in liquid or solid form) and take note of what they look like.
3. Students will use models of landforms to observe what may have caused them to be the way they are (google earth).
4. Students will develop and use a model to show different landforms and how they are caused by water.

**Class Discussion**

**Individual Performances:**

5. Students will create an explanation for how water can cause many different kinds of landforms to develop.

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### Lesson Steps:

1. Show phenomenon pictures of landforms and ask how the students think they formed.
2. Students will complete an investigation to learn how different landforms are created with the use of water
  - a. Get the sand damp so that it can be packed together and place it into the bins. It needs to be moldable.
  - b. Forming a canyon: watch this video for instructions
    - i. [https://www.youtube.com/watch?v=cgJHT\\_RTcdA&feature=youtu.be](https://www.youtube.com/watch?v=cgJHT_RTcdA&feature=youtu.be)
  - c. Forming an arch:
    - i. pack down sand very well, shape into a circle more than 1" tall.
    - ii. Slightly dig out two sides, the ones across from each other.
    - iii. Poke a small hole in the bottom of the dug out part on each side.
    - iv. Slowly pour water in until the arch is formed.
  - d. Forming Sea Stacks and other formations (like horseshoe bend):
    - i. Pack down sand very well in a large pile that's at least 5" tall
    - ii. Create a small indented circle around a part of the sand (So that the water will stay in the same place).
    - iii. As the water is poured in a circle in the same place, it should eventually become like a river with a sand formation standing in the center (much like the horseshoe bend)
3. Have a gallery walk so everybody gets a chance to see the different creations their classmates have made.
4. After the gallery walk, have each group take turns to explain how water formed the landform they created.
5. Hold a class discussion so students can discuss their findings (see "Reason" section above for discussion questions).
6. Look at Google Earth at different landforms and have students explain how each landform was formed (e.g. Grand Canyon, the Arches, Other national parks, etc.). This can be used as a formative assessment.

\*When you are done with the sand, let it dry out and then put it back with all the materials.\*

*(Teaching Suggestions: Students will use the resources given in Appendix B to be able to learn about landforms and how they form. Some of These resources will need to be modified for students to better understand. This can also be something that is covered and researched as a whole class rather than done individually. When they have learned about the general landforms they can use Google Earth in order to research specific famous landforms, such as the Grand*

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*Canyon and Arches National Park.)*

[Pictures and videos taken during lesson](#)

### **Appendix B -**

#### **Materials:**

Provided Materials:

- Flat Tote Bins
- Sand
- Plastic reusable cups

Classroom/Outdoor Materials:

- Water
- Access to Google Earth

<https://www.google.com/earth/> for students to use to research specific landforms. Examples for students to research include the grand canyon, the Arches in southern Utah, Ha Long Bay Vietnam, The Great Blue Hole Belize, Stone Forest China, Rain Rock Australia, and Bryce Canyon Utah.

*Additional Teacher links:*

[What are Canyons?](#) [The Grand Canyon](#)

[What are Valleys?](#)

[What are floodplains?](#)

[How did the arches form?](#)

[Landforms created by erosion](#)

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## 2.1.2 Slow and Fast Changes Stations

**Grade:** 2nd

**Time:** 2 days 30 minutes each

**Lesson Topic:** Changes in Earth's Surface

**Utah SEEd Standard:**

**Standard 2.1.2 Construct an explanation** about changes in Earth's surface that happen quickly or slowly. Emphasize the contrast between fast and slow changes. Examples of fast changes could include volcanic eruptions, earthquakes, or landslides. Examples of slow changes could include the erosion of mountains or the shaping of canyons. (ESS1.C)

**Lesson Performance Expectations:**

- **Construct an explanation** for the **causes** of the **changes** that happened to the surface of the Earth both quickly and slowly.
- **Plan and carry out an investigation** to determine some **cause** that contribute to **changes** to Earth Surfaces through different stations.

**Phenomenon:** *Changes on Earth can happen fast or slow.*

[Fast Changes](#)

[Slow Change- Erosion](#)

[Slow Change- River](#)

**Gather**

1. Students *carry out an investigation* to determine the **cause** of change to Earth's surface.
2. Students *obtain information* about fast and slow **changes** that happen to Earth surfaces.

**Reason**

3. Students **construct an explanation** for the **causes** of **changes** that happened in each station.
4. Students **demonstrate** various types of Earth's **changes** as fast or slow by moving their body.

**Class Discussion:**

*Questions to initiate Discussion:*

*Q: What evidence do you have that water is a cause of erosion?*

*Q: What changes have you noticed about the investigation you did?*

*Q: What do you think would happen if there were a storm and much more water running down the mountain?*

*Q: What kinds of changes to Earth happen quickly?*

*Q: Can you identify a change to Earth that happens very slowly?*

*Q: Do you think fast or slow changes can make the biggest change, why?*

**Communicate Reasoning**

5. Students <b>use information</b> from several sources to provide evidence that Earth events can <b>change</b> the Earth quickly or slowly.	
<b>Science and Engineering Practices</b>	Pose questions that are testable. Make careful observations that will generate evidence that can be used to explain the question.
Ask questions Plan and carry out investigations Constructing Explanations Develop an argument	Explain science observations using evidence found through the investigation. Use evidence to support arguments about scientific explanations and phenomena.
<b>Crosscutting Concepts</b>	Use patterns found during the investigation as evidence to support explanations.
Patterns Cause and Effect Stability and Change	Identify the components contributing to the cause of an effect. Describe stability and change in terms of time scales.
<b>Disciplinary Core Ideas</b>	Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe (2-ESS1-1).
Earth Change	

Lesson adapted from: [Changes to earth Fast and Slow](#)

#### Appendix A - Student Prompts for the Lesson

**Phenomenon:** *Changes on Earth can happen fast or slow.*

##### **Group Performances:**

1. Students **carry out an investigation** to determine the **cause** of change to Earth's surface.
2. Students **obtain information** about fast and slow **changes** that happen to Earth surfaces.
3. Students **construct an explanation** for the **causes** of **changes** that happened in each station.
4. Students **demonstrate** various types of Earth's **changes** as fast or slow by moving their body.

##### **Class Discussion**

##### **Individual Performances:**

5. Students **use information** from several sources to provide evidence that Earth events can **change** the Earth quickly or slowly.

*Lesson Steps:*

1. *Show the class phenomenon videos/pictures.*
2. *Ask the question and discuss what caused changes to the earth?*
3. *Students can be split into groups and complete stations to learn about slow and fast changes to the earth. This is recommended to be done over 2 days, completing 2 stations per day:*
  - a. *Earthquake station:*
    - i. *Shake Table, fact and fault model, K'Nex, Keva planks.*
    - ii. *Students build a structure using the keva planks or K'nex*
    - iii. *Place the structure on the shake table*
    - iv. *Shake table and observe what happens*
    - v. *Make changes to your structure and try again*
    - vi. *Use the fact and fault model to see how the tectonic plates shift*
  - b. *Hurricane/Tsunami (wind station):*
    - i. *Hair dryers, K'nex, Keva planks.*
    - ii. *Students build a structure using the keva planks or K'nex*
    - iii. *Use the hair dryer on the structure to see if their structure withstands the wind.*
    - iv. *Make changes to your structure and try again*
  - c. *Volcano stations: Volcano kit*
    - i. *Use ¼ cup of vinegar and pour into the volcano.*
    - ii. *Pour 1 spoonful of baking soda into the volcano.*
    - iii. *Observe the reactions.*
    - iv. *This can be done as a demonstration for the students, or they can complete this in small groups with explicit instructions on what to do.*
  - d. *Erosion stations:*
    - i. *Erosion Kit, outside materials, dirt, rocks, sticks.*
    - ii. *Students place trees, and plants in dirt*
    - iii. *See procedures card for erosion kit instruction*
    - iv. *Pour water down the erosion kit and observe what happens*
    - v. *Make changes and try again*
4. *Conduct class discussion (See above for questions)*
5. *Formative assessment: Show students a series of pictures that represent different fast and slow changes. Have students move their arms and legs fast or slow to demonstrate the specific type of change.*

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*(Teaching Suggestions: Students can create and fill out a graphic organizer (foldable) to help show their understanding of the concept of fast and slow changes, and what causes them.)*

[Sample. Please make a copy if used.](#)

[Pictures and videos taken during lesson](#)

### **Materials:**

Provided Materials:

- Volcano Kits
- Fact & Fault Model
- Wobble Table
- Erosion Kits
- Hair dryers
- Keva planks
- Plastic reusable cups
- Tote Bins
- Sand

Classroom Materials:

- Rocks
- Sticks/branches
- Leaves
- Other outdoor materials
- Water
- sticky notes
- Baking soda
- White vinegar
- Dish soap
- Food coloring

### **Procedures:**

[Erosion Kit Procedures](#)

[Fact and Fault Model Procedures](#)

[Volcano Kit Procedures](#)



## 2.1.3 Wind Shaping

**Grade:** 2nd

**Lesson Topic:** Weathering and Erosion

**Utah SEEd Standard:**

**Standard 2.1.3 Design solutions** to slow or prevent wind or water from changing the shape of land. *Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs.* Examples of solutions could include retaining walls, dikes, windbreaks, shrubs, trees, and grass to hold back wind, water, and land. (ESS2.A, ESS2.C, ETS1.A, ETS1.B, ETS1.C)

**Lesson Performance Expectations:**

- Students will **demonstrate** the **effects of wind** on the shape of the land.
- Students will **plan and carry out an investigation** to show how wind **causes** land to **change** over time.

**Phenomenon:** **Wind can cause changes on the shape and display of the land. (Arches)**

Watch the clip from [Wind and Sand](#) (start at 2:33)

**Gather**

1. Students **ask questions** to determine what is **changing the shape of earth's surfaces**.
2. Students **obtain information** on how wind **causes** the land to change.

*Teaching Suggestions: Start by showing students phenomenon videos or pictures, asking them to think about what is causing the earth to change. Students will now be placed in groups to learn about how weathering and erosion cause the land to change. See readings in appendix B.*

**Reason**

3. Students will **investigate** the power of **wind** by testing different speeds.
4. Students **develop a model** describing the observed **changes** to the land **caused** by wind. (before and after model).
5. Students **construct an explanation** from the evidence that **changes** to Earth can occur quickly or slowly.

**Class Discussion:**

Questions to initiate Discussion:

Q: How does the wind change Earth's surface?

Q: How do you think water changes the Earth's surface?

Q: Which had a bigger impact on the surface of your model, high or low wind speeds? How do you know?

Q: What differences did you notice to the surface of your model after wind was added to it?

Q: What did you notice about wind erosion in our investigation? What is happening to the sand?

Q: What caused changes in the system of Earth?

Q: What kind of changes to the Earth happen quickly?

Q: What caused the sand and rocks to move?

Q: Where have you seen erosion happening in the world?

Q: Does the change happen quickly or slowly?

*Teaching suggestions: Students will be placed in groups to investigate their experiments. Students will use a wind turbine to demonstrate the effects of wind on the shape of the land. Use a bin filled with materials to resemble land. Students will experiment with different speeds of wind and record observations of the effects of the wind on the land. Students should develop a model to record their data. Data should include before and after pictures. This can be done through drawings, or taking physical pictures with technology. After completing their experiment students should be able to explain that changes to earth's surface can occur quickly or slowly. You might point out other examples of ways the earth had been changed by wind or water. Example: the Grand Canyon formed by erosion from the Colorado river.*

**Communicate Reasoning**

6. Students **develop an argument** supported by evidence that wind **causes changes** in the land.

*Teaching suggestions: Students should be able to write out or explain how wind causes changes in the land. They might add in things like changes can happen slowly or quickly. Adding in how water can change the earth too is also great.*

**Science and Engineering Practices**

Develop questions  
Construct explanations  
Engaging in argument from evidence

Pose questions that help discover the effects of things on earth's surface.  
Explain science observations using evidence.  
Use evidence to support ideas.

**Crosscutting Concepts**

Cause and Effect  
Stability and Change

Identify and describe the causes of the phenomena.  
Identify things that trigger changes to a system that was previously stable.

<b>Disciplinary Core Ideas</b>	Some events happen very quickly; others occur very slowly over a time period much longer than one can observe. Wind and water can change the shape of the land
ESS1.C The History of Planet Earth ESS2.A Earth Materials and Systems	

## Appendix A - Student Prompts for the Lesson

**Phenomenon:** Wind can cause changes on the shape and display of the land. (Arches)

### Group Performances:

1. Students ask questions to determine what is changing the shape of earth's surfaces.
2. Students obtain information on how wind causes the land to change.
3. Students will investigate the power of wind by testing different speeds.
4. Students develop a model describing the observed changes to the land caused by wind. (before and after model).
5. Students construct an explanation from the evidence that changes to Earth can occur quickly or slowly.

### Class Discussion

### Individual Performances:

6. Students develop an argument supported by evidence that wind causes changes in the land.

### Lesson steps:

1. Show class phenomenon video
2. Discuss the video and phenomenon statement. Wind can cause changes on the shape and display of the land.
3. Divide students into groups to perform investigation. Each group will get a gray or white bin (the color doesn't matter), foldable hand fan, sand or dirt and possibly rocks.
  - a. Place sand/ rock in the bottom of the gray/white bins.
  - b. Have students gently use their hand fans to shape the sand.
  - c. Students should then record their observations
  - d. Adjusting the fan size may help to better direct where the sand blows.
4. Class discussion

*Teaching suggestions: This lesson could possibly be turned into an art project to help reinforce the idea that wind can cause things to move and shape things. An idea for this would be to have the student create sand art pictures ([Instructions](#)). We are unable to provide these materials for*

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*the pods so they will have to be personally acquired.*

[Pictures and videos taken during lesson](#)

### **Appendix B -**

**Phenomenon Video:** [Weathering and Erosion video](#) (start at 2:15-3:27) Pause clip after the video shows the change in the land from 1984-2014.

### **Student Reading #1:**

*The surface of the Earth is constantly being **changed**.*

**Weathering** is the process where rock is worn away or broken down into smaller and smaller pieces.

**Erosion** happens when rocks are picked up and moved to another place by ice, water, wind.

*Studying what happens at the coast, in rivers or in the desert can help us figure out how landscapes **change**.*

### **Student Reading #2:**

*Erosion of Soil*

*Erosion happens when the Earth materials are worn away and moved.*

*This can happen by natural forces like wind or water.*

*Erosion is mostly **caused** by water, wind, or ice.*

*Plants hold the soil together and prevent erosion.*

*Some trails become eroded when we walk on them too much.*

*We can use plants to slow or prevent erosion.*

### **Materials:**

- Foldable Fans
- Tote Bins
- Potting soil, or fill dirt
- Plastic reusable cups

Classroom materials:

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- Sticks/branches
- Rocks
- Leaves
- Other outdoor materials
- Water
- Plastic reusable cups

# Materials

### 2.1.1 - Models of Landforms and Water

Provided Materials:

- Flat Tote Bins (21)
- Sand (2 buckets) *\*Make sure to let the sand dry out before putting it was\**
- Plastic reusable cups (20)

Classroom/Outdoor Materials:

- Water
- Access to Google Earth

### 2.1.2 - Slow and Fast Changing Stations

Provided Materials:

- Volcano Kits
- Fact & Fault Model
- Wobble Table (7)
- Erosion Kits (1)
- Hair dryers (7)
- Keva planks (1100)
- Plastic reusable cups (20)
- Tote Bins (21)
- Potting soil, or fill dirt (1 box)

Classroom Materials:

- Rocks
- Sticks/branches
- Leaves
- Other outdoor materials
- Water
- sticky notes

### 2.1.3 - Wind Shaping

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### **Provided Materials:**

- Foldable hand fans (21)
- Tote Bins (21)
- Potting soil, or fill dirt and sand (1 Soil & 2 Sand)
- Possibly rocks
- Plastic reusable cups (20)

### **Classroom materials:**

- Sticks/branches
- Rocks
- Leaves
- Other outdoor materials
- Water

### **Books Provided as Resources in the Classroom:**

- Weathering and Erosion - (Science Readers) by Torrey Maloof
- Earth's Changing Surface

# Procedures

[Volcano Kit Procedures](#)

[Fact and Fault Model Procedures](#)

[Erosion Kit Procedures](#)