CMSC 6950 Final Project - pymagicc

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June 2021

1 Introduction

Pymagicc[1] is an open-source Python wrapper for the Fortran-based MAGICC climate model. It makes it simpler to use and run the MAGICC model Windows application. Pymagicc comes with several built-in data structures to model the several emission pathways. MAGICCData is the core data structure used to model the Representative Concentration Pathways (RCP) and comes with Pandas DataFrame like functionality and also has the ability to make line plots.

MAGICC, which stands for Model for the Assessment of Greenhouse Gas Induced Climate Change, is a climate model widely used to assess future Greenhouse gas emissions in climate policy analyses. It is most prominently used by the Intergovernmental Panel on Climate Change (IPCC) for crucial scientific publications and by many Integrated Assessment Models.

2 Tasks

This project utilizes the Pymagicc module to achieve the below computational tasks and visualizations. While MAGICCData object provides built-in functionality to make line plots, this project uses the Matplotlib library to generate plots. The majority of the tasks involve wrangling the scenario's data to generate the desired line charts.

Note: All of the visualizations have been recreated from the examples in the original git repository. Also, the data available in this project is time-series data. Hence there was little room for experimentation, and we were limited to just line charts.

2.1 Task 1- Generate Greenhouse Gas Emissions

The computational task involves reading data from RCP2.6, RCP4.5, RCP6, RCP,8.5 scenario files and converting the data in MAGICData format to a pandas DataFrame. Using the data previously saved, we build visualizations to show Carbon Dioxide and Methane gas emission projections for RCP2.6 and RCP4.5 scenarios.

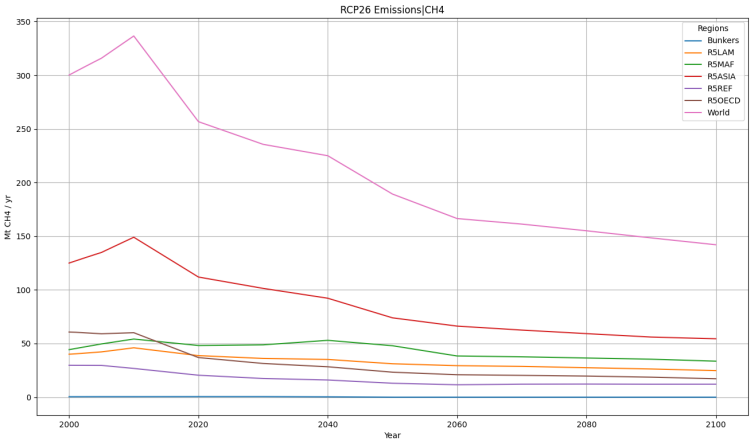

Figure 1: RCP26 CH4 Emissions Projections

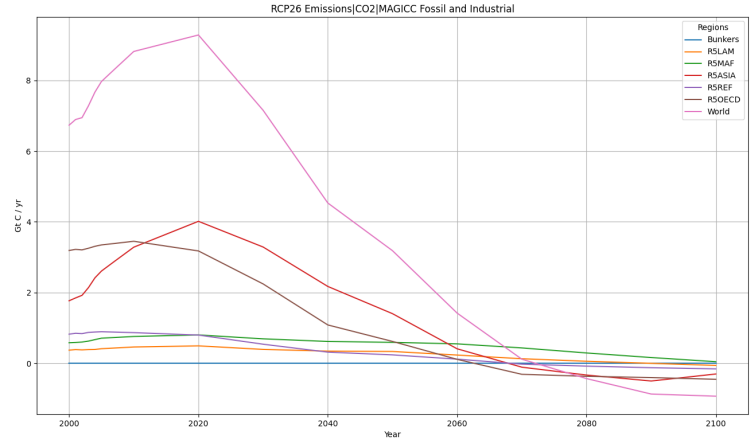

Figure 2: RCP26 CO2 Emissions Projections

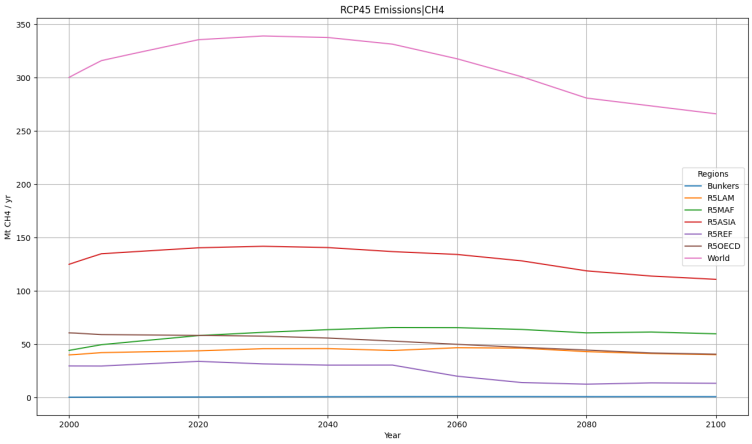

Figure 3: RCP45 CH4 Emissions Projections

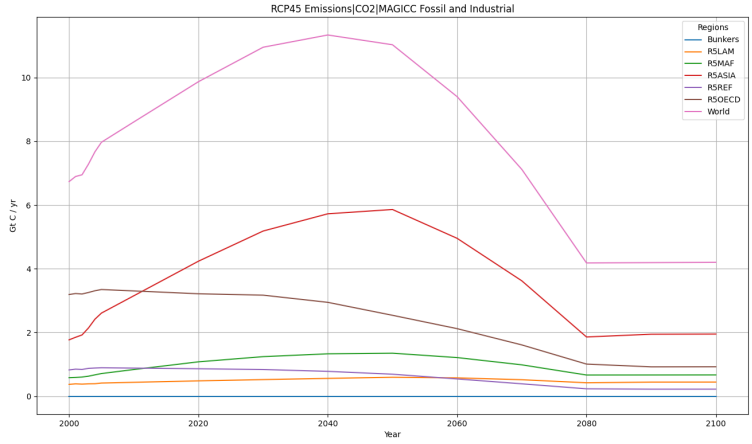

Figure 4: RCP45 CO2 Emissions Projections

2.2 Task 2- Run MAGICC model

Here, the computational task involves running the MAGICC model on the RCP2.6, RCP4.5, RCP6, RCP,8.5 scenarios. Running the model will build projections like Concentration of gases, Radiative Forcing, Surface Temperatures, etc., for each the given climate scenario. Then, we make visualizations to plot Radiative Forcing and Surface Temperature projections for each of the four general scenarios from 1765 to 2100.

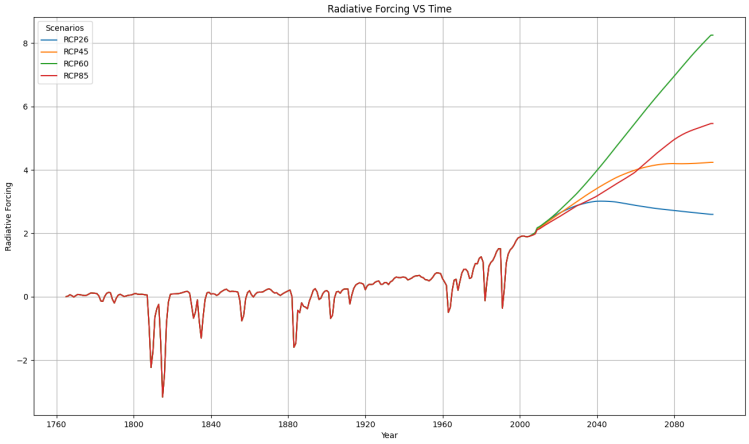

Figure 5: Radiative Forcing Projections

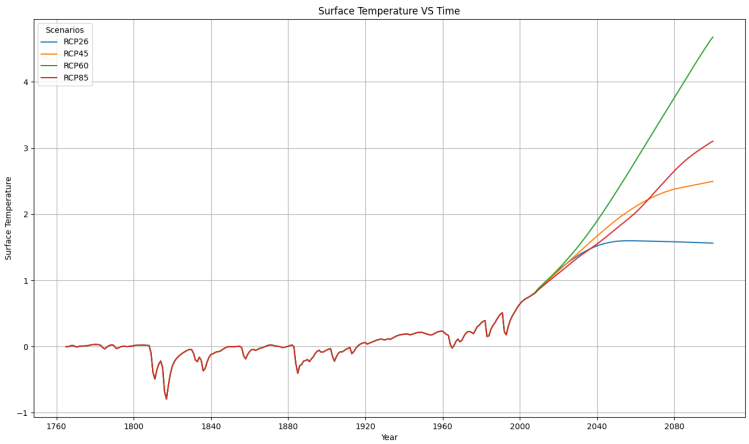

Figure 6: Surface Temperature Projections

References

[1] Robert Gieseke, Sven N. Willner, and Matthias Mengel. Pymagicc: A python wrapper for the simple climate model magicc. *Journal of Open Source Software*, 3(22):516, 2018.