## A Practical Guide to Climate Change in Alabama

John R. Christy Alabama State Climatologist Professor Atmospheric and Earth Sciences Director, Earth System Science Center Interim VP Research & Economic Development

## Dealing with Claims about Climate Change in 2021 can be extremely frustrating ... as it has been for 20+ years.



The Associated Press

Dr. John Christy of Huntsville testifies on Capitol Hill Thursday before the Senate Environmental and Public Works Committee.

#### **20** Congressional Hearings





2017

ALL THESE KOCH FUNDED CLIMATE SCIENCE DENIERS ARE CALLING ME NAMES ... AND I NEVER SAID THAT

#### DR. MANN TAKES THE HYPOCRITIC OATH

US GOV HOUSE COMMITTEE ON SCIENCE. SPACE. AND TECHNOLOGY HEARING - CLIMATE SCIENCE: ASSUMPTIONS. POLICY IMPLICATIONS. AND THE SCIENTIFIC METHOD

# A Practical Guide to Climate Change in Alabama

John R. Christy

Alabama State Climatologist The University of Alabama in Huntsville

We'll look at the actual evidence for Alabama and the world to see if there is a "climate crisis." This is something a dispassionate, objective scientist from UAH should do for Alabama.

Paraphrasing William Thomson (Lord Kelvin)

# All Science is Numbers



1824-1907

Note: UN IPCC AR6 "Evidence" includes model output and expert judgement







#### Average Number of Daily High Temperature Records set Per Decade per Station 1911-20 to 2011-2020. > 105 Years required per station

When have Daily Record High Temperatures occurred by decade?





#### Alabama Summer TMax 10-yr Running Averages



The latest climate model simulations for Alabama are already too hot by 4 °F in 2021 for 10-year averages.

Climate model projections are inadequate for policy direction.



Alabama Palmer Modified Drought Index (PMDI)





Total Cold Season (Nov-Apr) Snowfall for the Alabama Station with the Greatest Amount per Year



-UAH -NCEI





Count Major Tornadoes U.S. (F3-F5) 1954-2020



# Climate is not changing in Alabama as the theoretical hypotheses claimed.

What about the Globe?

# Claim: All Extreme Weather is getting worse due to human emissions of GHGs













# The record-shattering 2020 hurricane season, explained

## The Washington Post

Democracy Dies in Darkness

2020 Atlantic hurricane season breaks all-time record while leaving Gulf Coast battered



# Devastating 2020 Atlantic hurricane season breaks all records

Dozens of people have died this year as Theta becomes 29th major storm

#### Accumulated Cyclone (hurricane) Energy 2020 v. Average



1933 experienced 35% more ACE than 2020

Klotzbach Colorado St. Univ.



**Record Shattering?** 

Klotzbach Col State Univ

#### Count Major Tornadoes U.S. (F3-F5) 1954-2020



F3-F5

### Monthly Fraction of US with Very Wet (flood-like) or Very Dry (drought) Conditions

Jan 1895 – Dec 2020 NOAA/NCDC (20 driest months before 1988)



Average Number of Daily Record High Temperatures by year for 661 USHCN Stations with at least 105 years of record (1895-2020) (expected value is 366/126 = 2.9 events each year)



NCEI/NOAA data downloaded 6 Aug 2021



### **Global Drought Indices 1950-2019**



Fig. 2.34. Percentage of global land area (excluding ice sheets and deserts) with scPDSI indicating moderate (< –2), severe (< –3) and extreme (< –4) drought for each month of 1950–2019. Inset: Each month of 2019.

Western Wildfires in United States of 2020, especially California



California's wildfire hell: how 2020 became the state's worst ever fire season



California exceeds 4 million acres burned by wildfires in 2020

More than 8,200 fires have consumed more than double the previous record, fire officials said.



Record Torched: 2020 California Wildfires Have Burned More Than 4 Million Acres

# Los Angeles Times

California fire season shatters record with more than 4 million acres burned



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## Incidence in wildfires in North America 1600-2000 (It's all about human management)

Swetnam et al. 2016 Phil Trans B



Marking my property line in Fresno Co. This is 4 miles from southern border of Creek Fire.



California was subjected to annual burns by Native Americans or Mother Nature prior to Spanish settlement. *Pre-European burn area was 4.5 to 12 million acres in CA per year (Stephens et al. 2007.)* 

Subsequent settlers practiced "fire suppression" from the late 19<sup>th</sup>, through the 20<sup>th</sup> and 21<sup>st</sup> centuries as public policy. Significant human occupation of and access to formerly natural landscapes. Dry, unburned fuel load rose dramatically.

**2020 CA acreage burned was under 4.5 million acres.** Set up by (1) 2012-2015 drought, (2) weakening forests, (3) barkbeetles killed ~150 million trees left to stand (80% in areas). No harvesting allowed of dead trees creating a massive fuel debt to be burned ... 2020 took care of some of that debt.

What is the source of the climate data about which so much contention arises? How are these datasets constructed? Are they able to give us precise answers about climate change? Dr. Christy examines these questions in detail for one spot on the earth – his hometown of Fresno, California. He delves into the observations, adding some data never before used to build a dataset of temperatures starting in 1887. Along the way he mentions the personal experiences of his Fresno life that dovetail with his passion for climate science. After putting all of the information together, he arrives at a conclusion that implicates humans for the temperature changes Fresno has seen, but not in the way that is popularly promoted today. Finally, he offers insight from his background as a professional Climatologist and former resident of Africa as to how we might approach policy decisions regarding this highly contentious issue.



Dr. John R. Christy is the Distinguished Professor of Atmospheric and Earth Sciences, Director of the Earth System Science Center and Alabama's State Climatologist at the University of Alabama in Huntsville (UAH). His awards include NASA's Exceptional Scientific Achievement Medal, the American Meteorological Society's Special Award and the rank of Fellow of this Society for his satellite research. He has published over 100 scientific papers, appeared as an expert witness on climate in U.S. Federal Court, and has testified before the U.S. Congress 20 times. The greater Fresno area served as his home from birth to graduation from Fresno State (B.A. Mathematics). After teaching Physics and Chemistry in Kenya, East Africa, he earned a Master of **Divinity from Golden Gate Baptist Theological** Seminary, then served as a bi-vocational pastor while also teaching math at nearby colleges. He headed back to the classroom for M.S. and PhD degrees in Atmospheric Sciences from the University of Illinois which then prepared him for his career at UAH.





#### Amazon.com. All proceeds go to UAH scholarships



#### **Bjorn Lomborg**

1901-2007 from https://gupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2013/G002532, 1997-2016 from http://globalfiredata.org/analysis.html, and 2017-18 from https://gwis.jrc.e.europa.eu/static/gwis.statistics.portal/countries-estimates/NA. While estimates of global burned area attempt to be internally consisten, they differ in scope, hence data here shown as difference from 2000-7. Model estimate for that period is 3.63Mkm<sup>2</sup>, satellite estimate for period is 4.88Mkm<sup>2</sup>, twitter.com/bjornlomborg



119, Issue: 3, Pages: 249-263, First published: 14 February 2014, DOI: (10.1002/2013JG002532)

#### NH SNOW EXTENT Million KM<sup>2</sup> Average November to April 1967-68 to 2020-21



Rutgers U. Snow Lab. Plotted by John Christy, The University of Alabama in Huntsville

## The last century's warming has been good for Humanity





# The Theory of Greenhouse Warming – detecting a tiny influence on a massive climate system



Earth System Energy Flow Rates (1 unit  $\sim$  3.4 W m<sup>-2</sup>) IPCC

## What's happening at the surface?



## What's happening at the surface?



How do we test a claim that current global warming is significant and that it is caused almost entirely by the extra greenhouse gases that human economies emit as they enhance their wellbeing? To test the claim we must locate a test metric that has the following robust and scientifically defensible characteristics:

McKitrick and Christy (2018)

# The response is seen in all models as a dominate characteristic

Response is not there when extra greenhouse gases are not included (i.e. control and experiment are always different)

The metric cannot have been used in the tuning and development of the model

**Observations should come from multiple, independent** sources

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Test Metric: Temperature, Tropical upper troposphere 300-200 hPa (~30k-40k ft)



How does the claim relate to what "should" be happening in the upper atmosphere in the tropics?

Claim (or hypothesis): significant warming should have <u>already</u> occurred here to change our climate. Paraphrasing William Thomson (Lord Kelvin)

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### 39 IPCC Climate Model Simulations CMIP6 300-200 hPa Temperature Trend 1979-2020



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John R. Christy, The University of Alabama in Huntsville

Why do models warm too fast, and vary more wildly than observations?

Likely related to model processes which do not allow enough heat to escape to space (negative feedback) when warming events occur. This is likely related to the distribution of heat trapping clouds and/or water vapor. Roy Spencer UAH

Thus, the flow of energy is misrepresented in these hypotheses we call models





°C

Models represent the level of understanding (or misunderstanding) scientists have about the impact of extra greenhouse gases on the climate. As Hypotheses, do they succeed in describing the attributes of the physical climate so well as to Determine Policy?

Models fail to reproduce the past

Models fail to reproduce accurate energy flows

Models disagree with each other about the future

# Irony: The proposed "solutions" will not change whatever the climate is going to do?

**Red – Temperature IPCC A1B Emissions** Green – U.S. stops all emissions 2012



### What is apparent to me:

1. Alabama's climate shows no signs of remarkable change or that it is getting "worse."

2. The Established Global Warming Theory *significantly* misrepresents the impact of extra Greenhouse Gases.

3. The weather that affects people the most is not becoming more extreme or dangerous

Editorial Comment: 4. Progress toward eradicating poverty based on accessible and affordable energy (which is carbon today) is continuing.



**Thank You**