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Big Data Analytics for Climate Change Prediction

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ABSTRACT: Climate change has become a major global concern due to rising temperatures, extreme weather events, and environmental degradation. Big Data Analytics plays a significant role in predicting climate change research organizations such as the Intergovernmental Panel on Climate Change. This journalism report explores how big data technologies, machine learning algorithms, and data visualization tools help scientists and journalists identify climate patterns, predict future environmental changes, and communicate findings effectively to the public. The study highlights the importance of data-driven journalism in improving reporting accuracy, increasing public awareness, and supporting environmental protection measures. It also discusses the benefits and challenges of using big data in climate prediction. Overall, the integration of Big Data Analytics and journalism plays a crucial role in understanding climate risks and promoting sustainable development.

KEYWORDS: Big Data Analytics, Climate Change Prediction, Climate Journalism, Environmental Data, Machine Learning, Data Visualization, Global Warming,

I. INTRODUCTION

Climate change is one of the most serious global challenges of the 21st century. Rising temperatures, unpredictable rainfall, melting glaciers, and extreme weather events are affecting countries worldwide. To understand and predict these changes accurately, scientists and researchers rely on Big Data Analytics. Today, journalism plays an important role in presenting these complex climate predictions to the public in a simple and informative way. By combining data science and storytelling, journalists help society understand how climate patterns are changing and what actions are needed for protection.

II. THE GROWING CLIMATE CRISIS

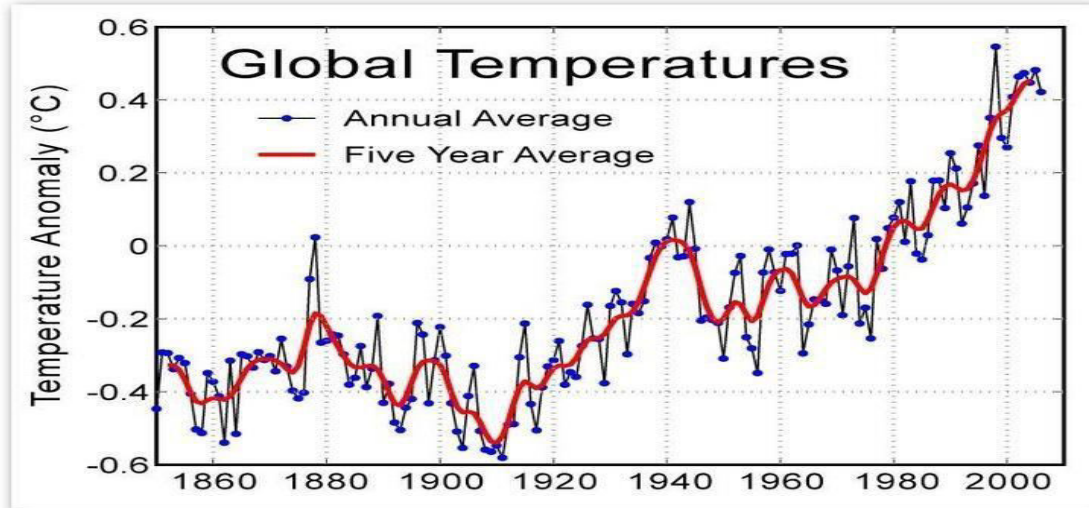
Over the past few decades, global temperatures have steadily increased. Carbon emissions from industries, vehicles, and deforestation have intensified the greenhouse effect. According to reports from organizations such as the Intergovernmental Panel on Climate Change, human activities are the primary cause of global warming. Climate journalism focuses on reporting these scientific findings responsibly and accurately to raise awareness among citizens.

A line graph displaying the steady increase in global average temperature over the last 100 years. This image visually explains how the Earth's temperature is rising year after year.



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Journalists use this processed data to create fact-based climate reports and explain future risks to the public. Big Data refers to extremely large datasets that cannot be handled using traditional software. In climate science, data is collected from satellites, weather stations, ocean sensors, and environmental monitoring systems. Agencies like National Oceanic and Atmospheric Administration collect massive volumes of temperature, rainfall, sea-level, and atmospheric data every day. This data is high in volume, velocity, and variety. This large-scale climate data is processed using advanced technologies such as Artificial Intelligence and Machine Learning. These technologies help scientists identify patterns, detect anomalies, and predict future climate conditions with greater accuracy. By analysing historical and real-time data, researchers can forecast extreme weather events such as hurricanes, floods, and droughts.

Furthermore, climate models developed using Big Data assist governments in planning environmental policies and disaster management strategies. Accurate predictions help reduce economic losses and protect vulnerable communities. Therefore, the integration of Big Data analytics and climate journalism ensures that scientific findings are communicated effectively to the public.

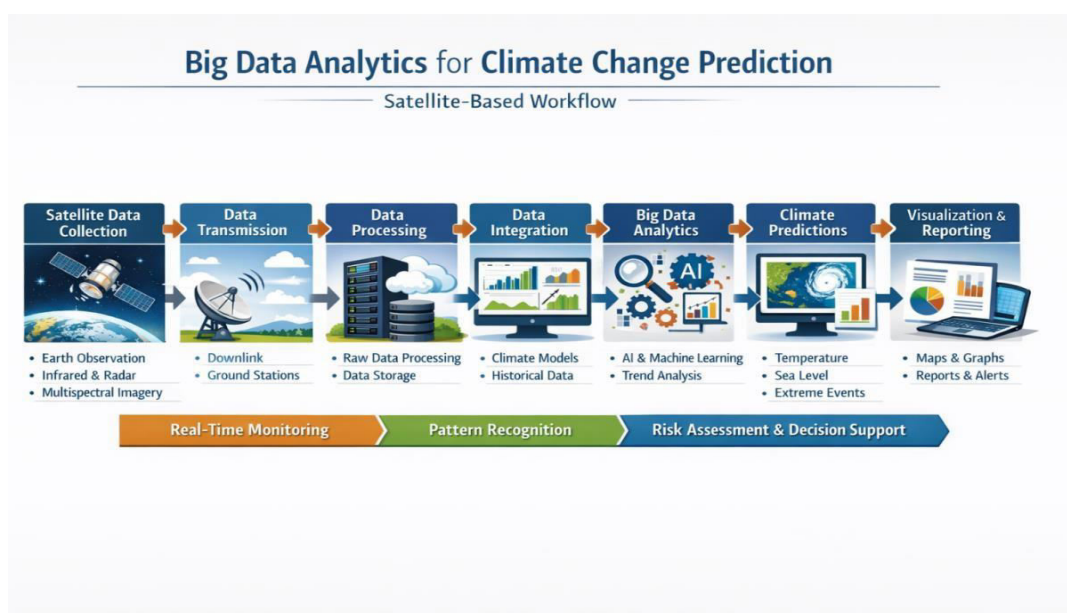


Image 2: Satellite Monitoring Earth



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1. Satellite Monitoring Earth for Climate Change Prediction

Satellites play a major role in collecting global climate data. Modern climate research depends on satellite technology to observe Earth continuously and accurately. Organizations like NASA and European Space Agency use advanced satellites to monitor environmental changes and predict future climate conditions.

2. Satellites Work in Climate Monitoring

A satellite orbits the Earth in space and uses special sensors and cameras to collect environmental data. These satellites observe different parts of the Earth such as the atmosphere, oceans, and land surface.

They collect information including:

- ❖ **Cloud movement** – helps track weather patterns and rainfall changes.
- ❖ **Ocean temperature** – indicates global warming and sea-level rise.

The satellite sends this large amount of information to ground stations on Earth for analysis.

3. Role of Big Data Analytics in Climate Prediction

Satellite systems generate massive amounts of data every day. This data is processed using **big data analytics** to understand climate patterns.

Big data analytics works in the following steps:

1. DataCollection

Satellites continuously capture images and environmental measurements worldwide.

2. DataStorage

Huge climate datasets are stored in powerful computer systems.

3. DataProcessing

Advanced algorithms and machine learning analyze the data.

4. ClimatePrediction

Scientists predict future temperature changes, rainfall patterns, and natural disasters.

This helps governments and researchers take preventive actions against climate change.

Here is **extended and improved content** for your journal topic on **Satellite Monitoring Earth for Climate Change Prediction** with more detailed explanation and academic style writing.

III. SATELLITE MONITORING EARTH FOR CLIMATE CHANGE PREDICTION

Satellites have become one of the most powerful tools in modern climate science. They provide continuous, large-scale, and real-time observations of the Earth's systems. Unlike ground-based instruments, satellites can monitor remote regions such as oceans, polar ice caps, forests, and deserts where direct measurement is difficult.

Space agencies like NASA, European Space Agency (ESA), and the Indian Space Research Organisation (ISRO) operate climate-monitoring satellites that collect valuable environmental data. These satellites help scientists understand global warming, extreme weather events, glacier melting, and rising sea levels.

Satellite monitoring provides:

- Global coverage
- Long-term climate records
- High accuracy measurements
- Early warning systems for disasters

IV. HOW SATELLITES WORK IN CLIMATE MONITORING

A satellite revolves around the Earth in a specific orbit (such as polar orbit or geostationary orbit). It carries advanced instruments like radiometers, spectrometers, and thermal sensors to measure different environmental parameters.

1. Atmospheric Monitoring

Satellites observe:

- Greenhouse gases like carbon dioxide (CO₂) and methane (CH₄)
- Ozone layer condition
- Temperature variations in different atmospheric layers



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HOW BIG DATA HELPS IN CLIMATE PREDICTION

Big Data Analytics uses technologies like machine learning, artificial intelligence, and statistical modelling to predict future climate conditions. By analysing historical climate records, experts can forecast temperature rise, predict drought conditions, and estimate flood risks.

For example, time-series models analyze past rainfall data to predict future rainfall trends. Machine learning algorithms detect patterns in temperature changes and identify abnormal climate behaviour. Journalists interpret these predictions and communicate them in simple language for public understanding.

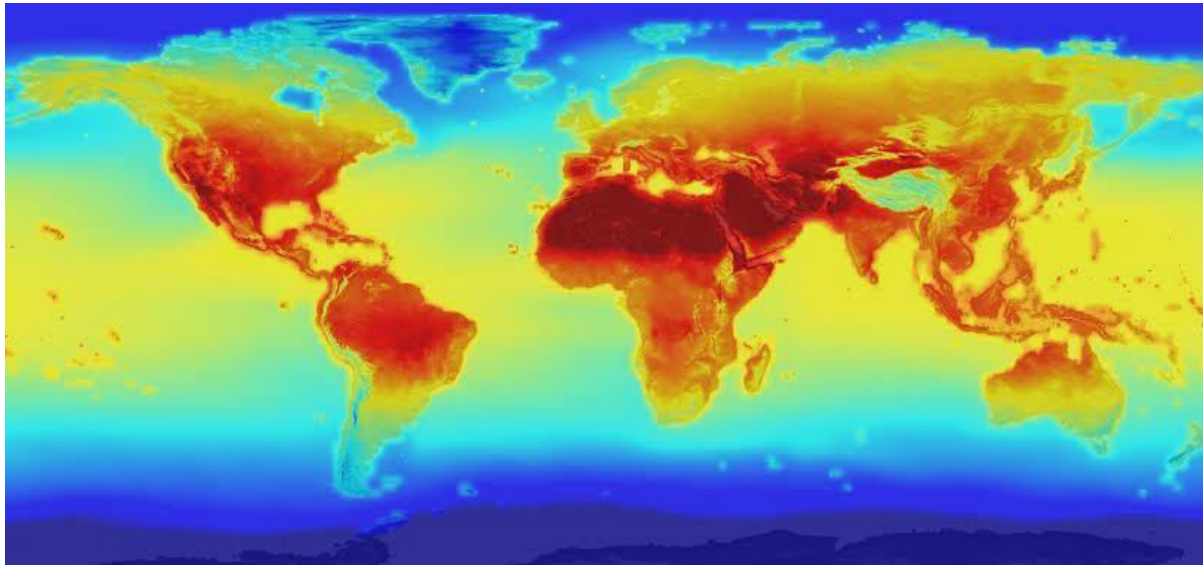


Image 3: Climate Prediction Model Dashboard

A digital dashboard showing graphs, charts, and predictive models related to climate data. It represents how advanced software processes and visualizes environmental information.

V. ROLE OF JOURNALISM IN CLIMATE PROTECTION

Climate journalism is not just about reporting disasters; it is about educating people and promoting sustainable actions. Data-driven journalism ensures that climate reports are based on scientific evidence rather than opinions. By using Big Data insights, journalists can:

- ❖ government environmental policies
- ❖ Report early warnings for natural disasters

Big Data Analytics uses technologies such as machine learning, artificial intelligence, and statistical modelling to process this enormous volume of information. Traditional systems cannot handle such complex and large datasets, but advanced data platforms can analyze years of historical climate records within minutes.

1. Data Collection from Multiple Sources

Climate data is collected from:

- Earth-observing satellites
- Ocean buoys and sensors
- Weather stations
- Radar systems
- Climate research institutions

These sources generate terabytes of data daily. Big Data systems organize and store this information for further analysis.



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2. Data Processing and Pattern Detection

Machine learning algorithms examine past climate data to identify hidden patterns and relationships. For example:

- Time-series models analyze rainfall records to predict future rainfall trends.
- AI models detect abnormal temperature increases.
- Predictive analytics estimate drought risks and flood probabilities.

These models improve over time as they process more data, making climate forecasts more accurate.

3. ROLE OF JOURNALISM IN CLIMATE PROTECTION

Climate journalism is not only about reporting natural disasters; it focuses on raising awareness, promoting sustainable solutions, and holding authorities accountable. Data-driven journalism ensures that climate reports are based on scientific evidence rather than opinions.

By using Big Data insights, journalists can:

1. Explain Government Environmental Policies

Journalists analyze climate data to evaluate government actions, carbon reduction plans, and environmental regulations. They compare official promises with scientific evidence and real-world outcomes.

2. Report Early Warnings for Natural Disasters

Using predictive climate models, journalists inform the public about possible storms, floods, or extreme heat conditions. Early reporting can save lives and reduce panic.

3. Encourage Sustainable Practices

Climate stories based on verified data encourage individuals and communities to adopt eco-friendly practices such as reducing carbon emissions, conserving water, and supporting renewable energy.

THE INTEGRATION OF BIG DATA ANALYTICS IN JOURNALISM PROVIDES SEVERAL BENEFITS:

- ❖ Increased accuracy in climate reporting
- ❖ Improved disaster prediction
- ❖ Better visualization of environmental trends
- ❖ Stronger public awareness
- ❖ Support for global climate policies

Data visualization tools such as heat maps and trend graphs make climate stories more engaging and understandable.

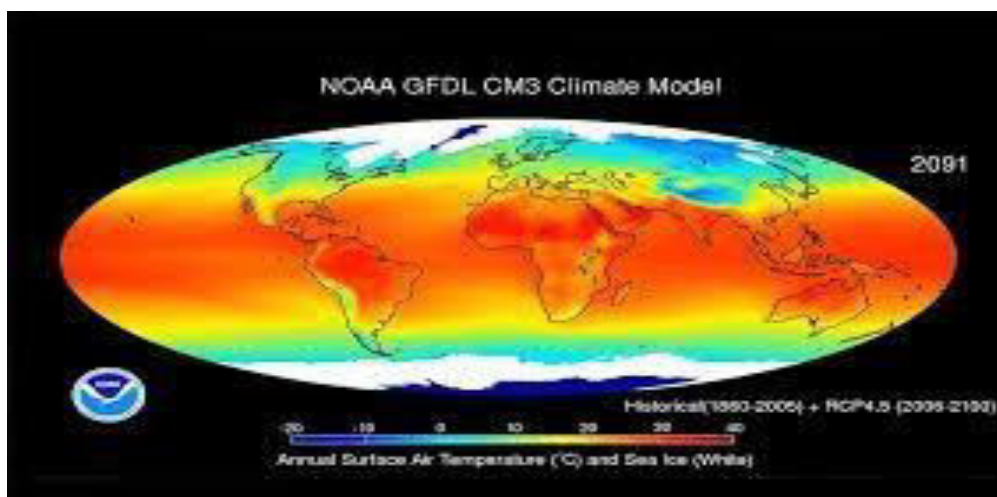
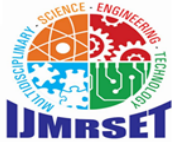


Image 4: Heat Map of Global Warming

WHAT THE IMAGE SHOWS:

A world map coloured in red and orange shades indicating regions experiencing higher temperature increases. This visually demonstrates the global impact of warming.



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The image presents a world map shaded in red and orange tones, indicating regions experiencing higher temperature increases. Darker shades represent more intense warming. This visual representation clearly demonstrates the global impact of climate change and highlights areas that are most vulnerable.

Heat maps like this help audiences quickly understand where warming is accelerating. They transform raw numerical data into a powerful visual message that supports climate awareness.

VI. CHALLENGES AND ETHICAL CONSIDERATIONS

Despite its advantages, Big Data Analytics in climate journalism faces challenges. Handling massive datasets requires technical expertise and powerful computing systems. Incorrect data interpretation can lead to misinformation. Journalists must ensure accuracy, transparency, and ethical reporting when presenting climate predictions.

Modern newsrooms now rely on large datasets collected from satellites, weather stations, scientific institutions, and global climate organizations. Reports from bodies such as the Intergovernmental Panel on Climate Change and the World Meteorological Organization provide verified scientific data that journalists use to strengthen their climate coverage.

1. Increased Accuracy in Climate Reporting

Big Data allows journalists to base their reports on scientific evidence rather than assumptions. By analysing verified datasets, reporters can present precise information about temperature rise, rainfall patterns, sea-level changes, and extreme weather events.

2. Improved Disaster Prediction

Advanced analytics and predictive models help forecast natural disasters such as cyclones, floods, droughts, and heatwaves. Journalists can communicate early warnings to the public, which helps communities prepare and reduce risks.

3. Better Visualization of Environmental Trends

Data visualization tools such as heat maps, line graphs, bar charts, and interactive dashboards make complex climate data easier to understand. Visual storytelling enhances audience engagement and simplifies scientific information.

4. Stronger Public Awareness

When data is presented clearly, audiences gain a better understanding of climate change impacts. This increases public awareness and encourages responsible environmental behaviour.

5. Support for Global Climate Policies

Data-driven journalism supports international climate agreements and environmental policies by highlighting scientific findings and tracking government commitments. It helps ensure accountability and transparency.

CHALLENGES AND ETHICAL CONSIDERATIONS

Despite its advantages, the use of Big Data Analytics in climate journalism comes with several challenges.

1. Technical Complexity

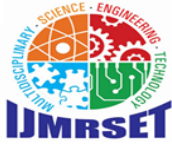
Handling massive climate datasets requires advanced software, skilled data analysts, and powerful computing systems. Not all news organizations have access to these resources.

VII. CONCLUSION

In conclusion, Big Data Analytics has transformed climate change prediction and journalism. By analysing vast environmental datasets through advanced technologies, scientists can forecast future climate conditions with greater accuracy. Journalists play a crucial role in translating these complex predictions into clear, understandable information for the public. Through data-driven reporting, society becomes more aware of environmental risks and the need for sustainable action. Although challenges exist, the collaboration between big data and journalism is essential for protecting the planet and promoting a more sustainable future.

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