

MECH-322 FLUID MECHANICS

GLOBAL WARMING AND CLIMATE  
CHANGE ESSAY:

“The Current State and Future of Climate  
Change”

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Climate change has steadily been on the rise for the past few decades, and unless certain actions are taken, it will take a long time before it would even begin to slow down. The amount of carbon dioxide that has been released into the air has increased from 378 parts per million back in January of 2005 to 418 parts per million, or from 378,000 kg/m<sup>3</sup> to 418,000 kg/m<sup>3</sup>, leading to some rather severe side effects all throughout the planet. Right now the global temperature has risen by 1.01 degrees Celsius since 1880, which, while it may not seem massive initially, there is the fact that there has been a total of nineteen of the warmest years have occurred since 2000 throughout recent history, signifying that the earth is only getting warmer with all of the carbon dioxide in the air. This also does have some major implications on locations such as the northern and southern poles of the planet specifically concerning the ice sheets present at both locations.

As a result of this change in temperature, the amount of Arctic sea ice has decreased by 13% since 1979, and from 2002 to the present day alone, over 400 billion tons of ice have melted. With all of the ice melting, it has resulted in rising sea levels across the world at approximately three millimeters per year since 1993, or seven inches within the past one hundred years. On top of all of that, the rise in air temperatures has also naturally changed the temperature of the ocean as well, increasing the ocean waters by approximately 0.14 degrees Fahrenheit, which causes the ice caps to melt at an even faster rate on top of other side effects such as coral bleaching, stronger and more devastating hurricanes, and causing the sea levels to rise even more so due to the melted ice. Cities such as Venice are extremely vulnerable to the changes brought about by climate change due to its canal systems tied directly to the ocean, and though efforts are being made to prevent future disasters, flooding has become a far more common problem for the populace for the past few decades.

Even here in the United States, climate change has already had a massive impact on the environment present in our country. Heatwaves and overall higher temperatures have ravaged the Southwest and Northeast, all the while causing an increase in droughts in the South. States in the Southeast are particularly vulnerable to the rising sea levels, and will likely have a negative impact on both the health and economy of the country as a whole. As a whole, climate change has had a wide range of effects on the population, including extreme heat increasing the chances of cardiovascular failure, the degradation of the environment and flooding forcing people to migrate to locations at higher elevations, droughts causing the food supply to decrease resulting in increased malnutrition, an increase in waterborne pathogens, and conditions such as asthma worsening due to the polluted air.

All of these previous statistics are the current measured statistics or what has already happened to the environment and the health of the population, but it's only going to get worse from here. Climate change will only become more and more severe as time goes on, with no sign of slowing down even if

measures are taken to stand right against it. As for the currently projected temperature, it is predicted that the temperature across the globe will continue to increase by the 22nd century and that the rise in temperature globally will reach upwards of 4 degrees celsius, almost quadrupling since 2022. As a result of the increase in air temperatures, the temperature of the sea will naturally continue to rise alongside it, leading to the inevitable shrinking of the polar ice caps at the northern and southern poles. Current estimations indicate that by the year 2100, depending on the severity of the continued addition of carbon dioxide into the atmosphere, the sea level will continue to rise by as little as one foot or as high as eight feet, either of which can cause major devastation across the globe, specifically to coastal settlements. Harbors, docksides, and both towns and cities that have been situated at the coast, especially locations such as Venice that have been previously mentioned, will either require extreme amounts of construction work done to repair and replace what will soon be submerged into the ocean or must be abandoned.

On top of all of that, the amount of precipitation will also continue to be on the rise as the greater heat generated will result in more evaporation and heavier rainfall, and storms such as hurricanes only grow more and more deadly than they already are currently. The ice sheets located in the northern hemisphere are expected to decrease by at least 15% by 2100, which of course directly leads to a major increase in sea levels across the globe as previously mentioned. On top of everything else, the increase in sea levels and air temperatures will continue to also lead to an increase in the degradation of human health, with heat stroke, dehydration, and cardiovascular cases increasing as time goes on. Wildfires are also expected to only become more and more common as the warmer temperatures make the creation of said fires all the more likely to continue for longer periods of time and require more effort from fire departments to quell the flames.

Though some areas will continue to see rises in precipitation, especially along the coast, settlements within continents and farther away from the coastline will experience even more severe droughts than are already occurring as lakes and rivers unconnected to the ocean continue to dwindle in size from the increase in evaporation. With an increase in droughts, it makes it far more difficult to effectively grow food inside of continents, and safe drinking water will become far more scarce as pools of freshwater continue to evaporate at an increasingly alarming rate as well as an increase in water-borne pathogens. Lastly, the acidity of the ocean will also continue to increase alongside the melting of the ice caps and the increase in the temperature of the air, leading to worsening conditions for life in the sea and potentially causing sharp declines in marine populations. Due to the conditions of Earth at the current moment and the continued addition of more and more carbon dioxide into the planet's atmosphere, these effects are being inflated more and more with time.

It is important to acknowledge that we know we are continuously adding carbon dioxide to the atmosphere. This in turn is causing relatively rapid change to our climate. In turn, increasing the global temperature and the likelihood of various extreme weather events and natural disasters. However it has always been human nature to engineer innovative solutions to the challenges we face, and climate change is no exception. There are a few approaches that are being attempted. Some with the goal of reducing the amount of carbon dioxide we emit into our atmosphere, while others are looking at actively removing carbon dioxide from the atmosphere.

One of the main advancements that are being used to combat climate change is renewable energy technologies. These technologies aim to reduce the amount of carbon dioxide that we emit by providing alternative options to fossil fuels for our energy uses. Some of the biggest sources of renewable energy include solar and wind energy. Solar energy uses energy captured from the sun, and wind uses energy captured from wind to turn generators.

Both of these technologies generate electricity without producing carbon dioxide. However these technologies have some down sides. Solar can only produce energy during the day and is more or less efficient depending on cloud cover. Wind also faces a similar challenge of being dependent on the weather. As well as being weather dependent, both of these technologies require a significant amount of land to be devoted to their use. This means that using them in urban areas can be difficult if at all possible. In the end these and other renewable technologies are becoming more and more widely adopted, resulting in lower demand for fossil fuel based energies taking another step towards ensuring our survival.

By gaining alternative sources of energy we reduce how much carbon dioxide we add to the atmosphere, however, this does little to reduce the amount of carbon dioxide actually present in our atmosphere. In order to combat this some people are working on developing carbon capture systems. These systems aim to actively remove carbon from the atmosphere by filtering it out of the air. By actively removing carbon dioxide from the atmosphere the harm that has been done in the past can be reversed. Although this initially seems like a great solution there are some serious drawbacks. One of the biggest reasons this technology isn't yet widely implemented is how expensive it is. A typical carbon capture facility can cost upwards of a billion dollars throughout its lifetime. This level of cost is extremely prohibitive, and is one of the biggest things preventing widespread adoption. Not only is carbon capture expensive financially but it is also expensive when it comes to energy. When used at power plants it can use from 11 to 40% of the energy produced depending on the type of plant. This greatly de-incentivises the use of this technology, as using it where it can have the most positive impact can further hurt those businesses that do decide to use it. One of the other barriers that carbon capture faces is the by-product. Once carbon is captured it must be stored, This means there must be separate storage facilities. The facilities that do this must be able store carbon dioxide securely for an indefinite amount of time. These

are just a few of the things holding carbon capture back from widespread use. If some of these barriers can be overcome then this technology may be able to protect us from the dangers we are facing.

## References

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