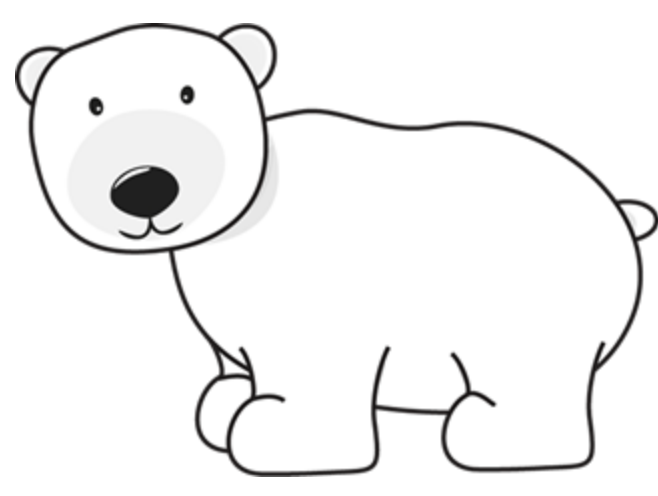
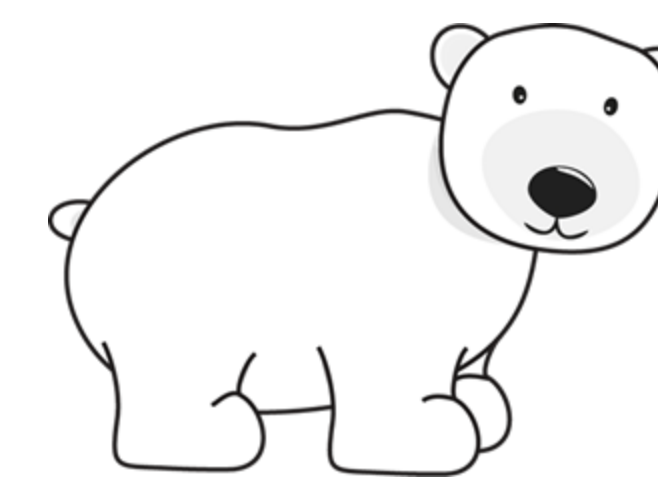
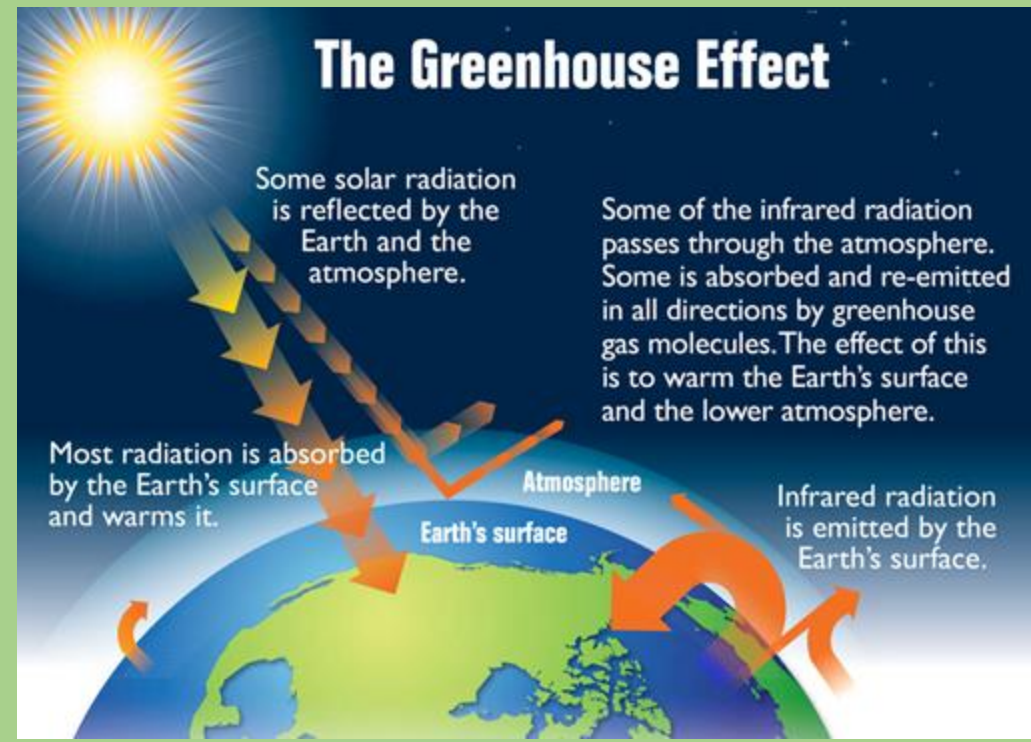


## Global Warming Skepticism and Politics

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 Advisor: Dr. Michael Crowder, Department of Chemistry, Miami University, Oxford OH



### What is climate change?

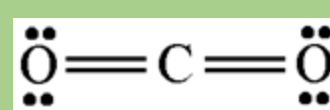


Greenhouse effect is what makes our planet livable

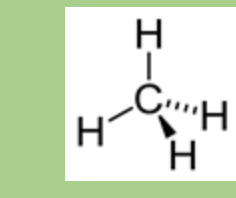
Without it the majority of solar radiation would be scattered off the Earth's surface and be released back into space. This would make Earth to be cold and inhospitable. As light is reflected off the Earth's surface it is absorbed by gases in the atmosphere. This traps the radiation and warms the Earth.

The global warming we hear about is not the result of the natural greenhouse phenomenon, but instead a result of excess gasses causing too much heat to be trapped in the atmosphere and therefore the Earth to become warmer than it should be naturally.

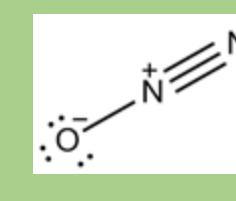
### Examples of Greenhouse Gases:



Carbon Dioxide



Methane



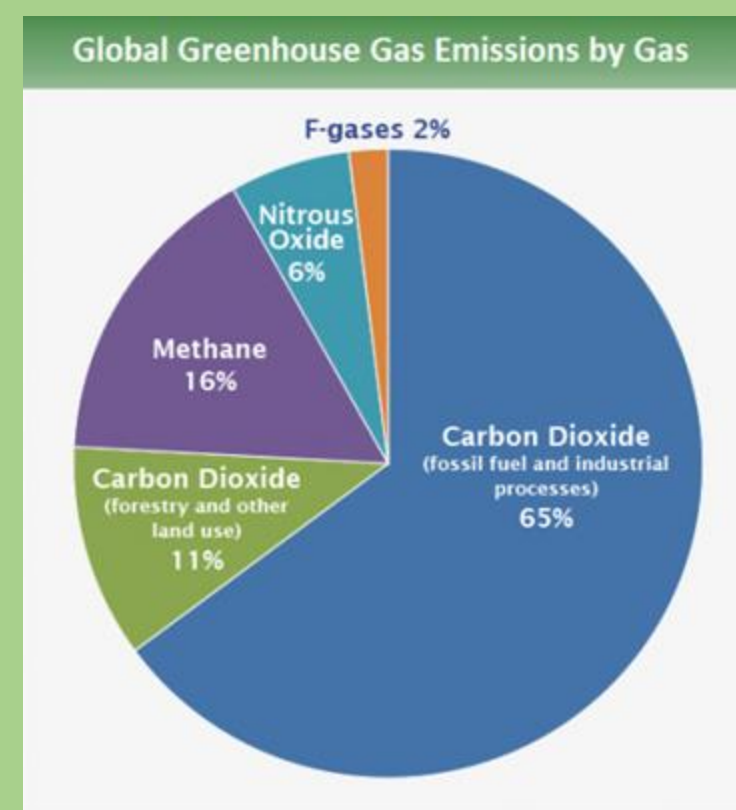
Nitrous Oxide

Dating back to the start of the Industrial Revolution, there has been a drastic increase in emission of fossil fuels due to the need for electricity, transportation and manufacturing purposes. Industrial processes are only becoming more prevalent in today's society.

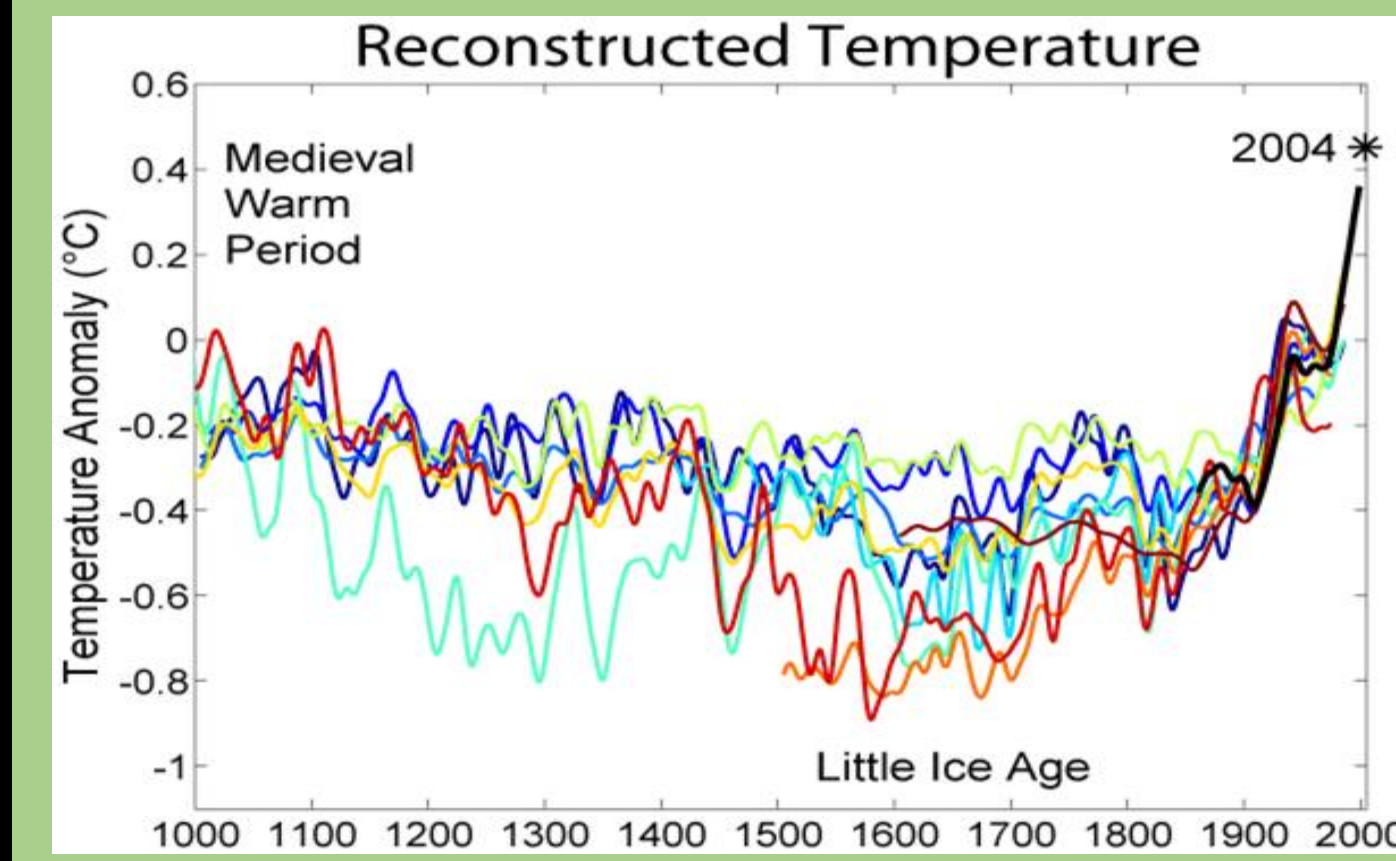
**Carbon Dioxide:** Combustion of fossil fuels to generate electricity to power homes and businesses, power vehicles to transport people and goods, and help the production of mineral products. Deforestation and killing of plants prevents CO<sub>2</sub> uptake.  
 -How to Cut Back: ENERGY STAR products, fuel efficient vehicles, energy conservation (turning off lights), prevention of deforestation.

**Methane:** Natural gas and petroleum systems, storage/distribution of natural gas, domestic livestock digestive processes, landfill and wastewater as it decomposes.  
 -How to Cut Back: Upgraded equipment for natural gas storage, transportation and production to prevent leaks, manure management, altered feeding practices, efficient landfill CH<sub>4</sub> reduction.

**Nitrous Oxide:** Use of Nitrogen on soil in the form of fertilizers, burning of gasoline to power vehicles, byproduct of production of nitric acid (fertilizers) and adipic acid (nylon/fibers/synthetics)  
 -How to Cut Back: Less concentrated fertilizers, better manure management, reduced fuel consumption, technological upgrades.

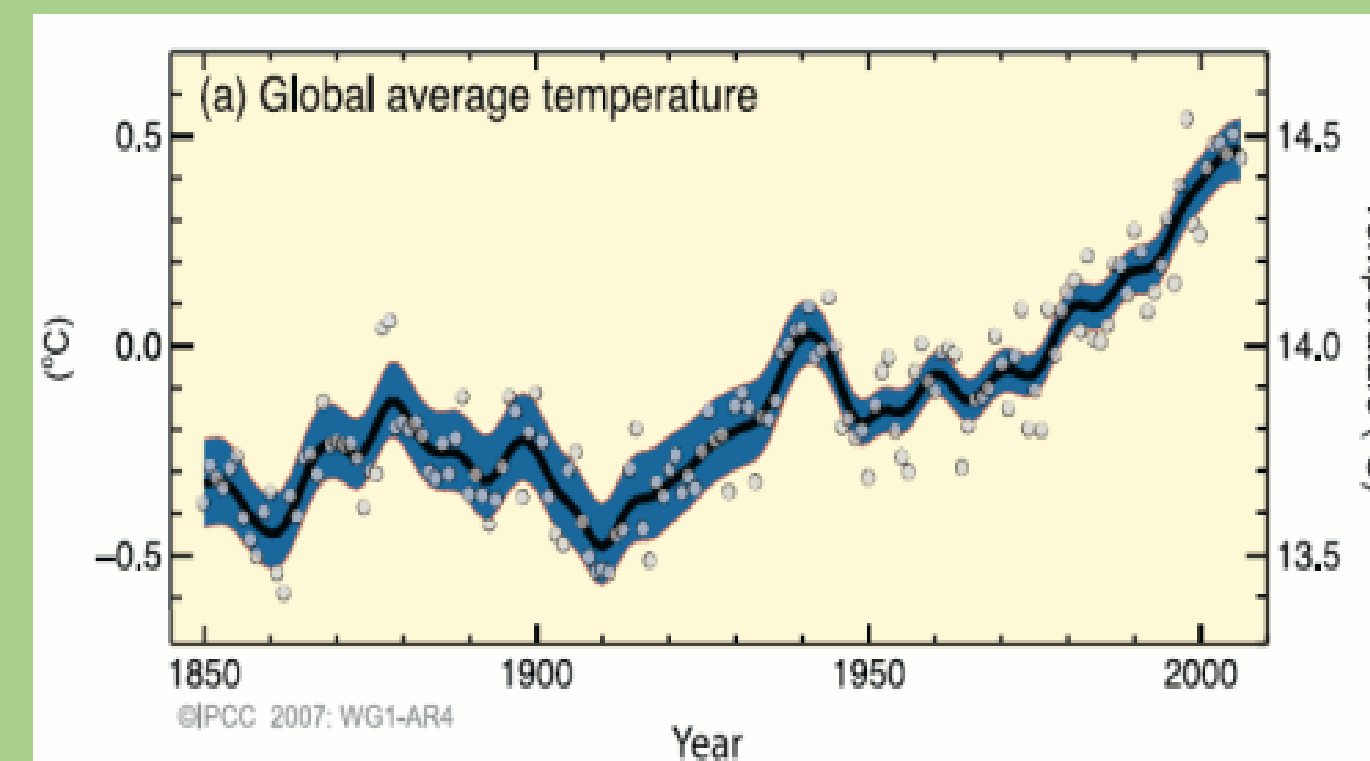


### Skepticism of Anthropogenic Climate Change:



Past climate changes, such as the Little Ice Age, are often used by climate skeptics to argue that current climate change is natural. They claim that the natural drivers of past climate change are likely the current drivers of climate change, rather than anthropogenic factors such as greenhouse gases.

The post-war economic boom of the 1940s and 50s coincided with both increases in carbon dioxide emissions and decreases in global mean temperature. Climate change skeptics point to this as evidence that carbon dioxide is not a cause of current global warming.



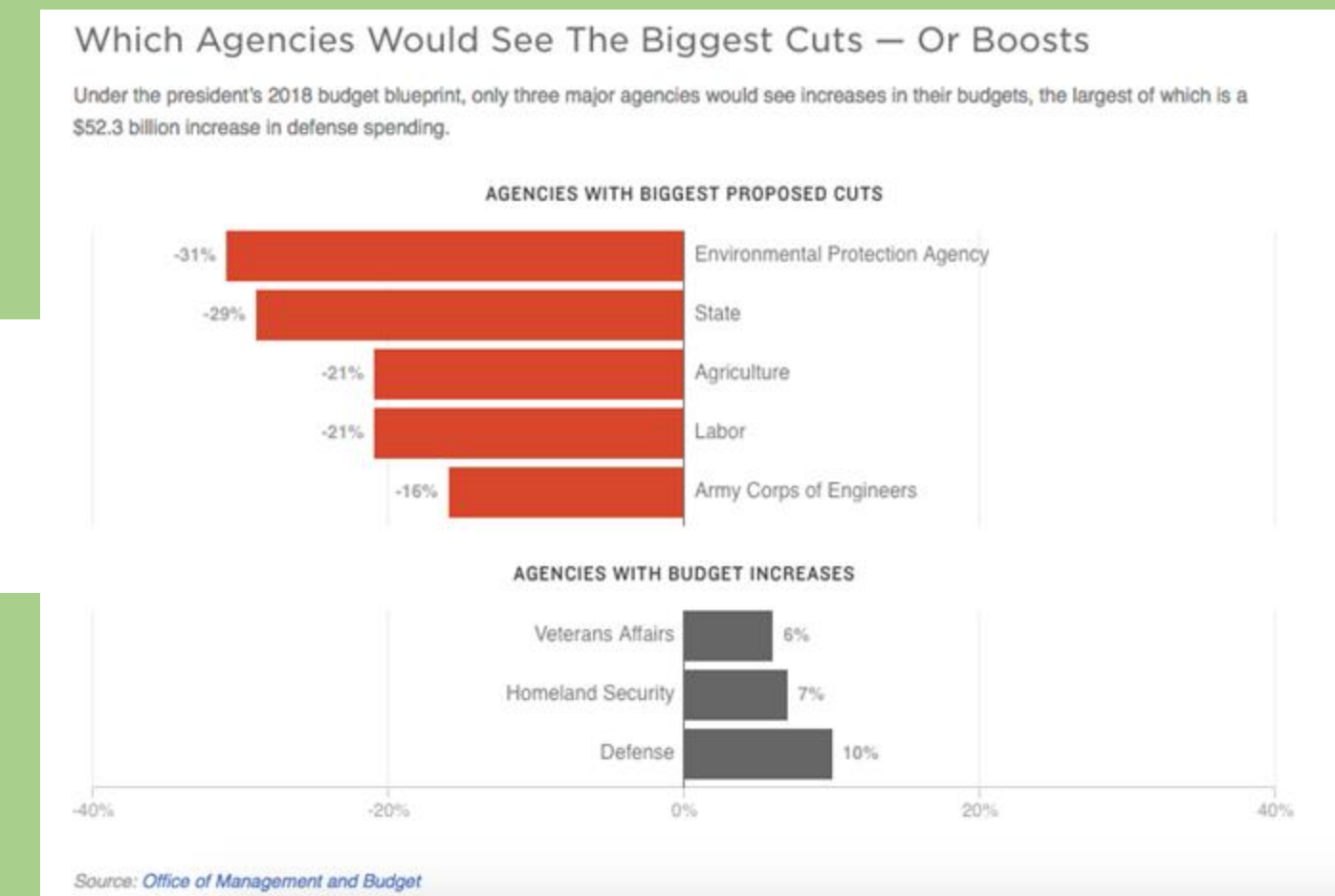
### Current Policies/Moving Forward

#### Trump Administration Position

- The Obama Administration
  - The President's Climate Action Plan (2013)
    - Sought to reduce overall atmospheric CO<sub>2</sub> levels and curb climate change
- Paris Agreement
- The Trump Administration
  - Removed global warming or climate change from the White House's official website.
  - Future legislation will likely serve to benefit oil/gas vs. renewable energy source companies.
  - Proposed 2018 Budget...

#### Environmental Protection Agency, 2017 budget

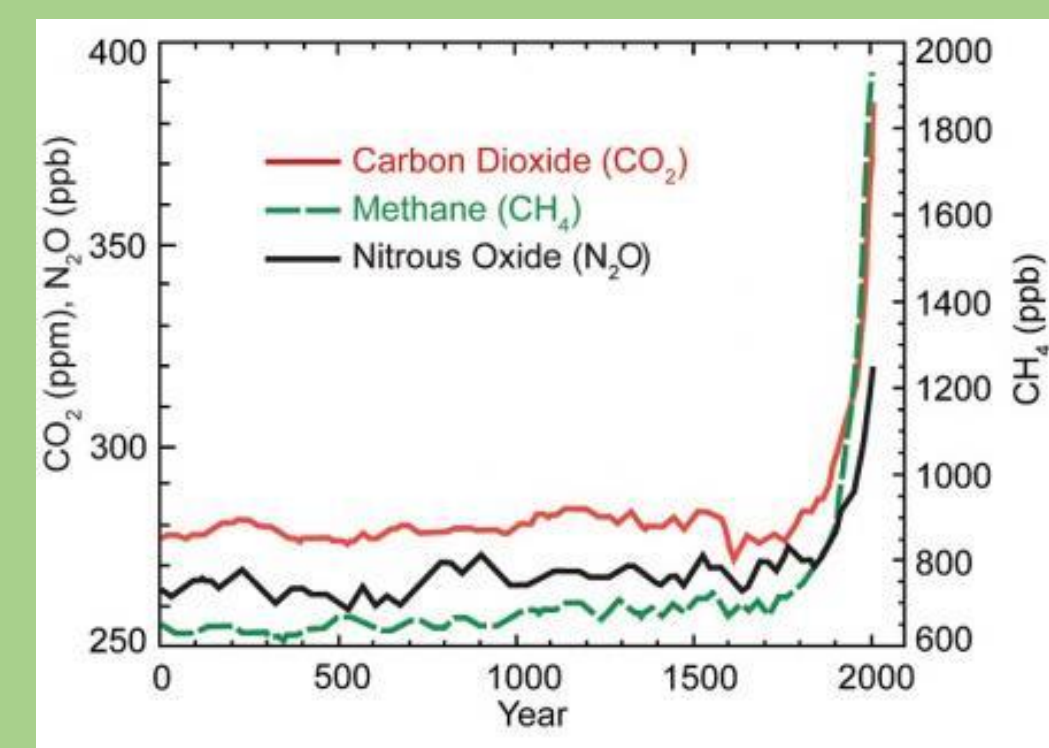
3,200 jobs slashed  
 \$2.6 billion less than last fiscal year  
 ↓ 31.4% decrease in budget



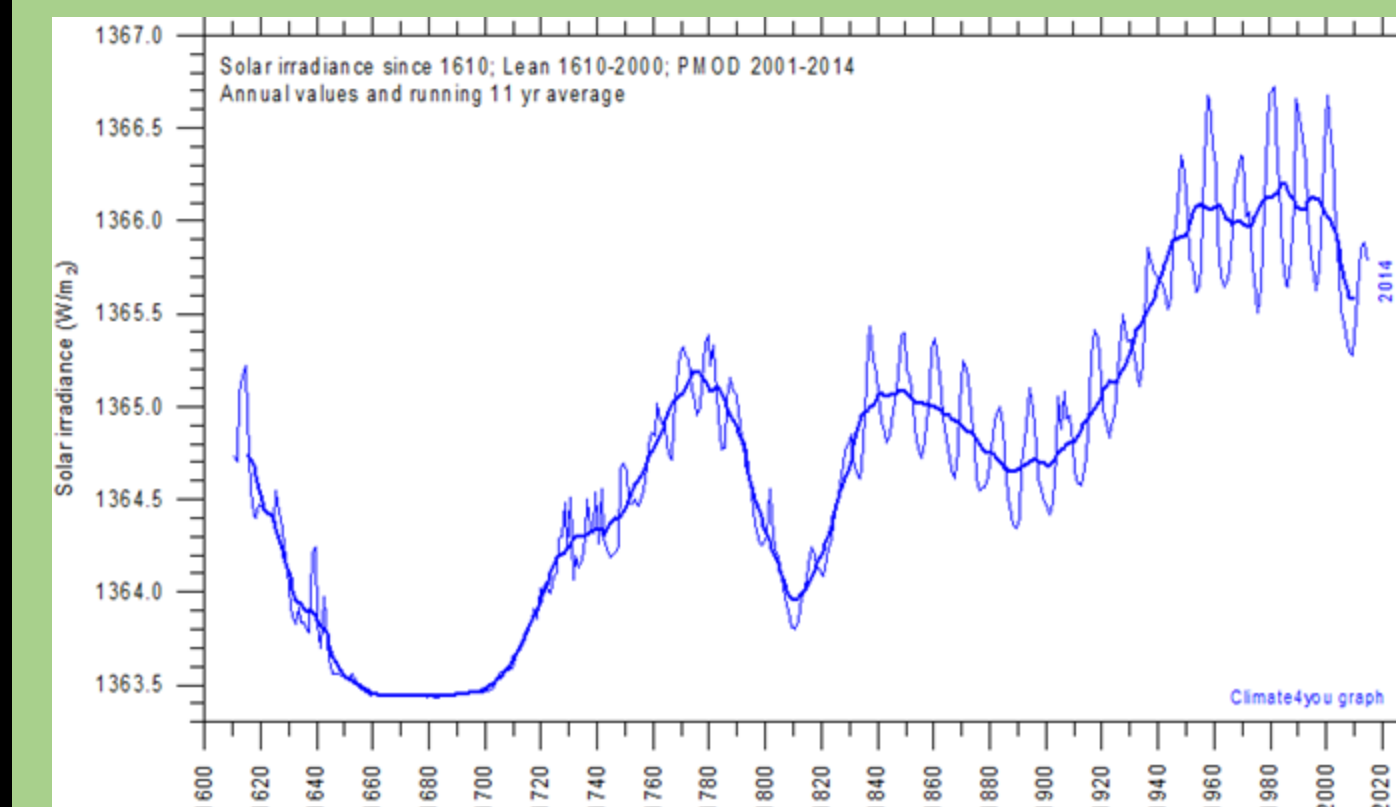
Water vapor is the most abundant greenhouse gas. Water vapor traps radiation from the sun raising the temperature just like other gases.

As non-condensable greenhouse gases like carbon dioxide accumulate in the atmosphere the temperature rises. An increase in temperature leads to increased in water vapor in the atmosphere since warm air can hold more water. Since water vapor acts as a greenhouse gas trapping heat in the atmosphere the temperature rises even further as excess water vapor enters the atmosphere. This leads more water to enter resulting in a positive feedback mechanism.

The water vapor effect doubles the warming effect of a greenhouse gas.

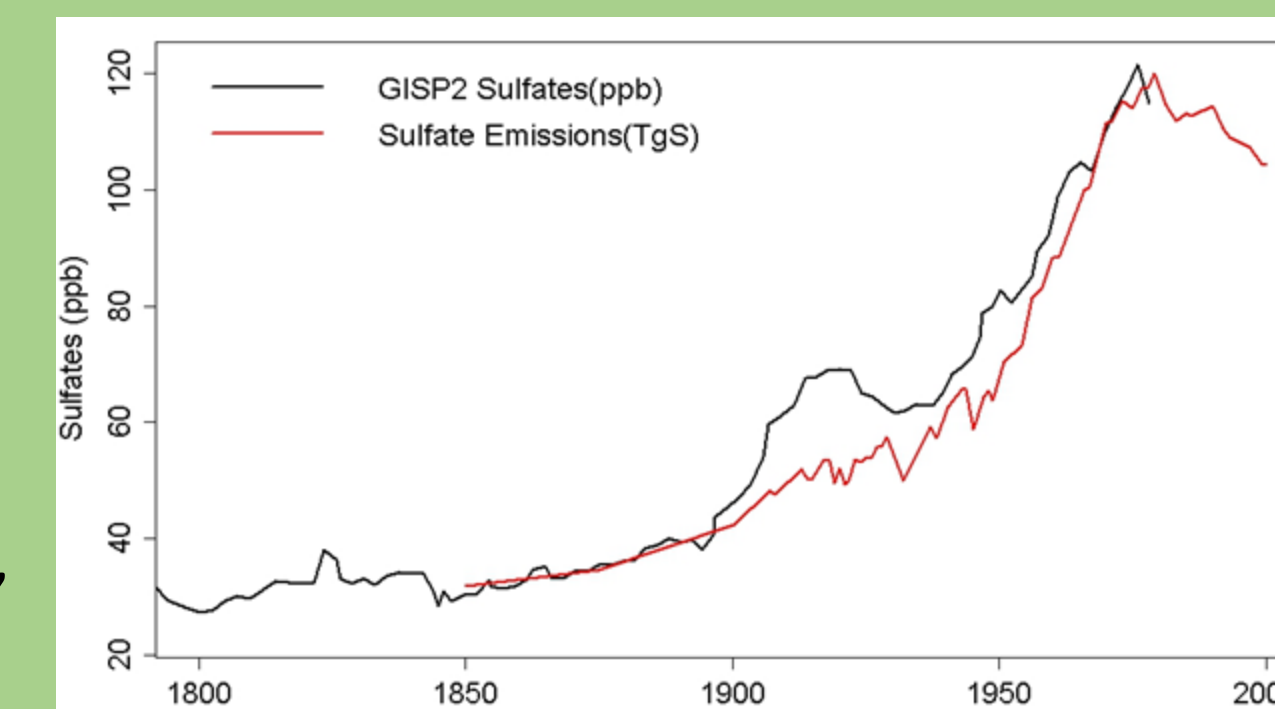


### What the Data Tell Us:



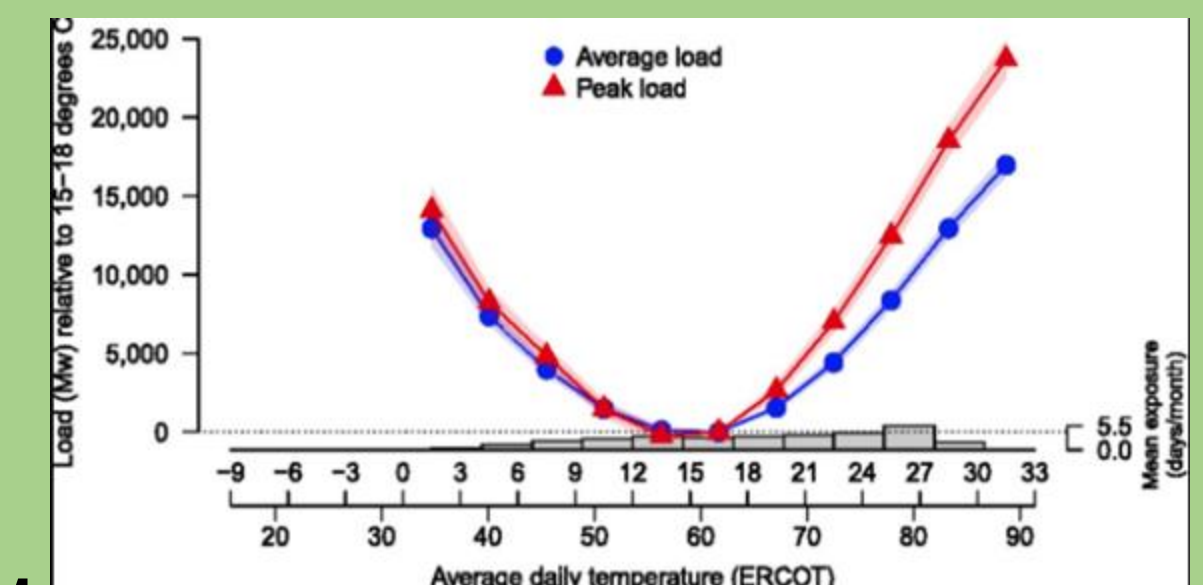
Solar irradiance fluctuations are considered to be a likely cause of the low temperatures during the Little Ice Age, and may have contributed to warming seen during the first half of the 20<sup>th</sup> century. However, solar irradiance has remained effectively constant since the 1960s and has declined in recent years, indicating that it is not a driver of current mean temperature increases.

Sulfate aerosol emissions are likely a main factor in the cooling observed in the decades following World War II, as they contribute to increased cloud coverage and scatter solar radiation through a process known as "global dimming." Emissions leveled off in the 1970s, diminishing such cooling effects.



### Economic Impact:

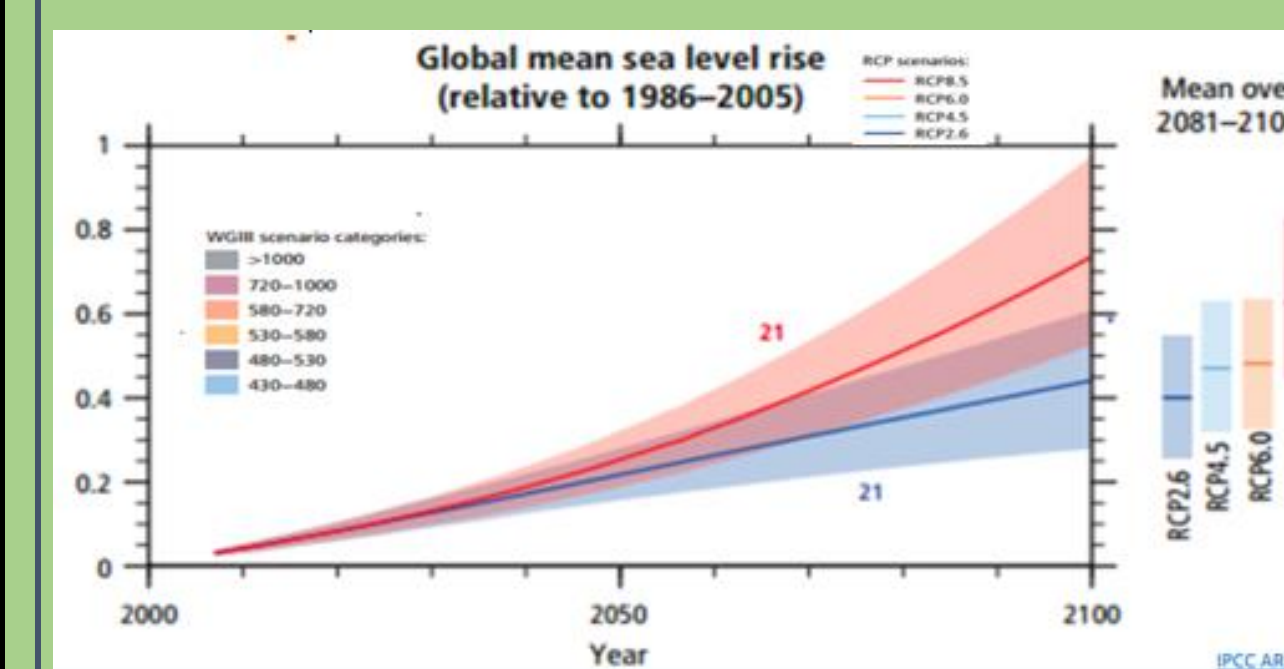
- The Trump administration protects jobs in a \$130 billion industry in the United States
  - "It is an issue that deserves attention," an official said of climate change, "But I think the President has been very clear that he is not going to pursue climate change policies that put the economy at risk."
- The federal government spends on average \$21 billion per year in production and exploration subsidies
- Suggests severe impact on global economy



- Methods?
  - 18 GCMs
  - ERCOT & PJM

Auffhammer, Maximilian, Patrick Baylis, and Catherine H. Hausman. "Climate Change Is Projected to Have Severe Impacts on the Frequency and Intensity of Peak Electricity Demand across the United States." Proceedings of the National Academy of Sciences 114.8 (2017): 1886-891. PNAS Web. 5 Mar. 2017.

### Future Impact on Sea Levels:

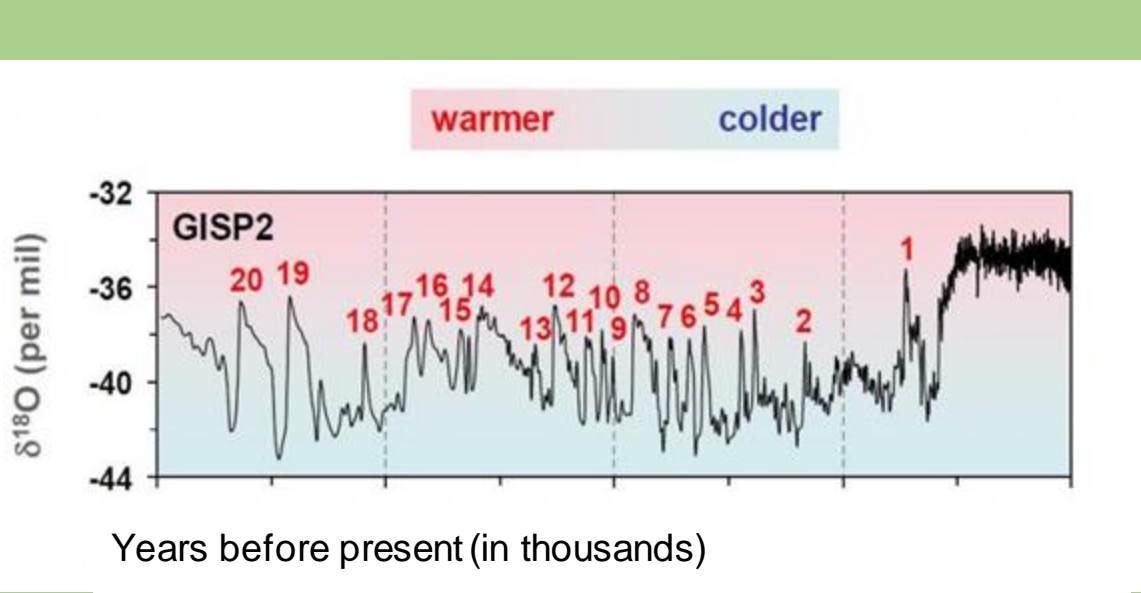


The graph to the left shows the predicted changes in sea level. The blue projection indicates the predicted rise in sea level if we start enacting proactive policies to reduce GHG emissions now. The red projection indicates the predicted rise if less strict policies are enacted. In order to reduce the amount that the sea level will rise we should enact policies to reduce GHG emissions now.

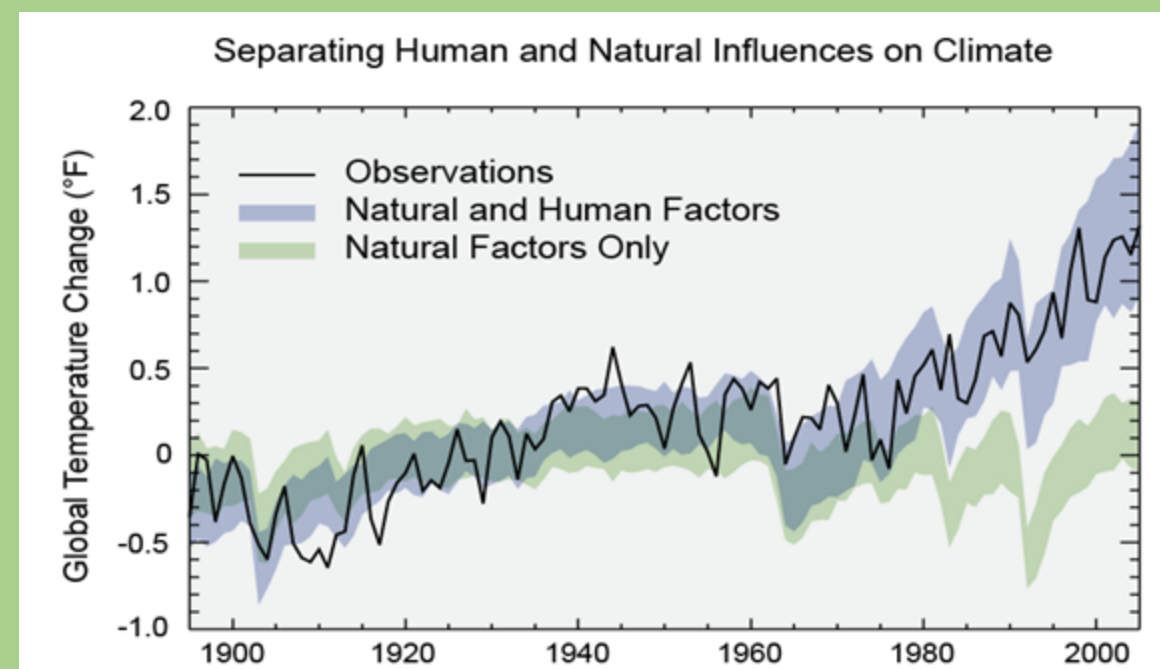
### Effects of Global Warming:



- Increased Temperature
- Sea level Rising
- Decreased Snow Cover
- Glacier Melting
- Rise in Extreme Events
- Warming Oceans



One cause of cyclical periods of warming and cooling are Dansgaard-Oeschger or D-O events. These events run on a cycle of roughly 1470 years. They are characterized by a pattern of abrupt warming followed by a period of gradual cooling then a more rapid cooling. The transition period between the cooling and warming periods were very abrupt occurring in only about 20-40 year transition period. The graph to the left shows that there were 20 D-O events in the past 80,000 years. The most recent D-O event was thought to take place in the medieval ages and is responsible for both what we call "the Medieval Warm Period" and "the Little Ice Age". It is though that these events are caused due to reversals of the Earth's thermohaline circulation: the movement patterns of water currents in the Earth's oceans.



Computer model climate simulations are used both to assess the causes of past climate changes and to estimate future changes by taking into account natural and anthropogenic forcings on the environment. Recent decades show that anthropogenic factors have become much more significant contributors to increases in global mean temperature.