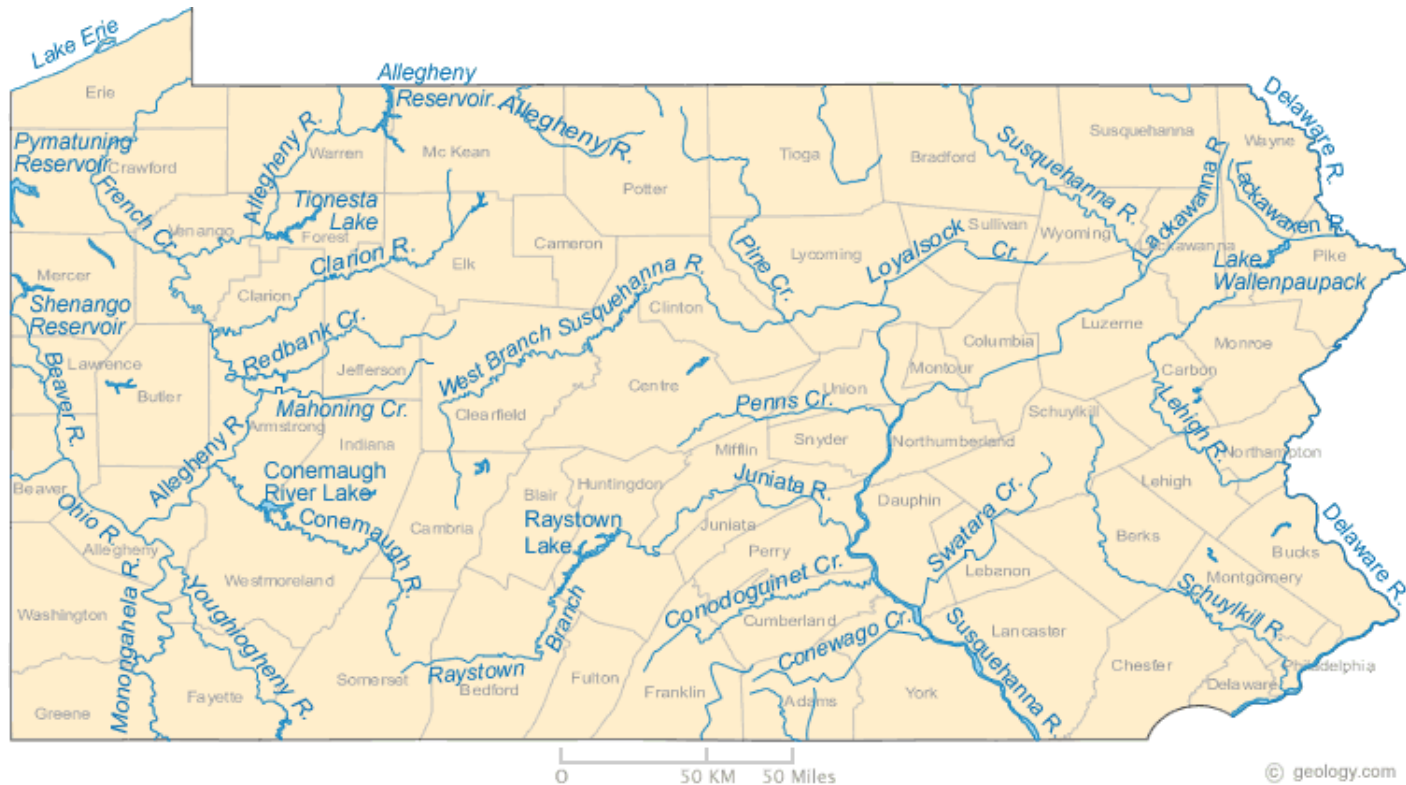


# How will global warming of 2°C affect Pennsylvania?



**Observed and projected changes  
in climate and their impacts**

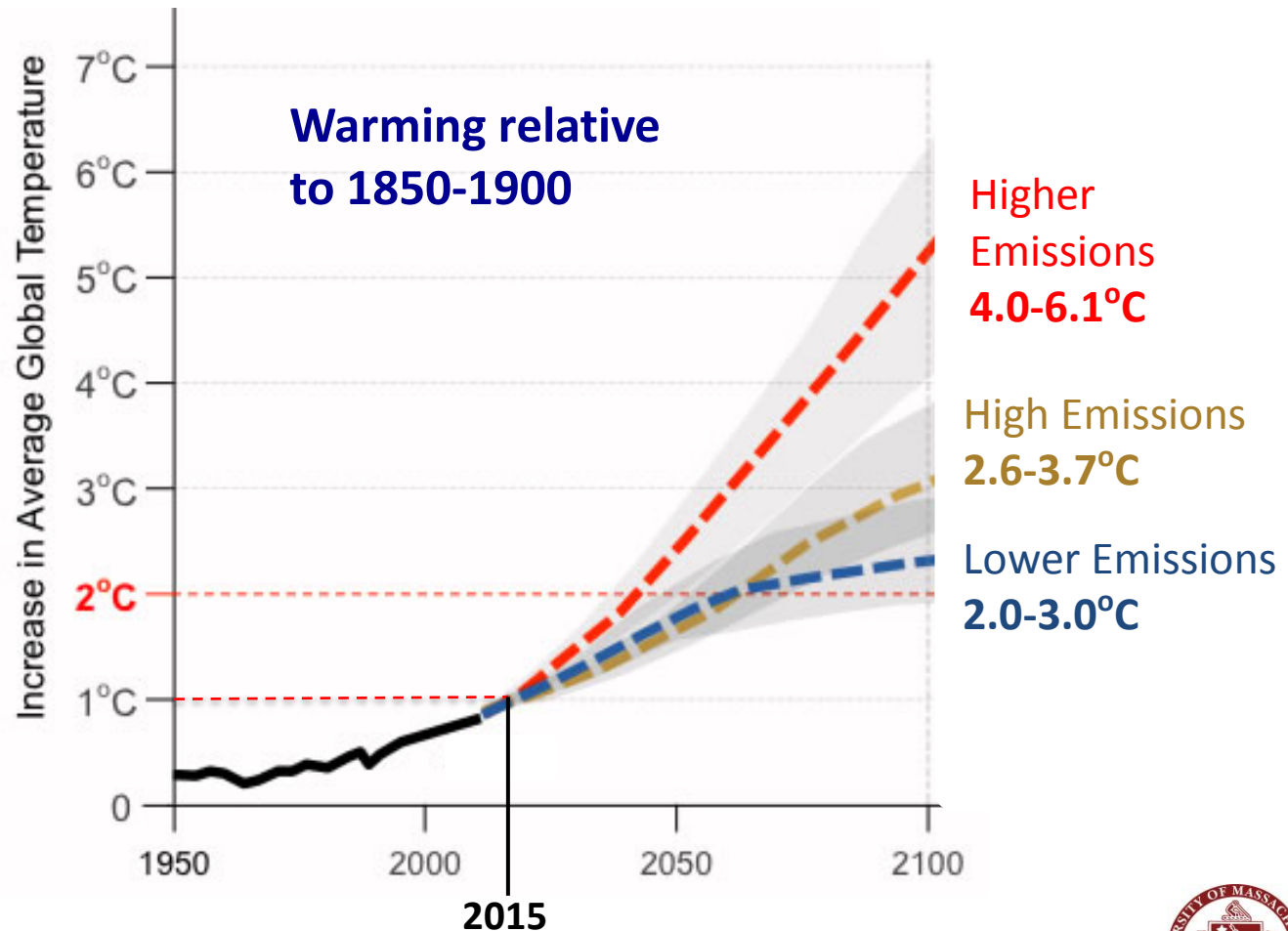
***“To prevent dangerous interference with the climate system, the scientific view is that the increase in global temperature should be below 2°C [relative to pre-industrial levels]”.***

- United Nations Framework on  
Climate Change, 2010

# How will global temperatures change in the future?

The global average temperature has already increased by about 1°C (1.8°F) relative to pre-industrial levels.

Current CO<sub>2</sub> emissions are tracking the 'higher emissions' scenario; unless emissions are reduced, the 2°C threshold will be crossed before 2050.

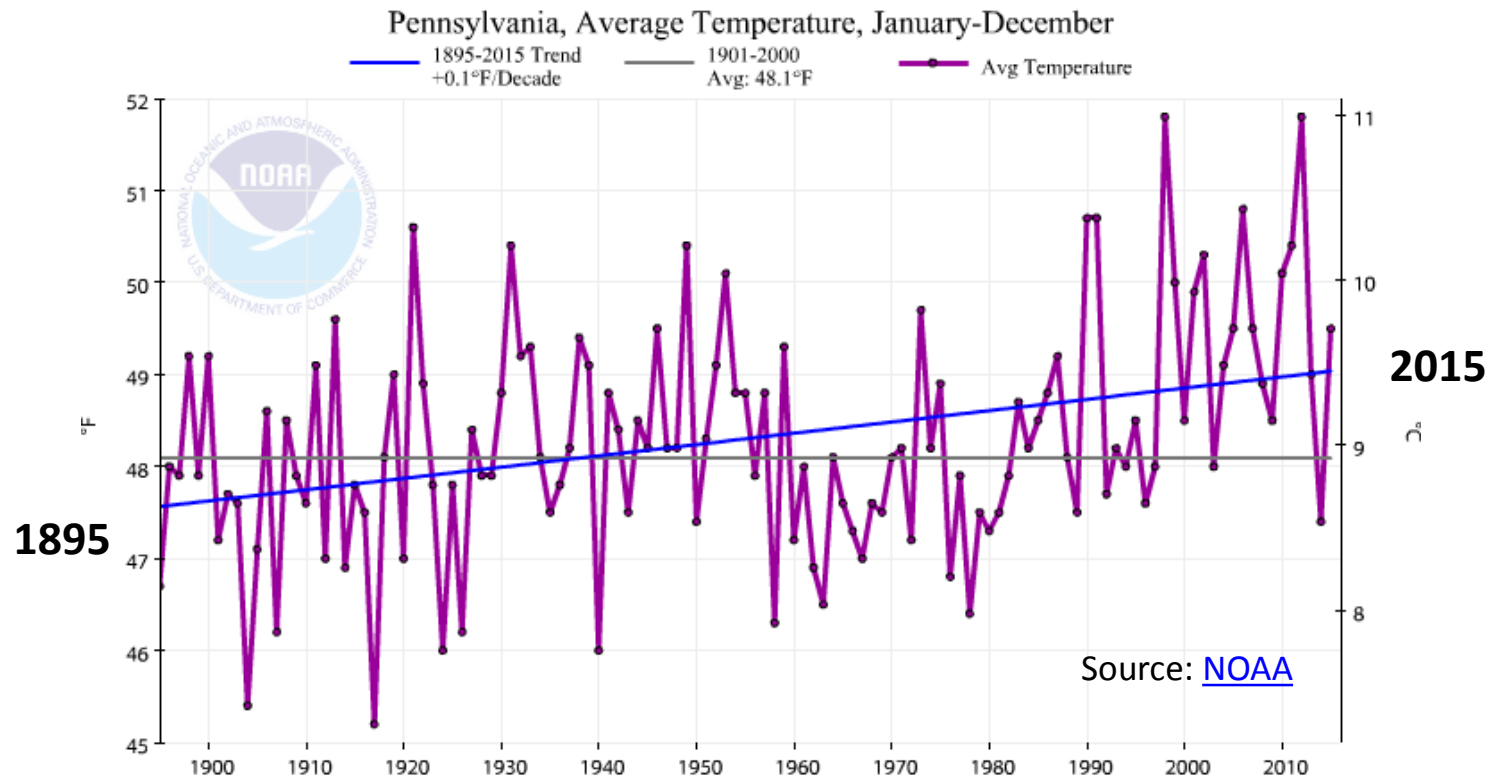


# Warming in Pennsylvania



## OBSERVATIONS

The annual mean temperature in PA has increased by about 1.4°F (0.8°C) since 1895.



***In 13 out of the last 15 years, the annual mean temperature in PA exceeded the 20th-century average every.***

# Warming in Pennsylvania

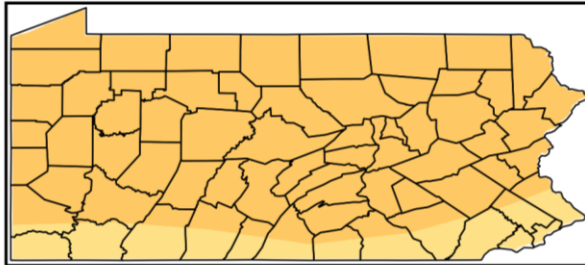


## PROJECTIONS

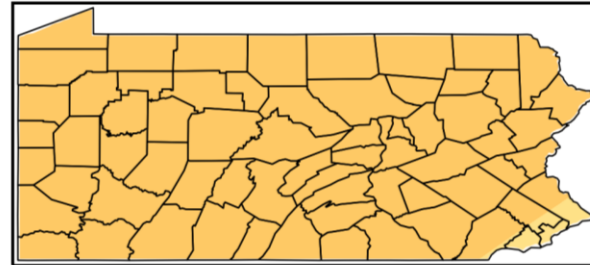
In the next 50-60 years, when global warming crosses the 2°C threshold, PA average summer and winter temperatures are projected to increase by over 5°F (2.8°C) relative to pre-industrial levels.

Lower  
Emissions

Winter

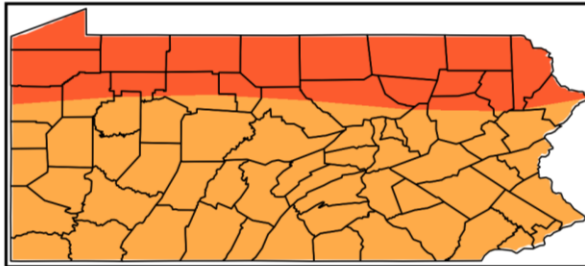


Summer

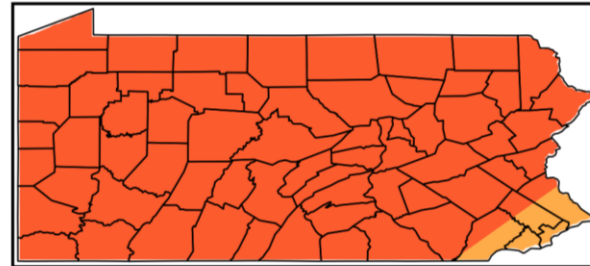


Higher  
Emissions

Winter

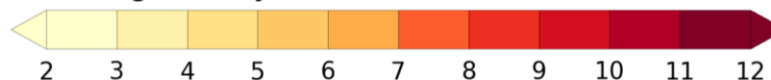


Summer



Source: produced by  
CSRC, UMass Amherst

Warming in °F by 2070 relative to 1961-1990 mean

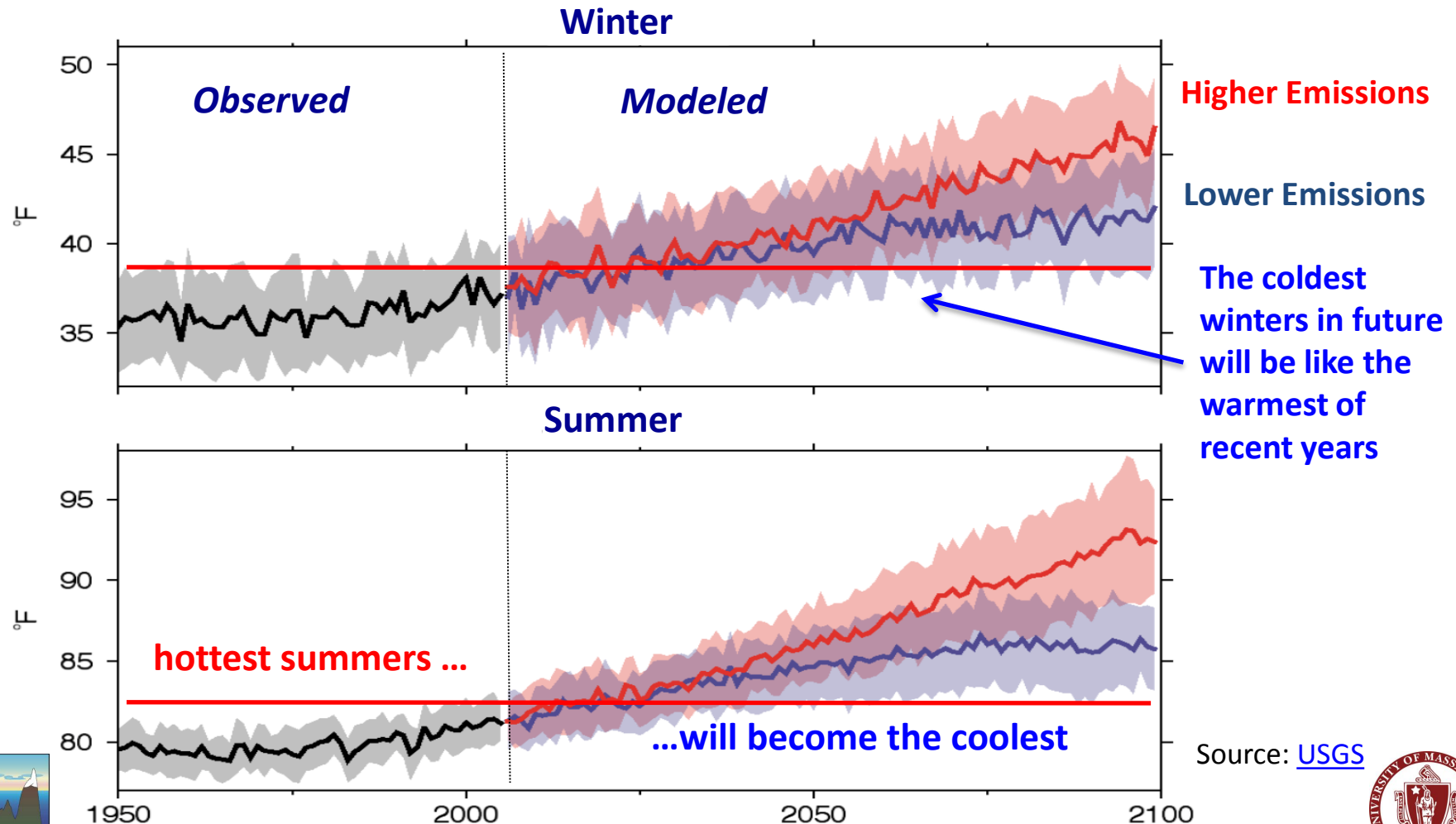


# Warming in Pennsylvania

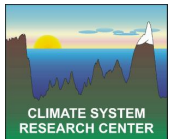


## PROJECTIONS

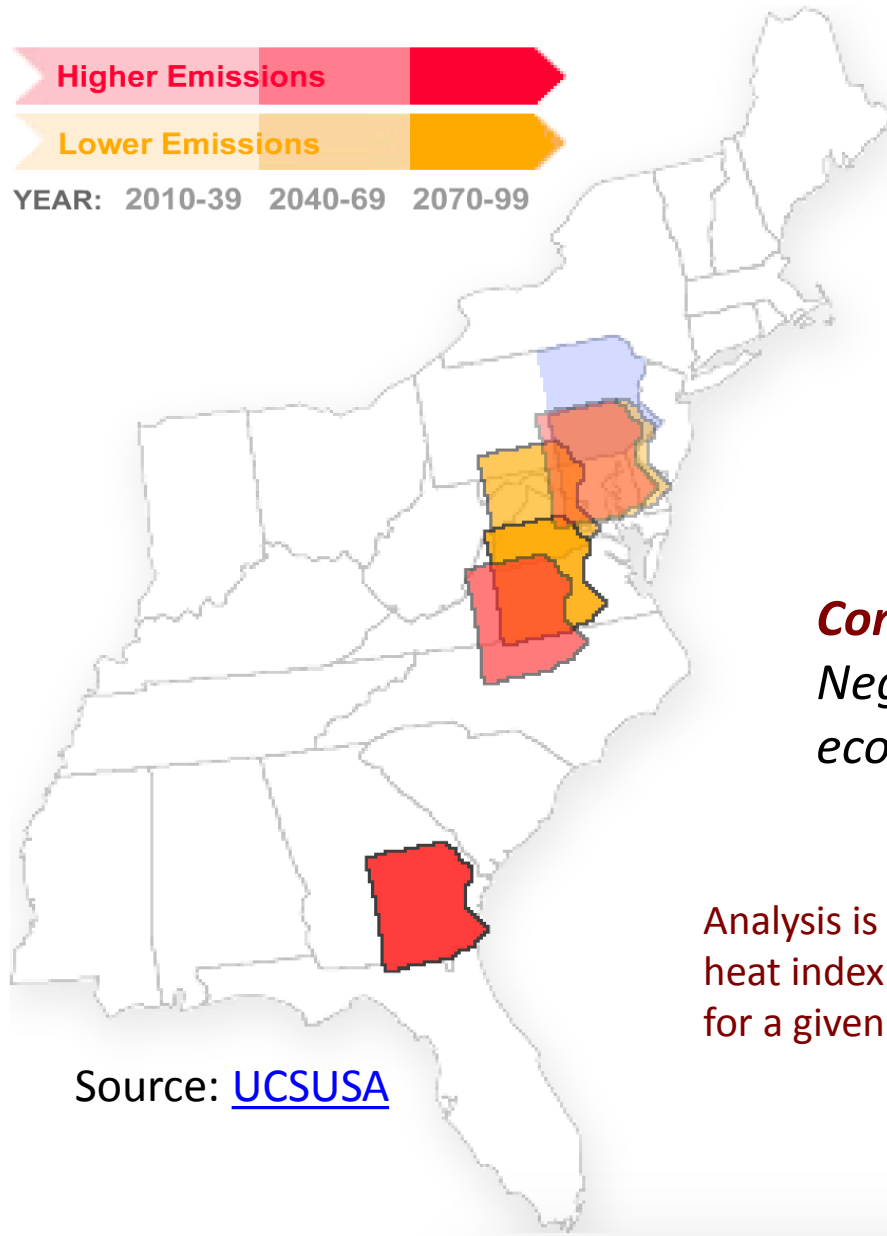
How warm will Winter and Summer temperatures become?



Source: [USGS](#)



# Migrating Eastern Pennsylvania Climate



## PROJECTIONS

**Summer in Eastern Pennsylvania by the end of this century could feel like a present-day typical summer in southern Georgia.**

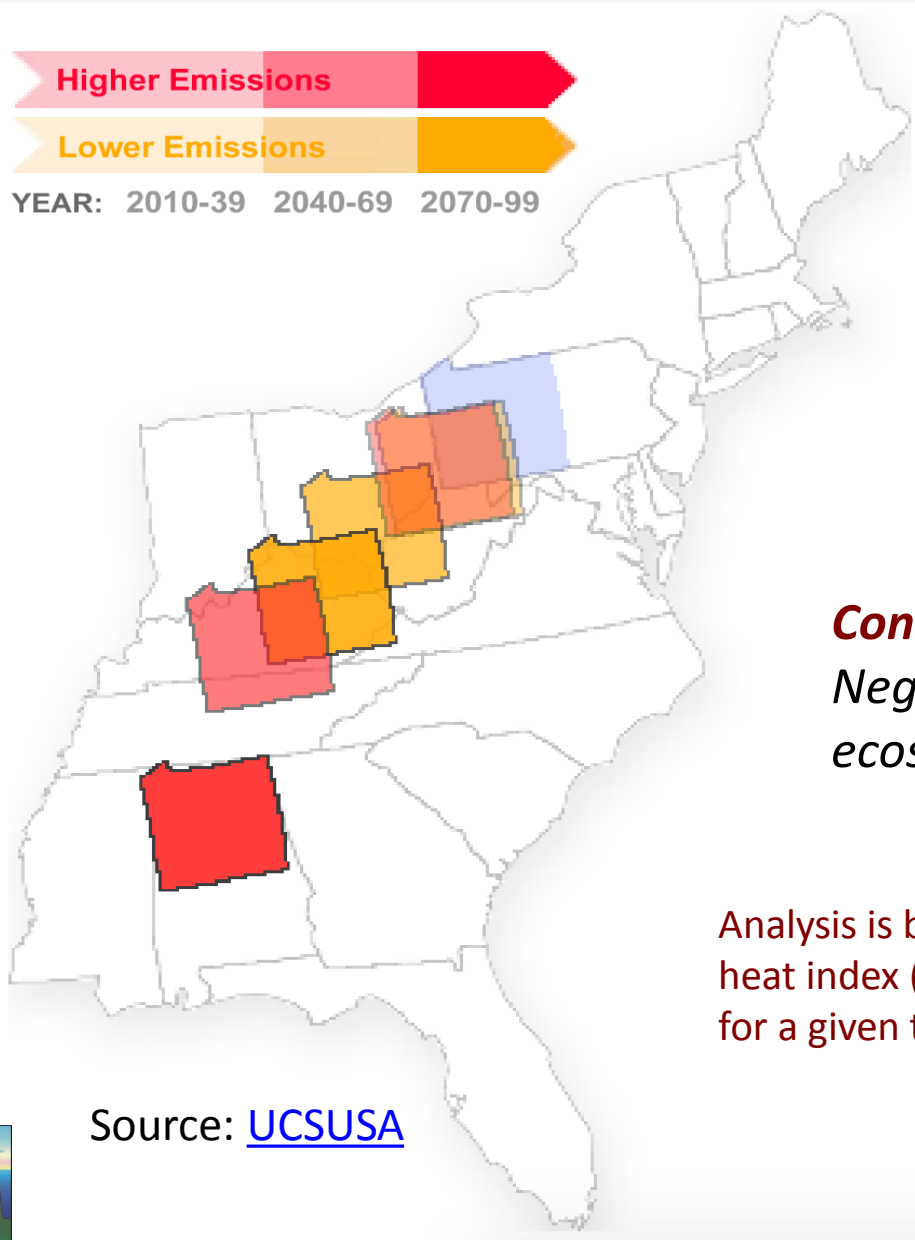
### *Consequences:*

*Negative impacts on human health, ecosystems, and the economy.*

Analysis is based on changes in average summer heat index (a measure of how it actually feels for a given temperature and humidity).

Source: [UCSUSA](https://climate.ucsf.edu/)

# Migrating Western Pennsylvania Climate



## PROJECTIONS

**Summer in Western Pennsylvania by the end of this century could feel like a present-day typical summer in Alabama.**

### *Consequences:*

*Negative impacts on human health, ecosystems, and the economy.*

Analysis is based on changes in average summer heat index (a measure of how it actually feels for a given temperature and humidity).

Source: [UCSUSA](https://www.ucsusa.org/climate-justice/communities/communities-impacted-by-climate-change)

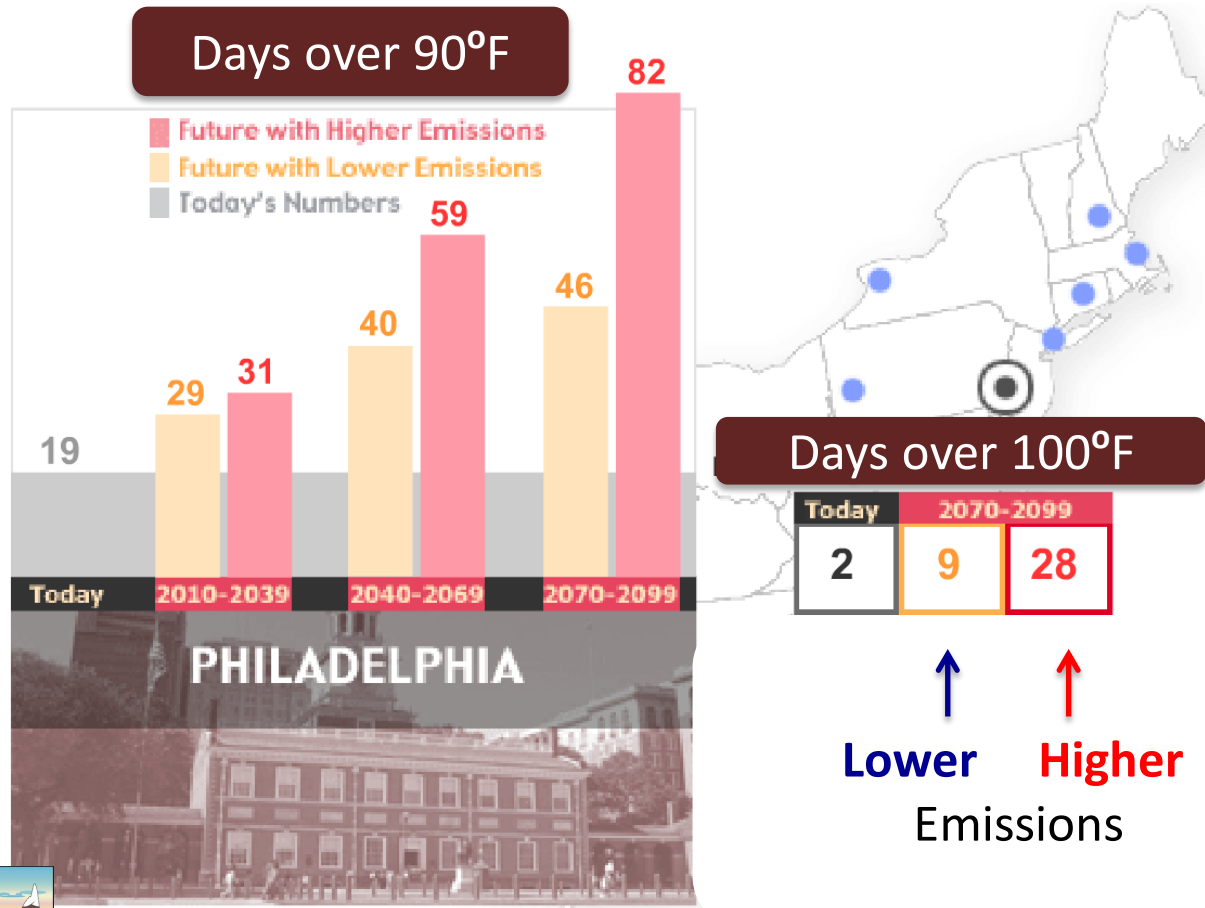


# Extreme Heat in Pennsylvania



## OBSERVATIONS

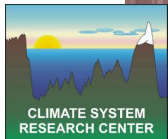
Summer daytime high temperatures in Philadelphia rarely go above 90°F in today's climate.



## PROJECTIONS

The number of days with dangerously high temperatures (above 100°F) is projected to increase significantly in the future.

Source: [UCSUSA](https://www.ucsusa.org/)

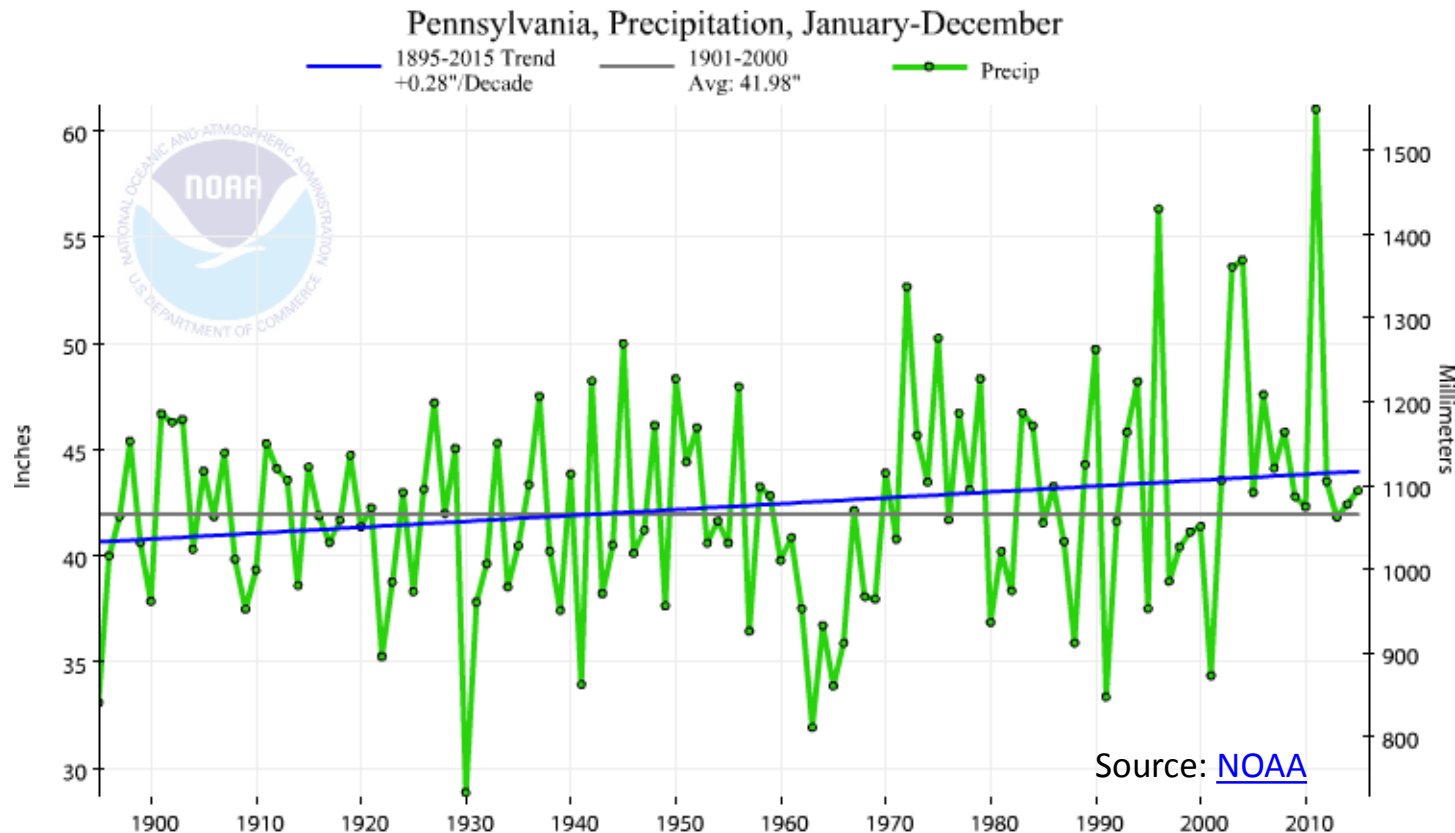


# Rain and Snow in Pennsylvania



## OBSERVATIONS

Annual total precipitation (rain + snow) has increased over the last few decades.



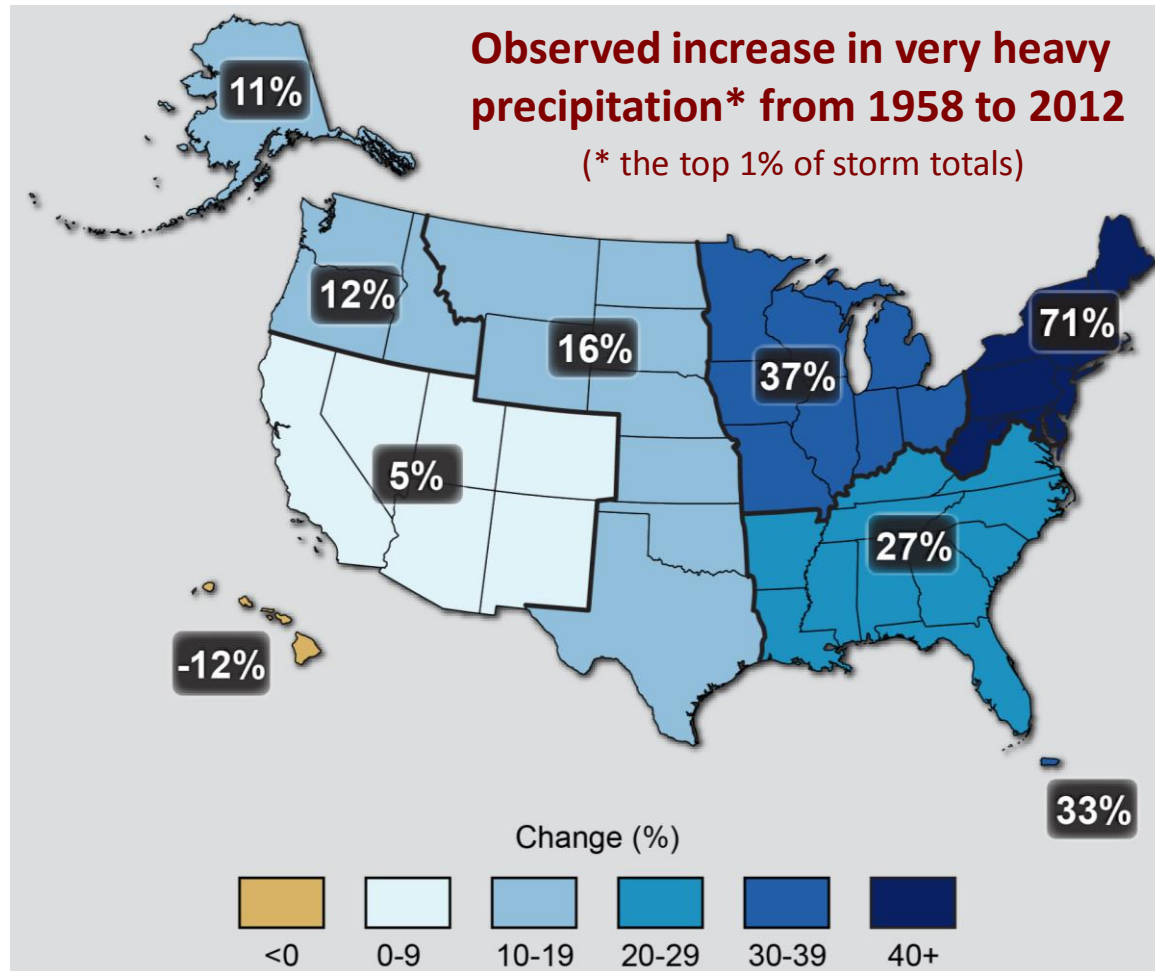
In 9 out of the last 10 years, Pennsylvania has received more precipitation than the the 20<sup>th</sup> century average.

# Very Heavy Rainfall



## OBSERVATIONS

The amount of precipitation falling during intense multi-day events has increased significantly in the Northeast US.



Source: [NCA](#)  
[2014](#)



# Powerful Storms



**Downed tree crushes car in  
Harrisburg, PA after Hurricane  
Sandy in 2012**



**Strong storm leaves trail of  
debris in Salisbury, PA, 2016**



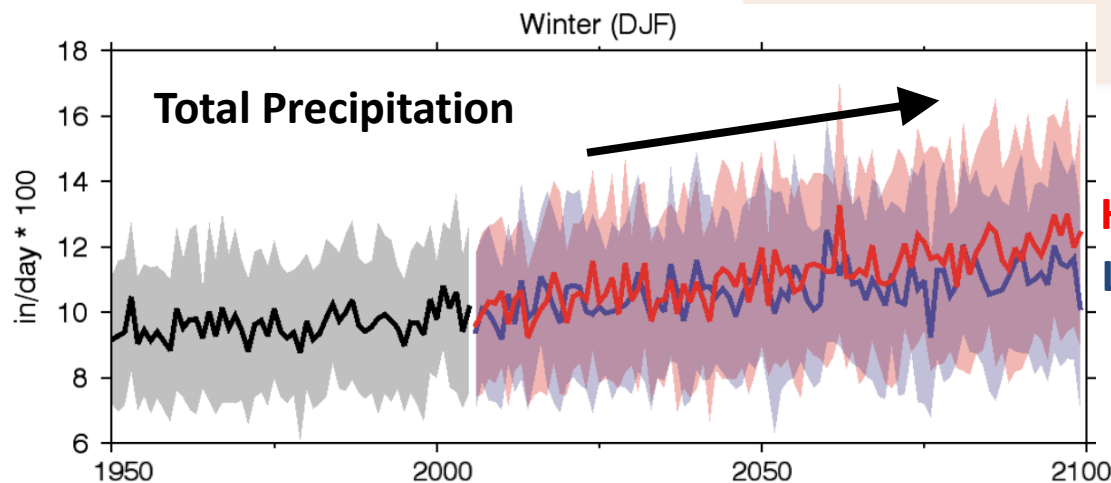


# Rain and Snow in Pennsylvania

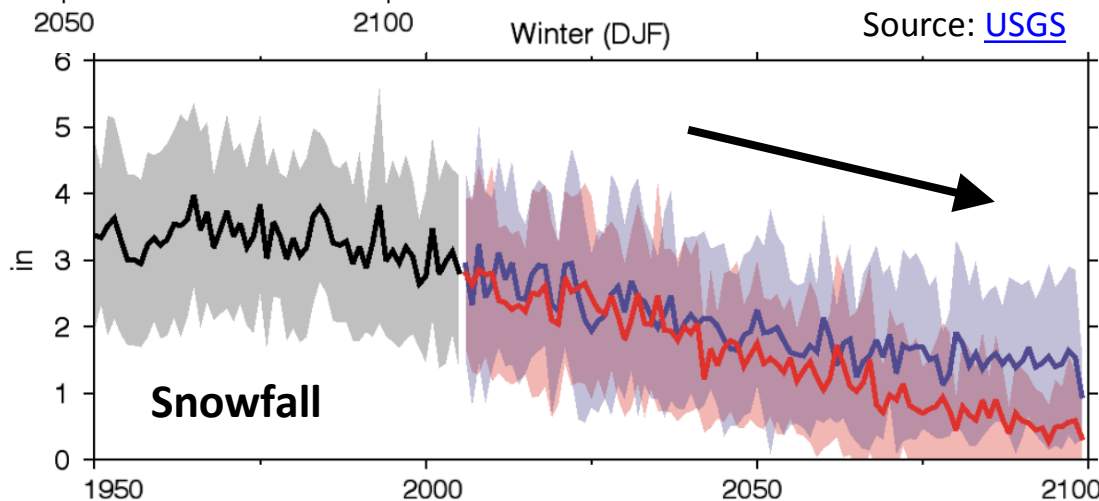


## PROJECTIONS

Winter precipitation is projected to increase through the 21<sup>st</sup> century.



Due to increasing temperatures, there will be more rain and less snow.



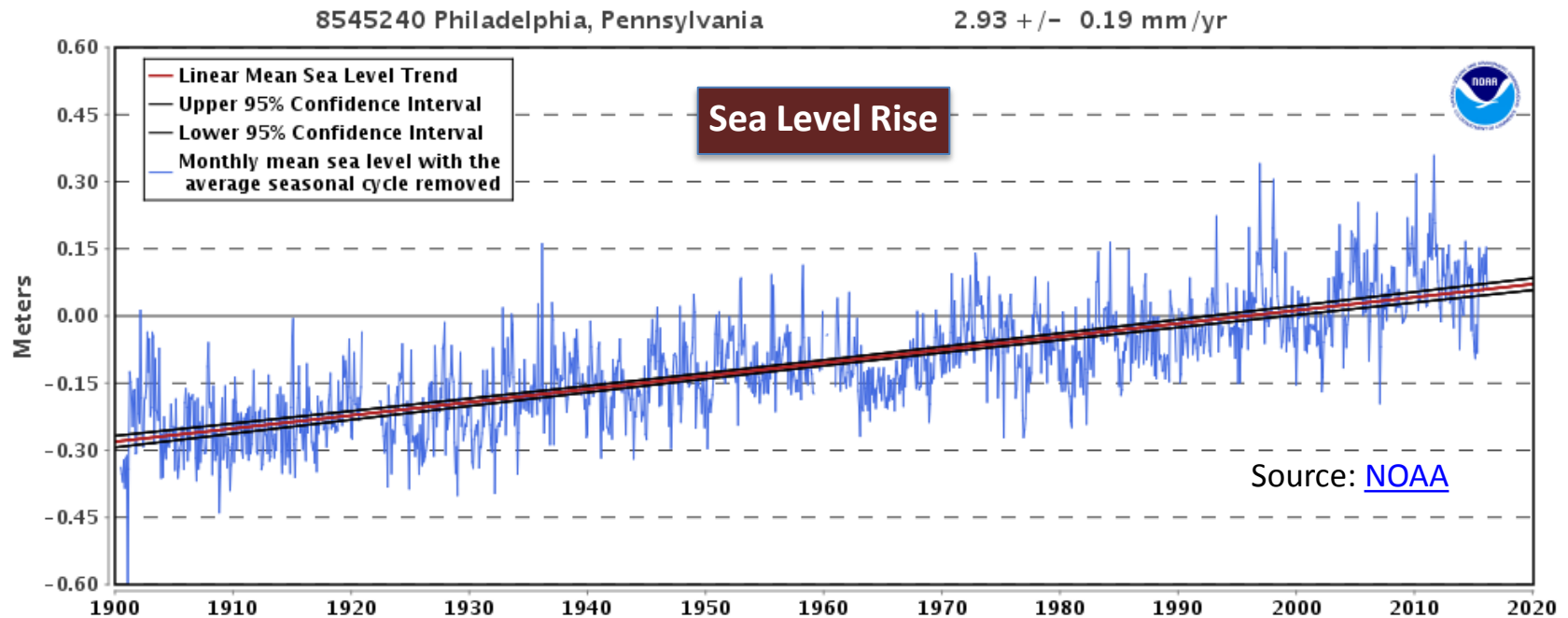
Projected changes in rainfall in summer are uncertain.

# Sea Level Rise



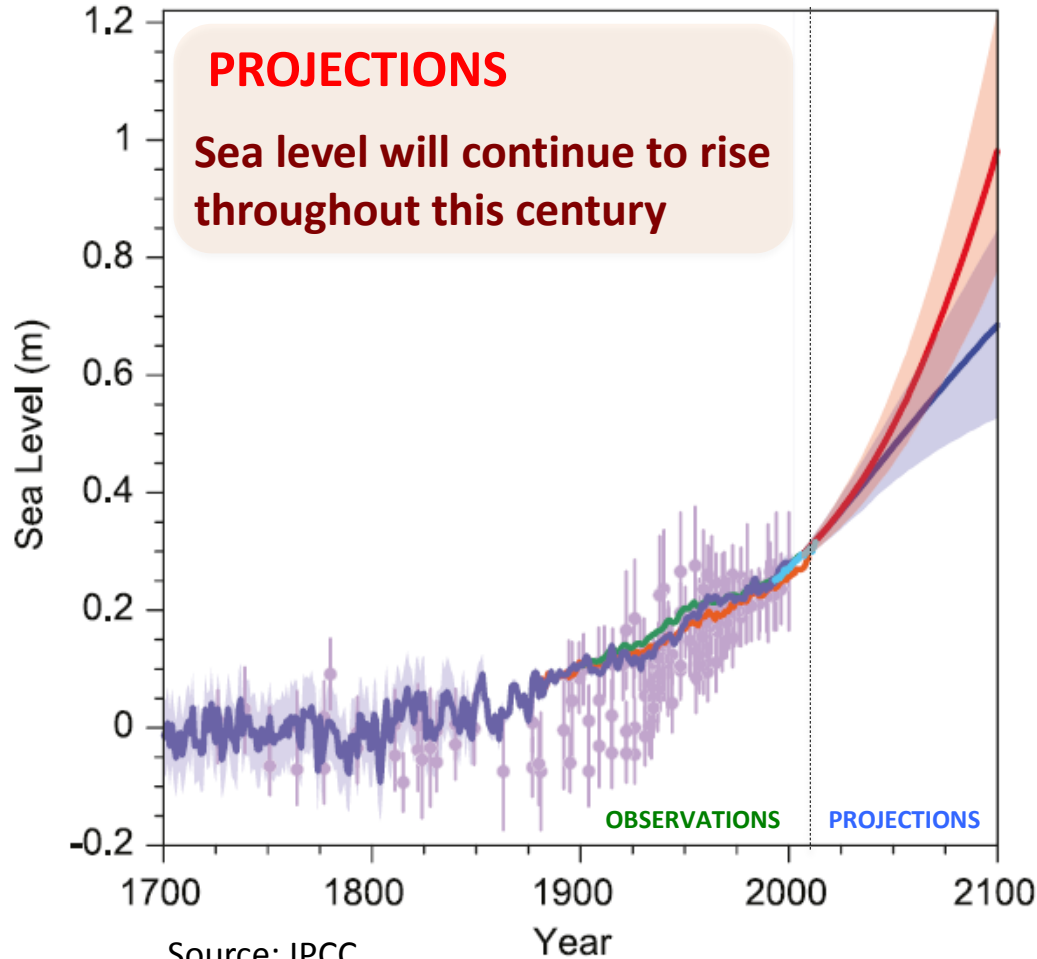
## OBSERVATIONS

Over the last century, sea level has risen by almost 1 foot around Philadelphia, PA.



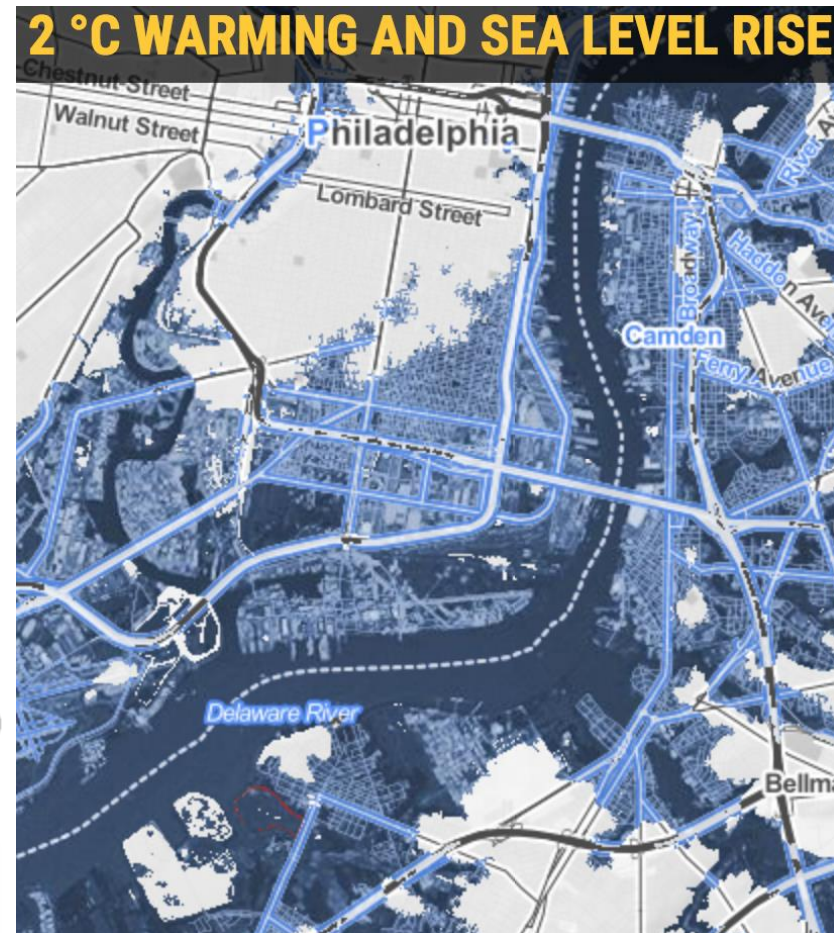
*Seemingly small increases in sea level can have large impacts along the coast due to storm surges and exceptionally high tides.*

# Sea Level Rise



Recent studies indicate that we are likely to experience more than 1m (3.3ft) of sea level rise by 2100

Projected inundation around Philadelphia

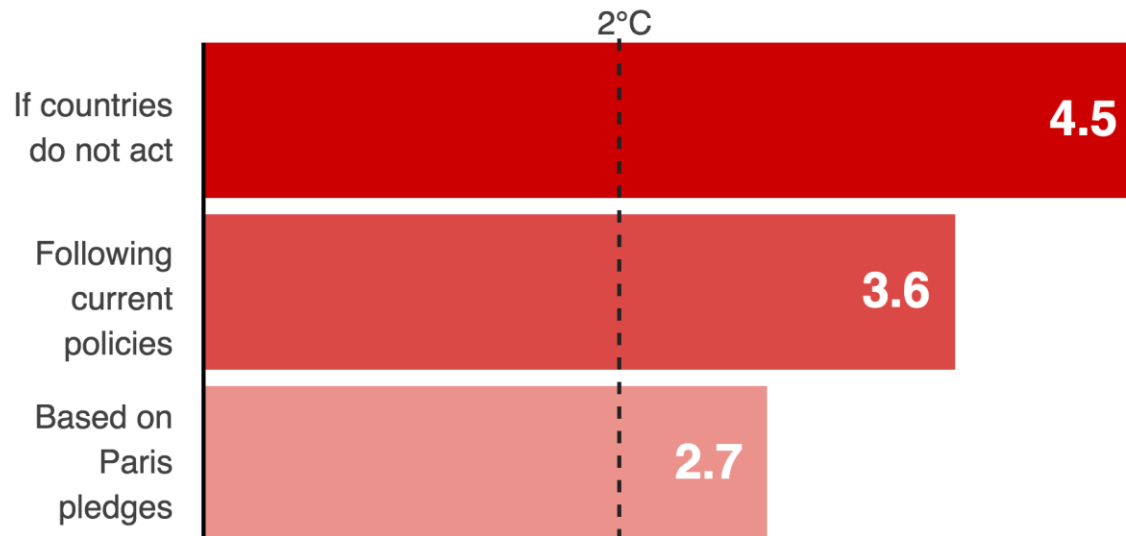


Source: [Climate Central](#)

# Climate Summit in Paris [COP21]

**Immediate action on local and global scales is required to limit the global mean temperature increase to 2°C (3.6°F).**

**Average warming (°C) projected by 2100**



Source: Climate Action Tracker, data compiled by Climate Analytics, ECOFYS, New Climate Institute and Potsdam Institute for Climate Impact Research.



# Strategies and Actions

## National Climate Assessment:

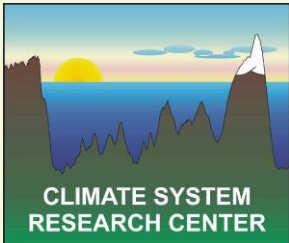
*The National Climate Assessment summarizes the impacts of climate change in the US, now and in the future.*

## Integrating Climate Change into State Wildlife Action Plan (SWAP):

*The goals of SWAP are to generate proactive, comprehensive wildlife conservation strategies that assess the health, challenges, and potential actions each State would like to accomplish during the coming decade and beyond.*

## Climate and Health Assessment:

*This scientific assessment examines how climate change is already affecting human health in the US and the changes that may occur in the future.*



This report was created by Prof. Raymond Bradley,  
Dr. Ambarish Karmalkar, and Kathryn Woods  
[Climate System Research Center \(CSRC\)](#)  
University of Massachusetts Amherst

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