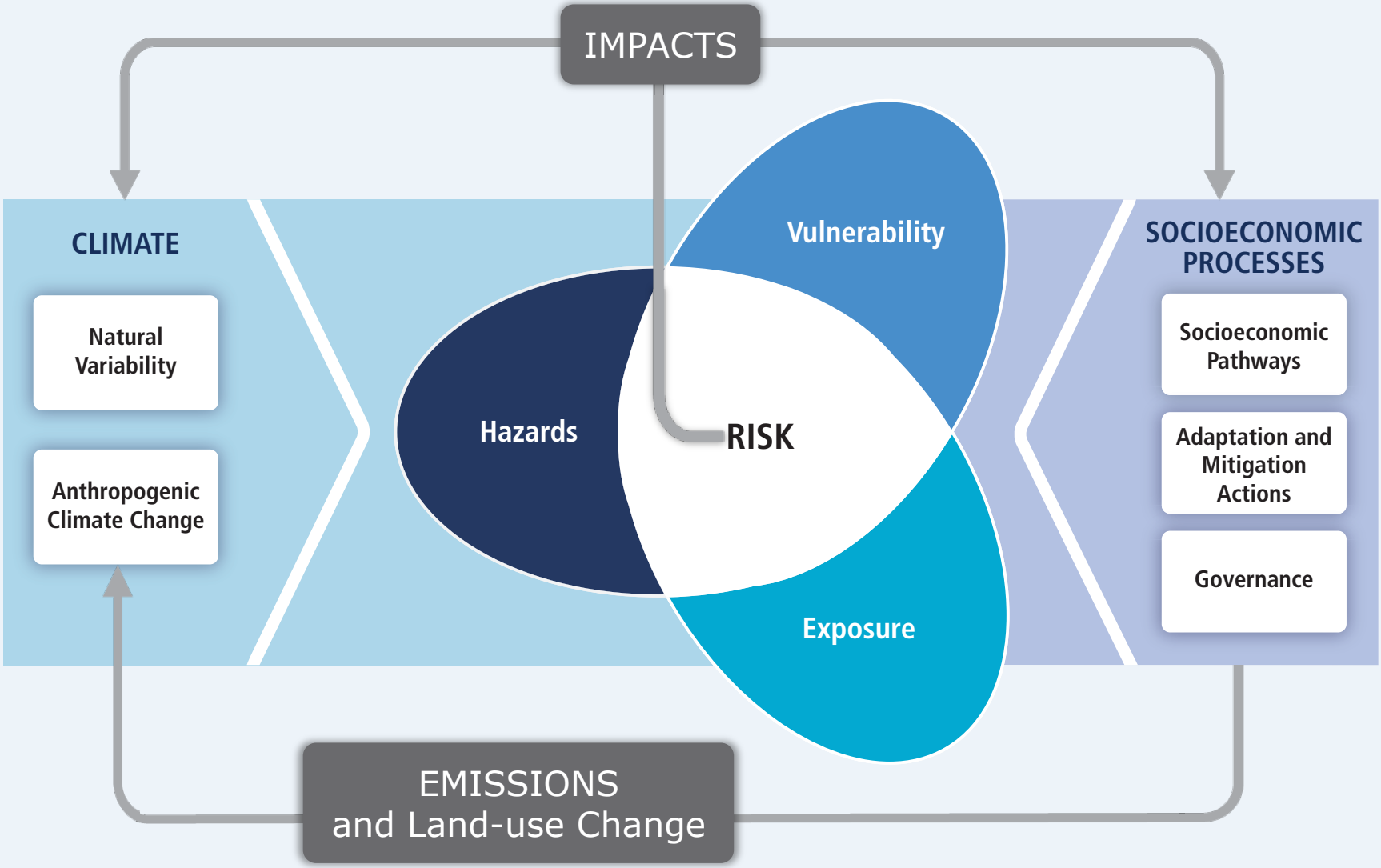
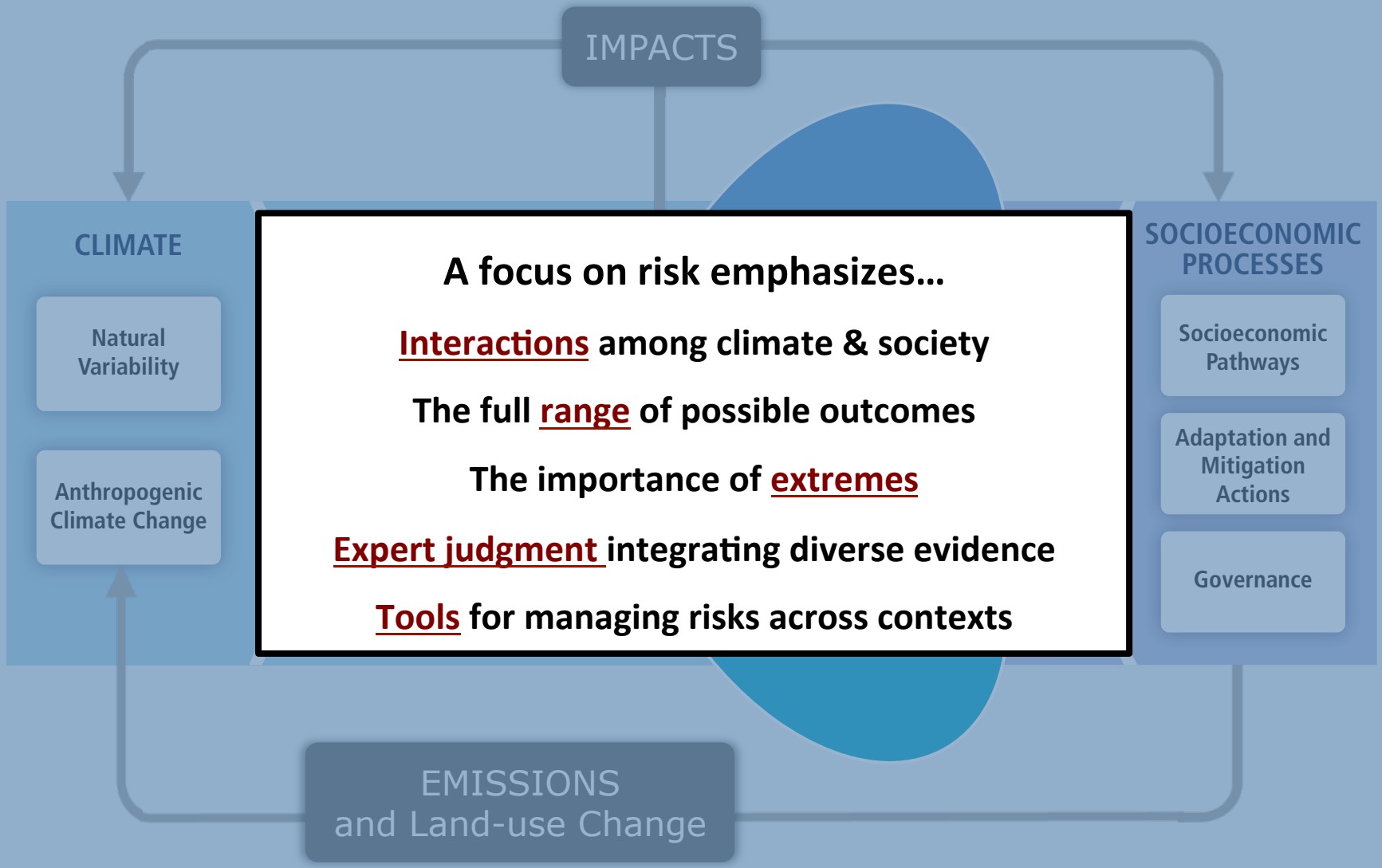
Future directions for global assessment of climate risks

Michael Mastrandrea
Near Zero / Carnegie Institution for Science
with thanks to
Katharine Mach, Chris Field, Patrick Freeman



Based on WGII AR5 Figure SPM.1



A focus on risk emphasizes…

Interactions among climate & society

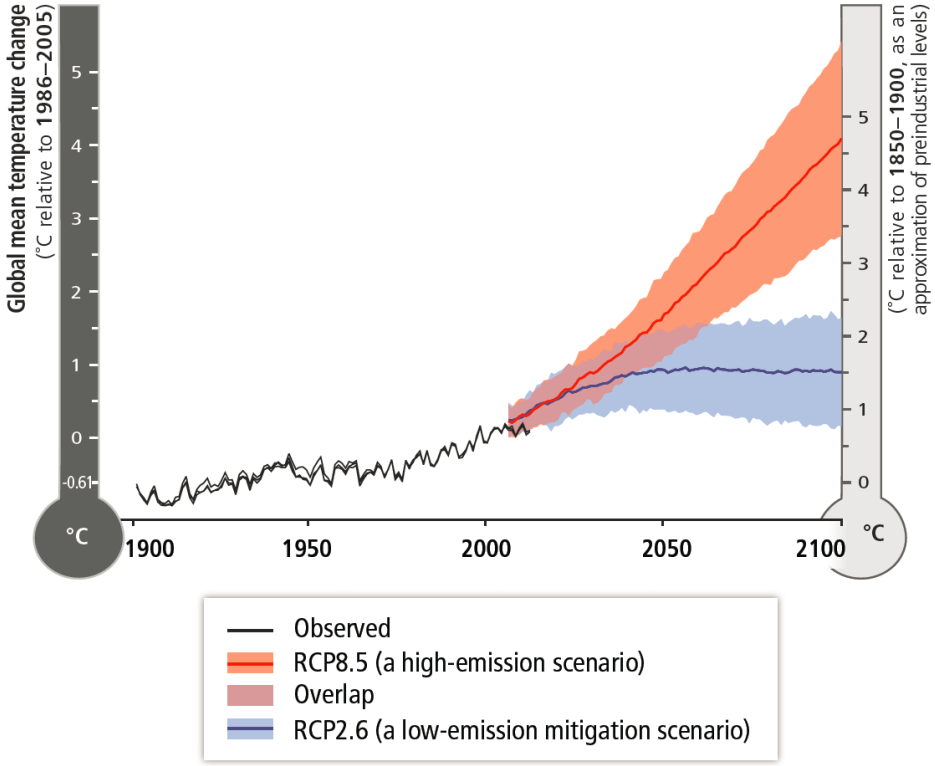
The full range of possible outcomes

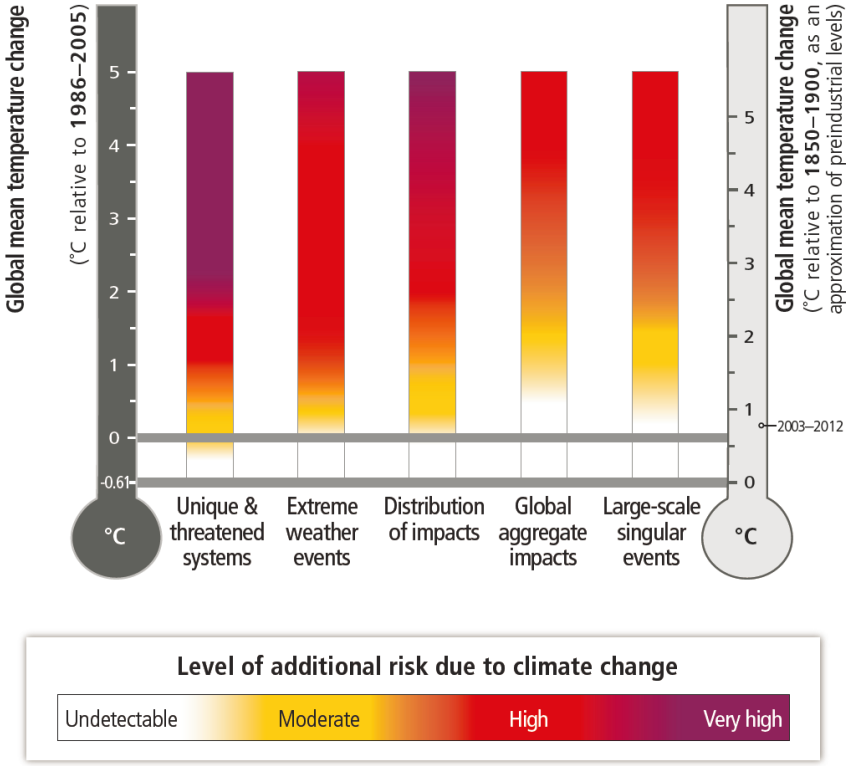
The importance of extremes

Expert judgment integrating diverse evidence

Tools for managing risks across contexts

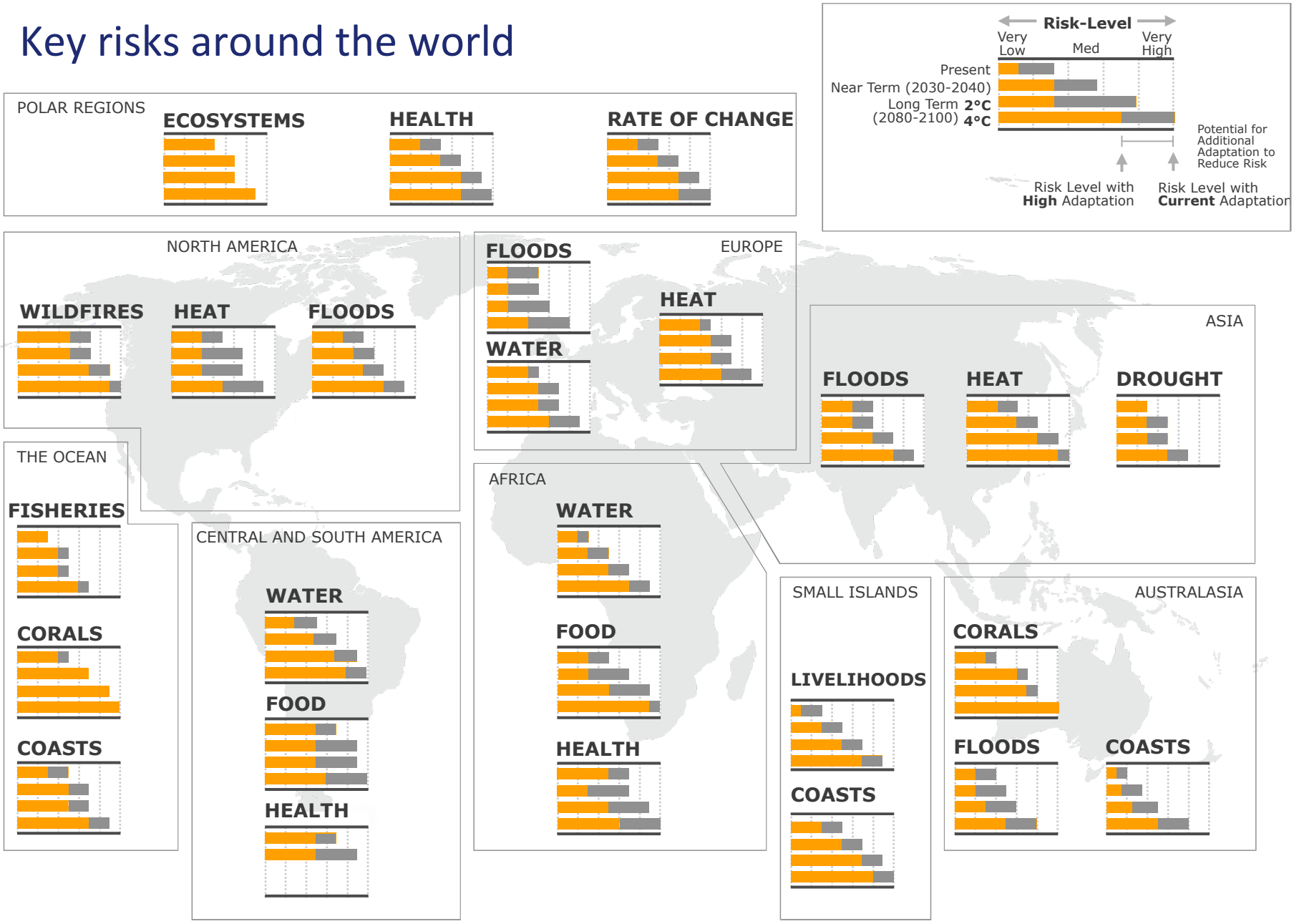
Global perspective on risks





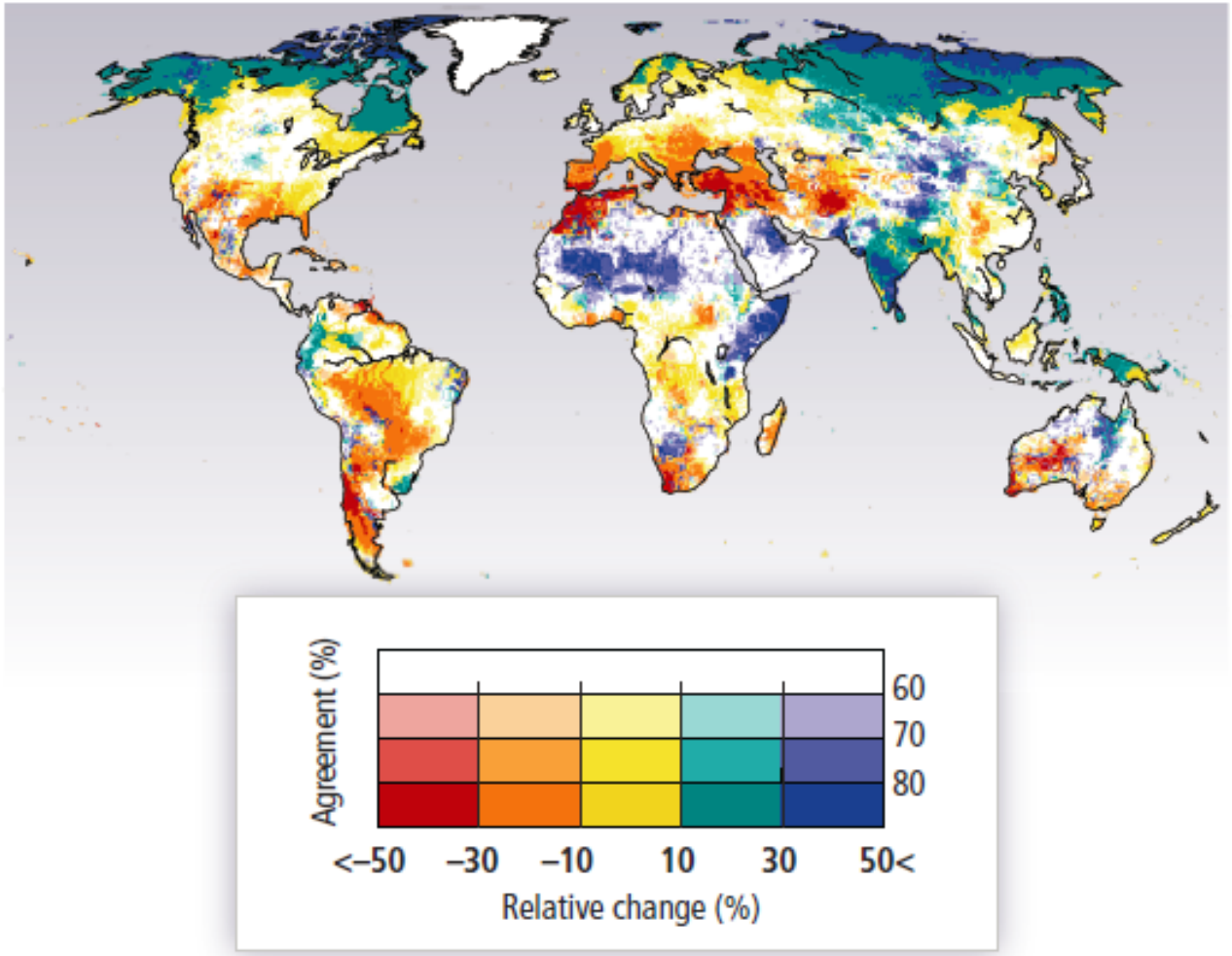
Based on WGII Box SPM 1 Figure 1

Key risks around the world



Based on WGII AR5 Box SPM.2

Water

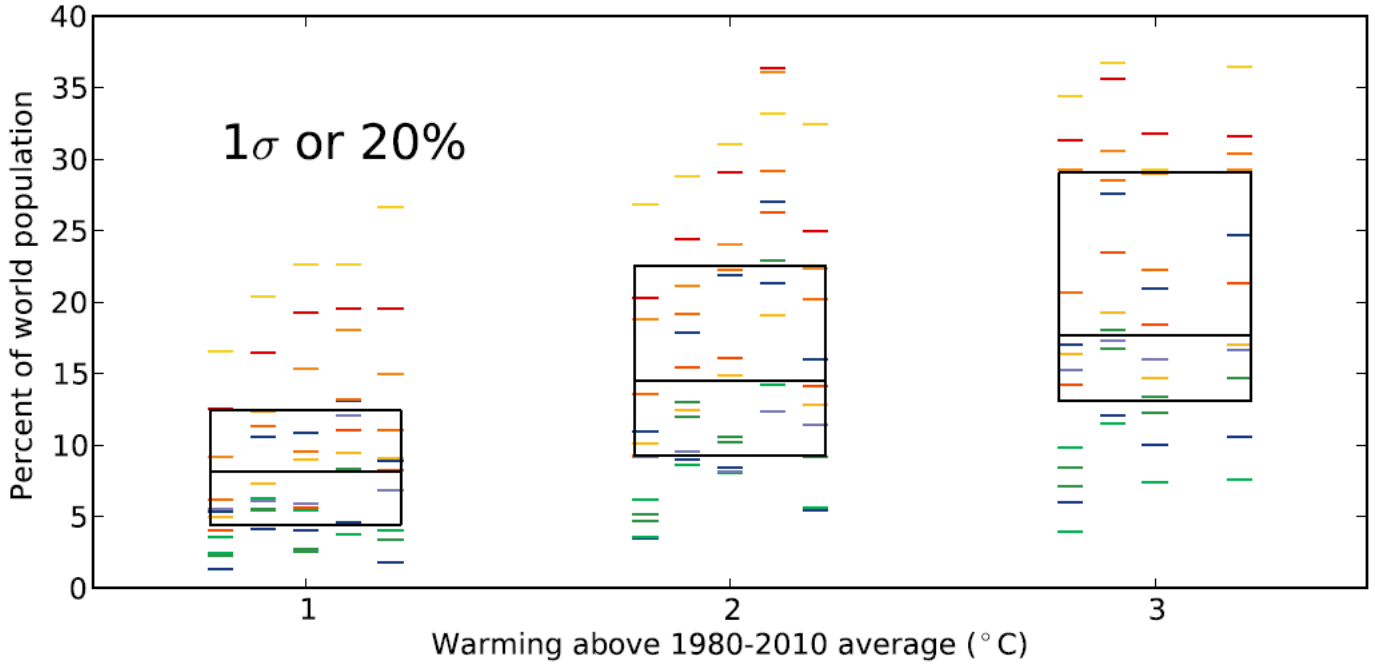


- **Reductions in dry, subtropical regions**
- **Increases at high latitudes**

WGII AR5 Figure TS.6

Water

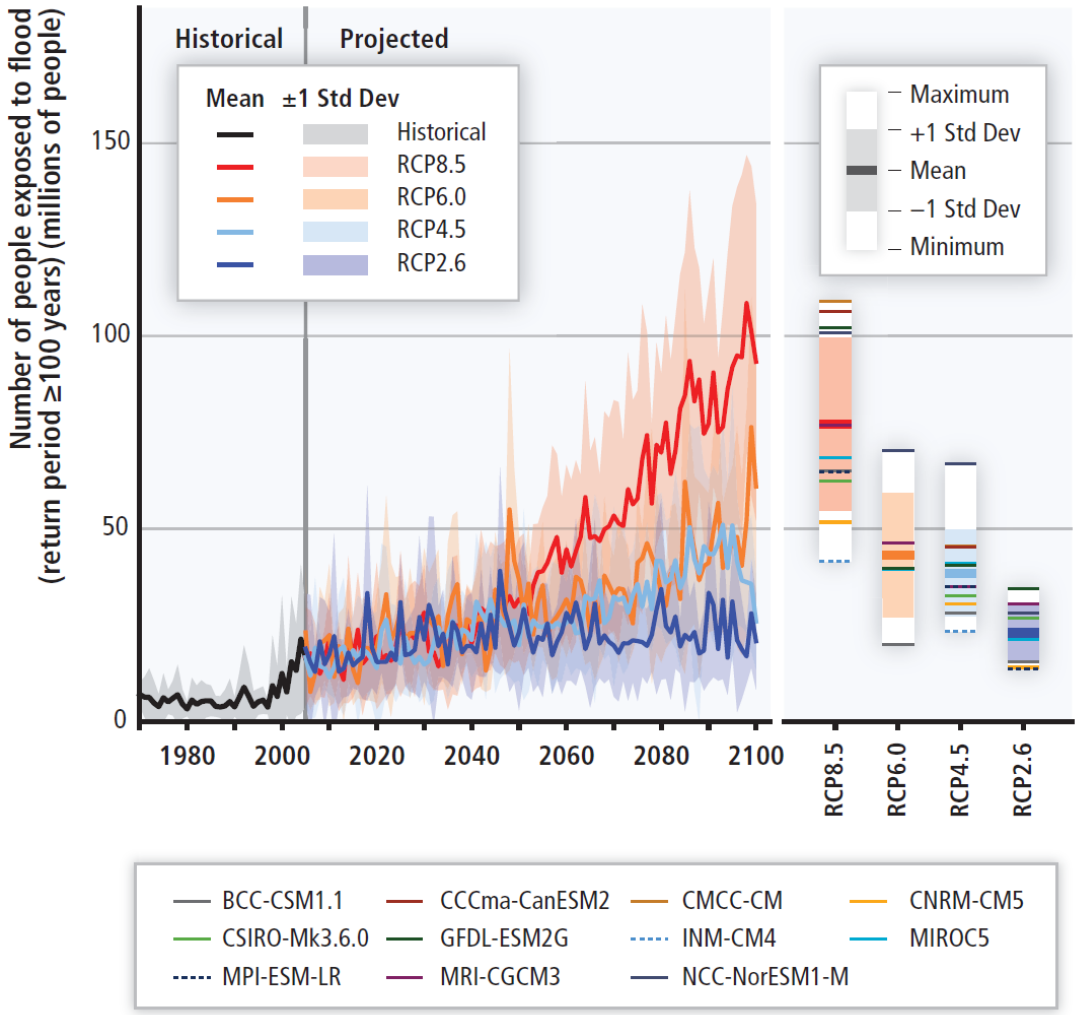
For each degree of global warming, approximately 7% of the global population is projected to be exposed to a decrease of renewable water resources of at least 20% (multi-model mean).



- **Diversity of results across GCM/GHM combinations, for one population scenario**

Schewe et al. 2013

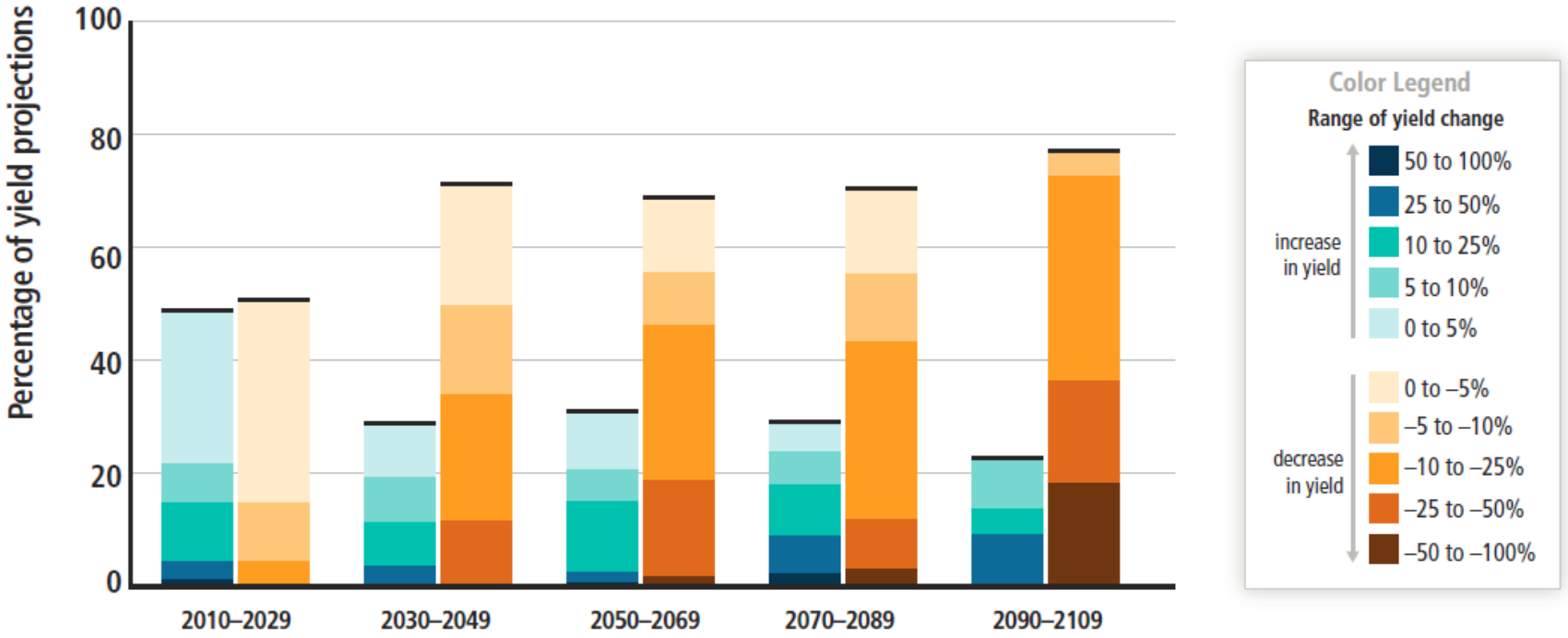
Water



WGII AR5 Figure TS.6

- **Projections with fixed 2005 population**
- **Need to understand interacting climate and socioeconomic drivers**

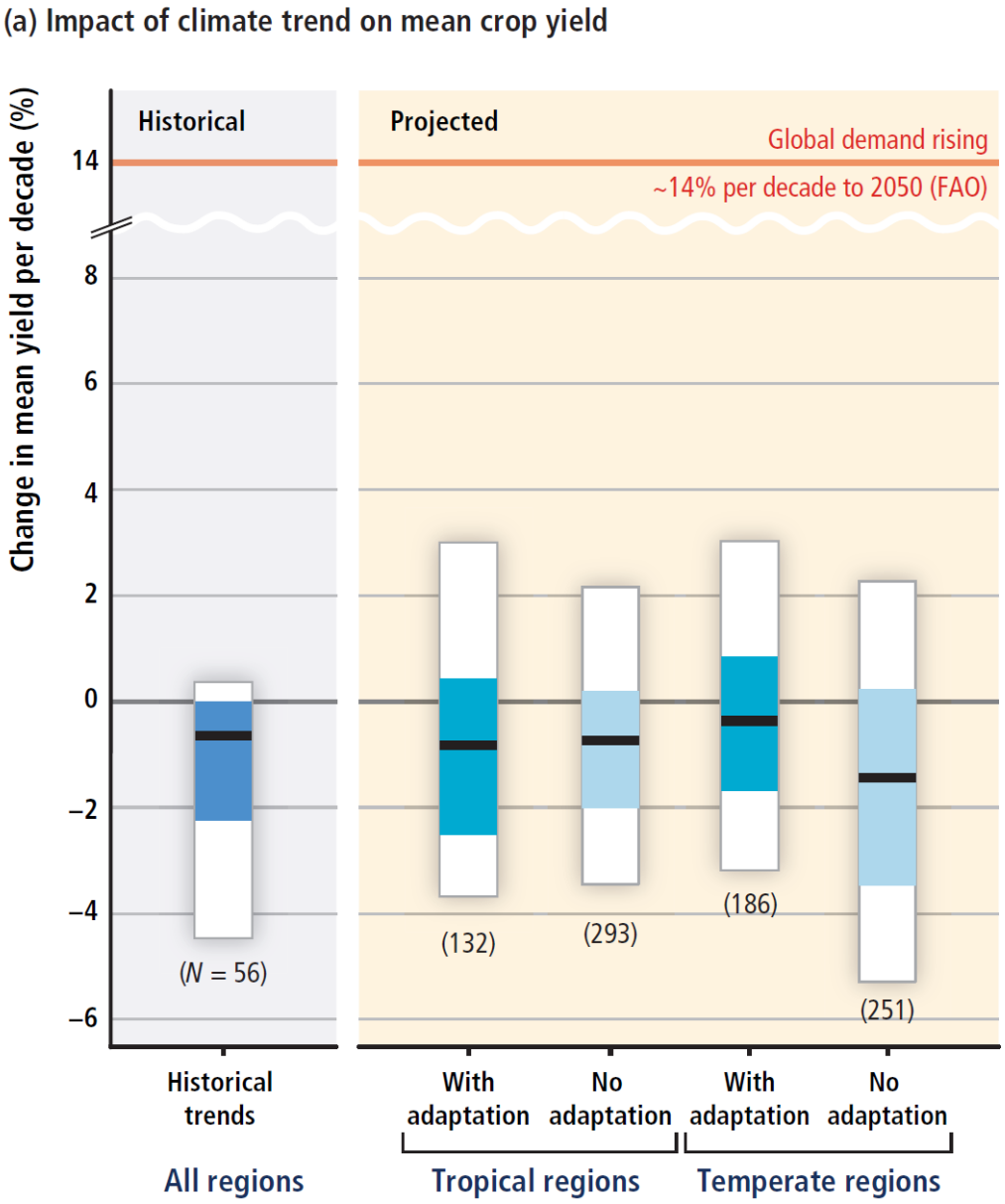
Food production



WGII AR5 Figure SPM.7

- **Increasing risks to crop yields, but diversity of projections**
- **Key challenge is understanding drivers of outcomes and how to integrate results**

Food production



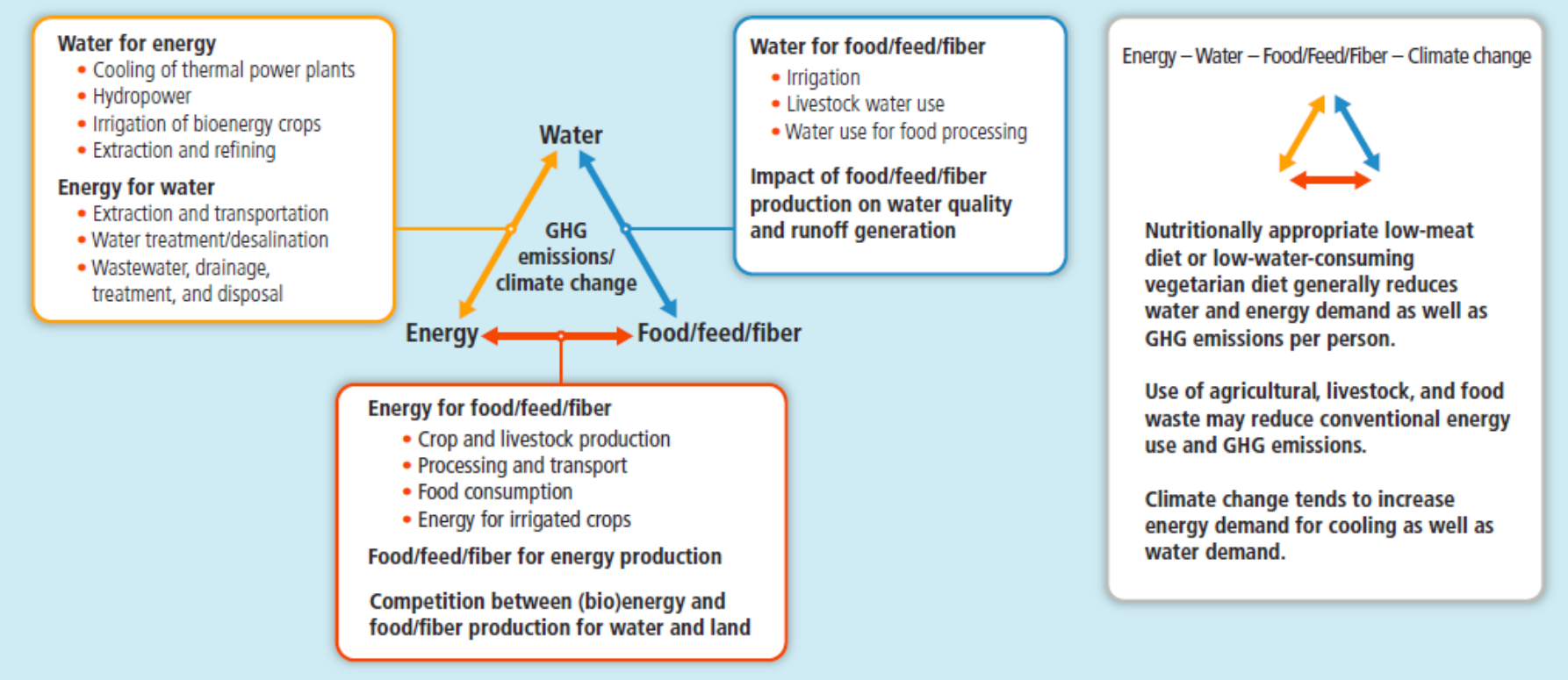
WGII AR5 Figure 7-7

Energy

Climate change will affect different energy sources and technologies differently, depending on the resources (water flow, wind, insolation), the technological processes (cooling), or the locations (coastal regions, floodplains) involved (*robust evidence, high agreement*).

- Climate-induced changes in the availability and temperature of water for cooling are the main concern for thermal and nuclear power plants.
- Availability of water (both amount and timing) for hydropower
- Reductions in thermal conversion efficiency due to higher air temperatures.
- Changes in solar and wind resources (due to changes in cloudiness, winds)
- Direct impacts of extremes

Climate-Water-Energy-Food Nexus



WGII AR5 Box CC-WE

- **Interactions among climate, water, energy, food, and nature**
- **Managing fundamental limits: competition for land and water resources**

Future directions

- Thinking in terms of risk, not just impacts
- Linking model results with broader (qualitative) evidence
- Facilitating rigorous expert judgment
- Evaluating robust actions for risk management