Question

How have different regions around the world been affected by changes in surface temperature in terms of climate-related disasters?

Data Sources

1. Annual Surface Temperature Change
   Metadata URL:
   https://climatedata.imf.org/datasets/4063314923d74187be9596f10d034914/explore
   Data URL: https://opendata.arcgis.com/datasets/4063314923d74187be9596f10d034914_0.csv
   Data Type: CSV
   Description: This dataset shows annual estimates of mean surface temperature change measured with respect to a baseline climatology, corresponding to the period 1961-2022.
   Data Structure: Semi-structured Data
   Data Quality:

Dimentions	Check
Accuracy	✓
Completeness	✗
Consistancy	✓
Timeliness	✓
Relevancy	✓

   License: Custom License [Click here to see full details]

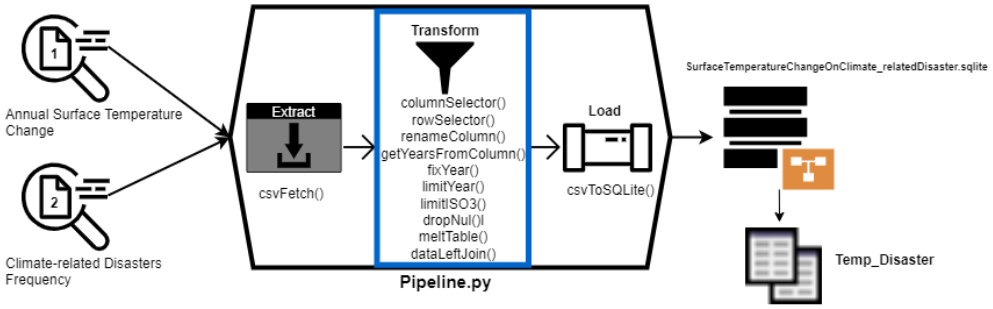
2. Climate-related Disasters Frequency
   Metadata URL:
   https://climatedata.imf.org/datasets/b13b69ee0dde43a99c811f592af4e821/explore
   Data URL: https://opendata.arcgis.com/datasets/b13b69ee0dde43a99c811f592af4e821_0.csv
   Data Type: CSV
   Description: This dataset shows number of climate related natural disasters between 1980-2022.
   Data Structure: Semi-structured Data
   Data Quality:

Dimentions	Check
Accuracy	✓
Completeness	✗
Consistancy	✓
Timeliness	✓
Relevancy	✓

   License: Custom License [Click here to see full details]

Data Pipeline

Technology



This project follows ETL pipeline structure, which stands **Extract**, **Transform**, **Load**. The ETL pipeline structure is implemented using python (installation packages- ***pandas, sqlite3***). The entry point of the project is ***pipeline.sh*** which runs ***pipeline.py*** file and results a SQlite file named–

"**SurfaceTemperatureChangeOnClimate_relatedDisaster.sqlite**".

Other then this, I have another python file name ***alerts.py*** *(Path: ./project/utils/**alerts.py**)* which was used for colorful command-line messages.

Use case of ETL in this project:

1. Extract: Fetch data from source.
2. Transform: Modify data by filtrations and cleaning error. Joining data to create meaningful dataset.
3. Load: Storing the dataset.

Code mapping with ETL

The ETL Pipeline was implemented using python by following OOP principles. The name of the class was given "**Pipeline**". Pipeline class got necessary methods for ETL. Class Abstract & Methods breakdowns-

Class Abstract:

```python
class Pipeline():
    PipelineData : object
    url : str
    dropColumns : object
    selectedColumns : object

    def __init__(self, PipelineData = None, url = None, dropColumns = None, selectedColumns = None):
        # Code


    def csvFetch(self):
        # Code


    def columnSelector(self):
        # Code


    def rowSelector(self, row : str, value : str):
        # Code


    def getYearsFromColumn(self):
        # Code

    def renameColumn(self, renameColumns : object):
        # Code


    def fixYear(self):
        # Code


    def limitYear(self, fromYear, toYear):
        # Code

    def limitISO3(self, iso):
        # Code


    def dropNull(self):
       # Code


    def meltTable(self, keep : object, melt : object):
       # Code


    def dataLeftJoin(self, left : object, right : object, key : object, leftSufx : str, rightSufx : str):
        # Code


    def csvToSQLite(self, savingPath : str, sqliteFileName : str, sqliteTableName : str):
        # Code
```

Methods Breakdowns:

	Methods
E	csvFetch()
T	columnSelector() rowSelector() renameColumn() getYearsFromColumn() fixYear() limitYear() limitISO3() dropNul() meltTable() dataLeftJoin()
L	csvToSQLite()

Data Transformation & Cleaning

For data transformation I took some steps-

1. Select Columns: Choose/delete desired/unnecessary columns.
2. Select Rows: Limit rows based on condition. **[For Source 2]**
3. Melt Table: Both data sources contain year as a column. Eg.-

```
Data
   ObjectId                  Country ISO2 ISO3  ...  F2019  F2020  F2021
0         1  Afghanistan, Islamic Rep. of   AF  AFG  ...  0.910  0.498  1.327
1         2                      Albania   AL  ALB  ...  1.675  1.498  1.536
2         3                      Algeria   DZ  DZA  ...  1.115  1.926  2.330

[3 rows x 72 columns]
```

In this step, I melted the table and made the columns as row value. This was done dynamically. Eg.-

```
Data
  ISO3                      Country variable  value
0  AFG  Afghanistan, Islamic Rep. of    F1961 -0.113
1  ALB                      Albania    F1961  0.627
2  DZA                      Algeria    F1961  0.164
```

4. Rename Columns
5. Fixing Year Data

```
Data
  ISO3                      Country  Year  Temperature
0  AFG  Afghanistan, Islamic Rep. of  1961       -0.113
1  ALB                      Albania  1961        0.627
2  DZA                      Algeria  1961        0.164
```

6. Joining Data
7. Dropping Nulls

```
Data
      ISO3                      Country  Year  Temperature  Incident
11025  AFG  Afghanistan, Islamic Rep. of  2010        1.613       4.0
11026  ALB                      Albania  2010        1.191       1.0
11030  AGO                       Angola  2010        1.194       3.0
```

8. Limit by Year [Optional]
9. Limit by Country (ISO3) [Optional]

Challenges

1. Converting Columns and row data.

This problem was solved using panda's ***melt*** function.

The data was like-

ISO3	***F2010***	***F2011***	***F2013***	***F2020***
AFG	1	3	2	7

After melting, I made it like-

ISO3	***Year***	***Incidents***
AFG	2010	1
AFG	2011	3
AFG	2012	2
AFG	2020	7

After melting the data, I selected Year column and removed ***'F'*** from every rows.

Handling Errors & Change of Inputs

Errors were properly handled.

1. If source URL faulty then the execution will stop by showing proper messages.
2. If program doesn't find saving directory [if pipeline.py was executed from project folder], it resolved automatically.
3. If source adds more year data, program automatically converts it to row value. Dynamic programming was implemented.

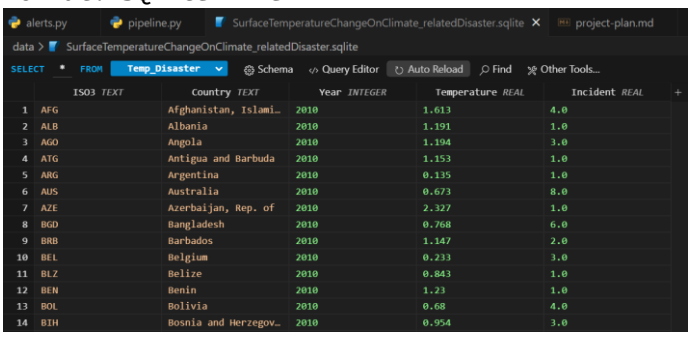
Results

Data Structure: Structured Data

Data Quality:

Dimentions	**Check**
Accuracy	✓
Completeness	✓
Consistancy	✓
Timeliness	✓
Relevancy	✓

Format: SQLite file



I saved the data in SQLite for-

a. ***Querying and Analysis:*** If the data is stored in SQLite, it can be easily queried using SQL. This allows for flexible data retrieval and analysis and make data-driven decisions.
b. ***Integration with Other Tools:*** It can be integrated with other data processing and analysis tools. For example, data visualization tools, machine learning frameworks, or business intelligence.