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# What is INCOIS's new product to forecast El Niño and La Niña conditions?

Known as Bayesian Convolutional Neural Network (BCNN), the new product uses the latest technologies such as Artificial Intelligence (AI)

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In India, while El Niño conditions usually lead to a weak monsoon and intense heatwaves, La Niña conditions result in a strong monsoon. (Express photo)

Hyderabad-based Indian National Centre for Ocean Information Services (INCOIS) has developed a new product to predict the emergence of **El Niño and La Niña conditions** — they are different phases of El Niño Southern Oscillation (ENSO) — up to 15 months in advance.

Here is a look at the product, what challenges scientists faced while building it, and what is the forecast.

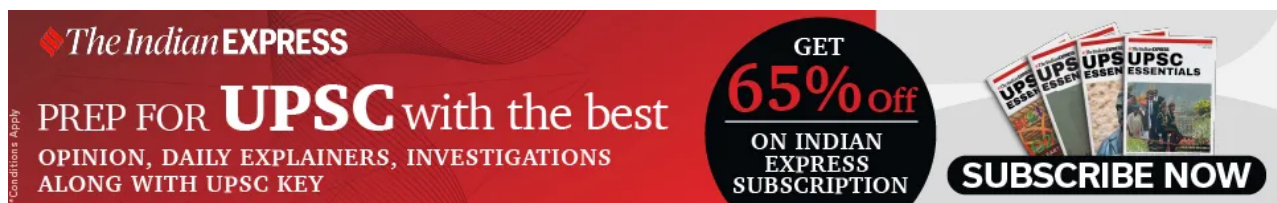
### **But first, what is ENSO?**

ENSO is a climate phenomenon which involves changes in the temperature of waters in the central and eastern tropical Pacific Ocean, coupled with fluctuations in the overlying atmosphere. It can alter the global atmospheric circulation, which, in turn, influences weather across the world.

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ENSO occurs in irregular cycles of 2-7 years and has three different phases — warm (El Niño), cool (La Niña), and neutral. In the neutral phase, the eastern side of the Pacific Ocean (near the northwestern coast of South America) is cooler than the western side (near the Philippines and Indonesia). This is due to the prevailing wind systems that move from east to west, sweeping the warmer surface waters towards the Indonesian coast. The relatively cooler waters from below come up to replace the displaced water.

In the El Niño phase, however, wind systems weaken, leading to lesser displacement of warmer waters. As a result, the eastern side of the Pacific becomes warmer than usual. In the La Niña phase, the opposite happens.



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In India, while El Niño conditions usually lead to a weak monsoon and intense heatwaves, La Niña conditions result in a strong monsoon.

### What is the new product?

Known as Bayesian Convolutional Neural Network (BCNN), the new product uses the latest technologies such as Artificial Intelligence (AI), deep learning, and machine learning (ML) to improve forecasts related to the ENSO phases.

the slow oceanic variations and their atmospheric coupling, which gives sufficient lead time to issue early forecasts. It calculates the Niño3.4 index value — used to determine the different phases of ENSO phases — and makes the forecast. The index value is obtained by averaging the sea surface temperature (SST) anomaly in the central equatorial Pacific, extending from 5°N to 5°S, and 170°W to 120°W.

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### **How does BCNN compare with existing models?**

There are largely two kinds of weather models used for forecasting. One is the statistical model, which generates forecasts based on various information sets received from different countries and regions. The other is the dynamic model, which involves a 3D mathematical simulation of the atmosphere done using High Performance Computers (HPC). The dynamic model is much more accurate than the statistical model.

**The BCNN, however, is a combination of the dynamic model with AI. This helps it forecast the emergence of El Niño and La Niña conditions with a 15-month lead time — unlike other models which can give a prediction up to six to nine months in advance.**

### **What were the challenges?**

Typically, researchers need historical weather data — spanning several decades, and even centuries — to feed into models to generate forecasts. While rich data are available for land, there is a scarcity when it comes to seas and oceans. This gap has hampered the weather and climate prediction accuracy.

“One challenge in applying deep learning to the El Niño or La Niña prediction is the scarcity of sufficient training data sets due to the limited observation period. Since global oceanic temperature records have only been accessible since 1871, fewer than 150 monthly samples are typically available to date,” an INCOIS official told

[The Indian Express](#).

The INCOIS team addressed the issue by incorporating data from historical runs (1850-2014 period) from the Coupled Model Intercomparison Project phases 5 and 6

to test the past climate and also project the future climate situations.

It took eight months to develop the BCNN model and it was put through several testing phases.

## What is the prediction?

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According to the June 5 bulletin, La Niña conditions would emerge during July-September (probability 70-90%) and continue till February 2025.

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