ANALYSIS ON INTERDEPENDENCE OF WEATHER PARAMETERS USING SPSS SOFTWARE

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Abstract- Climate change is viewed as a serious threat to conservation. The topic of this article is the observed variations in temperature, humidity, and rainfall during the past 50 years in the state of Kerala, as well as the conceptual underpinnings for comprehending variations in precipitation, floods, and droughts, as well as potential future developments. Three meteorological parameters—temperature, rainfall, and humidity—are used to study the changes in Kerala's climate change, and a correlation between each parameter has been discovered.. The mean value approach is used to get the average monthly value for each parameter for the research area based on IMD weather data. MS Excel has been used to produce graphs showing the daily fluctuation of each parameter over the last fifty years. For each parameter, trend line equations were also created. The sorted data from MS Excel was used as the input data to the SPSS software to calculate the correlation between the corresponding parameters. For a relevant evaluation of the fluctuations and dispersion of the climatic factors, the maximum monthly rainfall, temperature, and humidity have been taken. Both linear and polynomial regression techniques were used to create the trend charts for each parameter. The correlation was created using the "Pearson Correlation" method. The nature of the variables' dependency was determined based on the sign of the regression value. Finally, a regression equation linking three variables was developed utilising statistical methods. Temperature and humidity are major indicators of the maximum rainfall, according to the regression equation.

Key Words: Precipitation, temperature, humidity, correlation, regression

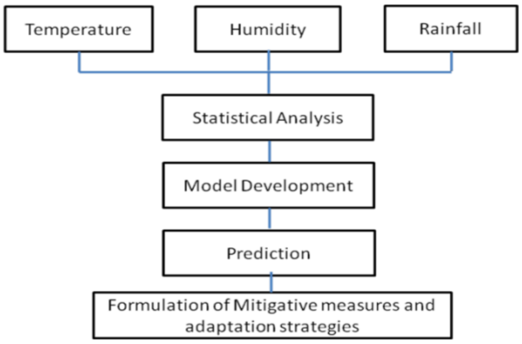
1. INTRODUCTION

During the ensuing centuries, it is predicted that Earth's climate will grow even more tropical, or hotter and more humid. Extreme humidity and temperature exposure have a major negative impact on society and the environment, and they even pose a threat to life as we know it. A significant portion of these changes are caused by greenhouse gas emissions. Over the past 100 years, studies show that the earth's temperature has risen by an average of 0.45 degrees Celsius. The ecological and physiologic systems are significantly disturbed by these changes. The population and reproductive biology are significantly impacted by the recent warming of the earth's climate. Precipitation and global warming are significantly related. The climate is challenging due to variations in precipitation frequency and intensity.

All types of creatures benefit greatly from moderate rainfall, as opposed to extreme intensity, which results in floods and is linked to droughts and higher temperatures. The society was forced to investigate the causes and predictability of the events as a result of the extensive devastation of life and property caused by natural calamities.. The research area's climate Kerala experiences a tropical monsoon with scorching summers and yearly excess rainfall. Due to the Arabian Sea's presence, the state has a very high humidity level.

The software IBM SPSS V 22 is utilised for advanced statistical data analysis, and it is used to analyse the rainfall, temperature, and humidity. The findings reveal a correlation between the aforementioned variables and an equation that aids in forecasting, allowing for the implementation of mitigating measures. Over decades, precipitation changes from year to year. These variations in the amount, intensity, frequency, and type of rainfall have had a tremendous impact on the environment and society. Natural disasters like heat waves and droughts are made worse by rising temperatures.

2. Design Methodology



3. Study Area

Kerala, an Indian state on the southwest coast, is the subject of the study. Except for the Thiruvananthapuram district, where the climate is tropical savanna with seasonally dry and hot summer weather, Kerala has a tropical monsoon climate with seasonal excessive rainfall and scorching summers. For climatological purposes, the entire state is categorised as a single meteorological sub division. Four seasons can be used to categorise the year. The hot season lasts from March to the end of May. The Southwest Monsoon season then begins and lasts through early October. The Northeast Monsoon season runs from October to December, while the months of January and February are winter months.. From September through February, the weather is pleasant. Due to the high temperatures and humidity, the summer months of March through May are miserable. Due to the Arabian Sea's presence to its west, the state experiences exceptionally high humidity levels.

Humidity: Relative humidity is often high over the State because it runs from north to south and has the Arabian Sea to its west. Between January and March, the afternoon humidity drops to 60 to 63 percent, ranging from 35 to 71 percent along the shore. Depending on how close the sea is, the highest daily variation in relative humidity during this time is from 4 to 16 percent. During the monsoon season, the state's relative humidity increases to roughly 85%. This time period's fluctuation is minimal.

Temperature: Except during the monsoon season, when they decrease by roughly 3 to 5°C, daytime temperatures over the plains remain essentially constant throughout the year. Over the plateau and at high altitude stations, temperatures are lower during the day and at night than over the plain. Daytime temperatures are lower along the coast than they are inland. With a mean maximum temperature of roughly 33°C, March is the hottest month. When there is a lot of rain and clouds in the sky in July, the mean maximum temperature is at its lowest. The average temperature for the entire state in July is 28.5°C, ranging from around 28°C in the north to roughly 29°C in the south. Beginning in May, both the maximum and lowest temperatures begin to drop, the latter quite quickly and the former gradually.

Rainfall: The State receives an average of 180 cm of rainfall in the south and 360 cm across its northernmost regions. The State receives over 70% of its annual rainfall during the southwest monsoon, which occurs from June to October. From 83 percent in the northernmost district of Kasaragode to 50 percent in the southernmost district of Thiruvananthapuram, monsoon rainfall as a proportion of annual rainfall declines from north to south. Northeast monsoon rainfall increases from north to south as a percentage of annual rainfall, ranging from 9% in Kasaragode, in the north, to 27% in Thiruvananthapuram, in the south. As the height of the Western Ghats declines, so does the amount of rainfall in the State. By around the first of June, the southwest monsoon begins to cover the State's southern regions, and by the fifth of June, it has covered the entire State. The rainy season are June and July, which together account for around 23% of the yearly rainfall. Distribution of Kerala's average and actual monthly rainfall during the past ten years.

4. Data

The past fifty years rainfall, temperature, humidity data collected from INDIAN METEOROLOGICAL DEPARTMENT (IMD). The data includes rainfall, temperature, humidity readings from fourteen stations within Kerala.

Table:4.1 Data was collected from the following weather stations

Station	Index Number
Thiruvananthapuram City	43371
Thiruvananthapuram Airport	43372
Punalur	43354
Alappuzha	43352
Kottayam	43355
Kochi Airport	43353
CIAL Kochi	43336
Vellanikkara	43357
Palakkad	43335
Karipur Airport	43320
Kozhikode City	43314
Kannur	43315

5. Data Analysis

5.1 Data Analysis Using MS Excel

The average value of relative humidity, maximum temperature, rainfall from fourteen different weather stations across Kerala was found out and this average value was analysed. Scatter graphs were plotted each parameter with time (number of days) on X axis and weather parameters on Y axis.

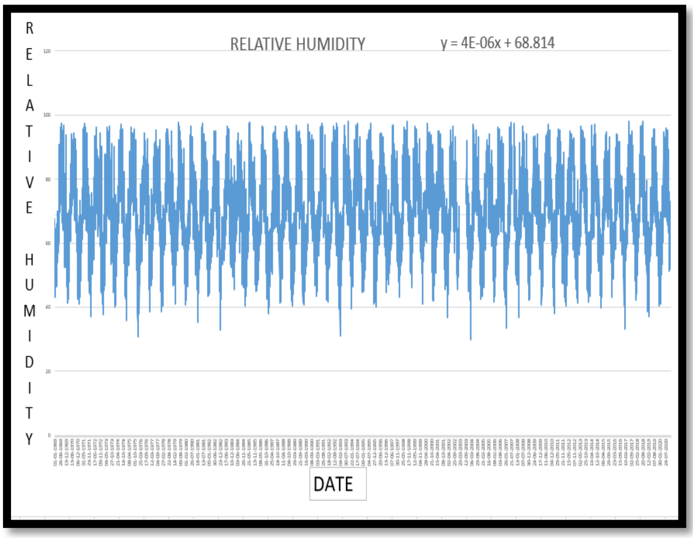


Fig.5.1.1 Relative humidity-time graph

The trend line of relative humidity-time graph indicates that there were only negligible variations in relative humidity in the past fifty years.

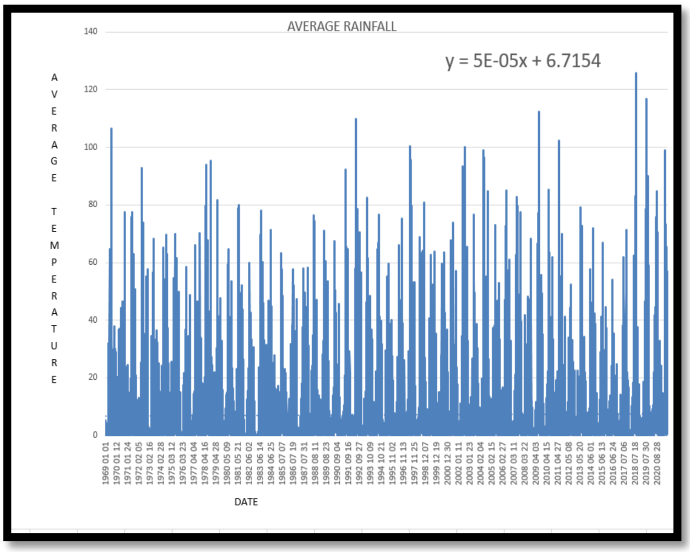


Fig 5.1.2 Rainfall-time graph

The trend line of rainfall-time graph indicates that there were only negligible variations in rainfall in the past fifty years.

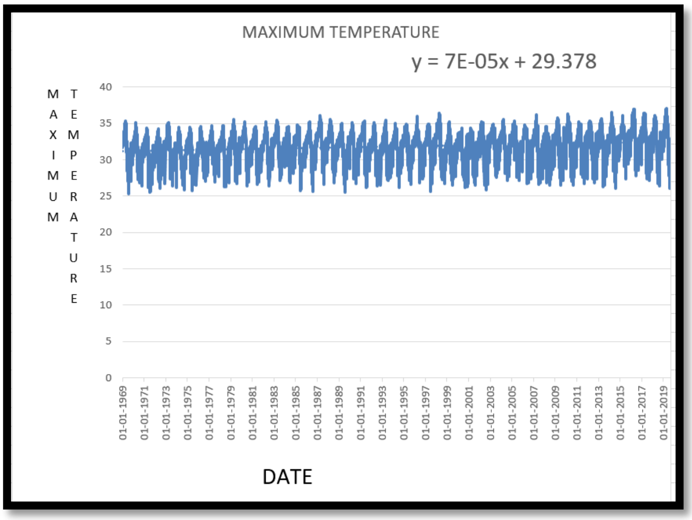


Fig 5.1.3 Maximum temperature-time graph

Trend line of maximum temperature-time graph indicates that there is was a gradual increase in maximum temperature in the past fifty years.

5.2 Data Analysis Using SPSS Software IBM SPSS V 22 SOFTWARE

For advanced statistical data analysis, many different types of researchers utilise SPSS, which stands for Statistical Package for the Social Sciences. It is simple to use and learn. Excellent charting, reporting, and presentation tools are provided by SPSS. Data sorted in MS Excel was applied as input to the SPSS Software. In this project, data was converted to suit our analysis. The given data consists of daily values, so monthly maximum for each year was taken for analysing the data, otherwise the analysis becomes meaningless as most of the values of the variable "AVERAGE RAINFALL" is zero. The data also contain missing values which can be compensated by filling those values with the previous values in the data. In this way, new dataset was prepared for SPSS analysis. Tools used for the analysis constitute linear regression, polynomial regression and multiple regressions.

5.3 INTERPRETATIONS

CORRELATION BETWEEN THE VARIABLES

Table 5.3.1 Correlation between the variables

Parameter	Variables	Rainfall	Humidity	Temperature
Rainfall	Pearson Correlation	1	0.799	-0.422
	Sig.(2-tailed)		0.000	.000
	N	632	624	632
Humidity	Pearson Correlation	0.799	1	-0.596
	Sig.(2-tailed)	0.000		0.000
	N	324	624	624
Temperature	Pearson Correlation	-0.422	-0.596	1
	Sig.(2-tailed)	0.000	0.000	
	N	632	624	632

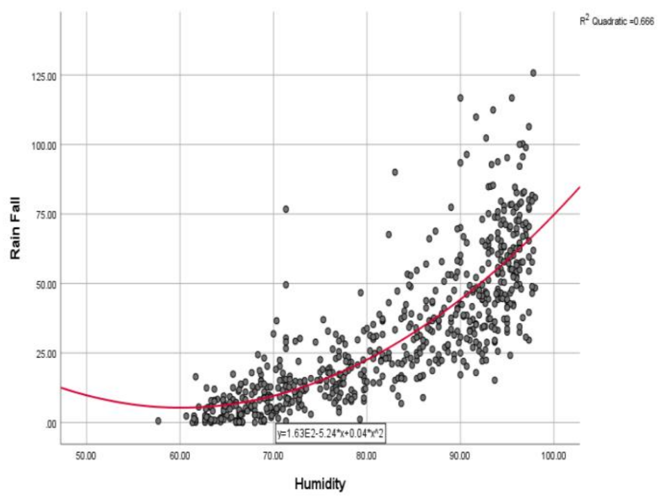


Fig 5.3.3 Scatter plot between rainfall and humidity

Model Summary Table

Multiple R value - 0.799 which is the correlation between relative humidity and average rainfall. This shows a positive correlation between the variables. R Square value - 0.666 which means that 66.6% change in average rainfall can be accounted by relative humidity.

ANOVA Table

Here the significance value is 0.000 which is less than 0.05. Hence, we can conclude that there is a significant impact of relative humidity on average rainfall. The regression equation is, $y = 1.63e2 - 5.24x + 0.04$.

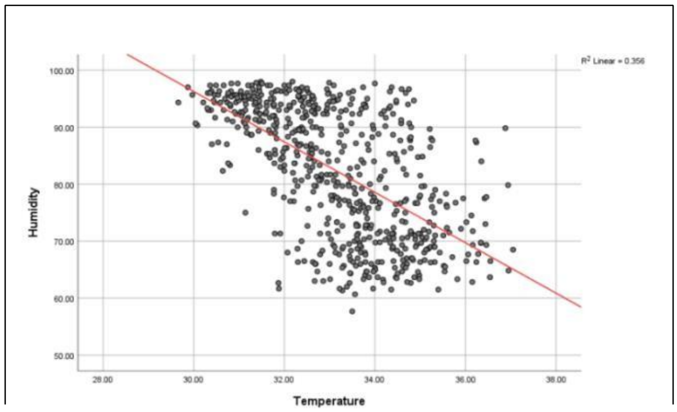


Fig 5.3.2 Scatter plot between temperature and humidity

Model Summary Table

Multiple R value - 0.596 which is the correlation between temperature and relative humidity. This shows a negative correlation between the variables. R Square value - 0.356 which means that 35.6% change in temperature can be accounted by relative humidity. The regression equation is,
$y = 2.29e2 - 4.42$.

ANOVA Table

Here the significant value is 0.000 which is less than 0.05. Hence, we can conclude that there is a significant impact of temperature on humidity

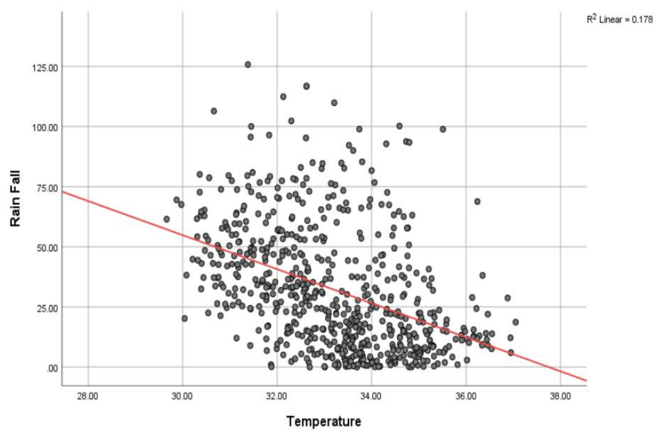


Fig 5.3.3 Scatter plot between temperature and rainfall

Model Summary Table

Multiple R value - 0.422 which is the correlation between temperature and average rainfall. This shows a negative correlation between the variables. R Square value - 0.178 which means that 17.8% change in temperature can be accounted by relative humidity.

The regression equation is, $y = 2.67e2 - 7.08\,x$

ANOVA Table

Here the significance value is 0.000 which is less than 0.05. Hence, we can conclude that there is a significant impact of temperature on average rainfall

6. RESULT AND MODELLING

To formulate an equation connecting temperature, humidity and rainfall based on statistical data. The regression equation connecting these three variables is, $y = -164.354 + 1.900h + 1.214$ where y is the average rainfall, h is the relative humidity and t is the maximum temperature.

Model Summary Table

R Square value - 0.642, which means that the predictors relative humidity and maximum temperature accounts for 64.2% of the variance in average rainfall.

ANOVA Table

Here the p-value is equal to 0.000 which is less than 0.05. Therefore, we can say that the regression model is significant. Here, (3, 621) = 557.111

Coefficients Table

Here, we are checking the p-value of the predictors. The p value of the coefficient humidity is 0.000 which is less than 0.05 as well as the p-value of temperature is 0.016 which is also less than 0.05. Therefore, we can say both humidity and temperature are significant predictors for average rainfall.

6.1 Validation

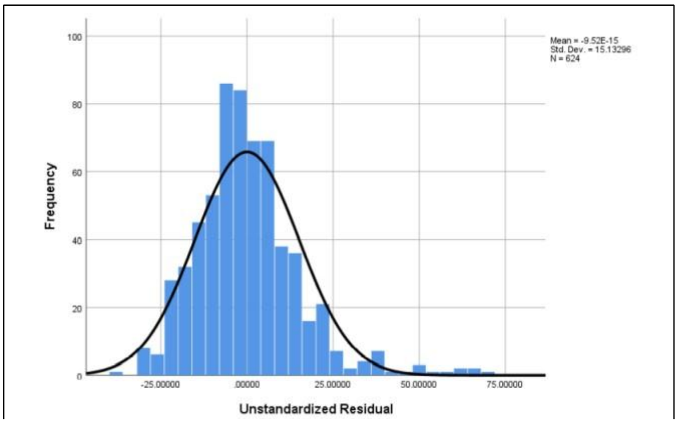


Fig 6.1.1 Histogram of residuals

From this histogram we can conclude that the residual values are concentrated near 0 more than expected. The graph shows a strict decline in frequency as the residual value changes from 0 which means that the predicted values are extremely good.

, T., Smale, D.A. and Thomsen, M.S., 2012. A decade of climate change experiments on marine Therefore, we can say that the equation best fits the data.

Table 6.1.1 Validation of average rainfall

YEAR	MONTHS	AVG RAINFALL (OBSERVED)	AVG RAINFALL (PREDICTED)
1969	6	57.43	56.06198
1974	6	17.16	45.24608
1979	6	81.68	62.4762
1984	6	71.26	53.2293
1989	6	71.09	58.46392
1994	6	66.93	57.29841
1999	6	62.72	57.27166
2004	6	96.42	46.54321
2009	6	66.47	52.97437
2014	6	42.41	48.50711
2019	6	46.41	53.5241
2020	6	44.57	55.33695

CONCLUSION

In this study we were able to establish a correlation between temperature, humidity and rainfall. Here, Trend line graph helps to analyse the future temperature variation. From this analysis it was found out that significant value of coefficient humidity is 0.00 and that of temperature is 0.016 both are less than 0.05, so we conclude that both humidity and temperature are the significant predictors of average rainfall. After validating the equation, it found out that it is 85% accurate, so we can use this equation for further prediction.

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