

# Compound impacts of extreme weather events on European supply chains

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# Supply chain disruptions

The New York Times

## *Climate Change Could Worsen Supply Chain Turmoil*

A drought that has crippled economic activity in southwestern China hints at the kind of disruption that climate change could wreak on global supply chains.



Shanghai's 'grim' Covid outbreak threatens more global supply chain disruption

INSIDER

**Add the climate crisis to the long list of things messing up supply chains this summer**

Forbes

**Global Supply Chains Face Disruption Following Russia's Invasion Of Ukraine**

Americas

**Panama Canal trims vessel passage quota again to deal with severe drought**

Reuters

# Research questions

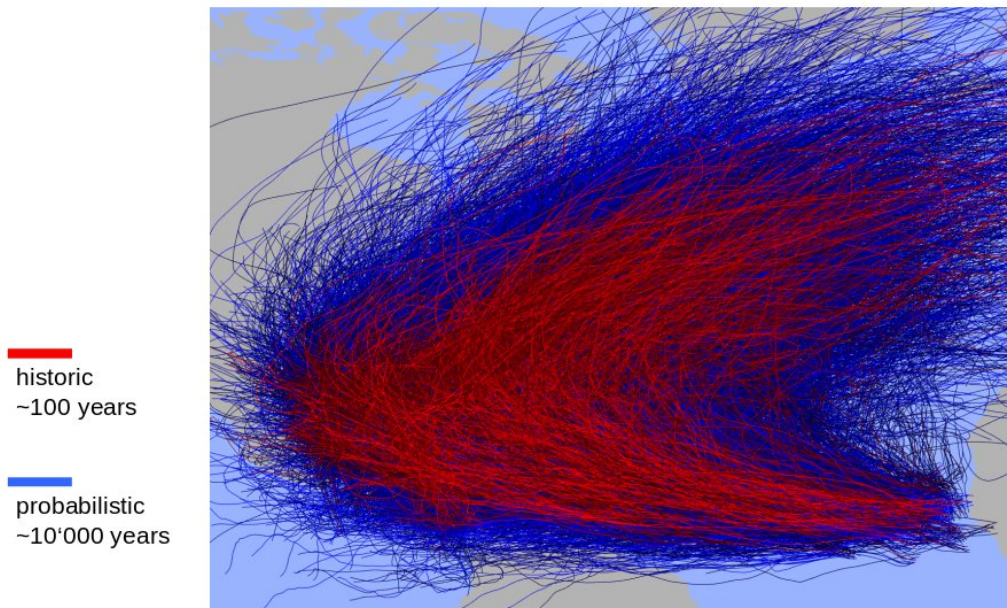
- Which events cause most indirect impacts to Europe?
- Can seemingly unrelated events lead to compounding impacts in Europe through supply chain?
- What characteristics do these events have?
- Can modelling tools be used to increase our understanding of these systems?



A satellite image of Earth from space, showing the Americas. North America is in the upper half, and South America is in the lower half. A dark, semi-transparent horizontal band runs across the center of the image, partially obscuring the continents. The word "Methods" is written in white text on the left side of this band.

# Methods

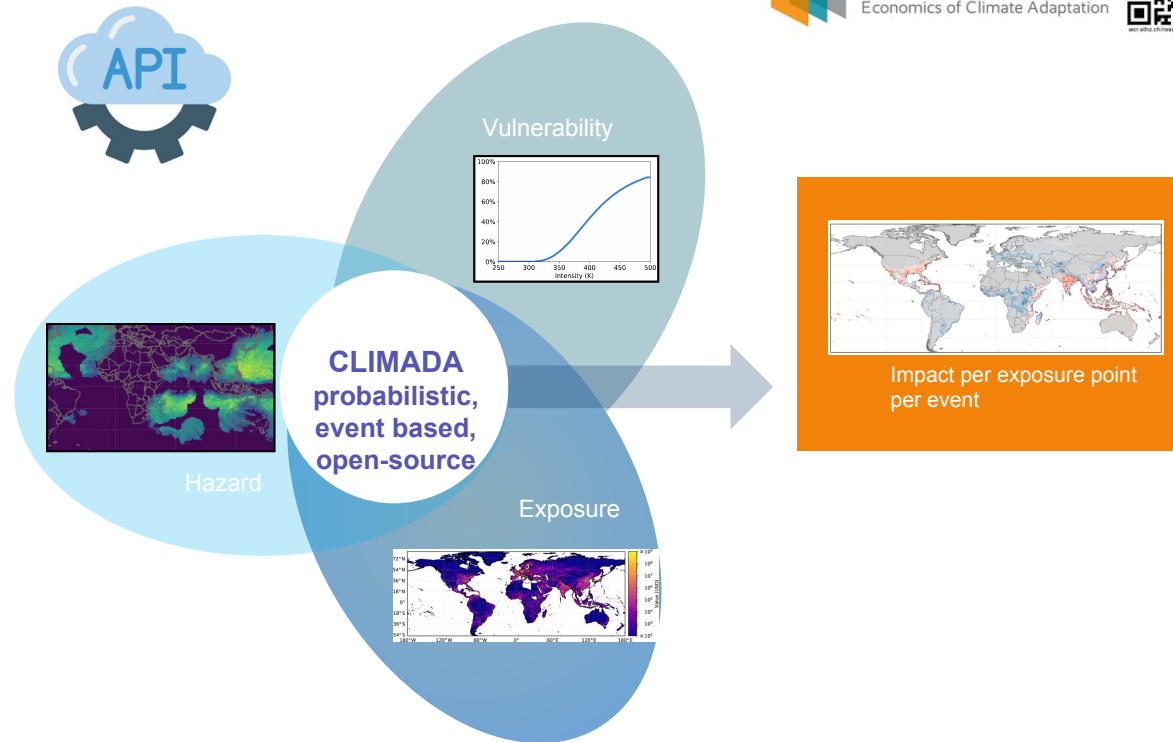
# Tropical cyclone modeling



100 samples of 5 years  
Focus only on North  
Atlantic and West Pacific  
(most exchanges with  
Europe)



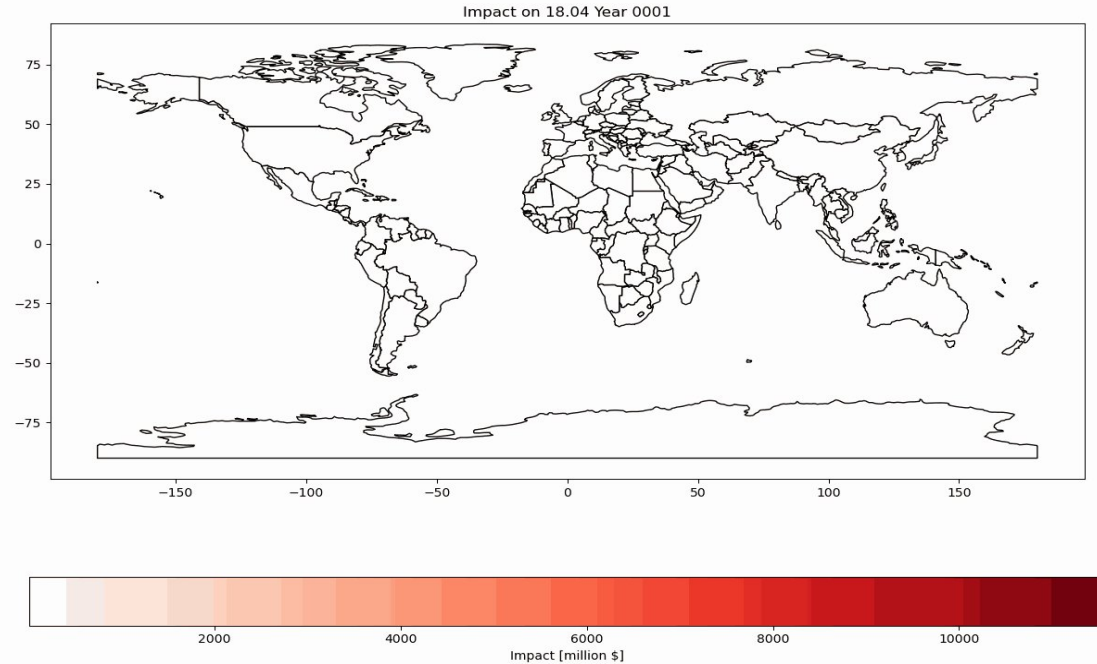
# CLIMADA framework



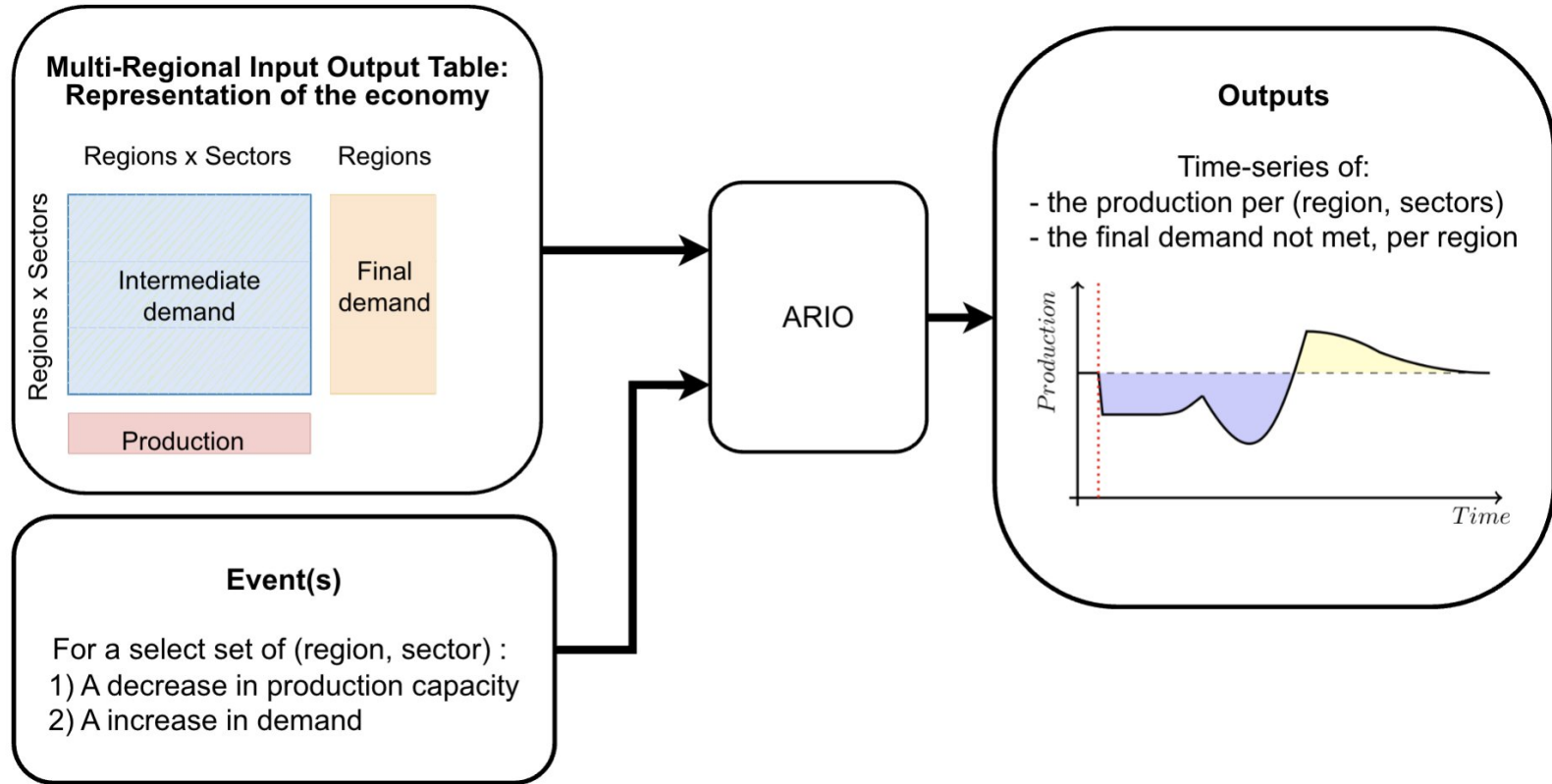
Eberenz, S., Stocker, D., Rösli, T., and Bresch, D. N.: Asset exposure data for global physical risk assessment, *Earth Syst. Sci. Data*, 12, 817–833, <https://doi.org/10.5194/essd-12-817-2020>, 2020.

Eberenz, S., Lüthi, S., and Bresch, D. N.: Regional tropical cyclone impact functions for globally consistent risk assessments, *Nat. Hazards Earth Syst. Sci.*, 21, 393–415, <https://doi.org/10.5194/nhess-21-393-2021>, 2021

# Direct impacts by country - BoARIO input for one sample

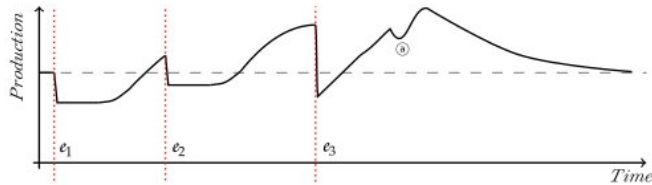


# BoARIO



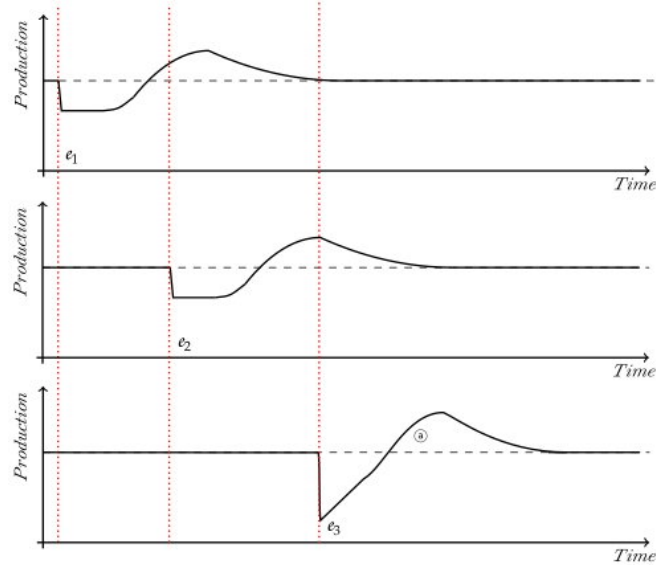


# Analysing the interaction of events



①

- 1) Indirect impacts of events are calculated together → interaction between events is considered



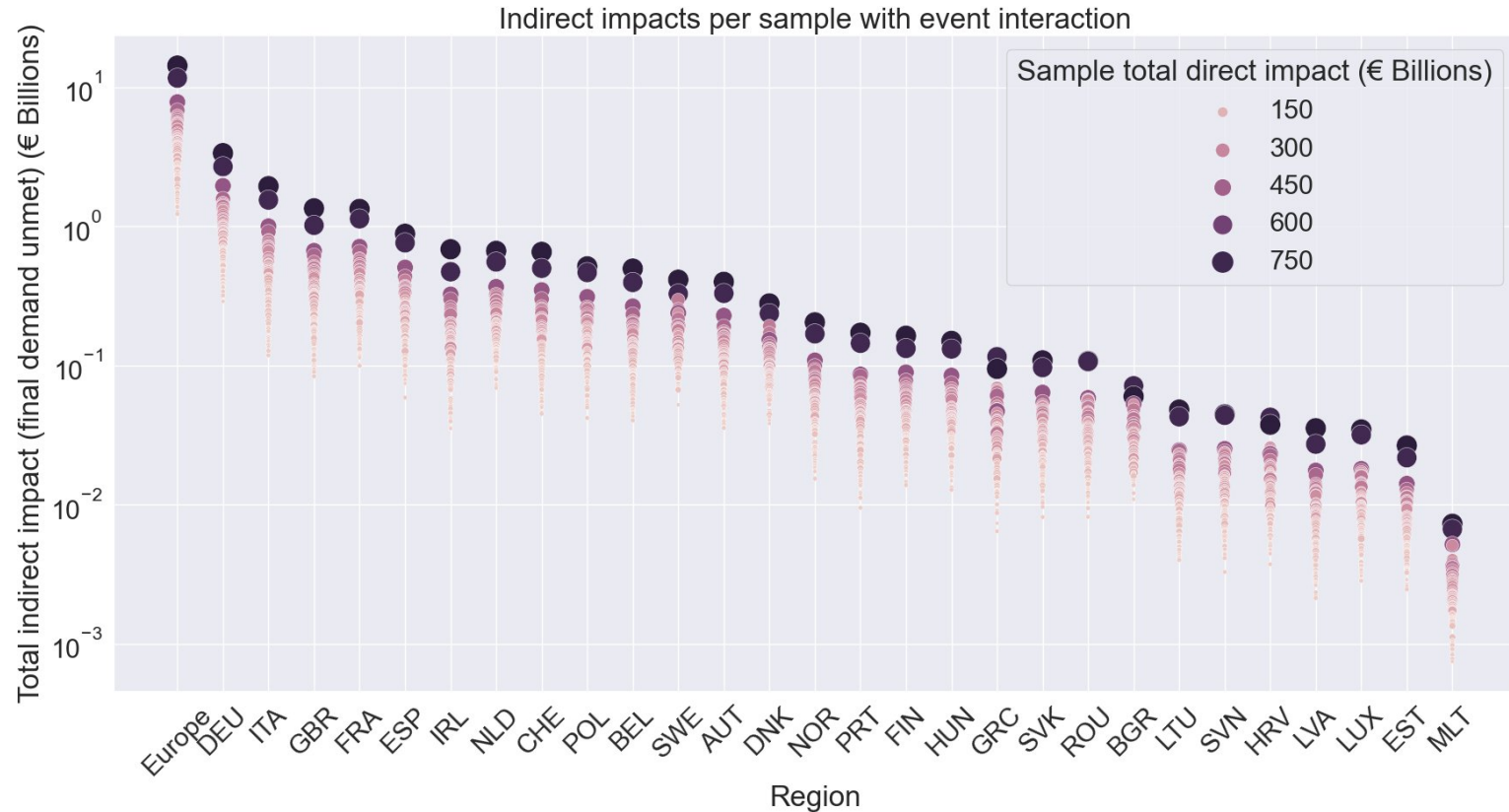
②

- 2) Indirect impacts of events are calculated separately

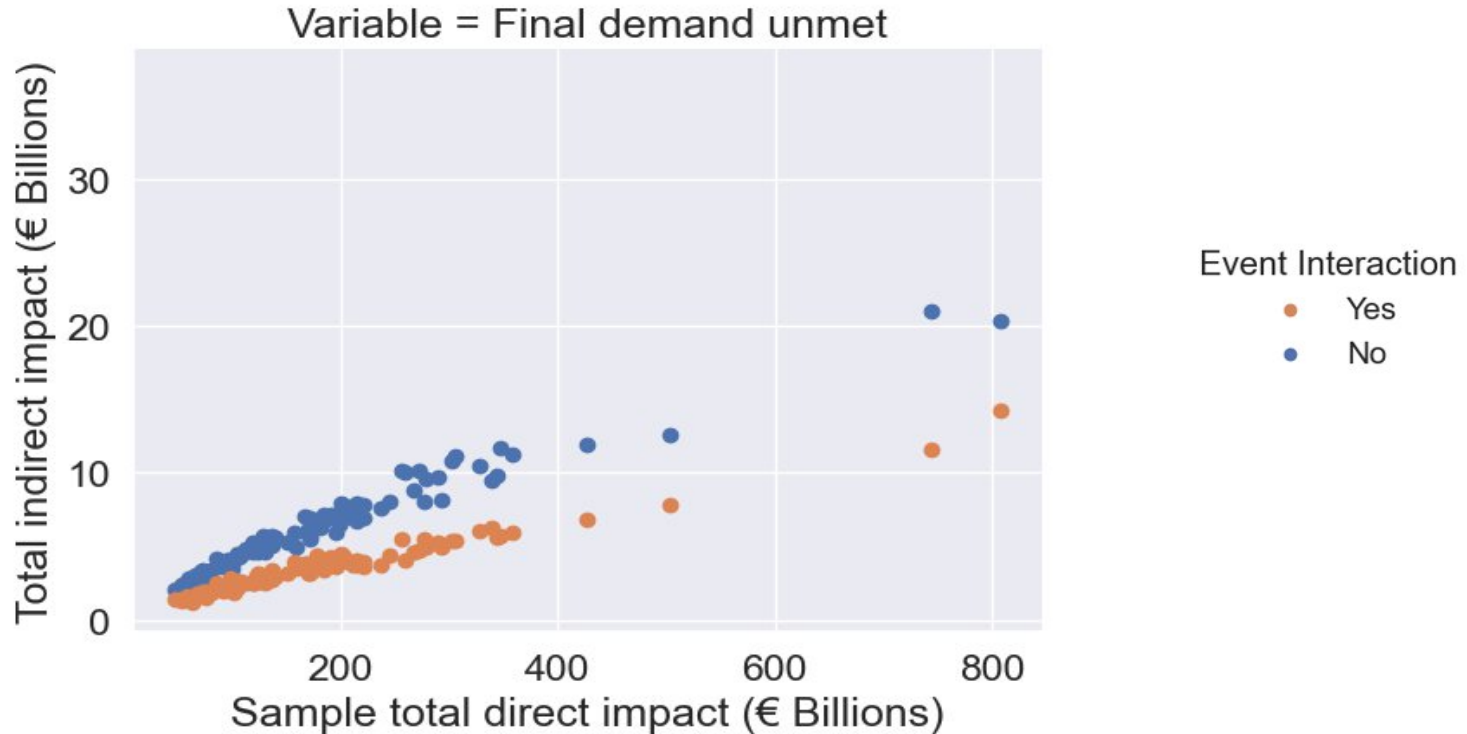
A satellite image of Earth from space, showing the Americas. North America is in the upper half, and South America is in the lower half. The oceans are a deep blue, and the landmasses are green with some yellowish-brown areas indicating arid regions. A large, white, swirling cloud pattern is visible in the North Atlantic. A black rectangular box with the word 'Results' in white text is overlaid on the left side of the image.

# Results

# Direct vs indirect impacts per sample

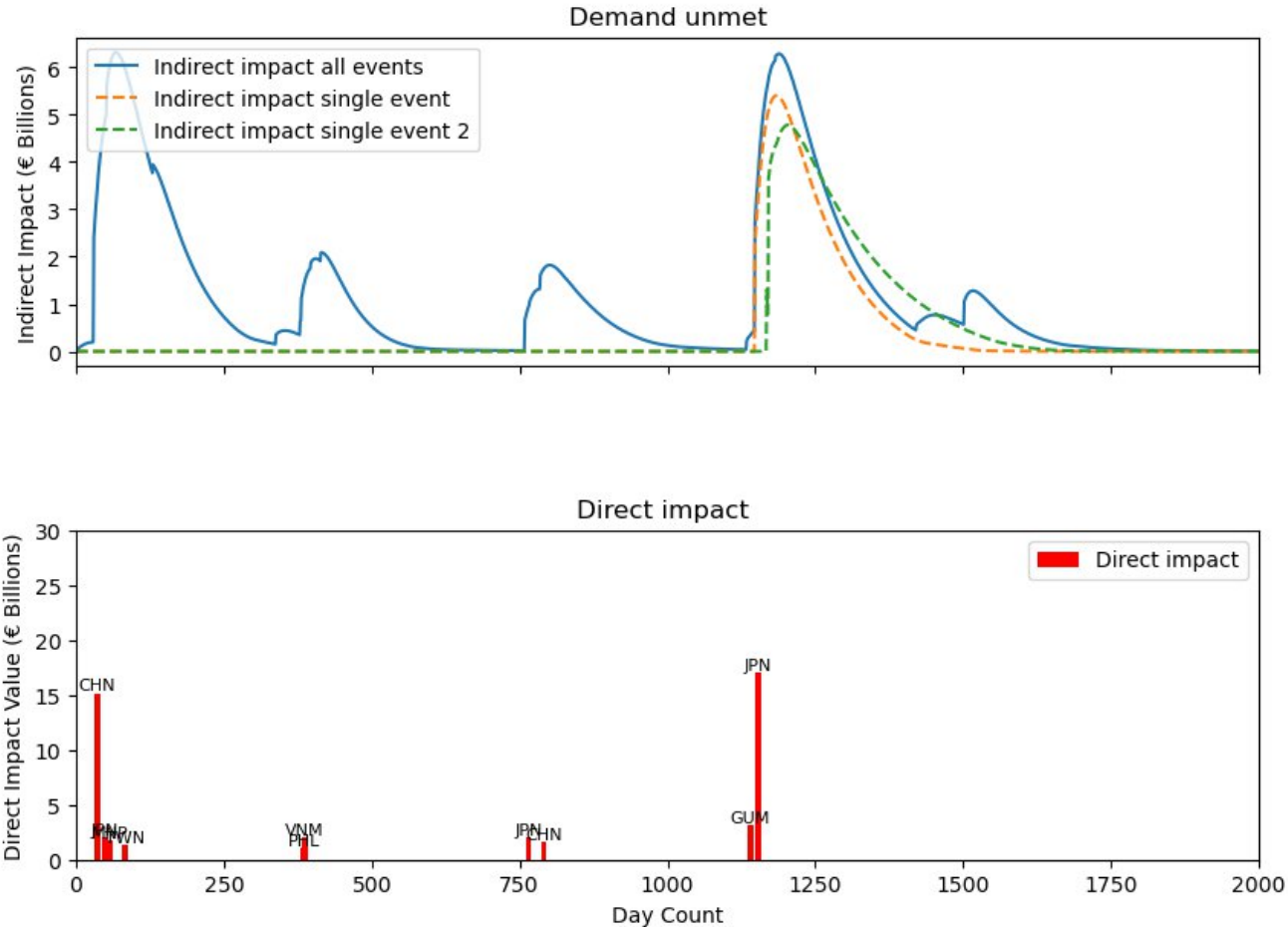


# Effect of considering event interaction





# Effects of all events together vs one event



# Conclusion and outlook

- Coupling of open source impact model and supply chain model
- Interactions of events can be observed
- Interactions mainly lead to positive effects in Europe
- Limitation: only macro-economic effects
  - Impacts are very small relative to the economy of large countries  
→ Some bottlenecks may not be represented
- Opportunity:
  - improve representations of critical supply chains and economic sub-regions affected
  - Effect of climate change & multi-hazards

# Contacts



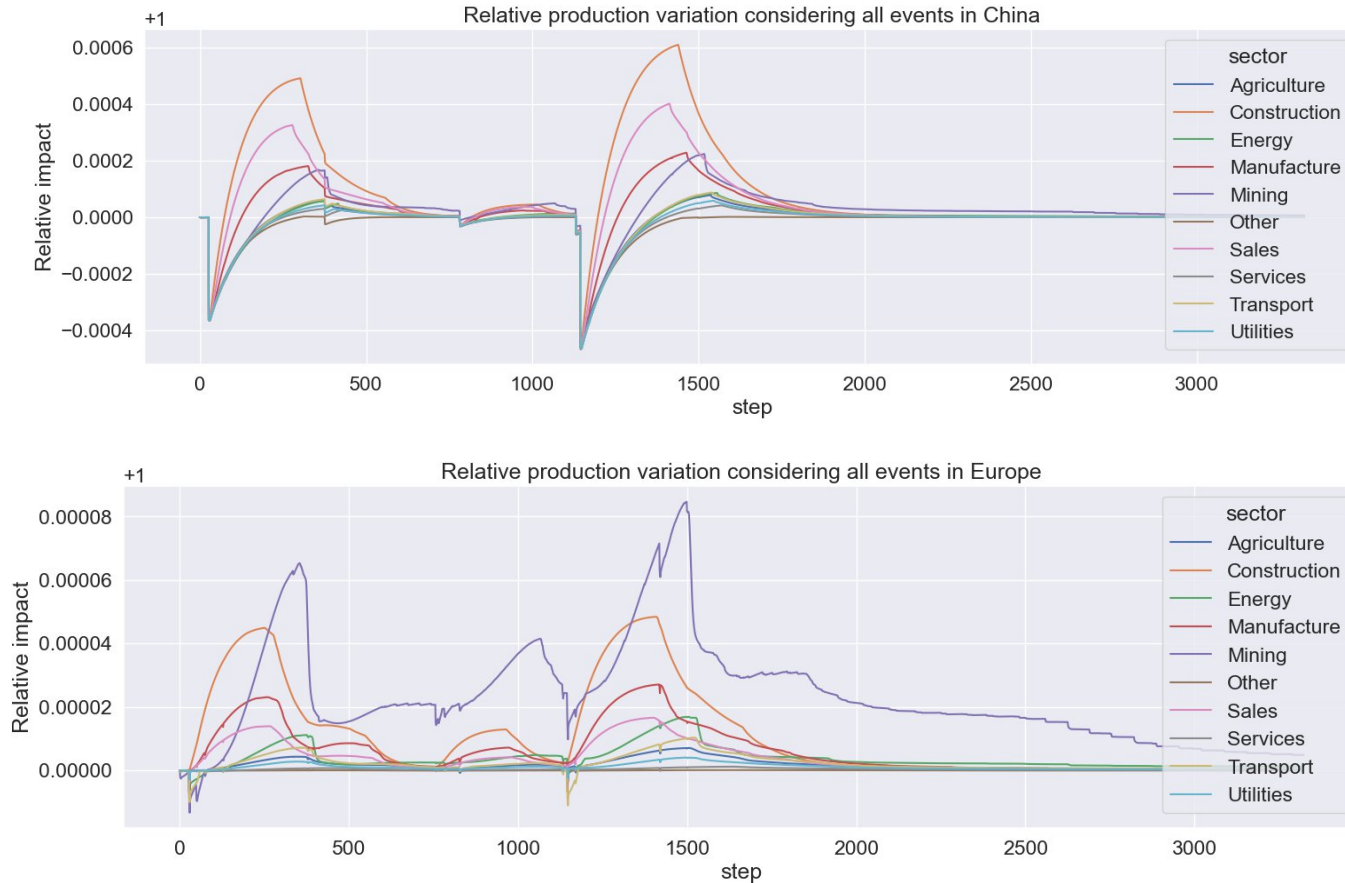
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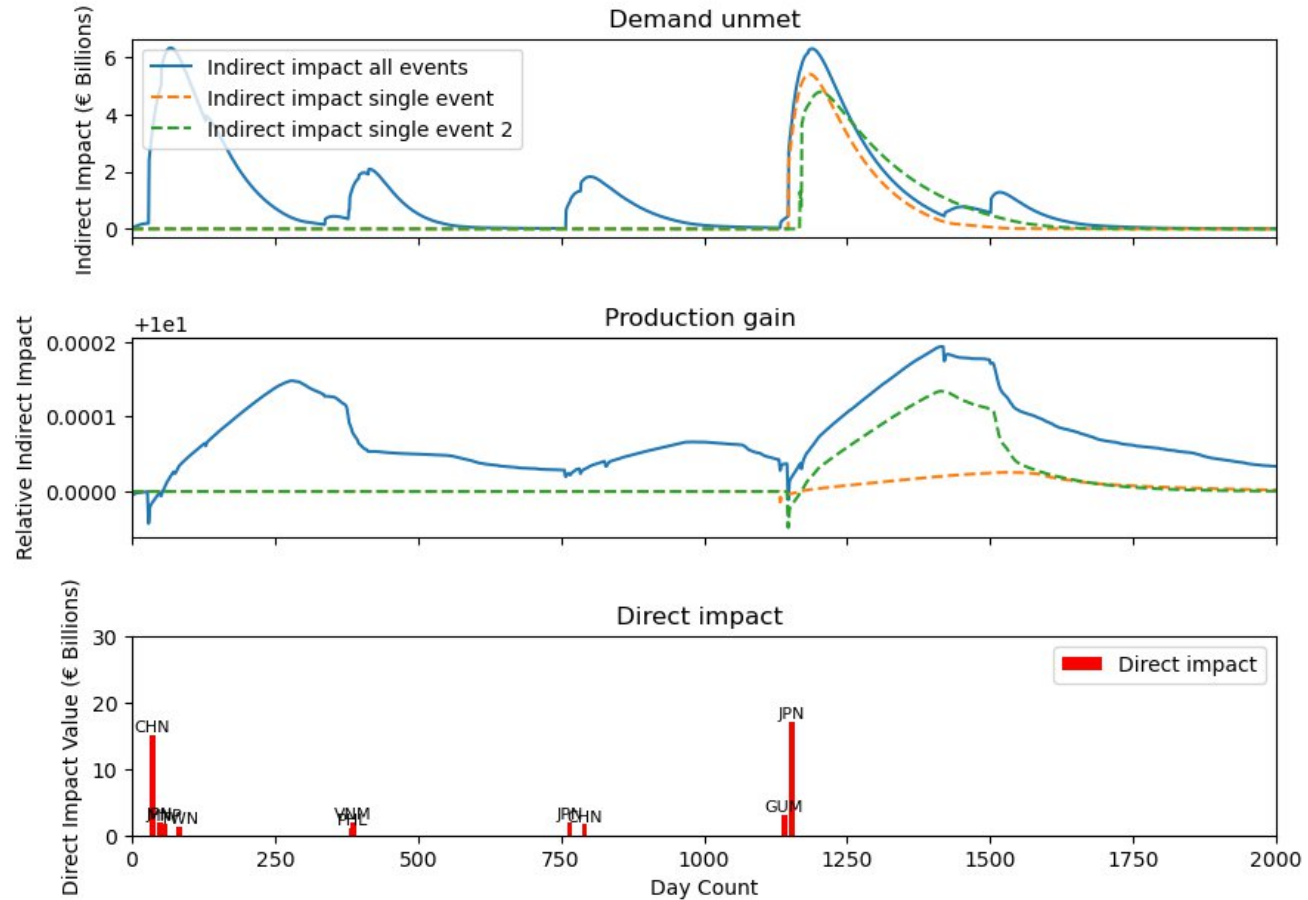


# Indirect impacts China

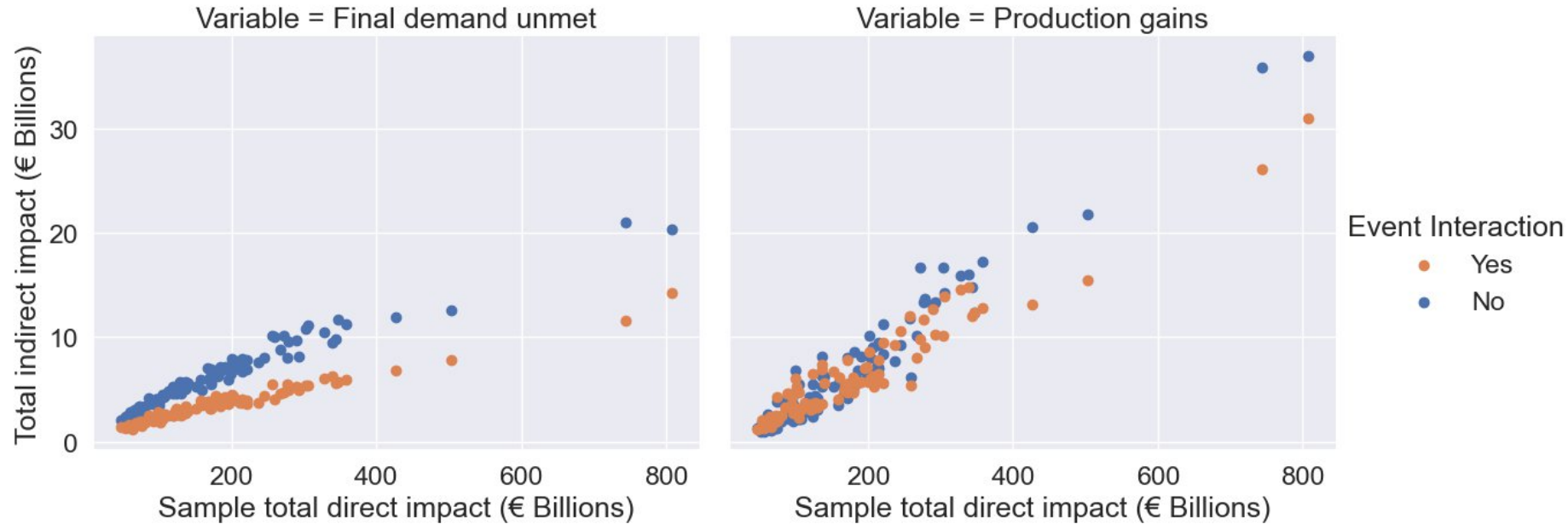




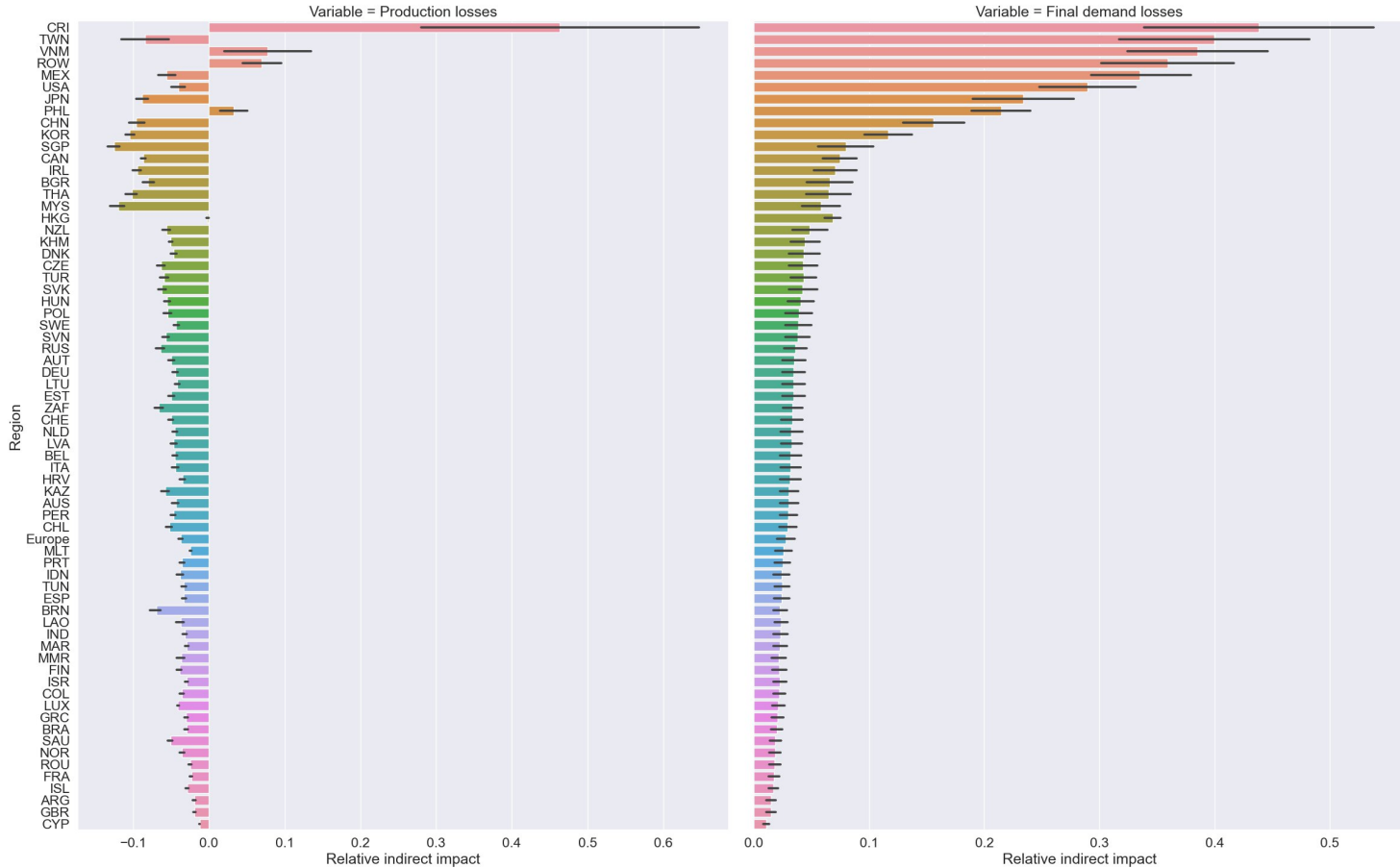
# Effects of all events together vs one event



# Effect of considering event interaction



# Indirect impacts by region



# SPC Europe

