Data Report

Introduction

The 21st century has seen a sharp increase in the importance of climate change, which is defined by notable changes in global temperature, precipitation patterns, and extreme weather occurrences. Sea level rise is one of the most significant and obvious effects of climate change. This phenomenon, which is caused by the melting of glaciers and polar ice caps as well as the thermal expansion of saltwater, is quite dangerous for coastal communities all over the world. The risk of flooding, erosion, and permanent inundation increases as sea levels rise, possibly resulting in the submergence of large urban areas. This study will show from 1990 till 2020. In this report we will investigate if it is possible to say that some cities in the near future will sink ?

Data Sources

Source: European Space Agency (ESA) Climate Change Initiative (CCI)

Data Contained: The ESA CCI provides a wide range of climate data sets derived from satellite observations. The data relevant to this project includes global temperature records, sea level anomalies, and ice sheet mass balance, all crucial for analyzing the impacts of climate change on sea levels.

License: The ESA CCI data is provided under the ESA CCI Data Policy, which promotes free and open access to data products for scientific research and educational purposes.

Data Processing Pipeline

Overview

The data processing pipeline aims to gather, filter, and prepare two distinct datasets related to global temperatures and Sea level. The pipeline consists of several stages, including data download, cleaning, filtering, and merging, ultimately resulting in a consolidated dataset for further analysis. Pipeline Steps

We have two datasets:

1. Temperature Change dataset
2. Sea Level Dataset

1.1 Data Download

The process begins with the download of global temperature data and sea level data from a reliable source. Pipeline.py is able to download the datasets from open-source datasets.

1.2 Cleaning and Filtering

For the cleaning

we need to remove Nan rows that in the two datasets and remove the unnecessary columns that will not be used such as Objectid and Unit etc.

1.3 Data Processing

we had to change the date formatting in the sea level, so we get the mean for each year and for the temperature datasets we need to change the datasets for each year.

1.4 Saving and Retrieval

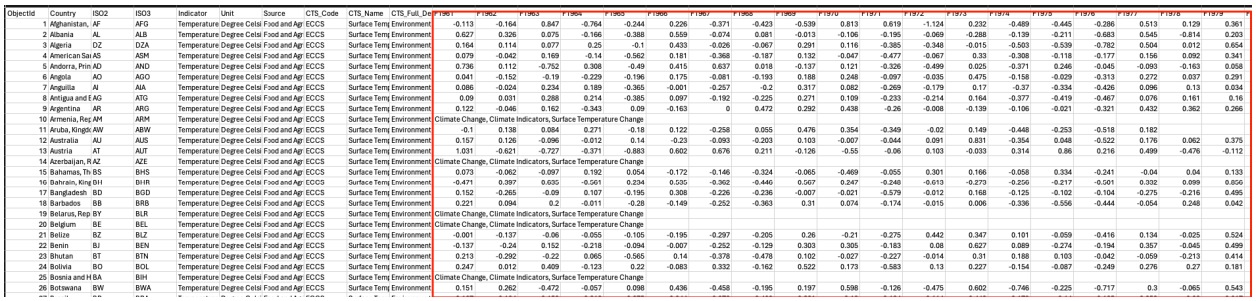
The cleaned data will be merged and then saved the merged the datasets into sqlite3 and in the notebook and will retrieve the dataset from sqlite3 with pandas.

1.5 Faced Problem

The faced Problem was regarding the how the date in each dataset is presented we needed to find a way to generalize this feature so it can be used for merge purpose. In the following Figures shows how the feature is presented in each dataset .

CTS_Code	CTS_Name	CTS_Full_De	Measure	Date	Value
ECCL	Change in Mean Sea Level	Environment	Andaman Sea	D12/17/1992	-10.34
ECCL	Change in Mean Sea Level	Environment	Arabian Sea	D12/17/1992	-18.46
ECCL	Change in Mean Sea Level	Environment	Atlantic Ocean	D12/17/1992	-15.41
ECCL	Change in Mean Sea Level	Environment	Baltic Sea	D12/17/1992	196.85
ECCL	Change in Mean Sea Level	Environment	Bay Bengal	D12/17/1992	3.27
ECCL	Change in Mean Sea Level	Environment	Caribbean Sea	D12/17/1992	-13.58
ECCL	Change in Mean Sea Level	Environment	Gulf Mexico	D12/17/1992	-3.95
ECCL	Change in Mean Sea Level	Environment	Indian Ocean	D12/17/1992	-27.63
ECCL	Change in Mean Sea Level	Environment	Indonesian	D12/17/1992	-3.09
ECCL	Change in Mean Sea Level	Environment	Mediterranean	D12/17/1992	39.02
ECCL	Change in Mean Sea Level	Environment	Nino	D12/17/1992	-3.13
ECCL	Change in Mean Sea Level	Environment	North Pacific	D12/17/1992	19.59
ECCL	Change in Mean Sea Level	Environment	North Sea	D12/17/1992	44.01
ECCL	Change in Mean Sea Level	Environment	Pacific Ocean	D12/17/1992	-14.88
ECCL	Change in Mean Sea Level	Environment	Persian Gulf	D12/17/1992	134.53
ECCL	Change in Mean Sea Level	Environment	Sea Japan	D12/17/1992	-46.65
ECCL	Change in Mean Sea Level	Environment	Sea Okhotsk	D12/17/1992	-4.39
ECCL	Change in Mean Sea Level	Environment	South China	D12/17/1992	-4.6
ECCL	Change in Mean Sea Level	Environment	Southern Ocean	D12/17/1992	-24.43
ECCL	Change in Mean Sea Level	Environment	Tropics	D12/17/1992	-19.64
ECCL	Change in Mean Sea Level	Environment	World	D12/17/1992	-15.95

Figure 1 : Change in sea level .



ObjectId	Country	ISO2	ISO3	Indicator	Unit	Source	CTS_Code	CTS_Name	CTS_Full_De	F1961	F1962	F1963	F1964	F1965	F1966	F1967	F1968	F1969	F1970	F1971	F1972	F1973	F1974	F1975	F1976	F1977	F1978	F1979
1	Afghanistan,	AF	AFG	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	-0.113	-0.164	0.847	-0.764	-0.244	0.226	-0.371	-0.423	-0.539	0.813	0.619	-1.124	0.232	-0.489	-0.445	-0.286	0.513	0.129	0.361
2	Albania	AL	ALB	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.627	0.326	0.075	-0.166	-0.388	0.559	-0.074	0.081	-0.013	-0.106	-0.195	-0.069	-0.288	-0.139	-0.211	-0.683	0.545	-0.814	0.203
3	Algeria	DZ	DZA	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.164	0.114	0.077	0.25	-0.1	0.433	-0.026	-0.067	0.291	0.116	-0.385	-0.348	-0.015	-0.503	-0.539	-0.782	0.504	0.012	0.654
4	American Sa	AS	ASM	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.079	-0.042	0.169	-0.14	-0.562	0.181	-0.368	-0.187	0.132	-0.047	-0.477	-0.067	0.33	-0.308	-0.118	-0.177	0.156	0.092	0.341
5	Andorra, Prin	AD	AND	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.736	0.112	-0.752	0.308	-0.49	0.415	0.637	0.018	-0.137	0.121	-0.326	-0.499	0.025	-0.371	0.246	-0.045	-0.093	-0.163	0.058
6	Angola	AO	AGO	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.041	-0.152	-0.19	-0.229	-0.196	0.175	-0.081	-0.193	0.188	0.248	-0.097	-0.035	0.475	-0.158	-0.029	-0.313	0.272	0.037	0.291
7	Anguilla	AI	AIA	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.086	-0.024	0.234	0.189	-0.365	-0.001	-0.257	-0.2	0.317	0.082	-0.269	-0.179	0.17	-0.37	-0.334	-0.426	0.096	0.13	0.034
8	Antigua and E	AG	ATG	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.09	0.031	0.288	0.214	-0.385	0.097	-0.192	-0.225	0.271	0.109	-0.233	-0.214	0.164	-0.377	-0.419	-0.467	0.076	0.161	0.16
9	Argentina	AR	ARG	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.122	-0.046	0.162	-0.343	0.09	-0.163	0	0.472	0.292	0.438	-0.26	-0.008	-0.139	-0.106	-0.021	-0.321	0.432	0.362	0.266
10	Armenia, Rep	AM	ARM	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	Climate Change, Climate Indicators, Surface Temperature Change																		
11	Aruba, Kingdo	AW	ABW	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	-0.1	0.138	0.084	0.271	-0.18	0.122	-0.258	0.055	0.476	0.354	-0.349	-0.02	0.149	-0.448	-0.253	-0.518	0.182		
12	Australia	AU	AUS	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.157	0.126	-0.096	-0.012	0.14	-0.23	-0.093	-0.203	0.103	-0.007	-0.044	0.091	0.831	-0.354	0.048	-0.522	0.176	0.062	0.375
13	Austria	AT	AUT	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	1.031	-0.621	-0.727	-0.371	-0.883	0.602	0.676	0.211	-0.126	-0.55	-0.06	0.103	-0.033	0.314	0.86	0.216	0.499	-0.476	-0.112
14	Azerbaijan, R	AZ	AZE	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	Climate Change, Climate Indicators, Surface Temperature Change																		
15	Bahamas, Th	BS	BHS	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.073	-0.062	-0.097	0.192	0.054	-0.172	-0.146	-0.324	-0.065	-0.469	-0.055	0.301	0.166	-0.058	0.334	-0.241	-0.04	0.04	0.133
16	Bahrain, King	BH	BHR	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	-0.471	0.397	0.635	-0.561	0.234	0.535	-0.362	-0.446	0.567	0.247	-0.248	-0.613	-0.273	-0.256	-0.217	-0.501	0.332	0.099	0.856
17	Bangladesh	BD	BGD	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.152	-0.265	-0.09	0.107	-0.195	0.308	-0.226	-0.236	-0.007	-0.021	-0.579	-0.012	0.168	-0.125	-0.102	-0.104	-0.275	-0.216	0.495
18	Barbados	BB	BRB	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.221	0.094	0.2	-0.011	-0.28	-0.149	-0.252	-0.363	0.31	0.074	-0.174	-0.015	0.006	-0.336	-0.556	-0.444	-0.054	0.248	0.042
19	Belarus, Rep	BY	BLR	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	Climate Change, Climate Indicators, Surface Temperature Change																		
20	Belgium	BE	BEL	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	Climate Change, Climate Indicators, Surface Temperature Change																		
21	Belize	BZ	BLZ	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	-0.001	-0.137	-0.06	-0.055	-0.105	-0.195	-0.297	-0.205	0.26	-0.21	-0.275	0.442	0.347	0.101	-0.059	-0.416	0.134	-0.025	0.524
22	Benin	BJ	BEN	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	-0.137	-0.24	0.152	-0.218	-0.094	-0.007	-0.252	-0.129	0.303	0.305	-0.183	0.08	0.627	0.089	-0.274	-0.194	0.357	-0.045	0.499
23	Bhutan	BT	BTN	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.213	-0.292	-0.22	0.065	-0.565	0.14	-0.378	-0.478	0.102	-0.027	-0.227	-0.014	0.31	0.188	0.103	-0.042	-0.059	-0.213	0.414
24	Bolivia	BO	BOL	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.247	0.012	0.409	-0.123	0.22	-0.083	0.332	-0.162	0.522	0.173	-0.583	0.13	0.227	-0.154	-0.087	-0.249	0.276	0.27	0.181
25	Bosnia and H	BA	BIH	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	Climate Change, Climate Indicators, Surface Temperature Change																		
26	Botswana	BW	BWA	Temperature	Degree Celsi	Food and Agr	ECCS	Surface Tem	Environment	0.151	0.262	-0.472	-0.057	0.098	0.436	-0.458	-0.195	0.197	0.598	-0.126	-0.475	0.602	-0.746	-0.225	-0.717	0.3	-0.065	0.543

Figure 2 : Change in Temperature Dataset

Results and Limitations

Output Data of the Data Pipeline

The output data of our data pipeline consists of a merged dataset that combines annual surface temperature changes and mean sea level changes. This data is structured to facilitate analysis of both global and regional trends in temperature and sea level changes over time.

Data Structure and Quality of the Result

Data Structure:

Year: Integer, representing the year of observation.
Country: String, representing the name of the country.
Temperature_Change: Float, representing the annual surface temperature change.
Measure: String, the specific body of water being measured for sea level change.
Mean_Sea_Level_Change: Float, representing the mean sea level change in millimeters.
Region: String, representing the geographical region of the country.

Data Quality:

Completeness: To guarantee data quality, rows with NaN values were removed during the preprocessing step, making the data reasonably complete.
Consistency: The date formats and nation names have been made uniform, and the data has been cleansed and standardized.

Reliability: Respected institutions such as the Food and Agriculture

Format of Output Data

One format is used to store the data pipeline's output:

SQlite : Large datasets can be handled efficiently with the SQLite database format, which also allows complicated queries to be run without requiring the full dataset to be loaded into memory. It is especially helpful for structured data and makes workflows and other analytical tools integration simple.