Indian Temperature Scenario: “No Global Warming Trend”

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Abstract

Indian climate is highly variable in space and time. Temperature is a part of it. It is influenced by several localized and regionalized factors such as oceans/seas on three sides (South, East & West), mighty Himalayan Mountain Ranges in the North; other hill ranges such as Western Ghats, Water Resources, etc. They as such don’t contribute to trend in temperature. Some of these are changed by mankind to meet their needs & greed under increasing population. Human induced changes in terms of land use and land cover do contribute to trend in temperature but they are mostly localized or at the most regionalized changes only. These are clearly reflected in Indian temperatures. Several groups studied Indian temperatures using seasonal, annual & decadal of maximum, minimum & mean at station, state & country levels. One such study claims there is 1.2 °C/100 years increase in Indian annual average temperature; another major study showed the trends varying from < 0.0 to around 1.5 °C over different parts in India. In India on the northwest the Thar Desert and on the northeast humid zone form the major heat wave and the cold wave zones. South-central zones present dry areas with higher temperature regime. Scientific groups are not interested to talk on the local-regional-national level variations in the temperature that affect agriculture. Truly speaking there is no global warming as such in Indian temperature. One must remember the fact that the location data is affected by several localized factors. Thus local and regional and thus national averages give contradicting inferences.

Keywords: Global warming; climate change; heat & cold waves; heat & cold islands; climate system & general circulation patterns

Introduction

There has been a high-pitch “hue and cry” around the world on the so-called “global warming and its impacts”. This propaganda has been directly or indirectly affecting the national economies, agriculture and irrigation; and thus knowingly and unknowingly that has been affecting people below the poverty line around the world. Globally several agencies have been taking part in this mischievous propaganda in which some are showing graphs by manipulating historical temperature data series and some others doing the propaganda by spending huge sums. On both sides’ business houses, NGOs, Multinational Companies, International Agencies like UN Organizations, World Bank, IMF, etc. have been involved with vested interests. This is clearly reflected in USA President’s cancellation of funds to WHO a UN body. Politicians around the world became pawns in this game. They are not interested to talk on the local-regional-national level variations in climate that includes temperature that affect agriculture.

In this process, at COP-21 the target was fixed for global warming as 1.5 to 2.0 °C; and fixed for green fund as $100 billion per year for five years – COP-25 in Madrid in December 2019 failed in reaching an agreement to share the meagre collections and posted for COP-26 to be held in Glasgow in Scotland on 9-18th November 2020, which is now postponed to 2021 with Covid-19. With the USA government’s withdrawal from this group the funds flow has come down drastically; and thus pro-global warming groups started attacking Trump and his government left and right but Trump hasn’t changed his opinion/policy even an inch. At this stage those pro-global warming groups brought in a well-trained young Swedish Girl. To counter her, a German teenage girl was roped in. The Swedish girl has been making loud statements including attacking Trump, the US President and getting awards/rewards with no or little knowledge on the science of climate and the science of climate change, at least what the IPCC or UNFCCC or WMO said in their respective reports. For her it is global warming and carbon credits. Here she invariably uses the word “climate change” as de-facto “global warming”, as she is shy of using the word global warming. Sometimes the global warming groups using “human caused or induced climate change”. However, according to IPCC’s AR5 all that caused by humans is not global warming. Therefore, we must demand those pro-global warming groups, use the word “global warming” and not “climate change” as climate change is a vast subject and climate covers several meteorological parameters.
Historical temperature data series both for the land surfaces and the ocean surfaces are highly varied between space and time. Some organizations created temperature series by mutilating raw data series (even with satellite data series) to show that there is global warming and growing uninterruptedly. Figure 1 presents one such data series of global yearly temperature anomaly for 1880 to 2010 [1-5]. The data series were subjected to statistical analysis. It showed natural variability and as well trend.

Figure 1: Global mean annual temperature anomaly for 1880 to 2010.

Global yearly mean temperature anomaly of 1880 to 2010 presented 60 years cycle varying between -0.3 and +0.3 °C in Sine Curve cycle [1895 to 1925, 1925 to 1955, 1955 to 1985, 1985 to 2015, 2015 to 2045, etc., starting with − ; + ; - and + ; -]. In the natural cyclic pattern of 60-year also includes the irregular variations, such as intra-seasonal and intra-annual (Figure 1) variations, which are highly location specific. This pattern is also seen in Figure 2. Here one must be careful in the selection of data set, wherein the temperature trends coincide with ocean and solar TSI cyclical trends. Figure 2 overlays standardized ocean temperature indices (PDO + AMO) and Hoyt Schatten/Willson TSI and USHCN version 2 temperatures. A 60-year cycle is clearly shown, including the observed warming trend. The similarity with the ocean multi-decadal cycle phases also suggest the Sun plays a role in their oscillatory behavior [6].

The linear trend in (Figure 1) presents 0.6 °C per Century. This is a human induced trend but this trend is not global warming. According to IPCC (a) 1951 is the starting point for the global warming; (b) the trend consists of greenhouse effect part, which is more than half of the trend. Global warming is part of it and another part includes volcanic aerosols (non-human induced). If we consider 50% is global warming component of more than half of greenhouse part then it is 0.3 °C per century or 0.45 °C for 1951 to 2100. According to IPCC reports the climate sensitivity factor showed gradually decreasing trend of 1.95 to 1.55. That means the trend is not linear but it must be non-linearly decreasing trend; and thus global warming part for 1951 to 2100 is far less than 0.45 °C. This factor is far less than location specific & seasonal-specific diurnal and seasonal variations in temperature at any given location or region or nation. (c) The non-greenhouse effect forms the part of less than half. This is associated with ecological changes, known as land use and land cover changes. This includes urban-heat-island effect and rural-cold-island effect.

Indian Historical Temperature

Several scientific groups studied the time series of historical temperature over India. Some presented factual results and few others tried to link the results to global warming related trend. Let me present few of such results in brief at annual level, seasonal and diurnal levels.

Trends in Annual Temperature

Annual Climate Summary 2016 was brought out by India Meteorological Department (IMD)/Pune/India. The spatial distribution of annual mean temperature trends (°C/100 years) for the period 1901–2016 over India, as published by IMD is shown in (Figure 3) [7]. In this figure the values are shown as contour lines of trend. Trends significant at the 95% level are shaded, with positive trends shaded in red [0.5, 1.0 & 1.5 °C] and negative trends are shaded in blue; zero trends are shaded in white or blank. The authors claimed that the linear trend seen in this figure depicts significant warming over most of India but there are two regions of significant cooling, one to the east and one to the west in the region 23 °N to 26 °N. Also we can see no trend or zero trend zones conspicuously along the Western Ghats zone and north central and eastern zones in India. That means the annual average temperature during 1901 to 2016 has no uniform trend over the country as a whole but varied from region to region.

Centre for Science and Environment (CSE) a pro-global warming group [also uses climate change as de-facto global warming, like many others] released a report based on their study of data of 1901-2017 on the occasion of world environment day [5th June 2017] that India has increased in the annual mean temperature by 1.2 °C, which is quite different from that seen from IMD map (Figure 3). Very recently NASA released a map of temperature trend [in ranges represented by colour shades] for the globe. In this map, India showed practically zero-trend. However, there are large differences in trend patterns over different countries and regions. IMD Scientists brought out a manual showing the trends in temperature at state level. They showed zero trend in central India [including UP], negative trend around Punjab and positive trend in other areas [8]. From all these it is clear that there is no global warming trend but there is significant localized trends (both positive & negative).

Citation: Reddy SJ, Indian Temperature Scenario: “No Global Warming Trend”. Op Acc J Bio Sci & Res 1(1)-2020.
However, all these have no uniform impact at station level in space and time as they are changing with time. Unless these are clearly characterized, it is not possible to say red area in (Figure 3) is part of global warming.

**Trends in Seasonal & Diurnal Temperatures**

Figure 4 presents “Decadal surface temperature trends in India [7]. It presents the trend maps of India for three seasons [A (pre-monsoon) – April 1 to May 31; B (monsoon) – July 1 to September 30 & C (post-monsoon) – January 1 to March 31] and for (a) maximum temperature, (b) minimum temperature and (c) mean temperature using the data of 1901 to 1917. The decadal means of 2000 were compared with decadal means of 1950 – this refers to global warming.

(A) April 1 to May 31

(B) July 1 to September 30

(C) January 1 to March 31

Figure 4: Seasonal maximum, minimum & mean temperature Trend Maps of India.

Rose et al. [7] inferred a consistent pattern of warming over north-western and southern India, and a pattern of cooling in a broad zone over north-eastern parts and extending south-westward across central India. These patterns are explained by the presence of a large region of anthropogenic brown haze over India and adjacent ocean regions. These aerosols absorb solar radiation, leading to warming of the haze layer over north eastern and central India and to cooling of the surface air beneath. The heated air rises and then sinks to the north and south of the haze region over north western and southern India, warming the air by compression as it sinks in those regions. The possible impact of these temperature patterns on Indian agriculture is considered. However, this is not a factual reason and it also doesn’t contribute to temperature trend.

This is quite obvious from the climate system as defined by IPCC in its AR5: Thar Desert dry belt in the north-western parts, high-rainfall wet belt in the north-eastern parts. Also, western disturbances in summer and winter causing heat-waves and cold-waves affecting similarly as part of general circulation pattern over this part with high pressure belt located around Nagpur latitude [Tropic of Capricorn]. These were there in the past and will be there in the future over these parts of the country. It only define high and low temperature zones but not trend in temperature with the time.

India is surrounded by oceans on three sides [Indian Ocean to the south, Bay of Bengal to the east and Arabian Sea to the west] and mighty Himalayan Mountains on the north. Inland zones were occupied by Western Ghats and other mountain ranges; forests, Thar Desert in the northwest and humid-wet region in the northeast; rapid urbanization with unabated population growth; changes in agriculture [dry-land to wet-land; cropping pattern & intensity]; spread of water resources; etc. in the main land. This is reflected clearly in temperature regimes and associated trends. From (Figure 4), it is clear that the trend in temperature over India shows seasonal differences [summer, monsoon and winter], diurnal differences [in maximum & minimum temperatures]. All these in turn showed large differences with north to south and west to east. To prove that there is a global warming phenomenon in Indian temperature, there must be increasing trend in temperature irrespective of the region. However, this is not seen in the Indian temperature over different parts of the country.

Also, urban-heat-island affect and rural-cold-island affects play major role as they are part of non-emission and non-greenhouse effect part of human induced trend but associated with changes in land use and land cover. Unfortunately in India these are not quantified but we indirectly infer based on the land-use and land-cover changes over years. [1] Presented the land use change in Washington D.C. and urban heat-island in California. In India there are large changes in dry-land to wet-land agriculture and spread of water resources over the last 70 years. All these contribute to trend in temperature [positively or negatively]. These are primarily defined by changes in greenbelt – forests & agriculture – [positive or negative] and spread of water resources – rivers, tanks & dams – [positive or negative]. In the temperature network in cold-island-effect part sparsely distributed and thus it under-emphasised in the temperature averaging. Temperature network is highly concentrated in urban areas and thus heat-island effect is over emphasised in the temperature averaging. These patterns reveal the fact that the temperature regimes
over different parts of the country have been influenced by the land use and land cover changes, changes in climate system and changes in general circulation patterns. Thus, at individual station levels the temperature is influenced by several localized factors such as:

- Changes in Climate System [as defined by IPCC in its AR5], such as destruction of Western Ghats, Himalayan Ranges; coastal zones; etc.
- Changes in General Circulation Patterns associated with western disturbances (heat waves & cold waves)); cyclonic disturbances, etc.
- Changes in land use and land cover associated with urban-heat-island & rural-cold-island effects with the high population growth and the associated growth of urbanization and irrigated agriculture (crops and cropping pattern, crop intensity, water spread areas, etc.); destruction of forests and hills/vegetation; etc.
- Mining activities, roads network [railways, buses, etc.], etc.

**Practical Issues**

![Figure 5a: Standard deviation of daily maximum temperature during March to June 1982 to 2013 over India.](image1)

**Heat & Cold Waves:** (Figure 5a) presents the standard deviation of daily maximum temperature, from March to June over the years 1982–2013, shows large values extending from northwest to central India apart from the east coast regions. Interestingly, the temperature anomalies during some of the recent heat waves also show large positive departures in those regions. That means, year to year variations are high with reference climate conditions in a given year. This is natural irregular part. (Figure 5b) presents the spatial distribution of heat-waves over India [9]. However they vary with year to year & region to region based on the position of the high pressure belt around Nagpur zone [10] and circulation patterns in Bay of Bengal and Arabian Sea. They present high year to year & region to region variations. They don’t contribute to trend in temperature. This is natural irregular part. From these results it is clear that the zone of high maximum temperature is not really associated with heat-wave zone wherein humidity plays the major role.

Wet-bulb temperature provides the information on the perceptible-water in the entire column of the atmosphere at a given point [11]. The wet-bulb temperature thus is an integrated function of temperature and relative humidity at the ground level, a human comfort factor. Higher the value of wet-bulb temperature, higher will be the heat stress – heat wave condition. The spatial distribution of wet-bulb temperature was presented by Reddy [12] over India. During the southwest monsoon season (July) higher values of wet-bulb temperature were seen over north-eastern parts of India (comparatively higher over Bihar region). The highest isotherm of 28°C (in July) is passing through Bihar and UP, which is the region where frequent heat wave conditions existed in this season. According to this study the high heat waves zones are towards north-eastern parts [exception to hilly tracts] surrounding Bihar and east coast. This is also seen in (Table 1), which presents state-wise number of heat & cold waves during 1911 to 1999 & 1901 to 1999, respectively in India [13]. IMD identified Core Heat wave Zone (CHZ) that spans over Punjab, Himachal Pradesh, Uttarakhand, Delhi, Haryana, Rajasthan Uttar Pradesh, Gujarat, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, West Bengal, Odisha, Telangana and meteorological sub-divisions of Madhya Maharashtra, Marathwada and coastal Andhra Pradesh.

**Table 1:** State-wise number of heat & cold waves in India during 1910-99 & 1901-99.

| State | Number Heat Cold Waves Number | State | Number Heat Cold Number |
|-------|--------------------------------|-------|-------------------------|
| WB    | 61 47                          | Bihar | 113 109                 |
| HP    | 1 22                           | J&K   | -- 211                  |
| MP    | 99 116                         | AP    | 51 2                    |
| Assam | 24 2                           | TN    | 3 --                    |
| TN    |                                 | RS    | 3 --                    |

Cold-waves follow the western disturbance patterns in any given year. The Highest number of cold waves recorded during 1901 to 1999 over India was recorded in J&K and next followed in descending order are Rajasthan, UP, MP, Bihar, Gujarat, Maharashtra, etc.

**Land use & Land cover changes:** Figure 6 presents major crop areas in India. This shows major irrigated and rain-fed zones wherein temperatures are lower and higher. This reflects in the mean temperature zones trends [8]. The summer or pre-monsoon high mean temperature zones are clearly reflected in Figure 6 on

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western side from north to south – low rainfall zone with low irrigation potential. Low mean temperature zone on the central-eastern zones with high irrigated agriculture zone.

**Summary and Discussion**

Using Indian temperature data series at station level, state level, seasonal level, diurnal level studies were carried out by several scientific groups to understand the trend. One study by CSE reported a trend of 1.2 °C during 1901 to 2017 in annual mean temperature over India. However, this is not seen in IMD map of annual mean temperature trend. It presented quite different patterns over different parts of India. [7] Study presented large variations in trend in-terms of seasons [summer, monsoon & winter], in terms of diurnal [maximum & minimum temperature], & in-terms of north to south and west to east. Though India has 2.3% of the global land area with 4.6% of water resources, 18% of the world population live on these. As a result there has been large drastic changes in land use and land cover and thus introduced urban-heat-island effect [warming trend] and rural-cold-island effect [cooling effect]. Also, the Thar Desert in the northwest present’s heat zone with less heat waves impact and with cold-humid zone in northeast presents severe heat wave zone. [7] Tried in their study to attribute the warming and cooling trends over different parts of India in the decadal-mean temperature to the presence of a large region of brownish haze that is found over most of the North Indian Ocean and South Asia, particularly in the winter and spring months. It is not correct as we are talking on trend of global warming. Warm and cool zones follow the changes in “Climate System” as defined by IPCC in ARS and associated changes in General Circulation Patterns in summer, monsoon and winter seasons. Finally, it is clear that in India as such there is no uniformity in trend in historical temperature series. Therefore, instead of blindly believing global warming projections by various national and international scientific groups, study the local and regional patterns to have successful adaptation of agriculture to that location and region.

Concluding Remark: If the selected data set forms part of truncated set of a systematic variation data series it gives misleading conclusions. Therefore one must be careful while selecting data series. Also, the trend is biased by the starting and ending year/decade/period. This can be seen from (Figure 1). The decadal average rainfall of all-India Southwest Monsoon presents a simple example [14]. Here the rainfall presents 60-year cyclic pattern, see below:

**Decadal average of all-India Southwest Monsoon Rainfall, mm**

| Period     | Rainfall | Period     | Rainfall | Period     | Rainfall |
|------------|----------|------------|----------|------------|----------|
| 1871-80    | 850.1    | 1881-90    | 881.8    | 1891-00    | 865.9    |
| 1901-10    | 822.7    | 1911-20    | 821.7    | 1921-30    | 837.6    |
| 1931-40    | 871.7    | 1941-50    | 889.1    | 1951-60    | 871.7    |

Bold = bell-shape and non-bold = inverted bell-shape

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