1 Introduction

1.1 Problem Background

From around 800,000 years ago, CO2 concentration in the atmosphere has stayed relatively stable around 280 parts per million until the Industrial Revolution[[1]](#endnote-1). From the prevalence of steam engines in the early 19th century and following dazzling evolvement of coal-consuming industries, together with multiple chain effects in economy, has led to rapid increase in CO2 levels in the atmosphere. The growth rate has kept rocketing with progresses in productivity throughout major industrial renovations. With an annual increase of 2.66 ppm in 2021---the tenth consecutive year of an increase over 2 ppm---compared to the 2020 CO2 emission of 412.04 ppm[[2]](#endnote-2), we are currently facing the highest speed of CO2 concentrating around the globe since the very beginning of human kind. Yet, not until the last century did modern observations of climate change and global warming remind researchers of the impacts of CO2 levels worldwide. Growing public awareness urges us to analyze the relevance of CO2 emission and temperature and to predict future trends for reference in economy and policy making.

Factors leading to CO2 emissions are far beyond estimation, and they are still expanding with new industries emerging from traditional ones. Direct emissions from industrial production and transportation block indirect agricultural factors responsible for increases in CO2 levels. Apart from the first and the second industry, following economic effects spread across the third industry. In underdeveloped regions, urban populations are booming and taking over more naturally vegetated fields and farmlands, decreasing the CO2 recycled through photosynthesis. These partially explain the controversy stirred up by predictions about the levels of CO2 in the atmosphere. In order to stress the urgent need, apart from seeking determining factors for prediction, observations on major variations that close resemble the changes are highly expected. Among these factors, temperature is widely endowed with the most importance.

1.2 Restatement of Questions

Question 1: In order to reassess current claims about CO2 levels, we will take various factors into account, including annual XXX. To select influential factors from mass amount of information, we should research in confirmed reliable resources in advance. We should build mathematical models to each of these variations and produce multiple algorithms that describes the historical levels of CO2 in the atmosphere as early as recorded, so as to predict future changes in CO2 concentration. According to the results, we will come to an opinion for or against the CO2 level claims and point out exactly when CO2 concentration reaches 685 ppm.

Question 2: To find out the relationship between temperature CO2 concentration in the atmosphere, we will first need to combine different functions to build a fitting curve for the history of land-ocean temperatures. From the tendency that this figure presents, we can come to a general judgement whether this model correlates with CO2 concentration in any forms of mathematical relationship.

1.3 Assumptions and Justifications

To simplify the problem, several assumptions and justifications are listed below.

Assumption 1: Solar cycle maintains stable before 2100 when the prediction ends.

Justification:

Assumption 2: Catastrophes with global influences, including alien invasion, world wars and large-scale natural disasters, are excluded from determining factors.

Justification: Upon reflecting on history, it is obvious that sudden turning points are generally out of expectation. Hardly are sudden changes dealt with well or in time, which leads to unpredictable chaos. Moreover, major nuclear-armed countries are to be trusted not to start world wars before 2100. Not only is the assumption realistic, but it also contributes to the simplification of models.

Assumption 3:

1. https://gml.noaa.gov/ccgg/trends/history.html [↑](#endnote-ref-1)
2. https://www.noaa.gov/news-release/increase-in-atmospheric-methane-set-another-record-during-2021#:~:text=Meanwhile%2C%20levels%20of%20carbon%20dioxide%20also%20continue%20to,increase%20in%20the%2063%20years%20since%20monitoring%20began. [↑](#endnote-ref-2)