



# भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर

## Indian Institute of Technology Bhubaneswar

Media/Publication	UniIndia.com		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	Study on Advancing Rainfall Prediction Accuracy through Deep Learning with special reference to complex terrains of Assam in Real Time		
Link	<a href="https://www.uniindia.com/bhubaneswar-iit-develops-hybrid-technology-to-forecast-prediction-of-heavy-rainfall-events/east/news/3260691.html">https://www.uniindia.com/bhubaneswar-iit-develops-hybrid-technology-to-forecast-prediction-of-heavy-rainfall-events/east/news/3260691.html</a>		

Bhubaneswar, Aug 12 (UNI) The IIT Bhubaneswar, for the first time, has developed a hybrid technology to improve prediction of heavy rainfall events with an adequate lead time.

The hybrid technology, integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model, will enhance prediction accuracy in respect to heavy rainfall events.

The studies, IIT Bhubaneswar said, were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems.

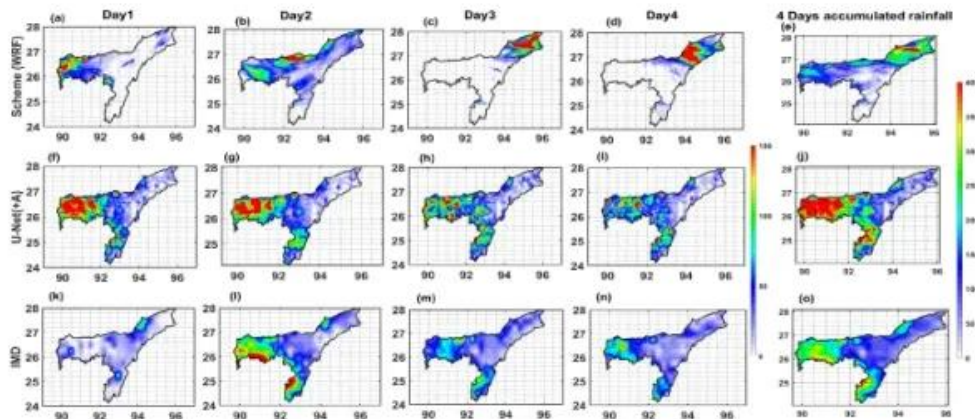
**Please log in to get detailed story.**

Tags: #Bhubaneswar IIT develops hybrid technology to forecast & prediction of heavy rainfall events



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Media/Publication	Update Odisha.com		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT Bhubaneswar Researchers Study on Advancing Rainfall Prediction Accuracy through Deep Learning		
Link	<a href="https://pragativadi.com/iit-bhubaneswar-researchers-study-on-advancing-rainfall-prediction-accuracy-through-deep-learning/">https://pragativadi.com/iit-bhubaneswar-researchers-study-on-advancing-rainfall-prediction-accuracy-through-deep-learning/</a>		



Spatial plot for HRE from day 1 to day 4 and all days accumulated for (a)–(e) WRF, (f)–(j) U-Net (+A), and (k)–(o) IMD.

**Bhubaneswar:** In climate change scenarios, there is a rapid rise in the intensity and frequency of heavy rainfall events over the Indian region.

These heavy rainfall events (HREs) have significant consequences and have a profound impact on our society. However, accurate rainfall prediction with adequate lead time is an immense challenge for the current state of art dynamical models. Furthermore, this problem is exacerbated over complex mountainous terrains.

State-of-the-art traditional numerical weather prediction (NWP) models and their ensembles, while useful, often struggle with accurately forecasting such events due to the intricate topography and varied climate patterns.

To overcome these limitations, for the first time, IIT Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy, particularly to improve prediction of heavy rainfall events with an adequate lead time.

The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic due to the



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landfall of multiple intense rain-bearing monsoon low-pressure systems. In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time of up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases. (Ref: <https://x.com/iitbbs/status/1817778185716846928>)

To demonstrate the robustness of the aforementioned technology for real-time situations over the complex terrain of Assam, in another ground-breaking study, researchers from the IIT Bhubaneswar have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques.

The study titled “Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam”, published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale. The research employed the WRF model to generate initial weather forecasts in real-time, which were then refined using the DL model. This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatial-attention module to better capture the intricate spatial dependencies in the data. As discussed, the model was trained using data from past heavy rainfall events from multiple ensemble outputs as well as observations from the India Meteorological Department (IMD), to improve its accuracy.

### Key Findings:

1. District-Level Precision: First of its kind in real-time to improve forecast skills on a district scale.
2. Enhanced Prediction Accuracy: The DL model demonstrated a notable improvement in forecast accuracy, capturing 54.4% of HREs compared to the WRF model’s 22.8%. The DL model also achieved a mean absolute error (MAE) of under 30 mm, significantly lower than WRF’s over 50 mm MAE for days 2–4 of the forecast period.
3. Technological Innovation: The research introduces a U-Net model with a spatial-attention (SA) module that captures intricate spatial dependencies of rainfall features at the district scale.



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Media/Publication	Prameya News.com		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT Bhubaneswar researchers study on advancing rainfall prediction accuracy through deep learning		
Link	<a href="https://odishabytes.com/iit-bhubaneswar-researchers-develop-solar-powered-microwave-pyrolysis-reactor-for-sustainable-waste-management/">https://odishabytes.com/iit-bhubaneswar-researchers-develop-solar-powered-microwave-pyrolysis-reactor-for-sustainable-waste-management/</a>		

Bhubaneswar, Aug 12: In climate change scenarios, there is a rapid rise in the intensity and frequency of heavy rainfall events over the Indian region. These heavy rainfall events (HREs) have significant consequences and have a profound impact on our society. However, accurate rainfall prediction with adequate lead-time is an immense challenge for the current state of art dynamical models. Furthermore, this problem is exacerbated over complex mountainous terrains. State-of-the-art traditional numerical weather prediction (NWP) models and their ensembles, while useful, often struggle with accurately forecasting such events due to the intricate topography and varied climate patterns.

To overcome these limitations, for the first time, IIT Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time. The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems.

In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases.

To demonstrate the robustness of the aforementioned technology for real time situations over complex terrain of Assam, in another ground-breaking study, researchers from the IIT Bhubaneswar have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques. The study titled "Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam", published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at districts scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model. This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data. As discussed, the model was trained using data from past heavy rainfall events from multiple ensembles outputs as well as observations from India Meteorological Department (IMD), to improve its accuracy.



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Media/Publication	Latestly.com		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar Develops Technology to Predict Rainfall Accurately		
Link	<a href="https://www.latestly.com/agency-news/india-news-iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately-6184546.html#google_vignette">https://www.latestly.com/agency-news/india-news-iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately-6184546.html#google_vignette</a>		

The IIT-Bhubaneswar claimed to have developed a technology to accurately predict rainfall, particularly in cases of downpours, with an adequate lead time.

The technology was developed by integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model, the institute said in a statement on Monday.

The institute has carried out studies using retrospective cases over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain-bearing monsoon low-pressure systems.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall.

"The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at districts scale," it claimed..

The research employed the WRF model to generate initial weather forecasts in real-time, which were then refined using the DL model," it said.

This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

In Assam, the model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time of upto 96 hours, showcasing its remarkable performance, the institute statement said.



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Media/Publication	News Drum.com		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar develops technology to predict rainfall accurately		
Link	<a href="https://www.newsdrum.in/national/iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately-6852786">https://www.newsdrum.in/national/iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately-6852786</a>		

Bhubaneswar, Aug 12 (PTI) The IIT-Bhubaneswar claimed to have developed a technology to accurately predict rainfall, particularly in cases of downpours, with an adequate lead time.

The technology was developed by integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model, the institute said in a statement on Monday.

The institute has carried out studies using retrospective cases over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain-bearing monsoon low-pressure systems.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall.

"The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at districts scale," it claimed..

The research employed the WRF model to generate initial weather forecasts in real-time, which were then refined using the DL model," it said.

This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

In Assam, the model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time of upto 96 hours, showcasing its remarkable performance, the institute statement said.



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Media/Publication	Orissa Post.com		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar claims to have developed technology to accurately predict rainfall		
Link	<a href="https://www.orissapost.com/iit-bhubaneswar-claims-to-have-developed-technology-to-accurately-predict-rainfall/">https://www.orissapost.com/iit-bhubaneswar-claims-to-have-developed-technology-to-accurately-predict-rainfall/</a>		

The IIT-Bhubaneswar claimed to have developed a technology to accurately predict rainfall, particularly in cases of downpours, with an adequate lead time.

The technology was developed by integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model, the institute said in a statement Monday.

The institute has carried out studies using retrospective cases over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain-bearing monsoon low-pressure systems, the statement added.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. “The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at districts scale,” it claimed.

“The research employed the WRF model to generate initial weather forecasts in real-time, which were then refined using the DL model,” it said.

This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

In Assam, the model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time of upto 96 hours, showcasing its remarkable performance, the institute statement said.



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Media/Publication	Odisha TV.in		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar develops hybrid technology using AI for accurate weather forecasting		
Link	<a href="https://odishatv.in/news/odisha/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-accurate-weather-forecasting-241475">https://odishatv.in/news/odisha/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-accurate-weather-forecasting-241475</a>		

The Indian Institute of Technology (IIT) Bhubaneswar has developed a hybrid technology by integrating the Weather Research and Forecasting (WRF) model into a deep learning (DL) model. This advancement aims to enhance the accuracy of predicting heavy rainfall events, particularly in complex terrains like Assam and Odisha, with adequate lead time. The study underscores the potential of artificial intelligence in real-time weather forecasting.

The Indian Institute of Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday.

The study also highlighted the potential of artificial intelligence in improving real-time weather forecasting, particularly for heavy rainfall events in the complex terrains over the Indian region.

The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems.

"In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases," official sources added.

Researchers from the IIT-Bhubaneswar through another groundbreaking study have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques. The study demonstrated the robustness of the new hybrid technology for real time situations over complex terrain of Assam.

"The study titled 'Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam', published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam," added sources.





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Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model.

The experts through this new method can now carry out a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

As discussed, the model was trained using data from past heavy rainfall events from multiple ensembles outputs as well as observations from India Meteorological Department (IMD), to improve its accuracy.

"This advancement is crucial for mitigating the impacts of natural disasters and public safety. Additionally, these pioneering works will also serve as a guiding light in creating analogous hybrid models for other intricate topographical terrain areas such as the Western Himalayas and Western Ghats regions of India," official sources said.



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## Indian Institute of Technology Bhubaneswar

Media/Publication	The Print		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar develops technology to predict rainfall accurately		
Link	<a href="https://theprint.in/india/iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately/2220557/">https://theprint.in/india/iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately/2220557/</a>		

The IIT-Bhubaneswar claimed to have developed a technology to accurately predict rainfall, particularly in cases of downpours, with an adequate lead time.

The technology was developed by integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model, the institute said in a statement on Monday.

The institute has carried out studies using retrospective cases over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain-bearing monsoon low-pressure systems.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall.

“The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at districts scale,” it claimed..

The research employed the WRF model to generate initial weather forecasts in real-time, which were then refined using the DL model,” it said.

This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

In Assam, the model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time of upto 96 hours, showcasing its remarkable performance, the institute statement said.



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Media/Publication	Investing.com		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar develops hybrid technology using AI for weather forecasting		
Link	<a href="https://in.investing.com/news/general-news/iitbhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting-4381317">https://in.investing.com/news/general-news/iitbhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting-4381317</a>		

The Indian Institute of Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday. The study also highlighted the potential of artificial intelligence in improving real-time weather forecasting, particularly for heavy rainfall events in the complex terrains over the Indian region.

The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems. "In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases," official sources added.

The researchers from the IIT-Bhubaneswar through another groundbreaking study have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques. The study demonstrated the robustness of the new hybrid technology for real time situations over complex terrain of Assam. "The study titled 'Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam', published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam," added sources.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model. The experts through this new method can now carry out a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

As discussed, the model was trained using data from past heavy rainfall events from multiple ensembles outputs as well as observations from India Meteorological Department (IMD), to improve its accuracy.

"This advancement is crucial for mitigating the impacts of natural disasters and public safety. Additionally, these pioneering works will also serve as a guiding light in creating analogous hybrid models for other intricate topographical terrain areas such as the Western Himalayas and Western Ghats regions of India," official sources said.



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## Indian Institute of Technology Bhubaneswar

Media/Publication	India.com		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	IIT Bhubaneswar Develops Hybrid Technology Using AI For Weather Forecasting		
Link	<a href="https://www.india.com/technology/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting-7161057/">https://www.india.com/technology/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting-7161057/</a>		

The Indian Institute of Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday.

The study also highlighted the potential of artificial intelligence in improving real-time weather forecasting, particularly for heavy rainfall events in the complex terrains over the Indian region.

The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems.

“In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases,” official sources added.

The researchers from the IIT-Bhubaneswar through another groundbreaking study have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques. The study demonstrated the robustness of the new hybrid technology for real time situations over complex terrain of Assam.

“The study titled ‘Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam’, published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam,” added sources.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model.



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The experts through this new method can now carry out a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

As discussed, the model was trained using data from past heavy rainfall events from multiple ensembles outputs as well as observations from India Meteorological Department (IMD), to improve its accuracy.

“This advancement is crucial for mitigating the impacts of natural disasters and public safety. Additionally, these pioneering works will also serve as a guiding light in creating analogous hybrid models for other intricate topographical terrain areas such as the Western Himalayas and Western Ghats regions of India,” official sources said.

Media/Publication	Silicon India.com		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	IIT Bhubaneswar Unveils AI-Driven Hybrid Tech for Precise Weather Forecasting		
Link	<a href="https://www.siliconindia.com/news/general/iit-bhubaneswar-unveils-aidriven-hybrid-tech-for-precise-weather-forecasting-nid-231249-cid-1.html">https://www.siliconindia.com/news/general/iit-bhubaneswar-unveils-aidriven-hybrid-tech-for-precise-weather-forecasting-nid-231249-cid-1.html</a>		

**The Indian Institute of Technology (IIT) Bhubaneswar** has developed a hybrid technology that integrates the output from the **Weather Research and Forecasting (WRF)** model into a deep learning (DL) model to enhance prediction accuracy, particularly focusing on improving the prediction of heavy rainfall events with sufficient lead time, according to official sources. The study also underscores the potential of **artificial intelligence** in advancing real-time weather forecasting, especially for heavy rainfall events in the complex terrains of the Indian region.

The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems.

“In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases”, official sources added.

Researchers from IIT Bhubaneswar, in another groundbreaking study, have made significant strides in accurately predicting heavy rainfall events in real-time using deep learning techniques. The study showcased the robustness of the new hybrid technology for real-time applications in the complex terrain of Assam.

“The study titled ‘Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam’, published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam”, added sources.

Between June 13 and 17, 2023, Assam faced severe flooding caused by heavy rainfall. The DL model successfully provided a more accurate prediction of the spatial distribution and intensity of rainfall at the district level. The research utilized the WRF model to generate initial real-time weather forecasts, which were then refined using the DL model.

With this new method, experts can now conduct a more detailed analysis of rainfall patterns by incorporating a spatio-attention module to better capture the complex spatial dependencies in the data.



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The model was trained using data from previous heavy rainfall events, including multiple ensemble outputs and observations from the [India Meteorological Department \(IMD\)](#), to enhance its accuracy.

“This advancement is crucial for mitigating the impacts of natural disasters and public safety. Additionally, these pioneering works will also serve as a guiding light in creating analogous hybrid models for other intricate topographical terrain areas such as the Western Himalayas and Western Ghats regions of India”, official sources said.



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## Indian Institute of Technology Bhubaneswar

Media/Publication	Statesman.com		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar develops hybrid technology using AI for weather forecasting		
Link	<a href="https://www.thestatesman.com/books-education/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting-1503331198.html">https://www.thestatesman.com/books-education/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting-1503331198.html</a>		

The Indian Institute of Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday.

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“In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases,” official sources added.

The researchers from the IIT-Bhubaneswar through another groundbreaking study have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques. The study demonstrated the robustness of the new hybrid technology for real time situations over complex terrain of Assam.

“The study titled ‘Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam’, published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam,” added sources.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model.





भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर  
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The experts through this new method can now carry out a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

As discussed, the model was trained using data from past heavy rainfall events from multiple ensembles outputs as well as observations from India Meteorological Department (IMD), to improve its accuracy.

“This advancement is crucial for mitigating the impacts of natural disasters and public safety. Additionally, these pioneering works will also serve as a guiding light in creating analogous hybrid models for other intricate topographical terrain areas such as the Western Himalayas and Western Ghats regions of India,” official sources said.



# भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर Indian Institute of Technology Bhubaneswar

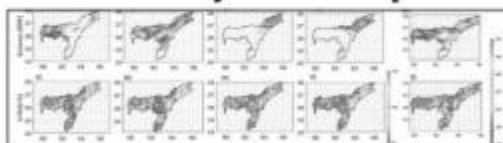
Media/Publication	The Pioneer		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT BBS researchers study rainfall prediction accuracy		

## IIT BBS researchers study rainfall prediction accuracy

PNS ■ BHUBANESWAR

In climate change scenarios, there is a rapid rise in the intensity and frequency of heavy rainfall events over the Indian region. These heavy rainfall events (HREs) have significant consequences and have a profound impact on the society.

However, accurate rainfall prediction with adequate lead-time is an immense challenge for the current state-of-the-art dynamical models. State-of-the-art traditional numerical weather prediction (NWP) models and their ensembles, while useful, often struggle



with accurately forecasting such events due to the intricate topography and varied climate patterns.

To overcome these limitations, for the first time, the IIT Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy par-

ticularly with an aim to improve prediction of heavy rainfall events with an adequate lead time. The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the State of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-

pressure systems. In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance.

To demonstrate the robustness of the aforementioned technology for real time situations over complex terrain of Assam, in another groundbreaking study, researchers from the IIT Bhubaneswar have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real time, using deep learning techniques.



Media/Publication	The Political & Business Daily		
Date	12 <sup>th</sup> August, 2024	Language	English
Headline	IIT Bhubaneswar develops technology to predict rainfall accurately		

## IIT-Bhubaneswar develops technology to predict rainfall accurately

**BHUBANESWAR, AUG 12**

THE IIT-Bhubaneswar claimed to have developed a technology to accurately predict rainfall, particularly in cases of downpours, with an adequate lead time.

The technology was developed by integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model, the institute said in a statement on Monday.

The institute has carried out studies using retrospective cases over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain-bearing monsoon low-pressure systems.

Between June 13 and 17, 2023, Assam

experienced severe flooding due to heavy rainfall. "The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale," it claimed..

The research employed the WRF model to generate initial weather forecasts in real-time, which were then refined using the DL model," it said. This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.

In Assam, the model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time of upto 96 hours, showcasing its remarkable performance, the institute statement said. —PTI



# भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर

## Indian Institute of Technology Bhubaneswar

Media/Publication	The Samaja		
Date	13 <sup>th</sup> August, 2024	Language	Odia
Headline	IIT Bhubaneswar develops technology to predict rainfall accurately		

## ବୃଷ୍ଟିପାତର ପୂର୍ବାନୁମାନ ଉପରେ ଅନୁଧ୍ୟାନ

ଜଟଣ, ୧୨।୮ (ନି.ପ୍ର): ସ୍ଥାନୀୟ ଆଇଆଇଟି ପରିସରରେ ତ୍ରିପ୍ ଲକ୍ଷ୍ୟ ମାଧ୍ୟମରେ ସୋମବାର ସଠିକ ବୃଷ୍ଟିପାତର ପୂର୍ବାନୁମାନ ସମ୍ପର୍କରେ ଅନୁଧ୍ୟାନ କରାଯାଇଥିବା ଜଣାପଡ଼ିଛି।

ଭାରତୀୟ ଅଞ୍ଚଳରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣାରେ ତୀବ୍ରତା ଦ୍ରୁତ ଗତିରେ ବୃଦ୍ଧି ଘଟିଛି। ବୃଷ୍ଟିପାତର ସଠିକ ପୂର୍ବାନୁମାନ ସହିତ ବର୍ତ୍ତମାନର ଗତିଶୀଳ ମଡେଲ ଗୁଡ଼ିକ ପାଇଁ ଏହା ଏକ ଆହ୍ୱାନ

ସୃଷ୍ଟି କରିଛି। ଆଇଆଇଟି ଏହି ଅବସରରେ ଉନ୍ନତ ମାନର ଜ୍ଞାନ କୌଶଳ ବିକଶିତ କରି ପାଣିପାଗର ଅନୁସନ୍ଧାନ ଏବଂ ଉଦ୍ଦିଷ୍ଟତାବାଣୀର ସଠିକତାକୁ ବୃଦ୍ଧି କରିବା ପାଇଁ ଲକ୍ଷ୍ୟ ରଖୁଥିବା ଆଇଆଇଟି ସୂଚନା ଦେଇଛି।

ଆଇଆଇଟି ପରିସରରେ ଏହାର ଏକ ଅଧ୍ୟୟନ କରା ଯାଇଥିଲା। ଆଇଆଇଟିର ମହାସାଗର ଓ ଜଳବାୟୁ ବିଜ୍ଞାନ ବିଭାଗର ଡ଼. ଧନଞ୍ଜୟ ତ୍ରିବେଦୀ, ଡ଼.

ଓମବୀର ଶର୍ମା, ଡ଼. ବିବେକାନନ୍ଦ ହାତ୍ତା, ଡ଼. ସନ୍ଧ୍ୟା ପଟ୍ଟନାୟକ ଏବଂ ବିଦ୍ୟୁତ ଓ କମ୍ପ୍ୟୁଟର ବିଜ୍ଞାନ ବିଭାଗର ଡ଼. ନୀଳାଦ୍ରୀ ବିହାରୀ ପୁହାଣ ପ୍ରମୁଖ ଏହା ଉପରେ ଗବେଷଣା ଓ ଅଧ୍ୟୟନ କରିଥିଲେ।

କାର୍ତ୍ତବୀର ଅପ୍ ସାଇଟିଂ, ଲକ୍ଷ୍ମିଆଲ୍ ରିସର୍ଚ୍ଚ ଏବଂ ନ୍ୟୁ ଭେଞ୍ଚର ପାଣ୍ଡୁ, ଯୁଏସ ପ୍ରମୁଖ ଏହି କାର୍ଯ୍ୟକ୍ରମରେ ସହଯୋଗ କରିଥିଲେ। ଏଥିରେ ସମସ୍ତ ବୈଜ୍ଞାନିକ ଉପସ୍ଥିତ ଥିଲେ।



# भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर

## Indian Institute of Technology Bhubaneswar

Media/Publication	The Prameya		
Date	13 <sup>th</sup> August, 2024	Language	Odia
Headline	IIT Bhubaneswar develops technology to predict rainfall accurately through Deep Learning		

### ଆଇଆଇଟି ଗବେଷକଙ୍କ ଉଦ୍ଭାବନ

## ‘ଡିପ୍ ଲର୍ଣ୍ଣିଂ’ ମାଧ୍ୟମରେ ବୃଷ୍ଟିପାତର ପୂର୍ବାନୁମାନ

ଭୁବନେଶ୍ୱର, ୧୩୮ (ବ୍ୟୋମ): ଜଳବାୟୁ ପରିବର୍ତ୍ତନ ଯୋଗୁ ଅସମୟରେ ବର୍ଷା ହେଉଛି । ଯାହା ସମାଜ ଉପରେ ଗଭୀର ପ୍ରଭାବ ପକାଉଛି । ବିଶେଷକରି ଚାଷୀମାନେ ଏହା ଦ୍ୱାରା କ୍ଷତିଗ୍ରସ୍ତ ହେଉଛନ୍ତି । ଏହି ସମସ୍ୟା ଦୂର ପାଇଁ ପ୍ରଥମ ଥର ଆଇଆଇଟି, ଭୁବନେଶ୍ୱର ପକ୍ଷରୁ ହାଇବ୍ରିଡ୍ ଟେକ୍ନୋଲୋଜି ଡିପ୍ ଲର୍ଣ୍ଣିଂ ବ୍ୟବହୃତ ହୋଇଛି । ଯାହା ପାଣିପାଗର ଅନୁସନ୍ଧାନ ଓ ପୂର୍ବାନୁମାନ କରିବ । ଏହି ଟେକ୍ନୋଲୋଜି ଉଦ୍ଭାବନ ପାଇଁ ଆଇଆଇଟିର ଗବେଷକ ଆସୀମ ଦଳ୍ୟାଞ୍ଜଳ ଓ ଓଡ଼ିଶାର ବିଭିନ୍ନ ସ୍ଥାନରେ ଗବେଷଣା କରିଥିଲେ । ଆସୀମରେ ବର୍ଷା ପାଇଁ ବାସ୍ତବ ସମୟ ସ୍ଥିତି ଦେଖିବାକୁ ଏହି ଟେକ୍ନୋଲୋଜିକୁ ପ୍ରୟୋଗ କରାଯାଇଥିଲା । ଏଥିସହ କ୍ଷେତ୍ରରେ ସଜାଗ ରହିଥିଲେ ଗବେଷକମାନେ । ଧର୍ଯ୍ୟ ହୋଇଥିବା ପ୍ରକୃତ ସମୟରେ ପ୍ରବଳ ବର୍ଷା ହେବାର ପୂର୍ବାନୁମାନ ସେମାନେ କରିଥିଲେ । ତେଣୁ ଆସୀମ ଭଳି ଏକ ବନ୍ୟା ପ୍ରବଣ ପାର୍ବତ୍ୟାଞ୍ଚଳ ପାଇଁ ଏଭଳି ଗବେଷଣା ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଅଟେ । ଗତବର୍ଷ ଜୁନ ୧୩ରୁ ୧୭ ତାରିଖରେ ଆସୀମରେ ପ୍ରବଳ ବର୍ଷା ସହ ବନ୍ୟା ସ୍ଥିତି ଉପୁଜିଥିଲା । ସେହି ସମୟରେ ଡିପ୍ ଲର୍ଣ୍ଣିଂ ମାଧ୍ୟମରେ ବୃଷ୍ଟିପାତ ପରିମାଣ ଓ ତାହାକୁ ସଠିକଭାବେ ପୂର୍ବାନୁମାନ କରାଯାଇଥିଲା । ତେଣୁ ପ୍ରାକୃତିକ ବିପର୍ଯ୍ୟୟ କମାଇବା ଓ ଲୋକଙ୍କୁ ଆରୁଆ ସଚେତନ କରିବା ପାଇଁ ଏହି ଟେକ୍ନୋଲୋଜି ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ । ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ଜଳବାୟୁ ବିଜ୍ଞାନ ବିଭାଗର ପ୍ରଫେସର ଡ. ଧନଞ୍ଜୟ ତ୍ରିବେଦୀ, ଡ. ଓମକାର ଶର୍ମା, ଡ. ବିବେକାନନ୍ଦ ହାତ୍ତା, ଡ. ସଦାପ ପଟ୍ଟନାୟକ ଓ ଡ. ନିଳାଦ୍ରୀ ବିହାରୀ ପୁହାଣଙ୍କୁ ନେଇ ଗଠିତ ଏକ ଟିମ୍ ଏହି ଟେକ୍ନୋଲୋଜି ଉପରେ ଅଧ୍ୟୟନ କରିଚିଲେ । ତେଣୁ ଓଡ଼ିଶାରେ ମଧ୍ୟ ଏହାକୁ ବ୍ୟବହାର କରାଯାଇ ପାରିବ ବୋଲି ଆଇଆଇଟି ପକ୍ଷରୁ କୁହାଯାଇଛି ।





Media/Publication	The Pragativadi		
Date	13 <sup>th</sup> August, 2024	Language	Odia
Headline	IIT Bhubaneswar develops technology to predict rainfall accurately through Deep Learning		

## ଆଇଆଇଟି ଭୁବନେଶ୍ୱରରେ ଡିପ୍ ଲର୍ଣ୍ଣିଙ୍ଗ୍ ମାଧ୍ୟମରେ ବୃଷ୍ଟିପାତର ସଠିକ୍ ପୂର୍ବାନୁମାନ

■ ଭୁବନେଶ୍ୱର, ୧୩୧୨।୮ (ପିଏନଏସ): ଜଳବାୟୁ ପରିବର୍ତ୍ତନ ପରିସ୍ଥିତିରେ ଭାରତୀୟ ଅଞ୍ଚଳରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣାର ଚାକିରି ଏବଂ ବାରମ୍ବାର ବୃତ୍ତ ଗତିରେ ବୃଦ୍ଧି ଘଟିଛି । ଏହି ପ୍ରବଳ ବର୍ଷା ଘଟଣା ର ମହତ୍ତ୍ୱପୂର୍ଣ୍ଣ ପରିଣାମ ରହିଛି ଏବଂ ଏହା ଆମ ସମାଜ ଉପରେ ଗଭୀର ପ୍ରଭାବ ପକାଇଥାଏ । ଅବଶ୍ୟ ପର୍ଯ୍ୟାପ୍ତ ସାଧା ସମୟ ସହିତ ସଠିକ୍ ବୃଷ୍ଟିପାତର ପୂର୍ବାନୁମାନ ବର୍ତ୍ତମାନର କଳା ଗତିଶୀଳ ମଡେଲଗୁଡ଼ିକ ପାଇଁ ଏକ ବଡ଼ ଆହ୍ୱାନ । ଅଧିକୃତ ଏହି ସମସ୍ୟା ଜଟିଳ ପାଠ୍ୟ ଅଞ୍ଚଳ ଉପରେ ବୁଦ୍ଧି ପାଇଛି । ଅତ୍ୟଧୁନିକ ପାରମ୍ପରିକ ସାଂଖ୍ୟିକ ପାଣିପାଗ ପୂର୍ବାନୁମାନ ମଡେଲ ଏବଂ ସେମାନଙ୍କର ସମ୍ବନ୍ଧଗୁଡ଼ିକ, ଉପଯୋଗୀ ଥିବାବେଳେ, ଜଟିଳ ଟପୋଗ୍ରାଫି ଏବଂ ବିବିଧ ଜଳବାୟୁ ଜାଣି ହେତୁ ଏହିପରି ଘଟଣାଗୁଡ଼ିକର ସଠିକ୍ ପୂର୍ବାନୁମାନ କରିବା ସହିତ ସଂଘର୍ଷ କରନ୍ତି ।

ଏହି ସମସ୍ୟାକୁ ଦୂର କରିବା ପାଇଁ, ପ୍ରଥମ ଥର ପାଇଁ, ଆଇଆଇଟି ଭୁବନେଶ୍ୱର ଏକ ହାଇବ୍ରିଡ୍ ଟେକ୍ନୋଲୋଜି ବିକଶିତ କରିଛି ଯାହା ପାଣିପାଗ ଅନୁସନ୍ଧାନ ଏବଂ ପୂର୍ବାନୁମାନ ମଡେଲରୁ ଏକ ଡିପ୍ ଲର୍ଣ୍ଣିଙ୍ଗ୍ ମଡେଲରେ ଫଳାଫଳକୁ ଏକତ୍ର କରି ଭବିଷ୍ୟବାଣୀର ସଠିକତାକୁ ବୃଦ୍ଧି କରିବା ପାଇଁ ଗର୍ବ୍ୟାସ ମାରିପାଣର ଗମନ

ସହିତ ବିଶେଷ ଭାବରେ ଭାରୀ ବର୍ଷାର ଭବିଷ୍ୟବାଣୀକୁ ଉନ୍ନତ କରିବାକୁ ଲକ୍ଷ୍ୟ ରଖିଛି । ଆସାମର ଜଟିଳ ଅଞ୍ଚଳ (ପ୍ରବଳ ବନ୍ୟାରେ ଅତ୍ୟଧିକ ଅସୁରକ୍ଷିତ) ତଥା ଓଡ଼ିଶା ରାଜ୍ୟ ଉପରେ ଏହି ଅଧ୍ୟୟନ କରାଯାଇଥିଲା ଯେଉଁଠାରେ

ପ୍ରବଳ ବନ୍ୟାରେ ଅତ୍ୟଧିକ

ଅସୁରକ୍ଷିତ ତଥା ଓଡ଼ିଶା

ରାଜ୍ୟ ଉପରେ ଏହି ଅଧ୍ୟୟନ

କରାଯାଇଥିଲା ଯେଉଁଠାରେ

ମୌସୁମୀ ଲଘୁତାପ ପ୍ରଣାଳୀରେ

ପ୍ରବଳ ବର୍ଷା ଘଟଣା ଅତ୍ୟନ୍ତ

ପ୍ରବଳ ବର୍ଷା ଘଟଣା ଅତ୍ୟନ୍ତ

ପରିବର୍ତ୍ତନଶୀଳ ଅଟେ ।

ମୌସୁମୀ ଲଘୁତାପ ପ୍ରଣାଳୀରେ ପ୍ରବଳ ବର୍ଷା ହେତୁ ପ୍ରକୃତିରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣା ଅତ୍ୟନ୍ତ ପରିବର୍ତ୍ତନଶୀଳ ଅଟେ । ଆସାମରେ, ହାଇବ୍ରିଡ୍ ମଡେଲ ଭବିଷ୍ୟବାଣୀ ସଠିକତା ପ୍ରଦର୍ଶନ କରେ ଯାହା ଜିଲ୍ଲା ସ୍ତରରେ ପାରମ୍ପରିକ ସଂଗୀତ ମଡେଲ ତୁଳନାରେ ପ୍ରାୟ ଦୁଇଗୁଣ ଅଟେ, ଯାହାକି ୯୬ ଘଣ୍ଟା ପର୍ଯ୍ୟନ୍ତ ଏକ ଲିଭ୍ ଟାଇମ୍ ସହିତ ଏହାର ଉଲ୍ଲେଖନୀୟ ପ୍ରଦର୍ଶନ ପ୍ରଦର୍ଶନ କରିଥାଏ । ଏହି ଅଭିନବ ଅଧ୍ୟୟନଗୁଡ଼ିକ ରିଟ୍ରୋସ୍ପେକ୍ଟିଭ୍ କେସ୍ ଉପରେ ଲାଗି ପଡ଼ିପାରେ ।



# भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर

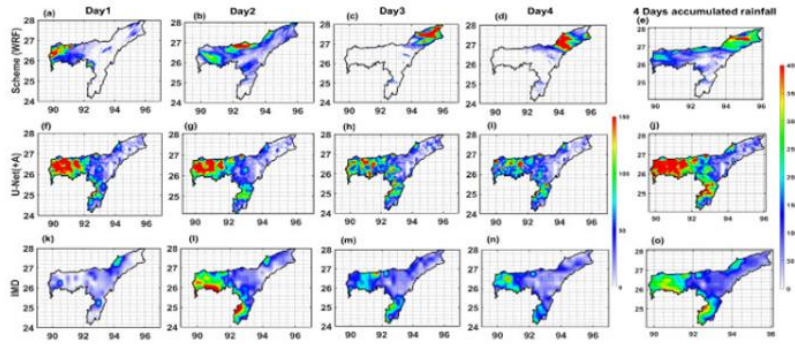
## Indian Institute of Technology Bhubaneswar

Media/Publication	Shashak Prashasak.com		
Date	12 <sup>th</sup> August, 2024	Language	Odia
Headline	IIT-Bhubaneswar Develops Technology Using AI To Predict Rainfall Accurately		
Link	<a href="https://shasakprashasak.com/index.php/state/42691-2024-08-12-11-34-28">https://shasakprashasak.com/index.php/state/42691-2024-08-12-11-34-28</a>		

ଆଇଆଇଟି ଭୁବନେଶ୍ୱର ଗବେଷଣାକାରୀଙ୍କ ଦ୍ୱାରା ଡିପ୍ ଲର୍ଣ୍ଣିଙ୍ଗ ମାଧ୍ୟମରେ ବୃଷ୍ଟିପାତର ପୂର୍ବାନୁମାନ ସଠିକତା ଉପରେ ଅଧ୍ୟୟନ

📅 12 AUGUST 2024 📈 HITS: 64 ⭐ RATING: ☆ ☆ ☆ ☆ ☆

ରିଆଲ୍ ଟାଇମରେ ଆସାମର ଜଟିଳ କ୍ଷେତ୍ର ଗୁଡ଼ିକର ବିଶେଷ ସନ୍ଦର୍ଭ



Spatial plot for HRE from day 1 to day 4 and all days accumulated for (a)-(d) WRF, (e)-(h) U-Net (+A), and (i)-(l) IMD.

ଭୁବନେଶ୍ୱର, ୧୨ ଅଗଷ୍ଟ ୨୦୨୪: ଜଳବାୟୁ ପରିବର୍ତ୍ତନ ପରିଚ୍ଛତିରେ, ଭାରତୀୟ ଅଞ୍ଚଳରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣାର ତୀବ୍ରତା ଏବଂ ବାରମ୍ବାର ବୁଡ଼ ଗତିରେ ବୃଦ୍ଧି ଘଟିଛି । ଏହି ପ୍ରବଳ ବର୍ଷା ଘଟଣା (HREs) ର ମହତ୍ତ୍ୱପୂର୍ଣ୍ଣ ପରିଣାମ ରହିଛି ଏବଂ ଏହା ଆମ ସମାଜ ଉପରେ ଗଭୀର ପ୍ରଭାବ ପକାଇଥାଏ । ଅବଶ୍ୟ, ପର୍ଯ୍ୟାପ୍ତ ସାମା ସମୟ ସହିତ ସଠିକ୍ ବୃଷ୍ଟିପାତର ପୂର୍ବାନୁମାନ ବର୍ତ୍ତମାନର କଳା ଗତିଶୀଳ ମଡେଲଗୁଡ଼ିକ ପାଇଁ ଏକ ବଡ଼ ଆହ୍ୱାନ । ଅଧିକନ୍ତୁ, ଏହି ସମସ୍ୟା ଜଟିଳ ପାର୍ବତ୍ୟ ଅଞ୍ଚଳ ଉପରେ ବୃଦ୍ଧି ପାଇଛି । ଅତ୍ୟାଧୁନିକ ପାରମ୍ପାରିକ ସାଂଖ୍ୟିକ ପାଣିପାଗ ପୂର୍ବାନୁମାନ (numerical weather prediction-NWP) ମଡେଲ ଏବଂ ସେମାନଙ୍କର ସମ୍ବନ୍ଧଗୁଡ଼ିକ, ଉପଯୋଗୀ ଥିବାବେଳେ, ଜଟିଳ ଟପୋଗ୍ରାଫି ଏବଂ ବିବିଧ ଜଳବାୟୁ ଜାତୀୟ ହେତୁ ଏହିପରି ଘଟଣାଗୁଡ଼ିକର ସଠିକ୍ ପୂର୍ବାନୁମାନ କରିବା ସହିତ ସଂଘର୍ଷ କରନ୍ତି ।



# भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर

## Indian Institute of Technology Bhubaneswar

ଏହି ସମସ୍ୟାକୁ ଦୂର କରିବା ପାଇଁ, ପ୍ରଥମ ଥର ପାଇଁ, ଆଇଆଇଟି ଭୁବନେଶ୍ୱର ଏକ ହାଇବ୍ରିଡ୍ ଟେକ୍ନୋଲୋଜି ବିକଶିତ କରିଛି ଯାହା ପାଣିପାଗ ଅନୁସନ୍ଧାନ ଏବଂ ପୂର୍ବାନୁମାନ (WRF) ମଡେଲରୁ ଏକ ଡିପ୍ ଲର୍ଣ୍ଣିଙ୍ଗ (DL) ମଡେଲରେ ଫଳାଫଳକୁ ଏକତ୍ର କରି ଭବିଷ୍ୟବାଣୀର ସଠିକତାକୁ ବୃଦ୍ଧି କରିବା ପାଇଁ ପର୍ଯ୍ୟାପ୍ତ ପରିମାଣର ସମୟ ସହିତବିଶେଷ ଭାବରେ ଭାରୀ ବର୍ଷାର ଭବିଷ୍ୟବାଣୀକୁ ଉନ୍ନତ କରିବାକୁ ଲକ୍ଷ୍ୟ ରଖିଛି । ଆସାମର ଜଟିଳ ଅଞ୍ଚଳ (ପ୍ରବଳ ବନ୍ୟାରେ ଅତ୍ୟଧିକ ଅପ୍ରଭାବିତ) ତଥା ଓଡିଶା ରାଜ୍ୟ ଉପରେ ଏହି ଅଧ୍ୟୟନ କରାଯାଇଥିଲା ଯେଉଁଠାରେ ମୌସୁମୀ ଲଘୁତାପ ପ୍ରଣାଳୀରେ ପ୍ରବଳ ବର୍ଷା ହେତୁ ପ୍ରକୃତିରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣା ଅତ୍ୟନ୍ତ ପରିବର୍ତ୍ତନଶୀଳ ଅଟେ । ଆସାମରେ, ହାଇବ୍ରିଡ୍ ମଡେଲ୍ ଭବିଷ୍ୟବାଣୀ ସଠିକତା ପ୍ରଦର୍ଶନ କରେ ଯାହା ଜିଲ୍ଲା ସ୍ତରରେ ପାରମ୍ପାରିକ ସଂଗୀତ ମଡେଲ୍ ତୁଳନାରେ ପ୍ରାୟ ଦୁଇଗୁଣ ଅଟେ, ଯାହାକି ୯୬ ଘଣ୍ଟା ପର୍ଯ୍ୟନ୍ତ ଏକ ଲିଭ୍ ଟାଇମ୍ ସହିତ ଏହାର ଉଲ୍ଲେଖନୀୟ ପ୍ରଦର୍ଶନ ପ୍ରଦର୍ଶନ କରିଥାଏ । ଏହି ଅଭିନବ ଅଧ୍ୟୟନଗୁଡ଼ିକ ରିଟ୍ରୋସେକ୍ଟିଭ୍ କେସ୍ ବ୍ୟବହାର କରି କରାଯାଇଛି ।

(Ref: <https://x.com/iitbbs/status/1817778185716846928>)

ଆସାମର ଜଟିଳ ଭୂମି ଉପରେ ବାସ୍ତବ ସମୟ ପରିସ୍ଥିତି ପାଇଁ ଉପଯୋଗୀ ଟେକ୍ନୋଲୋଜିର ଦୃଢ଼ତା ଓ ଦକ୍ଷତା ପ୍ରଦର୍ଶନ କରିବାକୁ, ଅନ୍ୟ ଏକ ଗ୍ରାଉଣ୍ଡ ଟ୍ରେକିଙ୍ଗ୍ ଅଧ୍ୟୟନରେ, ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ଅନୁସନ୍ଧାନକାରୀମାନେ ଡିପ୍ ଲର୍ଣ୍ଣିଙ୍ଗ କୌଶଳ ମାଧ୍ୟମରେ ବାସ୍ତବ ସମୟରେ ଏହି ଅଞ୍ଚଳରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣାର ସଠିକ୍ ପୂର୍ବାନୁମାନ କରିବାରେ ଏକ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ପଦକ୍ଷେପ ନେଇଛନ୍ତି । IEEE Xplore ରେ ପ୍ରକାଶିତ "ରିଆଲ୍-ଟାଇମ୍ ପ୍ରବଳ ବର୍ଷା ଇଭେଣ୍ଟ ପାଇଁ ଆସାମ ପାଇଁ ଡିପ୍ ଲର୍ଣ୍ଣିଙ୍ଗ ବ୍ୟବହାର କରି ପୂର୍ବାନୁମାନ ତ୍ରୁଟି ହ୍ରାସ" ("Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam") ଶୀର୍ଷକ ଅଧ୍ୟୟନରୁ ଜଣାପଡିଛି ଯେ ପାରମ୍ପାରିକ WRF ମଡେଲ୍ ସହିତ DL କୁ ଏକାକୃତ କରିବା ବାସ୍ତବ ସମୟରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣାର ପୂର୍ବାନୁମାନ ସଠିକତାକୁ ନାଟକୀୟ ଭାବରେ ଉନ୍ନତ କରିଥାଏ, ଆସାମ ପରି ଏହି ବନ୍ୟା ପ୍ରବଣ ପାର୍ବତ୍ୟ ଅଞ୍ଚଳ ପାଇଁ ଗବେଷଣା କ୍ଷେତ୍ରରେ ଏକ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଅଗ୍ରଗତି ।

ଜୁନ୍ ୧୩ ରୁ ୧୭, ୨୦୨୩ ମଧ୍ୟରେ ଆସାମ ପ୍ରବଳ ବର୍ଷା ହେତୁ ପ୍ରବଳ ବନ୍ୟା ପରିସ୍ଥିତି ସୃଷ୍ଟି କରିଥିଲା । DL ମଡେଲ୍ ଜିଲ୍ଲା ପରିସରରେ ବୃଷ୍ଟିପାତର ସ୍ଥାନିକ ବଣ୍ଟନ ଏବଂ ତୀବ୍ରତାକୁ ଅଧିକ ସଠିକ୍ ଭାବରେ ପୂର୍ବାନୁମାନ କରିବାରେ ସକ୍ଷମ ହୋଇଥିଲା । ଅନୁସନ୍ଧାନ ପ୍ରକୃତ ସମୟରେ ପ୍ରାରମ୍ଭିକ ପାଣିପାଗ ପୂର୍ବାନୁମାନ ସୃଷ୍ଟି କରିବାକୁ WRF ମଡେଲକୁ ନିୟୋଜିତ କରିଥିଲା, ଯାହା ପରେ DL ମଡେଲ୍ ବ୍ୟବହାର କରି ବିଶୋଧିତ କରାଯାଇଥିଲା । ଏହି ପଦ୍ଧତି ତଥ୍ୟର ଜଟିଳ ସ୍ଥାନିକ ନିର୍ଭରଶୀଳତାକୁ ଭଲ ଭାବରେ ଧରିବା ପାଇଁ ଏକ ସ୍ୱାତିଓ-ଆଡେନ୍ଟନ ମଡ୍ୟୁଲ୍ ଅନ୍ତର୍ଭୁକ୍ତ କରି ବୃଷ୍ଟିପାତର ତାତ୍କାଳିକତା ଏକ ବିସ୍ତୃତ ବିଶ୍ଳେଷଣ ପାଇଁ ପାଠ ପ୍ରଶସ୍ତ କଲା । ପୂର୍ବ ଆଲୋଚନା ଅନୁସାରେ, ଏହାର ସଠିକତାକୁ ବଢାଇବା ପାଇଁ ଏହି ମଡେଲକୁ ଏକାଧିକ ଏନ୍ଟ୍ରାଲ୍ ଆଉଟପୁଟରୁ ଅତୀତର ପ୍ରବଳ ବର୍ଷାର ତଥ୍ୟ ତଥା ଭାରତୀୟ ପାଣିପାଗ ବିଭାଗ (IMD) ର ପର୍ଯ୍ୟବେକ୍ଷଣ ବ୍ୟବହାର କରି ତାଲିମ ଦିଆଯାଇଥିଲା ।

ମୁଖ୍ୟ ଅନୁସନ୍ଧାନ:

୧. ଜିଲ୍ଲା ସ୍ତରୀୟ ସଠିକତା: ଜିଲ୍ଲା ସ୍ତରରେ ପୂର୍ବାନୁମାନ କୌଶଳର ଉନ୍ନତି ପାଇଁ ବାସ୍ତବ ସମୟ (ରିଆଲ୍ ଟାଇମ୍)ରେ ହୋଇଥିବା ପ୍ରଥମ ଗବେଷଣା ।

୨. ବର୍ଦ୍ଧିତ ପୂର୍ବାନୁମାନ ସଠିକତା: WRF ମଡେଲର ୨୨.୮% ତୁଳନାରେ DL ମଡେଲ୍ ପୂର୍ବାନୁମାନ ସଠିକତାରେ ଏକ ଉଲ୍ଲେଖନୀୟ ଉନ୍ନତି ପ୍ରଦର୍ଶନ କରିଛି, ଯାହାକି ୫୪.୪% ସଠିକତା ଦେଖାଇଛି । DL ମଡେଲ୍ ମଧ୍ୟ ୩୦ ମିଲିମିଟରରୁ ଏକ ହାରାହାରି ସଂପୂର୍ଣ୍ଣ ତ୍ରୁଟି (MAE) ହାସଲ କରିଛି, ଯାହାକି ୨-୪ ଦିନ ପୂର୍ବାନୁମାନ ସମୟ ପାଇଁ WRFର 50 mm MAE ଠାରୁ ଯଥେଷ୍ଟ କମ୍ ।

୩. ଟେକ୍ନୋଲୋଜିକାଲ୍ ଇନୋଭେସନ୍: ଏହି ଗବେଷଣା ଏକ ସ୍ୱାତିଓ-ଆଡେନ୍ଟନ (SA) ମଡ୍ୟୁଲ୍ ସହିତ ଏକ ଯୁ-ନେଟ୍ ମଡେଲ୍ ଉପସ୍ଥାପନ କରେ ଯାହା ଜିଲ୍ଲା ସ୍ତରରେ ବର୍ଷା ସମ୍ବନ୍ଧୀୟ ବୈଶିଷ୍ଟ୍ୟଗୁଡ଼ିକର ଜଟିଳ ସ୍ଥାନିକ ନିର୍ଭରଶୀଳତାକୁ ଲିପିବଦ୍ଧ କରିଥାଏ ।





## भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर Indian Institute of Technology Bhubaneswar

ଏହି ଅଗ୍ରଗାମୀ ଅଧ୍ୟୟନଗୁଡ଼ିକର ଅନୁସନ୍ଧାନଗୁଡ଼ିକ ବିଶେଷତଃ ଭାରତର ଜଟିଳ ଭୌଗୋଳିକ ଅଞ୍ଚଳରେ ପ୍ରବଳ ବର୍ଷା ଘଟଣା କ୍ଷେତ୍ରରେ ବାସ୍ତବ ସମୟରେ ପାଣିପାଗ ପୂର୍ବାନୁମାନରେ ଉନ୍ନତି ଆଣିବାରେ କୃତ୍ରିମ ବୁଦ୍ଧିମତାର ଅପାର ସମ୍ଭାବନାକୁ ଶ୍ରେଷ୍ଠ ଭାବରେ ଦର୍ଶାଏ । ପ୍ରାକୃତିକ ବିପର୍ଯ୍ୟୟ ଏବଂ ଜନସାଧାରଣଙ୍କ ସୁରକ୍ଷାକୁ କମାଇବା ପାଇଁ ଏହି ଅଗ୍ରଗତି ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ । ଏହା ସହିତ, ଏହି ଅଗ୍ରଗାମୀ କାର୍ଯ୍ୟଗୁଡ଼ିକ ଅନ୍ୟ ଜଟିଳ ଚପୋଗ୍ରାଫିକ୍ ଭୂଖଣ୍ଡ କ୍ଷେତ୍ର ଯେପରିକି ଭାରତର ପଶ୍ଚିମ ହିମାଳୟ ଏବଂ ପଶ୍ଚିମ ଘାଟ ଅଞ୍ଚଳ ପାଇଁ ଅନୁରୂପ ହାଇଡ୍ରୋ ମଡେଲ୍ ସୃଷ୍ଟି କରିବାରେ ଏକ ମାର୍ଗଦର୍ଶିକା ଭାବରେ କାର୍ଯ୍ୟ କରିବ । ଆଇଆଇଟି ଭୁବନେଶ୍ୱରର ପୃଥିବୀ ମହାସାଗର ଏବଂ ଜଳବାୟୁ ବିଜ୍ଞାନ ବିଭାଗର (School of Earth Ocean and Climate Sciences) ର ଡକ୍ଟର ଧନଞ୍ଜୟ ତ୍ରିବେଦୀ, ଡକ୍ଟର ଓମଜୀର ଶର୍ମା, ଡକ୍ଟର ବିବେକାନନ୍ଦ ହାତ୍ରା, ଡକ୍ଟର ସନ୍ଦୀପ ପଟ୍ଟନାୟକ ଏବଂ ବିଦ୍ୟୁତ୍ ଏବଂ କମ୍ପ୍ୟୁଟର ସାଇନ୍ସ ବିଭାଗର ଡକ୍ଟର ନିଲାଦ୍ରି ବିହାରୀ ପୁହାଣକୁ ନେଇ ଏକ ଟିମ୍ ଏହି ଅଧ୍ୟୟନ କରିଥିଲେ । ଏହି କାର୍ଯ୍ୟକୁ କାଉନସିଲ୍ ଅଫ୍ ସାଇଣ୍ଟିଫିକ୍ ଏବଂ ଇଣ୍ଡଷ୍ଟ୍ରିଆଲ୍ ରିସର୍ଚ୍ଚ (CSIR), ଏବଂ ନ୍ୟୁ ଜେଜର୍ ଫଣ୍ଡ, ଯୁଏସ୍ ଏବଂ ଆଇଆଇଟି ଭୁବନେଶ୍ୱର ସମର୍ଥନ କରିଛନ୍ତି ।



## भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर Indian Institute of Technology Bhubaneswar

Media/Publication	Odisha Bytes.com		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	<b>IIT-Bhubaneswar Develops Technology Using AI To Predict Rainfall Accurately</b>		
Link	<a href="https://odishabytes.com/iit-bhubaneswar-develops-technology-using-ai-to-predict-rainfall-accurately/">https://odishabytes.com/iit-bhubaneswar-develops-technology-using-ai-to-predict-rainfall-accurately/</a>		

IIT-Bhubaneswar has developed a hybrid technology to enhance rainfall prediction accuracy, particularly in case of downpours with an adequate lead time, by integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model.

“The studies were carried out using retrospective cases over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems,” the institute said in a statement on Monday.

It claimed that the hybrid model displayed prediction accuracy, nearly double that of traditional ensemble models, at a district level in Assam with a lead time up to 96 hours.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall.

“The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at districts scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model. This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data,” it said.

The study titled ‘Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam’, published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam, it added.

Media/Publication	Ap 7am.com		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar develops hybrid technology using AI for weather forecasting		
Link	<a href="https://ap7am.com/en/84580/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting">https://ap7am.com/en/84580/iit-bhubaneswar-develops-hybrid-technology-using-ai-for-weather-forecasting</a>		

The Indian Institute of Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday.

The study also highlighted the potential of artificial intelligence in improving real-time weather forecasting, particularly for heavy rainfall events in the complex terrains over the Indian region.

The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems.

"In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases," official sources added.

The researchers from the IIT-Bhubaneswar through another groundbreaking study have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques. The study demonstrated the robustness of the new hybrid technology for real time situations over complex terrain of Assam.

"The study titled 'Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam', published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam," added sources.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model.

The experts through this new method can now carry out a more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data.



## भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर **Indian Institute of Technology Bhubaneswar**

As discussed, the model was trained using data from past heavy rainfall events from multiple ensembles outputs as well as observations from India Meteorological Department (IMD), to improve its accuracy.

"This advancement is crucial for mitigating the impacts of natural disasters and public safety. Additionally, these pioneering works will also serve as a guiding light in creating analogous hybrid models for other intricate topographical terrain areas such as the Western Himalayas and Western Ghats regions of India," official sources said.



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## Indian Institute of Technology Bhubaneswar

Media/Publication	OmmCommNews.com		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar Develops Technology To Predict Rainfall Accurately		
Link	<a href="https://ommcomnews.com/odisha-news/iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately">https://ommcomnews.com/odisha-news/iit-bhubaneswar-develops-technology-to-predict-rainfall-accurately</a>		

IIT-Bhubaneswar has claimed to have developed a technology that can help to predict rainfall accurately, especially in cases of downpours, with adequate lead time.

The technology was developed by integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model, the institute said in a statement.

The institute has undertaken studies using retrospective cases over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over Odisha where heavy rainfall events are highly dynamic due to the landfall of multiple intense rain-bearing monsoon low-pressure systems.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall. “The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at districts scale,” the statement claimed adding, “The research employed the WRF model to generate initial weather forecasts in real-time, which were then refined using the DL model.”

This method allowed for a more detailed analysis of rainfall patterns, incorporating a spatial-attention module to better capture the intricate spatial dependencies in the data.

In Assam, the model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time of up to 96 hours, showcasing its remarkable performance, the statement said.

Media/Publication	PC Table.co.in		
Date	13 <sup>th</sup> August, 2024	Language	English
Headline	Revolutionary AI-Enhanced Weather Forecasting by IIT Bhubaneswar Targets Improved Accuracy		
Link	<a href="https://www.pc-tablet.co.in/revolutionary-ai-enhanced-weather-forecasting-by-iit-bhubaneswar-targets-improved-accuracy/37802/?amp">https://www.pc-tablet.co.in/revolutionary-ai-enhanced-weather-forecasting-by-iit-bhubaneswar-targets-improved-accuracy/37802/?amp</a>		

The Indian Institute of Technology Bhubaneswar has taken a significant step in advancing weather forecasting accuracy by developing a hybrid technology. This innovative approach combines the traditional Weather Research and Forecasting (WRF) model with cutting-edge deep learning techniques, aimed specifically at improving heavy rainfall predictions.

#### Groundbreaking Development in Weather Forecasting

The new hybrid model showcases an [impressive performance](#), particularly in Assam and Odisha—areas prone to dynamic weather changes due to intense monsoonal systems. The model not only predicts with nearly double the accuracy of traditional methods but also provides crucial lead times of up to 96 hours. Such advancements are vital for regions like Assam, where the terrain’s complexity and susceptibility to flooding pose unique challenges.

#### Significant Improvements in Real-Time Predictions

A recent study titled ‘Minimization of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam,’ published in IEEE Xplore, highlights the substantial benefits of integrating deep learning with the WRF model. This integration has led to remarkable improvements in [forecasting](#) heavy rainfall events accurately and in real time, which is crucial for disaster-prone areas.

#### Practical Applications and Future Prospects

Between June 13 and 17, 2023, when Assam faced severe flooding, the DL model demonstrated its ability to accurately predict rainfall intensity and distribution at a district level. The use of a spatio-attention module allows for a more detailed analysis of rainfall patterns, enhancing the model’s ability to [manage](#) the spatial dependencies within the data effectively.

This technological advancement not only aids in disaster mitigation but also sets a precedent for developing similar models for other geographically complex regions like the Western Himalayas and Western Ghats.



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Media/Publication	Bizz Buzz.news		
Date	14 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar uses AI to develop weather forecasting tech		

The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale

The Indian Institute of Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday. The study also highlighted the potential of artificial intelligence in improving real-time weather forecasting, particularly for heavy rainfall events in the complex terrains over the Indian region. The studies were carried out over the complex terrain of Assam (highly vulnerable to severe flooding) during June 2023 and over the state of Odisha where heavy rainfall events are highly dynamic in nature due to the landfall of multiple intense rain bearing monsoon low-pressure systems. "In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases," official sources added.



## भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर Indian Institute of Technology Bhubaneswar

Media/Publication	The Hans India.com		
Date	14 <sup>th</sup> August, 2024	Language	English
Headline	IIT-Bhubaneswar develops tech to predict rainfall accurately		
Link	<a href="https://www.thehansindia.com/news/national/iit-bhubaneswar-develops-tech-to-predict-rainfall-accurately-899333">https://www.thehansindia.com/news/national/iit-bhubaneswar-develops-tech-to-predict-rainfall-accurately-899333</a>		

**HIGHLIGHTS** The Indian Institute Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday.

**Bhubaneswar:** The Indian Institute Technology (IIT)-Bhubaneswar has developed a hybrid technology integrating the output from the Weather Research and Forecasting (WRF) model into a deep learning (DL) model to enhance prediction accuracy particularly with an aim to improve prediction of heavy rainfall events with an adequate lead time, said official sources on Monday.

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“In Assam, the hybrid model displays prediction accuracy that is nearly double that of traditional ensemble models at a district level with a lead time up to 96 hours, showcasing its remarkable performance. These innovative studies have been carried out using retrospective cases,” official sources added. The researchers from the IIT-Bhubaneswar through another groundbreaking study have demonstrated a significant leap in accurately predicting heavy rainfall events over the region in real-time, using deep learning techniques. The study demonstrated the robustness of the new hybrid technology for real time situations over complex terrain of Assam.

“The study titled ‘Minimisation of Forecast Error Using Deep Learning for Real-Time Heavy Rainfall Events Over Assam’, published in IEEE Xplore, has revealed that integrating DL with the traditional WRF model dramatically improves forecast accuracy for heavy rainfall events in real-time, a critical advancement for this flood-prone mountainous region like Assam,” added sources.

Between June 13 and 17, 2023, Assam experienced severe flooding due to heavy rainfall.

The DL model was able to more accurately predict the spatial distribution and intensity of rainfall across at district scale. The research employed the WRF model to generate initial weather forecasts in real time, which were then refined using the DL model. The experts through this new method can now carry out a





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more detailed analysis of rainfall patterns, incorporating a spatio-attention module to better capture the intricate spatial dependencies in the data. As discussed, the model was trained using data from past heavy rainfall events from multiple ensembles outputs as well as observations from India Meteorological Department (IMD), to improve its accuracy.”This advancement is crucial for mitigating the impacts of natural disasters and public safety. Additionally, these pioneering works will also serve as a guiding light in creating analogous hybrid models for other intricate topographical terrain areas such as the Western Himalayas and Western Ghats regions of India,” official sources said.