International Journal of Innovative Research in Engineering
Volume 4, Issue 2 (March-April 2023), PP: 688-692.
www.theijire.com ***ISSN No: 2582-8746***

Heat Wave Predication Correlate Data to Predict Drought

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How to cite this paper:
Vidya Mote[1], Adarsh Patil[2], Samrudhi Patil[3], Prof. Jaspreet Kaur[4] , "Heat Wave Predication Correlate Data to Predict Drought", IJIRE-V4I02-688-692.

https://www.doi.org/10.59256/ijire.2023040245

Abstract: *Climate change increases the frequency and intensity of heat waves and drought both cause significant human and material losses every time. This work aims at assessing the forecast quality in predicting the evolution of drought and heat stress by using user-relevant models such as S2S and GBDT to compare the model and predict the best accuracy and then collect the data from heat wave if heat wave found in the area, then use relevant algorithm and model to predict drought. I train Machine Learning models to predict the occurrence of heat waves over any 1° by 1° geographical co-ordinate over India a month in advance, using monthly or sometimes weekly, maximum temperature data from the 6 months preceding it and correlating given data and predict the drought and to notify people to allow them to take precautions to protect their lives and lifestyle. It is found that the developed criterion is functional in providing an outlook on the impending extreme temperatures with sufficient humidity to lead time. understanding and predicting the extreme temperatures and humidity leading to heat waves and drought are of the greatest importance.*

Key Word: *Heat Wave, Drought, S2S, RNN, India, Temperature, Humidity, IMD data.*

I.INTRODUCTION

The latest criterion for HW used by IMD is: Heatwave will be considered ifthe maximum temperature of a station reaches at least 40°C or more for Plains, 37 °Cor more for the coastal stations at least 30 °C or more for Hilly regions. Based on departure from normal: when the maximum temperature departure from normal is 4.5 °C to 6.4 °C, it will be considered HW day. Based on actual maximum temperature: when the actual maximum temperature is 45 °C or more,then it will be called HW day. farmers are left behind, so they should take a step ahead. Making them aware of t h e latest techniques is necessary. Heat Wave getting evolved as heat waves are the Two getting evolved too. Earlier the basic heatwave system mainly contains three phases. Question analysis, input processing, and answer extraction. Question analysis is the initial step, here the userquery in natural language is processed using POStagging, stemming, and removal of keywords. The input processing step fetches equivalent documents that contain keywords using different algorithms.

In the answer extraction phase, it retrieves the answer, tests the answer for correctness, and provides an exact answerto the user. As nowadays the expert system heatwave is adopted widely all over theworld for most-off the happening industry as they help the industries verbally and analytically to make the task easier for the user to extract the knowledge-based outputs to satisfy the user needs. Earlier the heatwave was only the question-answer type as discussed above. As the technologies evolved the heatwave system got updated with technologies such as the reasoning part got enhanced the accuracy enhanced and the time for the output was also a great factor for the heatwave to make them smart enough to answer the questions asked in various forms and various languages. Now languages are also b a great part of the discussion for the heatwave to make the use of the heatwave system wider and more eff for the users to usethe system.

Heat Waves typically occur between March and June, and in some rare cases even extend till July. The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death. Higher daily peak temperatures and longer, more intense heat waves are becoming increasingly frequent globally due to climate change. India too is feeling the impactof climate change in terms of increased instances of heat waves which are more intense in nature with each passing year, and have a devastating impact on human health thereby increasing the number of heat wave casualties.

One of the major challenges of agricultural systems is how to mitigate the impacts of droughts. Drought impacts agricultural systems economically as well as environmentally. Concerning economic impacts, droughts damage agricultural production and can cause economic damage to industries connected to agricultural production, in addition to causing unemployment as a result of reduced production. From an environmental perspective, droughts can deprive crops and soils of essentialprecipitation as well as increase the salt content in soils and irrigation systems.

II.LITERATURE REVIEW

The dataset has been collected from multiple stations. More recently, proposed a comparative study using models. This study performs a comparative analysis among several machine learning techniques including Support Vector Machine (SVM), Gradient Boosting Decision Tree (GBDT), and Seasonal to Sub-Seasonal(S2S) their ability to predict heat wave data. Recorded daily heat waves of these stations for the period of 2015-2020 are used in this study. These impacts may put

agricultural activities at significant risk. Climate change has already caused significant damage to our present crop profile and threatens to bring even more serious consequences in the future. High temperatures affect crops in different ways and cause decreased photosynthesis, leaf senescence, decreased pollen production and pollen viability, seed abortion, and consequently lower grain number and grain weight. However, critical temperature thresholds and sensitivities vary between crops, cultivars, and phenological development stages resulting in different plant responses. Large-scale heat stress assessments still do not reflect the cultivar diversity and heterogeneity in sowing dates observed under real field conditions.

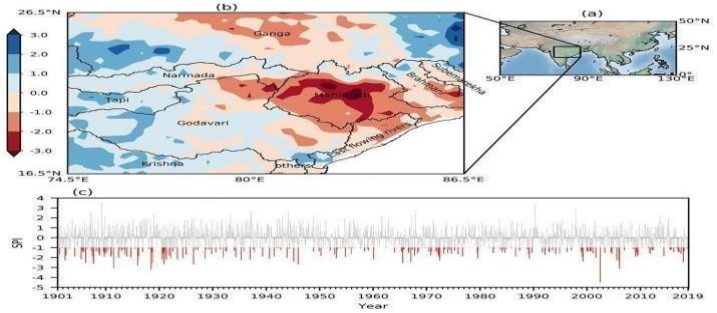


Fig 1.1 Drought Predication

A review of seasonal drought prediction given by Hao et al. (2018) identifies two typical predictor groups of variables:40 large-scale climate indices that reflect the atmosphere-ocean circulation patterns and local climate variables. The first ones are known to correlate with the precipitation patterns in special regions and therefore, are naturallycorrelated with the occurrence of drought. The teleconnection indices important for European precipitation include North Atlantic Oscillation (NAO), Scandinavian Oscillation (SCA), East Atlantic/Western Russia Oscillation (EA/WR), East Atlantic Oscillation (EA), and Atlantic Multidecadal Oscillation (AMO). The fact that global warming will increase temperatures over land masses, increasing the frequency of droughts and heat waves, is a certainty - as is the fact that climate change will alter the average amount of precipitation on land. The researchers have now used a novel model ensemble, comprising seven climate models, to reduce and better understand these uncertainties. Each model simulation was carriedout up to 100 times to account for natural climate variability. "The advantage of these multiple simulations is that we have a much larger volume of data than with conventional model ensembles, enabling us to better estimate compound extremes," explains Dr. Emanuele Bevacqua, first author and climate researcher at the UFZ.

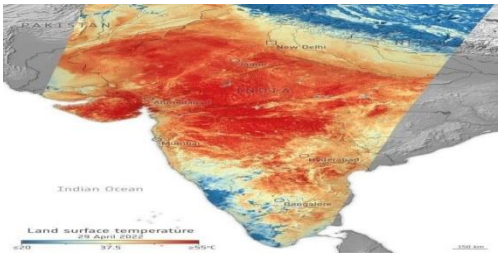


Fig 1.2 Heat Wave Prediction

Procedure methodology

Many meteorology criteria and past climate studies of temperature extremes remained focused on intra-day data. The main goal of this study is the real-time monitoring and extended-range prediction of heat waves using a multi-model dynamical ensemble prediction system developed at the Indian Institute of Tropical Meteorology, India. a criterion has been proposed based on the observed daily gridded Tmax datasets, which can be used for real-time prediction as well. The IMD also uses another criterion to declare a heat wave which is based on absolute recorded temperatures. If the temperature crosses the 45oC mark, the Department declares a heat wave, when it crosses 47, a 'severe' heat wave is declared. Human influence is the main driver of hot weather extremes (which have become more frequent and intense since the 1950s).

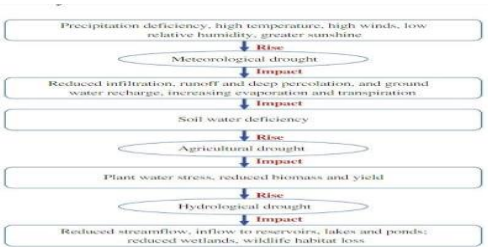


Fig 1.4 Data Flowchart

Data Model

1. The following datasets are used in this work: (1) Daily maximum temperature anomalies are obtained from the Global Historical Climatology Network Daily (GHCND) gridded dataset (HadGHCND) produced through a joint effort between the United States National Oceanic and Atmospheric Administration (National Climatic Data Center) and the United

Kingdom's Hadley Centre. Its temporal coverage ranges from 1950 to the present with a regular spatial resolution of 2.75 × 2.5 (Caesarea al 2006).

2. The following datasets are used in this work: (1) Daily maximum temperature anomalies are obtained from the Global Historical Climatology Network gridded dataset (HadGHCND) produced through a joint effort between the United States National Oceanic and Atmospheric Administration (National Climatic Data Center).

Data Analysis

The process quantifies the changing statistics of temperature evolution before global warming in the early 20th century and recent heat wave events to serve as early warning signals for potential catastrophic changes. In addition, the study illustrates the contrast between urban and rural early warning signals for extreme heat waves. The emergence of early-warning signals before heat waves provides new insights into the underlying mechanisms, such aspossible feedback via land-atmosphere interactions. Given the increasing frequency and intensity of heat extremes, theresults will facilitate the design of countermeasures to reserve the tipping and restore the resilience of climate systems.To study the ability of climate indices to predict heat-related data, we consider a two-stage approach applied to each MA. In the first stage, we estimate annual heat-attributable fractions (AF) of data through a distributed lag nonlinear model. In the second, AF estimates areconsidered as the response in a functional regression model with climate index curves as predictors.

Method

In this study, heat wave events are defined using the daily maximum temperature data of summer (June-June-August) for the period 1980–2019. Following Fischer and Schär(Fischer and Schär, 2010), a heat wave event is chosen when the daily maximum temperature exceeds the respective calendar-day 90th percentile and persists for at least six consecutive days. Considering the seasonal cycle, the 90th percentile is calculated at each grid point with a centered 15-day-long time window for each calendar day. With a moving window, the temporal dependence of each heat wave event is accounted for, and the sample size is reasonable to calculate a realistic percentile value (Wu et al 2016).

Model Adopted

1. S2S Model

One such model is sub-seasonal to seasonal (S2S) forecasting.S2S models use the observed state of the atmosphere at the time the prediction starts and, based on this, simulate how the climate system will likely evolve over the next four to eight weeks. To account for the climate's natural variability, the model produces a group of different simulations based on slightly varied conditions. S2S forecasting has the potential to accurately predict extreme weather events several weeks in advance – enough time for the impacted areas to react. S2S models can produce useful information on the probability of the occurrence of tropical storms within sufficiently large areas through the predictionof large-scale predictors.

2. GBDT

The gradient boosting decision tree (GBDT) is one type of ML technique called gradientboosting that gives an integrated prediction model in the form of an ensemble of weak prediction models.it is a supervised ML model that can be used in regression and classification tithe GBDT model is an iterative algorithm in which new DTs are added based on the residual produced by previous DTs during the iterations to continuously improve the overallaccuracy of the integrated model.

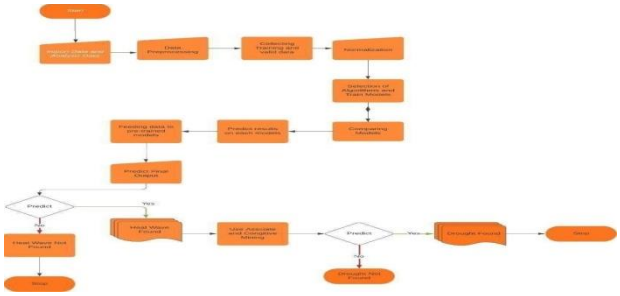


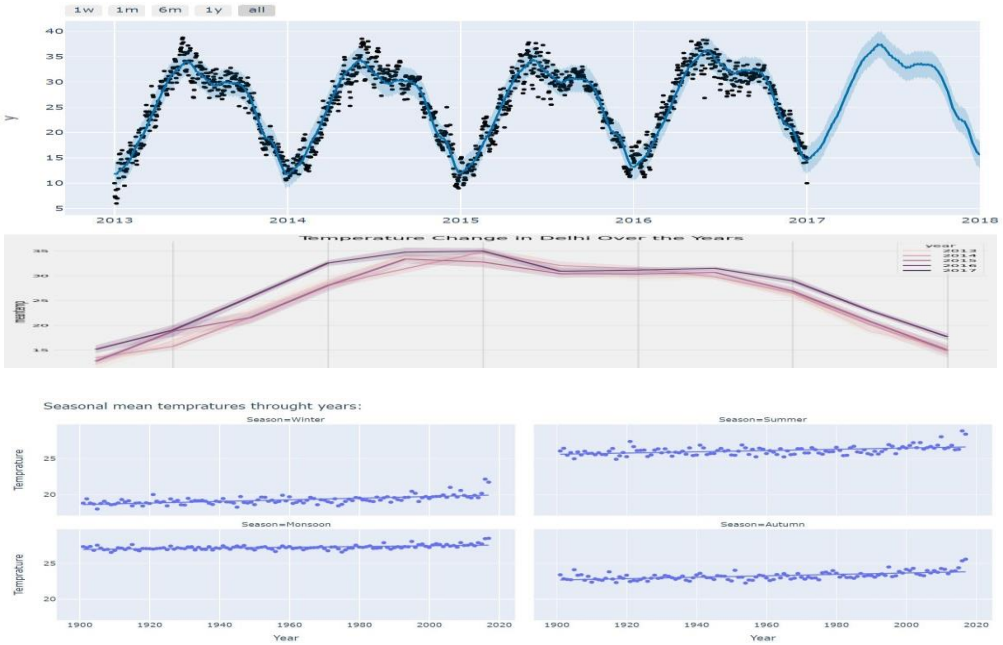
Fig 1.3 Flow Diagram

III.RESULT

Table no 1

Evaluation criteria	Description
Temperature Prediction	The performances of the proposed temperature prediction model are evaluated by measuring the index of agreement (IOA), Pearson correlation coefficient (R), root mean squared error (RMSE), mean absolute error (MAE), mean bias error (MBE), mean normalized gross error (MNGE) and mean normalized bias (MNB) between the real observed temperatures and those predicted by the proposed model.

Heat Wave Prediction	The latest criterion for HW used by IMD is: Heatwave will be considered if the maximum temperature of a station reaches leas40°C or more for Plains, 37 °C or more for the coastalstations at least 30 °C or more for Hilly regions. Based on departure from normal: when the maximum temperature departure from normal is4.5 °C to 6.4 °C then it will be considered as HW day
Best of Between S2S and GBDT	We are using S2S and GBDT models for the prediction of temperature whose is giving the best accuracy we are using that model
Forecasting Evaluation	Operational forecast skill is often evaluated using skill scores, which are relatively easy to compute and interpret. Certain skill scores are best implemented for probability forecasts of dichotomous events, such as heat wave/no heat wave, while others are better suited for verification of a deterministic prediction of heat wave/no heat wave



Conclusion And Future Scope

Sub-seasonal predictions have the potential to be useful to predict the onset, evolution, and decay of some large-scale, multi-week events such as long-lasting heat waves and droughts, as well as to predict changes in the probabilities of the occurrence of shorter-lived extreme weather events. An important goal of the S2S project is to create a few regional projects to demonstrate and quantify the benefits of using sub-seasonal forecasts of extreme events.

This project will further be extended, as the same neural network used to predict heat waves a month in advance can be reapplied to predict heat waves up to even a year in advance, repeatedly applying the model to predict the subsequent month's temperature based on a given month's predicted temperature. Due to the nature of the datasets utilized for this project, it can be expanded to help farmers globally, at any location near the Tropic of Cancer, as they would have similar climatic conditions as those of India. These methodsalong with optimization techniques can be used in the right direction or for further research. It is worth mentioning has drought assessment in various Indian regions using precipitation datacan further be applied to soil moisture, humidity, and wind speed parameters

IV.CONCLUSION

Rosuvastatin 20 mg on every other regimen had an equal effect when compared to daily dose regimen of atorvastatin 40 mg &rosuvastatin 20mg.

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