



Physical Aspects of Climate - Hydrosphere (Part 3:4)

Type of Lesson: Direct Instruction, Lab

Description of lesson: This program covers the physical aspects of climate change. There are three main activities that cover the direct content: Atmosphere, Oceans, and Cryosphere. This program is intended for classroom teachers to use as direct instruction and a hands-on activity for the students to complete. Direct instruction is given as a PowerPoint the teacher can project and a student note sheet has been created for interactive notebooks, or for students to fill out digitally. In addition, a lab has been curated that pairs with the material so students can have a kinesthetic learning experience to reinforce the material learned. Activities for vocabulary development and review have been included, as well as an end of the unit assessment where students show their knowledge of how the interactions between the Atmosphere, Cryosphere and Ocean create climate zones.

Enduring Understandings:

Climate is made up of multiple variables, a change in any of those variables can have a major impact on the planet

Essential Questions:

If predicted future impacts of Climate Change are as bad as the scientific community is predicting, is our home planet doomed or saveable?

Academic Standards:

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.

HS-ESS2-8.* Construct an explanation of how heat (energy) and water (matter) move throughout the oceans causing patterns in weather and climate.

HS-ESS2-9.* Construct an explanation for how energy from the Sun drives atmospheric processes and how atmospheric currents transport matter and transfer energy

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

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

HS-ENV1-2.* Use a computational representation to illustrate that humans are part of Earth's ecosystems and how human activities can, deliberately or inadvertently, alter ecosystems

HS-ENV1-3. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Student learning targets:

- Model convection in the ocean and how change in temperature can change the flow of water
- Connect convection currents with major ocean currents such as the Gulf Stream.
- Hypothesizing how the disruption of the Gulf Stream will affect climate
- Analyzing how climate in a region is determined by nearby ocean currents



Assessment task - At the end of part 4 students are given a climate zone and are tested to see if they can put together how the atmosphere, cryosphere, and hydrosphere come together to form that climate zone. Students will be tested in a Free Response format. Please see lesson 4 for a complete description of the assessment task

Differentiation:

- Students can watch the video of the lab instead of doing the lab
- For higher level students, encourage them to choose higher level Bloom's question stems
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Accommodations:

- Pre-filled notes printed out for students
- Embedding the PowerPoint in the LMS so that students can follow along at their own pace
- Vocabulary as a reference only instead of having them fill it out
- The use of notes during assessments

Prior Learning:

The climate unit is based on students who have learned about the atmosphere, hydrosphere and cryosphere. Before starting this unit students should be familiar with the following concepts

- Convection, ocean circulation and atmospheric circulation
- Greenhouse gasses
- Atmospheric composition
- Water holds more heat
- Carbon cycle, sources and sinks
- Albedo
- Coriolis effect
- Density

Prerequisite skills:

- Asking Questions
- Defining problems and creating solutions
- Data analysis
- Graphing
- Defending and argument with evidence
- Writing a free response

Materials

- Whiteboards
- Paper or index cards
- Clear bins or buckets
- Warm (red) water
- Cold (blue) water
- Droppers
- Hot plates
- Ice
- Food coloring

Technology:

- Youtube
- Projector

Vocabulary Development: Encourage students to write questions about key vocabulary words as a part of the wrap up activity

Procedures:**Introduction/Anticipatory Set/Bellringer**

Have students watch this video of the ocean temperatures over 22 years

<https://www.youtube.com/watch?v=GxDEwVwW9to>



Have them write down all of their observations in their notebook or on a whiteboard as a group. Have them share what they saw. Have students identify trends in the data.

Ask guided questions such as: Why does the heat at the equator seem to rise and fall, how would you explain this? Are there changes in the heat at the equator and other places in the 22 years? How does the ocean transfer heat?

Direct Instruction:

The PowerPoint has been designed for teachers to give direct instruction to their students. Students will fill out a note sheet as they listen to the teacher. This note sheet can be printed for an interactive notebook or filled in digitally on their iPads or Chromebooks.

Teachers should pause to ask students the discussion questions within the lecture. In addition, there are graphs that the teacher may want the students to attempt to analyze on their own.

Ocean PowerPoint & Ocean Student Note page

At the end of the lesson have students use the following question stems (have them choose some from each category) and write questions about the lesson. Have students pass their questions to each other and answer them as a review

(website Link) [Question Stems](#)

Lab:

Purpose of the lab: The climate is formed through the interaction of the hydrosphere, cryosphere, and atmosphere. This lab will focus on the impacts of the ocean currents within the hydrosphere.

Students will use various water temperatures to discover how climate will change important ocean currents such as the Gulf Stream and the Global Conveyor Belt. This lab can be done as a demo, or students can watch the video embedded in the lab sheet and answer questions.

https://youtu.be/r_OO8MZcb2Q

However, this video is focused on using this demo to talk about AIR FLOW, but remind the students this concept of convection works the same with water as it does with air.

Ocean Currents and Climate Lab

Attach: Ocean PowerPoint

Ocean Student Note Sheet

Ocean Currents and Climate Lab