#2. Weather & Climate

Summary: In this module you will learn what comprises weather systems and how that is tied to climate.

Goals: By the end of this module you will be able to describe how weather and climate differ, describe how greenhouse gas emissions (GHG) make the planet warmer, and identify (and use) reliable sources of information to describe weather and climate for your region.

Tribes Taking Action. Check it out: The Swinomish Tribe has a multi-faceted plan to respond to climate change and protect their culture and resources for at least the next 7 generations. https://www.swinomish-climate.com/

Required readings and videos:

General Introduction --

Weather

https://www.weather.gov/epz/weatherbasics_sunandweather

https://www.youtube.com/watch?v=E-5rieCUPuc&feature=emb_rel_end

Climate

https://www.nasa.gov/mission_pages/noaa-n/climate/climate.html

https://cnx.org/contents/F0Hv_Zza@45.1:5LqJn9Rx@18/Climate-Processes-External-and-Internal-Controls

https://cnx.org/contents/F0Hv_Zza@45.1:g2CdOhZm@6/Modern-Climate-Change

https://www.youtube.com/watch?v=sCxIqgZA7ag&pp=QAA%3D

More detailed information --

National Climate Change Assessment: https://nca2014.globalchange.gov/ (website navigation allows exploration by geographic region, or by sector/topic e.g. water, energy, transportation, etc) The NCA section on water is here: https://nca2014.globalchange.gov/report/sectors/water

Supplemental Content:

Canadian perspective: https://climateatlas.ca/climate-vs-weather https://climateatlas.ca/video/bad-news-fields https://climateatlas.ca/video/bringing-back-buffalo

Map Stories and Graphics: https://oceanservice.noaa.gov/map-stories/

Why greenhouse gases make the planet warmer. Video (with summary points).
https://www.youtube.com/watch?v=AIBk0pGV_BQ

Overview of chemical reactions in the global carbon cycle & how those relate to climate:
https://www.youtube.com/watch?v=aLuSi_6Ol8M&pp=QAA%3D

Key Vocabulary: weather, climate, Celsius, insolation, greenhouse gases, albedo, atmosphere, feedback loop, climate change, electromagnetic radiation, greenhouse effect, solar radiation, wind, atmospheric pressure

Assessment Tools:

Writing Assignments:

#1) Explain why greenhouse gases make the planet warmer. Cite your sources.

#2) Write a 1-2 page essay that discusses why not all of the Sun's energy is warming the earth. You should use at least 3 of the resources covered in this unit to support your argument; you may use additional sources too. (Note to instructor – student essays should mention reflective surfaces and albedo, at a minimum.)

Discussion Questions (can be used in classroom or for on-line discussion board or for quiz):

- These following questions are found at the end of the assigned readings.

Review Questions

Question:

The text describes how the high albedo of snow acts as a positive feedback—if the Earth is made cooler, the highly reflective snow can act to further cool the Earth. Today, part of the Earth is covered with snow and ice. Can you describe a mechanism by which warmer temperatures would also produce a positive feedback—this time heating the Earth further—through a similar albedo mechanism?

Question:

Mars is colder than the Earth. Venus, on the other hand, is much hotter, with average surface temperatures of around 450 °C. Venus is closer to the Sun than the Earth is, and so receives about twice as much solar radiation. Venus's atmosphere is also different than Earth's, as it is much thicker and mainly consists of carbon dioxide. Using the terms **insolation** and **greenhouse gases**, can you suggest reasons why Venus is so hot?

Question:

Oxygen makes up over 20% of Earth's atmosphere, while carbon dioxide makes up less than 0.04%. Oxygen is largely transparent to both visible and infrared light. Explain why carbon dioxide is a more important greenhouse gas in the Earth's atmosphere than oxygen, even though there is much more oxygen than carbon dioxide.

Question:

Figure Insolation shows the insolation at the surface of the Earth. The Earth is spherical, so we would expect the values to be the same for places of the same latitude. But notice that this is not true – compare, for example, central Africa with the Atlantic Ocean at the same latitude. What feature of the atmosphere might explain this variation, and why?

Source: https://cnx.org/contents/F0Hv_Zza@45.1:5LqJn9Rx@18/Climate-Processes-External-and-Internal-Controls

Review Questions

Question:

In Figure **Northern Hemisphere Surface Air** the dividing line on the graph is the 1961-1990 average temperature. Explain the relevance of this line to the data presented in this figure.

Question:

Explain how deforestation can lead to both a warming effect and cooling effect for global temperatures.

Question:

In Figure **Atmospheric Transmission**, which gas is contributing the most to the absorption of ultra-violet light? If this gas were removed from the atmosphere, how might global temperatures respond?

Question:

If the surface of the Greenland Ice Sheet continues to melt, how will this impact the albedo of this region and what impact will this have on the air temperature there?

Question:

When sea ice melts, what happens to global sea level?

Source: https://cnx.org/contents/F0Hv_Zza@45.1:g2CdOhZm@6/Modern-Climate-Change

Module 2 Lab Activity

Design a study and write a standard lab report to test the following null hypotheses: ***There has been no difference in either the average daily high temperature nor average total daily precipitation on July 4, for the past 10 years in my community compared to the 10 year period from 1980 – 1990.*** Use weather data from one of the federal agencies to complete this assignment. (Hint: you may find these tools to be useful in obtaining the data needed for this assignment https://www.ncdc.noaa.gov/cdo-web/datatools)

Follow the IMRAD method to prepare your lab report. This resource shows how to write a good lab report with IMRAD: https://writingcenter.unc.edu/tips-and-tools/scientific-reports/ Note: this resource also shows the correct way to cite reference materials.