Data Analytics with R - Term Project

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Introduction

Since the industrial revolution, methane has contributed about 30% of global temperature rise, and rapid and sustained reductions in methane emissions could limit global warming and improve air quality in the near future. prize. The energy sector, including oil, natural gas, coal and bioenergy, accounts for about 40% of anthropogenic methane emissions.

The following dataset has information about methane gas emissions globally. Details about the columns are as follows: region – Specifies the Continent or generalised area, country - Country of Emission, emissions - Methane Emissions in kt, type - Sector from which emissions occur. Segment- Sub-sector from which emissions occur. reason - The reason for the emission. year - Base year for the tracking of emissions.

Since the beginning of the industrial revolution, carbon dioxide emissions—which are mostly caused by the combustion of fossil fuels—have increased dramatically. A relatively small number of nations are responsible for the majority of the world's greenhouse gas emissions. On an absolute basis, the top three emitters are China, the United States, and the members of the European Union. The United States and Russia have the highest per capita emissions of greenhouse gases.

Literature Review

Road vehicles account for 72% of all worldwide transportation emissions, and they are also responsible for 80% of the increase in emissions between 1970 and 2010.

Other forms of transportation such as domestic, international, and coastal shipping have also seen an increase in emissions. Railways are the main exception; since a large portion of their power comes from electricity, their emissions have decreased.

A project to produce quick (bi-)annual updates of the EDGAR global emission inventory system was launched in 2004 by the Max Plank Institute for Chemistry (MPIC), the Netherlands Environmental Assessment Agency (MNP), and the Joint Research Centre (JRC) of the European Commission.

The desire of atmospheric modellers for more recent global emission inventories is further strengthened by the rapid expansion of high-resolution, spatially detailed satellite data that is generated in almost real time and from which total column concentrations of different atmospheric trace gases can be determined.

Agriculture accounts for 43% of all man-made methane emissions worldwide, with minor quantities coming from burning savannah (3%), enteric fermentation by animals (25%) and rice cultivation (12%). Other significant sources include energy transmission and production (29%)—primarily coal production (11%), gas transmission (11%), and oil production (3%); waste management currently accounts for about 18% of total emissions, with wastewater accounting for 11% of that and landfills for 7%.

“Energy and climate cannot be considered independent of each other. They are intimately linked as CO2 emissions impact climate change. So solutions to mitigate climate change must be commensurate with and responsive to the rising energy demands of the global community. Energy is also intimately linked with environment, food production, and fresh water availability, all of which also affect population shifts, growth, and mass migrations. For example, electricity is an essential component for both the extraction and distribution of water for human activity and needs. At the same time, water is the lifeblood of thermoelectric power production. Understanding such complex interlinks among these individual elements, i.e., the “*grand nexus*” [22,23], is essential for proper assessment of energy options, especially vis-à-vis carbon capture.”

There are excellent reviews of the literature on various aspects of CCS, in addition to the 2015 National Academy of Sciences report [32]. A recent article focused on the commercialization and integration of CCS into power systems for decarbonisation, providing an excellent comprehensive overview of carbon dioxide capture, use and storage (CCUS) technology and its technical economics. provides a comprehensive overview [33]. A recent article [34] presents and discusses zero-emission energy systems for a wide range of energy services and industrial sectors. Another review examined the combination of two or more different CCS technologies and suggested that hybrid processes have advantages in energy savings and CO2 capture compared to stand-alone systems.

Problems addressed and Purpose of the Application

Methane and other greenhouse gases pose a serious threat to the health of environment. The high rates of emission need to be monitored using modern data tools. A check on the rate of emissions can actually help to know when a country is contributing more than the allowed limit for a sustainable management of the emissions. Moreover, the global methane (CH4) budget is becoming an increasingly important factor in managing practical ways to mitigate climate change. [Earth System Science Data,]. This association is challenged by the as-yet-unexplained changes in atmospheric CH4 over the past decade, due to its shorter atmospheric lifetime and greater warming potential than carbon dioxide. Emissions and concentrations of CH4 continue to increase, making it the second most important man-made greenhouse gas after carbon dioxide. Two major problems in reducing uncertainty arise from the great diversity of geographically overlapping diffusive CH4 sources and the destruction of his CH4 by very short-lived hydroxyl radicals (OH).

Methane is an important greenhouse gas, responsible for about 20% of the warming from long-lived pre-industrial greenhouse gases. By reacting with hydroxyl radicals, methane reduces the oxidizing capacity of the atmosphere and creates ozone in the troposphere. Although most sources and sinks of methane have been identified, their relative contributions to atmospheric methane levels are highly uncertain. Thus, the factors that contributed to the observed stabilization of atmospheric methane concentrations in the early 2000s and recovery since 2006 remain unclear.

The purpose of the application is to show how the different countries are responsible for the emission of the greenhouse gases. The scatterplot shows that correlation between the multiple variables. This shows the strong dependencies of our energy systems and how the green house gases emission is affecting the world. It shows how many countries are pro emissions and how many are against it. Also, we can clearly see how many countries are helping in reducing the carbon foot print while others are creating chaos for the rest of the world. “Methane is a powerful climate warmer, and the amount of methane in the air is growing rapidly. Reducing human-caused methane emissions is urgent if the 2015 United Nations Paris Agreement to limit climate warming is to succeed.” ( <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019RG000675>). While China's oil and gas sector is paid the most attention internationally, the coal and power sectors have the highest impact on the country's energy security, economic vitality, and environmental sustainability.

Methane is formed during coalification (the process of coal formation). Generally, more methane is formed during the coalification than can be stored within the coalbed itself, so excess methane migrates into, and can be stored in, the surrounding strata. This trapped methane is released during the mining when the coal seam is fractured. Methane released in this fashion will escape into the mine works, and will eventually escape into the atmosphere (CitationKirchgessner et al., 2009; CitationIrwing and Tailakov, 2009; CitationAydin et al., 2009a).

Operational Instructions to use the application

The application can be accessed using below link.

The link to active app : <https://hk123.shinyapps.io/TermProject/>

Link to my Github repository: <https://github.com/harsimran59/TermProject/tree/main>

The shiny application lets you choose from a set of attributes and refine data by Country, Region and Year. The app shows the relation between the emission rate and the country which provides an insight into from where the emissions are more, what is the relation like linear, and predict the emission for next decades.

Conclusion

A single source of truth dashboard can provide timely information about the emission and help prevent their release into the atmosphere. Through this application is to show how different countries are responsible for their greenhouse gas emissions. Decreasing enteric methane (CH4) emissions from ruminants without altering animal production is desirable both as a strategy to reduce global greenhouse gas (GHG) emissions and as a means of improving feed conversion efficiency. We see that energy sector is responsible for 80 emissions of methane and other green house gases. Onshore oil is responsible for 14% of the emissions. Emission has increased when compared to the previous year. Thus we need to replace fossil fuels with better sources of combustion and energy.

**References:**

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