

# Climate Change is continuing to accelerate, impacts as well.



<https://www.ucsusa.org/resources/global-warming-midwest>

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NBCNews.com - June 13, 2020



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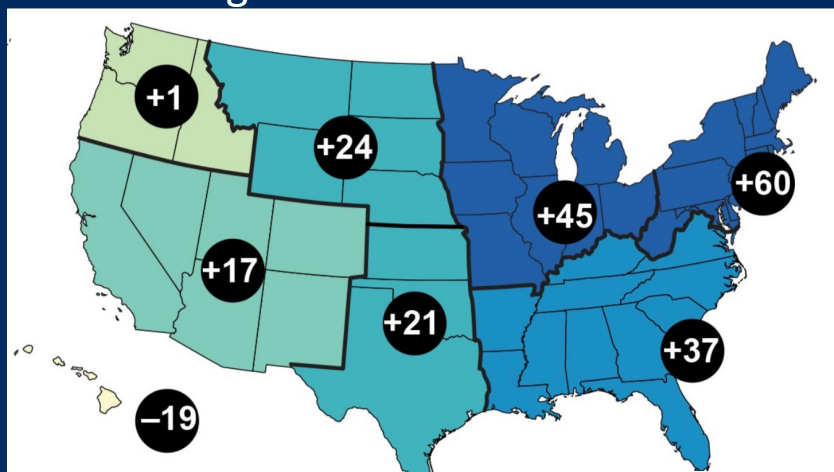
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## Warming drives many of the impacts we're seeing

Including an intensified hydrological cycle that can yield **increases in:**

- **Extreme Rainfall**
- **Flooding**


% falling in heaviest 1% of events



From: 5<sup>th</sup> U.S. National Climate Assessment (2023)

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*USA Today* - March 4, 2023



**Water crisis in West has prompted desperate ideas: Drain the Great Lakes, desalinate ocean water**

TREVOR HUGHES | USA TODAY  
Updated 10:57 am EST Mar. 4, 2023

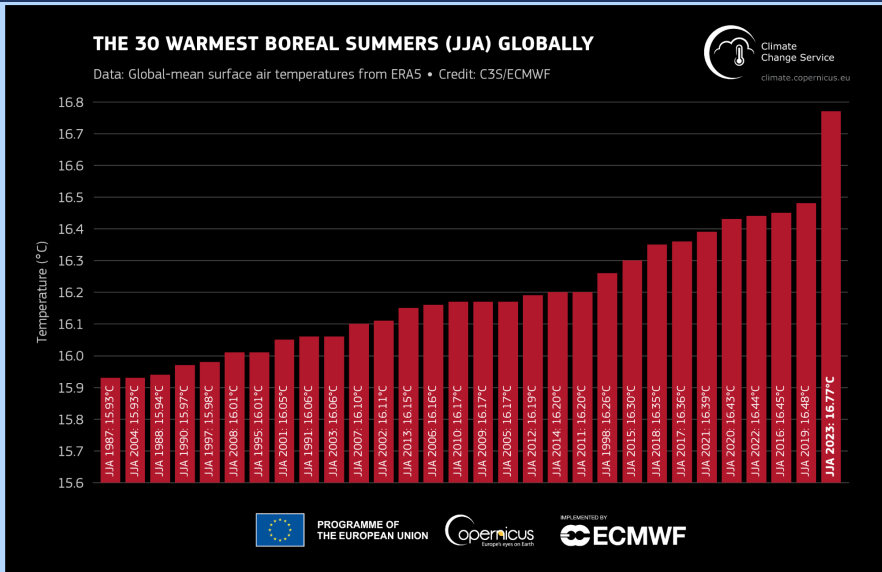
(Desperate people do desperate things...)

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**The 30 warmest northern hemisphere summers**

Summer 2023 was off the charts HOT (or, why we're lucky to live in Michigan)

Just due to an El Niño?



Data: Global-mean surface air temperatures from ERA5 • Credit: C3S/ECMWF

Climate Change Service climate.coopernicus.eu

PROGRAMME OF THE EUROPEAN UNION | coopernicus | ECMWF

Global-mean surface air temperatures for the 30 warmest boreal summers (June-July-August) in the ERA5 data record, ranked from lower to higher temperature - Data: ERA5. Credit: C3S/ECMWF.

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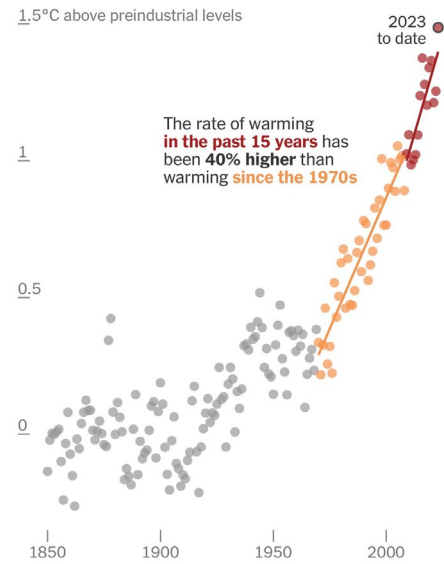
*Scientist love to debate – and it depends on the data set you’re using*

*Though everyone agrees there was a big acceleration in global surface air temperature after the 1970’s*

*New York Times 10/13/23*

**Global warming may have accelerated in the past 15 years**

Annual average temperatures since 1850



Zeke Hausfather

Source: Berkeley Earth Land/Ocean Temperature Record

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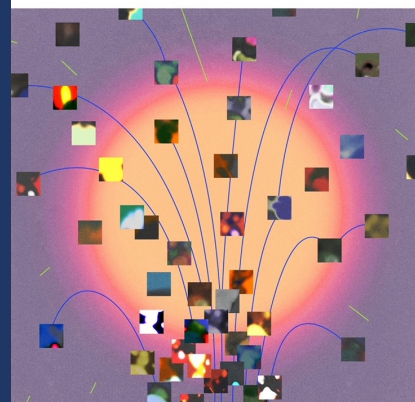
*“It is, James Hansen says, worse than you think”*

*“We would be damned fools and bad scientists if we didn’t expect an acceleration of global warming”*

**The Godfather of Climate Science Turns Up the Heat**

Nov. 8, 2023

*New York Times*



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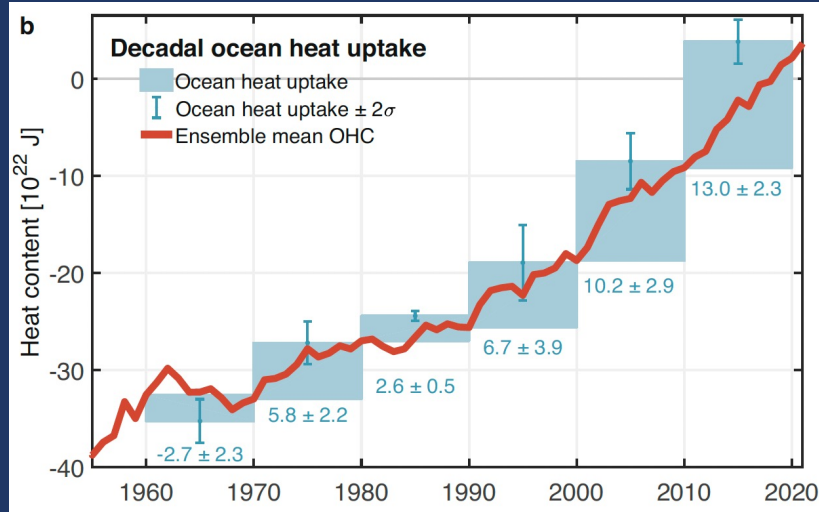
## The missing piece of the puzzle? Global Ocean Heat Content

The ocean takes up over 90% of the heat trapped by greenhouse gases.

It appears there could be a slowing in the ability of the ocean to take up heat.

Increasing El Niño heat is global warming heat!

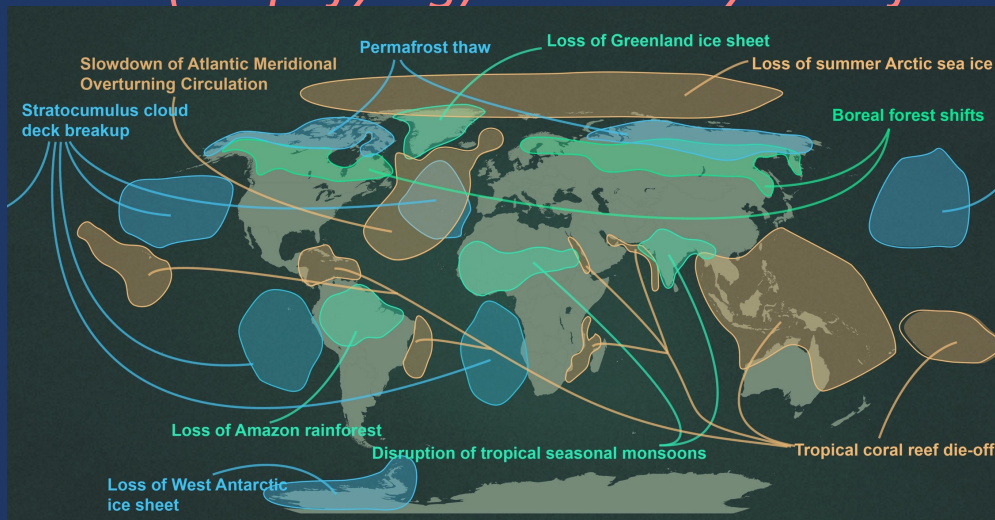
What would you predict for next summer?



Li et al., *Nature Communications*, Oct. 2023

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## Another big worry: Lurking Tipping Points & positive (amplifying) climate system feedbacks



U.S. National Climate Assessment (2023)

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# The "Death of Snow" - we are not alone...

**IS MICHIGAN NOW FACING THE 'DEATH OF SNOW'?**

Detroit Free Press  
Weather - Ecology - Climate Change  
1 Feb 2024 - 10:00 AM - Keith Matthews

**Is this Detroit, or Seattle?**

Metro Detroit just completed the wettest January on record — 5.25 inches of rain and melting snow. That breaks the previous record of 5.02 inches set in 1933.

"The events where we did get snow were on the wetter side, that wet, heavy snow. But a lot of the precipitation fell as rain," said Trent Frey, a meteorologist with the National Weather Service in White Lake.

It follows a December with the second-highest snowfall on record, a scant 0.1 inch. Only a snowless December says tops that.

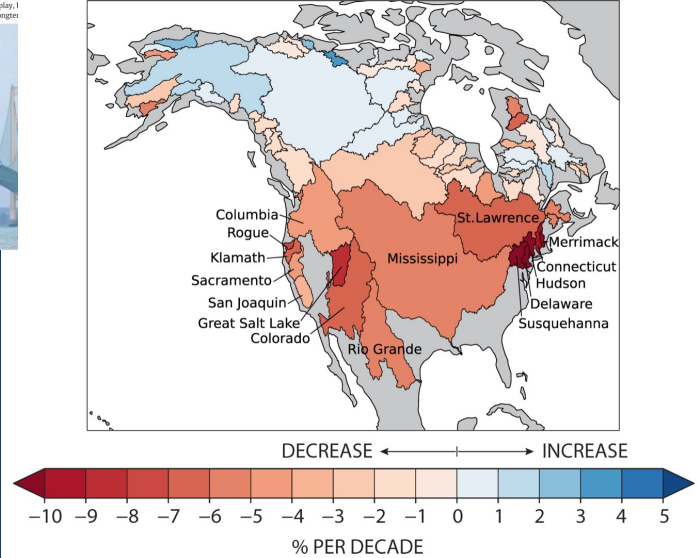


Detroit Free Press, Feb. 1, 2024

A 17°F average winter temperature "snow-loss cliff."

Gottlieb and Mankin, Nature (2024)

CLIMATE CHANGE EFFECT ON SPRING SNOWPACK, 1981-2020



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## Conclusions...

Climate Change: is it getting worse? **Yes!** (it's not just the rate of change, but the rate of resultant suffering)

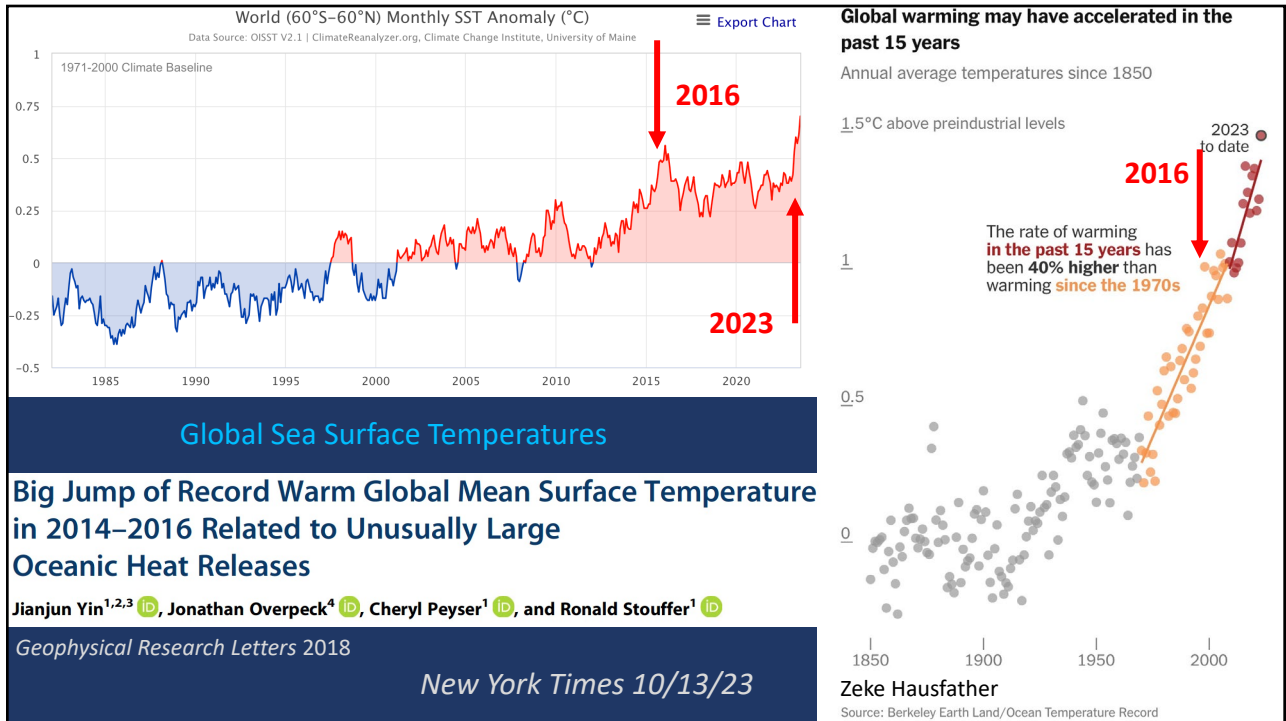
Is it too late to save the day? **No!**

**Take away?** We need to move faster than ever, in Michigan, across the U.S., and around the globe – note that it's potentially a MASSIVE economic engine if the Great Lakes can lead.

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