



CDS6324: Data Visualization

Trimester: 2410 (March 2024)

Assignment 2

Title: Global CO₂ Emissions from Fossil Fuels, Industry, and
Land-Use Changes since 1921

GROUP 06		
Section: TC2L		
ID	Name	Email Address
1201101292	LINGKESWARI A/P PONNUSAMY	1201101292@student.mmu.edu.my
1211104360	NDIRITU, COLLINS MUTURI	1211104360@student.mmu.edu.my
1191102236	PERAVENKUMAR A/L SIVAN	1191102236@student.mmu.edu.my

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1.0 Dataset Description

The dataset that has been utilised for this assignment includes global fossil fuel emissions and population data by country from 1921 to 2021. CO2 estimates for historical data are derived from the industrial activities specific to each time, providing a comprehensive overview of emissions trends and population changes over nearly three centuries.

2.0 Visualization Summary

2. Co2 Emission

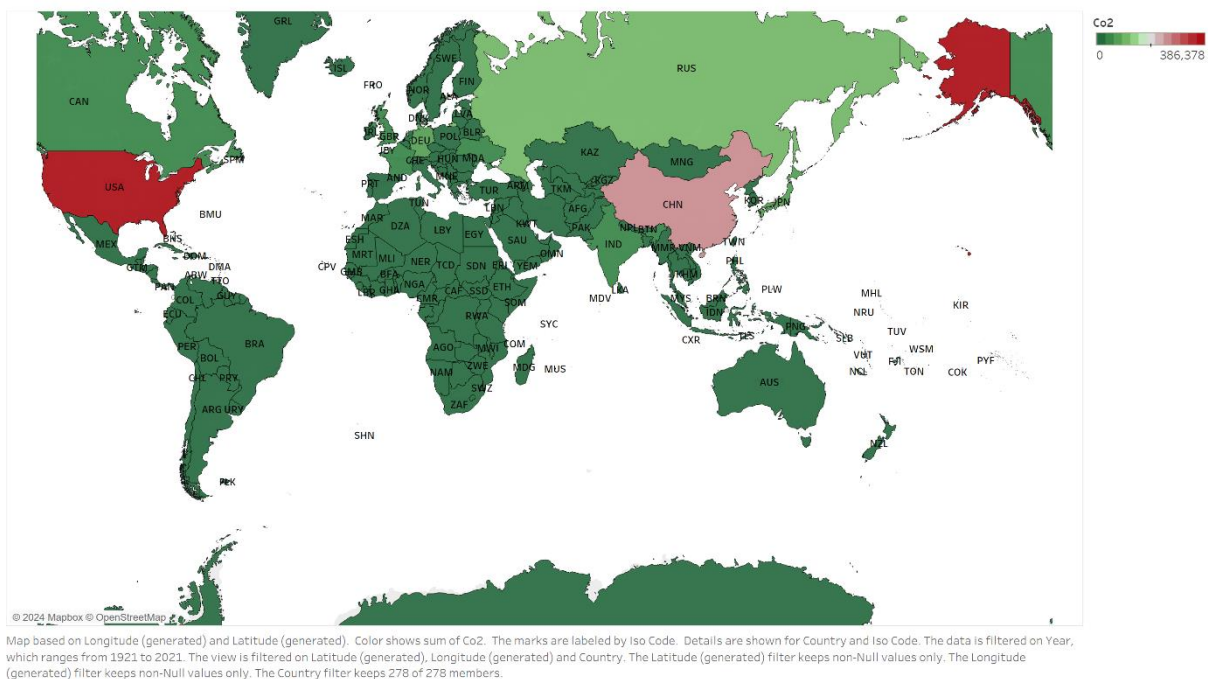


Figure 1: Global Carbon Dioxide (CO2) Emissions

The overall focus of this project is on global carbon dioxide (CO2) emissions. To highlight this, we chose a visualization that we believe to be the most interesting outcome of our work. Over the years, the use of fossil fuels, industrial processes, and land-use changes, such as deforestation, have resulted in high CO2 emissions. Figure 1 is particularly insightful as it clearly shows countries classified by CO2 emission levels, ranging from low to high, represented by colours from green to red. Additionally, we can predict that countries shaded in partial red onwards are more likely to contribute significantly to the greenhouse effect, leading to global warming and climate change. In relation to that, United States and China are in the red zone.

3.0 Trend in Data

The graph begins by illustrating that CO₂ emissions are main contributors to temperature changes, indicating a significant rise starting in the mid-20th century. Then, a geographical distribution of CO₂ emissions is shown to differentiate the level of concentration of emissions by regions, which may be related to intense industrialization and increased consumption of fossil fuels. We have illustrated CO₂ emissions from fossil fuels and industrial sources where it increases significantly right from 1950s with industrialization, while the emissions from the land-use change remain almost constant. Additionally, there is a positive linear correlation between primary energy consumption and CO₂ emissions, indicating that higher energy use leads to increased emissions. These visualizations collectively highlight the global and temporal distribution of CO₂ emissions and their association with energy consumption and industrial production.

4.0 Data Story

The story of CO₂ emissions from fossil fuels, industry, and land-use changes from 1921 to 2021 aims to track 100 years of data. Initially, we set out to examine the different types of gases involved in temperature change. We focused on carbon dioxide (CO₂) due to its high concentration in the atmosphere and its prominence in the data. We then created a map visualization to identify countries with high, medium, and low contributions to CO₂ emissions. Next, we segmented the CO₂ contributions by tracking fossil fuels and land-use changes over time. This visualization displays fossil fuels and land-use changes separately as we group the elements such as coal, cement, oil and gas with industrial activities, including flaring. Finally, we examined the correlation between CO₂ emissions and energy consumption. This correlation will help predict a country's CO₂ emissions based on its energy consumption. For example, if Country A uses more energy, it will emit more CO₂. We assume that if a developing or developed country uses more energy, it will likely increase its greenhouse gas emissions over time.

5.0 Exploratory Questions

The assignment included these exploratory questions to visualize our graphs:

1. Which greenhouse gas emissions contribute most significantly to temperature changes (co2, ch4, n20)?
2. How do global co2 emissions vary across countries over time?
3. How have global co2 emissions from fossil emissions (fossil fuels & industry) and land-use change evolved over time?
4. Has the primary energy consumption correlate with co2 emissions over time?

Note:

i) Fossil fuels: oil, gas, coal, cement

ii) Industry: flaring