Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)

Chapter 4 - Changes in Impacts of Climate Extremes: Human Systems and Ecosystems






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ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

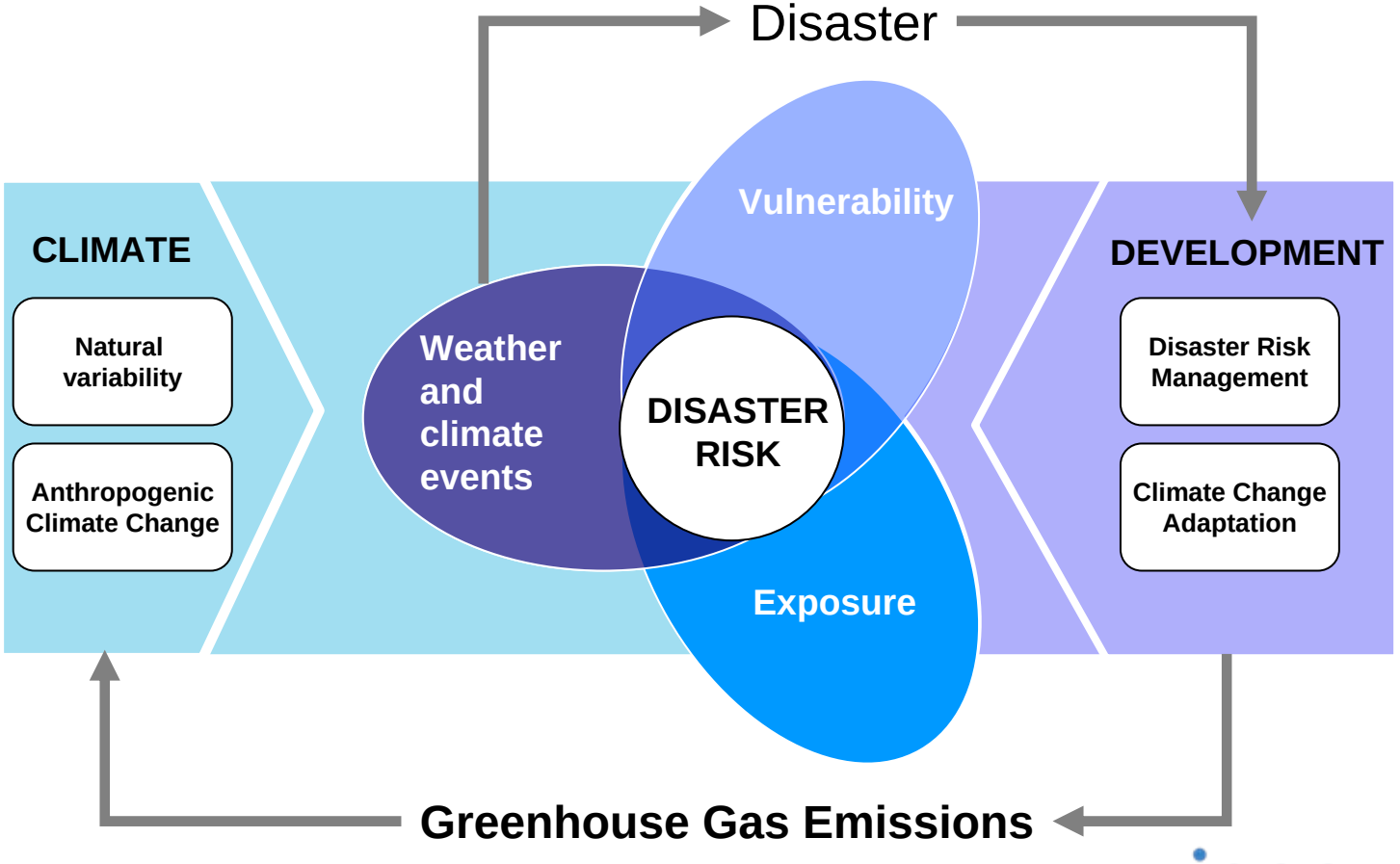
- Assesses exposure, vulnerability and impacts by sector and by IPCC regions
- the costs of climate related disasters
- the uncertainty of major conclusions.






3 Coordinating Lead Authors, **9** Lead Authors, **22** Contributing Authors, **2** Review Editors. About **3,500** reviewer comments (out of 18,611 for the whole report.)

Chapter 4 - Examines the intersection of weather and climate events with exposure and vulnerability (population, assets & ecosystems)



Extreme impacts can result from extreme weather and climate events, but can also occur without extreme events.

Increase impacts may come from:

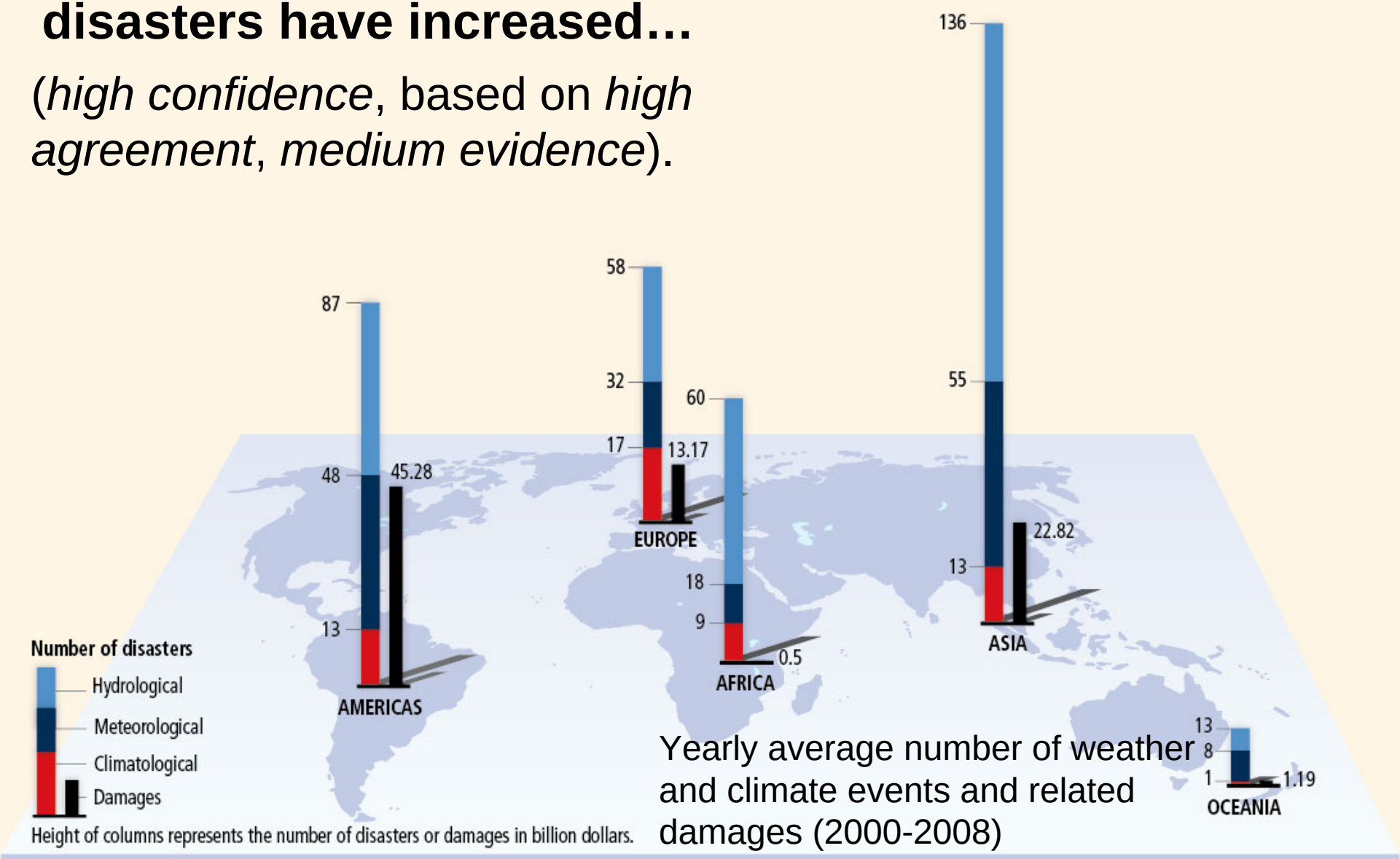
- **increase in hazard** (as assessed by Ch. 3)
- **increase in exposure, or**
- **increase in vulnerability**

Settlement patterns, urbanization, have all influenced observed trends in exposure and vulnerability to climate extremes (high confidence)

Between 1970 and 2008, 95% of deaths from natural disasters occurred in developing countries

Economic losses from weather- and climate-related disasters have increased…

(*high confidence*, based on *high agreement*, *medium evidence*).



Yearly average number of weather and climate events and related damages (2000-2008)

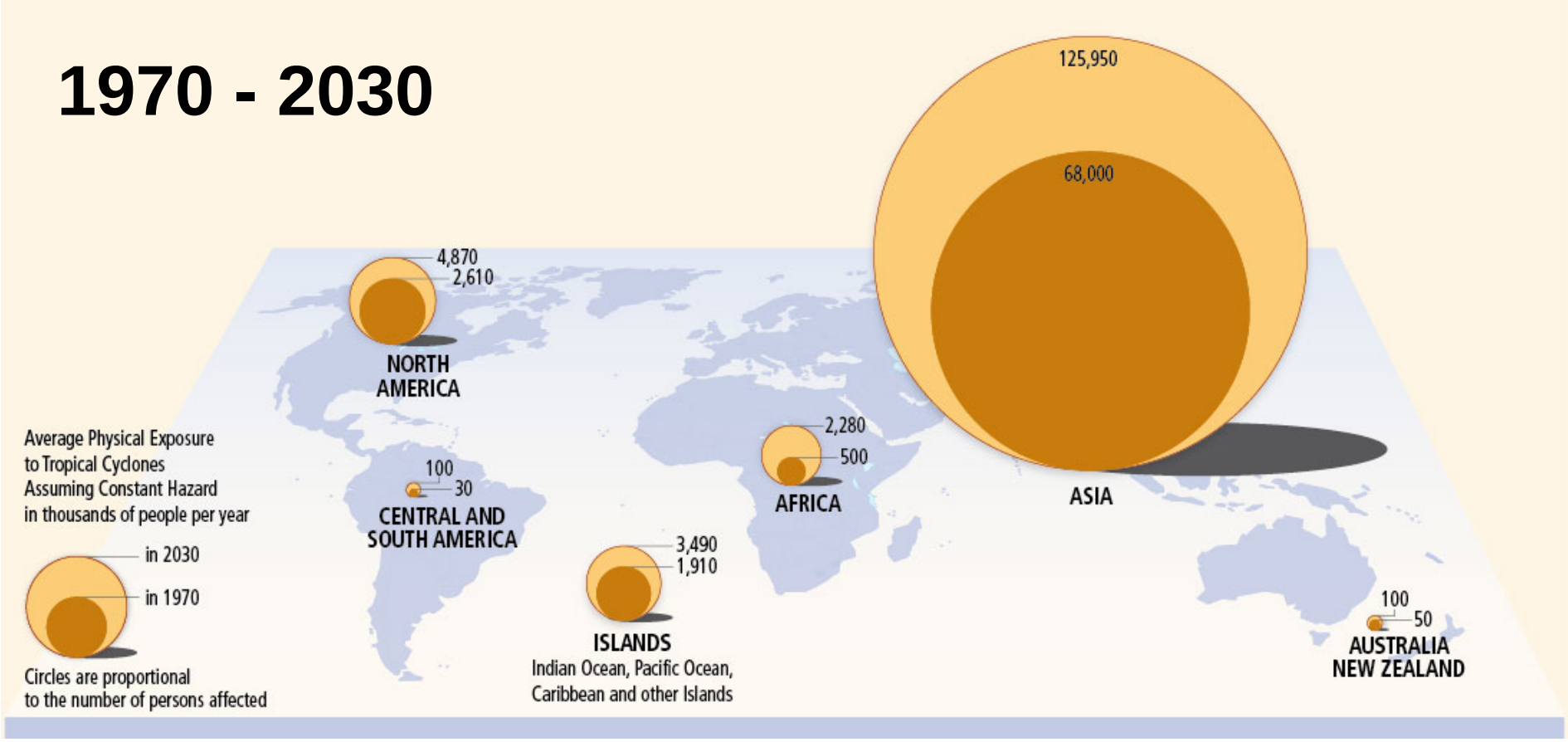
…but with large spatial and inter-annual variability

- Globally rose from few billions in the 1980' to above **200 billions** per year (in 2010 US$).
- Economic losses in percentage of GDP (2001-2006):

- 0.3% in low-income countries.
- 1% in middle income countries,
- 0.1% in developped countries,
- 1% in SIDS up to 8 % in extreme case.

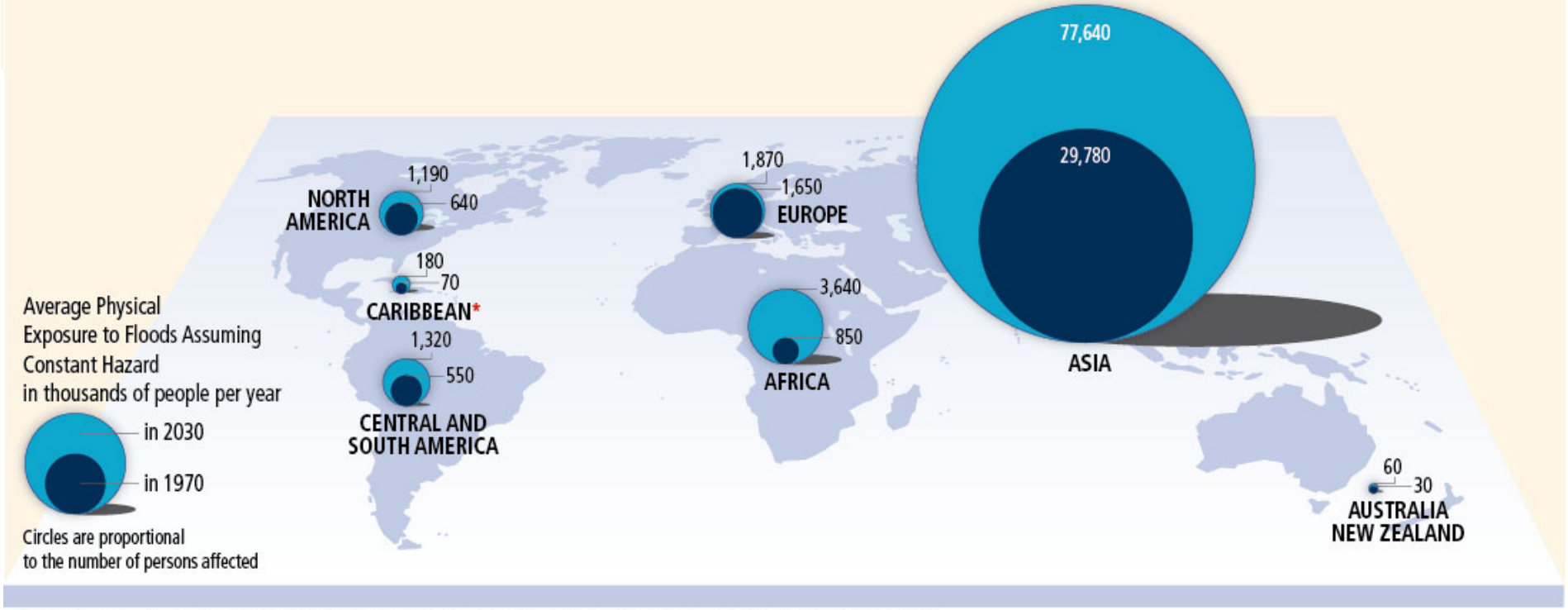
- **Most of the increase is due to increase in exposure (high confidence), but role of climate change has not been excluded (high agreement, medium evidence)**

Human exposure to tropical cyclones



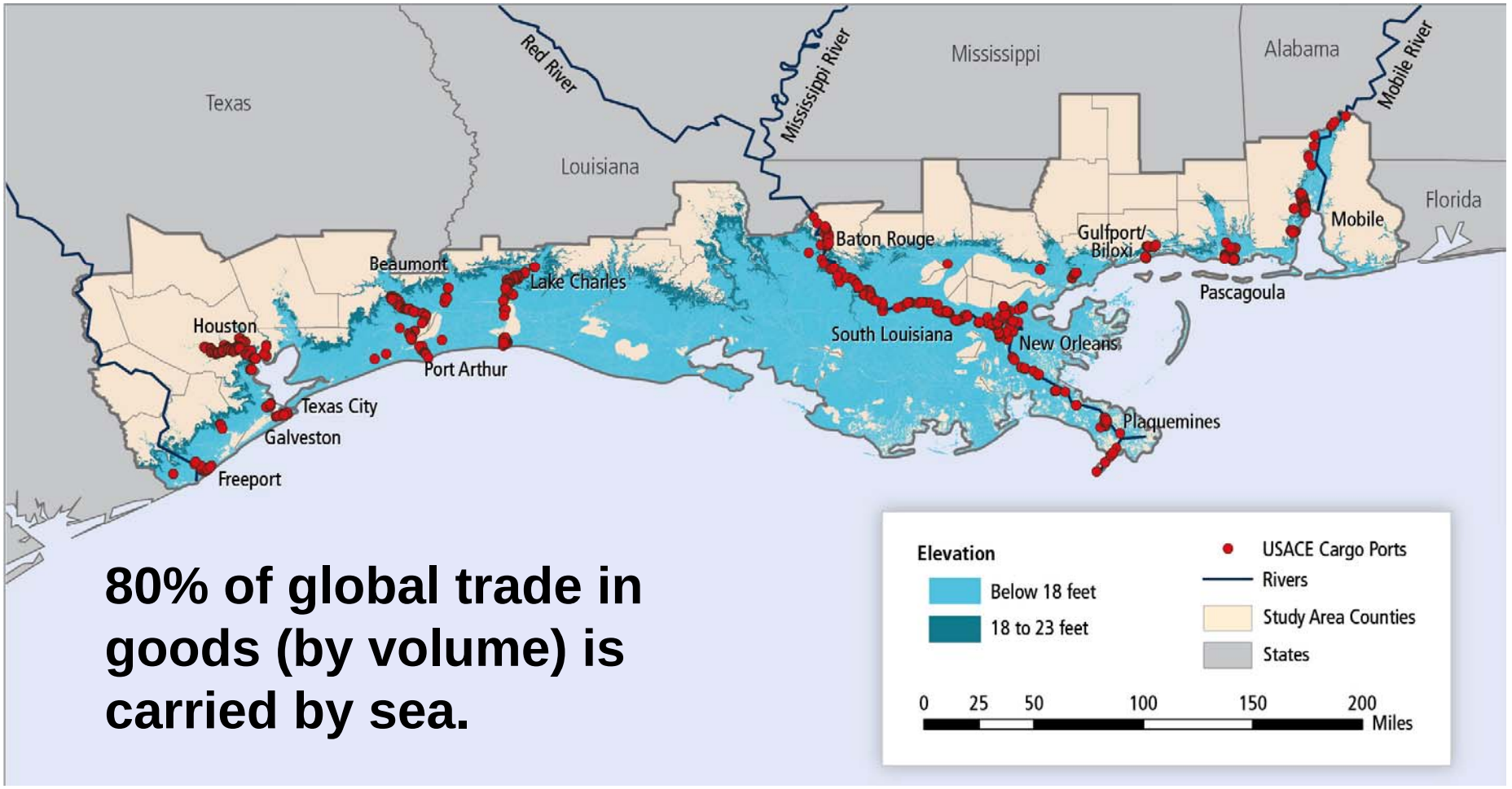
Human exposure to floods

1970 - 2030



*Only catchments bigger than 1,000 km^2 were included in this analysis. Therefore, only the largest islands in the Caribbean are covered.

Coastal settlements are exposed and vulnerable to climate extremes events & sea level rise.



80% of global trade in goods (by volume) is carried by sea.

Freight-handling port facilities at risk from storm surge of 5.5 and 7 m on the US Gulf Coast. Adapted from CCSP, 2008.

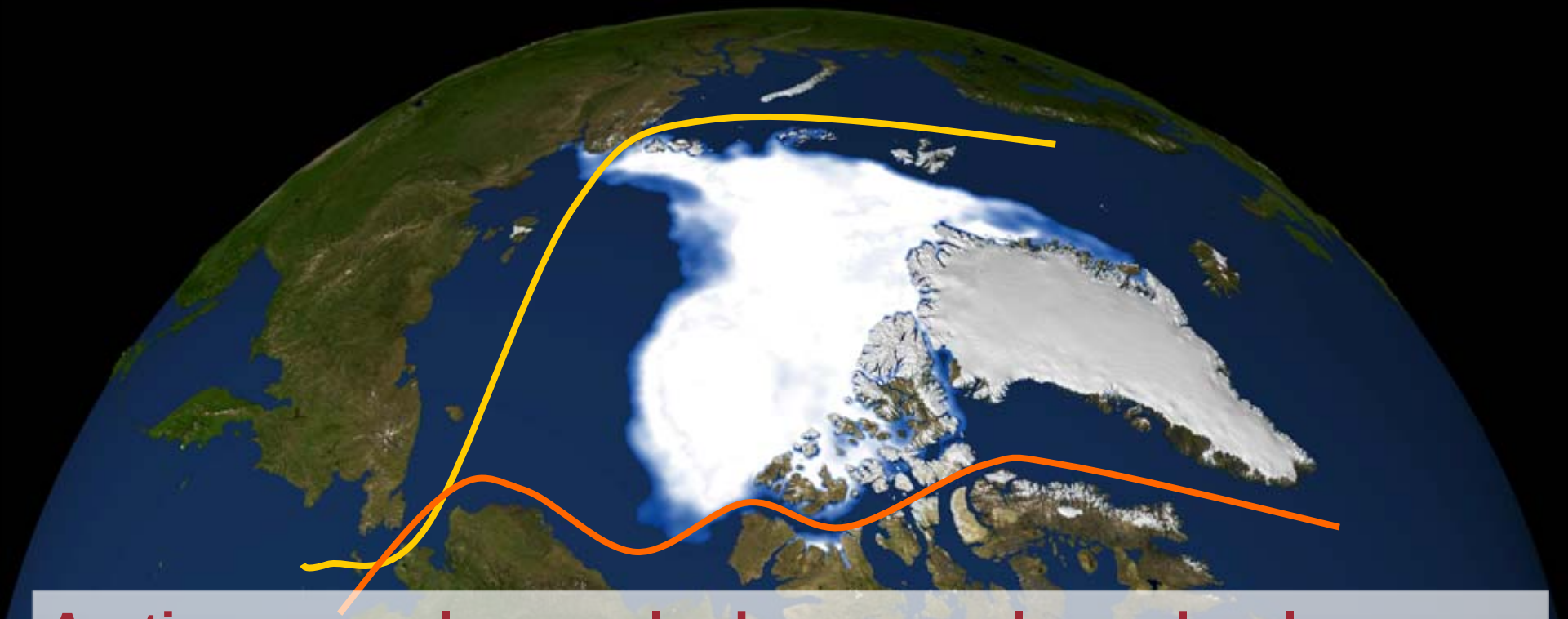
Transport infrastructure is vulnerable to extremes in temperature, precipitation/river floods, and storm surges.

permafrost thaw, reduced
to buildings.

ny existing buildings,
d industrial facilities are

Arctic ice retreat: new shipping road(s)

2007



Arctic mammals as polar bears, seals, and walruses depend on sea ice for habitat, hunting, feeding, and breeding. Declining sea ice can decrease polar bear numbers.

Ecosystems impacts

One of the most well-known biological impacts of warming is coral bleaching, but ocean acidification can also affect coral growth rates.

(1) warming of the surface ocean,
(2) ocean acidification
(3) reduction in oxygen concentration
All have potentially nonlinear multiplicative impacts on biodiversity and ecosystem function, and each may increase the vulnerability of ocean systems, triggering an extreme impact

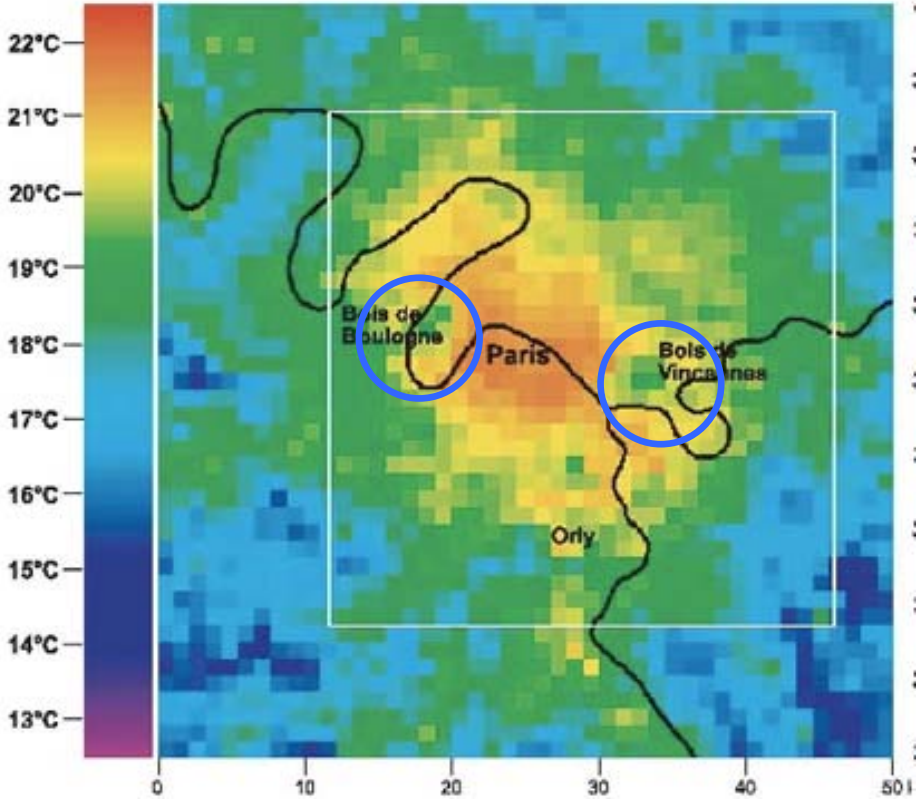
Drought can be a factor contributing to human-ignited forest fires, which can lead to widespread deforestation and carbon emissions (p.252)

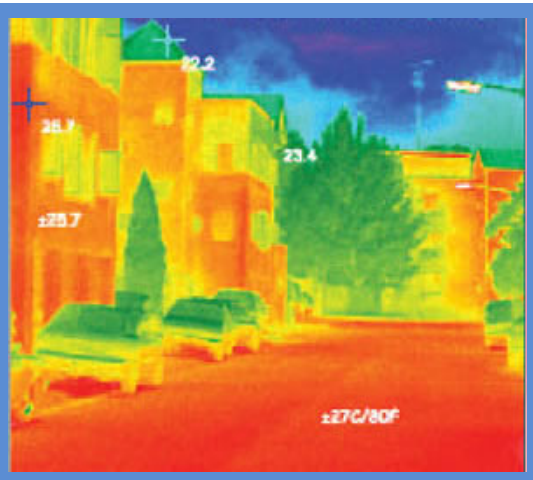
Deforestation

Due to the interrelated nature of forest fires, deforestation, drought, and climate change, isolating one of the processes fails to describe the complexity of the interconnected whole.

Urban heat islands

- Urban heat islands pose an additional risk
- Lack of green open areas in some parts of the cities may exacerbate heat load during heat waves.

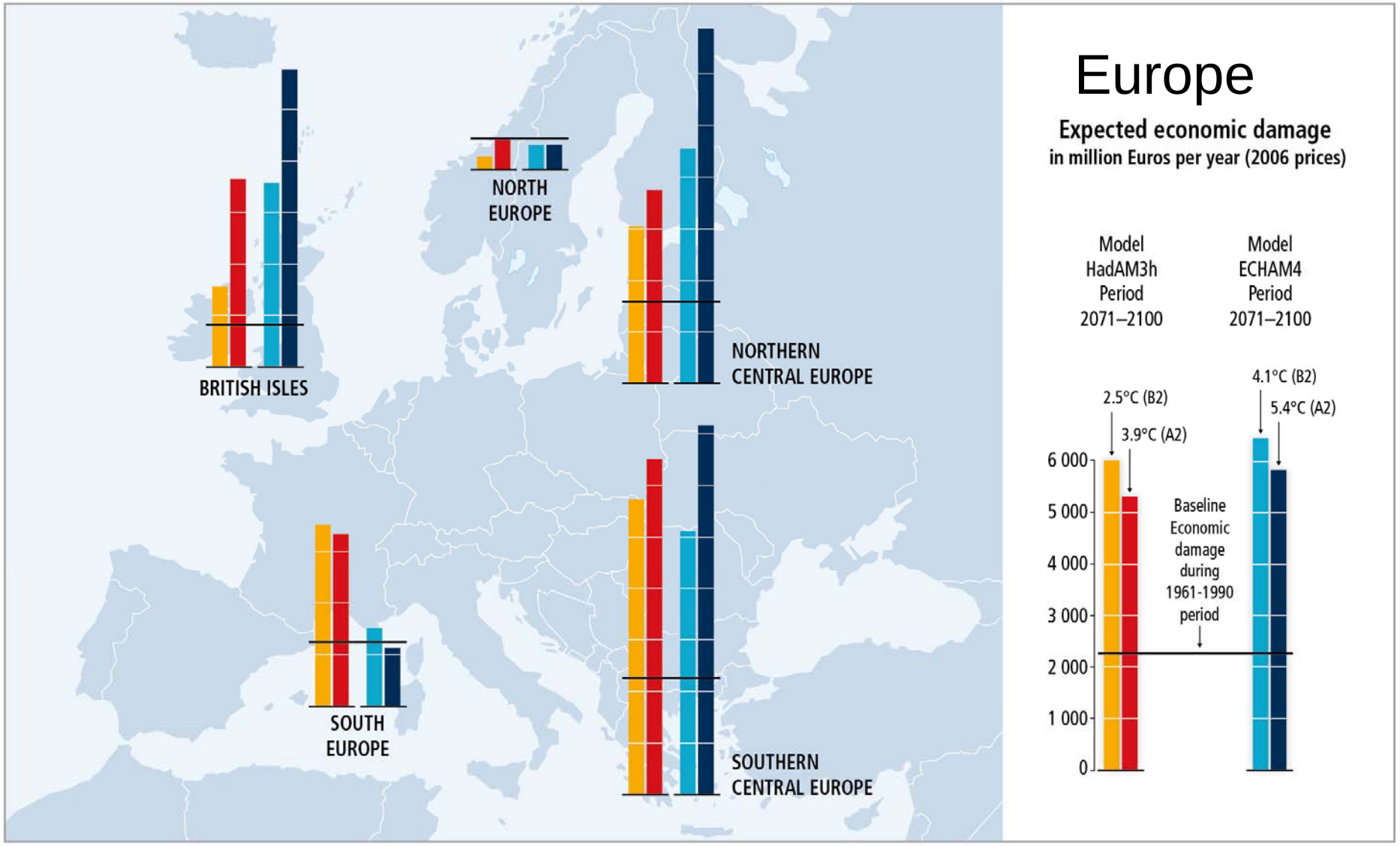




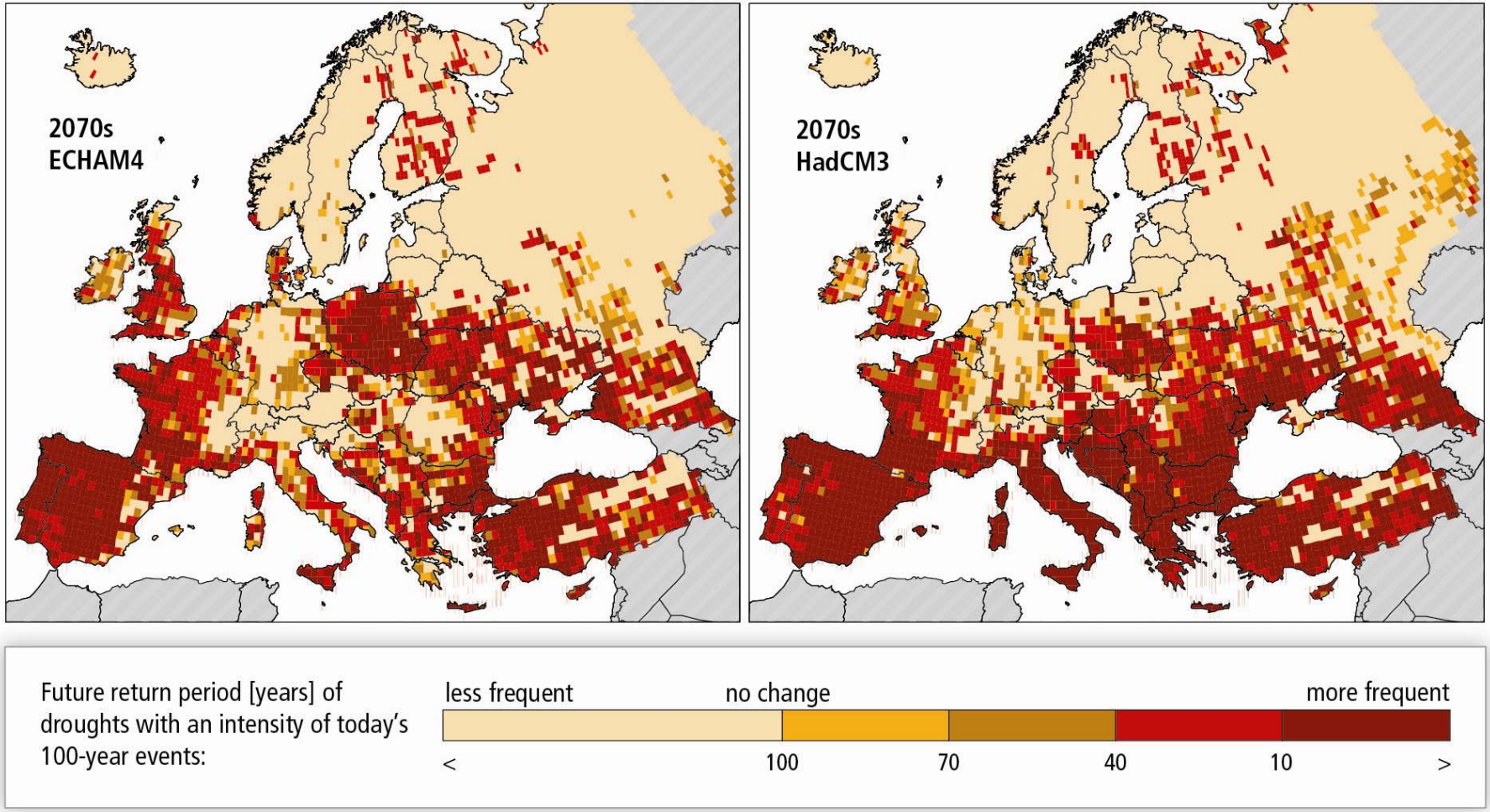
Decline of ecosystems

- Slope failure can affect settlements in tropical mountainous areas, particularly in deforested areas and hilly areas and especially following heavy prolonged rain.
- There is consensus on the important role of ecosystems in risk reduction and well-being, which would make the value of ecosystem services an integral part of key policy decisions associated with adaptation.

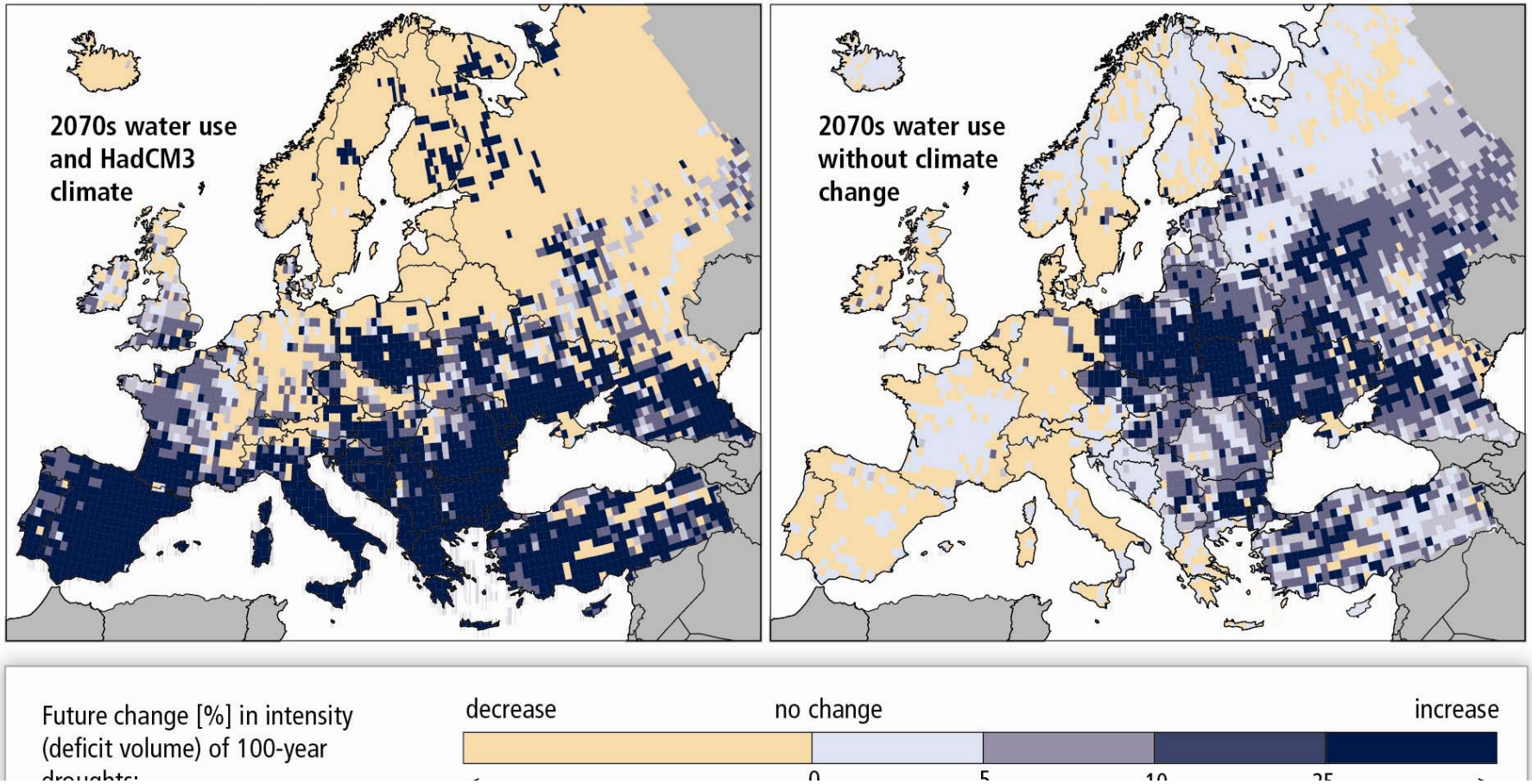
Expected economic losses from Floods



Drought will be more frequent in parts of Europe



Drought will be more intense in parts of Europe



Evidence that the current warming trends around the world have already begun to impact agriculture

Energy sectors will be impacted by drought

Severe droughts may also affect the supply of cooling water to nuclear power plants

Water

Glacier recession reduces the buffering role of glaciers, hence inducing more floods during the rainy season and more water shortages during the dry season. And in some regions place additional threat to water supply.

Impacts on tourism

1. **Direct impacts** on tourist infrastructure (hotels, access roads, etc.), on operating costs (heating/cooling, snowmaking, irrigation, food and water supply, evacuation, and insurance costs), on emergency preparedness requirements, and on business disruption (e.g., sun-and-sea or winter sports holidays);
2. **Indirect environmental change impacts** of extreme events on biodiversity and landscape change (e.g., coastal erosion), which may negatively affect the quality and attractiveness of tourism destinations; and
3. **Tourism-adverse perception** of particular touristic regions after occurrence of the extreme event itself. For example, adverse weather conditions or the occurrence of an extreme event can reduce a touristic region's popularity among tourists during the following season.

Tourism

Ski: areas currently on the edge of the snow limit may have limited alternatives.
Some ski resorts will be able to adapt using snowmaking.

Conclusions

- **Extreme events will have greater impacts on sectors with closer links to climate, such as water (*high confidence)*, agriculture and food security, transportation, health, and tourism.**
- **Greater impacts on small islands, coastal areas and small economies.**
- **High temperature extremes (i.e., heat wave), drought, and floods substantially affect ecosystems. It could result from increases in the frequency of large-scale disturbances due to extreme weather and climate events**

Limitations of attribution studies

Conclusions are subject to a number of limitations which reduce the strength of the evidence:

- **Vulnerability** is a key factor, yet it is not well accounted for in attribution studies.
- **Data availability**, as most data are available for standard economic sectors in developed countries.
- **Type of hazards** studied, for those where confidence in attribution of changes is *low*.
- **Processes used to adjust loss data over time**.
- **Record length**.
- **Confounding factors** some of which increase (movement to the coast) and some decrease (building regs and emergency management) the effects of climate change.

Thank you

Http://ipcc-wg2.gov/SREX/