



POTSDAM INSTITUTE FOR  
CLIMATE IMPACT RESEARCH

# Stressed economies respond more strongly to climate extremes

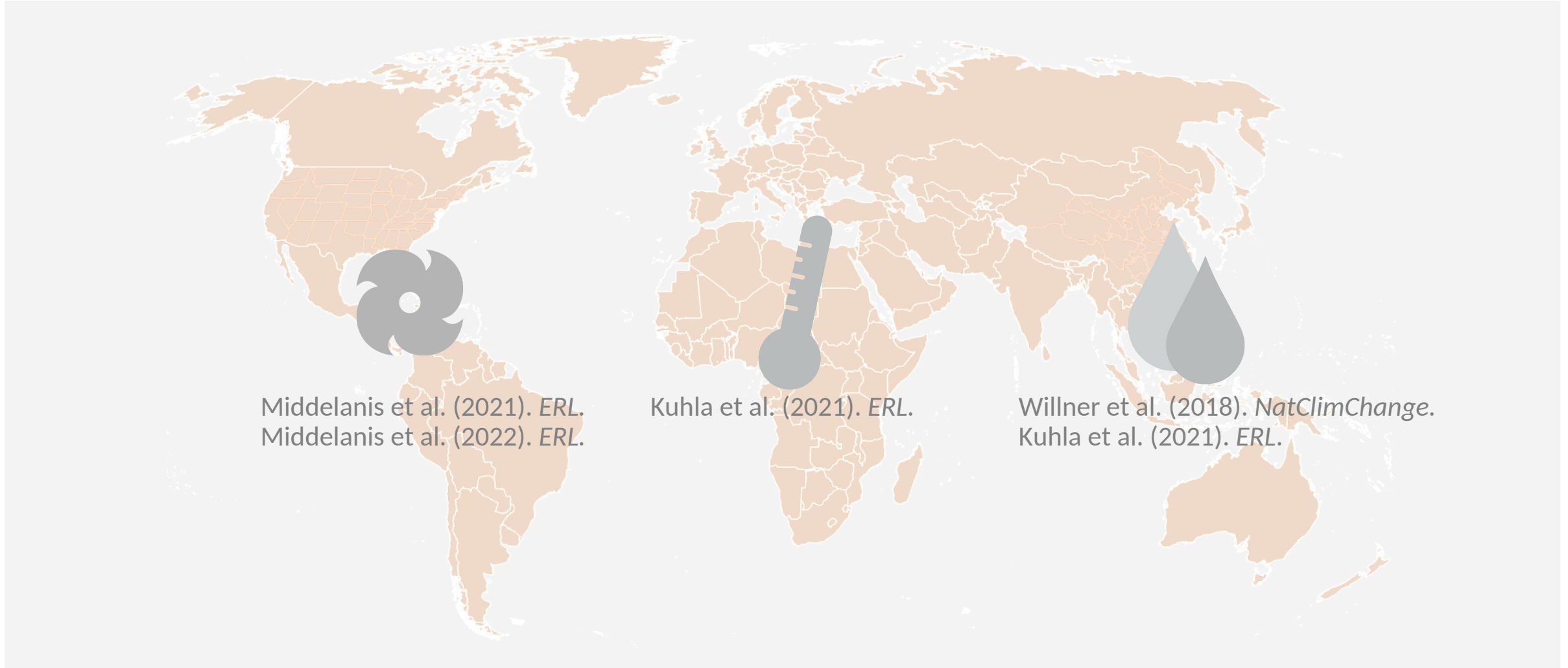
Robin Middelanis, Sven N Willner, Kilian Kuhla, Lennart Quante, Christian Otto, Anders Levermann

Potsdam, October 17th, 2023

# Thailand flood 2011

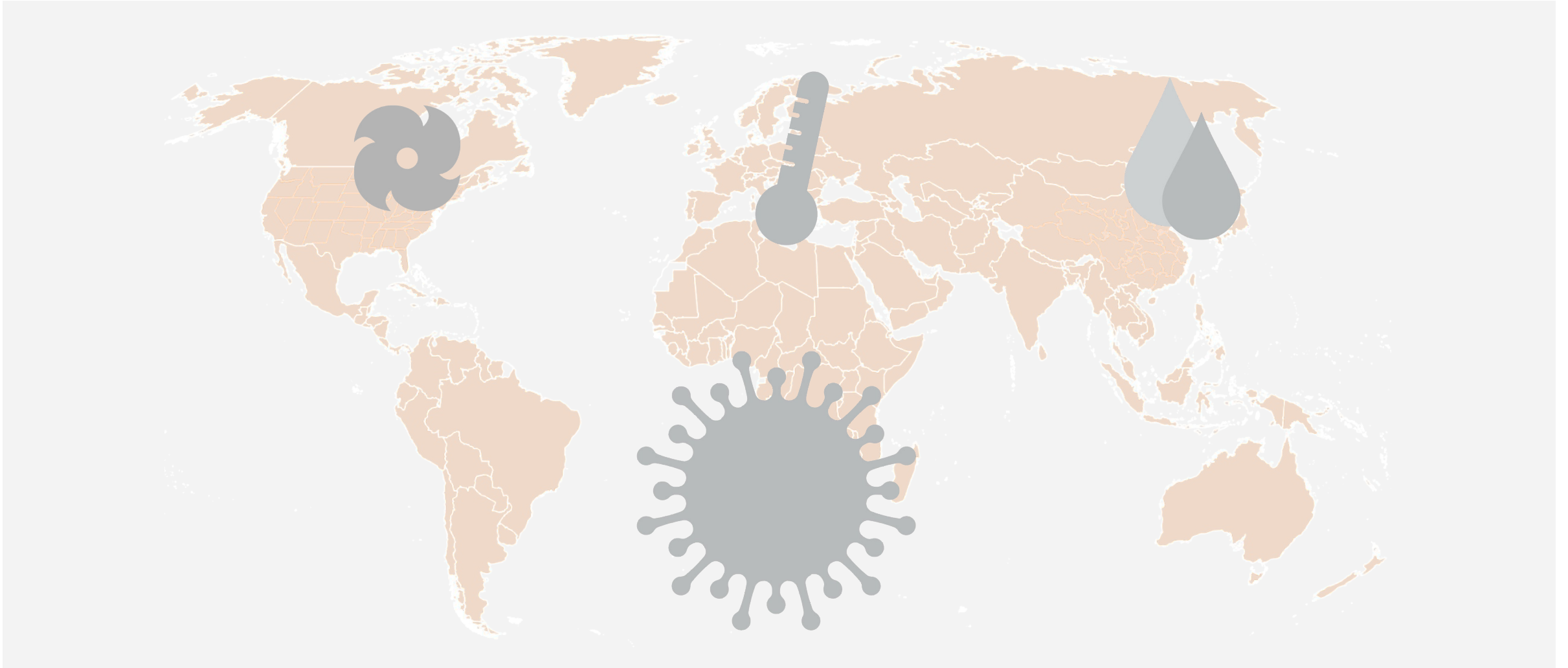


# Global economic response



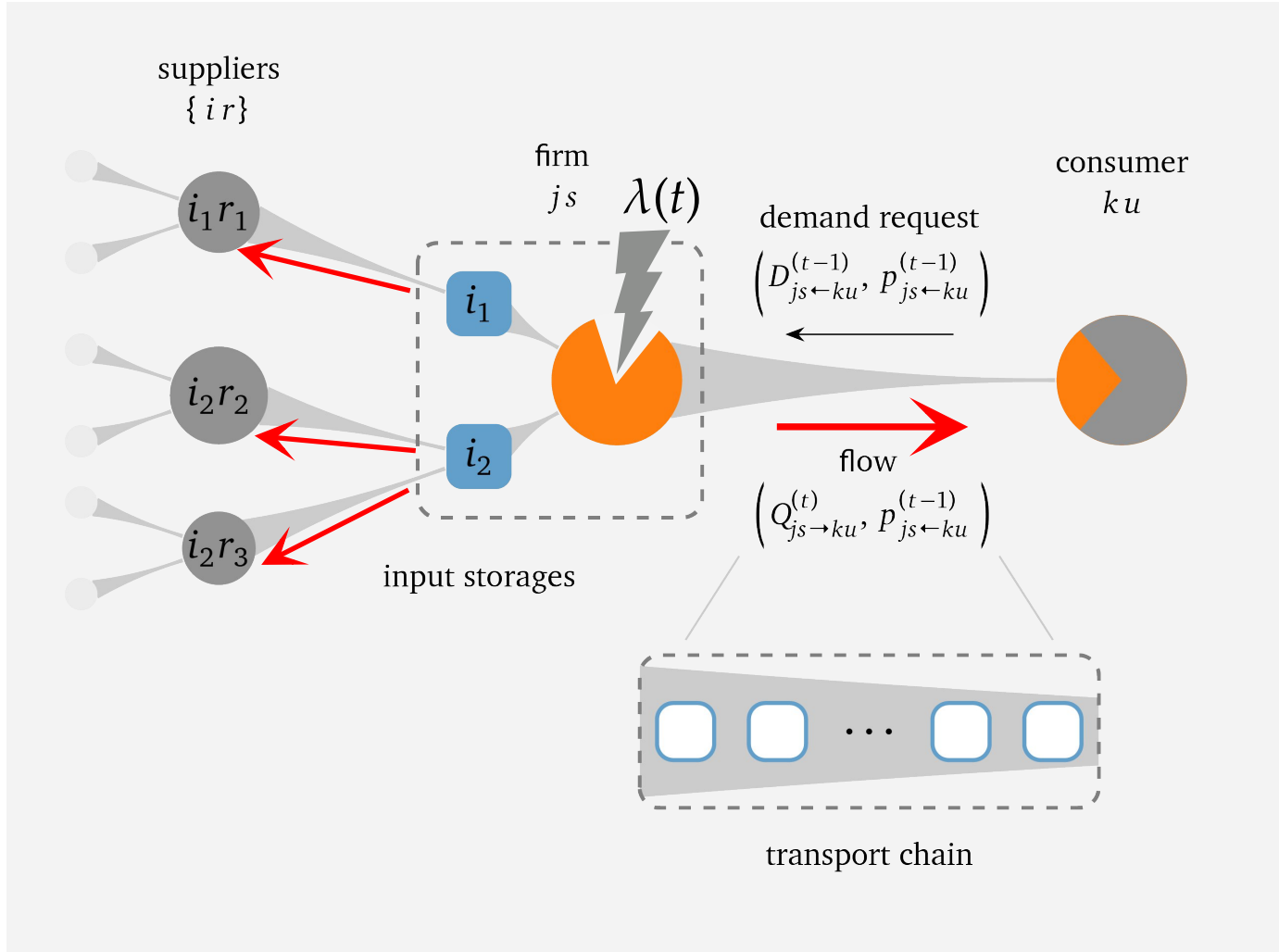
# Global economic response under stress

Middelanis et al. (2023). *ERL*.



# The Acclimate model

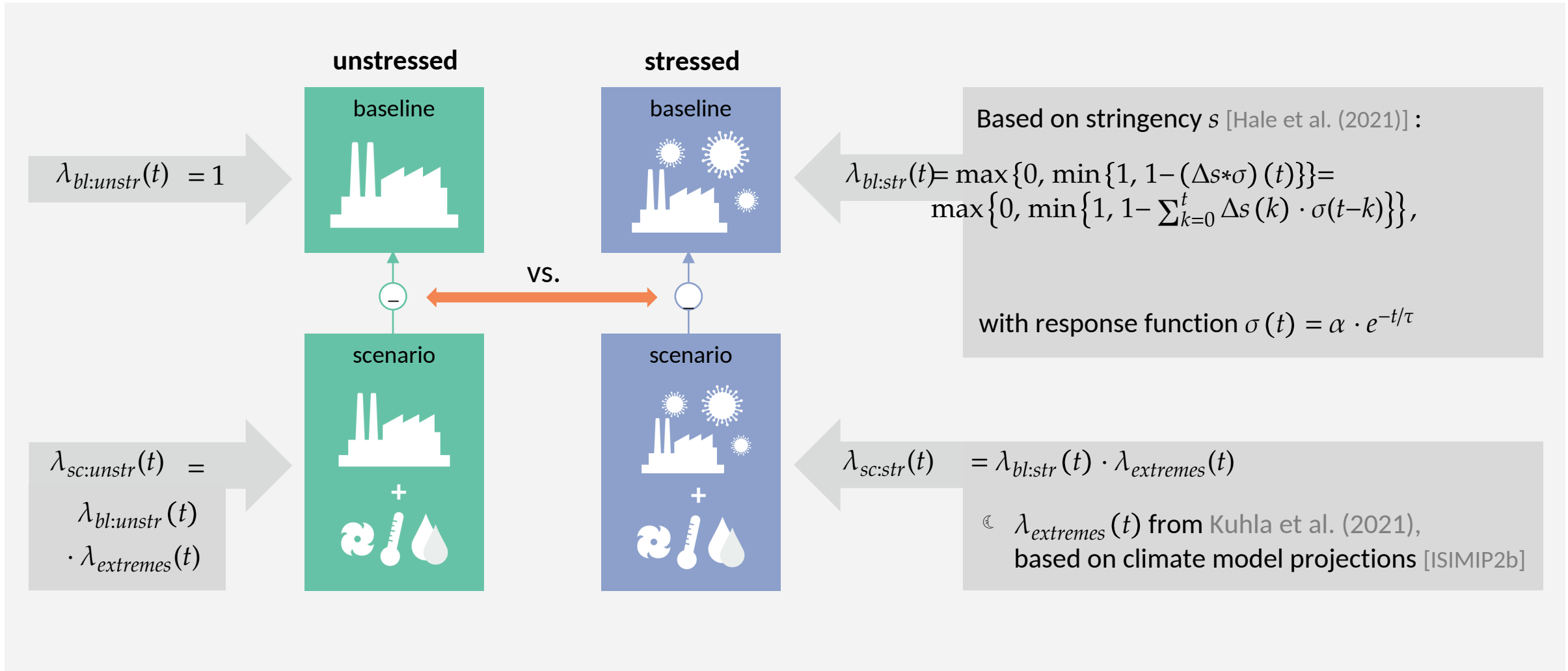
Otto et al. (2017). *JEDC*.



- › Myopic agents:
  - › Producers: 26 economic sectors
  - › Consumers: 1 per region
- › 268 regions, daily time steps
- › Local economic shocks  $\lambda(t)$ 
  - ☾ Disequilibrium
  - ☾ Endogenous prices
- › Local optimization principles

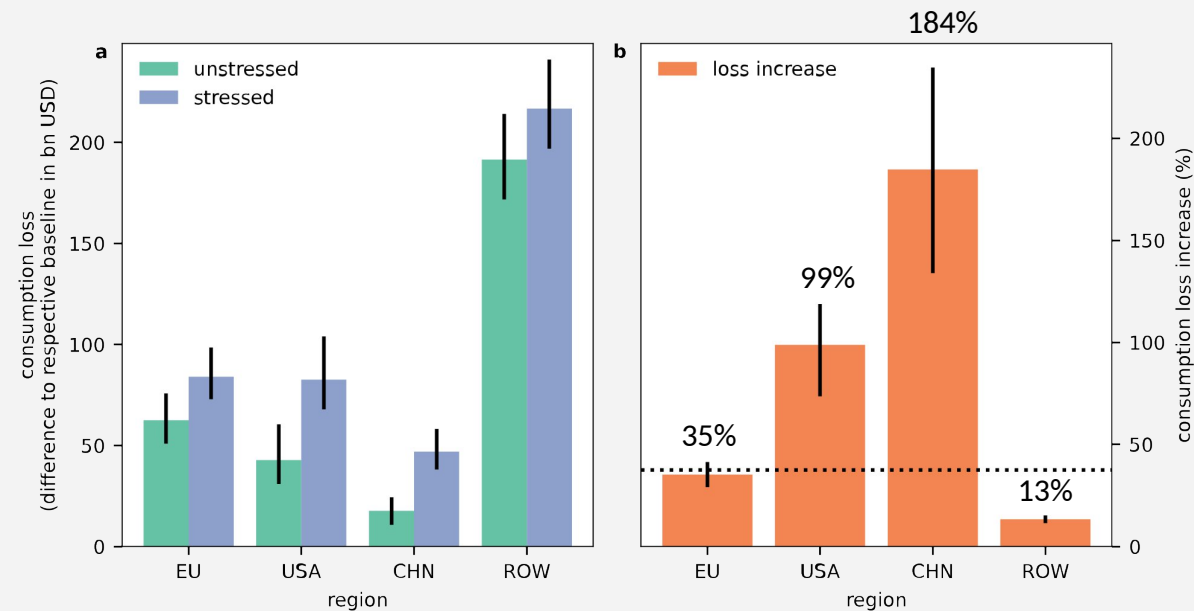
# Simulating indirect impacts under global economic stress

Middelanis et al. (2023). *ERL*.



# Increasing consumption losses

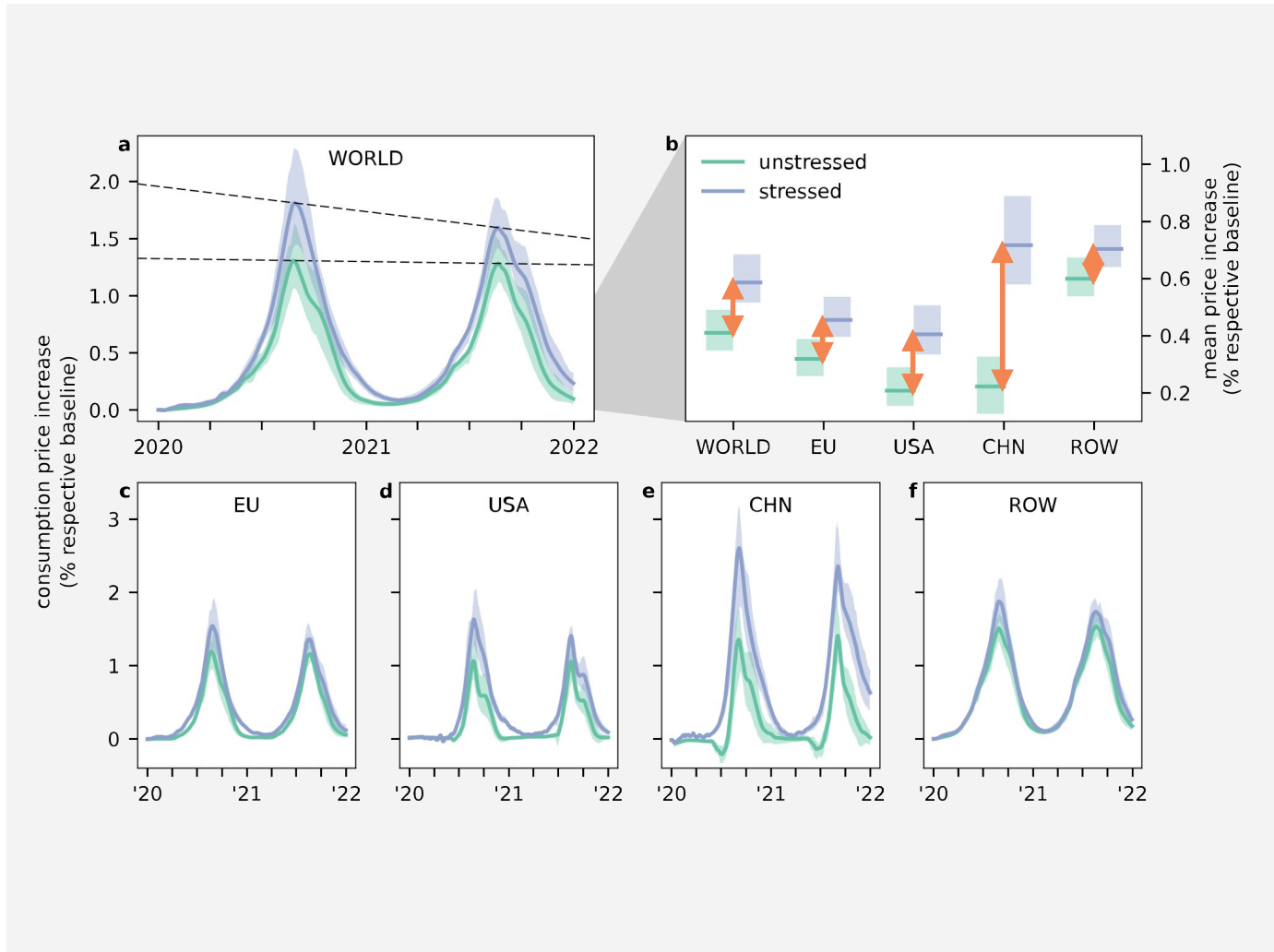
Middelanis et al. (2023). *ERL*.



- › Loss increase in all (aggregate) regions
- › Losses triple in China, double in the US and increase by about one third in the EU
- › 37% global loss increase

# Stronger price response under global stress

Middelanis et al. (2023). *ERL*.

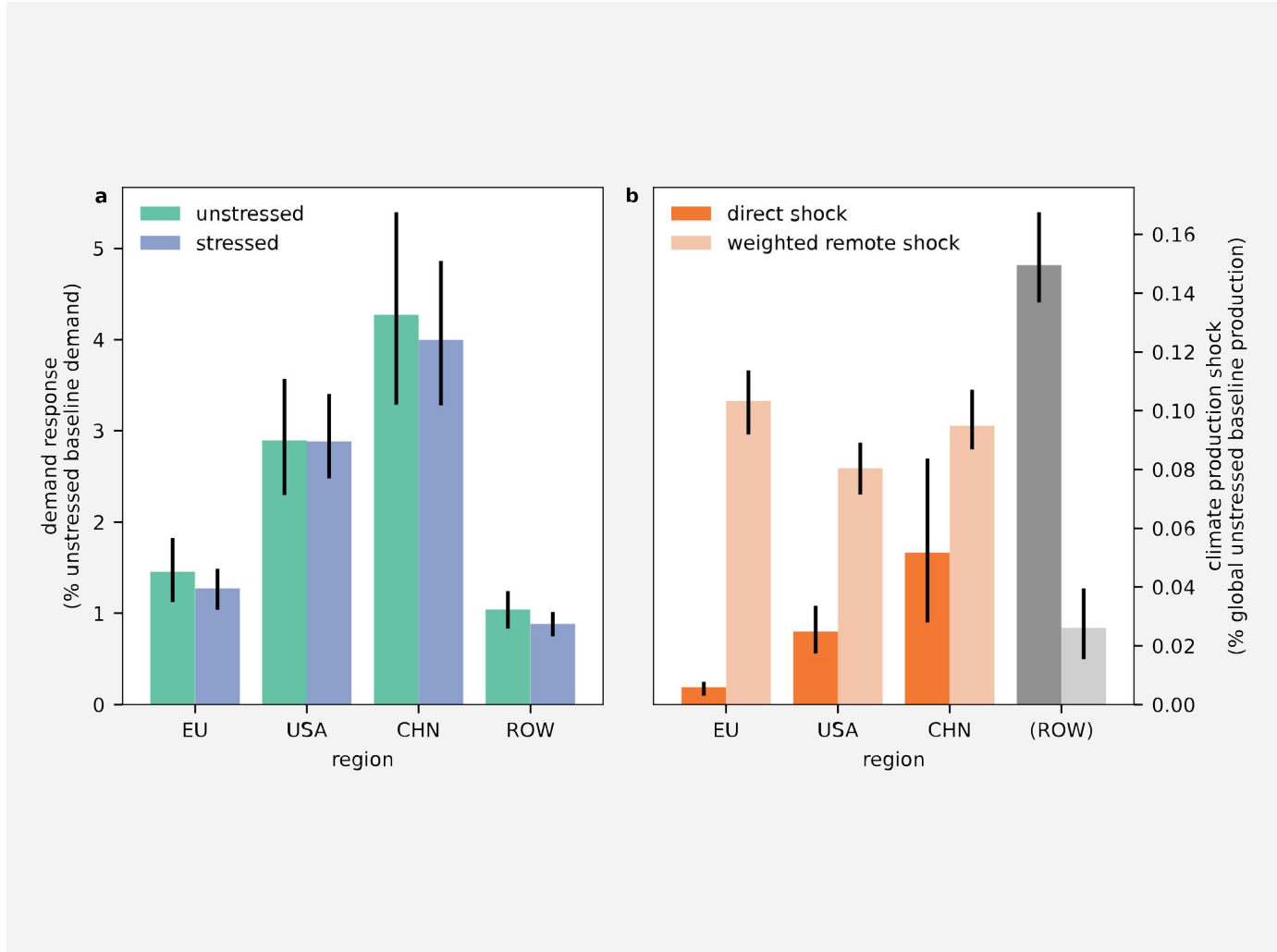


- › Seasonal consumption price increase
- › Global stress intensifies price response
- › Price gap between scenarios determines consumption loss increase



# Aggravated scarcity due to reduced supply capacity

Middelanis et al. (2023). *ERL*.



- › Similar compensation demand in both scenarios
- › Reduced supply capacity due to global stress in stressed scenario
- › Aggravated supply-demand mismatch causes higher prices
- › Compensation for both direct and remote losses

# Take home messages

Middelanis et al. (2023). *ERL*.

- › Extreme events:
  - › Local economic impacts can spread in the supply chain network
  - › Resulting price increases cause consumption losses
  - › Regions can be exposed indirectly via their trade relations
- › Under global economic stress:
  - › Consumption losses increase strongly
  - › Intensified price response due to reduced supply capacity
  - › Regional differences due to different direct and indirect exposure

**Thank you!**



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## **Stressed economies respond more strongly to climate extremes**

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