



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 4, April 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

 9940 572 462

 6381 907 438

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 www.ijirset.com

Impact of Global Warming on Net Claims: India

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ABSTRACT: Climate change is by far the most important issue of our time, and we are at a critical point. Weather events are becoming more extreme as average temperatures rise, making floods, fires, and heatwaves more devastating when they occur. Global warming is thus, altering the underlying risks of insurance. This paper studies the rise in the ambient temperature in India, using historical climate data and provides evidence for warming. It is aimed to find out the correlation between the major catastrophic events in the country and the Net Claims Incurred by the General Insurance sector.

KEYWORDS: Climate change, Global warming, Temperature, Insurance, Claims, Correlation.

I. INTRODUCTION

Global warming is the long-term heating of Earth's climate system observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere. [1]

India is already experiencing a warming climate. These shifts in temperature cause a chain reaction leading, directly or indirectly, to more frequent and destructive weather events, thereby putting more life and property at risk. Insurance is a contract in which an individual or entity receives financial protection or compensation from an insurance firm in case of losses covered under the insurance policy. An insurance claim is a formal request for this reimbursement. Life insurances do not cover accidental deaths caused due to natural calamities. Hence, the study considers all other insurances that do not fall under the umbrella of life insurance, namely General Insurance.

The trends in the mean temperatures seem to go hand in hand with the rising claims in India. This study aimed to find out the relationship between Net Incurred Claims and the following factors :

1. Mean Annual Temperature
2. Minimum Annual Temperature
3. Maximum Annual Temperature
4. Deaths caused by extreme weather events :
 1. Floods
 2. Earthquakes
 3. Cyclones
 4. Heatwaves
 5. Cold-waves
5. Land damage and cattle deaths

II. METHODOLOGY

The historical climate data is collected from multiple government websites [2],[3]. Net Incurred Claims are calculated on the basis of Incurred Claim Ratio and Net Earned Premium of General Insurance, Industry Total [4]. Data wrangling techniques were applied to eliminate multiple variables that did not fit the purpose of the study. It was then split into two parts according to the objectives. 1) To study the rate of warming, including 120 years of climate data. 2) Analysis involving Net incurred claims, considering 20 years of climatic data to meet the insurance data availability. The normality of the response variable, Net Incurred Claims was tested using the Shapiro-Wilk test in R-programming. After confirming the normality of the data, Karl Pearson's Correlation Coefficient was calculated between the dependent variable and the factors of interest. The significance of the coefficient was tested using T-test for correlation.



III. ANALYSIS I

Figures shows graphical representations of rise in Ambient temperature in India over the period 1901-2021. [2]

Fig. 1 shows a column chart plotting the mean annual temperatures throughout the country. The red trend line indicates a rising trend.

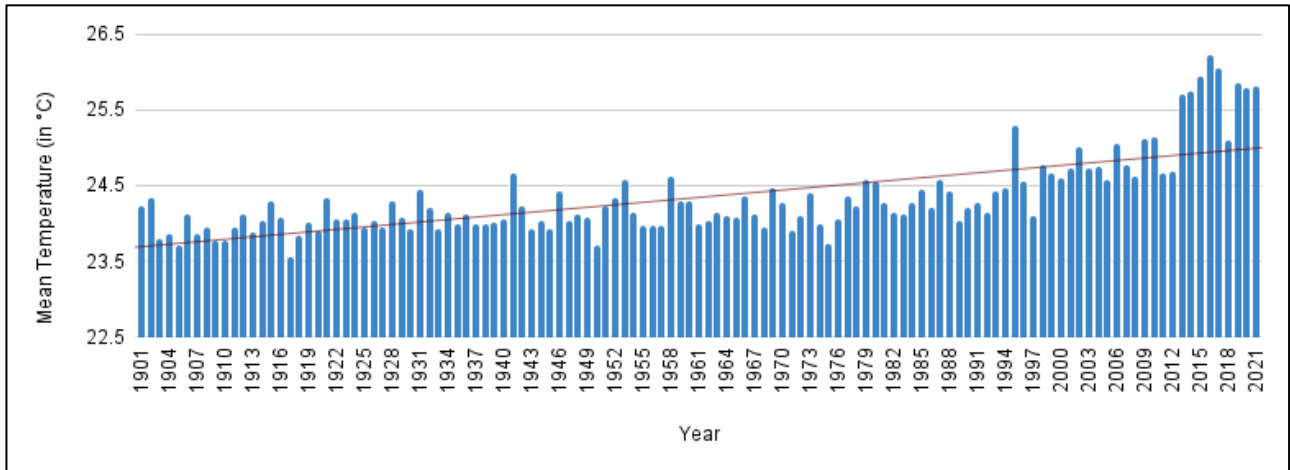


Figure 1. Mean annual temperature: 1901-2021

From the above data points, a decade-wise average was derived. The percentage change in temperature, over 12 decades is listed in Table 1.

Decade	1900-1910	1910-1920	1920-1930	1930-1940	1940-1950	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010
% Change	0.10	0.48	0.01	0.12	0.52	-0.36	0.18	0.31	1.08	1.29	2.91

Table 1. Decade-wise % change in mean Temperature.

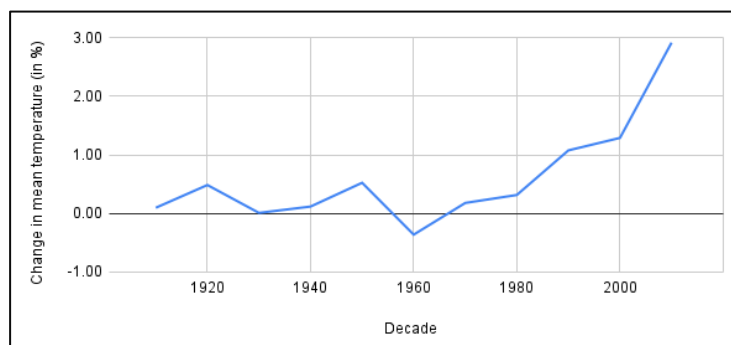


Figure 2. Decade-wise % change in mean Temperature

Fig 2. is plotted using the data listed in Table 1. It is a line chart that indicates the fluctuations in the mean temperature Kacross 12 decades. It can be observed that the last 4 decades, ie. 40 years. The rise in temperature in the last decade is particular high, compared to the rest of the temperature fluctuations.

This provides evidence that Global warming is not just a concept, but an increasing problem, especially in India.



IV. ANALYSIS II

This part of the paper studies the correlation between Net Incurred Claims and the factors mentioned in Table 2.(a), (b). The data collected involves climate-related data along with the Annual industry total for General Insurance. [3]

The Karl Pearson’s correlation coefficient is calculated after checking the normality of the data. The formula used to calculate the coefficient r, is given below[4].

$$\text{Correlation coefficient (r)} = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n \sum x^2 - (\sum x)^2] - [n \sum y^2 - (\sum y)^2]}}$$

Here, x: Explanatory variable
 y: Response variable (Net Incurred Claims)
 n: No. of observations = 20

A hypothesis test of the "significance of the correlation coefficient" was performed to decide whether the linear relationship in the sample data is strong enough to use to model the relationship in the population. The null and alternative hypothesis are as follows[5] :

H0: The population correlation coefficient IS NOT significantly different from zero. There IS NOT a significant linear relationship(correlation) between x and y in the population.

H1: The population correlation coefficient NOT significantly different from zero. There IS a significant linear relationship(correlation) between x and y in the population.

If the p-value obtained is less than the significance level α , we reject the null hypothesis.

For the purpose of the study, the correlation coefficient ‘r’, the test statistic ‘t’ and the p-value are calculated using Microsoft Excel and are listed in Table 2.(a), (b).

	Coefficient [r]	t	df	p-value
Min. Annual Temperature	0.73	4.54	19	0.00011
Max. Annual Temperature	0.77	4.85	19	0.00003
Mean Annual Temperature	0.72	4.40	19	0.00016

Table 2.(a)Correlation between Net Claims and Temperature.

Since the number of years under consideration is 20, the degrees of freedom for all factors is 19. Table 2.(a) shows the values or r and p-value for Temperature related factors. The confidence interval of 95% is selected for the study, ie. $\alpha = 0.05$.

All p-values in the table are less than 0.05. Hence, the minimum, maximum and annual mean temperature have a significant positive correlation with Net Incurred Claims. An increase in the temperature can thereby result in an increased in net incurred claims.

	Coefficient [r]	t	df	p-value
Heatwaves	0.52	2.56	19	0.00967
Floods	0.53	2.68	19	0.00738
Cold-waves	-0.23	0.68	19	0.25653
Cyclones	0.32	1.43	19	0.08483
Earthquakes	-0.05	0.21	19	0.41823
Crop damage (in Mha)	-0.06	0.25	19	0.40095
Cattle deaths	0.28	1.23	19	0.11774

Table 2.(b) Correlation between Net Claims and deaths by heatwaves, floods, cold-waves, cyclones, earthquakes, crop damage and cattle deaths



Considering the same level of significance and the same degrees of freedom, the values in Table 2.(b) indicate a positive correlation between deaths caused by Heatwaves and Floods. The correlation with the damage caused by all other factors considered is significant.

V. CONCLUSION

Global warming is a huge challenge for developing countries like India, as it is expected to have major health impacts, along with elevated climate risks. Climate risk is an underlying factor in any Insurance policy. The increasing damage associated with natural calamities has a positive correlation with Net Incurred Claims. These include deaths caused by floods and heatwaves. The rising surface temperature has a major impact the frequency and intensity of these weather events. Hence, all temperature related factors in the study show a strong positive relationship with Net Incurred claims. Since heatwaves and floods are both a result of the rising temperature, it is safe to conclude that Global warming is responsible for the rising trend in Net Incurred Claims.

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Impact Factor: 8.118



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