



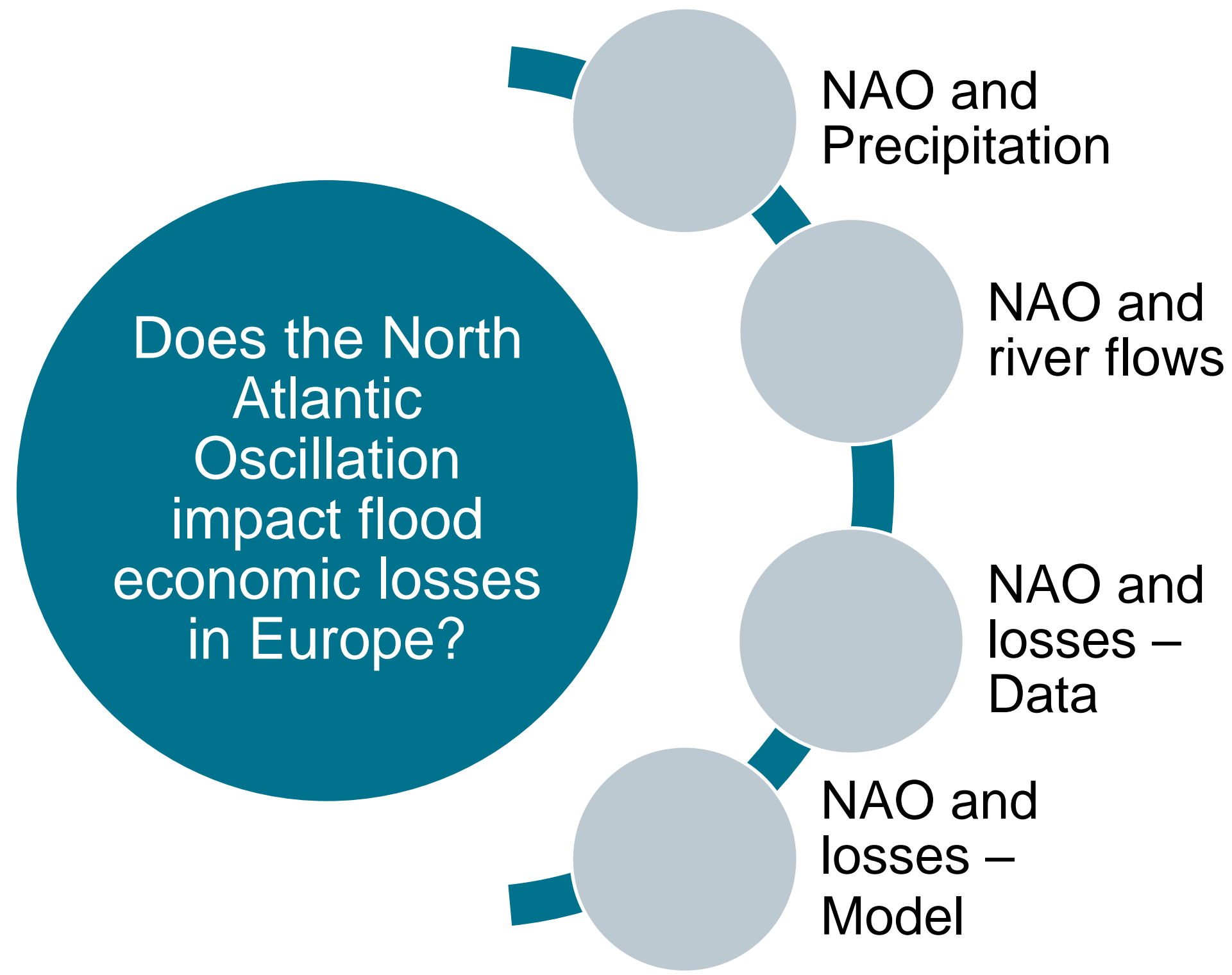
# MODULATION OF FLOOD ECONOMIC LOSSES BY THE NORTH ATLANTIC OSCILLATION

Stefano Zanardo

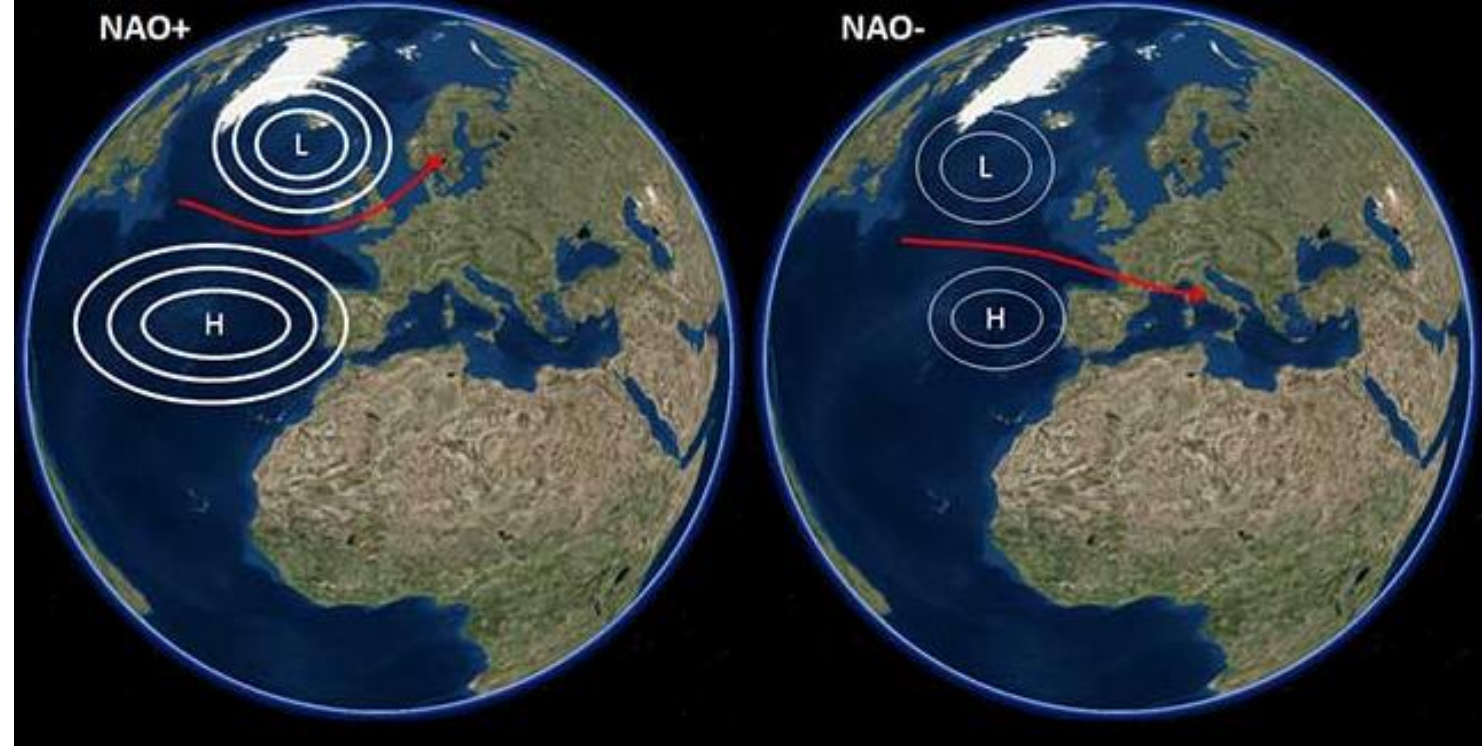
System-Risk final conference Potsdam 2019



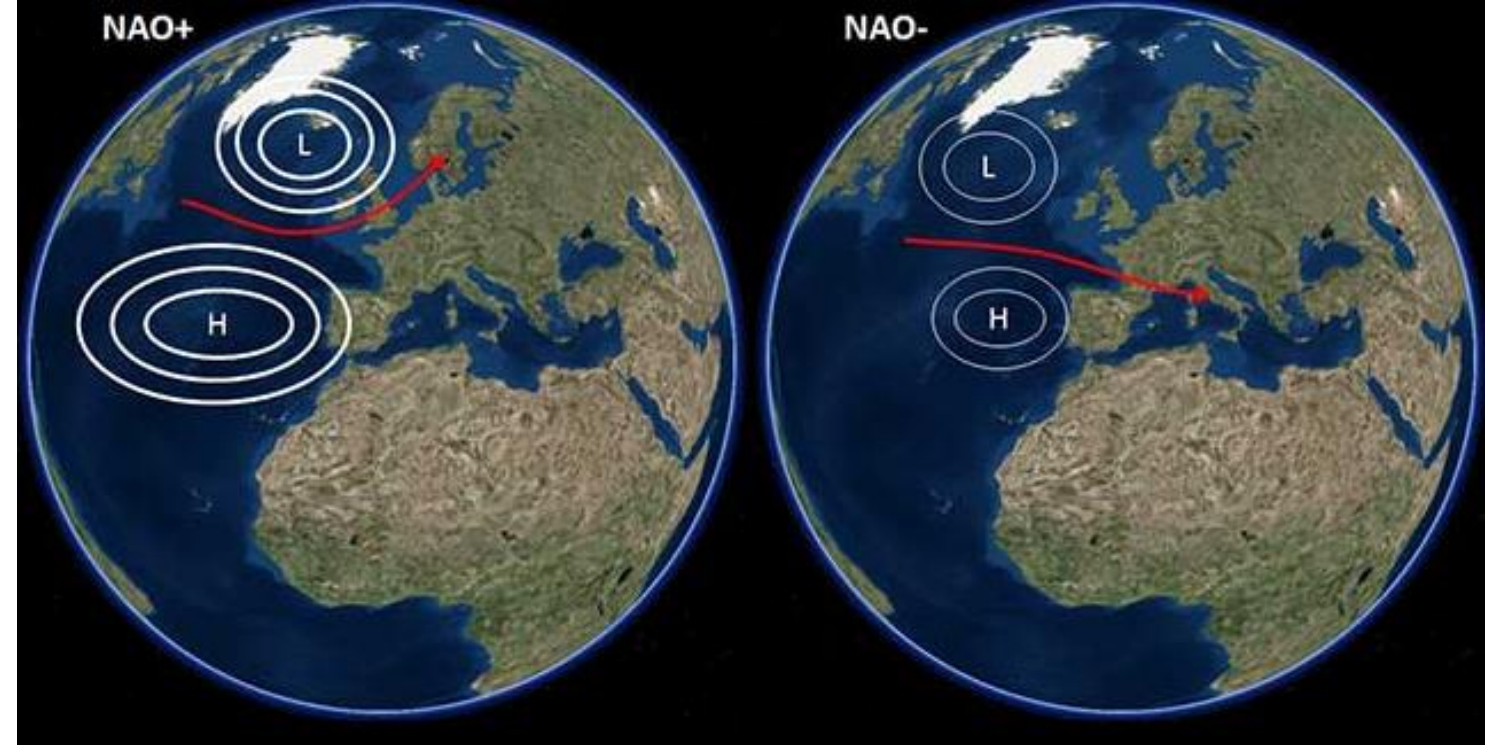
# OUTLINE



*“The North Atlantic Oscillation describes the changes in sea level pressure between the Azores high and the Icelandic low”*



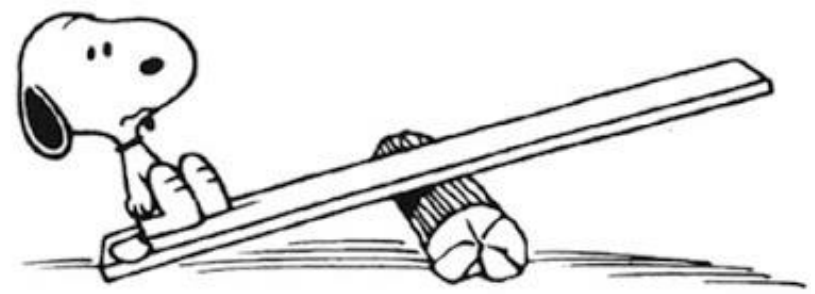
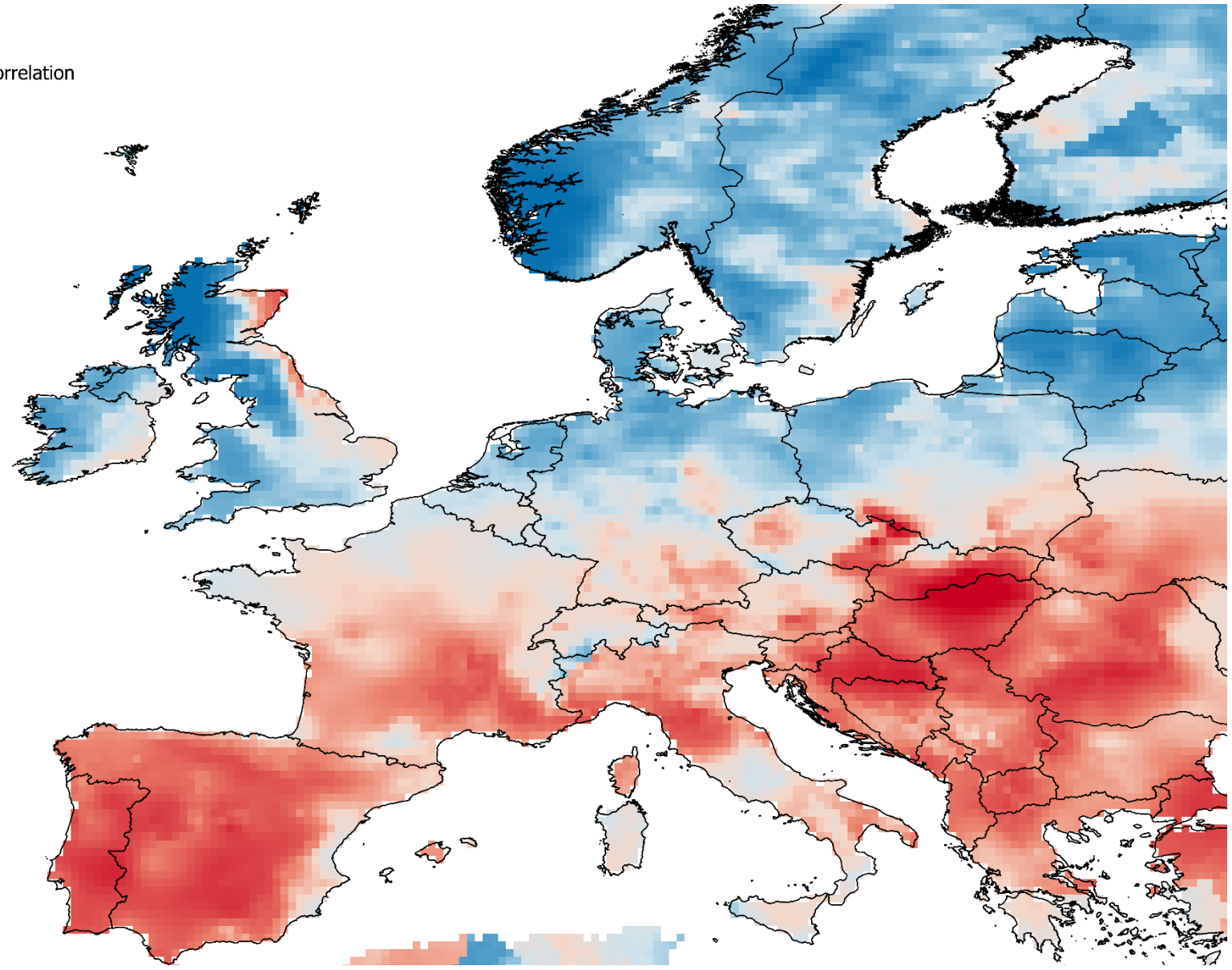
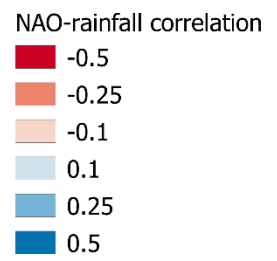
*“The North Atlantic Oscillation describes the changes in sea level pressure between the Azores high and the Icelandic low”*



- **The NAO correlates highly with European precipitation patterns**
- During **positive NAO** phases, stronger and more frequent storms travel Northern Europe, causing **wetter** than usual conditions, while Southern Europe is **drier** than usual
- During **negative NAO** phases, storms tend to travel across Southern Europe, causing **drier** than usual conditions in Northern Europe while Southern Europe is **wetter**

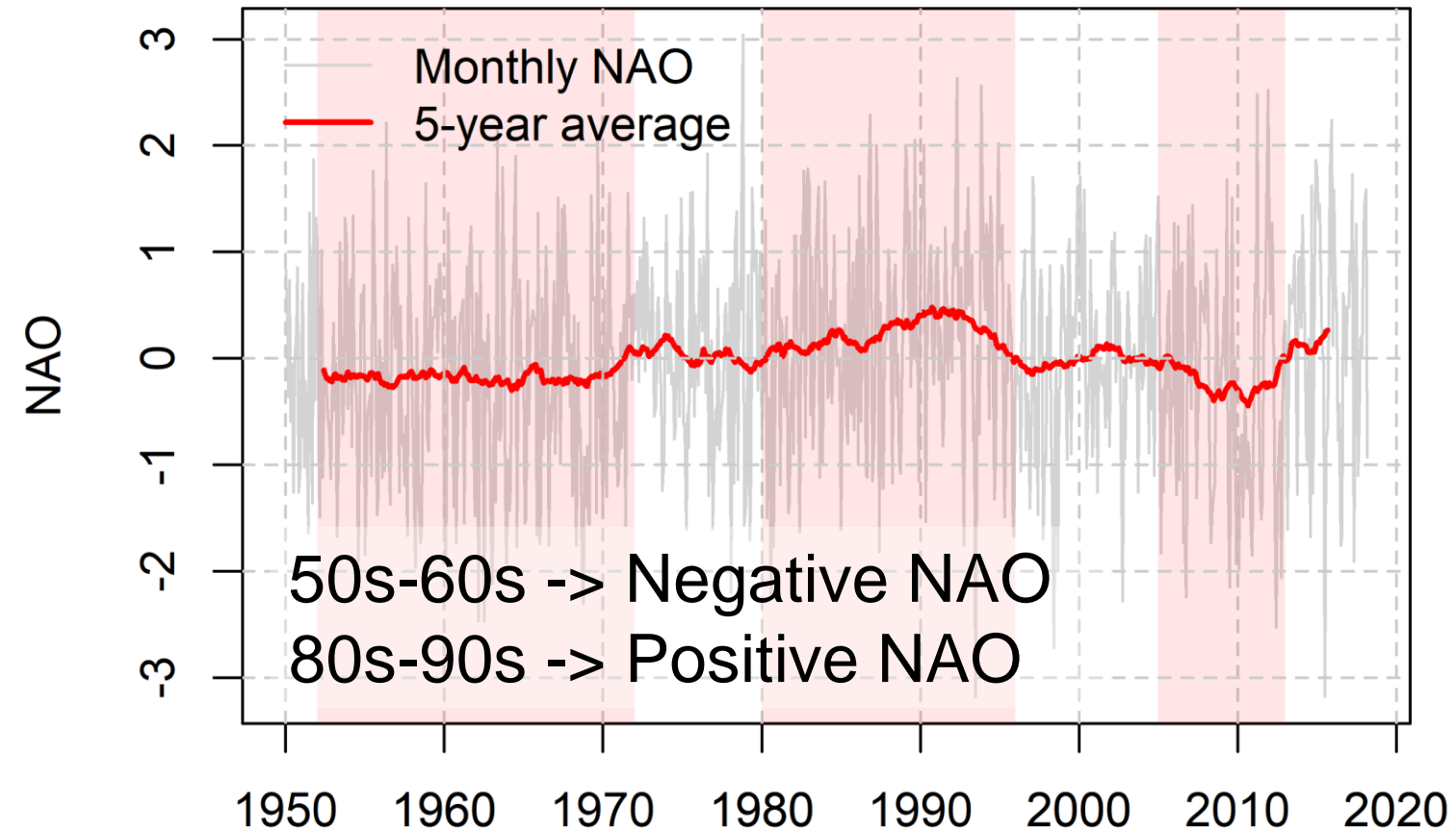
# NAO EFFECT ON WINTER PRECIPITATION

- Correlation between NAO and E-OBS data at monthly level
- Winter precipitation only – 1960 to 2010
- North-South seesaw pattern

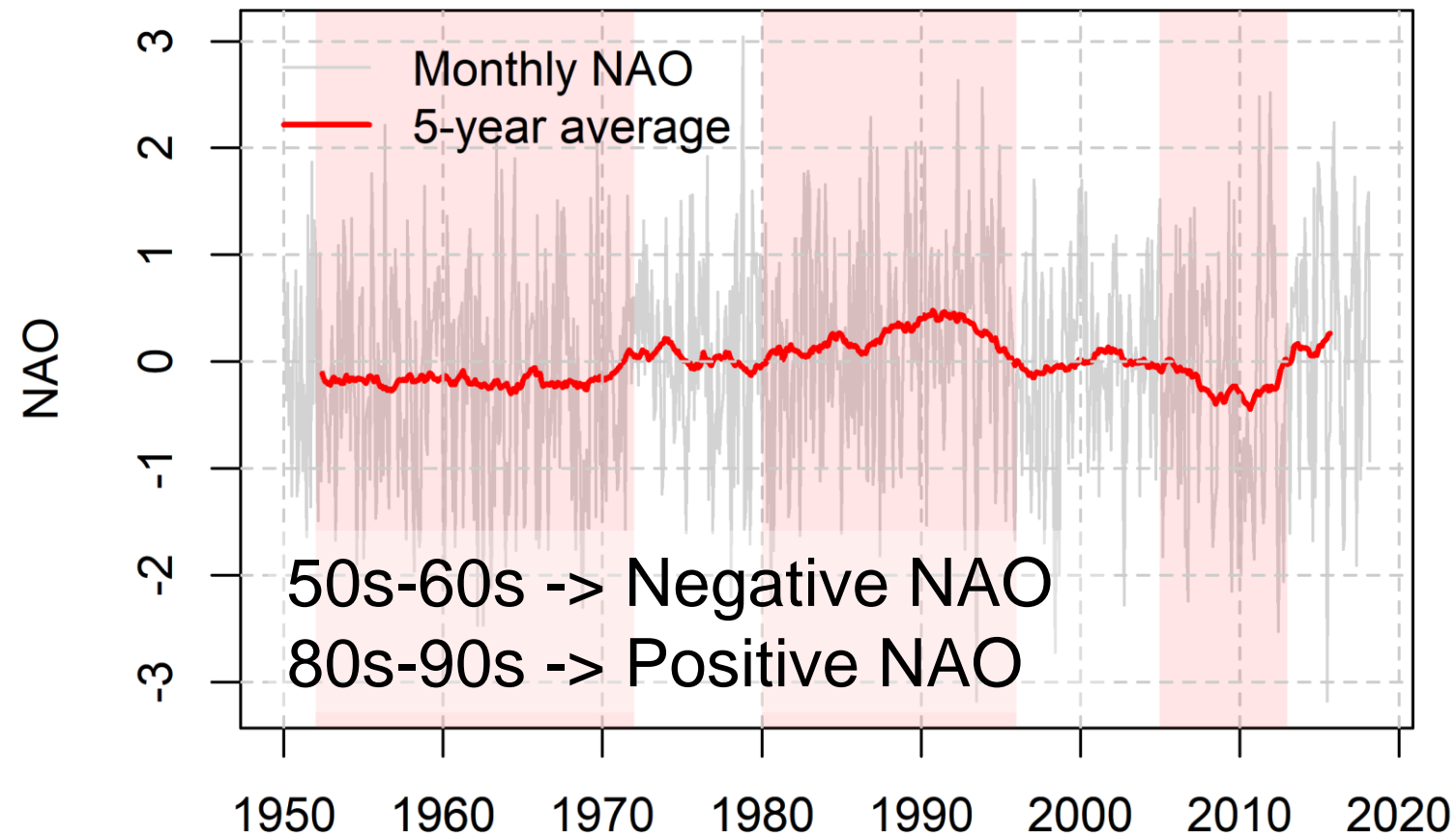




# The NAO displays long periods of positive or negative phase



# The NAO displays long periods of positive or negative phase



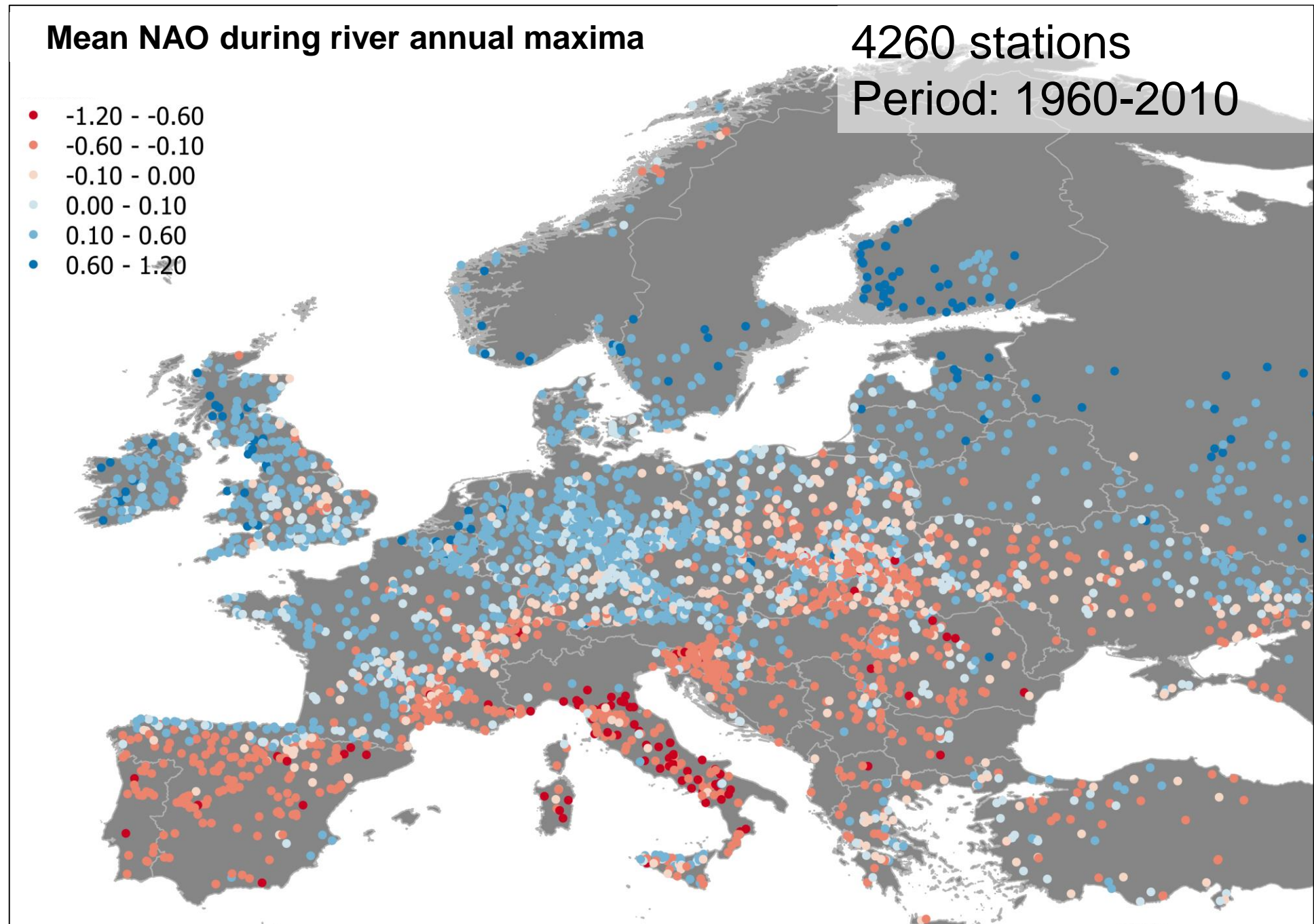
## long periods of wet or dry conditions

Dual effect of NAO on flood process:

- Direct effect through precipitation
- **Indirect effect through long-term wet/dry conditions**

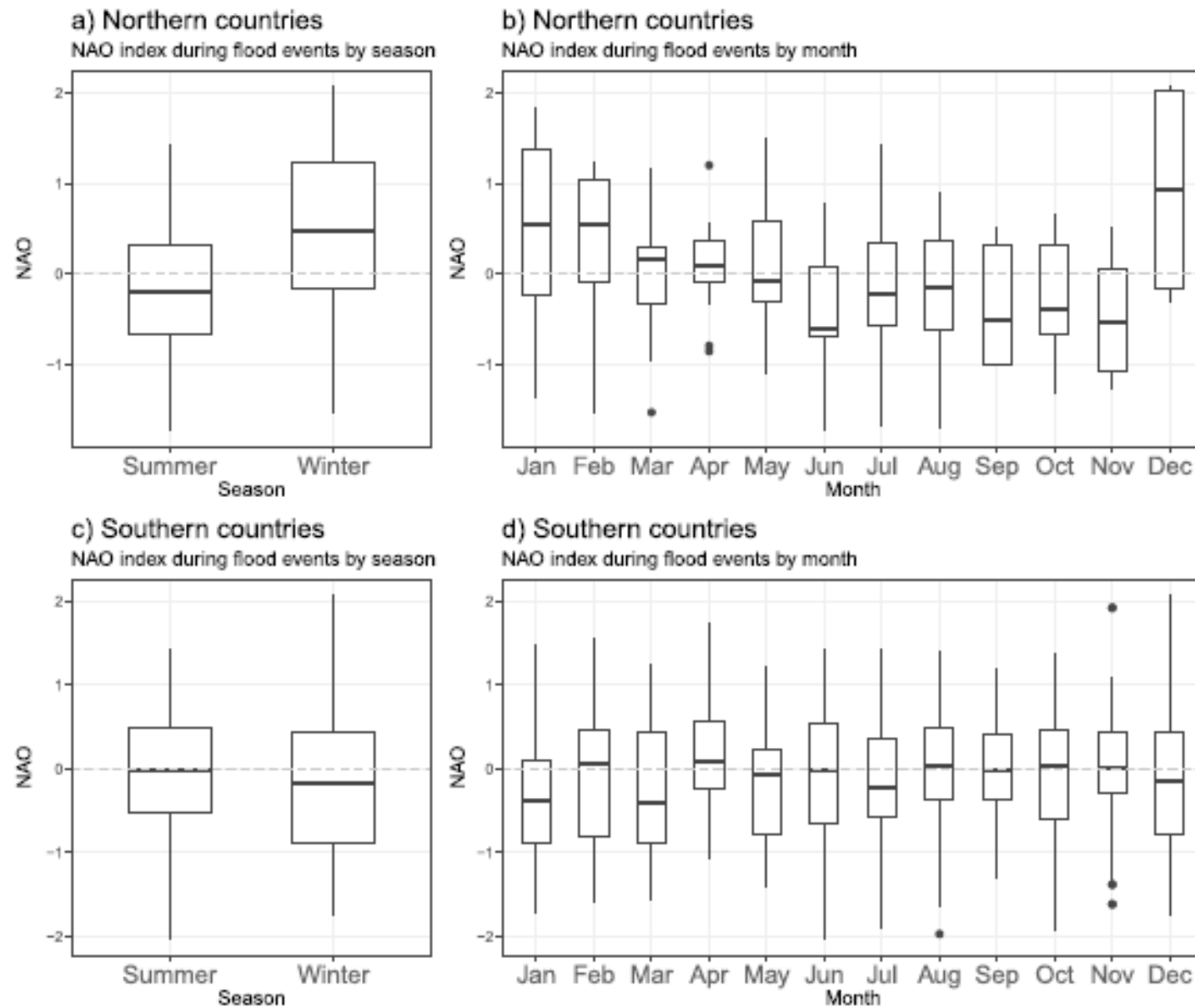
# What is the NAO when rivers peak across Europe?

- NAO is on average **positive** when rivers peak in **Northern Europe**
- NAO is on average **negative** when rivers peak in **Southern Europe**





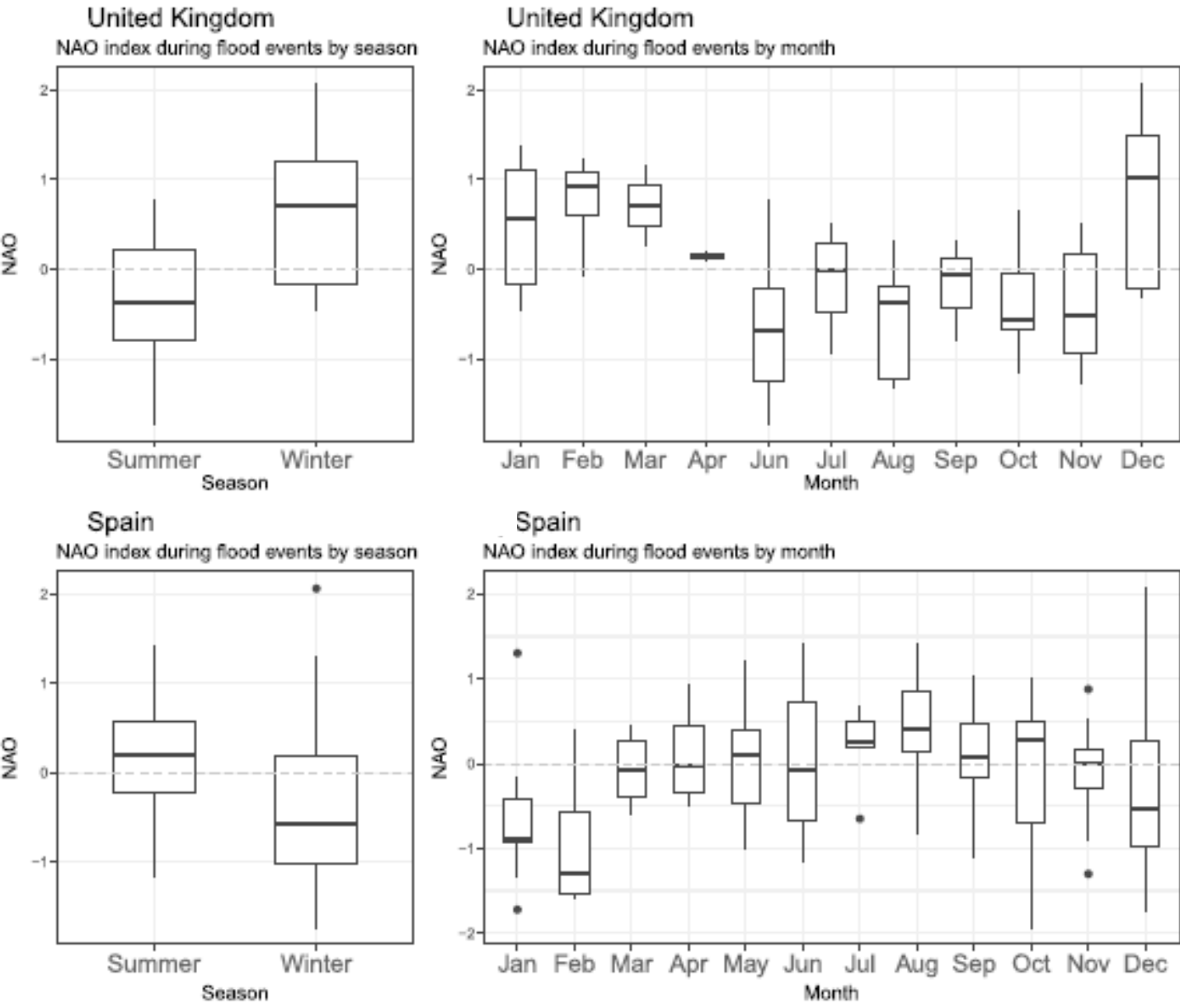
# Do catastrophic flood events follow the same pattern?



- Distributions of NAO observed during historical flood events
- Winter flood events in **Northern Europe** occurred mostly during a **positive NAO** phase
- Winter flood events in **Southern Europe** do not show any particular trend

## Hanze event dataset: 1950-2017 – data by country

# Do catastrophic flood events follow the same pattern?

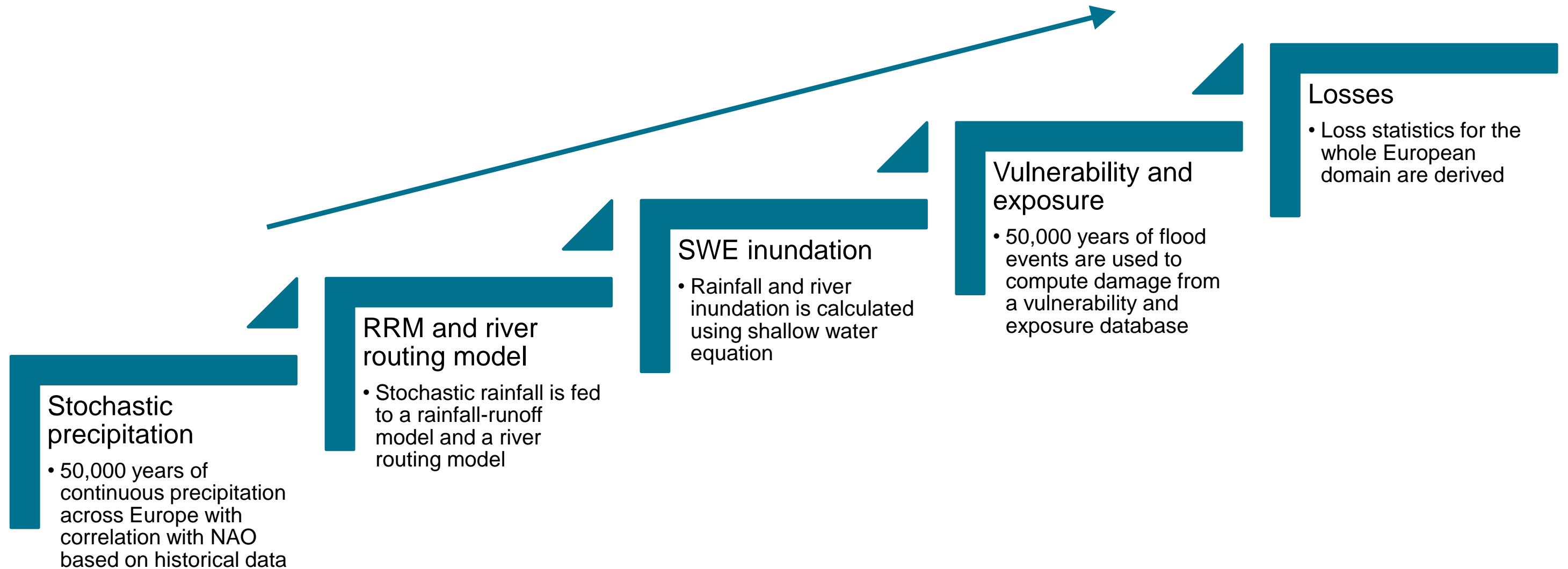


- Winter flood events in **UK** occurred mostly during a **positive NAO** phase
- Winter flood events in **Spain** occurred mostly during a **negative NAO** phase
- Clear pattern of occurrence can also be seen at monthly level

## Hanze event dataset: 1950-2017



# NEED FOR A FLOOD LOSS MODEL

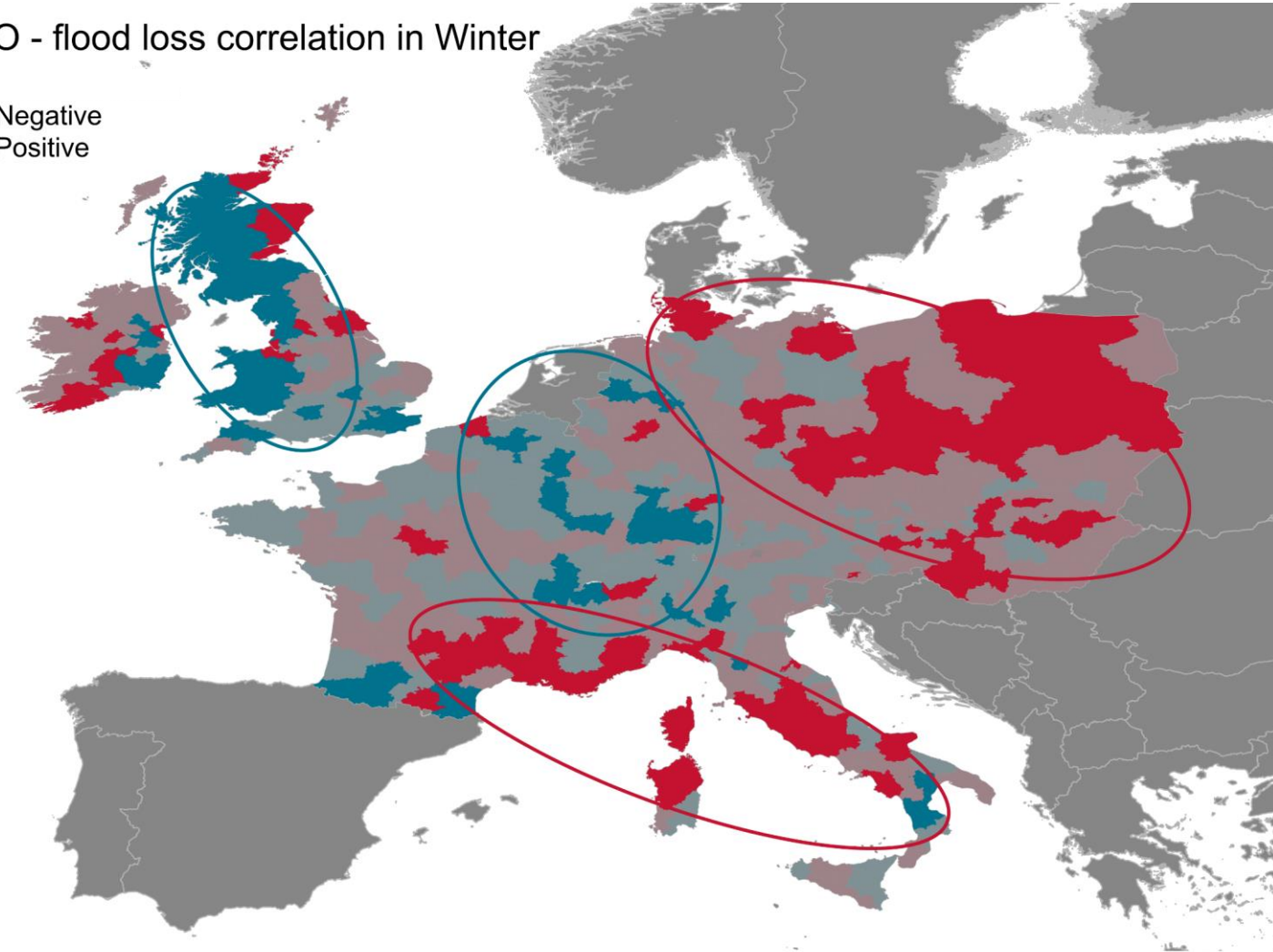


# Impact of NAO on flood losses across Europe

- 4 large clusters of positive/negative effect of NAO on losses
- NAO variability is a strong source for loss correlation across countries
- **Loss difference between opposite phases can reach 50%**

NAO - flood loss correlation in Winter

■ Negative  
■ Positive





# CONCLUSIONS

- We examined whether the NAO has a significant impact on flood losses across Europe.
- Data show that the NAO has an impact on precipitation and flows.
- Catastrophic flood data show an NAO “signature” on the event occurrence, however loss data are scarce.
- The application of a probabilistic flood catastrophe model shows that the impact of NAO on losses is significant and it has specific spatial patterns.

THANK YOU