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Research Article

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Impacts of WCCC on Sustainable Agriculture & Food Security [Part-I: Weather-Climate-Climate Chang [WCCC] w.r.t. Agriculture]

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Abstract

People of all-walks of life including United Nations; and its Organizations & Agencies have been using the word "Climate Change" like a "Blind Man" using a "Light Pole". We see hundreds and thousands of articles/reports every other day in print media around the world with the word "Climate Change" as an adjective with zero relevance and quoting the references of IPCC. In food security quantity of production is the primary component that links to weather/climate – climate change. Reports suggest that global warming, a fictitious index referred to as climate change and said causing 4 to 6% yield reduction but this is insignificant when compared to food waste of 30-50%. Food production relates to changes in local and regional weather conditions that take in to account the natural rhythmic variations in rainfall, the principal component of climate change; but not to global average weather conditions. These are discussed in Part-I.

Keywords: *Food Security; Weather; Climate; Climate Change; Quantity of food*

Introduction

The issue is divided in to two parts wherein Part-I deals "Weather-Climate-Climate Chang [WCCC] with respect to [w.r.t.] Agriculture" and Part-II deals "Sustainable Agriculture vs Food Security". This forms the Part-I.

Quote: *"Climate Change is Driving 2022 Extreme Heat and Flooding – Scientists have hard time figuring out how Climate Change affects the Drought"???*

Reports argued that rising temperature increase extreme rainfall. The fact is deserts record high temperatures and yet it is dry. Wildfires are primarily caused by humans intentionally by putting on fire and as it is dry it spreads fast to the neighbouring areas with the wind – this we generally call it as wildfires. In higher latitudes these are caused in addition by oil spills or top soil chemical reactions, etc.

The word "Climate change" is used as de-facto global warming, a fictitious word, which is nothing but an average which is controlled by changes at local/regional levels which have no role at global scale; and the global average has no role at local/regional level like normal value. World has been running around this word by wasting trillions of dollars each year.

With the sophisticated computers entry, science of climate and climate change shifted to hypothetical time pass research. In the past we carried out research with even no calculators in 70s and computers with 256 kb by writing our own programmes in Fortran IV & C+ languages in 80s.

I evolved a thumb rule during 1970's as an Agroclimatologist at ICRISAT to forecast occurrence or non-occurrence of rainfall for Patancheru Research Farm/Hyderabad city surroundings. This has scientific basis. According to this around Hyderabad surroundings will be dry when a low pressure system forms around Kolkata or vice-versa.

Brief on Indian Rainfall, Temperature, Few Others

Introduction

In this section presented in brief few basic components of weather-climate and climate change [WCCC] to help discussions in Part-II like rainfall, temperature, greenhouse gases, global solar radiation and net radiation intensities, soil types.

Rainfall

[1] All India Annual Rainfall [June to May for 1871/72 to 2014/15] presented 60-year cycle [same was the case with Southwest Monsoon Rainfall – June to September] -- Reddy (2000) presented this and later elaborated (Reddy, 1993, 2011, 2017, 2019a,b&c).Water flows in Godavari River, frequency of occurrence of severe floods in northwest Indian Rivers [Chenab, Ravi, Beas] and water flows in Brahmaputra River followed this cyclic pattern; Thus droughts and floods are part of the 60-year cycle – this followed the 60 year cycle in the Telugu Calendar [Prabhava, Vibhava, ---] – Chinese Astrological 60 year cycle lagged by three years to this. Southern Oscillation impacts the individual years droughts & floods: during El Nino years the rainfall varied between deficit – below normal -- normal; during La Nina years the rainfall varied between normal – above normal – excess; and in majority of the years they come under neutral wherein rainfall varied between deficit – normal – excess (Reddy, 2022a, b, & c).

[2] Andhra Pradesh [undivided] Annual Average Rainfall [January to December 1871 to 2000] presented 132 year cycle; and Krishna River water flows followed this cycle (Reddy, 1993, 2000, 2007 & 2016, 2017, 2018, 2019a&b, 2021). This region is influenced by the both Northeast & Southwest Monsoons and as well by Cyclonic Activity primarily in Bay of Bengal: The Southwest Monsoon Rainfall presented 56 year cycle and cyclonic activity followed this cycle; and Northeast Monsoon Rainfall also followed this cycle but presented exactly opposite pattern – above average to below average as below average to above average. Onset of Southwest Monsoon over the Kerala Coast presented a 52 year cycle (Reddy, 1977). The same was observed in Fortaleza Annual Rainfall in Northeast Brazil (Reddy, 1984) at around the same latitude belt in the Southern Hemisphere.

Temperature

Indian temperature regime showed urban-heat-island effect and rural cold-island effects in association with changes in land use and land cover (Reddy, 2020). Rural-Cold-Island Effect is seen over Punjab and the surrounding areas wherein presented decreasing trend in temperature due to changing dry-land to wet-land or dry to wet. This is part of greenhouse [water vapour] effect. This is part of natural phenomenon. Urban-Heat-Island Effect presented increasing trend in night temperatures in urban India – same is also seen in China –. This contributes to increasing trend in average temperature. This is not part of greenhouse effect but it is part of formation of temperature inversions [temperature increases with the height] due to air pollution in winter. Western Ghats Zones with the destruction of greenery the wet conditions changed to dry conditions and thus presented increasing trend in temperature. This is part of greenhouse [water vapour] effect. This is part of natural phenomenon but it is reverse function of cold-island effect. Renewable Energy systems: The solar panels and wind-turbines create artificial heat in the surrounding areas with advection activity. Heat & Cold Waves: India presents a typical pattern, namely Western Disturbances part of general circulation (Reddy & Rao, 1978), known as summer heat waves and winter cold waves. However, they vary with year to year place to place based on the systems in Arabian Sea or Bay of Bengal. However, this is part of average conditions. They stay only for few days at many places. De, et al. (2005) presented extreme events in 100 years.

Greenhouse gases

Carbon dioxide (CO_2) is the most commonly addressed greenhouse gas, and its atmospheric concentration is measured by parts per million (ppm). Methane (CH_4) and nitrous oxide (N_2O) are also form part of it measured by parts per billion (ppb). Carbon dioxide: 418.81ppm = 150% of preindustrial levels; Methane: 1889±2 ppb = 262% of preindustrial levels; & Nitrous oxide: 333.2±0.1 ppb = 123% of pre-industrial levels. But the primary greenhouse gas in the atmosphere is water vapour (H_2O). This change with land use and land cover changes. This forms the non-greenhouse effect part of human induced trend part. These gases have different resident times [life] in the atmosphere that plays important role on cumulative impact; Though water vapour has lesser residence time [about 9 days] it has 36-72% contribution [that includes cloud cover] and thus changes temperature accordingly as here no cumulative effect; Carbon Dioxide with longer residence time [around1000 years] -- this has cumulative effect -- it has 9-26% contribution, which is questionable as so far Climate Sensitivity Factor was not defined that relates increase in carbon dioxide contributing to rise in temperature; Methane has less resident time [less than 50 years] it has 4-9% contribution; and Nitrous Oxide has around 100 days resident time and Ozone has variable life times but contributes little on long term as the cumulative effect is short lived.

Except in the case of water vapour, other greenhouse gases impact on temperature was not proved so far. The Climate Sensitivity Factor that links these gases with increase in temperature was not quantitatively proved except followed "Trial & Error" method; a report observed that water vapour showed an increasing trend in the atmosphere at Boulder, Colorado (Figure I.1). This presents decreasing trend in temperature like in the case of Punjab and its surroundings in India.

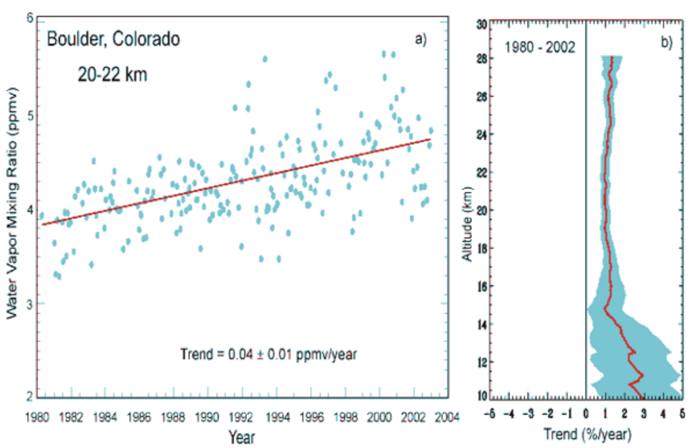

Figure 1: *Increasing water vapour in the atmosphere at Boulder, Colorado at 20-22 km height during 1980-2002.*

Reddy (1976 a&b) found a relationship with total water vapour in the atmosphere with wet bulb temperature at the surface; Wet bulb temperature presented in turn a relationship with dry bulb temperature and relative humidity; That means with increasing humidity conditions the temperature comes down and vice versa – which was observed around Punjab and Western Ghats in India as explained above; Carbon Dioxide showed a nearly linear increase with the time (Figure I.2a) and Population (Figure I.2b) -- By reducing population growth this can be controlled partly; Methane, Nitrous Oxide, Ozone, etc. have short lifespan in the atmosphere and also they have no direct impact on temperature.

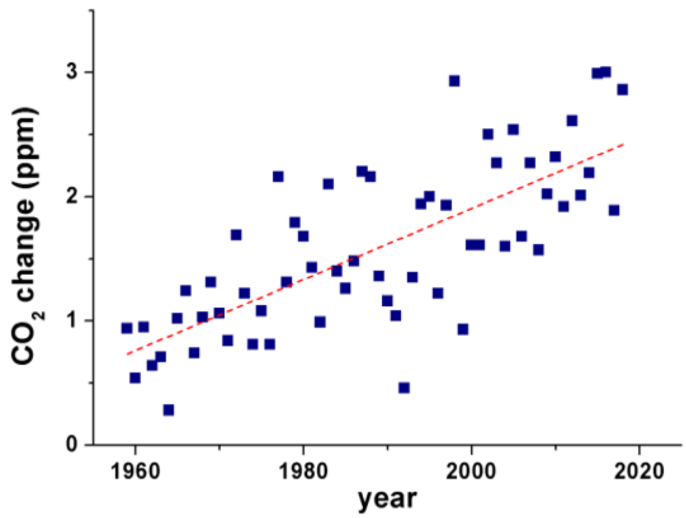

Figure 2a: *Recent year-to-year increase of atmospheric CO_2.*

According to Silicon India dated 16 June 2022 says that "Despite the promise of a worldwide green recovery in the wake of the Covid-19 pandemic, this historic opportunity has been lost, but India ranked third globally for total renewable power capacity additions with 15.4 GW in 2021, following only China (136 GW) and the US (43 GW)". According to the report, India added 843 MW of hydropower capacity in 2021, raising the total capacity to 45.3 GW. India ranked third globally for the total installed capacity of wind power (40.1 GW), behind China, the US and Germany. The 2022 report, state that the overall share of renewables in the world's final energy consumption has stagnated -- rising only minimally from 10.6% in 2009 to 11.7% in 2019 -- and the global shift of the energy system to renewables is not happening. In heating and cooling, the renewable share in final energy consumption increased from 8.9% in 2009 to 11.2% in 2019.

Big money business: Grantham Research Institute on Climate Change and Environment at London School of Economics and Political Sciences claim that litigations against fossil fuel industry increasing around the world – a big rich business to judicial entrepreneurs, especially since the Paris Agreement in 2015. Nearly 500 litigations cases filed around the world since 2020, more than double to those filed between 1986 to 2014; 475 cases 1st January 2020 to May 31st 2022. The reality is such litigations themselves causing huge carbon dioxide emissions around the world.

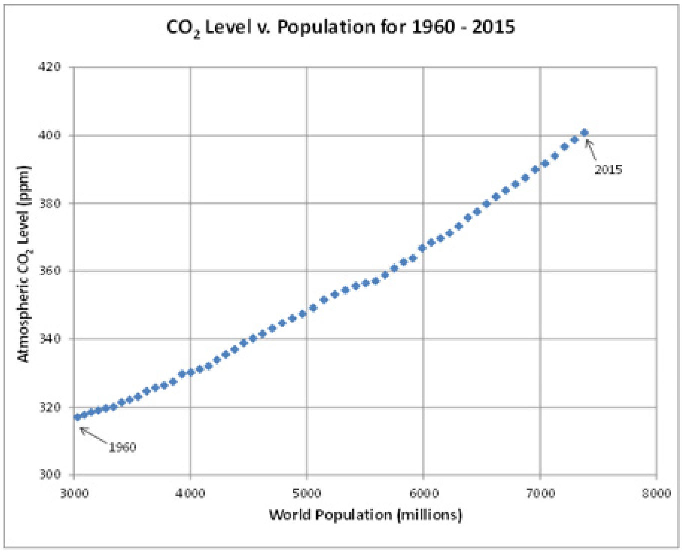

Figure 2b: *Growth of Carbon Dioxide with Population.*

Global Solar Radiation & Net Radiation Intensities

Reddy, et al. (1977) found global/total solar radiation reaching the ground and net (balance at the ground) radiation intensities following the sunspot cycle and its multiples. Reddy (1974) found a relationship between total cloud cover and sunshine hours and that in turn presented relationship with global solar and net radiation intensities. Reddy (1987) presented that cube root of rainfall is a function of global solar radiation and net radiation.

Local scale: That means relative humidity plays an important role on ground level temperature; Regional scale: natural variability in rainfall plays important role on ground level temperature; Global scale: sunspot cycle plays important role on ground level temperature as it presents natural variability [11, 22 & 44 year cycles] that affect the Global solar and net radiation intensities; Global scale: Southern Oscillation presents the changes in in rainfall and thus temperature.

Soil Types

Table I.1 presents the temperature regimes of three adjacent districts in the State of Andhra Pradesh in India under three soil types, namely Anantapur – Alfisols, Kurnool – medium soils & Kadapa – Black soils.

The average temperature at any given point is the sum and total of such factors. The global average of that has no relevance at local and regional levels. We need to study them in detail at that location or region for application in agriculture.

Station/Soil	Temperature, °C					
	Annual		Month		Day	
	Ma	Mi	H	L	H	L
Anantapur/Alfisols	33.3	21.9	41.4	13.2	42.2	12.2
Kurnool/medium	34.0	22.1	43.1	11.2	45.6	06.7
Kadapa/Vertisolsl	34.5	24.0	43.5	15.0	46.1	10.6

Table 1: *Variations in temperature regimes under 3 soil types.*

Annual = average of 30 years; Ma = maximum, Mi = Minimum, H = average of the highest month or day & L = the average of the lowest month or day in 30 years; Source: "1931-60, IMD Normal Book"

Weather-Climate-Climate Change [WCCC]

Agriculture point of view the two most important meteorological parameters are rainfall and temperature. However, in tropical countries as temperature is not a limiting factor for crop growth, rainfall is the principal factor. Let us see the rainfall patterns at all-India and AP met sub-divisions levels (Table I.2): The temporal variations at a station or region or country present either trend or cyclic variations or both. In temperature both are present but in rainfall only cyclic variation is present with zero trends. This comes under climate change. The variations shown in Table I.2 are not part of climate change but they form part of Normal book for 1931-60. They may be different for 1961-90 normal Book and 1991-2020 normal Book. In fact many researchers use them as climate change in their interpretations but they refer to climate specified 30 years period only. Weather and climate form part of climate shocks or weather aberrations.

Figure I.3 presents an example of drought under climate change condition. This figure presents variation with the time (a) starting of planting rains (S), week number and (b) growing period from the planting rains week (G) in weeks. They present a cyclic variation [56-year cycle]. This helps long term agriculture planning at that location (Kurnool in AP). In this figure G less than or equal to 5 weeks form drought years. The average of such years is drought index-risk for the location. (45% of years); but it increased to 70% of the years during below the average cycle pattern period and reduced to 30% of the years during above the average cycle pattern period. This issue was discussed by Reddy (1993) for different countries.

Region	Parameter	SWM	NEM	Annual
All-India	Mean, mm	852(78)	120(11)	1090(100)
	C.V., %	9.9	29.0	19.5
	The Highest	1020(120)	210	1348(124)
	The Lowest	604(71)	50	811(74)
Coastal Andhra	Mean, mm	507(42)	375(39)	971(100)
	C.V, %	22.2	38.8	19.8
	The Highest	780(154)	703	1501(155)
	The Lowest	309(61)	88	532(55)
Rayalaseema	Mean, mm	422(60)	204(29)	709(100)
	C.V., %	28.8	41.9	21.6
	The Highest	791(187)	455	1228(173)
	The Lowest	192(46)	12	226(32)
Telangana	Mean, mm	722(80)	107(12)	899(100)
	C.V, %	23.5	60.3	21.7
	The Highest	1186(164)	310	1485(165)
	The Lowest	371(51)	02	489(54)

Table 2: *Rainfall patterns at all-India and AP met sub-divisions levels.*

SWM = Southwest Monsoon, NEM = Northeast Monsoon; C.V. = Coefficient of Variation; The values in the brockets in the case of mean column refers to % annual value; in the case of the highest and the lowest columns refer to % of mean;

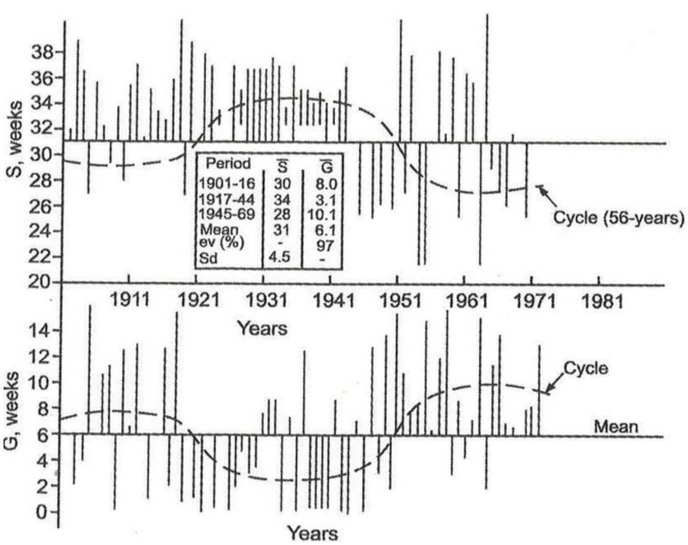

Figure 3: *Variation of date of planting rains (S) and growing period (G) in weeks and their variation with 56-year cycle for Kurnool in in AP.*

Figures I.4 & I.5 respectively presents the drought proneness map of India and Maharashtra (Reddy, 2021). This is average condition but differ for above and below the average parts of the cycle. However, they need to be assessed based on whether that location comes under 60-year cycle [All India] or 56 year cycle [undivided AP]. Figures I.4 & I.5 is not affected as they refer to average conditions. Rao, et al. (2013) presented elaborate study and presented an Atlas on "Vulnerability of Indian Agriculture to Climate Change". The study has not really studied the climate change but used it as an adjective. It also presented a map of drought proneness showing except coastal Gujarat, all parts of India present less than 25% but in Figure I.4 & I.5 they reach as high as 60% in the eastern side of Western Ghats [shadow zone covering Anantapur – Bellay – Sangly belt].

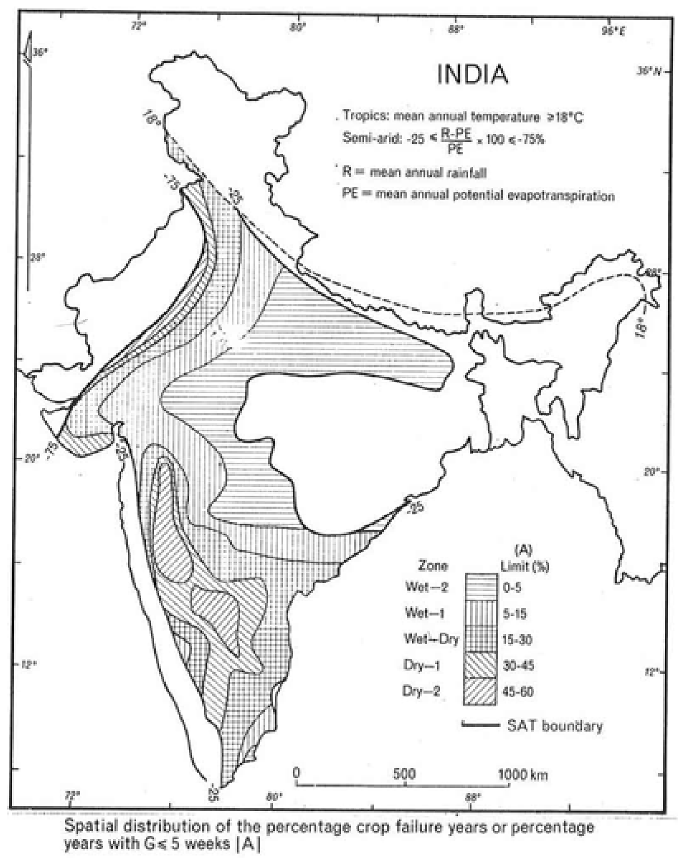

Figure 4: *Drought proneness map of India.*

In conclusion

The two natural resources that are vital for agriculture are soil and climate. Man has no control as yet over the later and needs to adapt to it. The nature of climate is sometimes complicated because of the wide range of Ecological and Topographical diversities and hence requires in-depth studies to develop such adoptive measures. This is one of the challenging areas of Agrometeorology & Agroclimatology (Reddy, 1993, 2002 & 2021). These issues are briefly presented in the above two sections. Climate is nothing but sum and total of weather.

Weather & Climate are highly variable in both space and time. In tropical areas temperature is not a limiting factor but in middle latitudes it is so as growing season is limited by onset and withdrawal of the winter that define the availability of growing season; and in that growing season the available degree-days. Thus, in agriculture weather is the primary driving force while climate presents the choice-selection-planning areas. On long-term strategic planning climate change becomes the driving force.

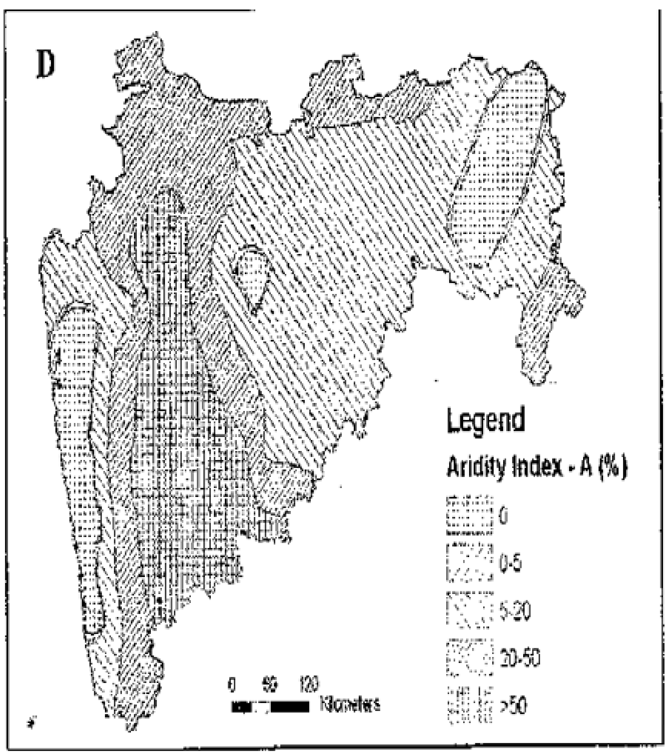

Figure 5: *Drought proneness map of Maharashtra.*

Source: Akumunchi Anand et al. (2009)

When we come to climate change, the main component is natural rhythmic variations in rainfall. To define droughts and floods on the one hand and on the other presents high variations with space. For example All-India Annual or Southwest Monsoon Season Rainfall has been following the Indian Astrological 60-year cycle pattern but in Andhra Pradesh [Coastal Andhra, Rayalaseema & Telangana met sub-divisions] receive rains during not only in the Southwest Monsoon Season but also in the Northeast Monsoon Season. In addition, these areas are affected by cyclonic activity primarily from Bay of Bengal (Reddy, 2021). These make agriculture highly risky venture. Proper planning is required. Global warming proponents started destroying this system, which is dangerous on long term to food security on the one hand and achieving the sustainable Agriculture on the other.

With the advent of "Global Warming" theories, the word "climate change" became a scapegoat. As a result global scientific community have been going with the wind by supressing the voices of few others who are going with the science. Those groups going with the wind are shy of using the word "global warming" and instead using climate change as de-facto global warming. Sometimes they refer it as human-induced/caused climate change. All these form part of erroneous science. Those who presented the definition of climate change [WMO, IPCC & UNFCCC] are also swept by such winds. Thus, there is an urgent need to use the word global warming instead of using the word climate change as de-fact global warming.

Few issues related to Climate Change

Introduction

We have seen that whenever the modern UN Agencies, whose primary goal is to collect and share $500 billion dollars under green fund, release reports international and national media bombarding the readers with articles, stories, editorials, etc. But none of them cared to understand the basic concepts of "the science of climate and the science of climate change" before writing such. They have been invariably using "climate change" as an adjective or weather as climate change or temperature as climate change. Clarifying these issues is very important to keep the science of climate and the science of climate change alive for future generations. FAO under FSN [Global Food Security & Nutrition – FSN Forum] made important efforts – I also contributed to them -- and now initiated CFS – Committee on World Food Security, promoting Youth Engagement, diet, etc. Main issues pertaining to Food Security are discussed in Part-II.

1966 the World Meteorological Organization of United Nation [WMO] brought out a manual with a title "Climate Change" and presented methods to separate natural variations from human caused variations. One of the simplest methods they proposed was Moving

Average Technique [another is Iterative Regression Approach & use of Blackman & Tukey concept to define cyclic variations if any in the met data series] which I used in 1975 (Reddy, 1977). In fact BRS & USNAS (2014) used this method to separate trend [human caused component] from natural variability in adjusted global average annual temperature – several groups created separate data series but all were adjusted for starting period. The analysis showed a 60-year cyclic pattern.

The natural variability component in climate, more particularly rainfall was neglected and emphasis was given to part of human caused/induced component in temperature and used it as climate change. Reddy (2008) presented this wherein it showed a 60-year natural cycle and a trend of 0.78oC for the period 1880 to 2010 global annual mean temperature anomaly [adjusted data series only, that affect the trend but not natural variability]. That means 0.6oC per century. In this global warming component is 0.3oC per century. For 1950 to 2100, it is 0.45oC. The data series were adjusted by lowering to increase the trend – without adjustments [raw data set] the USA data and Sydney temperature in Australia showed no trend but showed cyclic pattern. USA data series cover the major share of global adjusted data sets. The satellite data series presented no trend, which covers all aspects of human induced changes includes land use and land cover changes which is a major player in changes in temperatures at local and regional scale and thus national and international but this is not so with surface data. Also it better covers Oceans & Seas. But this data was removed from internet (Reddy, 2008) and replaced by adjusted data sets similar to surface data sets.

WMO Report of 2022

WMO on 18th May 2022 released the State of the "Global Climate 2021 Report". It claims that "WMO's flagship annual report presented details of climate indicators such as temperatures, ocean heat, ocean acidification, sea level rise, sea ice glaciers and extreme weather. It also has a section devoted to impacts on sustainable development, food security, displacement and ecosystems. It includes input from National Meteorological and Hydrological Services, climate centre and dozens of experts, as well as a wide range of UN partners". However, rainfall is the main component in agriculture. This was not given importance and talks of food security. This was released just ahead of the World Economic Forum 2022 Annual Meeting under the theme "History at a Turning Point: Government Policies and Business Strategies." Mobilizing public-private action to deliver on critical 2030 and 2050 global climate goals is a key topic on the agenda. Figures I.6 & I.7 respectively presents annual average temperature relative to 1981-2010 and annual average rainfall relative to 1951 to 2010 respectively for 2021. For rainfall, this has no meaning. Figure I.6 presents spatial variation patterns in temperature in any given year: as an example presented annual mean temperature anomaly for 2021.

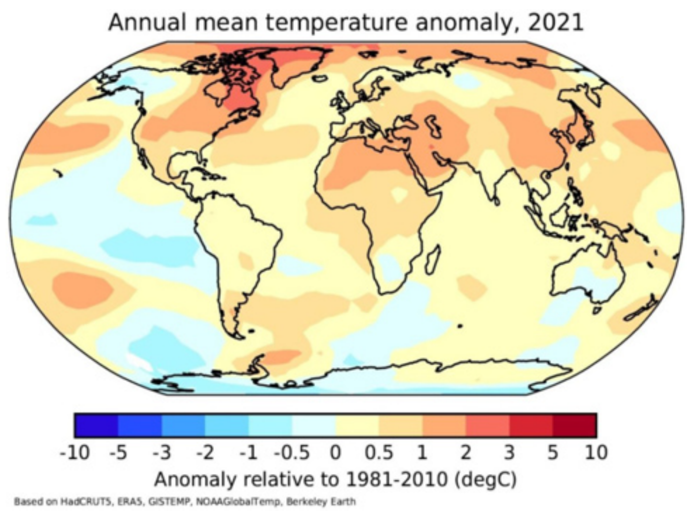

Figure 6: *Annual mean temperature anomaly, 2021.*

It is seen from Figure I.6 that the Southern Hemisphere was cooler than that of Northern Hemisphere and also between South America and Australia at broad scale. The temperature of 2021 presented 1.35°C for the globe with 1.54°C for Northern Hemisphere and 0.86°C for Southern Hemisphere. That means global average has no significance at local or regional levels.

When we look at global average temperature during 2010 to 2021 – it is claimed they represent the warmest years during 1880 to 2021 – it showed bell shape [0.67, 0.67, 0.72, 0.93, 0.99, 0.91, 0.82, 0.95, 0.98 & 0.84°C]. Global temperatures are affected by Southern Oscillation – El Nino a warm phase; La Nina a cool phase; neutral that varies between cool and warm phases. Large part of the world including India with the Oceans on the three sides showed 0.5 to 1.0°C.

It is seen from Figure I.7 that in 2021, large areas with above normal precipitation were in Eastern Europe, Southern Asia, the Maritime Continent, areas of northern South America and southwestern North America. Meanwhile, regions with rainfall deficit included southwest Asia and the Middle East, parts of southern Africa and Central North America. However the realistic comparison in temperature is different from precipitation, a big fallacy. Here we must remember one fact that rainfall present natural variability as discussed in the above section and they are different over different parts of the world.

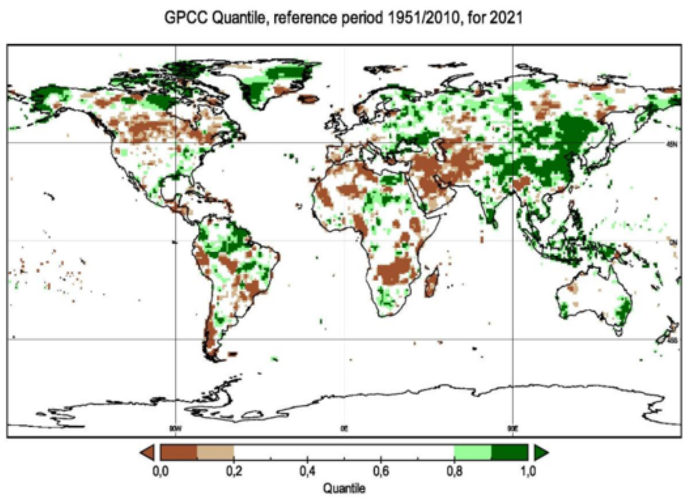

Figure 7: *GPCC Quantiles, reference period 1951-2010, for 2021.*

According to the United Nations Refugee Agency [UNHCR] (June 17, 2022): Millions Displaced Across the Globe in 2021. Close to 50 lakh Indians were displaced in 2021 due to climate change and natural disasters. In December 2020, a UN report had said that some 1.4 crore Indians had become displaced due to climate change. India is the fifth most vulnerable country in the world when it comes to climate change. Extreme weather incidents, including floods, landslides, cyclones, droughts, forest fires and more are on the rise in India and climate change is making such events more frequent. India is one of the countries that are highly vulnerable to climate change with 80% of population living in districts that are highly vulnerable to extreme hydro-met disasters.

Every year extreme weather events are making a large section of our population internally displaced as they flee their homes. Assam, Andhra Pradesh, Maharashtra, Karnataka and Bihar are the five states most vulnerable to droughts, floods, cyclones, or a combination of the three. Here he refers to latest IPCC report "that eleven Indian states Odisha, Assam, Meghalaya, Tripura, West Bengal, Bihar, Jharkhand, Chhattisgarh, Uttar Pradesh, Haryana, and Punjab will get most severely affected due to global warming. If emissions continue to increase, all Indian states may have regions that experience temperatures of 30°C or more, it said. A false analysis as the observed trend for Punjab and neighbouring regions in India is under decreasing/zero trend in temperature (Reddy, 2020). The word climate change in Red colour – basically used as an adjective only and not referred the specific component of climate change as defined by WMO/IPCC/UNFCCC.

Outlook of 17 June 2022 reported that extreme weather conditions claim 231 lives in 3 Months; Climate Change Is the New Silent Killer. According to the IMD report, the average mean temperatures across India were above normal by a degree Celsius during the last three months. Lightning, thunderstorms, deluges and landslides triggered by heavy downpours in several parts of the country are becoming more frequent in 2022 than ever. Heavy rainfall, deluges and massive landslides have claimed as many as 81 lives and 1,151 livestock, most of which were reported from Assam and neighbouring north-eastern states. They are not unusual to that region (Reddy, 2019a&d).

Here let me present in brief my article published in Newsmeter [23rd October 2020) titled "Opinion: Hyderabad Floods; is there a solution? Answer is "big NO". Why because: there is no way to restore water bodies; drainage/rainwater nalas; poor town planning; uncontrolled migration of rural population to urban areas; huge quantities of wastewater find their way into water bodies and nalas. Here the rainfall is highly variable, for example, June to October the lowest and the highest averages of month in mm (year) are: 17.3 (1903) and 323.6 (1933); 30.5 (1899) and 365.0 (1916); 25.1 (1904) and 333.9 (1957); 32.3 (1901) and 499.4 (1908); 0.0 and 355.1 (1916). Hyderabad faced severe floods in September 1908. After building two reservoirs on the river and its tributary, stopped floods of that order – see for more details Reddy (2019a & d).

In July 2022, river Godavari is in high spate and caused heavy inundations that lead submergence of villages in the basin and affected the agriculture severely in Telangana & Andhra States. However, it has not crossed the 1986 flood condition – at Badrachalam, a temple town water level reached to 75.6 ft mark but in 2022 July reached 71.30 ft mark; in 1990 it is 70.8 ft. Some argued with political interests that the flood level of 71.30 reached at Badrachalam due to Polavaram Project that is under construction. This is false from the data of 1986 & 1990 as the Polavaram project activity was started after 2006.

According to IMD, the average mean temperatures across India were above normal by a degree Celsius during the last three months. The seasonal average maximum, average minimum, and mean temperatures for the country as a whole during pre-monsoon were

34.49ºC, 22.86ºC, and 28.68ºC respectively, against the normal of 33.45ºC, 21.78ºC, and 27.61ºC based on the period 1981-2010. This is not unusual or associated with global warming. In 2002 and 2009 drought years the temperature of all India average was 0.79 & 0.81oC above the average.

In 17th June 2022, Meghalaya's Mawsynram, the wettest place in India, received a whopping 1003.6 mm of precipitation in 24 hours on Friday. This is the highest precipitation ever on a day in June. Cherrapunji, also one of the wettest places in the world located at an aerial distance of 10 km from Mawsynram, also witnessed the highest rainfall in June. Cherrapunji received 972 mm of rainfall, the highest in June since 1995 and the third highest in 122 years. "Mawsynram is at present the wettest place in India, with an average annual rainfall of 11802.4 mm (average of the 1974-2022 periods). Cherrapunji receives 11359.4 mm of rainfall in a year (average of the 1971-2020 periods)," According to the IMD data, Mawsynram had recorded 944.7 mm of precipitation on June 7, 1966. Cherrapunji has recorded more than 800 mm of precipitation on a day in June on eight occasions since the IMD started maintaining weather records in 1901. On June 16, 1995, Cherrapunji logged 1563.3 mm of rainfall. That means extreme precipitation occurrences are not unusual.

People of all-walks of life including United Nations; and its Organizations & Agencies have been using the word "Climate Change" like a "Blind Man" using a "Light Pole". As a result global scientific community have been going with the wind by supressing the voices of few others who are going with the science. Those groups going with the wind are shy of using the word "global warming" and instead using climate change as de-facto global warming. Those who presented the definition of climate change [WMO, IPCC & UNFCCC] are also swept by such winds. In the latest Global Annual to Decadal Climate Update, the WMO said that 2022 will be cooler (compared to the 1991 - 2020 average) over India, along with Alaska and Canada. One of the primary reasons for lowering of temperatures over India from next year is the possible increase in rainfall activity in this decade. In April this year, the India Meteorological Department (IMD) had said that the Indian monsoon will soon enter the positive epoch after remaining under a negative epoch since 1971. The future trend suggests that the decadal mean value will be close to near normal during 2021 to 2030. It will then turn positive, meaning that the decade 2031-2040 will be the beginning of a wet epoch, Mrutyunjay Mohapatra, director general of IMD, had said in April. D Sivananda Pai, director, Institute for Climate Change Studies (ICCS) in Kerala, said, "During the next five years, many parts of India will receive above-normal rainfall. This will keep temperatures low.

The following are the few findings of "District-Level Changes in Climate: Historical Climate and Climate Chance Projections for the North-Eastern States of India" by the Centre for Study of Science, Technology and Policy (CSTEP), a Bengaluru-based think tank. Report pronounces that Global Warming is here to stay and is affecting the world at a faster rate than we know. While the effects are being seen around the world, India is also experiencing changes and a recent study about climate change projections for the northeast Indian states that was released on June 15 has indicated it.

It has indicated an overall warming of minimum temperatures during the summer and winter. The study has also indicated an increase in the number of rainy days, and an increase in the number of heavy rainfall events in almost all districts of the region in India. The study projects changes in temperature and rainfall patterns in Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura over the next three decades (from 2021 till 2050) and compares it to the historical period (from 1990 to 2019).

From the above IMD/WMO reports they are inaccurate statements. In the last ten years [2010 to 2021]: the global average temperatures are: 0.67, 0.67, 0.72, 0.93, 0.99, 0.91, 0.82, 0.95, 0.98 & 0.84°C. In 2014 it was 0.99°C and in 2021 it was 0.84°C. Do you know, in India during 2002 and 2009 drought years the temperatures have gone up by 0.79 & 0.81°C?

1990 to 2019 is wet period; and 2021 to 2050 is expected dry period – as part of 60 year cycle -- see below. Figure I.8 presented the trend of summer and winter temperatures in India and in China. Winter temperature showed prominent increasing trend over summer. This is nothing to do with global warming concept as used in the above study.

Rainfall of All India Annual, June to May; and the Southwest Monsoon, June to September, presented a 60 year cycle [Reddy, 2000 & 2019a]. Coastal Andhra (CA) Southwest Monsoon Rainfall presented 56 year cycle while the Northeast Monsoon Rainfall presented opposite pattern and cyclones occurrence in Bay of Bengal followed the same pattern [Reddy, 2000]; Period refers to above the average and below the average part of the cycle, respectively given as positive and negative.

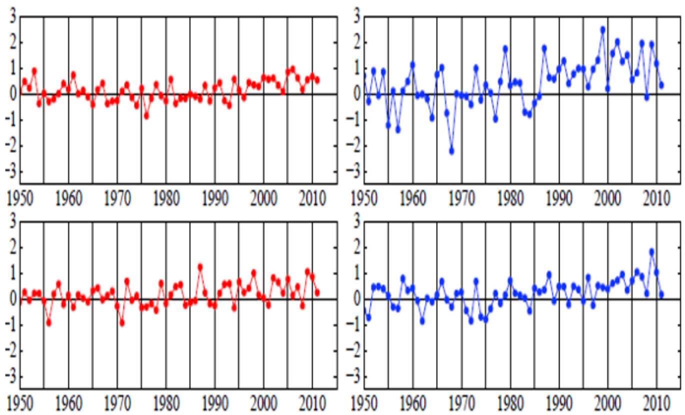

Figure 8: *Summer (June-August) and winter (December-February) temperature anomalies in oC: bottom – India; top – China.*

CWC used the all-India annual rainfall data for 30 years [1984/85 to 2014/15] provided by IMD-NRSA, in the data series of 1871 to 2014/15 along with IITM data set. In Table I.3 the period 1987/88 to 2016/17 is above the average part of 60-year cycle. The above presented IMD reports stated that the Indian monsoon will soon enter the positive epoch after remaining under a negative epoch since 1971. The future trend suggests that the decadal mean value will be close to near normal during 2021 to 2030. It will then turn positive, meaning that the decade 2031-2040 will be the beginning of a wet epoch. However, this does not match [Table I.3].

Reddy (2019a) presented the relationship between the all-Indian annual average rainfall 60-year cycle with river water flows [North Western Rivers, Brahmaputra River & Godavari River]. They are given as follows:

(1) Tree Rings study in Brahmaputra River basin [1304-2004]: A team of researchers conducted studies on tree rings in Brahmaputra River during 1309 to 2004 [7 centuries]. They identified two "30 year" dry periods as shown in Table I.3 with red mark – 1837/38 – 1856/57 & 1957/58 – 1986/87. This 60-year cycle followed the Telugu Astrological calendar 60 years [the current cycle started in 1987/88 as Prabhava, which is lagging by three years to Chinese Astrological 60-year cycle].

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Period	All-India Rainfall	Period	CA Rainfall
Negative	1837/38-1856/57	Positive	1888-1915
Positive	1867/68-1896/97	Negative	1916-1943
Negative	1897/98-1926/27	Positive	1944-1971
Positive	1927/28-1956/57	Negative	1972-1999
Negative	1957/58-1986/87	Positive	2000-2027
IT	1971-2000*		
Positive	1987/88-2016/17	Negative	2028-2045
DT	2001-2030*		
Negative	2017/18-2046/47		
IT	2031-2060*		
Positive	2047/48-2076/77		

Table 3: *All India annual and Coastal Andhra southwest monsoon cycles.*

Negative refers to 30 years of below the average period of 60-year cycle showed by inverted Bell shape; and Positive refers to 30 years of above the average period of 60-year cycle showed by Bell shape. These cover Sine curve of 60-year cycle.

**By joining centre of Bel shape to centre of inverted bell shape present a linear decreasing trend (DT) or by joining centre of inverted bell shape to centre of Bel shape present a linear increasing trend (IT).*

(3) Godavari River: The annual water flows in Godavari River during 1881 to 1946 [66 years period with one year data missing] -- this data set was taken from Bachawat Tribunal Award – followed all-India annual rainfall 60-year cycle pattern. Though the data presented 60 year period it presented zero trend as the central 30-years form below the average; and on either side of this period is above the average periods, wherein 36 years were divided in to 16 and 20 years – this started in positive part (1867/68 – 1896/97) continued in to positive part (1927/28-1956/57) in Table I.3. – DT to IT. The mean of 65 years is 3977.71 tmc ft and the averages of below the average and above the average periods are 3613.79 and 4270.86 tmc ft, respectively with a range of 657.07 tmc ft. The lowest values were received at Dawaleswaram (tmc ft): 459 in 1899, 958 in 1920, 286 in 1930 & 400 in 1937 -- by this period projects were not built.

NDTV on the occasion of World Environment Day 2022 presented a special "Sundarbans – the land of tides, Tigers and threats". "With cyclones becoming more frequent and intense over the past decade in Bay of Bengal" and quoted that "IPCC stressed that there is a direct link between climate change, extreme precipitations, and greater risk of regional scale flooding, and food insecurity". Sundarbans region witnessed cyclones during 2007, 2009, 2013, 2014, 2015, 2017, 2018, 2019, 2019, 2020, 2021 & 2021. Reddy (2000) presented Southwest Monsoon and Northeast Monsoon 56-year cycle pattern [but in opposite direction] in undivided Andhra Pradesh. However, the frequency of occurrence of cyclone storms in Bay of Bengal was associated with AP Southwest Monsoon rainfall [56 year cycle]. In this 2001 to 2028 form part of above the average 28 year cycle part (Reddy, 2008). The above referred cyclones during 2007 to 2021 are part of this only. The Council on Energy, Environment and Water – a Think tank based in Delhi state's that the frequency of cyclones in 15 WB districts has increased five-fold between 1970 and 2019. It also stated that areas in and around Sundarbans are "Extreme climate hotspots" due to cyclone impacts. According to Reddy (2000, 2008) the frequency of occurrence of cyclone storms were low during 1973-2000 & high during 2001 to 2028. Very severe floods and very severe droughts are common [Nile river changed it course] have been part of life in India since time immemorial. In 1876-78 Bengaluru experienced very very severe drought; in 1908 Hyderabad experienced very very severe floods.

Climate change and food security in India

Climate change amplifies the economic drivers of food insecurity. Variation in the length of the crop growing season and higher frequency of extreme events due to climate change and the consequent growth of output adversely affect the farmer's net income. India is particularly vulnerable because its rural areas are home to small and marginal farmers who rely on rain-fed mono-cropping, which provides barely a few months of food security in a normal year – this is inaccurate statement as follow inter or multiple cropping.

The impact of climate change on food access is not limited to rural areas. Urban food insecurity is also a critical issue because poor households from rural and coastal regions typically migrate to urban areas for livelihood options. Climate change will exacerbate India's existing problems of urban food insecurity. The highest risks related to climate change are likely to be concentrated among the low-income groups residing in informal settlements which are often located in areas exposed to floods and landslides and where housing is especially vulnerable to extreme weather events such as wind and water hazards. Mumbai and Chennai are especially prone to bear the brunt of climate change.

Given that food is the single largest expenditure for poor urban households, displacement, loss of livelihood or damage to productive assets due to any such extreme weather event will have a direct impact on household food security. The urban poor has also been identified as the group most vulnerable to increases in food prices following production shocks and declines that are projected under future climate change.

There are many potential impacts of climate change on food absorption but there is a dearth of quantitative studies on the subject which focus on India. Overall, the global threat is that climate change could lead to a reduction of production and consumption of certain foods that play a critical role in the diets of poor rural and indigenous populations such as fish, fruits and vegetables, and wild foods. Change in climatic conditions could lead to a reduction in the nutritional quality of foods (reduced concentration in proteins and minerals like zinc and iron) due to elevated carbon dioxide levels. In India, where legumes (pulses) rather than meat are the main source of proteins, such changes in the quality of food crops will accelerate the largely neglected epidemic known as "hidden hunger" or micronutrient deficiency.

The word Climate change is used by all the authors as an adjective [no reference added].

Country/Region	Kg/ha
East Asia & Pacific (developing only)	5,184.0
Central Europe and the Baltics	4131.1
Sub-Sahara Africa	1433.5
Europe & Central Asia (all income levels)	3661.6
North America	6671.0
India	2961.6
World	3851.3

Source: World Bank Data Base

Table 4: *Cereal yields (kg per ha, 2013).*

At the heart of the Sustainable Development Goals (SDGs) are targets to end hunger, achieve food security, and improve nutrition. About 12 Indian states fall under the 'alarming' category of the Global Hunger Index. According to the National Family Health

Survey 2015-16, the proportion of children under five years who are underweight is significantly high in states such as Bihar (43.9%), Madhya Pradesh (42.8%) and Andhra Pradesh (31.9%). Such statistics really reflect the reality. One of the biggest issues confronting Indian agriculture is low productivity. India's cereal yields are drastically lower than those of developed regions such as North America (6671 kg per ha), East Asia and the Pacific (5,184 kg per ha), and the Euro area (5855.4 kg per ha) (see Table I.4). Table I.5 shows that yield per hectare of food grains has stagnated in India since the 1980s. However, they are hypothetical figures as the realities are different.

Period	R	W	C	P	F
1980-81 to 1990-91	2.7	3.4	2.6	2.0	3.0
1990-91 to 2000-01	0.9	1.7	1.3	-0.6	1.7
2000-01 to 2010-11	1.6	1.0	4.1	2.4	1.7
2010-11 to 2014-15	1.6	-1.0	3.1	1.9	1.8

Table 5: *Growth rate of yield per hectare (%) of food grains*

R = rice, W = wheat, C = course cereals, P pulses, F = total food grains
Source: Reserve Bank of India database

Summary & Conclusions

More than 90% of the reports, articles, Scientific Articles, Books used the word "Climate Change" as an adjective; and invariably they refer to fictitious global warming or weather. This includes more particularly UN Agencies including IPCC, which in fact defined what is "Climate Change"? However, they rarely follow their own definition while presenting reports. Sometimes they refer it as "Human Induced [or Caused] Climate Change". Here one important point is human induced/cause climate change has two major components, one is greenhouse gases effect and the second is non-greenhouse gases effect. In the former one part is Global Warming. In fact they are using the word "human induced/caused climate change" for the word Global Warming. This is erroneous statement as per IPCC it refers to "more than half of the trend" and in that Global Warming is one part only. They feel shy of using the word "Global Warming" and to cover up their bad science.

There is no realistic "Climate Sensitivity Factor [CSF]" that relates carbon dioxide with temperature; and at the same time talks of other gases such Methane, Nitrous Oxide. Ozone, etc. which have short life time in the atmosphere over that of carbon dioxide with more than 1000 years. Water vapour is the principal greenhouse gases presented changes with dryland to wetland or vice-versa; sunspot cycle presented changes in incoming solar radiation, etc. IPCC has brought down CFS value from one report to the other mainly following "Trail & Error" approach. May be with the accumulation of carbon dioxide temperature increase is not linear but it is non-linear. In linear trend if it is 0.45°C for 1951 to 2100, under non-linear condition this will be far less than this, which will be insignificant when compared to seasonal and annual variations at a given place.

In tropical countries temperature is not a limiting factor for crop growth and development. Based on water/soil moisture availability more than one crop is grown in a year. The seed varieties are selected for those conditions. However, here farmers face few problems, namely post-harvest losses, government apathy in providing shelter, purchasing grains, transport facility, etc. and these vary with space and time. In middle latitudes, temperature comes in indirectly as the growing season is defined by onset and withdrawal of winter. That is crop growing period; and thus heat units or degree days. The other major component in agriculture is water which depends or varies with natural variability in rainfall a major component of climate change. They vary with location/region to location/region. These are rarely accounted. They use water in the ground and on the surface only. Natural variability in cyclones/hurricanes/Typhoons plays other important role in long term planning. Southern Oscillation [El Nino, La Nina] plays an important role in these two.

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