Carbon Dioxide Emissions and Mean Sea Level Pressure Analysis

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Introduction

- **Objective**: Figure out the correlation between Carbon dioxide emissions on sea level rise.

- **Main Questions of this project**:

1. What are the historical trends in carbon dioxide emissions in Europe from 1850 to 2022?

2. How has the mean sea level pressure changed globally over time (1951-2021)?

Data Source

Datasource 1: Data on CO2 and Greenhouse Gas Emissions by Our World in Data

- **Metadata URL**: https://github.com/owid/co2-data/blob/master/owid-co2-codebook.csv
- **Data URL**: https://raw.githubusercontent.com/owid/co2-data/master/owid-co2-data.csv
- **License Type**: CC BY 4.0

Datasource2: Worldwide Sea Level Pressure

- **MetadataURL**:https://opendata.dwd.de/climate_environment/CDC/observations_global/CLIMAT/monthly/qc/mean_sea_level_pressure/historical/
- **DataURL:**https://opendata.dwd.de/climate_environment/CDC/observations_global/CLIMAT/monthly/qc/mean_sea_level_pressure/historical/01001_195101_202112.txt
- **License Type:** CC BY 4.0

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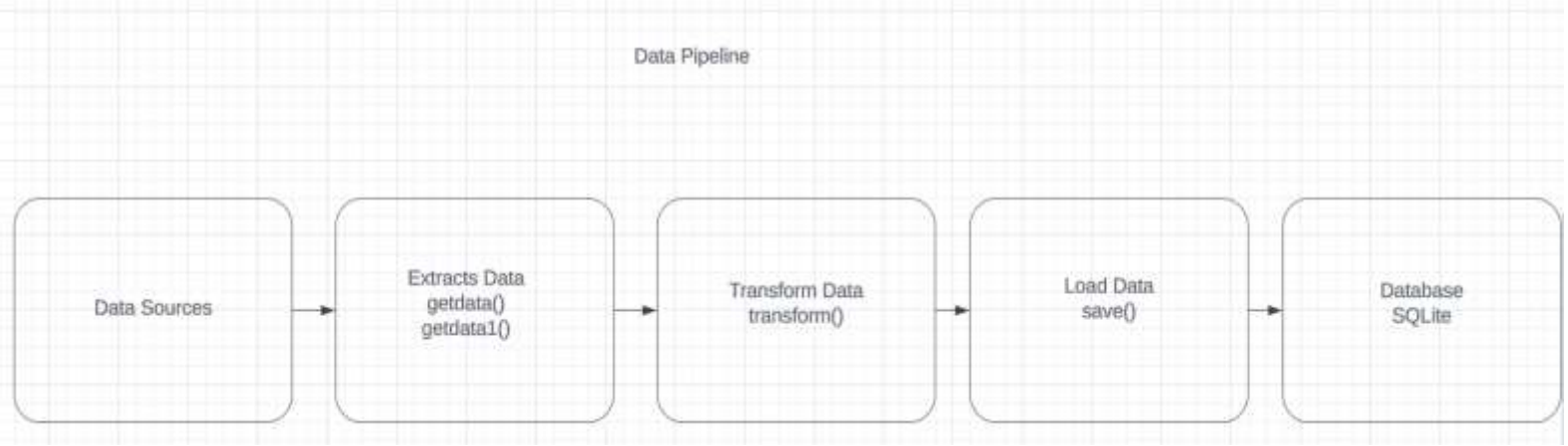
Structure of Data

- The project uses an ETL pipeline structure (Extract, Transform, Load)
- ***Extract***: **get_data() , get_data1()** functions uses to extract data from website.
- ***Transform***: **transform()** function is used for handling missing data, dropping rows, and only using European country's data.
- ***Load:*** **save() function** used to transform datasets into SQL database.



Output of Local SQLite Databases

MADE-23158587 > data > Output_data.db

Tables
- CO2_data
- Mean_Sea_Level

Rows: 7,536 — Filter 7,536 rows...

	country	year	population	co2	temperat...	co2_grow...
1	Albania	1933	1023495	0.807	0	NULL
2	Albania	1934	1034040	0.807	0	0
3	Albania	1935	1044694	0.818	0	150
4	Albania	1936	1055458	0.128	0	599.836
5	Albania	1937	1066333	0.297	0	131.437
6	Albania	1938	1077319	0.348	0	17.307
7	Albania	1939	1088816	0.432	0	24.211
8	Albania	1940	1100833	0.692	0	60.169
9	Albania	1941	1113381	0.626	0	-9.532
10	Albania	1942	1126469	0.744	0	18.725
11	Albania	1943	1140109	0.462	0	-37.931
12	Albania	1944	1153914	0.154	0	-66.667
13	Albania	1945	1167887	0.121	0	-21.429
14	Albania	1946	1182028	0.484	0	300
15	Albania	1947	1196341	0.927	0	91.667
16	Albania	1948	1210827	0.703	0	-24.111
17	Albania	1949	1229519	1.815	0	44.271
18	Albania	1950	1252587	0.297	0	-78.764
19	Albania	1951	1289175	0.403	0	35.81
20	Albania	1952	1326957	0.374	0	-7.274
21	Albania	1953	1366747	0.414	0	10.786
22	Albania	1954	1409011	0.502	0	21.242
23	Albania	1955	1453732	0.663	0	32.097

Tables
- CO2_data
- Mean_Sea_Level

Rows: 65 — Filter 65 rows...

	Jahr	Jan	Feb	Mrz	Apr	Mai	Jun
1	1951	1002	1003	1015	1015	1022	1017
2	1952	999	1009	1015	1007	1022	1010
3	1953	1003	1006	1009	1014	1018	1017
4	1954	1011	1005	1008	1015	1023	1012
5	1955	1008	1014	1013	1003	1015	1017
6	1956	1003	1017	1009	1016	1004	1013
7	1957	991	1008	1010	1010	1021	1017
8	1958	999	1010	1019	1010	1018	1019
9	1959	1013	996	1000	1010	1018	1010
10	1960	1015	1012	1014	1000.5	1019	1015
11	1961	1006	1000	1000	1016	1014	1003
12	1962	996	1005	1024	1013	1017	1012
13	1963	1021	1016	1009	1015	1007	1017
14	1964	1005	1009	1012	1013	1012	1010
15	1965	1005	1019	1013	1007	1022	1011
16	1966	1016	1016	1010	1019	1015	1013
17	1967	1017	997	996	1007	1020	1008
18	1968	1003.9	1010	1001	1014	1021	1011
19	1969	1003.9	1018.1	1001.9	1013	1022	1012
20	1970	1003.9	1018.1	1001.9	1013	1013	1010
21	1977	1003.9	1018.1	1001.9	1020.6	1014.5	1009.5
22	1978	1003.9	1018.1	1001.9	1020.6	1014.5	1009.5

Data Analysis

- The report uses many Python libraries like **pandas, mathplotlib, seaborn, sklearn, numpy**, etc. for visualizing and finding correlations between two datasets. **Jupyter Notebook** is used as a tool for visualizing the report.

What are the historical trends in carbon dioxide emissions in Europe from 1850 to 2022?

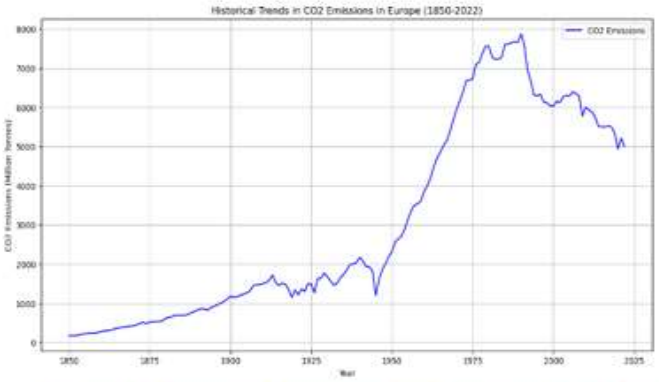


Figure 2: Historical Trends in CO_2 Emissions in Europe (1850-2022)

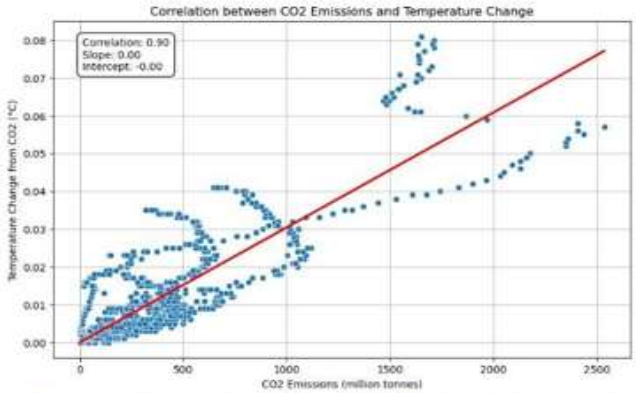


Figure 3: Correlation between CO_2 Emissions and Temperature Change

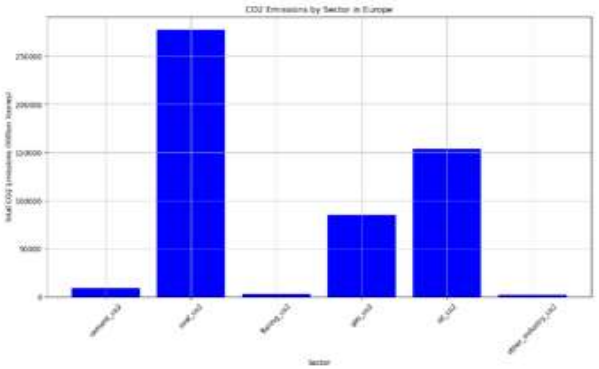


Figure 4: CO_2 Emissions by Sector in Europe

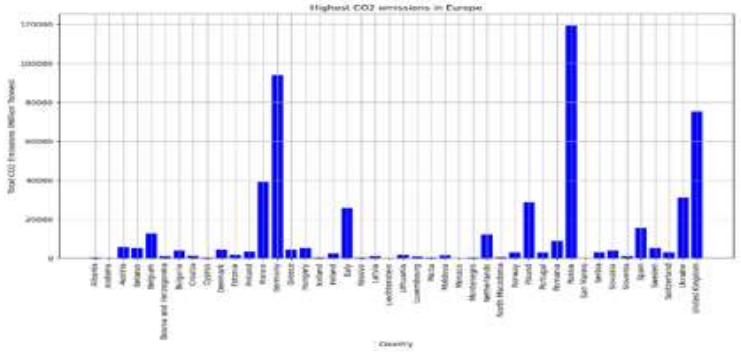


Figure 5: Highest CO_2 emissions by Country in Europe

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What are the historical trends in carbon dioxide emissions in Europe from 1850 to 2022?

- **Figure 2** shows that from the year 1850 to 1950 CO2 emissions were relatively low and increased gradually**.**
- **Figure 3** shows the correlation coefficient between CO2 emissions and temperature change is approximately 0.90, indicating CO2 emissions increase, the temperature also increases.
- **Figure 4** describes that the coal industry has the highest emissions standing at 250,000 million tonnes, displacing the rest of the industries.
- **Figure 5** shows that Russia ends up emitting the highest amount exceeding 100, 000 million tonnes

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How has the mean sea level pressure changed globally over time (1951-2021)

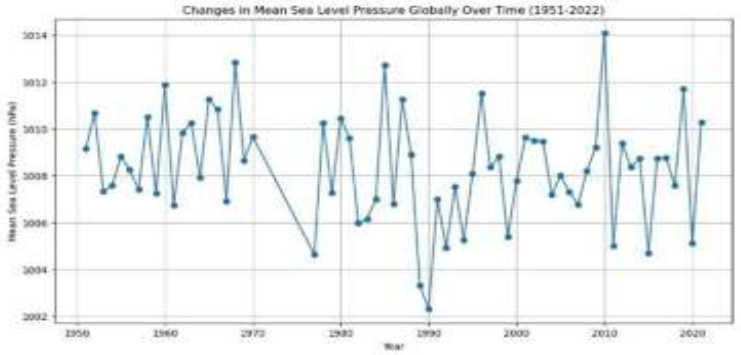

Figure 6: Changes in Mean Sea Level Pressure Globally Over Time (1951-2022)

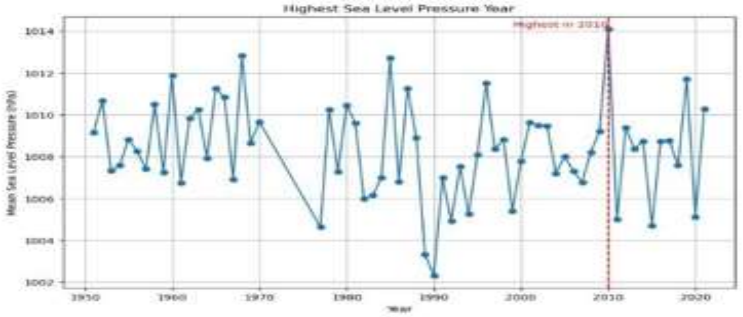

Figure 7: Highest Sea Level Pressure Year

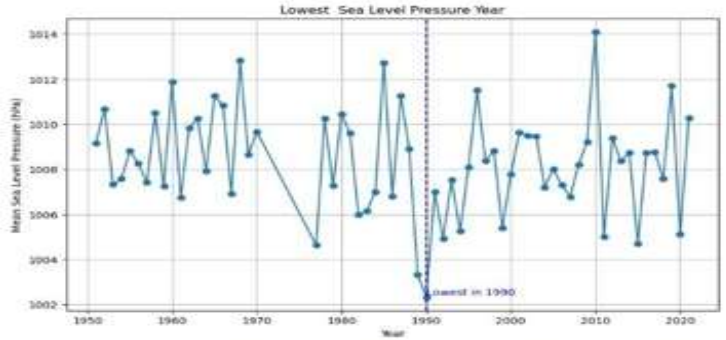

Figure 8: Lowest Sea Level Pressure Year

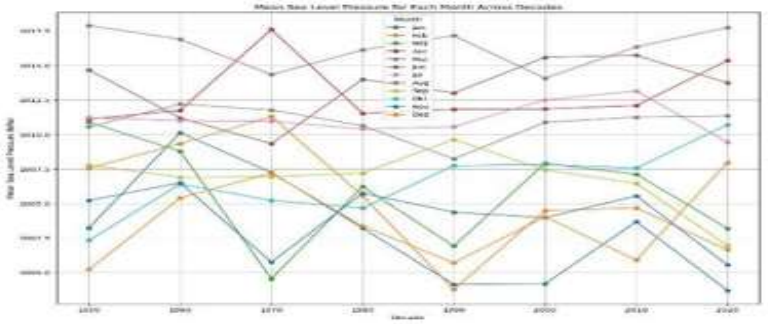

Figure 9: Mean Sea Level Pressure for Each Month Across Decades

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How has the mean sea level pressure changed globally over time (1951-2021)

- **Figure 6** shows that from 1951 to 2021 there are rising and falling trends as seen from high and low oscillations respectively.

- **Figure 7** shows that the highest recorded MSLP in this area, occurred in the year 2010.

- **Figure 8** shows that the lowest recorded MSLP was in the year 1990.

- **Figure 9** illustrates the monthly mean sea level pressure (MSLP) changes across different decades, showing higher pressure in months like January and December and fluctuating pressure in months like August and September.

How do CO2 emissions and the increasing population make an impact on sea level pressure?

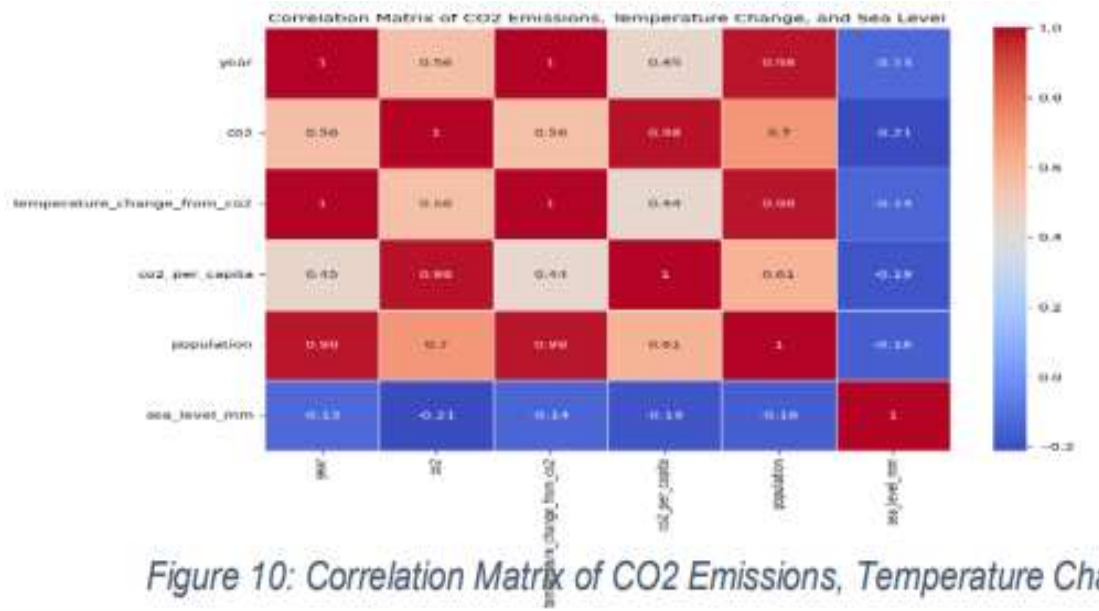

Figure 10: Correlation Matrix of CO2 Emissions, Temperature Change, and Sea Level

How do CO2 emissions and the increasing population make an impact on sea level pressure?

- The correlation matrix (**Figure 10**) reveals strong positive relationships between CO2 emissions, temperature changes, and population, indicating these variables have increased over time. CO2 emissions are highly correlated with CO2 per capita (0.98), reflecting the impact of population growth on emissions. Conversely, sea level shows weak negative correlations with all other variables, suggesting a more complex relationship with rising CO2 emissions and temperature changes.

Conclusion

Overview:

- ***Stable CO2 Emissions (1850-2022): Gradual increase observed.***
- ***Coal Industry: Highest emitter.***
- ***Top Emitting Nations: Russia and Germany.***
- ***Global Increase (1951-2021): Yearly and monthly rise in MSLP.***
- ***Low Correlation with CO2, Temperature, and Population: Indicates complex relationship***

Limitations:

- ***Understanding sea level rise requires a broader range of data due to its complexity.***

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HAVE YOU ANY
QUESTIONS?