

Too hot to handle- Chennai as a cauldron of the climate crisis

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Temperatures recorded in the city over the past 75 years show the city has been warming at an unprecedented pace since the 1990s, and will be worrisomely warm by 2050

We are, undeniably, in the throes of a climate emergency. Extreme weather events, temperature rise and changes in the monsoon patterns regularly and unfailingly point to the direness of the climate crisis upon us. Government policy and action at the national and state level though, often belie the emergency we are in. Responses with respect to the climate crisis have ranged from being in denial to knee-jerk to tokenistic, and have been woefully inadequate when not willfully oblivious of the urgency.

Take the case of coal-based power generation. Despite energy being recognised as the largest sector-wise contributor of greenhouse gas emissions¹, coal- its most polluting source- will continue to be the primary source of power generation in the foreseeable future in India and in Tamil Nadu, with more power plants being proposed and built. In Tamil Nadu, plans are afoot to augment coal power generation capacity by 11,300 MW, apart from projects in progress with a combined capacity of 5,700 MW. That most of these projects are to be situated along the coast, which is already bearing the brunt of a rising sea, is more cause for climate concern.

The start of an effort towards meaningful action would be a stocktake of the situation to prime for an commensurate response. While there is data at a national and global scale to point to the multifanged impacts that Climate Change unleashes, such an analysis at a hyperlocal city-level has been scarce. Such a localised report is necessary, because the climate catastrophe- while impacting all- is inequitable in the extent of impacts it leaves. The severity of the impacts will vary largely on the geographical landscapes of the regions, besides socio-economic and other factors determining the impacted's ability to respond. This report is an effort in creating that data for the city of Chennai, using temperatures recorded over a 75 year period.

Why temperature rise is significant

Seen as an important marker of climate change, rise in surface temperatures are being witnessed worldwide. The international community set out to limit temperature rise to 1.5°C this century since the Industrial Revolution by way of the [Paris Agreement](#) in 2016. However, recent [projections](#) suggest that global temperatures could rise by nearly 4°C by 2100. India's climate vulnerability can be gauged by its up-ranking in the Global Climate Risk [Index](#), 2020. From being ranked 14 in 2017, in 2018, it rose to Position 5 in a ranking of the most climate change-impacted countries. Since 2004, India has experienced 11 of its 15 warmest years in recorded history (*Chapter III, Page 20, Global Climate Risk [Index](#), 2020*).

¹ <https://www.wri.org/blog/2018/08/numbers-new-emissions-data-quantify-indias-climate-challenge>

According to a [study](#) done by the Tamil Nadu State Land Use Research Board, about 144 sq km of land and almost 10 lakh lives in Chennai would be in danger if the sea level rises by 1 metre by 2050. According to recent [projections](#) by a US-based think tank Climate Central, seawater will reach large swathes of the city even by 2030, including popular city landmarks such as the Puratchi Thalaivar Dr. MG Ramachandran Central and Egmore Railway Stations, Secretariat and Ascendas IT Park.

As a coastal state, with 13 of its districts along the Bay of Bengal, Tamil Nadu's discourse on the climate crisis has largely been focussed on the rising sea level. This has been true for the city of Chennai as well. Hence, this study endeavours to document changes in temperatures recorded in the city in the recent decades. For this purpose, archival temperature from the airport weather observations [available](#) with the Iowa State University's Iowa Environmental Mesonet, has been used.

Observations

Unsurprisingly, a study of temperature entries confirmed what has been observed globally. That Chennai indeed is getting warmer by the year. Some of the insights observed are as follows:

1. The significant change in the temperatures recorded is the spike in the maximum temperatures recorded. Daily Maximum Temperatures have increased from 40°C to about 43°C between 1945 and 2019.

An increase in daily maximum temperature has been observed at the national level as well, as recorded in [India in a Warming World](#), edited by Navroz. K. Dubash (*Section I: Impact of Climate Change on India* by J Srinivasan). In a study of the temperatures recorded across 1,100 stations in India between 1901-2010, daily maximum temperatures were found to be increasing.

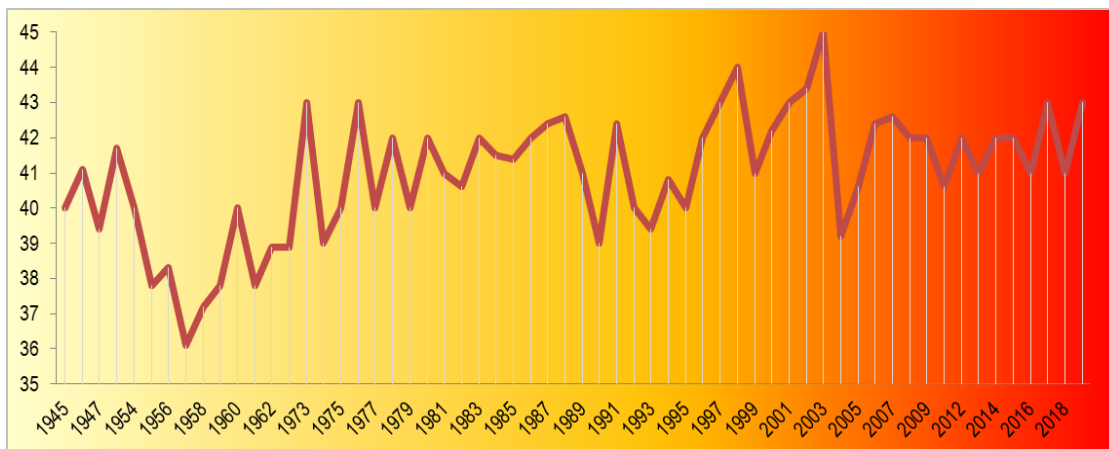


Figure 1: Maximum temperatures recorded (in °C) from 1945 to 2018

As a result, there have lately been more days with the mercury soaring over 40°C than before, as seen in *Figure 2*.

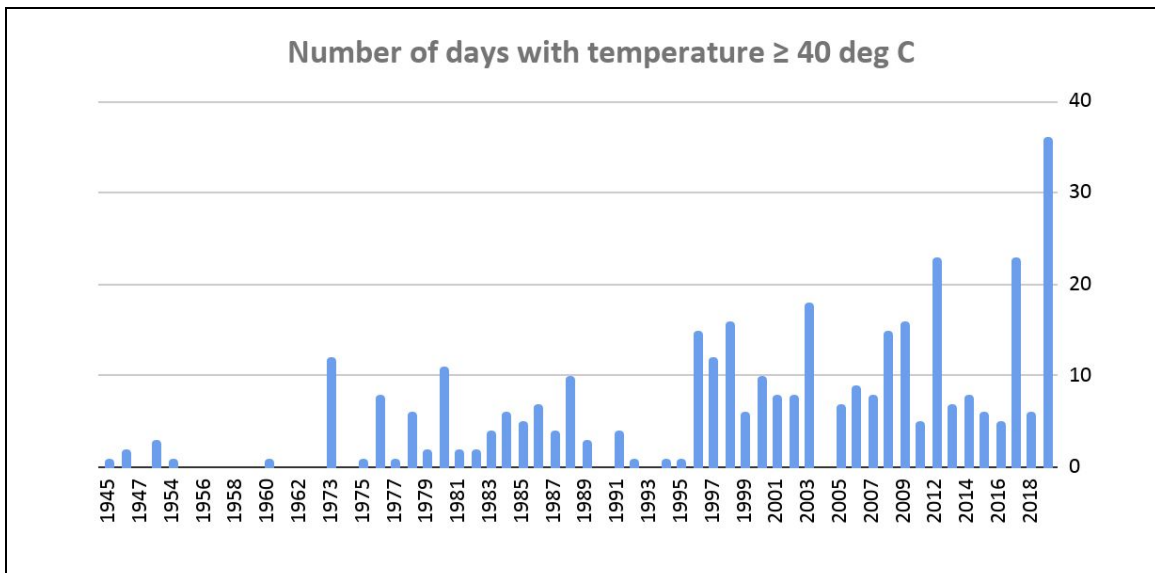


Figure 2: Number of days with a maximum temperature $\geq 40^{\circ}\text{C}$ from 1945

- While the maximum temperatures have been rising, the daily minimum temperatures have been reducing. The decrease has been gradual, from 20°C in 1945 to 19°C in 2019. This also points to a closing in of the temperature range recorded in a day. Interestingly though, this observation runs contrary to the trends for India in general recorded in the publication listed above, where daily minimum temperatures were increasing too, especially post 1980.

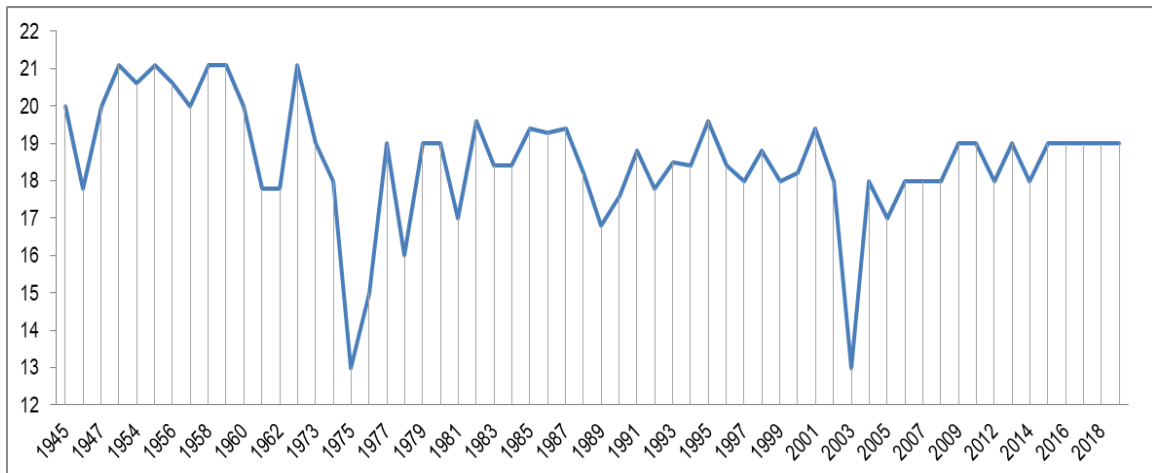


Figure 3: Minimum Temperatures recorded (in $^{\circ}\text{C}$) from 1945

- While global warming attributed to anthropogenic actions has been discussed since the 1970s, it was in 1990s that the issue gained traction, being mentioned in IPCC's First

Assessment Report of 1990. India, spurred on by the economic reforms ushered in 1991, saw the proliferation of polluting industries², and the development of the automobile sector, which led to higher greenhouse gas emissions. To meet the power demands for the mushrooming industries, India shored up its power generation capacity, driven largely by coal. The installed thermal coal capacity in the country rose from 43,379 MW in [1990-91](#) to 1,98,495 MW [currently](#).

These ‘developments’ led also to a steep increase in temperatures recorded from 1990, with every month recording a higher average temperature compared to the previous years (1945-90). The rate of change of temperature has been tenfold higher since 1991, compared to the period preceding it (1945-1990).

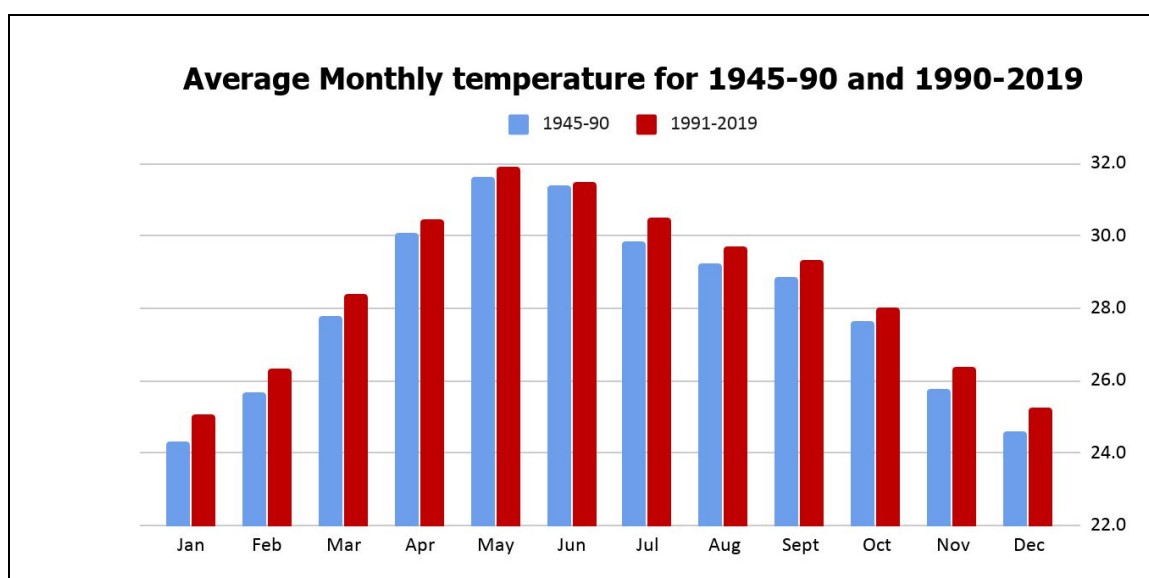


Figure 4: Average Monthly Temperature recorded in °C for the period 1945-90 and 1990-2019

To point to how drastic the change is, let us look at how the mean temperatures changed in the last 75 years, split at 1990. The mean temperature rose from 28.1°C in 1945 to 28.2°C in the first 45 years, while in the later 30 years, it rose from 28.3°C (1991) to 29.8°C (2019).

- Since 1990, there has been a marked spike in maximum temperatures in both the monsoon season (October- December) as well as summer (March-June). In all of these months, excepting October, there has been a rise in the minimum temperature as well. An increased frequency of outliers can be observed in the month of February and October, which seem to be recording lower minimum temperatures since 1990, compared to the previous years.

² Khan, Maria & Tarique, Md. (2017). [Environmental Impact of Industrial Liberalisation in India](#). 18-37. 10.9790/0837-2207151837.

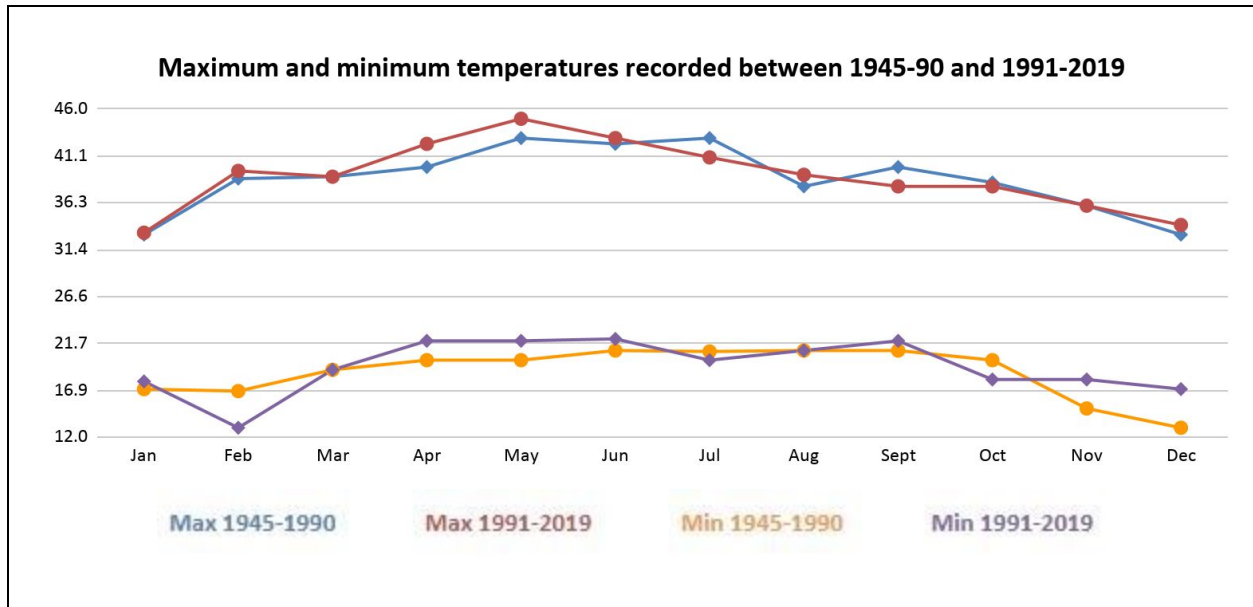


Figure 5: Maximum and minimum temperatures between 1945-90 and 1991-2019

Projections

As has been stated already, scrutiny of the temperature changes observed in the 75 year period point to an alarming increase in the temperatures recorded in the city. Can this historical data be used to project the temperatures likely in Chennai in the next couple of decades?

We attempted the same- Two scenarios have been considered for such projections. One, using the rate of change of temperature witnessed post 1990, and the other, halving the rate of change witnessed in that period.

Scenario 1: If we assume the rate of change of temperature to be consistent with what has been witnessed from 1991 to 2019, the city's mean temperature in 2050 would be 30.4°C, recording a 0.5°C increase from now.

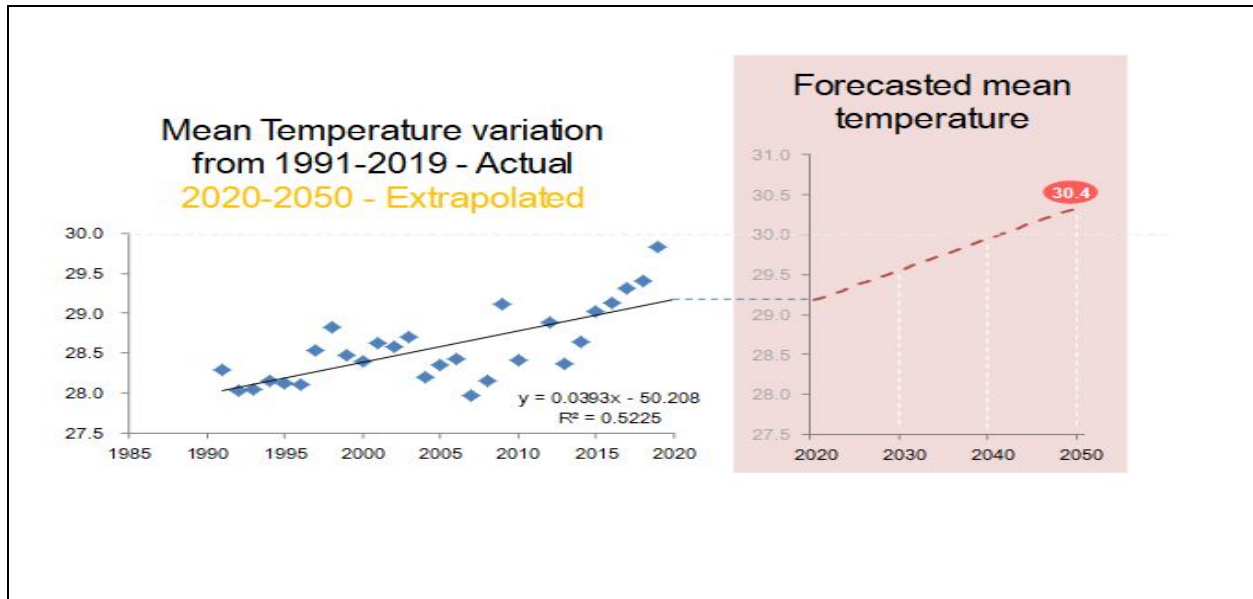


Figure 6: Mean temperature projection for 2050

Scenario 2:

As discussed earlier, the rate of change of temperature rose tenfold from 1991, compared to what had been observed between 1945-90. If we assume that 2020 turns out to be another landmark year like 1991, which saw a manifold jump in rate of temperature rise, Chennai would record a mean temperature of 41°C by 2050. To point to how drastic the change would be, we can look at the current mean temperature, which is at 29.8°C. The city in fact recorded only 36 days when the mercury soared over 40°C this year.

Conclusion

This data analysis confirms at a city-level what climate scientists have observed for long as a global trend- that the world is warming itself at a pace that is worrisome, and requires quick course correction for a livable future. The findings point to the urgency with which the state and local government has to plan to mitigate and adapt to the challenges that climate emergency poses. It should serve as a call for them to regulate sectors that contribute significantly to global warming- coal-based power generation, transport, industry and agriculture, and protect the carbon sinks such as forests, grassland, wetlands and other commons (poramboke).