

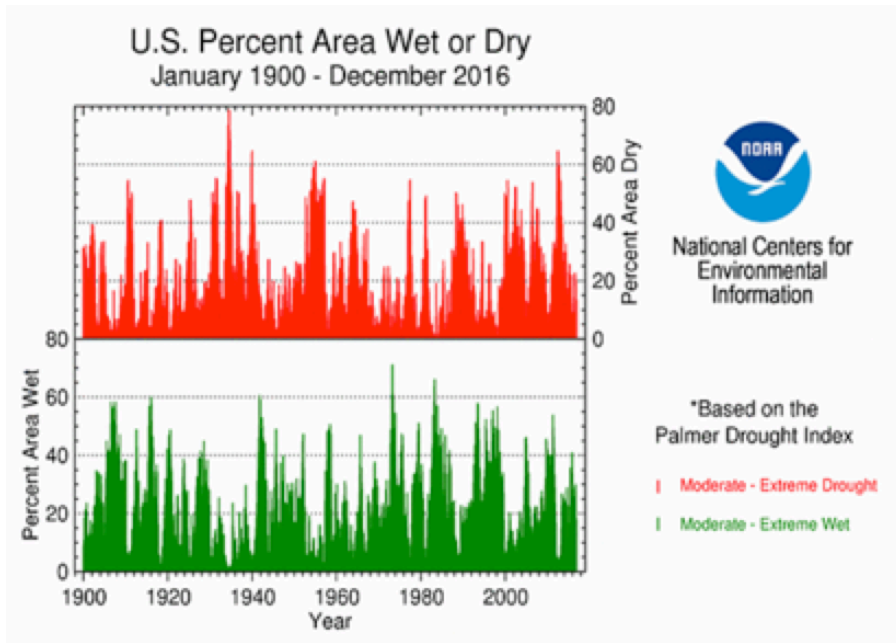
Claim: Global warming is increasing the magnitude and frequency of droughts and floods.

REBUTTAL

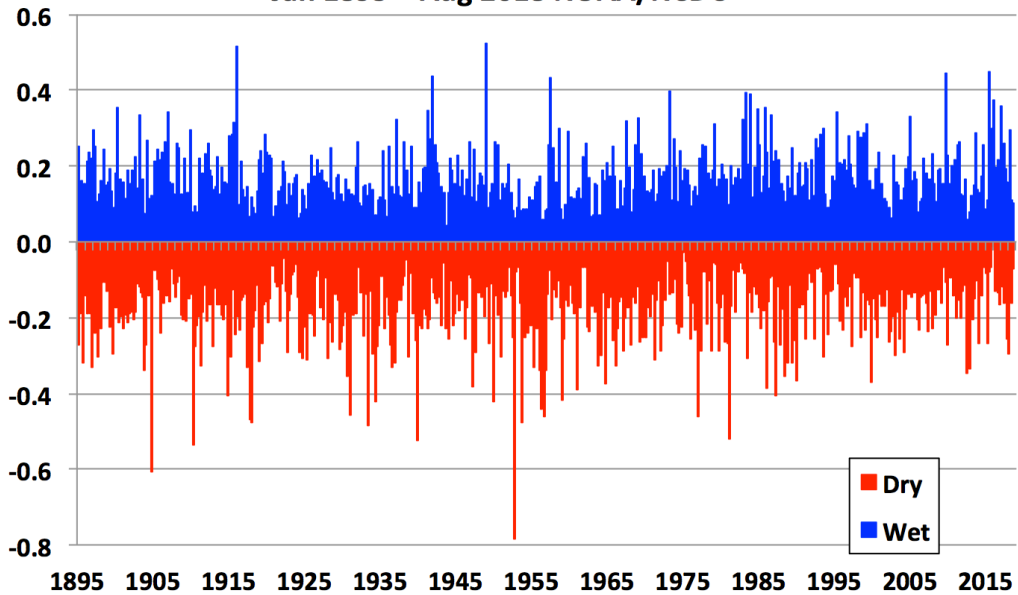
Our use of fossil fuels to power our civilization is not causing droughts or floods. NOAA found there is no evidence that floods and droughts are increasing because of climate change. The number, extend or severity of these events does increase dramatically for a brief period of years at some locations from time to time but then conditions return to more normal. This is simply the long-established constant variation of weather resulting from a confluence of natural factors.

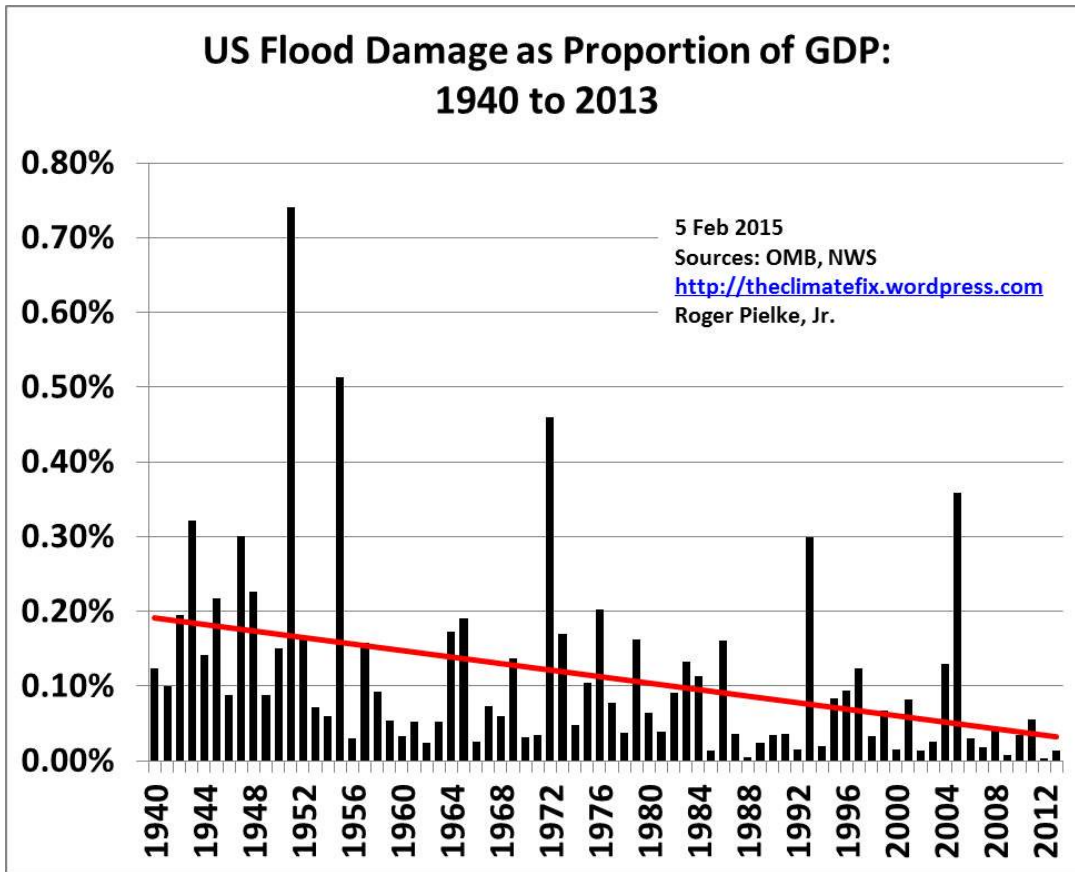
In testimony before Congress Professor Roger Pielke, Jr. said: "It is misleading, and just plain incorrect, to claim that disasters associated with hurricanes, tornadoes, floods, or droughts have increased on climate timescales either in the United States or globally. Droughts have, for the most part, become shorter, less frequent, and cover a smaller portion of the U.S. over the last century. The good news is U.S. flood damage is sharply down over 70 years," Roger Pielke Jr. said. "Remember, disasters can happen any time...". But it is also good to understand long-term trends based on data, not hype."

'Global warming' is not increasing the magnitude and frequency of droughts and floods.



**Monthly Fraction of US with Very Wet (floods) or Very Dry (drought) Conditions
Jan 1895 – Aug 2018 NOAA/NCDC**

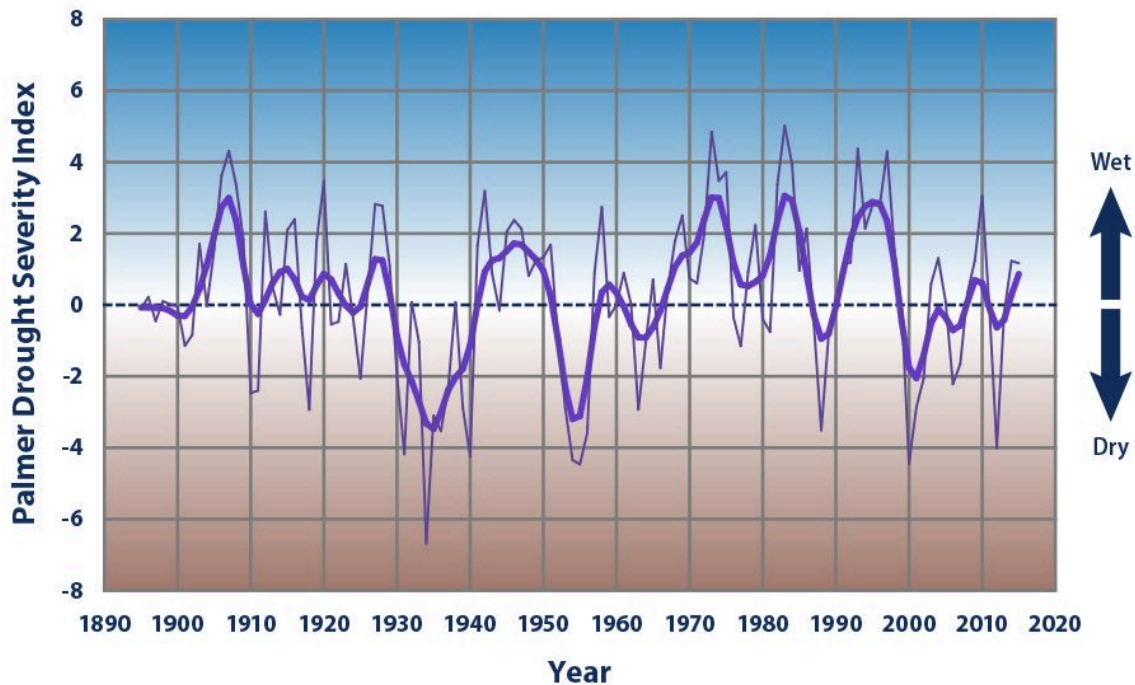




Flood damage in the United States as a proportion of GDP has declined since 1940.

Pielke also pointed to the hard scientific data that shows other types of extreme weather are not getting worse and may in fact be improving. “Is U.S. drought getting worse? No,” Pielke wrote and revealed this [EPA graph](#):

Average Drought Conditions in the Contiguous 48 States, 1895–2015



Data source: NOAA (National Oceanic and Atmospheric Administration), 2016. National Centers for Environmental Information. Accessed January 2016. www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.js.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

Dr. David Legates, Professor, University of Delaware, in a requested [statement](#) to the Environment and Public Works Committee of the US Senate on June 2014, said:

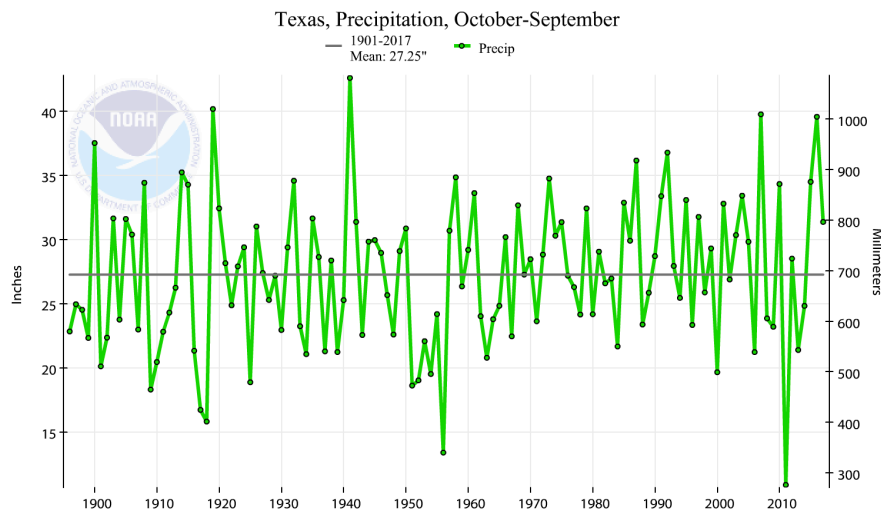
"My overall conclusion is that droughts in the United States are more frequent and more intense during colder periods. Thus, the historical record does not warrant a claim that global warming is likely to negatively impact agricultural activities."

"Given the limitations of the models not only in predicting global air temperatures but also in estimating precipitation and soil moisture conditions, it seems that a more reasonable approach is not to rely on the model prognostications; but rather, to focus on policies that allow for adaptation to the observed variability in precipitation and soil moisture.

Droughts that have happened in the past are likely to occur again, and with likely similar frequencies and intensities; thus, preparation for their return is a better strategy than trying to mitigate them through draconian CO2 emission control policies."

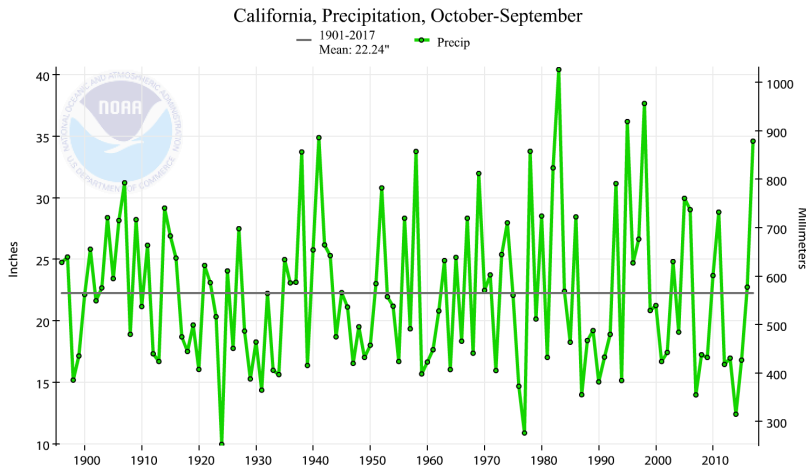
A 2015 study ([Cook et al](#)) found that Megadroughts in the past 2000 years were worse and lasted longer than current droughts.

When drought began in Texas in 2010 and worsened in 2011, alarmists claimed this event marked the start of a 'permadrought'. They shouted that as a farming and cattle ranching region, Texas was essentially finished. Three wet years followed culminating with the major flooding from hurricane Harvey. The Texas drought was over. The alarmists changed their warnings and claim that the flooding from Harvey was the result of climate change and an era of severe flooding storms has begun. The record for precipitation in Texas shows no trend. It does show the worst drought stretch – 6 years long occurred in the 1950s. Large swings are common.



In California there were four dry to very dry years ending in 2014 and the alarmists were again proclaiming a Permadrought there. However a record wet/snowy year occurred in the west with the heaviest snows in the Northern Sierra Nevada Mountains in 2016/17. It resulted in an accumulation of over 750 inches (63 feet) of snow at one location. Within months the California drought ended.

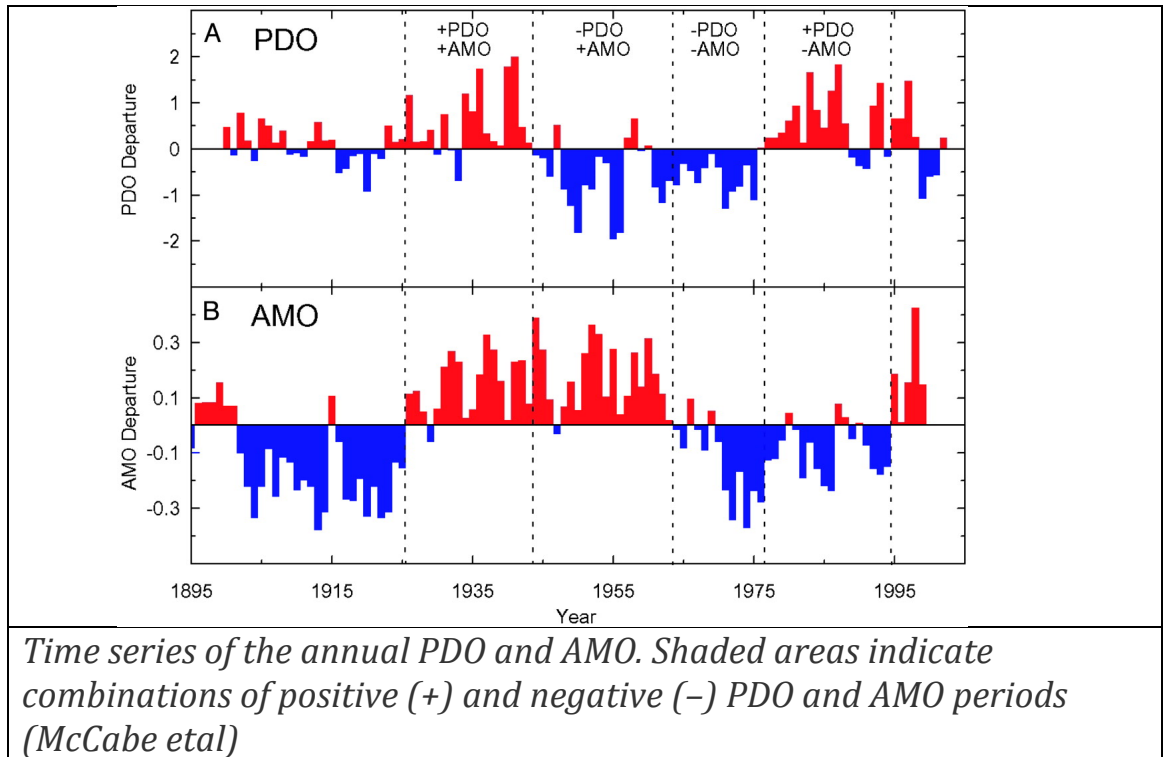
In 2017, overall drought conditions in the U.S. dropped even more as they dropped to only 1.6% of the continental U.S., a modern day record. Again, there is no trend long term to California precipitation.



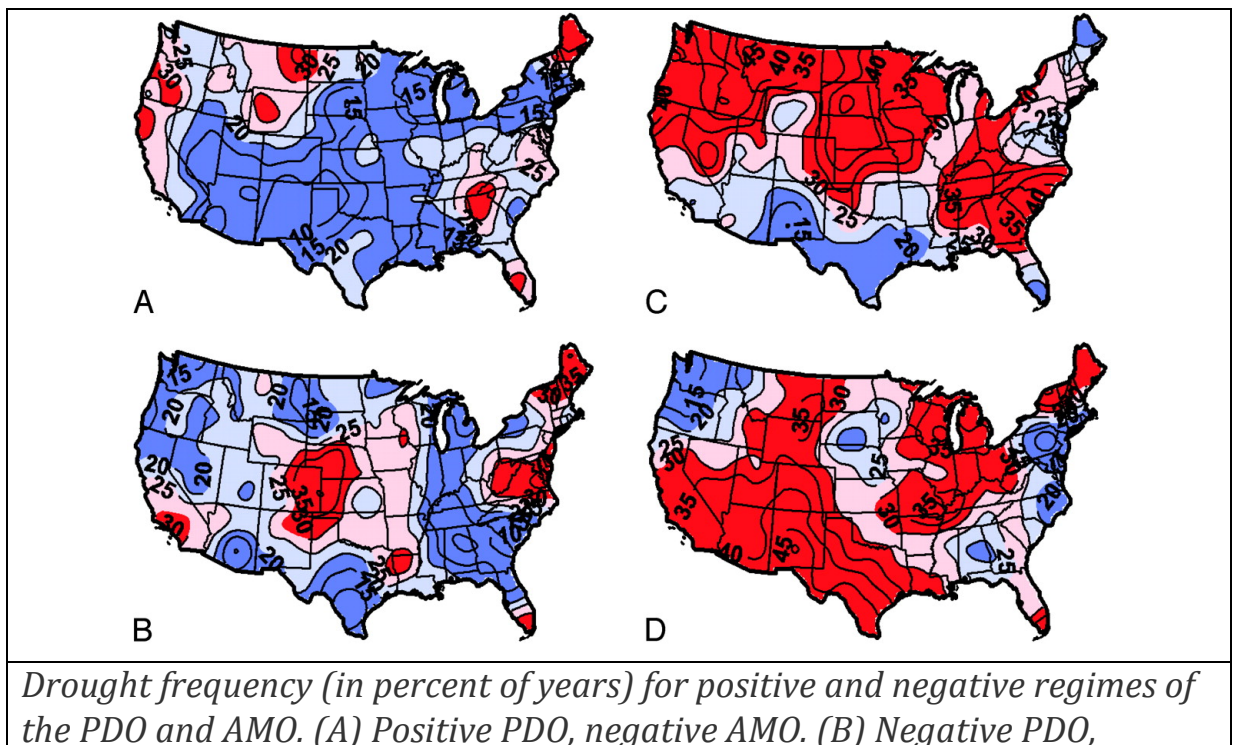
The United States is subject to sometimes extended serious droughts and floods as there are great variations in precipitation in the United States resulting from El Nino and La Nina, Atlantic and Pacific decadal scale oscillations in water temperatures.

[McCabe etal \(2004\)](#) found *“More than half (52%) of the spatial and temporal variance in multidecadal drought frequency over the conterminous United States is attributable to the Pacific Decadal Oscillation (PDO) and the Atlantic Multidecadal Oscillation (AMO).”*

The AMO and PDO are multidecadal ocean temperature oscillations. Because they are not in phase, there are four possible combinations.



It appears the Atlantic AMO determines the overall likelihood of drought (a warm Atlantic increases US drought chances) while the PDO determines the favored locations.



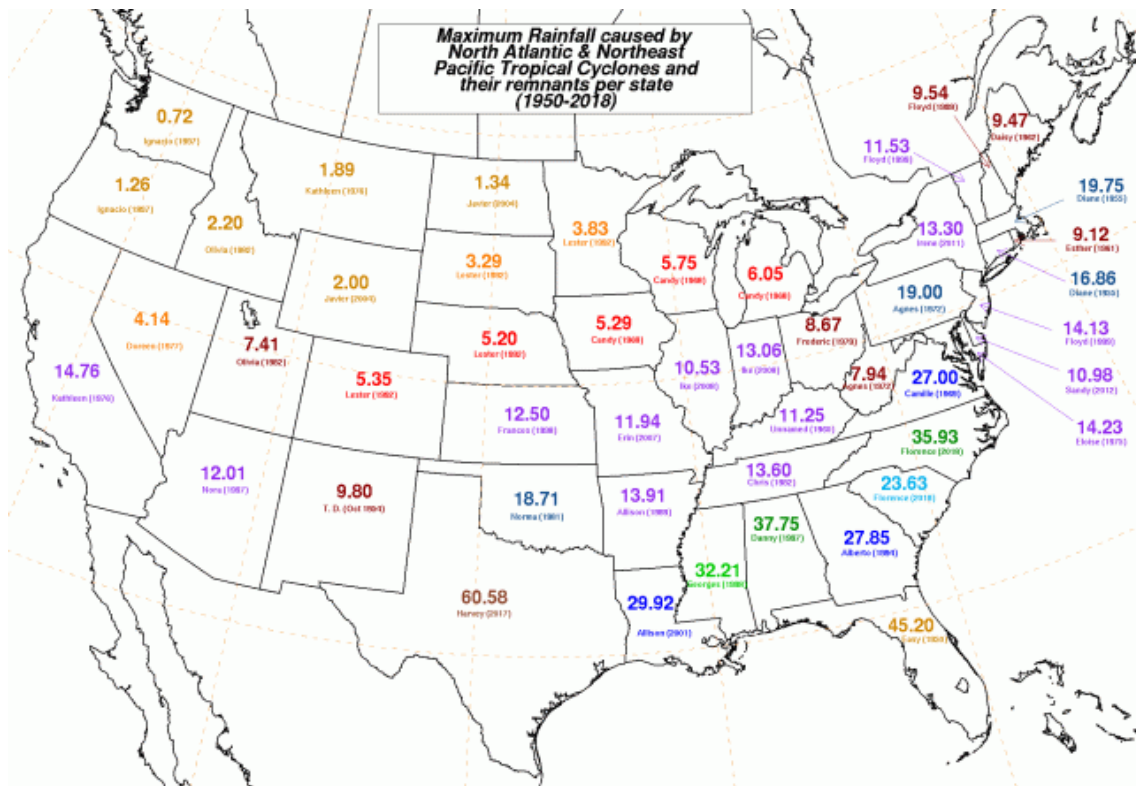
negative AMO. (C) Positive PDO, positive AMO. (D) Negative PDO, positive AMO.

One final note, although there have not been any statistically significant trends in floods and droughts over the last century, NOAA and recent climate assessments note that extreme rainfall amounts in some areas and specific events has increased in recent years. Some have used Harvey's (2017) and Florence (2018) record tropical rain as an example.

NOAA made changes in rain gauge technology to better capture rainfall when strong winds were blowing. As a result at those locations the rainfall totals in some events have jumped upward in step fashion over the last 20 years. The trend since the jump has been flat. It appears, the climate did not change, only the technology.

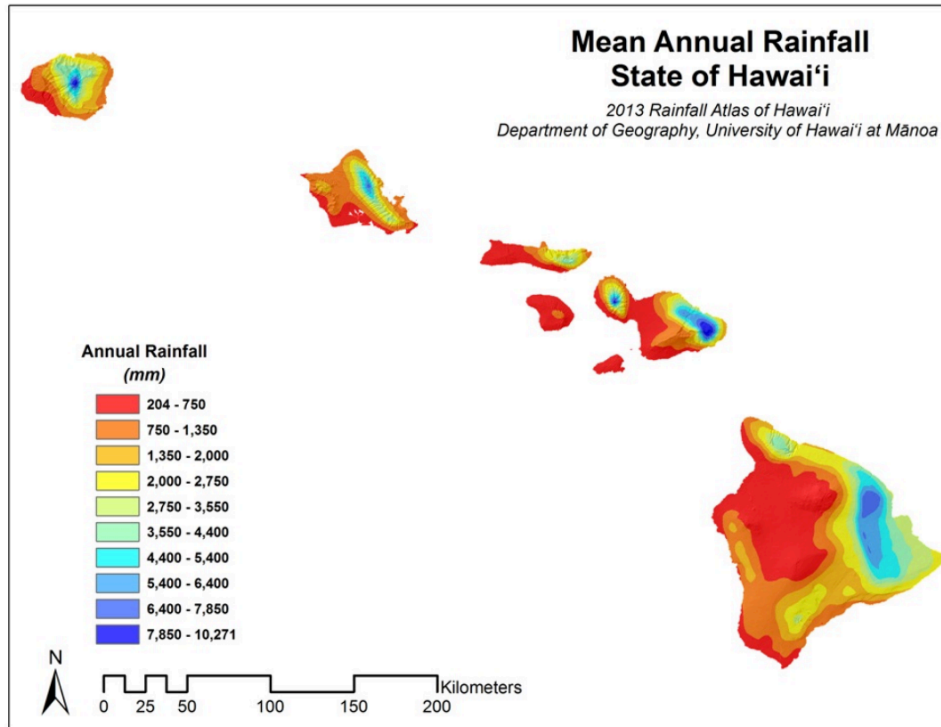
As for Harvey, the storm lingered for days with a continuous flow of moisture off the Gulf of Mexico. Houston and Harris County has implemented a dense network of 154 rain gauges, which improves the chances of capturing a locally heavy amount. Most of the gauges had between 35 and 45 inches in Harvey, but three gauges exceeded the prior record of 48 inches set in Amelia in Medina, Texas in 1978 with one recording 51.88 inches, setting a new record. 6 of the 10 greatest tropical rainfall events in U.S. history have occurred in Texas because storms are often moisture laden (Claudette in 1979 deposited 42 inches in 24 hours in Alvin Texas) or like Harvey stall for days.

NOAA has updated their list of maximum rainfall from tropical cyclones. They added North and South Carolina (Florence) and Hawaii (Lane) in 2018 and Texas in 2017 (Harvey).

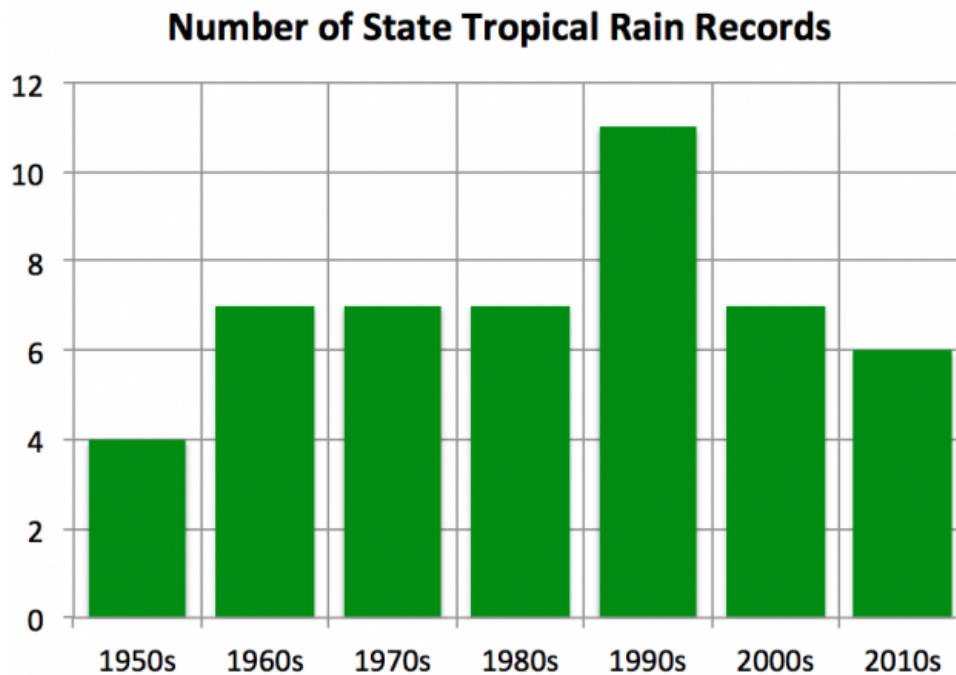


In the case of Lane, the storm never made landfall on Hawaii but the heavy outer rain bands enhanced the rains in the mountainous areas, with 51.53 inches at Mountain View, which has over 100 inches in an average year. The mountainous islands already are among the wettest places on earth because the moist northeast trade winds cause orographic rainfall with averages as high as 404 inches on the windward slope of Haleakalā, Maui.

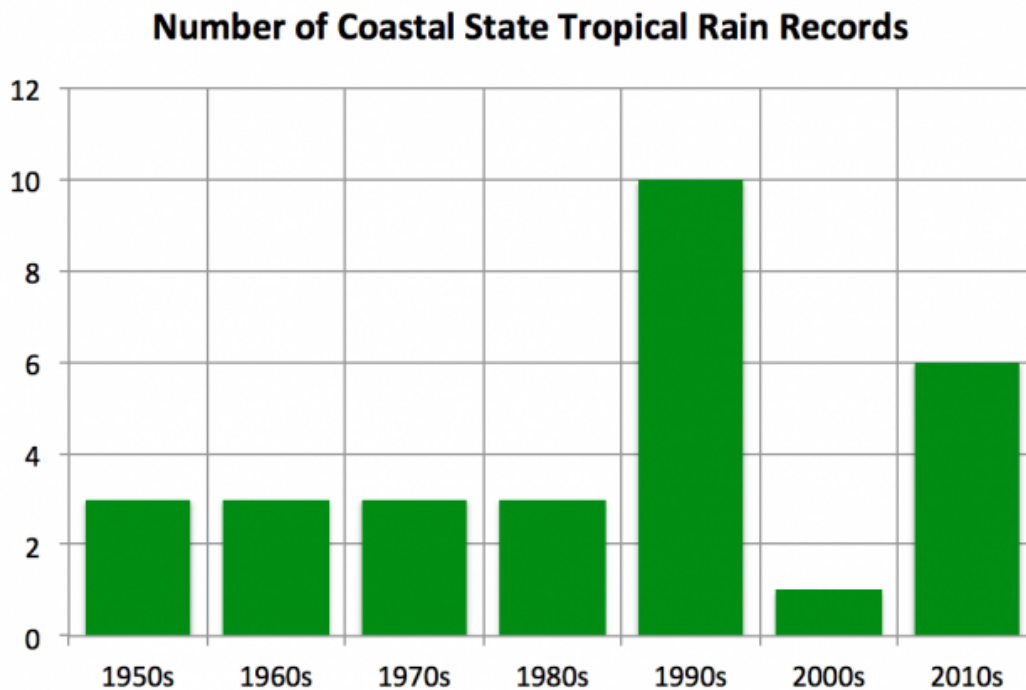
Trends for Hawaii rainfall since 1980 have been down slightly attributed to increased frequency of El Ninos in the El Nino favored warm Pacific Decadal Oscillation Mode. (Frazier et al 2017)



Harvey, Florence and Lane state record bounces the decadal total with a year to go to 6. The peak decade was the 1990s when the AMO and PDO both were in or entered their warm phases.



If you limit to states that are coastal, 1990s still reigns with this decade second.

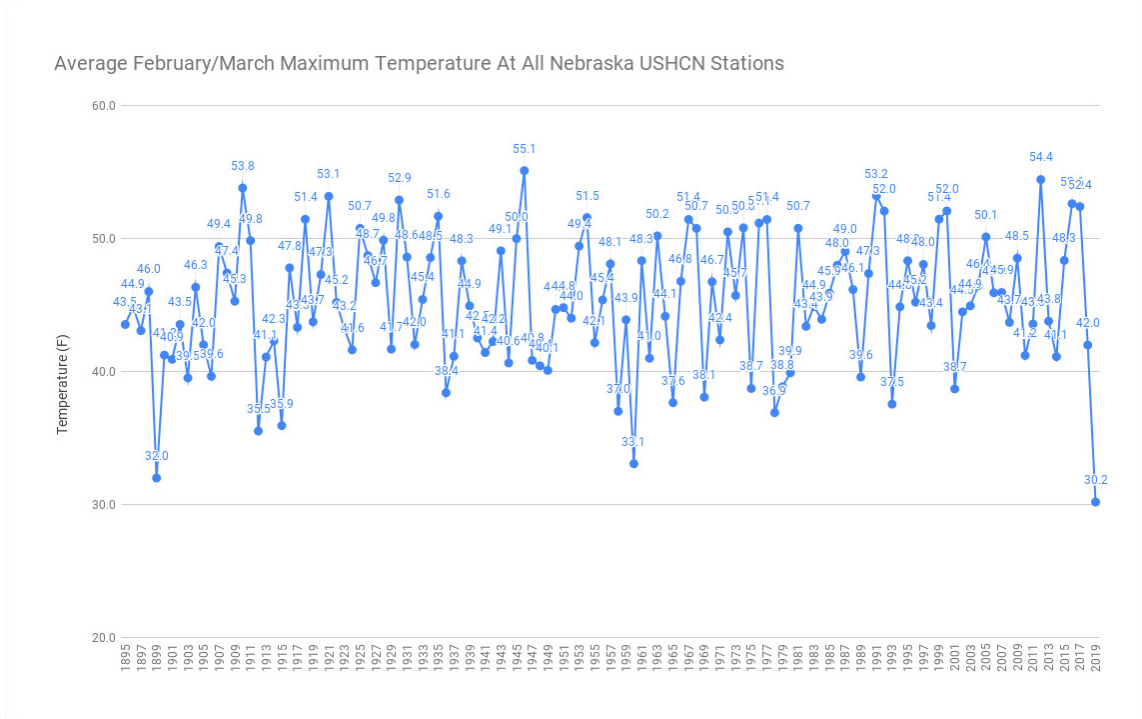


Major volcanism can further enhance heavy rainfall patterns by raining out additional nuclei for cloud droplets or ice crystals and a global cooling of 0.5C or more. The volcanoes have been shown to weaken the tropical and subtropical circulation and reduce tropical and subtropical rainfall while enhancing precipitation in mid latitudes including Europe ([Wegmann et al 2014](#)) and North America. The major floods in the Midwest, in the summer of 1993 may well have been enhanced by the major eruption of Pinatubo in 1991.

THE SPRING FLOODS OF 2019

For much of the country it was a cold and wet winter. In the Midwest, an extreme 'polar vortex' cold in January froze saturated ground with patchy snowcover down 1 to 2 feet. Heavy relentless and in places record snows fell in the northern Plains and Upper Midwest in February. In early March a strong cyclone moved through the western plains with heavy snows but to the east a fast warming and moderate rains caused rapid snowmelt. With frozen rivers and ground, the water

ran off and flooded many areas. Cold returned and the February to March period in Nebraska has been the coldest in the entire record (NOAA, Heller)



Nebraska has a long history of major flooding – 1935, 1936, 1940, 1941, 1945, 1950, 1951, 1962, 1963, 1978. Like 2019, many of the winters were among the coldest in the record.

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He is an environmental consultant on extreme weather events and a scientist with the Natural Resources Stewardship Project.

He has worked in the fields of weather and climate for nearly 50 years and has published more than 120 papers, reports, and book reviews and a monograph on ocean surface wave analysis and modeling (Springer-Verlag 1989).

Khandekar was one of the external reviewers for the Intergovernmental Panel on Climate Change's 1997 Fourth Assessment Report and Editor of the Extreme Weather section of the NIPCC report