ACTA SCIENTIFIC AGRICULTURE

Volume 2 Issue 4 April 2018

Role of Climate Change on Recent Weather Disasters

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Received: January 22, 2018; Published: March 21, 2018

Abstract

Natural disasters such as earthquakes, volcanoes, landslides, tsunamis, blizzards, floods, droughts, etc. can cause loss of life and damage to property and as well to nature that includes agriculture and water resources. The quantum of such loss or damage depends on several factors. In the case of weather disasters, humans play vital destructive role. For the past one decade world over witnessed extreme weather events such as urban floods in India, hurricanes in southern USA, bomb cyclones in northeastern USA-Canada. All these received wide media coverage; and rulers of the nations and so-called scientific community started attributing such events to climate change, which is used as de-fact global warming. The historical pattern on the occurrence of such extreme weather events dispels this type of notion. Many a time they try to look at short period information and come up with sensational conclusions, which have serious repercussions' on long-term planning for agriculture, water resources, etc. There is well-established data about these matters. However, there is a limitation on such historically data in both space and time as the recording started around 1850s; and prior to that written descriptions and as folklores of the events and consequent disasters are only available. Surprisingly extreme weather events are not only confined to warmer weather conditions but also to colder weather conditions. It is a fact that magnitude of temperature is not a driving force but temperature gradient plays vital role on extreme weather events formation. Both in summer and winter India gets cyclones; and the same is the case in USA. Also, we should not look at extreme weather events as destructive events but they provide succor by increasing on land and in ground water and thus their impact on agriculture.

Keywords: Weather Disasters; Climate Change; Global Warming; Winter Storms; Summer Storms; Agriculture and Water Resources

Introduction

In the past one decade, there were heated discussions on extreme weather events world over attributing to global warming. Unfortunately, "media" only picks up the material from such discussions to sensationalize the issue so that the "media" gets big hype. Figure 1 presents Times cover pages in 1977 and 2006, with contrasting headlines: "The Ice Age is Coming" and "Here's Global Warming". Figure 2 presents a Cartoon "Sign of Summer & Sign of Winter" that says "Stop Global Warming" and "Stop Climate Change". In this scenario, the basic question we can ask is "When was the period in the human history in which some persons, in some location or other, wasn't feeling that some recent day, month or season has been very unusual in some dry, wet, hot, or cold way?"

Figure 1: Time magazine cover page of 1977 and 2006.

Citation: S Jeevananda Reddy. "Role of Climate Change on Recent Weather Disasters.". Acta Scientific Agriculture 2.4 (2018): 22-29.



Further to my earlier article [1], this article analyzed the role of extreme weather disasters in agriculture and water resources. In this context, the article looks in to some of these issues in the context of India urban floods, USA Hurricanes and Bomb Cyclones.

Material and Method

The main fallacy in declaring an event as unusual is based on the past few years' records. The meteorological records started only around 1850s and that too at fewer locations. With the progression of time they increased in number covering wider space. Prior to 1850 only some documents-folklores narrated unusual weather events but they are rarely available to public to consult like met data. The modern politicians have been attributing the unusual weather events to global warming for the lapses committed by the government bodies; and the media gives them hype.

In all the unusual weather events they used invariably the word "climate change" but while discussing the events they talk of impact of temperature, which refers indirectly to global warming, a component of climate change. The unusual weather events are irregular variations part of systematic variations in climate change that are primarily associated with the general circulation patterns of a region in a climate system. Truly speaking the global temperature rise is not global. Major part is local and regional. Even here, the rise is part of data manipulation and is not seen in satellite and balloon data series. Even the satellite data is manipulated by withdrawing original data from internet.

Even, WMO Secretary General in his World Meteorological Day statement released in 2014 observed that the drought conditions were associated with global warming in the Southern Hemisphere in 2013. On this I sent my response saying that this was predicted (drought is expected in 2013 according to extrapolated predicted curve) in my studies on the natural cyclic variation in Southern Hemisphere rainfall series [2] - in fact this book is available in WMO-Geneva, library. Figure 3 presents the observed and predicted patterns of annual rainfall for Durban in South Africa (with 66 year cycle and its sub-multiple of 22 years) and Fortaleza in Brazil (with 52 year cycle and its sub-multiples). Also, heat waves and cold waves particularly related to general circulation patterns over different parts and they are part of intra-seasonal and intra-annual irregular variations [3]. Figure 4 presents predictive model of heat and cold waves in India during summer and winter. The main ambiguity in explaining the cause and effect syndrome, we must clear the fact that global warming is not climate change. If we correct this, we get correct cause and effect relations.

Figure 3: Observed and Predicted time series of annual Rainfall of Durban/South Africa and Fortaleza/Brazil.

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Source	India (%/Mha)		AP (%/Lha)	
	1960-61	1999-00	1960-61	1999-00
Canals	42.05/10.37	31.29/ 17.45	45.75/13.31	37.27/ 16.34
Tanks	18.50/04.56	05.18/ 02.94	39.57/11.51	14.85/ 06.51
Wells	29.56/07.29	57.81/ 24.70	11.31/03.28	43.34/ 19.00
Others	09.89/02.44	05.73/ 02.93	03.40/00.99	04.54/ 01.99



Parameter	AP	India
Annual replenishable Groundwater source (bcm)	36.50	433.02
Natural discharge during non-monsoon season (bcm)	03.55	033.77
Net groundwater availability (bcm)	32.95	399.25
Annual groundwater draft (bcm)	14.90	230.62
Stage of groundwater development (%)	45	58
Overexploited (blocks)	219	839
Critical (blocks)	77	226

Table 2: Groundwater resources availability, utilization and categorization.

Indian government is pronouncing that they will help double the farmers' income without taking these issues into account. On the contrary government agencies including respected prime minister of India in his speeches talk only global warming. However, the impact of flooding in urban areas is primarily relates to human interference on nature [5]. Majority of such cases are attributed to weather, as it cannot defend against such attacks on it both by media and by the government agencies. Under natural weather conditions scenario, many a time human greed plays vital role in the loss of human lives and destruction of property and natural resources. However, the urban flooding clears pollution by washing away and by diluting both surface water and groundwater. Also for water availability, floods are very important in dry areas.

The severity of destruction changes with the time of the year, the terrain, with the population growth, and growth in infrastructure. However, with the violation of existing local, state and national laws the destruction is aggravated. Let us see few examples.

Uttarakhand and Srinagar Floods: The causes of flood disasters in Uttarakhand in June 2013 (Figure 5a) and Srinagar ([Jammu and Kashmir) in 2014 (Figure 5b) scenarios were "manmade" due to apathy of government agencies, who were unable to control the illegal construction activities along the river beds. This has lead more than 10,000 deaths in Uttarakhand floods along the property

Figure 4: Weather associated with Western Disturbances [heat waves in summer and cold waves in winter].

To achieve this goal, the material and method basically relates to the comparative study of historical extreme weather events with the current extreme weather events in the context of human action on the nature. This provides the guide to understand the role of climate change and global warming. India witnessed hazardous urban floods during 2013, 2014 and 2015 over different parts of the country; southern parts of USA witnessed a series of hurricanes in 2017 summer; and northeastern parts of USA-Canada witnessed bomb cyclones in December 2017-January 2018. As usual scientific groups attributed these in terms of formation and severity to climate change, used as de-facto global warming. The media pickedup these and gave big hype. Here the basic problem with the scientific community is that they rarely look in to the historical facts and human interference on nature before making sensational theories attributing the cause of such events to global warming. In this article these issues are presented and discussed.

Results and Discussion

Urban Floods in India

Droughts and floods are common in India. Every year some parts or the other is affected by floods or droughts. Floods play havoc with people and at the same time provide succor by re-charging groundwater and filling the Reservoirs. In India groundwater is the major source for irrigation and drinking [4]. Table 1 presents the share of different sources of irrigation in India and undivided Andhra Pradesh (AP) and table 2 presents the groundwater resources availability, utilization and categorization. In fact these values vary with the years. With the steep rise in groundwater utilization, the area cultivated per motor has been gradually decreasing. To build up this gap, rainfall/snowfall is essential. With these, agriculture will be severely affected.

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losses running in to thousands of crores. Same was the case even with Jammu and Kashmir floods. Figure 5a clearly shows the erosion of river bank, which was filled with soil-rubbles and on which buildings were constructed. In fact when we fill the river banks, the width of the river comes down and thus the flow impact will be severe. This is clearly seen in figure 5b in Srinagar.

(a) Uttarakhand Floods in 2013

(b) Srinagar Floods in 2014

(c) Chennai Floods in 2015

Figure 5: (a) Uttarakhand Floods in 2013, (b) Srinagar Floods in 2014 and (c) Chennai Floods in 2015.

Chennai and Nellore Floods: Figure 5c presents the Chennai floods in 2015. This is typically different from the above two cases. Nellore to Chennai November 2015 floods are natural part and not due to global warming. One must verify the facts before attributing the floods to global warming. Unfortunately people are using the word "global warming or climate change" very casually. In the Southern coastal zones receive heavy rains during the Northeast Monsoon Season that coincides with severe cyclonic activity. Let me present the highest rainfall in 24 hours (mm)/year and the highest per month (mm)/year for Nellore and Chennai from 1931-60 Normal (Red Book of IMD):

Nellore – 444/1950, 357/1936 and 189/1902; 647/1920, 982/1915, 494/1946

Chennai – 234/1888, 236/1922 and 262/1901; 892/1943, 1088/1918, 699/1946

The November 2015 rains followed this pattern only.

The main problem here is that governments over the years allowed the people as well government agencies to destroy the rainwater channels and water bodies/rivers. This resulted the aggravating the impact for the same flood capacity. This is same in Uttarakhand in 2013, Jammu and Kashmir in 2014. Also, the August 2000 floods in Hyderabad.

To meet the greed, humans have destroyed the natural flow systems and now governments are putting the blame on global warming as it cannot defend against such onslaught by politicians and bureaucrats to protect themselves for wrong doings. For all ills [heat waves, cold waves, floods, cyclonic fury, etc.] the easy prey is global warming. Climate change is used as de-facto global warming, though natural variations are part of climate change for which we need to adapt to them. The Paris meet [COP21] is fight for getting their share from green fund of \$100 billion per year for five years.

Others: December 2015 floods in England and October 2015 floods in Nile Delta in Egypt were attributed to climate change. Even in India the scenario is the same. In all such human greed the easy scapegoat is climate change.

On 6th December 2015 received 9 - 10" rain in three days due to a huge storm "Goliath" in a belt across the central United States, centered just Southwest of St. Louis in the Mississippi River Basin. 1982 flood was similar to 2015 flood. Also, both were winter floods during an El Nino event. They should have been similar but it is not so. After 1982 there were large scale changes in the catchment area with construction activities and thus water level rise by several feet over 1982 flood level, resulting in the damage of 7000 buildings and several other damages and few people died. It is a manmade disaster.

Summer Storms of USA

Historical Facts: Global warming was brought in for the 2017 hurricanes that have land falls in USA and as well their frequency of occurrences. Historical reports suggest that major hurricanes, sometimes arriving in pairs, have been part of Atlantic and Gulf coastal life for centuries. Reports of lake-bottom sediments in Texas and Florida suggest that "more catastrophic hurricane landfalls occurred in the past 1,000 to 2,000 years ago". Over the last 150 years, the number of major hurricanes hitting Texas has been the same when Gulf of Mexico water temperatures were below normal or when they were above normal (Figure 6).



It is common when a storm moving slowly in the Ocean waters, gives copious rains with more moisture feed from the ocean waters – land fall decreases this moisture feed. Harvey's recordsetting rainfall totals were due to its slow movement. This can't be attributed to global warming as August 2017 was quite cool over most of the US. Number of recorded storms affected US showed a range of 25 in 1880s to 12 in 1970s. Currently in 2010s they are up to now only 8. During 1860s, 1920s, 1960s and 1990s they were 15 in number. The frequency of occurrence of hurricanes in Atlantic Ocean since 1913 reached peak on 10th September reaching lows on June 1st and November 30th. In the case of India, the frequency of occurrence of cyclonic storms starts rising from February, reaches to peak by September-October and again comes down by January. However, all these follow cyclic variations [7].

Disaster-damage Events: In the past the central pressure was used in determining the strength of a hurricane but now. Hurricanes have been ranked by the wind speed. Table 3 presents all hurricanes with landfall pressures <= 940 mb at time of US land fall. This table also presents the corresponding wind speeds. The lowest pressure ever recorded in an Atlantic hurricane was 882 mb while Wilma was in the northwest Caribbean Sea in 2005. The lowest pressure for a land falling hurricane was 892 mb when the 1935 hurricane crossed the Florida Keys. There have been 10 hurricanes with central pressures below 910 mb of which 5 were below 900 mb. Irma did not even make the top 10; therefore, it was not close to being the strongest hurricane ever observed In

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the Atlantic. Irma was 929 mb and Harvey was 938 mb. With Irma ranked 7th, and Harvey ranked 18th, it's going to be tough for climate alarmists to try connecting these two storms to being driven by CO_2 /global warming.

With the passing of time with the population growth the number of people and amount of infrastructure at risk along the Atlantic and Gulf of Mexico coastlines for the same category hurricane land falling changed dramatically. However, with the sophisticated disaster management technologies the death counts have been brought down drastically. This is clearly evident from 2017 hurricanes of USA land fall. Reports state that "The 1938 New England Hurricane (also referred to as the Great New England Hurricane and Long Island Express) was one of the deadliest and most destructive tropical cyclones to strike Long Island, New York and New England. In addition, it's the fastest tropical cyclone on record worldwide attaining a maximum speed of 70 mph. The storm formed near the coast of Africa on September 9, becoming a Category 5 hurricane on the Saffir-Simpson Hurricane Scale before making landfall as a Category 3 hurricane on Long Island on September 21. It is estimated that the hurricane killed 682 people, damaged or destroyed more than 57,000 homes, and caused property losses estimated at US\$306 million (\$4.7 billion in 2017)".

Report says that so far no storm beat the two major hurricanes that struck Massachusetts Bay Colony in 1635 and in 1675. Major hurricane Maria of Dominica and Guadeloupe, is probably no match for the Great Hurricane of 1780 in the Caribbean, which had estimated winds of 200 mph and killed 20,000 people. Regarding Hurricane Irma which terrorized Florida, one may be surprised to learn that it is consistent with a downward trend in both the number and intensity of land falling major Florida hurricanes (Figure 7). Damage from hurricanes has certainly increased over the years. But that is because far more people now live and work in far more expensive communities along America's Atlantic and Gulf coasts. **Global Warming versus Tropical Storms:** With the August-September, 2017 hurricanes, numerous articles suggest hurricanes Harvey and Irma were the result of global warming [6]. The concept is a warmer earth will generate stronger and wetter hurricanes. There is also science, which shows colder world is a stormier world. Classical examples to these are the pre-monsoon summer storms and the post-monsoon winter-storms (Northeast Monsoon season) in India [7].

A number of reports have said that "Irma was the most intense hurricane in the history of the Atlantic while Harvey was the wettest and both were good examples of what we can expect in the future because of global warming". Harvey has been labeled the wettest hurricane in history. The reason for the heavy rain is the hurricane stalled for 3 days and unfortunately southeast Texas is where that happened. However, the reality is that Alvin, Texas, was deluged by 43" of rain in 24 hours on July 24 - 25, 1979. That would be more impressive than 52" over four days. Commonly with the wind the cloud moves away and cause reduction in rain. There are numerous examples of stalled tropical systems producing excessive rains. For example, in 1979 tropical storm Claudette stalled for 2 days and generated over 40" in a broad area south of downtown Houston. A year earlier, stalled tropical Storm Amelia produced 48" in central Texas. In 1967 slow moving Hurricane Beulah moved into in south Texas and generated between 30 and 40" inland from Brownsville.

Global warming Impact on Hurricanes through Sea Level Raise: Some argued that "though in the past severe storms occurred, the current severity with hurricanes is contributed by global warming and this is acting through sea level raise". Figure 8 presents the results of a study relating to sea level raise along the Gulf Coast. However some others countered that "sea level raise might be due to groundwater pumping in the southwestern United States".



Figure 7: Major land falling hurricanes in Florida since 1900.

Figure 8: Sea level rise at stations along the Gulf coast.

However, reports suggest that "Land subsidence is lowering landsurface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydrocompaction).

Land subsidence occurs in nearly every state of the United States. In areas where climate change [natural variability] results in less precipitation and reduced surface-water supplies, communities will pump more ground water.

In the southern part of the United States from states on the Gulf Coast and westward including states of New Mexico, Colorado, Arizona, Utah, Nevada and California, major aquifers include compressible clay and silt that can compact when groundwater is pumped.

Also, increased population in the Southwest will increase demands on groundwater supplies, causing more land subsidence in areas already subsiding and new subsidence in areas where subsidence has not yet occurred. In the past, major subsidence areas have been in agricultural settings where groundwater has been pumped for irrigation. In the future, however, increasing population may result in subsidence problems in metropolitan areas where damage from subsidence will be great.

Another argument in this direction is that the current level of the sea in the Gulf of Mexico will be high due to the circulation".

Recently, several reports argued that "The common consensus among these studies is a conclusion that future hurricanes will tend to be stronger than those in the present-day climate, assuming that sea surface temperature will continue its current warming trend into the future." Contrary to this postulation can be seen from figure 8 wherein the red dots indicate years of major hurricane strikes in Texas, plotted on average SST departures from normal by year over the western Gulf of Mexico (25-30N, 90-100W).

If fossil fuels caused Harvey's rainfall, were previous deluges like Hurricane Easy (45" in Florida, 1950), Tropical Cyclone Amelia (48" in Texas, 1978) and Tropical Storm Claudette (a record 43" in 24 hours on Alvin, Texas, July 24-25, 1979) with the result of lower fossil fuel use back then? That would be more impressive than 52" over four days. A real deluge was taken place in 1926-27 Mississippi flooding that lasted one year.

Winter Storms of USA

The bomb cyclone of December 2017-January 2018 over northeast USA & Canada is also attributed to global warming. Nor'easters are common to this region and this is just another "Nor'easter". It is not even close to the blizzard of 1988. This was reported in the 1976 U.S. Dept. of Commerce book "American Weather Stories". Over the southern New York State and southern New England received on an average 40-50" of snowfall. Figure 9 presents Niagara Waterfalls freeze of 1911, which shows it is worse than that of January 2018. Figure 10 presents the inundation of the state capital city Sacramento in 1862 – the case in 2018 January has not reached to that level.

Figure 9: Frozen Niagara Falls in 1911.

Figure 10: Inundation of the State Capital City of Sacramento in 1862.

Bomb Cyclones: Warm air from the south [from the dissipated hurricane] meets cold air from the pole, under the rotation of the Earth creates cyclonic effect. The direction is counter-clock-wise in Northern Hemisphere and cock-wise in Southern Hemisphere.

Meteorologists at the Bergen School of Meteorology during 1940-50s coined the word "bomb" to refer those storms that grew over the Sea as they develop with great ferocity rarely seen over land. Sanders and his colleagues John Gyakum in 1980s defined "bomb" as an extra-tropical cyclone that deepens by 24 Sin φ / Sin 600 mb in 24 hours, where φ is latitude in degrees. For 600 latitude it is around 24 mb in 24hr; and it may vary between 12 mb/24 hr for 25° latitude and 28 mb/24 hr for polar zone. These studies clearly show that Bomb cyclone occurrences are not new or extreme to 2018 nor it is associated with global warming.

Bomb Cyclone Climatology: Figure 11 presents the global bomb cyclone climatology (1979 - 2010) both for Northern Hemisphere and Southern Hemisphere. 50 - 60 "bomb cyclones" each year (blue line 1979 - 2010) occurred in Northern Hemisphere. Majority of them occurred in North Pacific and North Atlantic. That means, current bomb cyclone is part of natural cycle and nothing to do with global warming.

Figure 11: Global bomb cyclone climatology [1979-2010].

Conclusion

We should not considered unusual weather events are evil but without their presence natural system will be affected drastically. Governments must develop region specific adaptive systems to minimize their negative impacts on nature and at the same time effectively utilize them for betterment of people.

However, it is pertinent to note that without cyclonic activity in terms of rainfall and snowfall the water resources availability will be severely affected more particularly drought prone zones. The shadow zone on the leeward side of Western Ghats in India is a classical example wherein droughts occur in 40 to 60% of the years. In this belt good rains occur rarely without cyclonic activity in Bay of Bengal.

The impact of such events is aggravated due to human physical interference on the nature to meet their greed. Politicians and vested groups have been attributing such events to global warming to cover up from their failures at all levels of governance. In India the severe urban floods in recent years are a typical example. We should not considered unusual weather events are evil but without their presence natural system will be affected drastically. Governments must develop region specific adaptive systems to minimize their negative impacts on nature and at the same time effectively utilize them for betterment of people.

Governments must evolve better disaster management practices based on historical status of such disasters. With reference to urban floods, the governments must restore the natural flow systems and improve them to minimize the damage.

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Volume 2 Issue 4 April 2018

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