The World Has Warmed

Globally averaged, the planet is about 0.8°C (1.4°F) warmer than it was in 1850.

This is based upon dozens of high-quality long records using thermometers worldwide on land, ocean buoy, and more recently, global satellite data.
Evidence of Climate Change

Rising atmospheric temperature

Rising sea level

Reductions in NH snow cover

The main data set used to evaluate NH snow cover is visible satellite imagery
Intergovernmental Panel on Climate Change

The IPCC formed in 1988 under auspices of the United Nations

Function is to provide assessments of the science of climate change

Scientific community contributes widely and on a voluntary basis

The IPCC Sequence of Key Findings……

IPCC (1990)  Broad overview of climate change science, discussion of uncertainties and evidence for warming.
IPCC (2001)  “Most of the warming of the past 50 years is likely (>66%) to be attributable to human activities.”
IPCC (2007)  “Warming is unequivocal, and most of the warming of the past 50 years is very likely (90%) due to increases in greenhouse gases.”
Industrial revolution and the atmosphere

The current concentrations of key greenhouse gases, and their rates of change, are unprecedented.

Carbon dioxide  Methane  Nitrous Oxide
Carbon dioxide is causing the bulk of the forcing.

On average, CO₂ lives more than a hundred years in the atmosphere and therefore affects climate over long time scales.
Understanding and Attributing Climate Change

Anthropogenic warming is discernible on all inhabited continents.

Most of the observed increase in globally averaged temperatures is very likely (>90% certainty) due to the observed increase in anthropogenic greenhouse gas concentrations.
In a warming climate, water vapor plays a major role in a positive feedback loop that amplifies global climate change. 

(H₂O responds to changes in climate, but it doesn’t drive climate change)
Changing Climate influences weather patterns (winds, temperatures & and storm tracks)

The IPCC report states that anthropogenic forcing has likely contributed to circulation changes (storm tracks, winds and temperature patterns)
Climate Predictions

**IPCC Climate Models** that project "business as usual" scenarios predict that global temperatures will warm by 2.8°C by 2099; much of land area warms by ~3.5°C (~6.3°F)

*This would be less for less emissions.*

![Temperature Map](image)

Even if Greenhouse gases were kept fixed at 2005 levels, there is a committed 0.6°C (1.1 °F) warming expected by 2100. Short of a major volcanic eruption or scientific breakthrough, *more warming will accompany more emissions.*