

## Scenario

A global research institution is studying the impact of climate change across different regions. They need a centralized system to track key climate indicators, monitor extreme weather events, and analyse their economic and infrastructural impact.

## Business Problem

The organization faces challenges in:

Tracking Climate Trends – Data is scattered across multiple sources, making it difficult to analyse temperature variations, air quality, and precipitation patterns over time.

Generating Reports Efficiently – Researchers rely on manual reporting, leading to delays in decision-making.

Assessing Climate Risks – There is no structured way to analyse how climate events impacts infrastructure and the economy in different regions.

To address these issues, we are going to develop a data-driven climate monitoring solution with automated reporting and real-time visualization, ensuring quick access to insights for informed decision-making.

## Climate Change Dataset: Column Descriptions

### Metadata Columns

#### Record ID

A unique identifier assigned to each individual climate data record.

#### Date

The specific date when the climate observation was recorded.

## **Geographic Columns**

### **Country**

The nation where the climate data was collected.

### **City**

The specific urban location where the data was gathered.

## **Climate and Environmental Metrics**

### **Temperature (°C)**

Measurement of the ambient air temperature in degrees Celsius.

### **Humidity (%)**

The amount of water vapor present in the air, expressed as a percentage.

### **Precipitation (mm)**

The total amount of rainfall or water equivalent measured in millimeters.

### **Air Quality Index (AQI)**

A numerical scale that indicates the level of air pollution and potential health risks.

### **Extreme Weather Events**

Significant and unusual meteorological occurrences such as hurricanes, heatwaves, or droughts.

## **Classification and Contextual Columns**

### **Climate Classification (Koeppen)**

A scientific system for categorizing global climate types based on temperature and precipitation patterns.

### **Climate Zone**

A broad classification of the ecological climate characteristics of a specific region.

### **Biome Type**

A large-scale biological community defined by its distinctive plant and animal species and environmental conditions. **Meteorological Columns**

**Heat Index**

A combined measure of air temperature and relative humidity that represents how hot it actually feels.

**Wind Speed**

The rate of air movement measured at the location.

**Wind Direction**

The compass direction from which the wind is blowing.

**Season**

The specific time of year when the data was collected.

**Impact and Vulnerability Columns****Population Exposure**

The number of people potentially affected by the observed climate conditions.

**Economic Impact Estimate**

A monetary valuation of the potential economic consequences related to the climate conditions.

**Infrastructure Vulnerability Score**

A numerical rating that assesses the potential risk and susceptibility of infrastructure to climaterelated challenges.

## 1.SQL Data Cleaning

-- Create a combined table

```
Create table "Climate Change"."Combined Data" as
select * from "Climate Change"."Australia" union
select * from "Climate Change"."Brazil" union
select * from "Climate Change"."Canada" union
select * from "Climate Change"."Germany" union
select * from "Climate Change"."India" union
select * from "Climate Change"."South Africa" union
select * from "Climate Change"."United States"
```

```
-- Check for duplicates
```

```
SELECT "Record ID" FROM "Climate
Change"."Combined Data" group by
"Record ID" having count(*) > 1;
```

```
SELECT distinct "Country"
FROM "Climate Change"."Combined Data"
```

```
-- Update the country
```

```
update "Climate Change"."Combined Data"  
set "Country" = 'India' where "Country" =  
'Inda';
```

```
-- Check for null values
```

```
select *  
from "Climate Change"."Combined Data"  
where "Record ID" IS NULL or "Date"  
IS NULL or "Country" IS NULL  
  
or "City" IS NULL or "Temperature" IS NULL  
or "Humidity" IS NULL or "Precipitation" IS  
NULL or "Air Quality Index" IS NULL or  
"Extreme Weather Events" IS NULL or  
"Climate Classification" IS NULL or "Climate  
Zone" IS NULL or "Biome Type" IS NULL or  
"Heat Index" IS NULL or "Wind Speed" IS  
NULL or "Wind Direction" IS NULL or  
"Season" IS NULL or "Population Exposure" IS  
NULL or "Economic Impact Estimate" IS NULL  
or "Infrastructure Vulnerability Score" IS NULL;
```

```
-- Update Population Exposure
```

```
update "Climate Change"."Combined Data"  
set "Population Exposure" = 5275135 where  
"Record ID" = 'aus_1338';
```

```
-- Update City
```

```
update "Climate Change"."Combined Data"  
set "City" = 'Toronto' where "Record ID" =  
'end_227';
```

## 2.SQL Data Analysis

```
-- Monthly Temperature Trends
```

```
SELECT TO_CHAR("Date", 'Month') AS Month_Name,  
       AVG("Temperature") AS Avg_Temperature
```

```
FROM "Climate Change"."Combined Data"

GROUP BY TO_CHAR("Date", 'Month'), EXTRACT(MONTH FROM "Date")

ORDER BY EXTRACT(MONTH FROM "Date");
```

**-- average temperature by country**

```
SELECT "Country",

       AVG("Temperature")    AS    Avg_Temperature

FROM "Climate Change"."Combined Data"  GROUP

BY "Country"

ORDER BY Avg_Temperature DESC;
```

**-- Extreme Weather Events by Month**

```
SELECT TO_CHAR("Date", 'Month') AS Month_Name,

       COUNT(*) AS Event_Count

FROM "Climate Change"."Combined Data"

WHERE "Extreme Weather Events" <> 'None'

GROUP BY TO_CHAR("Date", 'Month')

ORDER BY MIN("Date");
```

**-- Country-wise Extreme Weather**

```
SELECT "Country",  
       COUNT(*) AS Event_Count  
FROM "Climate Change"."Combined Data"  
WHERE "Extreme Weather Events" <> 'None'  
GROUP BY "Country"  
ORDER BY Event_Count DESC;
```

**-- Extreme Weather Events by Temperature Range SELECT**

```
CASE  
    WHEN "Temperature" < 10 THEN 'Very Cold (<10°C)'  
    WHEN "Temperature" BETWEEN 10 AND 15 THEN 'Cold (10-15°C)'  
    WHEN "Temperature" BETWEEN 15 AND 20 THEN 'Moderate (15-20°C)'  
    WHEN "Temperature" BETWEEN 20 AND 25 THEN 'Warm (20-25°C)'  
    ELSE 'Hot (>25°C)'  
END AS Temperature_Range,  
"Extreme Weather Events",  
COUNT(*) AS Event_Count  
FROM "Climate Change"."Combined Data"  
WHERE "Extreme Weather Events" <> 'None'  
GROUP BY Temperature_Range, "Extreme Weather Events"  
ORDER BY Temperature_Range, Event_Count DESC;
```



**-- which cities are experiencing extreme weather events this week and what are their economic and population impacts?**

```
select
    "Country",
    "City",
    "Extreme Weather Events",
    count(*) as "Event Type",
    Round(avg("Temperature"), 1) as "Average Temperature",
    sum("Population Exposure") as "Total Population Exposure",
    sum("Economic Impact Estimate") as "Total Economic Impact",
    round(avg("Infrastructure Vulnerability Score"), 0) as "Average Vulnerability"
from "Climate Change"."Combined Data" where "Date" between '2025-03-03' and
'2025-03-07' and "Extreme Weather Events" != 'None' group by "Country", "City",
"Extreme Weather Events" order by "Total Economic Impact" desc;
```

**-- what are the top 5 cities with the highest air quality concerns and their associate risks?**

```
select
    "Country",
    "City",
```

```

        round(avg("Air Quality Index"), 0) as "Average AQI",
count(*) as "Days above 200 AQI",

SUM("Population Exposure") as "Total Population
Exposure",    round(avg("Temperature"), 1) as "Average
Temperature" from "Climate Change"."Combined Data" where "Date"
between '2025-03-03' and '2025-03-07' group by "Country", "City"
having avg("Air Quality Index") > 100 order by "Average AQI" limit
5;

```

**-- Which biome types are most risk from extreme weather events this week?**

```

select
    "Biome Type",
        count(*) as "Total Records",
        count(distinct concat("Country", "City")) as "Locations Affected",
        count(case when "Extreme Weather Events" != 'None' then 1 end) as "Extreme Weather
Count",
        STRING_AGG(DISTINCT "Extreme Weather Events", ', ' ) as "Event Types",
        Round(avg("Temperature"), 1) as "Average Temperature",          sum("Economic
Impact Estimate") as "Total Economic Impact Estimate",
        Round(Avg("Infrastructure Vulnerability Score"), 0) as "Average Vulnerability" from
"Climate Change"."Combined Data" where "Date" between '2025-03-03' and '2025-03-
07' group by "Biome Type"

```

### 3. Tableau

#### **Avg AQI**

AVG([Air Quality Index])

#### **Current Month AQI**

IF DATENAME('month', [Date]) = [Current Month] THEN

{FIXED DATENAME('month', [Date]) : AVG([Air Quality Index])}

END

#### **Previous Month AQI**

IF DATENAME('month', [Date]) =

case [Current Month]

WHEN 'January' THEN 'December'

WHEN 'February' THEN 'January'

WHEN 'March' THEN 'February'

WHEN 'April' THEN 'March'

WHEN 'May' THEN 'April'

WHEN 'June' THEN 'May'

WHEN 'July' THEN 'June'

WHEN 'August' THEN 'July'

WHEN 'September' THEN 'August'

WHEN 'October' THEN 'September'

WHEN 'November' THEN 'October'

WHEN 'December' THEN 'November'

END

THEN {FIXED DATENAME('month', [Date]) : AVG([Air Quality Index])}

END

### **% Difference AQI**

$(\text{AVG}([\text{Current Month AQI}]) - \text{AVG}([\text{Previous Month AQI}])) / \text{AVG}([\text{Previous Month AQI}])$

### **Bad Percentage AQI**

IF [% Difference AQI] >= 0.03

THEN

IF [% Difference AQI] > 0

THEN "▲ " + STR(ROUND([% Difference AQI] \* 100, 2)) + "%" // Increase (bad)

ELSE "▼ " + STR(ROUND([% Difference AQI] \* 100, 2)) + "%" // Decrease (bad)

END

ELSE

""

END

### **Good Percentage AQI**

IF [% Difference AQI] < 0.03

THEN

IF [% Difference AQI] > 0

THEN "▲ " + STR(ROUND([% Difference AQI] \* 100, 2)) + "%" // Increase (good)

ELSE "▼ " + STR(ROUND([% Difference AQI] \* 100, 2)) + "%" // Decrease (good)

END

ELSE

""

END

### **Count of EWE**

IF [Extreme Weather Events] <> "None" THEN 1 ELSE 0

END

### **Current Month EWE**

IF DATENAME('month', [Date]) = [Current Month] THEN [Count of EWE]

END

### **Previous Month EWE**

IF DATENAME('month', [Date]) =

case [Current Month]

WHEN 'January' THEN 'December'

WHEN 'February' THEN 'January'

WHEN 'March' THEN 'February'

WHEN 'April' THEN 'March'

WHEN 'May' THEN 'April'

WHEN 'June' THEN 'May'

WHEN 'July' THEN 'June'

WHEN 'August' THEN 'July'

```
WHEN 'September' THEN 'August'

WHEN 'October' THEN 'September'

WHEN 'November' THEN 'October'

WHEN 'December' THEN 'November'

END
```

```
THEN [Count of EWE]
```

```
END
```

### **% Difference EWE**

```
(SUM([Current Month EWE]) - SUM([Previous Month EWE])) / SUM([Previous Month EWE])
```

### **Bad Percentage EWE**

```
IF [% Difference EWE] > 0 THEN "▲ " + STR(ROUND([% Difference EWE] * 100, 2)) + "%"
```

```
ELSE
```

```
""
```

```
END
```

### **Good Percentage EWE**

```
IF [% Difference EWE] < 0 THEN "▼ " + STR(ROUND([% Difference EWE] * 100, 2)) + "%"
```

```
ELSE
```

```
""
```

```
END
```

### **Avg Precipitation Intensity**

```
AVG([Precipitation])
```

### **Current Month Precipitation Intensity**

```
IF DATENAME('month', [Date]) = [Current Month] THEN  
  
{FIXED DATENAME('month', [Date]) : AVG([Precipitation])}  
  
END
```

### **Previous Month Precipitation Intensity**

```
IF DATENAME('month', [Date]) = case  
[Current Month]  
  
    WHEN 'January' THEN 'December'  
  
    WHEN 'February' THEN 'January'  
  
    WHEN 'March' THEN 'February'  
  
    WHEN 'April' THEN 'March'  
  
    WHEN 'May' THEN 'April'  
  
    WHEN 'June' THEN 'May'  
  
    WHEN 'July' THEN 'June'  
  
    WHEN 'August' THEN 'July'  
  
    WHEN 'September' THEN 'August'  
  
    WHEN 'October' THEN 'September'  
  
    WHEN 'November' THEN 'October'  
  
    WHEN 'December' THEN 'November'  
  
END
```

```
THEN {FIXED DATENAME('month', [Date]) : AVG([Precipitation])}
```

```
END
```

### **% Difference Precipitation Intensity**

```
(AVG([Current Month Precipitation Intensity]) - AVG([Previous Month Precipitation  
Intensity]))
```

/ AVG([Previous Month Precipitation Intensity])

### **Bad Percentage Precipitation Intensity**

IF [% Difference Precipitation Intensity] <= -0.02 or [% Difference Precipitation Intensity] >= 0.02 THEN

IF [% Difference Precipitation Intensity] > 0

THEN "▲ " + STR(ROUND([% Difference Precipitation Intensity] \* 100, 2)) + "%"

ELSE "▼ " + STR(ROUND([% Difference Precipitation Intensity] \* 100, 2)) + "%"

END

ELSE

""

END

### **Good Percentage Precipitation Intensity**

IF [% Difference Precipitation Intensity] > -0.02 AND [% Difference Precipitation Intensity] < 0.02 THEN

IF [% Difference Precipitation Intensity] > 0

THEN "▲ " + STR(ROUND([% Difference Precipitation Intensity] \* 100, 2)) + "%"

ELSE "▼ " + STR(ROUND([% Difference Precipitation Intensity] \* 100, 2)) + "%"

END

ELSE

""

END



### **Avg Temperature**

AVG([Temperature])

### **Current Month Temperature**

IF DATENAME('month', [Date]) = [Current Month] THEN

{ FIXED DATENAME('month', [Date]) : AVG([Temperature]) }

END

### **Previous Month Temperature IF**

DATENAME('month', [Date]) =

case [Current Month]

WHEN 'January' THEN 'December'

WHEN 'February' THEN 'January'

WHEN 'March' THEN 'February'

WHEN 'April' THEN 'March'

WHEN 'May' THEN 'April'

WHEN 'June' THEN 'May'

WHEN 'July' THEN 'June'

WHEN 'August' THEN 'July'

WHEN 'September' THEN 'August'

WHEN 'October' THEN 'September'

WHEN 'November' THEN 'October'

WHEN 'December' THEN 'November'

END

THEN { FIXED DATENAME('month', [Date]) : AVG([Temperature]) } END

### **% Difference Temperature**

$$\frac{(\text{AVG}([\text{Current Month Temperature}]) - \text{AVG}([\text{Previous Month Temperature}]))}{\text{AVG}([\text{Previous Month Temperature}] )}$$

### **Bad Percentage Temperature**

IF [% Difference Temperature] >= 0.03 OR [% Difference Temperature] <= -0.03

THEN

IF [% Difference Temperature] > 0

THEN "▲ " + STR(ROUND([% Difference Temperature] \* 100, 2)) + "%"

ELSE "▼ " + STR(ROUND([% Difference Temperature] \* 100, 2)) + "%"

END

ELSE

""

END

### **Good Percentage Temperature**

IF [% Difference Temperature] > -0.03 AND [% Difference Temperature] < 0.03

THEN

IF [% Difference Temperature] > 0

THEN "▲ " + STR(ROUND([% Difference Temperature] \* 100, 2)) + "%"

ELSE "▼ " + STR(ROUND([% Difference Temperature] \* 100, 2)) + "%"

END

ELSE

""

END

### **Temperature Variability**

STDEV([Temperature])

### **Current Month Temperature Variability**

IF DATENAME('month', [Date]) = [Current Month] THEN

{FIXED DATENAME('month', [Date]) : STDEV([Temperature])}

END

### **Previous Month Temperature**

**Variability** IF DATENAME('month',

[Date]) = case [Current Month]

WHEN 'January' THEN 'December'

WHEN 'February' THEN 'January'

WHEN 'March' THEN 'February'

WHEN 'April' THEN 'March'

WHEN 'May' THEN 'April'

WHEN 'June' THEN 'May'

WHEN 'July' THEN 'June'

WHEN 'August' THEN 'July'

WHEN 'September' THEN 'August'

WHEN 'October' THEN 'September'

WHEN 'November' THEN 'October'

WHEN 'December' THEN 'November'

END

THEN {FIXED DATENAME('month', [Date]) : STDEV([Temperature])}

END

### **% Difference Temperature Variability**

$$\frac{(\text{AVG}([\text{Current Month Temperature Variability}]) - \text{AVG}([\text{Previous Month Temperature Variability}]))}{\text{AVG}([\text{Previous Month Temperature Variability}])}$$

### **Bad Percentage Temperature Variability**

IF [% Difference Temperature Variability] >= 0.01 THEN

IF [% Difference Temperature Variability] > 0

THEN "▲ " + STR(ROUND([% Difference Temperature Variability] \* 100, 2)) + "%"

ELSE "▼ " + STR(ROUND([% Difference Temperature Variability] \* 100, 2)) + "%"

END

ELSE

""

END

### **Good Percentage Temperature Variability**

IF [% Difference Temperature Variability] < 0.01 THEN

IF [% Difference Temperature Variability] > 0

THEN "▲ " + STR(ROUND([% Difference Temperature Variability] \* 100, 2)) + "%"

ELSE "▼ " + STR(ROUND([% Difference Temperature Variability] \* 100, 2)) + "%"

END

ELSE

""

END