Using Current Events to Study Climate Change Among the Spheres

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Human actions often have major repercussions leaving implications for the health of our planet. One major topic of study in the last decade has been the way humans are altering the composition of our atmosphere with the amount of greenhouse gas emissions that are released from energy production. Our atmosphere is the compilation of various gases that surround our planet. One of the most prominent gases in our atmosphere is carbon dioxide, a greenhouse gas that effectively traps heat inside our atmosphere. While naturally occurring, humans have increased the amount of atmospheric carbon dioxide by burning fossil fuels. The problem is, burning these fossil fuels effectively throws off the natural balance of how much carbon is stored in the atmosphere and in the lithosphere (outermost layer of earth, mainly composed of rocks and some soil). According to Alan Buis, a scientist at NASA's Jet Propulsion Laboratory, the amount of atmospheric carbon has increased in volume by more than 45% since the beginning of the Industrial Revolution (Buis, 2019). This major increase in carbon dioxide in our atmosphere has major implications for all parts of the planet, not just the atmosphere.

To make Earth, a vast and complex planet, easier to study humans have split it up into separate "spheres", which are considered subsystems of Earth. This one change in the atmosphere has major implications for the planet's biosphere (living things on Earth), and hydrosphere (water on Earth's surface) just to name a few. For students to understand what climate change is, they must first understand that nothing on Earth happens without an effect being felt elsewhere. This is ultimately true when students are making sense of climate change, because the changes have been brought about by the actions of one species in the biosphere: humans. It is vital that we teach the next generation to be aware of their actions and how it impacts the planet they live on. In the classroom, teachers should connect the Earth's spheres to today's current events because it allows students to make real-life connections between their knowledge and the world around them. Learning about the spheres by way

of current events and interpreting data has a lasting impact on how students view how their actions impact the planet.

Atmosphere/Biosphere Current Event

In 2020, one of the most life changing events entered this portion of human history when a pandemic, COVID-19 rapidly plagued our planet causing changes to the daily lives of humans world-wide. Research revealed from Potsdam Institute for Climate Impact Research (PIK), is discussed in the article, "*Biggest carbon dioxide drop: Real-time data show COVID-19's massive impact on global emissions"*. In the article, it is discussed how the large drop in the amount of Carbon Dioxide emitted is largely due to the "work from home" orders that were instigated worldwide. This caused the largest drop of carbon emissions (40%) in the ground transportation sector as more individuals were staying home (PIK, 2020). This study is made possible by "real-time data" collected at PIK. Scientists at the Institute, as well as world-wide, are able to study the data being released by their research to interpret these events and even determine which aspects of the global economy were most slowed down in terms of energy production.

This current event is critically important as the connection between the biosphere and the atmosphere is so evident. Humans, being the most influential part of the biosphere, have the ability to alter the composition of the atmosphere. While these changes are relatively minute in the short term, these changes add up in the long run. It is amazing that the changes in actions of individuals at a small scale has such serious implications on such a large scale. It is important to note the article in discussion, does state that this will not be enough change, or even a change that can be sustainable in the long-term. Instead, the changes must come from changes within the sectors to reduce the amount of carbon emitted. This event would be a great way to connect to students when studying solutions to Climate Change in Earth Science because it shows the connections of the spheres and how humans

are at the heart of those changes. It also shows students that the reduction of carbon emissions is possible but will simply require some ingenuity and most importantly passion to make a change. These changes caused by humans in the biosphere have effects on not just the atmosphere but also the hydrosphere.

Hydrosphere/Atmosphere Current Event

The hydrosphere is one of the world's largest sinks of carbon. The ocean naturally dissolves into the ocean and is then used by marine organisms such as phytoplankton to create energy. Through the process of photosynthesis, organisms such as these phytoplankton have thus far been one of the biggest combatants in the fight against climate change because these organisms take up the carbon dissolved into the ocean with their bodies. This means that the ocean's are absorbing that excess carbon from the atmosphere but it is not without consequences. According to a study at the University of Technology Sydney, scientists revealed in the article, *"Acid oceans are shrinking plankton, fuelling faster climate change"*, these more carbonic oceans are now revealing to have harmful effects on these phytoplankton, making them "less effective at storing carbon" (2019). Ocean acidification is an event in which the excess carbon dioxide from the atmosphere is absorbed by the oceans. While on the surface this seems like a positive because the oceans pull up to 40% of carbon from the atmosphere, the effects are actually quite grim. Adding more carbon to the ocean actually can change the chemistry of ocean-water, which of course will have effects on marine-life, even if all of those effects are not yet known. Scientists, Katherina Petrou and Daniel Neilson at the University of Technology in Sydney have discovered a new effect that ocean acidification has on phytoplankton (the base of all marine food webs). They studied different diatom species and observed that those diatoms living in more acidic waters resulted in a thinner layer of silica creating their cell wall (Petrou and Neilson, 2019). Naturally when these diatoms sink to the ocean floor, they

carry the carbon inside their bodies with them. This means less carbon is being tucked away at the bottom of our oceans and the result is instead just more acidic waters and phytoplankton with weaker cell walls.

It is becoming more and more clear as more research is being done, how many ways that human caused changes in our atmosphere can affect the earth's hydrosphere. Perhaps what is most interesting is how the changes in the biosphere were what ultimately resulted in changes to life in the ocean. This current event does a fantastic job at showing how changes in one sphere of Earth ultimately results in changes to other spheres in an eventual chain of events. In this case, humans releasing carbon into the atmosphere is affecting the stability of ocean life, despite whether or not those humans have ever even visited the ocean to see for themselves. In an Earth science course, this would be a beautiful way to engage students in the subject of climate change. Allowing students to explore how their carbon footprint can reach as far as the ocean, despite their real footprint being hundreds of miles from the nearest ocean is an engaging and meaningful way to learn about a subject as important as Climate Change.

Biosphere/Hydrosphere Current Event

Lastly, changes in our hydrosphere eventually makes its way back to our Earth. In the article, *"Climate change causes landfalling hurricanes to stay stronger for longer*", scientists at Okinawa Institute of Science and Technology (OIST) ,a Graduate University, have studied the effects of warming oceans on hurricane strength and thus catastrophic tendency upon landfall. Hurricanes form when warm waters meet moist air. This is the foundation of understanding for how changes in the hydrosphere can affect changes in the atmosphere in reference to the formation of storms. Scientists researched hurricane intensity (specifically the time it takes for a storm to weaken after making landfall) and noticed the correlation between increase in the length of intensity of hurricanes after

landfall and an increase in sea surface temperature. The same change in carbon dioxide in our atmosphere that affects the acidity of our oceans also affects the temperature of our planet. Specifically, the temperature of sea surface water has increased in previous years and scientists attribute this largely to the fact that carbon dioxide is a greenhouse gas that traps heat in Earth's atmosphere. As the oceans continue to warm, hurricanes will make their way further inland where people and the natural ecosystems are not prepared for events. Of course, hurricanes make media coverage every year in late summer as they leave a path of destruction for coastal cities closest to the water, but what is not mentioned is the causes and effects stemming from the biosphere.

Understanding how the Earth's weather events operate is a major part of Earth Science and is a perfect example of how multiple spheres of the Earth are interacting with one another. This current event particularly is valuable in educating the next generation because it ties in not only the interaction between the spheres (the hydrosphere and atmosphere) that must occur for a hurricane to form but also tells the larger story of how climate change is causing more and more interactions with the biosphere.

Our planet is a collection of all the spheres, people, and animals that live on it. As educators it is vitally important that we use the events occurring around us to allow the students to make real-life connections. Without these current events, teaching the spheres can easily become a collection of vocabulary words that occur independently and have no interaction with one another. As you can see if this is the approach taken to learn the spheres there is so much opportunity for authentic, applicable learning that is being missed. The only true way to study the spheres of the Earth is to study how Earth itself as a system is made up of multiple subsystems that are in constant interaction to maintain life on Earth.

References

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