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Climate Science and the Need for Action

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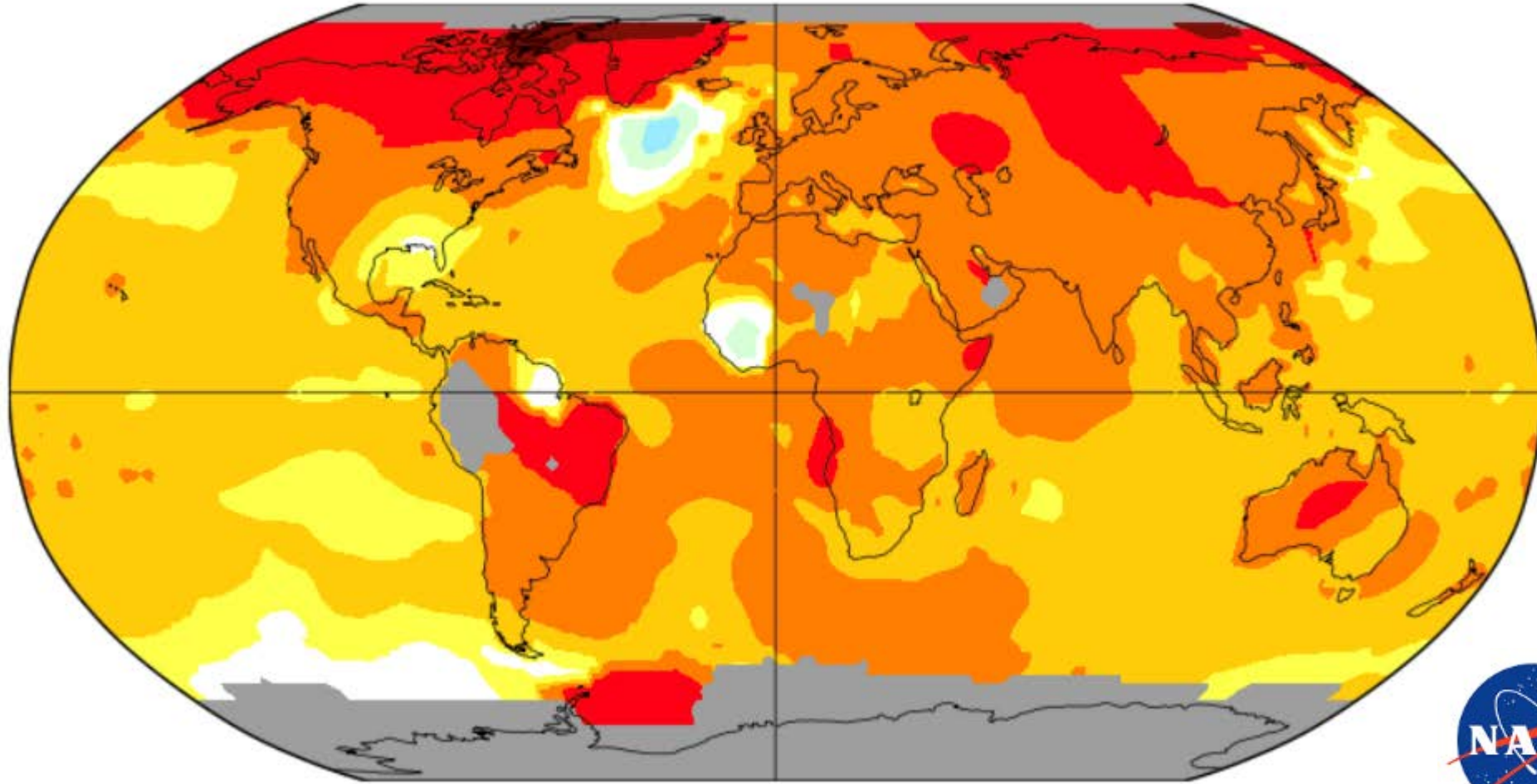


Presentation Overview

- There is a **climate opportunity** for the Great Lakes region
- There is also a **climate challenge** for the Great Lakes region
- Hope that we can work together toward solving the problem & making Michigan the top go-to place in the U.S.

The globe is warming almost everywhere

Mean Annual Temperature Trend 1880-2018

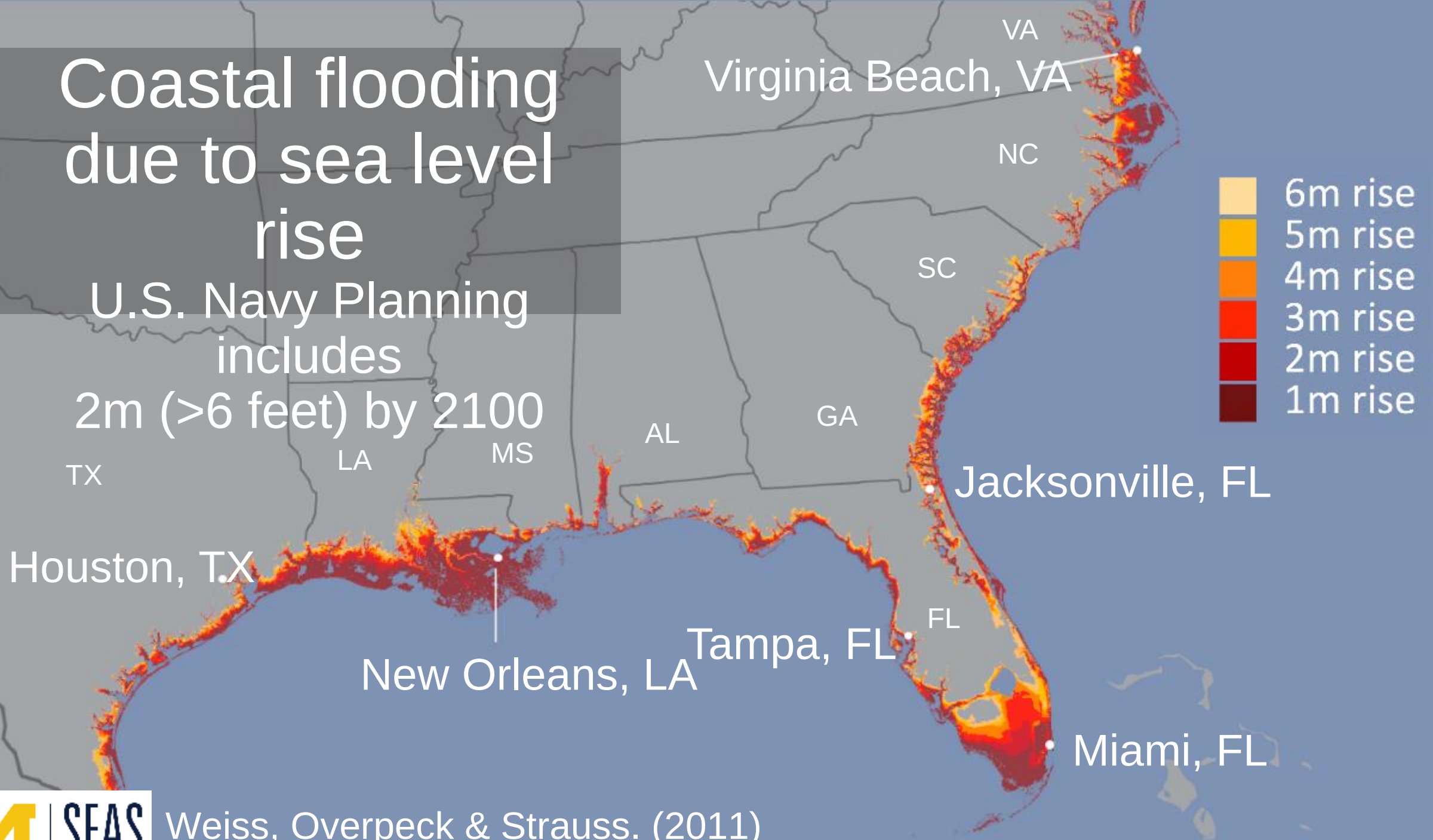


An aerial photograph of a large, deep reservoir carved into a desert canyon. The water is a deep blue, contrasting with the reddish-brown, layered rock formations. The canyon walls are steep and show signs of erosion. In the background, more distant mountain ranges are visible under a clear blue sky. A semi-transparent dark rectangle is overlaid on the upper portion of the image, containing white text.

Water shortages have begun in the Southwest U.S. Sustainable water supplies dwindling

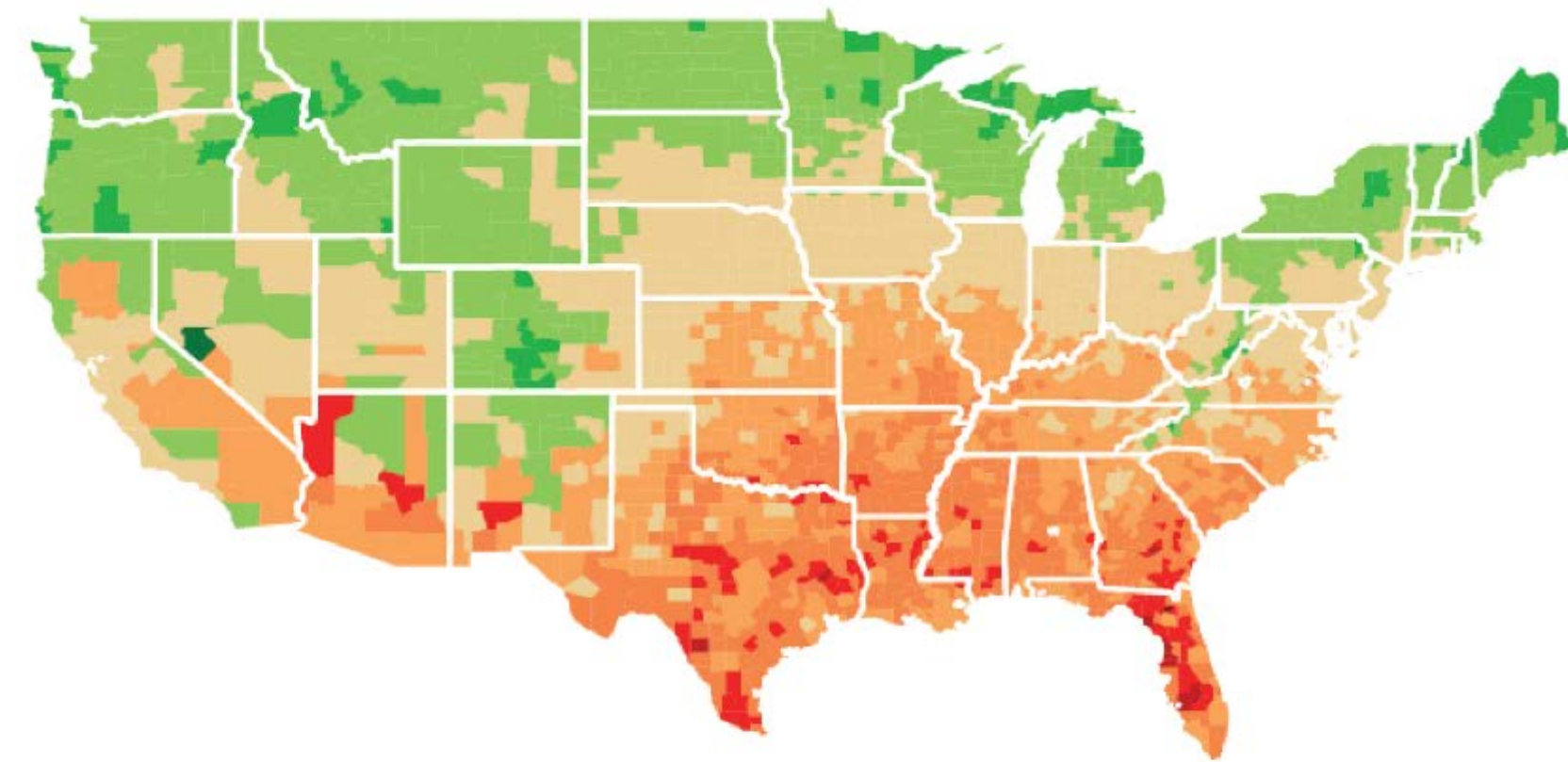
Coastal flooding due to sea level rise

U.S. Navy Planning
includes
2m (>6 feet) by 2100



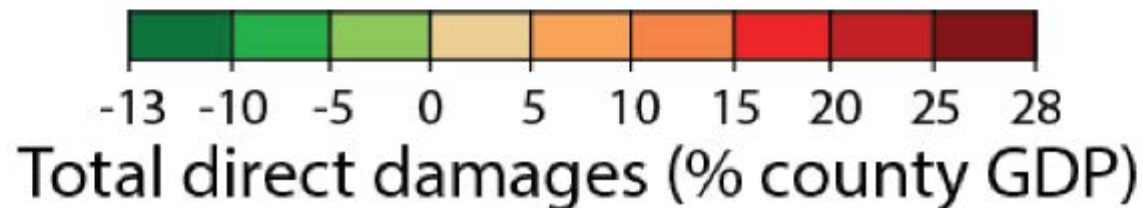
Estimating economic damage from climate change in the United States

Hsiang et al.,
Science (2017)



**Due to effects of warming
on select sectors:**

- ✓ Agriculture
- ✓ Crime
- ✓ Coastal storms
- ✓ Energy
- ✓ Human mortality
- ✓ Labor



Damages by end 21st century



- There is a **climate opportunity** for the Great Lakes region

A satellite image of the Great Lakes region in North America. The five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) are visible as large, dark blue bodies of water. The surrounding land is covered in green vegetation, with some brownish areas indicating urban or developed regions. The text is overlaid on the top right of the image.

Cooler temperatures
and 20% of world's
unfrozen freshwater are
going to be a huge draw

A satellite map of the Great Lakes region in North America, showing the five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) and the surrounding land. The lakes are dark blue, and the land is green with some brown patches. A semi-transparent grey box is overlaid on the top right of the map.

Cooler temperatures
and 20% of world's
unfrozen freshwater are
going to be a huge draw

But...

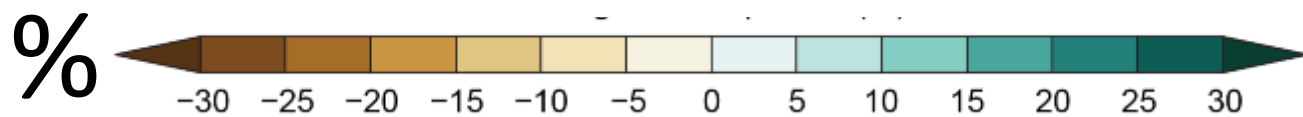
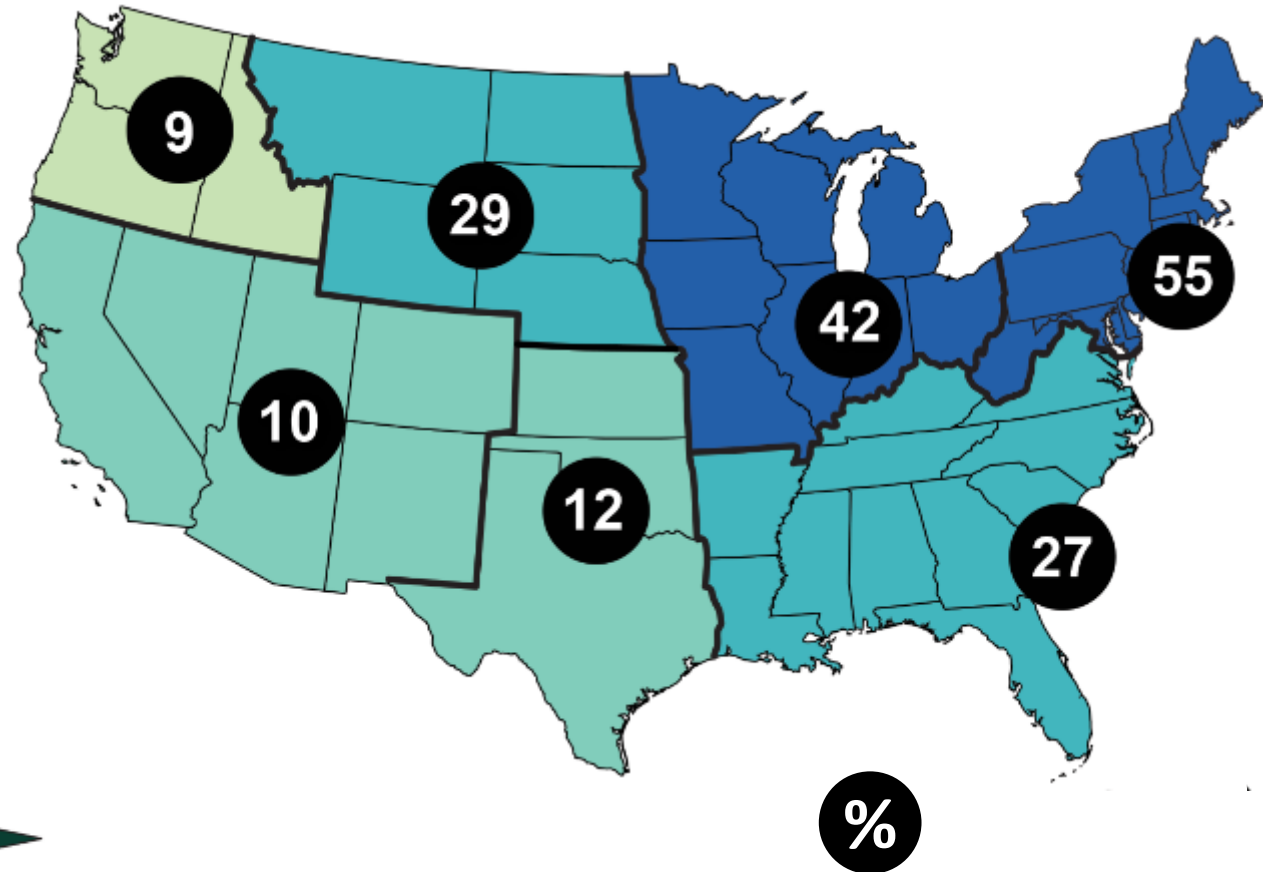
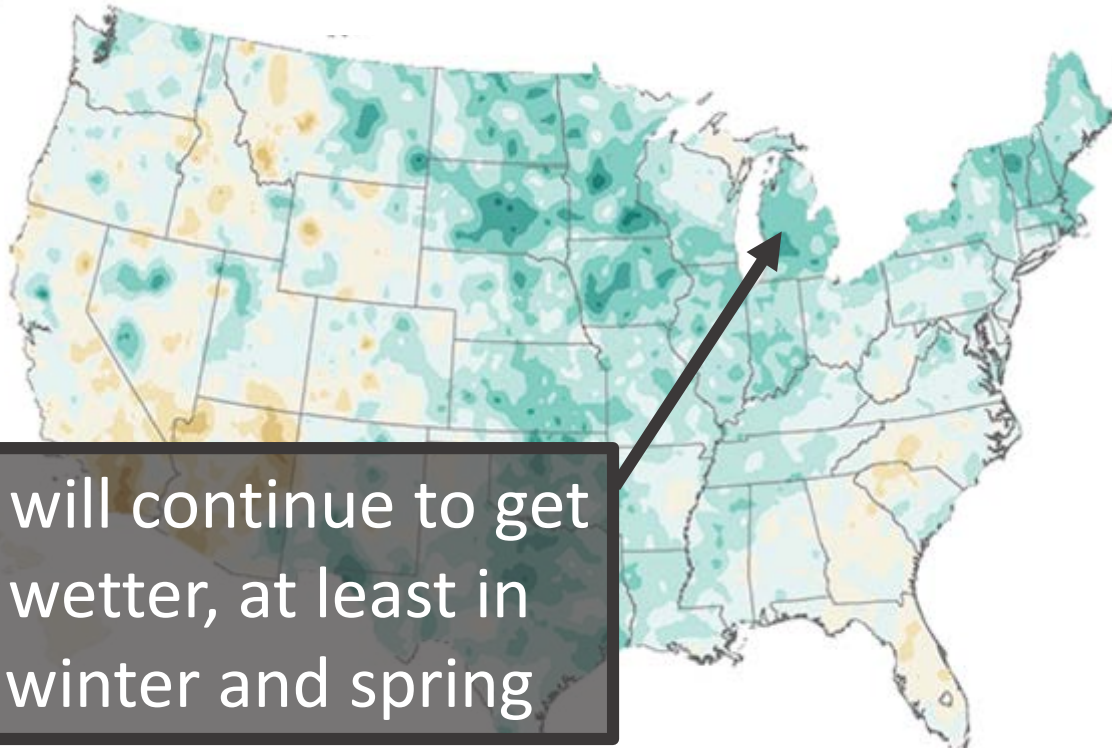


- There is a climate opportunity for the Great Lakes region
- There is also a **climate challenge** for the Great Lakes region

Observed Change in Average Precipitation (left) and % falling in heaviest 1% of events (right)

% Change: last 30 years versus 1901-60 average

% Change: between 1958-2016



%

Critical point: Too much climate change endangers the Great Lakes...

- more frequent/severe runoff and **flooding**
- water infrastructure risk and...
- expansion of harmful algae blooms into *all* of the Great Lakes*



* *Algae blooms also grow worse with warming*

Critical point: Too much climate change endangers the Great Lakes...

- longer/**hotter** heatwaves
and...

- more frequent and
severe **drought**

= **water stressed**
agriculture, forests,
small lakes, rivers
and more





What does all this mean for the Great Lakes?

- Region could rapidly become a desired place to live & do business
- **But, if we don't embrace renewable energy, adaptation will be tough**
- **If we do embrace renewable energy, the region could win big**
- Fortunately, the cost of clean energy is falling fast and the entire planet is transitioning out of fossil fuels...



What does all this mean for the Great Lakes?

- **We all need to work together to get it done...**
- The UM is planning a path to decarbonization and wants to partner with businesses, the state, communities (Ann Arbor!), non-profits, kids, adults, everyone... **to speed the transition to a robust clean-energy economy that is sustainable and just**



Questions?