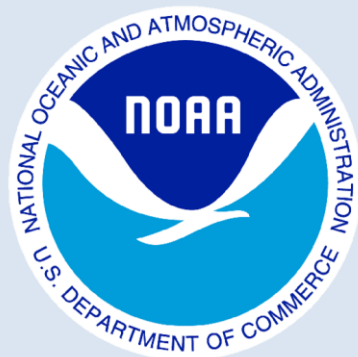


The Fourth National Climate Assessment: Observed Climate Change

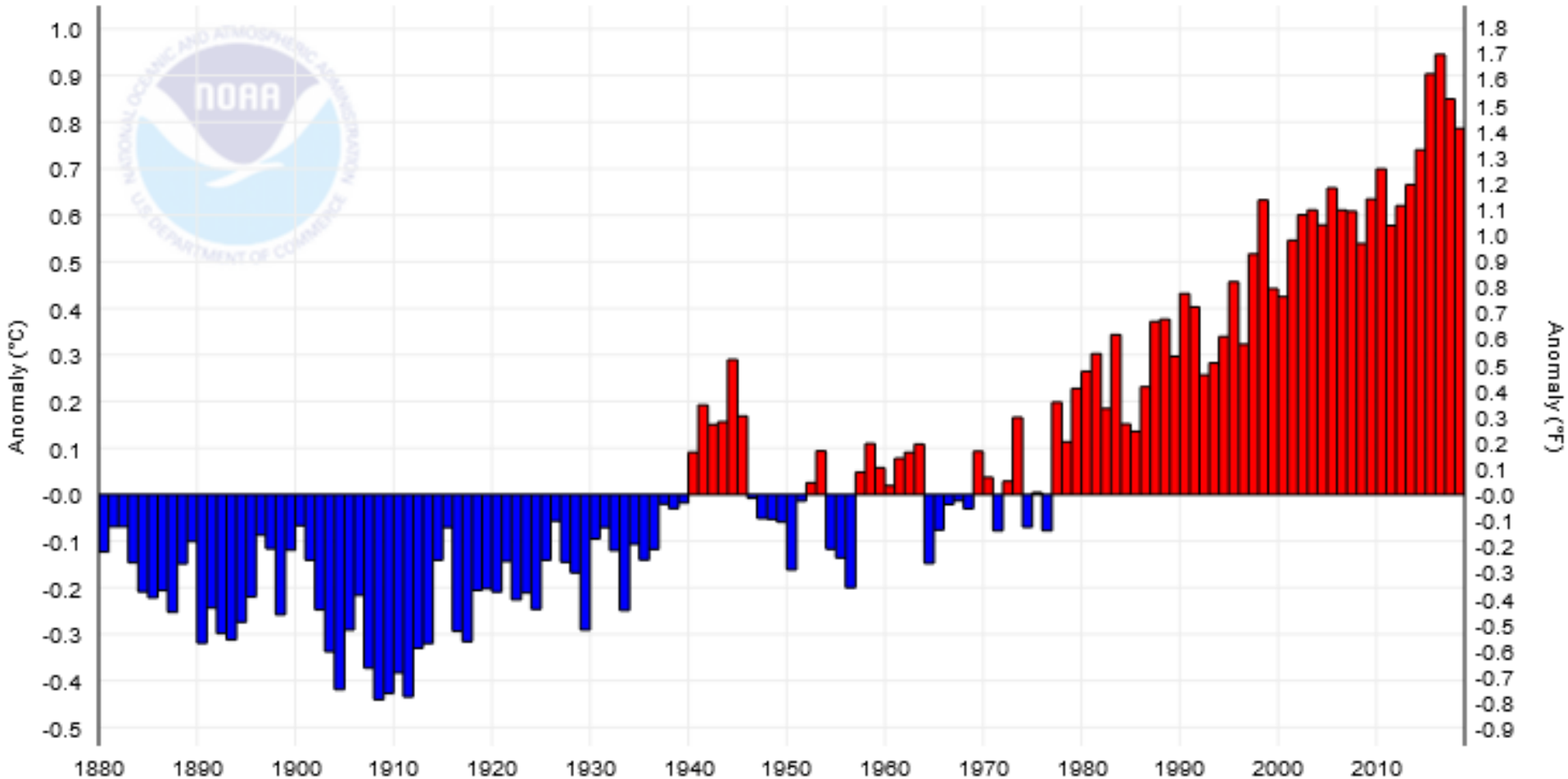
David R. Easterling, Ph.D.

**NOAA/NESDIS/National Centers for
Environmental Information
Asheville, NC**



2018 Was 4th Warmest Year on Record

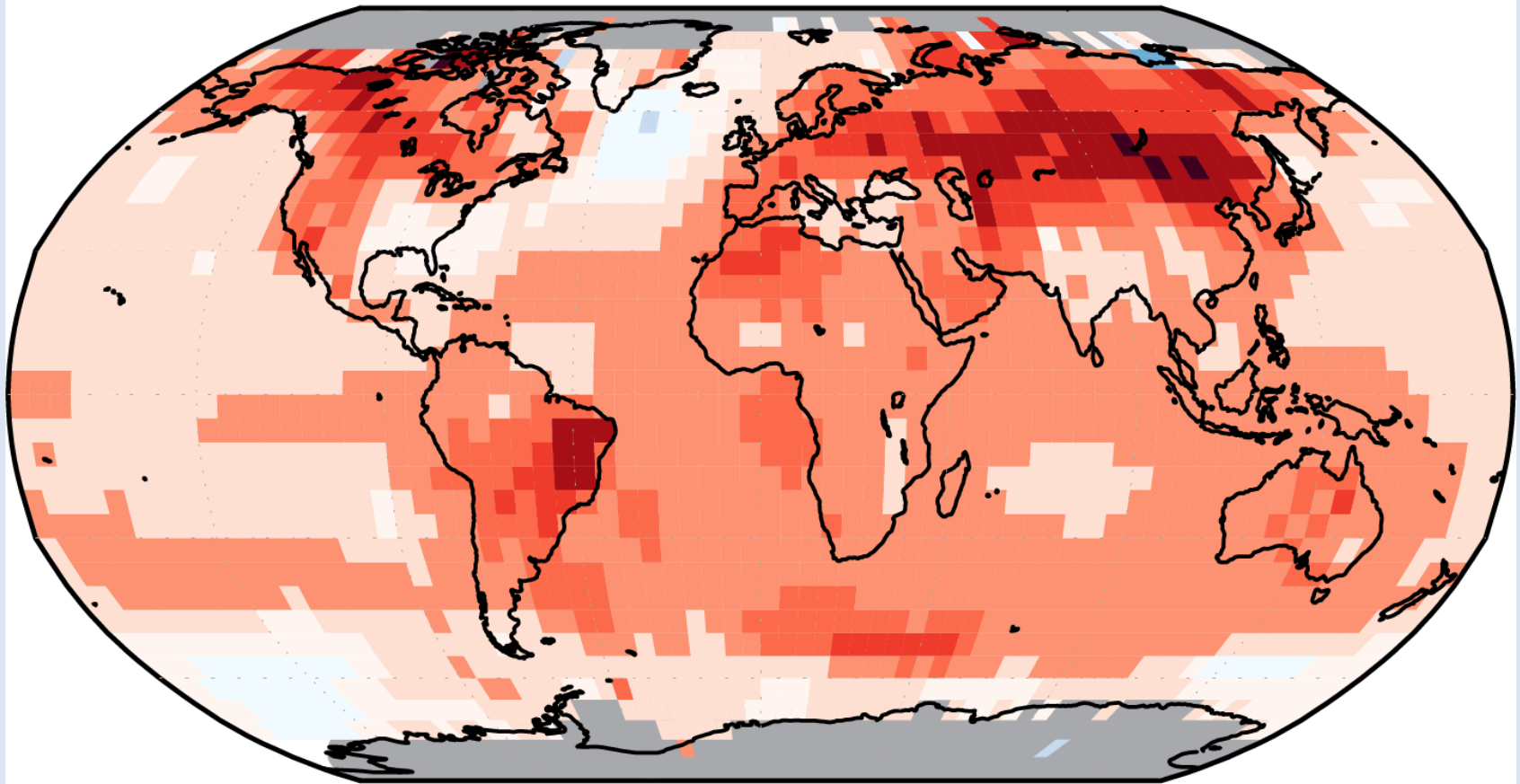
Global Land and Ocean Temperature Anomalies, January-December



Where Has It Warmed?

Annual Temperature Change Since 1901

Surface Temperature Change



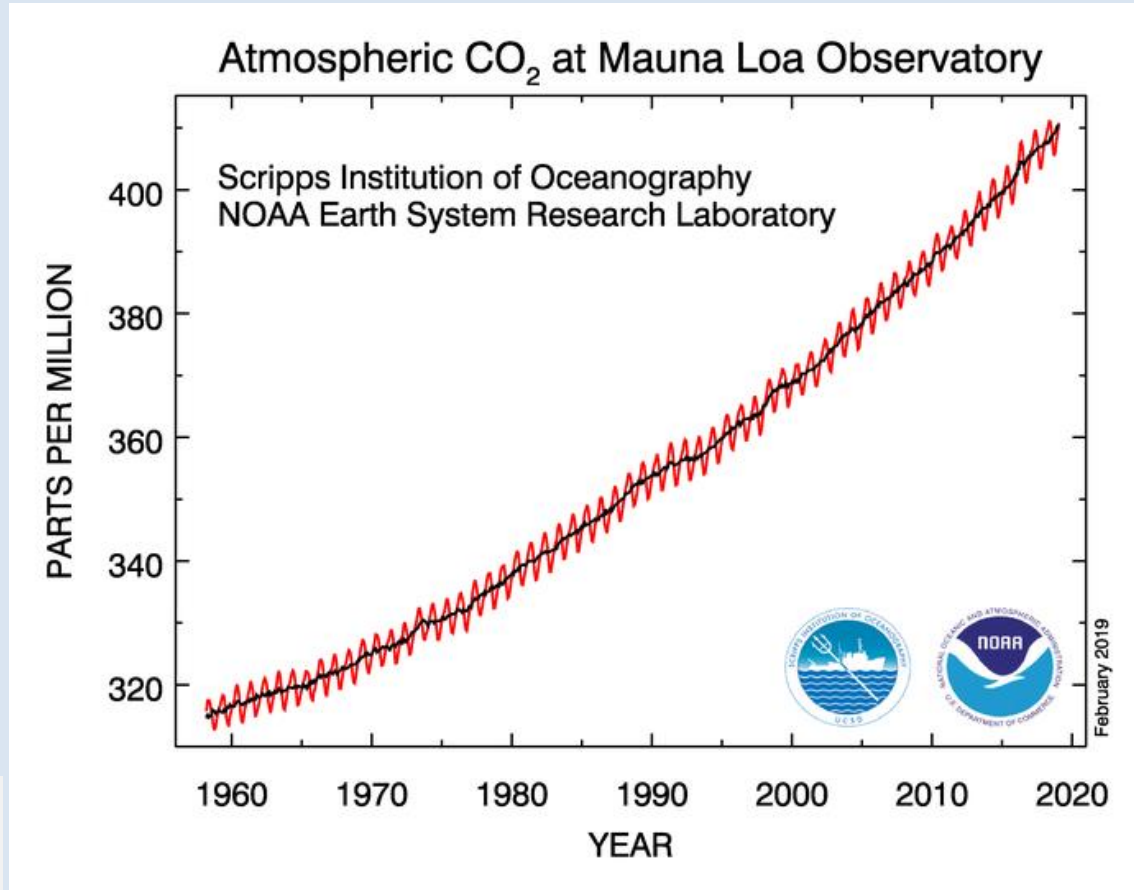
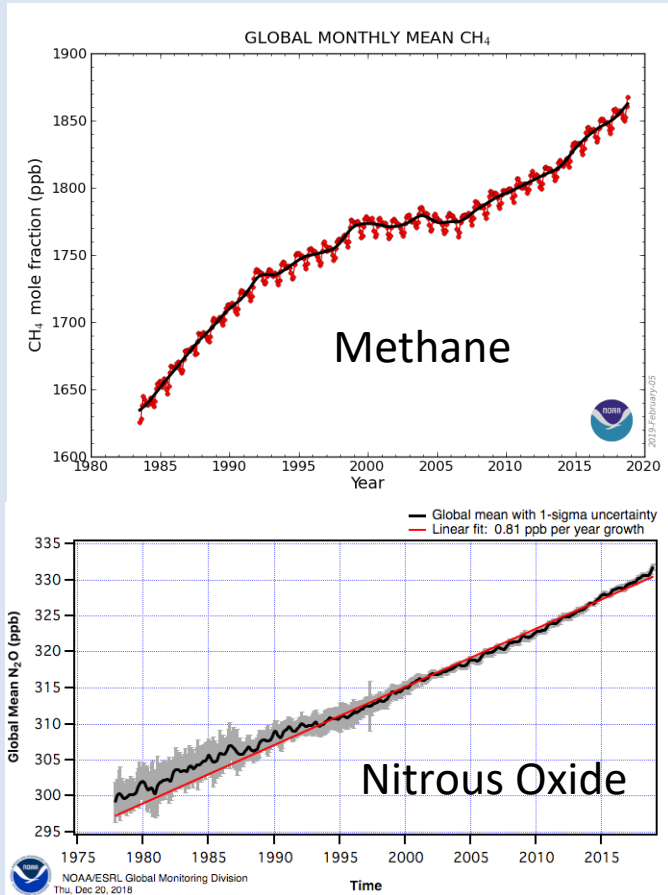
Change in Temperature (°F)



-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0

Recent Greenhouse Gas Trends

CO₂ is now over 411 PPM



Most major greenhouse gases are



Carbon dioxide (CO₂)

Methane (CH₄)

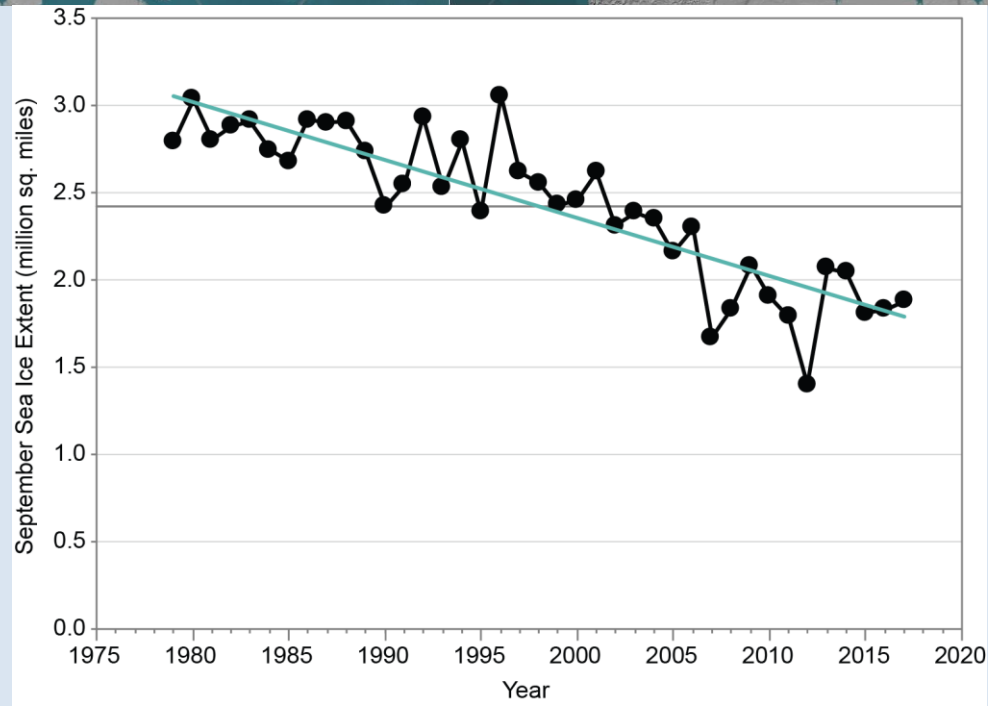
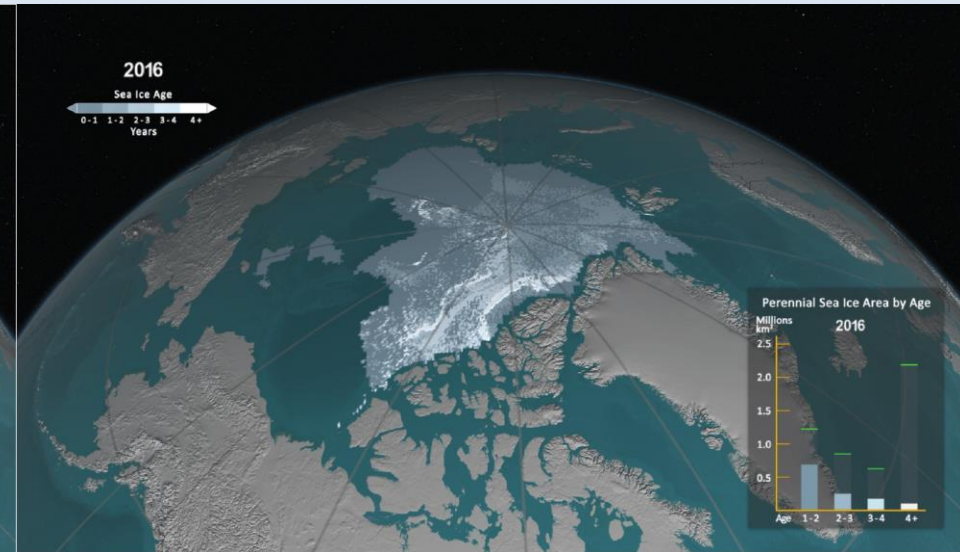
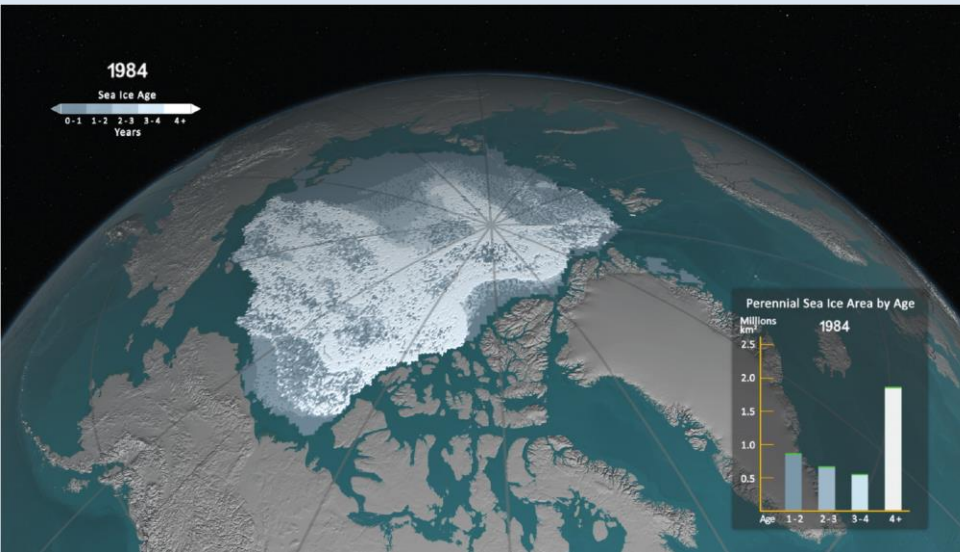
Nitrous Oxide (N₂O)

Other Indicators of Climate Change

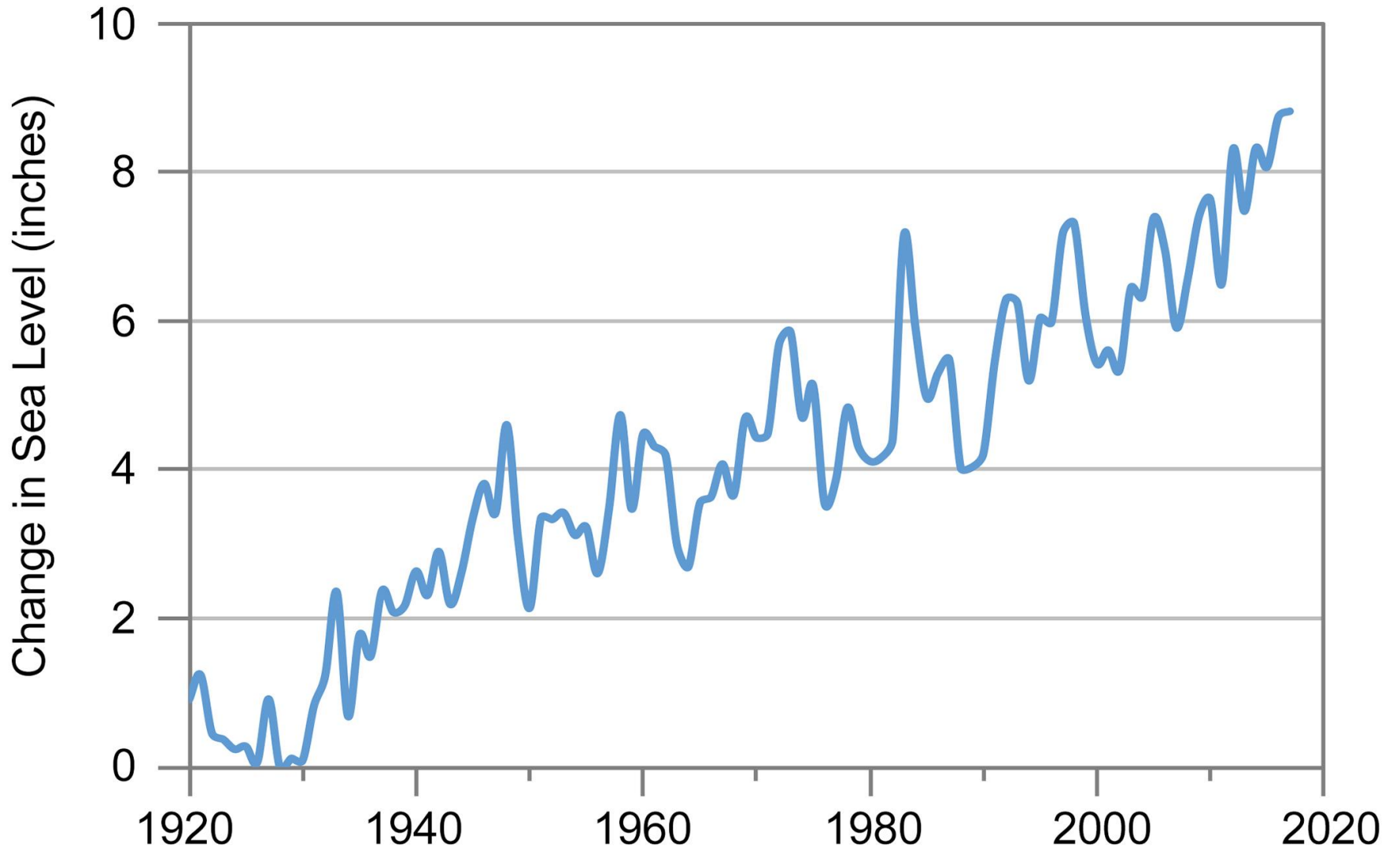
Arctic Sea Ice Decline

1984

2016



U.S. Sea Level

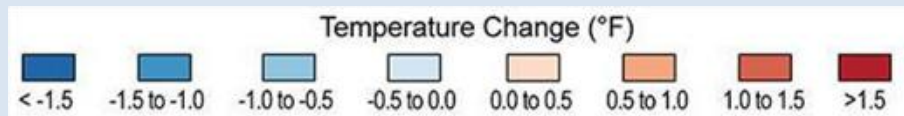
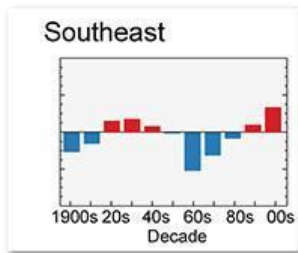
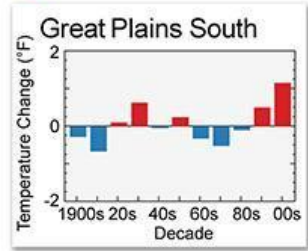
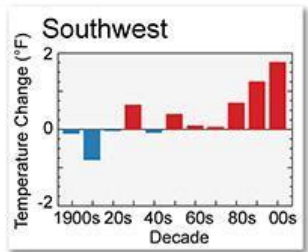
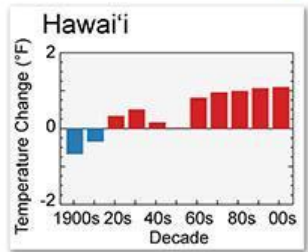
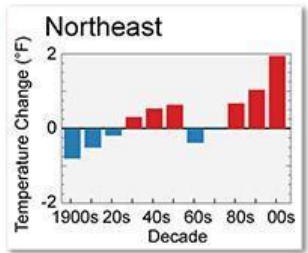
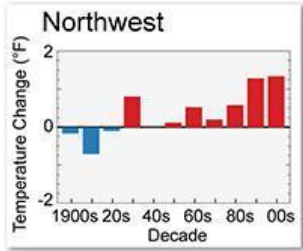
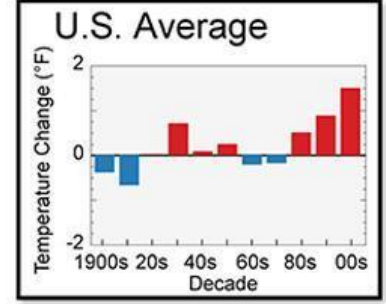
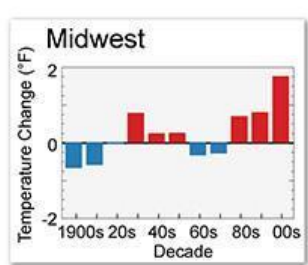
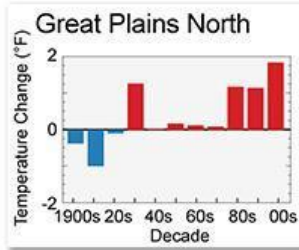
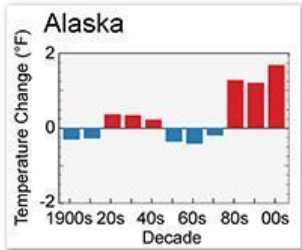


Tidal Flooding in Charleston, SC

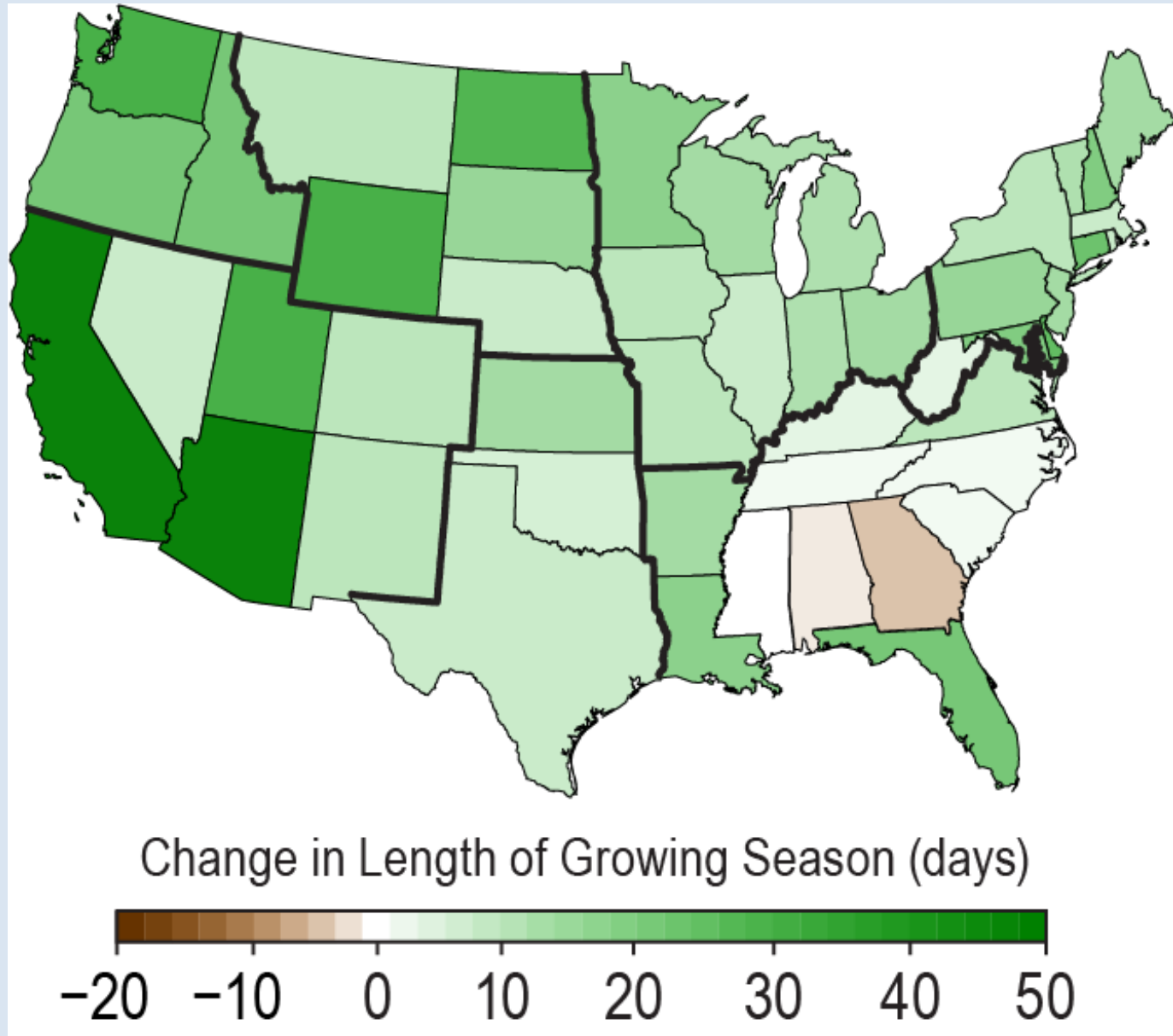
As sea levels have risen, the number of tidal floods each year that cause minor impacts (also called “nuisance floods”) have increased 5- to 10-fold since the 1960s in several U.S. coastal cities.



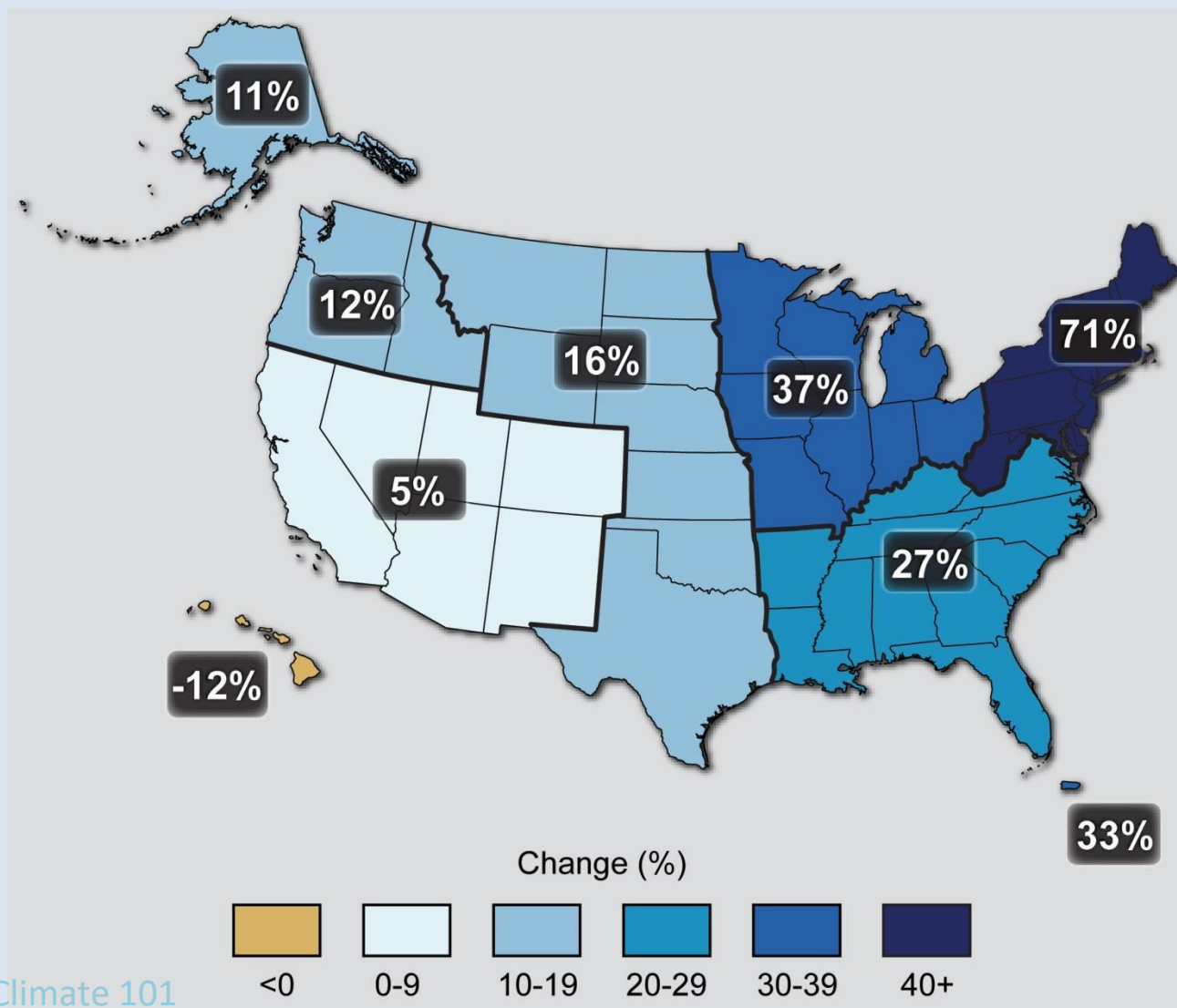
Observed US Temperature Change, 1901-2015



Change in Growing Season Length Since 1895



Observed Change in Very Heavy Precipitation

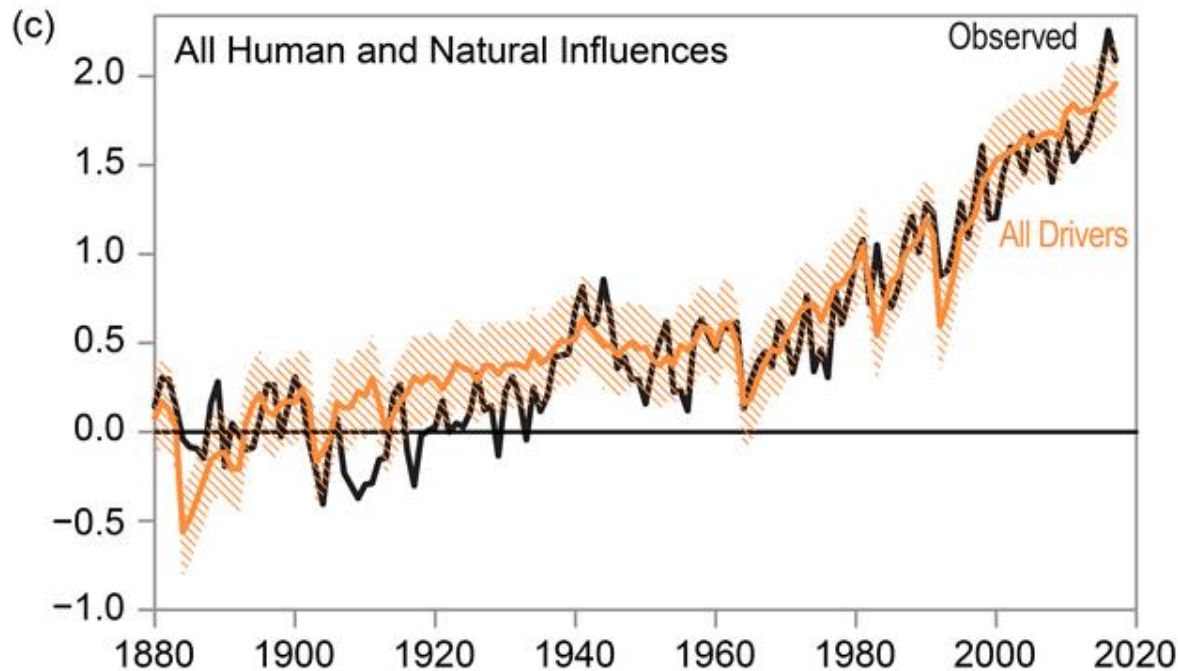
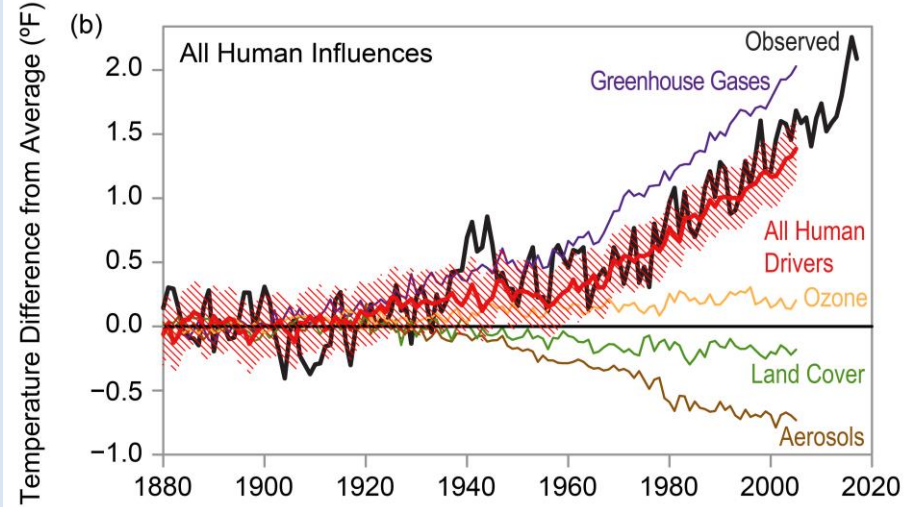
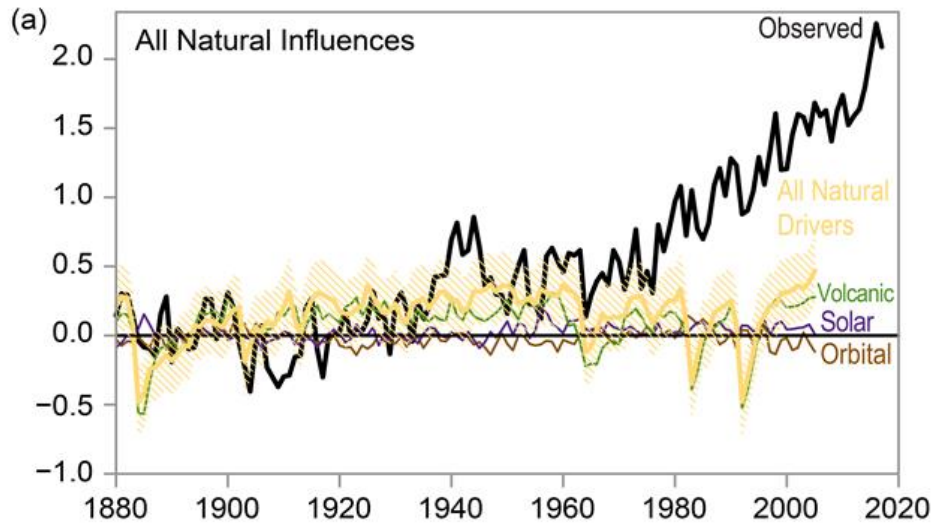


Hurricane Harvey Flooding, Houston, 2017

Some Areas Received Almost 50 Inches of Rain Over Four Days



Why Are We Confident That Human Emissions of GHGs Is The Dominant Cause of Warming?



Thank You