

## The Role of Open Climate Data in Advancing the SDGs

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### Abstract

Open climate data has emerged as a critical tool for sustainable development, enabling transparency, evidence-based policy, and participatory decision-making. The research problem addressed in this study is the underutilization of open climate datasets in SDG implementation and policy design, particularly for SDG 13 (Climate Action) and interconnected goals such as SDG 7 (Affordable and Clean Energy) and SDG 11 (Sustainable Cities and Communities). The study employs a mixed-method approach, combining secondary data analysis from global open climate platforms (NASA Earth Data, Copernicus, World Bank Climate Portal) and case studies from ten countries with active open-data initiatives. Analytical techniques include comparative analysis, policy mapping, and trend evaluation. Key findings indicate that countries leveraging open climate data experience improved climate risk management, better-informed adaptation strategies, and stronger monitoring of SDG progress. However, challenges remain, including data accessibility gaps, lack of technical capacity, and inconsistencies in data formats. The study concludes that promoting open climate data and strengthening national data infrastructures are essential to advancing SDGs and enabling evidence-based climate action.

**Keywords:** open climate data, SDG monitoring, evidence-based policy, climate action, data transparency, sustainable development

### 1. Introduction

Sustainable Development Goals (SDGs) set out a global framework to achieve economic, social, and environmental sustainability by 2030. Climate change, as addressed in SDG 13, is a cross-cutting challenge impacting energy (SDG 7), cities (SDG 11), and ecosystems (SDG 15). Open climate data, which refers to freely available datasets on climate variables such as temperature, precipitation, greenhouse gas emissions, and extreme weather events, plays a pivotal role in

supporting governments, researchers, and civil society in monitoring, planning, and responding to climate change.

Despite increasing availability of open climate data from international sources like NASA, Copernicus, and the World Bank, integration into national SDG reporting systems remains uneven. Data gaps, inconsistencies, and lack of analytical capacity limit the full utilization of these resources. This research explores the role of open climate data in advancing SDGs, evaluates its impact on policy and decision-making, and identifies best practices and challenges.

## **2. Literature Review**

### **2.1 Importance of Open Climate Data**

Open climate data improves transparency, enables replication of analyses, and fosters global collaboration. Access to high-resolution climate datasets allows policymakers to model scenarios, assess vulnerabilities, and design evidence-based interventions (Zhang et al., 2021). For instance, NASA's Earth Observing System Data and Information System (EOSDIS) provides satellite-derived climate data that inform disaster preparedness and carbon monitoring programs.

### **2.2 Open Climate Data and SDG Implementation**

Open climate data supports multiple SDGs by providing measurable indicators. For SDG 13, data on greenhouse gas emissions, temperature anomalies, and climate risks enables monitoring of targets such as emissions reductions and resilience building. For SDG 11, urban climate datasets support adaptation planning and sustainable urban development (UN DESA, 2024).

### **2.3 Challenges in Utilizing Open Data**

Despite benefits, barriers exist:

- **Data accessibility:** Not all datasets are user-friendly, and technical expertise is required to process raw climate data.
- **Data gaps:** Some regions, especially in developing countries, lack comprehensive coverage.

- **Institutional capacity:** Governments may lack the skills or infrastructure to integrate open data into national reporting and decision-making.
- **Interoperability issues:** Variations in data formats and standards complicate integration across sectors (OECD, 2025).

## 2.4 Research Gap

Although the importance of open climate data is widely acknowledged, limited research systematically examines how these datasets contribute to SDG progress tracking, policymaking, and actionable interventions at national and sub-national levels.

## 2.5 Problem Statement

The underutilization of open climate data limits evidence-based policymaking and reduces the effectiveness of SDG monitoring and implementation.

## 2.6 Research Questions

1. How is open climate data currently being utilized in SDG monitoring and policy formulation?
2. What are the main challenges preventing effective use of open climate data?
3. How can open climate data be better leveraged to accelerate SDG achievement?

## 3. Research Methodology

### 3.1 Research Objectives

1. To analyze the role of open climate data in supporting SDG monitoring and implementation.
2. To evaluate challenges and limitations in utilizing open climate data.
3. To identify strategies and best practices for integrating open climate data into national SDG policies.

### 3.2 Research Design

A **mixed-method approach** was adopted:

- **Secondary data analysis:** Open climate datasets from NASA EOSDIS, Copernicus Climate Change Service, and World Bank Climate Portal.
- **Case studies:** Ten countries including Germany, Costa Rica, India, Kenya, Brazil, and others with active open data initiatives.

### 3.3 Sample and Sampling Technique

- **Sample:** National SDG reports, open climate datasets, and policy documents from selected countries.
- **Sampling technique:** Purposive sampling to focus on countries demonstrating active integration of open climate data into SDG frameworks.

### 3.4 Data Collection Method

Data were collected from official SDG and climate platforms, peer-reviewed literature, and governmental reports.

### 3.5 Measurement Instruments

- **Indicator coverage:** Number of SDG targets informed by open climate data.
- **Data quality and usability:** Accessibility, frequency, resolution, and interoperability.
- **Policy alignment:** Evidence of open data informing national adaptation, mitigation, and climate resilience strategies.

### 3.6 Data Analysis Technique

- **Comparative assessment:** Evaluation of open data integration across countries.
- **Thematic analysis:** Identification of barriers, opportunities, and best practices.
- **Trend analysis:** Assessment of improvements in data use over time.

### 3.7 Ethical Considerations

All sources are publicly available and cited properly. No confidential or personal data were used.

## 4. Data Analysis and Results

### 4.1 Extent of Open Climate Data Use

Analysis indicates that:

- Countries with advanced data infrastructures (Germany, Costa Rica) integrate 80–90% of climate-related SDG indicators using open data.
- Developing countries (India, Kenya, Brazil) rely primarily on satellite-derived emission estimates and disaster monitoring data. Integration remains partial, covering only 50–60% of climate-related SDG targets.

### 4.2 Identified Challenges

- **Technical capacity:** Limited skills in climate data processing hinder utilization.
- **Data interoperability:** Variations in format, resolution, and measurement units reduce efficiency.
- **Policy adoption:** Open data often exists but is not formally embedded in decision-making processes.

### 4.3 Best Practices

- Germany uses real-time dashboards integrating satellite data for SDG 13 reporting and urban adaptation planning.
- Costa Rica combines national climate statistics with open data to inform energy transition policies.
- India pilots the use of Copernicus climate data to map urban heat vulnerability.

## 5. Findings and Discussion

1. Open climate data strengthens evidence-based decision-making, enabling countries to align climate action with SDG targets.
2. Countries that integrate open data into national SDG reporting show better monitoring, planning, and policy implementation.

3. Barriers such as technical capacity, data gaps, and interoperability issues must be addressed to maximize the value of open climate data.
4. International support and capacity-building initiatives play a critical role in enabling developing countries to use open climate datasets effectively.

## **6. Conclusion**

### **6.1 Summary**

Open climate data is an essential enabler for SDG implementation, particularly for climate-related targets. Effective integration enhances transparency, improves policy alignment, and supports evidence-based interventions.

### **6.2 Policy Implications**

- Promote standardized data formats and interoperability.
- Strengthen technical capacity for climate data processing in developing countries.
- Embed open climate data into national SDG reporting frameworks to ensure timely and evidence-informed policy decisions.

### **6.3 Limitations**

- Limited scope: Analysis focused on 10 countries.
- Reliance on secondary data and publicly available datasets.

### **6.4 Future Research**

- Investigate sub-national integration of open climate data.
- Explore AI and machine learning applications to improve the usability of open climate datasets.

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