Decoding Carbon

#DECODINGCARBON
Backgrounder: How is Climate Change Shaping this World?

Climate change is a term we hear often- in news articles, in television commercials, on the radio, in political talk shows, on social media, and overhearing discussions on public transit are just some of the places where we may have heard about climate change. It has become one of the most important topics in our world. As this topic appears everywhere frequently, it is important to understand what climate change is and how it is shaping our world.

What is Global Warming?

Global warming refers to the average increase in Earth's global surface temperature since the pre-industrial period caused by human activity, such as increases in greenhouse gas (GHGs) emissions from fossil fuel burning. Greenhouse gases trap heat in the Earth's atmosphere, resulting in a long-term increase in the Earth's average temperature (NASA, 2020). According to research undertaken by NASA and National Oceanic and Atmospheric Administration, "temperatures in 2019 were the second warmest since modern record keeping began in 1880", with a continuous upward trend of an increase of an Earth's global surface temperature (NASA, 2020).

See the next figure of the mean surface air temperature between 1960 to 2011, where the Arctic seen as red reflects the 50-year trend of an increase in air temperature of more than 2 degrees Celsius (NASA GISTEM Team, 2019).

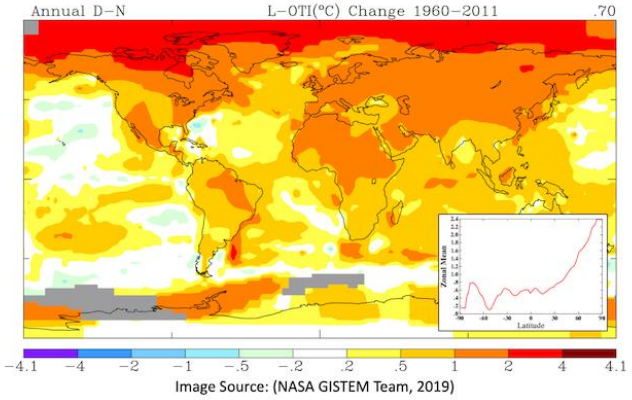


Image Source: (NASA GISTEM Team, 2019)

For further investigation, refer to NASA Scientific Visualization Studio's map on the progressive change in global surface temperature anomalies (NASA, 2020).

What is Climate Change?

Climate change is a long-term change in average weather patterns of the Earth, where these changes include a broad range of effects, such as extreme weather events (NASA, 2020). Climate change is sometimes used interchangeably with global warming; however, climate change "refers to both human- and naturally produced warming and the effects it has on our planet" (NASA, 2020). More recently, the term **anthropomorphic climate change** has been used to refer to climate change attributed to human activity that has led to an increase in greenhouse gas emissions in the earth's atmosphere.

Impacts of Climate Change?

In its recent report, the **Intergovernmental Panel on Climate Change (IPCC)** predicted severe consequences to our world if global warming increases beyond 1.5 degrees Celsius above the pre-industrial levels caused by human activities, and urging policy makers to take "rapid and far-reaching" actions to limit temperature increase to 1.5 degrees Celsius (Intergovernmental Panel on Climate Change, 2018). The report predicts an increase in the mean temperature of the world, and a rise in extreme weather patterns such as droughts in certain regions and heavy precipitation in other regions (Intergovernmental Panel on Climate Change, 2018).

Environment and Climate Change Canada published a report titled Canada's Changing Climate that found that on average Canada has been warming twice the rate of global warming (image to the right). The report further notes Northern Canada to be warming more than double the rate of global warming. This increase in warming has resulted in drastic and negative changes in extreme climate patterns, precipitation, snow and ice cover, freshwater availability and ocean and sea level changes (Government of Canada, 2019).

For more detailed review of findings, visit the link to the report below:

- https://changingclimate.ca/CCCR2019

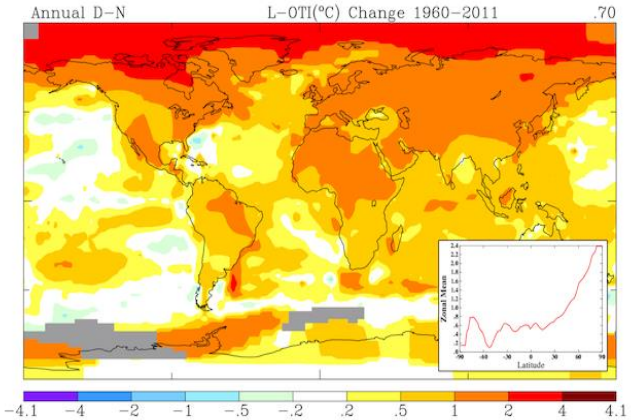


Image Source: (NASA GISTEM Team, 2019)

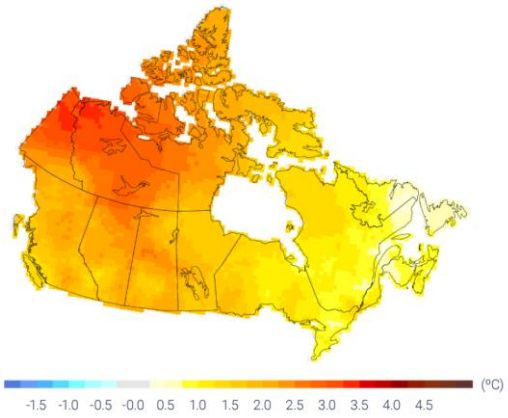
By posing threatening changes to our oceans, weather, food and health, the effects of climate change "will be felt across ecosystems and human communities and economies" around the globe (National Geographic, 2018). Below are some of the impacts of climate change that are being felt across our globe.

Glacial Melt

Climate change has led to an increase in glacial melt across the globe, including melting of ice at the Earth's poles. Below are some of the evidences that scientists have documented of glacial melt and its impacts:

- Confirmed melting of ice sheets covering West Antarctica and Greenland and the Arctic Sea ice (National Geographic, 2020)
- Confirmed melting of glaciers in the Montana's Glacier National Park has resulted in a decline of fewer than 30 glaciers compared to more than 150 in 1910 (National Geographic, 2020)
- Due to the glacial melt, the sea levels are rising at the rate of 0.13 inches or 3.2 millimeter per year (National Geographic, 2020).
- A report from the National Snow and Ice Data Center in the US shows that Arctic warming has caused air temperature to rise by 4 degrees Celsius in 2010 compared to 1968 to 1996 reference period. Additionally, the research conducted by the center shows that the Arctic Sea has declined by at least 30 per cent in 2010 in the last 30 years, and continue to decrease, see image below for reference (National Snow and Ice Data Center, 2020).

Annual temperature increase 2016 vs. 1968 based on linear trends



Source – (Environment and Climate Change Canada, 2019)

- An increase in temperature and the subsequent melting of ice has challenged many species around the world. In particular the populations of Adélie penguin in Antarctica, with some population in western peninsular declining at least 90 percent. Additionally, some species of "butterflies, foxes and alpine plants have migrated farther north or to higher, cooler areas" (National Geographic, 2020)

Flooding

Climate change has also resulted in an increase in extreme weather events, such as increase in precipitation (rain and snow) and severe droughts across many regions of the world (National Geographic, 2020). Although attributing flooding to climate change may be a difficult task, as there are many factors that lead to the cause of flooding, in its recent assessment report the IPCC concluded that "climate change 'has detectable influenced' several water-related variables that contribute to floods, such as rainfall and snowmelt"- as such by influencing various factors climate change indirectly increases the occurrence of flooding (Natural Resources Defense Council, 2019. Other effects of water-related events beside heavy precipitation include more frequent hurricanes and sea level rises, which make coastal communities increasingly vulnerable to the effects of climate change.

Land

Climate change leads to extreme weather events such as heavy precipitation and severe droughts in many regions of the world. In a recent special report, the IPCC concluded that climate change can be attributed to an increase in global land surface air temperature increase by twice as much compared to pre-industrial times (2019
These extreme weather events of severe droughts and rainfall will lead to concerns around potential loss of habitable land, in addition to concerns around food security, access to clean drinking water and secure shelter.

Health

An increase in heat waves, forest fires, extreme weather events such as hurricanes, droughts, and flash flooding, are just some of the effects of climate change being felt from human communities around the world. These impacts have a direct consequence on human health- risking access to "clean air, safe drinking water, sufficient food and secure shelter" (World Health Organization, 2018).

The World Health Organization (WHO) (2018) estimates that between 2 to 4 billion USD per year will be sent in direct damage costs to health as a result of the impacts of climate change, where these costs will be spent to improve food security, water and sanitation access to people. The WHO continues to estimate that climate change will cause about 250,000 additional deaths per year from between 2030 and 2050, with malnutrition, malaria, diarrhea, and heat stress being the leading actors leading to the projected mortality (World Health Organization, 2018).

More resources on this topic can be assessed here:

1. NASA- effects of climate change
2. IPCC Special Report; Global Warming of 1.5°C

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