

Temperature analysis

1. Temperature Changes in Developed vs. Developing Countries

- **Question:** Have developed countries, with historically high emissions, experienced greater or faster temperature increases than developing countries?
- **Method:** Divide the dataset into OECD (developed) and non-OECD (developing) countries. Calculate average temperature increases per decade and compare trends using regression analysis.
- **Relevance:** Highlights disparities in climate impacts, aligning with the Paris Agreement's emphasis on equity and support for vulnerable nations.

2. Regional Variation in Warming

- **Question:** Which regions (e.g., Arctic, Africa, South Asia) exhibit the strongest warming, and how does this align with the 1.5°C target?
- **Method:** Group countries by geographic region and analyze temperature deviations from a pre-industrial baseline (e.g., 1850–1900). Visualize with heatmaps or time series.
- **Relevance:** Identifies areas exceeding Paris targets, informing adaptation strategies.

3. Frequency and Intensity of Extreme Temperatures

- **Question:** Has the number of extremely hot days or heatwaves increased with global warming?
- **Method:** Define thresholds for extreme temperatures (e.g., 95th percentile for a given country) and count occurrences over time. Apply statistical tests (e.g., Mann-Kendall) to detect trends.
- **Relevance:** Relates to the Paris Agreement's focus on reducing climate risks and adapting to extreme weather.

4. Correlation Between Urbanization and Temperature Increase

- **Question:** Is warming more pronounced in highly urbanized countries compared to rural ones?
- **Method:** Integrate urban/rural indicators (e.g., from the World Bank) and analyze temperature trends in highly urbanized countries (e.g., Japan) vs. less urbanized ones (e.g., Bhutan). Use panel data analysis to control for time and country-specific effects.
- **Relevance:** Illuminates how human activity amplifies warming, a core concern of the Paris Agreement.

5. Timing of Accelerated Warming

- **Question:** When did temperatures begin to rise significantly, and does this vary across countries?
- **Method:** Apply breakpoint analysis (e.g., Chow test) to identify significant shifts in temperature trends. Compare timing across continents or economic groups.
- **Relevance:** Provides insight into when human influence became dominant, supporting the Paris Agreement's historical context.

6. Comparison with Pre-Industrial Baseline

- **Question:** How close are different countries to the 1.5°C or 2°C limit today?
- **Method:** Calculate average temperatures for 1850–1900 as a baseline and compare with recent decades (e.g., 2010–2020). Categorize countries by their exceedance of targets.
- **Relevance:** Directly tied to the Paris Agreement's temperature goals, showing progress or shortfalls.

7. Temperature Differences and Economic Capacity

- **Question:** Have countries with lower GDP per capita experienced greater temperature increases, and how does this affect climate adaptation?
- **Method:** Link temperature data with GDP data and use correlation or clustering methods to identify patterns.
- **Relevance:** Addresses Article 2 of the Paris Agreement on supporting developing countries to enhance resilience.

8. Coastal vs. Inland Countries

- **Question:** Do coastal countries exhibit stronger warming than inland countries due to ocean influence?
- **Method:** Classify countries as coastal or inland and analyze temperature trends separately. Use ANOVA to test for significant differences.
- **Relevance:** Highlights vulnerability to sea-level rise, a key adaptation focus in the Paris Agreement.

Greenhouse gases analysis

1. Emission Reductions Before and After the Paris Agreement

- **Question:** Have global or national greenhouse gas emissions decreased post-2016 compared to pre-Paris Agreement levels?
- **Method:** Split the dataset into pre- (e.g., 2000–2015) and post- (2016–present) Paris periods. Calculate average annual emission changes and use time series analysis (e.g., ARIMA) to detect trend shifts.
- **Relevance:** Directly tests the Paris Agreement's impact on emission trajectories.

2. Comparison of Emissions in Paris Agreement Members vs. Non-Members

- **Question:** Have countries that ratified the Paris Agreement reduced emissions more than non-members (e.g., the U.S. during its 2017–2021 withdrawal)?
- **Method:** Categorize countries by membership status and compare emission changes using t-tests or regression, adjusted for economic factors.
- **Relevance:** Assesses the effectiveness of the Paris Agreement's binding processes and voluntary NDCs.

3. Emission Intensity and Economic Development

- **Question:** Have high GDP-per-capita countries reduced emission intensity (CO₂ per GDP unit) more post-Paris Agreement than developing countries?
- **Method:** Compute emission intensity over time and use panel data analysis to compare developed and developing countries after 2016.
- **Relevance:** Relates to the Paris Agreement's goals of sustainable development and financial support for low-emission growth.

4. Sectoral Emission Changes

- **Question:** Which sectors (e.g., energy, transport, industry) show the greatest emission reductions post-Paris Agreement?
- **Method:** Use sector-specific data (if available) and analyze changes with clustering methods or stacked bar visualizations.
- **Relevance:** Reveals where Paris Agreement policies, such as renewable energy transitions, have had the most impact.

5. Correlation Between NDC Ambitions and Actual Emissions

- **Question:** Do countries' actual emission reductions align with the ambitions in their Nationally Determined Contributions (NDCs)?
- **Method:** Quantify NDC targets (e.g., % reduction by 2030) and correlate with observed emissions post-2016 using Spearman's rank correlation.
- **Relevance:** Evaluates the efficacy of the Paris Agreement's five-year ambition cycles.

6. Emissions in Coastal vs. Inland Countries

- **Question:** Have coastal countries, more vulnerable to sea-level rise, reduced emissions faster than inland countries post-Paris Agreement?
- **Method:** Classify countries as coastal or inland and analyze emission reductions with ANOVA or time series analysis.
- **Relevance:** Links emission behavior to climate adaptation, a core aspect of Paris Agreement Article 2.

7. Impact of Climate Finance on Emissions in Developing Countries

- **Question:** Have developing countries receiving climate finance (e.g., from the Paris Agreement's \$100 billion goal) shown greater emission reductions?
- **Method:** Integrate financial support data (e.g., from OECD or UNFCCC) and use difference-in-differences analysis to assess post-2016 emission impacts.
- **Relevance:** Tests the Paris Agreement's financing framework and its effect on low-emission development.

8. Emission Growth vs. Renewable Energy Share

- **Question:** Have countries with increased renewable energy shares post-Paris Agreement exhibited lower emission growth?
- **Method:** Link emission data with renewable energy share (e.g., from IEA) and use regression to measure the relationship.
- **Relevance:** Examines whether the Paris Agreement's focus on technology and transition has reduced fossil fuel emissions.