

# CM 615

## Climate change Impacts & Adaptation

**Risks, Hazards, Exposure, Vulnerability,**

**What are Hazards? Defining Extreme events.**

**How risks, exposure & vulnerability are associated with extreme events?**

**Vulnerability assessment**

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# Risk and Risk management

- The concepts of risk and risk management have in recent years been central to climate change research and practice related to impacts, adaptation, and vulnerability
- **Risk** is defined as the potential for adverse consequence or human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change impacts, risks result from dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system.
- **Risk management** is defined as plans, actions, strategies or policies to reduce the likelihood and/or magnitude of adverse potential consequences, based on assessed or perceived risks
- **Vulnerability** is a component of risk and is defined as the propensity or predisposition to be adversely affected. It encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt

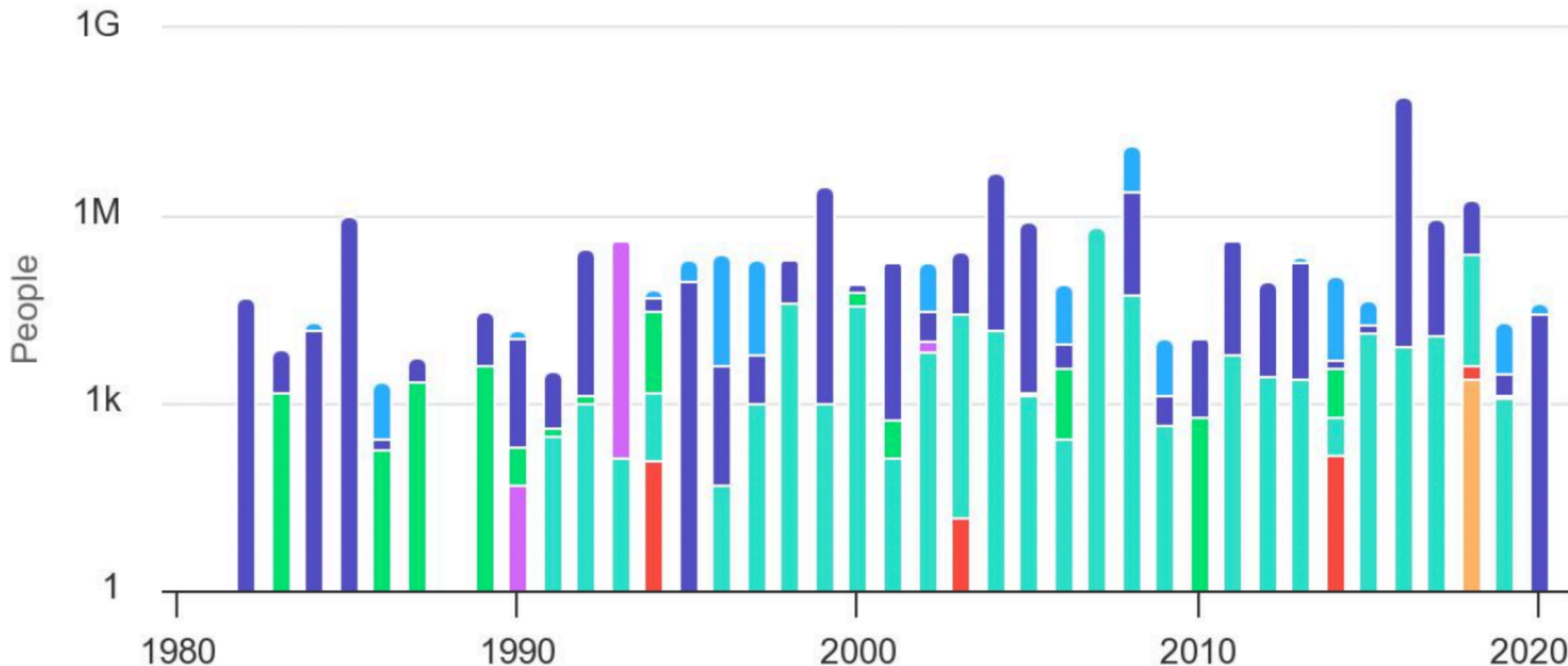
# Risk and Risk management

- **Adaptation** is defined, in human systems, as the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, adaptation is the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects. Adaptation planning in human systems generally entails a process of iterative risk management.
- **Resilience** is defined as the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation



# Key Natural Hazard Statistics for 1980-2020

Number of People Affected



- Flood
- Storm
- Earthquake
- Extreme temperature
- Wildfire
- Drought
- Epidemic
- Landslide
- Volcanic activity

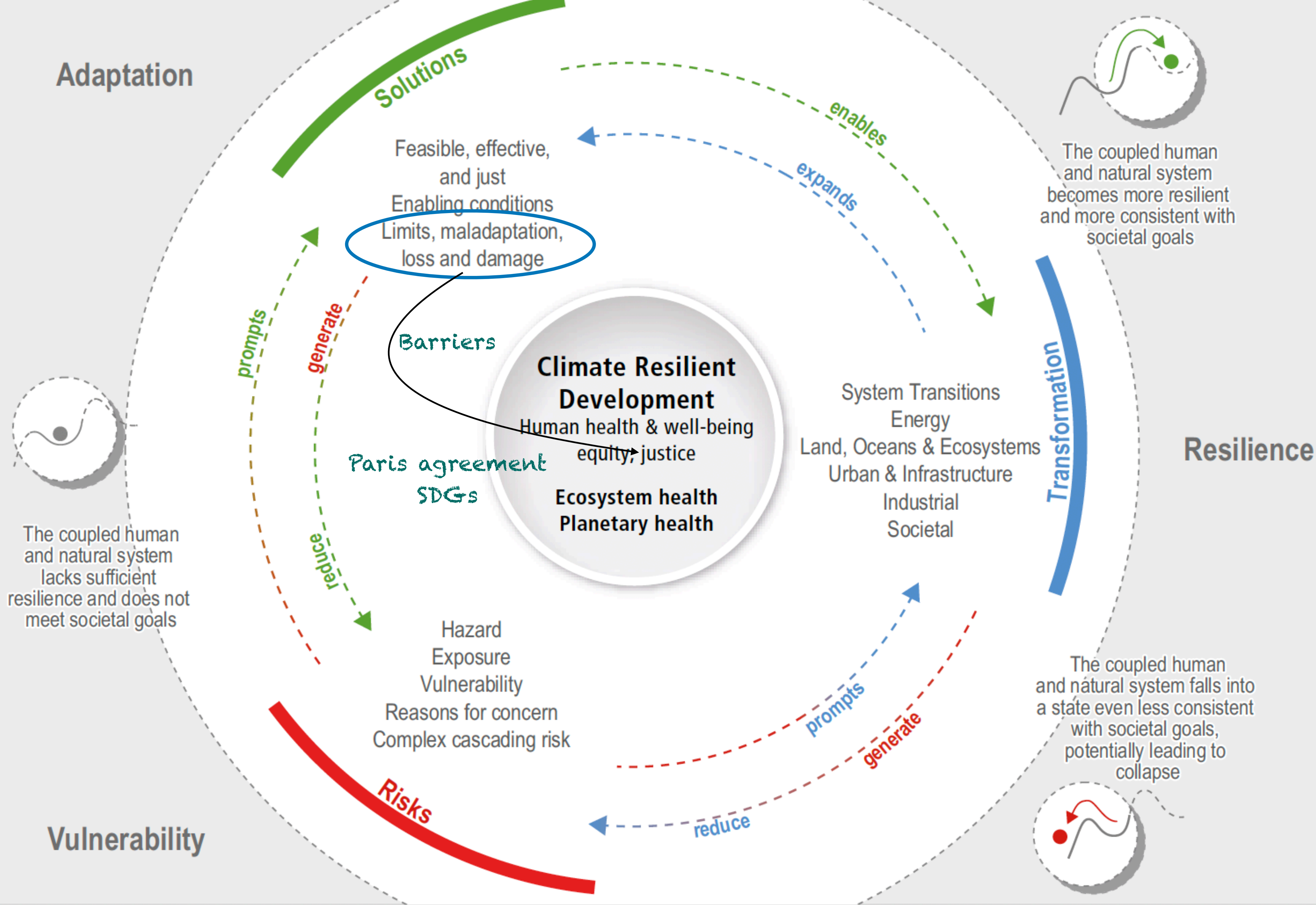
Types:

Hydro-meteorological

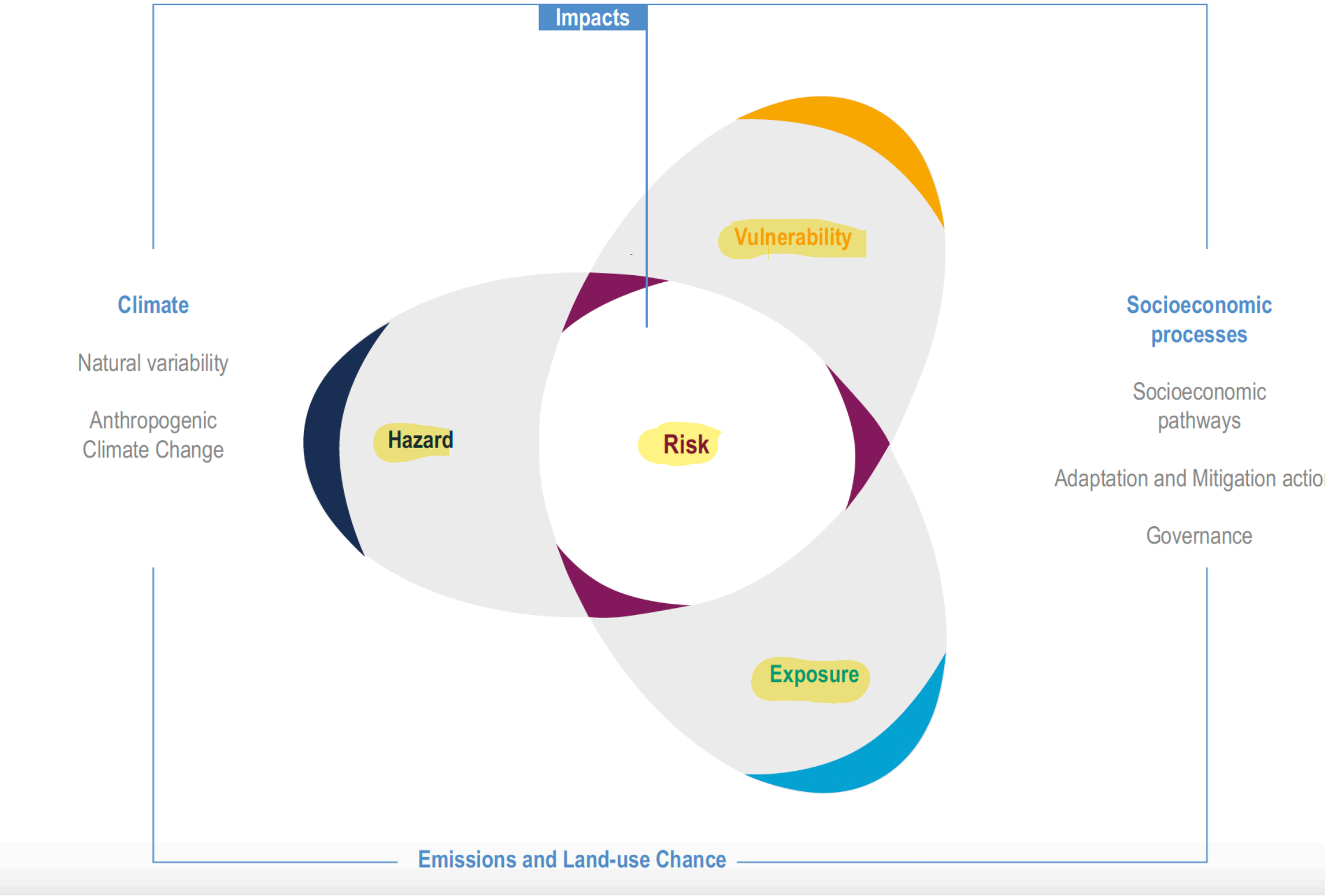
Geophysical

Environmental and  
Socio-economic impacts





(a) The AR5 risk graphic



**Hazard** (e.g., a storm or heatwave) is the potential threat.  
**Exposure** is who/what is in harm's way (people, infrastructure, ecosystems).  
**Vulnerability** is how susceptible those exposed elements are to harm (due to social, economic, or physical factors).

(b) AR6 additions: response risk and complexity

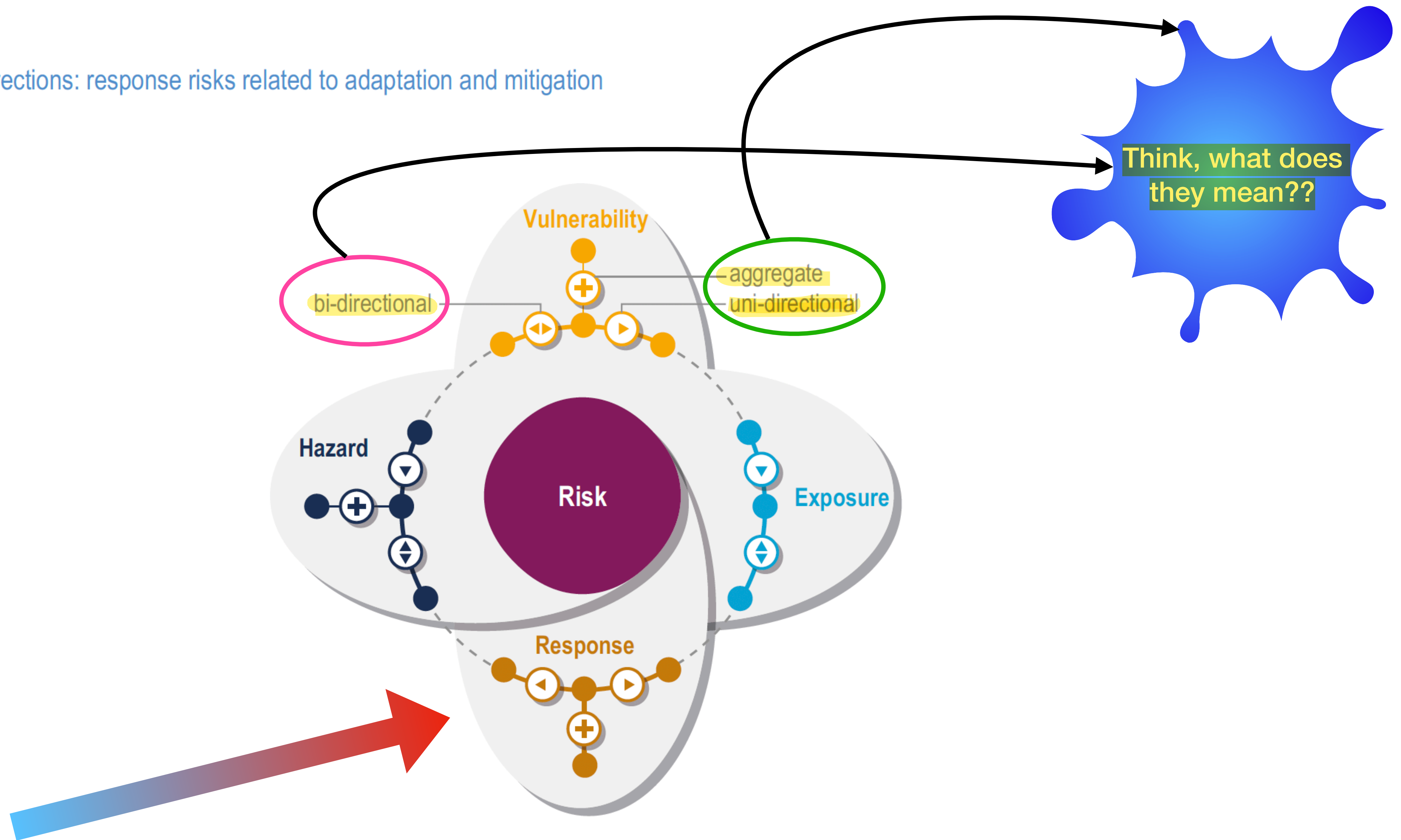




# NOTES

- The framework defines Risk as a function of three interacting factors
  - Hazard – Potential occurrence of a natural or human-induced physical event (e.g., extreme weather, sea level rise).
  - Exposure – The presence of people, livelihoods, species, ecosystems, infrastructure, and economic and social assets in places that could be adversely affected.
  - Vulnerability – The susceptibility of a system (e.g., a community or ecosystem) to harm from exposure to hazards.
- Drivers of Risk: Two key drivers shape these components
  - Climate – Includes natural variability and anthropogenic climate change influencing the nature and intensity of hazards.
  - Socioeconomic processes – Pathways that influence exposure and vulnerability, including:
    - Socioeconomic development
    - Governance structures
    - Adaptation and mitigation actions
- Impacts: The intersection of hazard, exposure, and vulnerability determines the level of risk. Impacts emerge when a hazard affects exposed and vulnerable systems
- Human Influence on Risk: Human activities affect risk through
  - Emissions and Land-use Change – Affecting climate and the frequency/severity of hazards.
  - Socioeconomic pathways – Shaping exposure and vulnerability through population growth, urbanization, infrastructure, governance, and adaptation strategies.
- The explicit framing of risk emphasizes that reducing climate risk requires action on all three components:
  - Reducing vulnerability (through adaptation)
  - Reducing exposure (through better planning and infrastructure)
  - Reducing hazard intensity (through mitigation and emissions reduction)

(c) Future directions: response risks related to adaptation and mitigation





# Extreme events

## Defining them...