science learning activities for SPS students during the COVID-19 school closure.

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While Seattle Public Schools endeavors to only post documents optimized for accessibility, due to the nature and complexity of some documents, an accessible version of the document may not be available. In these limited circumstances, the District will provide equally effective alternate access.

Due to the COVID-19 closure, teachers were asked to provide packets of home activities. This is not intended to take the place of regular classroom instruction but will help supplement student learning and provide opportunities for student learning while they are absent from school. Assignments are not required or graded. Because of the unprecedented nature of this health crisis and the District’s swift closure, some home activities may not be accessible.

If you have difficulty accessing the material or have any questions, please contact your student’s teacher.
Lesson 4: The Ocean in Motion
Hello Families,

We hope you and your family are well and safe during this time. During this unprecedented out-of-school time, the SPS middle school science team will be offering instructional opportunities for students that align with the district’s adopted middle school science instructional materials. **This work is optional and non-graded.**

This investigation packet is the first part in a series of district-aligned lessons about **Oceans, Atmosphere, & Climate**, a 6th grade life science unit developed by AmplifyScience. While Amplify Science lessons are designed to be done in the classroom with peers, there are some activities that students can complete at home. In this packet you will find activities to accompany lessons 1 and 2 of the unit. **Accompanying lesson videos will be aired on SPS TV and posted the SPS webpage under Grade 6**, however this packet can be used with or without the accompanying video.

The videos can be accessed either online or through Seattle’s Public television programming on **SPS TV** (local channel 26), social media (Facebook and Instagram: @SeattlePublicSchools, Twitter: @SeaPubSchools), and our **SPSTV YouTube channel**. KOMONews.com will also host on-demand videos under the tab “Lesson Plan” and broadcast on channel KOMO 4.3. These supplemental learning videos feature short segments supporting a variety of subjects and grade levels. All videos will be close captioned on YouTube. For more information regarding the SPS TV broadcast schedule and to find the videos, please visit the following website: [https://www.seattleschools.org/departments/media_operations_center___sps-tv/broadcast_schedule](https://www.seattleschools.org/departments/media_operations_center___sps-tv/broadcast_schedule)

For students who have access to the internet and the following devices and browsers may wish to log-in to their AmplifyScience account from home are welcome to do so. See below for guidance on which browser

- **Desktops and Laptops** (Windows 7+, Mac OS 10.11+) - *Suggested browsers: Chrome & Safari*
- **Chromebooks** - *Suggested browser: Chrome*
- **iPads that support iOS11.3+** (iPad5+) - *Suggested browser: Safari*

Sincerely,

Seattle Public Schools Science Department
Lesson 4
As a student climatologist, you determined that a location’s latitude affects its air temperature. But Christchurch’s air temperature and ocean surface temperature both become cooler during El Niño years. A city’s latitude does not change, so, other than latitude, what else might affect a location’s air temperature? Dr. Parata, the New Zealand Farm Council director, has sent an article that will help you begin to answer this question.

Vocabulary Review from Previous Lessons:

CLIMATE: General weather patterns over a long period of time

ENERGY: the ability to make things move or change

TEMPERATURE: a measure of how hot or cold something is; a measure of the average kinetic energy of the molecules of a thing

TRANSFER: to move from one object to another or one place to another

LATITUDE: the distance of a place north or south of Earth's equator

EQUATOR: the imaginary line that divides Earth into northern and southern hemispheres

Unit Question: During El Niño years, why is Christchurch, New Zealand’s temperature cooler than usual?
Lesson 4 – Part 1: Reading “Ocean In Motion”
So far, we know a location’s air temperature is affected by its distance from the equator. The closer a location is to the equator, the more energy it receives from the sun. But, both the air temperature and ocean temperature in Christchurch are cooler during El Niño years. Since a city's latitude does not change (cities might grow and expand over time, but they are located in the same basic place), we need to consider factors other than latitude.

One way air gets energy is when energy is transferred from the ocean to the air. Over the next few lessons, we will focus on ocean temperature to see how it might affect the air temperature of Christchurch during El Niño years.

Kiri Parata, the director of the New Zealand Farm Council, sent us this article. It will help you determine what factors other than latitude might be affecting Christchurch’s air temperature.

The Ocean in Motion

Surprising things sometimes wash up on shore, and this can happen all over the world. During a powerful storm in 1990, containers packed with 61,000 shoes fell off a cargo ship travelling across the Pacific Ocean and eventually washed up on beaches in Oregon, Hawaii, and Japan. These locations are hundreds or thousands of miles away from the place where the shoes were spilled. How did the shoes make their way to these locations?

If you look at a photograph of Earth, most of what you see is the big, blue ocean—after all, the ocean covers 71% of our planet. In a photograph or on a map, it may not look like the ocean moves very much, but the opposite is actually true. The water in the ocean is always moving from place to place, carrying objects and organisms wherever it goes. Ocean water doesn’t move randomly; it flows in consistent patterns. Scientists call ocean water flowing in a continuous path an ocean current. Currents carry all kinds of objects and organisms all over the world. The shoes made their way across the ocean with the help of ocean currents.
In addition to objects and organisms, ocean currents carry energy from the sun all around Earth. In fact, the motion of water around Earth’s ocean is one of the main ways energy moves around the planet. Energy from the sun is transferred to the ocean surface. As the currents move across Earth’s surface, the energy moves with them.

The current shown on the map to the right is moving away from the equator. At the equator, a large amount of energy is transferred from the sun to the ocean’s surface. As the current moves north, it carries this energy with it. If you place your finger on the map anywhere where this current moves, the water there would be warmer than you would expect for a location at this latitude because of the current that moves through this area.

A warm current moving north from the equator keeps Japan warmer than other places at the same latitude.

The current shown on the map at the bottom of this page is moving away from the South Pole. The farther away from the equator you are, the less energy is transferred from the sun to the ocean surface, with the least amount of energy transferred at the poles. This means the current traveling from the South Pole carries less energy with it than currents coming from the equator. If the ocean water weren’t moving, then ocean surface temperatures in different locations would only depend on their latitudes. However, in locations where a cold current moves

A cold current traveling north from Antarctica keeps the western coast of Australia cooler than other locations at the same latitude.
past, the ocean surface temperature is lower than you would expect.

**Major Ocean Currents**

Ocean currents form five main gyres, or circles: the Indian Ocean Gyre, the North Pacific Gyre, the South Pacific Gyre, the North Atlantic Gyre, and the South Atlantic Gyre.

The maps on this page make it look like ocean currents are constant. However, ocean currents can sometimes change direction. Since ocean currents carry energy around Earth, a change in the direction a current moves can change ocean surface temperatures at any locations the current passes on its journey.

In many parts of the ocean, surface currents come together to form gyres, huge areas of water moving in big circles. All together, these gyres move water in a predictable pattern all over the globe, carrying energy, organisms, and other objects with them. That’s how shoes that were spilled in the middle of the ocean can end up in Oregon, Hawaii, and Japan!
Tracking Currents in the Sim

Tracking a Current

A. Open the Ocean, Atmosphere, and Climate Simulation. Select Current Map mode. Be sure NONE is selected in Temperature View.
B. Find a current that could be a part of a gyre. Tap anywhere on the current to activate the tracking system and observe the path of the current.
C. Draw the path of the current that you tracked onto the image.
D. Then, based on your observations, answer the questions below.

1. Describe the shape of the path of the current you tracked.

2. Draw a star on the image to indicate the place where you think the current had the most energy. Why did the current have the most energy in this location?

3. Thinking back to the shoe spill in “The Ocean in Motion,” how might those shoes have traveled from the middle of the Pacific Ocean to Oregon, Hawaii, and Japan?