



The Role of Artificial Intelligence in Addressing Climate Change in India: A Critical Analysis

Dr. Pooran Chandra Pande

Advocate, Paramarsh Vidhi Karyalay, Shanti Kunj Lane no 2, Ramnagar, Nainital Uttarakhand
advocatepooranpande@gmail.com

DOI : <https://doi.org/10.5281/zenodo.21478583>

ARTICLE DETAILS

Research Paper

Received: 17-05-2026

Accepted: 28-06-2026

Published: 15-07-2026

Keywords:

*Artificial Intelligence,
Climate Change,
Environmental Law,
Machine Learning, and
Sustainable Development.*

ABSTRACT

Climate change has been identified as the main problem in the planet earth in this century due to its various impacts on environmental equilibrium, economic efficiency, and security and sustainability of humans. These impacts include greenhouse gas emissions, global warming, climate extremes, biodiversity losses and natural resource depletion, which requires some new technologies in order to cope with these impacts. The best technology developed to address this challenge is Artificial Intelligence (AI). The issue of the present research paper is concerned with artificial intelligence applications, benefits of artificial intelligence, drawbacks of artificial intelligence, and ethics of artificial intelligence in climate change. The present research paper studies the methodological aspect of the research conducted in the present research paper that is based on descriptive and analytical research using secondary data. It appears that artificial intelligence can become one of the most efficient tools of dealing with climate change on a global scale; however, its implementation should remain reasonable and cannot rely on any technology that would have a negative impact on the environment. In other words, artificial intelligence should be connected with people's decision making in this case.

Disclaimer: The opinions, interpretations, conclusions, recommendations, analyses, and statements expressed in this research article are solely those of the author(s) and do not reflect the views, policies, or positions of the Publisher, Chief Editor, Editors, Editorial Board, Reviewers, or their affiliated institutions. The author(s) are solely responsible for ensuring the originality, authenticity, and integrity of the manuscript and for ensuring that it is free from plagiarism, AI-generated content, copyright infringement, data falsification, and any other form of academic misconduct.



1. INTRODUCTION

Problems of environmental, social and economic nature caused by the global warming and ecosystem, man and development threats are described. Greenhouse effect which is produced by humans leads to temperature rise, climatic changes, melting of the icebergs and the rise in the sea level, according to the report of Intergovernmental Panel on Climate Change (IPCC). As a result of climatic changes, there appear such problems as droughts, fires, floods, heat waves and others. It means that conclusions of science concerning this problem should be considered. One can see that the traditional approach to monitoring and control of climate is inefficient because of complexity of the problem and quantity of information. Climate depends on the atmosphere, the ocean, the land, man and ecosystems. There is a lot of information about the climate that can be obtained by means of satellites and weather stations.

The emergence of artificial intelligence has brought about technology capable of processing a lot of data, analysing certain patterns arising out of the data, and making forecasts based on the outcomes of these processes. Artificial intelligence comprises smart machines created through computer algorithms that can think and form patterns like humans do. One component of artificial intelligence technology includes machine learning, where the machine learns things without programming. Artificial intelligence has gained much popularity in climate change research in recent times due to its high level of accuracy.

First of all, it is important to say that there are two approaches that can be applied to identify the connection between artificial intelligence and climate change. On the one side, there are some possibilities provided by AI, which would help to reduce the negative effect of climate change. On the other hand, there are different types of energy utilized by artificial intelligence. As far as computing power of AI is concerned, if artificial intelligence uses fossil fuel in order to generate electric power, carbon emissions will occur. That is why the advantages and disadvantages of AI for the environment should be analysed.

In this regard, the present research seeks to investigate the advantages which can be achieved through the use of artificial intelligence in solving climate change issues. In simple terms, this study will try to examine the different aspects of artificial intelligence and how useful they are in solving climate change issues.

To assess the importance of Artificial Intelligence in solving the challenges of climate change. To analyse the use of Artificial Intelligence technology in climate forecasting, renewable energy, agriculture, disaster management, and environmental monitoring. To find out the pros and cons of the use of Artificial



Intelligence technology for solving the challenges of climate change. To analyse the ethical, technical, and governance challenges of the use of Artificial Intelligence technology in climate change.

The following list shows the research questions that the study intends to address: In what ways can Artificial Intelligence help combat and adapt to climate change? What are the primary uses of AI in environmental observation and sustainability? What barriers stand in the way of effective climate action using AI? What policies need to be put in place for the ethical use of AI in climate governance?

2. Literature Review

This issue has already been investigated by professionals in science, ecology, and policy making. In accordance with the results obtained during the literature review, it can be assumed that there are many possibilities for the application of AI technology for collecting information related to climate change and its solution. The work of Rolnick et al. (2019) can be considered among the most detailed studies dedicated to the application of machine learning in regard to climate change. The research demonstrates different possibilities of using artificial intelligence in relation to climate change, including energy systems, transportation, climate modelling, and emissions. However, there are also other possibilities offered by machine learning.

Reichstein et al.'s (2019) research on deep learning algorithm was based on earth system sciences. The research demonstrated that artificial intelligence has the capability of integrating the information collected from satellite and climatic data in order to understand environmental changes. Deep learning algorithm made it possible to understand the nonlinear interactions in the climate system. In addition, Vinuesa et al. (2020) studied the connection between artificial intelligence and the SDGs. Their research revealed that artificial intelligence influences different aspects of sustainability such as climate action, affordable and clean energy, and sustainable consumption and production.

The relation between AI and climate change has been investigated by Hassani et al. (2021). In particular, it has been said that the usage of AI can be helpful to adjust to climate change because of the ability of predictions and managing resources. Still, it should be recognized that there is also the issue of ethical governance of AI and sustainable computing. However, some drawbacks related to the usage of AI have been also identified by other scholars. In particular, as noted by Crawford (2021), AI cannot be considered a neutral technology since certain requirements need to be satisfied when applying AI. Hence, the outcomes will be biased. The other issue that arises in relation to the usage of AI technology is that of environmental degradation. The reason for this is because the training process of AI technology is very



energy-intensive and requires immense computational powers. This is evident from the findings of Strubell et al. (2019) in which it is shown that the training process of AI leads to carbon dioxide emissions.

Indeed, the countries, which are subject to the influence of climate change due to warming, changes in monsoons, floods, droughts, and environmental degradation, can be regarded as one of the countries that can be influenced by the effects of climate change. Thus, taking into account the described factors, the technology of Artificial Intelligence can be regarded as one of the technologies that allow tackling climate change and adaptation. Scientists in India attempt to investigate the opportunities to apply this technology to climate change. The study on application of artificial intelligence and machine learning for climate change monitoring in India has been done by Malik, Pande, Nishi, and Khamparia (2020). The study mentioned above gives some information about application of AI in environment data analysis and climate change predictions. According to Malik et al. (2020), the climate change monitoring by means of AI requires applying machine learning.

Artificial Intelligence and Machine Learning techniques in Earth System Sciences have been studied by Singh et al. (2022) from the Indian Institute of Tropical Meteorology (IITM), Pune. The application of Artificial Intelligence for the analysis of climatic data and meteorological forecasts has been highlighted in this research article by Singh et al. (2022). The analysis carried out by Singh et al. (2022) has clearly indicated that Artificial Intelligence and Machine Learning techniques can prove to be very significant in the discipline of Earth System Sciences because of the analysis of climatic data and meteorological forecasts in South Asia. The parameters of climate change in India have been investigated through the application of the machine learning approach proposed by Wamanse and Patil (2022). The current research is devoted to the prediction of climate change parameters (temperature and rainfall, among others), using regression-based AI models.

Ensemble machine learning models for the climate prediction on the basis of the CMIP6 climate data in Western Ghats of India have been developed by Shetty, Umesh, and Shetty (2023). Hence, it can be concluded that according to the mentioned researches, the application of the models developed on the basis of the AI technology improves regional climate predictions. Moreover, the ensemble machine learning models for improving regional climate predictions in Western Ghats of India have been developed by Shetty et al. (2023). AI and Machine Learning Techniques in Climate Change Mitigation and Adaptation Including Environmental Monitoring, Prediction and Sustainability Have Been Investigated by Chaurasia, S., Wao, A. A., & Wao, A. (2025).



According to the International Energy Agency (IEA), the impact of artificial intelligence has been recognized as a technological method to increase efficiency and utilization of energy from renewables. The predictive analysis of artificial intelligence would help in coping up with the variations in production of energy using solar and wind energy by predicting the availability of energy and electricity distribution.

How artificial intelligence contributes towards achieving certain sustainable development goals (SDGs) is explained below:

- SDG 2 – Zero Hunger
- SDG 3 – Good Health
- SDG 6 – Clean Water
- SDG 7 – Affordable and Clean Energy
- SDG 9 – Industry, Innovation and Infrastructure
- SDG 11 – Sustainable Cities
- SDG 12 – Responsible Consumption
- SDG 13 – Climate Action
- SDG 15 – Life on Land

Based on the study by Vinuesa et al. (2020), it has been observed that up to 80% of the sustainable development goals can be realized through the use of artificial intelligence provided that they are used responsibly. Conversely, it is suggested that the use of artificial intelligence may pose threats to the concept of sustainability because of the following reasons: As discussed in the literature review, artificial intelligence can help significantly in solving the problem of climate change but it will depend on technology and sustainability.

M.C. Mehta v. Union of India (1987), This case pertains to the incident that results in damage to the environment and human beings, respectively. It refers to the incident of Oleum Gas Leak from Shriram Food and Fertilizer Industries located in Delhi. It is due to this case only that the Supreme Court of India has managed to formulate the environmental law. This is why the concept of Absolute Liability has been formulated by the Court, which states that any individuals carrying out hazardous activities shall be held liable regardless of their negligence.



Vellore Citizens Welfare Forum v. Union of India (1996), The issue in this case is the observation by the Supreme Court about the environmental pollution in the state of Tamil Nadu as a result of the activities of tanneries, resulting in pollution of water, rivers, and farm lands. According to the Supreme Court, the following would form part of the Indian environmental law: Principle of Sustainable Development, Precautionary Principle, and Polluter Pays Principle. This case is used to justify the use of artificial intelligence in the regulation of the environment, adapting to climate change and natural resources management.

Indian Council for Enviro-Legal Action v. Union of India (1996), This is a case of environmental pollution as a result of hazardous waste discharge in the village of Rajasthan by chemical industries. The Polluter Pays Principle is applied in this case whereby the industries polluting is made to pay for the entire cost of restoring the environment.

Subhash Kumar v. State of Bihar (1991), In this case, the plaintiff argued that because of pollution in the industries, pollution of the natural resource of water has occurred which negatively impacted the lives of the people who resided there. The Supreme Court of India held that the right to clean water and air is an essential component of the right to life under Article 21 of the Indian Constitution. From the above case, it can be concluded that the AI is not only a technological advancement but is also a very significant one to secure the environmental rights under Article 21.

T.N. Godavarman Thirumulpad v. Union of India (1997), Here, the court held that conservation of forests is a permanent duty under the Constitution and laid down different guidelines for conservation of the Indian forests. The use of technology such as AI satellite imaging, GIS, remote sensing, and drone imaging would help in monitoring the deforestation process, detecting any unlawful tree felling activities, the condition of forests, and carbon sequestration.

M.C. Mehta v. Kamal Nath (1997), In this case, the concept of doctrine of public trust was propounded. The court held that natural resources such as rivers, forests, lakes, and atmosphere are under the trusteeship of the State for the welfare of the common people. The use of AI technology would help in the monitoring of these natural resources.

A.P. Pollution Control Board v/s M.V. Nayudu (1999), The part played by science in decision-making in the domain of environment has been highlighted in various cases in The Supreme Court. In order to ensure the utilization of Artificial Intelligence for decision-making based on science, there must be an



analysis of climatic data in large amount, environmental risks to be predicted, and control of the environment scientifically.

Narmada Bachao Andolan v/s Union of India (2000), Sustainable development has been realized through the balance of economic development and environment protection. Sustainable development acts as a foundation for the implementation of Artificial Intelligence in renewable energy system, water system, and climate resilient infrastructure.

Hanuman Laxman Aroskar v Union of India (2019). The importance of using scientific and information-based EIA was emphasized in this extremely important case through the Supreme Court. The use of AI in EIA is extremely important because of its ability to predict and collect satellite information.

All these judgments, when taken together, can be the bedrock on which the legal provisions pertaining to the protection of environment in India are founded. Concepts like absolute liability, sustainable development, precautionary principle, polluter pays principle, and right to clean environment enshrined in Article 21 of the Indian constitution may come handy while framing a legal framework for incorporation of Artificial Intelligence into climate governance. The technological applications of artificial intelligence like machine learning, remote sensing, satellite imagery, big data analysis, Internet of Things, environmental sensors, and climate change modelling can really play an immensely important part in the field of environmental monitoring and management of pollution, disasters, carbon accounting, and climate change adaptation.

3. Research Methodology

3.1 Research Design

The following techniques of analysis will be used in investigating the role of artificial intelligence technology in solving the challenges caused by climate change in the study. The descriptive technique will be used to analyse different types of artificial intelligence technology and the application of technology in investigating climate change. The analytical technique will be used to investigate the effectiveness, advantages, and disadvantages of the technology in the future.

3.2 Nature and Sources of Data

The majority of the data sources that have been used in this present research study belong to secondary data sources. Some of the main sources from where the data was obtained through peer reviewed journal articles from the following databases Climate Assessment Reports of various countries, Climate



Change Assessment Reports of IPCC, Climate Change Reports of UNEP, Climate Change Reports of International Energy Agency (IEA), Climate Change, Artificial Intelligence and Environmental Sustainability Reports. Some of the main databases from where the data was obtained in this current research study include Nature, Springer, Elsevier, IEEE, and ACM.

3.3 Research Method

The research method adopted in this paper involves the systematic literature review (SLR). Literature review for each theme found include the following:

Climate prediction using AI technology. Disaster management through the use of AI. Efficient use of renewable energy sources. 4. Smart agriculture and food security. Environmental monitoring using remote sensing techniques. Carbon reduction. AI ethics and governance. This paper will critically evaluate the state of knowledge and deficiencies in the field of climate change solution using AI.

3.4 Data Analysis Framework

Analysis of the results of research was done qualitatively using qualitative content analysis. The articles were analysed as follows:

Dimension of Analysis	Theme of Research
Technological Capability	Accuracy and efficiency of AI models
Environment Practicality	Contribution towards climate mitigation
Social Impact	Accessibility and inclusiveness
Economic Impact	Cost-effectiveness and resource optimisation
Ethical Dimension	Transparency, bias and governance

3.5 Inclusion and Exclusion Criteria

Academic articles published in peer-reviewed journals. Academic articles focused on the application of AI technology in addressing climate change challenges. Academic articles from 2010 to 2026. Academic articles by international organizations. Non-academic online sources. Academic articles irrelevant to environmental sustainability. Lack of scientific approach.



4. Critical Analysis of AI in Climate Change Management

In addition to that, the use of the Artificial Intelligence technology opens a variety of opportunities for solving the problem of climate change. However, it is important to note that considering the efficiency of AI use in solving the climate change problem, its implementation should be carried out from different angles, namely the technological side, ethical one, ecological sustainability and correct use of the AI technology.

(a) The accuracy of climate prediction

The biggest strength of the AI technology is its ability to process big amounts of data and detect climate patterns. In comparison to traditional climate models, the process of predicting climatic conditions is quite costly and inefficient because of the complexity of nonlinear interactions of variables. Through the help of the AI technology, it becomes possible to predict the future climate trends.

(b) Environmental Monitoring

Artificial Intelligence in environmental monitoring is utilized in satellite image analysis and use of the environmental monitoring system. Previously, satellite image analysis was a very complicated task. But due to artificial intelligence, it is now possible to monitor automatically the deforestation, glacier change, ocean pollution, and soil degradation. Therefore, decision-making regarding the environment becomes easy.

(c) Renewable Energy Shift

There is no technology that will help to produce renewable energy by making use of alternative resources like solar and wind energy. The Artificial Intelligence system can help in predicting the production of energy from alternative resources. The artificial intelligence system can make renewable energy much more efficient and reduce its dependency on fossils and energy storage systems.

(d) Resource Management

Resource management through artificial intelligence is conducted through energy, water, and agriculture management. Artificial intelligence helps in conserving the resources by making them efficient. The irrigation system through artificial intelligence uses water efficiently, while the energy grid and transport systems through artificial intelligence conserve fuel.



5. Challenges of Artificial Intelligence in Climate Change

Despite having many benefits, AI cannot solve all issues connected to the climate changes. The following list gives an overview of problems that need to be considered.

5.1 Energy Consumption in AI Systems

Firstly, one of the issues to consider is the impact of AI technology on the environment. Development of AI model requires particular hardware and energy consumption. The training of deep learning models requires large data centres, computational capacity and high electricity consumption. If electricity is produced through the process of burning fossil fuels, then AI becomes an additional source of carbon emission. Thus, development of environmentally friendly AI requires application of renewable energy in data centres, energy-efficient algorithms and green computing. (Strubell, Ganesh, & McCallum, 2019)

5.2 Insufficiencies of Climate Data

AI technology is highly dependent on data. Nevertheless, there are some insufficiencies in the climate data, namely Incompleteness, Geographical inequity and Low availability. Lack of the climate observation system in the developing countries leads to unevenness of AI technologies connected with climate.

5.3 Bias and Lack of Transparency in Algorithm

When the amount of data available for the AI process is inadequate, there will arise a problem of bias in AI systems. That means, when the AI process relies on weather predictions from the developed countries, there is no chance of its effectiveness in the developing countries. The lack of transparency in the algorithm can result in compromising the AI system. So, explainable AI should be used in climate governance.

5.4 Technology Divide

Technology, knowledge, and financing are required for incorporating AI in addressing climate change. However, these developing nations do not have the ability to incorporate AI technology into their practices. However, climate justice demands it.



5.5 Ethical and Governance Challenges

The ethical questions that would arise when making decisions on the environment in relation to AI include Who has ownership of climate data, what determines the AI decision-making? And how can privacy be protected while monitoring the environment?

6. Discussion and Findings of the Study

It can easily be seen from the above analysis that the innovation in AI technologies has multiple possibilities of tackling the problem of climate change. The innovation does not conflict with any kind of policy, science, or decision of people regarding the environmental problem but, rather, provides some additional benefits of analysing the problem along with other means of its resolution. The innovation will become efficient only in the case if it is applied along with other measures aimed at solving the problem of climate change. For instance, forecasting the climate change will become efficient only when the government takes certain actions based on the forecast.

Firstly, the artificial intelligence is an effective technology that helps in adaptation and mitigation of climate change. This will be realized through the application of the machine learning and deep learning technologies in predicting the climate change and monitoring the environment. Artificial intelligence technology will help in prediction of disasters in ensuring that the impacts of disasters caused by climate change are mitigated. Another advantage that will be realized from artificial intelligence technology is the optimization of natural resources and renewable energy management. With the use of intelligent agriculture technology through artificial intelligence, one can adapt to climate change.

7. Policy Recommendations

On the basis of research, the following recommendations can be given:

1. Green AI; 2. International Cooperation; 3. Ethical Framework for AI; 4. Capacity Building and AI Implementation in Climate Policies. The governments as well as the technology companies should promote green AI that is energy efficient. There should be international cooperation for exchanging climate data and information about AI technologies and research. There should be development of an ethical framework that regulates the use of AI. The developing countries should get assistance for implementation of AI-enabled climate actions.



8. Conclusion

In other words, it appears that the technology of AI development may become an innovation that will allow demonstrating how they can assist in dealing with the problems caused by climate change using such technologies as climate modelling, disaster prediction, renewable energy optimization, intelligent agriculture, remote sensing, and carbon accounting. It is an innovative approach to saving the Earth. However, the assistance from the side of AI will not address all the problems. Climate change is a rather complex issue that requires participation of science, politics, economics, and society in general. Thus, the aforementioned environmental, data, inequality, and ethical problems have to be resolved.

References

1. A.P. Pollution Control Board v. M.V. Nayudu, (1999) 2 SCC 718.
2. Bengio, Y., Goodfellow, I., & Courville, A. (2016). *Deep Learning*. MIT Press.
3. Chaurasia, S., Wao, A. A., & Wao, A. (2025). Artificial intelligence and applied machine learning for climate change. *International Journal of Contemporary Research in Multidisciplinary*, 4(2), 43–46.
4. Crawford, K. (2021). *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence*. Yale University Press.
5. Digital Personal Data Protection Act, 2023.
6. Environment (Protection) Act, 1986.
7. Government of India. (2020). Ministry of Earth Sciences. *Climate Change Assessment: A Report of the Ministry of Earth Sciences*.
8. Government of India. (2022). *India's Long-Term Low Emission Development Strategy*. Ministry of Environment, Forest and Climate Change.
9. Government of India. (2023). *National Strategy for Artificial Intelligence: #AIforAll (Updated Perspective)*. NITI Aayog.
10. Government of India. (2023). *National Green Hydrogen Mission*. Ministry of New and Renewable Energy.
11. Hanuman Laxman Aroskar v. Union of India, (2019) 15 SCC 401.
12. Hassani, H., Huang, X., & Silva, E. (2021). Artificial intelligence and climate change: The role of AI in sustainable development. *Technological Forecasting and Social Change*, 165, 120562.
13. Indian Council for Enviro-Legal Action v. Union of India, (1996) 3 SCC 212.
14. Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate Change 2023: Synthesis Report*. Geneva: IPCC.



15. International Energy Agency (IEA). (2023). *Energy and Artificial Intelligence*. Paris: IEA.
16. M.C. Mehta v. Union of India, (1987) 1 SCC 395.
17. M.C. Mehta v. Kamal Nath, (1997) 1 SCC 388.
18. Malik, R., Pande, S., Nishi, & Khamparia, A. (2020). Artificial intelligence and machine learning to assist climate change monitoring. *Journal of Artificial Intelligence and Systems*, 2, 168–190. <https://doi.org/10.33969/AIS.2020.21011>
19. Narmada Bachao Andolan v. Union of India, (2000) 10 SCC 664.
20. NITI Aayog. (2021). *Responsible AI for All*. New Delhi.
21. Reichstein, M., Camps-Valls, G., Stevens, B., Jung, M., Denzler, J., & Carvalhais, N. (2019). Deep learning and process understanding for data-driven Earth system science. *Nature*, 566, 195–204.
22. Rolnick, D., Donti, P. L., Kaack, L. H., et al. (2019). Tackling climate change with machine learning. *ACM Computing Surveys*.
23. Subhash Kumar v. State of Bihar, (1991) 1 SCC 598.
24. Strubell, E., Ganesh, A., & McCallum, A. (2019). Energy and policy considerations for deep learning in NLP. *Proceedings of the Annual Meeting of the Association for Computational Linguistics*, 3645–3650.
25. Singh, M., Kumar, B., Chattopadhyay, R., Kasimahanthi, A., & others. (2022). Artificial intelligence and machine learning in Earth system sciences with special reference to climate science and meteorology in South Asia. *Current Science*, 122(9), 1019–1030. <https://doi.org/10.18520/cs/v122/i9/1019-1030>
26. Shetty, S., Umesh, P., & Shetty, A. (2023). The effectiveness of machine learning-based multi-model ensemble predictions of CMIP6 in Western Ghats of India. *International Journal of Climatology*, 43(11), 5029–5054. <https://doi.org/10.1002/joc.8131>
27. T.N. Godavarman Thirumulpad v. Union of India, (1997) 2 SCC 267.
28. United Nations Environment Programme (UNEP). (2021). *Artificial Intelligence and Environmental Sustainability*. Nairobi: UNEP.
29. Vellore Citizens Welfare Forum v. Union of India, (1996) 5 SCC 647.
30. Vinuesa, R., Azizpour, H., Leite, I., et al. (2020). The role of artificial intelligence in achieving the Sustainable Development Goals. *Nature Communications*, 11, 233.
31. Wamanse, R., & Patil, T. (2022). Analysis of various climate change parameters in India using machine learning. *arXiv*. <https://arxiv.org/abs/2201.10123>
32. Zhou, L., Zhang, Y., & Yang, H. (2021). Artificial intelligence applications in climate science: A review. *Environmental Research Letters*, 16(9)