

# Chapter 12

# Cloud Computing for Carbon Monitoring and Analytics

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## **ABSTRACT**

*This chapter explores the role of cloud computing in carbon monitoring and analytics, providing scalable and efficient solutions for tracking carbon emissions across various industries. Cloud platforms enable organizations to gather real-time data from multiple sources, including IoT sensors, satellite imagery, and environmental databases, to monitor, analyze, and visualize carbon footprints. Technologies such as big data analytics, machine learning, and artificial intelligence (AI) are integrated into cloud systems to generate actionable insights for reducing emissions. Additionally, this chapter discusses case studies of cloud-based carbon monitoring systems and examines challenges related to data security, privacy, and interoperability. By emphasizing the potential of cloud ecosystems in driving sustainable*

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*innovation, this chapter highlights cloud computing's critical role in climate action.*

## **1. INTRODUCTION**

### **1.1 Overview of Carbon Monitoring Systems**

Carbon monitoring as part of greenhouse gas monitoring refers to tracking how much carbon dioxide or methane is produced by a particular activity at a particular time. For example, it may refer to tracking methane emissions from agriculture, or carbon dioxide emissions from land use changes, such as deforestation, or from burning fossil fuels, whether in a power plant, automobile, or other device. Because carbon dioxide is the greenhouse gas emitted in the largest quantities, and methane is an even more potent greenhouse gas, monitoring carbon emissions is widely seen as crucial to any effort to reduce emissions and thereby slow climate change.

Monitoring carbon emissions is key to the 'cap-and-trade' program currently being used in Europe, as well as the one in California, and will be necessary for any such program in the future, like the Paris Agreement. The lack of reliable sources of consistent data on carbon emissions is a significant barrier to efforts to reduce emissions.

Carbon monitoring is an essential aspect of environmental sustainability, aiming to track greenhouse gas (GHG) emissions and identify strategies for reduction (Smith et al., 2020). Traditional carbon monitoring systems relied on manual data collection and reporting, making them inefficient and prone to errors. However, the advent of cloud computing, big data analytics, and IoT has transformed carbon monitoring into a more automated and real-time process (Brown & Green, 2019).

As the world increasingly focuses on sustainability, businesses and governments are adopting innovative solutions to track and reduce their carbon footprints. Cloud-based carbon monitoring and analytics platforms play a pivotal role in this effort by offering scalable, real-time insights into carbon emissions. These cloud solutions aggregate data from various sources—such as energy consumption, transportation, and supply chains—into centralized platforms, allowing organizations to analyze their carbon impact across multiple dimensions.

Cloud computing offers significant advantages in this context, providing the flexibility to store vast amounts of data, the power to process complex analytics, and the ability to access insights from anywhere in the world. With advanced tools like machine learning algorithms and big data analytics, cloud-based platforms can not only monitor emissions but also predict future trends, identify inefficiencies, and suggest actionable steps for reducing carbon footprints.

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