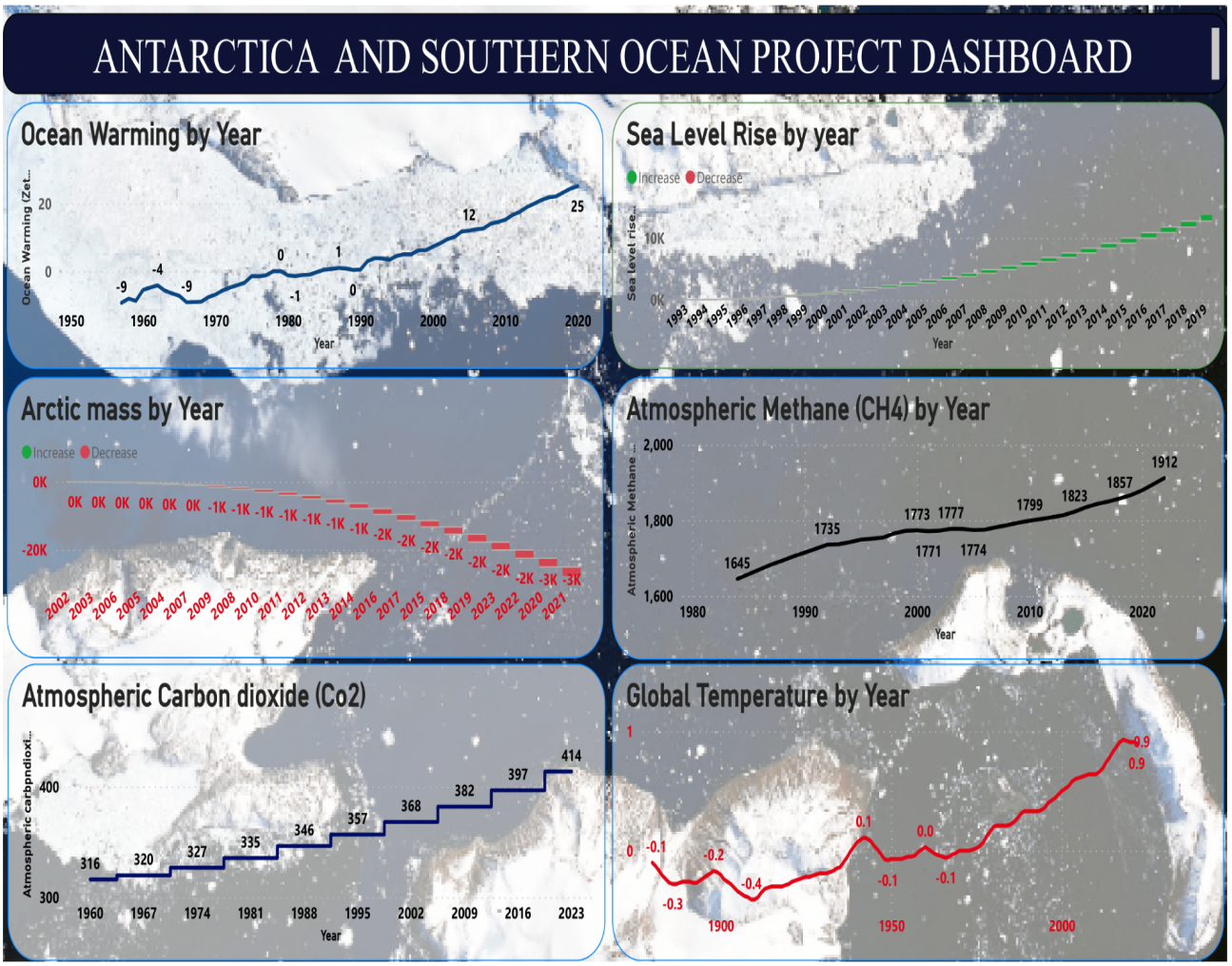

ANTARCTICA AND THE SOUTHERN OCEAN PROJECT DASHBOARD

EG-ABI DATA VISUALIZATION COMPETITION

PROJECT

IMPACTS OF CLIMATE CHANGE AROUND ANTARCTICA AND THE SOUTHERN OCEAN

ANALYSIS REPORT

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Introduction.

In a world grappling with the increasingly urgent challenges of climate change, this analysis embarks on a critical exploration, focusing on the pristine yet vulnerable realms of Antarctica and the Southern Ocean. Our research journey is underpinned by a rich tapestry of datasets, drawing from diverse sources and covering a spectrum of environmental indicators. We scrutinise the effects of climate change on these polar regions with unwavering precision and depth, utilising Microsoft Excel for meticulous data extraction and Power BI for advanced analysis and visual representation.

The datasets harnessed for this investigation serve as vital signposts on the path to understanding the multifaceted impacts of climate change. Atmospheric carbon dioxide (CO2) and methane concentrations, often labelled as the culprits behind the greenhouse effect, unveil the human fingerprint on global climate systems. The trajectory of global temperature, relentlessly ascending, captures the relentless march of climate change. Ocean warming, a testament to the planet's warming core, ushers in drastic changes in the world's largest carbon sink, the Southern Ocean, and the very foundation of Antarctica's icy expanse. Ice sheet and ice mass data crystallise the vulnerability of these polar ecosystems, hinting at the profound and irreversible shifts underway.

Excel, the venerable data workhorse, serves as our trusty guide through the labyrinthine archives of environmental data, meticulously extracting, organising, and preparing the information for analysis. Power BI, a powerful tool in the arsenal of

modern data analytics, emerges as our compass, enabling us to traverse this trove of knowledge, to draw actionable insights and to weave the narrative of climate change's effects on Antarctica and the Southern Ocean.

The overarching objective of this analysis is to shine a spotlight on the intricate interplay between climate change and these polar regions. As sentinels of the Earth's shifting climate, Antarctica and the Southern Ocean bear witness to cascading consequences: melting ice, altered ecosystems, and sea-level rise. Our journey, guided by data and powered by technology, seeks to deepen our understanding of these transformations. Ultimately, we aim to illuminate the urgency of climate action and the imperative to protect these remote, yet globally significant, ecosystems in the face of a changing world.

Data source.

The datasets used for this analysis were sourced from the nasa.gov website. The datasets were in text form; They were extracted from the webpage and saved in Excel format. Six datasets were used for this analysis. These datasets include data for atmospheric carbon dioxide, methane, global temperature, ocean warming, ice sheets and ice mass.

https://climate.nasa.gov/vital-signs/carbon-dioxide/

Data cleaning and transformation.

To ensure accuracy in the analysis, there was thorough cleaning and data transformation. This dataset was cleaned and transformed using the power query in Power BI. The dataset was imported into power query and the following were done:

- Changed wrong data types for easy and correct manipulation of the dataset. More so, for accurate analysis.
- Renamed column headers.
- Used DAX function to group years where we had multiple years.
- Removed errors.
- Checked for duplicates.

Problem Statements:

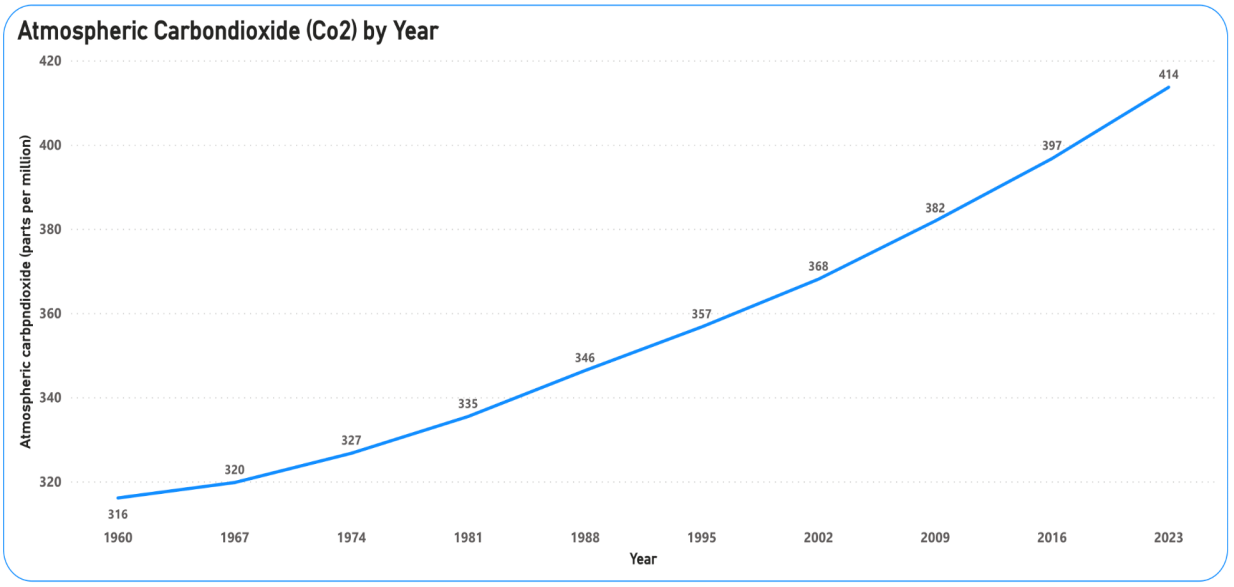
1. Examine the historical global temperature trends over the past years and assess how these temperature variations are influenced by increasing atmospheric carbon dioxide levels and its effect on Antarctica and the Southern Ocean.
2. Analyse the relationship between temperature rise and methane emissions and assess the long-term impact of climate change and its effect on the Antarctica region
3. Analyse the variations in global temperature and how it affects climate change and its effect on Antarctica.
4. Investigate the effect of rising sea levels due to the melting of ice sheets and the vulnerability of ecosystems in the southern ocean and Antarctica region to sea-level rise and propose adaptation and mitigation strategies
5. Study the interactions between ocean warming and global temperature rise and its consequences on the Southern Ocean and Antarctica.

Data analysis and visualisation:

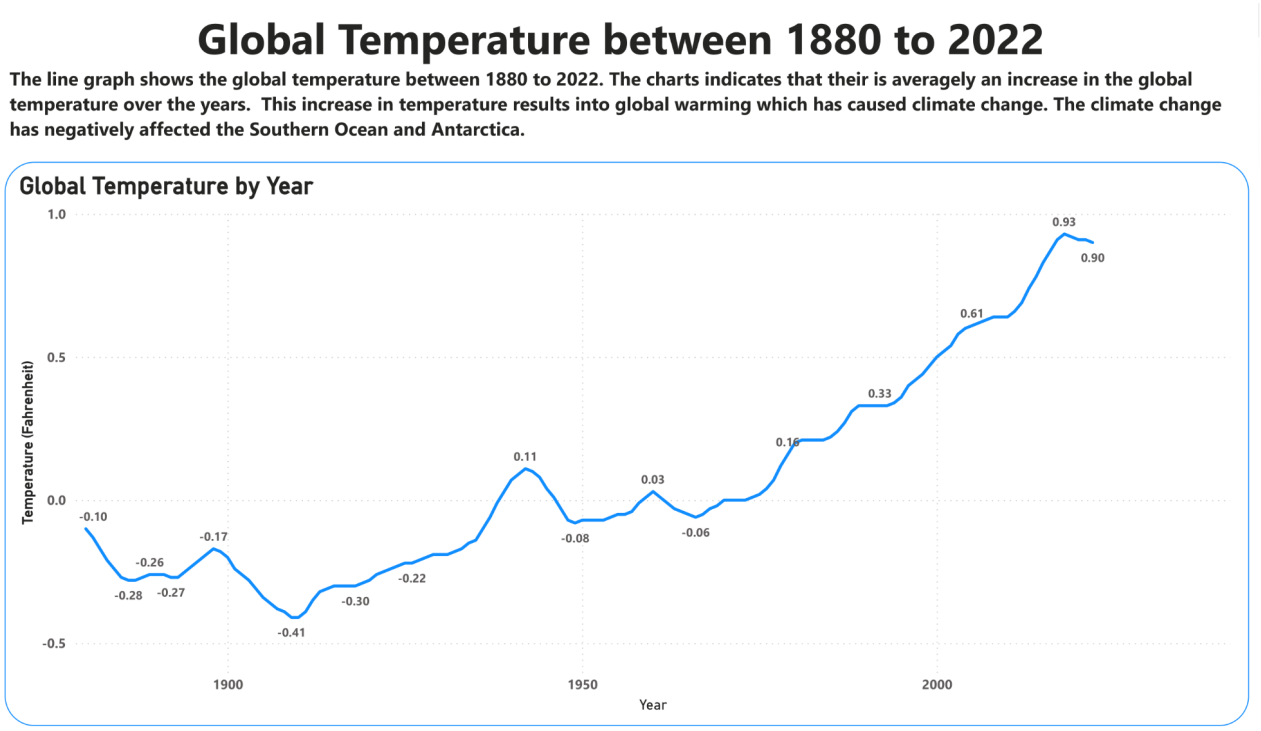
1. **Examine the historical global temperature trends over the past years and assess how these temperature variations are influenced by increasing atmospheric carbon dioxide levels and its effect on Antarctica and the Southern Ocean.**

Atmospheric Carbon dioxide (Co2) between 1960 to 2023

The chart shows an increase in the emission of carbon dioxide which is a key contributor to the greenhouse gases. The excessive emission of this gas has become one of the major causes of global warming. Global warming has caused climate change which has contributed to negative effects on the Antarctica and Southern Ocean. The southern ocean absorbs a significant portion of the atmospheric CO2 and that has resulted ocean acidification and can disrupt marine ecosystems.



Model 1: Atmospheric Carbon Dioxide by Year



Model 2: Global Temperature by Year.

Model 1 above shows the trend of carbon dioxide between 1960 to 2023. The chart shows that there has been an increase in the temperature over the years.

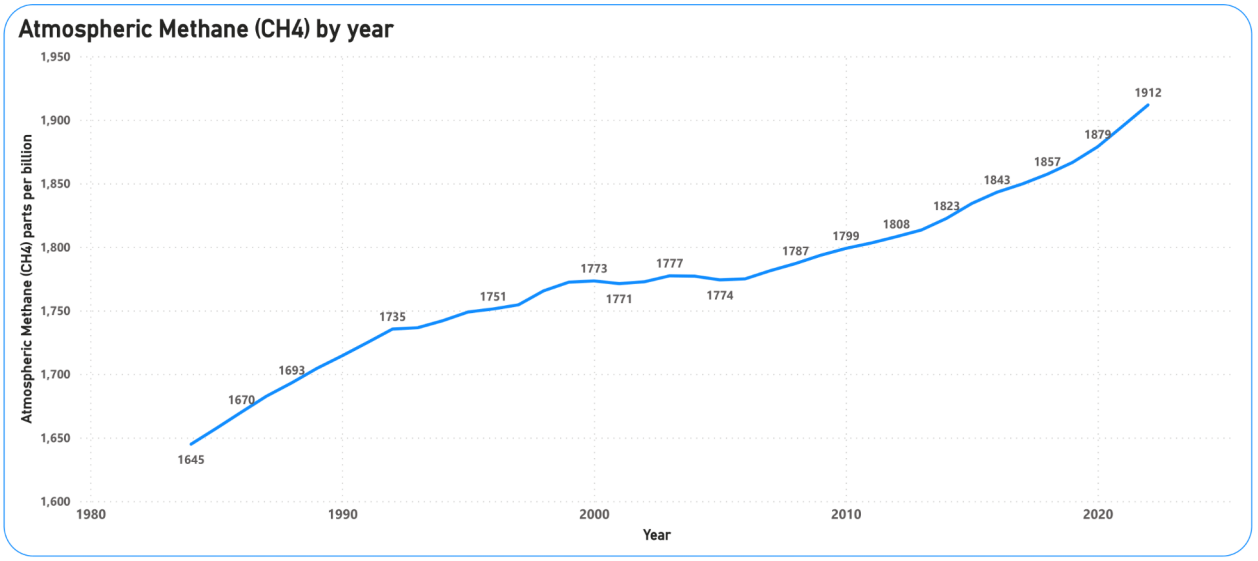
Model 2 above shows the trend of global temperature from 1880 to 2020. The chart shows the increase in global temperature which is a result of the increase in the emission of atmospheric carbon dioxide which is one of the key greenhouse gases. The Earth's climate is heavily influenced by the concentration of greenhouse gases in the atmosphere, with carbon dioxide being a major contributor. The burning of fossil fuels for energy, industrial processes, and deforestation has led to a substantial increase in atmospheric CO2 levels since the Industrial Revolution. This has intensified the natural greenhouse effect, trapping more heat within the Earth's atmosphere and resulting in global warming.

The scientific community is overwhelmingly in agreement that the excessive emission of CO2 is the primary driver of global temperature increase. The Intergovernmental Panel on Climate Change (IPCC) and numerous scientific studies provide substantial evidence and consensus to this claim.

2. **Analyse the relationship between temperature rise and methane emissions and assess the long-term impact of climate change and its effect on the Antarctica region.**

Atmospheric Methane (CH4) between 1984 to 2022

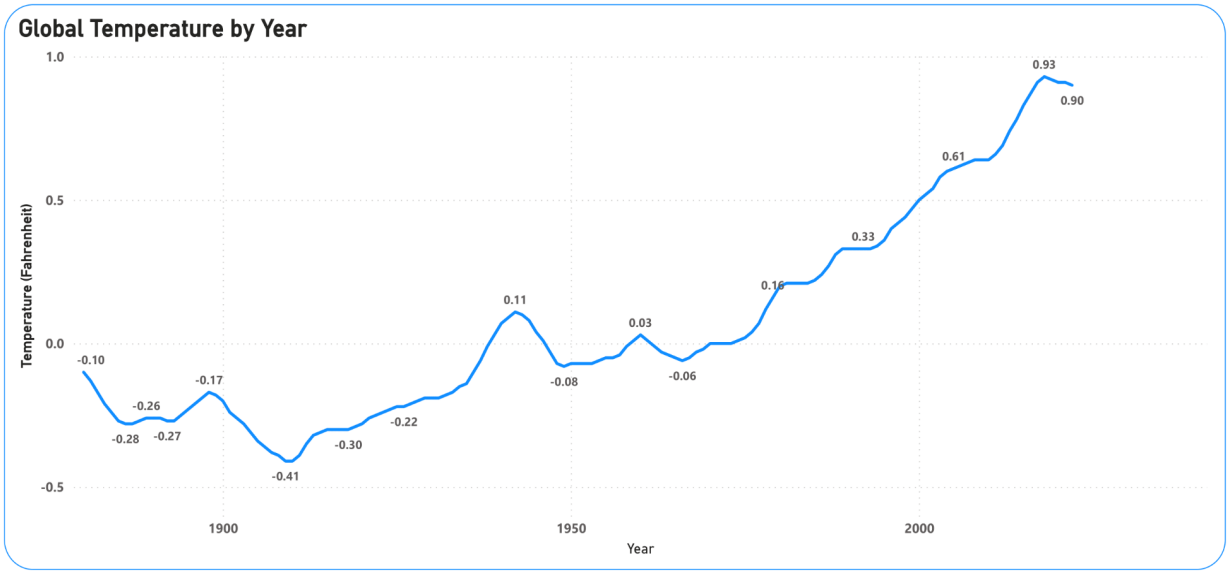
Methane gas is one of the vital greenhouse gases which causes global warming. The line chart shows there is a consistent increase in the emission of methane and this has contributed in the increase in global temperature. Increase in global temperature has caused climate change and this climate change has resulted into different negative effect in the Southern ocean and Antarctica. This negative effects include : Melting of ice sheets and glaciers, Ocean Warming, Feedback Mechanisms, and Thawing Permafrost and Methane Release



Model 3: Atmospheric Methane by year.

Global Temperature between 1880 to 2022

The line graph shows the global temperature between 1880 to 2022. The charts indicates that their is averagely an increase in the global temperature over the years. This increase in temperature results into global warming which has caused climate change. The climate change has negatively affected the Southern Ocean and Antarctica.



Model 4: Global Temperature by Year

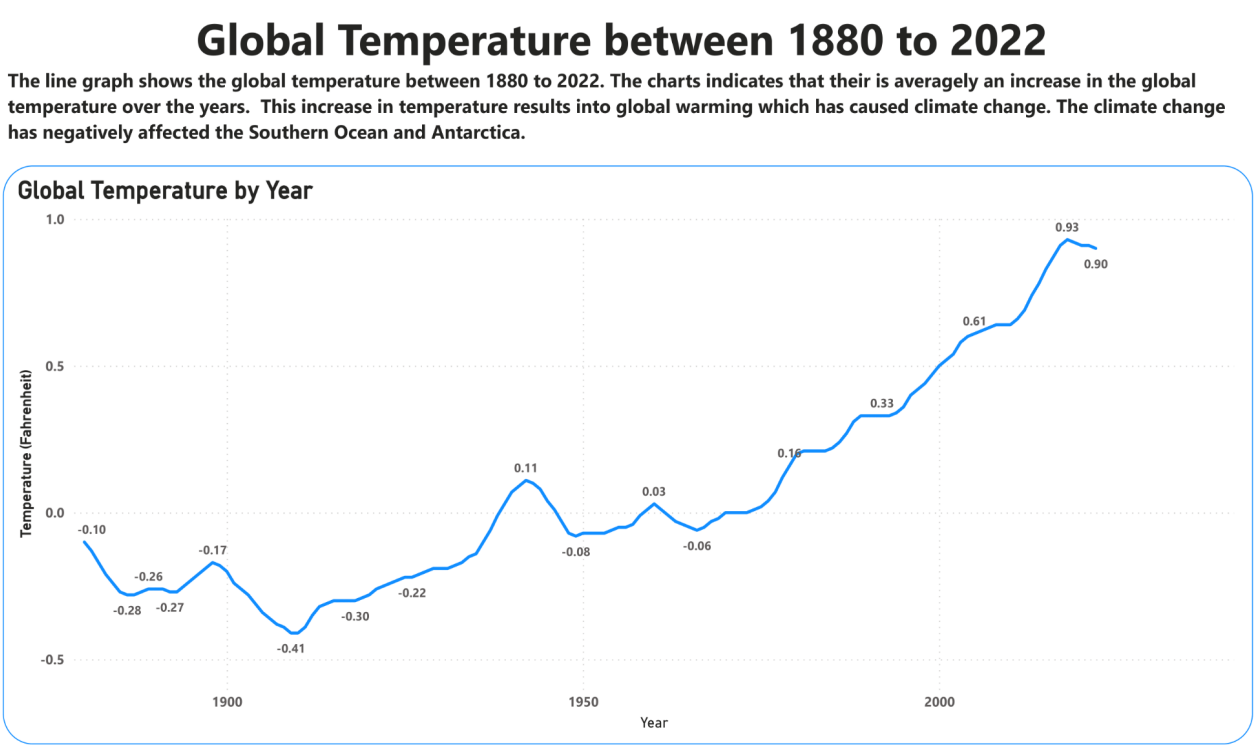
The model above shows the emission of methane which is one of the major greenhouse gases. The chart shows that there has been a consistent increase in the emission of methane gases.

The emission of methane is caused by human activities such as livestock agriculture, rice cultivation, and fossil fuel extraction. Also, the extraction and use of natural gas are significant contributors to methane emissions.

Research has shown that methane can increase the global temperature more than carbon dioxide does, though the lifespan of methane is relatively longer than carbon dioxide. Hence the increase in the emission of methane has resulted in a consistent increase in global temperature. This increase in global

temperature has caused climate change which has negative effects on Antarctica and the Southern Ocean.

3. **Analyse the variations in global temperature and how they affect climate change and its effect on Antarctica.**



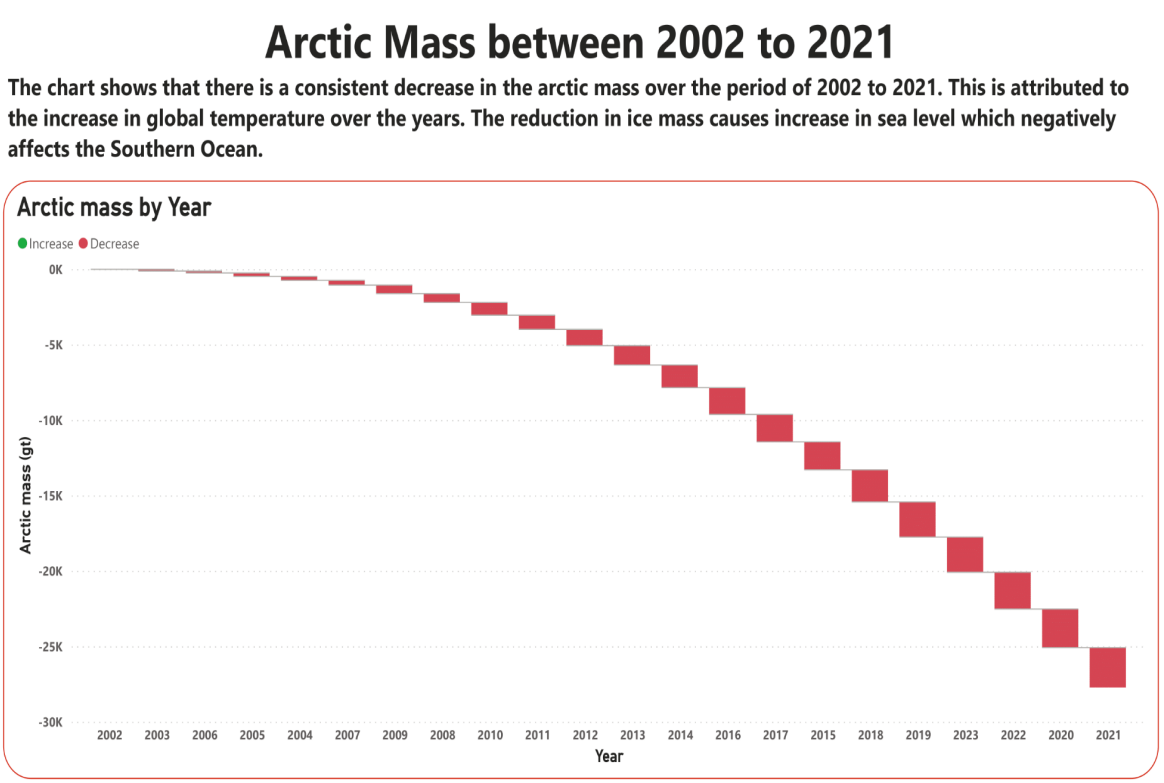
Model 5: Global Temperature by Year.

The model above shows the global temperature between 1990 to 2023. The model shows that there has been a steady increase in global temperature. The increase in temperature has resulted in climate change which in turn has affected the Antarctica region.

Increasing global temperatures are a fundamental driver of climate change. As temperatures rise, climate patterns and ecosystems undergo significant transformations. One of the regions most affected is Antarctica. Climate change is leading to the rapid warming of this continent, resulting in the melting of ice sheets and glaciers. This contributes to rising sea levels, with far-reaching consequences

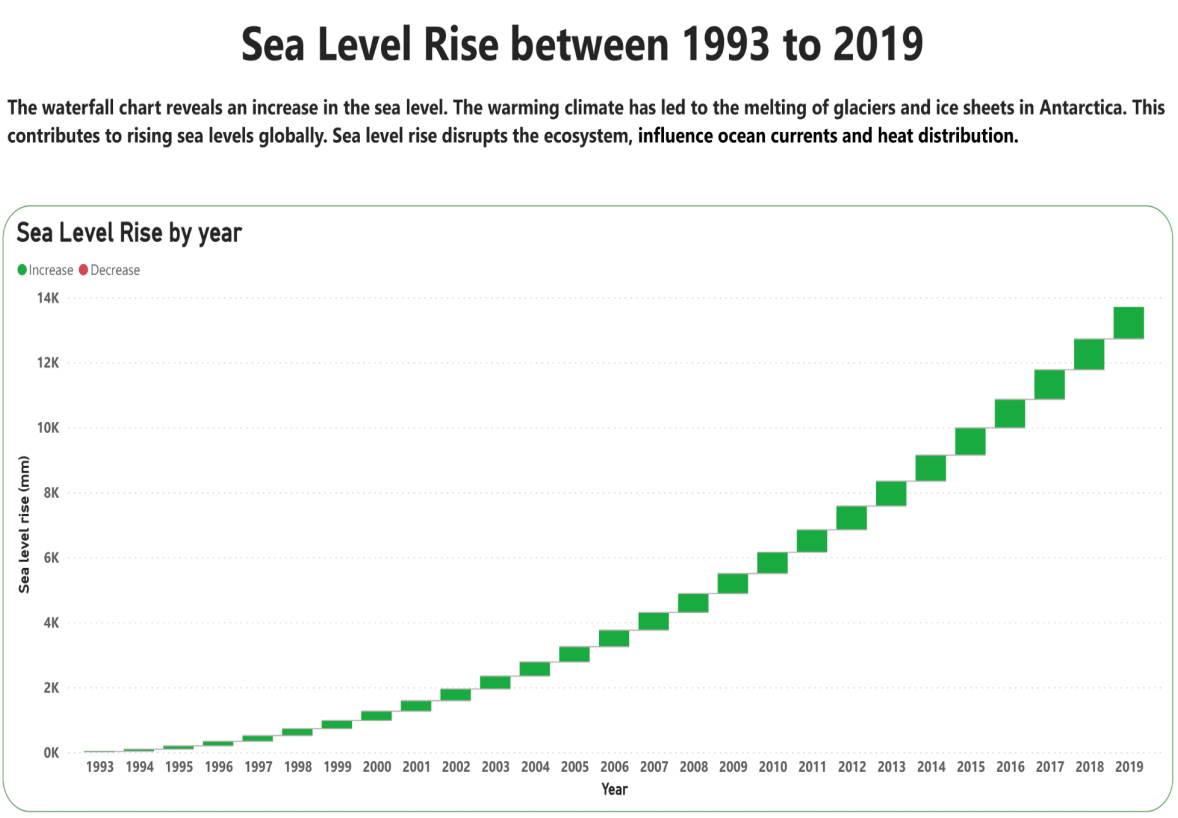
for coastal communities worldwide. The impact on the Antarctic region serves as a stark reminder of the urgent need for global climate action to mitigate the potentially catastrophic effects of a warming planet.

4. **Investigate the effect of rising sea levels due to the melting of ice sheets and the vulnerability of ecosystems in the southern ocean and Antarctica region to sea-level rise and propose adaptation and mitigation strategies**



Model 6: Arctic Mass between 2002 to 2021

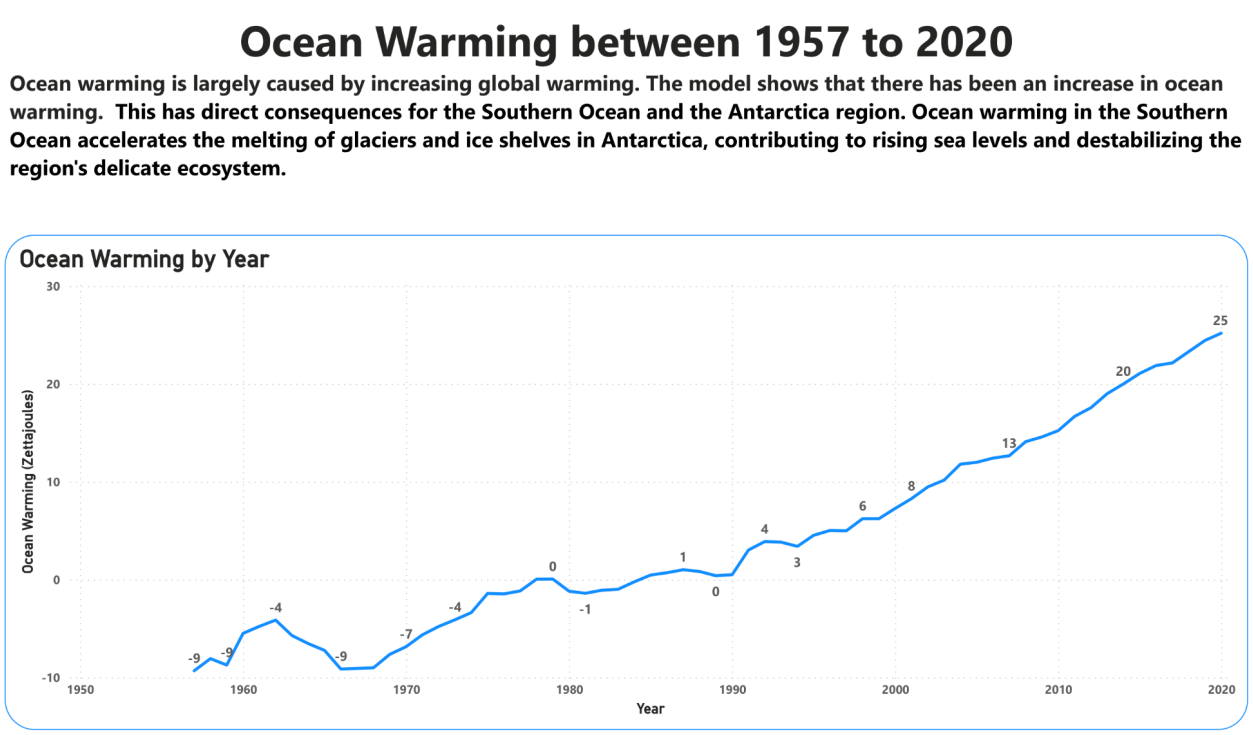
The model above shows the arctic mass between 2002 and 2021. The chart reveals a consistent decline in the global ice mass over the years. This is as a result of the increase in global temperature.



Model 7: Sea Level Rise between 1993 to 2019

The chart above shows the sea level rise between 1993 and 2019. The chart shows a consistent increase in sea level. The melting of Arctic ice contributes to rising sea levels and disrupts climate patterns worldwide. It's not only an outcome of climate change but also a driver of it. This phenomenon has direct consequences for the Antarctica region, as the freshwater influx from melting Arctic ice can influence ocean currents and heat distribution. This, in turn, accelerates the warming of Antarctica, exacerbating ice melt and raising concerns about potential sea-level rise, which underscores the intricate interconnection of polar regions and the pressing need to address climate change comprehensively.

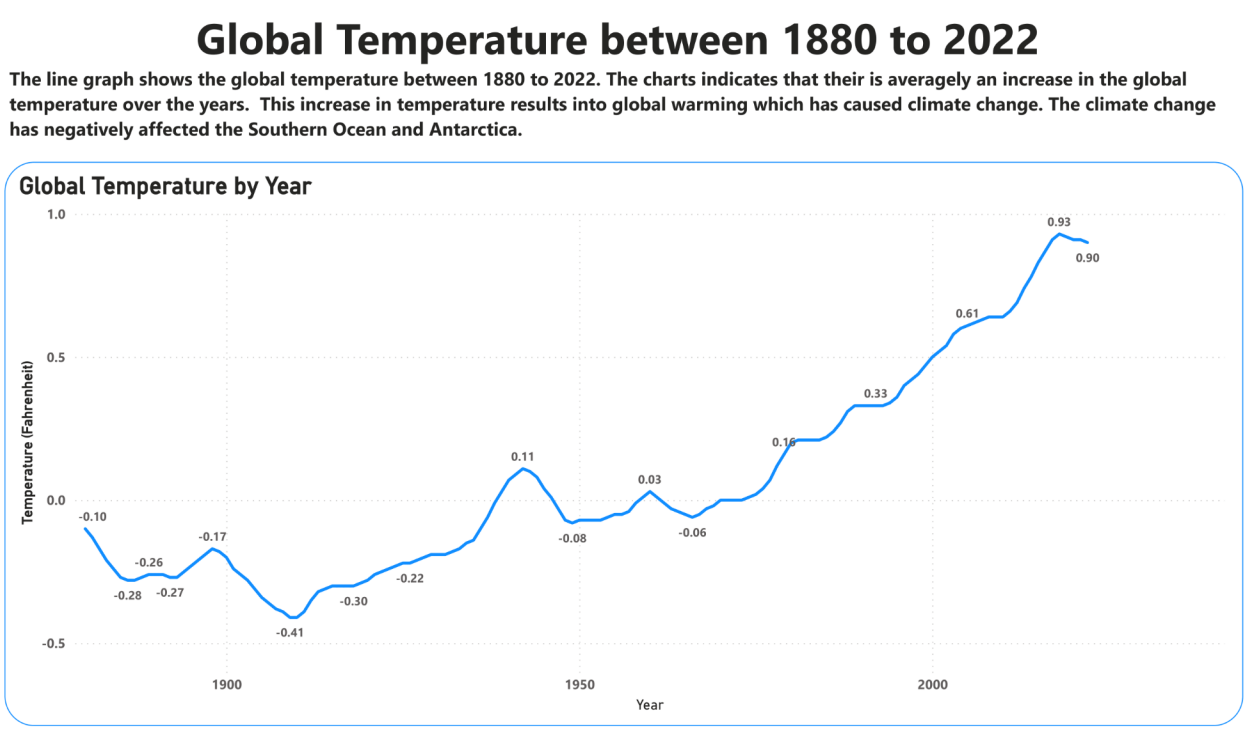
5. **Study the interactions between ocean warming and global temperature rise and its consequences on the Southern Ocean and Antarctica.**



Model 7: Ocean Warming between 1957 to 2020

The line chart above displays the ocean warming between 1950 and 2020. The chart shows that there is an increase in ocean warming over the period of years.

The consistent increase in ocean warming between 1950 and 2020 is a key driver and indicator of climate change. As oceans absorb heat, they influence weather patterns, marine ecosystems, and global climate systems. This has direct consequences for the Southern Ocean and the Antarctica region. Ocean warming in the Southern Ocean accelerates the melting of glaciers and ice shelves in Antarctica, contributing to rising sea levels and destabilising the region's delicate ecosystem. The interconnectedness of ocean warming, climate change, and the Southern Ocean's role in Antarctica's fate underscores the critical importance of addressing climate change to preserve the stability of this polar region and mitigate its global impacts.



Model 8: Global Temperature by Year

Recommendation:

Improving the conditions in Antarctica and the Southern Ocean requires a comprehensive approach that addresses climate change, environmental conservation, and sustainable management. Here are some actionable recommendations based on the insights generated from the analysis:

1. Mitigate Climate Change:
    - Advocate for and support policies that aim to reduce greenhouse gas emissions globally.
    - Promote renewable energy sources and energy efficiency measures to cut carbon emissions.

2. Strengthen Conservation Efforts:
    - Establish marine protected areas in the Southern Ocean to conserve critical ecosystems and marine life.
    - Implement strict regulations to prevent overfishing and protect vulnerable species in the region.

3. Promote Scientific Research:
    - Invest in research initiatives to better understand the changing dynamics of the Southern Ocean and Antarctica.
    - Support international collaboration to enhance scientific knowledge and monitoring of these areas.

4. Sustainable Tourism:
    - Implement strict guidelines for tourism in Antarctica to minimise its impact on the environment.
    - Encourage responsible tourism practices that respect the region's fragile ecosystems.

5. Adaptation and Resilience:
    - Develop strategies for coastal regions to adapt to sea-level rise caused by melting ice in Antarctica.
    - Invest in infrastructure and disaster preparedness to protect communities in the Southern Ocean.
6. Environmental Diplomacy:

- Engage in international diplomacy to ensure the protection and responsible management of the Southern Ocean and Antarctica.
- Collaborate with other nations to establish and enforce regulations that safeguard these regions.

7. Education and Public Awareness:
    - Raise awareness about the importance of the Southern Ocean and Antarctica and their connection to global climate systems.
    - Foster a sense of global responsibility and stewardship among the public.

8. Reduce Plastic Pollution:
    - Implement measures to reduce plastic pollution in the Southern Ocean, such as banning single-use plastics on research stations and vessels.
    - Promote recycling and waste reduction initiatives.

9. Support Indigenous Communities:
    - Collaborate with indigenous communities in the region to develop sustainable practices and safeguard their traditional knowledge.
    - Ensure their participation in decision-making processes related to the Southern Ocean and Antarctica
10. Invest in Technology:
    - Develop and deploy technology for monitoring and collecting data in the Southern Ocean and Antarctica, which can aid in climate research and environmental protection efforts.

By taking these actionable recommendations into account, we can work towards preserving the unique ecosystems of the Southern Ocean and Antarctica and mitigating the impacts of climate change on these critical regions. This involves a multi-faceted approach, including global cooperation, research, conservation efforts, and responsible stewardship

Conclusion.

In this analysis, we explored the profound impacts of climate change on Antarctica and the Southern Ocean, leveraging a diverse range of datasets. Atmospheric carbon dioxide and methane concentrations, global temperature trends, ocean warming, and ice mass dynamics collectively revealed the relentless encroachment of climate change on these polar realms.

Our data-driven journey, facilitated by Excel for data extraction and Power BI for analysis and visualisation, illuminated the interconnected challenges facing Antarctica and the Southern Ocean. The warming climate is triggering the accelerated melting of ice, disrupting ecosystems, and contributing to rising sea levels.

The urgency of addressing climate change, as underscored by our analysis, cannot be overstated. The polar regions serve as bellwethers of global climate change, and the consequences are not isolated; they reverberate worldwide. As we face a rapidly changing world, this analysis reinforces the critical need for collective action,

informed decision-making, and sustainable practices to safeguard these remote yet globally significant ecosystems and mitigate the broader impacts of climate change.