# Model-based predictions of unprecedented extreme weather

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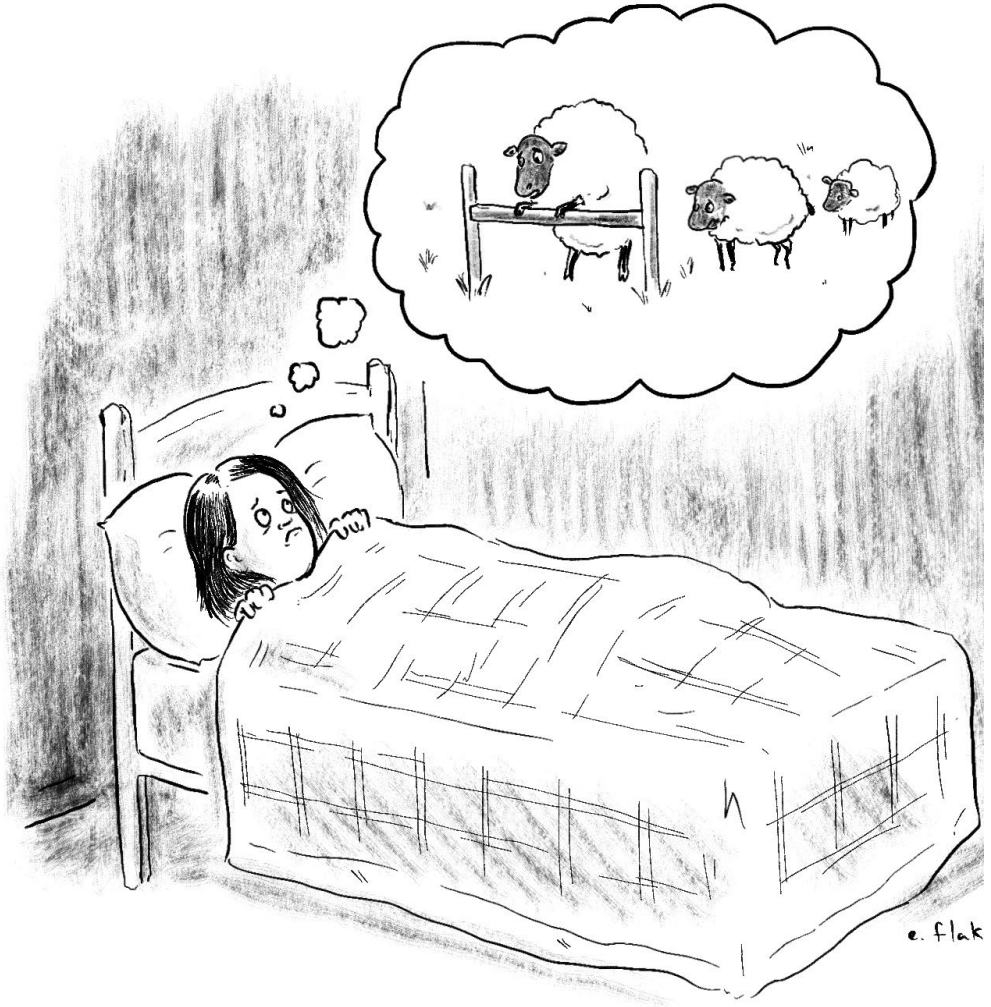
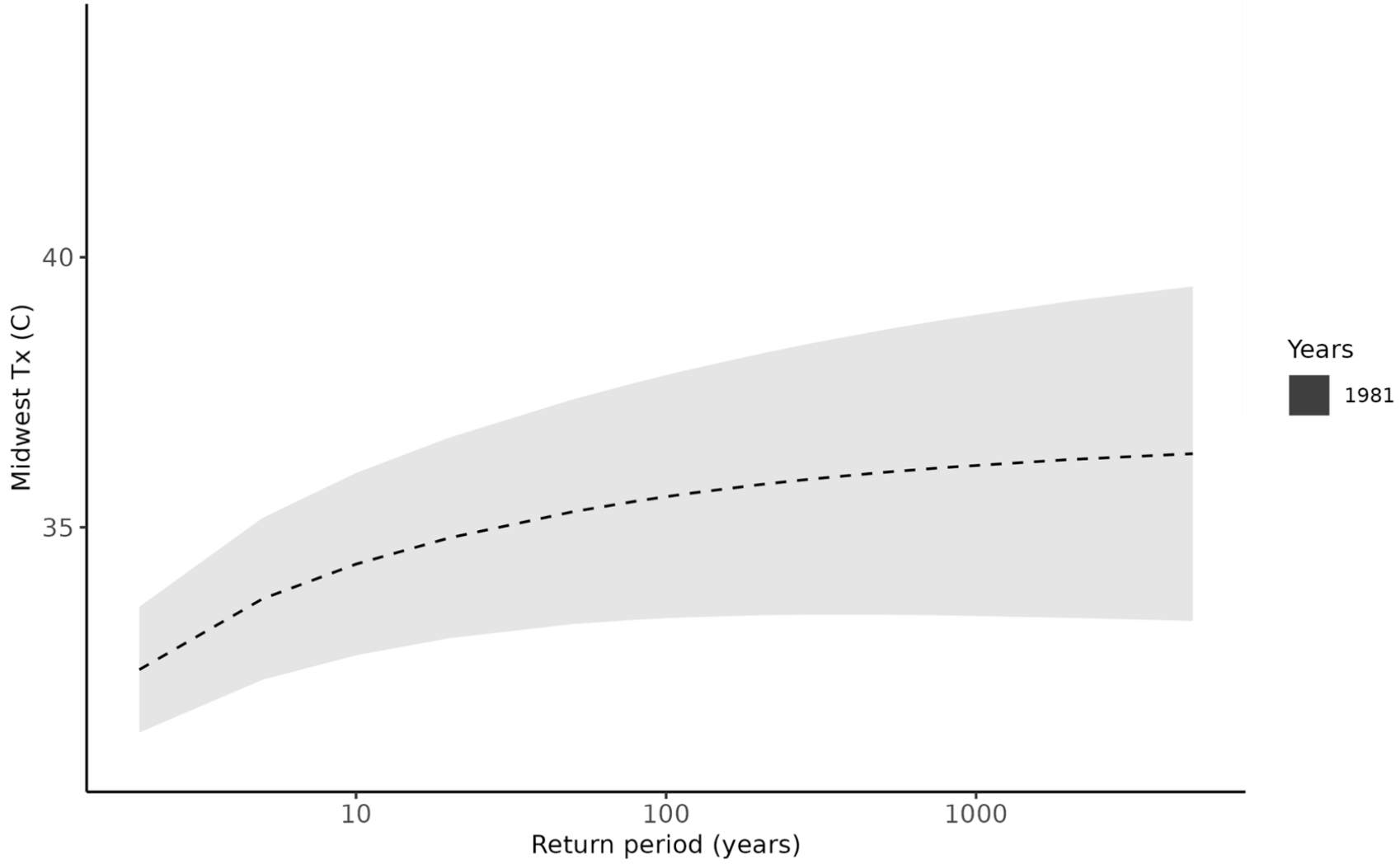


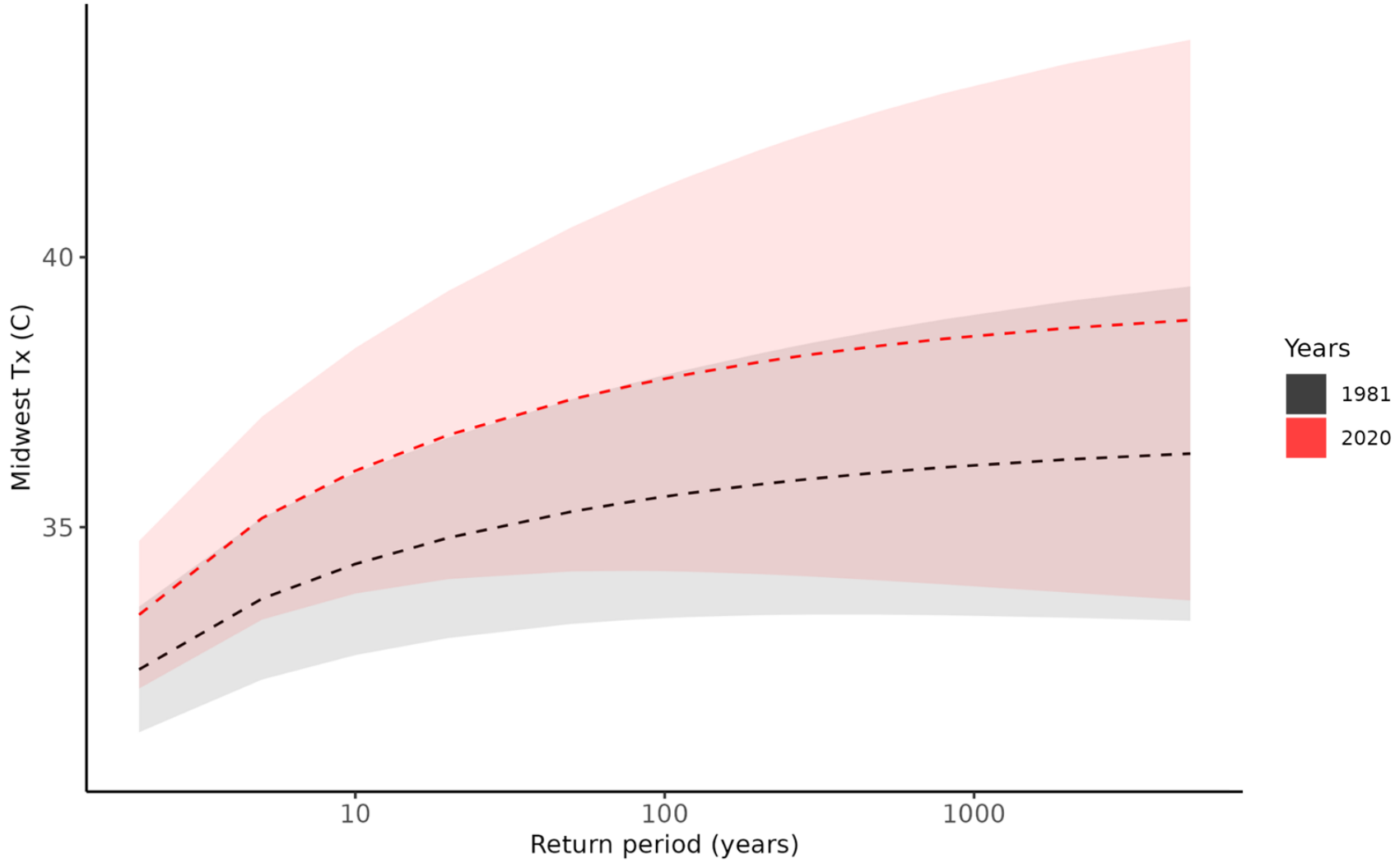
Studying extreme events is a challenge

If you wanted to estimate return period of an extreme heat event using only observations

# 1981

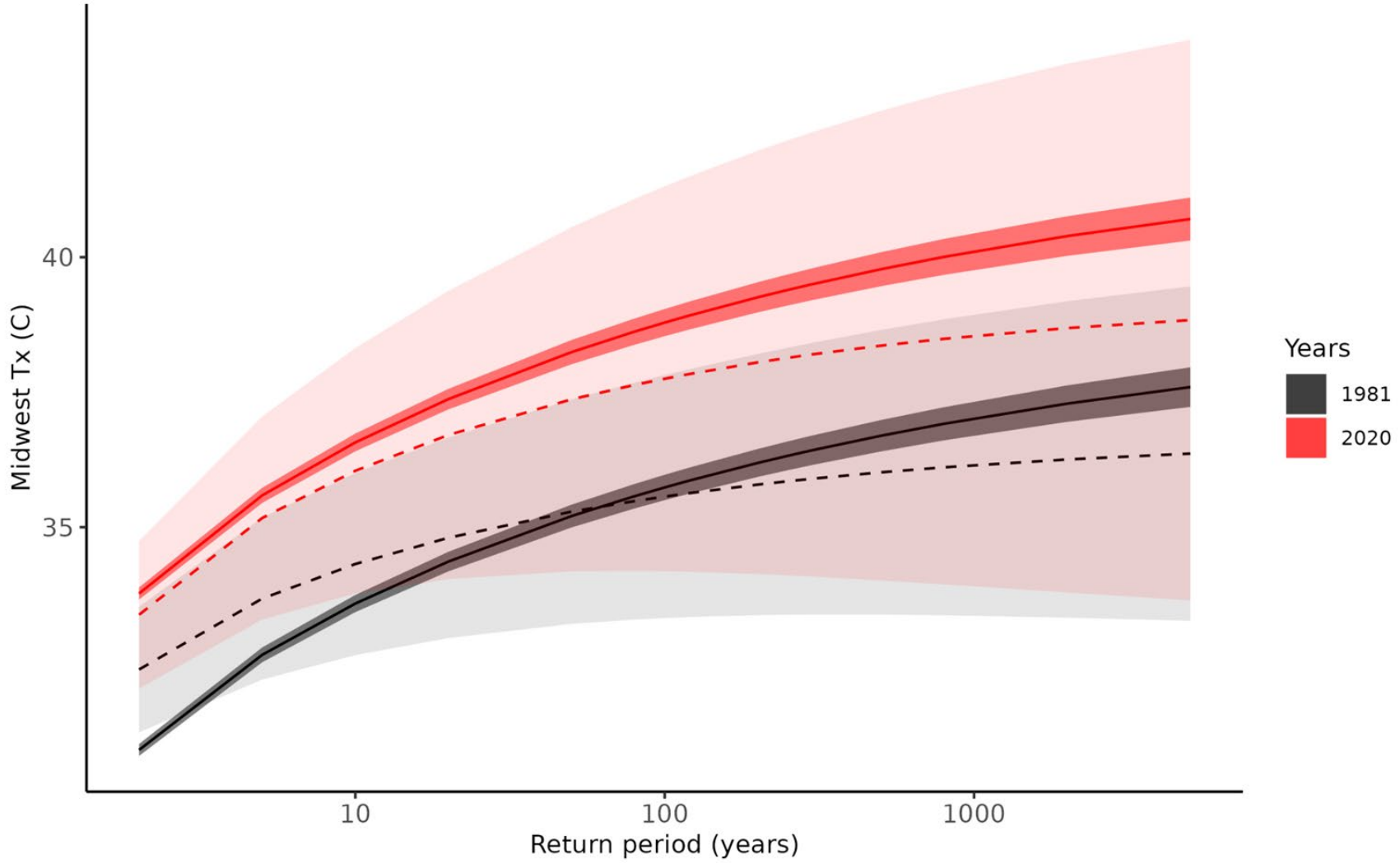


# 2020

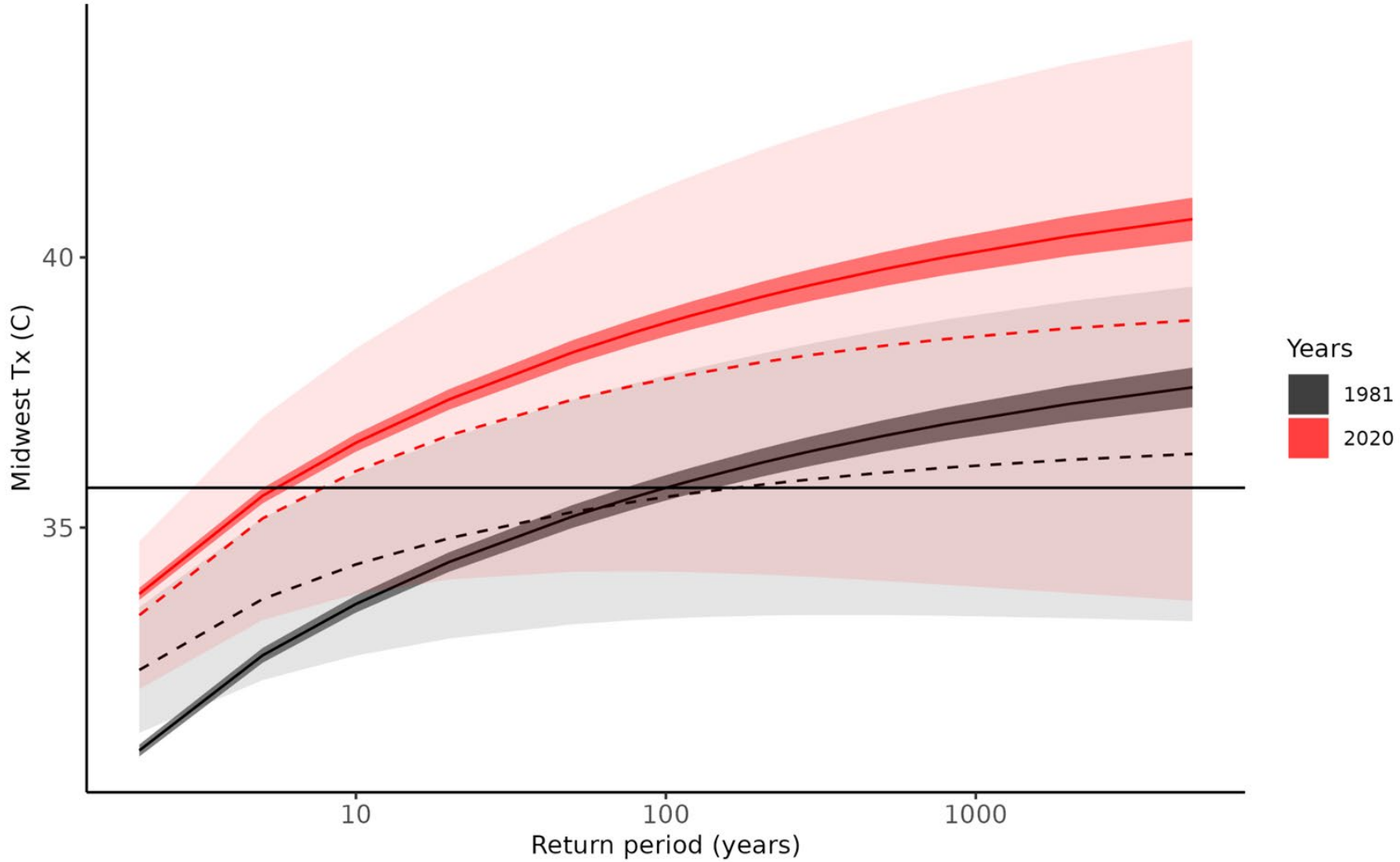

Midwest Tx (C)
40
35
10
100
1000
Return period (years)
Years
1981
2020

# UNSEEN approach

# Estimates from large ensemble



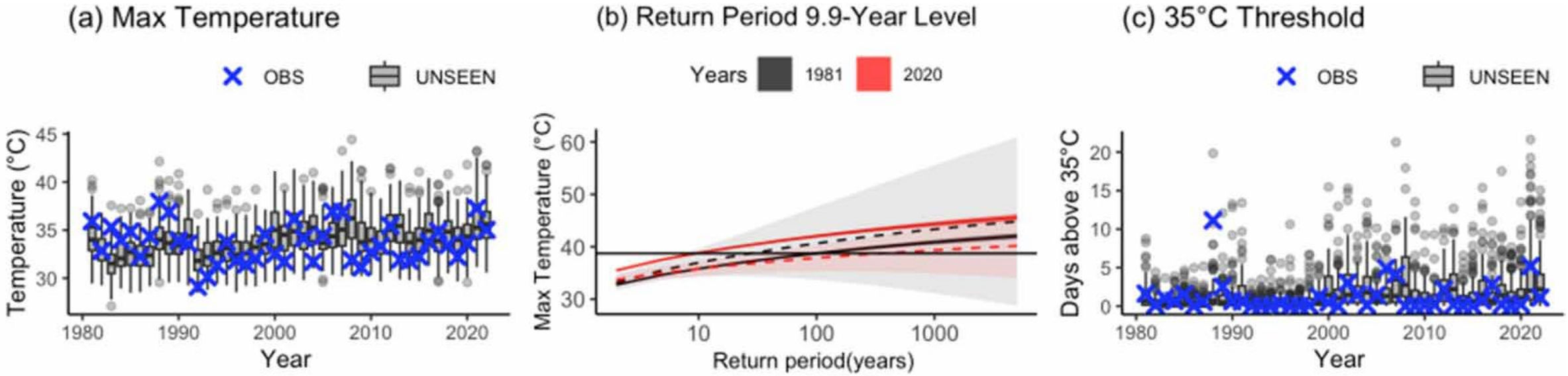
# Change in risk



How is this useful in the food system? What can we do with large numbers of simulations?

# 1. What to plant: risk of exceeding stressful thresholds

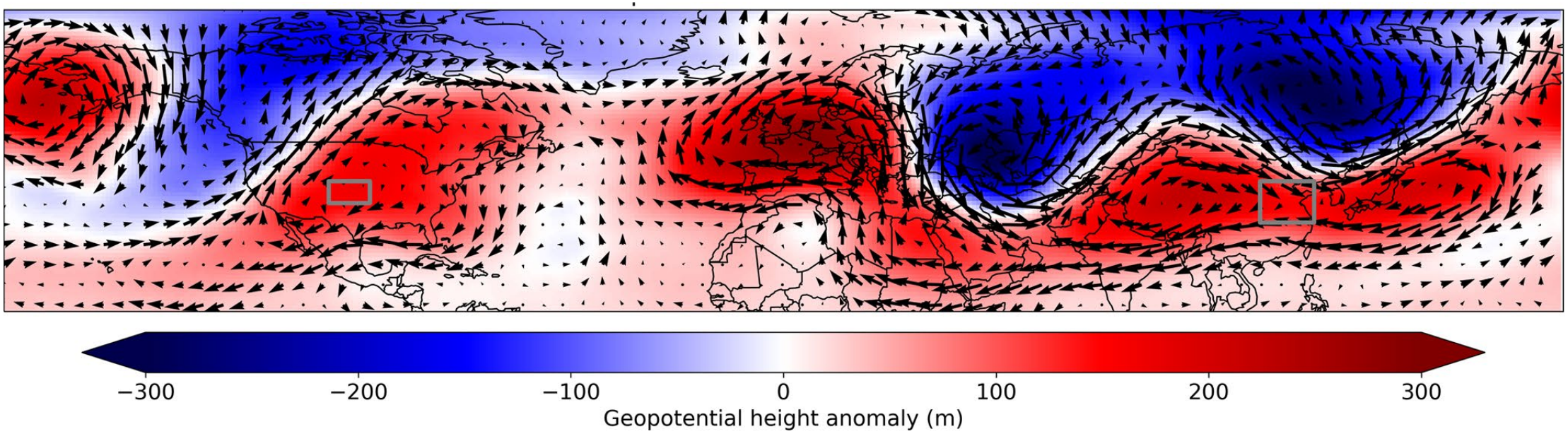
# Crop choices:
# Pulse production in North Dakota




Weiss, S., & Coughlan de Perez, E. (2025). An analysis of observed and predicted extreme heat and precipitation trends across four pulse producing regions in North America: North Dakota, Montana, Saskatchewan, and Northeastern United States. *Environmental Research: Food Systems*, *2*(1), 015013.

# 2. What to source? Risk of simultaneous extremes and crop failure in different parts of the world

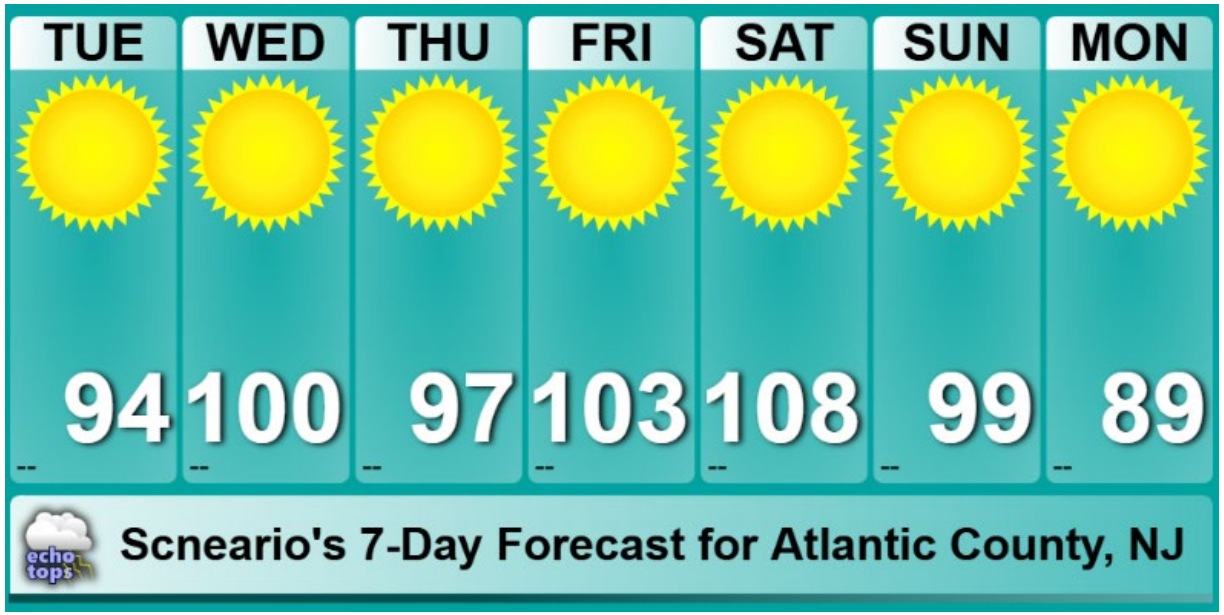
# Supply chain management: Risk of compound events

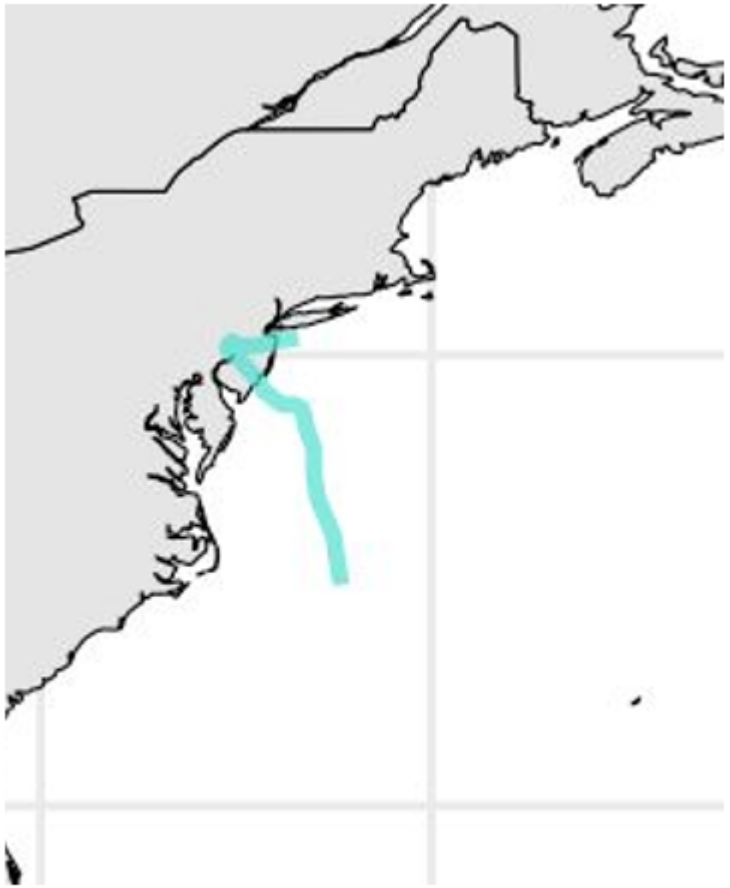



Coughlan de Perez, E., Ganapathi, H., Masukwedza, G. I., Griffin, T., & Kelder, T. (2023). Potential for surprising heat and drought events in wheat-producing regions of USA and China. *Npj Climate and Atmospheric Science*, *6*(1), 56.

# 3. What to prepare for? How could these extreme weather events unfold?

# Disaster management: Scenario exercises



Track of Hurricane Eleanor from Sunday to Tuesday

# 4. Where are the locations at greatest risk of an extreme event?

# Where do we need to do risk management: Sitting ducks


Masukwedza, G. I. T., Clark, J., Jaffe, A., Jeffries, I., Tietjen, B., & Coughlan de Perez, E. (2025). Storylines of unprecedented extremes in the Southeast United States. *Bulletin of the American Meteorological Society*, *106*(3), E441-E455.