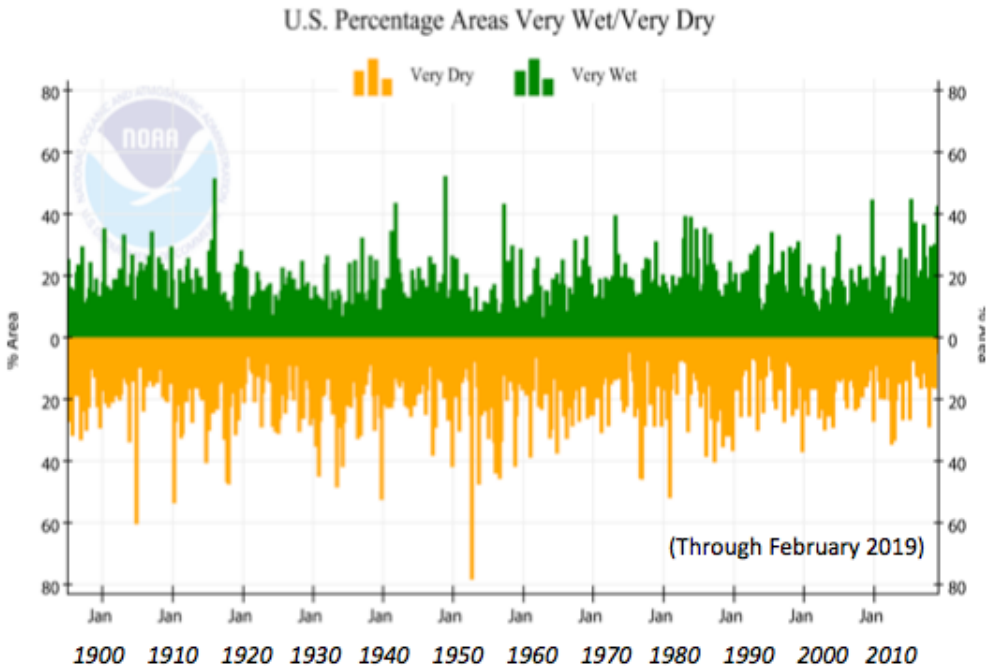
***Claim: Global warming is increasing the magnitude and frequency of droughts and floods.***

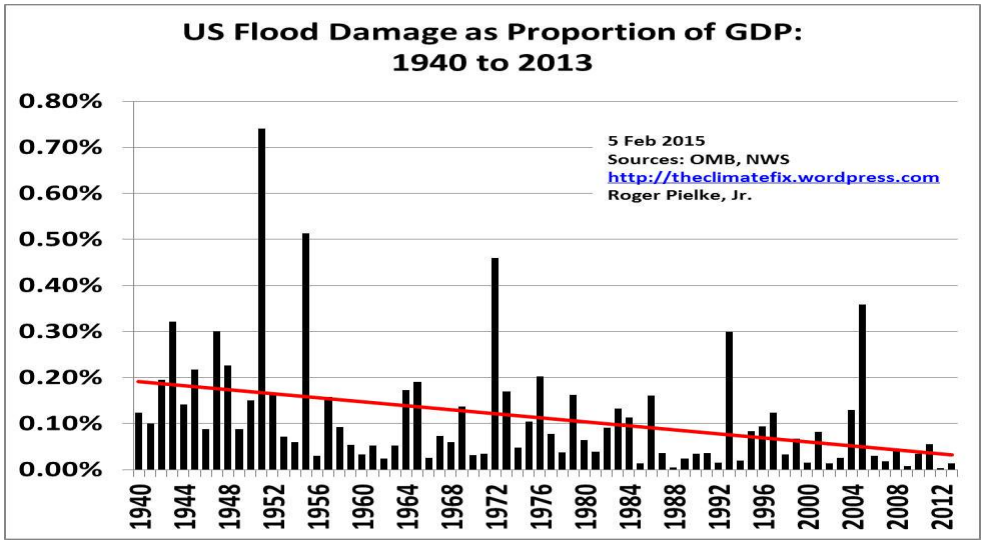
***REBUTTAL***

*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."*

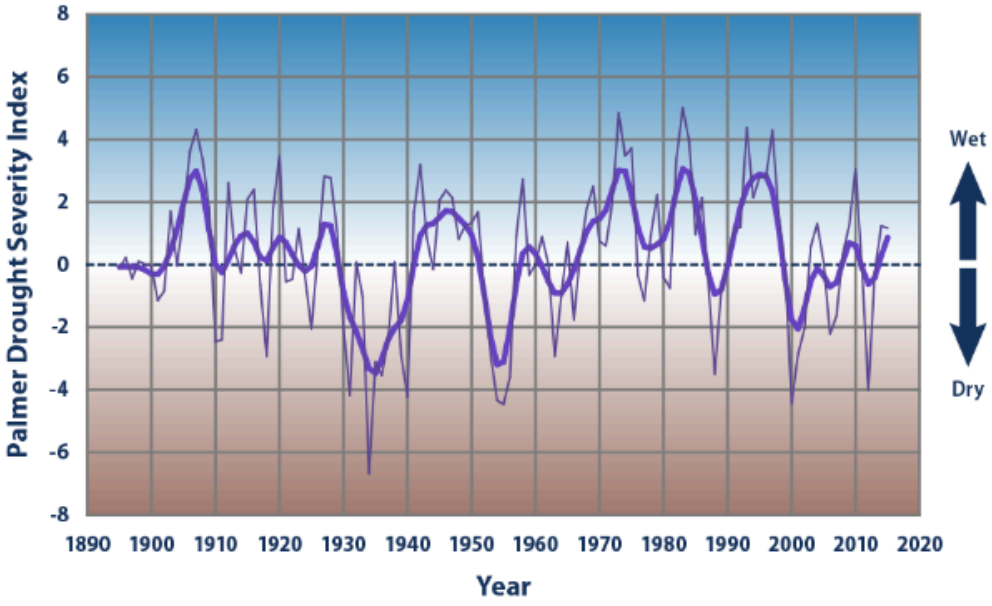


*"The good news is U.S. flood damage is sharply down over 70 years," Roger Pielke Jr. said. "Remember, disasters can happen any time…". "But it is also good to understand long-term trends based on data, not hype."*

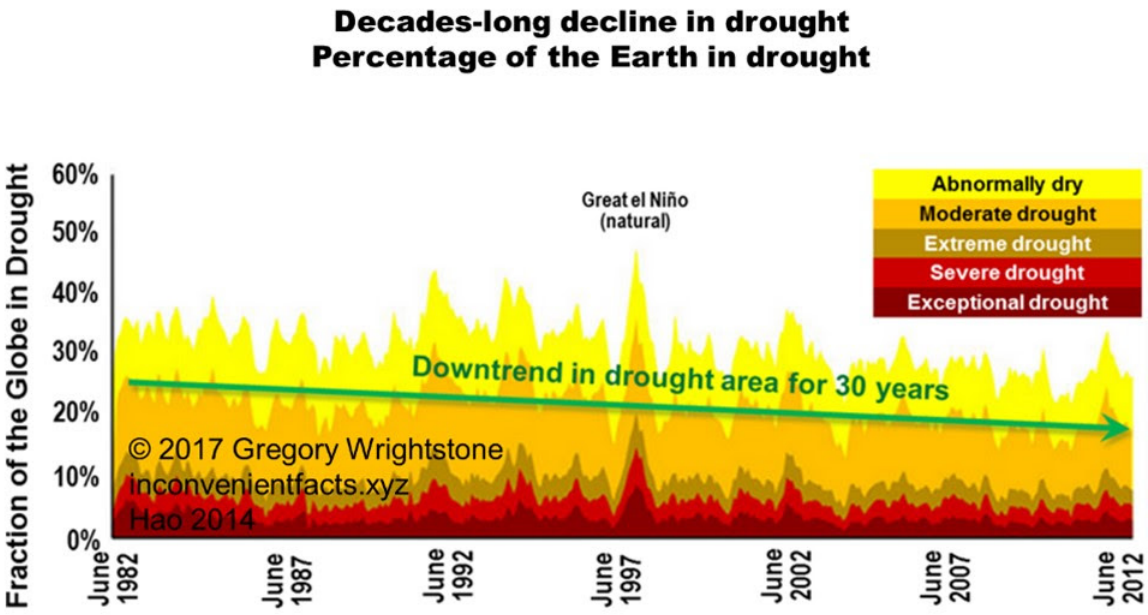



*"Is U.S. drought getting worse? No," Pielke wrote and revealed this EPA graph:*

**Figure 1.** Average Drought Conditions in the Contiguous 48 States, 1895–2015




*Hao etal (2014) showed globally area averaged drought too has declined in recent decades.*




Hao Z, AghaKouchak A, Nakhjiri N et al (2014) Global integrated drought monitoring and prediction system. Sci Data 1, doi:10.1038/sdata.2014.1

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."

*In Summary, the increased use of fossil fuels to power our civilization is not causing an increase in the magnitude and frequency of either droughts or floods.*

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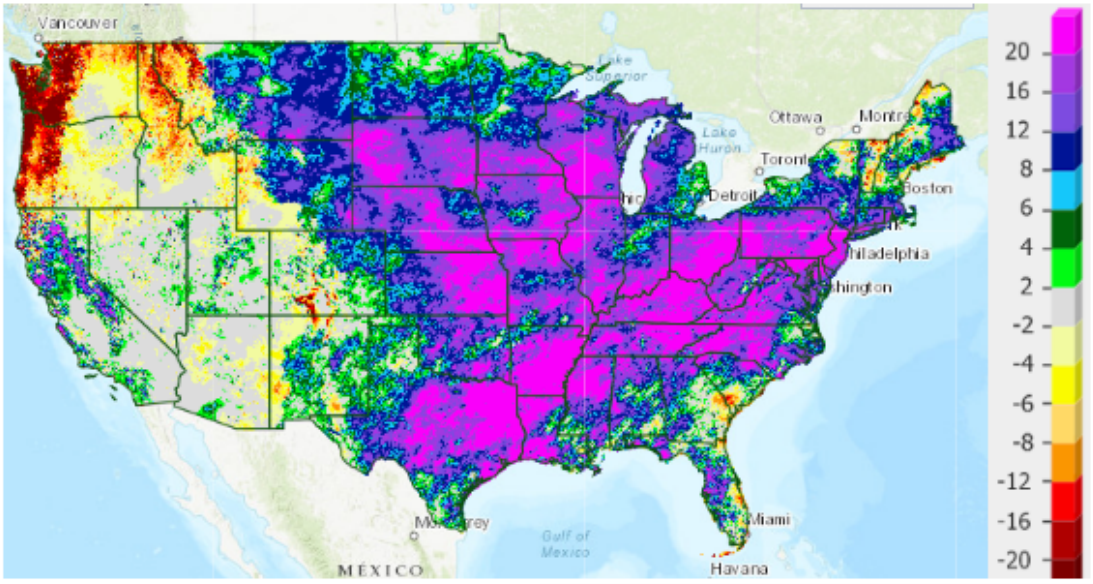
**More Details**

We often see year-to-year variability in the magnitude and areal extent of precipitation, usually related to cycles of El Nino and La Nina.

THE HEAVY RAINS OF 2019

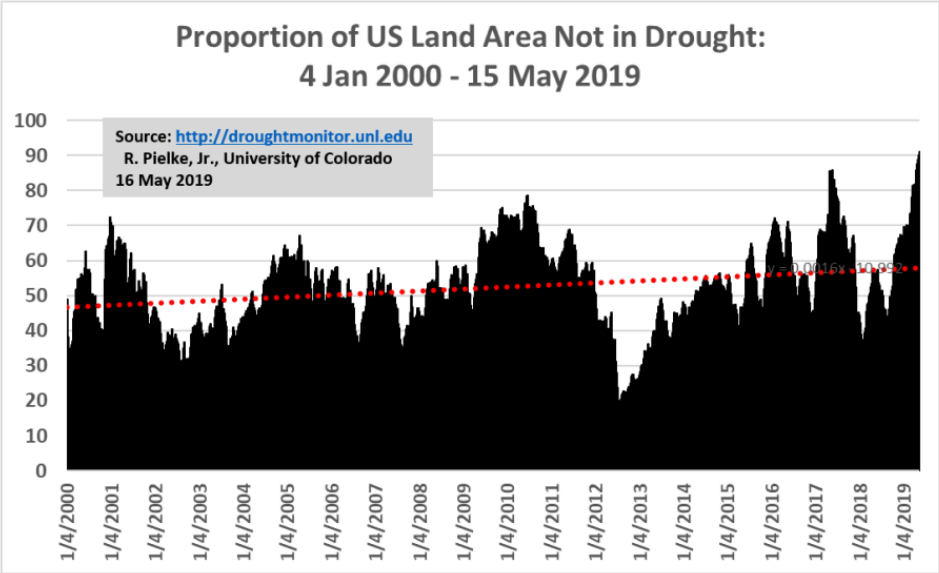
The winter and spring of 2018/19 resulted in extensive heavy rains and snows in much of the nation (image through August 16).




Precipitation Anomalies Last 365 Days (Inches)

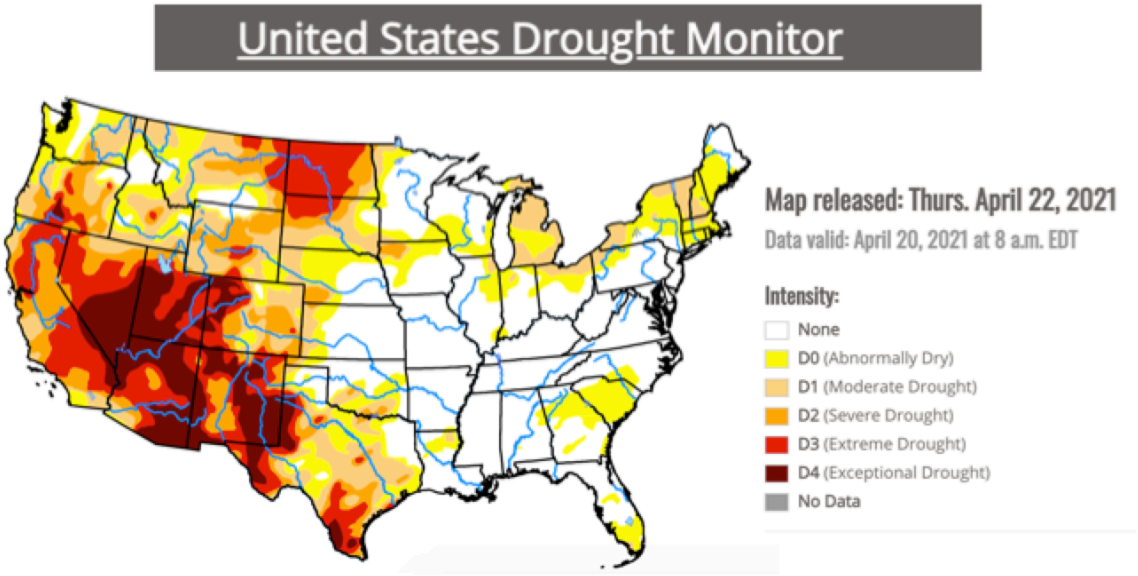
Most of the country's soils became saturated. The exceptions were the far northwest and coastal southeast.

Consistent with that, the country had the smallest area of drought this century.

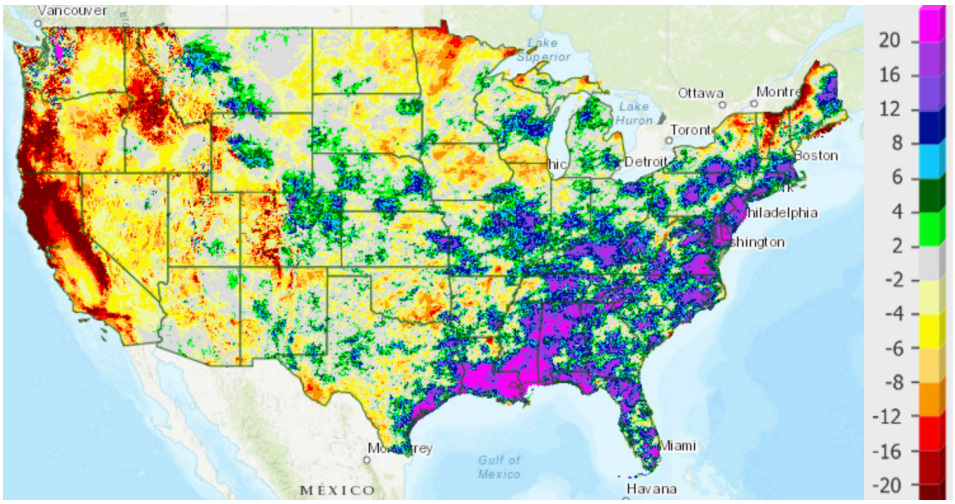



The frozen ground and deep snow helped produce heavy flooding in the central states when the first warmer rain fell, causing rapid melting and runoff. The key to this was the cold winter and heavy snows.

It turned dry by the winter of 2020/21. Drought areal extent grew rapidly in the western third of the nation as La Nina developed. La Ninas favor both summer heat and drought.

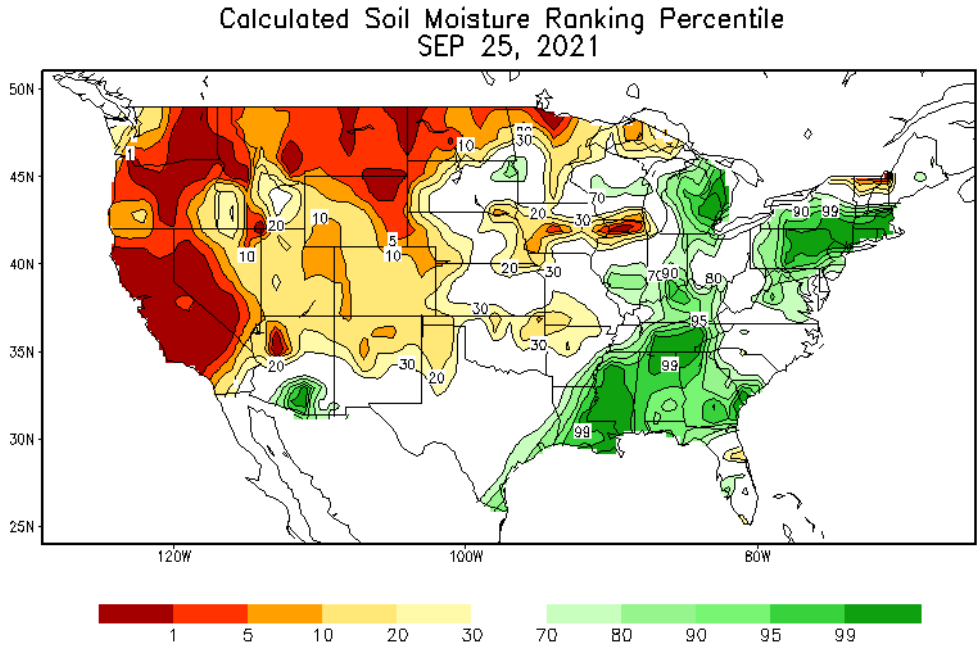


In a year with high persistence and amplified pattern, the drought continued west and north central while heavy rains, some related to tropical storms was seen in the south and east.

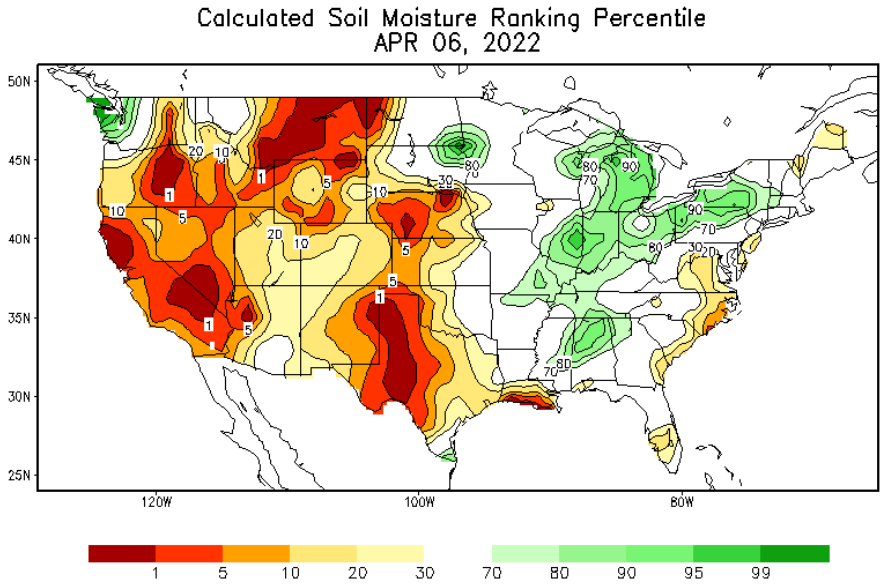



The Total Precipitation Anomaly for the Water Year, which began October 1, 2020 through September 26, 2021

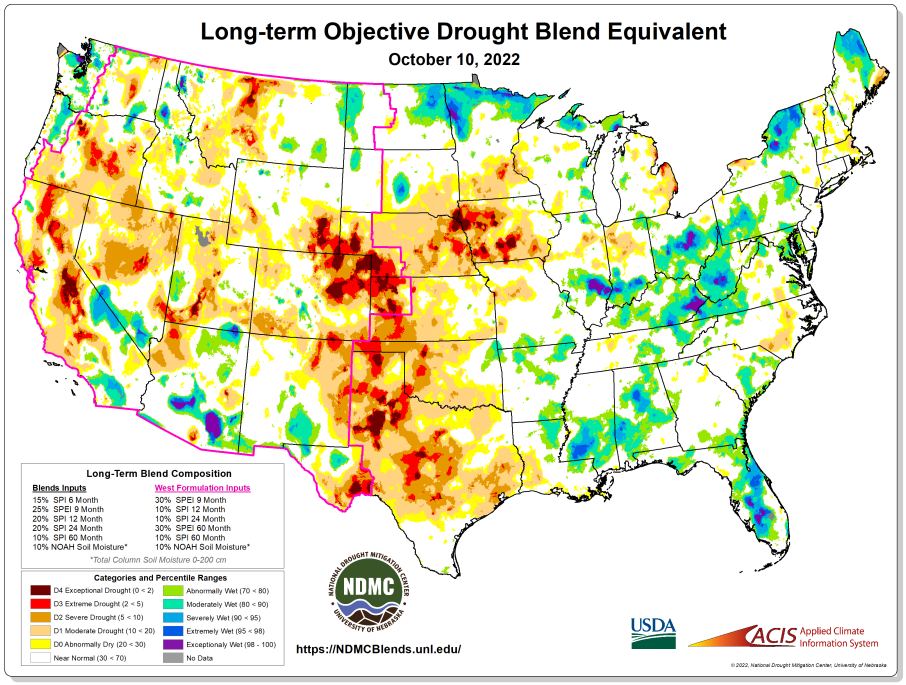
This resulted in soil moisture deficits and drought in the far west and northwest to north central. But these dipoles of wet and dry are common and vary in location and strength.



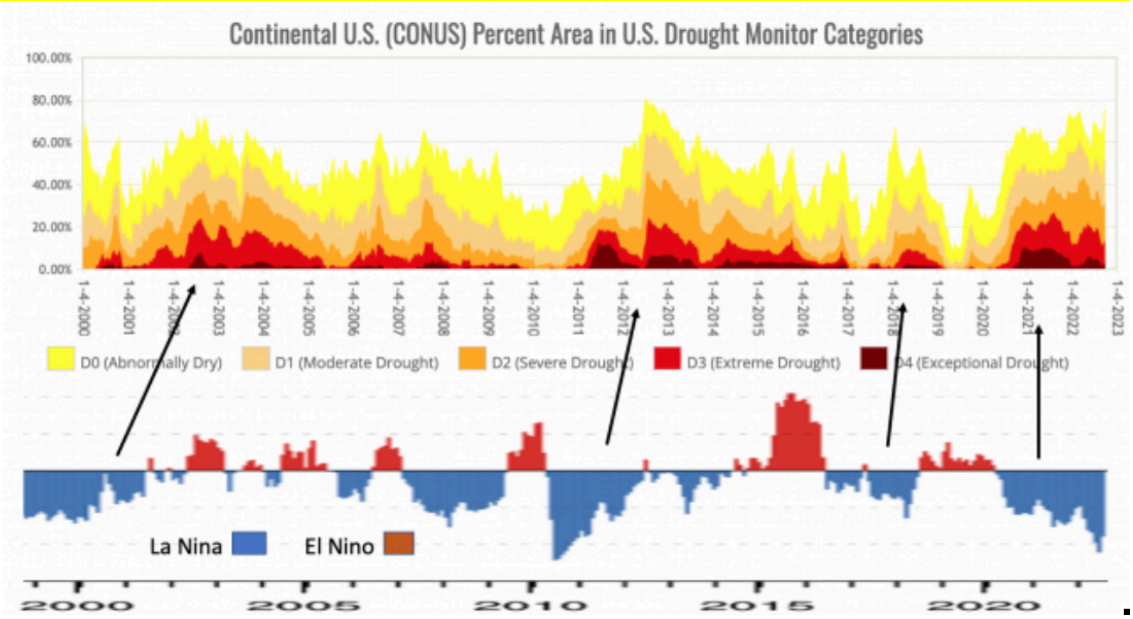
We should note the drought has expanded east as a two year La Nina.




For the third straight year, drought was in the news west and central this spring and summer related to natural cycles in the oceans. La Ninas favor both summer heat and drought.



See how La Ninas increase drought coverage, El Ninos and neutral years are wetter - 2010, 2019.



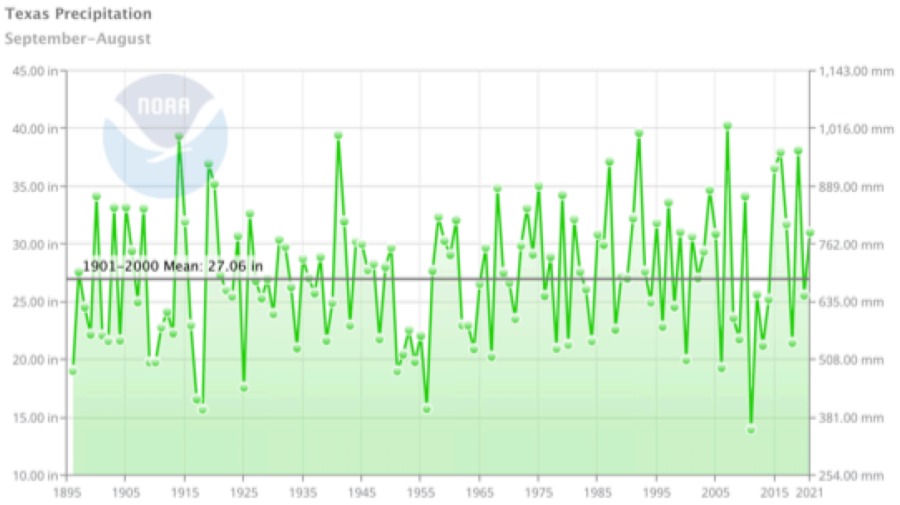

MEGADROUGHTS AND PERMADROUGHTS

When droughts persist for more than a season, talk of a permanent change to a megadrought or permadrought often begin. Expect that to be heard this year with the two year La Nina drought persisting and expanding.

A 2015 study (Cook etal) found that Megadroughts in the past 2000 years were worse and lasted longer than current droughts.

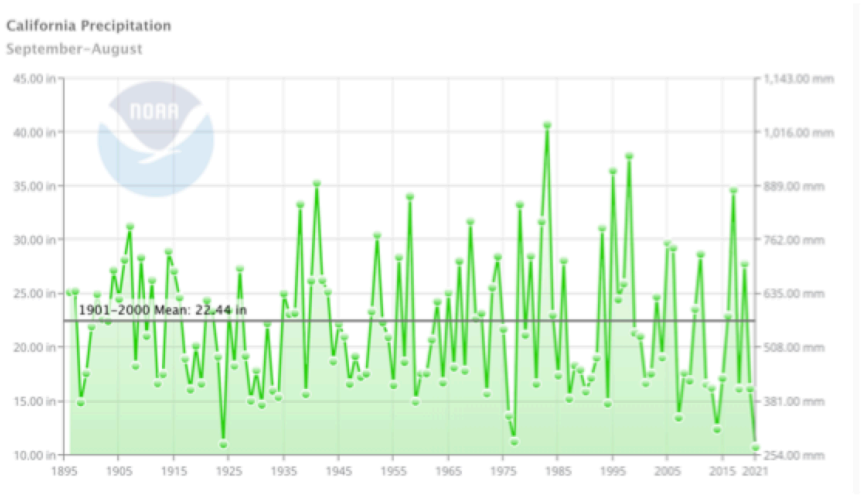
When drought began in Texas in 2010 and worsened in 2011, alarmists claimed this event marked the start of a 'permadrought'. Some worried that as a farming and cattle ranching region, Texas was essentially finished. Three wet years followed culminating with the major flooding from Hurricane Harvey. The Texas drought was over. So then alarmists changed their warnings and claimed that the flooding from Harvey was the result of climate change and an era of severe flooding storms had begun. However, the record below for precipitation in Texas shows a flat trend een with the wet and dry periods. It does show the worst drought stretch – 6 years long occurred in the 1950s. But, large swings are common.

Texas was said to be in Permadrought after the drought of 2010/11 but very wet years followed.
The longest stretch of serious drought (6 years) was in the 1950s and the trend in up 0.25"/decade since 1895



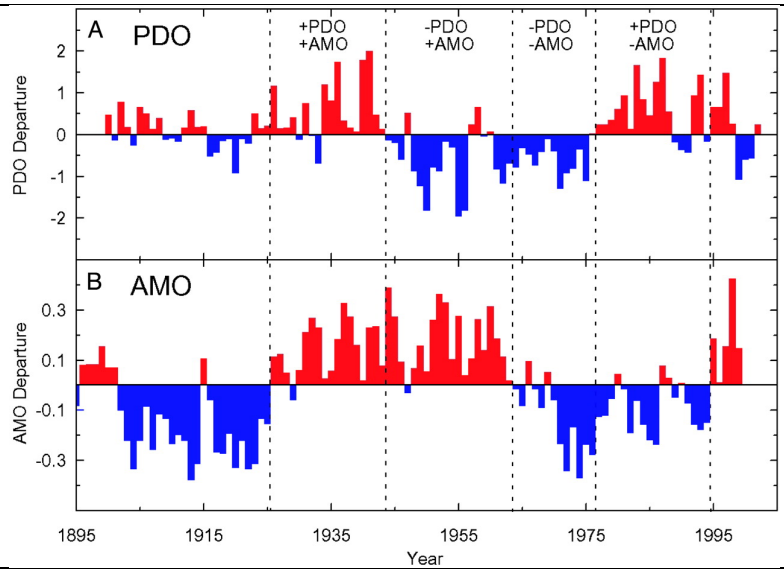

In California there were four dry to very dry years ending in 2014 and the alarmists were again proclaiming a Permadrought there. However a record wet/snowy year occurred in the west with the heaviest snows in the Northern Sierra Nevada Mountains in 2016/17. It resulted in an accumulation of over 750 inches (63 feet) of snow at one location. Within months the California drought ended. Drought returned the following year followed by another wet year before the wet 2019/20. Then the 2020/21 water year western drought followed. It ranked with 1923/24 and 1976/77 as the driest in the Sierras.. Despite these ups and downs, the long-term trend is flat.

California's 2020/21 drought was very similar to 1923/24 and 1976/77. The trend since 1895 is flat.



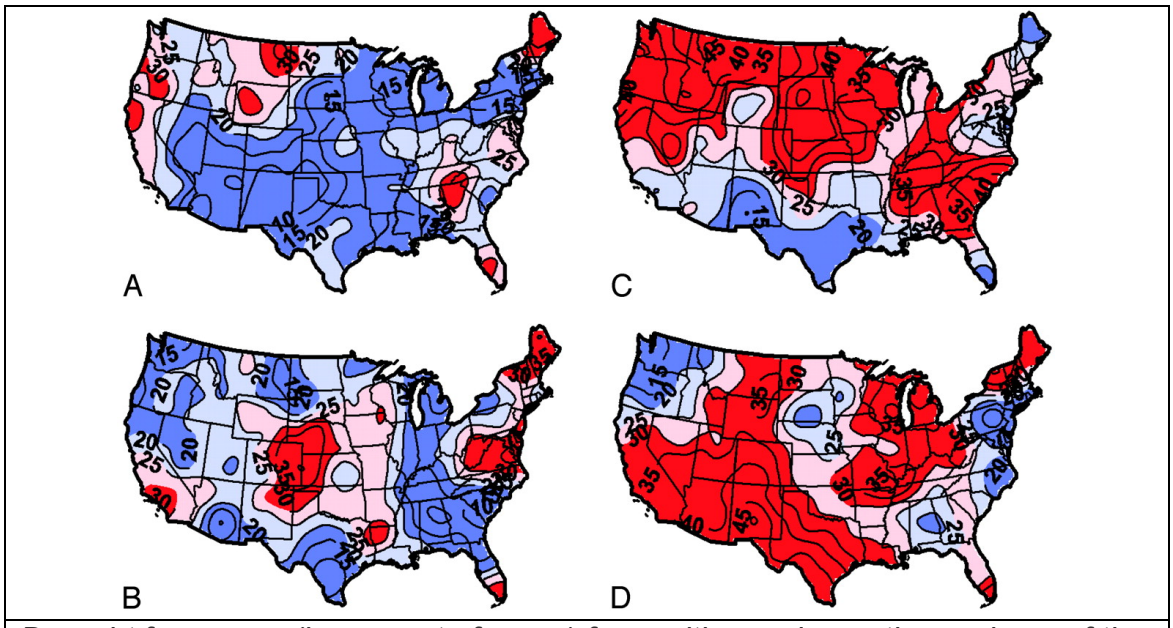

El Nino and La Nina and larger scale Atlantic and Pacific decadal scale oscillations in water temperatures were shown to favor the location for wet and dry.

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.



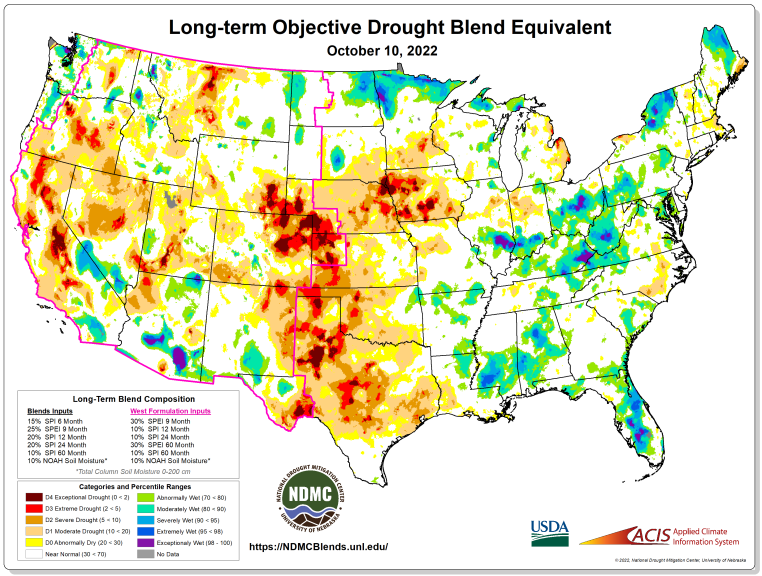

*Time series of the annual PDO and AMO. Shaded areas indicate combinations of positive (+) and negative (–) PDO and AMO periods (McCabe etal)*

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. See the figure below.




*Drought frequency (in percent of years) for positive and negative regimes of the PDO and AMO. (A) Positive PDO, negative AMO. (B) Negative PDO, negative AMO. (C) Positive PDO, positive AMO. (D) Negative PDO, positive AMO.*

Drought in 2022 occurred with a strong negative PDO and positive AMO (D in the figure above). Near the end of summer, the long-term drought blend was similar.

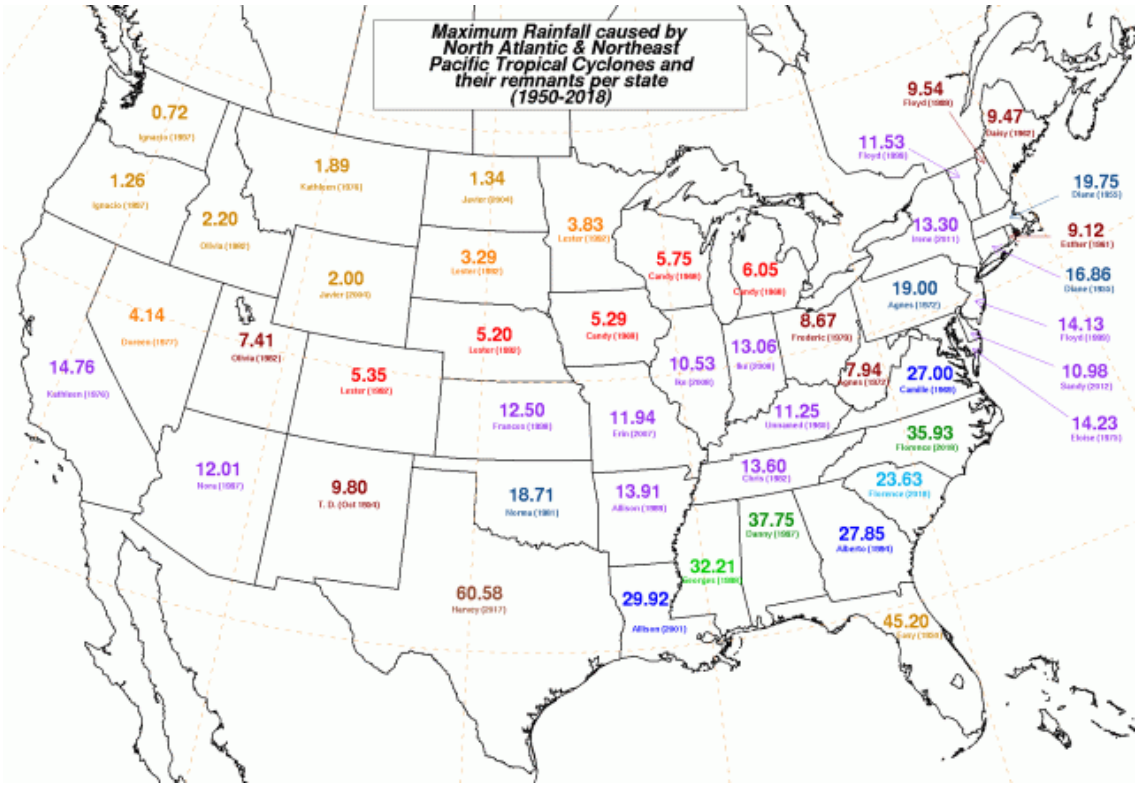


One final note, although there have not been any statistically significant linear trend slopes in the flood and drought data over the last century, NOAA and recent climate assessments note that extreme rainfall amounts in some specific events has increased in recent years. Some have used Harvey's and Florence's record tropical rains as an example. However, about 20 years ago, 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 linear 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. And, Houston and Harris County had implemented a dense network of 154 rain gauges, which improved 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 stalled for days.

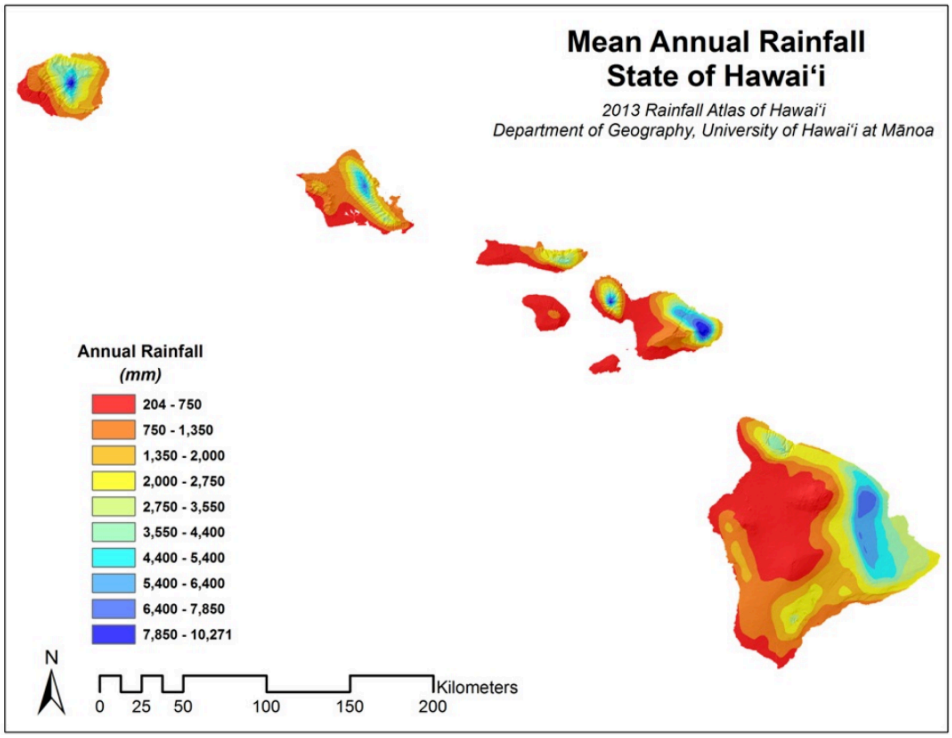
With regards to Florence, the records related again to slow movement of the heavy rain bands and the storm looped through the Carolinas.

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).

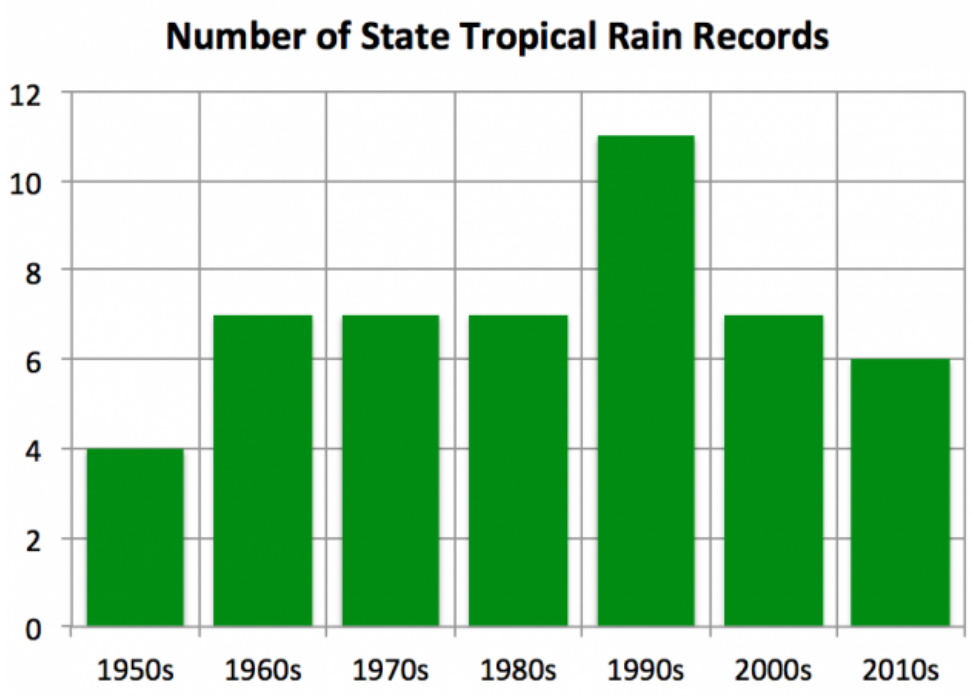



In the case of Lane, the storm never made landfall on Hawaii but the heavy outer rain bands enhanced the rains in the mountainous areas, with 51.53 inches at Mountain View, which has over 100 inches in an average year. The mountainous islands already are among the wettest places on earth because the 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 etal 2017)




Harvey, Florence and Lane state record bounced 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.



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 *etal 2014)* and North America. The major floods in the Midwest summer of 1993 may well have been enhanced by the after effects of the major eruption of Pinatubo in 1991.

## UK Confuses weather and climate

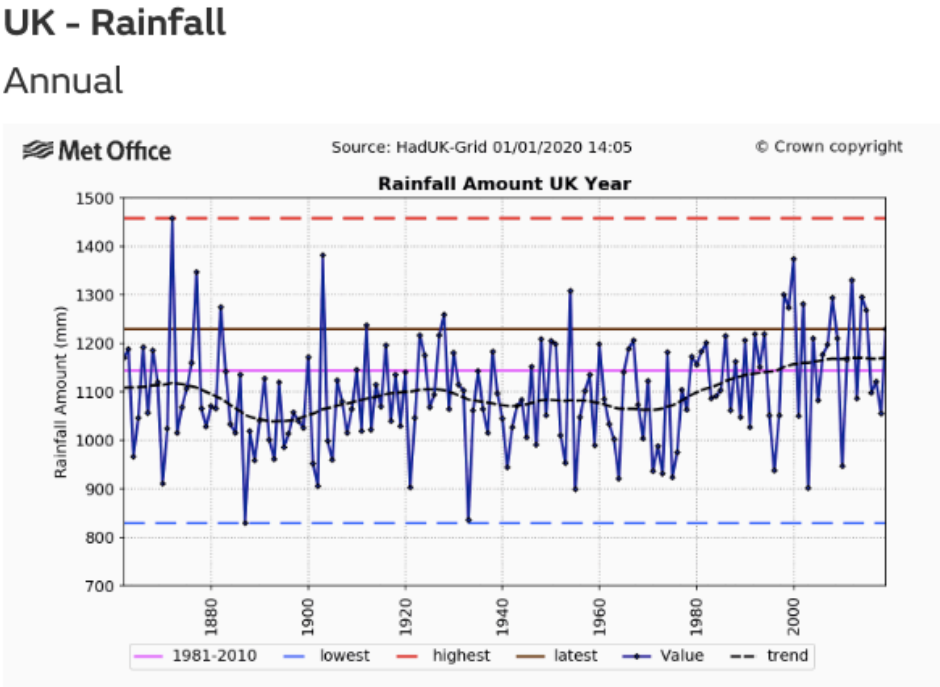
A new report, The Great British Rain Paradox (1), has just been published, warning of potential water shortages in the UK in years to come.

It claims that the major factor for this is climate change. The foreword, written by the CEO of the Environment Agency Sir James Bevan, states:

"Climate change is causing long spells of dry weather that are putting our water resources under increased pressure. May 2020 has been the driest on record and exceptionally dry weather across the south east between 2017 and 2019 led to some of the lowest groundwater levels we have ever seen."

These claims have no basis in fact.

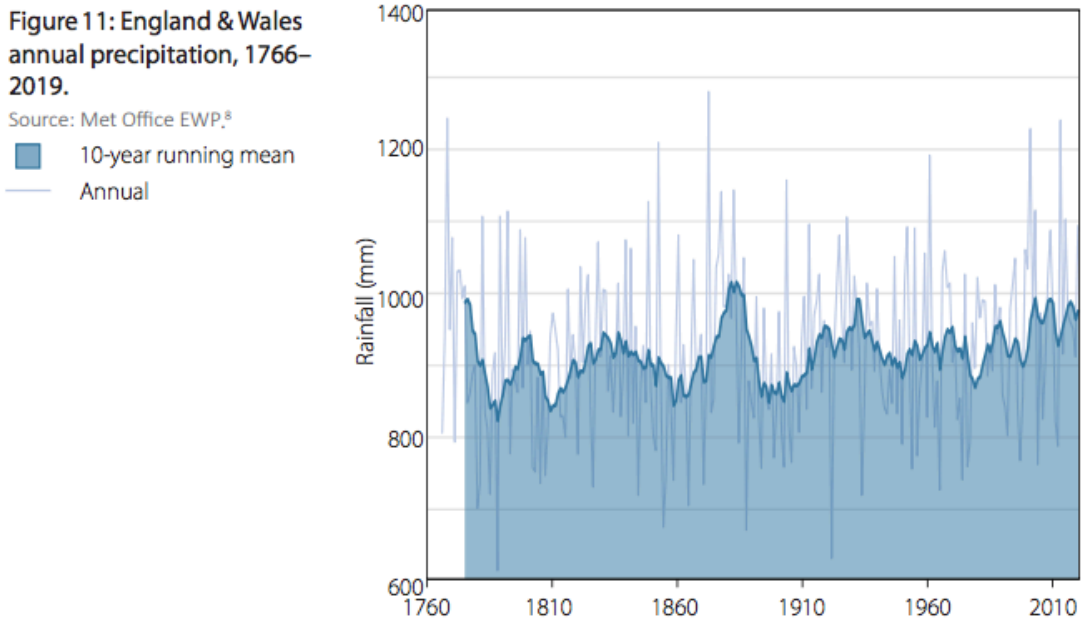
Official Met Office data shows that the UK has actually been getting wetter in recent decades.



What is particularly noticeable in England and Wales is the absence of severe drought years in recent decades.

**Figure 11: England & Wales annual precipitation, 1766–2019.**

Source: Met Office EWP.[8]




May 2020 certainly was not the driest on record either - in the UK as a whole, it was only the ninth driest since records started in 1862. The driest May was in 1896.

*"Annual trends are small relative to variability between years, with the decade 2009-18 being on average 5% wetter than the 1961-90 average and 1% wetter than 1981-2010. Much larger increases are seen when summers and winters are assessed separately. UK summers during 2009-18 were on average 13% wetter than the 1961-90 average and 11% wetter than 1981-2010, while the figures for winters are 12% wetter and 5% wetter, respectively."*

Analysis of regional rainfall data does not support the reports. Thanks to GWPF's Benny Peiser who concluded:

*"As with other alarmist claims, it is clear from the empirical data that there has been no long-term upward trend for droughts and floods."*

**Experts:**

**Dr. David R. Legates**

Ph.D., Climatology, University of Delaware
Associate Professor Geography, University of Delaware, taught at Louisiana State University, the University of Oklahoma, and the University of Virginia.

Chief Research Scientist at the Center for Computational Geosciences, and Visiting Research Scientist at the National Climate Data Center.

Associate Director of the Delaware Space Grant Commission
Certified Consulting Meteorologist. (CCM) AMS

**Dr. Anthony Lupo**

IPCC Expert Reviewer

Professor, Atmospheric Science, University of Missouri

Ph.D., Atmospheric Science, Purdue University

M.S., Atmospheric Science, Purdue University

**Dr. Madhav Khandekar**

Madhav is a former research scientist from Environment Canada and is presently on the editorial board of the Journal of Natural Hazards (Kluwer). 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.

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Co- founder and Chief Meteorologist at The Weather Channel, Chief Meteorologist at WSI, Hudson Seven LLC, WeatherBell Analytics LLC