Climate Change in Arizona

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How has climate changed and how do we know what is causing it?

Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years.

Figure SPM.1
IPCC AR6, 2021
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How has climate changed in Arizona?

**Temperatures**

https://statesummaries.ncics.org/chapter/az/

**Precipitation**
How has climate changed in Tucson?

Tucson Annual Average Temperature

Tucson Annual Total Precipitation

https://cales.arizona.edu/climate/misc/stations/calYear/Tucson%20Area/stationHistory.html
Record breaking temperatures – July 2023

https://berkeleyearth.org/july-2023-temperature-update/
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Why so warm so fast this year?

Factors Contributing to Global Temperature Change - Last 10 Years

- Man-made Global Warming
- El Niño / La Niña
- Solar Cycle
- Hunga Tonga Eruption
- Marine Fuel Pollution Reduction

Schematic illustration of selected factors contributing to changes in Earth's temperature since 2013. Values are approximate and uncertainties are not shown.
How might climate change into the future?

The Intergovernmental Panel on Climate Change (IPCC) uses scenarios called pathways to explore possible changes in future energy use, greenhouse-gas emissions and temperature. These depend on which policies are enacted, where and when. In the upcoming IPCC Sixth Assessment Report, the new pathways (SSPs) must not be misused as previous pathways (RCPs) were. Business-as-usual emissions are unlikely to result in the worst-case scenario. More-plausible trajectories make better baselines for the huge policy push needed to keep global temperature rise below 1.5 °C.
Highly unlikely
Unlikely
Likely

Arizona has warmed 1.4 C (2.5 F) since 1900
Global warming may have accelerated in the past 15 years

Annual average temperatures since 1850

1.5°C above preindustrial levels

The rate of warming in the past 15 years has been 40% higher than warming since the 1970s

Source: Berkeley Earth Land/Ocean Temperature Record

Reducing aerosols in the atmosphere has quickened global warming

Recent global temperatures compared with estimates of what they might have been if aerosol pollution had continued at its 2005 level

1.4°C above preindustrial levels

1.3°C (2.3°F)

1.2°C (2.1°F)

Warming from all factors

Warming if aerosol pollution hadn’t been reduced

Source: Based on FMI model runs performed by Dr. Chris Smith at the University of Leeds. Note: This model does not fully account for the 2020 change in marine fuel standards to lower sulfur emissions, as updated emissions data is not yet available.
Temperature Projections for Arizona

Observed and Projected Temperature Change

Arizona

- Observations
- Modeled Historical
- Lower Emissions
- Higher Emissions

(CMIP5 Models)

https://statesummaries.ncics.org/chapter/az/
Heat extremes scale with level of warming

IPCC Figure (2021) 11.11.
Closing thoughts

• Climate, especially temperatures, are changing at all scales from global to local
• Rising global temperatures are increasing the risk of local temperature extremes, especially in the summer
• Mitigation measures (e.g. move towards renewable energy) are gradually reducing GHG emissions making extreme climate scenarios unlikely
• But, heat extremes are likely to occur more frequently even with more moderate emission scenarios
• Need to continue to mitigate GHGs as well as adapt to changing conditions (e.g. heat extremes)
Thanks!

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