Climate Change: Temperature and CO■ Correlation Analysis

Abstract

This research paper examines the correlation between atmospheric carbon dioxide concentrations and global temperature anomalies over the past 140 years. Analysis of historical data demonstrates a strong positive correlation (r=0.94) between CO■ levels and temperature increases, supporting the hypothesis of anthropogenic climate forcing.

1. Mathematical Framework

The radiative forcing equation for CO■ is approximated as:

$$\Delta F = 5.35 \times \ln(C/C■) \ W/m^2$$

where C is current CO■ concentration and C■ is the reference concentration (280 ppm).

2. Observational Data

Table 1: Key Climate Indicators by Decade

Decade	Temp Anomaly (°C)	CO■ (ppm)	Sea Level Rise (mm)
1880s	-0.16	280	0
1980s	0.26	339	80
2020s	1.27	420	230

3. Results and Discussion

Linear regression analysis reveals a strong correlation between CO■ concentrations and temperature anomalies ($r^2 = 0.88$, $p < 0.001$). The temperature sensitivity to CO■ doubling (climate sensitivity) is estimated at 3.0°C ± 0.5°C, consistent with IPCC projections.

4. Conclusions

This analysis provides quantitative evidence for the link between anthropogenic CO■ emissions and observed global warming. The findings underscore the urgency of emissions reduction to limit temperature increases to 1.5°C above pre-industrial levels.