7ª CONFERENZA NAZIONALE SULLE PREVISIONI METEOROLOGICHE E CLIMATICHE

Bologna 17-18 giugno 2019

# La valutazione degli impatti socio-economici ed ambientali dei cambiamenti climatici attraverso un approccio multidisciplinare

Mario Martina, Roberto Buizza, Marco Frey

**3CSA** - Scuole Universitarie Federate

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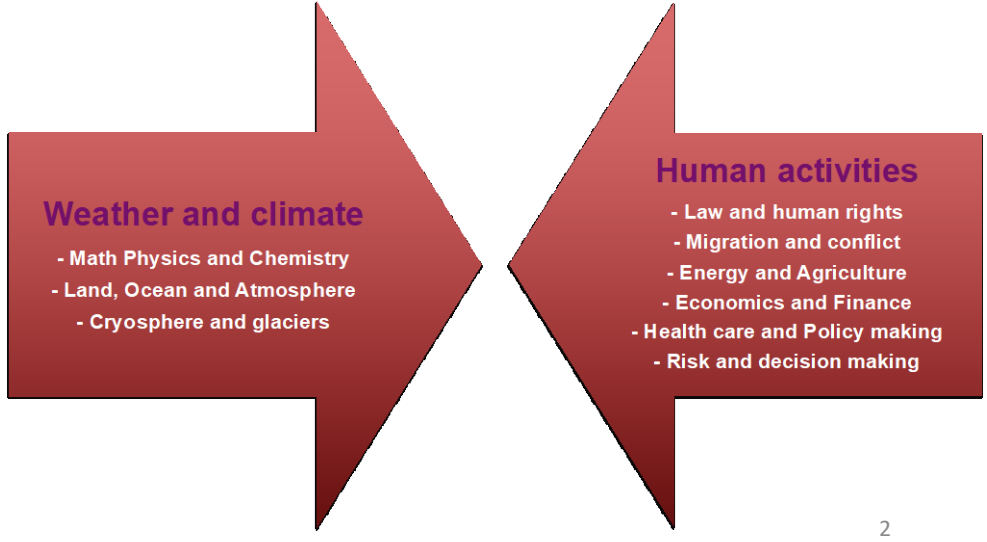
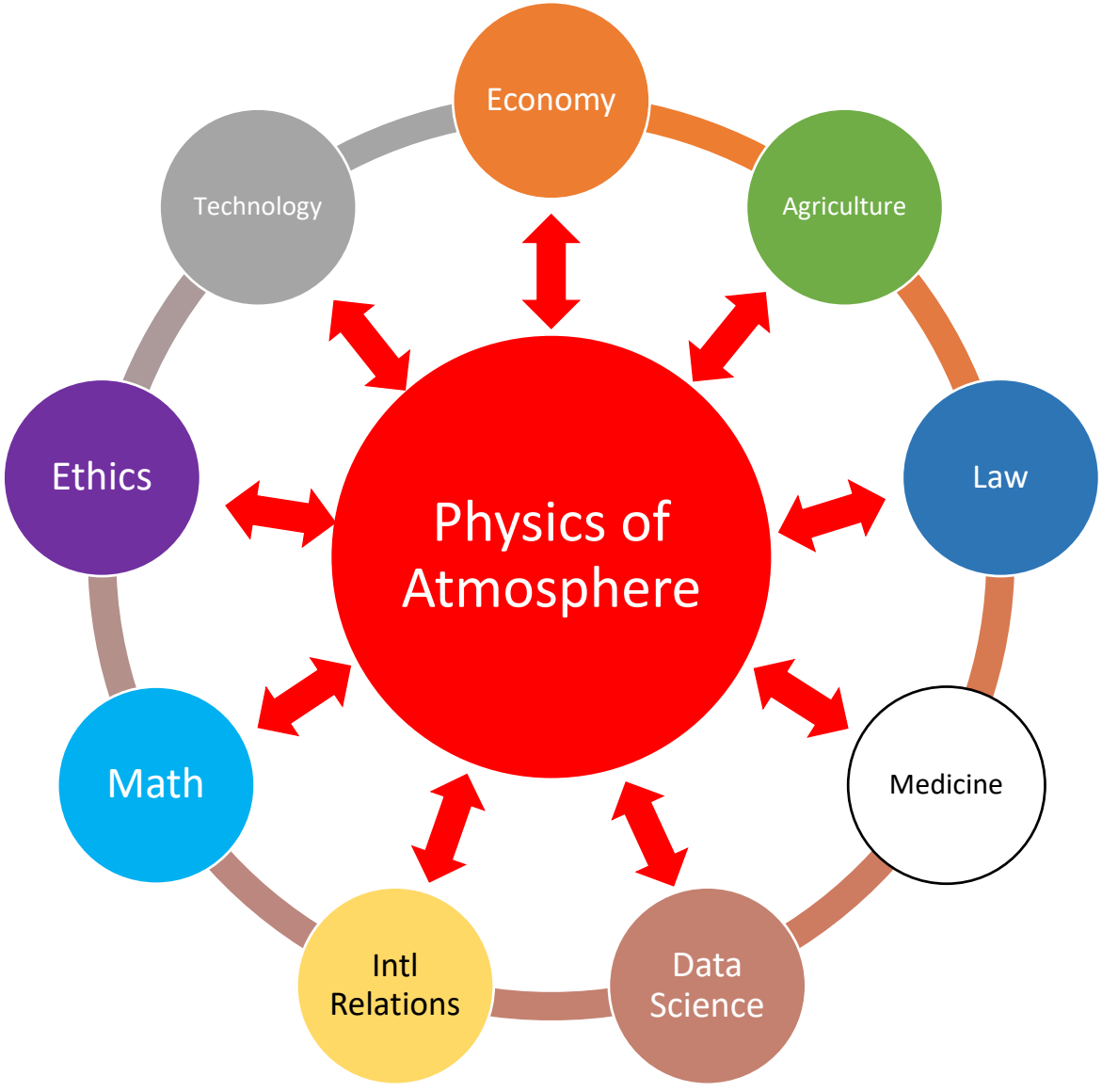
**C**entre for
**C**limate
**C**hange studies and
**S**ustainable
**A**ctions

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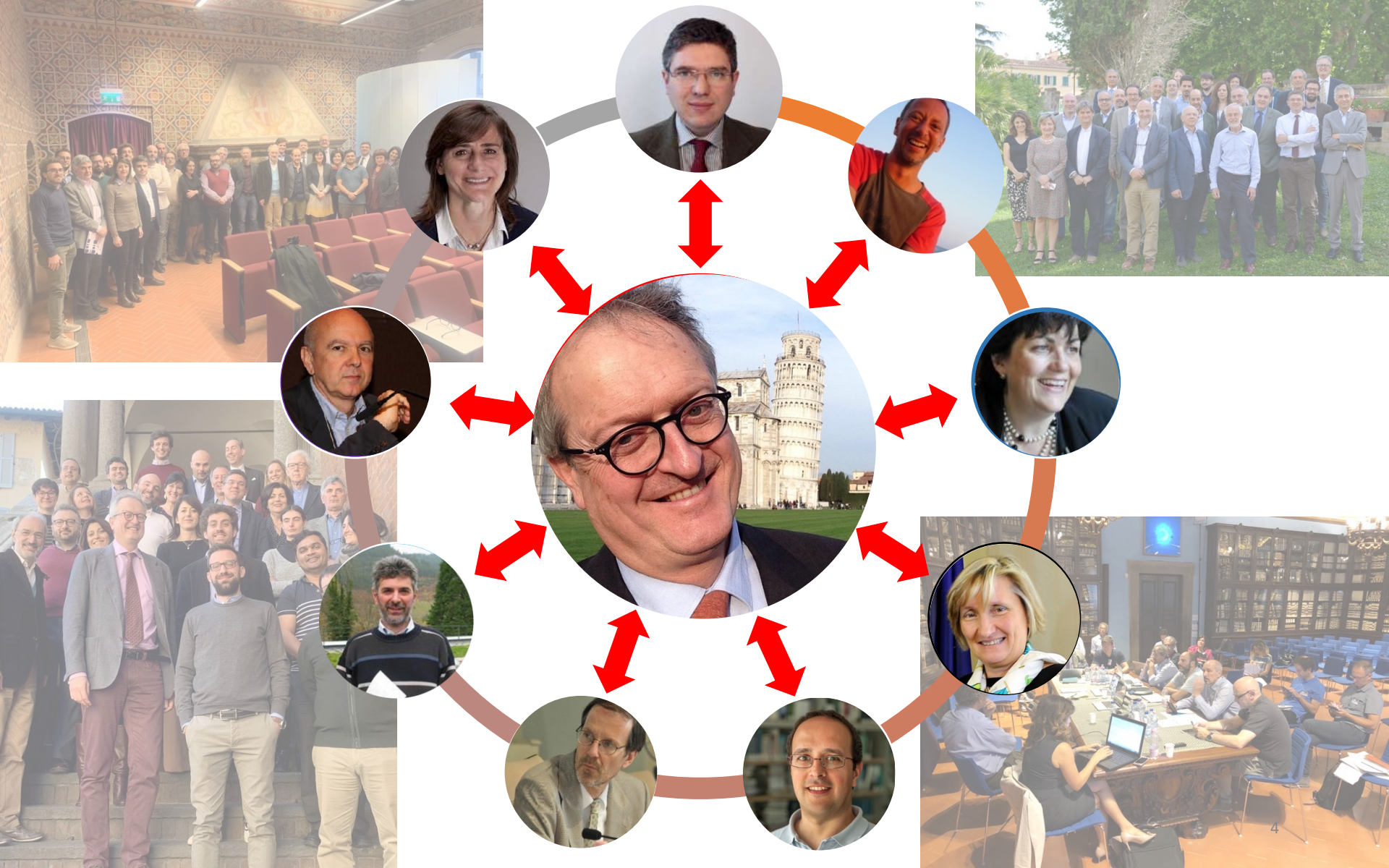
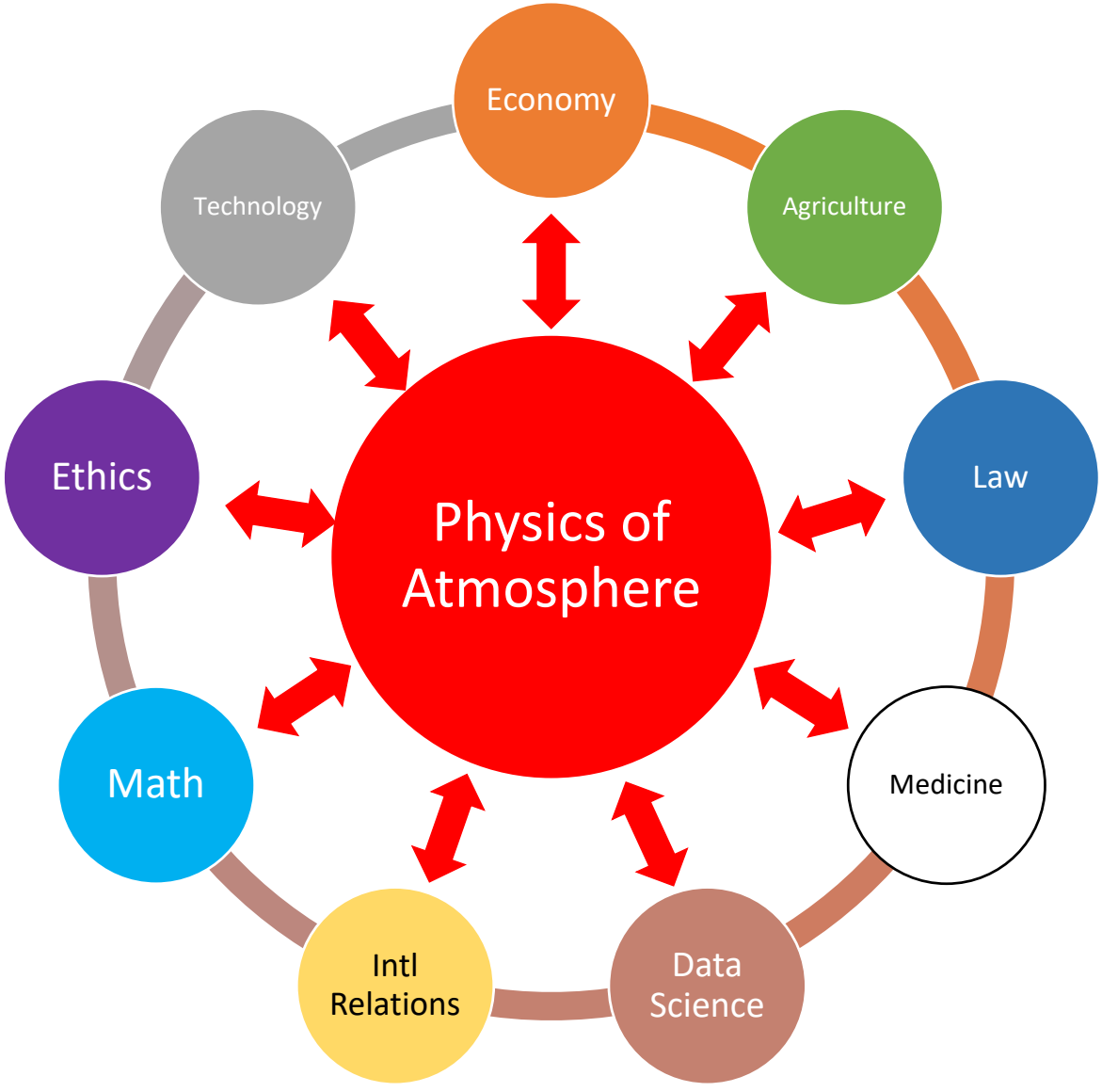
Law
Medicine
Data Science
Intl Relations
Math
Ethics
Technology
Physics of Atmosphere

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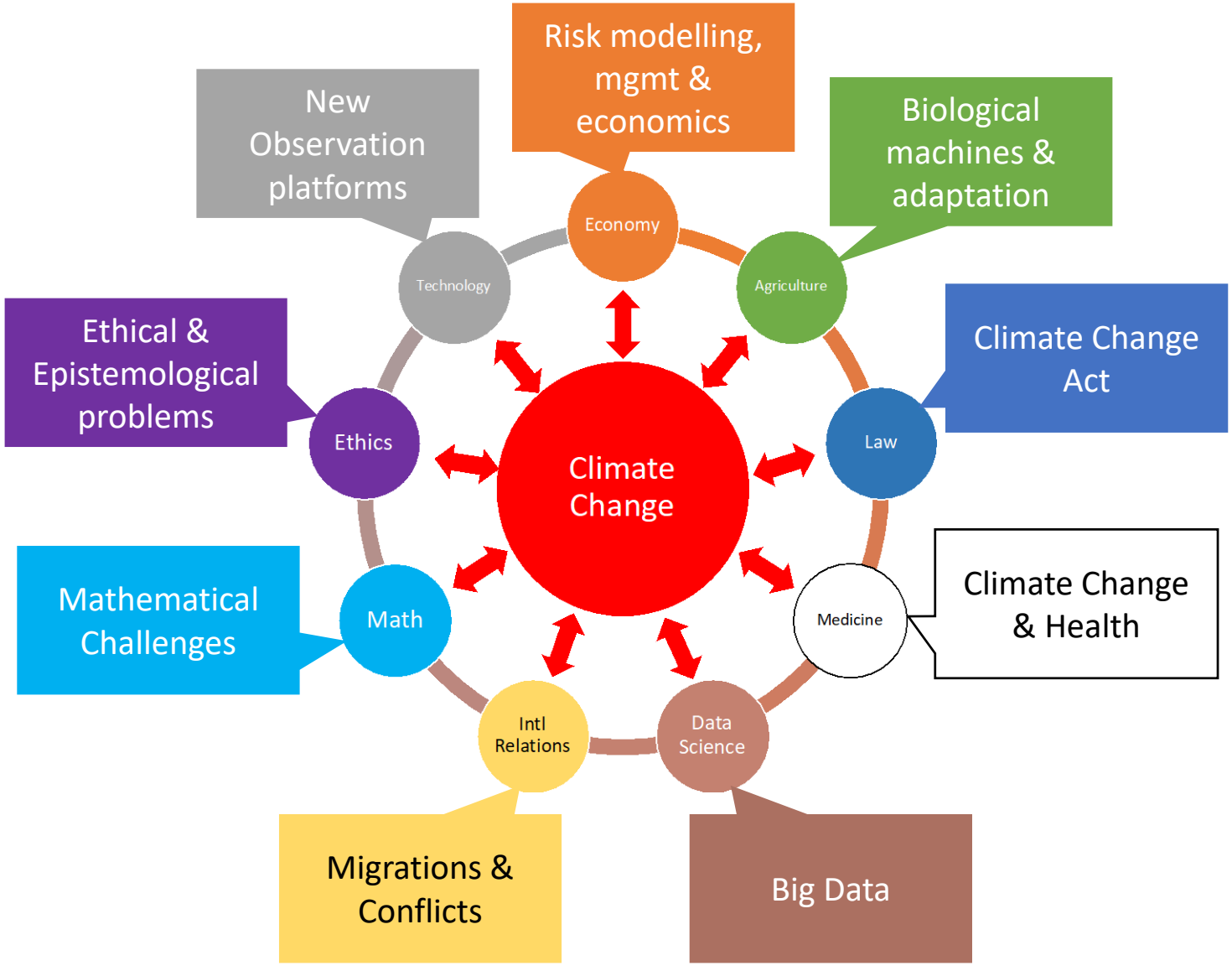
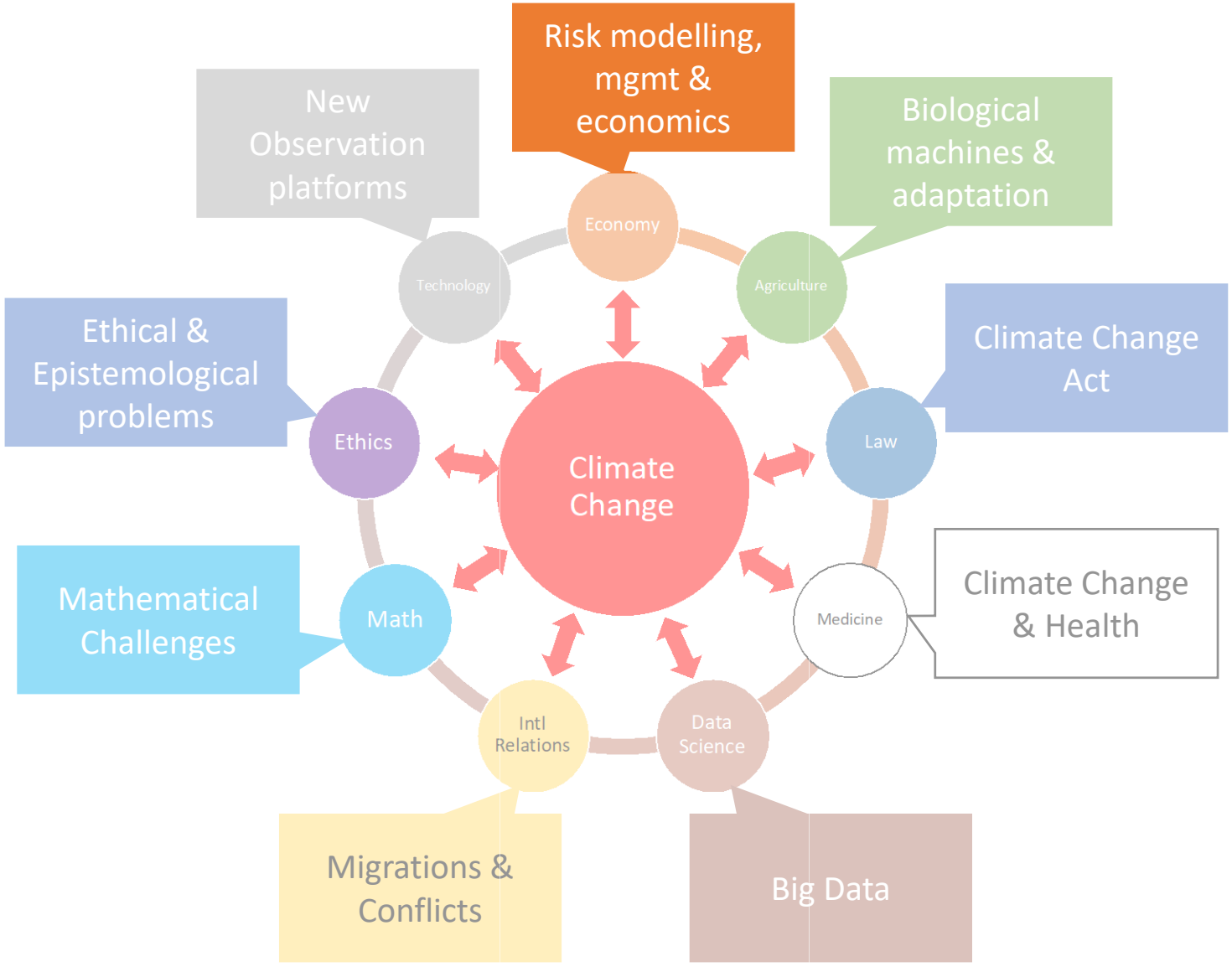

Risk modelling, mgmt & economics
New Observation platforms
Biological machines & adaptation
Economy
Technology
Agriculture
Ethical & Epistemological problems
Climate Change Act
Ethics
Climate Change
Law
Mathematical Challenges
Climate Change & Health
Math
Medicine
Intl Relations
Data Science
Migrations & Conflicts
Big Data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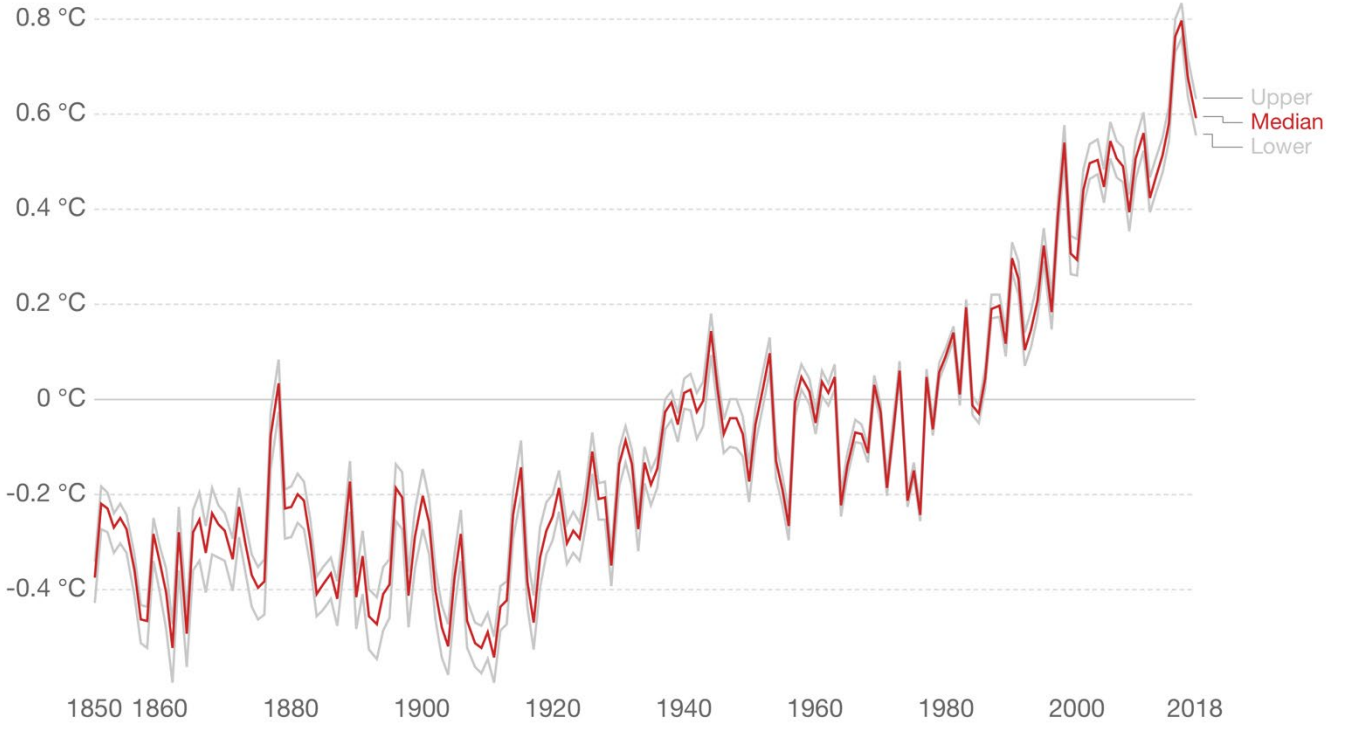
Migrations & Conflicts
Big Data

# Average temperature anomaly, Global

Global average land-sea temperature anomaly relative to the 1961-1990 average temperature in degrees celsius (°C). The red line represents the median average temperature change, and grey lines represent the upper and lower 95% confidence intervals.

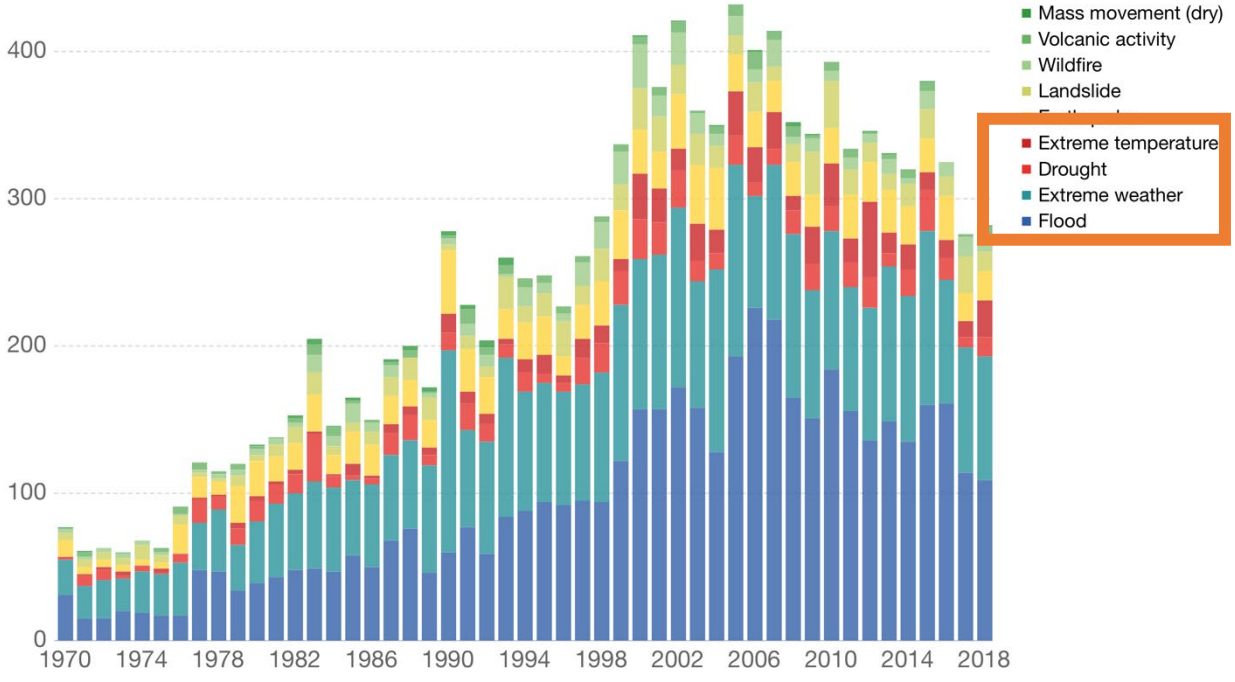



Source: Hadley Centre (HadCRUT4)

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

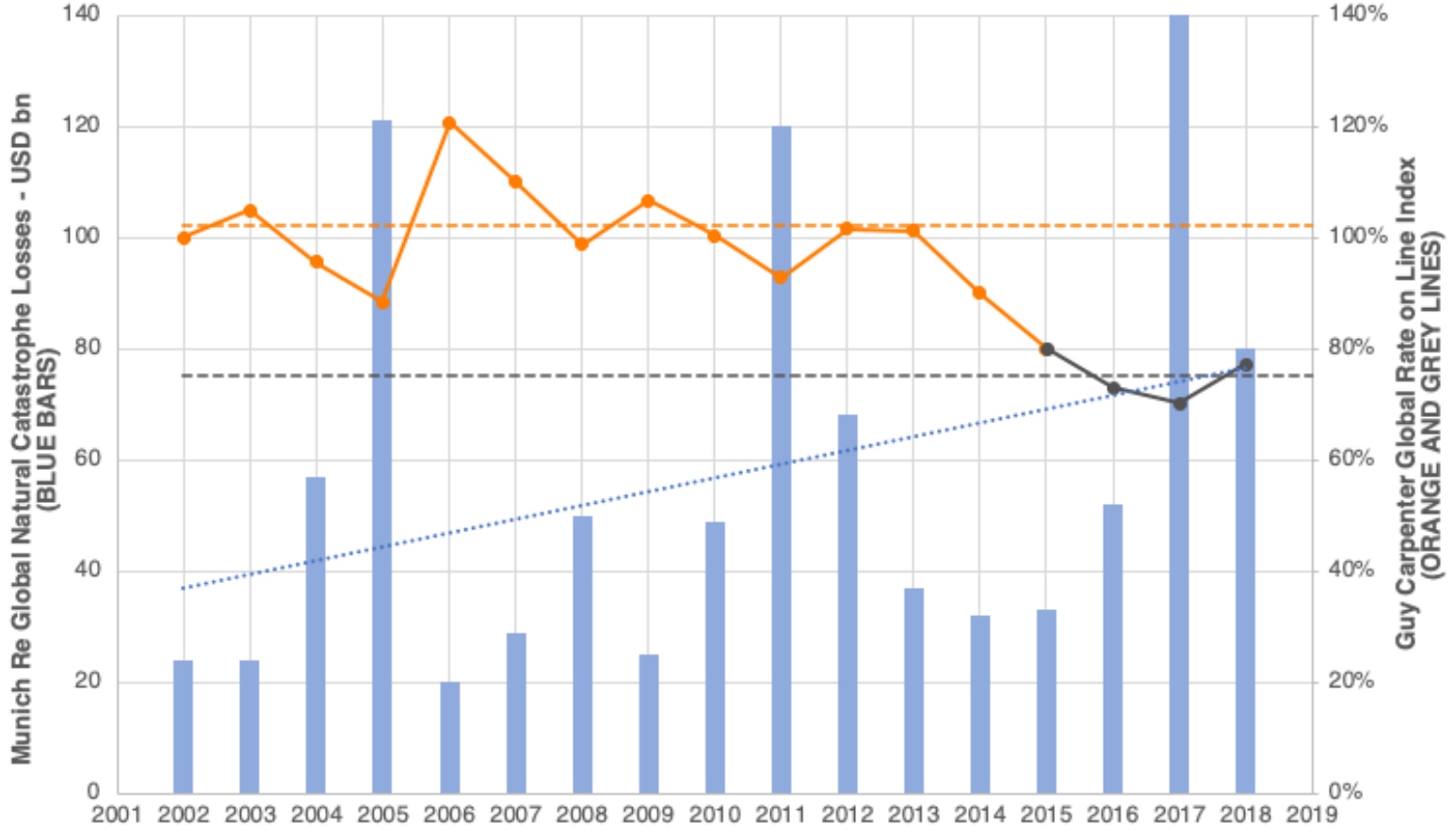
# Global reported natural disasters by type

The annual reported number of natural disasters, categorised by type. This includes both weather and non-weather related disasters.



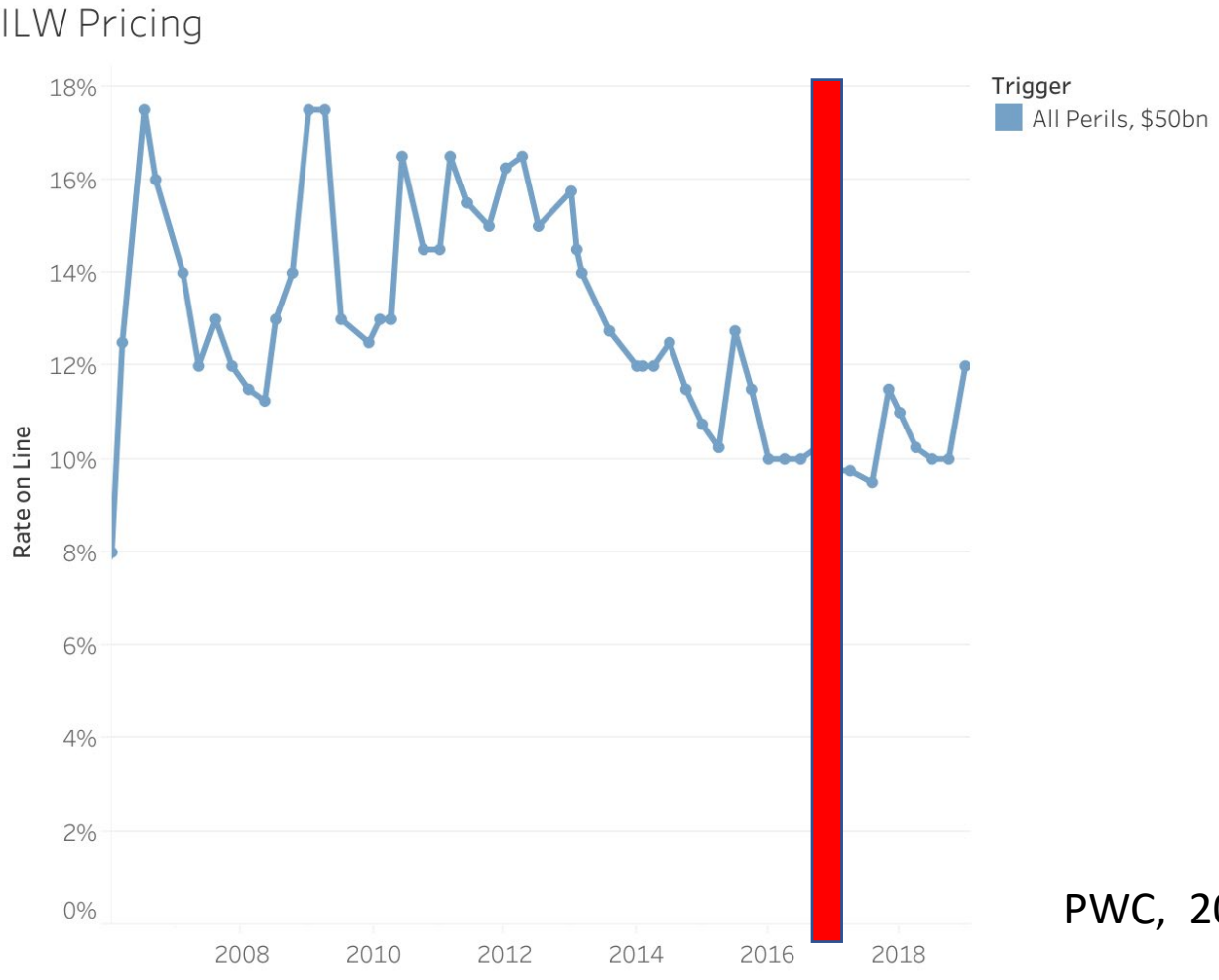

Source: EMDAT (2017): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium
OurWorldInData.org/natural-disasters • CC BY

# Global Nat-Cat (Weather-related) Insurance ROL

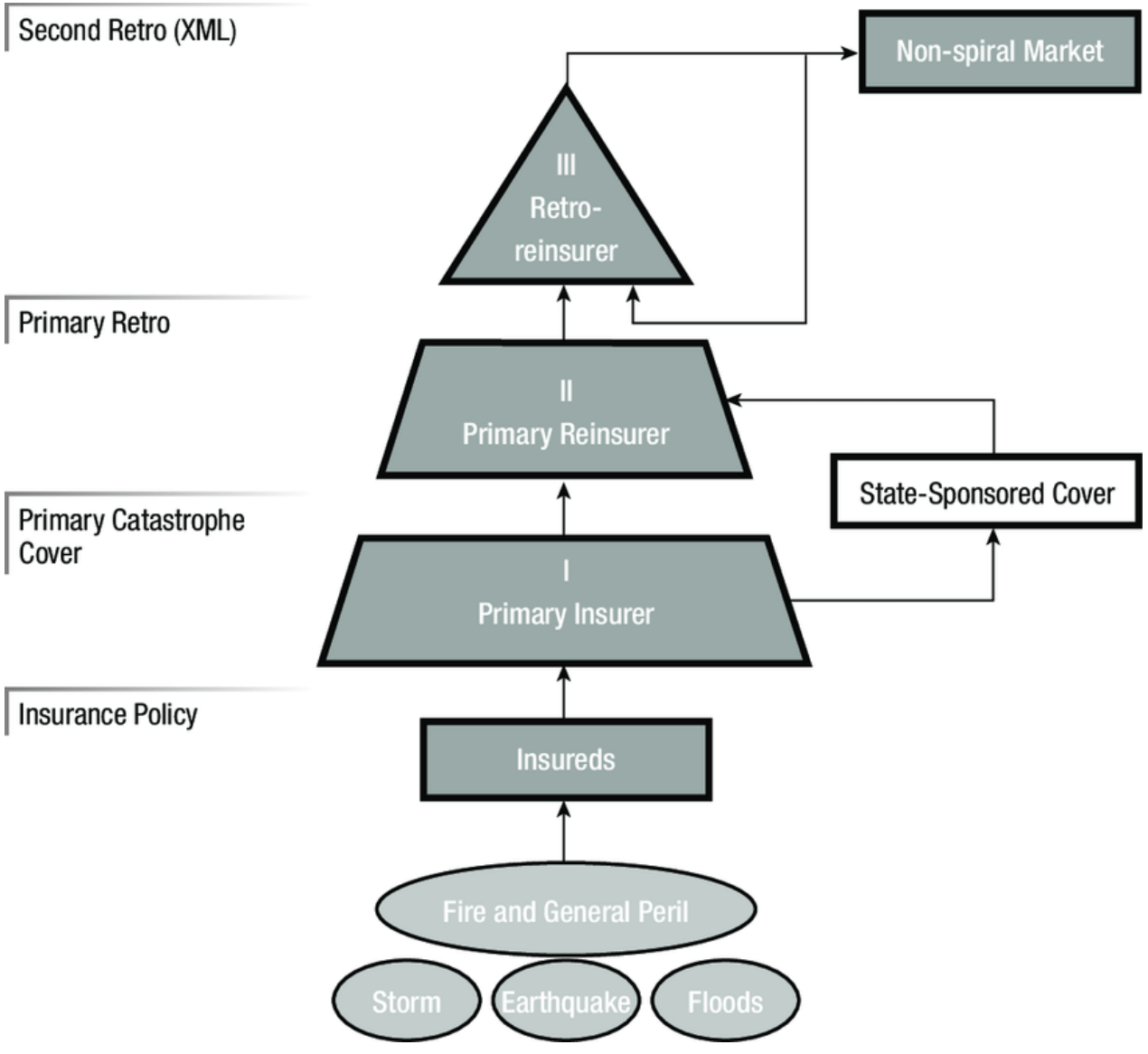


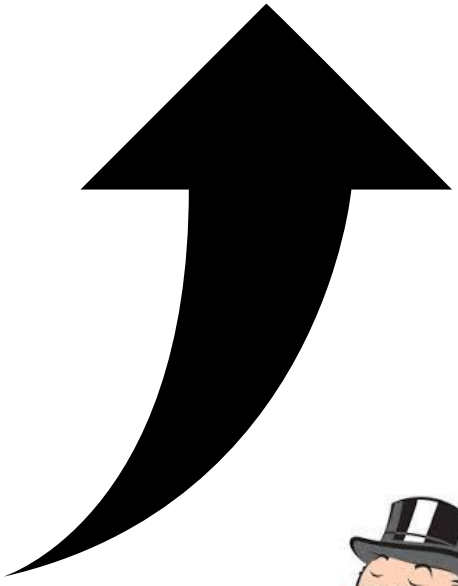

Guy-Carpenter, 2019

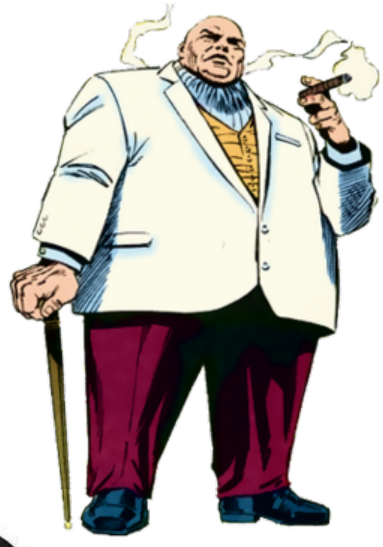
# US Nat-Cat (Weather-related) Insurance ROL




PWC, 2019


Second Retro (XML)
Non-spiral Market
III
Retro-
reinsurer
Primary Retro
II
Primary Reinsurer
State-Sponsored Cover
Primary Catastrophe
Cover
I
Primary Insurer
Insurance Policy
Insureds
Fire and General Peril
Storm
Earthquake
Floods

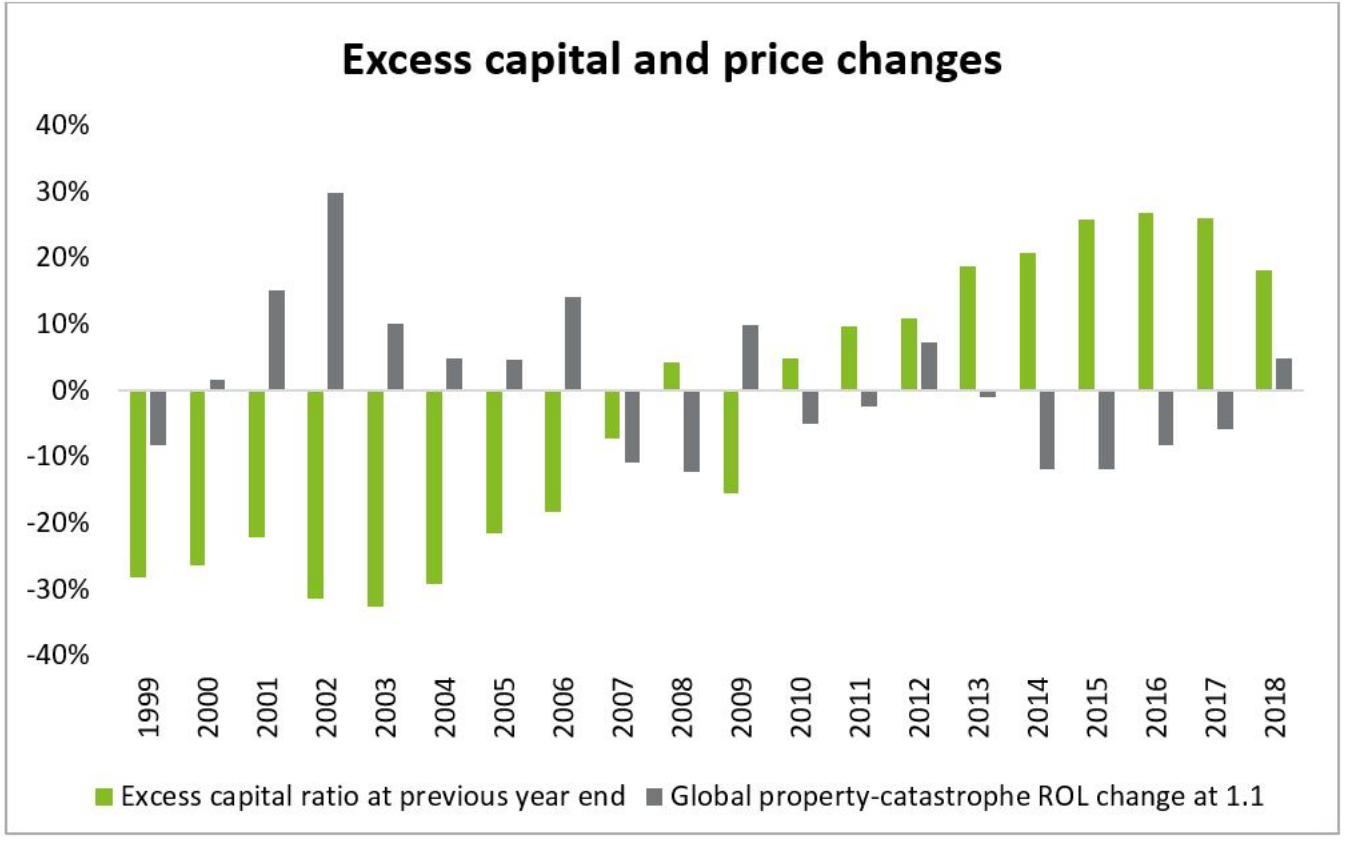




# Capital Market

## Re - Insurance

Primary Insurance




Deloitte, 2019

Premium & Excesses Rise
Policy terms tighten
Lower indemnity limits

Insurers make profits
Capital flows into the market
Insurers desire larger market share
Competition amongst insurers increases

Hard

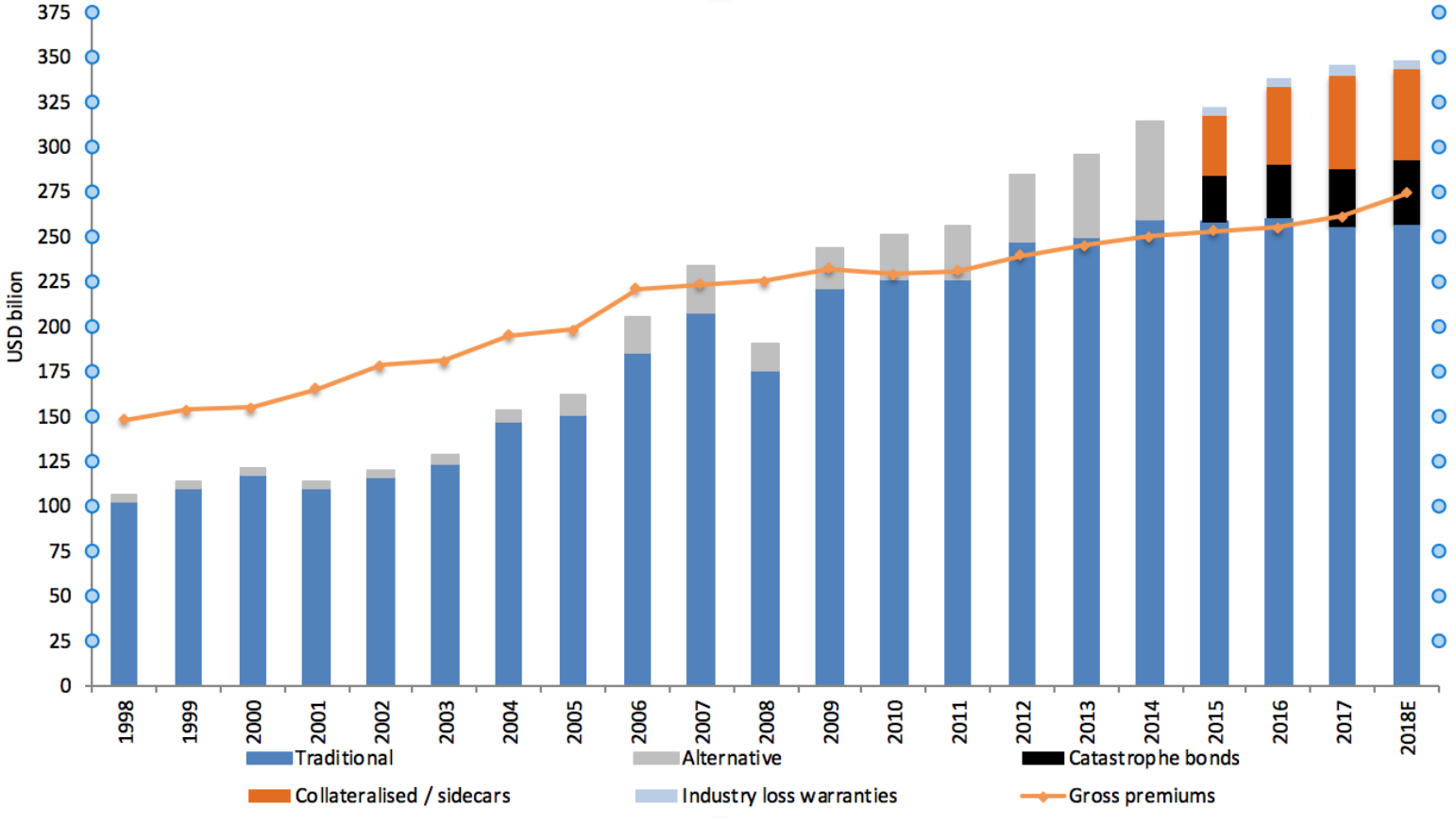
Market

Soft

Insurers suffer loss
Capital exits the market
Supply contracts

Premiums & excesses fall
Policy terms widen
Higher indemnity limits

# Nat Cat Capitals – Weather-related



# What can we do?

- Improve the models (risk, weather, climate, …) – increase reliability

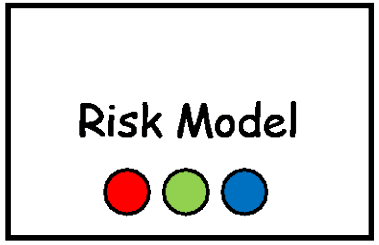
- New Financial – Insurance Programmes
  - Disaster Risk Financing and Insurance (DRFI) Program
  - Parametric Insurance / Index Insurance

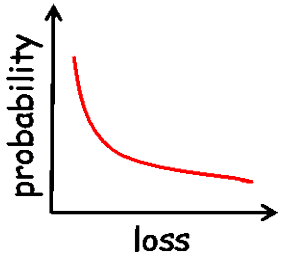
- Increase the Financial Resilience

# Models for risk assessment and management

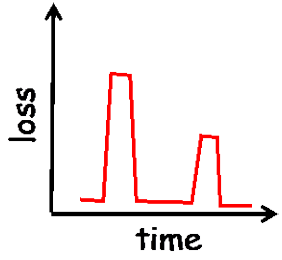
**Climate and Weather related hazards**

- Floods
- Drought
- Extreme Rainfall
- Wind storms
- Storm surge
- Heat/Cold waves




**Disaster Risk Assessment**




**Disaster Risk Management/ Financing**

Hazard: estimation of the frequency of the events

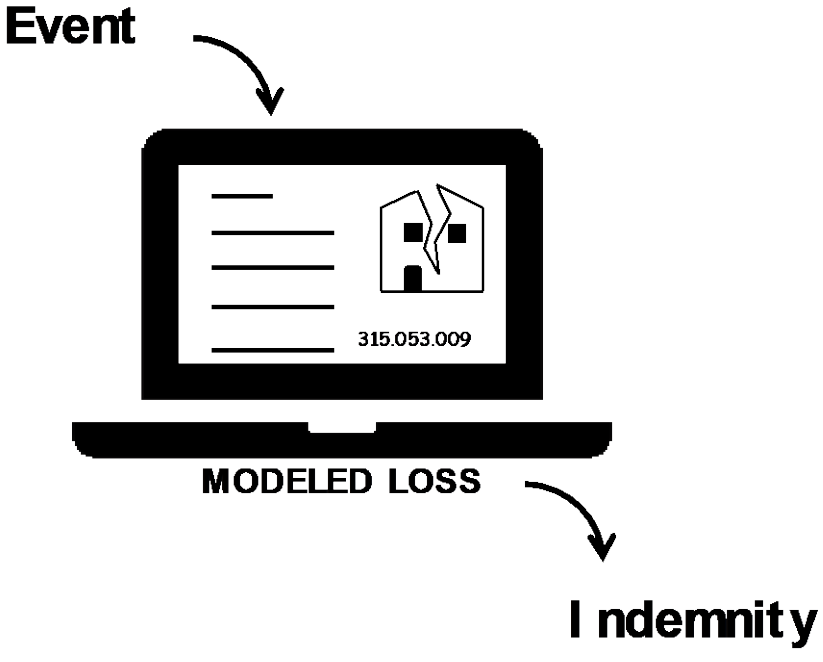
Vulnerability: loss/damage models

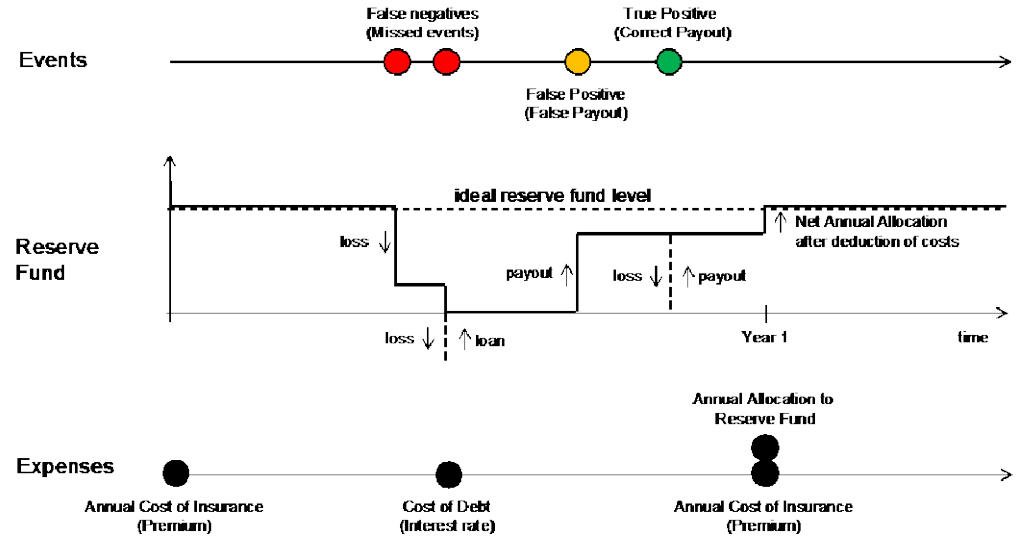
Exposure: identification of the assets and estimation of the exposure values

Premiums

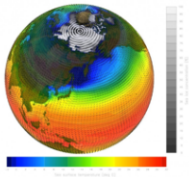
Payouts

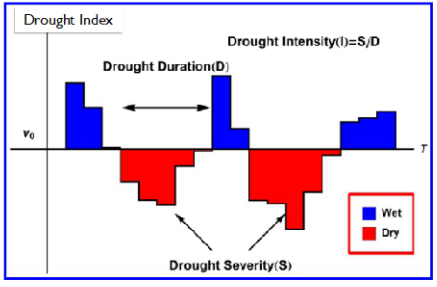
# Disaster risk financing: parametric insurance

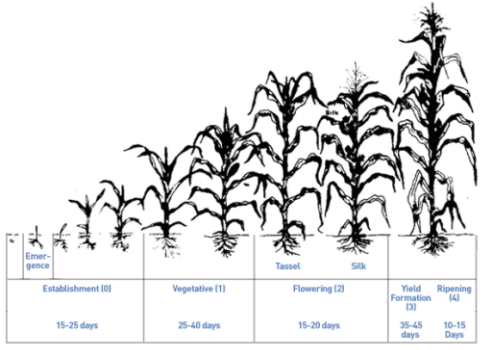


# Extreme Weather Event identification in near-realtime



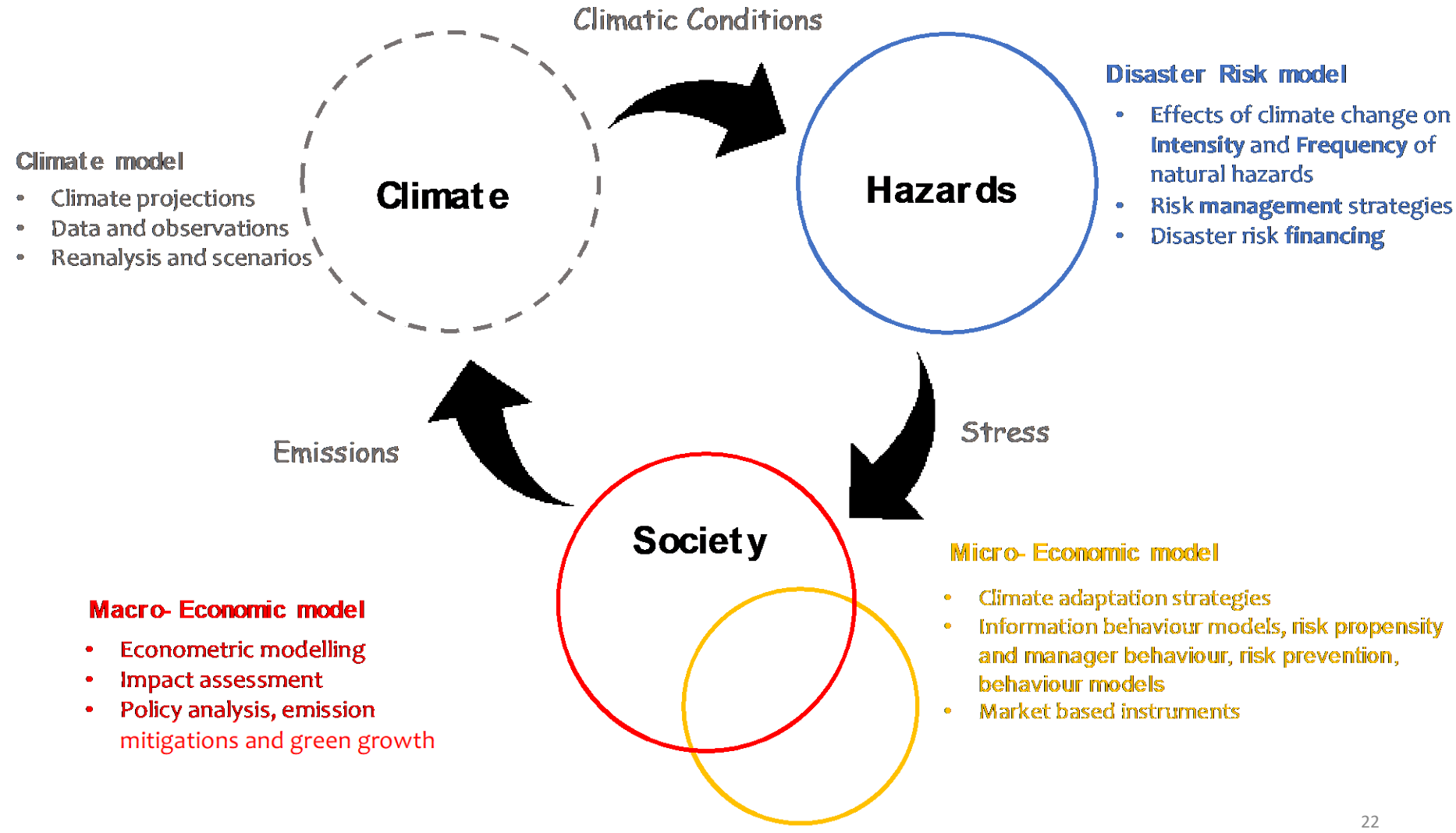



Climate model ⇨ Climate index ⇨ Risk/Loss model ⇨ Loss index

# … what else?

- Combine Climate – Risk – Economic models




**Climate model**

- Climate projections
- Data and observations
- Reanalysis and scenarios

**Disaster Risk model**

- Effects of climate change on **Intensity** and **Frequency** of natural hazards
- Risk **management** strategies
- Disaster risk **financing**

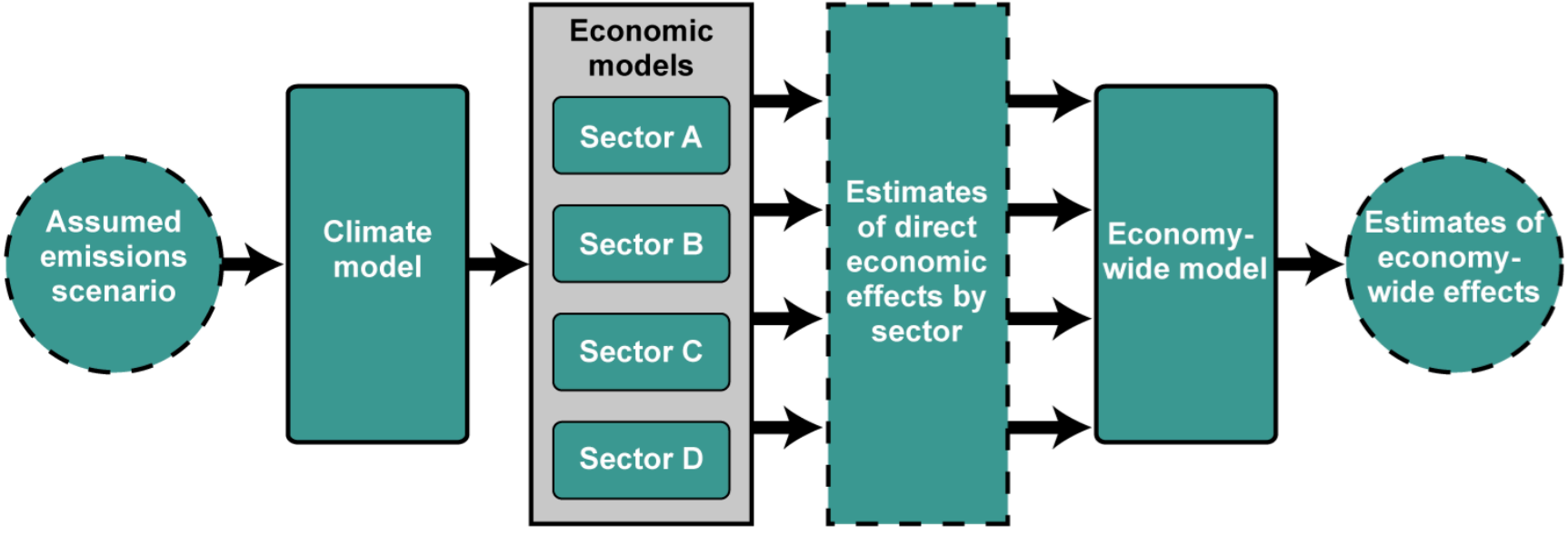
**Macro- Economic model**

- Econometric modelling
- Impact assessment
- Policy analysis, emission mitigations and green growth

**Micro- Economic model**

- Climate adaptation strategies
- Information behaviour models, risk propensity and manager behaviour, risk prevention, behaviour models
- Market based instruments

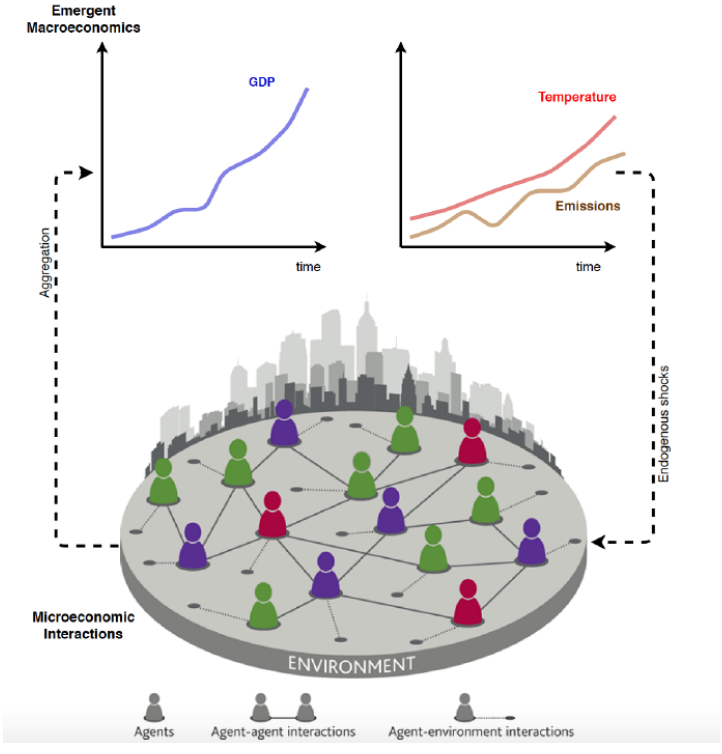
# Coupled Climate → Economic models

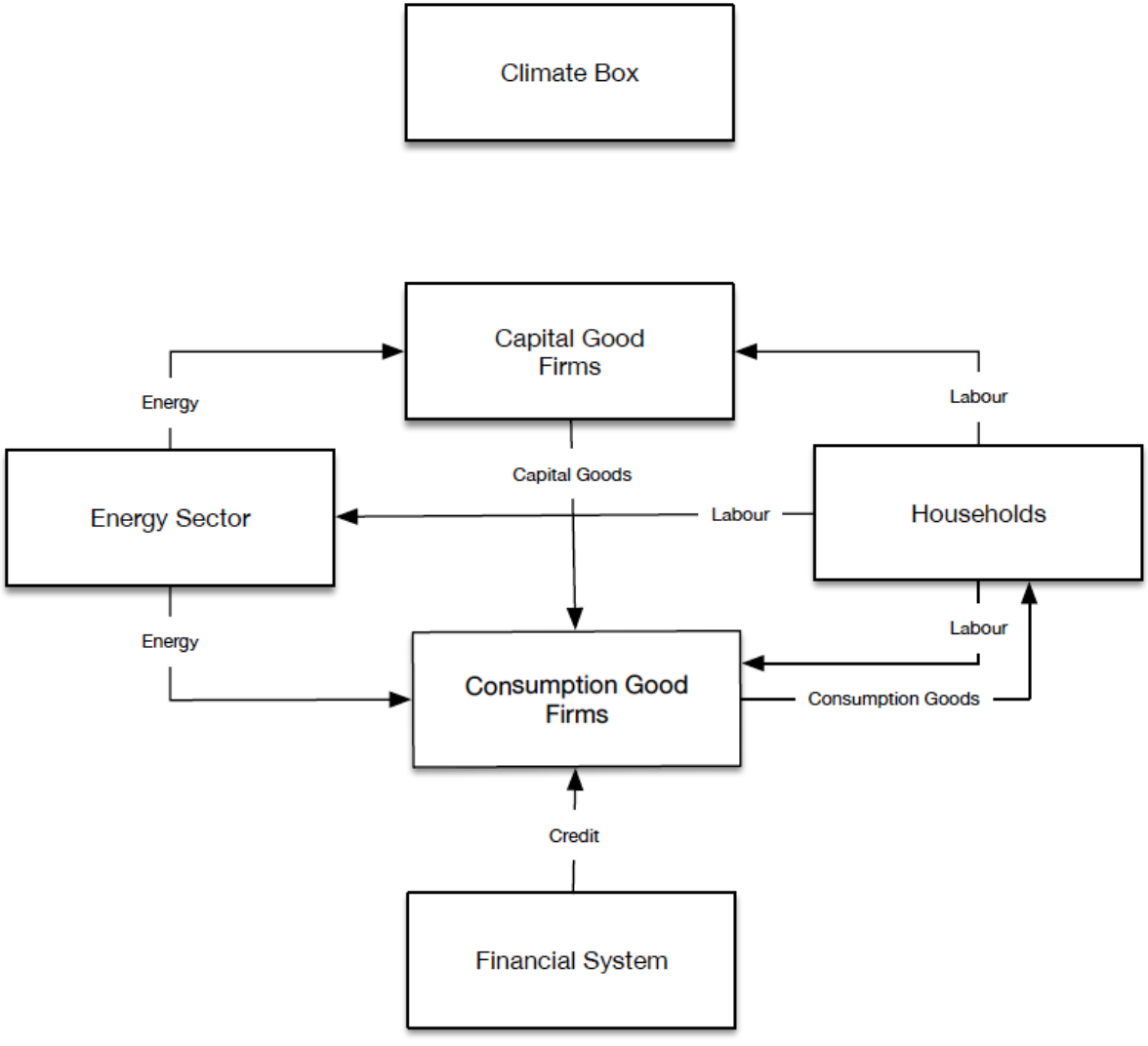


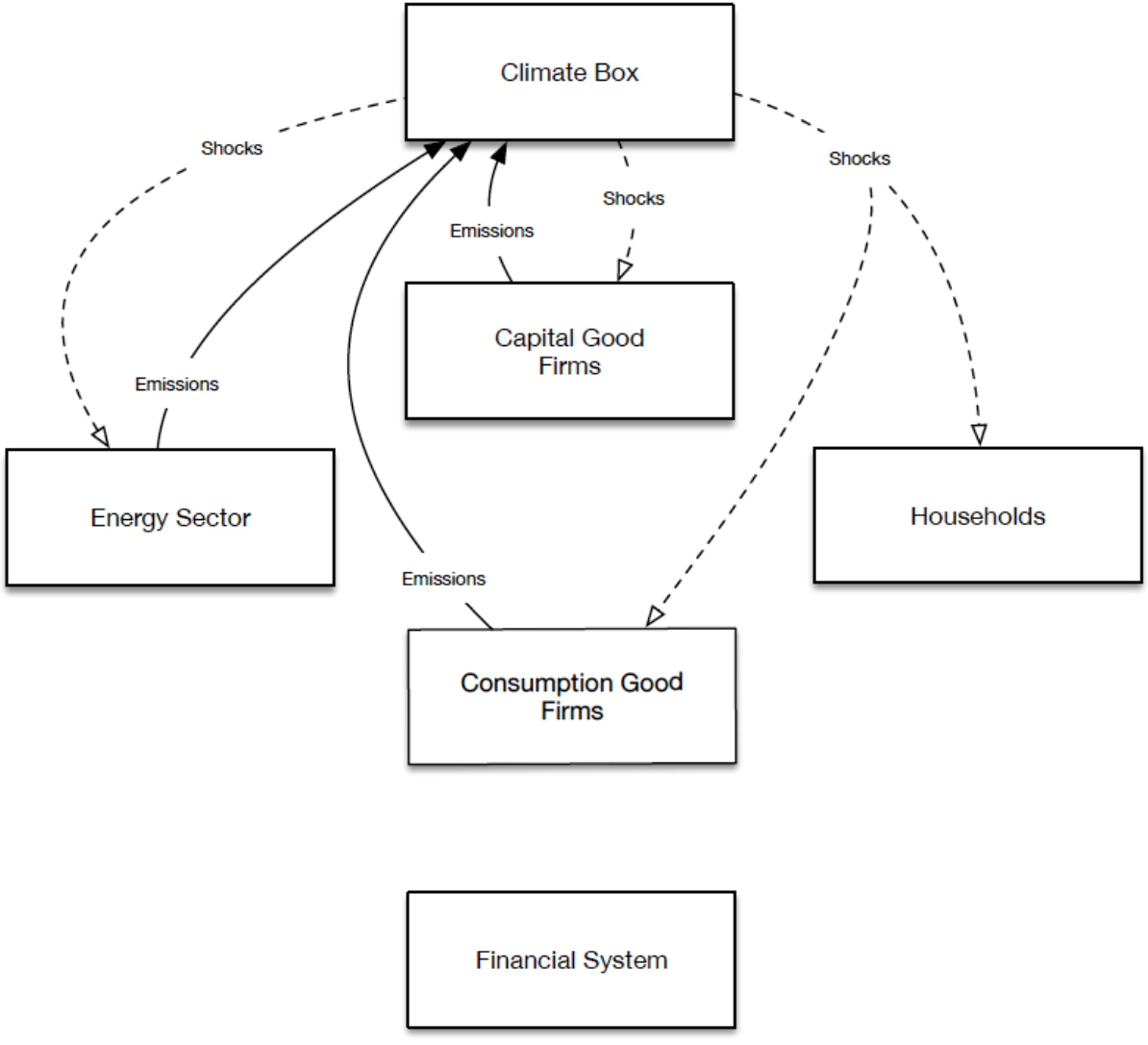

Source: GAO analysis. | GAO-17-720

# New Economic models

## DSK - The Dystopian Schumpeter meeting Keynes model




Climate Box
Capital Good Firms
Energy
Labour
Capital Goods
Energy Sector
Labour
Households
Energy
Labour
Consumption Good Firms
Consumption Goods
Credit
Financial System

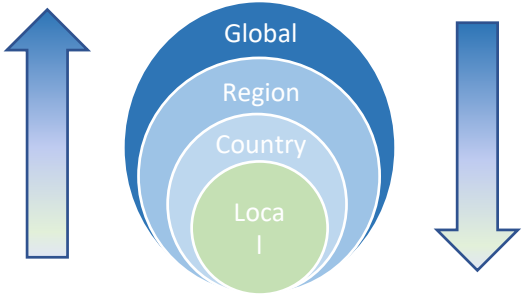

Climate Box
Shocks
Shocks
Shocks
Emissions
Emissions
Capital Good Firms
Energy Sector
Households
Emissions
Consumption Good Firms
Financial System

# The «scale» issue

- Level 1: Global
- Level 2: Region
- Level 3: Country
- Level 4: Local

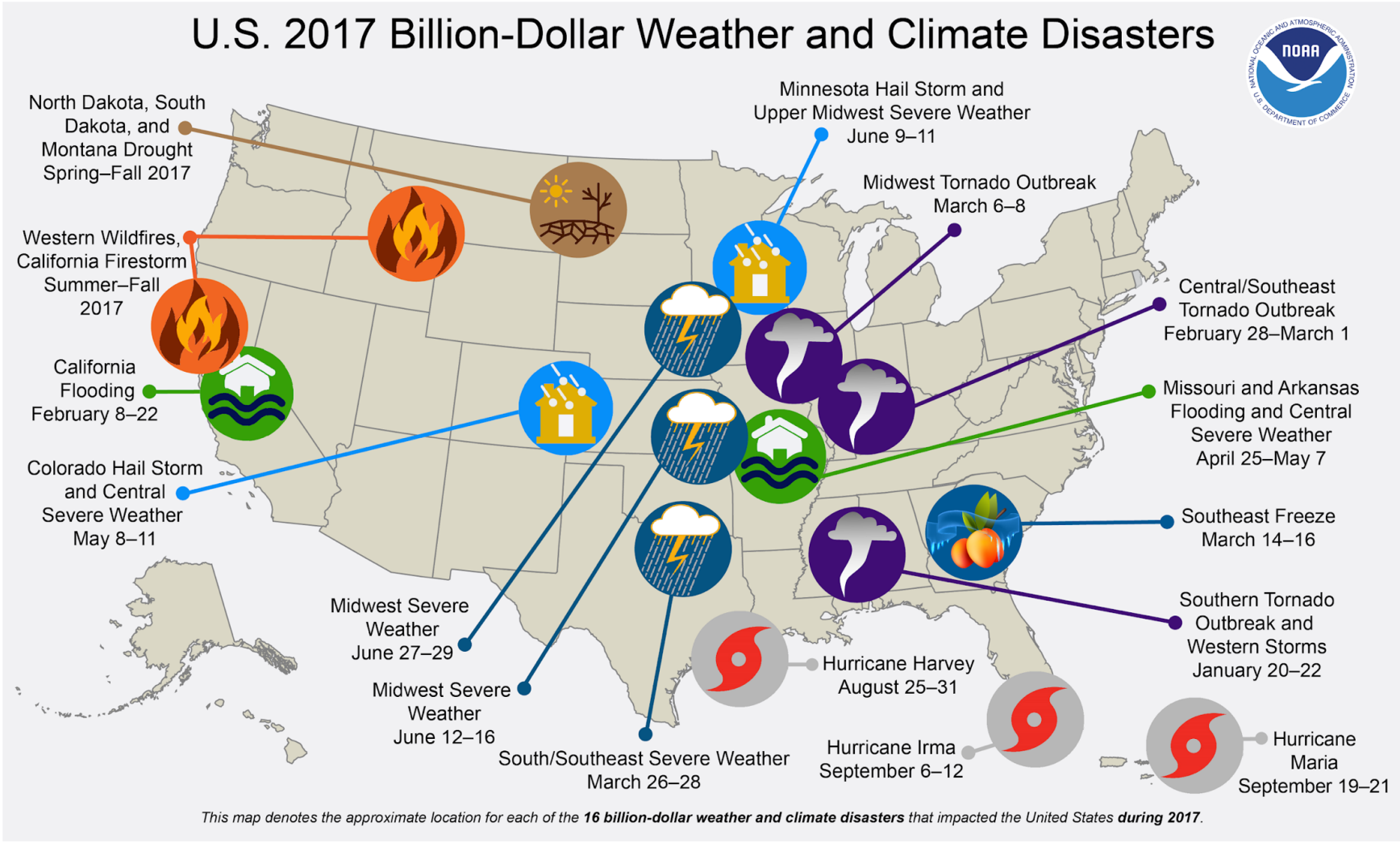
Macro-Economic Model

Climatic Model



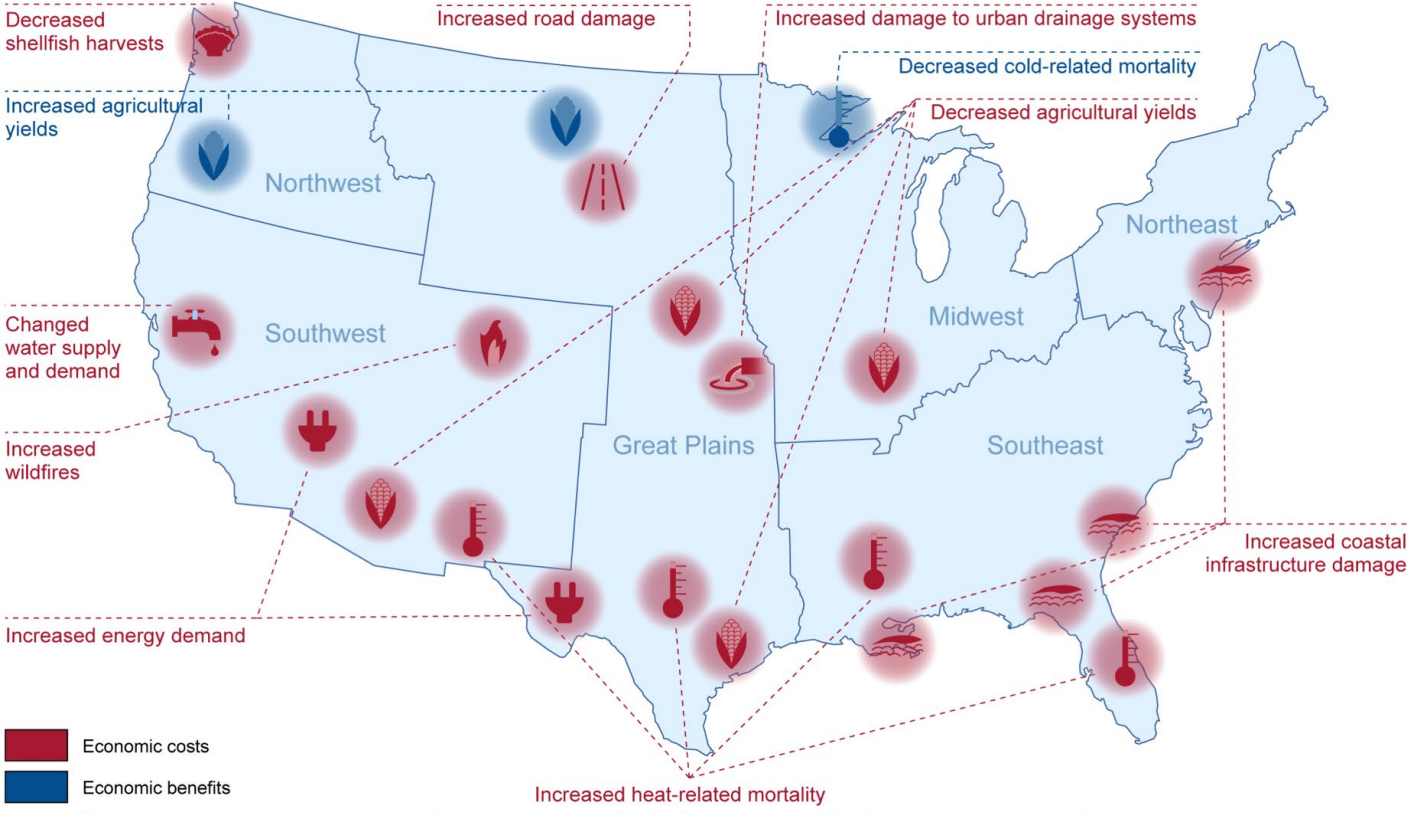

Micro-Economic Model

Risk Model




https://www.eesi.org/papers/view/fact-sheet-strengthening-financial-resilience-to-climate-change

# Example of CC impacts on the Real Economy




Sources: GAO analysis of Environmental Protection Agency, *Climate Change Impacts in the United States: Benefits of Global Action* (Washington, D.C.: 2015), and Solomon Hsiang et al., "Estimating Economic Damage from Climate Change in the United States," *Science*, vol. 356 (2017); Map Resources (map). | GAO-17-720

**CLIMATE CHANGE:**
**Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure**
GAO-17-720: Published: Sep 28, 2017. Publicly Released: Oct 24, 2017.

# Conclusions

- Improve models is not enough, we must combine them
- Need for inter-disciplinary and multi-disciplinary approaches
- Focus on Impacts

# Thanks

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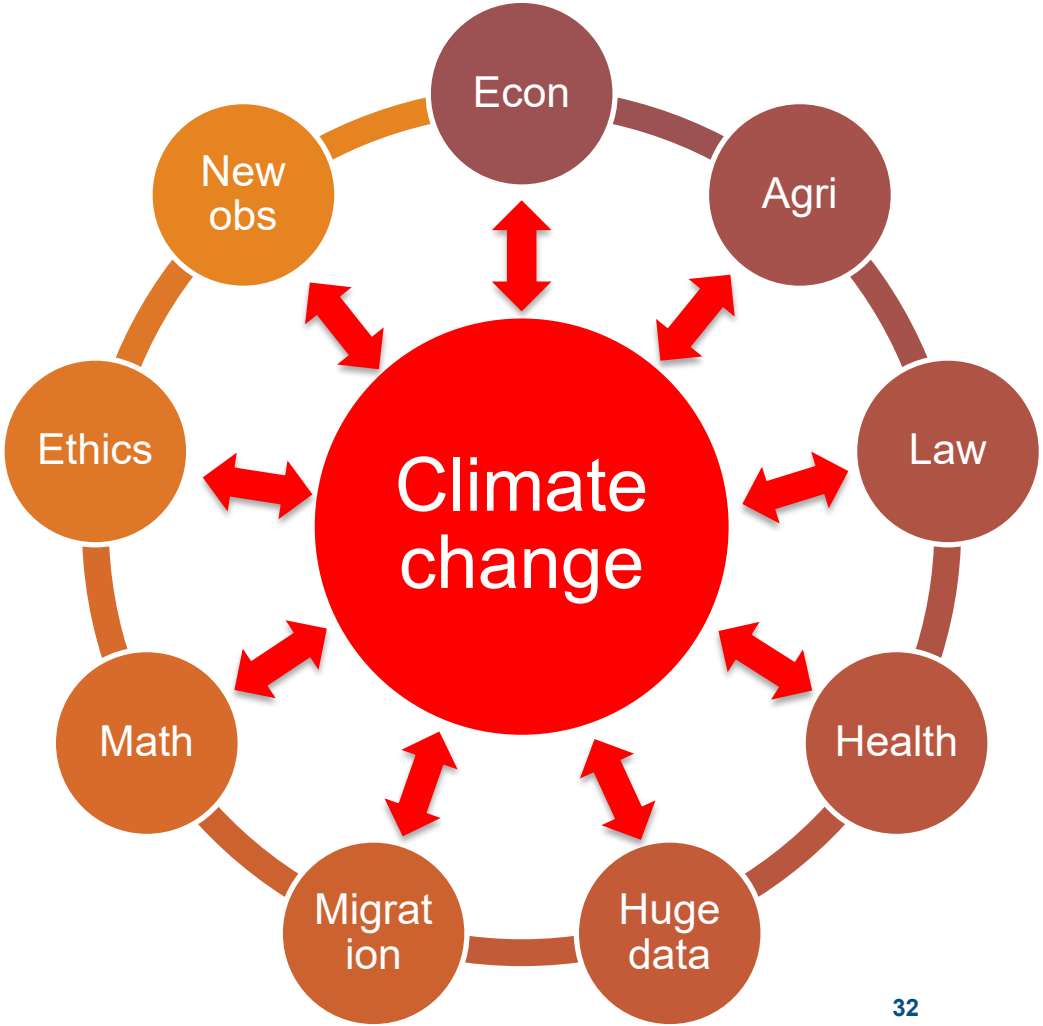
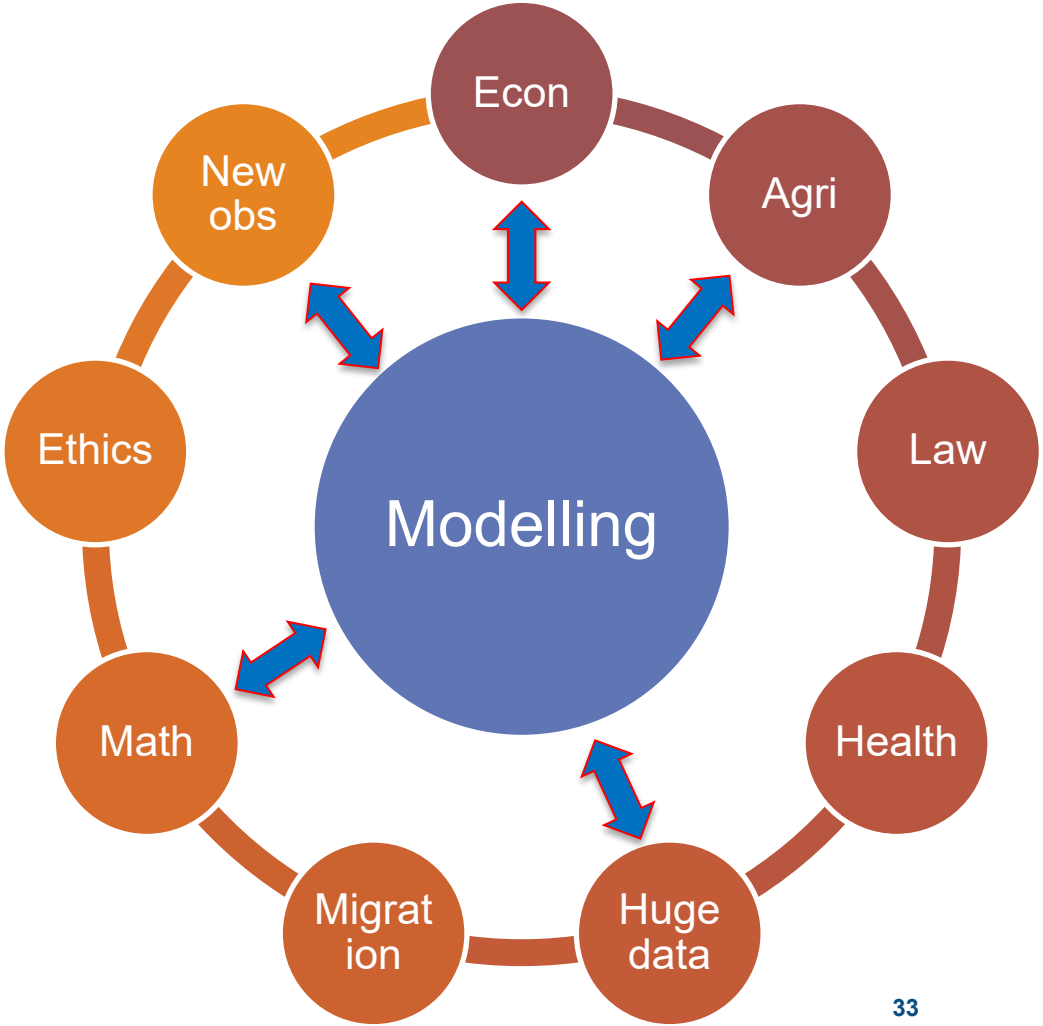
# What are the links?

1) **Climate Change** impacts all these areas



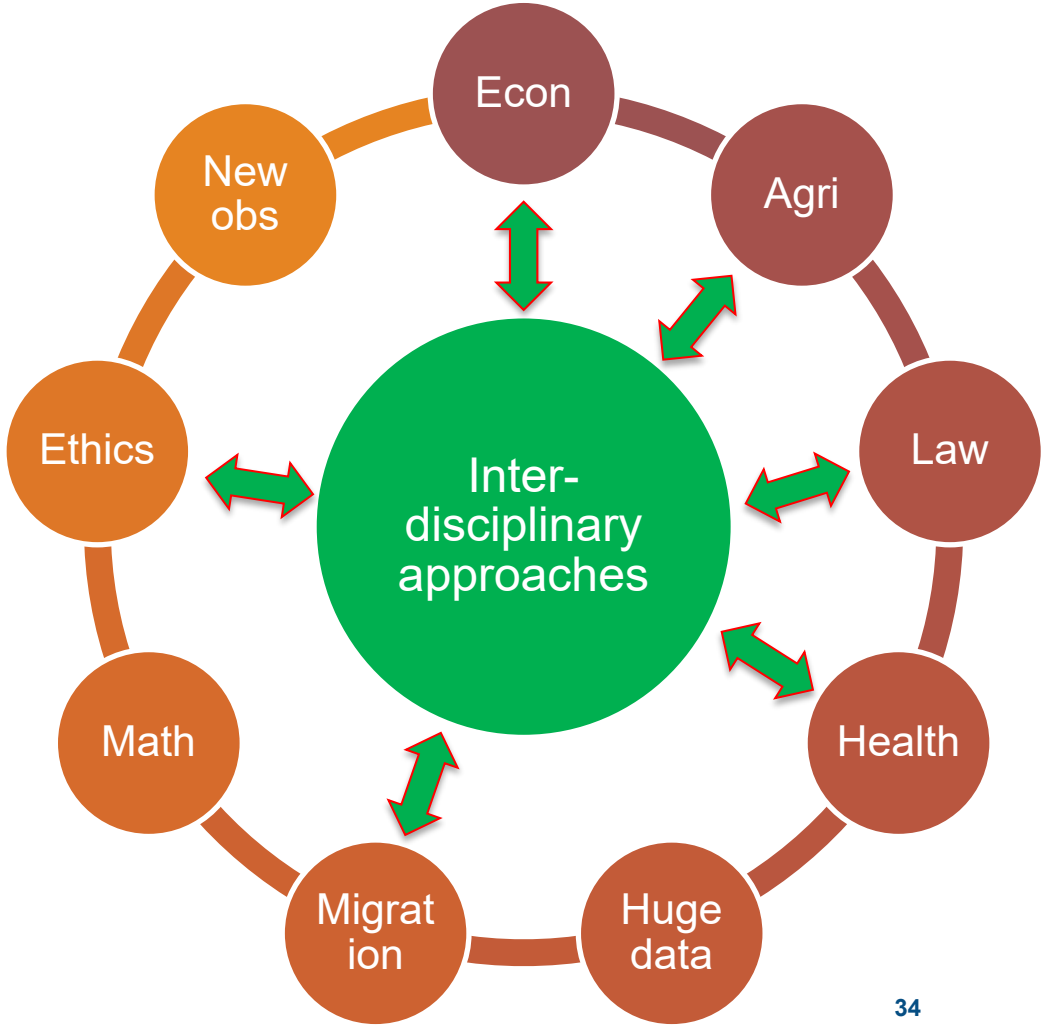
# What are the links?

1) **Climate Change** impacts all these areas
2) **Modelling** can help understanding and assessing future risk



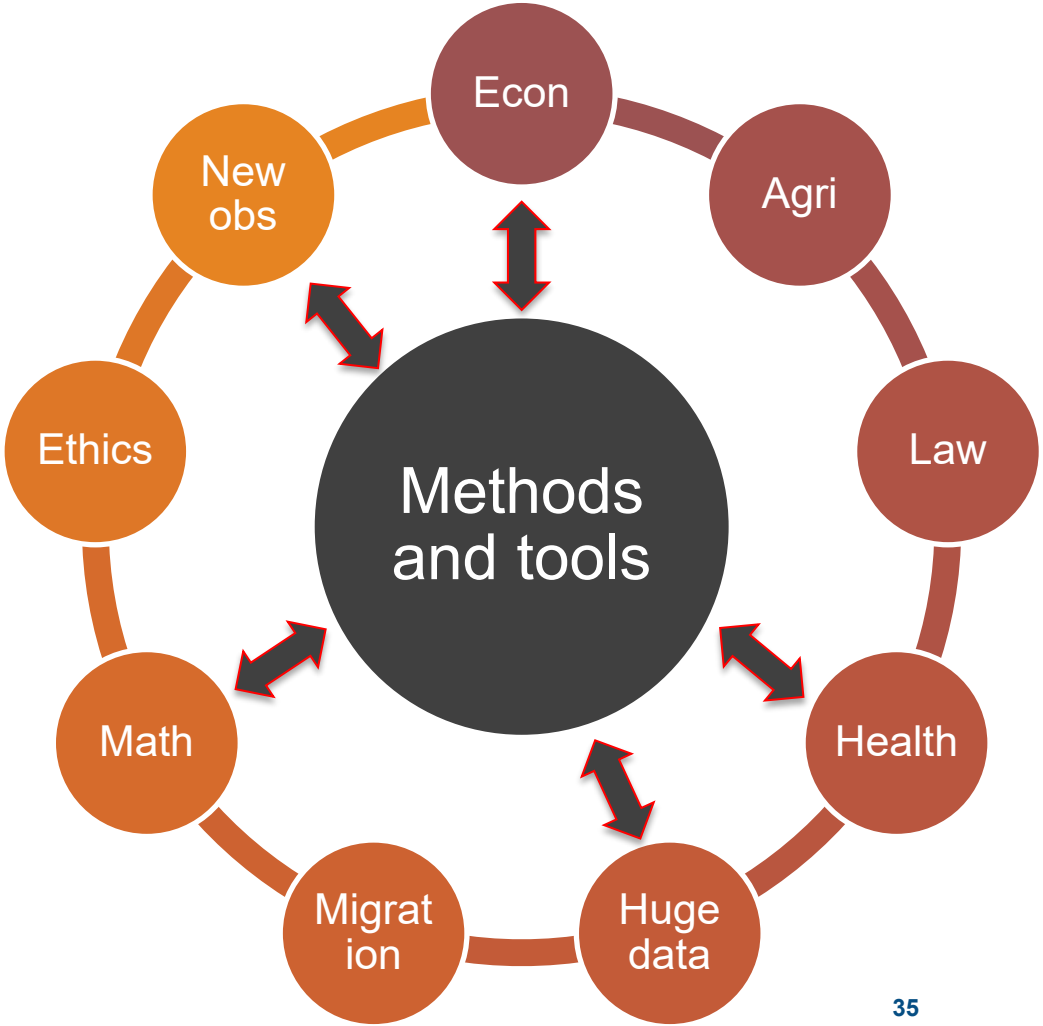
# What are the links?

1) **Climate Change impacts** all these areas
2) **Modelling** can help understanding and assessing future risk
3) Complexity implies that **inter-disciplinary approaches** are required



# What are the links?

1) **Climate Change** impacts all these areas
2) **Modelling** can help understanding and assessing future risk
3) Complexity implies that **inter-disciplinary approaches** are required
4) **Methods and tools** developed in one area could be applied in others



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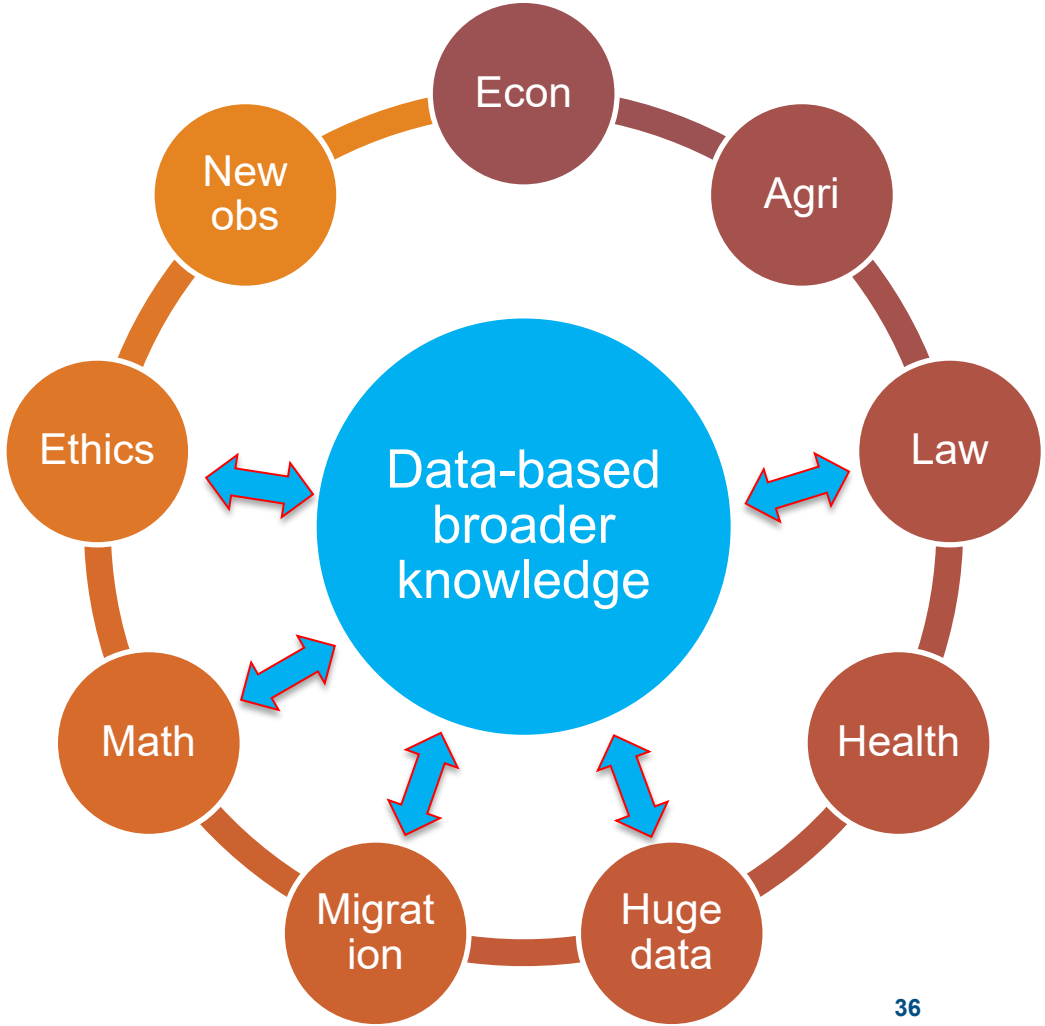
1) **Climate Change** impacts all these areas
2) **Modelling** can help understanding and assessing future risk
3) Complexity implies that **inter-disciplinary approaches** are required
4) **Methods and tools** developed in one area could be applied in others
5) Decision makers need data and **broader knowledge** than before